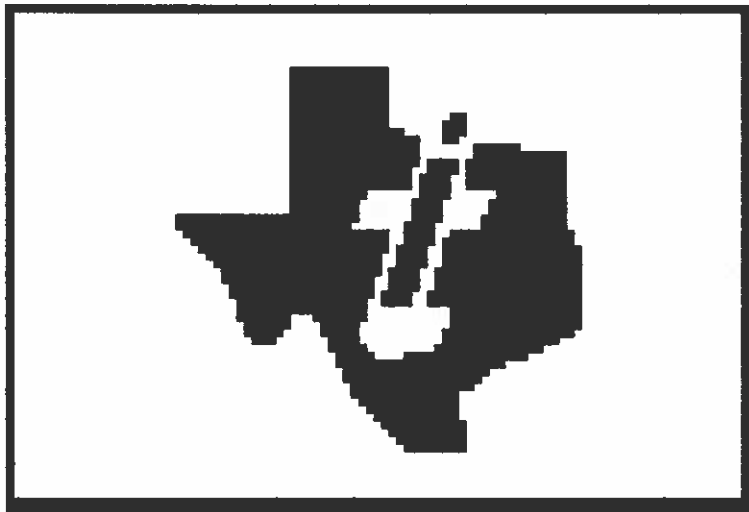


# TI-Net: The Texas Instruments Network



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Portsmouth, VA 23701  
I.C. Norcom High School

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# Abstract

- **Purpose:** This project will allow students to learn how to use the internet without the intimidation of an actual computer interface. It will also allow teachers (in mainly math and science) to more effectively introduce their lesson plans to the class, and check on student performance. TI-Net will do this by allowing the student and teacher to use an interface on which they both feel more comfortable; the Texas Instruments TI-82 calculator.
- **Hypothesis:** I believe that the first two steps will be a complete success but, I am not sure about the feasibility of a computer run mux box. There are also many new challenges as far as the programming. I am attempting to make a ROM based operating system rewrite itself. This will be very difficult.
- **Procedure:** To produce a working prototype of TI-Net for the first class room retro-fit, there are three sub levels.
  - ▲ calc to calc
  - ▲ switch board with calc/computer
  - ▲ 4-way calc/computer with chip

These three sub-levels will allow the project to tackle any unforeseen problems before a final product is produced. This also allows for flexibility in parts.

## Calc to Calc

The "calc to calc" setup is the basic connection made in all three sub-levels of the project. If failure at this point occurred, the entire project would have had to stop. Since this step was so imperative, my mentor Jim Trump and I have already tested and proven that it can be done.

## Manual Switch Board with Calc/Computer

This is the first network TI-Net will be operated on. This set-up allows for programs to be tested with the computer. This is also a test sight of how the real "Mux Box" will work with the *multiplexing chip*. Failure in this step will not stop the project, but it will slow down development.

## Four-way Calc/Computer with Chip

This is the final step in the prototype stage. Four-way calc/computer with chip will be the first computer controlled mini-internet. As you can see in the figure, it will at first only be able to connect four calculators to TI-Net. In the future this system will be expandable to 32 calculators (a class set). This stage is basically the final product. At this stage the first retro-fit classroom will be put into place and working.

- **Conclusion:** As I began this project I thought it would be a simple daisy chain connection to each calculator. To say the least, I was wrong. These calculators have been made to basically be run alone with the occasional connection to another calculator or computer in order to back-up programs. I attempted to give each calculator a header which would allow a computer connected to a multiplexing chip, to direct information (like a common ethernet router) to where ever the header says. Once again I found that it just couldn't be done automatically. By my data I can only say that the TI-82 calculator was built for math and science, not the internet. Nevertheless I can say that I am pleased with the fact that most of the operating systems are working, and both the "calc to calc" and "Manual Mux Box" portions of the project were a great success.

[Texas Instruments] [TI Calculators]

[TI-82 (6K)]

TI-82

Combines advanced graphing, tables, and data analysis with basic calculus functions.

#### Features

- \* 8-line-by-16-character supertwist display.
- \* Defines, saves, and graphs 10 rectangular functions,
- \* 6 parametric equations, 6 polar equations, and 2 recursively defined sequences.
- \* Function evaluation table shows numeric evaluation of functions in table format.
- \* Calculates roots, minimums, maximums, derivatives, and integrals.
- \* Link cable (included) allows data sharing with another TI-82.
- \* Slide case included.
- \* Optional TI-GRAPH LINK™.

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Function Matrix

Graph-TI Program Archive

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[Texas Instruments] [TI Calculators]

News Release

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CG-377

## 20 YEARS OF CONTEMPORARY HISTORY

### REMEMBERING SOME OF TEXAS INSTRUMENTS MOST MEMORABLE CONSUMER PRODUCTS

DALLAS (January 7, 1993) -- "Calculators from Texas who?" That question was often asked during the first days of the electronic calculator industry, but as the market grew, Texas Instruments became

an industry leader and a household name in homes -- as well as in schools, offices and factories -- around the world.

TI was already an industrial giant when it entered the consumer products business in 1972. Founded in 1930 as Geophysical Service, the company began by providing contract exploration services to the petroleum industry and evolved into a leading designer and manufacturer of innovative defense electronics systems and semiconductors. TI was the first to mass produce silicon transistors

in 1954 and invented the integrated circuit -- the micro-chip -- in 1958 and the electronic hand-held calculator in 1967. Shipments of calculators bearing the TI brand began five years later.

Here's a snapshot of some of TI's most memorable consumer products, beginning with the announcement of its first commercial calculator

20 years ago. (Note: models marked with an asterisk are part of the permanent collection of the Smithsonian Institution in Washington, D.C.)

1972 TI-2500\* DataMath[tm]calculator. TI's first consumer product, this electronic hand-held calculator made everyday math quick and easy. The TI-2500 performed four arithmetic functions (addition, subtraction, multiplication and division) and had a red, eight-digit

light-emitting diode (LED) display; it used an adapter to recharge the batteries. Announced in April 1972 with a suggested retail

price (SRP) of \$149.95, the price was reduced to \$119.95 when the product was formally introduced on September 21, 1972.

1973 SR-10\* began shipping in high volume. With an SRP of \$149.95, this portable slide-rule calculator with scientific notation was

the first with a price comparable to that of basic hand-held calculators.

It performed reciprocals, squares and square roots more quickly and more accurately than classical slide rules and handled four arithmetic functions, as well.

1974 SR-50\*. This advanced slide-rule calculator with memory

performed all the classical slide-rule functions including the SR-10's functions, universal powers and roots, factorials, trigonometric and hyperbolic functions and their inverses, common and natural logarithms and  $e(x)$ . Scientific notation. It also featured a 14-character LED display and pi key. Direct-marketed initially at \$169.95; later sold through dealers.

1975 SR-52\* programmable calculator with nonvolatile magnetic card storage. More programming and memory power than comparable models offered at twice the price, the SR-52 stored up to 224 program steps and values on 2-7/8 by 5/8-inch magnetic cards. Twenty user memories; 23 preprogrammed functions and operations; programming capabilities included 82 user-defined keys and labels, branching, flags and subroutines. AOS[tm] Algebraic Operating System with nine levels of parentheses. Basic Library software with 22 program cards included; optional software libraries, thermal printer/plotter and PPX-52 Professional Program Exchange available. Introduced at a \$395.00 SRP.

1976 TI-5040. TI's first desktop calculator with a large, bright vacuum fluorescent (VF) display and a clean, quiet, convenient thermal printer. Crisp styling and many useful features including four-function memory; independent add mode; floating or add-mode decimal; 10-digit display with comma and decimal point punctuation. Operated from household current. SRP \$149.95.

1977 TI Programmable 59\*. This advanced programmable calculator offered users 960 program steps or up to 100 memories, and it was the first TI calculator to offer both magnetic card storage and interchangeable, plug-in Solid State Software[tm] modules with up to 5,000 program steps. More than 175 functions and operations. Master Library with 25 programs included; optional software libraries, thermal printer/plotter and Professional Program Exchange available. SRP \$299.95.

1978 TI-1030. The first calculator TI manufactured with a low-power CMOS chip and a liquid crystal display (LCD). Thin as a pencil and supplied in a handy wallet folder, the Slimline TI-1030 operated for up to 3,000 hours on a pair of silver-oxide batteries. Performed four functions, percentages and square roots; weighed less than 2.5 ounces. Four-key memory with large eight-digit display.

1978 TI-50. The first scientific calculator TI manufactured with a low-power CMOS chip and an LCD. Handsome and compact, the Slimline TI-50 slide rule performed 60 math and statistics functions useful to college students and professionals. Two versatile Constant Memory[tm] registers retained data even when the calculator was turned off. Operated for up to two years on a set of batteries; weighed just three ounces. SRP \$35.00.

1979 TI-35. Another popular model in TI's scientific calculator family, the Slimline TI-35 slide rule for students packed with 54 easy-to-use math and scientific functions. Versatile memory with Constant Memory feature. Pencil-thin with a large LCD; long battery life. \$33.00 SRP.

for 1981 TI-1766. TI's first solar-powered, four-function hand-held calculator. Handled percentages and square roots. Sleek and convenient, the TI-1766 had solar cells that eliminated the need batteries and powered the calculator indoors and out. Eight-digit LCD; four-key memory. Weighed under 2.0 ounces. \$19.95 SRP.

TI's 1982 TI-30 SLR. The first solar-powered slide-rule calculator in line helped math and science students eliminate the expense of batteries. More than 50 functions; four-key memory; eight-digit LCD. SRP \$18.95.

AC wide 1983 Compact Computer 40[tm] (CC-40). A remarkable BASIC-language notebook computer that measured 9.5 by 5.75 by 1.00 inch, weighed just 22 ounces and operated from four AA batteries or an optional adapter. Had a typewriter-style keyboard, 31-character LCD and a range of optional peripherals -- four color printer/plotter, serial interface, Wafertape[tm] digital tape drive, modem and external monitor interface. Fully programmable; optional applications available in Solid State Software and tape cartridges.

the 1985 TI-30 Galaxy. Designed in Europe with pedagogical features. Contemporary horizontal styling; ergonomic features -- including angled display and extra-large, color-coded keys -- ensured that TI-30 Galaxy was easy to use. Performed 51 math and statistics functions; versatile storage with Constant Memory feature.

-- 1986 TI-60. An advanced scientific calculator with programmability up to 88 program steps and 12 constant user memories. One- and two-variable statistics, linear regression, trend-line analysis and other statistical functions. Number-base conversions and mixed-base calculations. Ten-digit LCD.

1987 TI-12 Math Explorer. The first TI calculator designed with the help of teachers. Especially for elementary and middle-school classroom use, the Math Explorer combines the utility of a four-function calculator with powerful fraction functionality.

as 1988 TI-68. Advanced scientific calculator for college students and professionals in math, science and engineering. Performs 254 functions including 40 complex-number functions; solves up to five simultaneous equations; calculates the real and complex roots of quadratic, cubic and quartic equations. Powerful, easy-to-use formula-programming capabilities handle up to 440 steps in as many 12 formulas. Twelve- character alphanumeric display scrolls to show long equations. Last-equation replay feature; up to 36 user

memories.

Initial SRP \$65.00; now \$55.00.

1990 TI-81. First graphics calculator developed for math education that adds a new visual dimension to mathematics instruction; makes it easier to explore functions and understand concepts. Large display has pull-down menus; TI-81 can define, save and graph four functions or three parametric expressions; enter, edit and manipulate three 6 x 6 matrices. Seven built-in zoom features; 4,632 bytes of memory (2,400 bytes reserved for programs. A single keystroke plots selected functions in the viewing rectangle. Performs graphic and numeric analyses of one and two-variable data. SRP \$110.00.

1991 BA II PLUS[tm]. Powerful business calculator for professionals and students solves time-value-of-money calculations; performs cash-flow analysis for up to 24 uneven cash flows; computes net present value and internal rate of return. Two day-count methods; four methods of calculating depreciation, book value and remaining depreciable amount. Advanced math functions including breakeven analysis. SRP \$45.00.

1992 TI-85. Sophisticated graphics calculator for professionals and college math, science and engineering students. Large display can show 64-by-128 pixel graphs; two levels of display menus. Stores, graphs and analyzes up to 99 functions, parametric equations and polar functions plus a system of nine first-order equations. Solves for any variable in an equation; solves 30 simultaneous equations; finds the roots of a polynomial up to the 30th order. Has 32K of memory to store any combination of equations, matrices, vectors, programs, pictures and graph databases. Optional software allows data transfers with another TI-85, IBM compatible or Macintosh personal computers. SRP \$130.00.

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# Letter Sent To Companies

NASA, AT&T, NEC, MCI, Hewlett-Packard and 8-Bit







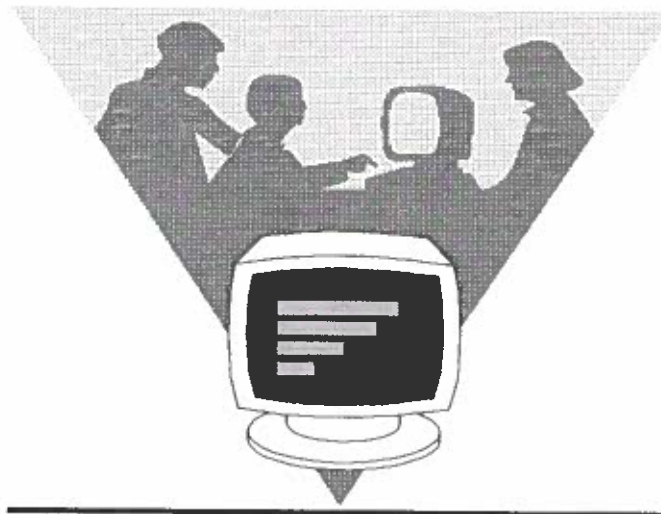
**Je'aime H. Powell**  
1219 Roosevelt Blvd.  
Portsmouth, VA 23701



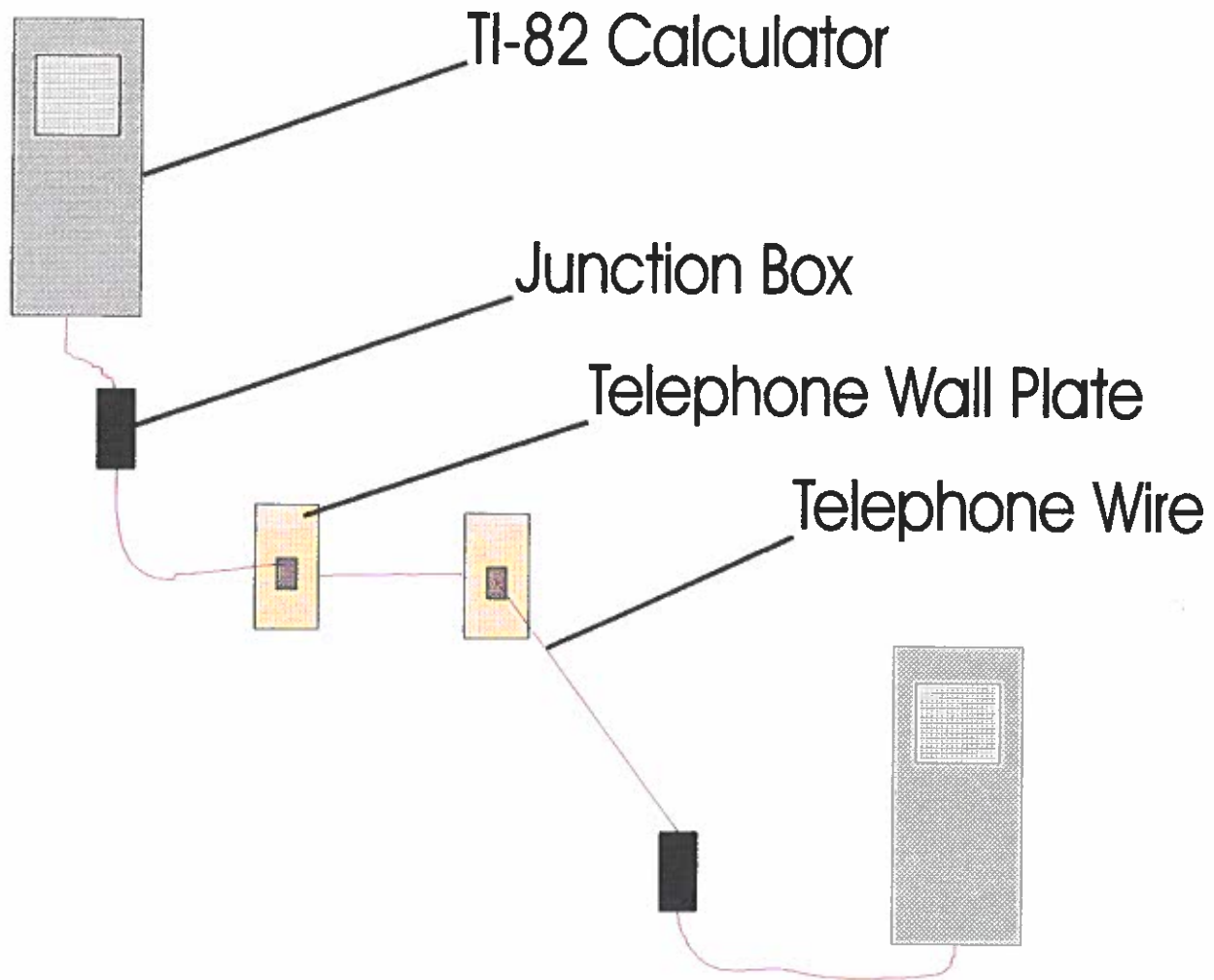
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- 4-way calc/computer with chip

These three sub-levels will allow the project to tackle any unforeseen problems before a final product is produced. This also allows for flexibility in parts.

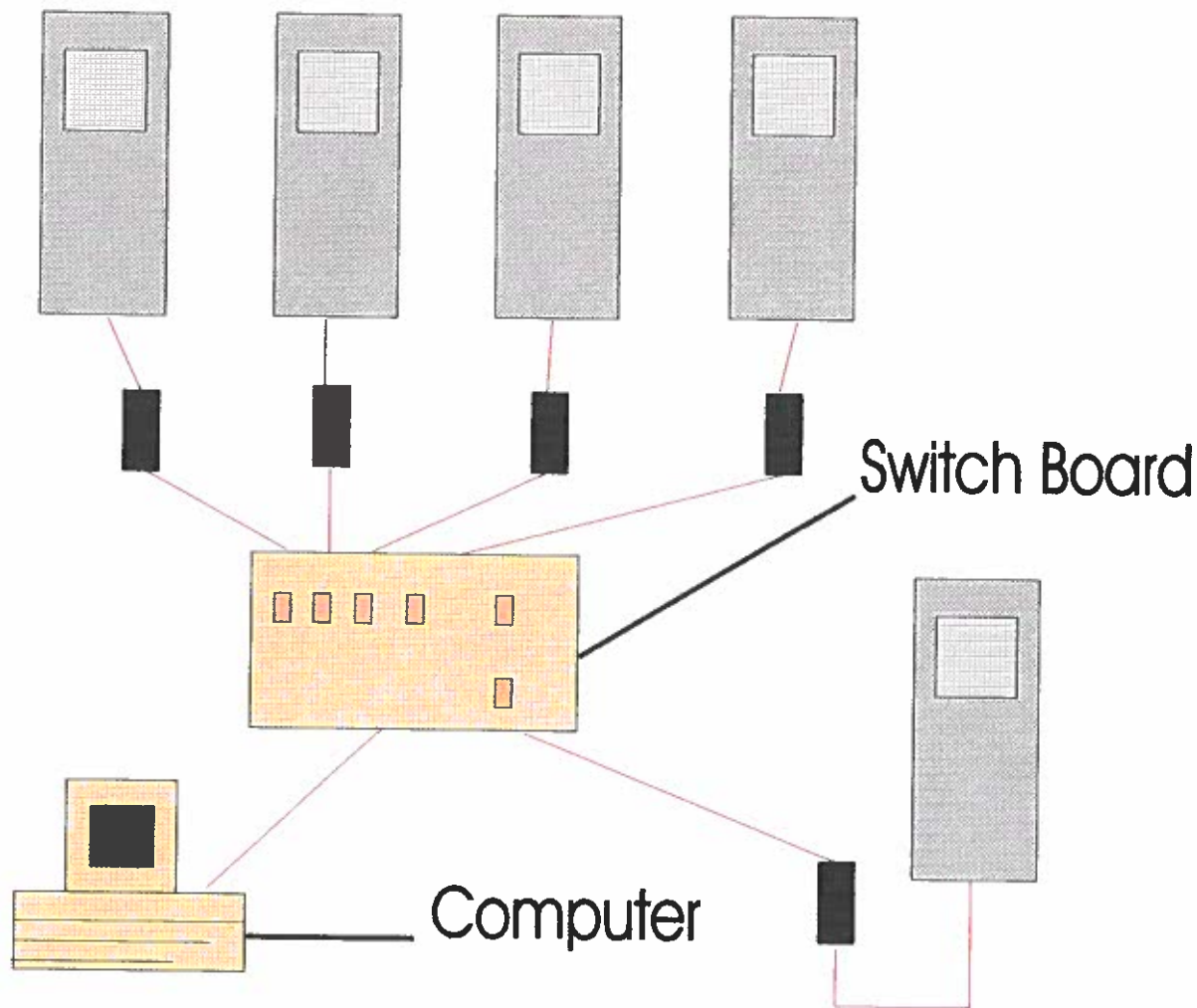


# Calc to Calc



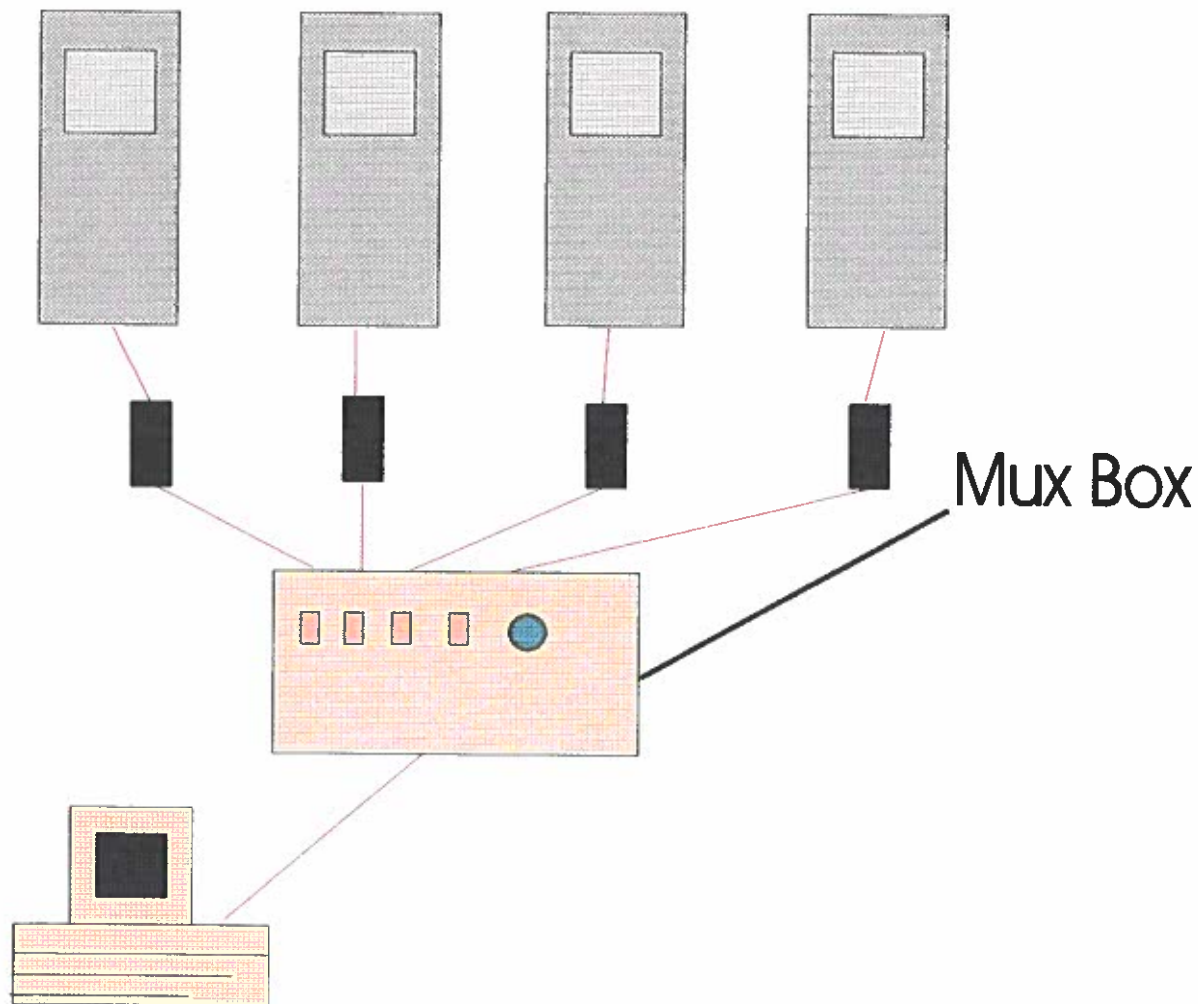
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# Switch Board with Calc./Comp.



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# Four-Way Calc./Comp. with Chip



This is the final step in the prototype stage. Four-way calc./computer with chip will be the first computer controlled mini-internet. As you can see in the figure, it will at first only be able to connect four calculators to TI-Net. In the future this system will be expandable to 32 calculators (a class set). This stage is basically the final product. At this stage the first retro-fit classroom will be put into place and working.

## Your Support

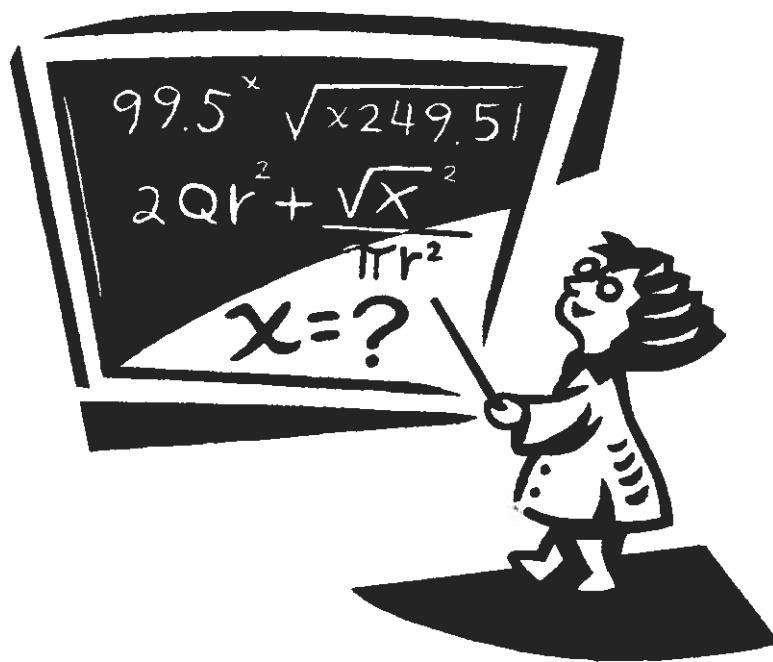
This is where I need your help. Below I have listed parts and prices of things I need to make TI-Net a reality. Any donations of parts or funds would be very much appreciated. Thanks again for your time and needed support.

Sincerely yours,

Je'aime H. Powell

| Item Name                                | Price     | # Needed     | Total Cost     |
|--|-----------|--------------|----------------|
| Modular IC Bread Board                   | 7.99      | 4            | 31.96          |
| Jumper Wire Kit                          | 5.49      | 5            | 27.45          |
| 100' Phone Cable                         | 14.99     | 1            | 14.99          |
| Phone Crimper                            | 9.99      | 1            | 9.99           |
| 6 Wire Modular Plug                      | 3.99      | 3pks. of 10  | 11.97          |
| Wall Plate                               | 3.99      | 30           | 119.17         |
| Ultra Compact Enclosure                  | 1.99      | 9            | 17.91          |
| Control Console Cabinet                  | 16.49     | 3            | 49.47          |
| 8 Position Standard Strip                | 2.19      | 9            | 19.71          |
| 8 Position DIP Switch                    | 1.79      | 3            | 5.37           |
| SPST Rocker Switch                       | 1.99      | 18           | 35.82          |
| 7 Segmented LED                          | 1.79      | 3            | 5.37           |
| Lamp Holder                              | 1.99      | 3            | 5.97           |
| Used Laptop or Desktop                   | 300.00    | 1            | 300.00         |
| Poster Presentation Budget               | 100.00    | 1            | 100.00         |
| RAM for Laptop or Desktop (presentation) | 40 per mb | 4            | 160.00         |
| DB 25 Gender Changer                     | 1.79      | 2            | 3.58           |
| DB 25 Female Plug                        | 1.99      | 2            | 3.98           |
| Emergency and CHIP Budget                |           |              | 76.76          |
|  |           | <b>Total</b> | <b>1000.00</b> |

# ASCII Versions Of Programs



```
\START82\  
\COMMENT=Program file dated 03/03/96, 19:00 \NAME=DCOM  
\FILE=DCOM.82p  
ClrHome  
Input "C:>",A  
  
If A=D:prgmDIRS:prgmDCOM  
If A=C:prgmDIRS:prgmDCOM  
If A=U:prgmUSER:prgmDCOM  
If A=N:prgmNAME:prgmDCOM  
If A=U+N:prgmUN:prgmDCOM  
If A=XC:prgmGET:prgmDCOM  
If A=XD:prgmXDIR:prgmDCOM  
  
If A=H:prgmDHELP:prgmDCOM  
If A=Q:Menu("ARE YOU SURE?", "YES", 1, "NO", 2) Lbl 1  
prgmTINET  
Lbl 2  
prgmDCOM  
  
Text(9,4,"BAD COMMAND OR NOT AVAILABLE") Pause  
prgmDCOM  
\STOP82\  
  
—
```



```
\START82\  
\COMMENT=Program file dated 03/03/96, 19:00 \NAME=DOS  
\FILE=DOS.82p  
ClrHome  
ClrDraw  
Text(0,0,"THIS PROGRAM IS A CLONE OF") Text(7,0,"MS-DOS 6.2.  
ALL PARTS OF DOS") Text(14,0,"ARE NOT THERE, BUT MOST OF")  
Text(21,0,"THE COMMON COMMANDS ARE") Text(28,0,"THERE FOR  
YOUR CONVINIENCE") Text(35,0,". IF THERE ARE ANY QUESTIONS")  
Text(42,0,"ABOUT TIDOS OR TI-NET") Text(49,0,"PLEASE TYPE  
\(-)\HELP\(-)\ OR") Text(56,0,"CONTACT YOUR SYSTEM  
ADMINISTRATOR.") Pause  
ClrDraw  
prgmDCOM  
\STOP82\  
—
```



```
\START82\  
\COMMENT=Program file dated 03/05/96, 15:18 \NAME=LOGO  
\FILE=LOGO.82p  
If A=1:Disp "A"  
If A=2:Disp "B"  
If A=3:Disp "C"  
If A=4:Disp "D"  
If A=5:Disp "E"  
If A=6:Disp "F"  
If A=7:Disp "G"  
If A=8:Disp "H"  
If A=9:Disp "I"  
If A=10:Disp "J"  
If A=11:Disp "K"  
If A=12:Disp "L"  
If A=13:Disp "M"  
If A=14:Disp "N"  
If A=15:Disp "O"  
If A=16:Disp "P"  
If A=17:Disp "Q"  
If A=18:Disp "R"  
If A=19:Disp "S"  
If A=20:Disp "T"  
If A=21:Disp "U"  
If A=22:Disp "V"  
If A=23:Disp "W"  
If A=24:Disp "X"  
If A=25:Disp "Y"  
If A=26:Disp "Z"  
Return  
\STOP82\  
—
```

```
\START82\  
\COMMENT=Program file dated 03/03/96, 19:00 \NAME=PASSWORD  
\FILE=PASSWORD.82p  
FnOff :AxesOff  
ClrDraw:Degree  
ClrHome:0\->\R  
For(I,0,29)  
Text(I,I,"WELCOME TO TI-NET" Text(10,59-I,"JAMIE POWELL"  
Text(int (.7I)+1,43,"":End Text(39,30,"COPYRIGHT 1996"  
  
Pause
```

```
\STOP82\  
—
```

```
\START82\  
\COMMENT=Program file dated 03/03/96, 19:00 \NAME=TINET  
\FILE=TINET.82p
```

```
FnOff :AxesOff  
ClrDraw:Degree  
ClrHome  
Line(0,55,94,55)  
Text(0,0,"TI-NET:      PRESS 1  FOR HELP") Line(0,7,94,7)  
Text(56,0,"UNIX      DOS      CLASS      MAIL      QUIT")  
Line(15,7,15,0)  
Line(31,7,31,0)  
Line(57,7,57,0)  
Line(76,7,76,0)  
Line(76,0,94,0)  
Line(94,55,94,0)  
Line(0,55,0,7)  
prgmTICOMS
```

```
\STOP82\  
—
```

```
\START82\  
\COMMENT=Program file dated 03/05/96, 15:18 \NAME=UNIX  
\FILE=UNIX.82p  
FnOff :AxesOff  
ClrDraw:Degree  
ClrHome  
For(I,0,29)  
Text(I,29,"TI-NET"  
Text(36,55-I,"TI-UNIX V.2"  
Text(int (.7I)+1,43,"":End Text(42,22,"COPYRIGHT 1996"  
Pause  
Lbl C  
prgmUHELP  
Input "TI-NET>",A  
If A=1:prgmUHELP  
If A=2:prgmLIST  
If A=3:prgmCOMM  
If A=4:prgmTINET  
  
Disp "BAD COMMAND":Goto C  
\STOP82\  
—
```

# E-Mail From Texas Instruments



From: Terri Donahue <AET3.DPCPO04A@dpcbgw1.itg.ti.com>  
Subject: 82 Programming Language  
To: Jeanne Henri Powell (jpowell@pen.k12.va.us)  
Date: Thu, 04 Jan 96 13:34:56 CST

Mr. Powell,

Thank you for your recent correspondence. The only language that the TI-82 can be programmed in is the keystroke language which is supported in the manual. What program are you referring to which appears to be a different language? Did you decode the file before you tried to open the file for viewing? Please respond directly to me for further assistance.

If I can be of further assistance, feel free to contact me again.

Best Regards,

Terri

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TI Consumer Relations      Internet:ti-cares@ti.com  
Texas Instruments          Phone:(817)774-6827  
P.O. Box 6118 m/s 3258      Fax:(817)774-6074  
Temple, TX 76503  
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Original text

>From JHPowell@smtp(Jeaine Henri Powell)(jpowell@pen.k12.va.us), on 1/2/96 11:05 PM.  
>To: DUGY@DPCPO04A  
>Cc: JHPowell@smtp(Jeaine Henri Powell)(jpowell@pen.k12.va.us)

Mr. Harnish,

Today I was looking at another programers program. It was located on the TI archive ftp site. It seems like they are using a new kind of language on the 82. I was wondering if you could send me a copy of this new programing language. I am also having some problems trying to save text as a variable to be downloaded to other calculators using the "get(" command. Could you please take a look at this and e-mail me back?

---

# Acknowledgements

Jim Trump  
Doug Harnish  
Scott Kale  
Terry Donahue  
Mark Quickly  
Steve Osborn  
Linda Osborn  
Bill Wright  
Roger Hathaway  
Cathy Ramerez  
Lorean Eton  
Cathy Prager  
Pete Thomas  
John Widrow  
Rick Blackwood  
Oneil Stephenson

Norfolk Wire and Cable  
NASA  
Texas Instruments  
ITT Technical Institute  
Allied Electronics  
Radio Shack  
CDI  
The DataBank  
AT&T  
NEC  
Hewlett-Packard  
8-Bit  
MCI  
The Virginia-Pilot

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