Hobbiests! Engineers! Technicians! Students!

Write and run machine language programs at home, display video graphics on your TV set and design microprocessor circuits — starting the very first night — even if you've never used a computer before!

ELF II featuring the amazing RCA COSMAC

Now you can own the world's most practical computer for just $99.95. ELF II comes with wonderfully-simple operating instructions that soon make you an expert, even if you've never had your hands on a computer before. Then, when you've mastered each of the commands an RCA 1802 will execute, ELF II's highly advanced add-ons let you run circles around "big name" personal computers that sell for a lot more money. ELF II has all the power most people will ever need for complex business, industrial, scientific or hobby applications.

1802 microprocessor/mini-

COMPUTER ONLY $99.95

THE FAST WAY TO LEARN COMPUTER FUNDAMENTALS! Owning an ELF II is probably the fastest, easiest, most foolproof way to gain a working knowledge of computers the world has ever known. First of all, you get your hands on *your own* computer, so you can spend all the time you want with it and use it for anything that turns you on.

Secondly, our *Short Course On Microprocessor And Computer Programming* makes it impossible for you to fail. We take you inside the RCA 1802 and teach you every instruction it can be given. Everything is explained in plain English. When you're finished, you'll know everything there is to know about using an ELF II. You'll be able to make ELF II do whatever you want it to do. You won't be limited to predeveloped software.

Third, once you understand ELF II inside and out, you'll be ready to use its highly sophisticated add-ons intelligently. And, as you expand your ELF II, you'll begin to appreciate just how advanced its technology really is.

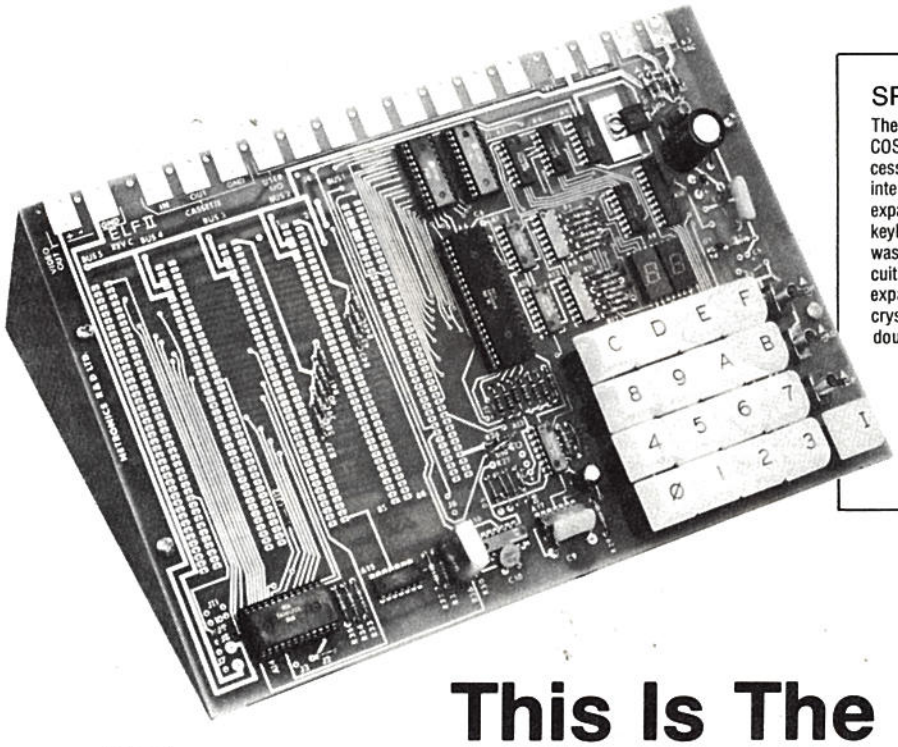
In addition to I/O, monitor, memory, ASCII keyboard and BASIC, ELF II offers you exotic add-on features such as the ELF II Light Pen and the ELF II Color Graphics & Music System.

It's no wonder ELF II's are being used by high schools and universities, IEEE seminars, factory training programs, trade schools and the R&D labs of leading high technology corporations.

(over please)

ELF II gives both students and professionals a chance to get their hands on a computer . . . and master it as they learn computer fundamentals. These people know that today a practical understanding of computers is as important as a college degree.

Owning your own ELF II gives you an understanding of computers far beyond anything you can get from reading books. You will learn to think in machine language — the fundamental language of computers — so even big computers will lose their mystery for you. In fact, once you've mastered ELF II you'll never be intimidated by any computer again, because now you'll have a sound knowledge of the fundamentals.



SPECIFICATIONS

The $99.95 ELF II computer features an RCA COSMAC COS/MOS 1802 8-bit microprocessor addressable to 64k bytes with DMA, interrupt, 16 registers, ALU, 256 byte RAM expandable to 64K bytes, professional hex keyboard fully decoded so there's no need to waste memory with keyboard scanning circuits, built-in power regulator, 5 slot plug-in expansion bus (less connectors), stable crystal clock for timing purposes and a double-sided, plated-through pc board plus RCA 1861 video IC to display any segment of memory on a video monitor or TV screen along with all the logic and support circuitry you need to learn every one of the RCA 1802's capabilities.

This Is The Famous

$99.95 ELF II Computer

The $99.95 ELF II is a self-contained personal computer that includes everything you need to write and run machine language programs. ELF II also lets you display computer-generated video graphics on any TV set or video monitor. If you're an engineer or hobbiest, you can use ELF II in microprocessor-based circuits of your own design as a counter, alarm, lock, thermostat, timer, telephone dialer, etc. The possibilities are endless.

ELF II was designed to be both a trainer and the heart of a powerful computer system. The $99.95 ELF II gives you all components and everything you need to write and run your own programs immediately, even if you've never used a computer before. Then, once you've mastered computer fundamentals, ELF II can be expanded to give you tremendous computing power.

USES Use your ELF II with a photocell or switch input to count packages, parts, cars or people • Add a simple motor driven photocell scanner to detect movement in a room • Monitor burglar alarm switches • Play games of all kinds . . . invent your own games • Maintain the water level in a fish tank with a moisture sensitive switch, ELF II and a water valve solenoid • Measure motor speed with a photocell input • Add an external speaker to create a programmable music box • Monitor and control experiments in labs and schools • Create a programmable multiple pulse generator • Use ELF II as a precision crystal controlled clock or timer, started and stopped by external events • Use ELF II to create a programmable tester for printed circuit cards, circuits, IC's, memories, etc. • Build a low cost microprocessor breadboard and program development system with ELF II • Make your own programmable sequencer for light shows, advertising displays, holiday lighting, etc. • Create a programmable complex waveform generator via appropriate D-A circuits • Add a speaker and use ELF II for a metronome • Create a random number generator • Build a telephone dialer • Use ELF II for controlling battery operated toys including cars, trucks, robots, etc. • Simulate digital circuits or systems • Use ELF II to detect tape player tones and control slide projectors . . . *that's just the beginning!*

The potential applications of ELF II are limited only by your imagination! As your ability to use ELF II grows, you may discover new applications for ELF II and the 1802 that RCA and Netronics never even thought of!

WRITE AND RUN PROGRAMS THE VERY FIRST NIGHT! ELF II can help anyone — even the layman — quickly develop a practical understanding of computers and their applications that goes far beyond what can be learned by reading textbooks or by working with giant computers in FORTRAN or BASIC. If you've been struggling to learn computers by reading books, owning an ELF II will make those books infinitely more meaningful for you.

The ELF II Owner's Manual and our *Short Course On Microprocessor And Computer Programming* give you all the easy instructions you need and get you started right away, even if you've never used a computer before. These manuals cover testing, programming, video graphics and games and make everything extremely easy to understand. The Owner's Manual also includes a program to display video graphics and an exciting new moving target and missile game.

Whether you're an absolute novice or a professional engineer, you'll find working with ELF II to be a pleasure. Simple, clear instructions let you write and run programs the very first night. From that moment on, the world of computers will be wide open to you!

ELF II kit (includes ELF II Owner's Manual with simple and complete instructions for assembly, testing) **$99.95**

Wall Mounted AC Power Supply **$5.00**

RCA 1802 User's Manual (RCA's own manual for the 1802. Very useful if you plan to design microprocessor circuits with ELF II) **$5.00**

***A Short Course On Microprocessor And Computer Programming* (See below)** **$5.00**

ELF II wired and tested (includes power transformer, RCA 1802 User's Manual and *Short Course* **$149.95**

Steel Cabinet (deluxe IBM blue and black) with smoked, see-through plexiglas dust cover **$29.95**

RF Modulator (Needed when connecting ELF II to a TV set, if you prefer the convenience of attaching ELF II to the antenna terminals rather than wiring it to your TV's video input circuit) **$8.95**

Gold Plated 86-Pin Connector (one required for each expansion board) each **$5.70**

Written For Anyone! Minimal Background Needed!

Learning Breakthrough!

A Short Course On Microprocessor And Computer Programming

Now — even if you're an extreme beginner — you can add a computer to your arsenal of personal business (or hobby) tools! Our *Short Course On Microprocessor And Computer Programming* lets anyone master an RCA 1802 computer, quickly, painlessly and without frustrations.

No other computer on the market today offers a learning aid so revolutionary in its simplicity. Everything you need to know is explained in plain English. You learn ELF II so thoroughly that you'll be able to fully exploit all of the 1802's capabilities.

This means you get all the power you're paying for when you buy an ELF II computer. No matter how little you may know about computers now, our *Short Course* will make you a master of the ELF II. You don't pay for one byte of power you can't use because we teach you to push ELF II to the limit. Then we offer you technically advanced add-ons that will expand ELF II and give you tremendous problem solving capabilities.

Our *Short Course* takes you, step by step, through each of the 91 instructions that an RCA COSMAC will

PILOT

The instructional language that makes your computer more fun!

Pilot is a programming language designed for use in computer-aided instruction. It is a text-oriented language that allows you to write educational programs in the Elf II with speed and ease. Among the many uses are programs for games, spelling drills, word tests and many others. Pilot opens up a whole new world of pleasure in programming your computer; for example, it makes the programming of conversational types of games vastly easier and quicker. Pilot greatly simplifies the process of game programming — in fact, such games are so simple with Pilot that a child can be taught in one hour to be up and running on the computer, and in time they can even be taught to do the programming! Here's why Pilot is so much easier than Basic for playing games: it was designed right from the start as a text-oriented language that allows for direct and simple programming-in of quizzes, of question/answer type games, and the utilizing of direct string comparisons. Result: Pilot delivers a lot more fun from your computer for both grownups and young people.

A GREAT BEGINNING INTO THE WORLD OF TEXT EDITING!

NO PREVIOUS PROGRAMMING SKILLS REQUIRED!

BONUS FEATURE! *Use the Pilot Editor to create a mailing list, or to produce copies of letters and reports.*

SPECIFICATIONS

Requires — 4K memory plus ASCII & Video Boards.

Commands

UP (Uxxx) — Moves text pointer up xxx lines. Displays new line.
DOWN (Dxxx) — Moves text pointer down xxx lines. Displays new line.
BEGIN (B) — Moves text pointer up to start of text. Displays new line.
END (E) — Moves text pointer down to end of text.
INSERT (I TEXT) — Inserts one line of text in front of current line.
KILL (Kxxx) — Deletes xxx line of text starting with current line. Displays new line.
TYPE (Txxx) — Types xxx lines of text to terminal, starting with current line.
CLEAR (C) — Deletes all text.
SAVES (S) — Outputs entire text buffer to cassette.
APPEND (A) — Inputs text from cassette. Appends to existing text.
MONITOR (M) — Returns control to system monitor.
RUN (R) — Causes execution of Pilot program.
LENGTH (L) — Text Buffer length (last page of available memory).

INSTRUCTIONS

ASK The program will display a ? then wait for a response from the terminal. The input is stored if a numeric or string variable is specified.

PRINT To output specified text, numeric values and contents of string variables to your terminal. A semicolon at the end of a print line suppresses the carriage return/line feed causing subsequent print instructions to continue to print on the same line.

END Terminates execution of a program and returns Pilot to the editor mode.

MATCH Compares response obtained by an ASK with one or more strings. If a match occurs, the yes/no flag is set to yes, else flag is set to no. The yes/no flag is tested by the *YES* and *NO* instructions.

YES Any valid Pilot instruction preceeding the ___Y: is performed if the yes/no flag is set to yes.

NO Same as *YES* except flag is tested for no.

EXAMINE This instruction evaluates the expression and sets the yes/no flag to *YES* if the expression evaluates to 0. If a comparison is specified then the yes/no flag is set to *YES* if the condition is satisfied and set to no otherwise.

JUMP Causes the program to branch to program line with same number.

SUBROUTINE Used to call a subroutine.

RETURN To return from a subroutine to the line just following the call to the subroutine.

COMPUTE Computes the value of an expression.

RANDOM Z This instruction assigns a random number with a value between 0 and (EXP-1).

CONTROL Outputs the ASCII equivalent of the value of the expression or constant to the terminal (i.e. 13=CR, 10=LF).

ERROR CODES If Pilot detects a program error, it will immediately stop execution of the running program and return to the text editor mode and display one of the fifteen error codes.

☆☆ PILOT ☆☆
(on cassette tape) . . . $19.95 postpaid.

Mail Your Order To:
Netronics Research & Development Ltd.
333 Litchfield Road, New Milford, CT 06776

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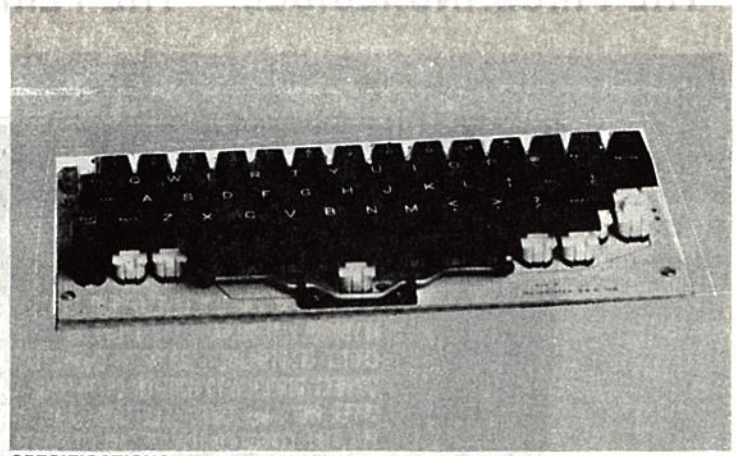
ASCII KEYBOARD/TERMINAL

The ASCII keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters.

The keyboard/terminal requires no I/O mapping. It includes 1k of memory, character generator, processor controlled cursor control and parallel ASCII/Baudot to serial conversion, as well as serial to video processing—all with crystal controlled accuracy. PC boards are glass epoxy and first class in every way.

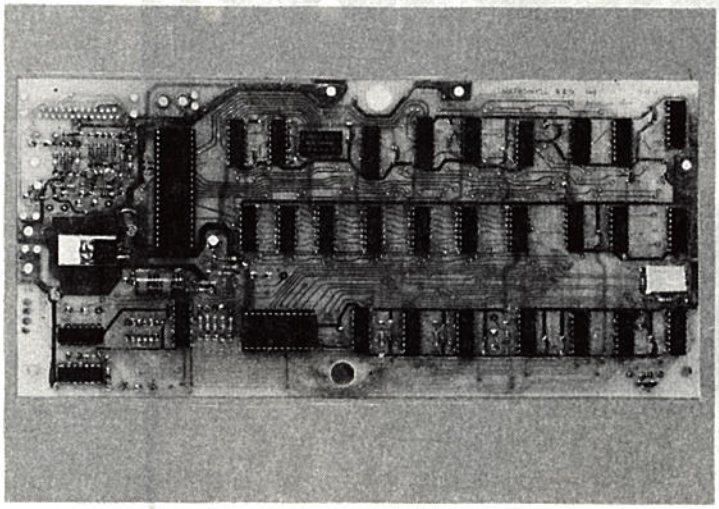


SPECIFICATIONS

Keyboard Section

- Full 128 character ASCII set.
- 2 key rollover.
- Upper and lower case.
- Selectable parity.
- Shift lock key.
- G-10 glass epoxy printed circuit board.
- Alpha lock jumper (Permits upper case only operation).

VIDEO DISPLAY BOARD

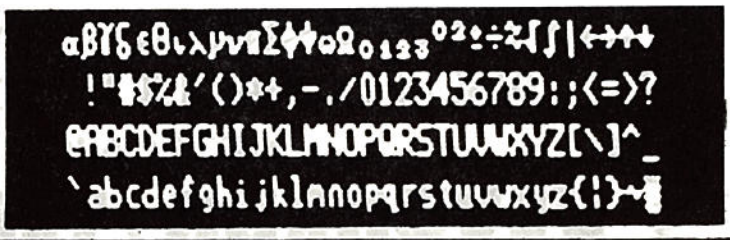


The Netronics ASCII Keyboard/Terminal includes the Netronics Video Display Board (VID) which was designed to be connected to a parallel ASCII or Baudot signal source. The VID converts the parallel data to serial data which is then formated to either RS232-C or 20MA current loop output which can be connected to the serial I/O on your computer or other interface, i.e. Mondem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting the data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

SPECIFICATIONS

Video Output	1.5 P/P into 75 ohm (EIA RS-120)
Baud Rate	110 and 300 ASCII 45.45 and 74.2 Baudot
Outputs	RS232-C or 20MA current loop.
ASCII Character Sets	128 printable characters.
Baudot Character Set	A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ & ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6
Cursor Modes	Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing.
Cursor Control Functions	Erase, End of Line, Erase End of Screen, Form Feed, Delete.
Monitor Operations	50 or 60Hz (jumper selectable).



Netronics ASCII Keyboard/Terminal Kit (will work with an RS232C or 20MA I/O and 110-300 Baud):
Includes ASCII keyboard and video display board $149.95
Deluxe Steel Cabinet for Netronics Keyboard/Terminal . . . . . $ 19.95
Video 100 12-inch Professional Monitor (see other side) $139.95

Mail Your Order To:
Netronics Research & Development Ltd.
333 Litchfield Road, New Milford, CT 06776

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THE PRICE: INCREDIBLE! THE PERFORMANCE: EVEN MORE INCREDIBLE!

ASCII or BAUDOT stand-alone

NETRONICS

KEYBOARD/TERMINAL

only **149.95**

Microprocessor controlled, the Netronics stand-alone terminal requires no computer memory or software. It gives you a choice of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output. The only additional hardware required is a power supply (such as the Netronics Heavy Duty 5 Amp Power Supply which can power both your computer and Netronic's Keyboard/Terminal) and a video monitor, or RF modulator/TV set combination.

More New Breakthroughs From Netronics For Your ELF II

BEFORE Netronics ASCII Keyboard with BASIC generates 14 characters by 7 line alphanumerics, as shown here.

AFTER Video Display Board has been added to Netronics ASCII Keyboard for a sharp, professional 64 or 32 character by 16 line display, as shown at right on Video 100 12" Monitor.

Video 100 12" Professional Monitor
Now Available Direct From Netronics . . . *only $139.95!*

Video Display Board

The new Netronics Video Display Board lets you convert the video display on your TV set or monitor to a sharp, professional 64 or 32 character by 16 line upper and lower case format. As your programs become longer and more complex, this format is virtually a "must." The Video Display Board fits conveniently inside the Netronics ASCII Keyboard cabinet.

By adding the Video Display Board to the Netronics ASCII Keyboard (or to *any* ASCII keyboard) plus a TV or monitor, you create a full stand alone terminal that requires no computer memory or I/O mapping. Your keyboard/terminal includes 1k of memory, character generator, processor controlled cursor control and parallel ASCII/Baudot to serial conversion, as well as serial to video processing with crystal controlled accuracy.

Video Display Board kit. **$89.95**

SPECIFICATIONS

Video output	1 volt P/P into 75 ohm (EIA RS-170)
Terminal I/O	RS232-C or 20 ma loop (full duplex)
Baud rate	300, 110 ASCII 74.2, 45.45 Baudot
Character output	5x8 dot matrix in 6x11 cell
Character set	128 characters
Data code	ASCII or Baudot
Keyboard required	Netronics ASCII keyboard or equivalent
Cursor modes	• Home • Back space • Horizontal tab • Line feed • Vertical tab • Carriage return Two special cursor sequences are provided for absolute and relative x-y cursor addressing.

EPROM Burner

Don't Waste Time Loading Programs From Cassette Tape Over And Over Again!

Now you can take any program including our BASIC, Assembler, Text Editor and Disassembler and transfer it from cassette tape to semi-permanent EPROM storage. Then, the next time you want to use that program, you don't have to waste time loading it again—you simply plug your EPROM into the PROM User Area on your EPROM Burner and your program is ready to run!

The Netronics EPROM Burner includes a fully mapped and addressed PROM user area. Designed to burn PROMs from programs in the memory field or from other PROMs, it also tests the EPROM to insure correctness. EPROMs are a tremendous convenience and our EPROM Burner lets you "blow" all the EPROMs you want!

EPROM Burner kit . . . . . **(coming soon)**

Your $99.95 ELF II can run this **Space Ship Program** or an exciting missile/target game with just 256 bytes of memory!

COLOR GRAPHICS/MUSIC BOARD

Add eight different colors to your graphics, plus three in background! ADD SOUND TO YOUR GRAPHICS! COMMAND 256 DISTINCT MUSICAL TONES!

CONTROL A FEAST OF LIGHT, SOUND AND COLOR FROM YOUR ELF II!

Now . . . play games in full color while increasing your programming skills. The Color Board provides eight principal colors in the main field (black, green, dark blue, light blue, red, yellow, purple, white) as well as four background colors (blue, black, green, red). The screen is divided into 256 blocks, eight across by thirty-two down, and each block can contain a color determined by you. All eight colors can be displayed and changed simultaneously, along with the four background colors, under your program control. The accompanying manual includes samples of programs as well as spec sheets for the color generator.

The music section produces 256 different frequencies ranging from 218.48 Hz. to 55,930.39 KHz. You can write programs transcribing sheet music directly into machine language code, or use the output as a signal generator for testing, or other applications. The system includes an on-board speaker. Output is always under program control. Complete spec sheets and programming instructions are included.

PROGRAM FULL ACTION INTO YOUR GRAPHICS!

COLOR GRAPHICS/MUSIC board kit . . . . . $49.95 (plus $2 P&H)
Fully wired & tested . . . . . $69.95 (plus $2 P&H)

Netronics Research & Development, Ltd. / 333 Litchfield Road / New Milford, CT 06776 / (203) 354-9375

New Breakthroughs From Netronics For Your ELF II

NEW FROM NETRONICS—A SOPHISTICATED FEATURE USUALLY FOUND ONLY ON LARGER COMPUTERS COSTING $5,000 AND UP!

Disassembler

Unlock The Mysteries Of Anyone's Program!

Now you can take anyone's program and translate the hexidecimal machine code listings into easily understood assembly language mnemonics. The Disassembler takes each grouping of hexidecimal machine code steps and tells you what these steps have accomplished. Both hexidecimal machine code and the corresponding assembly code mnemonics are displayed, line by line, on your monitor.

Thus, you can examine the *concepts* that went into the other person's program and determine exactly what he was trying to do. Armed with this knowledge, you may be able to find ways to compact the program to run on less memory or to modify it for new uses of your own.

Disassembler on cassette tape..... **$19.95**

Dual Tape Controller Board

For Text Editor & Assembler!

When using the Text Editor or Assembler, two cassette recorders and the Netronics ELF II Dual Tape Controller Board are required. The Dual Tape Controller Board includes all IC's and relays needed for completely automatic tape recorder operation. (Circuit to build it yourself is included with Assembler and Text Editor.)

Dual Tape Controller Board kit.... **$17.95**

Special Savings

Save $9.90 by purchasing the Text Editor, Assembler and Disassembler together for just **$49.95!**

Text Editor *Now You Can Write, Edit And Debug Assembly Language Programs—Fast And Easy—PLUS Give Your ELF II FULL WORD PROCESSING ABILITY!*

The ELF II Text Editor is one of the latest breakthroughs from Netronics. It gives you the ability to write, edit and debug extremely long programs with great ease and speed. It also gives you FULL WORD PROCESSING ABILITY—similar to that of sophisticated office machines. In fact, up until now it was almost impossible to find this text editing capability on *any* computer selling for under $5,000.

With the Text Editor you can write assembly language programs into memory so that they can be transferred as a file to a cassette tape for storage. You can then reload this file for review or modification.

Since the Netronics Text Editor features a *character* identification format, to edit a program you simply indicate the word or letter that you're interested in and the Text Editor will find that section of your program automatically and display it on your video monitor. If you're looking for a letter (or word) that appears more than once, the Text Editor can locate each of these instances, one after another. You can then edit the appropriate lines to your new specifications.

The edit commands include FIND, FIND & SUBSTITUTE, MERGE, APPEND, INSERT, HORIZONTAL TAB and many others, all on a character or name basis.

When you're working with programs that can easily run 1,000 lines or more, the Text Editor is a tremendous help because of its ability to locate any program instruction automatically, without your having to scan the program line by line.

And, because ordinary English words are "text" too, the Text Editor gives you full word processing ability. As you type, your text appears on your monitor where it can be read and edited. You can make additions, deletions or changes. Then, when everything meets with your complete satisfaction, signal your recorder or printer to store or type out a final draft, perfectly neat and error free.

For example, if the file stored on cassette tape is a letter in which you have asked a manufacturer for a price quote on green T-shirts for your computer club and you suddenly decide that you want to inquire about red T-shirts instead, simply use the FIND command, asking the Text Editor to "FIND (green)." The line in which the word "green" appears will be displayed on your monitor. Simply move the cursor to the "g" in green, delete "green" and type "red" instead. The Text Editor will automatically close up the extra space between the word "red" and the text which follows. Using various edit commands, whole paragraphs can be added, deleted or entirely rewritten.

Your Text Editor can also personalize form letters by automatically inserting individual names and addresses from a mailing list. You can create and maintain an index file system, maintain a mailing list, and even store kitchen recipes for instant recall.

If, for example, you have a file on cassette tape consisting of recipes, and you have a chicken in your refrigerator, you can ask your ELF II with Text Editor to "FIND (chicken)." One chicken recipe after another can be displayed on your monitor for your inspection. Then, when you have made your decision, signal your printer to obtain hard copy of the particular chicken recipe you want.

On a more serious note, finding and modifying sections of your assembly language program becomes a breeze with the Text Editor. For the ultimate in convenience the system uses two automatically controlled tape recorders. Just switch one to record and one to play and your Text Editor is ready to operate.

The Text Editor can move your program either forward or backward. Lines and characters are located, inserted, deleted or changed via a moveable internal pointer. The position of the pointer and the operations to be performed relative to its location are controlled by using 22 alphanumeric commands which can be strung together in macro-like fashion—for *superlative* editing capabilities!

Text Editor requires 8k RAM, Video Display Board and tape controller. Schematic for simple to build tape controller board is included. Dual Tape Controller Board kit with all components is now available from Netronics (see below).

Text Editor on cassette tape..... **$19.95**

Assembler *Now You Can Produce Machine Language Programs For ELF II "Automatically"!*

Assembly language allows you to work with *concepts* without getting bogged down in machine language detail. One assembly language instruction may encompass a number of machine language steps.

Assembly language also gives you the advantage of semi-English *mnemonics* which clue you to the significance of each of your instructions. Thus, when you review a program, you can spot errors with greater ease.

Assembly language is a great aid in program development, even if you *hand* assemble your programs. But, with an *assembler,* developing programs in assembly language really becomes a breeze.

The assembler takes mnemonic assembly language instructions and automatically translates them into the hexidecimal machine code steps your computer must execute to comply with your command. This translation is carried out so as to use the minimum amount of memory possible.

Assembly language is a *development* language, it allows you to *generate* machine language programs that will run without the extra memory that an *interpreter* language (such as BASIC, FORTRAN, COBOL, etc.) requires. When you use assembly language as a development tool, extra memory is required only as a tool to develop the program. Once the program has been written, you no longer need the extra memory to make it run. On the other hand, with an interpretative language, the program *cannot* be run without the memory consuming the interpreter.

The following light hearted example may help you to understand the distinction between a development language such as assembly language and an interpretative language such as BASIC.

Imagine that your dog has just treed the neighbors' cat. You must rescue the cat. Here are three possible ways in which you could do it—

1. You shinney up the tree, grab the cat and climb down again. You have solved the problem but a good pair of pants have been ruined and your hands have been badly clawed.
2. You place a ladder against the tree, climb the *ladder,* rescue the cat, climb back down again, *and put away the ladder!*
3. You call out Pharaoh's chief engineer who proceeds (with the help of 200,000 "volunteers") to recreate the Great Pyramid of Giza with the tree branch at its apex. When the work is finished, the cat is easily rescued. The pyramid remains as a monument to your efforts.

Example #1 illustrates machine language—the most elementary and economical way to get the job done.

Example #2 illustrates assembly language—a higher level language that gets the job done... and then allows the removal of the "ladder" (i.e., extra memory!)

Example #3 illustrates an *interpretative* language such as BASIC. The procedure is no longer elementary nor is it economical. Yet once the pyramid has been built, it now becomes possible to easily rescue any cat, dog, monkey or goat that should happen to get caught up the tree.

The term "economical" as used above refers to the amount of memory that is required to run a program. Machine language allows us to write programs that will run in the least possible amount of memory.

In assembly language, we need extra memory for the assembler. But, once the assembler has done its thing, it can be removed along with the memory that it required. We are left with the exact same machine language program that we would have written had we been using machine language all along *...but assembly language enables us to get the job done a whole lot faster!*

BASIC (FORTRAN, COBOL, etc.), on the other hand, require extra memory which *cannot* be removed after the program has been written. This memory must remain in order to interpret the operator's instructions (which he gives to the computer in BASIC, FORTRAN, COBOL, etc.) to the computer... which understands only machine code!

An *assembler* automatically converts assembly language into hexidecimal machine code. The Netronics Assembler for ELF II gives you the added advantage of being able to add *comments* to your program. This means that when you go back over them, not only will you be reminded of what you actually did (by the semi-English mnemonics), you'll also have comments in *plain English* to remind you of what you were *trying* to do!

The assembler also *compacts* your programs automatically into a minimum amount of memory. Ordinarily when writing a program you would leave extra memory between sections for steps that were accidently left out. But, with the assembler, mnemonics can be defined for registers and memory locations so that address changes can be made automatically when additional instructions are added to your program or parts of your program are moved around or deleted.

By using assembly language techniques, you develop a far greater understanding of programming. Assembly language is the key to writing longer, more sophisticated program *without* BASIC. Up until now it was almost impossible to obtain an assembler, unless you had a computer costing $5,000 or more. But, with ELF II, you can use assembly language and have an assembler to automatically translate it into hexidecimal machine code... and give you *comments* too!

Assembler requires 4k program space with a suggested minimum of 8k operating space. Also required are the Video Display Board, Text Editor and tape controller board. Schematic for tape controller board is included. Dual Tape Controller Board kit with all components is now available from Netronics (see below.)

Assembler on cassette tape..... **$19.95**

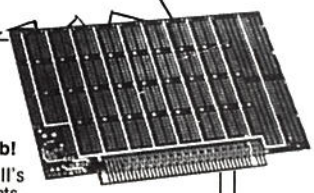
NOW! With These Breakthroughs From RCA And Netronics,

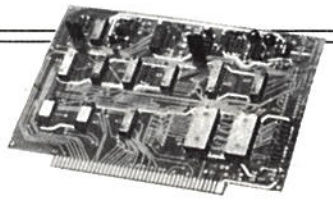
ELF II Explodes Into A Giant!

When you're learning to use a computer, you want to concentrate on learning machine language and the particular instructions that your computer will execute. You don't want to get bogged down with accessories. But, once you've taught yourself computer fundamentals, you want POWER . . . and ELF II can give it to you!

Expanded, ELF II is a perfect computer for solving complex industrial, business and scientific problems. You'll also find countless household and hobby applications for its advanced capabilities. And, when you want to relax, ELF II will entertain you with exciting electronic games.

ALL ELF II EXPANSION PC BOARDS PLUG DIRECTLY INTO ELF II'S EXPANSION BUS.





GIANT BOARD™

Let's ELF II Control Events In The Outside World!

Plug the GIANT BOARD™ into ELF's expansion bus and your $99.95 trainer becomes the heart of a powerful system. The GIANT BOARD™ lets ELF II "talk" back and forth to devices in the outside world. ELF II "listens" to their problems and tells them what to do.

The GIANT BOARD™ includes a system monitor/editor that works on all 64k bytes of possible memory. The monitor will search the entire memory for a particular instruction and tell you its address.

Using the monitor, you can examine and change the memory content at any location. An automatic scanning feature lets you locate and change or eliminate an incorrect instruction without stepping your way through the program. This is an extremely helpful feature for debugging.

Both the low order address and its memory content can be displayed, one after the other, on ELF II's built-in dual 7-segment display. The monitor is also programmed to allow you to begin execution of your programs at any location, so you can store a number of programs simultaneously and make use of every byte of memory you've paid for.

A cassette I/O routine lets you record programs on an ordinary cassette. A cassette read/write instruction allows dumping and loading programs from address to address. This is a very convenient feature when you want to move entire blocks of memory. The system includes a fail-safe device and will not indicate that a program has been properly loaded unless, in fact, this is the case.

The ELF II GIANT BOARD™ also includes two 8-bit parallel I/O ports with handshaking. This allows you to connect the ELF II to a printer and ASCII keyboard or any 8-bit parallel interface. In fact, the Netronics ASCII keyboard plugs right in. The serial RS 232 and 20 ma. TTY I/O's let you hook on to printers, terminals or any serial I/O device.

Using the GIANT BOARD™, ELF II can also be interfaced with dozens of other I/O's including photoelectric paper tape strip readers, input line scanning circuits, photocells and switches.

ELF II GIANT BOARD™ kit $39.95

wired & tested $59.95

Kluge (Prototype) Board

Let's You Wire ELF II Into Hobby Projects Or Use ELF II For One Experiment After Another In The Lab!

The ELF II Kluge Board gives you a quick, simple way to tap ELF II's resources for hobby applications and laboratory experiments, without having to wire your circuits permanently to ELF II's components.

This glass epoxy G-10 pc board has gold plated connectors and accepts up to 36 IC's including 40, 24, 22, 18, 16 and 14 pin. Space is available for an onboard regulator.

With the ELF II Kluge Board, you can put ELF II to work for you solving specific problems such as operating a more complex alarm system or controlling a printing press, etc. The Kluge Board gives you tremendous flexibility so you can use ELF II for one special application after another.

Kluge (Prototype) Board $17.00

4k STATIC RAM BOARDS

For more memory, add 4k RAM boards and write longer programs . . . or write 2, 3, 4 or even 5 programs or more in a single 4k memory card. This tremendous memory potential means you can use ELF II simultaneously for several different tasks. For example, with one single 4k memory card you can create an alarm system, a telephone dialer and a real time clock.

Expand ELF II's Memory!

The ELF II 4k RAM is mounted on a deluxe glass epoxy pc board with gold plated connectors. It uses low power 2102's, is fully buffered and decoded, features page selection in 4k blocks, anywhere in memory, and is complete with onboard regulator. Chip select circuit allows original 256 bytes of memory to be used too. 4k RAM requires ELF II Expansion Power Supply or 500-mA from a 5 or 8 volt source.

4k Static RAM kit $89.95

wired & tested $114.95

execute. Each of the 1802's capabilities is explained carefully and thoroughly along with hands on examples you can follow.

You'll learn I/O and branches, register operations, computer arithmetic and logic, control instructions, interrupts, DMA and video graphics, all in machine language — the fundamental language of computers. Terms that may be unfamiliar to you now are made simple. There's nothing in the *Short Course* beyond the average reader's grasp. The self-teaching format was designed for enjoyable home study.

The *Short Course* was written for Netronics by well-known author/engineer Tom Pittman and was intended for laymen — even novices — as well as for programmers and engineers with a computer background. Technical terms are explained to the reader in plain English. Concepts are simplified so you get a good foundation in the basics.

With our *Short Course* under your belt, you'll be able to write and run your own machine language programs — and machine language is the fundamental language of computers. Never again will you be limited to a manufacturer's library of predeveloped software. Now, if you can't find a predeveloped program to serve your needs, you'll be able to write the program you want yourself.

Our *Short Course* won't make you a professional programmer but it will teach you everything there is to know about using an ELF II and a lot about computers in general. Our *Short Course* will teach you how all computers "think" and how to frame problems so they can be solved by a computer. It will also help you spot situations where a microprocessor (costing just a few dollars) can solve $100,000 industrial problems.

Our *Short Course* was written specifically for ELF II owners but it will help you master any RCA COSMAC. And, once you've learned computer fundamentals with ELF II, you'll find it a lot easier to get on top of any computer they throw your way.

A Short Course On Microprocessor And Computer Programming by Tom Pittman $5.00

Professional ASCII KEYBOARD

The ELF II ASCII Keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulator, parity, logic selection and a choice of four handshaking signals that will mate the keyboard with almost any computer in addition to ELF II.

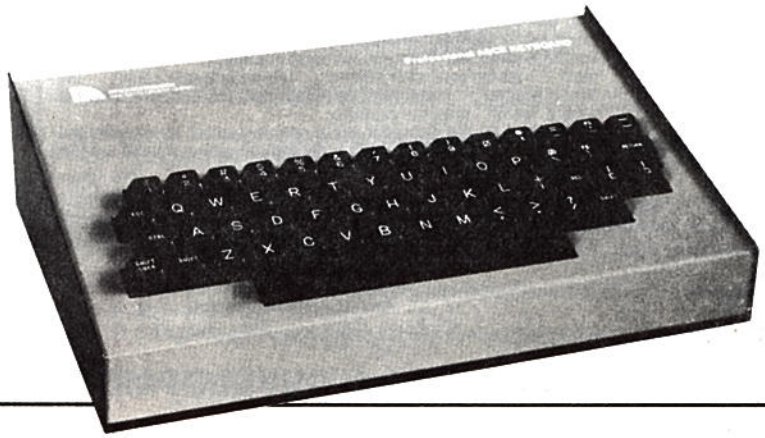
The ELF II ASCII Keyboard comes complete with a connector that plugs directly into the ELF II GIANT BOARD™. It takes its power from the ELF II Expansion Power Supply or the original wall mounted ELF II AC power supply.

The board is glass epoxy and the ELF II ASCII Keyboard is first class in every way.

ELF II ASCII Keyboard kit $64.95

wired & tested $89.95

Deluxe IBM Blue And Black Steel Enclosure $19.95



ELF II Tiny BASIC on cassette tape with complete documentation including 2 free games (tic-tack-toe and a drawing game) .....

$14.95

ELF II Tiny BASIC . . .

Once you've learned computer fundamentals, you'll want to graduate to a higher level of programming. To help you, Netronics ha developed a Tiny BASIC for ELF II. With it, you can program ELF II with simple words that can be typed out on a keyboard such as PRINT RUN and LOAD. ELF II responds by displaying answers on a printer, video monitor or TV screen.

Armed with ELF II and BASIC, programming becomes a breeze because ELF II Tiny BASIC translates routine instructions into machin language for you, a lot faster than you could possibly type them into ELF II yourself.

ELF II Tiny BASIC is compatible with either ASCII keyboard and TV screen or standard teletype/video terminal utilizing RS 232-C or 2 mil TTY interface. Commands include SAVE and LOAD for storing programs on standard cassettes, a PLOT command to display graphi information and special commands for controlling ELF II I/O devices.

Tiny BASIC also includes 16-bit integer arithmetic, ±, ×, ÷, ( ), 26 variables A-Z, LET, IF/THEN, INPUT, PRINT, OUT, GO TO, G SUB, RETURN, END, REM, CLEAR, LIST, RUN, PEEK and POKE as well as a random number generator and automatic error messag display.

PEEK and POKE let you switch back and forth from BASIC to machine language so that you can program ELF II at maximum speed without sacrificing the flexibility of being able to modify or supplement a program.

The Netronics Tiny BASIC also includes the alphanumeric generator that is required to display alphanumeric characters directly on you TV screen without an $800 terminal or the other hardware some BASICs require. Netronics has simply built the character generator int the program.

ELF II Tiny BASIC comes with an excellent user's manual. 4k memory is required.

Short Course On Tiny Basic by Tom Pittman

This "how to" book, written specifically for the ELF II, teaches you to program in Ti BASIC and includes sample programs illustrating simple checkbook balancing, conve ing decimals to roman numerals, plus plotting complex parabolic and hyperbolic curv (or any function) on your TV screen. It's an indispensible step-by-step text for getting t most out of basic.

Short Course On Tiny Basic ..... $5.(

EXPANSION POWER SUPPLY

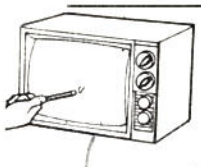
The ELF II Expansion Power Supply gives the ELF II system the reliability and stability required for optimum performance. All components are of the highest quality to provide ± 8 volts DC at 5 amps (unregulated) as well as a 7 volt AC output for timing and other power applications.

The heavy duty unit is fused and includes selector switches which take into account varying line voltage and load conditions, 25 amp rectifier and a deluxe IBM blue and black steel cabinet.

The ELF II Expansion Power Supply powers the entire ELF II system and is required when adding 4k RAM boards.

ELF II Expansion Power Supply kit $39.95

wired & tested $54.95



New! Our Fantastic ELF II Light Pen.. $7.95

Lets you write or draw anything you want on a TV screen plus play exciting games with just a wave of the "magic wand"!

If Building A Kit Worries You . . . Read This!

You don't need any special skill or manual dexterity to assemble one of our highly simplified Netronics ELF II kits.

Remember, the large electronics firms hire young girls in Asia, Mexico and South America to do much of their difficult assembly work.

Many of these assemblers can't read or write. Many live in primative homes without electricity or running water. Yet, by following simplified instructions, they are able to assemble highly sophisticated computers — and so can you!

The step-by-step instructions that come with Netronics kits are simple and clear. You'll have no trouble with them. They have already been used successfully by thousands of beginners who started with little or no kit building experience.

All components mount directly to rugged, high quality pc boards. Ordinary kit builder's tools are all you need — soldering iron, solder, needle-nose pliers, wire snippers, screwdriver — you probably have them already.

The $99.95 ELF II can be assembled in a single evening and you may even have time to write and run a few programs before going to bed. Other Netronics kits are just as simple. All our instructions are extremely clear.

And, as if all that weren't enough, the help that's always available from our **Service Department** further guarantees your success!

ELF II and all ELF II add-ons are also available wired and tested.

A New Breakthrough In Small Computer Technology!

ELF-BUG™ Monitor

Lets You Debug Your Programs With Lightening Speed!

As your programming skills develop and your programs become more complex, debugging becomes more of a problem. To help you debug programs with lightening speed, Netronics has developed a monitor system on cassette tape that's perhaps the most advanced small computer monitor on the market today.

The design eliminates the need to single step through a program to find the contents of the internal registers of the microprocessor. By simply adding break points, you display on your TV screen the contents of all the registers at any point in your program, so you're never in doubt about what's happening inside the microprocessor.

The auto scrolling monitor program will also display 24 bytes of memory with both high and low order addresses on your TV set or monitor and generate a cursor under a byte when it's being changed. The ELF-BUG™ Monitor also has the ability to run a program from any spot in memory. When break points are used to display registers, cutting back into the program is facilitated by reestablishing both X and P registers.

Developed by Netronics as part of its ongoing committment to the ELF II program, the ELF-BUG™ Monitor is the ultimate in programming debugging. It's as essential to the beginner as it is to the pro and it makes ELF II even more useable by both engineers and students.

The key to debugging is to know what's inside the registers and no other product on the market gives you that information, plus the ability to make corrections, with such exceptional speed!

ELF-BUG™ Monitor on cassette tape with complete documentation $14.95

SOON TO BE RELEASED!

Analog to Digital, Digital to Analog Converter

Extend ELF II's ability to deal with events in the outside world! The ELF II A-D, D-A Converter assigns discrete digital codes to continuous analog events such as changes in voltage, resistance, temperature, lighting, water level, etc. so that ELF II can vary the speed of a motor . . . the lighting in a room . . . the temperature in a freezer . . . the water level in a tank . . . the pitch of a rudder . . . the angle of a steering wheel, etc. — instead of having a mere "on-off" response capability.

ELF II's A-D, D-A Converter has an infinite number of industrial and hobby applications. And, if you're really into computers, you can use it to build your own robot!

Controller Board

. . . And More!

ELF II was recently used by a leading Midwestern TV station to predict election results . . . And ELF II was correct!

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