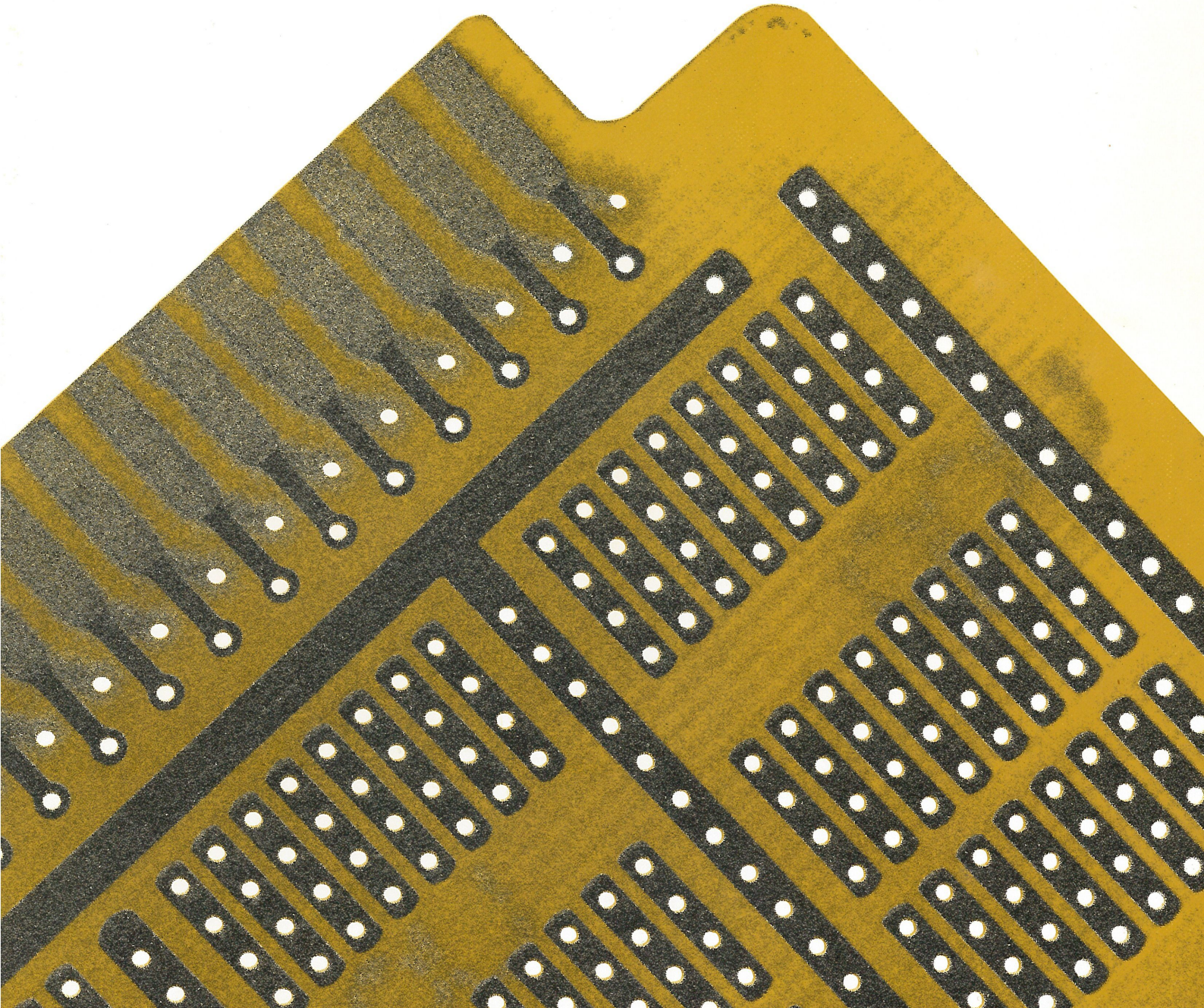
ARTEC ELECTRONICS

Centurion Microcomputer System • S-100 Microcomputer Products
General Purpose 44-Pin Breadboards • Custom Printed Circuit Boards



Microcomputer Products . . .

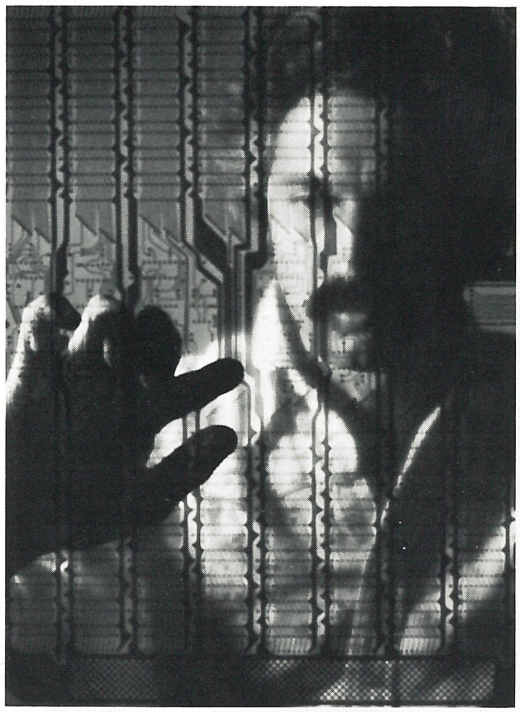
. . . precision built for designers and industry since 1972

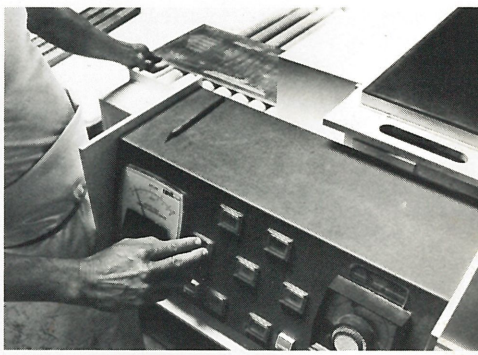
Founded in 1972 as a manufacturer of essentially hand-crafted prototyping breadboards for electronics designers, Artec Electronics has steadily grown and expanded to serve an ever-increasing demand for reliable products at a reasonable cost.

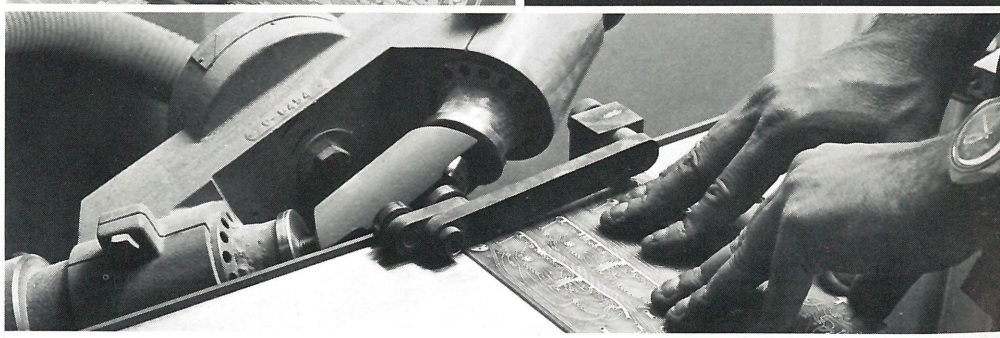
The atmosphere established at Artec in the very beginning—that of a small, closely knit "family" of craftsmen—has remained with us ever since. And, although our manufacturing operations now feature the latest equipment and techniques, the sense of personal pride and quality workmanship still is built into every Artec product.

Today, Artec manufactures a range of products to serve the computer hobbyist, industrial designer and business user alike—from standard prototyping boards to custom printed circuit boards, and from fully assembled microcomputer system cards to the new Centurion microcomputer.

Through the years, Artec has established a sound reputation as a consistent and dependable supplier. This dependability extends from meeting customer product specifications to meeting delivery commitments so that our customers can plan their schedules confidently, knowing that their Artec order will be accurate, complete and will arrive on time.







Standard or custom designs

Custom work continues to be an important part of Artec's business, and a large number of the standard products we manufacture initially were produced as custom designs for specific one-time needs. Our custom PC boards (see page 10) are manufactured to exacting customer specifications, on a flexible schedule to meet customer needs. And we maintain a large inventory of general purpose 44-pin designer products for immediate shipment (see pages 8 and 9).

Even our Centurion microcomputer can be customized with add-on RAM memory, and with several choices of floppy disc drives (see page 4).

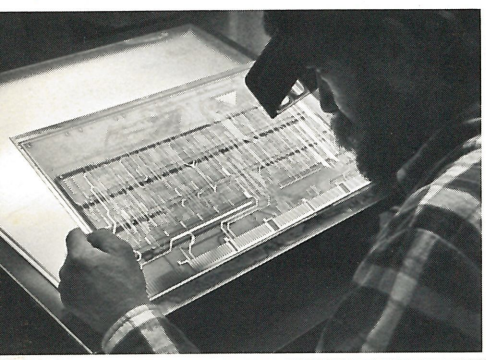
Or you can assemble your own microcomputer starting with Artec's unique Totally Silent Motherboard and building from Artec's broad range of S100 cards and accessories (see pages 5 through 7).

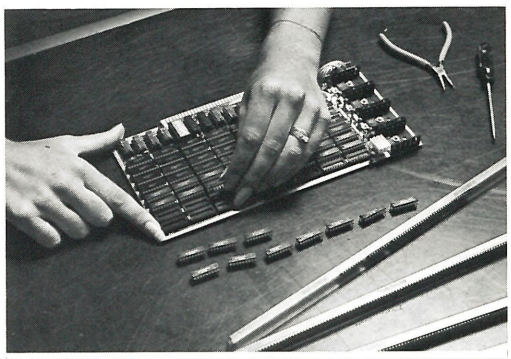
Continuing product development

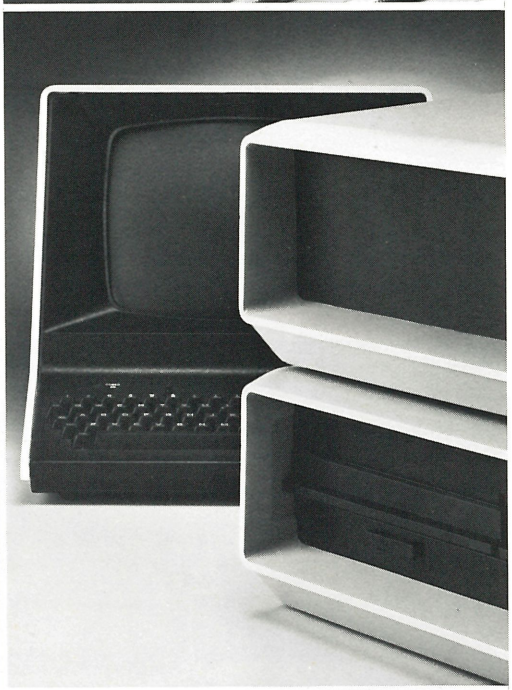
Artec's product line continues to expand to serve the needs of our customers. Recent additions include memory and other cards for both the LSI-11 and SBC systems (see page 7).

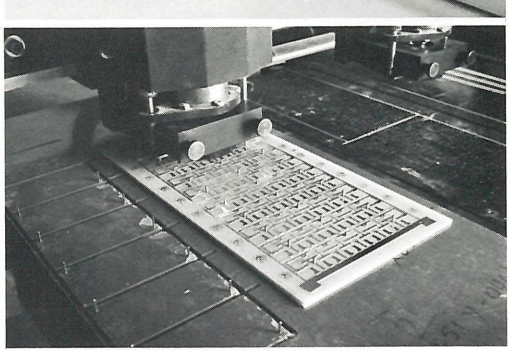
We welcome new ideas and suggestions from our customers, and we will be happy to discuss modifications of our standard products to meet your specific needs.

Whether you need three boards or a thousand, or a complete, ready-to-go Centurion microcomputer, give us a call. We'll do our best to meet your needs.









A. Precision photographic inspection.

B. Final touch-up of stencil prior to silkscreening.

C. Chamfering edges of gold tips for easy card insertion.

D. Conveyorized etching process.

E. One of three numerically controlled drilling machines.

F. Final quality control inspection.

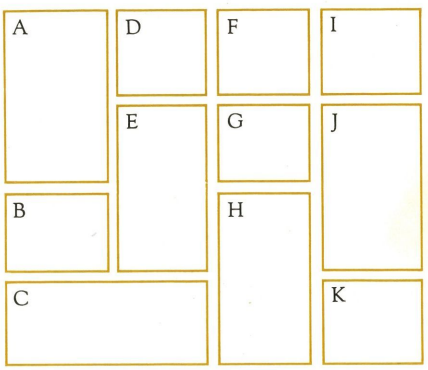
G. Silkscreening operation.

H. Sanding process prior to electroless plating.

I. Assembly of S100 microcomputer boards.

J. Centurion I microcomputer system.

K. One of three precision N/C routing heads guarantee accuracy and reproducibility.



Centurion Microcomputer System

The new Centurion 5 MHz microcomputer packs a lot of power and versatility into a small, rugged package.

It's built around the Intel 8085A-2 5 MHz microprocessor, and provides 64K bytes of RAM memory. The Centurion will operate a CRT screen and up to four 8″ Shugart disc drives (one-sided, double-density) or two 5¼″ drives (two-sided, double-density), making it an extremely versatile tool.

The Centurion system comes complete with its own software package, and is supplied with the Hazeltine 1500 CRT terminal (standard) or the Hazeltine 1420 CRT terminal (optional—contact Artec for price). And it's compatible with any RS-232 printer. The entire Centurion system is warranted by Artec for six months against defects in materials and workmanship.

Designed specifically for industrial applications, the Centurion is ideal for industrial and process control applications, business processing, or personal computing using Fortran, basic or machine language.

The Centurion system is available in three configurations as described below.

Centurion I: processor and two 8″ disc drives in separate enclosures. Includes:

- 5 MHz 8085A-2 CPU board
- 16-slot shielded motherboard
- 16K PROM board (2708 PROMs)
- Floppy disc controller
- CP/M* operating system
- Two 32K RAM memory boards
- Two 8″ Shugart disc drives (one megabyte)
- Enclosure with power supply for computer
- Enclosure with power supply for disc drives
- Hazeltine 1500 CRT terminal

Price..... $10,825.00

*CP/M is a registered trademark of Digital Research, Inc.

Centurion II: identical system except that both the processor and 8″ disc drives are housed in a single enclosure, with one power supply and an 8-slot motherboard.

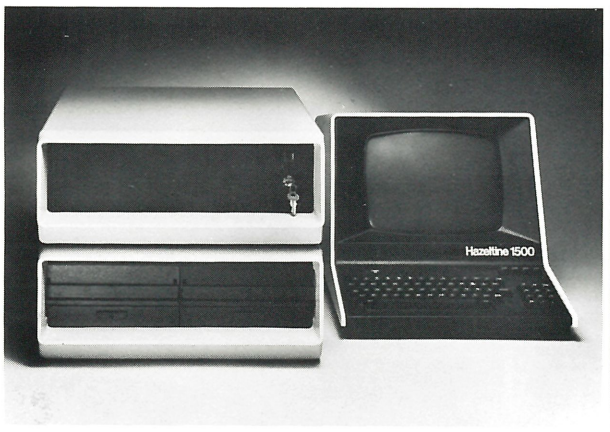
Price..... $9,500.00

Centurion III: single-enclosure system with two 5¼″ disc drives instead of the 8″ drives.

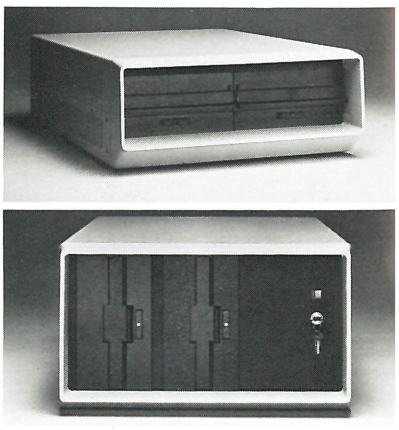
Price..... $8,025.00

An additional megabyte of disc storage may be purchased for either Centurion I or II (two 8″ drives in a separate enclosure).

Price..... $2,500.00



A. Centurion I microcomputer system includes 5 MHz processor, two 8-inch disc drives with 64K RAM memory, and Hazeltine 1500 CRT terminal.



B. Two additional 8-inch drives are available, for a total of two megabytes of RAM memory.

C. Centurion II system contains processor and disc drives in a single enclosure.

PRICE INCREASE: DUE TO T.I. PRICE INCREASE, ADD 20% TO FOLLOWING PRICES FOR RAM CARDS AND CHIPS EFF. JAN. 1, 1980

S100 Microcomputer Products

8–32K RAM Memory Cards	Kit	Assembled Tested & Burned In
Board & 8K of Memory	$150.00	$175.00
Board & 16K of Memory	265.00	315.00
Board & 24K of Memory	400.00	475.00
Board & 32K of Memory	525.00	620.00
8K Add on Kits	135.00	

TI TMS-4044 250 nsec Chips	
Quantity	Unit Price
1–24	$7.00
25–49	$6.75
50–74	$6.50
75–99	$6.25
100–499	$6.00
500+	$5.75

5 MHz CPU with monitor, math chip and on-board memory

Designed around Intel's 8085A-2 microprocessor, this CPU does it all. Hardware floating point performs math four times faster than other CPUs. A powerful, simple-to-use monitor in PROM memory lets you test memory, debug software and check the status of your program at any time.

For a scratch pad, the CPU uses 1K of RAM memory, sufficient for most simple control applications. Add-on memory is available. The card also features four vectored interrupts, variable clock frequency (2 and 5 MHz) and a phantom line. On-board DIP switches allow you to control two I/O ports at any baud rate from 75–9600 for use with either a keyboard or RS-232-C terminal.

Price $850.00

16K PROM memory card

The best cards start with the best components. Like the 2708 PROMs by Texas Instruments. And high-quality FR4 glass epoxy board stock, with fully buffered address and data lines, and plated-through holes.

You can choose from 0–4 wait states, selected by a DIP switch. You also can address any 4K group of memory to any 4K boundary. This bank-select feature permits you to control up to eight banks of memory.

Prices

Assembled board with 16 PROMs..... $300.00
Board and ICs only $125.00
PROMs, each ..... $ 11.00

Expandable 8–32K RAM memory card

TI's high-quality 18-pin 4044 RAM chip forms the basis of this superior memory card. You can start with just the board and 8K of memory, and add on as your needs expand.

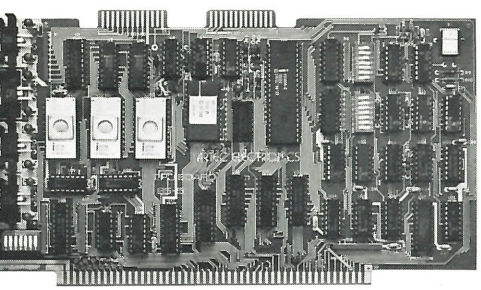
The board holds 32K of fully static memory. It features bank select and the same high-quality PC board construction that has earned Artec boards their outstanding reputation for long-lasting, trouble-free operation.

Prices (see chart)

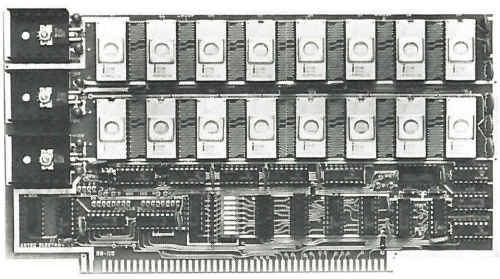
Disc Controller Card

Double-density disc controller card features IBM 3740 compatibility and the industry standard CP/M formatting.

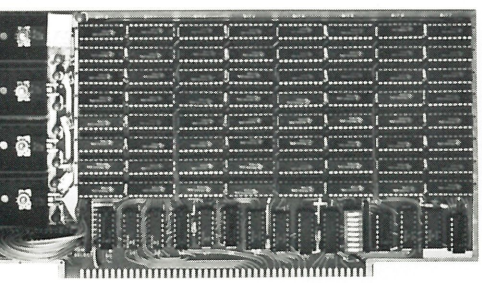
Price $325.00



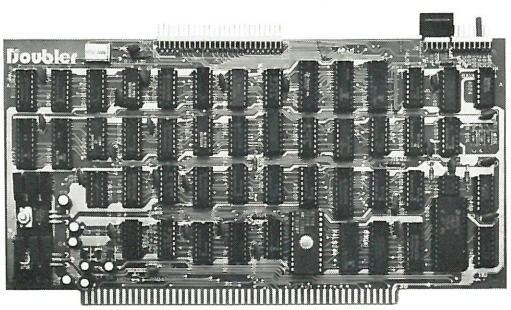
MHz CPU card



16K PROM memory card



-32K RAM memory card



Disc Controller card

Features—8–32K RAM card

- Maximum capacity: 32,768 8-bit bytes in 4K byte increments
- Access and cycle time is 250 nsec (compatible with Z-80)
- Runs at either 4 or 5 MHz
- Power requirements: operating +7.5 V to +10 V at 4 amps (standby 2.5 Vdc)
- Addressable in 4K increments within range of 0–65K
- Bank select: 1 to 8 banks, jumper selectable. Software controlled via output port 40 hex. Can be addressed up to 1/2 megabyte.
- All address and data lines fully buffered
- Compatibility: IMSAI Sol, Poly, Altair, North Star Cromemco, Xitax, Vector, Horizon, Digital Systems, Alpha Micro Systems, and more

S100 Microcomputer Products

The Artec S100 designer prototype breadboards offer the microcomputer designer or hobbyist new and better hardware than previously available. They are fully buffered and decoded for the S100 bus system, with switch-selectable data I/O components and addressing. The boards are manufactured to high quality specifications of FR4 glass epoxy, with plated-through holes, reflow solder plated circuitry, and nickle gold-plated connector fingers.

These boards are stocked for off-the-shelf delivery.

GP-100—Features include strobed data-in and gated data-out. DIP switch permits address selection in groups of four; four spare buffer gates and two spare DIP switch positions are provided. Will accommodate 14- to 40-pin ICs (maximum capacity 32 uncommitted 16-pin ICs plus generous room for bypass connectors). I/O can be by either DIP headers or Molex connectors. $22.00

WW-100—Similar to the GP-100, this card is designed for wire-wrap applications. Provides the same address decoding and buffering circuitry as the GP-100. Two regulator positions are provided for multiple voltage applications. Pad layout is uncommitted, permitting use of any type or size IC socket. Generous power and ground bussing provisions. $22.00

WW-100-R1 (has provision for external I/O connector) $22.00

WW-102—A copper-clad, uncommitted designer card. You mask and etch the card and drill the holes to suit your circuit requirements. $22.00

WW-106—This "pref" board provides the same address decoding and buffering circuitry as the GP-100. Holes are drilled on a 1/10th-inch grid, permitting wiring by the user. Accepts standard IC sockets or 1/4-watt components. $17.00

WW-108—This is the same card as the WW-106 except that the holes are plated-through. $25.00

EXT-100—Extender card, supplied without sockets installed. Can be supplied with or without a 100-pin edge connector.
Without edge connector $13.20
With edge connector attached $20.00

Parts kit—A standard parts kit is available for either the GP-100 or the WW-100, containing all components required for the buffering and decoding circuitry. Included are buffering and decoding ICs, a six-position DIP switch, resistor pack, regulator and heat sink, IC sockets and four capacitors. $13.95

Accessories

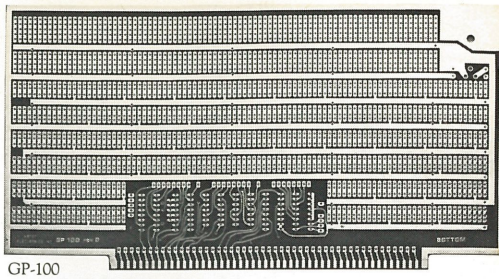
Motherboard—More than twice as thick as most motherboards available for the S100 bus, Artec's Totally Silent Motherboard is completely free from spurious noise at up to 5 MHz (see page 11 for technical description).
6 Slot ..... $ 91.00
8 Slot $101.55
10 Slot $115.00
12 Slot $131.00
16 Slot $190.00

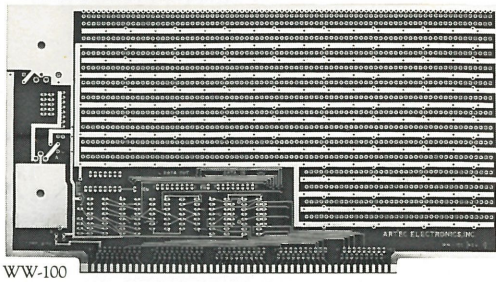
Card Cage—A rugged 12-gauge anodized aluminum card cage provides solid support and protection from vibration. Includes card guides.
6 Slot $30.00
8 Slot $35.00
10 Slot $45.00
12 Slot $55.00
16 Slot $65.00

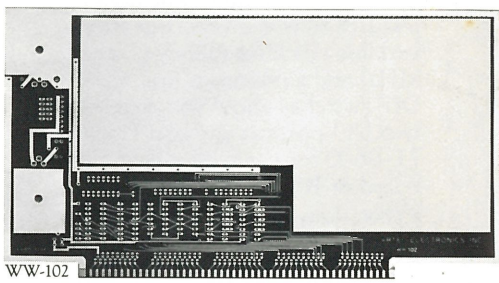
Power Supply—A 6″ × 6½″ × 10″ fully enclosed, ferro-resonant transformer with Schottky rectifiers for low power dissipation. $135.00

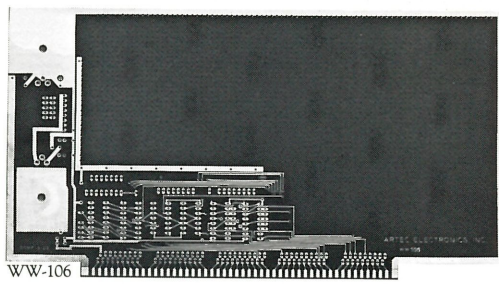
100-Pin Connectors—

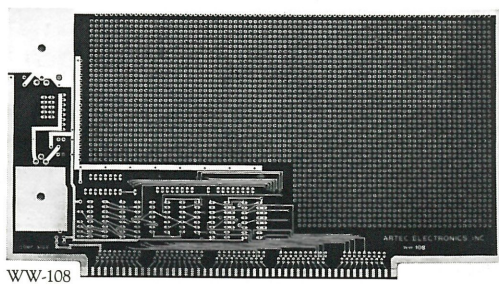
	1-49	50-99	100+
AE-100D DIP Plug-in	$5.50	$5.00	$4.50
AE-100E Solder Eyelet	$7.15	$6.65	$6.20

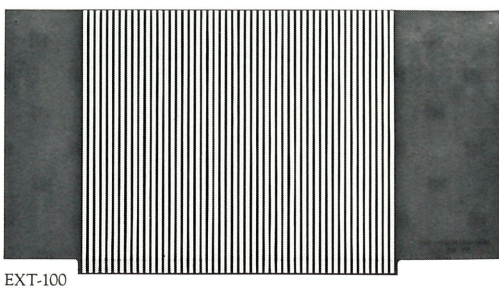

GP-100

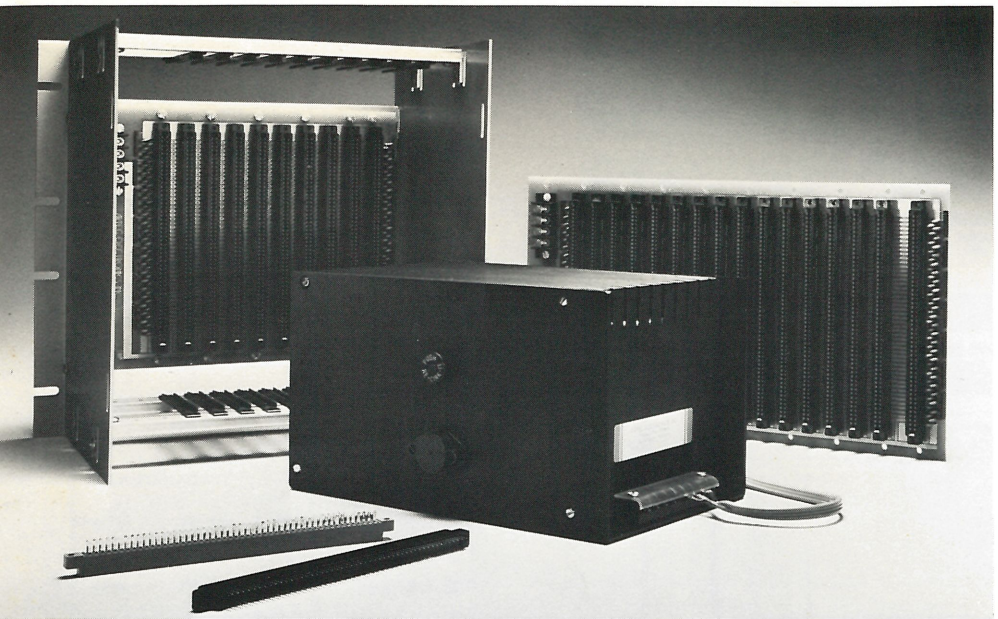

WW-100

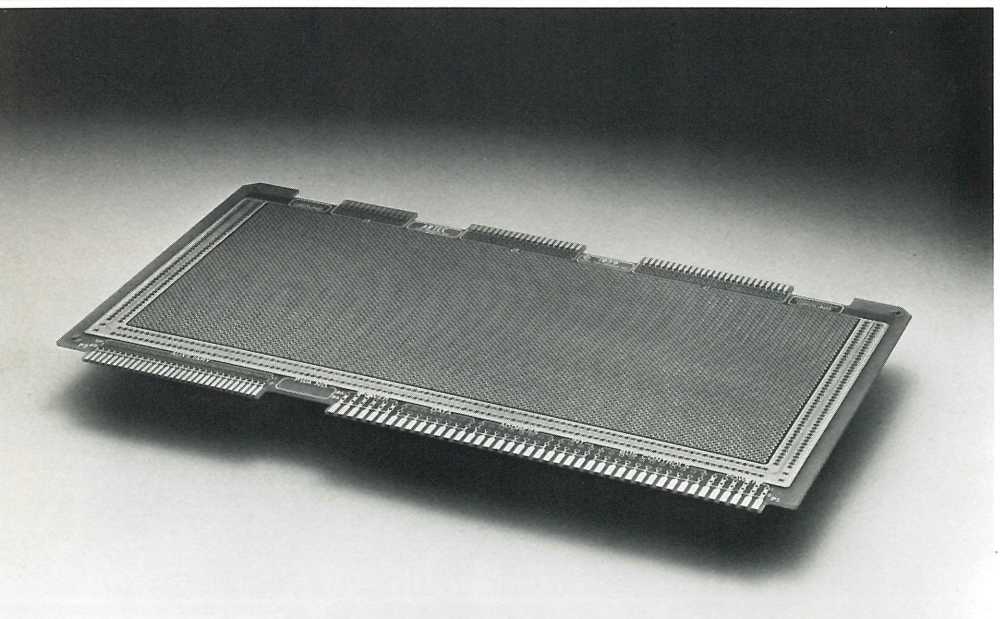

WW-102

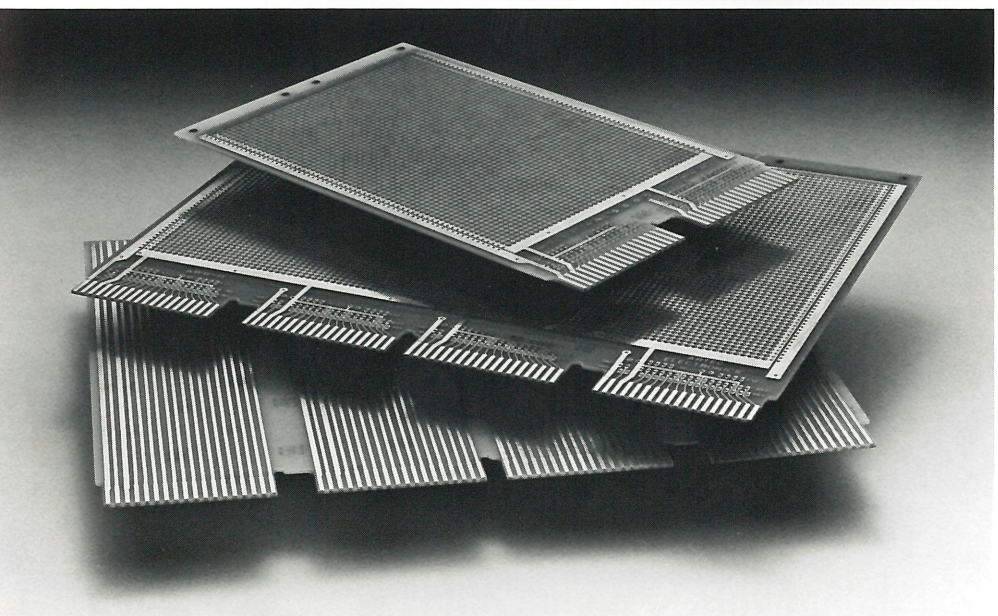

WW-106


WW-108


EXT-100







SBC System Cards

Artec is now in the process of final engineering on a new family of boards for use with the Intel Multi-Bus* that will offer improved performance characteristics and versatility over other available SBC boards. The following boards are scheduled for introduction in October, 1979. Contact Artec for details and prices.

Multi-Circuit Board (MCB): features of this basic prototyping board include two buses (+5 volts and user-specified); unique direct ground connection for low noise characteristics; bus bars mean no soldering, fast implementation; suitable for low-power Schottky memory devices.
Multi-Power Board (MPB): same characteristics as the MCB, with the addition of a 2″ × 2″ pad area in the lower right corner to accept most 2″ square dc/dc power converters.
Multi-Purpose Interface Board (MPIB): same characteristics as the MPB; user can design as either master or slave board; full complement of switches provided.
All Purpose Board: combines the characteristics of both the MPB and MPIB boards.
Multi-Memory Board (MMB): can accept any 24-pin byte-oriented memory, and user can short load and mix memory types on the same board.
Single Board Video Board (SBV-80): reduces graphic and alpha-numeric cards to one card; can scroll, pan, zoom and show oscillographic trends; high resolution 9 × 7 dot matrix; forms a glass keyboard when used with a light pen; applications oriented for medical monitoring, computer simulations, layouts, schematics, etc.

*Multi-Bus is a registered trademark of Intel Corporation.

LSI-11 System Cards

Two new general purpose wire-wrap circuit boards and an extender board now are available for users who want to build their own LSI-11 I/O and memory systems. The LSI-11 is totally uncommitted, and can accommodate 130 standard 14-pin and 16-pin DIPs, plus all necessary passive components. Fully grounded on one side, with grounded shield on the circuit side.

LSI-11 (10.45″ × 8.4″) **$75.00**
LSI-11.5 (5.225″ × 8.4″) **$35.00**
LSI-EXT Extender card **$30.00**

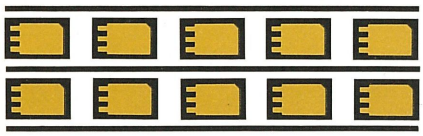
Two additional LSI boards—a memory card and disc controller card—are now undergoing final engineering for introduction in October, 1979. Contact Artec for details and prices.

Card cage, motherboard, power supply, edge connectors.

SBC Multi-Circuit Board (MCB)

LSI-11.5, LSI-11 and LSI Extender cards

General Purpose 44-Pin Breadboards

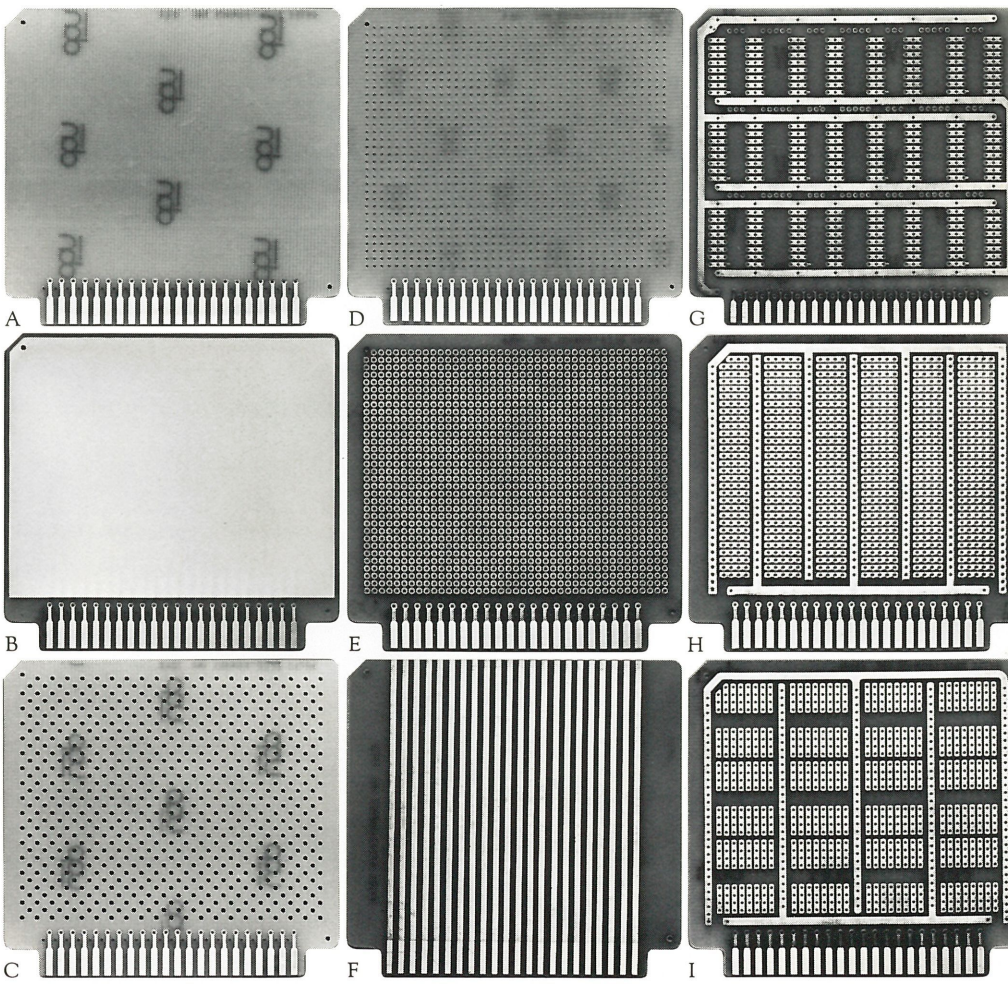


Wide selection of sizes and patterns in precision prototype boards

Artec 44-pin general purpose breadboards are available in a wide variety of configurations for maximum versatility for the electronics designer or hobbyist. And all are stocked for immediate off-the-shelf shipment.

All boards are made on a .062 glass epoxy base and have two-sided, gold-plated edge connector fingers on .156 centers. Circuit patterns are reflow solder plated and etched on one side only unless indicated otherwise. Holes for all boards are .038 ″ ± .002″, except for No. 104 which is

A. **100A** Blank Board
B. **102A** Copper Clad
C. **104A** Blank Board with .200 Grid Holes
D. **106A** Blank Board with .100 Grid Holes
E. **108A** .100 Grid Holes with Plated Through Pads
F. **110A** Extender Board
111A Extender Board with AE44W Connector
G. **116A** DIP—2-sided Pattern with Plated Through Holes
H. **118A** DIP and LSI
I. **120A** Basic DIP
121A DIP with IC Sockets
J. **122A** Wire Wrap
K. **118D** DIP and LSI



.067″ ± .002″, and No. 108 which is .038″ ± .002″.

The part number of each board indicates both pattern and size, and the accompanying charts provide dimensions and prices for each board and each size.

We welcome new breadboard ideas from our customers, and are happy to discuss modifications of standard boards to meet specific applications.

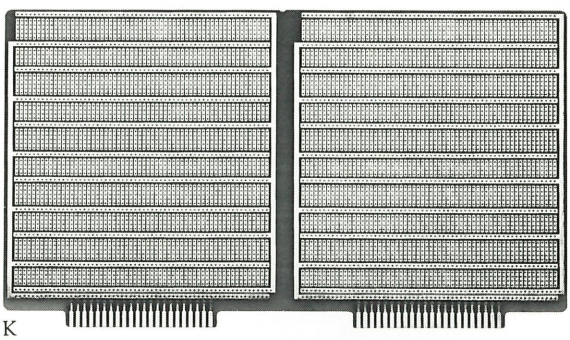
44-Pin Breadboard Prices

No.	A	B	C	D
No. 100	$ 4.75	$ 5.65	—	—
No. 102	$ 5.80	$ 7.15	—	—
No. 104	$ 6.95	$ 9.35	—	—
No. 106	$ 9.05	$11.55	—	—
No. 108	$12.65	$17.60	—	—
No. 110	$ 5.20	$ 6.50	$ 8.00	—
No. 111	$11.70	$12.95	$14.30	—
No. 116	$13.20	$19.80	—	—
No. 118	$ 9.60	$14.55	$22.00	$38.50
No. 120	$ 9.05	$12.35	$21.00	$38.50
No. 121	$24.35	$36.55	—	—
No. 122	$ 8.25	$12.40	$19.80	$30.80

Dimensions

A size: Width 4.50″, Height 4.25″
B size: Width 4.50″, Height 6.50″
C size: Width 6.50″, Height 7.50″
D size: Width 13.25″, Height 7.50″

J

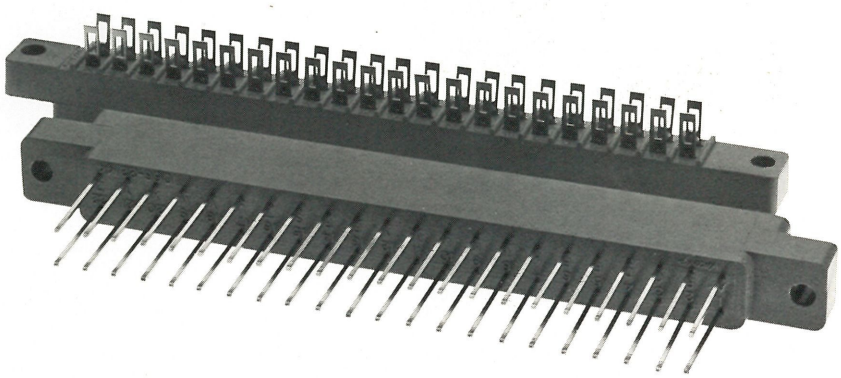


K

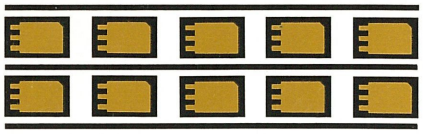
44-Pin Edge Connectors

Edge Connector Prices

Type	Part No.	1–49	50–99	100+
44-Pin Wirewrap	AE-44W	$6.60	$5.50	$4.70
44-Pin Solder Eyelet	AE-44S	$3.50	$3.10	$2.65



Custom Printed Circuit Boards



Custom printed circuit board manufacturing always has and continues to be of major importance to Artec, and accounts for a substantial portion of our investment in facilities, equipment and skilled personnel. We accept both large and small orders, and take pride in maintaining superior quality workmanship.

Our shop is highly automated and is organized for smooth, efficient work flow all the way from the photo department to final inspection and shipping. Yet, because so much of our work *is* custom work, we have never lost our dedication to the careful, personal attention to detail that makes the difference in quality.

For repeat orders, all we need to begin work is the quantity and the AE number assigned to the previous order.

Capabilities

- Original artwork preparation and photo reduction
- N/C or template drilling
- 10 mil line or space image definition
- .001" copper through-hole plating
- Infra-red tin-lead reflow
- Nickel/gold contact plating
- Solder mask or screen legend
- Terminal installation (we maintain a large in-house inventory of all types of terminals)

Prototype delivery

- 48 hours on three-board lots
- Three to four days for larger quantities
- 24 hour turnaround usually available on request

Production delivery

- One week for 50 boards or less
- Two to three weeks for full production runs

Specifications/Pricing Information

Pricing is done by computer for fast and accurate quotations for all quantities of custom boards. Being less understanding than we mortals, the computer *requires* the following information before it will complete its price calculations.

1. Quantity
2. Dimensions (width and length)
3. Gauge thickness of FR4 glass epoxy: 1/32, 1/16, 3/32, 1/8
4. Type: One side; two side; two side with plated through holes
5. Plating: Solder, solder/gold
6. Profiling: Number of slots, cutouts, punches, chamfers, etc.
7. Silkscreening: Solder mask, legend, none
8. Hole count and number of different hole sizes
9. Number of large holes (over .093) and unplated holes
10. Are camera reductions required (or will negatives be supplied)
11. Delivery turnaround required

This information will help ensure the accuracy and completeness of both our quotation and the final product, and will facilitate clear communications concerning your order. We will be happy to quote from either your prints or a verbal description.

Technical Description— Artec's Totally Silent Motherboard

The motherboard in your computer is probably its most important single component. All of the boards must communicate reliably over its signal lines. Because of the high frequencies present, each line must be a good radio frequency transmission line. If it is not, signal distortion can lower the noise immunity of the system and make it more susceptible to data errors.

The Artec Shielded Motherboard was designed using strip-line techniques. This is a technology developed for constructing RF transmission lines on printed circuit boards. Each line is bounded by a ground plane to ensure a proper impedance characteristic and to minimize coupling between adjacent lines.

Signal line termination

Because of inherent inductance and capacitance, each signal line is a resonant circuit. When there is an abrupt change in voltage on a bus line, it is shocked into resonance. The resonance, or ringing as it is referred to in logic circuits, will die out as the resonant energy is dissipated by the resistance in the circuits connected to the signal line.

The amplitude of the resonance and the rate at which it dies are determined by the value of the resistive component. This ringing can cause data errors on the bus. The optimum value of resistance which will minimize the ringing on TTL bus lines is approximately 100 ohms.

Passive termination scheme

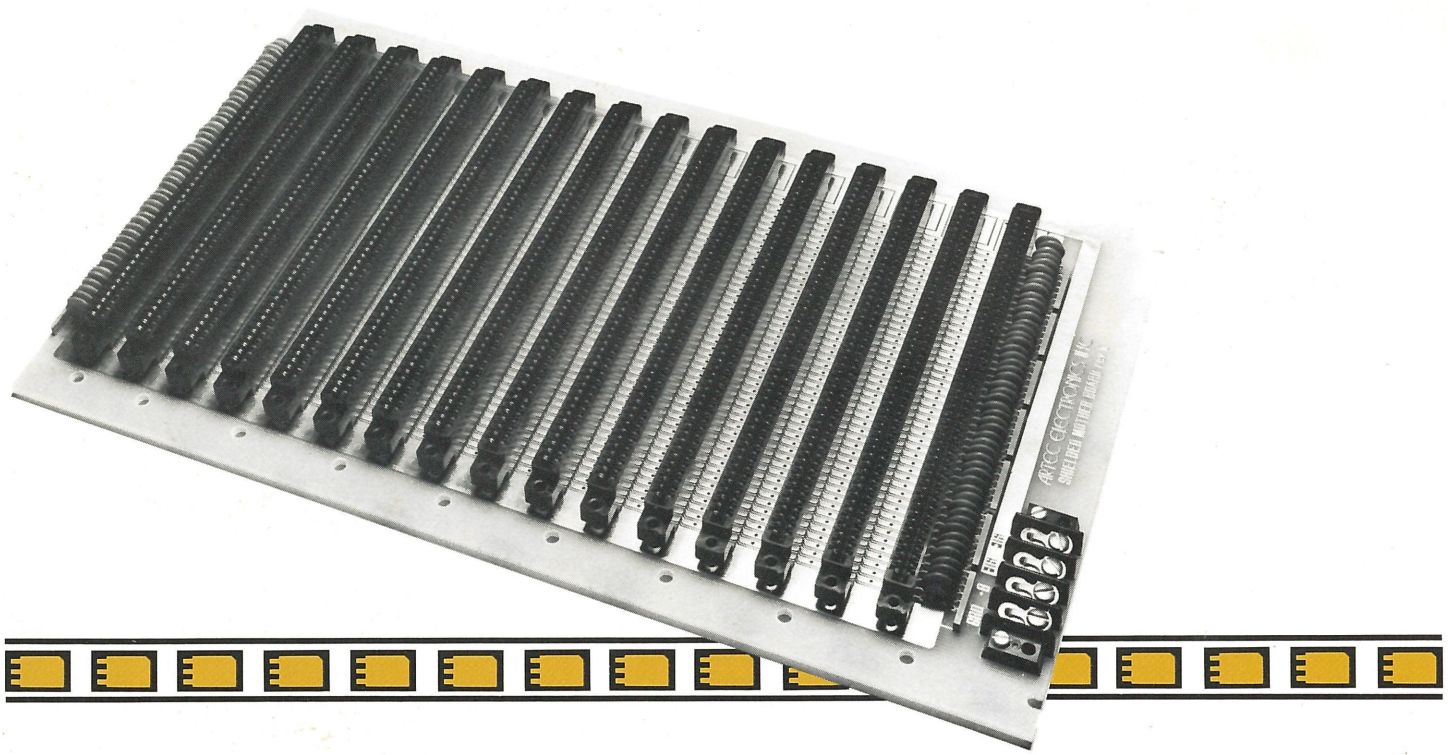
This all sounds very straightforward, but the 100 ohms resistance presents a problem. It cannot be tied directly to ground or +5 volts because the bus drivers cannot handle the 50 milliamperes resulting from this low resistance. To overcome this, a resistor divider scheme was devised for minicomputers which is a 270 ohm and 390 ohm resistor in series from +5 volts to ground, with the bus line connected to the junction of the resistors. This circuit is commonly referred to as a passive terminator. The equivalent resistance seen by the bus is 160 ohms. This value is a compromise; it provides a fairly good termination resistance and the bus driver must sink only 18.5 milliamperes in the zero state. This is not a very satisfactory solution for microcomputers for two reasons: (1) not all board manufacturers use bus drivers which can handle this much zero-state current, and (2) the power supply must supply current to 94 dividers.

The so-called active terminator is not much of an improvement. The passive terminator can be replaced by an equivalent circuit which is a single resistor connected to a supply voltage equal to the voltage at the junction of the two-resistor divider. The advantage being that the power supply current required is much less.

Artec's unique PRC terminator eliminates noise

The Artec PRC terminator provides an optimum termination impedance without putting undue strain on the bus drivers. It is an elegantly simple circuit which requires no power supply current. Each bus line is connected through a resistor and capacitor in series to ground. TTL signals have rise and fall times between 5 and 15 nanoseconds. The termination impedance seen by the bus line over this range is 100 to 168 ohms. Since there can be no dc current through this circuit, the zero- and one-state voltages are not affected. It also turns out that the optimum termination impedance should be lower for fast rise and fall times and higher for slow rise and fall times. Since capacitive reactance is inversely proportional to rise and fall time, the resistive/capacitive terminator automatically provides this optimum impedance.

The result is a unique motherboard design that eliminates all noise and ringing on the S100 computer bus, fits any standard chasis, is easy to install and requires no soldering.



Warranty and Customer Service

Centurion microcomputer system. The Artec Centurion microcomputer system has been skillfully engineered and carefully constructed using the highest quality materials and components available. Artec warrants the entire system (excluding the Hazeltine CRT terminals) for a period of six months from date of purchase against defects in materials and workmanship. Should you experience difficulties with any part of the system, give us a call and we will arrange for immediate repair or replacement as appropriate. The Hazeltine CRT terminals are warranted separately by the manufacturer.

Assembled S100 computer cards. The four assembled S100 computer cards (CPU, PROM card, RAM memory card and the Disc Controller Card) are warranted for one year from date of purchase for defects in materials or workmanship. Artec will repair or replace any card found to be defective upon receipt at Artec Electronics.

S100 breadboards, general purpose breadboards, custom printed circuit boards. In the event that any Artec board is found to be defective or does not meet specifications upon delivery, return it for replacement or repair.

It is our intention and expectation that all Artec products actually provide the service they were designed to provide, and we will do our best to assure that this actually occurs.

Ordering Information. Minimum order: $40.00 in merchandise. Sales terms: net 30 days to established Artec accounts. First time customers: COD, Mastercharge, VISA, money order, cashiers check or bank transfer. Personal checks are not accepted. California residents add 6.5% sales tax. All orders are FOB San Carlos, California. Add $5.00 for freight and handling in U.S. and Canada (freight and handling for Centurion orders will be quoted on request). Foreign orders: remit in U.S. dollars; include $20.00 for freight and handling.

Orders should be placed directly with our Sales Office in San Carlos, California. Phone (415) 592-2740.

ARTEC ELECTRONICS, INC.
605 Old County Road, San Carlos, CA 94070

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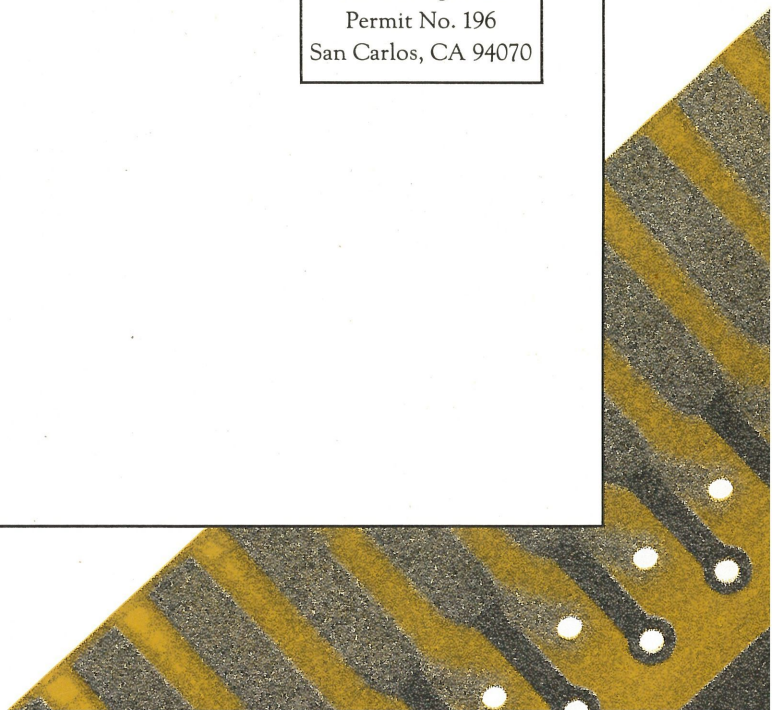

Printed in USA 9/79 (30M)