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APRIL 1981/95¢

An Oscilloscope Buyer's Guide
Expanding Microcomputer Memories
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Speed Control for Synchronous Motors



450864 CEM 0007C094 141D NOV82
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MA 01564 3DG

Machine
Tektronix T922 Dual-Trace Scope

MANUFACTURER'S SPECIFICATIONS

CRT

Display area: 8 × 10 cm (rectangular)

Phosphor: P31

Accelerating potential: 12.4 kV

Built-in graticule

Vertical amplifier

Deflection factor: 2 mV/div to 10 V/div,
12 steps, 1-2-5 sequence

Accuracy: +20°C to 30°C within 3%
0°C to 45°C within 4%

Variable range: continuous between settings.

Extends deflection factor to at least 25 V/div.

Frequency response: dc to at least 15 MHz.

Risetime: 23 ns or less

Chopped mode: approximately 250 kHz

Input impedance: approximately 1 MΩ/30 pF

Max. input voltage: 250 V (dc + peak ac)
500 V (p-p ac) at 1 kHz

Sweep Rate

Range: 0.5 s/div to 0.2 μs/div,
20 steps in 1-2-5 sequence.

Magnifier: ×1 to ×10

Accuracy (0° to +45°C): Unmagnified within 4%,
magnified within 6%

X-Y operation

Deflection factor: ×10 magnifier approximately 100 mV/div,
×1 approximately 1 V/div.

X-axis bandwidth: dc to at least 1 MHz.

Input impedance: 1 MΩ/30 pF

Phase difference between axes: 5° or less
from dc to 50 kHz.

Triggering

Sensitivity: 0.5 div internal or 100 mV external from 2 Hz to 1 MHz,
increasing to 1.5 div int. or 150 mV ext. to 15 MHz.

TV sync: composite sync 1 div internal or 100 mV external
(approximately 2.3 div or 230 mV composite video).

External trigger: max. 250 V (dc+peak ac) or
500 V (p-p ac) 1 kHz or less.

Input impedance: 1 MΩ/30 pF.

Level range: +0.5 to -0.5 V external,
+5 to -5 V external/10.

Power: 120/240 V, 50/60 Hz, 50 watts.

Environmental

Storage temp: -55 to +75°C.

Operating temp: 0 to +45°C.

Altitude: 50,000 feet.

Physical

Weight: approximately 15 lb.

Width: 7.09 in.

Height (to top of handle): 10 in.

Depth: 18.7 in.

Accessories: 2 probes, clear filter, manual.

Optional Accessories: plain and rainproof covers, stand,
1× probe, switchable 1×-10× probe,
100× probe, 1000× probe,
ac current probe, 10× dc to 35 MHz probe.

trigger syncs the sweep in accordance with the preset switches, NORMAL means manual adjustment of the triggering, while TV selects an internal TV-like sync clipper as the source of sync pulses. This latter position is useful for TV servicing. Trigger SLOPE can be either positive or negative, with the triggering point determined by the LEVEL control.

Like the vertical attenuator, the time base SEC/DIV switch is also arranged so that only the range in use can be easily read. Coaxial with this switch is a red-colored knob that allows sweep time magnifications from ×1 to ×10 between each step-switch setting. This latter control is used in place of the usual fixed sweep magnifier.

Mounted on the rear of the chassis, the Z-axis connector can be used to modulate the intensity of the traces with a positive-going signal causing a decrease in trace intensity. Discretely molded into the front panel are a series of slots for an optional camera or protective front panel cover. Each of the two P6006 Probes that come with the T922 are of the ×10 type, having an input resistance of 10 megohms, and a voltage rating of 600 volts dc, or 600 volts ac peak-to-peak and dc combined.

Accompanying each probe is a 12" and 5" ground lead having an alligator clip, a plastic probe holder, BNC tip, banana plug, probe tip hook, spring tip, and a pincher tip. The last five items screw onto the probe.

Probe compensation is accomplished by connecting the probe tip to the scope front-panel PROBE ADJ connector, loosening the probe locking sleeve, then

twisting the probe body until a clean square wave is displayed. After compensation, the locking sleeve is tightened.

The manual accompanying the T922 is impressive and contains everything you need to know for initial start-up, adjustments, service, etc. It is profusely illustrated and contains complete schematics, board interconnections, and a detailed parts list.

Comments. The manufacturer's own specifications for the T922 are shown in the Table. The instrument was checked by the Lockheed Instrumentation Measurements Lab., against standards traceable to the Nation Bureau of Standards. The lab issued a certificate testifying that the T922 meets or exceeds its claimed specifications in all respects.

We found the T922 very easy to use, with all controls clearly identified. At first, the small knobs felt a little uncomfortable, but we soon got used to them. Triggering quality was excellent, even on very short duration waveforms. Even after several hours of use, the scope ran cool.

The only flaw we found was a trace "ghost"—a faint defocused image that accompanies each trace and produces a faint background haze. Tektronix informed us that this "ghosting" is due to the use of 12.4 kV on their post acceleration CRT, as compared to the 2 to 3 kV usually used in scopes. This very high voltage gives the T922 its excellent writing speed but also knocks secondary electrons out of the CRT faceplate mesh element thus causing the haze. From where we sit, the haze is a very small

tradeoff for the writing speed. Never does it seriously obscure the traces.

During our dozens of hours of T922 use, we found the beam finder very advantageous when the screen "went blank" due to excessive manipulation of the trace position controls. That single pushbutton has saved many hours of pot twisting in search of a missing trace. We also like the trace brightness when examining some rather fast waveforms, and have found the T922 excellent for examining some of the fast waveforms on a disc-controller board. With our old scope, we had to darken the room just to get a glimpse of what was happening, but the T922 lets us work in normal room light. Even at the high brightness, the focus remains excellent. We also found the T922 capable of rock-steady sync at low-amplitude high frequencies.

The clearly identified controls have positive detents to permit easy setting. We also found that keeping the front-panel clean is a snap—all you need is a small sponge and warm water.

The relatively light weight of the T922 has allowed us to take the instrument into the field. It has withstood being bounced around in a van with no damage.

We find the T922 a well-balanced combination of accuracy, ruggedness, versatility, and human engineering. It is a bit more expensive than some of the "low-cost" dual tracers available, but the difference, in our opinion represents money well spent. Without a doubt, the instrument delivers value for its cost.

—Leslie Solomon.

CIRCLE NO. 104 ON FREE INFORMATION CARD

POPULAR ELECTRONICS

COMPUTER
BITS

NCC Is Just Around The Corner

By Carl Warren

THOSE of you who live in the Chicago area will want to get ready to visit the National Computer Conference (NCC), to take place May 4-7 at McCormick Place. If you're unfamiliar with the show, it's the one where just about all computer companies in the industry get together to show their wares.

This year, the format of the show has been changed. Personal computers will no longer be separated; they will be part of the main exhibits.

Expect very heavy crowds and limited parking facilities. Those of you who may be coming from out of town will find that hotel space is at a premium, too, and you may have to stay quite a distance away if early hotel room reservations were not made.

Advance reports indicate that some of the real excitement at the show will be generated by the introduction of a number of personal computers from Japanese manufacturers. Expect to see units that are priced well under \$500, and possibly a new offering from Apple.

Should your interest be in innovative disk systems, you can expect to find very-high-density floppies. For example, Iomega (Ogden, UT) is planning to show a 10M-byte floppy system. The unit employs a unique cartridge-type design and a flying head. No pricing yet for the end user, but expect something in the \$3,000 range.

While there, you will want to make a stop at Vector Graphic's booth, where you will see the Models 3005 and 2600 desk-top computer systems. Both are unitized systems each consisting of a CRT, a keyboard, a four-slot S-100 bus backplane that houses a Z-80 microprocessor-based single-board computer, 64K RAM board, Flashwriter video board, and a dual-mode disk controller board. The basic differences in the systems are, as follows. The 3005 comes with a Seagate Technology ST-506 Microwinchester and a Tandem quad density 5.25-in. floppy. The Model 2600, on the other hand, comes with two floppy drives.

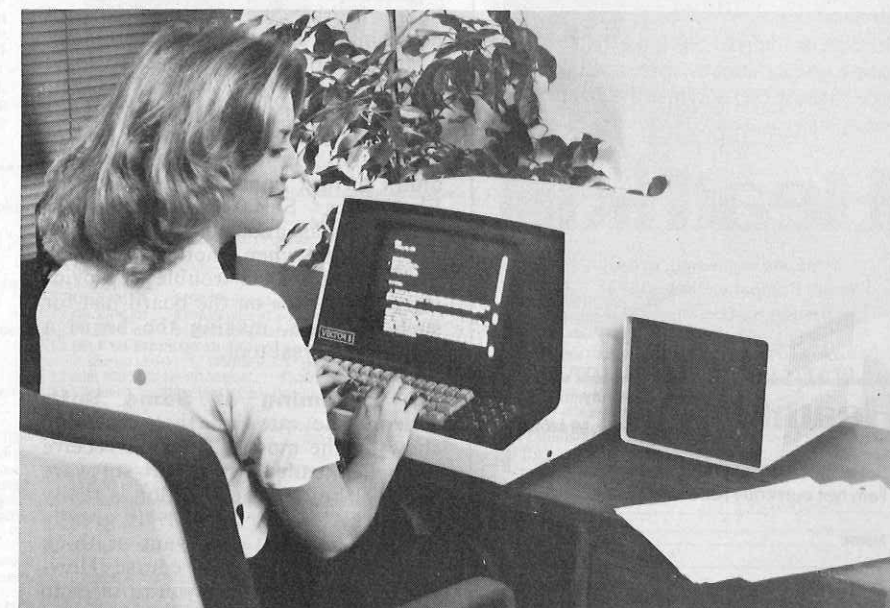
A nice feature of the 2600 is that it can be easily upgraded to the 3005 by simply buying the Microwinchester. The controller will support it and three floppies. Its software is already optimized to support it. The Model 3005 is priced at \$7,950; the 2600 at \$4,995.

Vector Graphics has some really exciting software. Specifically, its Memorite III word processing package, with a 33,000-word spelling dictionary, is very useful. In concert with this type application software, they are offering "Execugraph," which is a Visicalc-like (from Personal Software) tabulating system.

When I asked Robert Harp, the company's chief executive officer, if they were going to be offering any of the software separately, he gave a qualified no. Harp asserts that they would lose too much control and wouldn't be able to offer the same level of support for the software as they do when it's with their systems.

Follow this visit by heading to Hewlett-Packard to view the new HP-83 system. Interestingly, the HP-83 is not really a new system; it's actually a downgrade of the popular HP-85. The 83 offers all the features of the 85, including graphics, but is minus the built-in printer and tape cartridge drive.

HP officials said that they took this move since there was so much interest in the machine among computer hobbyists. However, a lower price was desirable and interest in the small printer and special tape cartridge system wasn't high. The HP-83 is priced at \$2,250.



Vector Graphic's 3005 word and data processing system has 5-MB 5 1/4-inch Winchester disk and one 630-KB floppy disk for expanded capability.

Think PM. One of the many things users of computer systems seem to forget is preventive maintenance (PM). This is basically just taking care of your system to avoid costly breakdowns.

In reality, PM is cleaning the CRT screen, dusting off the keyboard, and cleaning out paper dust from the printer.

Although this sounds simple enough, it is often forgotten. To assist you in keeping your system up to snuff, Inmac, a computer supply house, is offering specialized maintenance kits for around \$35 to \$50, depending on contents.

Typically, what you can expect to find in the helpful kits are: a screwdriver and nutdriver set, CRT cleaning solution, font cleaning paper, and canned air for blowing out dust in hard-to-reach places. Some of the kits will contain small vacuums, and other specialized PM items.

To introduce these items, Inmac will be providing a free little kit at NCC just to get you started. Don't write for one—they won't send it! You must stop by their booth.

Make a MODEM Choice. One category of products that seems to hold high interest, among peripherals is the MODEM. Microperipheral Corp. in Redmond, WA, recently added some exciting products to their line in this field. This includes the TRS-80 Connection; the RS-232C Connection, for any system with an RS-232C port, the Atari Connection; and even support for some European systems. The Connection Modems start at \$199.95 with an additional \$79.95 for the autodial/autoanswer option. The MODEMs come complete with software, and you really only have to plug them in and compute. (Continued overleaf)

user area, and the IRQ line is jumper programmable for one or both 6850 IRQ outputs. \$8.50 for bare pc board and instructions. Address: Quality Research Co., Box 7207, Spokane, WA 99207.

Software

List Management The Ultimail Version 5 List Management System for the TRS-80 Model I with 48K requires two mini-disks or one 8" floppy. It uses ran-

dom disk files and stores 650 records on a mini or 1000 on the 8" diskette. Program routines include: data entry, database-record display, edit, delete, directory in alphabetic order, labels with zip code, and any number of labels printed per address. Each record consists of a zip code, alpha key entry for directory printouts, and 3 to 4 lines per address with the first up to 31 characters, second and third lines 29 characters, and fourth line 28 characters. Errors can be immediately corrected. \$124.95. Address: Computer Generated Data, 5541 Parliament Drive, Suite 208, Virginia Beach, VA 23462 (Tel: 804-497-1165).

Apple PASCAL. The PASCAL Utility Express Package contains four procedural units that simplify I/O formatting: access and/or change in the disk directory from a PASCAL program; perform integer, string, and real conversions; and support files of variable-length records. It also contains five sample programs of PASCAL demos with BASIC equivalents, a routine to view disk files in ASCII or hex, a text formatter for simple word processing, and a program to maintain a variable-length data file for the international traveler. \$45 on diskette. Address: Software Express, Box 50453, Palo Alto, CA 94303 (Tel: 415-856-9244).

Typing Tutor. Type-It is a typing tutor, a drill master, and a speed tester. It assumes the user knows nothing about typing, and is self paced. Runs on TRS-80 Model I, Level 2 or disk BASIC. Supplied on cassette or disk. \$14.95. Address: Bluebird's Inc., 2267 23rd St., Wyandotte, MI 48192 (Tel: 313-285-4455).

New VisiCalc. The VisiCalc program, previously only available for the Apple, is now available for the Atari 800 and Commodore systems. The Commodore version automatically senses whether it is running in a PET with a 40-character screen, or the CBM 8032 with an 80-character screen. The VisiCalc creates a 64-column wide, 254-row high matrix on screen. It speeds repetitious calculations like inventory planning, sales forecasts, financial analyses, and modelling of physical phenomena. Address: Personal Software Inc., 1330 Bordeaux Drive, Sunnyvale, CA 94086 (Tel: 408-745-7841).

Payroll Package. The Payroll System calculates complete payroll transactions including Federal tax returns for 300 employees. It permits up to four user-definable pay rates for each employee, and handles tips, bonuses, expense reimbursements, advances, sick pay, and vacation pay. It will calculate for any combination of pay schedules: weekly, bi-weekly, monthly or semi-monthly. Three additional categories may be created for each employee. It will operate stand alone, or with the SSG General Ledger. Requires CP/M with 54K RAM, two disk drives, 132 column printer, 24 x 80 terminal, and 2.04 version of CBASIC. Address: Structured Systems Group, 5204 Claremont Ave., Oakland, CA 94618 (Tel: 415-547-1567).

PL/65 for AIM-65. The high-level system implementation language PL/65 is now available for the Rockwell AIM-65 computer. Control statements such as conditional execution (IF-THEN-ELSE) and conditional looping (FOR-TO-BY), coupled with simplified block capability, support structured program design techniques. It generates R6500 assembly language source code and allows assembly language instructions to

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be incorporated in line. It is contained in two 4K-byte ROMs which plug in the AIM 65 master module. \$125. Address: Microsystems Marketing, Electronic Services Div., Rockwell International, Box 3669, Anaheim, CA 92803 (Tel: 714-632-3729).

Medical Software. The Medical Secretary, written for the Apple computer, is a complete administrative package that includes elements for appointment scheduling, patient registration, private patient billing, insurance claim preparation, and medical record preparation. The system requires one or two Apple II's (or Apple II Plus) with either two or three disk drives each and a 130-column printer. Comes on four diskettes. \$500. Address: Monument Computer Service, Village Data Center, Box 603, Joshua Tree, CA 92284 (Tel: 800-854-0561 Ext. 802; in CA, 800-432-7157).

TRS-80 Time Keeping. Timetrak is a utility for adding time intervals to a TRS-80. The start and stop boundaries in hours and minutes are entered via the keyboard. In operation, the program processes all start/stop time pairs and displays to five decimal places. An interval can be from one minute to 48 hours and up to 150 intervals can be entered. Applications include time charging, rental, equipment operating times, lab experiments, etc. Cassette is \$25, diskette is \$35. Address: Omni Systems Co., Box 29347, Minneapolis, MN 55430.

OS Business Package. The EIS GEN-200 is an accounting package designed for all Ohio Scientific disk-based systems. It contains journals, general ledger, statements, aging reports, and customer/vendor files. It can be integrated with an upcoming payroll and inventory system. Address: Electronic Information Systems, Box 5893, Athens, GA 30604 (Tel: 404-353-2858).

TI Music Packages. Two music programs for the Texas Instruments TI-99/4 Home Computer are now available. The first is Music Melody for one or two players that includes 50 melodies in which players race to identify the melody played. Points are awarded according to the amount of time required to identify the score. The Music Skills Trainer features: "Pitch Trainer" to help the user recognize particular notes; "Interval Recognition" to test the ability to recognize intervals between two notes; "Chord Recognition" for identifying a key and major/minor chords; and "Phase Recall" to improve aural memory by asking the student to repeat a sequence of notes played by the computer. \$24.95 for tape cassette, \$29.95 for diskette. Address: Texas Instruments Inc., Consumer Relations, Box 53, Lubbock, TX 79408 (Tel: 800-858-4565, in Texas 800-858-4279).

POPULAR ELECTRONICS

THE AFFORDABLE HOME COMPUTER



When PMC-80 was first introduced to the United States, the response was overwhelming! The Computer World was ASTONISHED at the QUALITY, as well as the PRICE. In fact, the PMC-80 has almost all the features of America's best selling computer, the TRS-80, but with a price tag of \$200.00 less! (SIMUTEK'S price is \$275.00 less!) **Microsoft's Level II Basic and 16K Memory.**

Another reason for all the commotion is that the PMC-80 uses the same, easy to learn, LEVEL II BASIC language that the TRS-80 uses! What does this mean? It means that the PMC-80 can run all the 1000's of programs that have been written for the TRS-80 Level II, 16K computer! Some of the programs available include: Flight simulation, World Champion Chess program, Scores of educational and business programs. Word processing programs and hundreds of other games and simulations.

The PMC-80 is expandable!

Your PMC-80 is ready to grow with your needs. Using a special cable, available from Simutek for \$35.00, it may be connected to Radio Shack's Expansion interface, to give you up to 48,000 characters of memory, up to 4 disk drives, addition of a telephone communication system, Voice Synthesizer, various printers, a real time clock, as well as plotters and other neat interfaces! As your skills with the PMC-80 improve, you're sure to want some of the ADD-ON's described above. (And these are just a few!)

Save Money! Use your own television!

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Comparison Chart

| Features | PMC-80 | TRS-80 |
|--|-----------------|-----------------|
| Microsoft's Fantastic Level II Basic | Yes | Yes |
| Full 128 x 48 Graphics | Yes | Yes |
| 16,000 characters memory | Yes | Yes |
| Tape recorder for storing or retrieving programs | Yes | Yes |
| Use your own TV (Save \$\$) | Yes | No |
| Expandable to 48,000 characters of in computer memory | Yes | Yes |
| Use TRS-80 expansion interface | Yes | Yes |
| Expandable to 4 floppy disk drives (over 100,000 characters of storage on each one) | Yes | Yes |
| Telephone Communications available: connect to large computers/electronic mail etc. | Yes | Yes |
| 1000's of ready made programs available for "educational" and "scientific" applications? | Yes | Yes |
| Printers available | Yes | Yes |
| High Speed Z80 CPU | Yes | Yes |
| Interface available for controlling lights and appliances in home | Yes | Yes |
| Retail Price | \$845.00 | \$849.00 |

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