

ELECTRONICS & Wireless world

MARCH 1986 95p



Computer-aided electronic design

Crystal analysis by computer

Memory telephone dialler

Intelligence in machines

Australia	A\$	3.75
Denmark	DKr	38.00
Germany	Dm	7.50
Greece	Dra	360.00
Netherlands	DFI	9.20
Italy	L	470.0
New Zealand	NZ\$	4.80
Spain	Pts	420.00
Switzerland	SFr	8.00
Singapore	M\$	7.00
USA	\$	4.00

MARCONI INSTRUMENTS

The last word in test instrumentation



2022 10 kHz to 1000 MHz AM/FM Signal Generator

The 2022 is a compact and lightweight Signal Generator, offering frequency, phase and amplitude modulation over the frequency range 10 kHz to 1000 MHz. It is designed for applications in maintenance and servicing, and will also find uses in production and education. Microprocessor control provides simple and rapid operation by direct keyboard entry of settings and the non-volatile memory, which can store up to one hundred settings, further reduces measurement time. Full GPIB programmability adds greater flexibility and faster throughput in systems applications.

£2950.00



2018A & 2019A AM/FM Signal Generators

Signal Generators 2018A and 2019A are high performance synthesised generators with frequency ranges — 80 kHz to 520 MHz and 80 kHz to 1040 MHz respectively. Microprocessor control provides simple and rapid operation by direct keyboard entry of settings and the non-volatile memory, which can store up to one hundred settings, further reduces measurement time. Optional GPIB programmability extends the range of applications to include use in automatic test systems. The excellent overall performance and wide range of facilities provided ensure that the generators have many uses in development, production and maintenance areas and for military applications.

2018A **£4775.00**

2019A **£5125.00**



2955 Radio Communications Test Set

The 2955 Radio combines all the instruments required for transceiver testing from 0.4 MHz to 1000 MHz within a single unit. It is designed for bench and mobile field service applications in maintenance workshops. The instrument is lightweight, portable and may be operated from all standard a.c. supplies or vehicle supplies. Comprehensive facilities are provided for testing all types of AM, FM and Φ M mobile radio equipment, including low-power hand portables and mobiles using selective calling, full duplex radio telephones, base station and repeater equipment. Major users include mobile radio manufacturers, providers of mobile radio telephone networks, service maintenance workshops, commercial and public service organisations, and the military.

£5750.00

through
**ELECTRONIC
BROKERS**
The first name in
test equipment distribution

Electronic Brokers are now distributors for a full range of Marconi Test Instruments

including Signal Generators, Microwave Counters, Power Meters, Modulation Meters, Spectrum Analysers, Radio Communication Test Sets and other general test and

measuring equipment. For further information and a colour brochure please contact our Sales Office.

Electronic Brokers

**Electronic Brokers 140-146 Camden Street, London, NW1 9PB
Tel: 01-267 7070 Telex: 298694 Fax: 01-267 7363**

All prices exclusive of VAT. Prices correct at time of going to press. A copy of our trading conditions is available on request.

CIRCLE 1 FOR FURTHER DETAILS.

ELECTRONICS & Wireless world

over 70 years in independent electronics publishing

CONTENTS

March 1986
Volume 93
Number 1601

FEATURES

Memory telephone dialler 17 by T. Segaran Number storage, last-number redialling and call-progress monitoring.	Computer aids in electronic design 35 Computer design tools can assist the designers to produce anything from a simple circuit to a complicated multilayer p.c.b. or an i.c.
Level-translating full-wave rectifiers 22 by K. Lewis Using transistors as rectifiers to provide high-impedance output and source/load isolation.	Computer-aided metallurgy 45 by L. Paul Goodwin Video processing and computer technology combine to allow automatic analysis of metallic structures.
Data-conversion 25 Final listing of a-to-d and d-to-a converters.	Synchrodyne a.m. receiver — 2 58 by J.L. Linsley Hood The r.f. and demodulator stages complete the design.
Digital audio editing 29 by John Watkinson Editing equipment for the tapes from which a master tape is made, which in turn is used in the production of a compact-disc.	Digital input circuitry using voltage comparators 64 by William E. Barr Versatile alternatives to the Schmitt trigger, with input protection.
Human responses to 'intelligent' machines 33 by Tom Ivall A discussion on the interaction of living beings with dead, but cognitively active matter.	High-speed buffer/interface 71 by J.F. van der Walle Storing 500 million data words in 16Kbyte of memory.

Editor
PHILIP DARRINGTON

Deputy Editor
GEOFFREY SHORTER, B.Sc.
01-661 8639

Technical Editor
MARTIN ECCLES
01-661 8638

Projects Editor
RICHARD LAMBLEY
01-661 3039 or 8637 (lab.)

News Editor
DAVID SCOBIE
01-661 8632

Drawing Office Manager
ROGER GOODMAN
01-661 8690
BETTY PALMER

Advertisement Manager
ASHLEY WALLIS
01-661 3130
MICHAEL DOWNING
01-661 8640

Northern and Midland Sales
BASIL MCGOWAN
021-356 4838

Classified Executive
SUSAN PLATTS
01-661 3033

Advertising Production
BRIAN BANNISTER
(Make up and copy)
01-661 8648

Electronics & Wireless World is published monthly
USPS NO 687-540

Current issue price 95p, back issues (if available) £1.06, at Retail and Trade Counter, Units 1&2, Bankside Industrial Centre, Hopton Street, London SE1. Tel. 01-928 3567.

Available on microfilm; contact editor. By post, current issue £1.30, back issues (if available) £1.40, order and payments to EEP Sundry Sales Dept, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel. 01-661 3378.

Editorial & Advertising offices: Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Telephones: Editorial 01-661 3611 Advertising 01-661 3130.

Telex: 892084 BISPRS G (EEP)

Facsimile: 01-661 2071 (Groups II & III)

Beeline (300 baud): 01-661 8978, type EWW to start, NNNN to end.

Subscription rates: 1 year £18 UK and £23 outside UK.

Student rates: 1 year £11.40 UK and £14.10 outside UK.

Distribution: Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Telephone 01 661 3248.

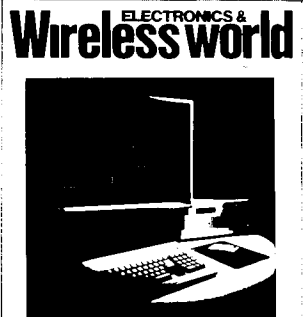
Subscriptions: Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Telephone: 0444 59188. Please notify a change of address. **USA:** \$49.40 surface mail, \$102.60 airmail. Business Press International (USA). Subscriptions Office, 205 E. 42nd Street, NY 10117.

Overseas advertising agents: see back page.

USA mailing agents: Expeditors of the Printed Word Ltd, 515 Madison Avenue, Suite 917, New York, NY 10022, 2nd class postage paid at New York. Postmaster — send address to the above.

©Business Press International Ltd 1986. ISBN 0043 6062

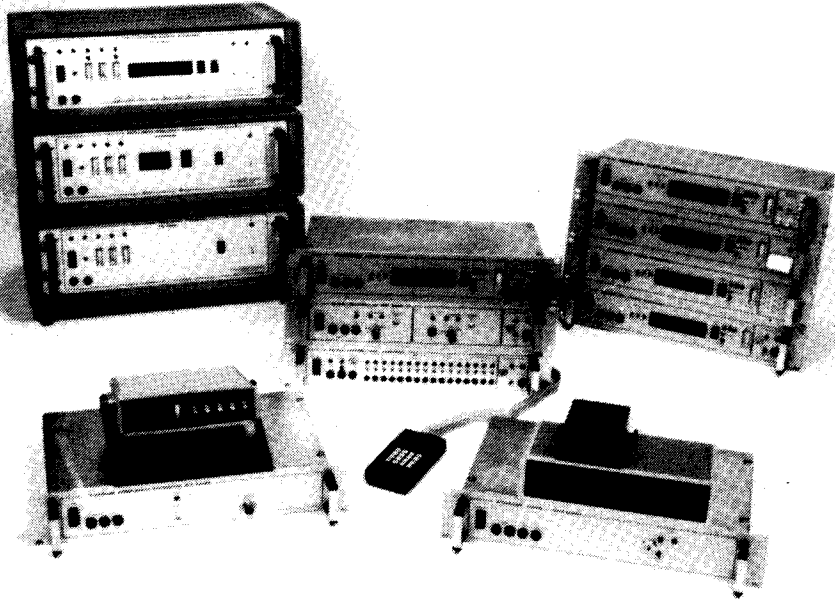
REGULARS

News 6 Acorn's new Beeb. In-car pilot. Alvey's word processor.	Switching inductive loads. Faster memory access.	 <p>ELECTRONICS & Wireless world</p> <p>Computer-aided electronic design Crystal analysis by computer Memory telephone dialler Intelligence in machines</p>
Communications commentary 20 Medical r.f. FCO give up Orfordness. 50kW solid-state. 50MHz opened. Limited e.r.p.?	Feedback 62 A question about Q. H.d.tv Renting the spectrum. Stereo hiss.	
Circuit ideas 51 Electronic irrigation controller.	New products 77 C.a.e. and c.a.d. products to accompany the feature on p.35.	

Cover picture is the Daisy Systems Personal Logician, a c.a.d. system for application-specific i.c.s. Further details in our c.a.d. feature, starting on p.35.

RADIOCODE CLOCKS LTD

SPECIALISTS IN ATOMIC TIME, FREQUENCY AND SYNCHRONISATION EQUIPMENT



NEW PRODUCTS

- **MINIATURE RUBIDIUM OSCILLATOR MODULE**
Lower power, fast warm up, optional output frequencies, programmable frequency offsets.
- **RUBIDIUM FREQUENCY STANDARD**
High performance, compact and rugged instrument. 2U rack or 1/4 ATR case options.
- **INTELLIGENT OFF-AIR FREQUENCY STANDARDS**
Microcomputer controlled instruments, directly traceable to N.P.L., precision ovened local oscillator, comprehensive monitoring and status information, real time synchronisation.
- **LOW COST MSF FREQUENCY STANDARD**
Instant operation, directly traceable to N.P.L., self-contained portable unit, no scheduled frequency changes, 24 hr transmission, real time synchronisation

- Off-air frequency standards
- Intelligent time systems
- Caesium/Rubidium based clocks & oscillators
- Master/slave systems

- Time code generators/readers
- Record/replay systems
- Intelligent display systems
- Precision ovened oscillators
- Time/frequency distribution systems

Radiocode Clocks Ltd*

Unit 19, Parkengue,
Kernick Road Industrial Estate, Penryn,
Falmouth, Cornwall. Tel: Falmouth (0326) 76007

(*A Circuit Services Associate Co.)

CIRCLE 67 FOR FURTHER DETAILS.

TDS 9000

FORTH COMPUTER

Remember that -

- * FORTH is fast
- * It is interactive like BASIC
- * It contains its own compiler
- * You can mix FORTH and assembler code
- * You can comment properly without penalty
- * Names can be left long or shortened
- * TDS900 series computers have a full-screen editor
- * TDS900 series has both N-channel and C-MOS versions
- * TDS902 consumes 25mA and has 62K bytes memory
- * Address and data buses take 6800/6500 peripherals
- * Many systems are just one TDS900 in a box
- * Others may have one extra card for special needs
- * All cards have mounting holes, or use a rack
- * TDS971 offers RS232 and IEEE-488 expansion
- * TDS972 adds RS232, A to D and parallel ports
- * TDS973A gives opto-isolation on 32 input/outputs

FORTH computers start at £99



Triangle Digital Services Ltd
100a Wood Street, London E17 3HX
Telephone 01-520-0442 Telex 262284 (Ref M0775)

CIRCLE 14 FOR FURTHER DETAILS.

SPECIAL OFFERS Prestel Adaptor Model P.1. Complete with remote control keypad. Operating instructions c/w. All electronics. C.P.U. Isolation Transformer. Modem 1200 Bauds Rate. Power supply. U.H.F. Modulator. I.C.'s inc: AY-3-1015D AY-3-9710HK. PIC 1650A. TY 1650z-536. AY-3-9725. New & Boxed. £15.95 c/p 3.00.

6" G/Screen 75Ω Comp: Video Monitors cased. 12 v.d.c. 9½ x 6½ x 4½" tested. £15.95 c/p 3.00.

9" G/Screen 75Ω Comp: Video Monitors cased 240v high res. Tested 10 x 9½ x 9½". £36.00 c/p 5.00.

All-Die cast box 114 x 64 x 30mm £2.00 c/p 50p.

4 x AA N-Cad re-chargeable shrink wrap. Ex-new-equip. £2.00 inc. c/p.

Soft 24v 3.3 Ah rechargeable batts. 7½ x 2½ x 5" sealed alkaline n/boxed. £10.95 c/p 3.00.

P.C. Boards 47 various I.C.'s 1 x 16mhz xtal. 5 x D2764-4 Eproms N/boxed £13.00 c/p.

Kingshill stabilised p.s.u. 0-30A metered 0-60v 240v input. £390.00 + 15% VAT.

Farnell + 5v 10.3a + 12v1a - 12v 1a Switch Mode p.s.u. New 7½ x 4½ x 2½" 240v input c/p £22.50 c/p 2.75.

Farnell fan cooled switch mode p.s.u. + 5v 10a - 5v1a + 12v 3a - 12v1a 240v input £28.00 c/p 2.75.

Gould/Farnell 12v8a Switchmode p.s.u. 240v input £35.00 c/p 2.75.

AC/DC Electronics 24v 4.8a linear p.s.u. 240v input N/boxed. £19.95 c/p 3.50.

Advance 5v 20a switch mode p.s.u. 240v input £14.95 c/p 2.75.

Gould PMA 47 12v 3a Linear p.s.u. 240v input £16.95 c/p 2.75.

Kingshill 30v 25a Linear p.s.u. 240v input £30.00 c/p 9.50.

Farnell Switch Mode p.s.u. 145 x 87 x 32 6v 5a 240v input. £20.00 c/p 2.25.

Gould Multi-Rail switch mode p.s.u. 5v 40a-124a + 15v 11a £55.00 c/p 3.50 240v input.

25 gram tube silicon grease. £1.25 inc c/p min 2 tubes.

Bulgin 240v 3a Keyswitch £1.20.

Capacitor Packs 100 caps per pack. £1.00 c/p 25p.

Painton rotary switches 2p 15 way. £2.50 c/p 50p.

Cetronic Ltd 3000c Line Conditioner 50Hz input frequency. 240v - 12% + 10% 192-264v or 220v + 20% 192-264v output volts 240v ± 1% 12.5a max load. £250.00 + 15% higher rating ava.

Solartron Schlumberger 1510 Spectrum Analyzer. 1Hz 25 kHz.

Marconi TF 2671 digital multimeter £60.00 c/p 5.00.

Advance TC9a 35mHz Frequency Counter/Timer. £75.00 c/p 5.00.

Keppo Operational p.s.u. 0-2000v 0-10 m/a. Type Ops 2000. £120.00.

Polyroid Spectrum analyzer 10-63,680mc £480.00

Tektronix O'scope 454 150mHz D/trace £525.00 plus 15% VAT.

Tektronix plug in type 067/0521/01 calibration fixture £75.00 15% VAT.

Tektronix plug in type 53/54d high gain calibrated Pre-amp. £25.00.

Riply 230v prim: 12.5/0/12.5 750ma. 7/0/7 1a. £2.95 c/p 50p transformers.

RS 6va 230v prim: 0/20/0/20v = va max per winding £3.25 c/p 60p.

RS 20va 230v prim: 0/6/0/6V £4.50 c/p 50p. 230v prim: 9/0/9v 1a £1.95 c/p 50p.

230v prim: 0/12v/0/24v £2.95 c/p 50p. 230v to 115v Auto 500w £23.95 c/p 3.00.

230v Prim: 16/0/16 2.5a per winding £9.00 c/p 2.00.

230v Prim: 20/22v 2a. £5.50 c/p 50p. 12-0-12 2a per winding 230v Prim: £2.50 c/p 1.00.

240v to 240v 10a Isolation Transformer £60.00 c/p 5.50.

Portable Isolating Transformer 240v Input 115v output. 3a cont: 5.5 intermittent £25.00 c/p 6.75 higher ratings ava.

Data Recording Fan cooled Linear p.s.u. + 15v - 15v 8a per output. 240v/115v input New & Boxed. £40.00 c/p 4.50.

Woden 240v Prim: 11v 80 amp Transformer £35.00 c/p 6.00.

Universal Coupling Arms ideal for robotics 4" closed app: £2.00 c/p 25p.

High Power Aluminium heat sink typical thermal res: 2.5 c/w 6ft. length £25.00 or £5.00 per ft. cut.

Hewlett Packard 6824a D.C. p.s.u. amp ± 50 1a £100.00.

1 Megabyte general purpose Random Access Memory. New & Boxed. £100.00.

Hewlett Packard 180a O'scope with 1801a D/channel vertical amp 50mhz, 1821a time base and delay generator £550.00 NC manual etc.

Solartron A100 O'Scope with A101 30mhz amp A112 D/Timebase unit £150.00 inc manual etc

FIELD ELECTRIC LTD.

3 Shenley Road, Borehamwood, Herts.
01-953 6009

Official Orders/Overseas Enquires Welcome.
Open 6 Days 9am/5pm. Thur. 9am/1.00pm



Credit Card Telephone Orders Accepted



ALL PRICES INC 15% VAT Unless stated please ring for c/p details not shown.

COUNTERS & OSCILLATORS

LEVELL COUNTERS MET100/600/1000 £99/126/175
8 digit 0.5" LED display. 5Hz to 100/600/1000MHz. Resolves 0.1Hz. Sensitivity 5mV up to 10MHz. Low pass filter. Mains/rechargeable battery powered.

LEVELL FUNCTION GENERATORS TG302/3 £156/236
0.02Hz-2MHz in 7 ranges. Sine, square, triangle, pulse and ramp 20mV to 20Vpp from 50Ω. DC offset 0±10V. TTL output. TG303 also has a CMOS output and 6 digit 10MHz counter with INT/EXT switch.

LEVELL RC OSCILLATORS TG152D/DM £95/120
3Hz-300kHz. 5 ranges, acc 2% + 0.1Hz up to 100kHz, 3% at 300kHz. Sine or square <200μV to 2.5Vrms. Distn. <0.2% 50Hz-50kHz. DM has an output meter.

LEVELL RC OSCILLATORS TG200D/DMP £130/165
1Hz-1MHz. 12 ranges, acc 1.5% + 0.01Hz to 100kHz, 2% at 1MHz. Sine or square outputs <200μV-7Vrms. Distortion <0.05% 50Hz-15kHz. Sync output >1V. DMP has output meter and fine frequency control.

LEVELL DECADE OSCILLATOR TG66A £330
0.2Hz-1.22MHz. 5 ranges. 4 digits, acc 0.3% 6Hz-100kHz. Sine output <30μV-5Vrms. 2dB/4dB and V scales. Distn.<0.15% 15Hz-150kHz. Mains/battery.

ANALOGUE METERS

LEVELL AC MICROVOLTMETERS TM3A/B £150/170
16 ranges 1μVfs/500Vfs, accuracy 1% + 1%fs + 1μV. 20dB/4dB scale. ±3dB 1Hz-3MHz. 150mVfs output. TM3A: 83mm scale. TM3B: 123mm scale and LF filter.

LEVELL BROADBAND VOLTMETERS TM6A/B £235/265
16 LF ranges as TM3A/B + 8 HF ranges 1mVfs/3Vfs, accuracy 4% + 1%fs at 30MHz. ±3dB 300kHz-400MHz.

LEVELL DC MICROVOLTMETER TM8 £130
23 linear ranges ±3μV±300V and ±3pA±300nA plus 2 log ranges for nulling. Output ±300mV at fs.

LEVELL DC MULTIMETERS TM9A/BP £199/235
18 voltage ranges 3μV-1kVfs. Current ranges 3pA to 1A (TM9A 1mA). Linear R ranges 3Ω to 1GΩ.

LEVELL MULTITESTER TM11 £175
50μV/500Vfs ac, 50pA/500mAfs ac, 150μV/500Vfs dc, 150pA/500mAfs dc, 0.2Ω to 100GΩ, lin/log null. Diode/LED test. Optional RF, HV and Temperature.

LEVELL TRANSISTOR TESTER TM12 £195
Transistor, diode and zener leakage to 0.5nA at 2V-150V. Breakdown to 100V at 10μA, 100μA, 1mA. Gain at 1μA-100mA. Vsat and Vbe at 1mA-100mA.

LEVELL INSULATION TESTER TM14 £210
Log scale covers 6 decades 10MΩ-10TΩ at 250V, 500V, 750V, 1kV; 1M-1TΩ at 25V-100V; 10k-100GΩ at 2.5V-10V; 10k-10GΩ at 1V. Current 100pA-100μA.

DIGITAL METERS

LEVELL DIGITAL THERMOMETER DT1K £44
120°C/+820°C, acc 0.2%±1°C. 3 digit 8.5mm LCD. A standard Type K thermocouple socket is fitted. Bead couple is supplied. Battery life >3000 hrs.

THURLBY DIGITAL CAPACITANCE METER CM200 £89
1pF to 2500μF, acc 0.2%. 4 1/2 digit 9mm LCD. Fast settling. 3 readings per second. Mains/battery.

THURLBY DMMs 1503/1503HA/1504 £169/185/199
4 1/2 digit LCD. Up to 1.2kVdc, 750Vac, 10A, 32MΩ, 4MHz. Resoln. 10μV, 10nA, 10mΩ. Mains battery. 1503: dcV 0.05%. 1503HA: 0.03%. 1504: True rms ac.

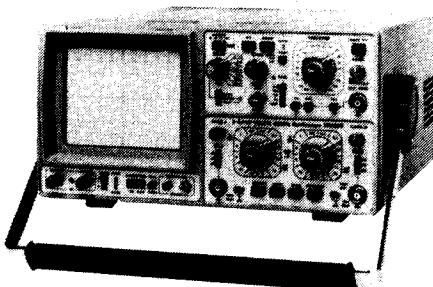
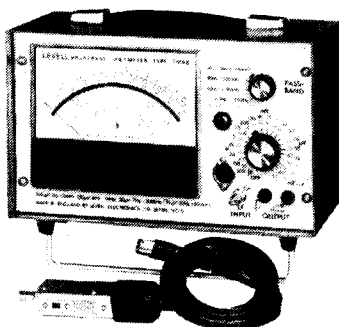
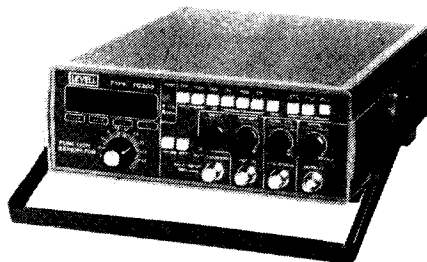
THURLBY INTELLIGENT MULTIMETER 1905a £349
5 1/2 digit LED. Up to 1.1kVdc, 750Vac, 5A, 21MΩ. Resoln. 1μV, 1nA, 1mΩ. dcV 0.015%. Computing and storage functions. RS232C/IEEE interface options.

FREE DELIVERY IN UK. VAT EXTRA. QUANTITY DISCOUNTS AVAILABLE.

LEVELL ELECTRONICS LTD.

**Moxon Street, Barnet, Herts., EN5 5SD, England
Telephone: 01-440 8686 & 01-449 5028**

LEVELL for INSTRUMENTS



LOGIC ANALYSERS

THURLBY LOGIC ANALYSERS LA160A/B £395/495
16 data channels. Clock DC-10MHz (20MHz for B). Binary, octal, decimal, or hex. formats. 2K word acquisition memory. Non volatile ref. memory.

BENCH POWER SUPPLIES

THURLBY SINGLES PL154/310/320 £159/125/155
LED digital displays with resolution 10mV, 1mA. <0.01% change for 50% load change. Remote sense. 154: 0-15V 0-4A. 310: 0-30V 0-1A. 320: 0-30V 0-2A.

THURLBY DUALS PL310QMD/320QMD £269/339
Two 0-30V 0-1A (2A on 320) with isolated, series tracking, series or parallel modes of operation.

THURLBY TRIPLES PL310K/320K £275/345
310K: 0-30V at 0-1A, 0-30V at 1/2A & 4V-6V at 3 1/2A. 320K: 0-30V at 0-2A, 0-30V at 1A & 4V-6V at 7A.

OSCILLOSCOPES

CROTECH SINGLE TRACE 20MHz 3031/36 £195/216
2mV-10V/div. 40ns-0.2s/div. Component tester. 3031: CRT 1.5kV 5x7cm. 3036: CRT 2kV 8x10cm.

CROTECH DUAL TRACE 20MHz (@2mV) 3132 £285
2mV-10V/cm. Ch1±Ch2. X-Y mode. Cal 0.2V 1kHz sq. 40ns-0.2s/cm. Auto, normal or TV trig. Component comparator. DC outputs. Z input. CRT 2kV 8x10cm.

CROTECH DUAL TRACE 30MHz (@5mV) 3337/39 £425/570
5mV-50V/cm. Ch1±Ch2. Signal delay. X-Y mode. 40ns-1s/cm. Auto, normal or single shot trigger. Cal 0.2V 1kHz square. Z input. CRT 10kV 8x10cm. 3339: VDU mode. Component tester. DC outputs.

HAMEG DUAL TRACE 20MHz (@2mV) HM203-5 £270
2mV-20V/cm. Ch2±Ch1. X-Y. Cal 0.2V/2V 1kHz sq. 20ns-0.2s/cm. Auto, normal or TV trig. Component test. CRT 2kV 8x10cm. Long decay CRT £25 extra.

HAMEG DUAL TRACE 20MHz (@5mV) HM204-2 £365
1mV-50V/cm. Ch2±Ch1. Sig delay. X-Y mode. Y out. 10ns-1.25s/cm. Sweep delay 100ns-1s. Cal 0.2V/2V 1kHz/1MHz. Z input. Comp. test. CRT 2kV 8x10cm.

HAMEG DUAL TRACE 60MHz (@5mV) HM605 £515
1mV-50V/cm. Ch2±Ch1. Sig delay. X-Y mode. Y out. 5ns-2.5s/cm. Sweep delay 100ns-1s. Cal 0.2V/2V 1kHz/1MHz. Z input. Comp. test. CRT 14kV 8x10cm.

HAMEG DIGITAL STORAGE 20MHz HM208 £1300
1mV-50V/cm. Ch2±Ch1. Single shot and X-Y modes. 20ns-0.25s/cm. 20MHz sampling. Two 2K memories. Plotter output 0.1V/cm, 10s/cm. CRT 14kV 8x10cm.

HITACHI BATTERY DUAL 20MHz (@5mV) V209 £680
1mV-12V/div. Ch1±Ch2. X-Y mode. Cal 0.5V 1kHz. 50ns-0.5s/cm. Auto, normal or TV trig. Internal rechargeable batt. or mains. CRT 1.5kV 5x6.3cm.

HITACHI DUAL 20MHz V212/22/23 £299/395/450
1mV-12V/cm. 20MHz@5mV. Ch1±Ch2. X-Y. Ch1 output. 100ns-0.5s/cm. Auto, normal or TV trigger. Cal 0.5V 1kHz square. Z input. CRT 2kV 8x10cm. V222/V223: DC offset and alternate magnify. V223 : Sweep delay 1μs-100ms.

HITACHI DUAL 40MHz (@5mV) V422/23 £580/650
As V222/V223 but 40MHz, 20ns/cm and 12kV on CRT.

HITACHI QUAD 100MHz (@5mV) V1050F £1095
Ch1/Ch2: 0.5mV-12V/cm. Trigger Ch3/Ch4: 0.2V/cm. Dual time bases 2ns-0.5s/cm and 2ns-50ms/cm. Signal and sweep delay. CRT 20kV 8x10cm.

HITACHI QUAD 100MHz V1070/1100A £1580/2390
Ch1/Ch2: 1mV-12V/cm. CH3/Ch4: 0.1V-0.5V/cm. Dual time bases 2ns-0.5s/cm and 2ns-50ms/cm. Digital display of set values. CRT 18kV 8x10cm. V1100A: Digital display of ACV, DCV, frequency.

HITACHI DIGITAL STORAGE 10MHz VC6015 £1350
5mV-12V/cm. Ch1±Ch2. Single shot and X-Y modes. 100ns-0.5s/cm. 1MHz sampling. Two 1K memories. Plotter output 1V/cm, 5-10s/cm. CRT 2kV 8x10cm.

HITACHI DIGITAL STORAGE 40MHz VC6041 £3850
1mV-12V/cm. Ch1±Ch2. Single shot and X-Y modes. 20ns-0.5s/cm. 40MHz sampling. Two 4K memories. Plotter output 1V/cm, 2-10s/cm. CRT 12kV 8x10cm.

THURLBY 8 CHANNEL MULTIPLEXER OM358 £179
Increases any oscilloscope to 8 channels. Choice of trigger from any channel. Response DC-35MHz.

LEVELL DECADE BOXES

C410	: 10pF to 111, 110pF, acc 1%±2pF	£45
R401 (410)	: 4 decades. 1(10)Ω steps, acc 1%	£45
R601 (610)	: 6 decades. 1(10)Ω steps, acc 1%	£58
R601S	: 6 decades. 1Ω steps, acc 0.3%	£69
R701	: 7 decades. 1Ω steps, acc 1%	£66

CIRCLE 55 FOR FURTHER DETAILS.

DISK FORMAT COPYING SYSTEMS

A full range of systems available to copy between different computer formats. Select the system that YOU require from our modular range.

FEATURES:

Easy, user friendly commands
 In-built library functions
 Full support of bad side select (BBC)
 After sales updating service
 Over 100 disk formats supplied

On-line help facilities
 Interrogation/examination routines
 On screen editing of data
 Format any disk in the library

Support for many different disk drives and types.

COMPATIBLE WITH:

IBM PC DOS, MSDOS, TORCH/BBC CP/N, CP/M 80, CP/M PLUS, CP/M 86, MP/M, MP/M 86, CONCURRENT CP/M, CONCURRENT PC DOS, DEC TR11, TURBODOS and many others.

Software available separately for most MAP80, NASCOM and GEMINI Computers.

ACCESS and BARCLAYCARD ACCEPTED. CALLERS WELCOME BY APPOINTMENT. RING FOR FURTHER INFORMATION.

CONTACT:

For further information contact:



MAP 80 Systems Ltd
 Unit 2 Stoneylands Road, Egham, Surrey
 Tel: 0784 37674



CIRCLE 22 FOR FURTHER DETAILS.

USED TEST EQUIPMENT & COMPUTER PRODUCTS

- ★ Fully guaranteed
- ★ Performance to original specification
- ★ Wide range of instruments & computer products

From **CARSTON**

01 943 4477
 Ring for latest stock information



99, Waldegrave Road, Teddington, Middlesex TW11 8LL.
ELECTRONICS LTD. Telephone 01-943 4477. Telex 23920 (Euhire)
 Used test equipment and computer specialist

CIRCLE 75 FOR FURTHER DETAILS.

KESTREL ELECTRONIC COMPONENTS LTD.

- * All items guaranteed to manufacturers spec.
- * Many other items available.
- * Exclusive of V.A.T. and Post and Package

74LS00	1+	50+	74LS273	.46	.42	2732A	1+	50+
74LS04	.13	.12	74LS373	.43	.45	7816	£2.20	1.90
74LS08	.15	.13	74LS374	.48	.45	27C64	2.10	1.90
74LS14	.19	.17	74LS393	.65	.45	2764-250	4.50	3.80
74LS23	.28	.26	74LS541	.45	.35	27128-250	1.80	1.60
74LS25	.27	.25	8155	1.50	1.30	27256	2.50	2.00
74LS138	.30	.25	8251	1.50	1.30	6116LP-3	4.20	3.60
74LS139	.30	.25	8253	1.50	1.30	6284LP-3	1.50	1.25
74LS157	.27	.24	8255	1.50	1.30	4164-15	2.40	2.20
74LS161	.35	.32	6810	1.30	1.10	41256-15	1.00	0.80
74LS174	.40	.35	6821	1.40	1.25	Z80ACPU	2.90	2.60
74LS140	.50	.42	6850	1.50	1.25	Z80ACTC	1.40	1.00
74LS244	.48	.45	4 neg Xtels	.70	.55	Z80AP10	1.99	1.70
74LS245	.50	.43	6 neg Xtels	.70	.55	Z80ADMA	2.50	2.20
							3.00	2.60

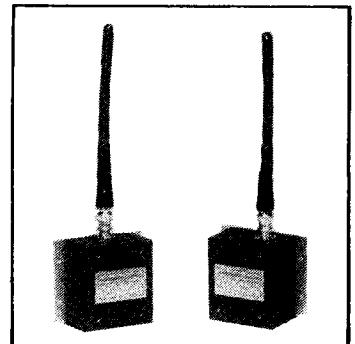
All memory prices are fluctuating daily, please phone to confirm prices.

178 Brighton Road,
 Purley, Surrey CR2 4HA
 Tel: 01-688 7522

CIRCLE 37 FOR FURTHER DETAILS.

173MHz FM TELEMETRY RADIO LINK

- Range up to 100 metres
- Modular, Wall Mounting Transmitter + Receiver
- Direct Baseband Inputs + Outputs (3kHz B/W)
- Approved to MPT1309
- Each Module 86x104x45mm + requires only 30mA dc at 7.2V
- Selective Baseband signalling by 'add on' modules now available.



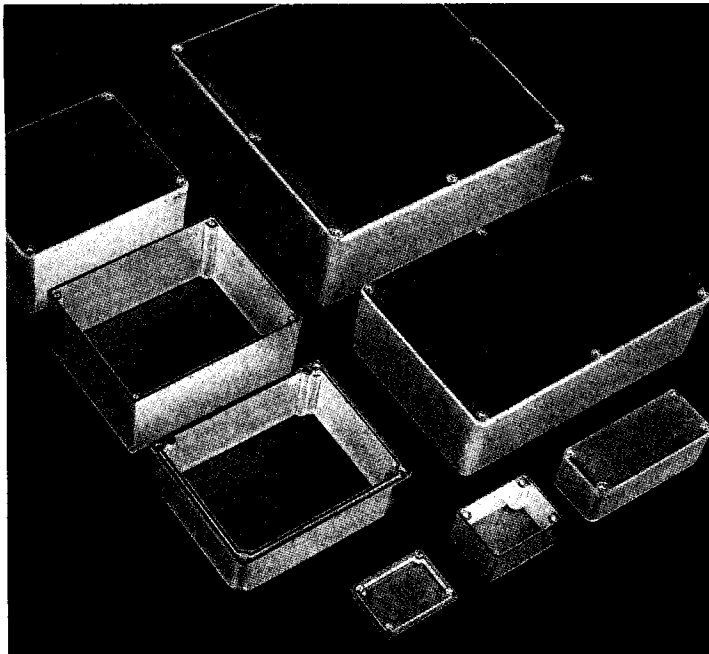
ADENMORE LTD

27 Longshot Estate, Bracknell, Berks. RG12 1RL Tel: 0344 52023

CIRCLE 23 FOR FURTHER DETAILS.

ELECTRONICS & WIRELESS WORLD MARCH 1986

imhof EXPRESS



Imhof-Express gives you a 24-hour delivery of the most comprehensive range of small diecast boxes available anywhere.

They are ideal for the hobbyist who wants strong metal boxes with good screening properties.

To order you simply phone your Access or Visa card number and the goods will be despatched within 24 hours.

For details on these and all our many other products, ask for our latest catalogue.

Imhof Express

Riverside Way, Uxbridge
Middlesex UB8 2YX

☎ (0895) 72247/8/9 and 72261/2/3/4



0895 72247

CIRCLE 39 FOR FURTHER DETAILS.

FIBRE-OPTICS MONITOR

Test Equipment for
MULTIMODE FIBRES, including
50µm GRADED INDEX.

SMA and STRATOS
Connector Options.

Examples of Applications:
ATTENUATION MEASUREMENTS
VOICE COMMUNICATIONS
CONTINUITY TESTING

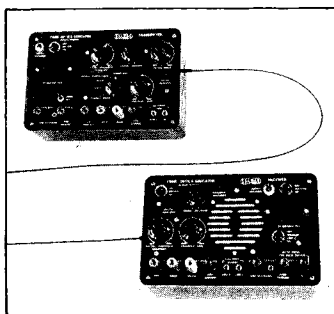


FIBRE-OPTICS EDUCATOR

Training Equipment for use in
Industry, Technical Colleges,
Polytechnics and Universities.

*Applications and
Demonstrations include:*
ANALOGUE and DIGITAL
Transmission over FREE-SPACE
and OPTICAL FIBRES,
ATTENUATION MEASUREMENT
TECHNIQUES,
Showing Properties of VISIBLE
and INFRA-RED RADIATION

Designed and Manufactured in the UK

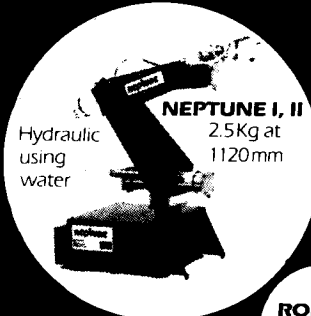


Comes Complete with
Accessories and Case


For Further Details Contact:
Ellmax Electronics Ltd.
Unit 29, Leyton Business Centre,
Etloe Road, Leyton,
London, E10 7BT, England
Tel: 01-539 0136

ELLMAX ELECTRONICS

CIRCLE 80 FOR FURTHER DETAILS.

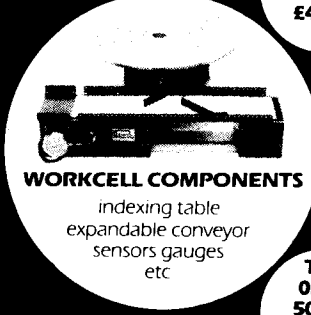


NEPTUNE I, II
2.5Kg at
1120mm
Hydraulic
using
water

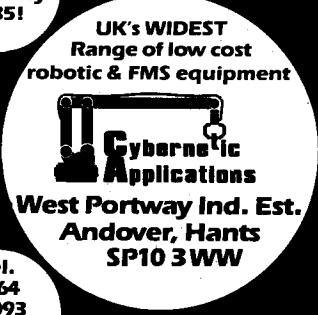


MENTOR
1 Kg at
420mm
DC servos

**ROBOTS
from only
£435!**

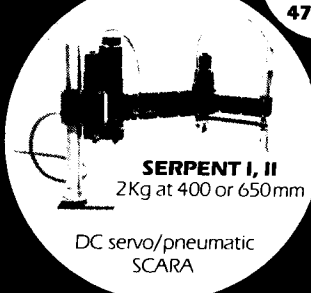


WORKCELL COMPONENTS
indexing table
expandable conveyor
sensors gauges
etc

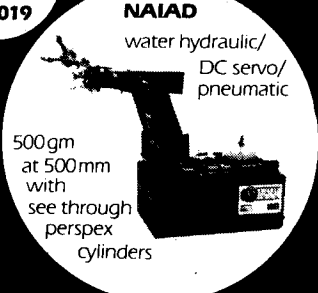


**UK's WIDEST
Range of low cost
robotic & FMS equipment**
**Cybernetic
Applications**
West Portway Ind. Est.
Andover, Hants
SP10 3WW

Tel.
**0264
50093**
Telex
477019



SERPENT I, II
2Kg at 400 or 650mm
DC servo/pneumatic
SCARA



NAIAD
water hydraulic/
DC servo/
pneumatic
500gm
at 500mm
with
see through
perspex
cylinders

CIRCLE 31 FOR FURTHER DETAILS.

Acorn's new Beeb

Acorn Computers have at last announced the latest version of the BBC Micro, called the Master series. Over the years since the Model B was launched, there have been a number of additions both from Acorn and from third party manufacturers; extra memory, better disc interfaces, rom expansions, word processors, graphics extensions, second processors and so on.

The new series incorporates many of these upgrades in the basic model, the Master 128 which is still recognisable as being an enhanced Model B.

Master 128

Externally it is wider to accommodate an extra numerical keypad and the top cover has been made deeper to allow space for plug-in expansions.

Internally it has a lot more memory: 128K of ram which is divided between main ram and paged 'sideways' ram. It also has 128K of rom in one i.c. nicknamed the Megarom. This contains the operating system which has been enhanced to include extended graphics facilities and terminal software: BBC Basic (version 4) which includes extra commands to take advantage of the other enhancements; an Edit rom which is used as a Basic program and text editor, the View wordprocessor and Viewsheet spreadsheet program and two disc filing systems. The DFS ensures some compatibility with software developed on the Model B; and the ADFS which is a double-density system with, at last, an unlimited number of files. To make this possible Acorn have devised an hierarchical system with file directories nested within files.

There is space for four additional roms inside the computer and it is possible to have three other 128K roms or even two 256Kbyte roms. This has limited application because such monster roms have to be programmed and be made available. However there are also two external cartridge rom sockets which offer the 1MHz

bus of the Model B, uprated to 2MHz. Through these not only can rom firmware be plugged in but also sound input/output with such peripherals as the Music 500, and, for example, a video genlock. Each cartridge socket has a capacity of 256Kbyte.

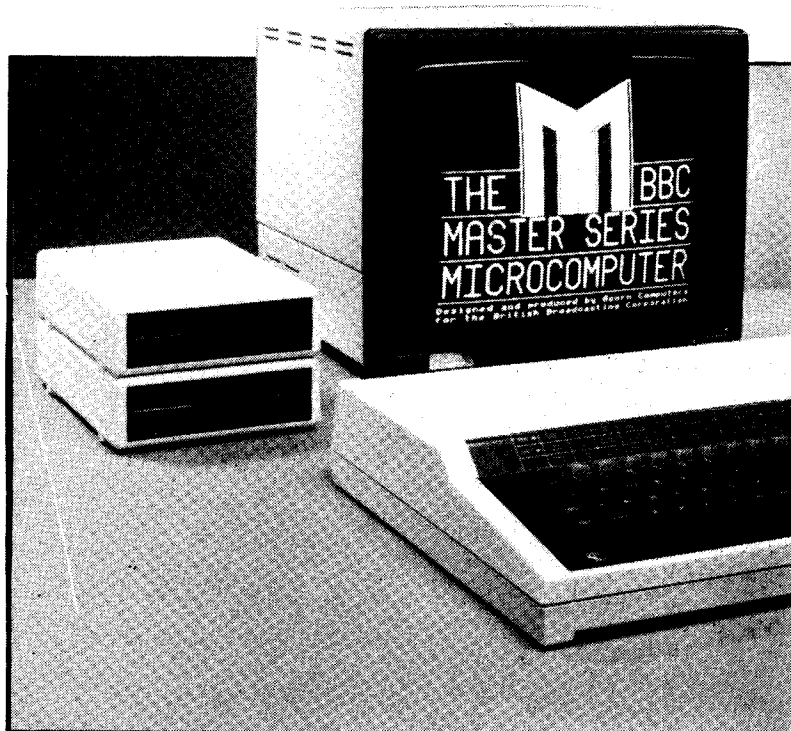
Another addition is the provision of a battery-backed real-time clock and some ram which is reserved for the start-up options so that the computer will automatically switch itself into the wordprocessor mode, for example, if needed.

The display modes are similar to those of the Model B, though the additional ram means that 'shadow' modes do not take any ram from the user. Similarly there is no extra ram required for the filing systems. The rest of the specification duplicates the facilities of the Model B: The same video outputs are provided; modulated u.h.f, composite video and RGB. It uses the same sound chip and internal loudspeaker though an audio socket has been added to drive an external loudspeaker or amplifier. Also duplicated are the user port, the 1MHz bus, the Tube for connecting external second processors, analogue input and cassette interface. Software is provided on a "Welcome" disc and tape which includes a suite of demonstration programs, assorted utilities including disc filing system utilities and Basic 128 - BBC Basic for use in sideways ram. The package is completed with a Welcome manual and reference cards for the firmware utilities. The Master 128 costs £499.

One feature we have omitted is the internal Tube bus and socket which enables the plugging in of additional processors and memory. These permit the expansion of the system and the expanded versions are also available as computers in their own right. There is no difference in price between buying the 128 and upgrading it or buying the enhanced versions of the computer.

Turbo

The first expansion adds to the 128 an additional 64C102



processor with a clock frequency of 4MHz, along with 64Kbyte of ram and 4Kbyte of rom, and a disc with a version of Basic for use with the system. It is designed for high-speed processing and is claimed to be faster than any other microcomputer for interpreted Basic. Turbo costs an additional £125.

Master 512

This adds a 16-bit 80186 processor, running at 8MHz and 512Kbyte of ram; up to 128K of rom. This is provided with Digital Research's DOS-plus which makes it compatible with MS-DOS and CP/M 86 and

opens up a wide field of applications software. MS-DOS being almost identical to PC-DOS enables some software written from the IBM-PC to be used. Also provided on disc is DR's GEM suite of utilities: GEM Desk Top, GEM Paint and GEM Write. The price of this addition is yet to be announced but is likely to be about £500, making the combined computer cost £1000.

Master Scientific

This adds the facilities of the Acorn Cambridge Workstation: 32-bit 32016 processor and a floating-point 32081 co-processor; 512K ram, 16K rom

Poor job prospects

Job prospects in the electronics engineering field are poor for at least the first quarter of this year. Statistics have come from Manpower Ltd, who specialize in such surveys.

The decline in confidence now being shown by electronics manufacturers reflects the decline in confidence in all sectors of employment, according to Manpower. Their survey points out that this is the first time in five years that New-year prospects in Britain have failed to show an improvement over the previous year.

Fewer employers in electronics manufacturing are

planning to increase their workforce and projected job cuts are higher than in the last quarter of 1985. The relative decline in job prospects in electronics is shown clearly by the 'balance' or difference between the proportion of employers increasing their staff and those cutting jobs. The balance now stands at +9, only barely positive, in contrast with +24 last quarter.

Manpower claims these results confirm its forecasts made in three prior surveys during 1985, that job prospects in Britain will increasingly "flatten" over the next 12 months. ■