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APRIL 1977

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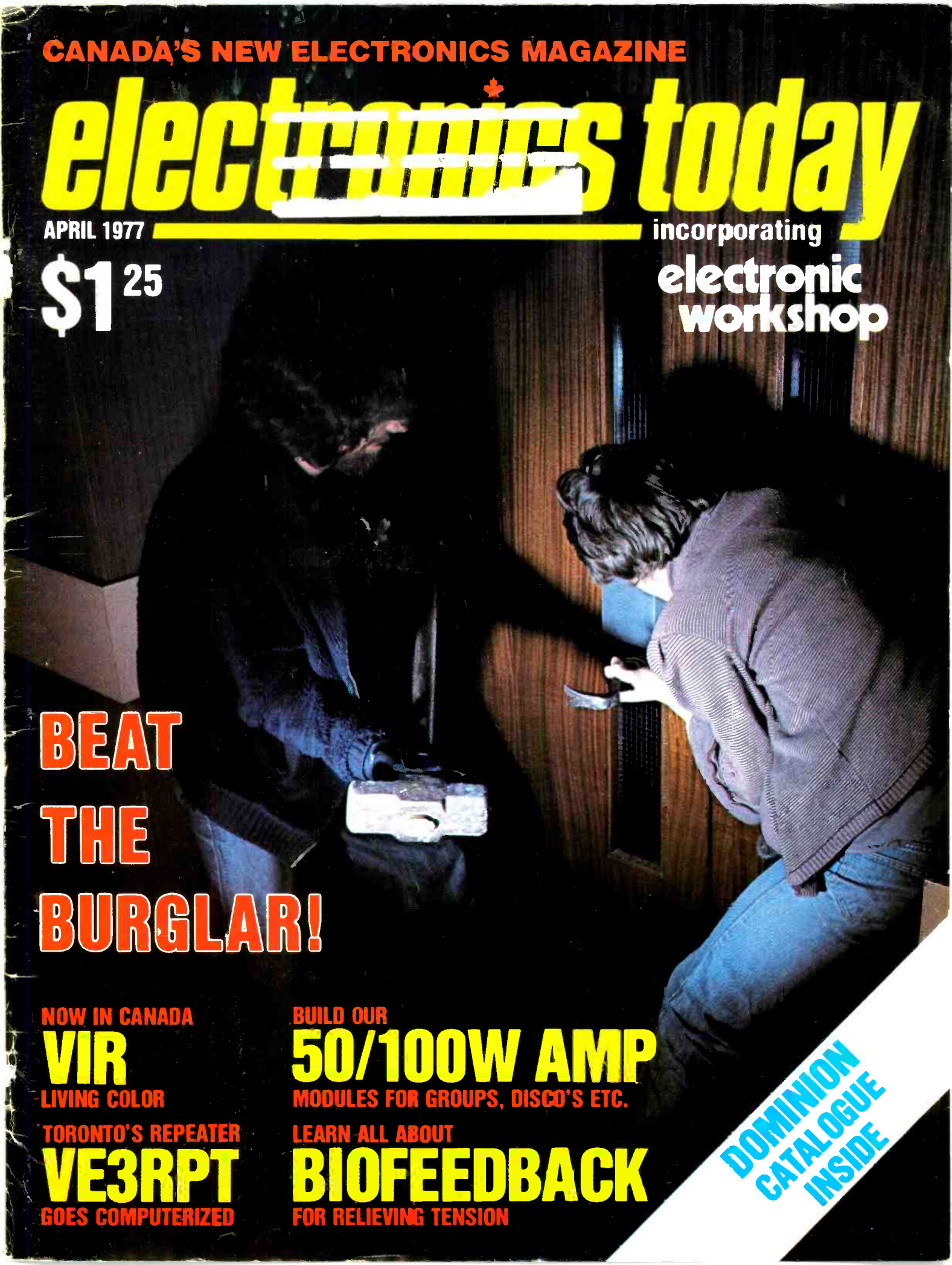

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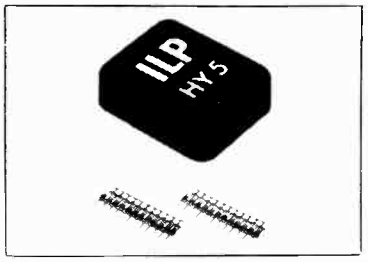
HY5
Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag Cartridge, tuner, etc.) are catered for internally, the desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre-amplifier.

FEATURES: Complete pre-amplifier in single pack. – Multi-function equalization. – Low noise. – Low distortion. – High overload. – two simply combined for stereo.
APPLICATIONS: Hi-Fi. – Mixers. – Disco. – Guitar and Organ. – Public address.
SPECIFICATIONS:
INPUTS: Magnetic Pick-up 3mV. Ceramic Pick-up 30mV. Tuner 100mV. Microphone 10mV. Auxiliary 3-100mV. input impedance 47kΩ at 1kHz.
OUTPUTS: Tape 100mV. Main output 500mV R.M.S.

ACTIVE TONE CONTROLS: Treble ± 12dB at 10kHz. Bass ± at 100Hz.
DISTORTION 0.05% at 1 kHz. Signal/Noise Ratio 68dB.
OVERLOAD: 38dB on Magnetic Pick-up. SUPPLY VOLTAGE: 16-50V.



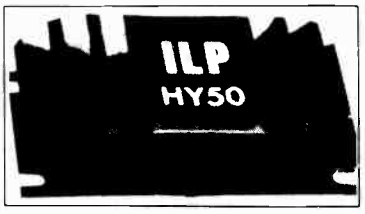
HY30
15 Watts into 8Ω

The HY30 is an exciting New kit from I.L.P. It features a virtually indestructible I.C. with short circuit and thermal protection. The kit consists of: I.C., heatsink, P.C. board, 4 resistors, 6 capacitors, mounting kit, together with easy to follow construction and operating instructions. This amplifier is ideally suited to the beginner in audio who wishes to use the most up-to-date technology available.
FEATURES: Complete kit. – Low Distortion. – Short, Open and Thermal Protection. – Easy to Build.
APPLICATIONS: Updating audio equipment. – Guitar practice amplifier. – Test amplifier. – Audio oscillator.
SPECIFICATIONS:
OUTPUT POWER 15W R.M.S. into 8Ω. DISTORTION 0.1% at 15W.
INPUT SENSITIVITY 500mV. FREQUENCY RESPONSE 10Hz-16kHz. – 3dB.
SUPPLY VOLTAGE ± 18V.

Now Available

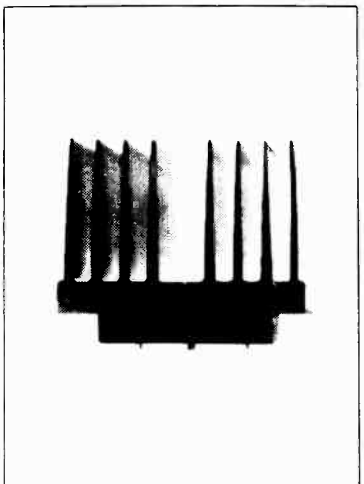
HY50
25 Watts into 8Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.
FEATURES: Low Distortion. – Integral Heatsink. – Only five connections. – 7 Amp output transistors. – No external components.
APPLICATIONS: Medium Power Hi-Fi systems. – Low power disco. – Guitar amplifier.
SPECIFICATIONS: INPUT SENSITIVITY 500mV.
OUTPUT POWER 25W RMS in 8Ω LOAD IMPEDANCE 4-16Ω. DISTORTION 0.04% at 25W at 1kHz.
SIGNAL/NOISE RATIO 75dB. FREQUENCY RESPONSE 10Hz-45kHz. – 3dB.
SUPPLY VOLTAGE ± 25V. SIZE 105-50-25mm.



HY120
60 Watts into 8Ω

The HY120 is the baby of I.L.P.'s new high power range, designed to meet the most exacting requirements including load line and thermal protection, this amplifier sets a new standard in modular design.
FEATURES: Very low distortion. – Integral Heatsink. – Load line protection. – Thermal protection. – Five connections. – No external components.
APPLICATIONS: Hi-Fi. – High quality disco. – Public address. – Monitor amplifier. – Guitar and organ.
SPECIFICATIONS:
INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8Ω LOAD IMPEDANCE 4-16Ω. DISTORTION 0.04% at 60W at 1 kHz.
SIGNAL/NOISE RATIO 90dB. FREQUENCY RESPONSE 10Hz-45kHz. – 3 dB. SUPPLY VOLTAGE ± 35V.
SIZE 114x50x85mm.



HY200
120 Watts into 8Ω

The HY200, now improved to give an output of 120 Watts, has been designed to stand the most rugged conditions, such as disco or group, while still retaining true Hi-Fi performance.
FEATURES: Thermal shutdown. – very low distortion. – Load line protection. – Integral Heatsink. – No external components.
APPLICATIONS: Hi-Fi. – Disco. – Monitor. – Power Slave. – Industrial. – Public address.
SPECIFICATIONS:
INPUT SENSITIVITY 500mV.
OUTPUT POWER 120W RMS into 8Ω LOAD IMPEDANCE 4-16Ω. DISTORTION 0.05% at 100W at 1kHz.
SIGNAL/NOISE RATIO 96dB. FREQUENCY RESPONSE 10Hz-45kHz. – 3dB. SUPPLY VOLTAGE ± 45V.
SIZE 114-100-85mm.

HY400
240 Watts into 4Ω

The JY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω. It has been designed for high power disco or public address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.
FEATURES: Thermal shutdown. – Very low distormion. – Load line protection. – No external components.
APPLICATIONS: Public address. – Disco. – Power slave. – Industrial.
SPECIFICATIONS:
OUTPUT POWER 240W RMS into 4Ω. LOAD IMPEDANCE 4-16Ω. DISTORTION 0.1% at 240W at 1 kHz.
SIGNAL/NOISE RATIO 94dB. FREQUENCY RESPONSE 10Hz-45kHz. – 3dB. SUPPLY VOLTAGE ± 45V.
INPUT SENSITIVITY 500mV. SIZE 114 x 100 x 85mm.

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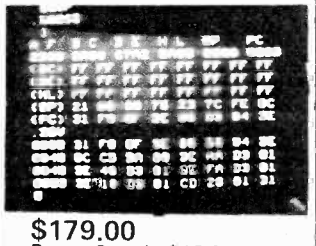

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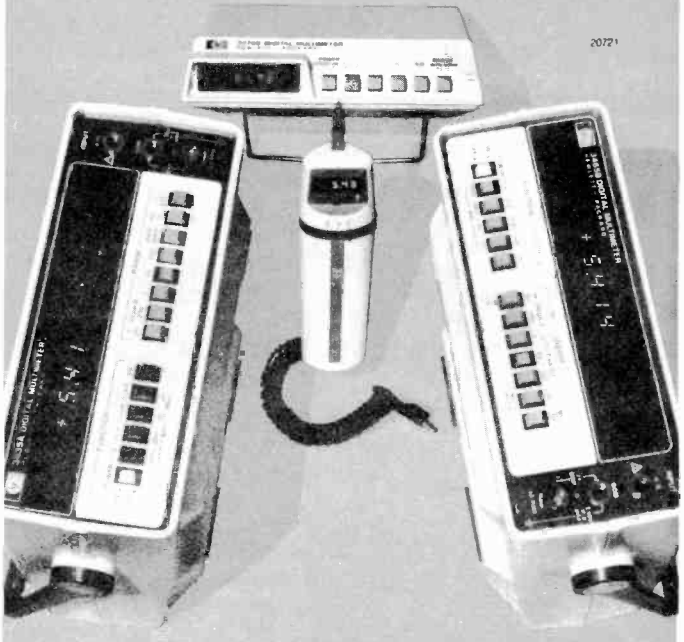

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Features

Projects

Information

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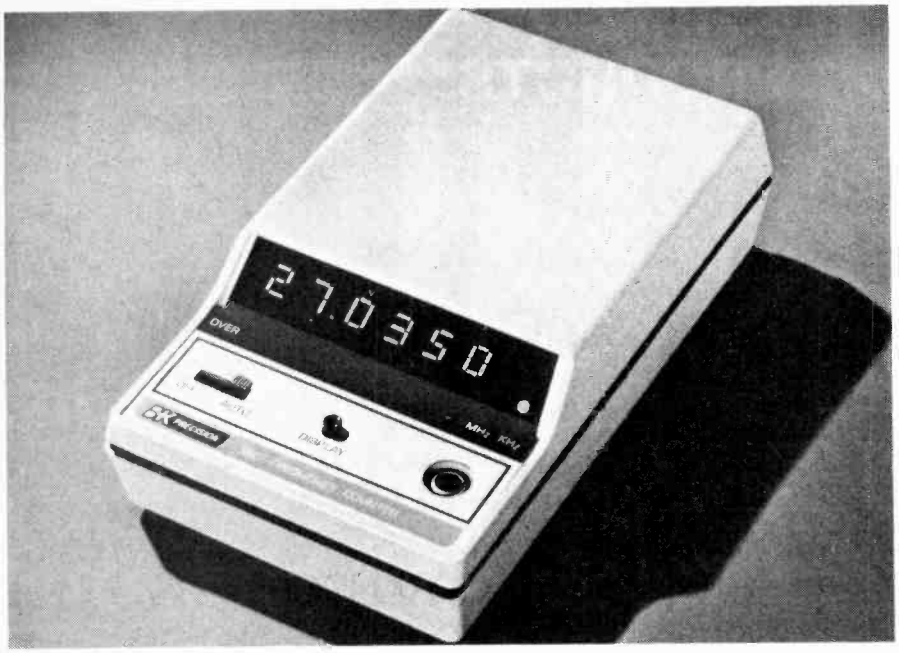
NEWS DIGEST

30MHz COUNTER



A 30MHz portable frequency counter costing only US $120.00 has been announced by B&K-Precision, Dynascan Corporation. Not much larger than a pocket calculator, the 1827 offers full six-digit LED display with autoranging and guaranteed operation to 30MHz with 1Hz resolution. It features 1ppm resolution on a six-digit scale with ±0.25ppm stability. The input circuitry is sensitive enough to display a 100mV sinewave signal, but is protected against an input signal of up to 200 volts peak. An optional signal tap allows the 1827 to continually monitor the output frequency of a 23- or 40-channel CB transceiver without affecting normal set operation. The signal tap is rated at 100 watts. The 1827 is also fully compatible with the B&K-Precision 40-channel CB service bench. Other optional accessories include rechargeable batteries and an AC adapter/charger, an under-shelf or under-dash mounting bracket, 27MHz pickup antenna (for use near portable transceivers), general purpose input clip-lead and vinyl carrying case. With appropriate accessories, the 1827 will also operate from either an external 6.7 to 9.7 VDC, 12 VDC (for mobile operation) or 110 VAC. Including optional Nicad batteries, the 1827 frequency counter weighs less than 1 lb. Size is only 1.75 x 3.75 x 6.6". *B&K Precision, 6460 W. Courtland Ave., Chicago, IL 60635, U.S.A.*

ANALOG GUIDE

A new 36-page Short Form Guide provides detailed technical specifications, application data, and prices for over 300 analog devices: electronic products for precision measurement and control.

Among the products described are A/D and D/A converters; V/F converters; sample-hold amplifiers; analog interface subsystems; data-acquisition subsystems; digital panel meters; operational, instrumentation, and isolation amplifiers; thin-film networks; and power supplies. For free copy, write: *Analog Devices, Inc., P.O. Box 280, Norwood, Massachusetts 02062.*

I HEARD IT THROUGH THE GRAPEVINE

Rumour is that *Commodore* (CBM) are about to introduce a home computer for less than $700, with built-in VDU and keyboard. Chances are that this is based on the MOS Technology 6502, as CBM recently bought that company. Motorola are also known to be looking at the personal computing market, and are believed to have something up their sleeve for release later this year. . . .

ARRL CONVENTION

On June 3rd–5th, Scarborough Amateur Radio Club is hosting the American Radio Relay League National Convention at the Sheraton Centre Hotel in Toronto. This will be the second time the ARRL National has been held in Canada, the previous occasion being in Montreal, 1967. A varied program has been arranged with speakers and forums on a wide range of topics, and of course, there are programs for XYL's and junior ops. A variety of social functions have been arranged. For further details and registration form, write *'77 ARRL National Convention, P.O. Box 1011, Station 'C', Scarborough, Ontario M1H 2Z4.*

YET ANOTHER

Computer Mart Ltd. have opened a retail computer store at *1543 Bayview Avenue, Toronto M1K 4K4.* This store stocks Imsai, Polymorphic, Cromemco, Sphere, Digital Group, TDL, IASIS, North Star and Volker Craig as well as video monitors, tools, in fact everything you need. Demo systems are up and running, so why not drop in?

SUPERGRAPHICS

Tektronix have introduced a new interactive graphics terminal which gets over the drawback of their storage graphics terminals. Storage tubes cannot satisfactorily display moving graphics — the whole screen is erased with a brillian green flash. This new 19 inch tube uses two acceleration voltages — the high voltage beam writes, but the lower voltage image decays and so has to be refreshed. The whole system is run by an Interdata 16-bit mini which requires 32kbytes of memory. Sounds great for playing Lunar Lander, Star Trek, Star Trader. . . .

1-CHIP F8

Fairchild Camera and Instrument is to offer a one-chip version of its F8 microprocessor. The 3859 will carry 1K of memory and will be functionally compatible with the older 3850/3851 combination. A 2K version, the 3860 is also in the pipeline.

PUBLICATIONS FROM ETI

CIRCUITS No. 1:

A brand new concept from the house of ETI more than 100 pages packed with a wide range of experimenters circuits. Based on the 'Tech Tips' section carried in the overseas editions of ETI, Circuits 1 is the first of a series of specials - produced for the enthusiasts who know what they want, but not where to get it! Circuits 1 will also act as a catalyst for further development of ideas, ideal for the experimenter. The collection of more than 200 circuits is complemented by a comprehensive index, making searches for a particular circuit quick and simple. Also, similar circuits can be compared easily, due to the logical layout and grouping used throughout. Last and by no means least, Circuits 1 has no distracting advertisements in the main section!

TOP PROJECTS No. 4:

A collection of 28 constructional projects reprinted from ETI. This is the fourth in a series published by the British edition (Nos. 1,2, and 3 are not available). Projects are complete and include: Sweet Sixteen Stereo Amp, Waa-Waa, Audio Level Meter, Expander/Compressor, Car Anti-Theft Alarm, Headlight Reminder, Dual-Tracking Power Supply, Audio Millivoltmeter, Thermocouple Meter, Intruder Alarm, Touch Switch, Push-Button Dimmer, Exposure Meter, Photo Timer, Electronic Dice, High Power Beacon, Temperature Controller, Electronic One-Armed Bandit plus many more.

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ELECTRONICS — IT'S EASY:

Volumes 1 and two of the best introductory series to electronics ever published in a magazine. Volume three, completing the series, will be available in a few months.

Electronics - It's Easy! takes a fresh look at electronics: it avoids the usual introductions to the subject which mostly seem designed to frighten you away before you reach page 10!

Volume one leads the raw beginner from a gentle introduction, explaining circuits in 'black-box' form up to the use of operational amplifiers.

Volume two deals with more advanced techniques, and deals with digital and logic circuits.

These books have sold extremely well in Australia and in Britain. In Holland they form the basis for a correspondence course.

$6.00 FOR BOTH,
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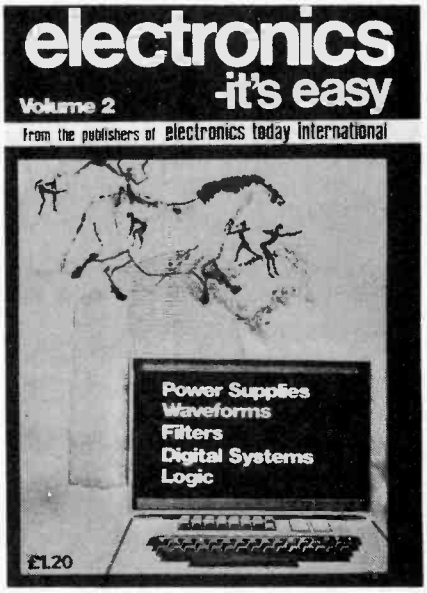

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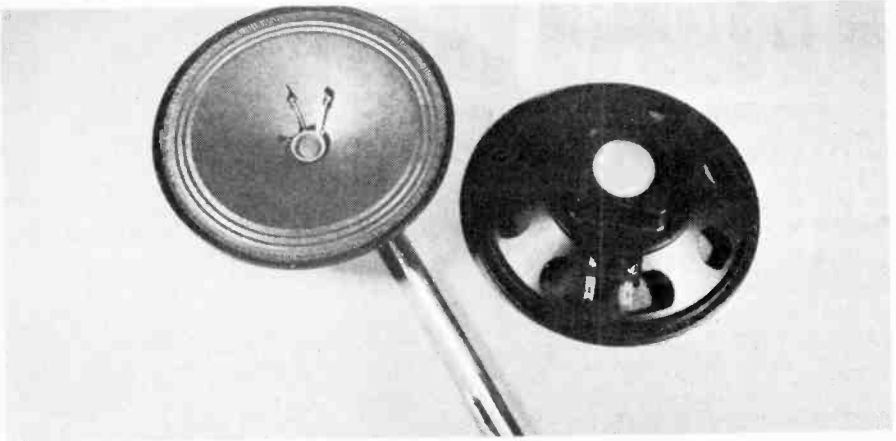
NEWS DIGEST

NEW SMALL SPEAKERS

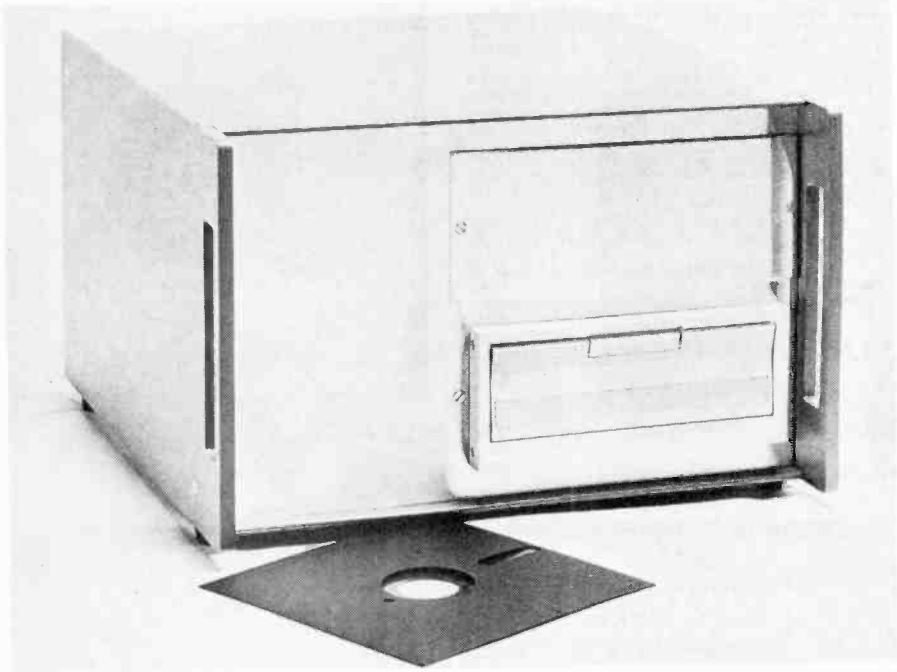


Automatic production of this range of injection-molded speakers has led to very close tolerances in sound reproduction. In most applications the frame is simply spot-cemented to mount the speaker, eliminating hardward. The Ferroxdure magnet systems of the loudspeakers are encapsulated in the black plastic frames during the injection-molding process. The paper cone and voice coil assemblies are ultrasonically welded to the frames at the rim, and the voice coil connections are automatically inserted in the terminal holes.

Designated AD2071/Z and AD4072/X these speakers, which have nominal cone diameters of 2", 3" and 4" have a frequency range of approximately 300 to 6000 Hz and are available with impedances of 4Ω, 8Ω, 15Ω and 25Ω. They are intended for loudspeaker telephones and intercoms. *Philips electronics Ltd., 601 Milner Ave., Scarborough, Ontario M1B 1M8.*

FLOPPY DISK

Electronic Product Associates, Inc., announces the availability of a complete floppy disk system for the 6800 microprocessor. Housed in a ruggedized, medium blue aluminum cabinet, the Micro-68 floppy disk system comes complete with single or dual disk drive, drive electronics, controller and Exorcisor compatible interface for the 6800. Each IBM compatible disk will hold ¼ million words of information. Price complete with power supplies is US $2595 for the single drive system and US $3295 for the dual drive system. Floppy disk operating system, assembler and editor are included. Delivery is two weeks. *Electronic Product Associates Inc., 1157 Vega Street, San Diego, California 92110, U.S.A.*



HARDWARE MULTIPLIERS

If you want to add hardware multiplication to your computer, check out some new devices from TRW. The MPY-18, MPY-12, MPY-16 are (surprise, surprise!) 8, 12 and 16 bit IC multipliers which have separately clocked parallel inputs and a double-precision output. All versions from from a 5V supply and are fully TTL compatible.

AUDIO CLINIC

Eaton's Yorkdale Plaza will be the scene of an Audio Clinic held by Superscope of Canada on April 22nd. A wide variety of equipment will be on hand to perform tests on stereo equipment, so why not bring yours along and see what your frequency response really is.

MPU SEMINARS

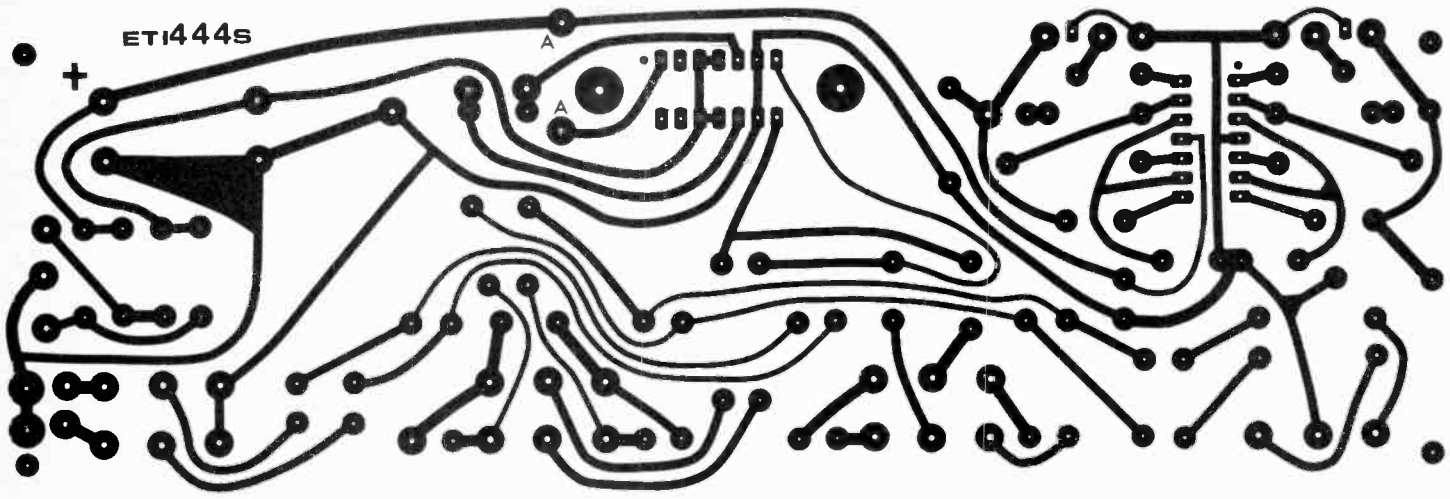
L. A. Varah Ltd. are sponsoring MPU seminars by Adam Osborne (author of 'An Introduction to Microcomputers') in Winnipeg, Calgary and Vancouver. These one day seminars cover Intel's 8080, 8085 and 8748, Motorola's 6800 and 2900, National's PACE and SC/MP and RCA's CDP1802 and are designed to provide an overview and applications perspective. Dates and locations are: Winnipeg, April 19th at Wandyn/Birchwood Inn, 2520 Portage Ave.; Calgary, April 21, at the Convention Center; Vancovuer, April 23, at BCIT Room 197, and they all start at 8:30 am. To register phone: Vancouver, 873-3211; Calgary, 276-8818; Winnipeg 633-6190.

We notice that Varah's are selling the Motorola MEK6800D2 evaluation kit. This two-board kit has a crystal clock, tape cassette interface (Kansas City), undedicated parallel interface, 256 bytes of RAM, J-BUG monitor progran and hex keyboard and display. The main board is fully expandable and compatible with the EXORciser and Micromodules. Most attractive is the price: $284 + sales taxes. *L. A. Varah Ltd., 2077 Alberta Street, Vanacouver 10, B.C.*

CB WIPEOUT

The change from 23-channel to 40-channel CB caused pretty bad headaches for some manufacturers, as people have virtually stopped buying 23 channel rigs. But when the FCC announced the expansion, they also prohibited the sale of 40-channel rigs until Jan. 1, so sales dropped tremendously. *Gladding Corp.*, for example, got stuck with several hundred thousand CB rigs, and although they made US $5.4 million in the first nine months of 1976, they could be back to zero. Other manufacturers are facing similar problems.

NEWS DIGEST



As we mentioned last month, National Semiconductor have changed the package of the LM379. Here is the revised PCB layout which fits the LM379S, which most readers will find easier to obtain. Our thanks go to Canmos Electronics for their assistance with this.

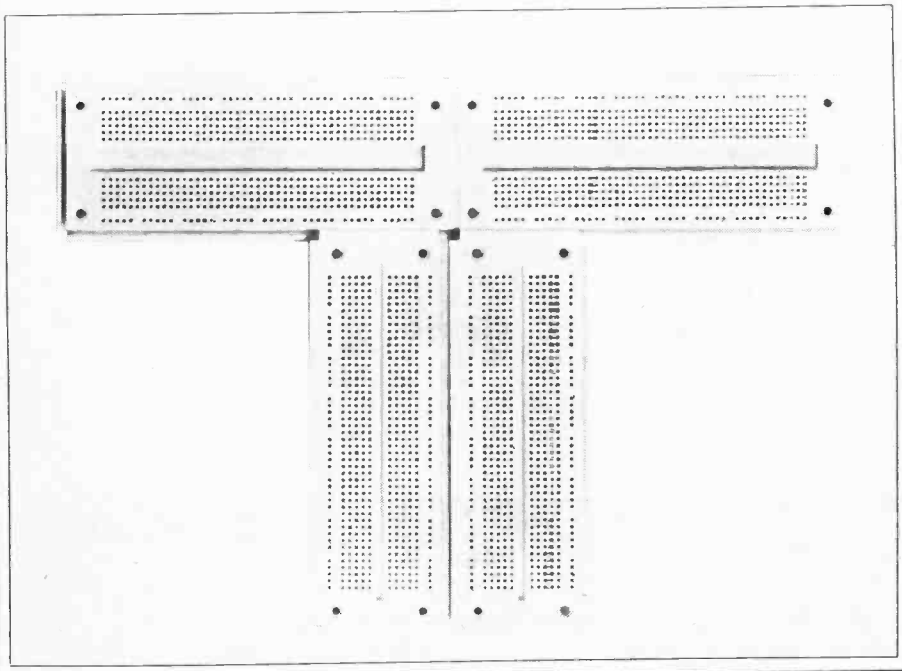
MICROWAVE MICROPROCESSOR

Apparently Texas Instruments have been having great success with their TMS1000 PMOS microprocessor in the microwave oven market. It seems as though the average IQ of the microwave ovens is increasing rapidly. TI are now preparing to introduce an upgraded series of MPUs, the NMOS TMS2000. Meanwhile, National Semiconductor have done a similar rework to produce an NMOS SC/MP. . . .

SOLDERLESS SOCKETS

Continental Specialties Corporation has announced two new profesional-quality solderless breadboarding sockets, which combine a number of highly desirable features, yet are "hobbyist-priced". Designated Experimentor 300 and Experimentor 600, the new one-piece sockets both provide 94 five-point terminals, plus two 40-point bus strips, for a total of 550 solderless tie-points. Experimentor 600 has a 0.6" center channel, making it the only socket currently on the market with full four-terminal fan-out for microprocessors, clock chips, RAMs, ROMs and other larger DIP packages. Experimentor 300 has a 0.3" center channel that is perfect for smaller DIPs.

For further information contact: *Len Finkler Limited, 25 Toro Road Downsview, Ontario M3J 2A6*



45ns MOS MEMORIES

Both Intel and AMI have disclosed advances in MOS technology which allow access times of 45ns and less, with the density of MOS. Intel are poised to produce a 4K by 1 static RAM with 45ns access time and dissipation of only 40mW in the power-down mode. AMI plan to produce a 1K RAM with similar access time using their VMOS process, so named because it uses a V shaped transistor.

BURGLAR PROOF YOUR HOME!

A layman's guide to protecting the home; or how to keep what you've got for longer!

THERE ARE TWO rising things in modern society, inflation and crime. We can't help you beat inflation but can help to slow down the crime rate! It seems anything that isn't bolted down tends to disappear rapidly, the more expensive the item the faster it goes. When it comes to the home not only is the financial burden enormous, the trauma of a burglary is great as well.

Burglars fall into three general categories; the walk-in thief who does just that, and walks out with any small valuables and cash. The small time burglar, who will break in usually in the late afternoon, and take considerably more than a casual walk-in thief. Professional gangs who will literally clean out a house — carpets, furniture, hi-fi, everything!

PHYSICAL SECURITY

So how do you go about stopping them? The first step is physical security, locks and bolts, moats, bars, trained crocodiles etc. The reason physical security is mentioned first, is that burglars usually don't like making much noise, if they have to use a sledge-hammer to open a door, they'll pick another house.

All exterior doors should have mortice deadlocks fitted. The advantage of these, over the normally used front door lock, is that without a key you can't open them. Even if the door is solid wood, there are ways of opening the common front door lock — from the outside! A point to watch is that if the door is less than 1½ inches thick, a mortice may weaken the door — in cases like this consult a local locksmith. Also if you have a garage — with connecting door — make sure it's as secure as the front and back doors. Further door security is provided by hinge bolts; these are fitted on the hinge side, and automatically engage when the door is closed.

An important thing to remember is to use a professional locksmith, if you have not fitted locks before. If you do fit them yourself follow the instructions carefully. A badly fitted lock can give a false sense of security. Don't fall for door to door lock salesman — they may offer to fit locks — but chances are they could keep extra keys!

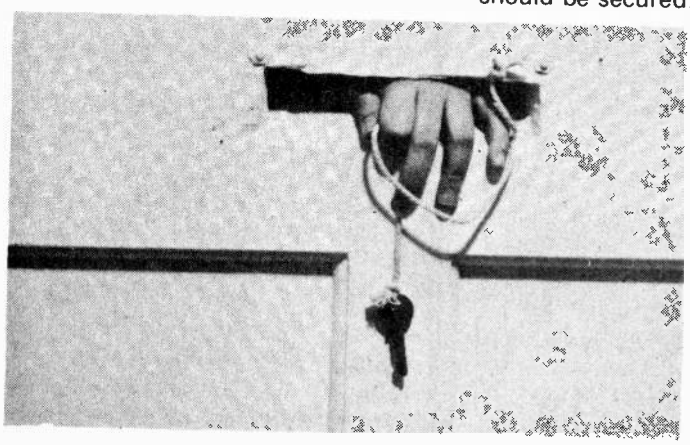
WINDOWS

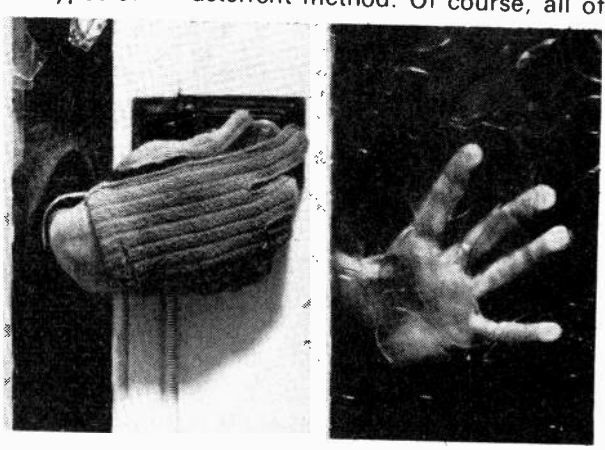
Next the accessible windows should be secured. Several types of locks are available for windows, the best type for each type of window needs to be worked out. Metal framed, wood framed and sash windows all need different locks which secure the frame or the handle depending on the particular model used. They rely on the principle that burglars don't like climbing through a window, with broken glass still int it. In general windows are the weakest point of any house; all ground floor and accessible higher ones must be locked.

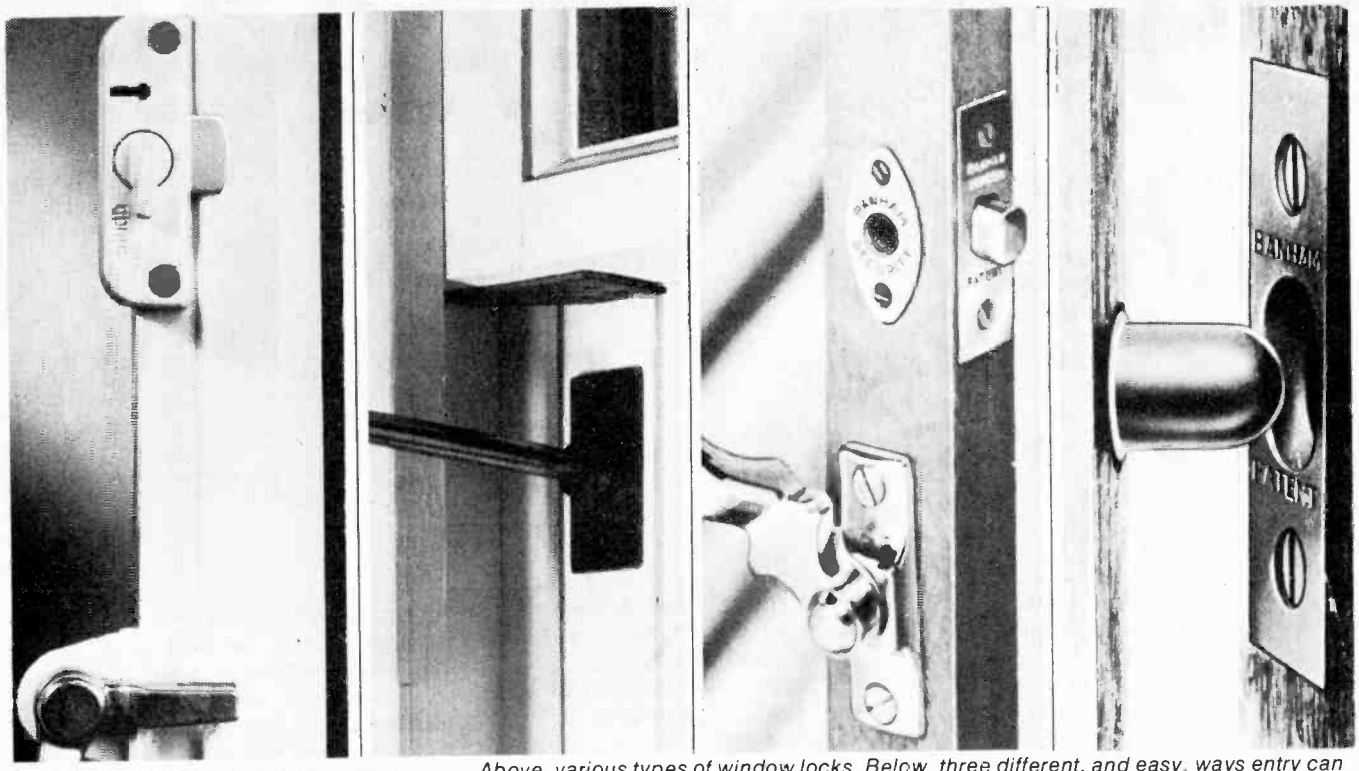
WET PAINT

Other physical security measures are locks on internal doors, or security bolts, so that if a room is entered the burglar is contained in one room. Non drying paint can be used on drainpipes: this wonderfully messy stuff is a good measure. It looks like normal paint, but is like jelly when the surface is broken, any cat burglar grasping the drainpipe gets a very nasty surprise, and will tend to beat a hasty retreat covered in wet paint! Don't use it less than 7 feet from the ground.

Leaving lights on at night, with a radio playing is another simple deterrent method. Of course, all of







Above, various types of window locks. Below, three different, and easy, ways entry can be gained.

these precautions are only effective if you use them — close windows and lock doors, even if you go out for ten minutes. A fact to bear in mind is that a good housebreaker, can "do" a house in six minutes, and get a lot of small valuables.

ELECTRONIC SECURITY

If the precautions discussed have been taken, you will have cut by about 75 per cent the chances of being done. For most people this would enable them to sleep at night, but the remaining 25 per cent risk can be cut to virtually no risk, with a well installed electronic alarm system. As with physical security an alarm system is only effective if it is used. The variety of electronic systems possible makes selection and installation a very important part of the system.

SENSORS

All alarm systems need sensors, to detect (hopefully) an intruder. In order to be of any use they must be placed in the way of potential entry points. Also the optimum type must be used at each point. For example a loop of foil on the back of a window, is not much use, without a sensor to detect if the window is open!

PASS SWITCHES

Alarm systems also need a control box to house any electronics, power supply, batteries, bell and main on/off switch. An external bell is also needed, with possibly an autodial unit, to alert the police. Usually a key operated pass switch is used, so that silent entry and exit can be made. This can either be integral with the mortice deadlock, or a separate switch mounted in the door frame. The advantage of being in the mortice deadlock, is that only one key is required. This is not good practice in industrial systems, where two keys is an added security measure. But for the home it is much simpler to have one key, as it can control a virtually automatic system, when you lock the door the alarm is on. Most security mortice deadlocks can be obtained with an integral microswitch, for a few dollars extra.

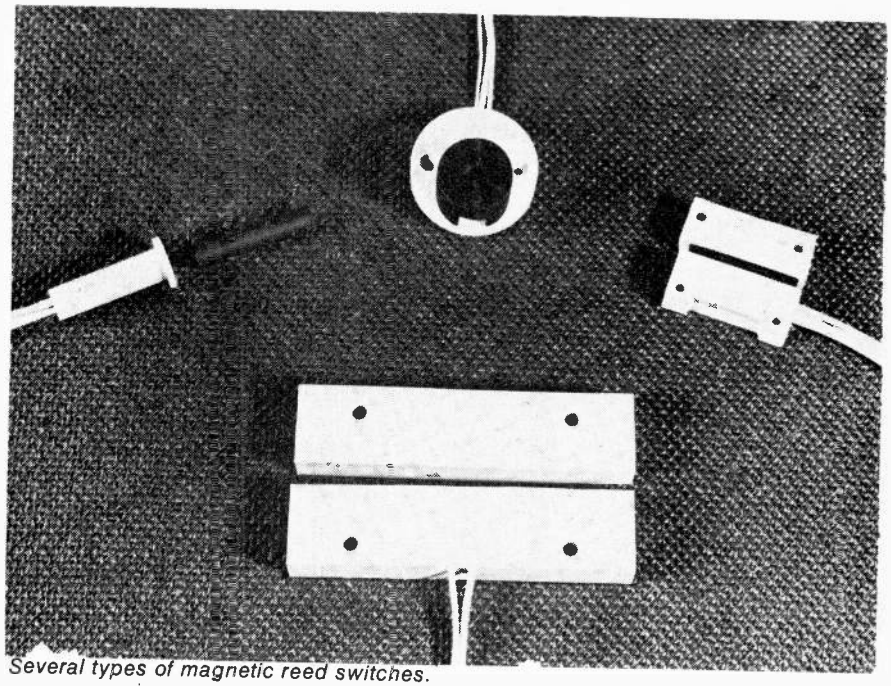
DOORS

External doors should be fitted with reed switches or micro-switches. There are several types available, some are completely hidden when installed, others are mounted on the surface of the door and frame. Always fit the magnet or microswitch actuator to the door itself, not to the frame. This is to eliminate wires from the frame to the door. The only exception to this is when a pass switch is fitted, then fitting a reed switch to the door eliminates wiring over the top of the door.

WINDOWS

Windows are usually a large part of the sensor network. There are several ways of protecting them,

BURGLARPROOF YOUR HOME!



Several types of magnetic reed switches.

giving different degrees of effectiveness, and various costs. Reed contacts are an obvious choice for opening windows, mounted in the frame, so that the magnet moves when the window opens. This will not prevent anyone climbing through a broken pane.

Aluminum foil applied to windows, acts as part of the alarm circuit, when broken sets the alarm off and is quite cheap. However installation is not quick for the inexperienced, and can look very amateurish, if not unsightly. If installed properly foil can act as a powerful deterrent, to all but the most determined burglar. After all why risk detection, when next door is not alarmed? This reasoning also applies to the mounting of your external bell unit, if it is visible.

SHOCK TACTICS

Vibration sensors can be used on large windows. These rely on the physical shock, produced when a window is broken. They are quite expensive, compared to using foil, but much simpler to install. Careful adjustment is needed, to prevent spurious operation.

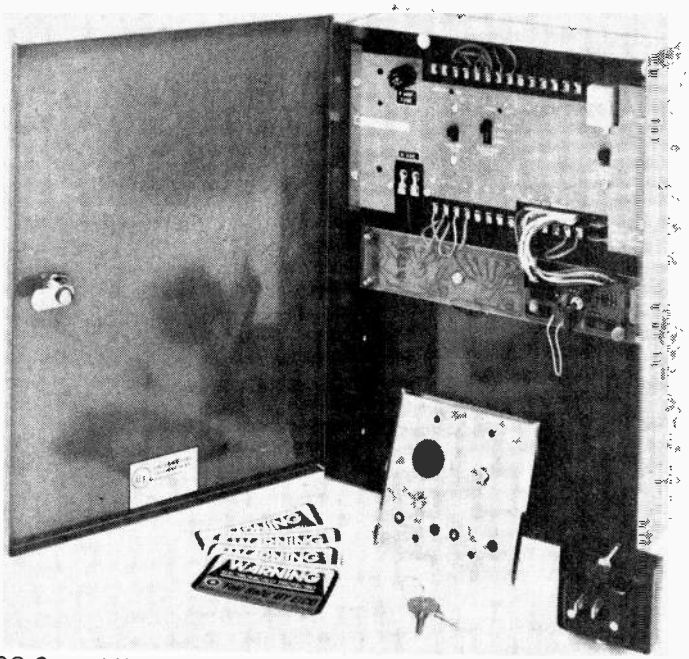
MATS & BEAMS

Another approach is to lock the windows, and defend the rooms. Rather than wire up every window only the most vulnerable are connected to the alarm. In this case the interior needs protection, to detect an intruder as soon as possible. The simplest method is to use pressure mats, placed in the positions most likely to be walked on. The obvious place is by door ways, and on the stairs. If pressure mats are used on stairs it is a good idea to use two — with one at the top, and one half way. They should be installed underneath the carpet, and the wiring hidden from view.

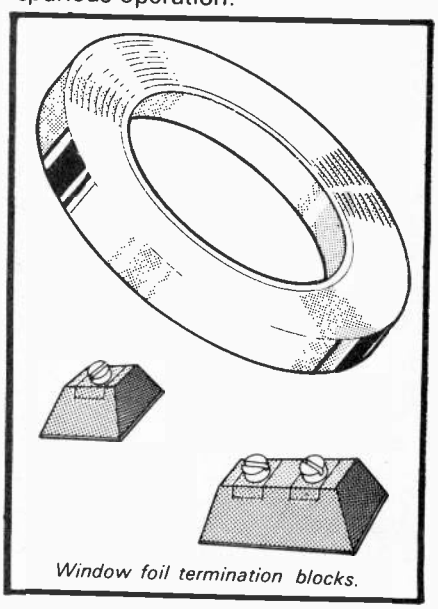
Invisible beams can be used, to cover the hallway. These operate the alarm when anything gets in the way of the beam. Simple beams can be bypassed easily with a torch, by shining it onto the light sensitive part. More sophisticated units use modulated beams, so that the constant light from a torch will operate the alarm.

SPACE ALARMS

The hardest sensor to get past, is the space alarm. These can be ultrasonic or microwave units. They operate by beaming out a signal and detecting the reflected signal, any change in the reflected signal (caused by an intruder) produces an alarm signal. Set up and calibration of these units is quite delicate, spurious signals can be produced by mice or even air currents. About 60 per cent of false alarms are produced by space alarms, that have been set too sensitively. The more expensive units have built-in delay electronics, to help eliminate spurious operation.

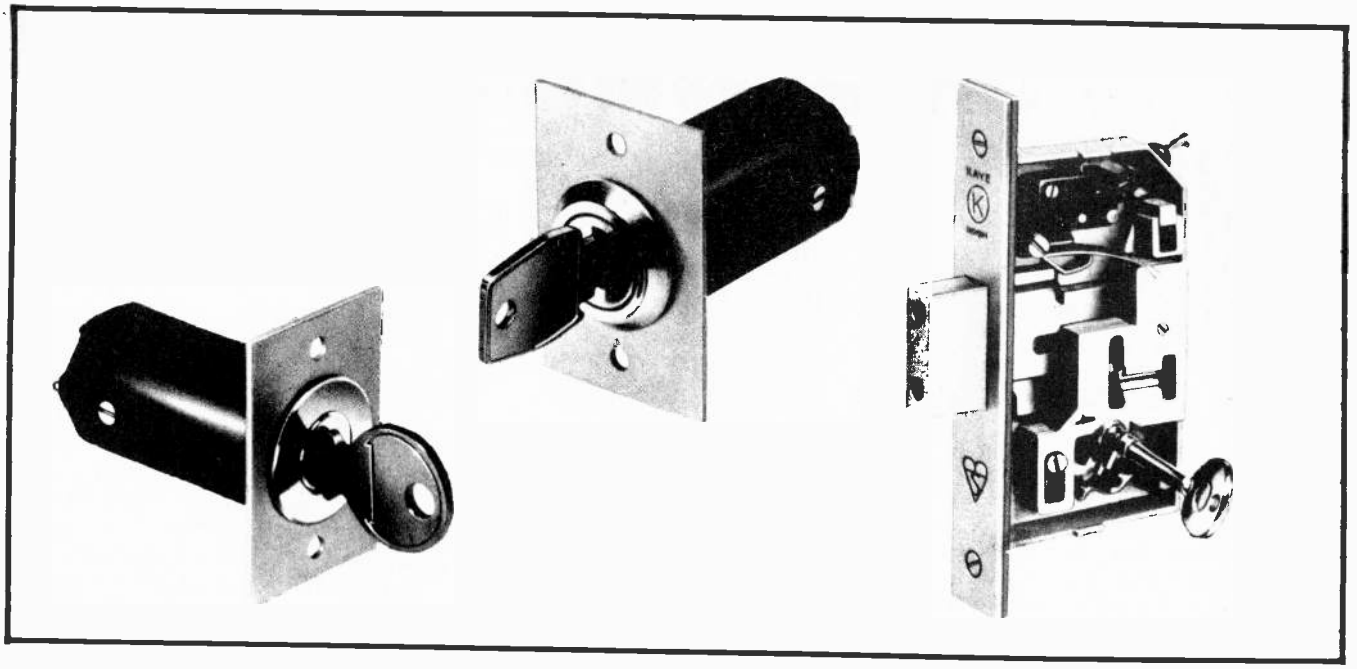


An EICO Control Unit.



Window foil termination blocks.


VANDALS ENTRANCE
BEWARE MINES AND CARNIVOROUS PLANTS
10,000 VOLTS
CROMWELL VILLA
ACHTUNG
WRP



BURGLARPROOF YOUR HOME!

FOILED AGAIN

Window foil should only be applied to prepared glass. First clean the glass with ammonia and water (commercial cleaners tend to leave deposits), dry with a lint free cloth. Mark the line of the foil with chinagraph on the outside of the window. Right angles are made by bending in the opposite direction first, and then in the direction you want to go. This produces a small triangular tab, which should be glued down with varnish. Although, for most home installations the foil can be used from side to side without any angles, practice on a sheet of glass first. If in doubt use another form of sensor.

UPSTAIRS/DOWNSTAIRS

It is good practice to arrange two separate circuits. One for downstairs and one for upstairs. In this way you can have the downstairs protected while you sleep without the chance of late night visits to the bathroom setting off the alarm.

Make sure everyone in the house knows how to use the system, and does use it. If you have pets, it is possible to use window vibration sensors on locked internal doors. This is instead of mats or space protectors, force used on the doors will set off the alarm. Beams should be above the height of any dogs, liable to walk through them.

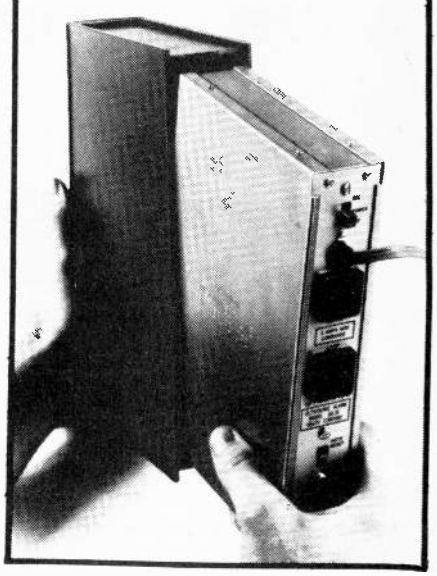
Virtually any combination of the various sensors can be used. Degrees of security can range from slight to Fort Knox.

FINALLY

Don't forget the burgler is generally an opportunist, and will always take the easiest way in. Also if it is worth installing a system, it may be worth increasing your insurance cover to present values.

Top, two different types of pass-switch, and a shunt mortice lock.

Centre and Bottom, two views of the Heathkit ultrasonic intruder unit, type DD39.



The Vertical Interval Reference signal can be used by broadcasters for quality control — but now it's finding its way into the home.

VIR

IT HAS ALWAYS AMAZED US that although people will spend hours of their time and thousands of dollars on selecting high fidelity sound reproduction equipment, very few people are anything like as discriminating when it comes to choosing a TV receiver. Certainly, it is very rare to see a technical review of a TV set and there are, so far as we know, no magazines similar in approach to *Stereo Guide* or *Audio Scene,* for the videophile.

At last, things are starting to happen which may change this situation. With home video cassette recorders already here and embryonic video discs gestating in research labs everywhere, viewers can now choose what they want to watch and when. Projection TVs offer large screen brilliance, and now there is a system that promises to do for video what Dolby did for audio, and more.

If you turn your TV from station to station, you will see that there are significant differences in both tint and colour in pictures transmitted by different stations. This means readjusting the tint and colour controls often, and you can never be quite sure that you are seeing what the program producer intended you to see — even flesh tones are not an accurate guide. Colour and tint can also vary from program to program, depending upon the processing the signal has undergone before leaving the studio — some pass through chroma-key switching units, some are recorded and replayed on video tape recorders.

CGE's new 20 inch colour TV incorporates a VIR decoder, providing automatic control of colour and tint

VIT

In order to ensure that equipment is properly set up and introduces minimum distortion, broadcasters use a Vertical Interval Test (VIT) signal. This signal is inserted, and removed from, the program whenever required, and gives information on the correct operation of equipment in the transmission chain. It carries no information regarding the program signal, and is not a reference for comparison between stations.

VIR

In 1968, a committee was formed to tackle the problem of station-to-station colour variation, and after several years of tests and hard thought, came to the conclusion that the main problem lay in variation of the relationship between chrominance and colour burst amplitude and phase amplitude. They further concluded that the luminance and black levels and the luminance to chrominance ratio were as important and that for comprehensive control of signal quality sync to luminance and burst to sync ratios were also needed. the idea was to encode a reference signal into the program to serve as a reference for correction of the signal to a standard. The signal would undergo all processing along with the program so that it is distorted in exactly the same way and restoring the reference signal to the correct form should also correct the program.

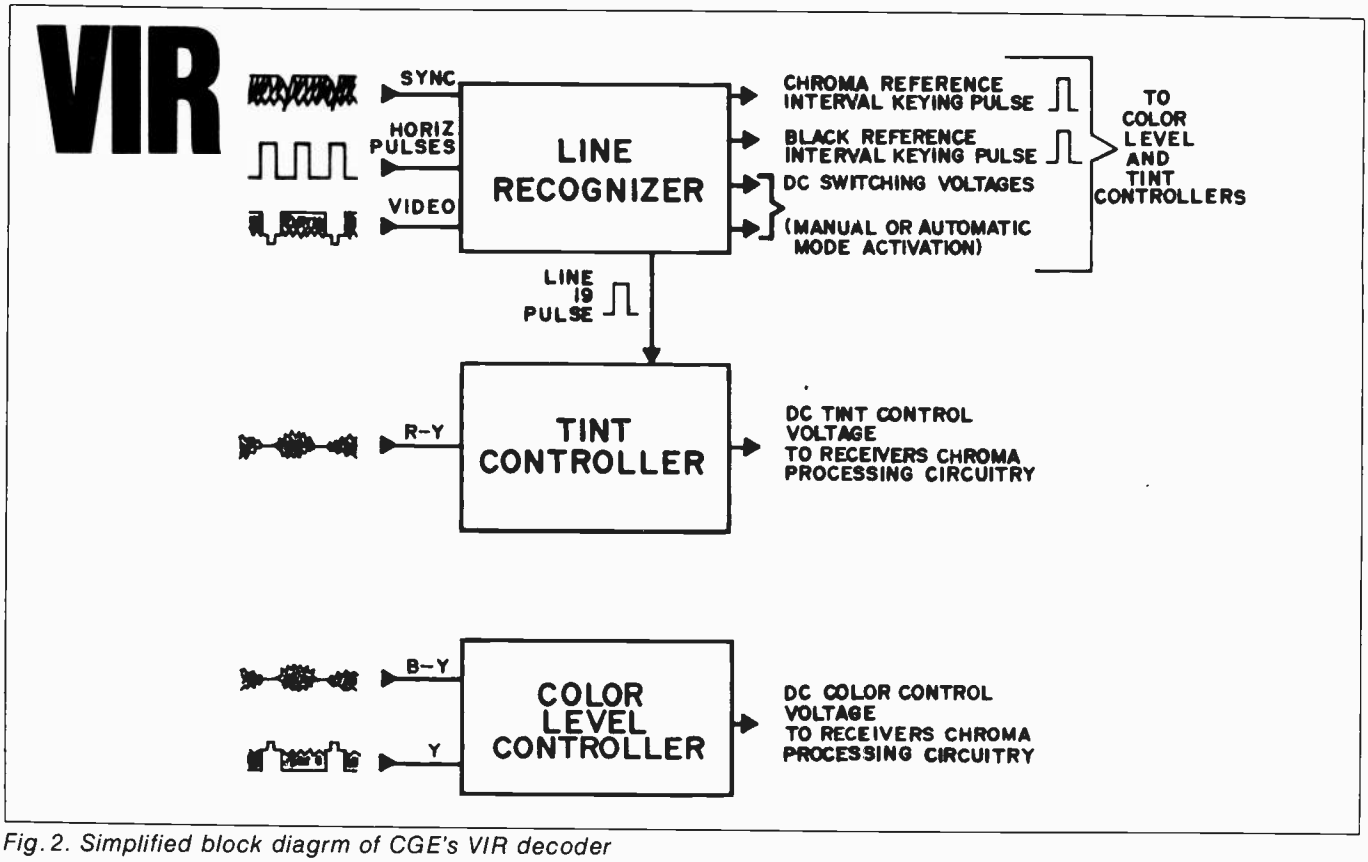


Fig. 2. Simplified block diagrm of CGE's VIR decoder

THE VIR SIGNAL

The signal finally adopted as standard is shown in Fig 1, which is transmitted on line 19 of the TV picture, in the blanking bar. If you reduce the height of your picture, or roll it down using the vertical hold, the VIR signal can be seen as a yellow and white line at the top of the picture. If you don't see it, then it's possible that the station you are watching is not transmitting a VIR signal, but most US network produced programs are transmitted on Canadian TV with the VIR signal, and already, many locally produced programs carry VIR.

The first 24 microseconds of the VIR signal is a chrominance reference of 40 IRE units p-p, superimposed on a luminance pedestal of 70 IRE units, with the chroma phase the same as the program signal colour burst phase at the beginning of the line. The 70 IRE unit luminance pedestal is significant, because this is a typical flesh tone luminance value. The next 12 microseconds of signal is a 50 IRE unit luminance reference-note that this is the same level as the lower edge of the chroma reference and so gives a check on the chrominance to luminance ratio. Finally, there is a 12 microsecond black level reference of 7.5 IRE units.

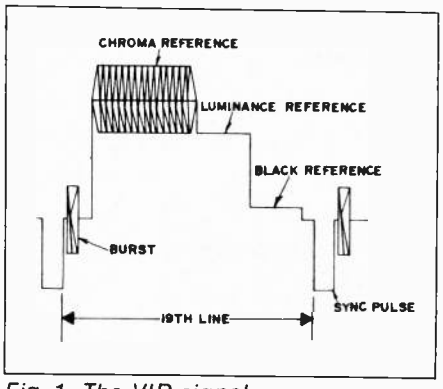


Fig. 1. The VIR signal

VIR & VTRS

Broadcasters can make use of the VIR signal in a variety of ways. Firstly, although not primarily intended for use as a test signal, it is a convenient standard against which measurements can be made to gauge the performance of equipment. More important is the use of VIR when assembling programs from several sources such as news film, documentaries etc. If the VIR signal is inserted at the program source, e.g. camera, telecine machine, VTR, where the producer is certain that the picture quality is OK, then the VIR signal will accompany the program through all the equipment in the distribution chain. Automatic VIR correction equipment can examine the VIR signal and correct the picture quality at any point in the chain.

An example of this would be in video tape recording. VTRs are extremely sensitive and critical in adjustment, and must always introduce some distortion into the signal. If the original VIR signal is recorded onto tape along with the program, VIR-controlled automatic correction can be applied on playback virtually eliminating inconsistencies between machines.

Correction based on the VIR signal can be applied almost anywhere in the production and distribution of TV programming, right up to the transmitter. *Tektronix* manufacture a unit which can be used to monitor the on-air signal and adjust the input to the transmitter so that the transmitted signal is correct. The 1440 Automatic Video Corrector can correct sync amplitude, burst amplitude, picture modulation depth, chrominance to luminance gain errors and burst to chroma phase errors, all from the VIR signal.

But this is not the end of the line for VIR. There's no real point in screening out the VIR signal, even if it's not being used for transmitter correction, and so a great many stations, both in the US and now in Canada, are pumping it out into the ether. If it's there, why not use it?

DOMESTICATED VIR

CGE asked themselves this, and saw that there was good reason to use it. The TV signal is being plucked out of the air, fed through RF preamps, mixer stages, video IF stages, sync separators, chroma amps, demodulators and phase detectors, and the chances of it coming out in the same pristine condition as it entered the transmitter are extremely thin.

But! VIR comes to the rescue. We know what the VIR signal *should* look

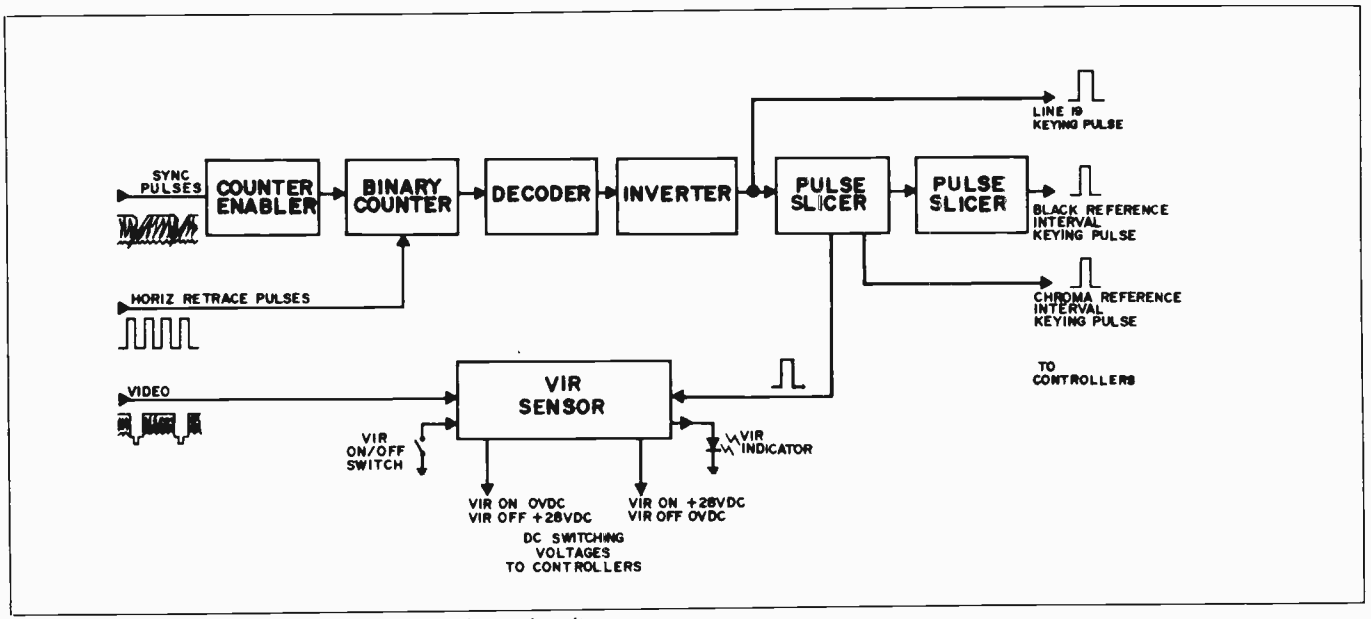


Fig. 3. Block diagram of the line recognizer circuitry

like, so now we know just how unpristine it actually is, and can correct the whole signal until it is pristine again. Sounds simple in theory; in practice it's not quite that easy!

The basis of the operation of the VIR circuitry in *CGE*'s new receiver is that: when the chrominance reference and black level reference are equal in amplitude at the R-Y output, then the chroma phase (i.e. tint) is correct; and when the same two parameters are equal at the blue drive output, then chroma amplitude (i.e. colour) is correct. The explanation of this phenomenon is heavily mathematical, so we won't go into it here.

All the circuitry associated with the VIR processing is on one board, and is rather interesting in operation. Three distinct functions are involved: (1) Recognizing the 19th line, producing pulses during the chroma reference and the black reference, detecting the presence of a VIR signal, and enabling or disabling the circuitry accordingly; (2) Sampling and comparing the appropriate portions of the R-Y signal and using these to control tint; and (3) Performing the same function on the blue drive signal to control colour. These functions are shown in Fig 2.

Figure 3 shows the line recognizer in block diagram form. The counter enabler inhibits the counter for the first four horizontal retrace pulses, and is simply half a 74123 dual monostable. The binary counter is a 7493, and counts from 0000 to 1111 (0 to 15), when all its outputs go high. The decoder (½ X 7420 4I/P NAND) output then goes low, and the following inverter output goes high. The counter started at line 4, so 15 lines later must be line 19, and we thus have produced a line 19 keying pulse. The pulse slicers are both halves of another 74123 one-shot, and produce pulses during the chroma and black level reference portions, respectively, of the VIR signal. The VIR sensor samples the signal during line 19 to see if a signal is present, and produces DC switching voltages to enable or disable the controller circuits.

TINT CONTROL

Both the tint and colour controllers operate in a similar manner, so we shall use the tint controller as an example. Fig 4 shows the basic operation of the circuit. Notice that there are two tint controls; the Tint Preference Control only operates when the VIR circuitry is switched on, and gives a fine adjustment to the otherwise automatic tint control.

Figure 5 is the circuit of the tint comparator. Transistor Q38 and its associated components simply form an impedance matching emitter follower and clean up the signal, removing noise spikes. Now the circuit gets interesting. Diodes Y39-Y42 form a diode switch, which operates as follows: normally Y40 is forward biased (i.e. low impedance) while Y42 is reverse biased, and consequently no signal reaches the base of Q42. When the second pulse slicer in the line recognizer produces its black reference interval pulse, however, Y40 is reverse biased and Y42 conducts so that the signal reaches the base of Q42, and C42 is charged.

A similar process takes place during the chroma reference interval, except that C41 is charged. So this part of the circuit is a dual sample-and-hold, sampling different parts of the demodulated VIR waveform. If the two sampled voltages are equal, we know that the tint is spot-on and needs no adjustment,

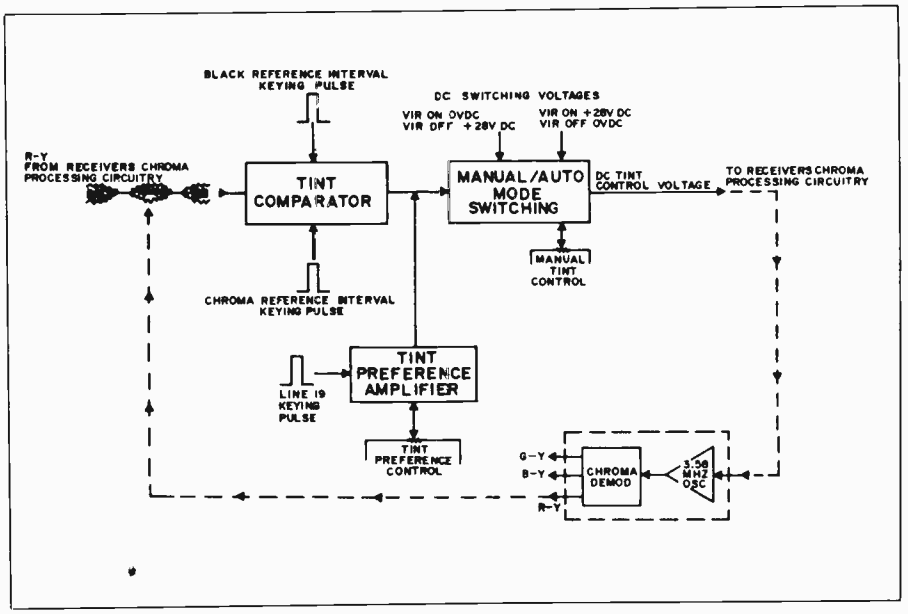


Fig. 4. The VIR tint controller stages from a closed loop feedback system

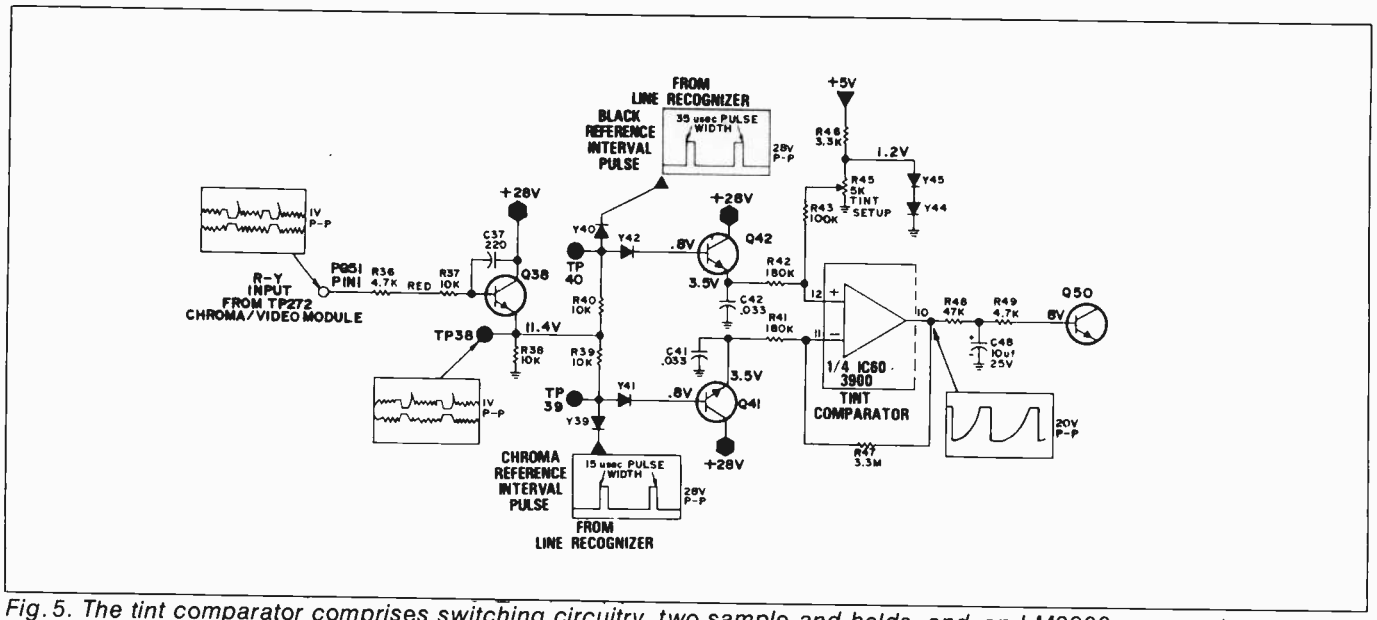


Fig. 5. The tint comparator comprises switching circuitry, two sample-and-holds, and an LM3900 comparator

VIR

hence the control voltage should be zero.

The circuit that does this is a comparator based on ¼ of IC60, which is an LM3900 current-differencing amplifier. The output of this circuit, at pin 10, is the difference between the voltages on the two capacitors. Because of voltage leakage, this will be a curious, sawtooth-like waveform which is integrated by R48, R49 and C48 to produce a DC control voltage. This voltage is fed through some switching circuitry, and finally goes to the chroma/video module.

COLOUR CONTROL

The colour control circuitry is very similar to the tint controller. It is impractical to take an input to the circuit from the receiver blue drive, however, and so the colour controller incorporates a matrix which produces a simulated blue drive signal from the Y and B-Y inputs. The colour level comparator which follows the matrix operates in the same way as the tint comparator, but incorporates an extra buffer stage before the transistor switching circuits. The same arrangement of a preference control plus manual colour control is used here, the circuitry producing a DC control voltage which is fed to the chroma processing circuitry.

IN OPERATION

The VIR system is impressive in use. A front panel control can disable the VIR operation. If the receiver is picking up a VIR signal, and the VIR circuitry is in operation, a red LED lights up on the front panel, indicating that the colour and tint are being automatically controlled.

In a recent demonstration, CGE's new 20 inch model with VIR showed an ability to cope with large differences in colour and tint on transmitted pictures. With the VIR module switched off, flesh tones especially showed tremendous variations from station to station, both off-air and from cable. But with the VIR circuitry on, these differences were eliminated, except on stations which were not transmitting the VIR signal, of course. An interesting side effect is that, due to the time constants in the circuit, when VIR is switched on, the receiver immediately goes wild, producing bright colour with red tints, and then settles down in about three seconds to "track" the correct picture, so the system can be seen to work!

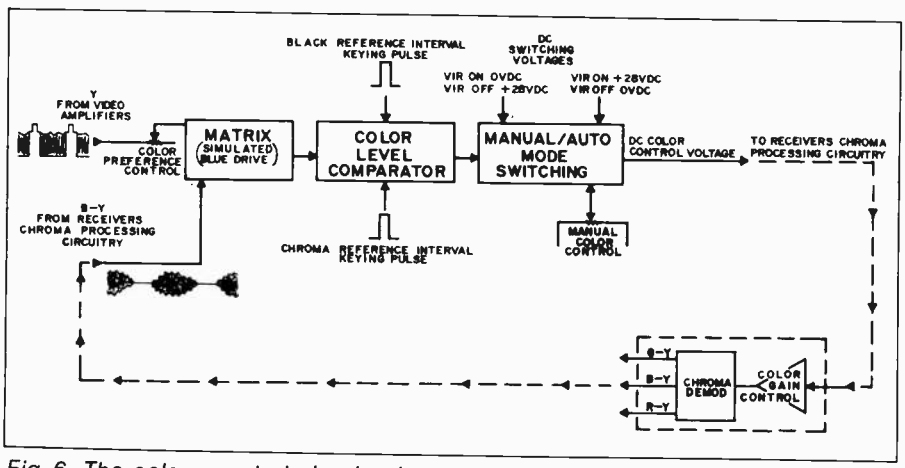


Fig. 6. The colour control circuitry is similar to the tint controller

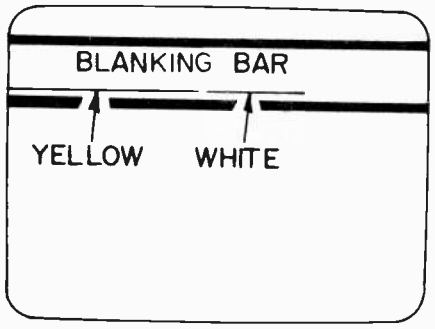


Fig. 7. Location of the VIR signal

As we have said, most American-originated programs have a VIR signal present, and in the US, line 19 is reserved by the FCC for the exclusive use of VIR. In Canada, most stations are already conducting tests, and CBC, the Global TV Network and other stations will officially start transmissions this year, though many are transmitting VIR now (look for the yellow-and-white line). The DOC is expected to reserve line 19, although it will not be mandatory to transmit VIR.

There you have it. Within a year most stations will be transmitting higher quality pictures, and the viewer will not have to constantly adjust the controls. Perhaps the day of high fidelity TV isn't so far away. . . . ●

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DEVELOPMENTS

by John Kirkpatrick

AND NOW THE LINEAR MPU?

THE MICROPROCESSOR GREW from the requirement for a general purpose digital logic handling system, in eighteen months or so that requirement has caused the growth of a sackful of different devices. Now two new types of technology look as if they could do the same for linear or digital/linear applications.

The first of these new technologies is called bi-MOS or bi-FET and these usually have bipolar outputs and matched field-effect transistors at their inputs. This means that the devices have input bias currents that are typically 1000 times lower than those of bipolar only chips, also they respond more than 10 times faster, offer broader bandwidths and have lower noise figures. The difference between bi-FET and bi-MOS is that bi-MOS is easier to produce but has problems like diode protection requirements on the inputs to guard against static and they have slightly worse noise and drift characteristics than bi-FETs.

Most of today's mixed-process linears are operational amplifiers but other types of devices are beginning to appear with our old friends National Semiconductors leading the field at present with a list of op-amps, instrumentation amplifiers, comparators, analogue switches and sample and hold circuits. Motorola is getting in on the act with a quad op-amp where each amplifier in the package will have a 10MHz bandwidth, at about $30 per package it will look expensive but the savings in associated circuitry could be vast. The problem which most manufacturers seem to be having is in deciding which direction to take from here, with so many combinations of technologies possible on one chip the range of possible products is enormous, so if they don't have what you want at present they probably will have within the next eighteen months. With RCA working on a bipolar/CMOS op-amp and Siliconix using bi-MOS in a 3½ digit A-D converter the days of standard hybrids is coming to an end and the day of the linear MPU is coming; just imagine what you could do with bi-polar and MOS linear and digital circuits on one chip!

According to National, bi-FET processing, besides being more complex than straight bipolar technology, requires 5 to 10 times more die area than the equivalent bipolar function. As a result bi-FETs will always cost about 15% more than the bipolar equivalent, if there is a bipolar equivalent.

MORE BITS IN ONE BASKET

Signetics Corp, a division of Philips, have recently announced a new technique which may help to cut back the requirements for additional die area mentioned above. Consider a standard bipolar or MOS memory or shift register, each data byte is defined by eight data bits (or ten or sixteen) each of which could be in a logic '0' or '1' status. With the advent of bus structured systems a third (TRI-STATE) output was required which had a very high impedance state and thus followed the status ('0' or '1') of any other data connected to that bus. TRI-STATE is however simply a third alternative output state, any data inside the memory, buffer or gate is still stored in binary for the simple reason that the memory transistors can only be in an ON or OFF state; with my knowledge of transistors even I can see that a transistor system can hold a current level which is between ON and OFF.

Signetics have announced that they have built and tested some non-binary circuits which could increase the processing capability of bipolar LSI some 4 to 10 times, with figures of 1000 times being muttered for the future. The firms first multivalued circuits use integrated injection logic and current-mode thresholding for a four-level system; eight, ten or sixteen level logic systems are also practical. In such systems, metal conductors carry either 0, 1, 2 or 3 levels of current with resultant savings in pin counts and die area.

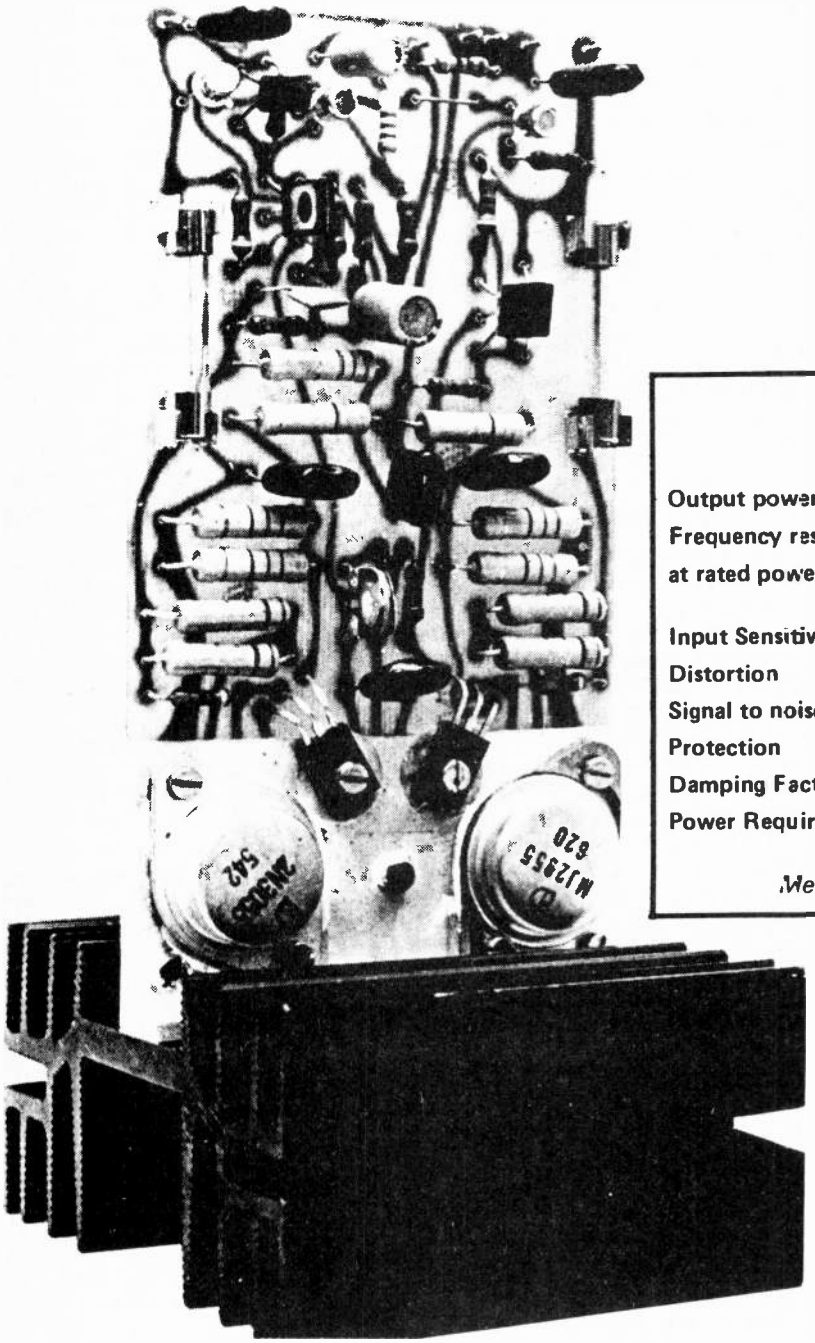
So far as I can gather, the technique is simply to adjust the outputs of the input transistors so that one set of transistor outputs are connected together to form a weighted version of the input, this is virtually a digital to analogue converter. The ability to discriminate from several input thresholds is derived from binary based ECL. It differs because I^2L requires a conversion from current to voltage at its output. This conversion is adapted from operational amplifier circuits that use current-mirroring techniques to produce a current that varies linearly with the applied input voltage.

To test the concept Signetics have built several commercial ICs that have threshold function gates with binary inputs and outputs for connecting to external binary circuits but with multi-level weighted summing and detection circuitry internally. As an example of the savings possible the 8X04 FIFO memory uses such gates to determine whether the memory was ¼, ½, ¾ or completely full. If ordinary TTL or even I^2L had been used at least 4000 transistor devices would have been required; with this new technique the transistor count was cut drastically — to four!

Put a few design engineers into a lab with the concepts of bi-MOS, multi-level logic and a few thousand dollars and we could have some very nice toys to play with in 1977 or 1978! ●

50/100W AMP

MAKING HIGH POWERS EASY TO OBTAIN — 50W OR 100W THE CHOICE IS YOURS — THE ONLY DIFFERENCE IS TWO TRANSISTORS!



PROBABLY THE MOST POPULAR design ever produced by ETI was the 100W Guitar Amplifier, published over two years ago in Ausralia and Britain. This circuit has become a 'standard' and thousands, perhaps tens of thousands, are still in use. That design had the power transistors mounted on a separate heatsink and linked to the PCB by some rather fiddly wiring. This revamped and updated version is simple to build, and can be constructed in 50W or 100W versions, (or even converted, if need be).

Specification

	50 W version	100 W version
Output power	50 W into 8 ohms	100 W into 4 ohms
Frequency response	5 Hz – 50 kHz	5 Hz – 50 kHz
at rated power	$^{+0}_{-3}$ dB	$^{+0}_{-3}$ dB
Input Sensitivity	500 mV	1 V
Distortion	see graph	
Signal to noise ratio	100 dB	100 dB
Protection	1.5 A fuses	3 A fuses
Damping Factor	25	20
Power Requirement	33 V @ 1.2 A	33 V @ 2.4 A

Measured performances of prototypes

CONSTRUCTION

Assemble the module, less the heatsink components, with the aid of the overlay in Fig. 5. Now mount the heatsink bracket on the component side of the board with two screws making sure the other holes line up with those in the PC board.

Mount the power transistors and the BD 139/140 using insulating washers and silicon grease. If the amplifier is to be run continuously at full power we recommend you use berylium oxide washers rather than mica ones. This will lower the junction temperature about 10°C.

The screws holding the 2N3055/MJ 2955 should also be insulated where they pass through the heatsink bracket. The BD 139 and BD 140 do not need any insulation other than the mica, provided 3mm screws are used. In the 100W version the additional transistors are mounted on the heat-sink bracket outside the PC board area.

The heat sensing transistor Q6 should be inserted into the bracket using silicon grease, bend the lead flat against the PC board and solder to the pads provided. When installed, the transistor should be in the centre of the heatsink.

The recommended power supply is shown in Fig.3. This supply gives about 40V on no load, dropping to about 32V on full output. This allows reproduction of transients beyond 50W (or 100W) whilst providing a degree of protection for the output

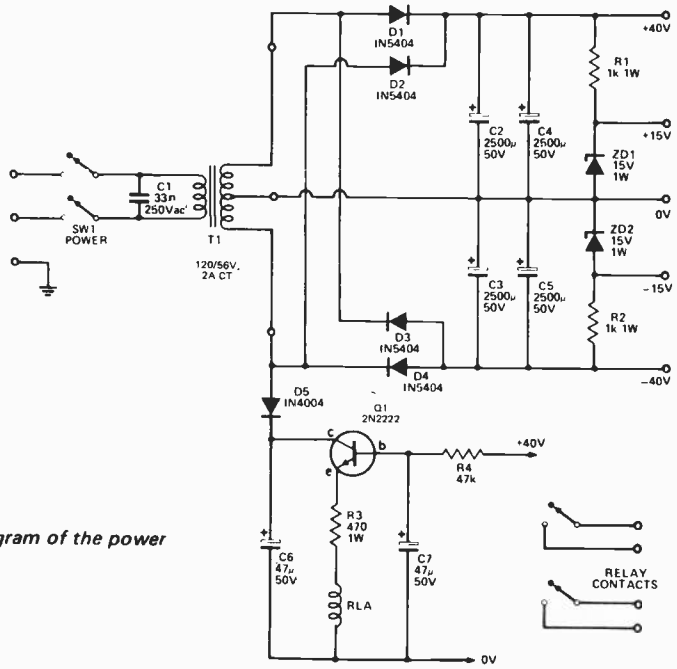


Fig. 3

Circuit diagram of the power supply

Parts List

Resistors

R1, 2	1 k	1 W	5%
R3	470 R	1 W	5%
R4	47 k	½ W	5%

Capacitors

C1	33 n 250 V ac
C2–C5	2500 µF 50 V electro lytic
C6,7	47 µF 50 V electro lytic

Diodes

D1-D4	1N5404
D5	1N4004

Transistor

Q1	2N2222

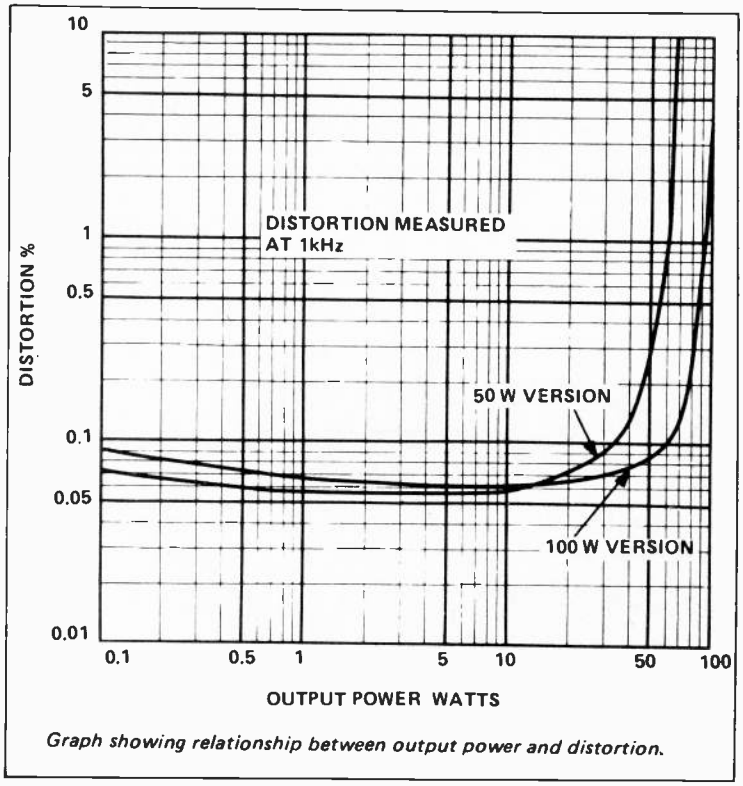
Zener diodes

ZD1, 2	15 V 1 W

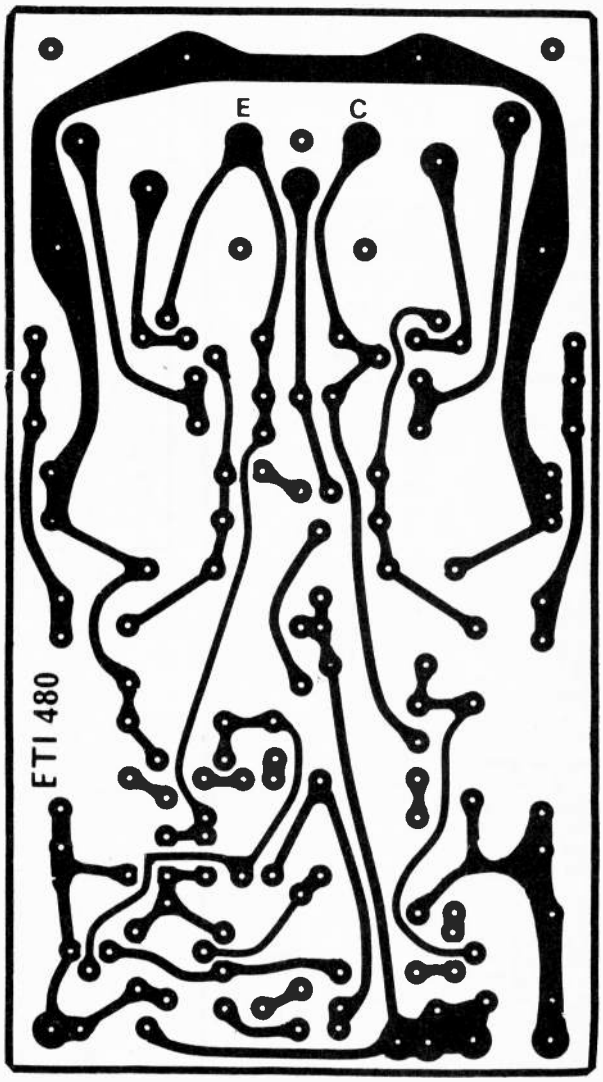
Miscellaneous

PC board – ETI 480 PS
Relay 2 pole 280 ohm coil

SW1 – on/off switch
T1 – 120V/56V 2A CT.



Graph showing relationship between output power and distortion.



Printed circuit layout of the amplifier. Full size 140mm x 76mm.

transistors. If a regulated supply is used, it should not be higher than ±35V.

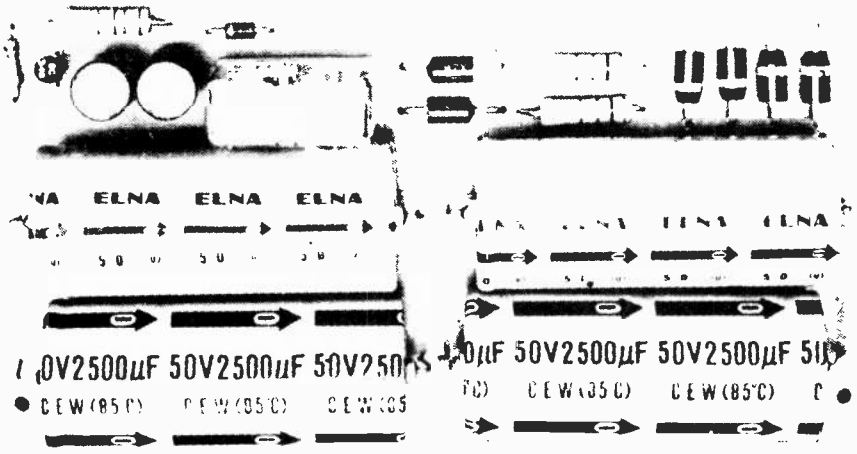
If no preamp is to be used, a couple of chassis-mounting capacitors

Parts List

Resistors	*all ½ W 5% unless noted*
R1	1k5
R2	10k
R3	10R
R4	5k6
R5	2k7
R6	3k3
R7	220
R8*	10 k
R9	1k2
R10	470
R11	1k2
R12	560R
R13	470R
R14	47R
R15	33R 1 W
R16	10 R1 W
R17	33R 1 W
R18	47R
R19	1 R 1 W
R20–R23	220R 1 W
R24 R26 R27 R30*	1R 1 W
Potentiometer	
RV1	470R trim type
Capacitors	
C1	4μ7 25 V electrolytic
C2	100 μ 16 V electrolytic
C3	100 p ceramic
C4	3n3 polyester
C5	330 p ceramic
C6	100 n polyester
C7	27 p ceramic
C8–C12	100 n polyester
Transistors	
Q1–Q3	2N2604
Q4	BD140, 40410
Q5	BD139, 40409
Q6	2N4250
Q7	BD139, 40409
Q8	BD140, 40410
Q9	MJ2955
Q10	2N3055
Q11*	
Q12*	
Zener diode	
ZD1	5.6 V 400 mW

Miscellaneous
PC board ETI 480
Four PC mounting fuse clips (FC1)
Two fuses 1.5 A*
Heatsink
Insulation kits for Q7–Q12.

*** For 100 W version**
R8 is 4k7 ½ W
R27–R30 are 1 Ω 1 W
Q11 is MJ2955
Q12 is 2N3055
Fuses are 3A



The layout of the power supply PCB. Note the polarity of the diodes. The relay in the upper left centre is to 'dethump' any pre amp used.

How it works

The input signal is fed via C1 and R1 to the base of Q2 which, with Q3, forms a differential pair. Transistor Q1 is a constant-current source supplying about 2mA. This current is shared by Q2 and Q3. Transistor Q4 is also a constant-current source supplying about 10mA which, if no input signal exists, flows through Q5 and Q6. The differential pair controls Q5 and thus the voltage at its collector.

The resistors R11 and R12 together with potentiometer RV1 control the voltage across Q6 and maintains it at about 1.9V. But as Q6 is mounted on the heatsink, this voltage will vary with heatsink temperature. Assuming that the voltages on the bases of Q7 and Q8 is equally spaced about zero volts (i.e. 0.95 volts) the current will be set at about 12mA through Q7 and Q8. The voltage drop across the 47 ohm resistors (R14, R18) will be enough to bias the output transistors Q9 and Q10 sufficiently to give about 10mA quiescent current in these transistors. This quiescent current is adjustable by means of potentiometer RV1.

Local feedback is applied to the output stage by the network R20-R23, giving the output stage a voltage gain of about four. The overall feedback resistor, R8, gives the required gain control.

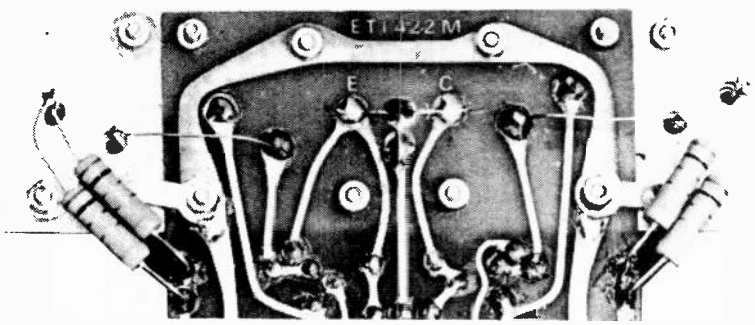
Protection to the amplifier (against shorted output leads) is provided by fuses in the positive and negative supply rails to both amplifiers.

Temperature stability is attained by mounting Q6 on the heatsink and this transistor automatically adjusts the bias voltage.

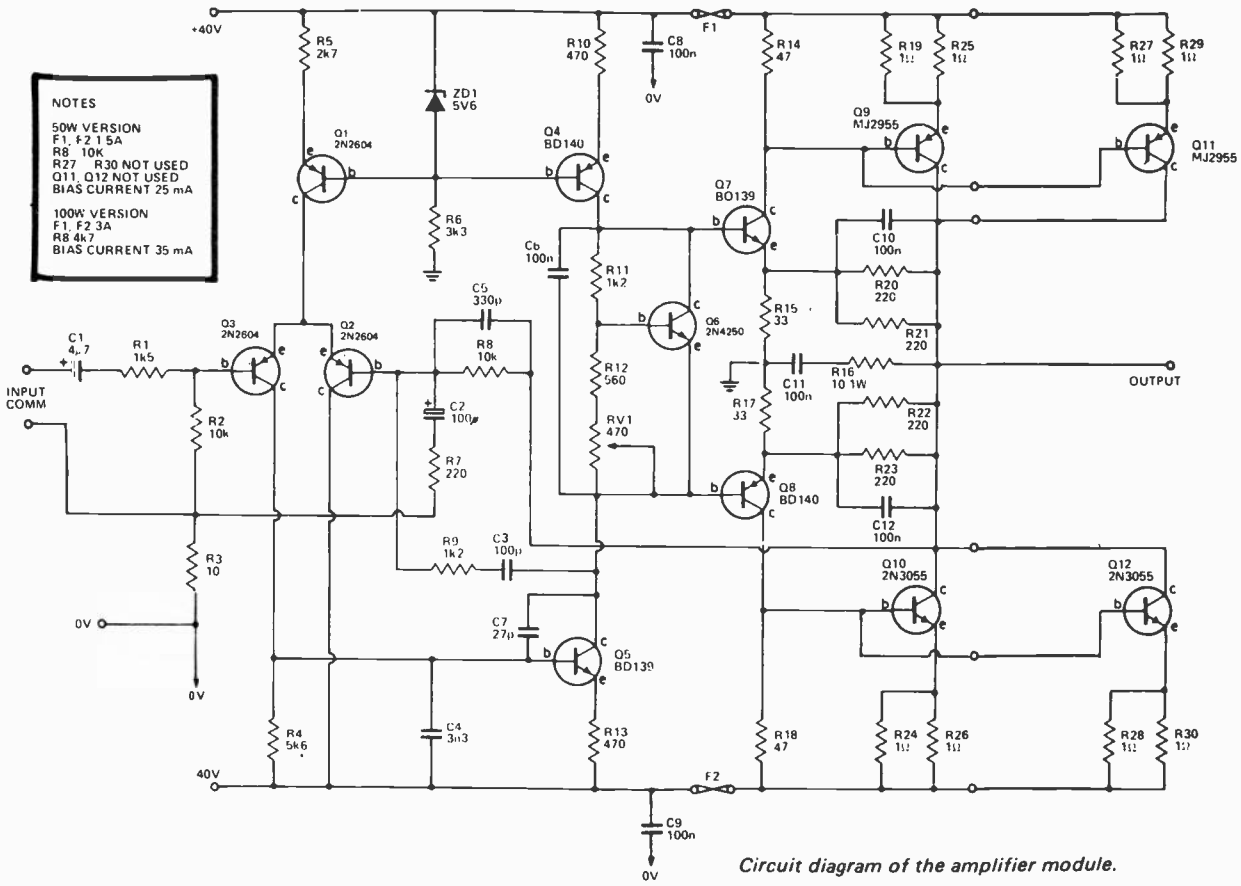
The power supply uses a full wave rectifier and a centre tap to derive ±40V dc. Dropping resistors and zener diodes are also provided for a preamplifier (if required).

As some preamplifiers cause the main amplifier to give a thump on switch-on, a relay is provided to overcome this. R4 and C7 cause a delay of about 3 seconds on switch-on. The relay can be used to switch the output leads from the main amplifier.

IMPORTANT: Q9, Q11 are specified as MJ2955, these must be TO3 cased. If not available in TO3 under this type number — use 2N2955 which are commonly available in TO3 cases.



Rear view of the 100 W module showing the links and resistor which are external to the pc board.



Circuit diagram of the amplifier module.

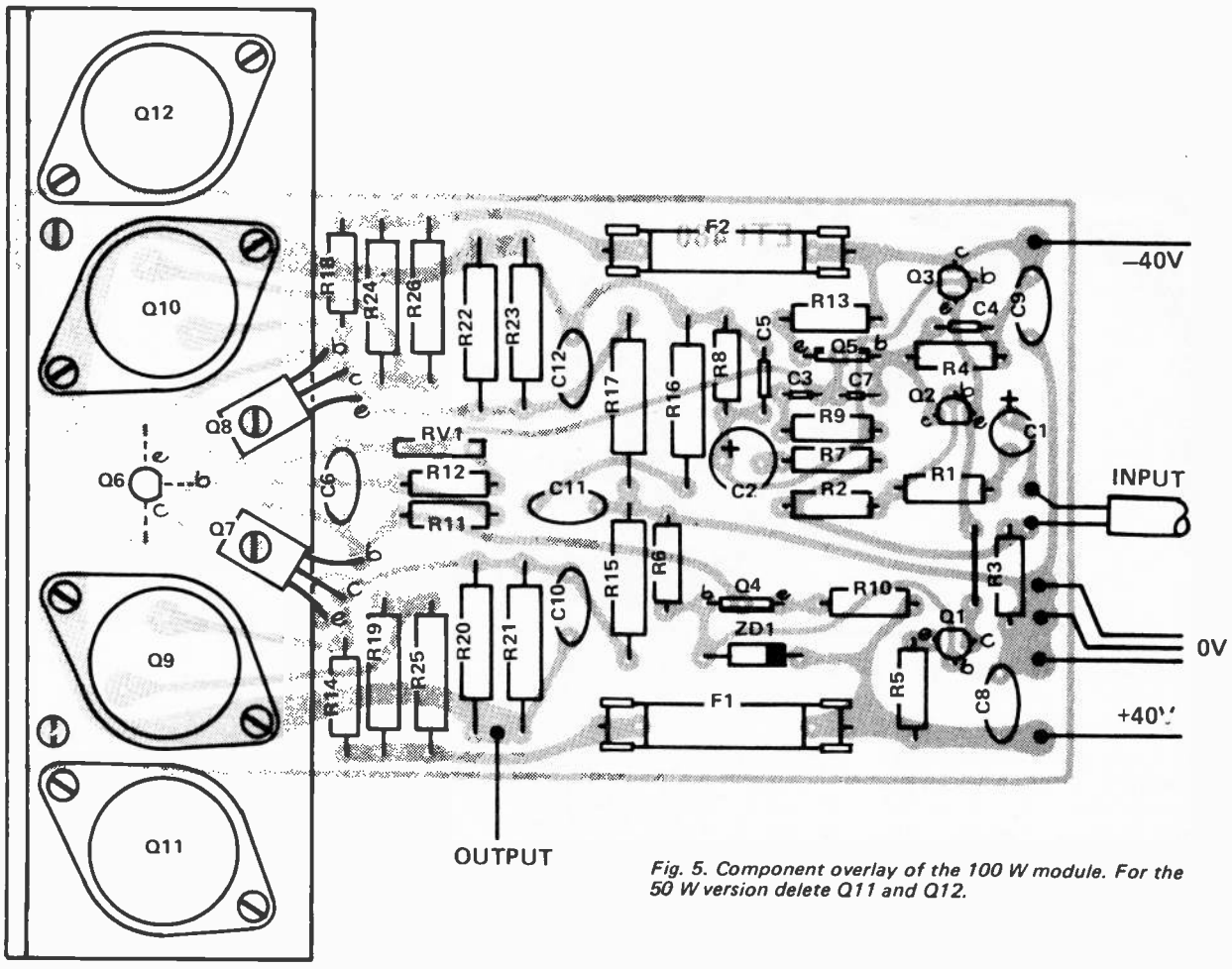


Fig. 5. Component overlay of the 100 W module. For the 50 W version delete Q11 and Q12.

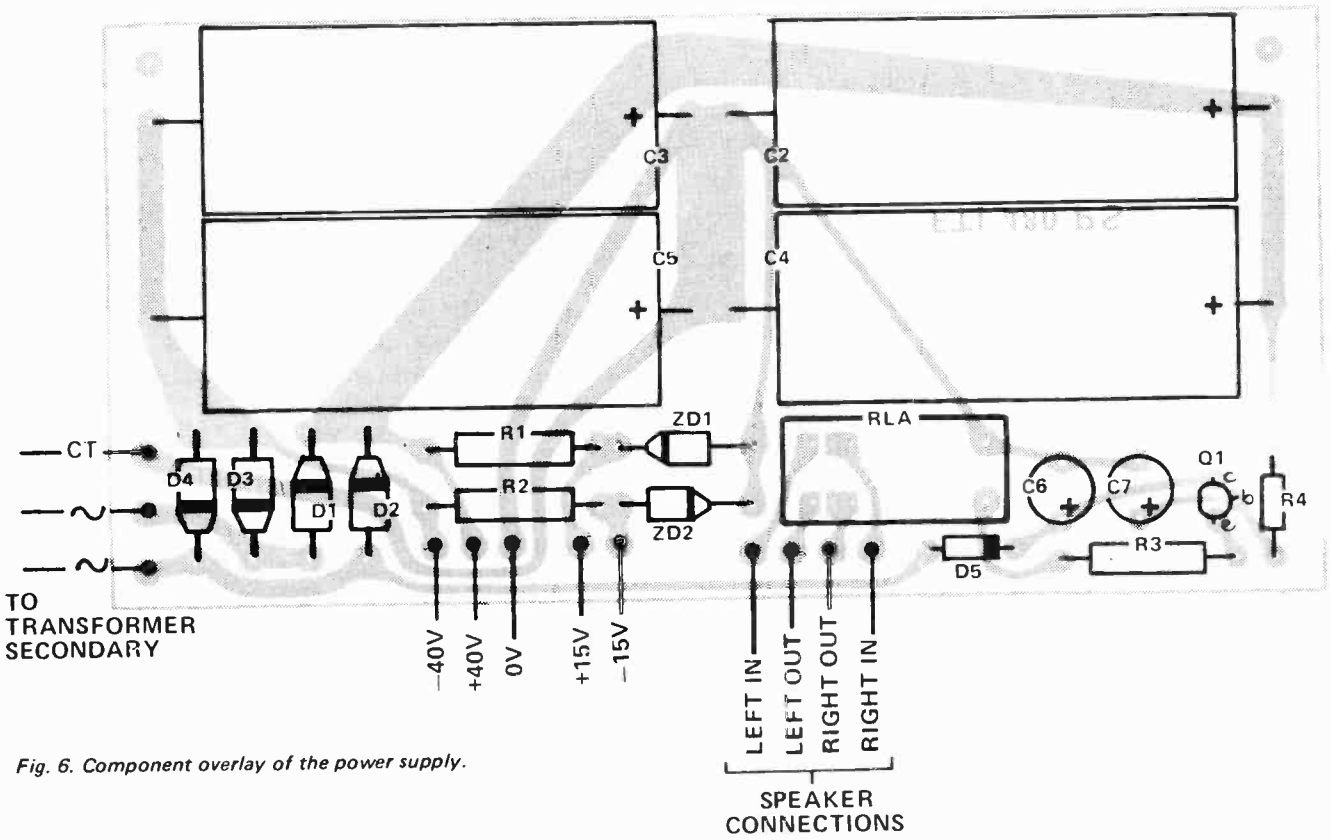
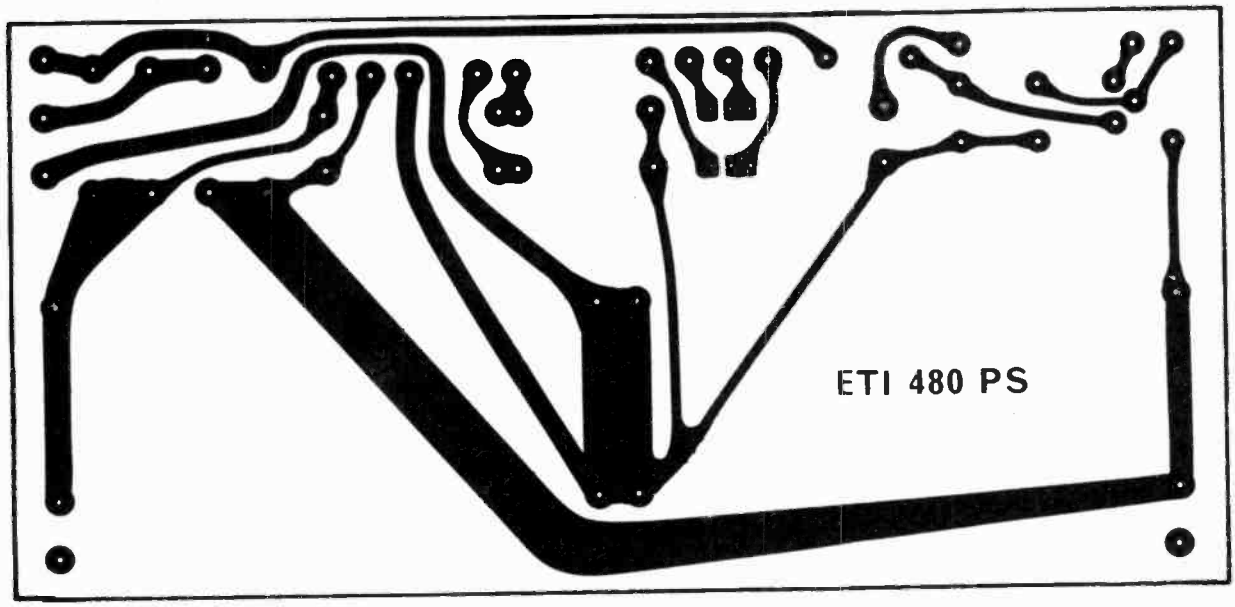


Fig. 6. Component overlay of the power supply.



Printed circuit layout of the power supply. Full size 160mm x 76mm.

(4700μF) with the diodes wired across the terminals will suffice. If the PC board is used, there is facility for building the preamp regulator and fitting a dethump relay (if required). The power amplifier itself does not produce any thump.

ALIGNMENT

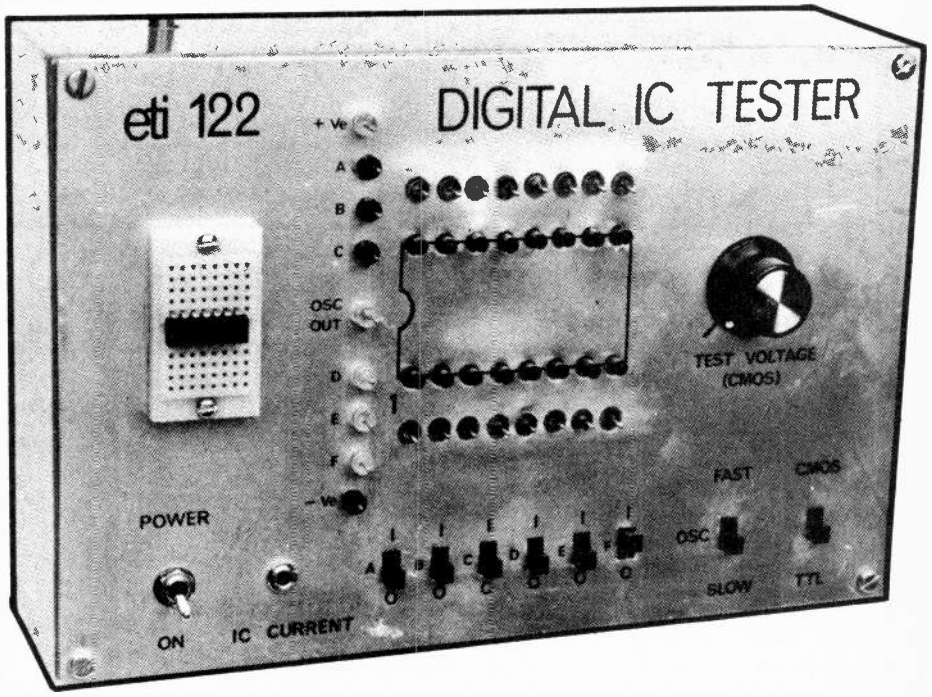
The only adjustment you have to make is to set the current using RV1. The bias current for the 50W version should be 20-25mA and for the 100W version it should be 30-35mA. The figures are for the amplifier running cold. These currents increase about 50% when the amp gets hot.

To measure the current we recommend soldering a 100 ohm ½W resistor across each fuse-holder and removing the fuses. With no load connected and no input, adjust RV1 until there is about 2.5V (3.5V for 100W version) across the resistors. There may be a slight voltage difference between the two resistors, so just take an average. It's not that critical. This method of measuring current is much easier on your testmeter, should there be a fault in the amplifier. ●

ETI project 122

LOGIC TESTER

This useful piece of test equipment has had versatility engineered into it — it will test both CMOS and TTL circuits for correct operation and can be used for breadboarding simple circuits or as a logic tutor.



EXPERIMENTERS often damage ICs in the process of developing a new circuit and often try a new IC in a circuit that is not working to eliminate that as a possible cause. The result of this is that one usually finishes up with a box full of ICs which are of dubious value. To sort out these ICs one must use a tester that is capable of testing the wide range of differing ICs that are available in the most commonly used families.

Until recently the most commonly used family has been TTL. But CMOS is rapidly gaining widespread usage and any tester, to be of value these days, must be able to test both these families. The ETI Logic Tester is capable of testing both families, and is also capable of being used to breadboard and test simple circuits based on single ICs.

An LED indicator is associated with each pin of the IC under test and these are arranged around the perimeter of a box representing the IC under test. This allows a small card, which has the schematic of the particular IC drawn on it, to be fitted to the front of the tester as an aid to the interpretation of the LED test indications.

CONSTRUCTION

The most expensive single component in the tester, after the transformer, is the case. For this reason we decided to make a wooden case and a plain aluminum front panel. Some people may however wish to mount the unit in a diecast box and for this reason the printed circuit board has been sized to fit in a standard 222 x 146 x 51 mm die-cast box. The following description is for a wooden box specifically, but applies equally well to the metal box.

The printed-circuit board is mounted to the rear of the front panel, copper side to the panel, such that the LEDs and patch pins, mounted on the printed-circuit board, project through the front panel. This greatly simplifies construction as it saves some 48 leads and solder joints. The switches are secured to the front panel by first glueing two pieces of printed-circuit board to the rear and then soldering the switches to the copper side of the board. This procedure avoids the necessity of a multitude of screws passing through the front panel.

The printed-circuit board should be assembled with the aid of the component overlay by fitting all components with the exception of IC1, 5, 6 and 7, and LEDs 1 through 16, and the patch pins. Check that the ICs are orientated correctly as are also C2, 5, 7, 9 and D1, 2 and 3. Now solder these parts into position using the least amount of heat necessary on ICs 2, 3 and 4.

Position the LEDs and patch pins onto the copper side of the board but do not solder them in place as yet. Now fit the board to the front panel so that the pins and LEDs protrude through the panel evenly. Secure the pins and LEDs in position by using a very small drop of five minute epoxy for each, on the component side of the

How it works

The tester consists of four basic sections. The socket for the IC under test, the output level-detect logic, oscillators and switches for the inputs, and the power supply.

The socket for the IC under test has the pins in each row electrically connected to each other. These rows are the groups of five holes which are perpendicular to the central groove on the socket. Each row (ie, each pin on the IC under test) is connected via a 10 megohm resistor to ground to prevent the build up of static charges. The resistors also hold all unconnected inputs at ground potential thus preventing any damage to the IC.

Each row is also connected to a pin on the front panel. Test connections are made to these pins by patchable links from the oscillator and test switches so that the correct test conditions may be set up.

Resistors R19-26 and R43-R50 connect each row (ie pin) to a logic level detector, ICs 5, 6, and 7. These CMOS hex-inverters buffer each pin and drive an LED to indicate the logic state of the pin. When the logic voltage on a pin is high the LED will be alight. Resistors R19 to R26 and R43 to 50 protect the internal diodes of ICs 5, 6 and 7 against the possibility of a pin being taken above the positive supply voltage or below ground potential. Resistors R11 to R18 and R51 to R58 in conjunction with the five volt supply set the operating currents for the LEDs.

A 555, IC4, is used as an astable oscillator which initially charges C8 via R9 and R10 until the 2/3 supply threshold is reached. C8 is then discharged via R9 and pin 7 of the 555 to the lower threshold of 1/3 supply volts. Switch SW6, when operated, puts a larger value of capacitance into the circuit which gives a frequency of about one hertz.

This is slow enough so that the eye can follow each logic state transition. The high speed operation is used for checking very long counters and shift registers and can also be used in conjunction with an oscilloscope.

The square wave output of the oscillator is made available at a

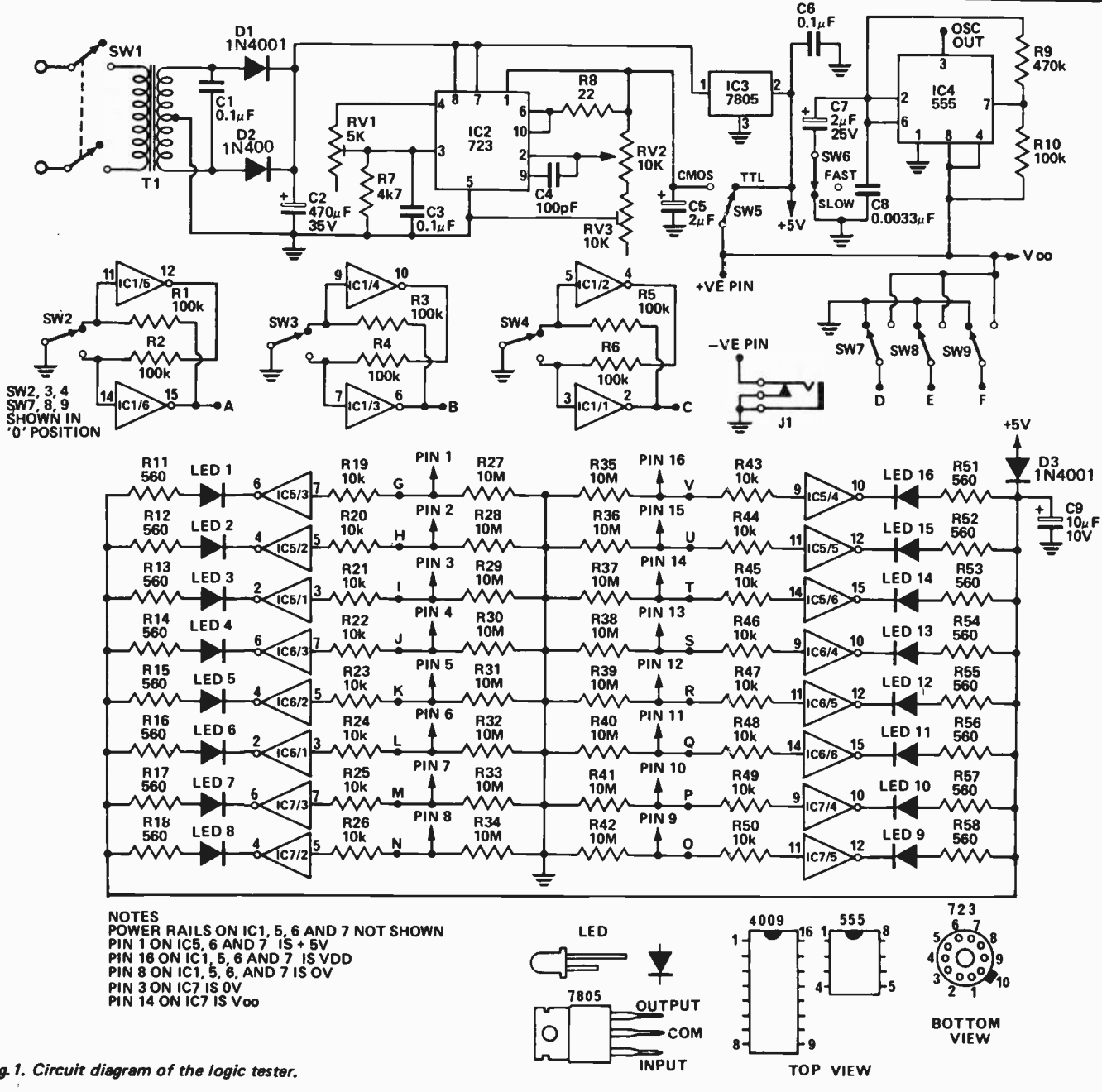


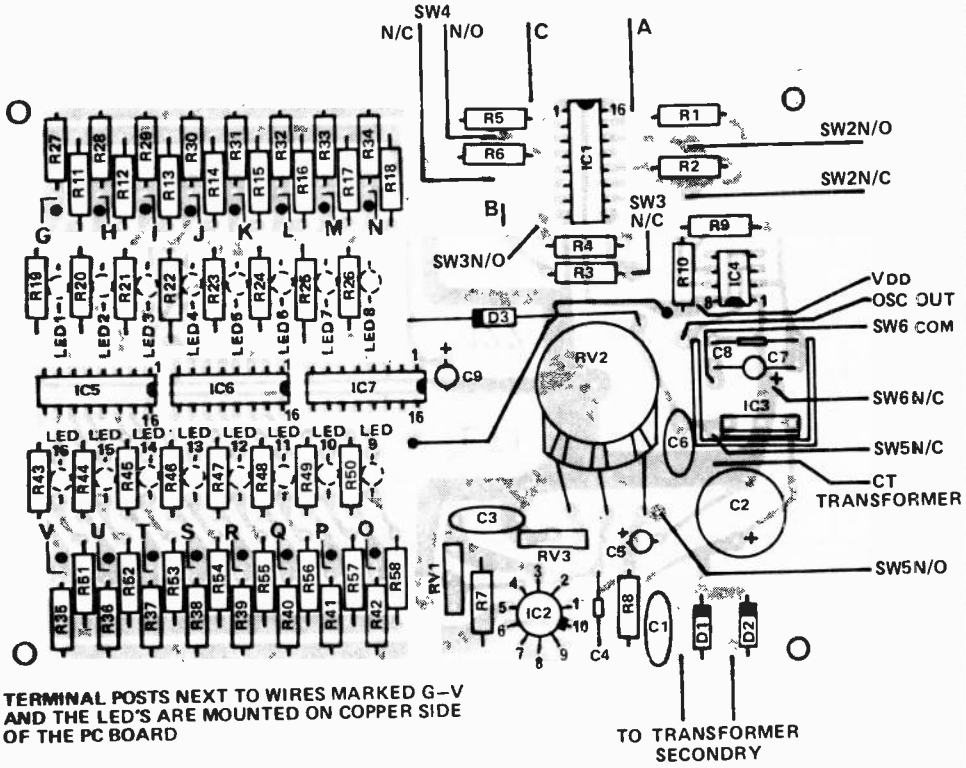
Fig. 1. Circuit diagram of the logic tester.

patch-pin on the front panel.

There are six further output pins on the front panel three of which, D, E and F, are set to negative or positive supply by means of toggle switches. As there is no debounce logic associated with these pins they can only be used to set up static conditions and not for clocking counters and shift registers. The remaining three pins are also programmed by switches but these switches are connected to IC1 which contains three RS flip-flops to effectively remove any contact bounce of the switches. This operates as follows. If initially the input of IC 1/5 is earthed by SW2 its output will be high and hence the output of IC 1/6 will be low. When IC 1/6 SW2 is operated again it earths the input of IC 1/6 sending the output of IC 1/6 and input of IC 1/5 high and the output of IC 1/5 low. Since the input of IC 1/6 is connected to the output of IC 1/5 it is held low even if the contacts of SW2 bounce several times when the switch is operated. Thus the output at A is one single transition from high to low (low to high when next the switch is operated). The output of the three debounced switches are labelled on the front panel as A, B, and C.

In the power supply diodes D1 and D2 full-wave rectify the output from the power transformer. The output from the rectifier is smoothed by C2 and regulated to five volts by IC3. The resulting five volt supply is used to drive the LED indicators and to power the TTL device under test. Integrated circuit IC2, a type 723, is a regulator the minimum output of which is set to five volts by RV1 and the maximum of 15 volts by RV3. Front panel control RV2 allows the output voltage to be adjusted between five and 15 volts. The current limit on the output is set to 30 mA by means of R8. SW5 selects the high current five volt supply for testing TTL or the low current variable supply for CMOS. Terminal J1 in the negative supply lead is provided for checking the current drawn by the IC under test. ●

Fig. 2. How the components are mounted on the pc board.



PARTS LIST — ETI 122

R8	Resistor	22Ω	¼W	5%
R11,18	"	560	"	"
R51,58	"	560	"	"
R7	"	4 k7	"	"
R19,26	"	10 k	"	"
R43,50	"	10 k	"	"
R1,6	"	100 k	"	"
R10	"	100 k	"	"
R9	"	470 k	"	"
R27,42	"	10 M	"	"
RV1	Potentiometer	5 k	Trim type	
RV3	"	10 k	"	"
RV2	"	10 k	Linear	
C4	Capacitor	100 pF	Ceramic	
C8	"	0.0033μF	polyester	
C1,3,6	"	0.1μF	"	
C5,7	"	2μF	25V electro	
C9	"	10μF	10V "	
C2	"	470μF	35V "	

D1,2,3 Diode 1N4001 or similar
LED 1 — LED 16 Light Emitting Diodes

IC1,5,6,7	Integrated Circuit	4009 (CMOS)
IC2	"	723 (metal can case)
IC3	"	7805 (TO-220 case)
IC4	"	555
J1	Jack	small earpiece type
SW1	DPST	toggle 120V rated
SW2-SW9	miniature	slider switch 2 pole 2 position

PC BOARD ETI 122

IC Socket
Wooden case see text
Transformer 120V primary 30V CT secondary or 2 x 15 V windings

25 patching Pin feed throughs

front panel
flex and plug
heatsink for IC3 (see Fig.6)

boards. Do not glue the LEDs to the front panel. Once the glue has set, carefully remove the board from the front panel and then solder the LEDs and pins into position. Fit 250 mm long leads to the board for later connection to the switches and power transformer and then, using a minimum amount of heat, solder ICs 1, 5, 6 and 7 into position.

Solder the leads to the pins on the IC socket — the front panel must be cut out so that these leads may be passed through. Now affix the socket to the front panel and install the printed circuit board. Mount the transformer into the base of the box and interconnect the board and switches etc.

The wooden box was constructed from 12 mm thick pineboard such that the outside dimensions were 225 x 148 x 70 mm. We finished our box with coloured high-gloss enamel which

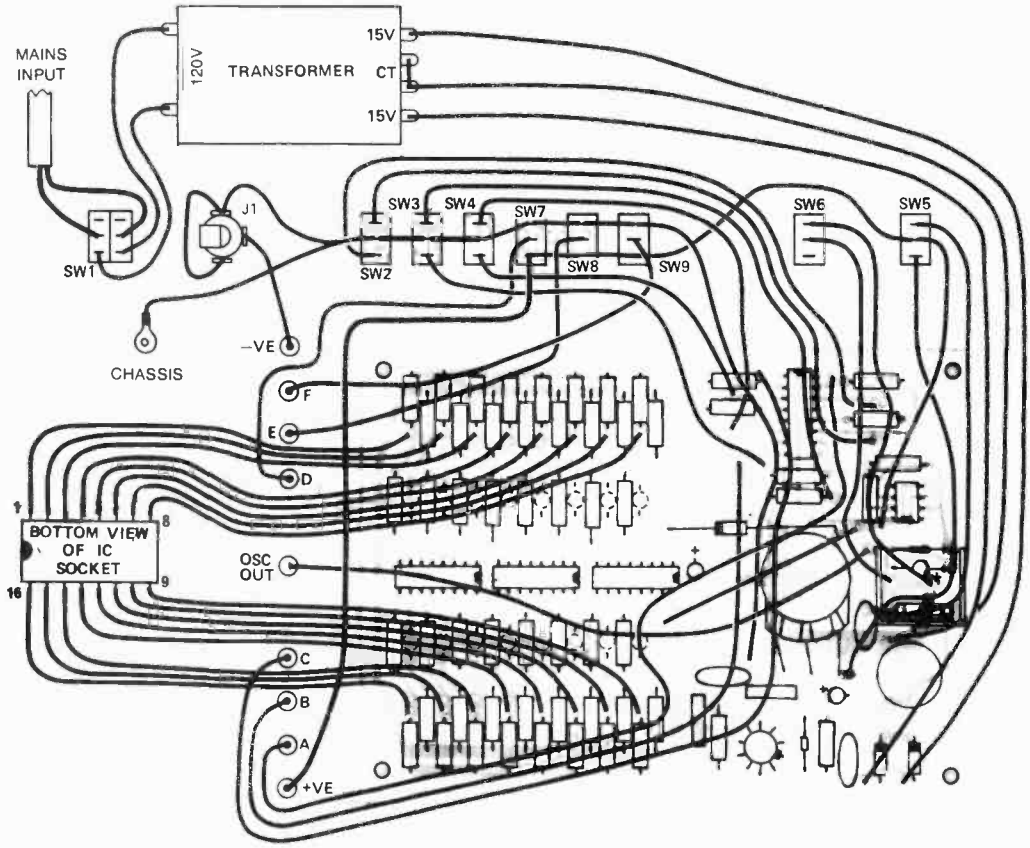
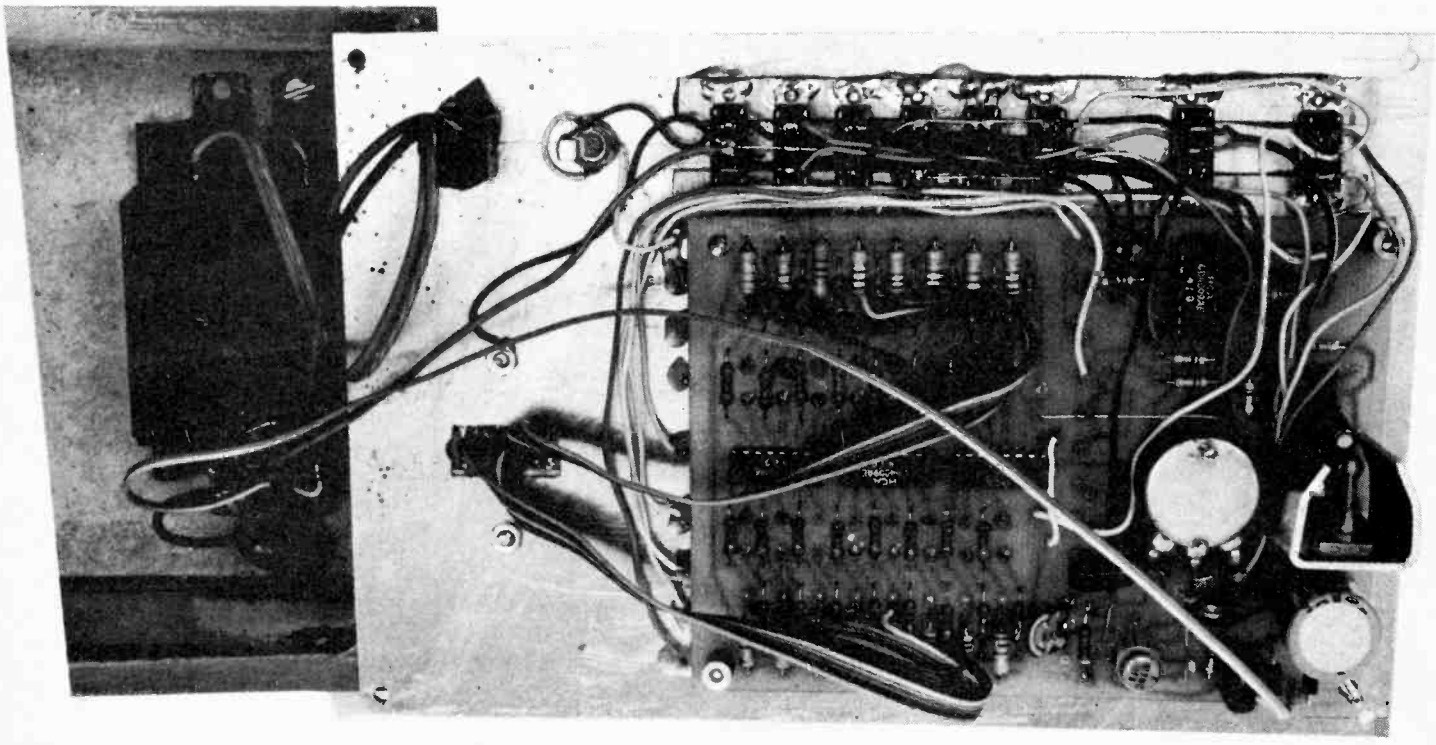


Fig. 3. Wiring diagram of complete unit.



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Manual Parastat

Record Care Equipment

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$6.95

Dust Bug

THE ONLY POSITIVE WAY TO CLEAN, MAINTAIN AND PROTECT RECORDS.

25 — 240 Watts!

HY5
Preamplifier

The HY5 is a mono hybrid amplifier ideally suited for all applications. All common input functions (mag. Cartridge, tuner, etc) are catered for internally, the desired function is achieved either by a multi-way switch or direct connection to the appropriate pins. The internal volume and tone circuits merely require connecting to external potentiometers (not included). The HY5 is compatible with all I.L.P. power amplifiers and power supplies. To ease construction and mounting a P.C. connector is supplied with each pre amplifier.

FEATURES: Complete pre-amplifier in single pack. – Multi function equalization. – Low noise. – Low distortion. – High overload. – Two simply combined for stereo.
APPLICATIONS: Hi-Fi. – Mixers. – Disco. – Guitar and Organ. – Public address.
SPECIFICATIONS:
INPUTS: Magnetic Pick-up 3mV. Ceramic Pick-up 30mV. Tuner 100mV. Microphone 10mV. Auxiliary 3.100mV. input impedance 47kΩ at 1kHz.
OUTPUTS: Tape 100mV. Main output 500mV R.M.S.
ACTIVE TONE CONTROLS: Treble ± 12dB at 10kHz. Bass ± at 100Hz.
DISTORTION: 0.1% at 1kHz. Signal/Noise Ratio 68dB.
OVERLOAD: 38dB on Magnetic Pick-up. SUPPLY VOLTAGE ± 16-50V.

17.85

HY50
25 Watts into 8Ω

The HY50 leads I.L.P.'s total integration approach to power amplifier design. The amplifier features an integral heatsink together with the simplicity of no external components. During the past three years the amplifier has been refined to the extent that it must be one of the most reliable and robust High Fidelity modules in the World.

FEATURES: Low Distortion. – Integral Heatsink. – Only five connections. – 7 Amp output transistors. – No external components.
APPLICATIONS: Medium Power Hi-Fi systems. – Low power disco. – Guitar amplifier.
SPECIFICATIONS: INPUT SENSITIVITY 500mV.
OUTPUT POWER 25W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0.04% at 25W at 1kHz.
SIGNAL/NOISE RATIO 75dB FREQUENCY RESPONSE 10Hz-45kHz –3dB.
SUPPLY VOLTAGE ± 25V. SIZE 105 50 25mm.

23.20

HY120
60 Watts into 8Ω

The HY120 is the baby of I.L.P.'s new high power range, designed to meet the most exacting requirements including load line and thermal protection this amplifier sets a new standard in modular design.

FEATURES: Very low distortion. – Integral heatsink. – Load line protection. – Thermal protection. – Five connections. – No external components.
APPLICATIONS: Hi-Fi. – High quality disco. – Public address. – Monitor amplifier. – Guitar and organ.
SPECIFICATIONS
INPUT SENSITIVITY 500mV.
OUTPUT POWER 60W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0.04% at 60W at 1kHz.
SIGNAL/NOISE RATIO 90dB FREQUENCY RESPONSE 10Hz-45kHz –3dB SUPPLY VOLTAGE ± 35V.
SIZE 114 50 85mm.

50.35

NEW

HY200
120 Watts into 8Ω

The HY200 now improved to give an output of 120 Watts has been designed to stand the most rugged conditions such as disco or group while still retaining true Hi-Fi performance.

FEATURES: Thermal shutdown. – Very low distortion. – Load line protection. – Integral heatsink. – No external components.
APPLICATIONS: Hi-Fi. – Disco. – Monitor. – Power slave. – Industrial. – Public Address.
SPECIFICATIONS
INPUT SENSITIVITY 500mV.
OUTPUT POWER 120W RMS into 8Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0.05% at 100W at 1kHz.
SIGNAL/NOISE RATIO 96 dB FREQUENCY RESPONSE 10Hz-45kHz – 3dB SUPPLY VOLTAGE ± 45V.
SIZE 114 100 85mm.

72.85

HY400
240 Watts into 4Ω

The HY400 is I.L.P.'s "Big Daddy" of the range producing 240W into 4Ω. It has been designed for high power disco or public address applications. If the amplifier is to be used at continuous high power levels a cooling fan is recommended. The amplifier includes all the qualities of the rest of the family to lead the market as a true high power hi-fidelity power module.

FEATURES: Thermal shutdown. – Very low distortion. – Load line protection. – No external components.
APPLICATIONS: Public address. – Disco. – Power slave. – Industrial.
SPECIFICATIONS
OUTPUT POWER 240W RMS into 4Ω LOAD IMPEDANCE 4-16Ω DISTORTION 0.1% at 240W at 1kHz.
SIGNAL/NOISE RATIO 94dB FREQUENCY RESPONSE 10Hz-45kHz – 3dB SUPPLY VOLTAGE ± 45V.
INPUT SENSITIVITY 500mV. SIZE 114x100x85mm.

99.90

TWO YEARS' GUARANTEE ON ALL OF OUR PRODUCTS

POWER SUPPLIES

- ALL POWER SUPPLIES ARE FOR STEREO APPLICATIONS EXCEPT THE HY-120K.
- THE HY-5 PRE-AMP WILL WORK WITH ALL POWER SUPPLIES.

NEW

USE FOR	POWER TRANSFORMER	FILTER CAPACITOR UF	BRIDGE RECTIFIER	COMPLETE KIT
HY50	HY50T 36VCT 3A **19.95**	2X4700 40V **4.95**	BR3A1 3A 100V **1.95**	HY50K **26.85**
HY120	HY120T 50VCT 2A **18.95**	2X4700 40V **4.95**	BR3A1 3A 100V **1.95**	HY120K **25.85**
HY200	HY200T 64VCT 4A **29.95**	2X4700 63V **10.95**	BR4A1 4A 100V **5.95**	HY200K **46.85**
HY400	HY400T 64VCT8A **44.95**	2X4700 63V **10.95**	BR8A1 8A 100V **7.95**	HY400K **63.85**

- 5% DISCOUNT ON ALL COMPLETE MONO SYSTEMS.
- 10% DISCOUNT ON ALL COMPLETE STEREO SYSTEMS.

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5055

The NIKKO model 5055 is an all new stereo multiplex receiver featuring direct-coupled OCL pure complementary power amplifier, phase lock loop multiplex circuit, a quadrature detector, and phase linear ceramic filters.

The amplifier section carries a minimum RMS power rating per channel of 18 watts, both channels driven, 20-20kHz into 8 ohms at no more than 0.8% total harmonic distortion. The FM tuner section features a sensitivity of 2.0uV, a selectivity of 55dB and a capture ratio of 1.5dB.

6065 NIKKO

The NIKKO 6065 all new stereo multiplex receiver, features a direct-coupled OCL all pure complementary power amplifier, phase lock loop multiplex circuit, a quadrature detector and phase linear ceramic filters.

The amplifier section carries a minimum RMS power rating per channel of 30 watts, both channels driven, 20-20kHz into 8 ohms at no more than 0.5% total harmonic distortion. The FM tuner section has a sensitivity of 2.0uV, a selectivity of 55dB and a capture ratio of 1.5dB.

9095

The NIKKO 9095 stereo multiplex receiver features a direct-coupled OCL pure complementary power amplifier, a phase lock loop multiplex circuit and a phase linear ceramic filter.

The amplifier section contains a minimum RMS power rating per channel of 68 watts, both channels driven, 20-20kHz into 8 ohms at no more than 0.3% total harmonic distortion. The FM tuner section has a sensitivity of 1.8uV, a selectivity of 70dB and a capture ratio of 1.6dB.

THE AUDIO REFLEX MR-110

SPECIFICATIONS:

TYPE	Belt-drive automatic record player
POWER SOURCE	AC 120 V, 60Hz
POWER CONSUMPTION	12 watts
DIMENSIONS	457(W) x 355(D) x 179 *mm* (Approx.) 17¾" x 13¾" x 7" (Approx.)
WEIGHT	6.8kg (15 lbs.) (Approx.)
DRIVE SYSTEM	Belt-drive system
MOTOR	4-pole synchronous motor
TURNTABLE SPEED	33⅓ & 45 r.p.m.
SIZE	30 *cm*, dia. aluminum alloy diecast
S/N RATIO	Better than 48 dB
WOW & FLUTTER (CARTRIDGE)	Less than 0.1% (WRMS)
TYPE	Moving magnet (MM) type
OUTPUT VOLTAGE	Standard, 3 mV at 1 KHz
SEPARATION	20 dB (at 33⅓ r.p.m., 1 KHz)
STYLUS	0.7 *mm* diamond stylus
STYLUS PRESSURE	2.0g ± 0.5g
FREQUENCY RESPONSE	20 — 25,000Hz
COMPLICANCE	6 x 10^{-6} *cm*/dyne
LOAD RESISTANCE (TONE ARM)	47 — 100 Kohms
TYPE	Static balance type
OVERHAND	15 *mm*
ADJUSTABLE RANGE OF STYLUS PRESSURE	0 — 3g

AUDIO REFLEX

TRANSCRIPTION TURNTABLES

The MR-110 turntable is similar in quality excellence and design to the MR-116. This belt-drive system was designed with the music connoisseur in mind.

THE AUDIO REFLEX MR-116

SPECIFICATIONS:

TYPE	Belt-drive full automatic record player
POWER SOURCE	AC 120V /60Hz
POWER CONSUMPTION	12 watts
DIMENSION	500(W) x 360(D) x 190(H) *mm* (Approx.) 19½" x 14" x 7½"(Approx.)
WEIGHT	8.5kg (18.5 lbs.) (Approx.)
DRIVE SYSTEM	Belt-drive system
MOTOR	4-pole synchronous motor
TURNTABLE SPEED	33⅓ & 45 r.p.m.
SIZE	30cm dia. aluminum alloy diecast
S/N RATIO	Better than 48 dB
WOW & FLUTTER (CARTRIDGE)	Less than 0.1% (WRMS)
TYPE	Moving magnet type
OUTPUT VOLTAGE	3 mV at 1 KHz
SEPARATION	20 dB
STYLUS	0.7 *mm* diamond stylus
STYLUS PRESSURE	2.0 g ± 0.5 g
FREQUENCY RESPONSE	20 — 25,000Hz
LOAD RESISTANCE (TONE ARM)	47 — 100K Ohms
TYPE	Static balance type
OVERHAND	11 *mm*
ADJUSTABLE RANGE OF STYLUS PRESSURE	0 — 3 g

SPECIFICATIONS

MARSLAND SPEAKERS

Speaker Complement	LTC 8 MK IV	LTC 10 MK IV	LTC 12 MK IV
	• One 8" Hi-Compliance Bass Driver • One 1¾" Phenolic Ring Flare Dome Hi-Driver	• One 10" Hi-Compliance Bass Driver • One 1¾" Phenolic Ring Flare Dome Hi Driver	• One 12" Hi-Compliance Bass Driver • One 5" Hi-Compliance Closed back Mid-Driver • One 1¾" Phenolic Ring Flare Dome Hi-Driver
Cross-Over Type	LC 2-way 2500 Hz	LC 2-way 2500 Hz	LC 3-way 1000 and 5000 Hz
Frequency Response	35 — 22,000 Hz	30 — 22,000 Hz	25 — 22,000 Hz
Resonance	65 Hz	50 Hz	50 Hz
Power Handling	Watts Rms 35 Watts Music 50	50 70	75 100
Efficiency — Power required to produce 90 DB SPL @ 6 feet	2.5 Watts	2.5 Watts	2.5 Watts
Impedance	8 Ohms	8 Ohms	8 Ohms
Dimensions and Weight	21 x 11¼ x 9½ 21 lbs	24 x 13¾ x 11¼ 30 lbs	26½ x 15½ x 12 37 lbs

LTC enclosures are warranteed for five years against manufacturing defects.

	SYSTEM 1	SYSTEM 2	SYSTEM 3
RECEIVER	NIKKO 5055 - 36 WATTS RMS	NIKKO 6065 - 60 WATTS RMS	NIKKO 9095 - 136 WATTS RMS
TURNTABLE	AUDIO REFLEX MR - 110	AUDIO REFLEX MR - 116	AUDIO REFLEX MR - 116
SPEAKERS	2 X LTC-8 MK IV	2 X LTC-10 MK IV	2 X LTC-12 MK IV
	$ 499.00	**$ 699.00**	**$ 899.00**

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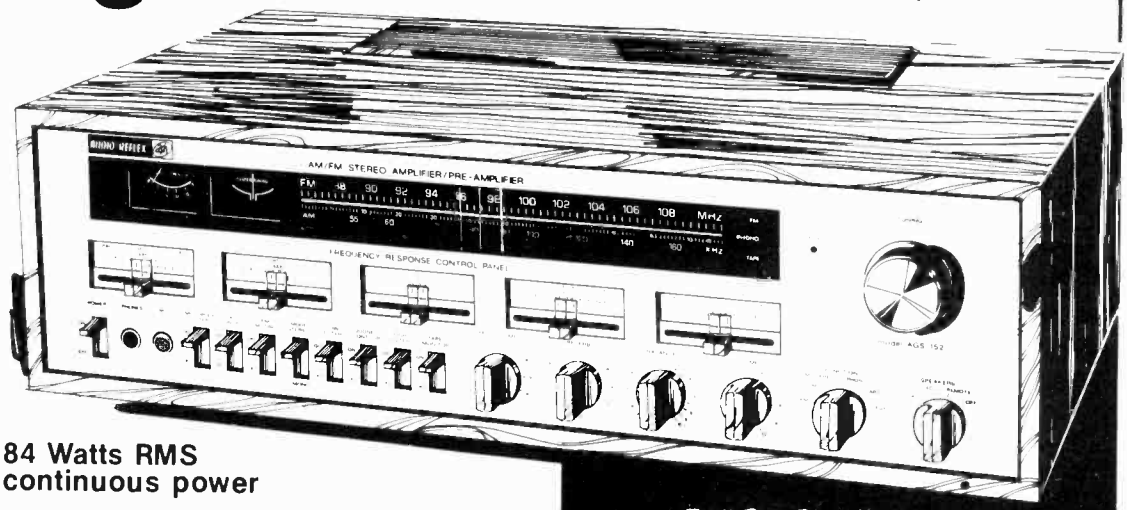
FOR INDIVIDUAL PRICING ON THESE COMPONENTS AND MANY MORE, PLEASE CIRCLE #15 ON THE ORDER FORM PAGE.

The hi-fi of the eighties...TODAY!

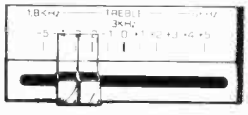
TOTAL PACKAGE $666.00



84 Watts RMS continuous power

FREQUENCY RESPONSE CONTROL PANEL: Five slide tone controls boost or cut signals around 80 Hz, 300 Hz, Ik Hz, 3k Hz, and 10k Hz, giving complete control over the entire audio spectrum. Additional switches for low filter, high filter and loudness complete this comprehensive control system.

REVERBERATION: This feature is built into the receiver for generating and adding an echo effect.



SOUND MIXING: Controlled by the Mic volume control.

"FOUR DIMENSIONAL" sound and speaker selection.

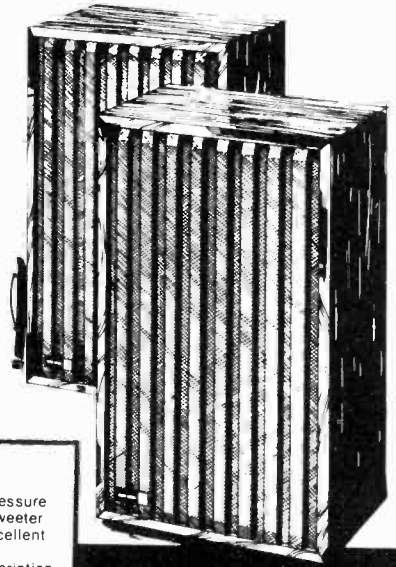
AUDIO REFLEX

High pressure Dome speakers

Air suspension 3 way 3 speaker system using 1 - 12" woofer, 1 - 5-1/4" dome mid range and 1 - 4-1/8" dome tweeter.

Frequency response, 30 Hz — 22k Hz within 10 dB.

Power handling 50 watts per speaker. Walnut grain cabinet finish to match the receiver and turntable.



Fully Automatic Transcription Turntable

AUTOMATIC START AND STOP: After placing a record on the turntable simply position the lever to 'START' the pick up arm will gently and accurately lower onto the record. After the completion of play the tone arm automatically returns to the 'REST' position and the mechanism will shut off.

AUTO CUT: By pushing the 'AUTO CUT' at any point during play, the tone arm will automatically lift, return to the 'REST' position' and the mechanism will shut off.

REPEAT: This feature allows for continuous play of any selected record. Ideal for background music.

- Hydraulically damped cueing.
- 4 pole synchronous motor, belt drive system.
- Tone arm. Long 'S' curved tone arm has excellent tracking characteristics.
- Magnetic cartridge included.

High pressure dome tweeter with excellent sound characteristics.

12" high quality woofer with a huge 64 oz. magnet.

AUDIO REFLEX

you'll hear a lot from us ...

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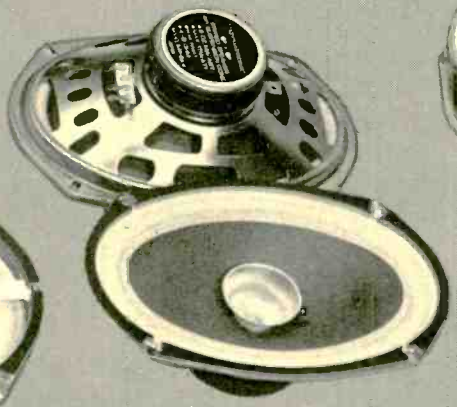
DYNATRONIC®

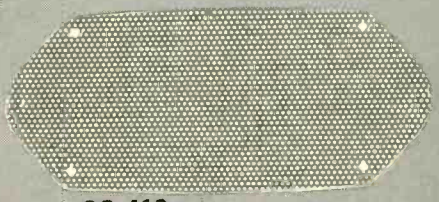
Replacement Speakers

BS 6912CX
BS 6920CX
BS 6930CX

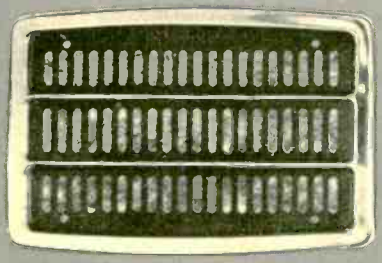


NRS 6903A
NRS 6908

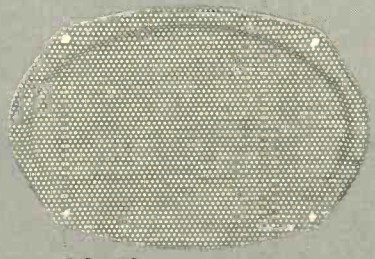
BS 503
BS 505
BS 508
BS 512



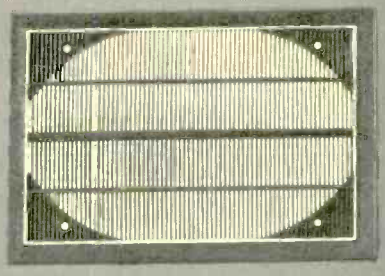
SG 410 metal $1.29



SG 69S metal $2.79



SG 69 metal $1.69



SG 69P plastic $2.29

MODEL NO. MODÈLE NO.	DESCRIPTION	SPEAKER HAUT-PARLEURS	CERAMIC MAGNET AIMANT EN CÉRAMIQUE	SORTIE MAXIMUM OUTPUT (WATTS)	IMP. (OHMS)	PRICE
BS-503	Pin Cushion / Épingle de coussin Replacement / Remplacement	5" with dustcover / avec couvercle	3 oz	5	8	$ 3.95
BS-505		5"	5 oz	8	4-8	$ 4.95
BS-508		5"	8 oz	10	4-8	$ 5.95
BS-512		5" AIR SUSPENSION / SUSPENSION ACCOUSTIQUE	12 oz	15	4-8	$ 9.95
NRS-6903A	Standard replacement / Remplacement	6" x 9"	3 oz	8	8	$ 4.95
NRS-6908	Replacement / Remplacement	6" x 9" AIR SUSPENSION SUSPENSION ACCOUSTIQUE	8 oz	15	4-8	$ 7.95
BS-6912CX	Deluxe	6" x 9" CO-AXIAL AIR SUSPENSION SUSPENSION ACCOUSTIQUE 2 way / deux manières (6" x 9" woofer & 3" tweeter)	12 oz CO-AXIAL	25	4-8	$ 13.95
BS-6920CX	Super Deluxe		20 oz CO-AXIAL	35	4-8	$ 14.95
BS-6930CX	Grande Deluxe		30 oz CO-AXIAL	50	4-8	$ 19.95

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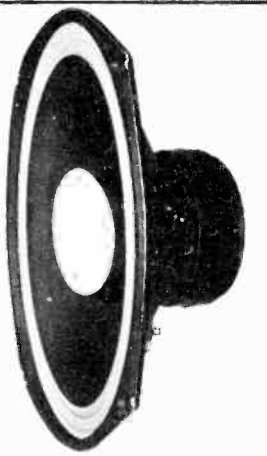
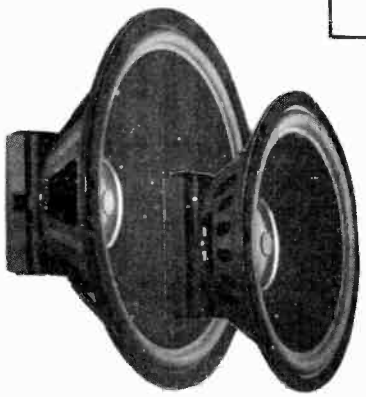
Marsland Speakers

Linear 'A' 6 x 9



SPECIAL **$15.95**

30 Hz — 20 KHz
25 Watts RMS

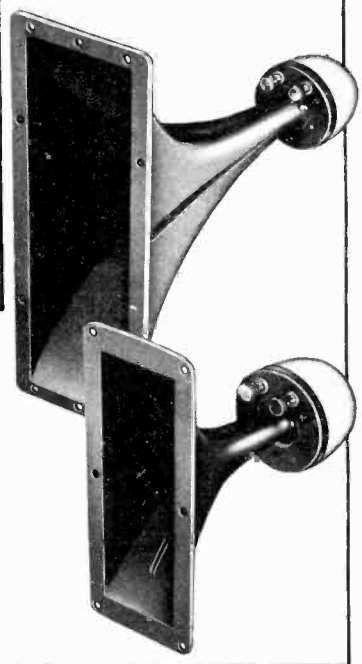


ANNOUNCING

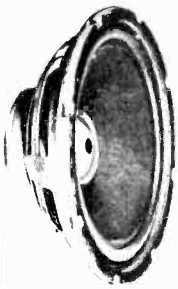
VHP
VERY HIGH POWER

VHP — 1500
$84.95
15 Hz — 4 KHz
100 Watts RMS

VHP — 1200
$74.95
18 Hz — 4 KHz
100 Watts RMS



Linear 'B' 10" Woofer



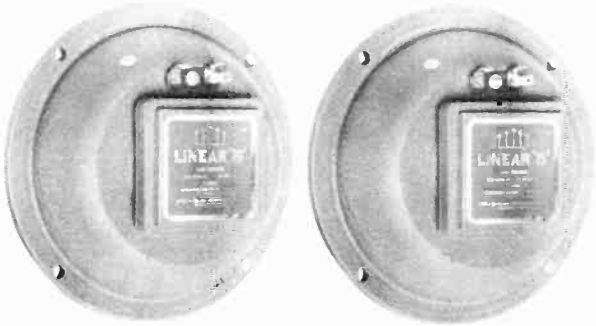
$16.95 Ea.
Case of 4
$59.00
20 Hz — 5 KHz
40 Watts RMS

HORN TWEETERS

2" x 6"
$19.95 Ea.
3 — 20 KHz
25 Watts RMS

4" x 10"
$24.95 Ea.
1 — 20 KHz
25 Watts RMS

Linear 'B' MID DRIVER



$18.95 Pr.
600 Hz — 8 KHz
60 Watts RMS

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PHILIPS ACOUSTRON

QUALITY LOUDSPEAKERS

Max. System Power (RMS)	Resonance Frequency (free air)	Magnet	Voice Coil	Type Number
8" WOOFERS				
20 W in .25 cu. ft. sealed enclosure (7ℓ)	60 Hz treated fabric cone edge	10 oz ceramic (.27kg)	1"	AD081020W8 **$5.24**
25 W in .75 cu. ft. sealed enclosure (22ℓ)	45 Hz foam roll suspension	10 oz ferrox-dure (.27kg)	1"	AD8071W8 **$12.00**
40 W in 1.2 cu. ft. sealed enclosure (38ℓ)	25 Hz foam roll suspension	20 oz ferrox-dure (.55kg)	1.5" Al.	AD80100W8 **$24.00**
10" WOOFERS				
25 W in 1.2 cu. ft. sealed enclosure (38ℓ)	25 Hz foam roll suspension	10 oz ferrox-dure (.27kg)	1" multi-layer	AD101025W8 **$13.75**
50 W in 1.2 cu. ft. sealed enclosure (38ℓ)	25 Hz foam roll suspension	20 oz ferrox-dure (.55kg)	1.5" multilayer	AD102050W8 **$27.50**
70 W in 1.2 cu. ft. sealed enclosure (30ℓ)	20 Hz foam roll suspension	40 oz ferrox-dure (1.05kg)	2" Al.	AD10240W8 **$42.00**
12" WOOFERS				
25 W in 2.4 cu. ft. sealed enclosure (80ℓ)	25 Hz foam roll suspension	10 oz ferrox-dure (.27kg)	1" Al.	AD1271W8 **$15.00**
50 W in 2.4 cu. ft. sealed enclosure (80ℓ)	25 Hz foam roll suspension	20 oz ferrox-dure (.55kg)	1.5" Al.	AD122050W8 **$27.00**
70 W in 2.4 cu. ft. sealed enclosure (80ℓ)	19 Hz foam roll suspension	40 oz ferrox-dure (1.05kg)	2" Al.	AD12240W8 **$44.50**
15" WOOFERS				
80 W in 3.5 cu. ft. sealed enclosure (110ℓ)	19 Hz foam roll suspension	40 oz ferrox-dure (1.05kg)	2" Al.	AD15240W8 **$54.95**
5" MIDRANGE (sealed back)				
40 W (crossover 1500 Hz or above)	850 Hz	ferrox-dure 3 oz (85g)	9/16"	AD5010SQ8 **$6.35**
40 W (crossover 400 Hz or above)	210 Hz	ferrox-dure 10 oz (.27kg)	1"	AD5060SQ8 PHILIPS DEFOREST) also SQ4 4ohm **$11.95**
TWEETERS (sealed back)				
20 W (crossover 1500 Hz or above) 40 W (4500 Hz or above)	1.2 KHz	ferrox-dure 5 oz (140g)	1" Al./Cu.	AD0140T8 (PHILIPS DEFOREST) Also T4 4 ohm **$6.75**

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

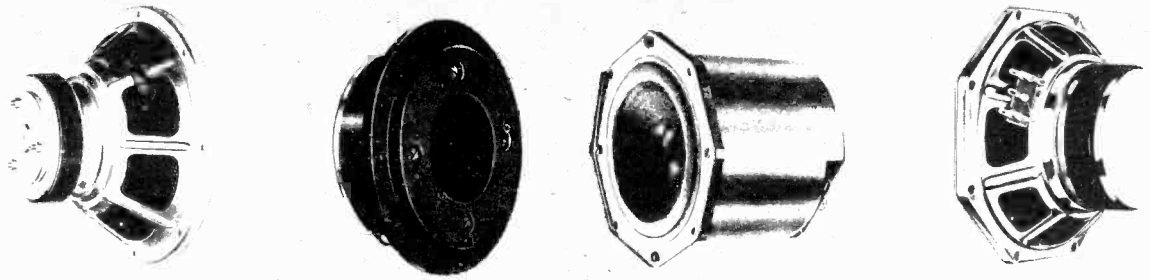
For complete specifications on Acoustron loudspeakers, please circle #2 on the order form page.

DeForest

DeForest loudspeakers...the heart of serious sound systems

LOUDSPEAKERS

PRENIUM QUALITY



These speakers have been specially designed for use in Hi-Fi equipment, where a high power-handling capacity, a very wide frequency-range and a negligible distortion level are required.

High quality high fidelity, two and three-way systems

Used in airtight enclosures.

NUMBER	TYPE	SIZE	RMS POWER	RES.	PRICE
AD 0160/T8*	Tweeter	4"	40w	1kHz	$6.95
AD 5060/SQ8*	Squaker	5"	40w	250Hz	$11.95
AD 5060/W8	Woofer	5"	10w	50Hz	$11.50
AD 7066/W8	Woofer	7"	40w	28Hz	$19.50
AD 8061/W8	Woofer	8"	30w	28Hz	$19.50
AD 8066/W8	Woofer	8"	40w	28Hz	$23.00
AD 10100/W8	Woofer	10"	40w	20Hz	$39.95
AD 12100/W8	Woofer	12"	40w	19Hz	$42.50

* Also Available In 4 Ohms

High quality full-range, single speaker systems (all types twin-cone)

Generally used in ported enclosures.

NUMBER	TYPE	SIZE	RMS POWER	RES.	PRICE
AD 5061/M8	Full Range	5"	10w	85Hz	$11.50
AD 7062/M8	Full Range	7"	30w	55Hz	$15.00
AD 9710MC	Full Range	8"	20w	50Hz	$25.95
AD 1065/M8	Full Range	10"	10w	55Hz	$27.00
AD12100/M8	Full Range	12"	25w	45Hz	$50.00
AD12100/HP8	Full Range	12"	50w	60Hz	$50.00

PHILIPS
Application book
Electronic components and materials

Building hi-fi speaker systems
VOL 6

This new 232 page publication reveals everything about speakers and associated enclosures. To be exact, it deals with 17 individual speaker systems ranging from one speaker up to a maximum of 20.

$3.95

Furthermore this publication is an absolute must to any person wishing to construct his own speaker system. It is obtainable for just

Contents

- Room Placement
- Sound Reproduction
- Moving Coil Loudspeakers
- Multiway Speaker Systems
- Loudspeaker Enclosures
- Listning Room Acoustics
- Step By Step Construction of 7 Litre Enclosure
- 17 Tested Speaker Systems
- Frequency Response & Distortion in an Anechoic Chamber
- Energy Response in a Live Room
- Frequency Response in a Live Room
- Impedance

Crossovers

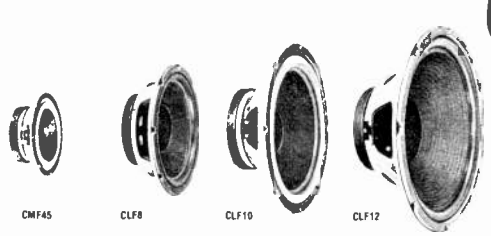
Number	Power	Crossover Freq.	Price
AD3WXB	40 Watt	500/4500	12.95
AD3WXSP	100 Watt	700/2400	39.95
AD2WXB	40 Watt	1800	6.95

For a complete catalogue on Philips speakers, please circle #2 on the order form page.

RSC AUDIO SALES LIMITED

LOUDSPEAKERS

Classic series



CMF45 CLF8 CLF10 CLF12

$22.50 $33.00 $47.00 $66.00

These driver units by RSC have been designed for use in sealed enclosures in order to achieve optimum response and power handling. To take full advantage of the five years of research designing these speakers, you are advised not to mix these components with any others. Specifications should not be changed. Your cabinet must have no air leaks . . . caulk all seams and speaker frames. Speakers are to be mounted from the front and flush with the face of the baffle. The grille cloth should be an open weave material that you can breathe through easily . . . make sure the grille clears the speakers by at least 3/8". Follow these specifications . . . and you'll have speakers offering you acoustical excellence.

Norseman series

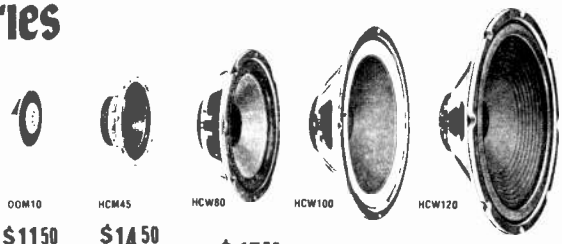
hi-compliance woofers

These driver units by RSC have been designed for use in sealed enclosures in order to achieve optimum response and power handling. To take full advantage of the five years of research designing these speakers, you are advised not to mix these components with any others. Specifications should not be changed. Your cabinet must have no air leaks . . . caulk all seams and speaker frames. Speakers are to be mounted from the front and flush with the face of the baffle. The grille cloth should be an open weave material that you can breathe through easily . . . make sure the grille clears the speakers by at least 3/8". Follow these specifications . . . and you'll have speakers offering you acoustical excellence.

HCW80	Hi Compliance Woofer (2 or 3 Way) Haut-parleur grave grande élasticité (2 ou 3 voies)	1200 cu in Cabinet Boîtier 1200 po cu
HCW100	Hi-Compliance Woofer (2 or 3 Way) Haut-parleur grave grande élasticité (2 ou 3 voies)	2600 cu in Cabinet Boîtier 2600 po cu
HCW120	Hi-Compliance Woofer (3 Way Only) Haut-parleur grave grande élasticité (3 voies seulement)	4300 cu in Cabinet Boîtier 4300 po. cu.
HCM45	Closed Back Mid-Range Haut-parleur moyen a dos ferme	3 Way Systems Systèmes a trois voies

DOM10 Dome Tweeter
Haut-parleur aigu a dôme

3 Way Systems Above 5000 Hz.
Systèmes a 3 voies au-dessus de 5000 Hz.



DOM10 HCM45 HCW80 HCW100 HCW120

$11.50 $14.50 $17.50 $19.50 $24.50

POWER: 10w TO 25w rms

SPEAKER SPECIALS

FULL RANGE

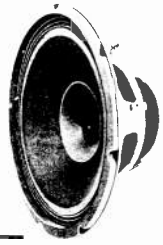
These driver units by RSC have been designed for use in reflex enclosures for optimum response and powar handling. Specifications should not be changed. Your cabinet must have no air leaks other than the vent . . . caulk all seams and speaker frames. Speakers are to be mounted from the front and flush with the face of the baffle. The grille cloth should be an open weave material that you can breathe through easily . . . make sure the grille clears the speaker by at least 3/8". We suggest you line the cabinet with two inches of damping material making sure the front and vent are clear. Follow these specifications . . and you'll have speakers delivering you acoustical exellence.

8" $15.95

20 WATTS RMS

8 OHM

12" $24.95



DRE DC8 DRE DC12

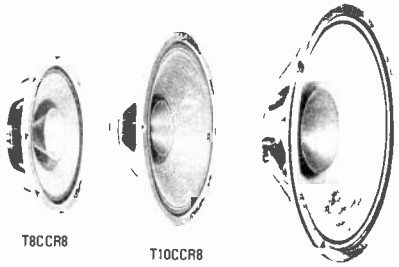
DOME TWEETER

$9.95 DRE 10

RSC Classic SERIES

Specify 8 or 16 ohm 40 Watts

Twintone series



T8CCR8 T10CCR8 T12CCR8

$14.50 $17.70 $19.75

60-14,000 Hz 55-14,000 Hz 50-14,000 Hz

POWER HANDLING CAPACITY

15 watts RMS

These driver units by RSC have been designed for use in reflex enclosures for optimum response and power handling. Specifications should not be changed. Your cabinet must have no air leaks other than the vent . . . caulk all seams and speaker frames. Speakers are to be mounted from the front and flush with the face of the baffle. The grille cloth should be an open weave material that you can breathe through easily . . . make sure the grille clears the speaker by at least 3/8". We suggest you line the cabinet with two inches of damping material making sure the front and vent are clear. Follow these specifications . and you'll have speakers delivering you acoustical exellence.

MODEL NO	Description	Application (Reflex Enclosure)	Size	Magnet Weight (Oz.)	Voice Coil Diameter	Voice Coil Imp. (Ohms)
T8CCR8	Wide Range Speaker Haut-parleur large gamme	1700 cu in. 1700 po cu.	8"	10.0	1"	8
T10CCR8	Wide Range Speaker Haut-parleur large gamme	2500 cu in 2500 po cu	10"	10.0	1"	8
T12CCR8	Wide Range Speaker Haut-parleur large gamme	3500 cu in 3500 po cu	12"	10.0	1"	8

5 Year Guarantee

CHD 10, CMF 45, CLF 8, CLF 10, CLF 12

This Five Year Guarantee becomes effective upon your receipt of this certificate. The products listed above are unconditionally guaranteed for Five Years against failures as a result of defective workmanship or material under normal operating conditions. This guarantee is null and void if damage is caused by operation above rated power, fire, flood, explosion, corrosive atmosphere, physical force or shipment and any unit so damaged will be repaired for normal material and service charges.

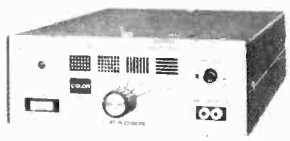
LEADER TEST INSTRUMENTS

LBO-506
5" DUAL TRACE OSCILLOSCOPE

$625.00

- Automatic Vertical input gain & Automatic trigger.
- Compact, lightweight with low power consumption.
- Direct input for RF signals up to 100MHz.
- X-Y display, less than 3° phase shift.

LCG-391
COLOR BAR PATTERN GENERATOR



$171.00

- White raster pattern for purity and white balance tests.
- Square crosshatch for raster linearity tests.
- Four basic patterns dots, crosshatch, vertical lines, and horizontal lines for tests and adjustments of convergence and raster alignments.

NEW

LBO-310A
3" OSCILLOSCOPE

$225.00

- Bandwidth, DC to 4 MHz, usable to 6MHz.
- Waveform monitoring up to 450MHz with direct connections.

LSG-16
SIGNAL GENERATOR

$110.00

Here is a compact solid-state RF signal generator designed for the hobbyist, service bench and technical instruction. The generator is most suited for checking and aligning the IF circuits and tuners in AM, FM and TV sets.

LAG-26
AUDIO GENERATOR

$129.00

The stable generator for testing all types of audio circuits, from the simple to hi-fi amplifiers. Operating controls are functionally laid out for ease in handling.

NEW, DELAYED SWEEP, DUAL TRACE 25MHz OSCILLOSCOPE

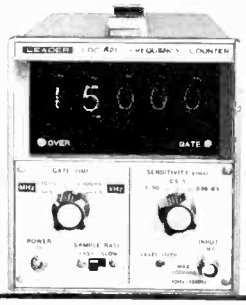
$1660.00

LBO-515
including probes and accessories

A significant advance in oscilloscope technology that provides close tolerance accuracy and control procedures at an outstanding cost/value payout ratio. This wideband, 25MHz, dual trace 5" scope features a built-in delay circuit continuously variable from 1μsec to 5sec coupled with a high sensitivity of 5mV/Div. Thus, the LBO-515 allows the user to view the leading edge of a pulse or pulse train and quickly helps determine functional characteristics. It has an easy to read, rectangular CRT in a space saving, horizontal package ideally suited for research & development, production, quality control, and service requirements. It

LEADER
"Put us to the test"

LDC-821
DIGITAL FREQUENCY COUNTER



FOR A COMPLETE CATALOGUE ON LEADER TEST EQUIPMENT AND ACCESSORIES, PLEASE CIRCLE #3 ON THE ORDER FORM PAGE.

DOMINION RADIO & ELECTRONICS COMPANY

Terminal Strips

1 Terminal..... 2¢
2 Terminal..... 4¢
3 Terminal..... 6¢
4 Terminal..... 8¢
5 Terminal.....10¢
6 Terminal.....12¢
7 Terminal.....14¢
8 Terminal.....16¢
9 Terminal.....18¢
10Terminal.....20¢
11Terminal.....22¢

SCREW TERMINAL STRIPS

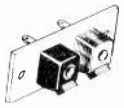
TERMINAL BOARD. High insulation bakelite with twin screw termir als. Standard replacement for most TV sets, and many other applications.

2 SCREW TERMINAL.....15¢
3 SCREW TERMINAL.....20¢
4 SCREW TERMINAL.....25¢

FLEXIBLE TERMINAL BLOCKS

99¢

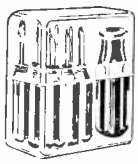
FLEXIBLE TERMINAL BLOCKS WILL CONFORM TO IRREGULAR SURFACE AND CAN BE EASILY CUT TO SIZE. LONG LEAKAGE PATHS ARE PROVIDED BY THE MOULDED POLYETHELENE INSULATION. BOLTS AND SLEEVES ARE OF BRASS WHICH HAS BEEN NICKEL PLATED.



2 TERMINAL..$ .75
4 TERMINAL..$1.50
8 TERMINAL..$2.95

5136. **SPEAKER TERMINALS.** Spring loaded, push-button terminals mounted on bakelite strip for positive and instant connect disconnect

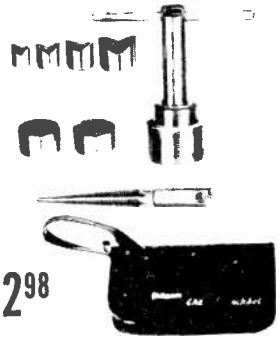
Tool Sets With Power Handle



$1.99

J-4766. Includes 3 standard drivers in small, medium and large sizes; 3 Phillips drivers; one special tool with awl tip; and one special tool with 'corkscrew' tip. All tools measure 3½" long and have colour coded hex handles. Torque amplifier handle is 3" long. Complete with unbreakable plastic carrying case.

CHASSIS PUNCH SET



$12.98

Complete set of punches in a leatherette carrying case. All precision machined of top grade steel. Following sizes. ½", ⅜", ¾", 1", 1⅛", plus burring reamer.

99¢

4720. RETRACTABLE STEEL RULE. Spring loaded for self-retract, extends to 78-3/4" (2 meters) Rule is 1/2" wide and has both metric and inches scale. Metal and plastic case, push button for automatic retract.

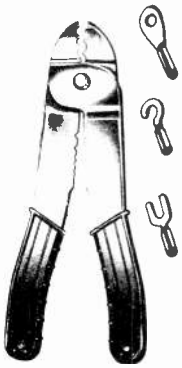
CABLE AND WIRE STRIPPER

$1.89

J-4742. ECONOMY WIRE STRIPPER. Cuts or strips at any point. Tempered steel, insulated handles. Pawl lock for wire sizes 12 through 22.

Shop Tools

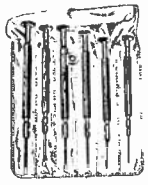
CRIMP/STRIP TOOL



$4.95

J-5085. CRIMP/STRIP TOOL. Tempered steel with insulated handles, this handy tool will cut and strip all popular wire sizes from 10 to 22, and will crimp on solderless lugs. 7¼" length, assortment of lugs included.

JEWELLERS SCREW DRIVERS



$1.98

J-4735. 6-PIECE JEWELLER'S KIT. Finely crafted drivers of tempered steel with free-turning barrels. Includes transparent vinyl carrying case.

PLIERS AND CUTTERS

Imported

$3.95

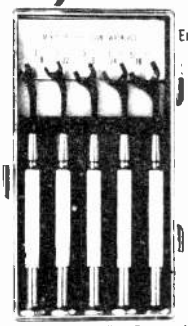
4" **DIAGONAL SIDECUTTERS.** Quality drop-forged steel with insul-grip handles.

$3.95

4" **LONGNOSE PLIERS,** with sidecutters. Drop-forged steel with tempered nose and cutting edges. Precision ground for close tolerance. Insul-grip handles.

Tiny Tool Sets

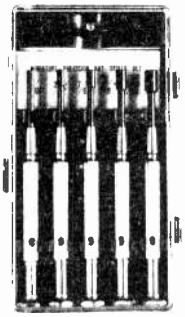
Offset Open End Wrench Set



$3.95
#562

This Set #562 contains five precision wrenches with offset open end. Blades made of hardened steel. Sizes; 1/8", 5/32", 3/16", 1/4", and 5/16".

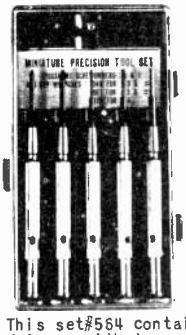
Socket Wrench Set



$3.95
563

This set #563 contains five precision Nut Drivers with torque hole and bar. Blades are made of hardened steel. Sizes: 5/64", 3/32", 7/64, 1/8", 5/32".

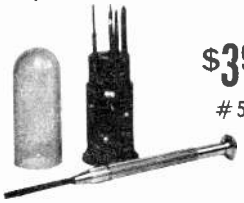
Phillips Driver & Allen Type Wrench Set



$3.95
#564

This set#564 contains five drivers with torque hole and bar enabling you to set fastenings up tight. All blades are of hardened steel. Two cross recessed driver No. No. 1.
Three allen type wrenches: No. 4 - No. 5 - No. 8.

Tiny Screw Driver & Awl Set



$3.95
#565

This set # 565 contains five interchangeable Tools. Three steel screw driver blades: 1/16", 3/32", 1/8", One cross recessed driver No.1 One awl, All heact treated. Chuck type handle.

waldom

SOLDERLESS TERMINALS AND CONNECTORS

PRINTED CIRCUIT HARDWARE

FASTENING DEVICES

WE HAVE THE COMPLETE LINE OF WALDOM HARDWARE. FOR YOUR COPY OF THE WALDOM CATALOGUE, PLEASE CIRCLE #13 ON THE ORDER FORM PAGE.

IF YOU DON'T SEE WHAT YOU NEED IN OUR CATALOGUE, PLEASE DROP US A LINE AND ASK. BE IT OLD OR NEW, THERE IS A GOOD CHANCE THAT WE EITHER HAVE IT IN STOCK, OR WE MAY BE ABLE TO ORDER IT FROM ONE OF OUR SUPPLIERS. WE WANT YOUR BUSINESS.

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

INJECTORALL ELECTRONICS CORPORATION

PRINTED CIRCUIT BOARDS

1 oz. COPPER-CLAD BAKELITE LAMINATES—one side copper

PC1	1/16"	XXXP bakelite	3" x 4½"	.95
PC2	1/16"	XXXP bakelite	4" x 6"	1.25
PC3	1/16"	XXXP bakelite	6" x 9"	2.71
PC4	1/16"	XXXP bakelite	12" x 18"	7.55

1 oz. G-10 EPOXY GLASS BASE LAMINATES—one side copper

PC5	1/16"	G-10 epoxy glass	3" x 4½"	1.33
PC6	1/16"	G-10 epoxy glass	4" x 6"	2.44
PC7	1/16"	G-10 epoxy glass	6" x 9"	4.70
PC8	1/16"	G-10 epoxy glass	12" x 18"	5.52

2 oz. G-10 EPOXY GLASS BASE LAMINATES—one side copper

PC9	1/16"	G-10 epoxy glass	3" x 4½"	1.41
PC10	1/16"	G-10 epoxy glass	4" x 6"	2.79
PC11	1/16"	G-10 epoxy glass	6" x 9"	5.57
PC12	1/16"	G-10 epoxy glass	12" x 18"	18.58

1 oz. G-10 EPOXY GLASS BASE LAMINATES—two sides copper

PC40	1/16"	G-10 epoxy glass	3" x 4½"	1.89
PC41	1/16"	G-10 epoxy glass	4" x 6"	3.78
PC42	1/16"	G-10 epoxy glass	6" x 9"	7.55
PC43	1/16"	G-10 epoxy glass	12" x 18"	25.06
PC44	1/32"	G-10 epoxy glass	3" x 4½"	1.33
PC45	1/32"	G-10 epoxy glass	4" x 6"	2.44
PC46	1/32"	G-10 epoxy glass	6" x 9"	4.70
PC47	1/32"	G-10 epoxy glass	12" x 18"	12.39

PRINTED CIRCUIT BOARDS

Light Sensitized Coated Boards

1 oz. COPPER-CLAD BAKELITE LAMINATES—one side copper

PC13	1/16"	XXXP bakelite	3" x 4½"	sensitized	1.41
PC14	1/16"	XXXP bakelite	4" x 6"	sensitized	1.89
PC15	1/16"	XXXP bakelite	6" x 9"	sensitized	4.35
PC16	1/16"	XXXP bakelite	12" x 18"	sensitized	14.92

1 oz. G-10 EPOXY GLASS BASE LAMINATES—one side copper

PC17	1/16"	G-10 epoxy glass	3" x 4½"	sensitized	1.89
PC18	1/16"	G-10 epoxy glass	4" x 6"	sensitized	3.78
PC19	1/16"	G-10 epoxy glass	6" x 9"	sensitized	7.43
PC200	1/16"	G-10 epoxy glass	12" x 18"	sensitized	25.06

2 oz. G-10 EPOXY GLASS BASE LAMINATES—one side copper

PC9S	1/16"	G-10 epoxy glass	3" x 4½"	sensitized	2.21
PC10S	1/16"	G-10 epoxy glass	4" x 6"	sensitized	4.09
PC11S	1/16"	G-10 epoxy glass	6" x 9"	sensitized	9.97
PC12S	1/16"	G-10 epoxy glass	12" x 18"	sensitized	27.92

1 oz. G-10 EPOXY GLASS BASE LAMINATES—two sides copper

PC40S	1/16"	G-10 epoxy glass	3" x 4½"	sensitized	2.79
PC41S	1/16"	G-10 epoxy glass	4" x 6"	sensitized	5.01
PC42S	1/16"	G-10 epoxy glass	6" x 9"	sensitized	10.60
PC43S	1/16"	G-10 epoxy glass	12" x 18"	sensitized	37.28
PC44S	1/32"	G-10 epoxy glass	3" x 4½"	sensitized	1.89
PC45S	1/32"	G-10 epoxy glass	4" x 6"	sensitized	3.78
PC46S	1/32"	G-10 epoxy glass	6" x 9"	sensitized	7.55
PC47S	1/32"	G-10 epoxy glass	12" x 18"	sensitized	25.06

ETCHANT

For Printed Circuit Boards

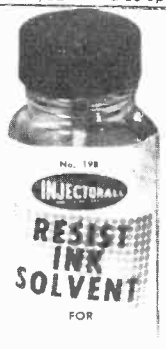
Injectorall's ETCHANT is a ferric chloride solution to remove excess copper from printed circuit boards. It is an electronic-grade solvent from which solvent impurities have been carefully removed to meet the most stringent requirements of the electronic industry. It is packaged in a plastic bottle.

ETCHANT •

No. 199-6 • 6 oz. plastic bottle	1.89
No. 199P • 1 pint plastic bottle	2.98
No. 199Q • 1 quart plastic bottle	4.62
No. 199G • 1 gallon plastic bottle	15.85

RESIST INK SOLVENT

For Printed Circuit Boards



RESIST INK SOLVENT is an excellent solvent for removing inks, markings and surplus flux. It is non-flammable, non-toxic and evaporates quickly after use.

RESIST INK SOLVENT •

No. 198 • 2 oz. glass bottle	2.13
No. 198G • 1 gallon can	20.69

PHOTO RESIST SPRAY

For Sensitizing Boards

For coating printed circuit boards. Photo Resist is a high quality resist which will cause less pin-holing and has less sensitivity to white light exposure than other resists.

PHOTO RESIST

No. PC194-3 • 3 oz. spray can	5.01
No. PC194-16 • 16 oz. spray can	13.97
No. PC194G • 1 gallon	209.40

RESIST INK PEN

For Printed Circuit Boards

Injectorall's felt-tip RESIST INK PEN makes resist circuits directly on printed circuit boards. Injectorall's pen enables the application of resist ink as easily as if using any felt marker pen. It is available in black only, in fine and medium widths. Dries instantly and remains until removed with any resist ink remover or fine steel wool. Blister-packed.

RESIST INK PEN •

No. 195 • Black-fine tip, blister-packed	1.92
No. 196 • Black-medium tip, blister-packed	1.92

PHOTO RESIST DEVELOPER

For Photo-Sensitized Boards

PHOTO RESIST DEVELOPER is a specially prepared solvent for developing photo resist images. It can be used for printed circuits, semiconductor parts and electroplating stopoff. Compatible with Kodak KPR resists.

PHOTO RESIST DEVELOPER

No. D2-8 8 oz. can	3.67
No. D2G 1 gallon can	22.84

BREADBOARDS

PERFORATED PLASTIC BOARDS

Made of 1/16" polyester glass with holes either regularly spaced or staggered for transistors.

	HOLE SIZE			
No. B653	.062	alternate	3x4"	1.84
No. B655	.062	alternate	3x6"	2.52
No. B656	.062	alternate	4x8"	4.14
No. B657	.093	straight	3x4"	1.75
No. B658	.093	straight	3x6"	2.38
No. B659	.093	straight	4x8"	3.81
No. B663	.038	IC Breadboard	3x4"	1.75
No. B664	.038	IC Breadboard	3x6"	2.05
No. B665	.038	IC Breadboard	4x6"	2.52
No. B666	.038	IC Breadboard	4x8"	3.24

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

535 YONGE STREET
TORONTO 5, ONTARIO

FOR A COMPLETE CATALOGUE OF PC ACCESSORIES AND CHEMICALS FROM INJECTROL, PLEASE CIRCLE #7 ON THE ORDER FORM PAGE.

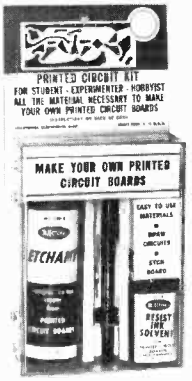
INJECTORALL ELECTRONICS CORPORATION

KIT 500

For Printed Circuits

KIT 500 is a low cost kit that comes complete with all materials to make a printed circuit board. Consists of two copper clad boards, a resist ink pen, resist ink solvent, a 6 oz. bottle of etchant, a 1/16" drill bit and a 5 x 7 x 2" plastic case in which the boards are etched. Comes with complete directions. Packaged on a display card. Weight 2 lbs.

$9.95



KIT 650

Photo-Etch Kit for Printed Circuits

KIT 650 is a complete kit using a photographic method to produce professional quality printed circuits. No dark room is necessary. Contains 2 photo-sensitized 3 x 4" phenolic boards, a photographic test negative & an ultraviolet light source. Materials are included to make negatives of magazine layouts. Also contains exposure glass, clamps, developer, etchant, trays, resist remover, drill and complete instructions. Ideal for solid-state and integrated circuits. Packed in a display box. Weight 3 lbs.

$19.95

$1.10

TAPE HEAD CLEANING STICKS

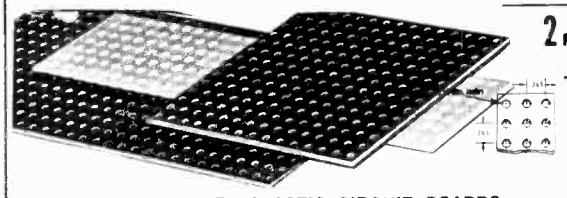
TAPE HEAD CLEANING STICKS are 6 inch cotton-tipped wooden swabs. They are excellent to reach dirty recorder heads without taking the tape recorder apart. Packed 100 on a hanging package.

No. 255 • 100 wooden swabs

"BREADBOARDING" AND PRINTED CIRCUIT DESIGN

LJ-12006

LJ-12006 Perfect for prototypes, breadboards, hobby and science projects. Made of tough plastic with clean-punch holes. Size 6¼" x 3¾"



2 FOR $1.95

PERFORATED PLASTIC CIRCUIT BOARDS

Unexcelled for prototypes, breadboards, hobby or science projects. Made of tough mil-spec phenolic with clean punched holes.

$1.69

TAPE HEAD CLEANER

For Tape Recorder Heads

Extra Frost FREEZER

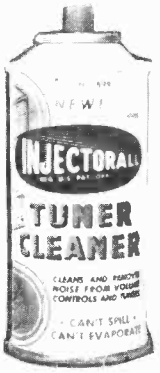
$4.49

PHONO GRIP-WELL

$1.98

TUNER CLEANER

Cleaner and Lubricant



$1.89

DRIVE WHEEL CLEANER

$1.98

VERNIER SALE

PRECISION VERNIER DIALS

$1\frac{1}{2}$" $1.49 ea
2" $1.99 ea
3" $2.39 ea

Stock No.	Diameter Inches	MM	Reading
5232	1½"	36	0 to 10
5233	2"	50	0 to 100
5234	3"	70	0 to 100

Precision planetary drive vernier dials with 8 to 1 ratio in 180 degrees. Front surface mounting. Set Screw bushing accomodates 1/4" shafts. Metal dial has brushed silver finish with deeply etched black numerals. Scales calibrated counter-clockwise from zero to maximun setting

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

535 YONGE STREET
TORONTO 5, ONTARIO

FOR A COMPLETE CATALOGUE ON THE INJECTROL LINE OF CHEMICALS AND PC EQUIPMENT, PLEASE CIRCLE #7 ON THE ORDER FORM PAGE.

ELECTRET CONDENSER MICROPHONE

$44.95

jana ELECTRET CONDENSER MICROPHONES

AJ-1015

Here's a versatile, high-quality microphone. Used regularly in professional recording studios and perfect for use with tape recorders, for rock groups, for demanding PA applications, and for lectern use in churches and schools. Beautifully finished in textured, brushed aluminum. Comes complete with a swivel mount stand adapter, wind screen and a 20-foot two-conductor shielded cable, which may be fitted with a phone plug, mini plug or Cannon connector.

BATTERY LIFE One new UM-3 (1.5V) battery powers this microphone for 8,000 to 10,000 hours (almost for a year)

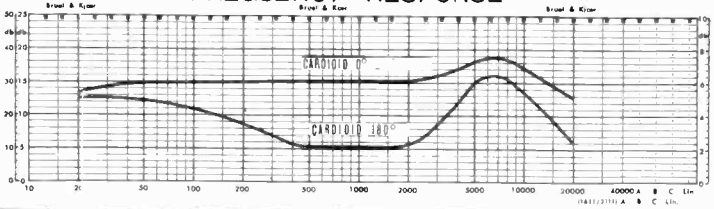
SPECIFICATIONS:
Directional: Cardioid or Uni-directional
Frequency Range: 30-16,000 Hz.
Output Impedance: 600 ohms ±20%
Output Level: —68 dB ±2.5 dB at 1K Hz.
Max. Sound Pressure Level: 125 dB
Equivalent Noise Level: Less than 30 dB SPL
Signal to Noise Ratio: More than 44 dB at 1K Hz.
Dynamic Range: Up to 98 dB
Power Supply: AA type, UM-3 (1.5V)
Current Consumption: 200uA ∓ 50 uA
Battery Life: 8,000 hours continuous
Cable: 20-ft., 2-conductor shielded
Accessories: Stand holder
Optional: Crade suspension

ELECTRET CONDENSER MICROPHONE

Here's a versatile, high-quality microphone. Used regularly in professional recording studios and perfect for use with tape recorders, for rock groups, for demanding PA applications, and for lectern use in churches and schools. Beautifully finished in textured, brushed aluminum. Comes complete with a swivel mount stand adapter, wind screen and a 20-foot one-conductor shielded cable, which may be fitted with a phone plug, mini-plug, or Cannon connector.
BATTERY LIFE One new UM-3 (1.5V) battery powers this microphone for 8,000 to 10,000 hours, (almost for a year.)

$39.95

FREQUENCY RESPONSE



SPECIFICATIONS

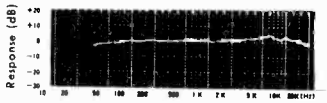
Directional	:	Cardioid
Frequeney Range	:	30-16,000 Hz
Output Impedance	:	600 ohms ± 20% (Low)
Output Level	:	−70 dB ± 2.5 dB at 1K Hz. (Low)
Max. Sound Pressure Level	:	125 dB
Equivalent Noise Level	:	Less than 30 dB SPL
Signal to Noise Ratio	:	More than 44 dB at 1K Hz.
Dynamic Range	:	Up to 98 dB
Power Supply	:	AA type, UM-3 (1.5V)
Current Consumption	:	200 uA ± 50 uA
Battery Life	:	8,000 hours continuous
Cable	:	20-foot, 1 conductor shielded with plug
Accessories	:	Stand holder and wind screen.

OMNI-DIRECTIONAL ELECTRET CONDENSER MICROPHONE

NO.6486

$19.95

Response Curve



Frequency Response

Specifications

Frequency Response	40~18,000Hz
Impedance	600 ohms
Sensitivity	−65dB± 3dB
Operating Voltage	1.1 to 1.5 Volts
Consumption Current	160μA
Continuous hours	10,000 hours
Coble	16.5 Ft with phone plug
Dimentions	0.87×6.38 in
Weight	6.7 ounces
Accessories	Built in talk switch Mike holder, Lavalier, Wind screen and Battery (UM-3)

DESK STAND MICROPHONE
Model SOM-260

Omnidirectional electret condenser mike for desk top use. FET preamp and battery are in base. On-off switch. Response 60-13,000 Hz, -66 db output. Battery life over 600 hours continuous use.

$44.95

SPECIFICATIONS

Polar Pattern:	Omni-directional
Frequency Response:	50—13,000 Hz
Power Supply:	Internal 1.3 mercury battery (Toshiba HS-D)
Amplifier:	FET Impedance convertor
Output level: (1,000 Hz)	−66 dB ± 3 dB
Generating Element:	Electret Condenser
Output Impedance:	Low Z (600 ohms)
S/N Ratio:	Greater than 44 dB
Equivalent Noise Level:	Less than dB SPL
Current Consumption:	200 uA ± 50 uA
Battery Life:	600 hours
Cable:	20-ft., shielded

MICROPHONE CRADLE SUSPENSION

$16.95

AJ-1014

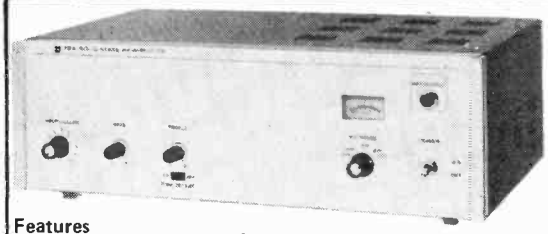
CRADLE SUSPENSION WITH SOUND HOLDER. FOR USE WITH AJ-1013, AJ-1015, AJ-1016 AND ANY 20 MM MICROPHONES.

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

TOA 900 SERIES SOLID-STATE PA AMPLIFIERS

APPROVED:
UL America
CSA Canada



Features
- All-solid-state, all silicon circuitry design.
- Full frequency range response; 20 ~ 20,000 Hz.
- High-pass filter switch.
- Bass tone control, Treble tone control.
- Tone defeat switch.
- AC circuit breaker/speaker fuse.
- Peak clipping light.
- Balanced outputs complete with 4, 8 and 16 ohms, and 70 and 25 volts.
- Built-in VU meter.
- VU meter range switch.
- Portable or rack-mounting type.

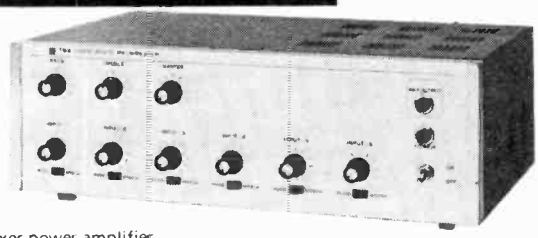
Dimensional diagram

TA-907
60-watt Solid State Amplifier

$325.05

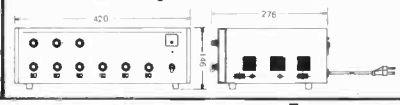
TA-908
100-watt Solid State Amplifier

$413.40



Features
- 6-channel mixer power amplifier.
- All-solid-state, all-silicon circuitry design.
- Full frequency range response; 20 ~ 20,000 Hz.
- Speech-music selector switch for each input.
- Bass tone control, Treble tone control.
- Bridging output-input.
- Signal processing output-input.
- Mute circuit on Input #6.
- AC circuit breaker/speaker fuse.
- Peak clipping light.
- Balanced outputs complete with 4, 8 and 16 ohms, and 70 and 25 volts.
- Receptacled plug-in input units.
- Portable or rack-mounting type.

Dimensional diagram



TA-956
30-watt Solid State Amplifier

$277.45

TA-957
60-watt Solid State Amplifier

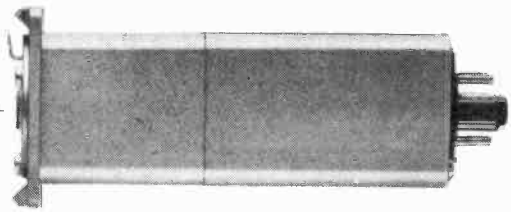
$361.15

TA-958
100-watt Solid State Amplifier

$446.00

Accessories for 900 Series Solid State Amplifiers

Receptacled Plug-in Input Units



Features
- All-solid-state, all silicon.
- No interconnecting wiring required.
- Rapid installation.
- High reliability.
- Variety of receptacles.

Front view →

	Receptacle	Amphenol (A)	DIN 5P/3P (D)	Cannon XLR-3-13 (F)	Cannon XLR-3-14 (M)	Phone Jack (P)	RCA Phono Jack (R)	3P Screw terminal (S)
High Z microphone unbalanced 50,000Ω	HAU-10 series	HAU-10A	HAU-10D	HAU-10F	HAU-10M	HAU-10P	HAU-10R	–
Equalized Mag. phono unbalanced 50,000Ω	HAU-20 series	HAU-20A	HAU-20D	HAU-20F	HAU-20M	HAU-20P	HAU-20R	–
High Z Auxiliary unbalanced 0.5MΩ	HAU-30 series	HAU-30A	HAU-30D	HAU-30F	HAU-30M	HAU-30P	HAU-30R	HAU-30S
Low Z microphone with transformer balanced 200Ω	HAU-60 series	–	HAU-60D	HAU-60F	HAU-60M	HAU-60P	–	HAU-60S
Low Z microphone with differential amp. balanced 200Ω	HAU-70 series	–	HAU-70D	HAU-70F	HAU-70M	HAU-70P	–	HAU-70S
Line matching Transformer balanced 600Ω	LTU-01 series	–	LTU-01D	LTU-01F	LTU-01M	LTU-01P	–	LTU-01S
Bridging transformer balanced 10,000Ω	BTU-01 series	–	BTU-01D	BTU-01F	BTU-01M	BTU-01P	–	BTU-01S
Lo Z microphone with transformer balanced 200Ω	HAU-80 series	–	HAU-80D	HAU-80F	HAU-80M	HAU-80P	–	HAU-80S

TENCO

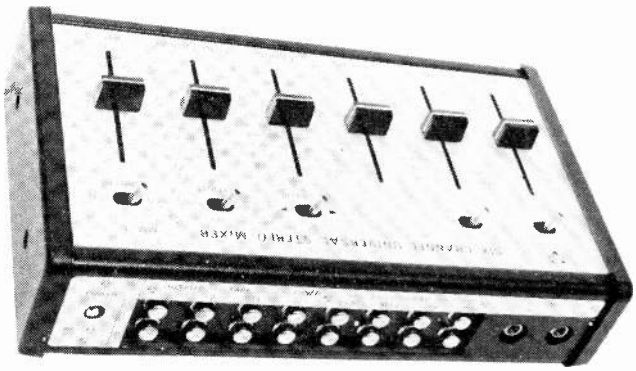
STEREO MIKE MIXER WITH SLIDE CONTROLS.

Microphone Mixer

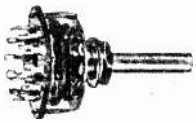
STEREO MONO SWITCH
DUAL IMPEDANCE
SIX INPUTS:-
- MIKE 1
- MIKE 2
- PHONO 1
- PHONO 2
- TUNER/TAPE 1
- TAPE 2

$84.95

THE MM-1 MICROPHONE MIXER IS OUR LATEST MIXER IS LATEST MIXER FEATURING LOW NOISE LEVEL, HIGH RELIABILITY, VERSATILITY AND ECONOMY.



Rotary Switches

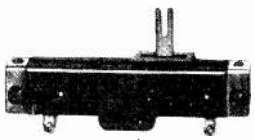


Useful for many audio, stereo and hi-fi applications. Spring loaded, shorting type, positive detent action. 1-1/4" diameter with 1-1/4" shaft length, plated lugs.

5201. 11 position, single pole.
5202. 12 position, single pole
5203. 5 position, 2-pole
5204. 6 position, 2-pole.
5205. 3 position, 3-pole.
5206. 4 position, 3-pole.
5207. 2 position, 4-pole
5208. 3 position, 4-pole.
5209. 2 position, 6-pole

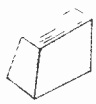
$1.09

Slide Controls



79¢

TS302. Ruggedly designed slide controls for a wide variety of general replacement and OEM applications. Solder lugs on all terminals, threaded end flanges for panel mounting. Available in 10K 50K, 100K ohms — please specify when ordering. 2-1/4"L x 7/16"D x 5/16"W.



Custom replacement knobs for above controls and other standard types.

GP10. BLACK, with marker. **49¢**
GP16. Silver/chrome finish, r. **59¢**

HOME & TV ACCESSORIES

75-300 OHM Matching Transformer

$1.59

N-9065. CATV MATCHING TRANSFORMER. Now you can match the impedance of any CATV co-axial line to the impedance of your TV or FM receiver. Converts 75 ohms CATV output to 300 ohms FM/TV input. Hardware and F-59 connector included.

N-9066. Same as above but with slimline ½" casing.

15¢

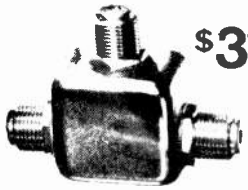
N-1015. TV ANTENNA CLIP. Strong plated springs with screw terminals and coloured plastic handles. Quick way to connect or disconnect antenna lead-in wires to TV set, FM radio etc.

Q4807

$1.59

Q4807. TELEPHONE PICKUP. Suction cup attaches to phone handle behind earpiece and picks up both sides of telephone conversation. Miniature phone plug connects to amplifier or tape recorder.

CATV/MATV HARDWARE

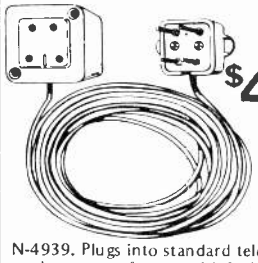


$3.95

N-9067. 75 OHM SPLITTER. Splits incoming 75 ohm line to dual 75 ohm outputs, for use with TV-FM combination, etc. Standard F-61 connectors, all-metal casing.

N-9068. As above, 3 outputs. **4.95**
N-9069. As above, 4 outputs. **5.95**

Telephone Extension Cable



$4.95

N-4939. Plugs into standard telephone equipment, or for use with jacks and plugs shown below. White vinyl covered cable is 30 feet long with four colour coded conductors.

25¢

N-F59.

N-F59. MALE CONNECTOR. For use with RG-59/U cable. Fits F-61, F-61A, F-81 and F-81B Connectors. Ferrule supplied.

49¢

N-F61A.

N-F61A. FEMALE CONNECTOR. Fits F-59, F-59A and F-56 connectors. Complete with nut and washer.

69¢

N-F81.

N-F81. FEMALE ADAPTOR. Mates with F-59, F-59A and F-56 connectors.

4 PRONG PHONE PLUG

89¢

N-4936. Fits all single and 2-line phones. Easy to attach without soldering.

4 PRONG PHONE JACK

89¢

N-4937. Mounts to wall with 2 wood-screws, included. Screw-type terminals.

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

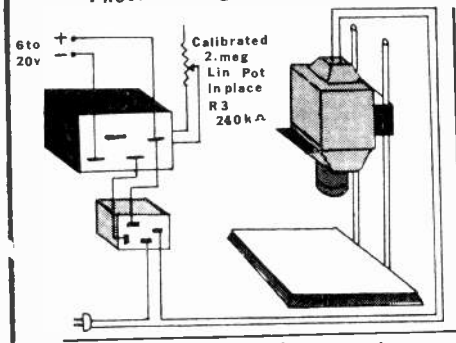
FOR A COMPLETE CATALOGUE ON TENCO PARTS AND ACCESSORIES, PLEASE CIRCLE # 5 ON THE ORDER FROM PAGE.

FOR THE HOBBYIST SOLID STATE TIMERS

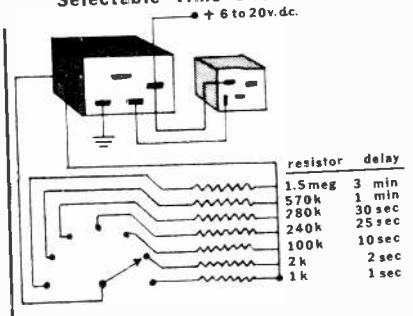
APPLICATIONS

$3.95 pr.

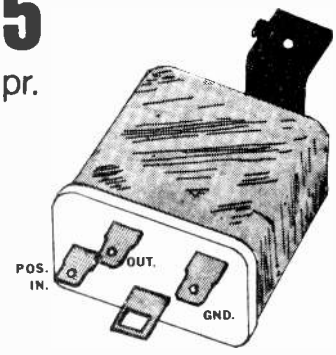
Photo Enlarger Timer



Selectable Time Switch

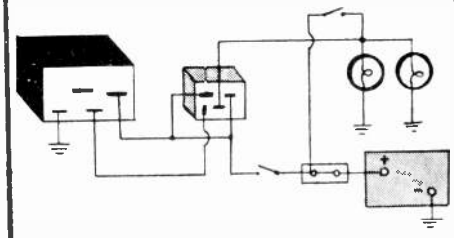


Omit R3 with Selector Switch added

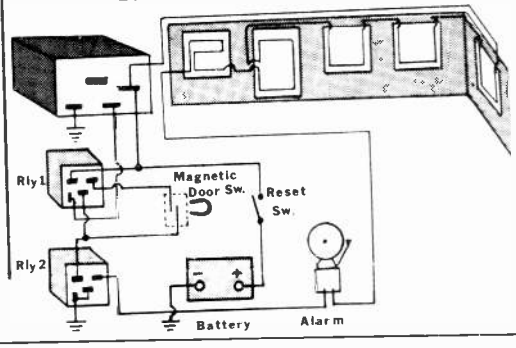


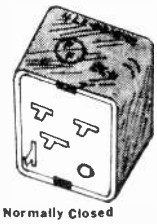
25 Second Turn On SOLID STATE AUTO TIMER

Automotive Light Delay Switch



Local BURGULAR ALARM





Normally Closed SPST Relay

jana EDUCATIONAL KITS

STOCK NO.	NAME KIT	NET
3449-0075-2	12V Hi Power Flasher	8.00
3449-0120-1	6V Power Supply	10.95
3449-0125-2	9V Power Supply	10.95
3449-0130-9	0 - 24V 1A Power Supply	17.95
3449-0175-9	Tone Generator	6.95
3449-0230-5	Crystal Radio	5.50
3449-0240-2	"Bug Shoot"	4.95
3449-0251-8	Auto Headlight Reminder	4.95
3449-0280-1	Code Oscillator	6.95
3449-0301-8	Single Channel Color Organ 300 Watts	6.25
3449-0310-7	Battery Operated Flourescent Light Kit	13.95
3450-3759-4	3 Channel Color Organ	19.95
3449-0025-6	Loud Mouth Siren	9.95
3449-0041-8	Xenon Strobe	11.50
3449-0030-2	Roulette Wheel	11.95

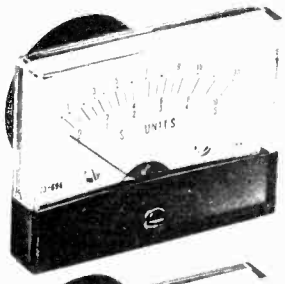
FOR COMPLETE CATALOGUE OF JANA KITS, PLEASE CIRCLE #6 ON THE ORDER FORM PAGE.

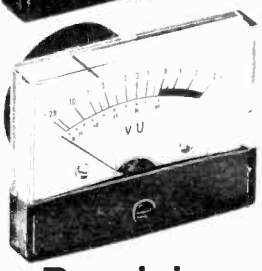
DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

jana

WIDE VIEW PANEL METERS





Precision WIDE-VIEW Panel Meters

•

Highly Readable and Accurate Design

RANGE	2"	PRICE	4"	PRICE
DC MICROAMMETERS				
O-30 uA			HJ-8801	9.95
O-50 uA	HJ-8202	10.95	HJ-8802	12.95
50-O-50 uA	HJ-8203	10.95	HJ-8803	12.95
O-100 uA	HJ-8204	10.95	HJ-8804	12.95
O-200 uA	HJ-8205	9.95	HJ-8805	9.95
O-300 uA	HJ-8207	9.95		
O-500 uA			HJ-8806	9.95
DC MILLIAMMETERS				
O-1 mA	HJ-8301	10.95	HJ-8811	10.95
O-5 mA			HJ-8812	10.95
O-10 mA			HJ-8813	11.95
O-100 mA	HJ-8303	10.95	HJ-8814	11.95
O-200 mA	HJ-8304	10.95	HJ-8815	11.95
O-300 mA			HJ-8816	12.95
O-500 mA	HJ-8306	10.95	HJ-8817	9.95
AC VOLT METERS				
O-15 V	HJ-8401	9.95	HJ-8821	12.95
O-150 V	HJ-8402	10.95	HJ-8822	10.95
O-250 V			HJ-8823	10.95
DC VOLT METERS				
O-10 V			HJ-8831	11.95
O-15 V	HJ-8502	9.95	HJ-8832	12.95
O-50 V	HJ-8503	9.95		
O-100 V	HJ-8504	6.95	HJ-8834	11.95
O-300 V	HJ-8505	6.95	HJ-8835	9.95
O-500 V	HJ-8506	10.95	HJ-8836	9.95
"S" METER				
	HJ-8701	9.95	HJ-8841	11.95
ILLUMINATED "S" METER				
	HJ-8703	9.95		
"VU" METER				
	HJ-8702	10.95		
ILLUMINATED "VU" METER				
	HJ-8704	11.95	HJ-8851	13.95
DC AMMETERS				
O-15 A	HJ-8601	10.95	HJ-8861	13.95
O-30 A	HJ-8602	10.95	HJ-8862	10.95

INDUSTRIAL MULTITESTER

* 10 AMP D.C. SCALE
* 20K OHM/VOLT D.C.
* 10K OHM/VOLT A.C.
* CARRYING CASE
* 40μA METER MOVEMENT
* STURDY BAKELITE CASE

$25.95

HJ-8010

20,000-ohm/V Multitester

Specification:

DC Volt:	5-25-125-500-1000 (20K ohm/Volt)
AC Volt:	10-50-250-1000 (10K ohm/Volt)
DC Current:	50uA-2.5mA-250mA and 10A
Resistance:	Rx10, (30K) Rx100, (.3m) Rx1000 (3m) (Center Scale 30 ohms)
Decibels:	Decibels: -20dB to +22 dB
Dimensions:	Dimensions: 3⅜" x 4⅝" x 1 5/16"

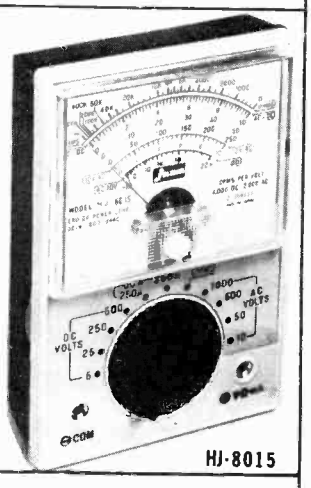
POCKET MULTITESTER

* IDEAL FOR THE HOBBYIST
* 4K OHM/VOLT DC
* 2K OHM/VOLT AC
* 11 RANGES
* 2 JEWELS
* WHITE EASY TO READ FACE
* COMPLETE WITH TEST LEADS

$13.95

SPECIFICATIONS:

DC Volt:	0-5-25-250-500
AC Volt:	0-10-50-500-1000
DC Current:	0-250uA, 250mA
Resistance:	0-600K (7000-ohm center)
Decibels:	—10 dB to +22dB
Dimensions:	2¼" x 3 9/16" x 1⅛"



HJ-8015

DOMINION RADIO & ELECTRONICS CO.

THE HOME OF SURPLUS RADIO & ELECTRONIC SUPPLIES

FOR A COMPLETE CATALOGUE OF PARTS AND ACCESSORIES FROM JANA, PLEASE CIRCLE #6 ON THE ORDER FORM PAGE.

TDK

LOW-NOISE HIGH FIDELITY CASSETTES

Model	Running Time (Double Track)	Tape Length	Tape Thickness	COST
C-120LN	120 minutes (60x2)	600 ft	0.35 mil	$4.99
C-180LN	180 minutes (90x2)	900 ft	0.25 mil	$7.49

SUPER DYNAMIC

Model	Running Time (Double Track)	Tape Length	Tape Thickness	COST
C-45SD	45 minutes (15 x 2)	225 ft	0.7 mil	$ 3.19
C-60SD	60 minutes (30 x 2)	300 ft	0.7 mil	$ 3.59
C-90SD	90 minutes (45 x 2)	450 ft	0.5 mil	$ 4.99
C-120SD	120 minutes (60 x 2)	600 ft	0.35 mil	$ 6.59

Krom·O_2

Model	Running Time (Double Track)	Tape Length	Tape Thickness	COST
C-60KR	60 minutes (30x2)	300 ft	0.7 mil	$ 4.29
C-90KR	90 minutes (45x2)	450 ft	0.5 mil	$ 6.39

SA

TDK Professional Range Cassettes

Super Avilyn (SA) Cassettes. The new state-of-the-art in cassette recording.

Model	Running Time (Double Track)	Tape Length	Tape Thickness	COST
C-60	60 minutes (30x2)	300 ft	0.7 mil	$ 4.69
C-90	90 minutes (45x2)	450 ft	0.5 mil	$ 6.99

S-Series Open-Reel Tape. A new moderately priced Studio Quality tape.

S OPEN-REEL TAPE

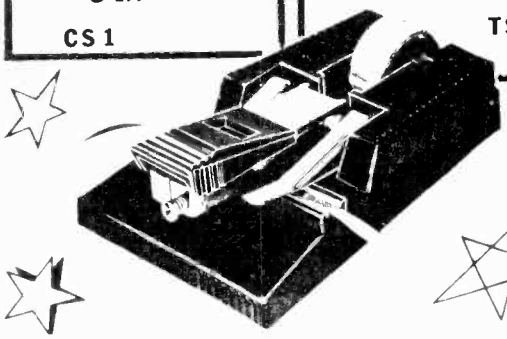
SOUND RECORDING TAPE
TDK S-1800

Type	Overall Tape Thickness	Tape Length	COST
1200SD (Large, low-torque hub)	1.5 mil	1200 ft.	$ 8.59
1800SD (standard hub)	1.5 mil	1800 ft.	$10.99

PROFESSIONAL TAPE SPLICERS

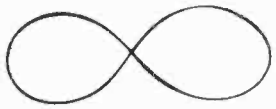
NEW! CASSETTE SPLICER
$5.95 EA
CS 1

¼" TAPE SPLICER
$5.95 EA
TS 1



UNIVERSAL CASSETTE 8-TRACK

DRIVE BELTS



NOW 99¢ EA

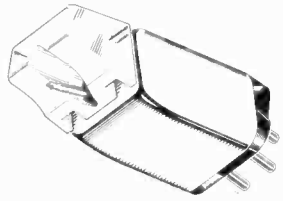
SQUARE CASSETTE DRIVE BELT
GJ7070
280 mm (11 in.) dia. · 1/16" (1.6 mm) square
GJ7071
150 mm (6 in.) dia.
GJ7072
240 mm (9.4 in.) dia.
GJ7073
230 mm (9.0 in.) dia.
GJ7074
255 mm (10 in.) dia.
GJ7076
220 mm (8.8 in.) dia.

ROUND CASSETTE DRIVE BELT
GJ7075
150 mm (5.9 in.) dia. · 3/32" (2.4 mm) round

FLAT 8 TRACK BELTS
GJ7080
330 mm, (13 in.) dia. · ¼" wide (6.4 mm)
GJ7081
280 mm, (11 in.) dia. · 3/16" wide (4.8 mm)
GJ7082
280 mm, (11 in.) dia. · ¼" wide (6.4 mm)

EMPIRE
EMPIRE

66 E/X



$13.95

ELLIPTICAL STYLUS CARTRIDGE

FREQ. RESPONSE	8-30,000HZ
SEPERATION	30db
STYLUS TYPE	.3X.7mil ELLIPTICAL DIAMOND

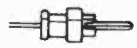
Canada's Most Popular Audio and General Purpose Connectors

Here are the latest additions to our line of Hi-Fi and P.A. cable assemblies :

RCA plug - Bare Wires		
W1	36"	$ .89
W2	72"	1.20
W3	120"	1.49
RCA plug - Spade lugs		
W4	36"	.79
W5	72"	1.20
RCA plug - Alligator clips		
W7	72"	1.20
RCA plug - RCA plug		
W8	36"	.89
W9	72"	1.20
W10	120"	1.49
RCA plug - 90 RCA plug		
W11	72"	1.20
W12	120"	1.49
RCA plug - RCA jack		
W15	36"	.89
W16	72"	1.20
2 RCA plugs - 2 RCA plugs		
W17	72"	2.19
RCA plug - ¼" phone plug		
W18	36"	.89
W19	72"	1.20
RCA plug - ¼" phone jack		
W22	72"	1.50
MINI plug - Bare wires		
W23	72"	1.20
MINI plug - Alligator clips		
W24	72"	1.20
MINI plug - RCA plug		
W25	72"	1.20
MINI plug - RCA jack		
W26	72"	1.20
MINI plug - Mini plug		
W27	72"	1.20
MINI plug - Mini jack		
W28	72"	1.20
MINI plug - ¼" Phone plug		
W29	72"	1.20
MINI plug - Phone jack		
W30	72"	1.20
¼" Phone plug-RCA Jack		
W31	72"	1.20

ACTUAL SIZE


ALLIGATOR CLIPS


RCA PHONO PLUG


MINI PLUG


¼" PHONE PLUG

ACTUAL SIZE


SPADE LUGS


RCA PHONO JACK


MINI JACK


¼" PHONE JACK

Complete Cable Assemblies for Hi-Fi

with European connectors

NO.	CONNECTOR	CABLE	CONNECTORS	PRICE
W40	3 PIN DIN PLUG	6' 2 COND & SHIELD	2 PHONO PLUGS	3.25
W41	3 PIN DIN PLUG	6' 2 COND & SHIELD	2 PHONO JACKS	3.25
W42	3 PIN DIN PLUG	6' 2 COND & SHIELD	2 MINI PLUGS	3.25
W43	3 PIN DIN PLUG	6' 2 COND & SHIELD	3 PIN DIN PLUG	3.25
W44	3 PIN DIN PLUG	6' 2 COND & SHIELD	3 PIN DIN JACK	3.25
W45	5 PIN DIN PLUG	6' 2 COND & SHIELD	2 PHONO PLUGS	3.25
W46	5 PIN DIN PLUG	6' 4 COND & SHIELD	4 PHONO PLUGS	3.95
W47	5 PIN DIN PLUG	6' 4 COND & SHIELD	4 MINI PLUGS	3.95
W48	5 PIN DIN PLUG	6' 4 COND & SHIELD	5 PIN DIN PLUG	3.95
W49	5 PIN DIN PLUG	6' 4 COND & SHIELD	5 PIN DIN JACK	3.95
W50	4 RCA PLUGS	6' 4 COND & SHIELD	4 RCA PLUGS	3.95

FLEXIBLE "Y" CONNECTORS

W51	1 RCA PLUG	-	2 RCA JACKS	$1.10
W52	1 RCA JACK	-	2 RCA PLUGS	1.10
W53	1 RCA PLUG	-	2 RCA PLUGS	1.10
W54	1 MINI PLUG	-	2 RCA PLUGS	1.10
W55	1 MINI PLUG	-	2 MINI JACKS	1.10

3 WAY "Y" ADAPTERS

SHIELDED "Y" ADAPTOR

70¢

2 RCA jacks parallel connected to one RCA plug.

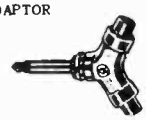
SHIELDED "Y" ADAPTOR

70¢

3 RCA jacks parallel connected

SHIELDED "Y" ADAPTOR

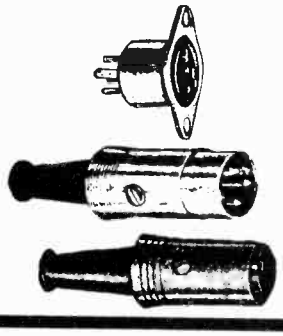
70¢

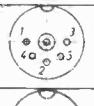
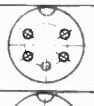


2 RCA jacks parallel connected to one ¼" phone plug.

NEW

CONTINENTAL CONNECTORS



	PINS	MALE	INLINE FEMALE	CHASSIS MOUNT
	2	1.29 72M Metal	1.49 73F Metal	
	2	.59 56M Plastic		.59 57C Plastic
	3	.79 58M Plastic	.79 59F Plastic	.59 66C Plastic
	5	.89 60M Plastic	.99 61F Plastic	.59 67C Plastic
	5	1.89 76M Metal	1.89 77F Metal	
	6	1.99 70M Metal		.69 71C Metal

DOMINION RADIO & ELECTRONICS CO

NEW

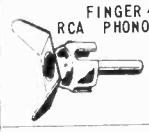
PLUGS JACKS & ADAPTERS

RCA PHONO PLUG

10¢
A1

INSULATED RCA PHONO PLUG

15¢
A2 Red or Black

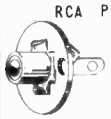
FINGER-GRIP RCA PHONO PLUG

15¢
A3

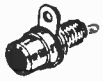
INSULATED RCA PHONO PLUG

25¢
A4

SHIELDED RCA PHONO PLUG

45¢
A5

RCA PHONO JACK

15¢
A6

CHASSIS MOUNT RCA PHONO JACK

25¢
A7

INLINE RCA PHONO JACK

25¢
A8

DUAL RCA PHONO JACKS

30¢
A9

SHIELDED INLINE RCA PHONO JACK

45¢
A10

ULTRS MINI ATURE PLUG

15¢
A11

ULTRA MINIATURE LONG BARREL PLUG

25¢
A12

MINIATURE PLUG

15¢
A13

MINIATURE PLUG

25¢
A14

CHROME MINIATURE PLUG

45¢
A15

ULTRA MINIATURE CHASSIS MOUNT JACK

10¢
A15

ULTRA MINIATURE INLINE LONG BARREL JACK

25¢
A17

CHASSIS MOUNT JACK

15¢
#901 Closed Circuit
#902 Open Circuit

MINIATURE INLINE JACK

25¢
A19

CHROME MINIATURE INLINE JACK

45¢
A20

STANDARD PHONE PLUG

45
A21 Black

SHIELDED PHONE PLUG

89
A22

90 STANDARD PHONE PLUG

99
A23

90 SHIELDED PHONE PLUG

99
A24

CHROMED BARREL PLUG

1.19
A25

INLINE PHONE JACK

45¢
A26

SHIELDED INLINE PHONE JACK

89¢
A27

CHASSIS MOUNT PHONE JACK

35¢
A28 Closed Circuit

CHASSIS MOUNT PHONE JACK

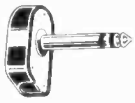
35¢
A29 Open Circuit

CHROMED BARREL INLINE JACK

$ 1.19
A30

STEREO PHONE PLUG

69¢
A31

90 STEREO PHONE PLUG

$ 1.09
A32

SHIELDED STEREO PHONE PLUG

99¢
A33

STEREO PHONE JACK CIRCUIT CLOSING

45¢
A34

36 STEREO Y ADAPTOR

$ 2.19

INLINE stereo PHONE JACK

69¢
A35

STEREO PHONE JACK

45¢
A36

SHIELDED STEREO INLINE JACK

99¢
A37

EPOXY STEREO PHONE JACK

99¢
A38 CIRCUIT CLOSING

STEREO Y ADAPTOR

$ 2.99

MINIATURE MALE INLINE MIKE CONNECTOR

79¢
A39

MALE INLINE MIKE CONNECTOR

79¢
A40

MIKE CONNECTOR TO PHONE PLUG ADAPTOR

79¢
A41

SHIELDED PHONO JACK TO PHONO JACK ADAPTOR

79¢
A42

PHONO JACK TO PHONO JACK ADAPTOR

69¢
A43

MINIATURE MALE CHASSIS MOUNT MIKE CONNECTOR

49¢
A44

MALE CHASSIS MOUNT MIKE CONNECTOR

49¢
5/8 - 27 thread A45

MIKE CONNECTOR TO PHONE JACK ADAPTOR

89¢
A46

PHONO PLUG TO PHONE PLUG ADAPTOR

79¢ A47

PHONO JACK TO PHONO JACK ADAPTOR

79¢ A48

MINIATURE FEMALE INLINE MIKE CONNECTOR

69¢
A49

FEMALE INLINE MIKE CONNECTOR
5/8-27 thread

69¢
A50

MIKE CONNECTOR TO PHONE JACK ADAPTOR

79¢
A51

PHONO JACK TO MINIATURE PLUG ADAPTOR

79¢
A52

ULTRA MINIATURE JACK TO MINIATURE PLUG ADAPTOR

79¢
A53

MINIATURE JACK TO ULTRA MINIATURE PLUG

79¢
A54

MINIATURE JACK TO PHONE PLUG ADAPTOR

79¢
A55

MINIATURE JACK TO PHONO PLUG ADAPTOR

79¢
A56

PHONE JACK TO ULTRA MINIATURE PLUG ADAPTOR

79¢
A57

ULTRA MINIATURE JACK TO STANDARD PHONE PLUG

79¢
A58

PHONE JACK TO MINIATURE PHONE PLUG

79¢
A59

PHONE JACK TO PHONO PLUG ADAPTOR

79¢
A60

PHONE JACK TO PHONE JACK ADAPTOR

79¢
A61

PHONE PLUG TO PHONE PLUG ADAPTOR

79¢
A62

MIKE CONNECTOR TO PHONO JACK ADAPTOR

79¢
A63

FILM CAPACITORS

PHILIPS

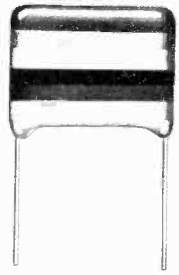
280 METALLIZED FILM TYPE, DIPPED FLAT WITH RADIAL LEADS

ALL TYPES 10% STD.

Popularly called "flat foil" capacitors, this series is ideal for mounting on Printed Circuit Boards having lead spacings based on 2.54mm (0.1") grid system. They are widely used as coupling and decoupling capacitors and their almost negligible capacitance change with temperature makes them preferable to ceramic capacitors in many applications.

All metallized foil capacitors have self healing properties. They are designed to withstand temporary over voltages of 40%, thus avoiding the necessity of specifying 400V capacitors in tube circuits.

TYPE NO.	Capacitance µF	DC Working Voltage 5th BAND	PRICE
CH SERIES: 100V working			
280CHA1M	1.0	brown	.39
280CHA1M5	1.5	brown	.59
280CHA2M2	2.2	brown	.69
280CHA3M3	3.3	brown	.89
280CHA4M7	4.7	brown	1.19
280CHA6M8	6.8	brown	1.69
AE SERIES: 250V working			
280AEA10K	0.010	red	.10
280AEA15K	0.015	red	.10
280AEA22K	0.022	red	.10
280AEA33K	0.033	red	.10
280AEA47K	0.047	red	.10
280AEA68K	0.068	red	.10
280AEA100K	0.10	red	.15
280AEA150K	0.15	red	.15
280AEA220K	0.22	red	.15
280AEA330K	0.33	red	.25
280AEA470K	0.47	red	.25
280AEA680K	0.68	red	.35
280AEA1M	1.0	red	.60
280AEAIM5	1.5	red	.70
280AEA2M2	2.2	red	.90



TYPE NO.	Capacitance µF	DC Working Voltage 5th Band	PRICE
CF SERIES: 400V working			
280CFA10K	0.010	yellow	.15
280CFA15K	0.015	yellow	.15
280CFA22K	0.022	yellow	.15
280CFA33K	0.033	yellow	.15
280CFA47K	0.047	yellow	.15
280CFA68K	0.068	yellow	.15
280CFA100K	0.10	yellow	.20
280CFA150K	0.15	yellow	.20
280CFA220K	0.22	yellow	.25
280CFA330K	0.33	yellow	.30
280CFA470K	0.47	yellow	.40
280CFA680K	0.68	yellow	.50
280CFA1M	1.0	yellow	.70
CG SERIES: 630V working			
280CGA10K	0.010	blue	.15
280CGA15K	0.015	blue	.15
280CGA22K	0.022	blue	.20
280CGA33K	0.033	blue	.20
280CGA47K	0.047	blue	.25
280CGA68K	0.068	blue	.30
280CGA100K	0.10	blue	.35
280CGA150K	0.15	blue	.40
280CGA220K	0.22	blue	.45
280CGA330K	0.33	blue	.50
280CGA470K	0.47	blue	.65

ELECTROLYTIC CAPACITORS

PHILIPS

431 LARGE GENERAL PURPOSE TYPE – NOW WITH AN EVEN BIGGER RANGE

Tolerance: −10/+50%. Temp. Range: −40 to +85°C

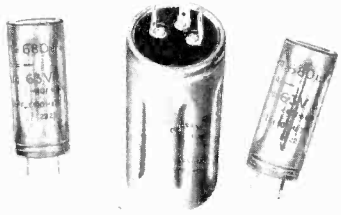
These capacitors are suitable for use in power supplies for transistorized equipment.

The can had longitudinal indents to fix the core and to promote heat transfer. Paralleled double capacitors may be preferred over single capacitors because they are shorter.

These capacitors are used in power supplies for professional and high quality entertainment equipment, power supplies in digital equipment, energy storage in pulse systems and filters in measuring and control apparatus.

Low values of impedance and inductance are achieved by a special construction with several internal anode and cathode connections.

Aluminum foil with a high etching factor and new electrolytes provide a high C-V product. The aluminum cans are fully insulated and sealed by a synthetic resin disc with a vent, which releases in case of over pressure.



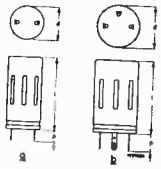


Fig a & b

TYPE NO.	WORKING VOLTAGE (V)	CAPACITANCE (µF)	CAN SIZE	PRICE
431CR A10000	6.3	10000	6	3.50
431CR A15000		15000	8a	4.10
431CR A22000		22000	9a	5.20
431CR A33000		33000	9	6.00
431CR A47000		47000	10	6.90
431CR E3300	16	3300	5	2.70
431CR E4700		4700	6	3.50
431CR E6800		6800	8a	3.70
431CR E10000		10000	8	4.20
431CR E10000/9A		10000	9a	5.20
431CR E15000		15000	9	6.20
431CR E22000		22000	10	6.90
431CR F2200	25	2200	5	2.70
431CR F3300		3300	6	3.50
431CR F4700		4700	8a	3.70
431CR F6800		6800	8	4.20
431CR F6800/9A		6800	9a	5.20
431CR F10000		10000	9	6.20
431CR F15000		15000	10	6.90
431CR G1000	40	1000	5	2.70
431CR G2200		2200	6	3.50
431CR G3300		3300	8a	3.70
431CR G4700		4700	8	4.20
431CR G4700/9A		4700	9a	5.20
431CR G6800		6800	9	6.20
431CR G10000		10000	10	6.90
431CR H680	63	680	5	2.70
431CR H1000		1000	6	3.50
431CR H1500		1500	8a	3.70
431CR H2200		2200	8	4.20
431CR H2200/9A		2200	9a	5.20
431CR H3300		3300	9	6.20
431CR H4700		4700	10	6.90

CAN SIZE	FIG	DIMENSIONS (mm) & (ins)*					
		d		l		p	
		mm	ins	mm	ins	mm	ins
5	a	21	0.84	50	2.0	12	0.47
6	a	25	1.0	50	2.0	12	0.47
8a	a	30	1.2	50	2.0	12	0.47
8	a	30	1.2	80	3.2	12	0.47
9a	b	35	1.4	50	2.0	12	0.47
9	b	35	1.4	80	3.2	12	0.47
10	b	40	1.6	80	3.2	12	0.47

*Measurements in inches approximate only.
N.B. Can sizes 9 & 9a do not have lugs.

CLAMP TYPE NO.	CAN SIZE	PRICE
CCR20	5	30¢
CCR25	6	
CCR30	8a, 8	
CCR35	9a, 9	
CCR40	10	

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

535 YONGE STREET
TORONTO 5, ONTARIO

FOR COMPLETE CATALOGUE ON TYPES AND SPECIFICATIONS ON THE PHILIPS CAPACITOR LINE, PLEASE CIRCLE #1 ON THE ORDER FORM PAGE.

Resistors & Capacitors

1/4W			1/2W	1W		2W	
9.1	18K	39	13K	3.3	16K	33	2.2K
11	22K	56	15K	10	18K	39	2.7K
12	27K	68	16K	33	20K	47	3.3K
15	56K	75	18K	56	22K	82	4.7K
16	82K	82	27K	82	27K	100	5.6K
18	100K	91	30K	100	33K	180	6.2K
20	130K	120	33K	220	39K	270	6.8K
22	150K	130	36K	270	47K	330	8.2K
27	160K	180	39K	330	56K	560	13K
30	180K	220	43K	390	68K	680	15K
33	220K	270	62K	470	150K	820	16K
36	300K	330	82K	560	180K	1K	18K
39	330K	390	150K	680	390K	1.5K	22K
43	390K	510	160K	1.5K	820K	1.8K	33K
68	1 meg	620	180K	2.7K	1 meg		82K
100	2 meg	750	300K	3.9K	1.2 meg		820K
110		820	330K	4.7K	1.5 meg		1.8 meg
180	1/2W	910	360K	5.1K	1.8 meg		2.7 meg
300	3.16	1K	390K	5.6K	2.2 meg		4.7 meg
390	3.3	1.2K	620K	7.5K	2.7 meg		
430	3.9	1.5K	680K	8.2K	4.7 meg		
470	5.1	1.6K	1 meg	12K	5.6 meg		
680	5.6	1.8K	1.2 meg	15K	15 meg		
2.2K	7.5	2.2K	1.5 meg				
3.3K	12	2.4K	1.6meg				
3.9K	13	2.7K	1.8 meg				
4.3K	15	3K	2.7 meg				
4.7K	18	3.3K	3.3 meg				
5.1K	22	3.6K	3.9 meg				
5.6K	24	5.1K	4.7 meg				
6.8K	28	5.6K	5.6 meg				
9.1K	30	6.8K	6.8 meg				
10K	33	8.2K	7.5 meg				
12K	35	9.1K	8.2 meg				
15K	36	12K	15 meg				

RESISTORS

1/4W, 1/2W — 3 1/2¢

1W, 2W — 5¢

POTENTIOMETERS

10K w/sw
100K
300K
470K Linear
500K w/sw

1.5 meg
2 meg Linear
3 meg
4 meg Screw adjust
5 meg Screw adjust

300K & 100K w/s
50K & 500
15K & 250K
800 & 100
3 meg & 1.5 meg w/dpst
5 meg & 1.5 meg w/sw
1 meg & 400 w/sw
50K & 250K w/sw
500K & 50K w/sw
1 meg & 500
1 meg & 300
50K & 500K w/sw
50K & 10K w/sw
50K & 250K

500K & 500
50K & 2 meg log
150K with 4 pos. sw
50K & 2 meg Linear
1meg & 5 meg
1 meg & 500K w/switch

Singles 20¢
Duals 35¢
Dual w/sw. 50¢

5¢ EA. DISC CERAMICS 5¢ EA.

3	500v	39	5Kv	100	500v
3.3	500v	39	500v	100	1.4Kv
5.6	500v	39	2Kv	110	4Kv
6	500v	39	3Kv	110	6Kv
6.8	500v	40	6Kv	120	5Kv
6.8	3Kv	43	500v	120	6Kv
7	500v	47	500v	121	500v
8	500v	47	100v	127	500v
8.2	500v	47	500v	130	4Kv
9	500v	47	1Kv	135	500v
10	500v	47	2Kv	150	500v
12	500v	51	6Kv	160	500v
13	500v	56	500v	170	100v
13.5	500v	56	2.5Kv	180	200v
15	500v	58	200v	200	500v
17	500v	62	500v	210	500v
18	500v	68	500v	320	500v
18	2Kv	68	500v	330	2.5Kv
20	6Kv	68	500v	370	500v
22	500v	68	1Kv	390	1.5Kv
22	500v	68	3Kv	660	500v
24	1Kv	68	4Kv	680	500v
27	500v	70	500v	882	500v
27	200v	80	500v	1000	200v
27	500v	82	100v	1200	500v
29	5Kv	82	1Kv	2200	200v
30	500v	82	6Kv	2200	500v
33	500v	91	500v	2500	500v
33	500v	91	500v	3900	500v
33	1Kv	95	3Kv	.005	500v

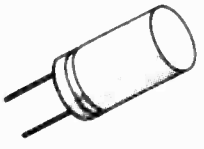
15¢ TRIMMER CAPACITORS 25¢

SINGLES

0-5	Pfd.	20-130	Pfd.		
0-6	Pfd.	30-200	Pfd.	60-220	Pfd.
0-85	Pfd.	DUALS		60-220	Pfd.
0-100	Pfd.	0-100	Pfd.	200-200	Pfd.
4.5-25	Pfd.	0-100	Pfd.	200-200	Pfd.
5-75	Pfd.				
5-80	Pfd.	15-120	Pfd.	350-500	Pfd.
7-85	Pfd.	15-120	Pfd.	75-110	Pfd.

ELECTROLYTIC CAPACITORS

25¢ EACH



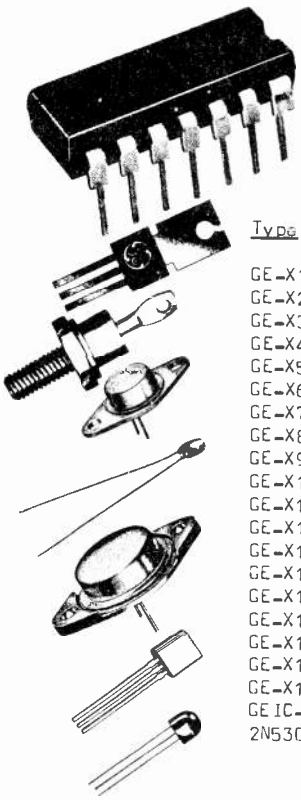
PC Cap. 10MFD. 16V
PC Cap. 22MFD. 16V
PC Cap. 33MFD. 16V
PC Cap. 47MFD. 16V
PC Cap. 100MFD. 16V
PC Cap. 220MFD. 16V
PC Cap. 470MFD. 16V

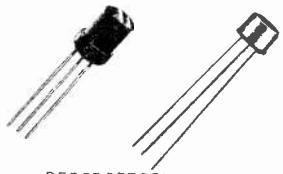
PC Cap. 4.7MFD. 25V
PC Cap. 10MFD. 25V
PC Cap. 22MFD. 25V
PC Cap. 33MFD. 25V
PC Cap. 4 7MFD. 25V
PC Cap. 100MFD. 25V
PC Cap. 220MFD. 25V

DOMINION RADIO & ELECTRONICS COMPANY

TRANSISTORS • DIODES & RECTIFIERS • INTEGRATED CIRCUITS

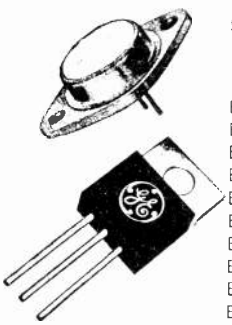
"A FEW WILL DO" SEMICONDUCTORS





PART #	TYPE	APPLICATION	PRICE
GE 1	Germ.	PNP AM IF Ampl.	$1.50
GE 3	Germ.	PNP AF Power Ampl.	2.70
GE 4	Germ.	PNP AF Power Ampl.	6.35
GE 5	Germ.	NPN AM RF IF Ampl.	1.60
GE 6	Germ.	NPN AM RF Ampl.Mixer	2.25
GE 7	Germ.	NPN AM IF Ampl.	3.55
GE 8	Germ.	NPN AF Ampl.	1.70
GE 10	Silicon	NPN Gen.Purpose Ampl.	1.10
GE 10A	Silicon	NPN Gen.Purpose Ampl.	1.10
GE 11	Silicon	NPN RF IF Ampl.Mixer	1.30
GE 12	Silicon	NPN AF Power Ampl.	4.10
GE 13MP	Matched Pair GE3		4.90
GE 14	Silicon	NPN AF Power Ampl.	3.35
GE 15MP	Matched Pair GE 14		6.90
GE 16	Germ.	PNP AF Power Ampl.	3.65
GE 18	Silicon	NPN AF Ampl.Output	2.30
GE 19	Silicon	NPN AF Power Ampl.	3.80
GE 20	Silicon	NPN Gen.Purpose Ampl.	1.60
GE 21A	Silicon	PNP AM RF-IF Ampl.	1.45
GE 23	Silicon	NPN AF Power Ampl.	3.55
GE 24MP	Matched Pair GE 23		7.25
GE 25	Germ.	PNP TV Horiz.Vert.Sweep	8.85
GE 26	Silicon	PNP AF Power Ampl.	5.10
GE 27	Silicon	NPN TV Video Output	2.55
GE 28	Silicon	NPN AF Power Ampl.	3.45
GE 29	Silicon	PNP AF Power Ampl.	4.10
GE 30	Germ.	PNP AF Power Ampl.	3.45
GE 31MP	Matched Pair GE 30		6.90
GE 32	Silicon	NPN AF Output HV TVAmpl.	3.20
GE 33	Silicon	NPN AF Output	5.00
CGE 50	Germ.	PNP FM-RF TV-IF	2.75
CGE 51	Germ.	PNP AM-RF AM/FM-IF	3.65
CGE 52	Germ.	PNP Low Noise AF Ampl.	2.30
CGE 53	Germ.	PNP AF Ampl. Output	1.20
CGE 54	PNP/NPN Mat.		
CGE 54	Germ.	PNP/NPN Mat.Compl.Pair	2.75
CGE 60	Silicon	NPN RF-IF Ampl.	1.30
CGE 61	Silicon	NPN TV 3rd IF	1.55
CGE 62	Silicon	NPN High Cain Low Noise Ampl.	1.00
CGE 63	Silicon	NPN AF Ampl.Output	2.00
CGE 64	Silicon	Very High Cain Ampl.	1.20
CGE 66	Silicon	NPN AF Output	3.00
CGE 67	Silicon	PNP AF Ampl. Output.	2.00
CGE 68	Silicon	NPN TV Vert. Horiz.otpt	2.35
CGE 69	Silicon	PNP AF Output.	4.20
CGE 70	Silicon	NPN AF Power Driver	2.30
CGE 71	Silicon	PNP AF Power Driver	4.00
CGE 74	Silicon	PNP High Power Output	18.20
CGE 75	Silicon	NPN High Power Output	15.45
CGE 77MP	Matched Pair CGE 74		36.80
CGE 78MP	Matched Pair CGE 75		31.80
CGE 79	Silicon	NPN Vert.Horiz Output	10.90
GE-FET-1	N-Channel FET Gen.Purpose		1.65
GE-FET-2	N-Channel FET FM/TV RF		2.70

Type	DESCRIPTION	PRICE
GE-X1	SCR 200 PIV 4.7A	5.40
GE-X2A	Light Activated SCR	9.80
GE-X3	SCR 50 PIV 13A	11.00
GE-X4	Rectifier 200 PIV 20A	5.55
GE-X5	SCR 50 PIV 1.6A	1.55
GE-X6	Photocell	2.65
GE-X7	Reed Switch	2.30
GE-X8	Transistor NPN Germ.	1.95
GE-X9	Transistor PNP Germ.	1.95
GE-X10	Unijunction Transistor	2.80
GE-X11	Zener Diode Iw 8.2V	3.45
GE-X12	Triac 200V 6A	6.60
GE-X13	Diac	2.10
GE-X14	Thyrector	4.00
GE-X15	Thermistor	17.00
GE-X16	SCR 400 PIV 7.4A	6.15
GE-X17	Programmable Unijunction	2.95
GE-X18	Power Transistor	2.80
GE-X19	Phototransistor	2.65
GE IC-1	Intergrated Circuit	5.00
2N5308A	Darlington Transistor	.90



SILICON ZENER DIODES

Type Number	Zener Volt.	1 Watt ·5% Tolerance.	PRICE
B-IN4732B	4.7V		$1.10
B-IN4733B	5.1V		1.10
B-IN4734B	5.6V		1.10
B-IN4735B	6.2V		1.10
B-IN4736B	6.8V		1.10
B-IN4737B	7.5V		1.10
B-IN4738B	8.2V		1.10
B-IN4739B	9.1V		1.10
B-IN4704B	10V		1.10
B-IN4741B	11V		1.10
B-IN4742B	12V		1.10
B-IN4743B	13V		1.10
B-IN4744B	15V		1.10
B-IN4745B	16V		1.10
B-IN4746B	18V		1.10
B-IN4747B	20V		1.10
B-IN4748B	22V		1.10
B-IN4749B	24V		1.10
B-IN4750B	27V		1.10

REPLACEMENT MANUAL

A semiconductor cross-reference manual containing the latest substitutions is available on request. Cross-references may be made directly from either the JEDEC or original manufacturer's part number. Service technicians will find this manual an invaluable aid for replacing semiconductors in the majority of sets on the Canadian domestic market.

SILICON VOLTAGE VARIABLE CAPACITORS

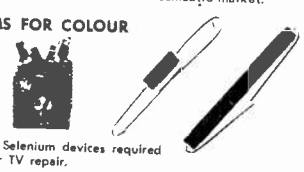
For FM AND TV Tuning, FM AFC, TV AFT

CGE 90	10V 30pf @ 4V	1.65
CGE 91	30V 6.8pf @ 4V	1.65
CGE 92	30V 8.2pf @ 4V	1.65
CGE 93	30V 10.0pf @ 4V	1.65
CGE 94	30V 12.0pf @ 4V	1.65
CGE 95	30V 15.0pf @ 4V	1.65
CGE 96	30V 18.0pf @ 4V	1.65
CGE 97	30V 22.0pf @ 4V	1.65
CGE 98	30V 27.0pf @ 4V	1.65
CGE 99	30V 33.0pf @ 4V	1.65
CGE 100	30V 39.0pf @ 4V	1.65

FOR YOUR COMPLETE LISTING OF GE SEMICONDUCTORS AND A FREE CROSS-REFERANCE GUIDE, PLEASE CIRCLE #14 ON THE ORDER FORM PAGE.

DOMINION RADIO & ELECTRONICS COMPANY

SELENIUMS FOR COLOUR



Just three G.E. Selenium devices required complete colour TV repair.

GECR-1	Focus Rectifier	$ 2.00
GECR-2	Boosted Boost	1.35
GECR-3	Convergence	2.10

GE SELENIUM DUAL DIODES

The Dual Diode is used widely as a discriminator or phase detector in television receivers. Forward current 1.1 ma. at 2.5 VDC. Reverse current .4 ma. at 20 VDC.

6GC1	Common Cathode	$ .60
6GD1	Series Connected	.60
6GX1	Common Anode	.60

New Products. From: SGS-ATES

SGS-ATES SEMICONDUCTOR CORPORATION

LINEAR INTEGRATED CIRCUITS

Audio amplifiers

TYPE (DIP E)	V_S max (V)	VOLTAGE GAIN (dB) (open loop)	P_o (W) @ DISTORTION (%)	and R_L (Ω)	and V_S (V)	OUTPUT PEAK (A) CURRENT	PACKAGE (DIP C with spacer / Pentawatt ®)	NOTE	PRICE EA.
TBA 800	30	74	5 @ 10	16	24	1.5	DIP E		$ 2.25
TBA 810S/	20	80	7 @ 10	4	16	2.5	DIP E,	Thermal shut-down	2.50
			6 @ 10	4	14.4				
TDA 2010	± 18	100	12 @ 1	4	± 14	3.5	DIP C	Fully protected	5.95
			9 @ 1	8	± 14				
TDA 2020	± 22	100	20 @ 1	4	± 18	3.5	DIP C	Fully protected	6.95
			16.5 @ 1	8	± 18				
TDA 2002	18	–	8 @ 10	2	14.4	3	Pentawatt ®	Thermal shut-down	3.95
			6 @ 10	3.2	14.4				

Voltage regulators

TYPE	V_o (V)	REGULATED I_o (mA)	PACKAGE	PRICE EA.
L 129	5	850	TO-126 (1)	$ 1.50
L 130	12	720	TO-126 (1)	1.50
L 131	15	600	TO-126 (1)	1.50

L200 ADJUSTABLE MONOLITHIC VOLTAGE & CURRENT REGULATOR
OUTPUT VOLTAGE 3 – 30 VOLTS
OUTPUT CURRENT 1.8 AMPS 3.00
PACKAGE Pentawatt ®

Special functions

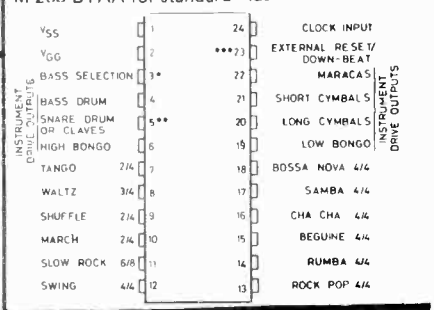
L 120	Phase control for TRIAC and SCR triggering	DIP J	6.00
L 121	Burst control for TRIAC and SCR triggering	DIP J	6.00
L 202	High-voltage, high-current darlington transistor array	DIP J	2.95
TDA 1054	Preamplifier for tape recorder with ALC	DIP I	2.50
TBA 231	Dual operational amplifier	DIP G	1.50

TYPE	DESCRIPTION (DIP J)	TECHNOLOGY	CHANNELS (n°)	V_{DD} (V)	POWER CONS. (mW)	TEMP. RANGE (°C)	PACKAGE	
M 1025*	TV remote control receiver	3 CMOS	30	-17	400	0-70	DIP J	14.95
M 1024*	TV remote control transmitter		30	+8	20	0-70	DIP J	17.95

M 253 $ 16.50

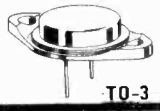
RHYTHM GENERATOR

M 253 B1AA for standard music content



POWER TRANSISTORS

Metal can

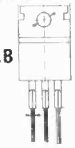

TO-3

TYPE	POLARITY	V_{CBO} (V)	I_C max (A)	P_D (W) @ T_C = 25°C	PACKAGE
2N 3055	NPN	100	15	117	TO-3
2N 3055U	NPN	100	15	150	TO-3
2N 3442	NPN	160	10	117	TO-3

2N3055 $1.59 2N3055U $1.95 2N3442 $2.50

Epitaxial-base darlingtons - Plastic


TO-126


TO-220 AB

TYPE NPN	TYPE PNP	V_{CBO} (V)	V_{CEO} (V)	h_{FE} min/max @ I_C (A)	$V_{CE(SAT)}$ (V) @ I_C/I_B (A)	I_C max (A)	P_D (W) @ T_C = 25°C	PACKAGE	NPN OR PNP PRICE EA.
2N 6037	2N 6034	40	40	750-15000 @ 2	2 @ 2/0.008	4	40	TO-126	$ 1.39
2N 6038	2N 6035	60	60	750-15000 @ 2	2 @ 2/0.008	4	40	TO-126	1.59
2N 6039	2N 6036	80	80	750-15000 @ 2	2 @ 2/0.008	4	40	TO-126	1.79
BDX 53A	BDX 54A	60	60	750 @ 3	2 @ 3/0.012	8	60	TO-220AB	2.25
BDX 53C	BDX 54C	100	100	750 @ 3	2 @ 3/0.012	8	60	TO-220AB	2.95

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

A **MONO 8 OHM L PAD**

$2.95 ea.

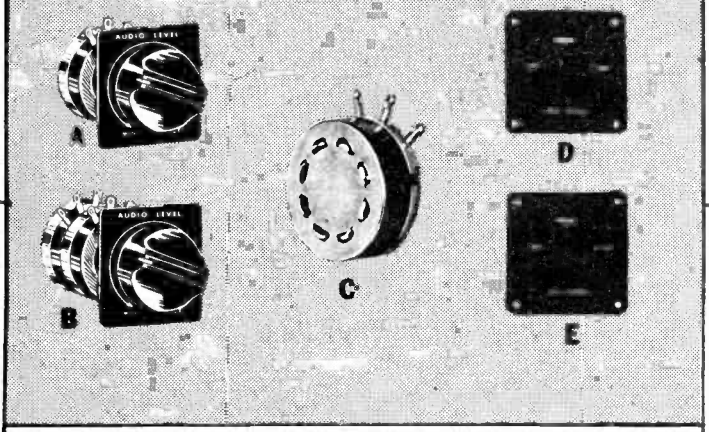
10 WATTS

B **STEREO 8 OHM L PAD**

$3.95 ea.

10 WATTS

8 OHM AUDIO PADS



C **HEAVY DUTY MONO 8 OHM L PAD** **$7.95 ea.**

100 WATTS

D **TWEETER CONTROL**

$4.95 ea.

20 WATTS

E **MID RANGE CONTROL**

$4.95 ea.

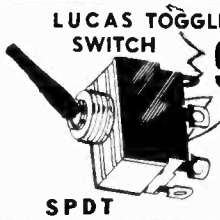
20 WATTS

SWITCHES

Miniature

Cat. No.	Type	PRICE
DJ-4030	SPST	$1.29
DJ-4031	SPDT	$1.49
DJ-4034	DPDT	$1.69
DJ-4032	SPDT Center Off	$1.89
DJ-4033	DPDT Center Off	$2.09

LUCAS TOGGLE SWITCH **99¢ ea**



SPDT **amp 20a**

TOGGLE SWITCH 59¢ S.P.S.T.

99¢ D. P. D. T.

$1.59 D. P. D. T. CENTER OFF

PUSH SWITCH

S. P. S. T. $1.29

S. P. D. T. $1.49

D. P. D. T. $1.69

PIHER SLIDER CONTROLS

60mm Travel

$2.95 ea.

Available in
10 K ohms
50 K ohms
100 K ohms
log or linear taper

Matching Knob **59¢ ea**

jana CONTROLS

MODEL		TRAVEL	
JJ-10006	- 10K	30mm	$1.49 EA
JJ-10006B	- 100K	30mm	
JJ-10006C	- 500K	30mm	
JJ-10006D	- 1 MEG	30mm	
JJ-10007	10K	45mm	$1.89 EA
JJ-10007A	- 50K	45mm	
JJ-10007B	- 100K	45mm	
JJ-10007C	- 500K	45mm	
JJ-10007D	- 1 MEG	45mm	

Available in log taper only

Knob included

PANEL LIGHTS

120V PANEL LAMP
JJ-10027R — Red
JJ-10027A — Amber
Built in resistor for 120VAC

Head diameter ½"

$1.19

$1.29

PANEL LAMP FOR BAYONET BASE LAMPS
JJ-10018 — Red Dome
JJ-10019 — Green Dome
JJ-10020 — Amber Dome

NEON PILOT LIGHT

99¢

Resistors not supplied

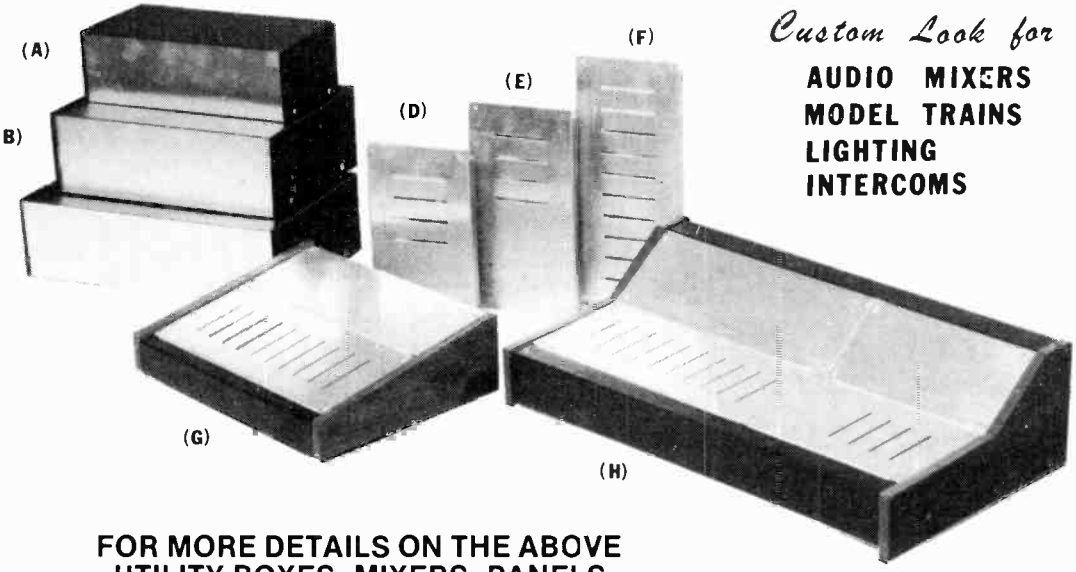
ATTENTION

FOR COMPLETE LISTING ON PANEL LAMPS & SWITCHES, CIRCLE # 9 ON THE ORDER FORM

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

METAL EQUIPMENT CABINETS



Custom Look for

AUDIO MIXERS
MODEL TRAINS
LIGHTING
INTERCOMS

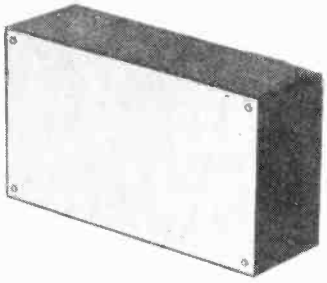
(A) $5.95
(B) $7.95
(C) $9.95
(D) $2.60
(E) $3.40
(F) $5.10
(G) $17.95
(H) $28.95

FOR MORE DETAILS ON THE ABOVE UTILITY BOXES, MIXERS, PANELS PUNCHED AND UNPUNCHED
CIRCLE #10 ON ORDER FORM

DOMINION RADIO & ELECTRONICSCO.

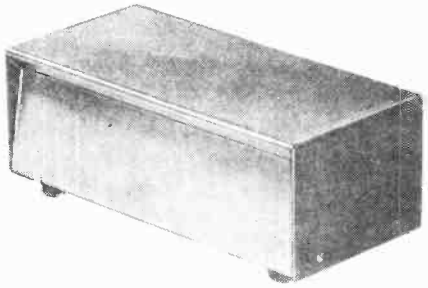
535 YONGE STREET, TORONTO, ONTARIO. M4Y-1Y5

UTILITY BOXES



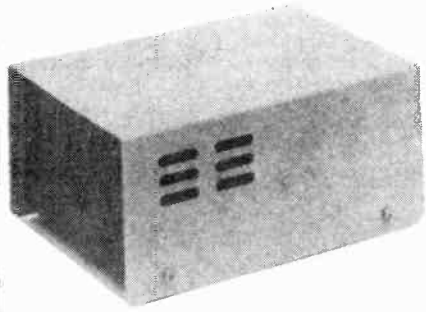
STURDY COMPACT BLACK PLASTIC CABINETS WITH ALUMINUM TOPS. ESPECIALLY SUITABLE FOR TRANSISTORIZED RECEIVERS, CODE OSCILLATORS, METERS & MANY OTHER APPLICATIONS. ALUMINUM PANEL REMOVES FOR EASY ACCESS TO COMPONENTS.

#UC-1 3¼"x2 1/8"x1 1/8"D $1.59
#UC-2 4"x2 5/8"x1 5/8"D 1.79
#UC-3 5 1/8"x2 5/8"x1 5/8"D 2.49
#UC-4 6¼"x3 3/4"x2"D 2.99
#UC-5 7 3/4"x4 3/8" x2 3/8"D 3.29



COMPLETELY ENCLOSED 2 PIECE STEEL BOX IN HANDSOME GOLD FINISH. UNLIMITED USE FOR HOBBYISTS, BUILDERS, AUDIO & SHOP PROJECTS. IDEAL FOR RF PROJECTS.

#UC-6 4"x2"x1½"D $1.99 without rubber feet
#UC-7 4"x1½"x1½"D 2.59 with rubber feet
#UC-8 6"x2"x1½"D 2.99 with rubber feet



OUR NEWEST CABINETS FEATURE A STRONG 2 PIECE STEEL COVER OVER AN ALUMINUM CHASSIS, FINISHED IN GREY MATTE. PERFECT FOR POWER SUPPLIES, COLOUR ORGANS AND MANY OTHER APPLICATIONS.

#UC-9 4"x2"x3 3/16"D $2.79
#UC-10 5 7/8"x2½"x4"D 3.69
#UC-11 6"x2 3/4"x5¼"D 4.29
#UC-12 7¼"x2 5/8"x6¼"D 4.79

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

Wire & Cable

STANDARD SPEAKER WIRE

2½¢ PER Ft.

SPECIAL SALE

500 foot roll

$7.95

24 guage

Pot Wire

PARALLEL LAMP CORD

Colors: Black, Brown, White.

6¢ PER FT.

ANTENNA ROTOR CABLE

4 COND 4¢/FT.

5 COND 5¢/FT.

TV LEAD-IN WIRE

REG 2½/FT.

HEAVY 5/FT.

HOOK UP WIRE

65¢ 100'

Coaxial Cables

RG 58
RG 59
RG 62

10¢/FT

RG 8

30¢/FT

VINYL MICROPHONE SHIELDED CABLES

HI-FI Connecting Cable

1 COND + SHIELD

8¢/FT

2 COND + SHIELD

10¢/FT

Dual Channel Audio Cable for head set, stereo and language labs

15¢/FT

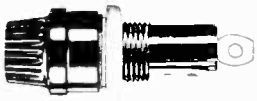
FAST ACTING

FUSES

½ AMP 3 AMP
1 AMP 4 AMP
2 AMP 5 AMP

.99 PACK OF 5

250 Volt or Less
1/4 x 1 1/4 inch. Glass Tube. Formerly 3AG



79¢ ea

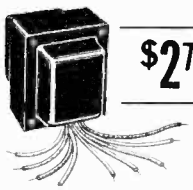
Panel Mount Fuse Holder

Bayonet type Knob - ½" (12.7 mm) panel hole. Accommodates all ¼" (6.3 mm) x 1¼" (31.7 mm) Fuses.

POWER TRANSFORMER

PRI: 110V

SEC: 80VCT 2 A.
63V 500 MA.

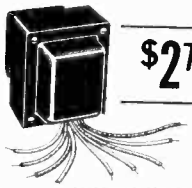


$2.75 EA

POWER TRANSFORMER

PRI: 110V

SEC: 125 V 3A



$2.75 EA

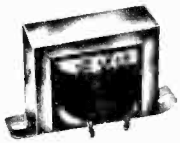
AC Chassis Mount Receptacle

19¢ EA

SALE

FILAMENT TRANSFORMERS

CENTER TAPPED



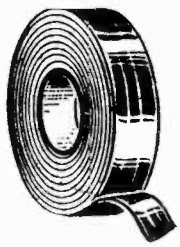
MAX. CURRENT	VOLTAGE PRIMARY	VOLTAGE SECONDARY
1A	117	6.3 CT
1A	117	12.6 CT

CSA Tape

59¢ ROLL

66 ft. rolls.
Low cost CSA & UL approved
PVC insulating tape.

BLACK ONLY

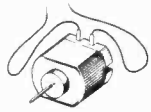


110 VOLT DC RELAY

$4.95 EA

DPDT
40 AMP CONTACT

MINIATURE DC MOTOR

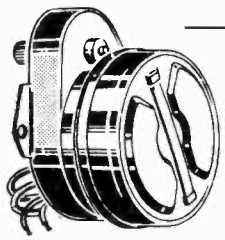


25¢ EA

TIMING MOTORS

2 RPM

#M10 $1.50 EA.



- ★ 5" Leads
- ★ Dustproof Gear Housing
- ★ Self Starting
- ★ Sizes: 2½" x 1¼" x 2"
- ★ All Operate on 117 V. AC.

DOMINION RADIO & ELECTRONICS COMPANY

THE HOME OF RADIO & ELECTRONIC SUPPLIES

CANADIAN GENERAL ELECTRIC

RECEIVING TUBES

ONE YEAR UNCONDITIONAL GUARANTEE

1B3GT	2.25
1BC2	2.65
1G3GT	2.25
1J3	2.45
1K3	2.45
1S2A	2.30
1V2	1.80
1X2B	2.25
2AV2	2.15
2CY5	3.00
2FQ5A	2.50
2GK5	2.50
3A3	2.55
3A3C	3.30
3AL5	1.75
3AT2	2.85
3AU6	1.90
3AW2	2.95
3AW2A	3.55
3BS2A	3.90
3BT2	3.90
3BUB	3.40
3BZ6	2.65
3CB6	1.60
3CF6	1.60
3CN3B	3.50
3CU3A	4.45
3CY3	3.85
3DB3	3.85
3DC3	4.55
3DF3	4.30
3DH3	4.00
3DT6A	2.00
3FQ5A	2.50
3GK5	2.50
3GS8	3.40
3HA5	3.05
3HM5	3.05
3HQ5	3.40
4AU6	2.70
4BZ6	2.25
4BQ7A	2.70
4BZ7	2.70
4CB6	2.15
4CS6	2.70
4DT6A	2.75
4EH7	2.85
4EJ7	2.85
4HA5	2.70
4KE8	5.90
4LJ8	4.65
5AQ5	2.15
5AR4	4.00
5AS4A	2.65
5CG8	2.25
5CL8A	3.25
5GHBA	3.70
5GJ7	3.50
5GS7	2.85
5GX7	4.30
5KD8	2.10
5KE8	4.20
5LJ8	4.00
5U4GB	2.65
5U8	2.95
5Y3GT	2.70
6AG10	4.45
6AF9	5.00
6AG9	5.45
6AJ8	2.50
6AK5	2.95
6AK6	4.25
6AL3	2.30
6AL5	1.60
6AM8A	3.45
6AN8A	2.95
6AQ5A	1.70
6AQ8	2.35
6AU6A	1.50
6AU8A	3.95
6AV6	1.60
6AW8A	2.65
6AX3	2.90
6AX4GTB	2.70
6BA6	2.00
6BA11	4.30
6BE6	2.25
6BH6	2.45
6BJ6	3.45
6BK4C	5.95
6BL8	2.00
6BM8	2.70
6BN6	3.45
6BN8	2.95
6BQ5	2.10
6BQ6GTB	3.30
6BQ7A	2.75
6BR8A	3.40
6BS8	3.30
6BU8	2.95
6BS8	3.30
6BU8	2.95
6BW11	5.75
6BZ6	1.90
6BZ7	2.75
6BZ8	3.45
6C4	2.25
6CA4	2.70
6CA7	5.40
6CB6A	1.75
6CD3	3.00
6CE3	3.00
6CF6	1.75
6CG3	3.00
6CG7	1.60
6CG8A	2.45
6CJ3	2.50
6CL3	2.50
6CL6	4.00
6CL8A	2.65
6CM5	4.65
6CM7	2.50
6CS6	2.25
6CS7	3.35
6CU5	2.45
6CU6	3.30
6CW4	5.75
6CY5	2.65
6FM7	4.10
6FQ5A	2.70
6FQ7	1.60
6FVBA	3.40
6GB5A	5.55
6GE5	3.85
6GF7A	3.50
6GH8A	1.90
6GJ7	3.15
6GK5	2.70
6GK6	2.45
6GM6	2.65
6GS7	3.55
6GU7	2.45
6GV8	3.65
6GW6	3.85
6GW8	2.75
6GX6	1.80
6GX7	4.15
6GY6	1.80
6HA5	2.95
6HE5	4.30
6HG5	1.70
6HM5	2.95
6HQ5	2.95
6HV5A	7.50
6HZ6	2.25
6J6A	2.65
6J10	5.15
6JB5	4.30
6JC5	4.30
6JC6A	3.10
6JD6	2.50
6JE6C	6.95
6JF6	5.05
6JH6	2.70

6JS6C	6.00
6JU6	7.40
6JU8A	3.20
6JV8	4.00
6JW8	2.60
6JZ8	3.05
6KA8	3.60
6KD6	7.80
6KD8	2.10
6KE8	4.20
6KG6A	7.85
6KS6	3.45
6KT8	4.65
6KZ8	3.50
6L6GC	4.30
6LB6	7.90
6LD6	8.40
6LE8	5.05
6LF6	7.75
6LF8	3.70
6LH6A	7.30
6LJ6A	7.30
6LJ8	3.85
6LJ6A	7.30
6LJ8	3.85
6LN8	2.15
6LQ6	6.95
6LT8	3.90
6LU8	4.60
6Y9	5.90
6Z10	5.15
7AU7	2.30
8AW8A	3.10
8B10	4.50
8BM11	5.90
8CB11	8.15
8CG7	1.60
8FQ7	1.60
8GJ7	3.45
8LT8	3.35
8U9	5.15
8X9	6.75
9A8	2.00
9JW8	2.55
10CW5	2.40
10DE7	3.40
10GF7A	4.55
10GK6	2.95
10GN8	3.60
10GV8	4.40
10JY8	2.85
10KR8	3.40
11BM8	5.80
11BQ11	4.85
11HM7	4.55
11KV8	5.60
11MS8	3.90
12AE10	5.15
12ST6	1.80
12AT7	2.10
12AU6	2.10
12AU7A	1.85
12AV6	1.50
12AV7	4.05
12AX4GTB	2.30
12AX7A	1.70
12AZ7A	2.90
12B4A	2.95
12BA6	1.70
12BE6	1.90
12BH7A	2.05
12BR7	3.70
12BV7	1.90
12BY7A	1.90
12C5	2.65
12CU5	2.65
12DQ6B	3.75
12DQ7	1.90
14GW8	2.85
15BD11A	4.85
15CW5	2.20
15DQ8	2.75
15EA7	4.10
16AQ3	3.15
16LD6	7.90
16LU8	7.05
17AX4GTA	2.30
17BE3	2.70
17BF11	3.95
17DQ6B	3.90
17DW4A	2.85
17GE5	4.10
17GW6	3.90
17JN6	4.05
17JZ8	2.85
17KV6A	7.05
17Z3	3.70
18GV8	3.95
19CC3	3.20
20AQ3	3.10
21GY5	4.95
21JS6A	6.70
21JZ6	5.25
21KA6	5.00
21LR8	4.75
21LU8	4.25
22JF6	5.55
22JR6	4.95
22JU6	6.15
23JS6A	6.70
23Z9	4.25
24JE6C	6.95
24LQ6	6.95
25EH5	2.90
25L6GT	3.40
26HU5	9.25
27GB5	5.95
29KQ6	7.20
30AE3	2.60
31JS6A	7.20
33GY7A	5.90
34CE3	3.10
34DE3	3.10
35C5	2.10
35L6GT	3.10
35W4	1.45
35Z5GT	2.55
38HE7	6.30
38HK7	6.55
40KD6	8.60
40KG6A	7.75
42EC4	4.95
50C5	2.00
50EH5	2.10
50L6GT	3.30
6267	2.65
6973	4.40
7025	1.70
7027A	6.55
7199	4.65
7591A	4.10
7868	4.55

ANTIQUE COLLECTORS

We have a large stock of 'OLD TUBES & PARTS' in our warehouse. For complete details, please circle number 8 on the order form page.

DOMINION RADIO

Where you get

VALUE

for your dollar

DOMINION RADIO & ELECTRONICS CO.

THE HOME OF SURPLUS RADIO & ELECTRONIC SUPPLIES
535 YONGE STREET
TORONTO 5, ONT.

FOR OFFICE USE ONLY
(DO NOT FILL IN)

SHIPPED VIA _____
AMT. _____
REFUND _____
OWING _____
B # _____
_____
DATE _____

FILL IN AMOUNT ENCLOSED

SHIP TO _____

STREET OR R.R. NO. _____

TOWN _____ PROV. _____

PLEASE PRINT YOUR NAME AND ADDRESS CLEARLY.

MONEY ORDER $	CHEQUE $
CASH $	C. O. D. ☐

IF THIS IS YOUR FIRST ORDER TO US, PLEASE CHECK HERE ☐

IMPORTANT – Please use a separate sheet for all correspondence to speed your order and assure prompt reply to your letter.

IF YOU MOVED, PLEASE ADVISE NEW ADDRESS.

PLEASE NOTE:
MINIMUM ORDER
SHIPPED $ 5.00

MASTERCHARGE NO. _____

SIGNATURE _____

DO NOT USE	QUANTITY DESIRED	STOCK NUMBER	DESCRIPTION (Show Manufacturer's Name Whenever Possible)	PRICE: Each, Foot, Set, Pair, Roll, Pkg., Etc.	TOTAL PRICE DOLLARS	CENTS

PLEASE CIRCLE HERE FOR LITERATURE

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

TOTAL Imported Tubes

MERCHANDISE ORDERED FROM CATALOG NUMBER

Ontario Residents ONLY ADD 7% SALES TAX.

Ontario Vendors:– Please state Vendor's Permit number for sales tax exemption.
Enclose completed Exemption Certificate if not already filed with this firm. _____

Final TOTAL

VISTA

DC POWER SUPPLIES

VISTA IV

CSA approved
Homologation ACNOR

$26.95

* SUPPLIES 2 AMPS @ 12 VDC - 4 AMP SURGE
* AUTOMATIC CIRCUIT BREAKER
* CSA APPROVED

Converts home 115 VAC to 12 VDC. Now you can enjoy car tape players in you home by using this, our most popular power supply. The unit is overload protected, includes automatic circuit breaker, neon indocator light, on/off switch. Size: 3¼"H x 5"W x 5"D. CSA approved.

VISTA CB-IIIR

* 3 AMP REGULATED POWER SUPPLY
* FULL POWER OUTPUT FOR CB
* SOLID STATE OVERLOAD PROTECTION

Integrated circuit regulated.
Converts 115 VAC to 13.8 VDC ±.5 volts.
This power supply is regulated and will deliver maximum power from your CB rig, with a surge of 5 amps. Also can be used to trickle-charge 12 volt batteries.
Special features: Neon indicator light, on/off switch, circuit breakers. Canadian made, CSA approved.
Size: 3¼"H x 5"W x 5"D.

$41.95

FULL CB POWER!

CSA approved
Homologation ACNOR

VISTA CB-IVR

CSA approved
Homologation ACNOR

$74.95

FULL CB POWER!

* 4 AMP REGULATED POWER SUPPLY — 6 AMP SURGE
* SOLID STATE DUAL OVERLOAD PROTECTION
* CROWBAR OVERVOLTAGE PROTECTED

Converts 115 VAC to 13.8 VDC ±.5 volts.
A heavy duty power supply for use with all types of transistor equipment requiring 4 amps or less. Will operate radios, intercoms, recorders, car stereo tape players, CB transceivers, etc. Features neon indicator light, on/off switch. Size: 4"H x 6½"W x 8"D. CSA approved.

VISTA X-R

* 10 AMP REGULATED POWER SUPPLY — 12 AMP CPR*
* DUAL OVERLOAD PROTECTED
* CROWBAR OVERVOLTAGE PROTECTED

Converts 115 VAC to 13.8 VDC +.5V.
A heavy duty regulated power supply designed for use with Ham, CB and marine mobile radio stations. Also for linear amplifiers up to 200 watts P.E.P. Size: 4¼"H x 6½"W x 8"D.

* CPR: Continuous Periodic Rating-
Duty Cycle 3 min. on, 1 min. off.

$99.95

ZENON STROBE

$39.95

The longest lasting, most dependable strobe ever developed.

We unconditionally guarantee everything including flash-tube for 6 months. (And we're the only ones to do so!).

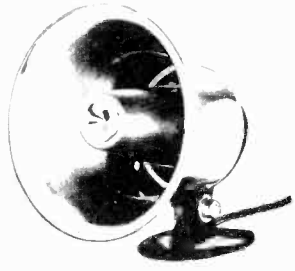
No-drift feature controls flash-rate up to 10 flashes per second.

5" Indoor-Outdoor Paging Speaker

$11.95

Frequency Response:	400-7,000 Hz
Power Rating:	5 Watts
Air Column Length:	3¼"
Bell Diameter:	5"
Horn Length:	5-3/8"
Driver:	Permanent Magnet
Weight:	1 lb.

–8-Ohm



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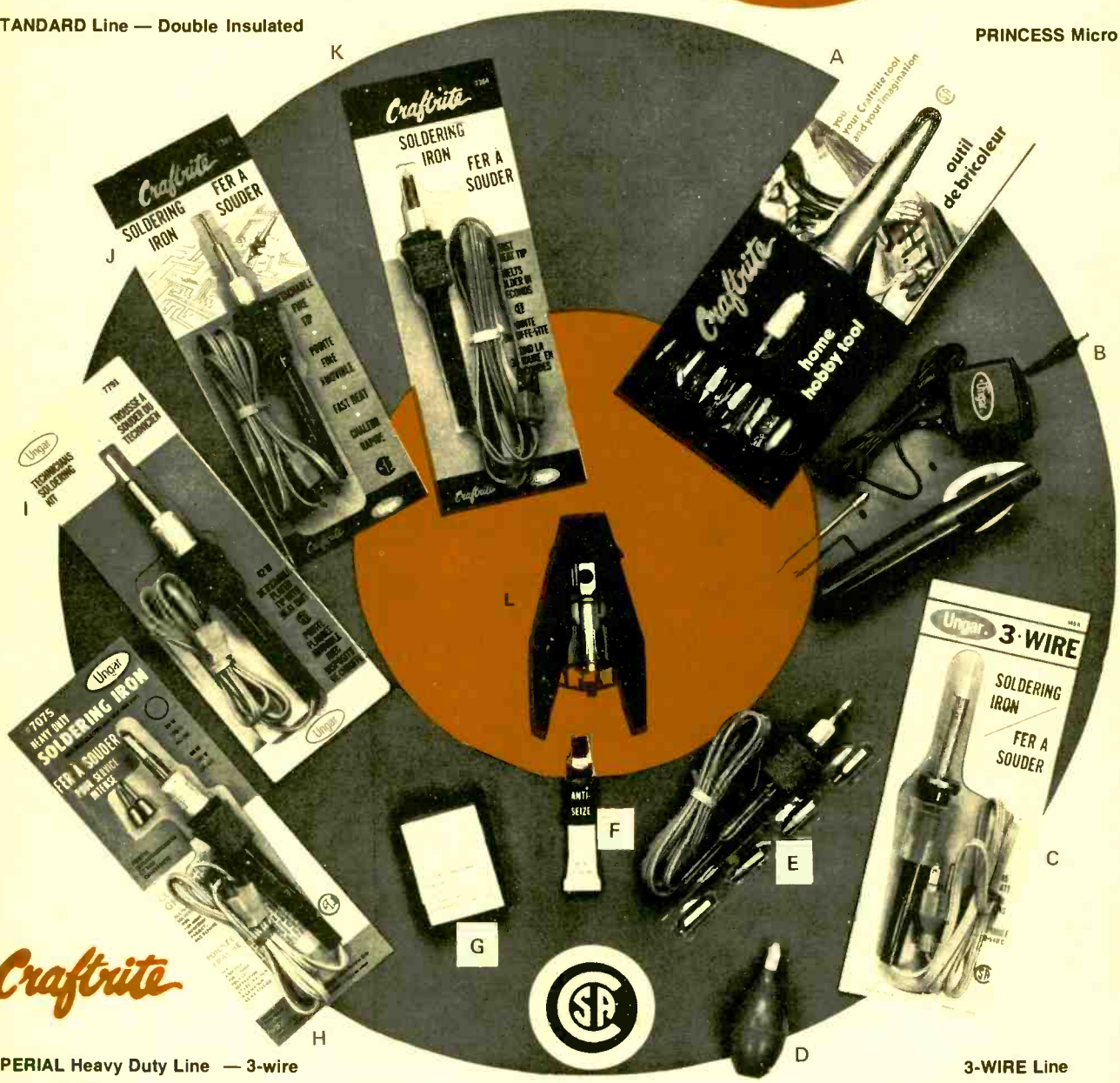

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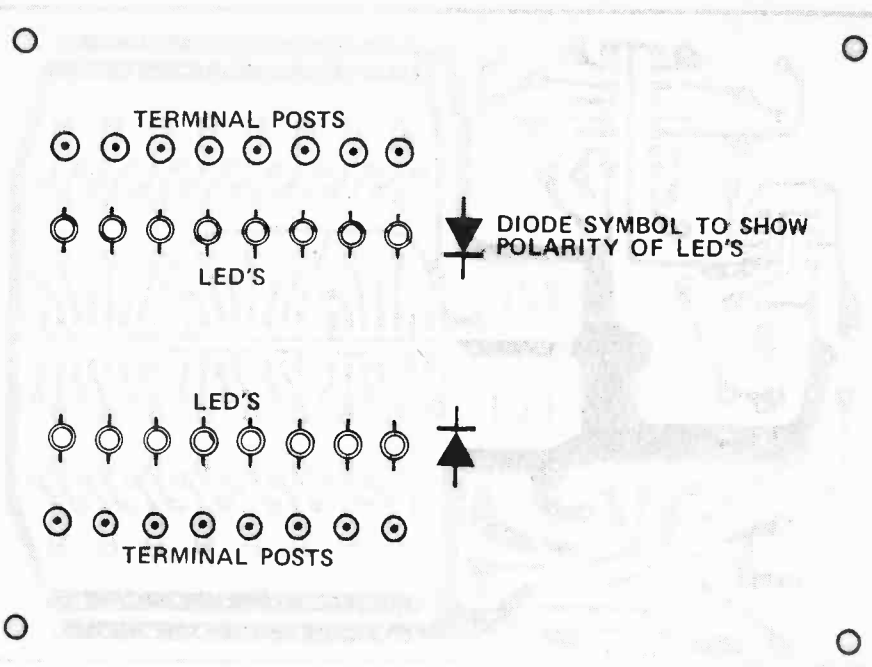


Fig. 4. Positioning of LEDs and terminal posts on the copper side of the printed-circuit board.

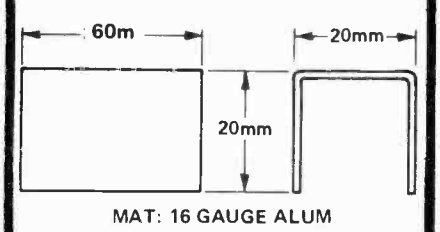


Fig.6. Heatsink for IC3. The IC is mounted (by a screw) through a 3.2 mm hole in the base of the heatsink (see photograph of inside of unit).

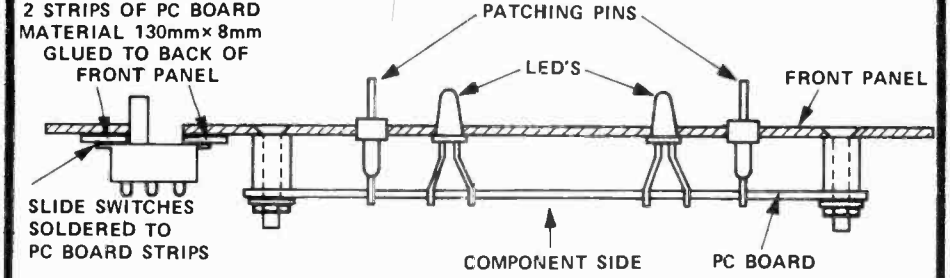


Fig. 5. How the front panel and printed-circuit board are assembled.

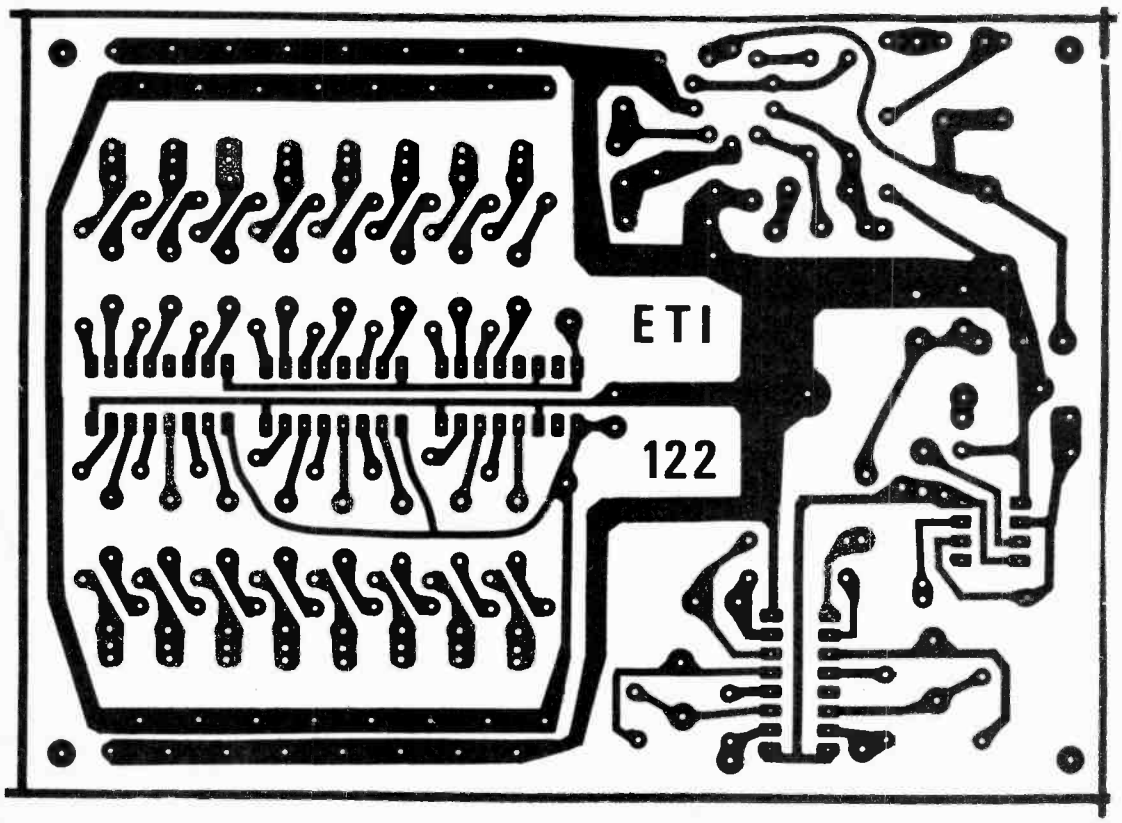


Fig.7. Printed circuit-board artwork. Full size 142 x 104 mm.

LOGIC TESTER

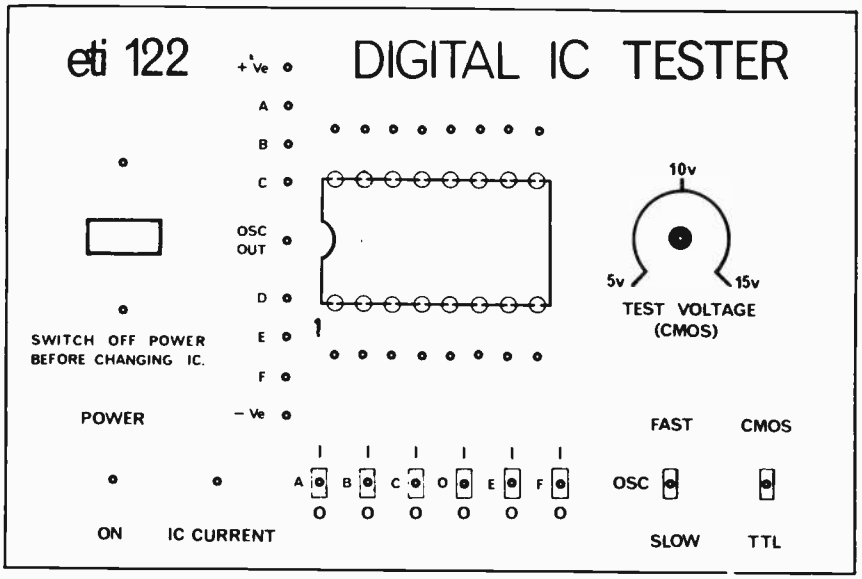


Fig.8. Front panel artwork (shown half-size — full size should be 223 mm x 148 mm).

WARNING:

When using the tester, remember that manufacturers recommend that CMOS ICs should not be inserted or removed from a circuit without first switching off the power supply.

resulted in a very pleasing final appearance.

DESIGN FEATURES.

There are several design requirements which must be met in a unit which is designed to test both CMOS and TTL devices. These may be summarized as follows.

1) The unit must be capable of correctly testing both types of logic.

2) Simple gate functions should be tested by go/no-go checks and complex functions such as counters and shift registers should also be reliably checked.

3) There should be the least possible chance of damaging the device during testing.

4) CMOS ICs must be testable with a variety of supply voltages.

5) A clock oscillator and a means of setting up the input conditions must be provided.

One of the major design difficulties with a unit such as this is coping with the many different pin configurations of the differing functional requirements (eg a shift register versus a two-input NAND gate) of devices within the one family, as well as those between different families. A multi-way switch could be used for each input pin but would greatly increase the expense of the unit. A good alternative is to use patchable links, and this is the approach that we have chosen to use in our unit. In addition we have used a small breadboard socket as the test socket, rather than a standard 16 pin dual-in-line socket, as this allows us to improvise special test circuits for the more complex logic ICs, and the means to breadboard simple circuits.

The need for a variable power supply for CMOS testing presented two additional problems. The first of these was the danger of plugging a TTL IC into the unit when it is set up for CMOS and for some higher supply voltage than the five volts required for TTL. Secondly the LEDs used for monitoring each pin would draw more current as the supply voltage increased. The current ratio could be as high as four to one and a corresponding variation of LED intensity would occur. To overcome this problem it was decided to provide a second supply of five volts to operate the LEDs which will also provide the higher current required by TTL for its operation. The other supply is a variable one for testing CMOS and is not capable of supplying more than 30 mA. Thus a TTL gate inadvertently connected to this supply would not be damaged.

The regulator used for the five-volt supply is a three terminal IC which has built in current limiting and thermal shutdown. It will not therefore be damaged by a short circuit due to testing a faulty IC. It is not possible to construct a discrete design, as cheaply, that has the same performance.

Next we need a device that will detect the state of each pin on the device under test and drive an LED to indicate that state. The device has to be driven by TTL and CMOS outputs, that is, by voltages anywhere between 5 and 15 volts. A suitable IC is the CMOS 4009 IC which has six inverters in one package. Each inverter will monitor a pin without drawing appreciable current. The 4009 is also designed to translate logic levels. Thus we may use it to monitor a 5 to 15 volt input level at its input but provide a five volt signal only at its output.

Switches are provided which have debounce logic associated with them. This is necessary so that single bounce free rise and fall transitions can be generated for the testing of more complex logic. The debounce logic must be capable of operating on 5 to 15 volts and of sinking at least two milliamps for TTL tests. The 4009 IC with its high output current capability was again considered to be most suitable for this task.

We would also like to have used the 4009 as the oscillator, but RCA do not recommend using CMOS that has a high output capability in a linear mode as the power dissipation of the device may be exceeded. The oscillator must provide pulses that swing between the positive and negative supply rails (in order to drive CMOS) and must be capable of sinking the two milliamps required by TTL. It must also be capable of operating on supply voltages of 5 to 15 volts. Since the standard CMOS devices cannot provide the current requirement it was decided to use a 555 IC as the oscillator.

CMOS devices should not be operated with inputs left floating as some devices may drift into the linear mode and be destroyed by excessive power dissipation. For this reason a 10 megohm resistor is connected between each pin, on the test socket, and ground. These resistors also conduct away any static charge that may build up. ●

ETI DATA SHEET

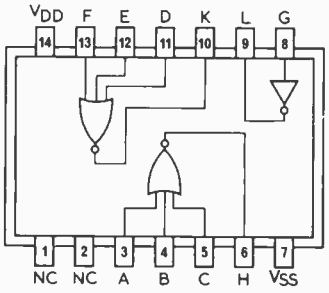
TO COMPLEMENT last month's TTL connections Data Sheet, we reproduce here the pinouts of the CD 4000 series of CMOS chips. These pinouts are fairly standard, and so cover the competition's devices as well.

Every time we produce a circuit using CMOS chips we nag our readers to be careful how they treat them. Nonetheless we still receive countless telephone tales of woe to the common testimony of blown, melted, or otherwise deceased CMOS. The gate oxide of some MOS devices is only 1000 Ångstrom units thick and can be ruptured by static potentials as low as 80V — such potentials are not uncommon, especially in dry atmospheres. So, repeat after me:

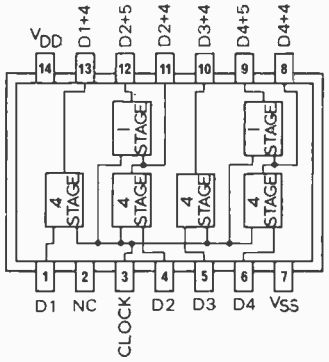
1. CMOS should be stored in black conductive foam — never in conventional polystyrene — and removed only at the last moment.
2. All equipment, especially soldering irons, should be grounded.
3. Don't wear nylon knickers.
4. Don't touch the pins.

Got that? Good.

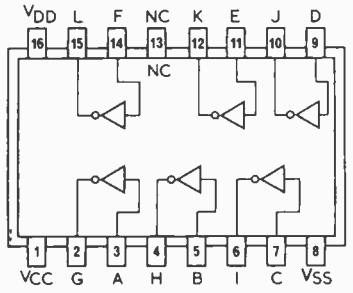
CD 4000A DUAL 3-INPUT NOR GATE PLUS INVERTER



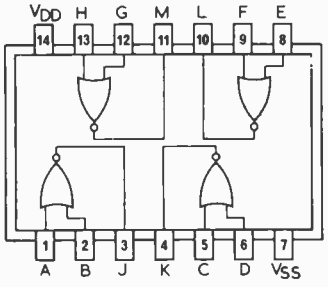
CD4006A 18-STAGE STATIC SHIFT REGISTER



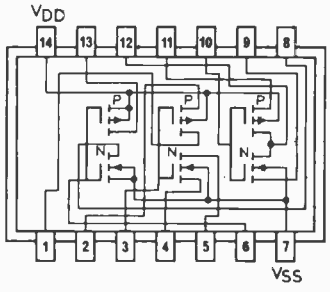
CD4009A, 4049A HEX BUFFER CONVERTER – INVERTING



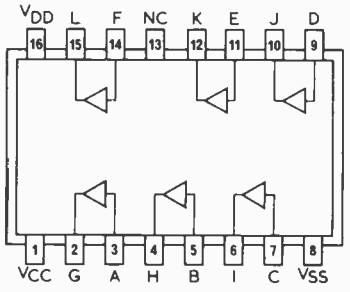
CD4001A QUAD 2-INPUT NOR GATE



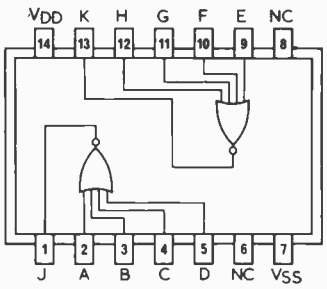
CD4007A DUAL COMPLEMENTARY PAIR WITH INVERTER



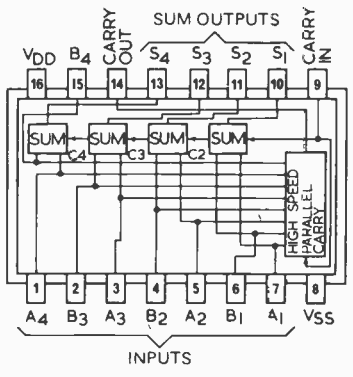
CD4010A, 4050A HEX BUFFER CONVERTER – NON-INVERTING



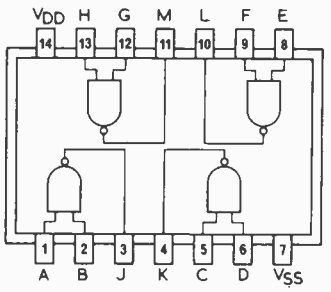
CD4002A DUAL 4-INPUT NOR GATE



CD4008A 4-BIT ADDER WITH PARALLEL CARRY

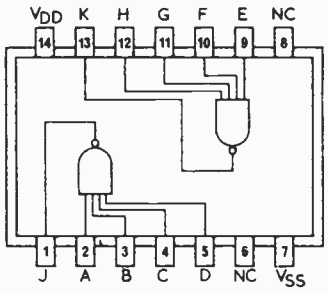


CD4011A QUAD 2-INPUT NAND GATE

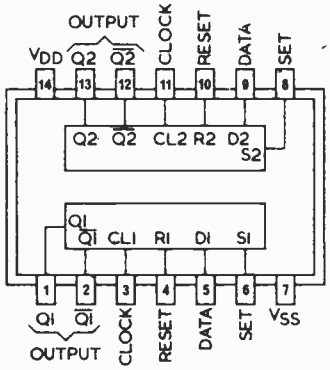


CMOS PINOUTS

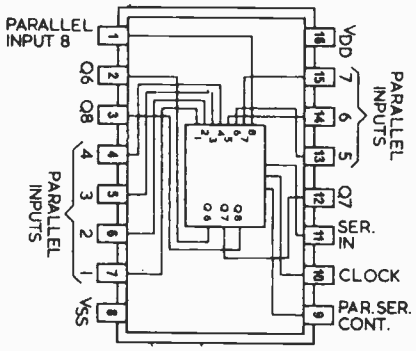
CD4012A DUAL 4-INPUT NAND GATE



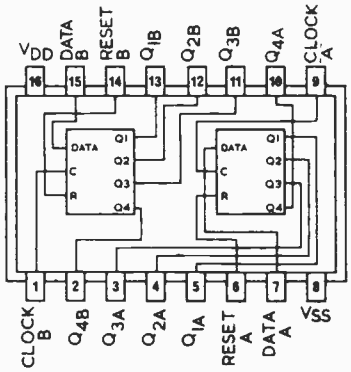
CD4013A DUAL D-TYPE FLIP-FLOP WITH RESET



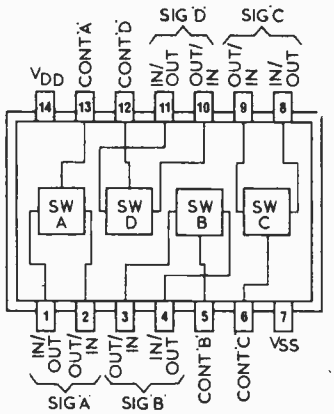
CD4014A 8-STAGE STATIC SHIFT REGISTER



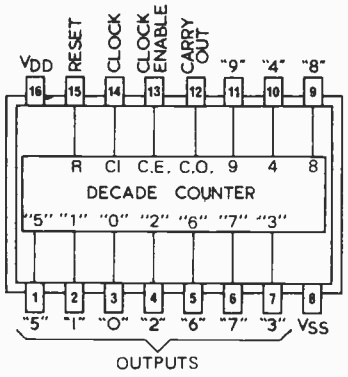
CD4015A DUAL 4-STAGE SHIFT REGISTER



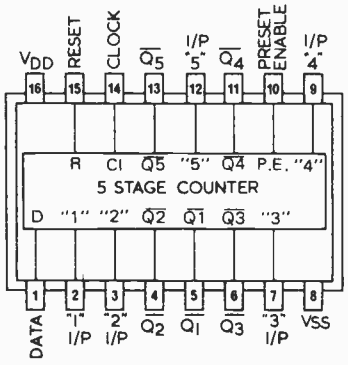
CD4016A, 4066A QUAD SWITCH



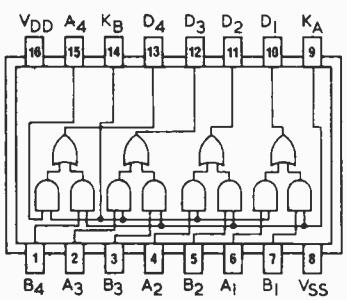
CD4017A DECADE COUNTER



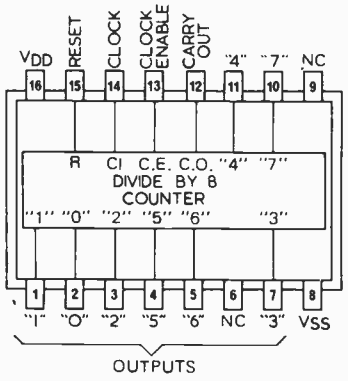
CD4018A PRESETTABLE DIVIDE-BY-N COUNTER



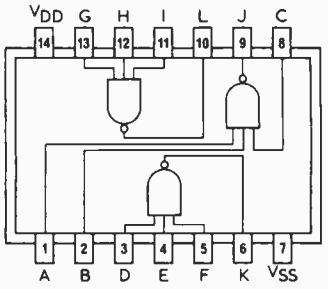
CD4019A QUAD AND-OR SELECT GATE



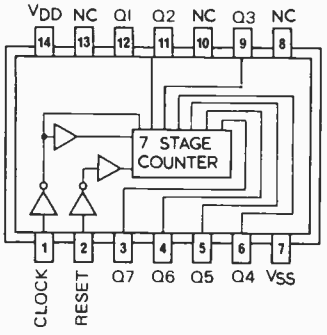
CD4022A DIVIDE BY 8 COUNTER-DIVIDER



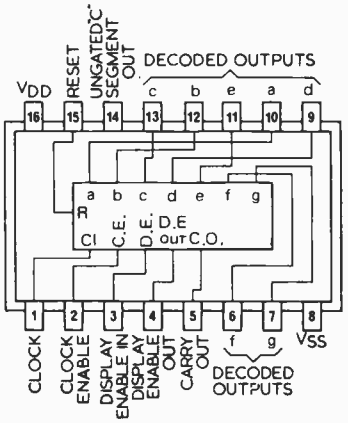
CD4023A TRIPLE 3-INPUT NAND GATE



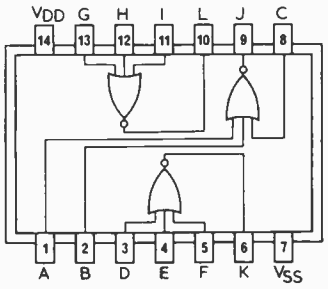
CD4024A 7-STAGE BINARY COUNTER



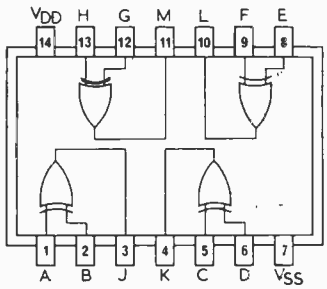
CD4026A DECADE COUNTER-DIVIDER



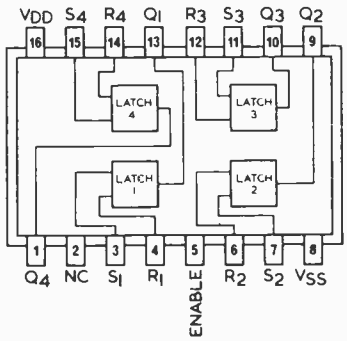
CD4025A TRIPLE 3-INPUT NOR GATES



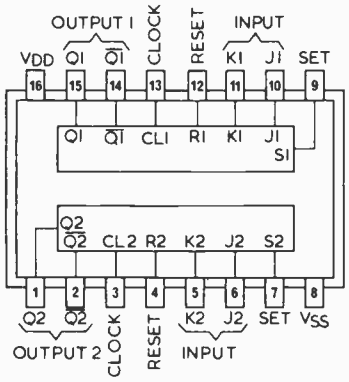
CD4030A QUAD EX-OR GATES



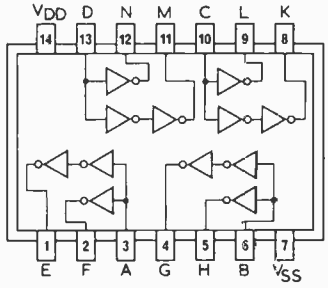
CD4044A QUAD 3-STATE NAND R/S LATCH



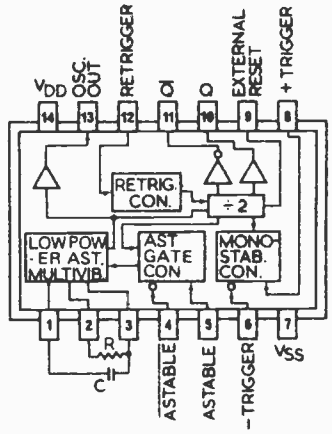
CD4027A DUAL J-K FLIP-FLOP



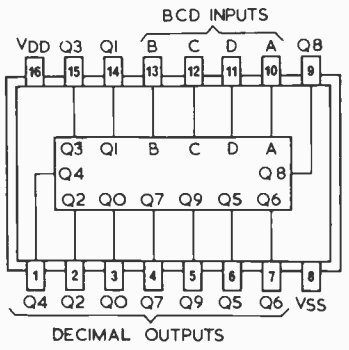
CD4041A QUAD TRUE COMPLEMENT BUFFER



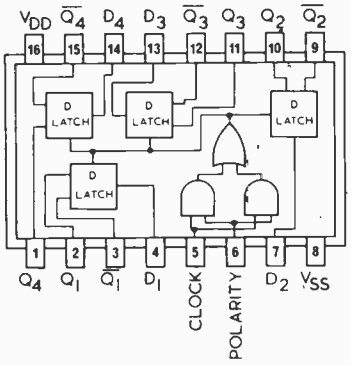
CD4047A MONOSTABLE ASTABLE MULTIVIBRATOR



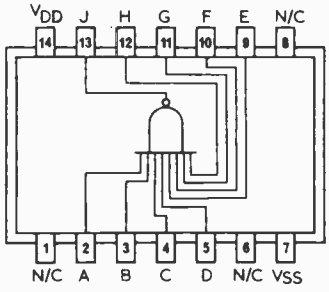
CD4028A BCD TO DECIMAL DECODER



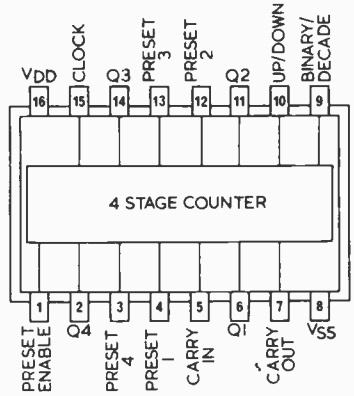
CD4042A QUAD D-TYPE LATCH (CLOCKED)



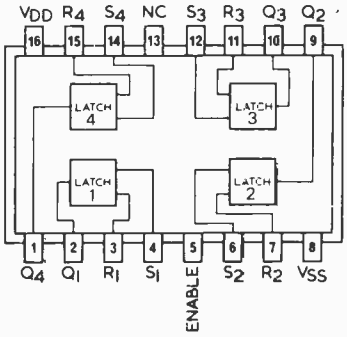
CD4068B 8-INPUT NAND GATE



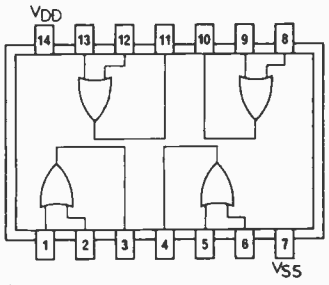
CD4029A PRESETTABLE UP-DOWN COUNTER



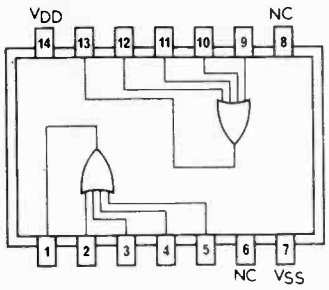
CD4043A QUAD 3-STATE NOR R/S LATCH



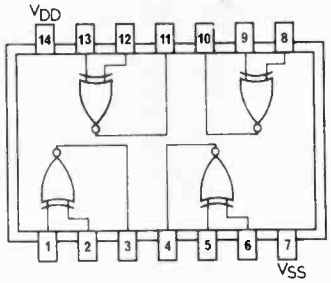
CD4071B QUAD 2-INPUT OR GATE



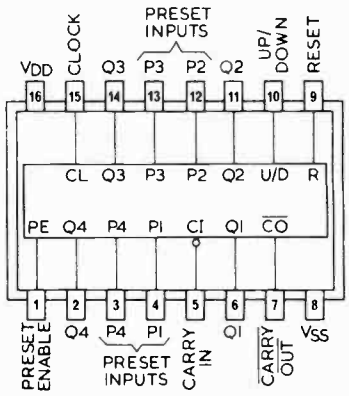
CD4072B DUAL 4-INPUT OR GATE



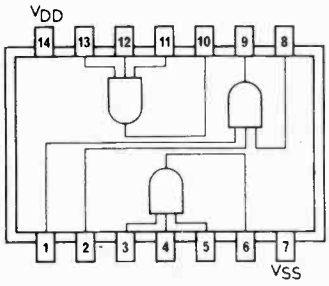
CD4077B QUAD EX NOR GATES



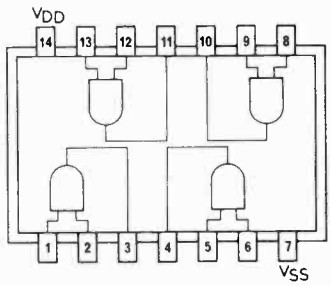
CD4510B BCD UP-DOWN COUNTER



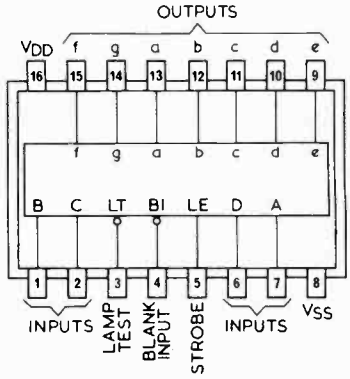
CD4073B TRIPLE 3-INPUT AND GATE



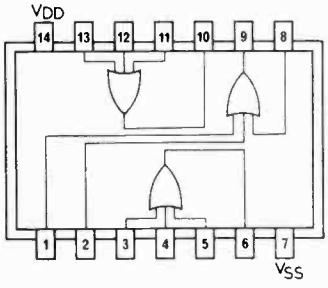
CD4081B QUAD 2-INPUT AND GATE



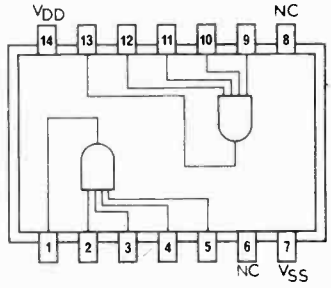
CD4511B BCD-TO-7-SEGMENT DECODER/DRIVER



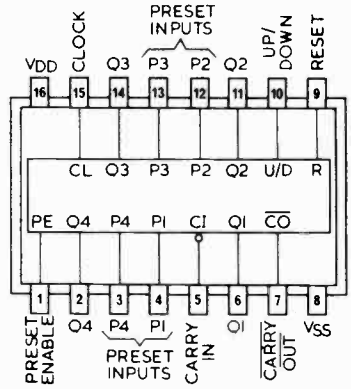
CD4075B TRIPLE 3-INPUT OR GATE



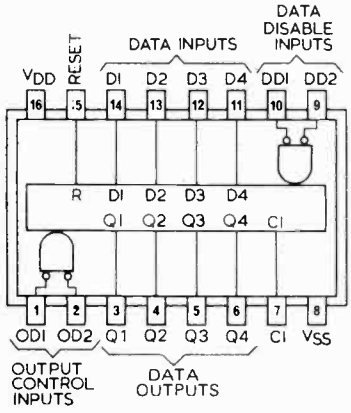
CD4082B DUAL 4-INPUT AND GATE



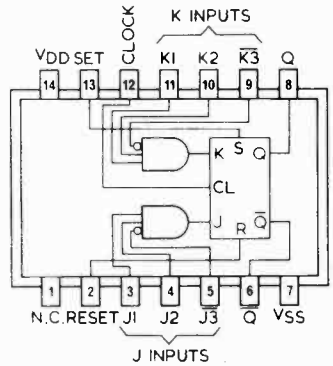
CD4516B BINARY UP-DOWN COUNTER



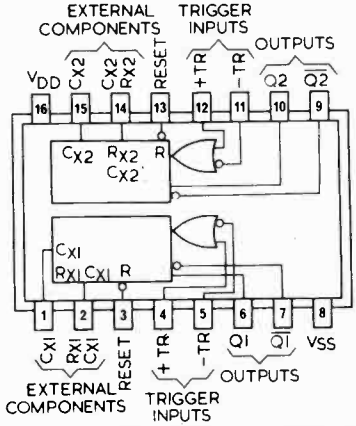
CD4076B QUAD D TYPE FLIP-FLOP



CD4096B GATED J-K FLIP-FLOP



CD4528 DUAL RETRIGGERABLE MONOSTABLE



A computer-controlled ham repeater:

VE3RPT VE3RPT

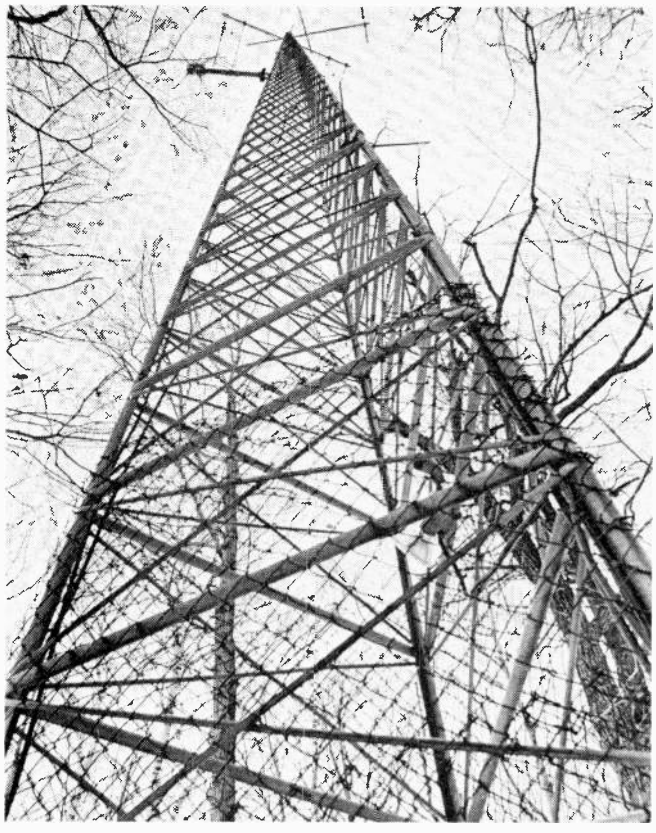
by Bill Johnson, VE3APZ

TEN YEARS AGO, the upper 2 MHz of the amateur two metre band was a desolate wasteland, inhabited only by those hardy amateurs who could build their own FM equipment, or were lucky enough to get their hands on some commercial-surplus equipment that could easily be converted to the amateur frequencies.

However, two major factors arose which have caused a change in that situation: amateur radio clubs became interested in establishing repeater stations to make the band more useful, and the congestion on the commercial channels led the FCC (Federal Communications Commission) in the US to bring in regulations to force commercial users to occupy much narrower bandwidths. The latter meant that a flood of used commercial equipment hit the amateur market, since it was not economically feasible to convert radios to meet the new bandwidth requirements.

There was a steadily-increasing interest in this band amongst amateurs, and as numbers grew, so did the number of repeaters, and the channel congestion. For the first time ever, amateurs were forced to split up an amateur band into discrete channels, and to do this they formed regional councils where repeater owners of a particular area could meet, exchange ideas, and plan frequencies so that their repeaters would not interfere with each other.

Their original band plan for two metres called for 60 kHz channels, starting at 146.10 MHz. Repeaters would input on the lower of two channels 600 kHz apart, and output on the higher. This plan became widely adopted across Canada and the US, but it soon became clear that there weren't enough channels to go around. By 1970, repeater councils were beginning to issue frequencies on split channels, i.e. 30 kHz between the old 60 kHz channels. At the present time, in some of the larger cities, they have even gone to 15 kHz channels, with congestion on some channels being bad enough that users have to emit tones to key only their intended repeater.



This tremendous growth on 2 FM has created a need for repeater systems and in the larger cities some pretty sophisticated systems have evolved, which include automatic phone patches (autopatches), UHF links into other repeaters, and other remotely-controlled gadgetry such as voice time identifiers, brag tapes, and digital telemetry.

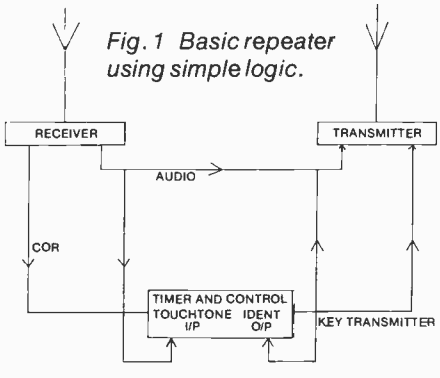


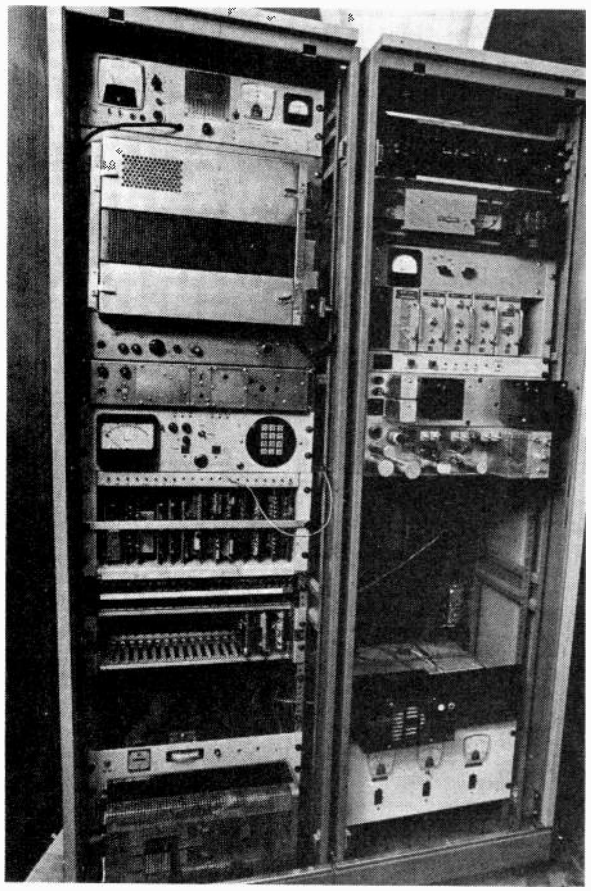
Fig. 1 Basic repeater using simple logic.

This is the story of one such system, VE3RPT, located on the Great Pine Ridge, northeast of Toronto, Ont. With the high concentration of electronic industries in the Toronto area, and the close proximity of the K2LDT (now WR2ABU) repeater system in Buffalo, NY, it is not surprising that the first Canadian repeater should have its home here.

EARLY CONTROL LOGIC

One of the necessary parts of a repeater system is the control logic, which must by law be capable of allowing the licensee of the station to shut down any transmitter, or the whole system, should user abuse or technical malfunction occur. The original control system for VE3RPT was a telephone stepping switch, which, when connected to some DTL logic and tone detectors, allowed the licensee to send tone

VE3RPT VE3RPT



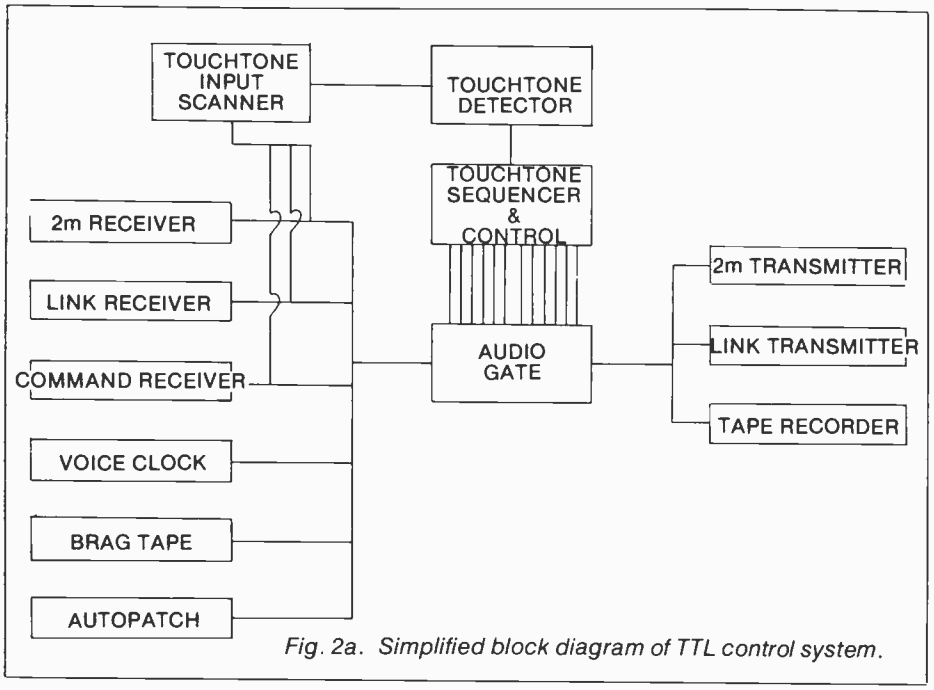


Fig. 2a. Simplified block diagram of TTL control system.

pulses from a rotary dial in his car or base station to control the repeater. The original VE3RPT was thus not very sophisticated (the identifier was made out of pieces of black insulating tape stuck onto a transparent disk with a photocell to detect the tape and thus send the dots and dashes of the call-sign as the wheel went around), but it represented the first step in a whole new branch of amateur radio technology. Commercial electronic identifiers were rare on the surplus market, and very expensive to buy or build.

CHANGING NEEDS

The original system had not been operational for more than a few months, when its owners, the Toronto FM Communications Society, Inc., realised that more sophistication was needed and started to work on a new repeater. TTL Logic, Touchtone signalling, and solid-state rf gear were the objectives.

The new repeater was installed in a newly-built concrete blockhouse in the side of a hill at an Uxbridge, Ont., ski club. The site serves Toronto well, and puts an excellent signal along the 401 highway east from Toronto as far as Belleville, as well as serving Barrie-Orillia to the north and Kitchener to the west. To the south, Buffalo and Rochester base stations have no trouble getting into VE3RPT.

After the installation of the basic system, such niceties as an autopatch, digital systems telemetry, a "peaker tweeker", a brag tape, and a voice clock were added. The peaker tweeker is a device which sends back a rising or falling tone after you key the repeater and let go to tell you if you are low or high in frequency, respectively. The above appeared gradually, as the station engineers found the time to design them.

However, two metres continued to grow beyond all expectations, and new equipment kept getting added-on to the repeater. To relieve channel congestion, the club installed another repeater, VE3TFM, in downtown Toronto. Yet another site was opened up in Don Mills, to house the six metre input to RPT, which was linked up to the main Uxbridge site on 450 MHz to be retransmitted from there.

The club was approached by some microcomputer hobbyists who wanted to use VE3RPT, linked to an Ottawa repeater, to exchange microcomputer programs. Another group of amateurs from the Toronto area wanted to link RPT with their newly-installed repeater in the cottage country. Dialling up links between repeaters can sometimes be a very time-consuming job, requiring a lot of patience. You must not only signal the local repeater to establish a link to the distant one, but when this

outward link is established, you must then signal the distant repeater to turn on its link back to the local one. Needless to say, faced with the future possibility of having three or more repeaters linking together, the designers started thinking about making the repeater do some of the dialling itself.

All this led to one irrevocable conclusion — once again, demand had outgrown the facilities available and the logic at RPT could not be easily modified to meet these new demands. The only solution that made sense was to redesign using a microprocessor. (The term MPU, meaning Micro Processor Unit, will hereafter be used to abbreviate this.)

BASIC DESIGN CONCEPTS OF A MICROPROCESSOR-CONTROLLED REPEATER SYSTEM

It became apparent at the outset that to build a microprocessor system based on the actual TTL logic design currently in use at RPT would lose us many of the advantages of the MPU, so it was decided to take a completely fresh look at what is, and what will be required of such a repeater system, now and in the future.

First and foremost, the repeater's main purpose in life is to receive an FM signal, demodulate it, and remodulate it on an FM transmitter operating on a different frequency, with as little AF shaping and distortion as possible. Other than for the fulfillment of the licensees legal control obligations, any logical control system must cause minimal interference to the basic role of a repeater, while providing the benefit of things such as autopatches, inter-repeater links, etc. Any failure of the logic should not prevent the repeater from doing its basic job. This philosophy is carried out in our MPU design by the implementation of a simple fail-safe timer which, when the computer fails, will connect receivers up with their predetermined transmitters for basic carrier-operated operation.

Secondly, a choice VHF site is wasted if only a single repeater is installed. It is possible, as has been proven already at RPT, to run 2 metres, 6 metres, and 450 MHz all at the same time, with little or no mutual interference. Therefore the logic system should be expandable so that new receivers and transmitters may be added into the main system in the future with a minimum amount of disturbance to the original equipment.

Another important consideration is that an incoming link should be able to be routed through the system without having to interfere with communications on the main output of the repeater. To achieve this end, the number of

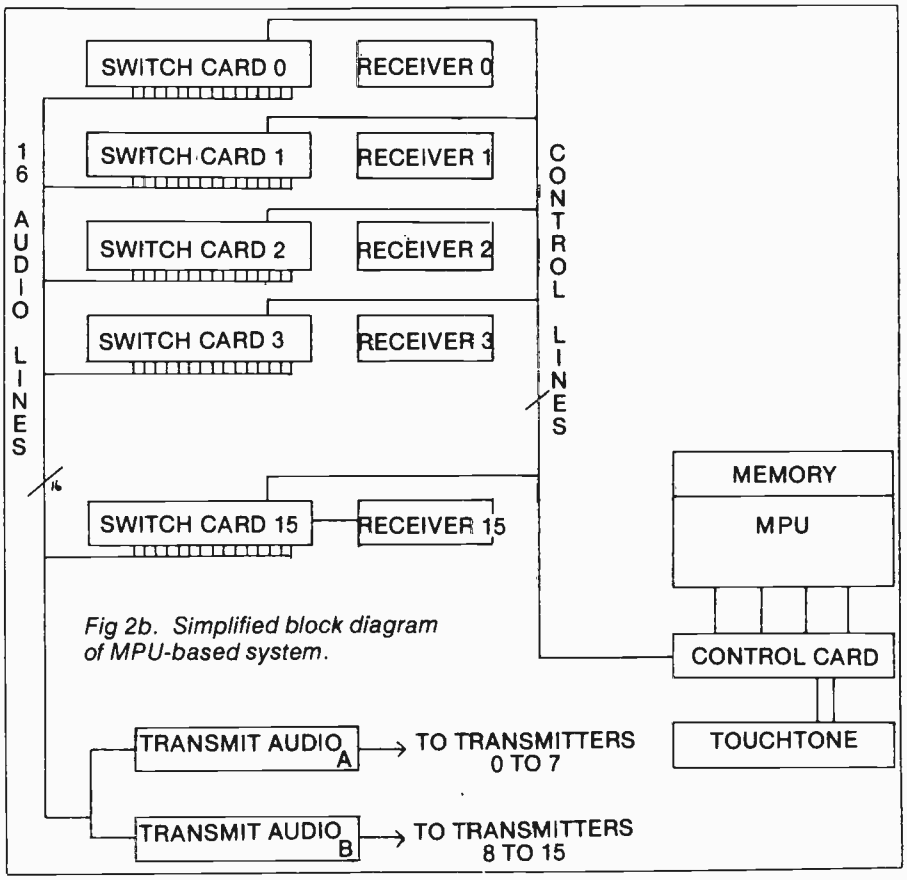


Fig 2b. Simplified block diagram of MPU-based system.

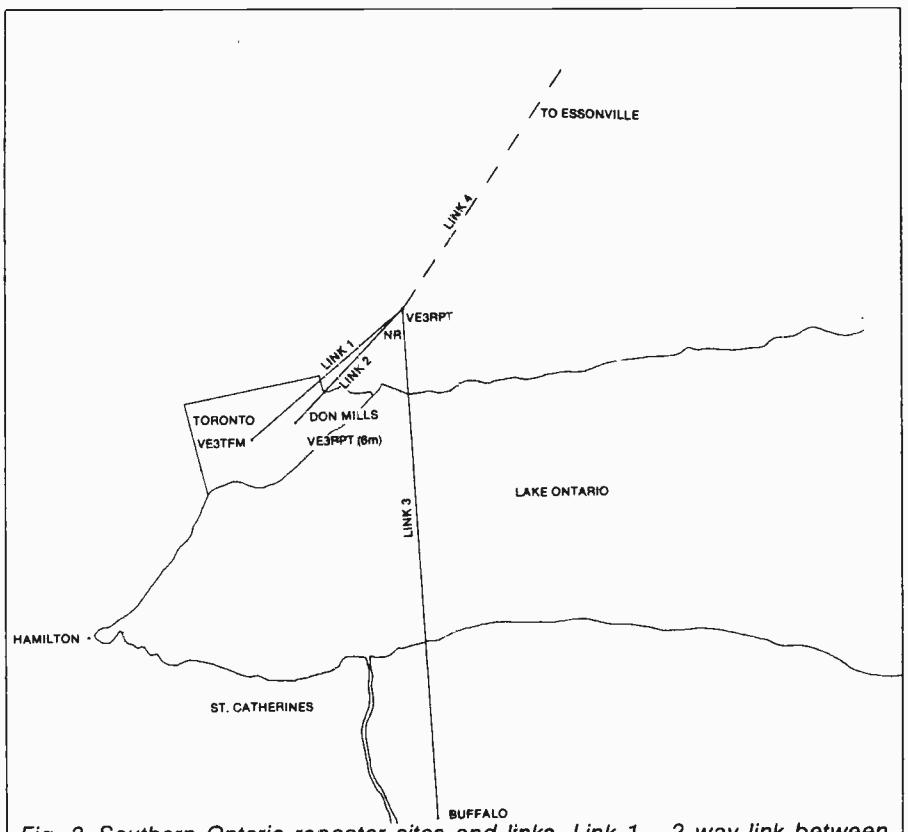


Fig. 3 Southern Ontario repeater sites and links. Link 1 – 2 way link between VE3RPT & VE3TFM, used for Autopatch only. Future use includes inter-repeater signalling. Link 2 – One-way link from VE3TOR TO VE3RPT. Feeds signals received on 52.76 MHz up to main Tx on 52.525 MHz. Link 3 – 2 way link to the Buffalo repeaters. Link 4 – Proposed link will give Toronto uses access to VE3TBF, Essonville and one repeater in Ottawa.

VE3RPTVE3RPT

audio busses must equal the number of sources of audio.

The tones sent by some amateurs quite often leave a lot to be desired, so when making an autopatch call, the logic system should receive the tones, check to see if a valid telephone number has been dialled, and then send the number into the phone line from its own dialler.

Another desirable extra easily afforded by an MPU-based system is emergency speedcalling — where a person who does not belong to the sponsoring club and therefore does not have the autopatch access code can dial 911 and cause the MPU to pick up the phone line and make a call to the local police emergency number.

When a user does not dial a code properly, it would be useful as a debugging aid to send back a signal telling him what was wrong with his tones. This could consist of a series of 'beeps', such as is used on the telephone network, but with licensed amateurs as users a morse code diagnostic of two or three letters would be most helpful and self-explanatory. Bearing in mind also that the one MPU might control more than one actual repeater at its location, and the different repeaters may want to have different callsigns sent on their transmitters, it would be desirable for the MPU to generate the timing for all CW sent from the station, rather than have separate discrete callsign generators for each series of letters.

ACTUAL DESIGN OF THE VE3RPT SYSTEM

From the above considerations, some basic design rules were developed:

1. Anything in the system that generates audio shall be called a receiver, and all such devices shall be treated the same. The standard input signals from a receiver to the switching buss shall be:
   (a) An audio signal, 9 volts peak-to-peak.
   (b) A squelch open signal, to indicate presence of carrier.
   (c) an auxiliary signal (AUX) which can be used by the MPU to start some input devices such as tape recorders, tone generators, etc. that are not activated remotely by somebody transmitting, as is the case with regular receivers. The effect of this signal, when sent from the MPU, will be to start up whatever mechanisms are necessary to generate the audio signal (tape recorders, generators, etc.) and then cause the squelch open (COR) signal to come up and signal to the MPU that there is a receiver here to be connected to some transmitters.
2. Likewise, anything that takes audio from the system shall be called a transmitter, and will be provided with a nine volt p-p signal and a relay keying lead (PTT). This category will include the record half of tape recorders, modems, touchtone decoders, etc., as well, of course, as actual transmitters that put the audio out on the air.
3. There shall be an audio path from each audio input to each audio output independent of all other audio signals present.
4. Since this is an amateur project, anything that can be done with software (programming) shall be, at a saving in cost on the hardware needed to build the system. The reasoning for this is that time spent on the programming doesn't cost us anything, and is only spent on the first system, whereas new hardware is required for each system.

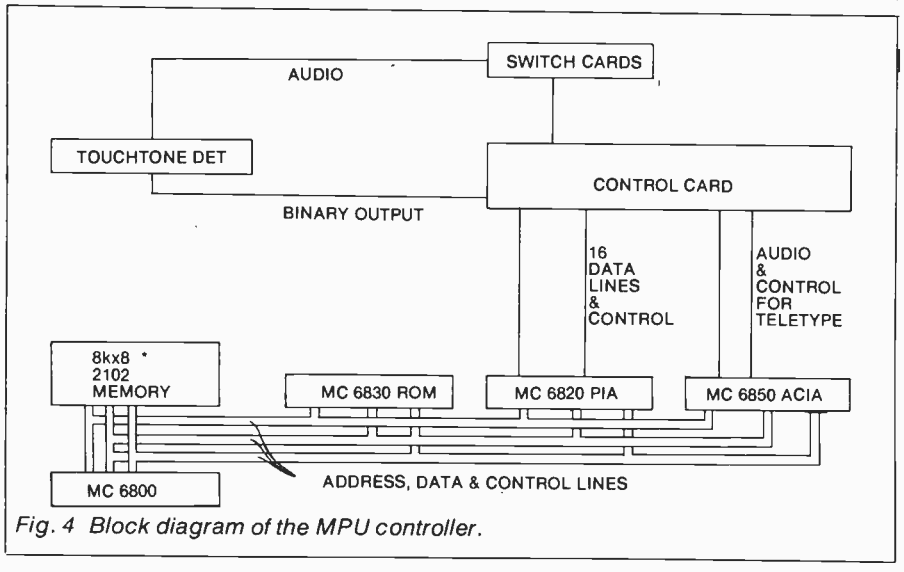


Fig. 4 Block diagram of the MPU controller.

DOWN TO THE NUTS AND BOLTS

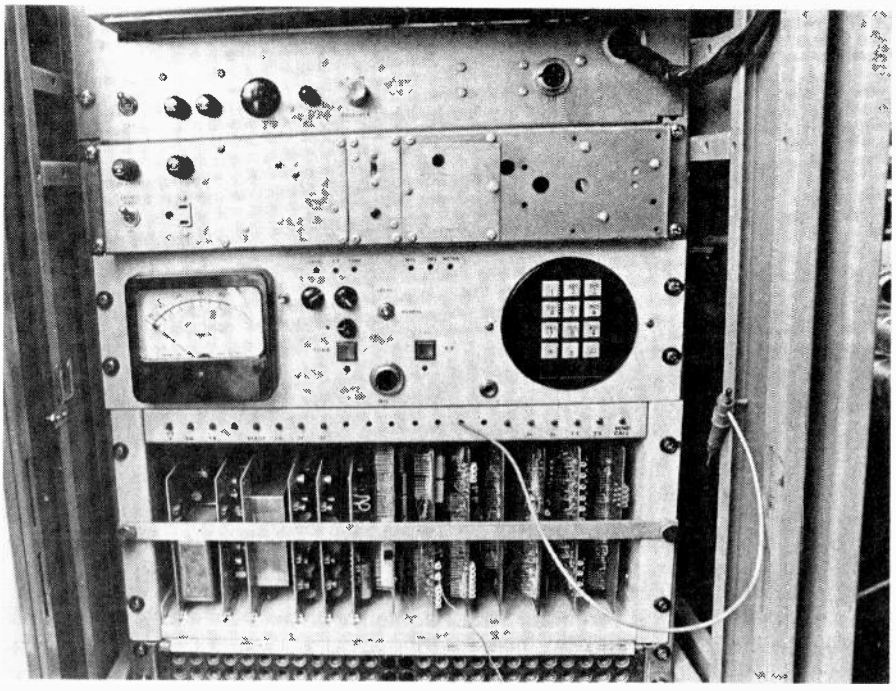
The design which evolved, and is now under construction, enables a repeater owner to get "on-the-air" with the smallest amount of hardware. Later additions mean simply adding one card (value approx. $30) per receiver, and changing the already-written programming to tell it that the card is now present. The basic system will handle up to eight transmitters before an additional transmitter interface card needs to be built. Total cost for the basic system, including MPU, memory, control card, transmitter interface card, and three switch cards, plus card cage and sockets will probably be around $500 (assuming printed circuit cards are made commercially and all the rest of the labour is supplied by willing volunteers).

The system is built around a 22-card file for the specially-designed hardware, another rack space 14 cm high for the MPU, a third 8 cm rack space for the memory, and various power supplies, which can be built separately and housed somewhere else in the rack, or each unit can have its own smaller power supplies built in. Total space taken on a 49 cm wide rack is approx. 36 cm.

The card file contains the following:

1. A control card, which connects the MPU to the rest of the system by a 40 wire flexible cable. This card is the heart of the system. It allows the MPU to address one switch card at a time as well as controlling the gating of all binary information passing into and out of the system.
2. Two transmitter buffer cards. These cards sum the audio from all sixteen switch cards and key any transmitter for which there is an audio signal. Each card handles up to eight transmitters, and the second need only be installed when the system expands to this level. The maximum system configuration is sixteen receivers, or other sources of audio, feeding sixteen transmitters, touchtone detectors, tape recorders, etc.

3. Sixteen switch cards. Each of these cards takes the audio from one receiver and gates it to one or more transmitters, up to the maximum of sixteen, in any combination. This card also changes the net voltage on the audio buss line to the transmitter card, causing the transmitter corresponding to that line to be keyed. The transmitter that gets the audio is controlled by sixteen flip-flops on the switch card, which are changed as necessary every 16.7 ms by the computer through the control card. An input from this card tells the computer that the squelch is open on its associated receiver. As soon as the squelch opens after being closed, the computer sets all the flip-flops necessary to connect this receiver to its transmitter(s) as stored in memory. As long as the squelch stays open, the computer ignores this card and the connections are held by the flip-flops. When the squelch closes, the computer sends signals to this card that clear the flip-flops and drop the transmitters, providing that they are not being held on by other cards.



It is on this card that the important 'fail-safe' operation wiring is installed. There is a signal generated by the control card that tells all the switch cards that the computer is still alive and well and keeps accessing it. However, if the computer misses a few scans of the logic rack, the control card declares the MPU dead and signals this to the switch cards. Their reaction is to abandon the above routine of transmitter control and connect the squelch line of their associated receivers directly to only one transmitter, this having been decided beforehand by a wired jumper on the board. Thus the two metre receiver repeats directly to the two metre transmitter etc., but with no fancy logic or touchtone user control. (A last-ditch black box will kill the system on command of the licensee if things get really fouled up.)

4. A register card. This is a user-definable option which gives the station engineers 32 signals controlled by the MPU to do things such as turn on lights, unlock the shack door, sense the battery voltage, read the output power of the transmitter, or even measure the battery voltage. They can also check to see if somebody is in the shack, or detonate four sticks of dynamite in the corner if it is ever established that spies from an unfriendly power are in the shack to find out why two metre FM is so popular in North America.

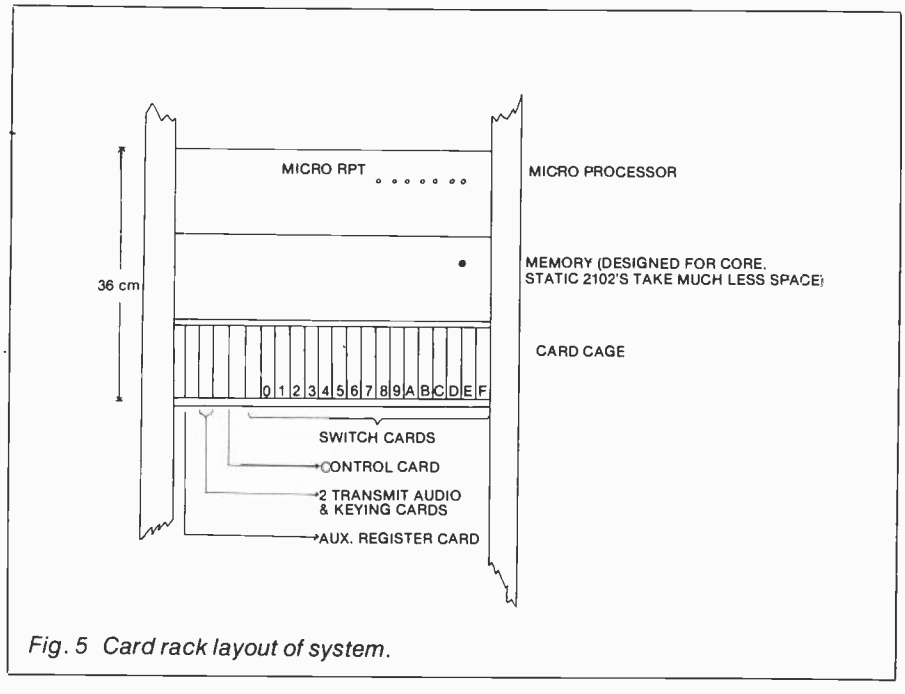


Fig. 5 Card rack layout of system.

At the time of writing this article, the system construction had been underway for several months. The MPU is working and the special logic cards designed and partly prototyped. The switch cards were just going to the PC board designers after passing all tests using a wire-wrapped prototype. By the time you read this the system will be well underway and we hope to have enough building finished to have a very interesting display on FM and Microprocessors at the 1977 ARRL National Convention in Toronto. The author will be on hand there to answer any questions from repeater users regarding the system. ●

electronics today international

What's in the May issue

CATALOGUE SURVEY

If you're building some of the projects featured in ETI, you'll have noticed that we use up-to-the-minute components and techniques. If you want to get hold of these components, you'll sometimes find that your local supplier just doesn't have them. The answer? Mail-order — but you have to have a few catalogues to know who's got what. Next month, we'll browse through some catalogues — so now there's no excuse for not building that project.

BURGLAR ALARM

Since we've given you all the background information on how to protect your home, we thought it would be nice to have some hardware so you can actually do something about it. So, here's a nice design with inputs for different types of sensors, featuring low power consumption for battery operation. And, it's designed to the same high standard you expect of all ETI projects.

PROJECTION TV

If you have a large room, a conventional colour TV tends to get lost in the corner and prevents you spreading out to use the whole room. But with a projection TV you can have large-screen brilliance and view from anywhere in the room. The whole story is in the next issue.

741

35 spicy recipes using the 741 op-amp as main ingredient, dreamt up by master chef R. M. Marston and served up in next month's ETI. Whatever your tastes, there's something in here for

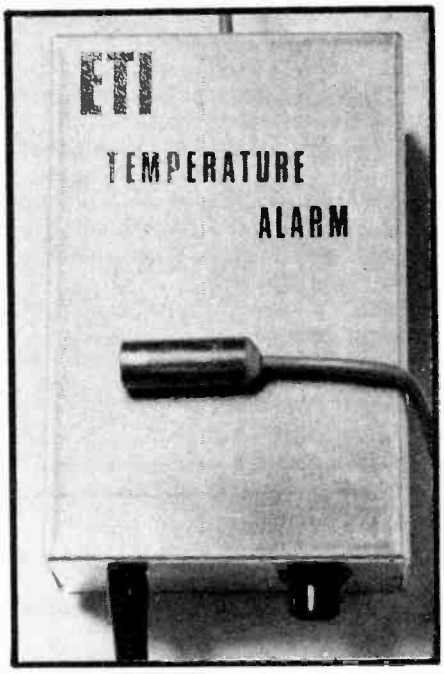
COOK

you, so pop down to your neighbourhood supplier and have him put aside a pound or two of best 741s for you — you'll probably have the other ingredients on your shelf.

BOOK

—SHORT CIRCUITS—

TEMPERATURE ALARM



A SIMPLE BUT VERSATILE monitor to provide for over or under alarm was the main aim of this circuit. It may be used to keep an eye on fish tanks, deep freezes (by monitoring the heat exchanger), cooking vessels, incubators etc etc.

The temperature at which an alarm is given is adjustable over a range predetermined by the combined values of the components RV1 and R1. RV1 is a potentiometer which is used to adjust the final 'set point' (the temperature at which the alarm is given).

Actual temperature sensing is done by a device called a 'thermistor'. This is basically a resistor in which the resistance value varies with changes in temperature. Thermistors are obtainable in innumerable shapes, sizes and temperature ranges.

The unit may be built so that a small loudspeaker provides an audible warning when the set limit is reached.

OVER + UNDER

The unit can be constructed so that the warning (or relay action) takes place as temperature *exceeds* the set limit - or so that the warning (or relay action) takes place as temperature falls *below* the preset level.

All that is required to convert either unit from one mode of operation to the other is simply to change over the position in the circuit of the thermistor and the combination RV1 and R1.

Figure 1a shows the unit with loudspeaker set up to warn if the temperature exceeds the limit preset by RV1. Figure 1b shows the circuit set up to warn when the temperature falls below the preset limit.

Figure 2 shows the circuit for adding a relay to enable a blower or heater depending on the circuit chosen, to be switched on.

How it works

Temperature is sensed via a thermistor. This is a resistor which varies its resistance as temperature changes. The one chosen for this application is an NTC (negative temperature coefficient) type in which resistance falls as temperature rises. The resistance at 25°C is about 47k falling to about 3k at 100°C. This thermistor forms a voltage divider with RV1 and R1.

The familiar 555 IC is the basis of the unit. The IC will oscillate if pins 2 and 6 are allowed to exceed approximately two-thirds of the supply voltage. However, the voltage divider, along with diode D1 can prevent this and while it does so the alarm will be off.

As temperature increases thermistor resistance falls and the voltage begins to rise at the junction of D1, the thermistor, and R1. When the voltage reaches 2/3 V_S–0.6V, the 555 begins to oscillate and causes the loudspeaker to sound (at about 1.2kHz). If an 8 ohm speaker is available then R4 must be included. However if an 80 ohm speaker is available then R4 may be left out - the sound will then be much louder.

The circuit may be arranged so that a relay is actuated rather than an alarm. Figure 2 shows how this is done. Here diode D2 and capacitor C2 rectify the output of the 555 IC. Resistor R4 is added to ensure that there is some overlap between pull-in and drop-out set points. The lower the value of R4 the greater the difference there will be between these two points (this effect is known technically as 'hysterisis').

TABLE 1
APPROXIMATE VALUES OF R1 + RV1 FOR DIFFERENT TEMPERATURES

°C	OVER ALARM	°C	UNDER ALARM
20	85k	12	37k
25	75k	14	35k
35	50k	16	31k
45	30k	18	29k
55	18k	21	27k
65	10k	24	25k
75	6k5	27	23k
85	4k	30	18k
95	2k5		
100	1k8		

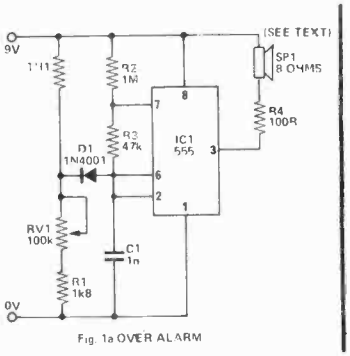


Fig. 1a OVER ALARM

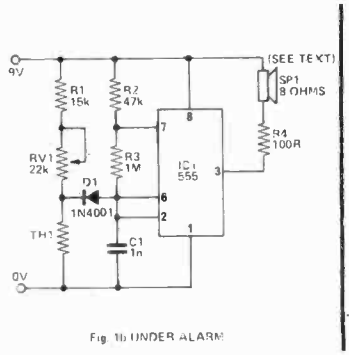


Fig. 1b UNDER ALARM

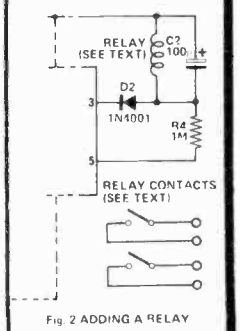


Fig. 2 ADDING A RELAY

Short Circuits

The relay is external to the board, and should be a 6V, 185R (min.) coil type. The contact rating needed will depend on the application.

CONSTRUCTION

The thermistor should be mounted in some thin-walled glass tube, say an old perfume bottle (or cap!). If this component is not sealed, its working life will be very truncated to say the least! Electrolytic action quickly dissolves the leads. Our's lasted a day!

Obviously though, if all you're monitoring is air temperature, then sealing is unnecessary.

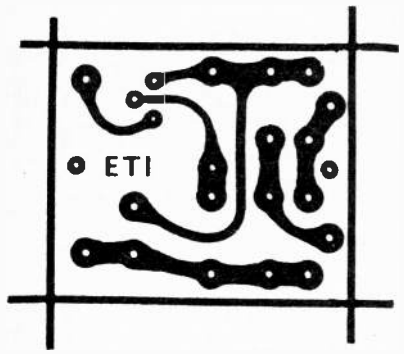
The power supply is a conventional series-pass circuit, and no comment is needed. The stabilisation components are included on the PCB. The use of a supply is recommended as the standing current is quite high.

Table 1 shows the approximate values of RV1 and R1 to cause triggering at various temperatures. ●

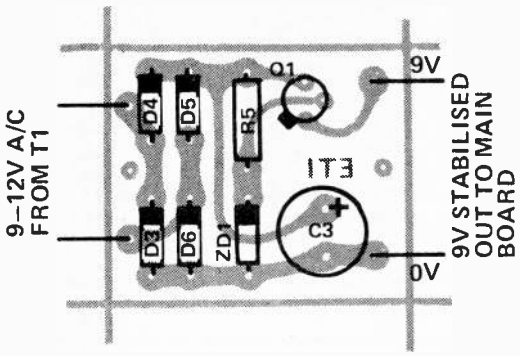
Parts List

	OVER ALARM WITH 8Ω SPEAKER	UNDER ALARM WITH 8Ω SPEAKER	CHANGES FOR USING RELAY
RESISTORS			
R1	1k8	15k	---
R2	1M	47k	---
R3	47k	1M	---
R4	100R	100R	1M
R5	270R	270R	---
	All ½W 5%	All ½W 5%	
CAPACITORS			
C1	1n ceramic	1n ceramic	---
C2	---	---	100u 16V electrolytic
C3	470u 16V electrolytic	470u 16V electrolytic	---
SEMICONDUCTORS			
Q1	2N3904	2N3906	---
IC1	555 Timer	555 Timer	---
D1, 3-6	1N4001	1N4001	---
D2	---	---	1N4001
ZD1	9V1 400mW Zener	9V1 400mW Zener	---
POTENTIOMETER			
RV1	100k Mini Trim	22k Mini Trim	---
THERMISTOR			
TH1	205-CE/P47K*	205-CE/P47K*	---
TRANSFORMER			
T1	120V - 9V - 150mA	120V - 9V - 150mA	---
FUSE/HOLDER			
F1	To suit 250mA fuse	To suit 250mA fuse	---
BOX			
	4½"x 3"x 2" 114 x 75 x 52mm.	4½"x 3"x 2" 114 x 75 x 52mm.	---
RELAY			To suit applications with 6V 185Ω (min) coil.

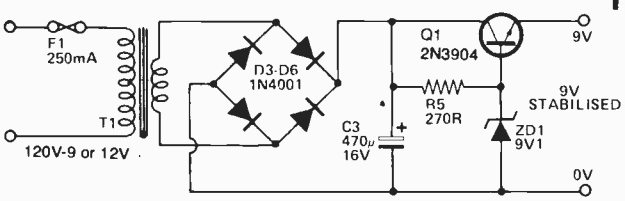
MISCELLANEOUS
3-core flex, 2-core flex, P.C. board spacers, glass tube, grommets, etc.
* The 205-CE/P47K is an NTC bead type, thermometer style thermistor. It is available from Electrosonic.



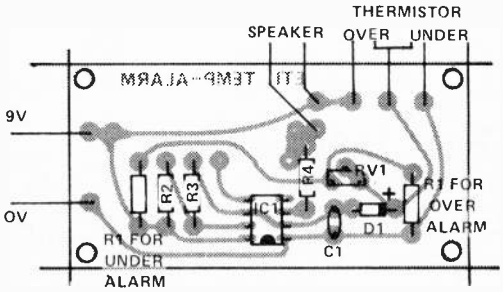
Temp Alarm P.S.U. Board Foil Pattern — Full Size



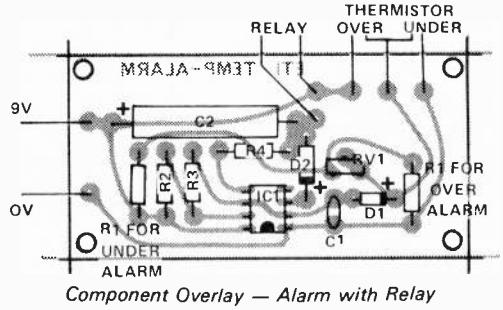
Temp Alarm P.S.U. Overlay



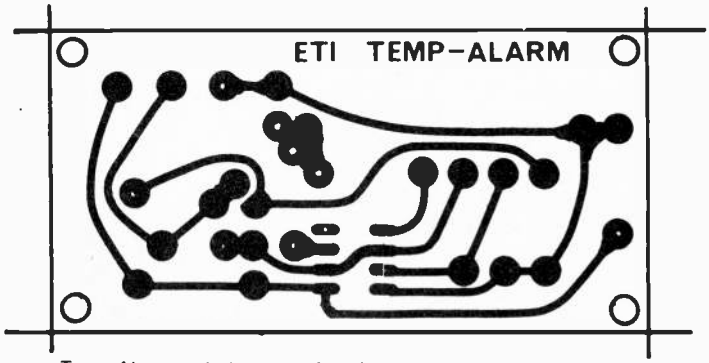
Temp Alarm Power Supply Circuit



Component Overlay — Alarm with Speaker



Component Overlay — Alarm with Relay



Temp Alarm main board — full size

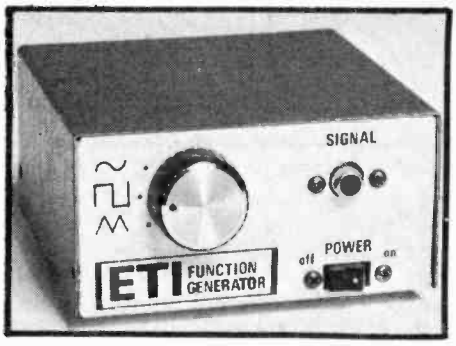
FUNCTION GENERATOR

IT IS NOT AN UNREASONABLE prediction to say that this circuit will find great usage as a general servicing implement. It produces greater test flexibility than the usual sine-wave signal injector, providing 1kHz square and triangle waves as well, and is both cheap and simple to build.

As it stands the output is around 3V ptp on square wave, and 2V r.m.s. on the sine-wave. A switched attenuator could easily be added should you wish to be kinder to the circuit you're testing, but being heartless to electrons, we haven't included one!

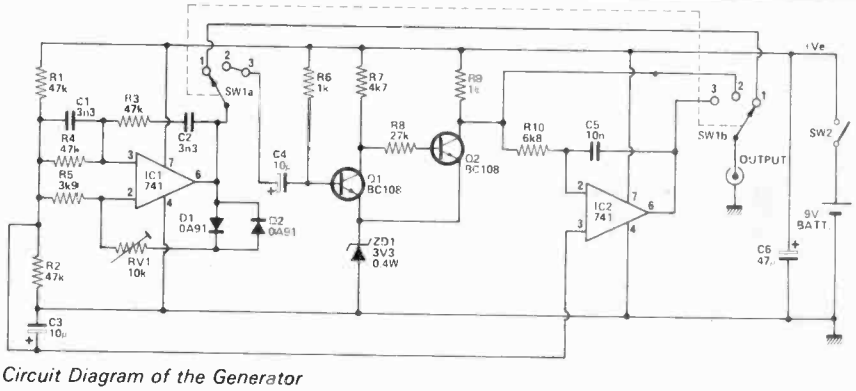
How it works

IC1 is set up as a Wien bridge running at 1kHz. Amplitude control is provided by the diodes D1 and D2. The output from this IC is switched through either to the output socket or to the squaring circuit. This is coupled to SW1a via C4 and is a Schmidt trigger (Q1-Q2). The zener ZD1 forms a 'hysterisis-free' trigger. The integrator of IC2, C5 and R10 produces the triangular wave from the input square wave.



CONSTRUCTION

Assemble the components onto the PCB as shown in the overlay, and watch the orientation of the zener, electrolytics and ICs. To set up the circuit, simply adjust RV1 until the sine-wave is just *below* clipping level. This gives you the best sine-wave from the oscillator. The square and triangle do not need any further setting-up. ●



Circuit Diagram of the Generator

Parts List

RESISTORS
R1,2,3,4	47k
R5	3k9
R6,9	1k
R7	4k7
R8	27k
R10	6k8

All ¼W 5% H.S.

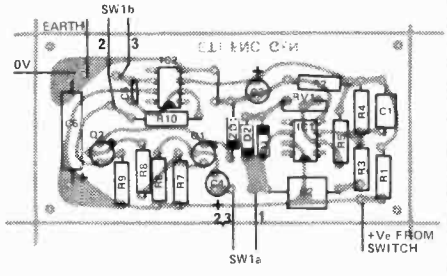
CAPACITORS
C1,2	3n3 polystyrene
C3,4	10u10V electrolytic
C5	10n ceramic
C6	47u 16V electrolytic

SEMICONDUCTORS
IC1,2	741 8-pin DIL
Q1,2	2N2222 or similar
D1,2	OA91 diodes
ZD1	3V 3/4W zener

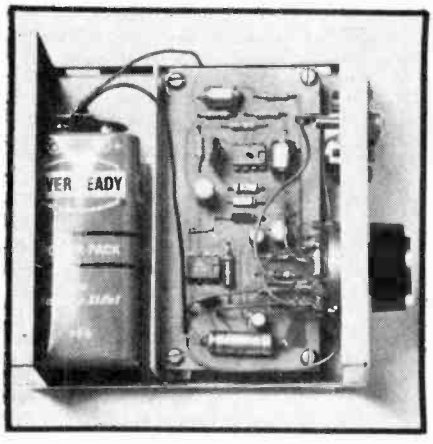
POTENTIOMETER
VR1	10k vertical miniature trim

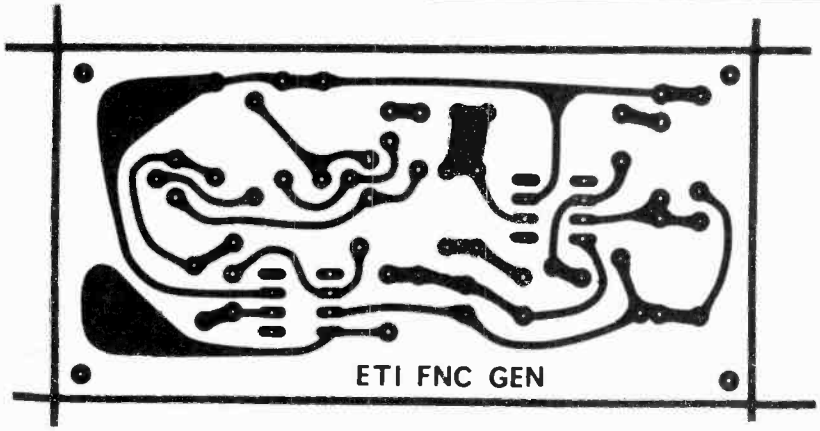
SWITCHES
SW1 a/b	2-pole 3 way rotary
SW2	Single pole off-on rocker

MISCELLANEOUS
Phono socket, knob, board spacers, nuts, bolts, etc. 9V battery (246) and clip.



PCB Overlay For The Function Generator





PCB Foil Pattern — Full Size

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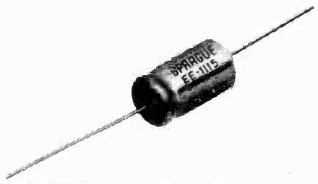

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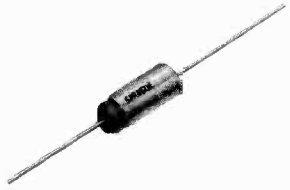

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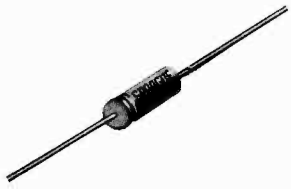

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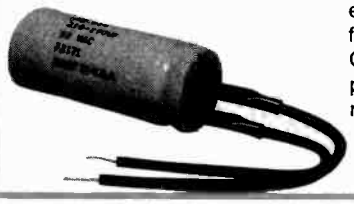

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biofeedback — instant yoga?

Using electronic biofeedback techniques you can monitor the internal operation of your body. But that's not all - knowing what's going on enables you to control usefully some of the processes, helping you to relieve tension and the disorders resulting from it. Collyn Rivers explains.

AN ESSENTIAL PART OF MOST control processes is some form of feedback information which enables the system to maintain a controlled equilibrium.

A room thermostat, for example, senses room temperature and regulates heat output accordingly – an indication of the heater's operation is 'fed back' to enable temperature to be automatically controlled.

When you learn the piano you see or sense where the keys are, and how hard you are striking them. The piano makes corresponding sounds which are fed back to your ear. Your brain now compares what you've got with what you hoped you had. This process of feeding back information about what you are achieving so you can compare it with what you are *trying* to achieve enables you to make appropriate corrections. In this example the acoustic feedback is vital.

A similar process is involved when you learn to ride a bicycle – the feedback process is so effective that balancing eventually becomes automatic.

Feedback is used when you first drive a strange car. The first time you brake you know only within wide limits the relationship between pedal pressure and deceleration. It may be as low as 5 kg or as high as 25 kg for (say) 0.4 G. But the very first time you press that pedal several feedback loops come into operation. Your stomach is sensitive to rate of change of velocity and it sends signals to your brain – your eyes sense the rate of change also – this data too is sent to your brain. If the tyres are squealing then there's an acoustic loop as well.

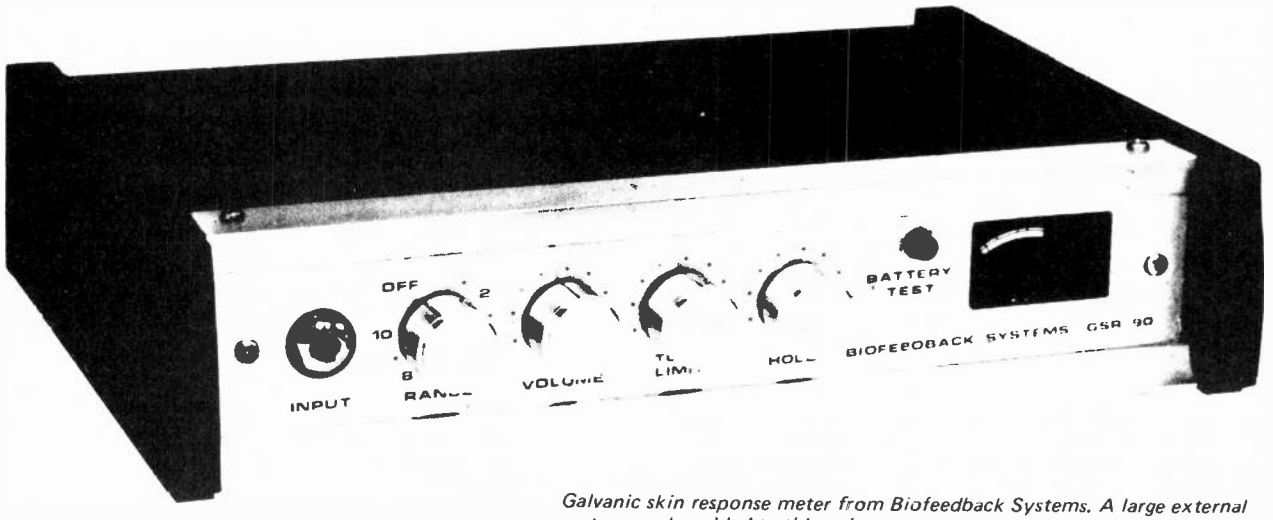
These and innumerable other physiological mechanisms collectively tell you whether you're pressing that pedal too hard or not hard enough, and you make a series of appropriate corrections – virtually instantaneously. Once you've done this a few times the response becomes automatic. You've used feedback to learn, and subsequently reinforce, a new skill.

THE AUTOMATIC NERVOUS SYSTEM

So far we've described what are primarily external feedback loops. But the body has a vast number of internal automatic mechanisms – what medics call the autonomic nervous system. These are internal feedback loops and whilst they're working correctly all one normally perceives is the end result. If the body is too hot it perspires – if you run for a bus your respiratory rate increases, if you walk from a light area to a dark area your pupils expand accordingly. And all these mechanisms work in very much the same way as their technological equivalents.

Until recently it has been taken totally for granted that man had no control over the autonomic nervous system. We could learn to control at least some of our external bits – but not our internal systems. We knew we could learn to use our hands – or even wiggle our ears – but to control body temperature or heart rate was something else again.

And until very recently Western science believed this implicitly – despite ever-increasing evidence to the contrary. Yogis have long maintained that *they* have some measure of control over their autonomic systems, but the evidence was always anecdotal rather than scientific. (It is only in the last decade that their performances have been monitored and scientifically authenticated.)



Galvanic skin response meter from Biofeedback Systems. A large external meter may be added to this unit.

biofeedback —

Then ten or so years ago the scene suddenly changed. It was caused by a now classical experiment involving the study of part of the brain's electrical activity. Researchers were studying a subject's alpha rhythms (a low amplitude 10 Hz generated when the subject is relaxed). It was found that if the subject could *perceive* a signal corresponding to his alpha activity he could learn to generate more or less of it at will. Even more excitingly, it was found that almost all subjects could do the same.

CONTROLLING YOUR INSIDES

For the first time it was proved scientifically that humans could control some internal processes once a visual or aural feedback loop was established. Yet the tremendous significance of this discovery was not at first appreciated by the medical profession, but rather by engineers and physicists who were of course more familiar with the use of feedback in control systems.

Subsequent experiments have shown that a very large number of internal functions can be controlled in the same fashion — and even more importantly that many partially mal-functioning mechanisms can be 're-programmed' so that newly-learnt patterns can become automatic.

One of the most important of these is conscious control of tension and anxiety, for this implies that it is possible to control tension-related conditions such as migraine, colitis, asthma etc.

Other work has shown that it is possible to control hypertension (high blood pressure), heart rate, muscular tension, body temperature — and of course to generate, or at least partially control, alpha, beta and theta brainwaves. It is in fact now commonly believed that it may eventually be possible to bring under some degree of voluntary control *any* physiological process that can be continuously monitored, amplified and displayed.

GALVANIC SKIN RESPONSE

The skin is an extraordinarily sensitive and rapid indicator of stress. Some people know this only too well — they literally develop nervous rashes.

When you become tense a number of readily measurable changes take place. A major change is the massive shift in electrical resistance of the dermis (the layer beneath the skin's outside surface). This shift is not only large but also very swift and the reaction happens regardless of where the centre of stress happens to be. A minor change in tension of a stomach muscle will cause just as large a change as clenching your fingers.

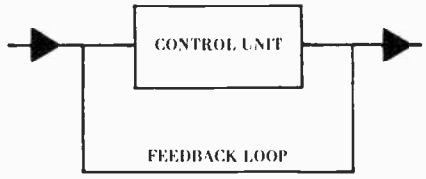
Galvanic skin response monitors (or GSR machines as they're generally called) monitor the resistance between two adjacent fingers of one hand. They translate and present this data as a meter indication or as a tone of related pitch (i.e. as tension decreases, pitch falls, and vice versa).

GSR machines are quite easy to build: they can be simply expanded-scale ohmeters covering the range 5000–100 000 ohms. A sensitivity control is essential, as is a readily adjustable method of switching resistance ranges.

Readout may be a simple analogue meter (digital tends to be harder to read in this application) or preferably a corresponding audio tone in which the pitch decreases as tension falls. Surprisingly perhaps GSR resistance *increases* as tension falls.

Electrodes may be made from any flexible conductive material — like steel wool, soft metal mesh etc — held firmly against the fleshy part of your finger tips by a velcro strap or something similar.

GSR machines are very easy to use. In fact one of the best ways is simply to switch on and try to cause the meter reading to fall — or the tone to drop in pitch. Usually you will find out how to do this within a few minutes.

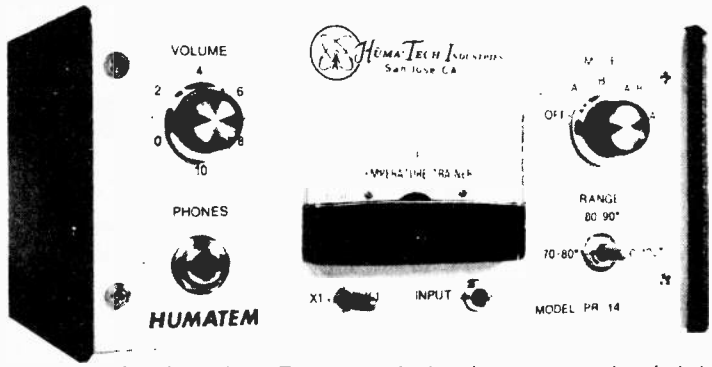


The basic feedback loop.

GSR machines make you *aware* of tension — and then enable you to *control* that tension. Eventually — after ten or so half-hour sessions the conscious control that you have learned becomes an automatic response. From then on the GSR machine is no longer required. In fact it becomes a handicap to further progress just like retaining 'training wheels' on a kid's bicycle.

Biofeedback thus operates in the opposite way to drugs. You can use sedatives to control tension if you wish. But if you do you've then got *two* problems. You still have the underlying tension — which will become only too apparent when you run out of sedatives. And you've become a drug addict as well.

To fully appreciate the efficacy of GSR machines in tension reduction it should be understood that there is an almost one-for-one relationship between mind and body. If you reduce muscular tension you will automatically reduce mental tension which in turn will reduce muscular tension yet further — and so on.



Temperature trainer from Huma-Tech Industries has three ranges each switchable to provide 0-10° or 0-1° fsd.

TEMPERATURE MONITORING

Tension is also reflected in skin temperature — particularly in the hands. A considerable amount of work in this field has been performed by Green and Green of the USA's Menninger Foundation research dept, who use this technique extensively in the control of migraine.

As with GSR, the technique and equipment is remarkably simple. Subjects are simply taught to raise their hand temperature — meanwhile monitoring the effect on an expanded-scale temperature meter. A small thermistor is taped to a finger tip to monitor changes and the output from this is backed off against a second thermistor within the instrument to compensate for ambient temperature changes.

instant yoga

Advanced alpha/theta instrument from Bioscan uses digital filtering and threshold adjustment to eliminate interference from spurious phenomena.

At a recent demonstration (attended by the writer) some fifty subjects with no previous experience of temperature training all succeeded in varying their hand temperature (in some cases by as much as 5°C within a single twenty minute session).

If you're contemplating building your own temperature monitor choose thermistors with a two to three second response time. Build the thermometer so that ambient temperature can be backed off, thus enabling the meter to give a centre zero indication at the beginning of the experiment. The instrument should have two switchable ranges — ± 2.5°F and ± 7.5°F.

As with GSR machines the readout may be either a tone of varying pitch and/or a meter reading.

People teach themselves to use these devices very quickly — usually within ten to fifteen minutes. However, whilst almost everyone can effect a change of temperature, about 50% will find the change to be in the opposite direction to that intended! Nevertheless the correct technique is quickly acquired after a few more minutes.

ELECTROMYOGRAPHS

Feedback electromyographs (EMGs) provide information about muscular tension by visually and aurally displaying neuron firings caused by muscular activity. They are commonly used in both clinical and research applications for the observation and reduction of stress and anxiety, tension and migraine headaches, tension backaches, muscle spasms and tics, essential hypertension etc.

Unlike the far simpler GSR and temperature indicators, myographs necessarily need sophisticated electronic circuitry in order to monitor the very low level activity of neuron firings.

The actual signals are picked off by silver, silver-chloride or gold electrodes placed on the surface of the skin directly across the muscle concerned. In some cases the signal may be obtained via implanted electrodes.

Signal level is very low — often as small as 0.1 microvolts, so noise rejection must be high. A typical unit will have common mode rejection of better than 100 dB. A bandpass filter is usually incorporated. This typically rolls off at 18 dB/octave beyond 100–500 Hz. The output signal is generally averaged over an adjustable 0.5 to 5 second period.

This type of instrument is not really suitable for home designing or building.

HEART RATE

The heart is simply a four-chambered pump. It receives circulating blood, causes the blood to be pushed into the lungs where it picks up oxygen, then causes this blood to be returned to the heart and finally and very powerfully this re-oxygenated blood is forced through the body.

The rate at which the heart beats appears to be directly related to the metabolic requirements of the body, but the way in which this is done is not currently understood. However virtually every part of the brain yet examined appears to play some part in the determining and controlling heart rate.

Short of simply feeling one's pulse and timing it with a stopwatch, the next simplest method is to monitor fluctuations in blood density as the pulse occurs. This may be done opto-electronically using a simple light source and photocell attached across an ear-lobe or finger tip.

There is growing evidence that the ability to control heart rate via a biofeedback process would be of value in protecting it from undue stress. As with most biofeedback activities it is very easy to do this given the correct apparatus. Yogis have, of course, gained such

biofeedback

control *without* apparatus. Nevertheless it should be emphasised that less appears to be known about heartrate control than galvanic skin response or myography.

BRAINWAVE MONITORS

The brain produces four major electrical rhythms, classified by frequency. These rhythms may be monitored by an electroencephalograph (EEG) which detects, amplifies and displays them electrically.

The major rhythms are –

Beta: 13-30 Hz – associated with attention, anxiety.

Alpha: 8-12 Hz – associated with relaxation, well being.

Theta: 4-8 Hz – associated with imagery, meditation.

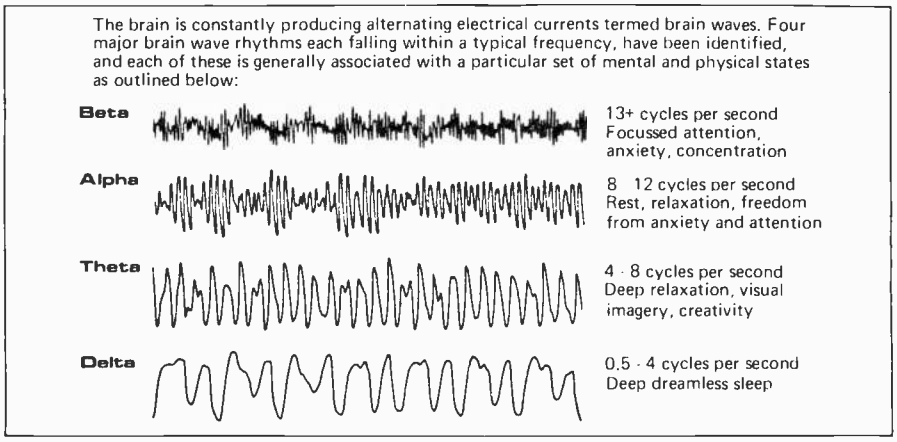
Delta: 0.5-4 Hz – associated with dreamless sleep.

Generally the rhythms are produced in short bursts – often of 10–25 cycles – and generally non-overlapping.

The signals may all be monitored via one set of electrodes placed at the front and rear of the skull – a third electrode is also used to provide a 'reference'.

All four rhythms have very low amplitude – about a microvolt or two – so that good noise performance is essential if the equipment is to function correctly.

Very good filtering is also required to eliminate interference from stray 60 Hz signals and also to prevent interference from artifacts (spuria generated by muscular activity). Analogue filters having the required characteristics can be produced but digital filters should preferably be used. If an analogue filter is used, a good one is a three-pole Butterworth with 18 dB/octave rolloff.



It is almost essential to use a differential input amplifier using low noise devices. Input cables must be shielded. Common mode rejection should be about 120 dB at 10 Hz and if possible at least 150 dB at 50 Hz. Input impedance should be no less than one megohm. The output indication should be aural. Most people prefer to have their eyes closed when trying to generate alpha rhythms.

Alpha training has become somewhat of a cult – particularly in the USA where a large industry exists simply to supply alpha monitors (of varying efficacy!)

Most people can learn to generate alpha rhythms at will and there is a great deal of evidence that a state of well-being and deep relaxation is associated with alpha production.

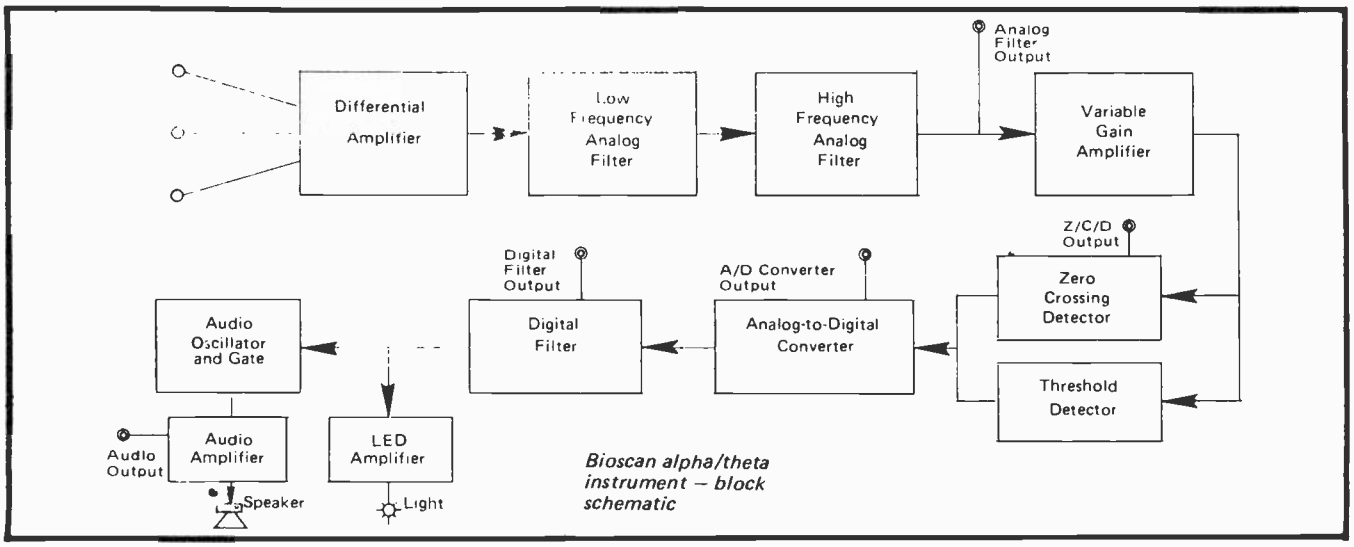
Alpha training is also used by clinical psychologists and psychiatrists particularly in attitude change and re-inforcement.

Theta waves are also controllable. This type of waveform appears to be in some way associated with creativity. It may well be that creativity can be enhanced by learning to control a theta state: we understand that some researchers are investigating this at present.

Biofeedback is still very much an infant and largely orphan science and at present it is difficult to forecast just what impact it will have on mankind.

There is ample evidence that by using biofeedback the average subject can in minutes learn to vary his state of tension, body temperature, heart rate, brainwave generation etc – techniques which have taken gurus a lifetime to master.

Many autonomic nervous functions clearly *can* be willfully controlled and there is growing evidence that many tension-related illnesses (and about 90% of illnesses are currently believed to be so related) can be alleviated or cured by biofeedback techniques. ●



Bioscan alpha/theta instrument – block schematic

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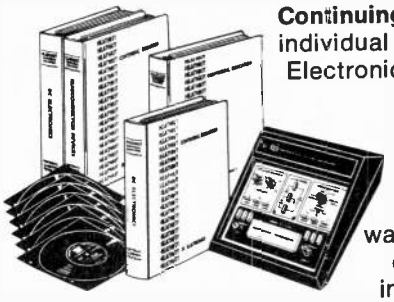

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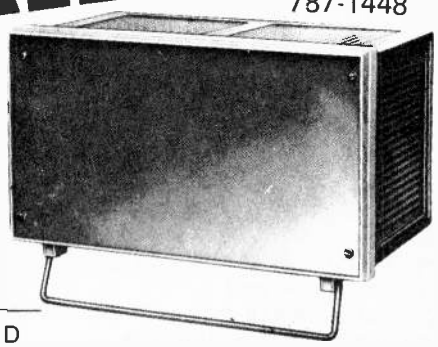

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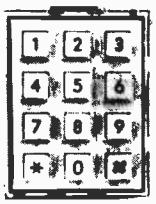

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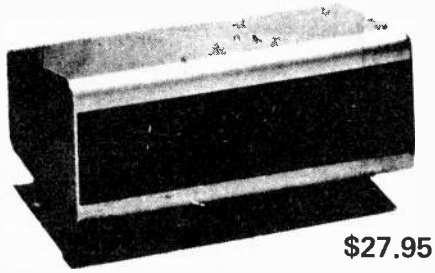

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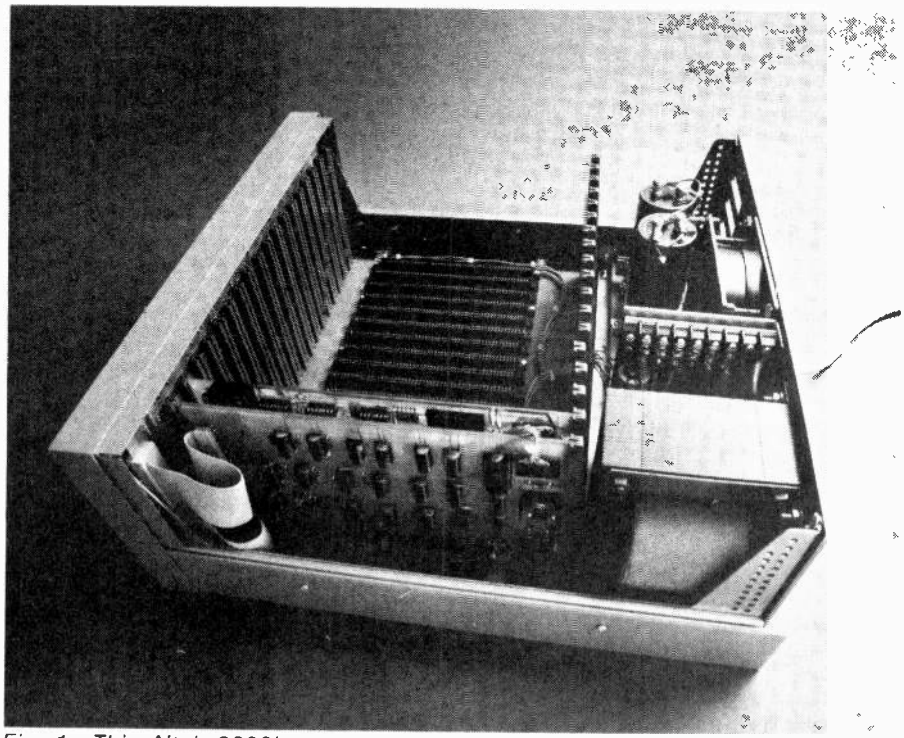

Fig. 1. This Altair 8800b shows the internal construction of a microcomputer. Note the heavy duty supply and the card slots, both designed for easy expansion.

IN THE LAST TWO ISSUES, we have devoted considerable space to a description of microprocessors, using Intel's 8080 as an example. That's fine, some of you may be saying, but isn't it a bit abstract? Why are electronics mags devoting so much space to this subject anyhow? And what can you do with a microprocessor?

This month, we're going to try to answer some of these questions.

ANCIENT HISTORY

Way back around five years ago, a company called *Viatron* were in the business of making Video Display Terminals for computers. They thought it would be great, instead of using conventional logic, to make the internal organization of the VDT more like a computer, and give it some "thinking" power.

Now, the terminal didn't require mini-computer type power; something much simpler would do. Viatron asked *TI* and *Intel* to develop a chip which had several registers for holding bit patterns and the ability to do shifting, addition, ANDing, ORing — all basic computer functions. Intel actually made the device, and got it to work, but unfortunately Viatron folded, and Intel were left with a product and no-one to buy it. They could either ditch the project or announce it to the outside world — fortunately, they chose the latter course, and that was the birth of the 8008.

The first people to start using the microprocessor were the computer industry, as they could see the possibilities in giving computer peripherals such as printers, card readers, etc., some degree of "intelligence", i.e. the ability to make rudimentary decisions and control their own operation without referring back to, and tying up, the controlling computer. Other sections of the electronics industry soon caught on, and microprocessor-controlled oscilloscopes, frequency counters and other equipment started to appear.

WHERE NEXT?

The advantages of the microprocessor over other forms of logic were obvious — a few chips could be made to do the work of many, instruments could be made to do tricks like converting Fahrenheit to Centigrade automatically, the operation of equipment could be changed, or options added, merely by changing the control program; which usually involved changing over one or two ROM chips.

But the 8008 was slightly limited in instruction set and speed and awkward to interface. Development was under way at Intel to produce the first of the second-generation MPUs — the 8080. The use of NMOS technology allowed a 10 to 1 improvement in speed, 30 extra instructions, and simpler interfacing, as the lower power dissipation of NMOS allowed more output buffers to be used in a 40 pin package. The 8080 contains about 5000 transistors and can execute an instruction in as little as 2μs.

Meanwhile, other manufacturers were frantically preparing to launch new products, notably *Motorola*,

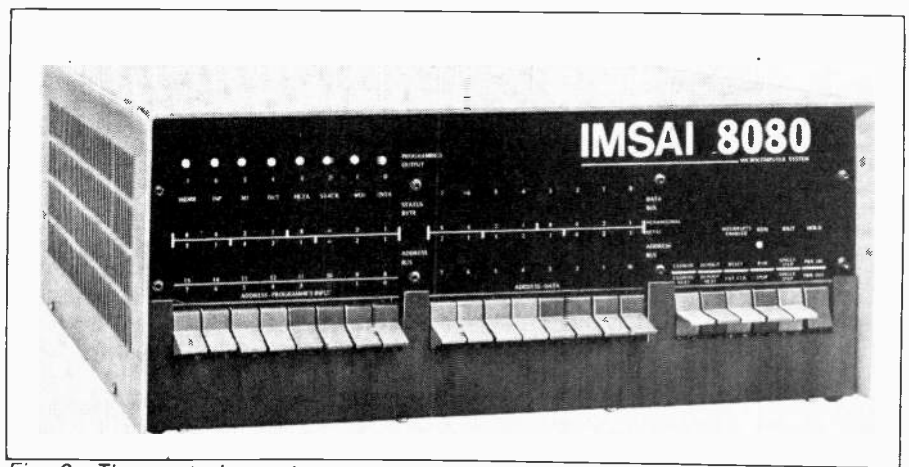

Fig. 2. The control panel on this IMSAI 8080 has LEDs to display the address bus, the data bus, and a programmed output, and switches to input addresses and data. There are also switches and LEDs to control and display the status of the processor.

whose 6800 is broadly comparable to the 8080. Other designs have appeared such as the *MOS Technology* 6502, *RCA*'s CDP 1802, *National*'s SC/MP, the *Fairchild* F8, *Rockwell*'s PPS-8. As well as these 8 bit models, there are 4 bit types (Intel 4004 and 4040), 12 bit (*Intersil* 1M6100 — a PDP 8 lookalike), and 16 bit (such as *National*'s PACE, *GI*'s CP1600, and *TI*'s TMS9900). The result has been a vast number of alternative and generally incompatible devices, which the professional has to evaluate to suit his particular requirements.

THE AMATEUR SCENE

As far as the hobbyist is concerned, it all started around late 1973 when a well-known US publication came up with a design for a rudimentary computer based on the 8008. This created a stir of interest, which became more than a stir when *MITS*, in conjunction with another US publication, announced the *Altair* 8800. This is based on the 8080 microprocessor, and most importantly, it is built like a proper computer. It has an impressive, but functional, front panel, a large power supply at the rear, and a card cage which can accept a large variety of plug-in options, all in a solid metal case.

Orders piled up immediately, and the whole hobby computer craze took off! Soon it seemed like every month a new computer was announced, and clubs were formed, new magazines appeared.

Fig. 3. The Poly-88 is a 'front-panelless' computer and uses a built-in VDU to control its operation.

WHAT'S AVAILABLE?

Here's a quick, very mini, consumer guide. The top of the line in computers is the mini-computer equivalent, in a case with front panel switches, card frame and power supply, such as the Altair 8800b shown in Fig. 1 or the *IMSAI* 8080 in Fig. 2. Both these computers, and the *POLY-88* shown in Fig. 3, use what is termed the S100, or Altair, bus, which means that the 100-pin connectors in their card frames are wired identically and carry the same logic signals. This means that the same plug-in cards will theoretically operate in all of these computers; and this has been a dominant factor in the hardware development of hobby microcomputers.

The Altair-type computer is normally supplied with a front panel and processor card — in order to make it work at all some memory (on another card) is required, and to work with a teletype or video display unit, some type of Input/Output (I/O) card is required. Remember this when estimating prices!

Information can be got into, and out of, this type of computer through the front panel switches and lights, but this is slow and boring and not at all conducive to relaxing with your hobby. A much more exciting, and useful, way to communicate with a computer is through an alphanumeric display such as a teletype or a video display unit. Teletypes are (a) expensive, (b) heavy, (c) noisy and (d) hungry for paper, so most hobbyists use video display units which produce printed text on a TV screen. These devices are available from many different manufacturers and the most popular are constructed on PCBs which plug directly into the S100 bus of an Altair or Imsai. More sophisticated models are available which can produce coloured patterns and graphics, such as the *Cromemco* Dazzler shown in Fig. 4. This is constructed on two boards which will plug into the S100 bus, and comes complete with programs to play various games.

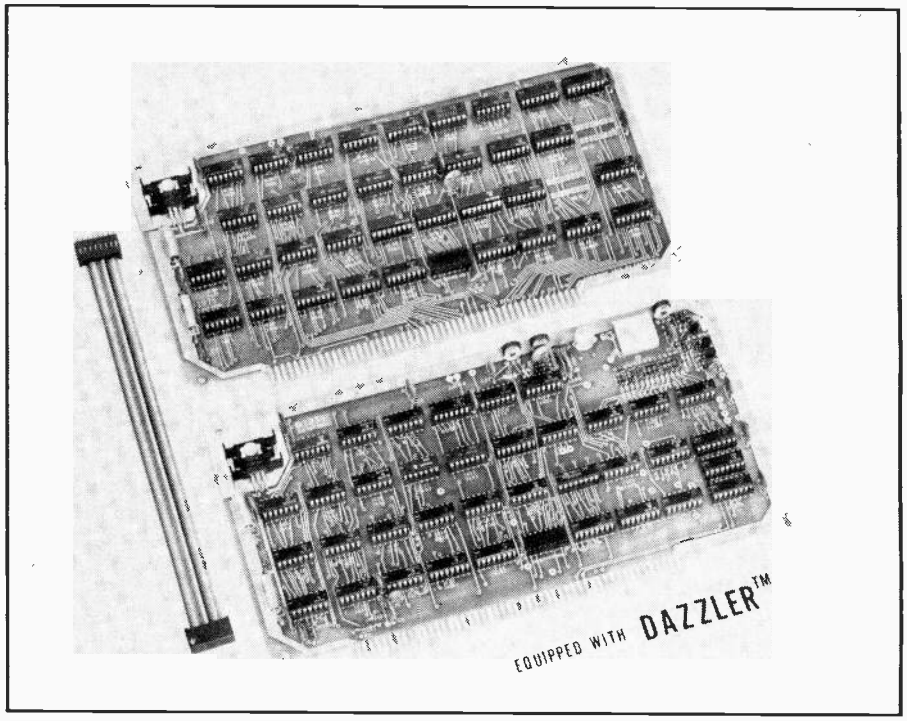

Fig. 4. Cromemco's Dazzler is a colour VDU for graphic computer games, like the smaller TV games chips but many times more versatile. It is built on two S-100 bus compatible cards and so fits several computers.

The Poly-88 in Fig. 3 does not have a full front panel, and so a VDU (or printer) is necessary to communicate with it. Similar computers are the *SWTPC* 6800, the *Wave Mate* Jupiter II and the *OSI* Challenger. All of these computers do without front panels by having monitor programs stored internally in Read Only Memory which can be used to interface the computer to a VDU or printer. When a computer is switched on, if it has no program already in memory, it will do absolutely nothing. There is no way of loading in a program automatically, it must be done manually — and if there is no front panal you're stuck. So most computers have a permanently stored program which can be utilized to load the user's programs and perform some other editing and debugging functions as well.

The next step from the fully expandable top line computers is the computer with built in keyboard and display. There are several of these available today, such as the *EPA* Micro 68 in Fig. 6. This uses the Motorola 6800 microprocessor and uses a calculator-type keyboard and display to key in and edit programs, which can then be stored on magnetic tape. This type of approach is ideal if you do not require lots of I/O as in conventional computer applications, but instead wish to use an MPU to (say) control your central heating. Other computers of this kind are *MOS Technology*'s KIM 1, the *EBKA* Famil-

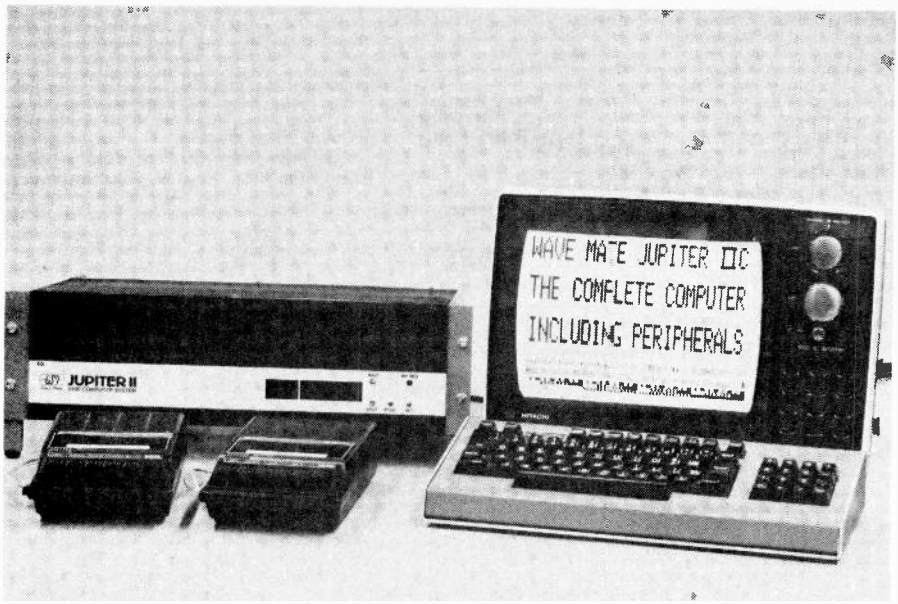

Fig. 5. The Jupiter II is a 6800-based computer built using wire-wrap cards. Again, a VDU is the prime method of communication with the computer.

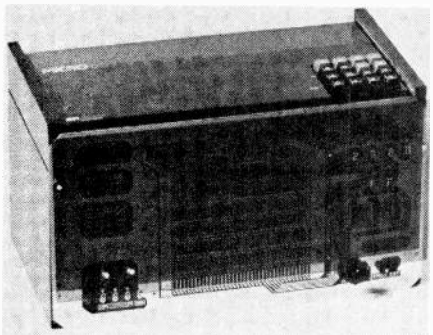

Fig. 6. The keyboard-and-display approach is illustrated by this EPA Micro-68 (shown here in its expanded form).

iarizor, *Infinite*'s UCI800, which is based on the RCA CMOS MPU, and *Motorola*'s MEK6800D2.

Finally, there are the single board microcomputers produced by the microprocessor manufacturers as evaluation kits. These are available from Motorola, Intel, National, RCA, Signetics, General Instruments, Intersil — in short every manufacturer produces these. Drawbacks are: they are generally memory limited, require a teletype, have little or no support software or hardware and conform to no particular standards. Advantages: cheap, and make you learn — fast.

WHAT DO I DO NOW?

OK, assuming you've got a microcomputer of some sort, what do you do with it? Or, more rationally: why did I buy this thing?

This is the question that is virtually impossible to answer. Most people buy a computer because they want to buy a computer, but why that should be is difficult to say. Not very many computer hobbyists have got a genuinely useful application for their machines — they really just like the mental exercise of trying to write a program or solve a problem and the feeling of accomplishment when they succeed.

Everybody who owns a computer is doing different things with it. Amateur radio computerists are running silent TV-based teletype, using computers for station control, keeping files on computer. Some people are using them for education, letting kids play computer games. Professional engineers and statisticians are solving their problems without punching cards. Other people are playing around with computer generated speech (plug-in speech synthesizers are available).

By far the most popular activities, however, are central to computing itself — mainly concerned with software. People are spending a lot of time writing I/O routines, floating-point calculator packages, and patch-up software simply to firstly, make their computers work, and secondly, make them work better. As we have said, most of the thrill of hobby computing is in the challenge of being able to do things — it's rather like mountain climbing.

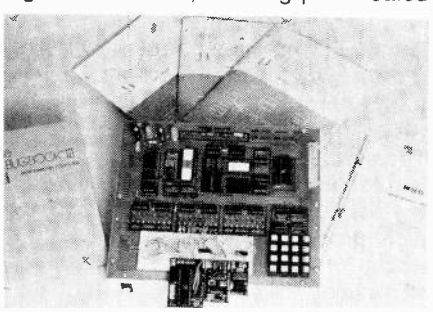

Fig. 7. The MMD-1 is specially designed to let you breadboard circuits for I/O and then test them – great for educational applications.

The point of all this diatribe is that people are out there having fun with computers — what they are all doing is anybody's guess, but everyone's found some interesting project to get their teeth into. At ETI, we intend to be involved in hobby computing to a considerable extent, and we'd like to hear from you. Only with feedback from you can we generate the kind of material we'd all like to read. And we're on the lookout for good articles, too.

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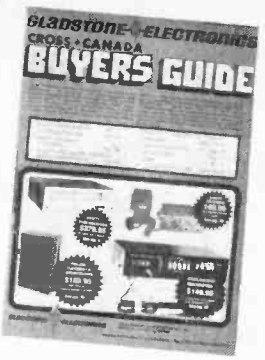

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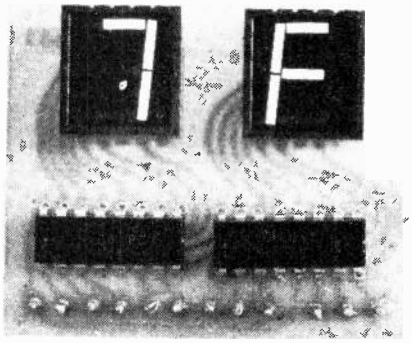
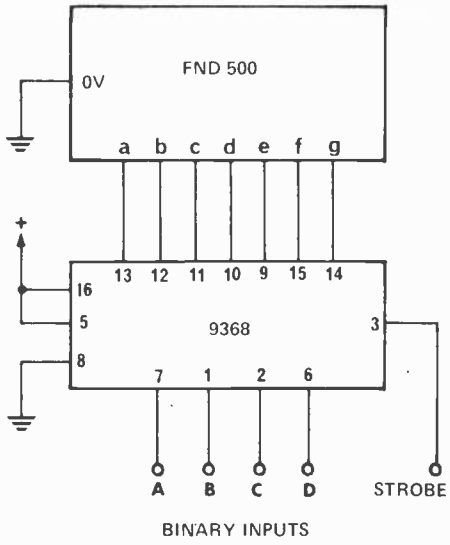




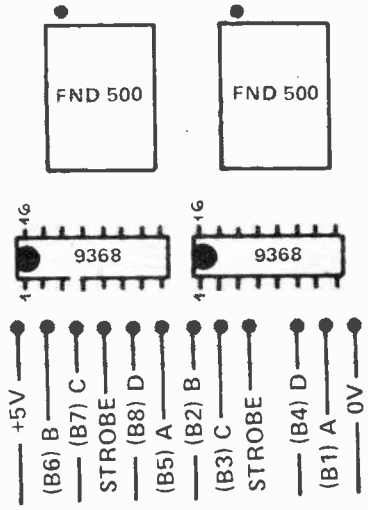
The circuit diagram of one half of the display.

THERE ARE MANY SITUATIONS in which the computer enthusiast wants to see the data on a parallel binary data bus (such as the one carrying the output from the terminal keyboard in this issue). Certain conventions have arisen to provide standard ways of displaying and manipulating large binary data words — because we are not equipped to handle information in the form of words like 00000000 or 11111111 (or words from 0000000000000000 to 1111111111111111.

Conventionally parallel buses are organised in multiples of four lines, and in microcomputing the most common bus-width is eight lines. Binary display is easily achieved — data on the bus is strobed into a latch and the contents of this latch are used to set up a display on eight LEDs. This project provides a small board with two displays to read an eight-bit word. If one display is all that is needed (to read a four-bit word) half of the design can be used — just saw the PCB in half.

The data is loaded into a latch on the 9368 IC when the strobe line is taken low. This IC also contains the display drivers and all the electronics for decoding. The inputs are standard TTL-level and positive-logic ('0'<0.4V, '1' >2.4V).

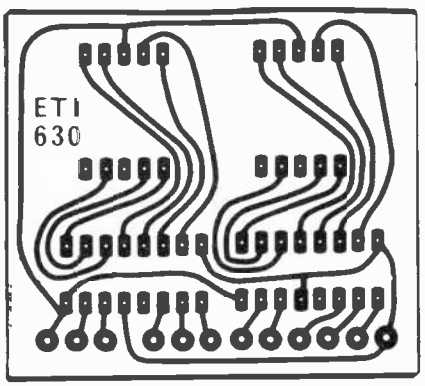
The power-supply requirement is a single +5V.



Component overlay for the ETI 630 board shown below.

SPECIFICATION ETI 630

No of digits	Two
Number system	Hexadecimal (base 16).
Display format	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, b, C, d, E, F.
Data input level	TTL positive logic.
Strobe input level	TTL active low.
Power supply	5 V, ± 0.25 V. Current consumption depends on display.



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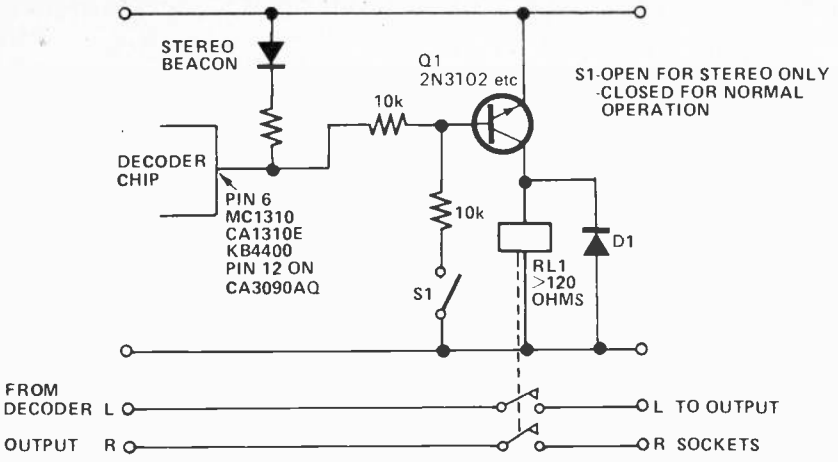


STEREO ONLY

This circuit allows only stereo broadcasts to be outputed by a tuner using either a 1310 or 3090 type stereo decoder chip. In both cases the stereo beacon driver is used to switch the audio output of the tuner. When a stereo signal is being received the beacon driver output is low which turns the Q1 and energises reed relay RL1. The two contacts which switch the output lines are closed and the stereo signal is available at the tuner output sockets. RL1 can be any reed relay with a coil resistance greater than 120 ohms and two normally open contacts.

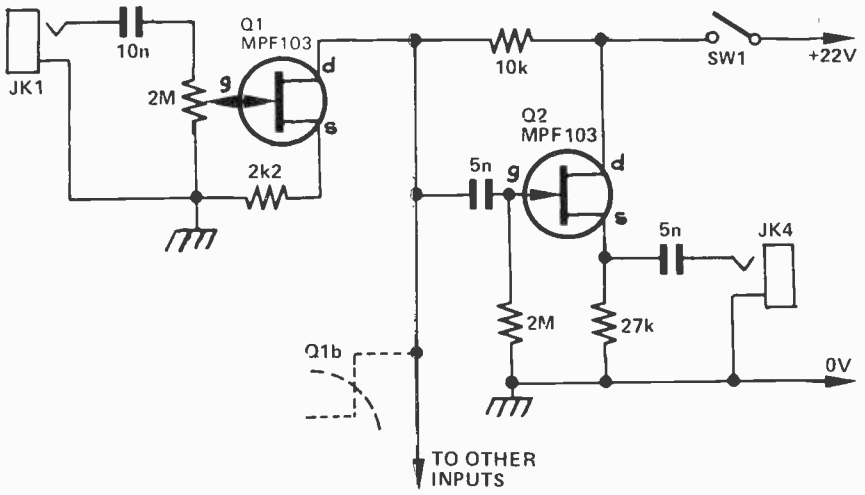
BASIC MIXER

This simple mixer circuit will work with two or three channels, providing excellent input isolation and exceptional frequency response, extending well over the top end of the audio spectrum.

It is usable by one or more instruments plus microphone, or with special effects, such as mixing an input with pink noise, to give 'surf'.

The unit will give 8db gain, and since low-level signals are involved, should be housed in an aluminium box. If a mains supply is used, the usual anti-hum precautions must be taken.

It is useful to use scaled slider potentiometers, so that effects may be re-created.



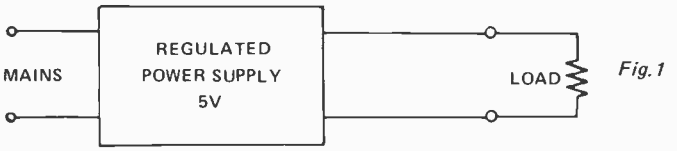


Fig.1

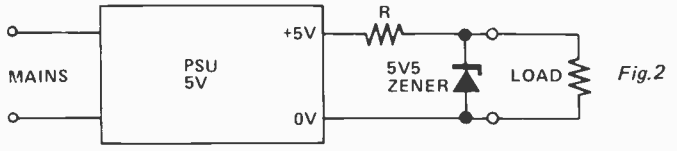


Fig.2

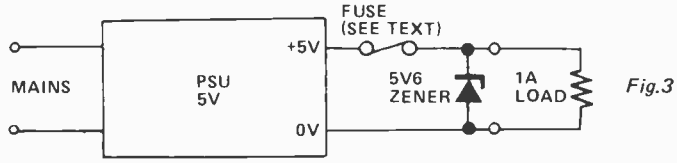


Fig.3

PROTECTION FROM TTL PSU FAILURE

With this circuit, a fault in the sophisticated PSU might cause the output voltage to rise above about 5.5V, (the maximum allowable) and thus cause damage to the ICs.

A simple zener regulator across the output as in Fig. 2 with a zener voltage of about 5.5V, means that at normal voltage, the zener is effectively open circuit. The effect of the load resistor R, would be to eliminate all the regulation of the main PSU.

In the circuit shown in Fig. 3, there is no load resistor to cause regulation problems, and the zener normally appears as an open circuit. But as soon as the voltage rises above about 5.5V the zener tries to draw a great deal of current and the fuse blows, cutting off the supply from the load.

CIRCUITS 1: $5

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See page 63 for details of how to order this publication from ETI.

OPEN CIRCUIT

by Tom Graham

"Associations must police TV servicing"

THAT HEADING WAS the essence of Sydney Handleman's comments with regard to some statements referring to policing the TV service industry in Ontario. This is a result of a recent article in the *Toronto Star*, who set up a trap and called 18 TV service companies at random to service an Admiral 19" color set with a high voltage rectifier tube deliberately blown.

While there are a few questionable aspects to this "survey" their conclusions were that if you call a TV service company at random the chances are 50–50 of getting overcharged.

Handleman pointed out that there is no way that the government could police the TV repair industry. But the problem lies in the fact that the MTTSA or the new OTEA for that matter, cannot police non-members. The MTTSA did take direct action on two members. One member was suspended for one year with the admonition that he take a refresher course in servicing and be able to prove his competence before being allowed back in to the Association. Another member was expelled from the Association for good.

Belonging to any association does not automatically make a person honest any more than not belonging makes a person dishonest. The Ontario government would have to give associations extraordinary powers and also financial support in order to have any association police the entire industry.

Ontario should look to the example of the cooperation between the P.E.G. and the Alberta government to see how the provincial association convinced the government to make it mandatory that all TV shops be certified and run a full time legitimate business before they are allowed to service any TV set. This has had the effect of virtually eliminating the 'moonlighters'.

The basic problem however still is in the fact that you cannot legislate honesty and the few bad apples in the barrel will always give the entire service industry a bad name. Of course you also cannot legislate competence. Too many servicemen do not take courses to update themselves on the state of the art. Also, unfortunately, these same incompetents won't even read this or any electronic servicing magazine in the first place.

If the Ontario government passed some sort of legislation that required every serviceman to obtain a Certificate of Qualification and also be required to write an up-date examination every two years or so, this would go a long way towards solving at least part of the dilemma.

Finally, with regard to this particular set-up, after studying the entire survey and listing to the MTTSA members' comments, the real probability of being overcharged is 30% or even 20%. This is because Admiral have issued a memorandum on this particular set that states that if the HV rectifier blows you should also replace the damper and the horizontal output tube as a measure of preventive maintenance. ●

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