

# Breadboard survey — 1

A look at solderless circuit construction aids

EVER SINCE electronic circuits have not behaved as designers intended, "breadboards" or patchpanels have been built to quickly assemble, modify and dismantle circuitry. Over the years various commercial types have appeared varying in style from a bare board sprouting with leads and "croc-clips," to a panel two foot long and littered with enough readouts, switches and controls to confuse even the most seasoned engineer. In the last few years several breadboard systems have been designed which are simple to use and can quickly pay their way in a work-

shop. Although any system which allows components to be temporarily connected together can be called a breadboard, the more popular types have a number of standard features. The most important of these is the method of interconnection. A socket based system where components are plugged in is essential for good breadboarding because the components can be quickly changed and used repeatedly. Flexibility is also important so that different component types and sizes can be used on the same board. A third facility which makes for a good bread-

board is the inclusion of power supply points or rails.

Apart from these main features, there are several other points to consider before choosing a system. Size is important and this will depend on the flexibility of the breadboard, and whether it can be extended. Compatibility must also be considered together with any accessories which can or have to be purchased.

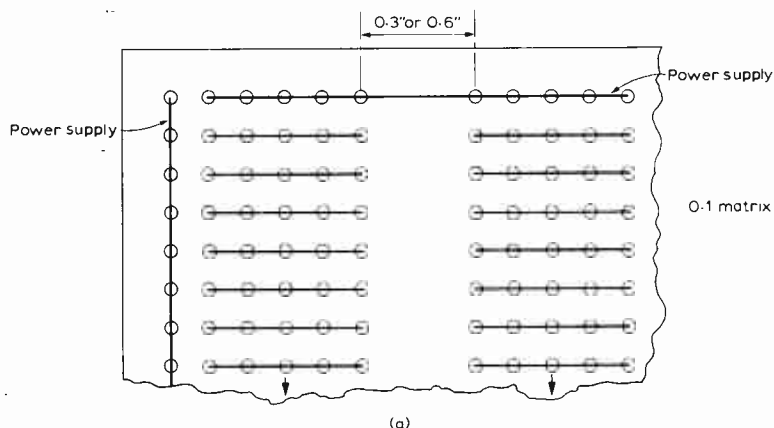
In general there are three types of breadboard currently available. The simplest types are breadboard blocks which are normally based on a matrix of sockets. These blocks will accept individual components which are then interconnected by the sockets and supplementary wiring on the block. When the circuit has been completed, the components and wires are unplugged and can be used again.

The second group of breadboards are more elaborate assemblies, often composed of several blocks mounted on a base board, with the provision of power supply terminals and several supply rails. These systems often have accessory kits such as jumper leads which can save more time. The most elaborate breadboards systems are normally housed in a purpose built case, and offer built-in power supplies, oscillators and other general purpose outputs which simplify circuit evaluation even further. Again, these complete systems are often based on individual breadboard blocks and can be used in the same way.

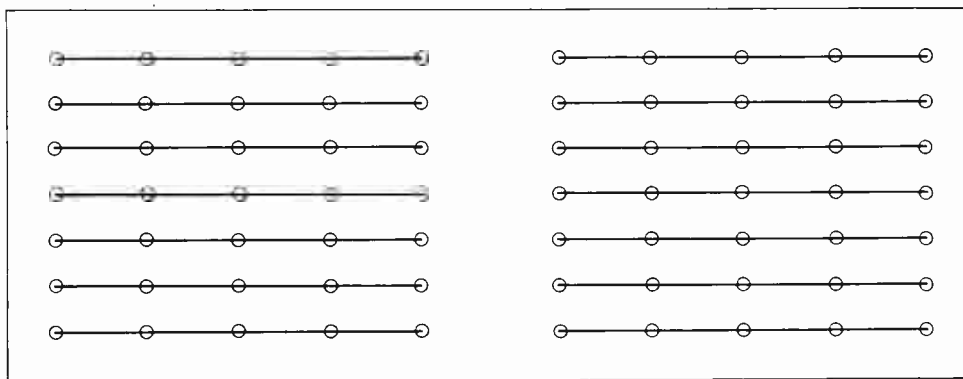
The main problem with all solderless breadboards is the socket connection. Unlike i.c. sockets, which are only used a few times, the conductive contacts have to be robust enough to survive many operations, and always provide a reliable low resistance contact. To overcome this potential problem, several types have strips of contacts which can be replaced if a socket is damaged. This facility is very useful because a damaged or intermittent connection can waste more time than the breadboard will save.

## Breadboard blocks

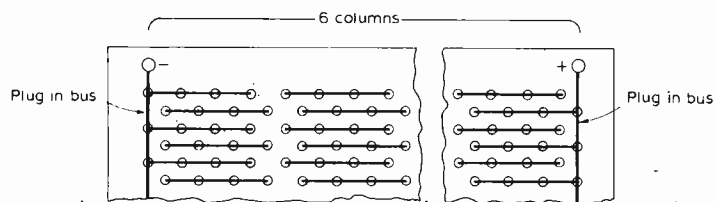
**Euro Bread Board**, see Fig. 2, measures  $92 \times 82\text{mm}$  and follows the socket connection system of Fig 1(a). A single panel will accept 0.3 and 0.6in i.c.s as well as most discrete components with leads of up to 0.85mm dia. A total of 500



(a)



(b)



(c)

Fig. 1. Breadboard socket systems.

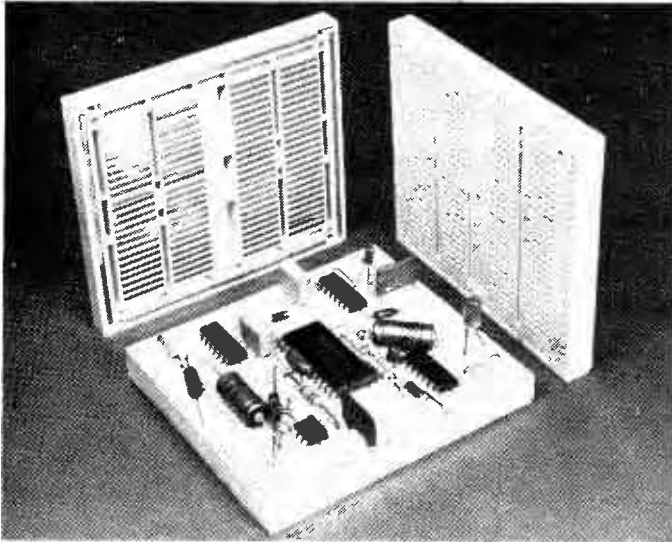


Fig. 2

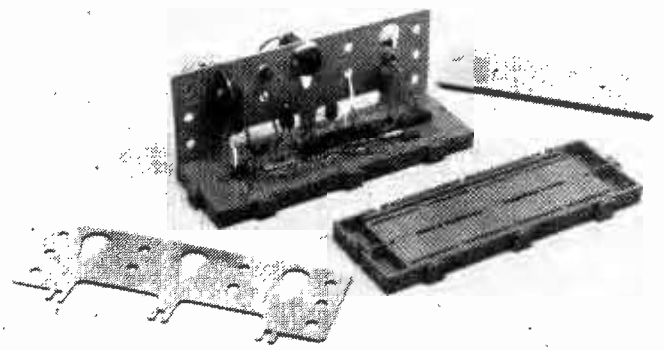


Fig. 3

sockets are provided based on a 0.1in matrix with four columns of 25 separate rows each containing five interconnected sockets. Four extra rows, each of 25 sockets, surround the matrix and are used as power supply rails. The layout is designed to accept two rows of 0.3in i.cs and one row of 0.6in i.cs. All of the socket strips, which are replaceable, are double sided types made from nickel silver alloy and rated at 1A. Contact resistance is specified as below 10m $\Omega$  and the life is quoted as above 10,000 insertions.

**Bim Board 1**, see Fig. 3, measures 150  $\times$  50mm and follows the socket connection system in Fig. 1(a). The layout will accept 0.3in i.cs, or 0.6in types by sacrificing some potential connection points. Most other discrete components can be accommodated with lead diameters up to 0.85mm. The block has 470 main sockets in a 0.1in matrix organised in two columns, each of 47 rows containing five interconnected sockets. Two extra rows, each of 40 interconnected sockets, serve as power supply rails. The strips of sockets, which are replaceable, are double-sided types constructed from nickel silver with a contact resistance rating at 1A of 10m $\Omega$ . On the top of the board the matrix area has the columns and rows numbered and lettered for easier circuit construction. The plastic moulding is provided with male and female connectors so that several boards can be locked together in an expanded system. A plug-in vertical panel is also provided for mounting external components.

**Super Strip**, see Fig. 4, measures 165  $\times$  57mm and follows the pin connection system in Fig. 1(a). The layout will accept 0.3in i.cs, or 0.6in types by sacrificing some potential connection points. Most other discrete components can be accommodated with lead diameters up to 0.81mm. The layout has 640 main sockets in a 0.1in matrix which is arranged as two columns, each of 64 rows containing five interconnected sockets. Four extra rows, each with two

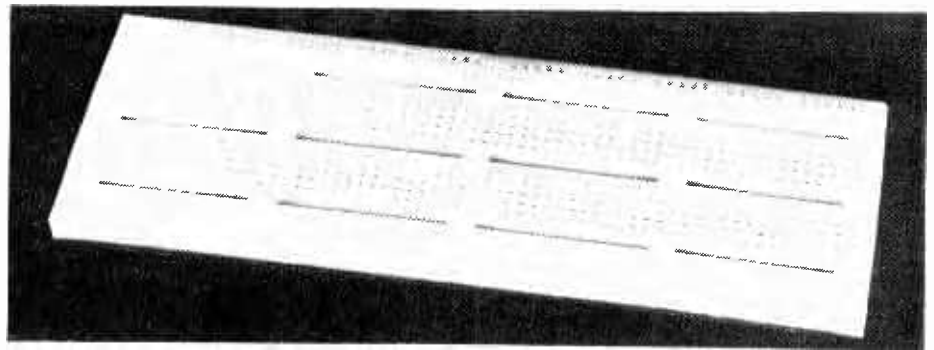


Fig. 4

strips of 25 linked sockets, provide eight power supply rails. The double-sided strips of sockets are available in nickel silver or with a gold plated finish. The blocks are supplied with a self adhesive backing compound for instant and semi permanent mounting. This backing can be peeled off to expose the socket strips which can then be removed. However, this is a sticky procedure and normally destroys the backing. Alternatively, the block may be mounted with self-tapping screws which are supplied.

**S Dec**, see Fig. 5, measures 114  $\times$  76mm and follows the socket connection system in Fig. 1(b). The board is designed to accept only discrete components with lead diameter up to 1mm. The layout has 70 sockets arranged in seven rows each with two strips of five linked sockets. The double-sided sockets are constructed from brass, and are rated at 5A. Each hole is numbered from 1 through to 70 on the top of the board.

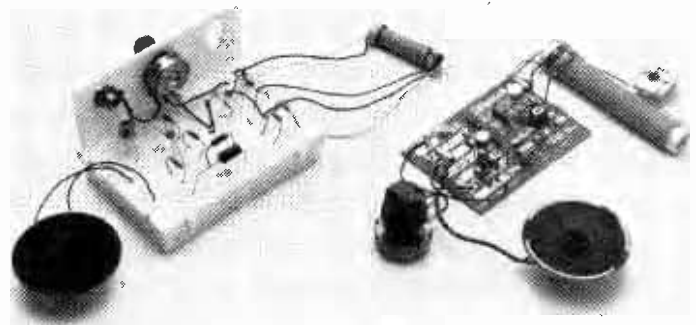


Fig. 5

An extension of this system, known as T-Dec, contains 208 contacts with alphanumeric labelling for the rows and columns. This board allows one i.c. to be plugged into the block via an adaptor. A further extension, known as  $\mu$ -Dec has a similar layout, but allows two i.cs to be used either directly or by adaptors.

A useful feature of all three versions is the availability of complementary printed circuit boards which reflect the layout of each board. This allows a breadboard layout to be transferred permanently to a p.c.b.

**Experimentor**, see Fig. 6, type 300 measures 152  $\times$  53mm, and type 600 measures 152  $\times$  60mm. Both versions follow the connection system in Fig. 1(a), and are designed to accept 0.3in or 0.6in i.cs together with most discrete components. The layout has 470 main sockets in a 0.1in matrix organised as two columns, each of 47 rows containing five interconnected sockets.

Two extra rows, each of 40 interconnected sockets, serve as power supply rails. The strips of sockets, which can be removed by peeling off an insulated backing paper, are a double-sided type constructed from nickel silver alloy. The top of the block has the matrix area numbered and lettered, and the plastic moulding has a male and female locating groove on each side. This allows both types of block to be snapped together either side-by-side or side-to-end. For permanent mounting, the moulding is also provided with four screw holes.

**I.C. breadboards** from Cambion are based on i.c. sockets and 0.040in jacks. Type 702 2 105 02 has four 18-pin i.c. sockets which are connected to corresponding jack sockets. By using patch leads, connections are made between the i.c. pins. Power supply and ground terminals accept bare wires or spade connectors. Type 705 0369 01 is a similar system measuring 165 × 159mm, but with 16 0.3in i.c. sockets. Solder turrets are provided for input/output and supply connections, and supply buses travel inbetween the rows of i.c.s. Two other boards in this range accommodate 32 and 64 i.c. sockets.

Alternatively, the three boards can be supplied with i.c. jacks instead of sockets.

**The Hirschmann Experimental Plate** in Fig. 7 follows the layout in Fig. 1(c). The board will directly accept most discrete components with lead diameters up to 1.2mm and, via special adaptors, 0.3in i.c.s. Interconnection of components is by special patch leads which are supplied in a kit. The plate has 1,128 connection points organised in six columns each with 47 rows of 4 interconnected sockets. The board is supplied with two plug strips which are used as power supply buses, and connect either 23 or 24 rows of sockets together.

The socket springs, which are constructed from beryllium copper and can be either nickel plated or gilded, have a contact resistance of around 45mΩ for 5,000 operations, and a current rating of 1A. The moulding has the columns and rows lettered and numbered, and dovetail clips are provided on two sides so that several plates may be joined together. The plate also incorporates four 4mm sockets which can be used for input and output connections.

A screw-fixed vertical panel is also available for mounting switches and potentiometers. Draft sheets are supplied which have a socket layout. This enables the constructor to draw a circuit plan on paper before assembling the breadboard.

**Wonderboard** is available in two sizes which measure 81 × 35mm and 81 × 140mm. The layout will accept most i.c.s and discrete components as shown in Fig. 8. The basic board contains six

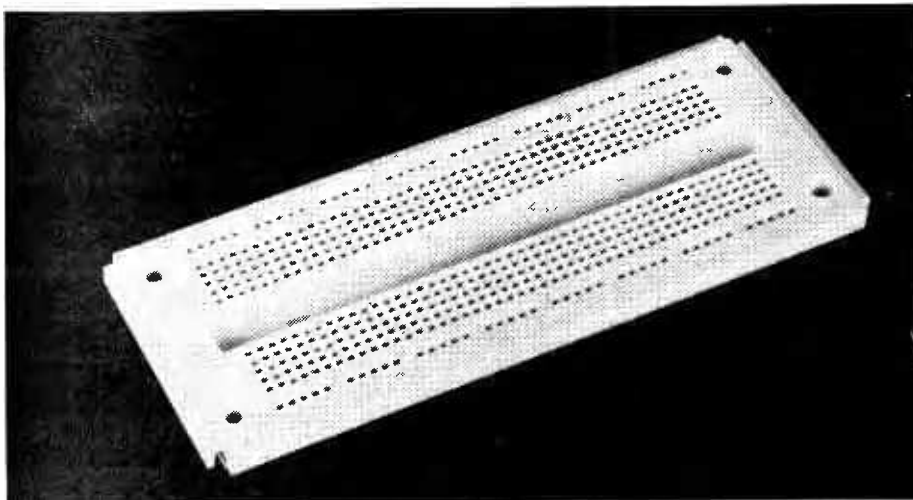


Fig. 6

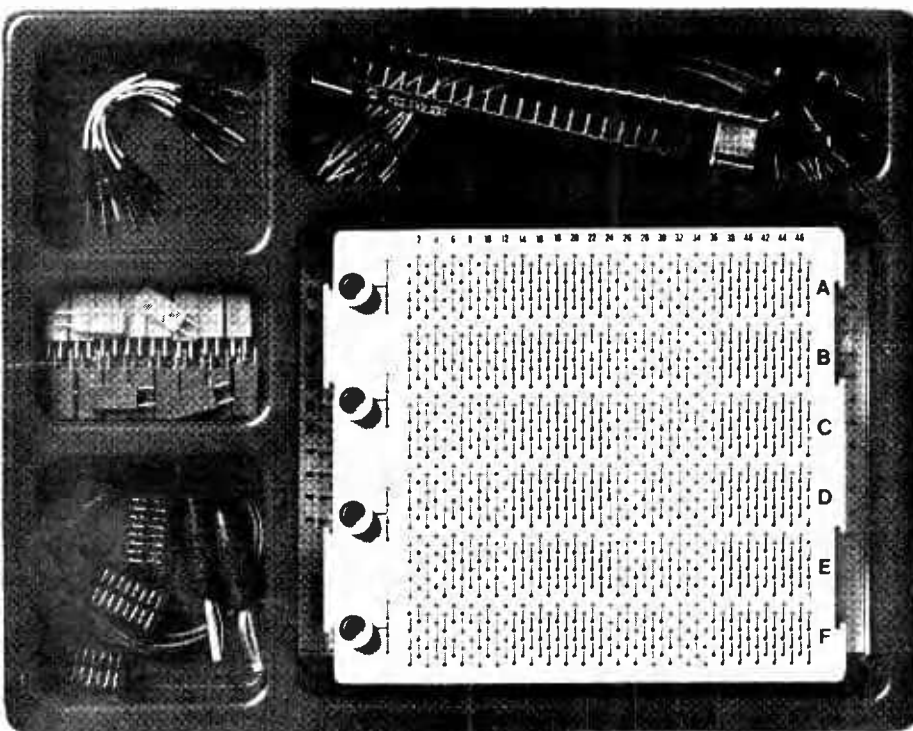


Fig. 7

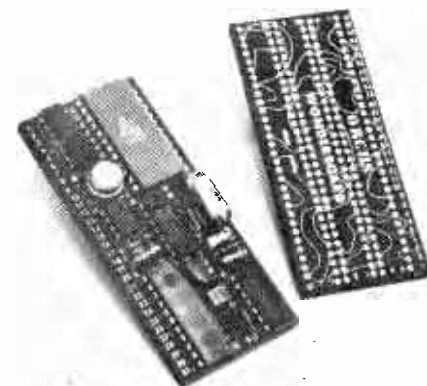


Fig. 8

rows of 31 holes. These rows are spaced at 0.3in and the holes are filled with a conductive elastomer.

Components are pushed into these contacts from the top of the board, while interconnection leads are used on the underside. Each contact can accept one component lead and up to six 26 gauge wire contacts. Contact resistance is specified as 10mΩ and the current rating is 7A, with a breakdown voltage of 9kV. Contact life is given as 150 insertions in a temperature range from -55 to +100 deg C. Both sides of the board have the co-ordinates labelled with numbers and letters for easier wiring. The larger board is laid out as four standard boards side-by-side.

*The concluding article describes breadboard assemblies, and gives a list of suppliers together with prices.*

# Breadboard survey — 2

## Assemblies and systems

Part one described the basic breadboard blocks. This concluding article covers breadboard assemblies and systems, many of which are based on the individual blocks.

THREE ASSEMBLIES based on the Bimboard 1 consist of either 2, 3 or 4 blocks mounted on a rigid aluminium base plate as shown in Fig. 9. Four screw-terminals are also supplied for connection to incoming power supplies. As with the single block, a vertical panel can be mounted to support switches and potentiometers.

Eight assemblies from A.P. Products, based on either their distribution strips or super strips, offer from 728 connection points and two screw terminals, to 3,648 connection points and four screw terminals.

Six assemblies from Continental Specialities, based on their bus strips mounted on a base plate, offer from 630 connection points with four screw terminals, to 3,060 connection points also with four screw terminals.

**The Vector Klip-Blok** breadboard system shown in Fig 10 consists of 0.1in matrix blocks organised as 12 rows each with four interconnected beryllium copper sockets. These blocks have four pins which locate in a base plate which contains a matrix of holes. Because the individual blocks can be moved, the system automatically accommodates all dual-in-line i.cs and most discrete components with lead diameters between 0.38 and 0.8mm. For larger lead diameters, special sockets are supplied. To supplement the blocks, metal socket strips are supplied, also with locating pins, which serve as power supply rails. These metal strips can be cut into shorter lengths to produce several supply rails. Both sides of the matrix base board are printed with a labelled grid to help with component placement. A useful feature of the Klip Blok system is the ability to wire on both sides of the base board.

Three board sizes are available from model 49X, which measures 67 × 114mm and accommodates two blocks and two metal socket strips, to model 51X which measures 114 × 203mm and

accommodates eight blocks, eight metal socket strips and three screw terminals. All of the base boards are mounted in an aluminium frame, and two larger frames will accommodate two or four 51X baseboards.

**Function boards** are modules designed to be used with the Ramp base board which also accommodates up to four Bimboards. A power board, see Fig. 11 which measures 150 × 50mm, allows breadboard circuits to use either TO3P, TO126, TO220, TO66 or TO3 type semiconductor cases on two 10W heat-sinks. The components are either plugged into a fixed socket and bolted to the

heatsink or bolted and wired with plug in leads to a breadboard circuit. Two terminal blocks allow external connections to, for example, a loudspeaker. The power board is supplied with connector leads and mounting hardware.

An oscillator board, which measures 150 × 50mm, contains a 1MHz crystal oscillator, six counters and a one-shot circuit. All inputs and outputs are brought out to labelled connectors which accept stripped wire connections in the same way as the breadboard. A set of four display boards, which again all measure 150 × 50mm, range from a four digit 5V version to a six digit 5 to 15V type. All of the boards accept multi-

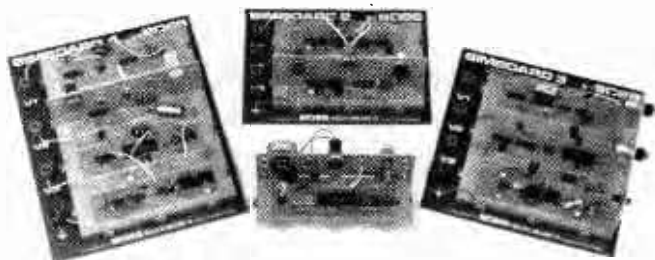


Fig 9

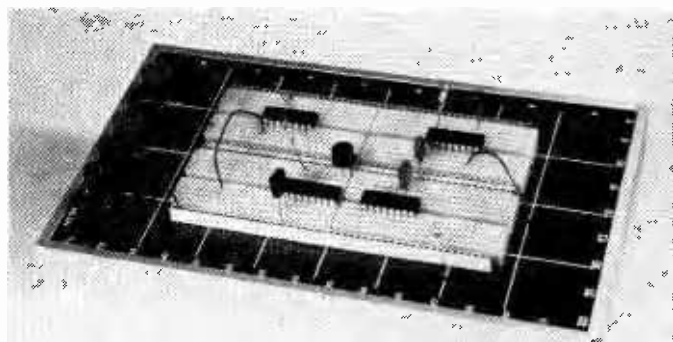


Fig 10

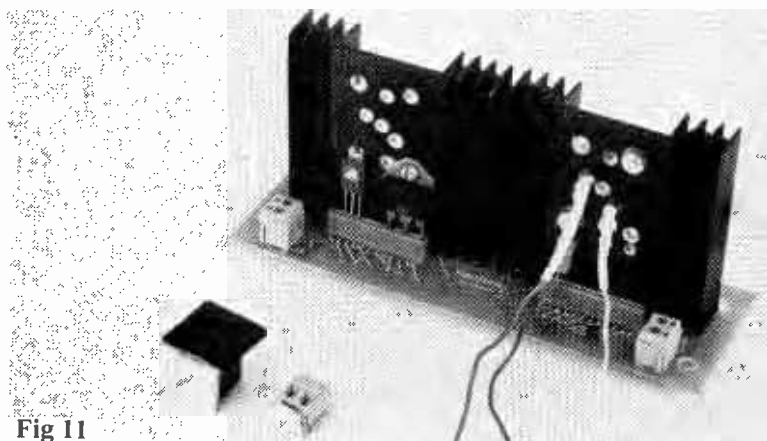


Fig 11

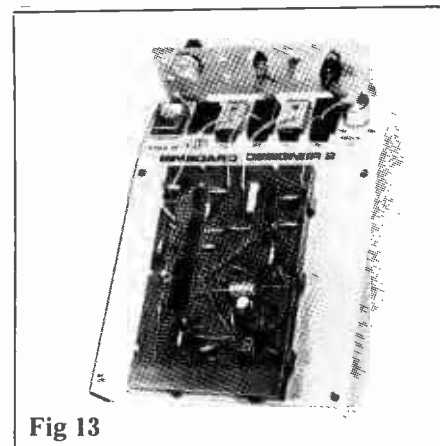


Fig 13

BREADBOARD	PRICE	SUPPLIER	BREADBOARD	PRICE	SUPPLIER
<b>Augat Breadboard Panels</b>		<b>Rastra Electronics Ltd,</b> 275 King Street, London W6 9NF.	" -1022- "	£73.30 + v.a.t.	
8 130-36DG1R	£269.72 + v.a.t.		" -1024- "	£41.50 + v.a.t.	
8 130-36DG1R-25	£139.16 + v.a.t.		Klip block 51X	£21.00 + v.a.t.	<b>Rhopoint Ltd,</b> Eastman House, 98-102 Station Road, East Oxted, Surrey RH8 0AY.
8 130-36DG1R-10	£58.97 + v.a.t.		" 50X	£14.00 + v.a.t.	
Bimboard 1	£8.83 inc.	<b>Boss Industrial Mouldings Ltd,</b> Higgs Industrial Estate, 2 Herne Hill Road, London SE24 0AU.	" 49X	£7.50 + v.a.t.	
" 2	£21.01 inc.		Laboratory Bread-board (kit)	£72.15 inc. v.a.t.	<b>Heath (Gloucester) Ltd,</b> Gloucester GL2 6EE.
" 3	£29.84 inc.		Ramp base board	£5.00 + v.a.t.	<b>Ramp Electronics</b> 105 Harehills Avenue, Leeds LS8 4HU.
" 4	£38.79 inc.		" power board	£10.95 + v.a.t.	
Bimboard designer 1	£55.62 inc.		" oscillator board	£22.95 + v.a.t.	
" " 2	£61.02 inc.		" display board A	£18.50 + v.a.t.	
" " 3	£66.42 inc.		" B	£19.95 + v.a.t.	
Euroblock	£5.80 inc. v.a.t.	<b>David George Sales</b> 74 Crayford High Street, Crayford, Kent DA1 4EF.	" C	£25.95 + v.a.t.	
Experimenter 300	£5.75 + v.a.t.	<b>Continental Specialties Corporation,</b> Spur Road, North Feltham Trading Estate, Feltham, Middlesex.	" D	£28.50 + v.a.t.	
" 600	£6.30 + v.a.t.		Super strip	£11.05 inc.	
Assembly 6	£9.20 + v.a.t.		Assembly 200	£12.53 inc.	
" 100	£11.80 + v.a.t.		" 201	£16.75 inc.	<b>Lektrokit Ltd,</b> Sutton Industrial Park, London Road, Reading, Berks RG6 1AZ.
" 101	£17.20 + v.a.t.		" 208	£19.35 inc.	
" 102	£22.95 + v.a.t.		" 212	£23.60 inc.	
" 103	£34.45 + v.a.t.		" 218	£31.70 inc.	
" 104	£45.95 + v.a.t.		" 227	£40.35 inc.	
Breadboard system 203A	£74.70 + v.a.t.		" 236	£53.50 inc.	<b>OK Tool Co Ltd,</b> 48a The Avenue, Southampton, Hants SO1 2SY.
Hirschmann Experimental Plate	£45.00 + v.a.t.	<b>Lectroustic Ltd,</b> 20 Wilbury Grove, Hove, Sussex BN3 3JQ.	236 with power supply	£78.95 inc.	
IC breadboards		<b>Cambion Electronic Products Ltd,</b> Castleton, Sheffield, S30 2WR.	S Dec	£3.50 + v.a.t.	<b>Bandridge Ltd,</b> 80a Battersea Rise, London SW11 1EH.
705-2105-02	£16.40 + v.a.t.		T Dec	£4.50 + v.a.t.	
705-0169-01	£173.40 + v.a.t.		µ-Dec A	£4.65 + v.a.t.	
" -0269- "	£92.80 + v.a.t.		µ-Dec B	£7.20 + v.a.t.	
" -0369- "	£54.20 + v.a.t.		Wonderboard small	£2.80 inc. v.a.t.	<b>Charcroft Electronics,</b> Charcroft House, Sturmer, Haverhill, Suffolk.
" -1020- "	£150.20 + v.a.t.		" large	£11.20 inc. v.a.t.	

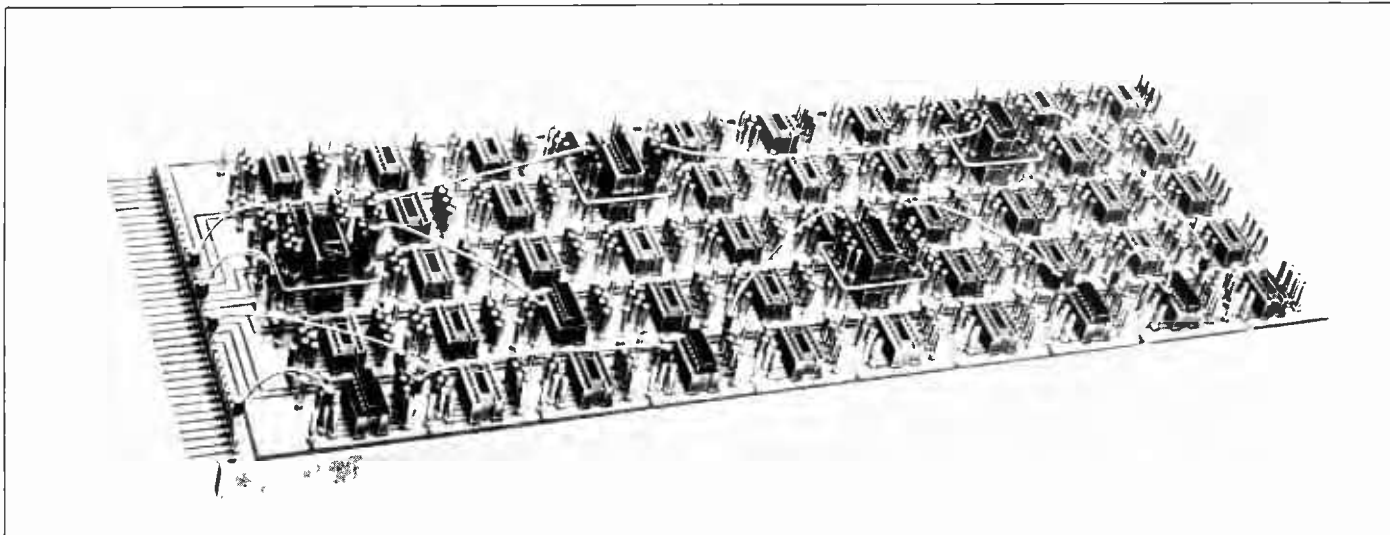


Fig 12

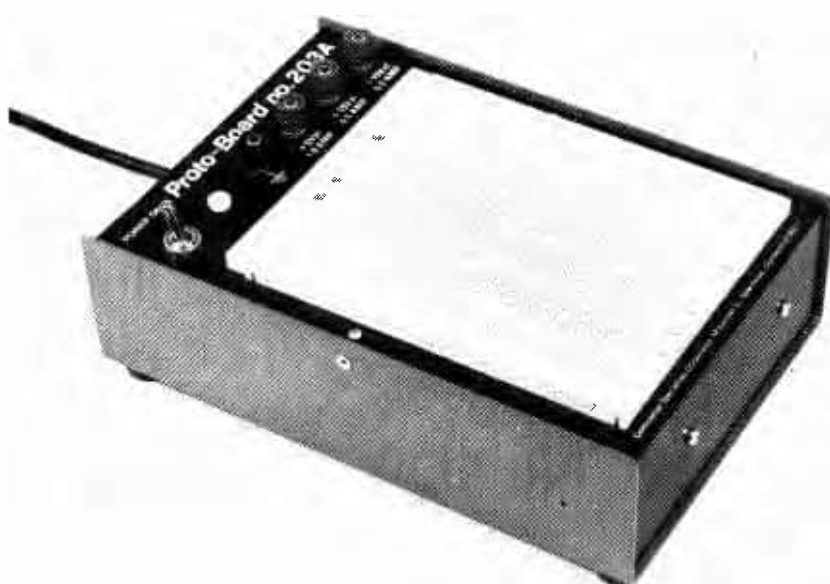


Fig 14

plexed b.c.d. or seven segment inputs via labelled sockets and stripped wires.

To supplement the function boards, there is a range of terminal blocks, sockets and a multi-zener, all designed to plug into a 0.1in matrix breadboard. The last mentioned is a single circuit-block which gives an adjustable zener voltage from 2.7 to 30V.

**Augat i.c. test panels** are available in three sizes, each 155mm wide by 106, 231, or 441mm long. These panels accommodate 10, 25 and 50 i.c. sockets respectively. Each i.c. pin has a vertical socket constructed from beryllium copper with gold-over-nickel plating, see Fig. 12, and connections are made by special patch leads. A 36-way edge connector, also with vertical sockets, is used for input/output connections and several power supply busses which travel in between the i.c. sockets.

This system can be extended by using single breadboard units. These small

boards contain similar vertical sockets together with pins on the underside which will locate on top of any one i.c. on the main board. The individual breadboards can accept more i.c.s or other components as required. A special plug/socket patch lead enables a connection to be made to the socket underneath the piggy-back module.

**The Bimboard Designer** in Fig. 13 consists of one, two or three Bimboards mounted on a console which contains a triple-rail d.c. power supply, comprising a dual tracking 100mA supply which can be varied from  $\pm 5$  to  $\pm 15$ V, and a fixed 5V output rated at 1A. All of the supplies, which are isolated from earth and from each other, offer short circuit protection. Power supply terminals on the top of the console accept either 4mm plugs or stripped wire.

The console is fitted with a mains switch/neon indicator, a fuse holder, and a vertical panel.

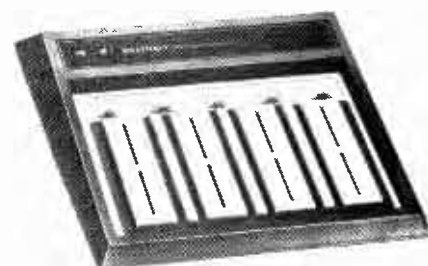


Fig 15

**Proto Board 203A.** Fig. 14, is composed of three Continental Specialties 0.1in breadboard strips and five power supply strips mounted on a steel case. A total of 2,270 connection points will accommodate up to 24 14-pin i.c.s together with discrete components. An internal power supply with short circuit protection gives three d.c. outputs of 5V at 1A and  $\pm 15$ V at 0.5A. Four screw terminals are provided for supply and earth connections, together with a mains switch and neon indicator. Dimensions for the unit are 247 × 165 × 90mm.

**Laboratory Breadboard Type ET3300** from Heathkit, see Fig. 15 is available in kit form or ready built. The console comprises four 0.1in matrix strips and three bus strips which will accept up to 24 14-pin i.c.s. The internal d.c. power supplies offer +5V at 1.5A,  $\pm 12$ V at 100mA, and are short circuit protected. Overall size of the unit is 89 × 304 × 304mm. □