MODIFICATIONS TO CYCLOPS

Part 2

by L. C. Galitz

This article concludes our 2-part series and describes the construction of the modifications which enable Cyclops to exhibit further reflex actions.

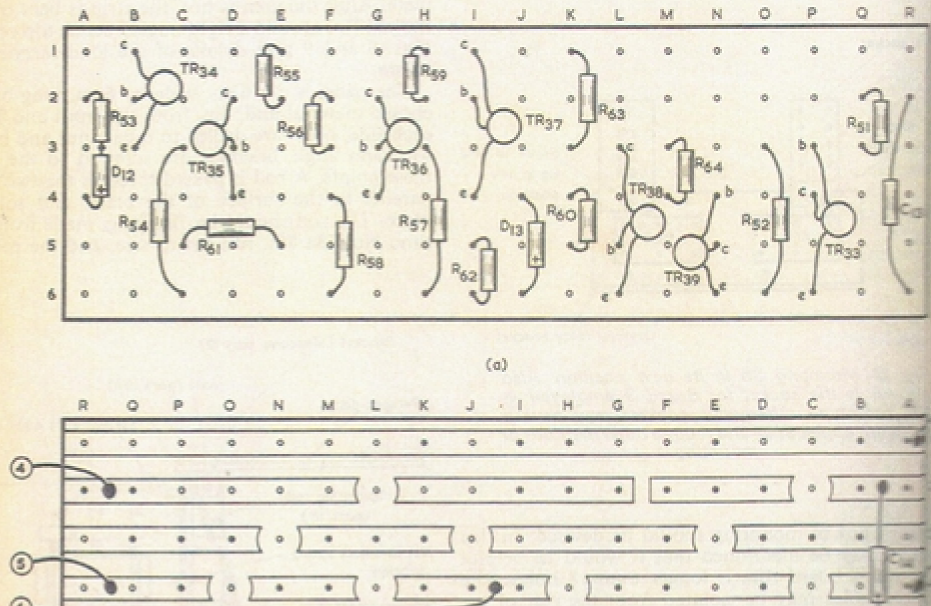


Fig. 5. (a) Component side of the veroboard employed for Board 3
(b) The copper side of the board

CONSTRUCTION

FIRSTLY, THE NEW BOARD HAS TO BE ASSEMBLED AS shown in Figs. 5(a) and (b), which illustrate the component and copper sides respectively. The board has a matrix of 0.15in., and has 6 strips with 18 holes each. The strips are cut as indicated in Fig. 5(b). Note that there is a break between F2 and G2 which is made with a knife, as opposed to the more usual method of cutting the strip at a hole.

It will probably be found most convenient to fit the following components vertically rather than horizontally: R53, D12, R61, R55, R56, R59, R62, R60, R64, R51. Note that the junction between R53 and the negative end of D12 is made above the board and not at any of the copper strips.

The circled numbers, from 1 to 8, in Fig. 5(b) show the plug pin numbers to which the various circuit points connect. The appropriate connections are listed also in Table II. If an 8-way plug is not employed the number references still apply so far as external connections to the board are concerned. Capacitor C14 is wired on the copper side of the board.

The new board is positioned above relay RLB, its socket being secured to the bracket which retains the relay in position. See Fig. 6. If a socket is not used, a suitable means of mounting should be devised. In this respect it may be mentioned that it would be helpful here to use a board that is longer than 18 holes. The additional holes may be isolated from the rest of the board by cutting the strips, and the extra section drilled to take a mounting bracket.

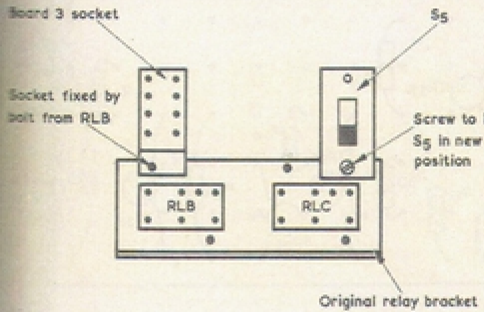


Fig. 6. Mounting S5 in its new position. Also shown is the socket for Board 3 employed in the prototype. Alternative sockets may have a different appearance and require other methods of mounting

Next, S5, the paralyse switch, which was originally mounted at the side of the push button unit S1-S4, should be moved to the back of the robot and mounted on the relay bracket along with the new board as in Fig. 6. Then the new push-button unit can be mounted. In the author's case, the switch was mounted by soldering two rods on top of the existing switch, and soldering the new switch to the rods, as in Fig. 7. However, there is plenty of room between the front of the robot and Board 2, and the new switch may be mounted there if preferred.

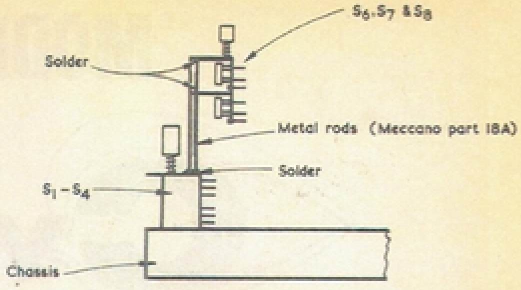


Fig. 7. Fitting the added switch, S6, S7 and S8

The two brackets for the load-carrying mechanism are made of Perspex, since they would otherwise obstruct the path of external light reaching Cyclops' eye. In the prototype the panel on which loads are placed was also made of Perspex. However, since the panel is above the level of the eye, any other suitable material could be employed instead.

The brackets are made 6¼in. long and ⅜in. wide. They are bent ¾in. from one end by gently heating the position to be bent over a flame or over an electric cooker hot plate. After the area is hot, the strip is bent by folding the last ¾in. around a right-angled bench top or the like. Figs. 8 and 9 give details of the load-carrying mechanism.

The panel is cut 6⅜in. wide by 6½in. long out of the chosen material and, ⅜in. from the front and ⅜in. from each side, holes are drilled to take a nut and bolt. Two Meccano angle brackets are screwed to the panel at these points. A rod is passed through the two brackets parallel to the surface of the plate, and soldered in place. The rod should be 7in. long, made from a Meccano No. 13a 8in. rod cut to size, and the rod should

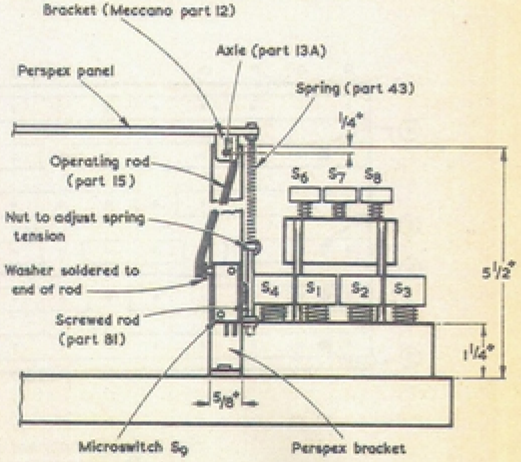


Fig. 8. The load-sensing assembly. When a load is placed on the Perspex panel this moves down slightly, against the tension spring, and operates the microswitch

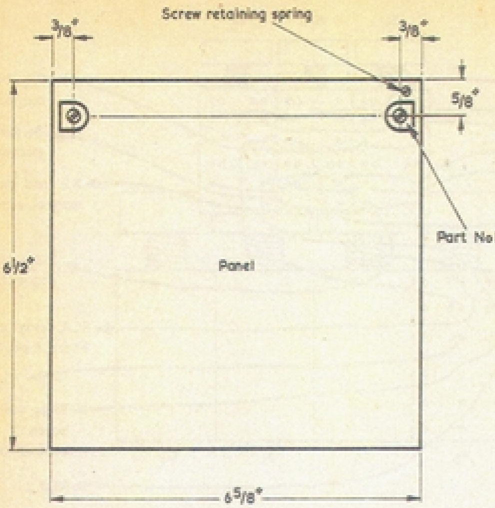


Fig. 9. Details of the Perspex load-carrying panel

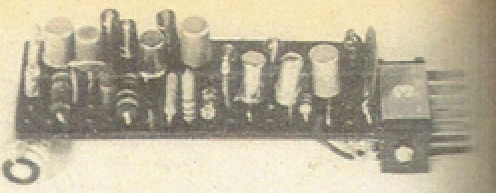
protrude from each angle bracket by ⅜in. Holes should then be drilled in the top of the Perspex brackets, ¼in. from the top, to take the rod ends. Holes should also be drilled in the bottom of the brackets in the centre of the bent section, so that the bracket may be screwed down to the chassis. The bracket on the switches side is screwed to the chassis between the end of the lower push-button unit and the bracket supporting the scan motor. The bracket on the other side is screwed in a matching position so that it is exactly opposite the first bracket. To the first bracket is screwed the micro-switch, 1½in. up and on the inside. The panel is put in position.

On the lower push-button switch assembly is drilled a hole beneath the edge of the panel above, to take a 2in. length of Meccano screwed rod. Directly above this hole is drilled a hole in the panel to take a nut and bolt, and a Meccano spring is screwed to the underside of the panel by means of this nut and bolt. About 1½in. of screwed rod is held in position on the switch unit by a nut above and below the switch framework. The other end of the spring now threads on the screwed rod, and is held in position by a third nut. This latter nut should now be adjusted so that the plate is horizontal.

Finally, a 5in. length of rod (Meccano Part 15) is bent to such a shape that, when soldered to the Meccano angle bracket at the top, it operates the microswitch when the panel is depressed slightly. The rod is soldered in position, and also a washer is soldered over its lower end so that a larger area is presented to the operating button of the microswitch.

The top nut on the screwed rod is finally adjusted so that normally the microswitch is not operated, but when a weight is placed on the panel the lever operates the microswitch. The spring should provide sufficient tension to return the microswitch to the off position when the load is removed.

It may happen that due, maybe, to a differing switch system, the microswitch details just given cannot be applied to a particular version of Cyclops. An alterna-



The appearance of the completed Board 3. Note that C14 is at the top, away from the plug end

tive position for the microswitch is just under the [...] away from the hinged end (i.e. at the back of Cyclops) so that the panel operates the microswitch directly.

The next stage is to add the new noise suppression capacitors C11 and C12. The former is soldered between the positive end of RLB coil and the positive [...] on the new board. See Fig. 10. C12 is soldered directly between pins 2 and 4 of the socket holding Board 2.

The penultimate stage consists of changing the wiring around the relays RLB and RLC, changing the wiring around S3, and wiring S6, S7, S8 and the new [...] into circuit. All the connections involved here are illustrated in Figs. 10, 11 and 12.

The final stage consists of carrying out modifications to Board 2 as outlined in Figs. 13 and 14, which show the alterations to the En output circuitry and the S[...] input circuitry respectively. These diagrams correspond to Figs. 33 and 34 in Part 6 of the series.

Cuts are made at locations B25 and F29, and the cut at D29 is bridged by a wire link. Then transistor TR[...] is inserted, along with R50. The positions of TR2[...] and diode D8 are altered as in the diagram.

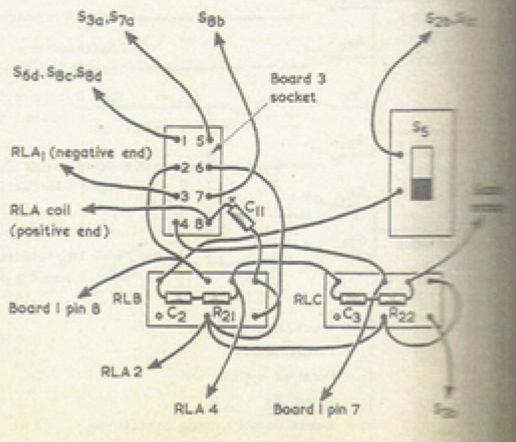


Fig. 10. Connections around Board 3 and relays RLB and RLC. Some of the wiring to the relays is already in existence

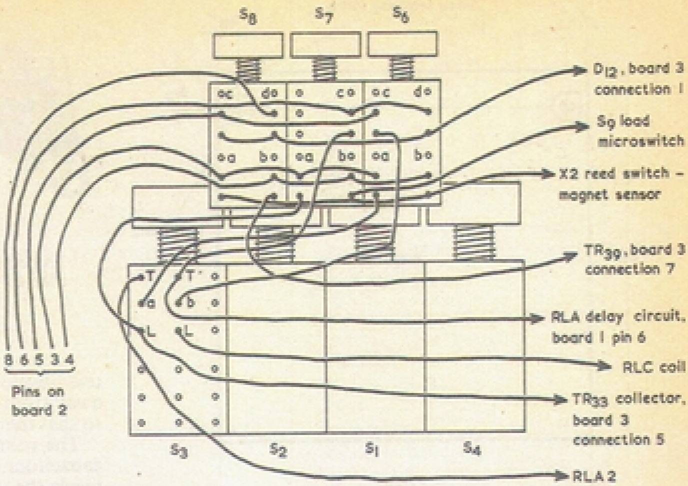


Fig. 11. New and existing wiring around switches S3 and S6 to S8

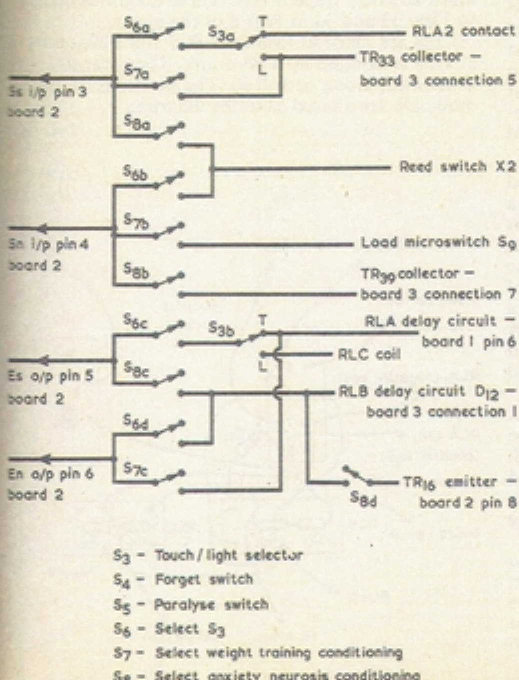


Fig. 12. Illustrating in detail the selector switch functions

The link from D28 to H15 is removed, and in its place is fitted a link from F31 to pin 7 on the plug. A 56KΩ resistor, R49, is wired between pin 7 and pin 4, the Sn input. Thus pin 7 on the plug serves as a link because the resistor wires are not long enough to stretch the whole distance by themselves. The final step in this part of the circuitry consists of replacing the link between D30 and pin 6 by a link consisting of two diodes between B26 and pin 6, wired with the polarity shown

Table II
Board 3 Connections

Connection Number	Nearest Hole	Board 3 Connection	External Circuit
1	A4	D12	From S6(d) S8(c), S8(d)
2	A5	R61	From RLB coil
3	A1	Negative line	From RLA1
4	R2	C13, R51	From RLC coil
5	R4	TR33 collector	From S3(a) S7(a)
6	I4	TR37, D13, R60	RLB coil
7	R5	TR39 collector	S8(b)
8	R6	Positive line	Positive line from RLA

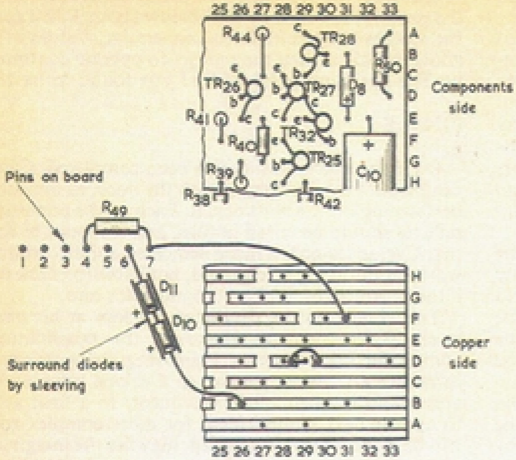


Fig. 13. Modifications to the En output circuit on Board 2. These are described in detail in the text

in Fig. 13.

Fig. 14 shows what Board 2 around the Ss input circuitry should look like after modifications. At location M5 is made a break, and the break originally at J3 is bridged by a wire link. The link between pin 2 and L5 is moved to M3, and now R47 is soldered from L5 to pin 3. The wire from pin 3 to J10 now goes to D5. Finally, a link goes from K4 to pin 8. It should be pointed out here that the pair of wires originally passing from pins 7 and 8 of the socket to switch S3(c) should be totally removed, because pin 7 is now used as part of the circuitry.

Referring to the top of the board, R23 should be removed from its present position, and another resistor, of value 2.2kΩ instead of 1kΩ, should be soldered in the new position between A4 and D4. R24 and R26 should be removed completely. The transistor at location I2, J2 and K2 should be allowed to remain, but is now TR16 instead of TR15. A new resistor, R48, is soldered between I3 and J3, and the transistor at I4, J4 and K4 should be displaced to J4, L4 and M4 respectively.

TESTING

The first items to test are the circuits which do not contribute anything new to Cyclops when considered by themselves, namely the circuitry around TR33 which replaces the use of RLC1 contacts, and the circuitry around TR34 to TR37, in conjunction with the modified En output circuitry.

Monitoring the output of the Ss monostable, i.e. the voltage at TR18 collector, check that shining a light into Cyclops' eye triggers the Ss monostable when both S3 and S6 are depressed. If the monostable does not trigger, then the values of R51 and R52 can be changed slightly to allow the pulse at their junction to have a greater magnitude when RLC coil energises. The monostable should not trigger when RLA is operated – if it does, then the values of R51 or C11 must be increased. With the selector switches in the same position, the magnet should be applied to the reed switch for a moment. RLB should operate for approximately three seconds. If the time is greater than about five seconds or less than about two seconds, the value of C14 must be changed to allow for this.

The next stage is testing the circuitry around TR38 and TR39. The collector of the latter transistor should, when S8 is depressed, rise from about 0.05V to 5.25V when either of the coils of RLB operates. The Sn monostable should thus fire when RLB *de-energises*, that is, when the input goes positive. It is important to check that Sn monostable does not fire when RLA operates, disconnecting the bottom ends of RLB's coils from the positive line. If Sn monostable should fire under these circumstances, then C11 should be increased in value, and if Sn monostable still fires, then R60 and R61 must be increased.

With S8 still depressed, operation of RLB when the magnet is applied will check the operation of the circuitry around TR15 and TR16.

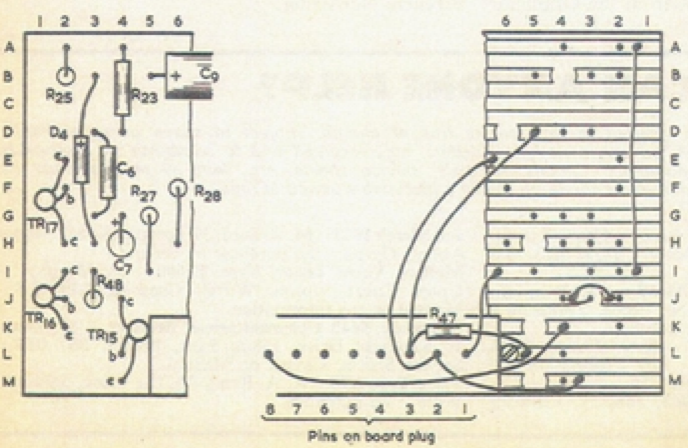


Fig. 14. The modifications that are carried out at the Ss input circuit

The final thing to do is check the value of R53. When Cyclops has been conditioned, with S8 depressed, the moment the coil voltage of RLB drops, a pulse is fed into Sn, which immediately evokes Es due to conditioning, thus sending a pulse to D12 which causes RLB to operate again. The moment RLB operates the Sn input is cut off, switching off Es whereupon, after the delay afforded by the RLB delay circuits, the cycle of events repeats. The desired visual effect is that Cyclops' motors should pulse momentarily, pause, pulse, pause, and so on, until conditioning ceases through lack of reinforcement.

However, a finite time interval lapses between the voltage dropping on RLB coil and the motors starting, due to the finite time it takes for the magnetic field inside RLB to collapse, and due also to the finite time required for the motors to accelerate from rest. The electronics, however, work instantaneously. The moment the voltage drops on RLB coil, Sn triggers, causing Es to trigger, and causing RLB to energise before the motors have had a chance to operate. The function of R53 is to prevent the above happening, by allowing a finite time interval to elapse between a voltage appearing on D12, and C14 charging up sufficiently to operate the Schmitt trigger.

The value of R53 must be found experimentally. In the prototype, values of R53 below about 3.3kΩ caused the motors to be completely inoperative. Values of R53 above 100kΩ caused the motors to operate continuously. The optimum value of R53 was found to be 10kΩ.

FINALE

Once the above testing has been completed, Cyclops can be put through his paces on the floor, as opposed to performing on the workbench. Each of the conditioned reflexes should be tested in turn, and it should be found that Cyclops is now a more dedicated animal, willing to work for his living if rewarded, but liable to break down if the pressures of 'life' get too much for him.

This concludes the details on Cyclops at his present level of development. However, the possibilities of adding further senses or improving the existing performance of robots similar to Cyclops offer exciting and rewarding fields for experiment. In a final article, to appear next month, ideas for more complex robots will be given which, it is hoped, may fire the imagination of some constructors, who may even build the first all-purpose domestic robot! ■

CLUB EVENTS

● University of East Anglia Radio and Electronics Club are to hear a talk, illustrated by films and slides, by Keith Schleitcher, VK4KS on Friday 4th May on an expedition to the Mellish Reef. Thursday 24th May there will be a visit to the Royal Naval Reserve Communications Centre at Norwich.

The Club now has its own Clubroom – Room 29 U.E.A. Village. The Hon. Secretary is Mike Wade, c/o G3UEA.

● Otley Radio Society are presenting the Northern Mobile Rally at the Moorgrange School, Ring Road, West Park, Leeds, on Sunday 20th May. Details from D. G. Mott, 17 Newall Carr Road, Otley, Yorkshire.

● Spalding & District Amateur Radio Society will be holding the 1973 Spalding Tulip-Time Mobile Rally on Sunday 6th May at Surfleet, 4 miles north of Spalding on the A16.

They will also be operating a special activity station, GB3STF, on 12th and 13th May, from the Grammar School, Priory Road, Spalding, in connection with the 1973 Tulip festival. The Wireless Preservation Society will have an exhibition of vintage radio on show to the public.

Details of the above from R. Harrison, G3VPR, 38 Park Avenue, Spalding, Lincs.

● Derby Radio Society have the following programme for May – 2nd. Surplus sale – 9th. Surprise Night – 16th. D. F. Practice Night, No. 2 – 23rd. Expedition to Andora A.R.C.O.N. – 30th. Film show.

Hon. Secretary F. C. Ward, 119 Green Lane, Derby.

● The British Amateur Electronics Club inform us that they have no lady members and they hope that as a result of this announcement, some of our lady readers will write to enquire about membership.

Those interested should write to C. Bogod, 26 Forrest Road, Penarth, Glamorgan, for details which he will gladly supply, together with a sample copy of the club's excellent Newsletter.

CAN ANYONE HELP?

Requests for information are inserted in this feature free of charge, subject to space being available. Users of this service undertake to acknowledge all letters, etc., received and to reimburse all reasonable expenses incurred by correspondents. Circuits, manuals, service sheets, etc., lent by readers must be returned in good condition within a reasonable period of time.

Radio Constructor, August 1969 issue – Chas. Tyrrell, 3 Grenville Ave., Torquay, Devon, TQ2 6DS. To purchase or borrow.

Philips Oscilloscope Model GM5659 – S. Simpson, 8 Hallfield Avenue, Micklefield, Nr. Leeds, Yorkshire – Circuit, Service Manual, loan or purchase.

Murphy Lowband Mobile Unit – R. McCormack, 44 Mountainview Park, Belfast 14 – Any information and circuit diagram, loan or purchase.

Radio Constructor, December 1962, January, February and March 1963 – M. A. Seed, 39 Torquay Road, Newton Abbot, Devon – To purchase or borrow.

Mullard Valve Tester, Type E7600 – F. Murphy, 10 Upton Court, Upton, Wirral, Cheshire, L49 6LS – Manual or any information.

Eddystone 5640 Communications Receiver – M. Lewis, 10 Kenmore Drive, Filton Park, Bristol, BS7 0TT – Service Sheets, Circuit or Manual.

Valve Type X78 – R. A. Read, 7A The Close, Salisbury, Wilts – To purchase.