the junior reaches maturity

This is the final article on a very important stage in the development of the Junior Computer — the extension boards. All constructional details will be covered together with modifications to the main board and the power supply. It will be apparent that Junior will become too big for its original case and will therefore require a new one — many readers may welcome the change!

As in the previous two articles on the extension card this can only be a relatively brief summary of the constructional details required to build and fit the boards to the Junior Computer. The subject will be covered at length in the forthcoming Junior Computer Book 3 but sufficient information is presented in this article to enable readers to get to grips with the hardware now.

The addition of the extension card will involve a few minor alterations to other areas of the computer.

- certain modifications have to be made to the main board (some are optional);
- the power supply will have to be adapted to allow it to cope with the added current required;
- the interface card can then be mounted and linked to both the main board and the bus board and finally
- the PLL must be calibrated.

There are in fact further extension possibilities which will not be discussed here but will be considered at length in Book 3.

Preparing the main board

When an upper storey is built on to a house, it is a good idea to check the foundations and make sure the whole lot won't collapse under the strain . . . Actually, as far as the Junior Computer is concerned, there isn't that much to do (see Table 1) and, in any case, people who feel wary about removing components may rest assured, as they have the choice between changing resistors (for ones with a lower value) or connecting resistors in parallel to the ones already present. Don't forget to modify the wire link at point D! Point D should now be connected to point EX. Readers with the intention of using the Printer Monitor (PM) program, including the step by step reading facility, should include the circuit shown in figure 2b. This is a special module which can be mounted on the main board in the manner indicated in table 2. The module's component overlay and printed circuit board are shown in figure 1. Figure 3 shows how to mount and wire the module.

The need for the circuit in figure 2b was explained in the 'Junior Cookbook' article (Elektor, April 1981, p. 4-28/29). Two ports belonging to IC10 which were not used before, now come into their own. This supplementary circuit is mounted 'piggy-back' on top of the main board.

There will be no problem here if IC10 is mounted in a socket. If not, a socket will have to be installed after first removing the IC by careful application of pencil point soldering iron and a good quality 'solder sucker'. Alternatively, the pins of the IC can be 'snipped' off and removed with a pair of needle-nose pliers. Operate with care and a steady hand!

The module that is to be mounted contains a substitute for IC10, two resistors and two solder pins to connect the K lines. On the copper track side, only pins 1, 2, 4 . . . 7 and 14 will be used. These act as links with the socket which has just been mounted on the main board in place of IC10. Pins 3 and 8 . . . 13 are not used and can be cut off. As an alternative seven pieces of wire may be used to link the module directly to the main board.

Now the K lines are dealt with. If the PM program is desired, K4 (together with K5, as will become apparent) and

Table 1.

Modifications to the main JC board
R5 = 470 Ω (or 560 Ω in parallel to 'old' R5) — indispensable
R14,R15,R16 = 470 Ω (or 560 Ω in parallel to 'old' R) — optional
1 wire link D-EX

Table 2.

module EPS 81033-3
R21,R22 = 1 k (continuation of numbers on main JC board)
IC10 = 7401, 74LS01 (only if original IC10 has to be desoldered)
1 printed circuit board EPS 81033-3
1 IC socket 14 pins (provided IC10 was not already in socket)
1 IC connection socket (see text)
2 solder pins

1

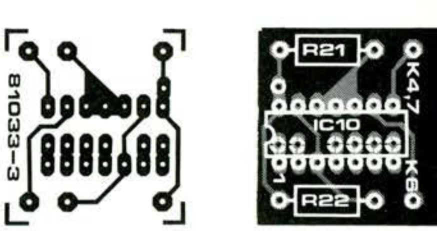

Figure 1. The 'piggy-back' board, which includes the circuit shown in figure 2b, replaces IC10 on the main board.

K6 will be connected to IC10. The module will enable decimal calculations to be carried out without any problem, even without the use of the PM program. In the latter case, K7 and K6 are linked to IC10.

Boosting the supply

How to get a few more (milli) amps . . . and minus 12 V

The circuit diagram of the modified power supply is shown in figure 4a and the printed circuit board for the −12 V circuit is drawn in figure 5. The parts required are listed in table 3 and the constructional details are given in figures 4b and 6.

'Feeding the five thousand' does not apply in electronics. There may well be enough power for two boards, but not necessarily for three! Especially where EPROMs are concerned, as they are particularly greedy components. In addition, there will have to be a −12 V supply for the RS 232 interface. The 'revised' Junior Computer power supply produces:

+5 V, 4 A max.
−5 V, 400 mA max.
+12 V, 400 mA max.
−12 V, 400 mA max.

This will amply feed the main board, the extension card and 5 additional memory cards (the Elekterminal has its own power supply). What is needed therefore is to add a separate −12 V supply on a suitable printed circuit board, modify the existing supply, include another transformer, provide the larger +5 V voltage regulator with a heat sink and adapt the wiring. Figure 6 gives the necessary ingredients to 'cook up' this extra bit of power.

On the existing printed circuit board D1 and D2 are removed (they can now be used for D7 and D8) so are IC1 . . . IC3 along with the heat sink. After virtually demolishing the board it is time to build it up again: C19 is connected in parallel to and above C1. It is also possible to replace C1 by a 680 µF/40 V electrolytic capacitor. Likewise, C21 is mounted in parallel with C6. Again, C6 may be substituted for an electrolytic 4700 µF/25 V capacitor. It all depends on what happens to be available.

Next, the new ICs 1 and 3 are introduced to replace their predecessors and are mounted on the board. Read and reread the following very carefully: *the metal face of each IC is situated to one side of C2.* In other words, don't take any notice of the component overlay. The two ICs should be provided with a heat sink, as shown in figure 4b. The centre pin of each is linked internally to the metal face and therefore to the heat sink. It is quite obvious from the pin assignments in figure 4b that *the heat sinks of IC1 and IC3 should not touch.* The solution is to bend the pins of one of the ICs while keeping them vertical and then mount the two heat sinks so that they face in opposite directions.

The new IC2 is mounted on a pre-drilled TO3 heat sink which can be fixed to the back of the case. The pin assignment of the 78H05 is identical to that of the LM 309K. There is no need to insulate the IC, as its case is grounded. The whole supply case will therefore automatically be earthed as well, provided it is made of conductive material! Watch out for shorts between the case and conductive components (caused by metal spacers, for instance!).

The supplementary power supply board is very easy to construct. IC4 should have a heat sink as well (see figure 4b). With respect to the +5 V, this will require an additional transformer (Tr2). The bridge rectifier B1 is a newcomer too. This can be mounted (without being insulated) at the bottom of the power supply case. It is best to use four terminal connectors when wiring B1.

Time to wire the board. Things get slightly more complicated here, but the drawings should be clear enough. The power supply is connected to the

2

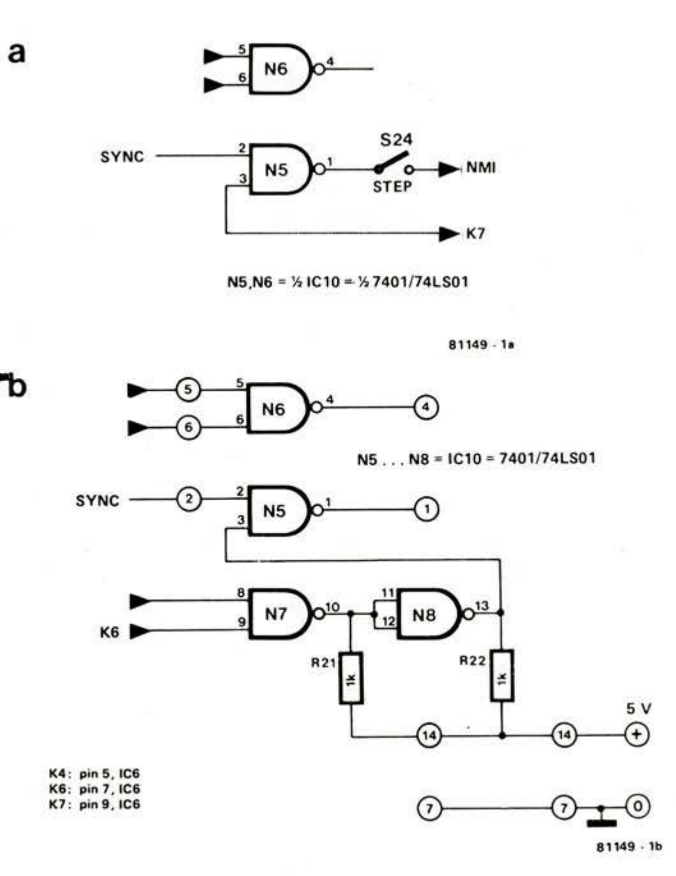

Figure 2. The Junior Computer: before (2a) and after (2b): additional electronics on the main board as an alternative to the step-by-step facility in some cases.

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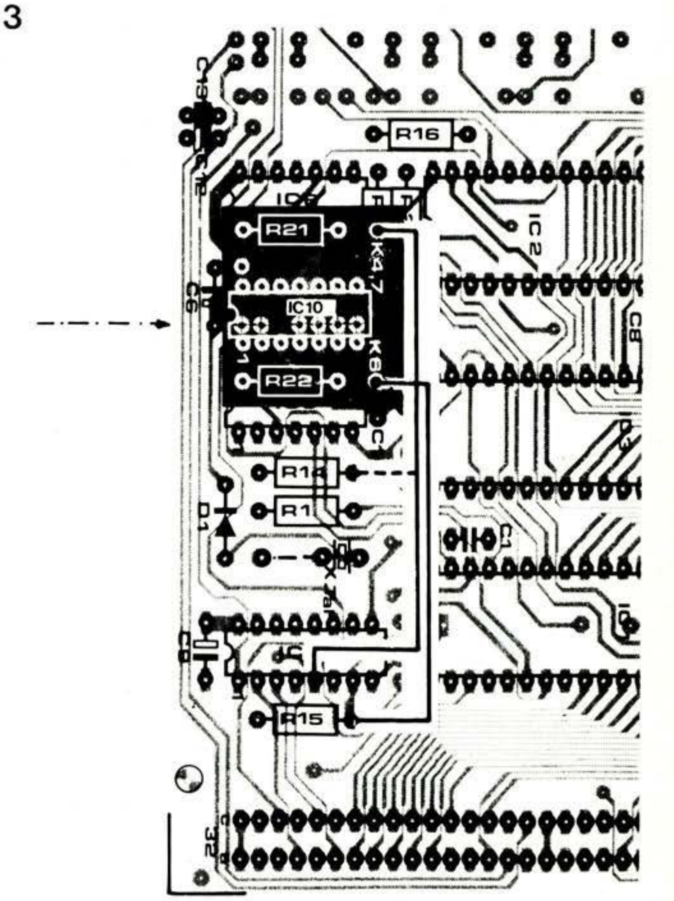

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Figure 3. This is how the board in figure 2 is connected to the main board. Two wire links are involved: one leading to K6 and one to either K4 or to K6.

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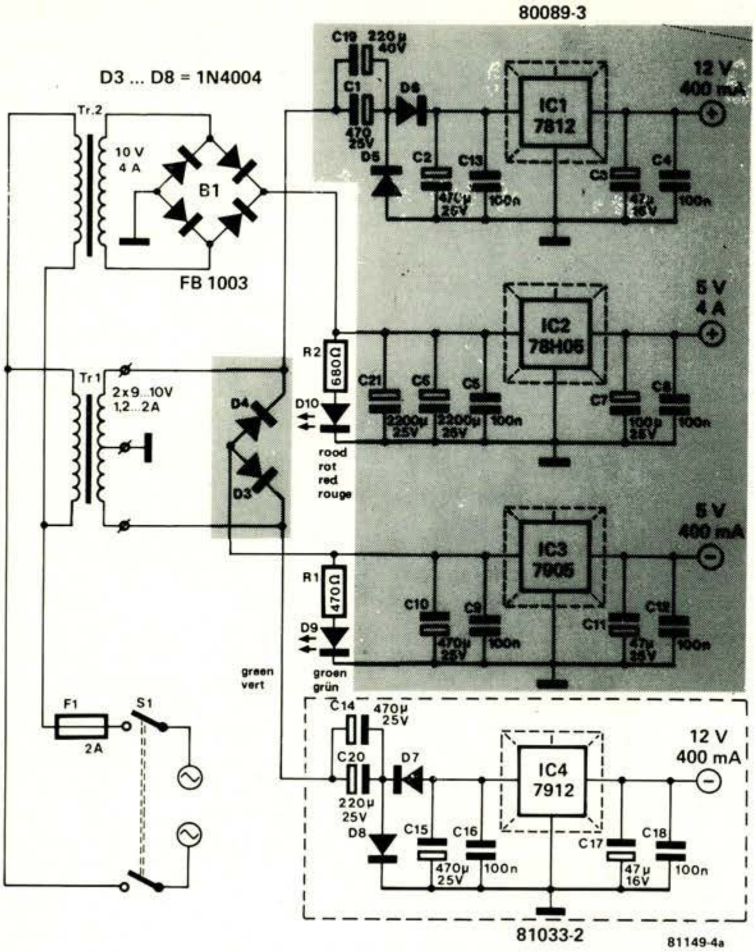
a



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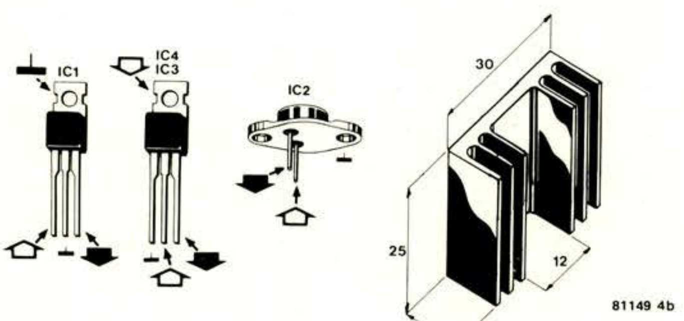

Figure 4. The 'revised' power supply (4a) and various practical considerations (4b).

Table 3.

Parts list for revised power supply (additional board: EPS 81033-2: −12 V power supply)
NB. '%' stands for 'modified'
'&' for 'new' (numbers run on)

Capacitors:
C1,C2,C10,C14(&),C15(&) = 470 µ/25 V
C3,C11,C17(&) = 47 µ/16 . . . 25 V
C4,C5,C8,C9,C12,C13,C16(&),
C18(&) = 100 n MKH
C6,C21(&) = 2200 µ/25 V (C21//C6)
(of C6(%) = 4700 µ/25 V; C21 is left out)
C7 = 100 µ/25 V
C19(&),C20(&) = 220 µ/40 V
(C19//C1; C20//C14) (C19 and C20 are omitted when C1(%),C14(%) = 680 µ/40 V)

Semiconductors:
IC1(%) = 7812 (TO - 220)
IC2(%) = 78H05 (TO - 3)
IC3(%) = 7905 (TO - 220)
IC4(&) = 7912 (TO - 220)
D1,D2 = are omitted; see D7 and D8
D3,D4,D5,D6,D7(&),D8(&) = 1N4004
B1(&) = FB 1003
Tr1 = existing transformer
Tr2(&) = 1 x 10 V 4 A transformer
S1 = existing mains switch
F1(%) = 2 A-fuse
(&): heat sinks for IC1,IC2,IC3,IC4

indicators:
D9 = green LED; R1 = 470 Ω
D10 = red LED; R2 = 680 Ω

extended Junior Computer system by way of the five solder pins on the interface card provided for the purpose.

The interface card

The main connection

Last month the circuit diagrams were published in the article on the hardware. The parts list is indicated in table 4 and the printed circuit board is illustrated in figure 7. Both sides are shown in the same drawing to save space! The wire links for ICs 4 and 5 must be installed according to table 5 and details concerning the connectors are presented in figure 8.

The printed circuit board is double-sided with plated-through holes like the main board. There is, however, one fundamental difference between the two boards: the interface card has a component overlay on one side only. This does not mean the components are all mounted on that side. Most of the connectors will in fact be placed on the other side (not on the component overlay!)

Generally speaking, the component overlay is considered to be the upper side. Well, we'll have to break with this tradition, as we're going to make a sandwich with the upper 'slice' being the interface card. Watch your fingers, because the 'buttered' side is going to be on the outside! First of all, there are the resistors, 36 or 37 in all, to contend with. The 37th may be left out unless the loudspeaker or headphone output of a cassette player is to be used. Otherwise R37 must be omitted as it will cause a considerable loss of signal even on low impedance lines.

Preset P2 is an everyday type and preset P1 (to calibrate the PLL) is a 10 turn trimmer potentiometer. When mounting the tantalum electrolytic capacitors, make sure the correct polarity is observed. After inserting the transistors and the three normal diodes (the LEDs are not included) three insulated wire links are placed next to the expansion and RS 232 connectors (links 4 & 5, 5 & 8 and 6 & 20). No less than 62 solder pins have to be located (see table 4), most of which are mounted on the component overlay side, but the ones near the edge may be placed on the 'copper' side. The links between the points indicated alphabetically depend on the user's requirements. If an Elekterminal or a printer is used (this refers to most types) the P-Q link should be omitted. If additional memory is introduced by means of the bus board, points R and S (WITH) should be linked, otherwise points R and T should be connected ($\overline{\text{WITH}}$). The A . . . O links are determined by the choice of IC4 and IC5 (table 5).

It is advisable to provide the 17 ICs and the two Reed relays with good quality sockets. When mounting the ICs in their corresponding sockets, first check their position and then make sure the 8, 14, 16, 18, 20, 24 or even 40 pins have well

and truly penetrated into the socket. Very often pins get twisted and flattened underneath the ICs . . . leading to irate telephone calls on Monday afternoons, quite unnecessary if due care is taken!
At least one IC will have to be programmed: this is the PROM IC17. Provided it is an 82S23 type, it can be programmed using the PROM programmer which was published in the 1980 Summer Circuits' issue. If IC4 is to be an EPROM, this will have to be programmed as well.
If a 2716 containing the TM program is not used, everything that refers to the cassette interface may be omitted. The same is true of IC5. If the G and S functions that are involved in the PM program are used, the TM routine must also be available. (see the 'sophisticated software' article in the May issue). On the other hand, relays Re1 and Re2, their corresponding sockets and J3 and J4 are rendered superfluous, if software control using a cassette recorder is deemed unnecessary.

The connectors and other links

The interface card requires at least three connectors (not counting the 'connector' belonging to the VIA). The input connector is mounted on the component overlay side. This is the nucleus of the entire connection network between the interface card and the main board (see figure 8a). The output (expansion) connector is mounted on the copper track side of the board (figure 8c). This is only employed if the memory is to be further extended. Alternatively, the two boards may be linked with wires, in which case the connectors will not be needed at all. The wire option carries a certain amount of risk, as it may lead to shorts, but of course you are welcome to give it a try!
Then there is the RS 232 connector (figure 8e). This is also mounted on the copper track side, in fact it has to be, as otherwise the line network would be inverted. If the chassis connectors J1 . . . J4 are mounted to the side or back of the case instead of on the copper side of the board, screened cable will have to be used.

Put your cards on the table

Bird's eye view of the system

The full constructional details are shown in figure 9 and the connectors can be found in figure 8. With regard to the latter there is a small problem . . . The output connector cannot be mounted in the normal manner by inserting it and then soldering the 64 pins. In view of the position of the two rows of 32 holes, the connector cannot be placed on the edge, but must be placed on the board itself. The pins pass through to the other side at a pinch and could in fact be soldered, but it is

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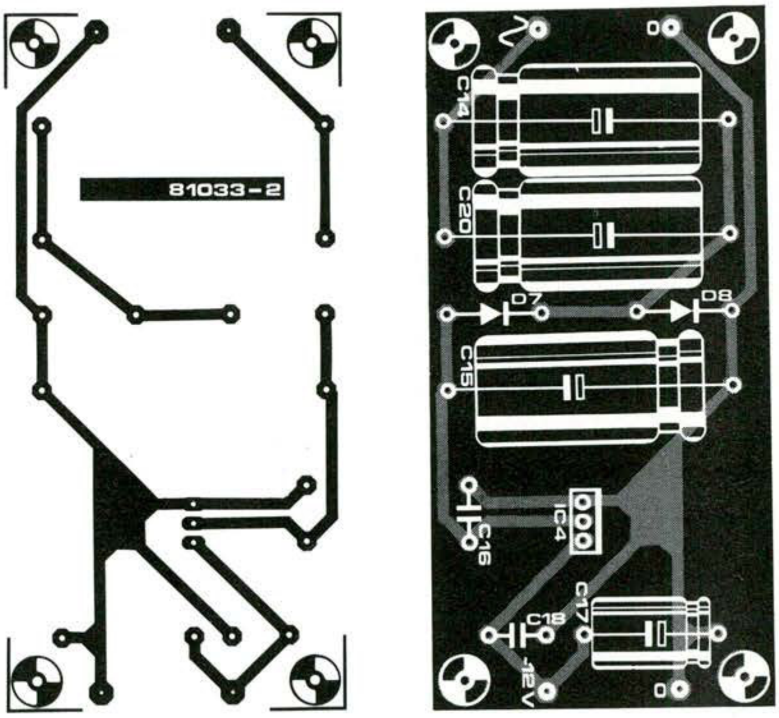

Figure 5. The −12 V power supply board.

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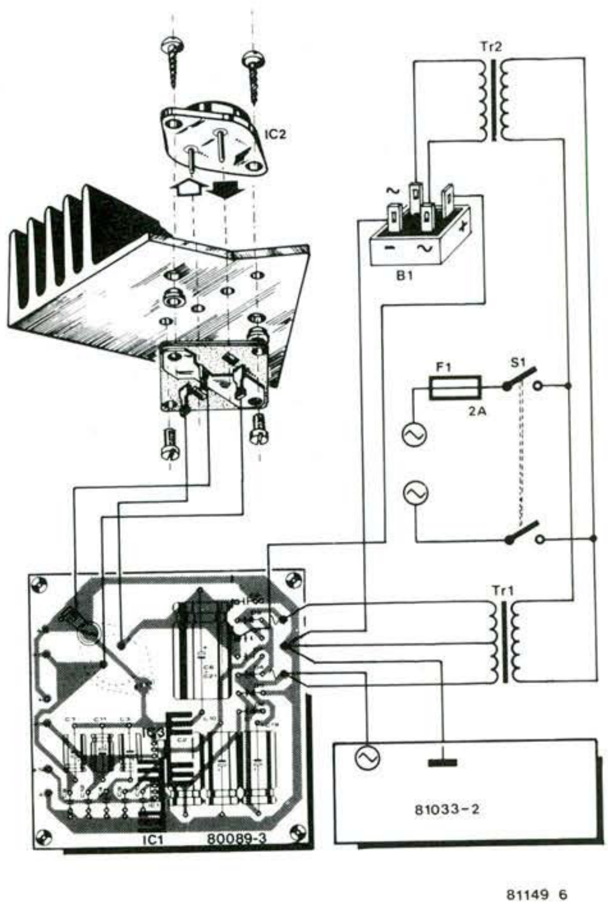

Figure 6. The constructional drawing for part of the revised power supply.

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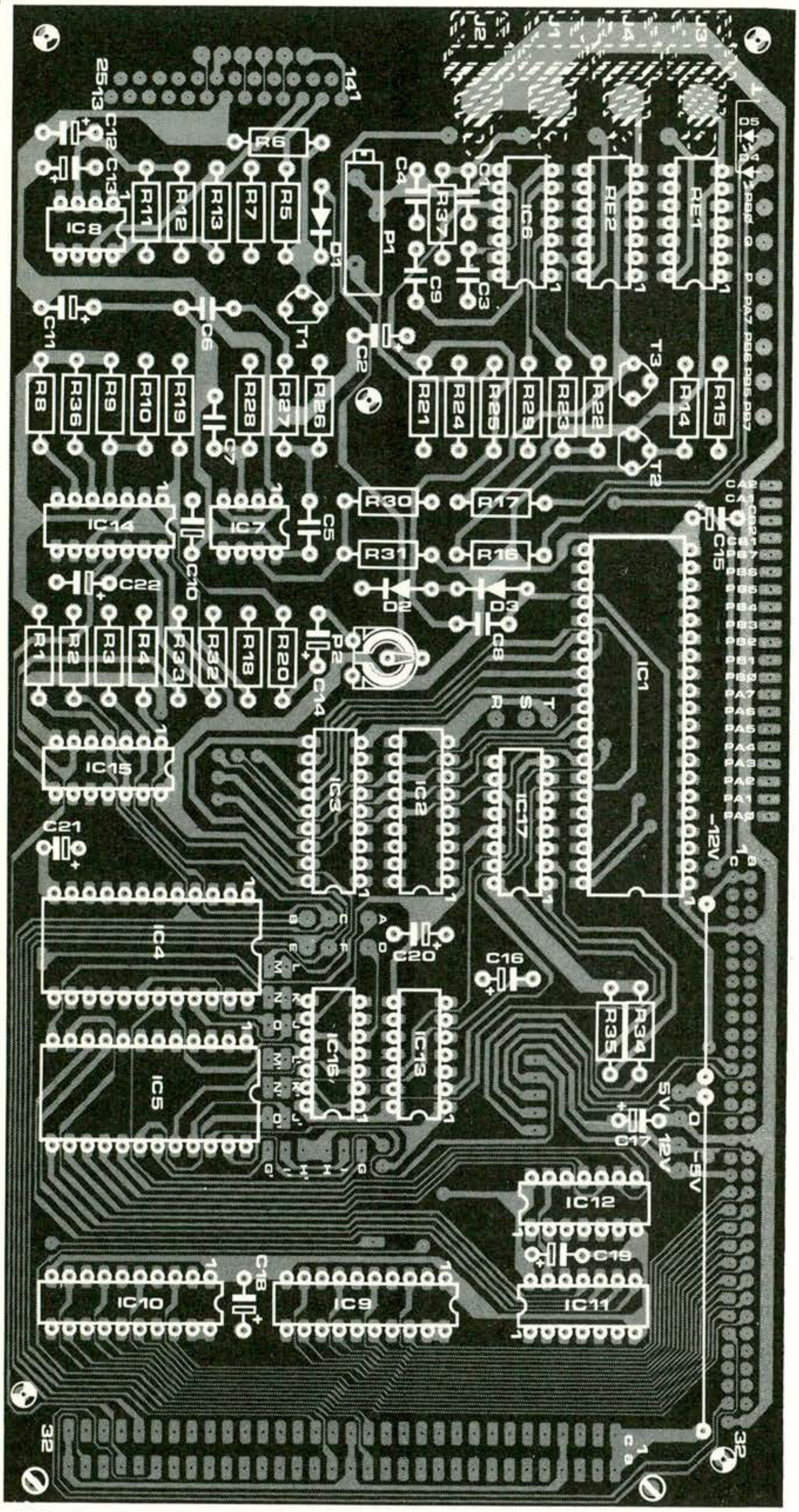

Figure 7. The printed circuit board for the interface card is 'doubled-sided'. Only the component overlay with the corresponding copper track pattern is illustrated.

better to choose one of the following solutions:

- Using a pair of tweezers the pins can be bent to gain a few extra millimetres (see figure 8c).
- Take a connector of the type shown in figure 8b with pins that are at least 13 mm long (wire wrap type) and again bend them so that they easily fit into the holes.
- Take a connector like the one in figure 8b and connect it to the board by means of 64 wires (hardly ideal!).

The parts list is printed in table 6. The interface card is exactly the same size as the main board, enabling the two cards

Table 4.

Parts list for the interface card

Resistors:

R1,R2,R3,R4,R32,R33,R34,R35 = 1 k
R5 = 22 k
R6,R10,R11,R14,R15,R24,R26,R27, R28 = 10 k
R7,R8,R36 = 8k2
R9,R18,R22,R23 = 4k7
R12 = 6k8
R13,R25,R31 = 2k2
R16 = 100 Ω
R17 = 330 Ω
R19 = 470 Ω
E20 = 1k2
R21 = 15 k
R29 = 33 k
R30 = 4M7
R37 = 33 Ω (see text)
P1 = 5 k (4k7) multiturn preset
P2 = 1 k preset

Capacitors:

C1 = 220 n MKH
C2,C11,C12,C13 = 10 µ/16 V tantalum
C3 = 22 n MKH
C4 = 1 n MKH
C5,C6,C7 = 6n8 MKH
C8 = 100 n MKH
C9 = 47 n MKH
C10,C14 . . . C22 = 1 µ/16 V tantalum (total 10)

Semiconductors:

T1 = BC 547B
T2,T3 = BC 516
D1,D2,D3 = 1N4148
D4 = LED green
D5 = LED red
IC1 = 6522 (Rockwell, Synertek)
IC2,IC3 = 2114
IC4 = 2716, 2708, 8114
IC5 = 2716, 2708, 8114
IC6 = 565
IC7,IC8 = 311
IC9,IC10 = 74LS241
IC11,IC12 = 74LS243
IC13 = 74LS27, 7427
IC14 = 74LS01, 7401
IC15 = 74LS30, 7430
IC16 = 74LS00, 7400
IC17 = 82S23, 74188

Miscellaneous:

Re1,Re2 = DIL reed relays (Günther 1301, 3802)
2 8-pin IC sockets
9 14-pin IC sockets
1 16-pin IC socket
2 18-pin IC sockets
2 20-pin IC sockets
2 24-pin IC sockets (see text)
1 40-pin IC socket
5 wire links on board (in addition to ones marked alphabetically)
J1 . . . J4 = cinch chassis connectors
1 25-pole D connector (RS 232), mounted at right angles to board (see figure 8e)
20 solder pins (VIA 'connector')
29 solder pins (marked A, B, C, etc.)
1 input connector (64-pin) placed at right angles, DIN 41612, male! (is identical to expansion connector in standard JC) — see figure 8a
5 solder pins (links to port connector)
5 solder pins (links to power supply)
3 solder pins (LED connections)
1 output connector (64-pin) placed at right angles, female (see figure 8c and text)

to be 'sandwiched' together, which saves a lot of space. There is one important consideration to bear in mind, however; the main board contains the keyboard which will obviously have to be within finger-tip reach, thus with the interface card below it, but with as little space between them as possible. The links will have to be kept short!

Now let us consider the interface card from the following angle: the component overlay facing downward, the input connector facing west, the RS 232 connector facing east and the output connector facing north. The next 'floor' consists of the main board with the keys facing you, which is logical. The space between the two cards depends on the size of the two switches S24 and S25. The whole unit will be more compact if these and the RS 232 connectors are removed and placed elsewhere on the case.

This brings us to the case. Ideally, it should be in the form of a lectern or desk with enough room in it for the main board/interface card sandwich, the power supply and the bus board and memory extensions. However, this is just a suggestion, as of course the number of equally suitable possibilities is legion. Please inform us if you come up with any original ideas!

Figure 9a provides an elegant solution towards linking the interface and main boards. The connectors are equipped with one female connector each, as shown in figure 8b. These will be interconnected either by means of part of the bus board described in January 1980 (EPS 80024) or by means of ribbon cable. Using the bus board mentioned above will involve a rather delicate operation: it will have to be cut to size. Thus, the distance between the two connectors on the bus board will largely determine the space between the two cards.

N.B. The copper tracks on the bus board are asymmetrical. Points 3 and 4 are joined by wide tracks. If the bus board is used the other way around, lines 30 and 29 will act as lines 3 and 4. These are not wide, however. Looking at the sandwich as drawn in figure 9a, point 32 is in the foreground and point 1 is in the background.

The interface card has five mounting holes, just like the main board, so that the two boards can be sandwiched together with ease and precision. It is advisable to use fairly solid spacers (metal ones can cause short circuits — beware!). The interconnections between the two boards are illustrated in figure 9b. The use of the bus board mentioned above is highly recommended, but it is also possible to make your own.

If the ready-made bus board is employed, note the asymmetrical copper tracking. Holding the double-decker sandwich in the position described earlier (figure 9a), point 32 of the bus board will face west and point 1 will face east.

That by no means covers all there is to

Table 5.

Wire links around IC4 and IC5

IC	memory	type	G . . . O G'. . . O'	A . . . F	memory range
IC4	1K-RAM	8114	O - M	A - B	Ø800 . . . ØBFF
	1K-EPROM	2708	O - N G - H J - K	A - B	Ø800 . . . ØBFF
	2K-EPROM	2716	O - N G - I J - L	A - B - C[1]	Ø800 . . . ØFFF[1]
IC5	1K-RAM	8114	O'- M'	D - C[2] D - E[4]	ØCØØ . . . ØFFF[2] 1ØØØ . . . 13FF[4]
	1K-EPROM	2708	O'- N' G'- H' J' - K'	D - C[3] D - E[4]	ØCØØ . . . ØFFF[3] 1ØØØ . . . 13FF[4]
	2K-EPROM	2716	O'- N' G'- I' J' - L'	D - E - F[5]	1ØØØ . . . 17FF[5]

1) Meant for system program TAPE MONITOR (TM)
2) Preferable if IC4 = 8114 (continuous RAM range)
3) Preferable if IC4 = 2708 (continuous EPROM range) of if IC4 = 8114 (continuous memory range)
4) When IC4 = 2716
5) Meant for system program PRINTER MONITOR (PM)

NB. Various other K connections are possible, only the most logical choices are mentioned in the table.

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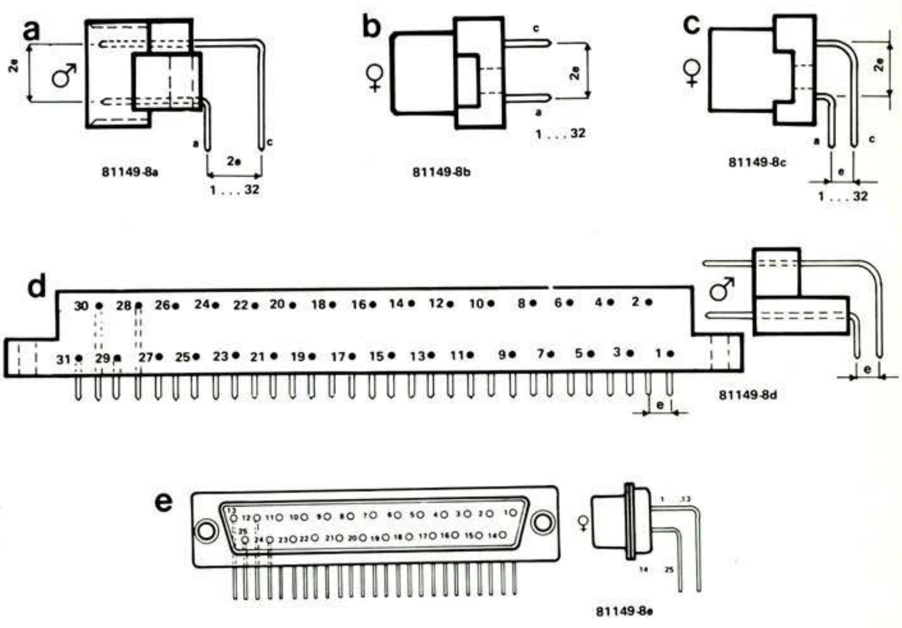

Figure 8. Data for all the connectors involved in the extension of the Junior Computer.

Table 6.

Electrical connections for the entire unit

a. between main board and interface card
   - 2 64-pin connectors, female (see figure 8b)
   - 1 printed circuit board EPS 80024 (partly used)or 1 piece of Veroboard (2.54 mm hole pattern)
   - 1 31-pin male connector (see figure 8d)

b. between interface card and bus board
   - 1 64-pin male connector placed at right angles (see figure 8a)
   - 1 . . . 5 64-pin female connector(s) (see figure 8b)
   - 1 printed circuit board EPS 80024 or 1 piece of Veroboard (with 2.54 mm hole pattern)

9

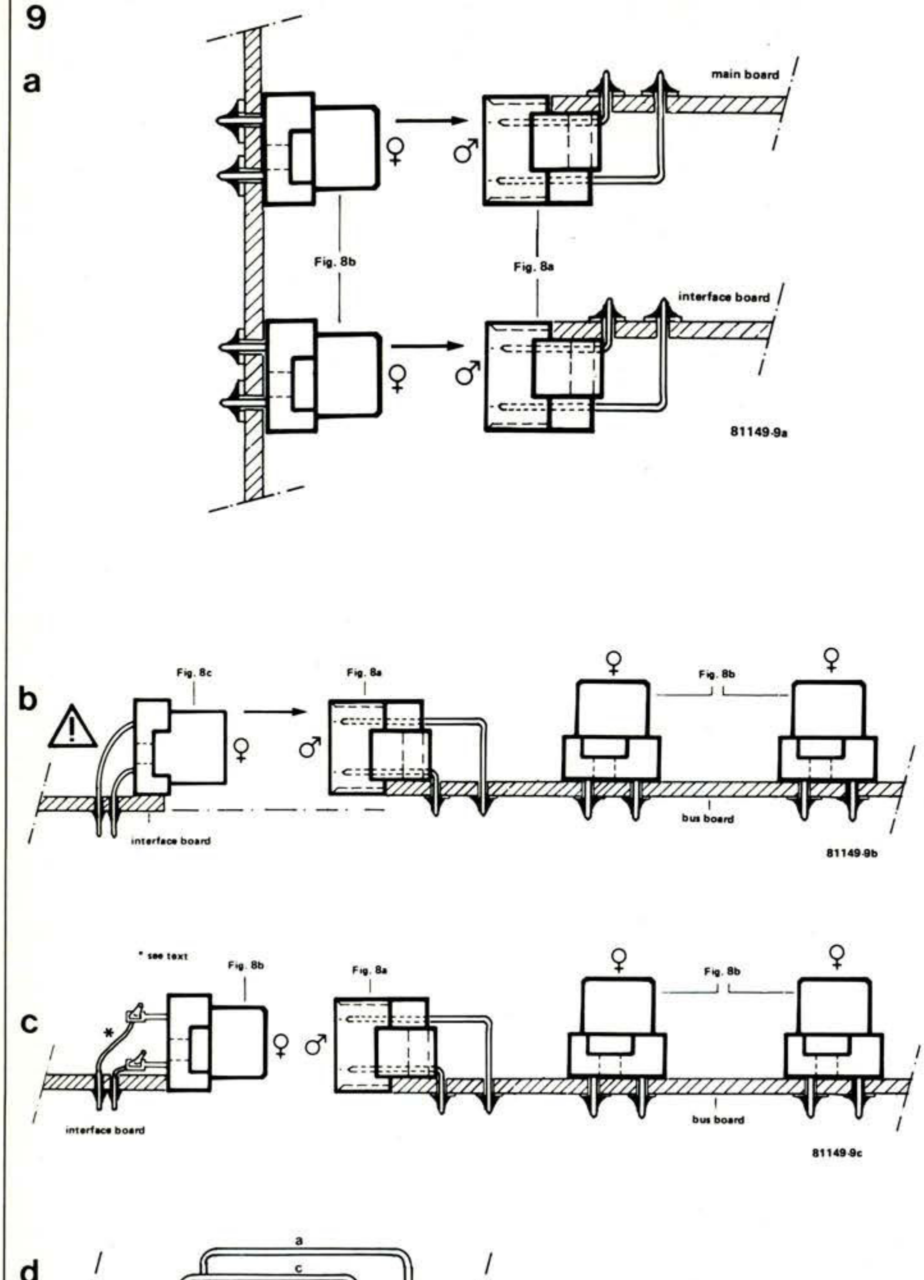

Figure 9. Detailed view of the electrical connections between the main and interface boards (9a) and between the interface and bus boards (9b, 9c and 9d).

say about the bus board. According to what is marked on the connectors, pins 'a' will be on the edge of the card and so the 'c' pins will be towards the middle. Watch out for the misprint on the component overlay of the bus board, near the connectors, where 'a' and 'c' have inadvertantly been swapped round. N.B. The reference to the 'a' and 'c' pins in figure 8 are quite correct, but do not correspond to those on the component overlay!

If the interface card and the bus board are linked by ribbon cable, in other words, without using connectors, it is particularly important to make sure 'a' and 'c' do not get mixed up. The wires leading to both points will be equal in length (see figure 9d). (If the component overlay were correct in this respect, the 'a' wire links would be much shorter than their 'c' counterparts).

The bus board is best positioned with point 1 facing right (east) as seen from the interface card.

Figure 9b shows how the output connector of the interface board is mounted *on* the card: the bus board will not be level with the interface card. Figure 9c, on the other hand, shows the connector mounted against the interface card and here the two cards are level with each other, which is preferable as it saves having to adjust the spacers, etc. The two cards are also linked by way of the port connector. For this either a male connector or terminals are used (the connector pin assignments are provided in figure 8d).

The PLL control

Reading data without spelling mistakes

So far the interface card is mounted, the 'new' power supply is ready and IC4 is a 2716 containing the TM program. Get set . . . Depress RST to jump to the standard monitor routine, then enter AD Ø 8 1 Ø (start address of TM) and depress GO: 'id 00' will appear on the display. Now to calibrate the PLL to allow data transfer from the cassette tape to take place without a hitch. We have already explained how the PLL works. The VCO frequency must be adjusted to about 3 kHz with the aid of P1, when no input signal is available. Nevertheless, it will be seen that calibration does not necessarily have to take place without an input signal.

Two routines (table 7) co-operate in the procedure. The first (Ø2ØØ . . . Ø25Ø) uses a TM subroutine and provides about 4 minutes' worth of synchronisation characters which are recorded on tape. The second (Ø251 . . . Ø283) monitors the synchronisation character reading from the tape, with the assistance of four TM subroutines.

P1 should be adjusted in such a way that these characters are read on tape correctly. This can be seen on the display: the configurations that are likely to appear were published in figure 3 in last month's issue in the article on the 'sophisticated software'. P1 will be properly adjusted when the situation, as shown in the second drawing in figure 3, is stable. That is to say, when the display does not flicker between drawings 1 and 2.

The calibration procedure takes place in the following steps:

1. The machine is switched on and the programs given in table 7 are entered.
2. The cassette recorder is connected. P2 is turned fully on and the recording level of the cassette recorder is set in the mid position.
3. The recorder is switched to 'record' and is started. Enter: AD Ø2ØØ GO.

The red LED lights and the synchronisation characters are recorded.

4. After about 4 minutes the write operation will have been completed.

The red LED will go out and Ø2ØØA9 appears on the display. The cassette recorder is stopped and the 4 minutes' tape is rewound.

5. Start the recorder on 'play' (read) this time and enter: AD Ø 2 5 1 GO.

If the headphone of the cassette recorder is used, turn the volume up half-way. The green LED lights. If we have reached the tape section that preceeds the synchronisation characters drawing 1 in figure 3 belonging to the software article will now be displayed. This will flash! However, once the synchronisation characters are being read, the PLL can be calibrated.

6. Turn P1 (with a screw-driver) until the second drawing appears on the display. *If this does not alter for the entire synchronisation character reading, P1 is sure to have been properly adjusted.* To be absolutely sure this procedure should be repeated a few times. We are not going to tell you in which direction to turn P1, as this depends on certain parameters which are rather complicated and cannot be dealt with here.

EOT

End Of Text . . . end of the road or turning point?

Right, it's up to you now! We hope the trilogy on the interface card has supplied readers with enough information. Obviously, there are plenty of details to fill in. Judging by the letters that we've been receiving lately people seem to think the sun rises and sets out of PASCAL and BASIC! But what about machine language? Assembler, for instance, is a very interesting proposition so why not make the effort? It's boring wanting to do everything the easy way! As for the ASCII keyboard and the Elekterminal, readers are recommended to read the following articles:

- Elektor, November 1978, p. 11-06, ASCII keyboard.
- Elektor, December 1978, p. 12-16, Elekterminal.

Your soldering irons must be white-hot by now, so it's high time you got started. There should be plenty to keep you occupied and off the 'phone until books 3 and 4 are available. ■

Table 7.

The hex dump of the two test programs used to calibrate the PLL.

```
M
HEXDUMP: 2ØØ,25Ø
       Ø  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
Ø2ØØ: A9 7D 8D 6C 1A A9 C3 8D 6D 1A A9 Ø3 8D 76 1A A9
Ø21Ø: Ø2 8D 77 1A A9 47 A2 FF 8D 82 1A 8D 78 1A 8E 83
Ø22Ø: 1A A9 ØØ A2 7F 8D 8Ø 1A 8E 81 1A A9 DD 8D ØØ 1A
Ø23Ø: 8D Ø1 1A 18 A9 Ø1 6D ØØ 1A 8D ØØ 1A A9 ØØ 6D Ø1
Ø24Ø: 1A 8D Ø1 1A BØ Ø8 A9 16 2Ø A3 ØA 4C 33 Ø2 4C 1D
Ø25Ø: 1C
JUNIOR
M
HEXDUMP: 251,283
       Ø  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
Ø251: A9 32 8D 82 1A 8D 78 1A A9 7E 8D 83 1A A9 7F 8D
Ø261: 81 1A A9 FF 8D 6B 1A 2Ø C2 ØB 6E 6B 1A AD 6B 1A
Ø271: 2Ø E8 ØB C9 16 DØ FØ 2Ø 36 ØC 2Ø 5D ØC C9 16 FØ
Ø281: F6 DØ DF
JUNIOR
```


coming soon...

Summer circuits

The next issue of Elektor will be the July-August Summer Circuits double issue with its usual quota of over 100 circuits.

Some circuits are basic design ideas, others are complete with printed circuit board layouts. With subjects ranging from audio to microprocessors every reader will find something of interest. Just to whet your appetite, here is a list of a few of the proposed articles;

- audio level meter
- proximity detector
- loudspeaker overload indicator
- frequency and phase detector
- temperature alarm
- Hi-Fi siren
- EPROM light organ
- binary keyboard
- crystal tuning fork
- digital alarm for car
- 50 Watt car booster
- digital sine wave oscillator
- over 90 other circuits

September

- TV games: the TV games extension board didn't fit in this issue. We're holding it for September. A TV games book and two more tapes will also be available at that time.
- Teletext, Elektor-style. For this type of construction project to be practical, connections to the TV set must be considered. Manufacturer's application notes make interesting reading, but they are of little value to the home constructor.