

JAVA SYSTEMS

USER GUIDE

for the

MODE 7 Mk 2

DISPLAY

UNIT

(Including Kit Construction Notes)
(and Fitting Instructions.)

1	2	3	4	5	6	7	8	9	0	=
Alpha	Alpha	Alpha	Alpha	Alpha	Alpha	Alpha	Flash	Flash	Block	
Red	Green	Yellow	Blue	Magenta	Cyan	White	On	Off		
Q	W	E	R	T	Y	U	I	O	P	
Graphic	Graphic	Graphic	Graphic	Graphic	Graphic	Graphic	Line	Full	Block	
Red	Green	Yellow	Blue	Magenta	Cyan	White	Up	Graphic	Graphic	
A	S	D	F	G	H	J	K	L	+	
Background	Overlap	Double	Height	Line	Line	Line	Line	Window		
Off	On	On	Off	Off	On	Left	Right			
Z	X	C	V	B	N	M	<	>	?	
Screen	Screen	Tab	Tab	Screen	Screen	Line			Shape	
Top	Left	Left	Right	Right	Bottom	Down			Definer	

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Wordwise and Wordwise-Plus are designed and distributed by Computer Concepts Ltd.
The Master EAM card is produced by Gloger Computers Ltd.

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The Mode 7 Master unit is guaranteed against defects due to manufacture for a period of 6 months from date of purchase. Any misuse of, or modification made to, the unit during this time will invalidate the guarantee.

This manual was prepared using WORDWISE-PLUS on an Electron computer fitted with a MODE 7 MASTER display unit.

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1. Introduction.

When the Electron was brought out as the "baby brother" of the BBC micro several useful facilities on the latter were omitted for ease and cheapness of production.

Amongst these facilities was one of the display modes, mode 7. This was the most efficient of the BBC modes because it required very little screen memory, but it did depend on special "chips" that were not used on the Electron.

The results of this omission were twofold. Firstly, the majority of BBC micro programs could now not run on the Electron without modification. Secondly, any programs that were modified had to make do with a much reduced memory capacity, especially if any colours were required.

The JAFSA Systems Mode 7 Adaptor used the special chips and was able to give true mode 7 on the Electron, but at a price.

Your new Mode 7 Mark 2 unit consists of a board fitted inside the Electron and a ROM. The board is much smaller and cheaper than the original Adaptor because it dispenses with the memory scanning sections. The ROM, which is an extension of the Adaptor ROM, programs the Electron ULA to scan the memory, as well as containing the PRESTEL terminal software and demonstration screen editor.

Because the ULA scanning system requires sufficient memory for a mode 4 display, you will still need a Master RAM board for your longer programs and files.

Note that in this User Guide actual key names are enclosed by <> symbols. For example <RETURN> refers to the RETURN key.

2. Installing the ROM.

**** NEVER fit or remove any device on your
** Electron without SWITCHING OFF first. ****

In order to fit your ROM you need a ROM expansion unit. If you use the socket on the JAGA Systems RS423 cartridge then you will have a self-contained PRESTEL terminal.

Consult the expansion unit manual regarding the correct orientation of the ROMs on the board. Pin 1 of the ROM is at the end with the small semi-circular notch in it.

Carefully insert the ROM into the chosen socket, making sure that none of the pins are bent, and press it well in. Switch on the computer and type:

***HELP <RETURN>**

Amongst the help messages you should see one similar to:

**Mode 7 Mk2 v1.0
MODE7
BARS (only in Mode 7)**

If the message is not present check the ROM closely for bent or broken pins and to see that its orientation is correct. If everything looks OK and your other ROMs' help messages are appearing properly, contact JAGA Systems immediately.

Once everything seems in order, type:

***MODE7ON <RETURN> <BREAK>**

The MODE 7 break screen will then appear.

3.1 Updating the display.

The Acorn Operating System that controls the display on the Electron has various 'legal' methods of inserting text or graphics on the screen, eg. PRINT and VDU from BASIC, and Osrch from machine code. However, many mode 7 programs 'POKE' directly to the area of memory reserved for the screen display. For this reason the Mode 7 Mk2 ROM maintains two areas of memory for screen data storage. One, between &7C00 and &7FE8, is the normal mode 7 display area where the character codes are stored both by the 'legal' methods and by POKEs. The other, between &4000 and &6800, is the mode 4 display area that is actually scanned by the Mode 7 Mk2 circuits. The character codes are stored there automatically during 'legal' operations, but POKEd data is treated differently.

Every 10mS the Mode 7 Mk2 ROM examines a row of characters in the mode 7 memory and transfers them to the mode 4 memory, thus taking 250mS to transfer the whole screen.

3.2 Scrolling.

Normally, the time taken to scroll the screen, ie. move it up or down by one line, will be the time taken to update it - 250mS. Although this is a very fast time for the software that is doing the scrolling, it does make the process of listing long programs tedious.

To speed up listings, etc. press:

<CTRL>

and only the bottom line will be printed immediately, the rest of the screen being updated as described above.

Note that, as the updating is interrupt controlled, anything that disables interrupts, eg. disc operation, will affect the updating process.

3.3 Mode 7 Memory Map.

Display pointer variables	&7FFF)	
	&7FE8)	Always in main memory
Mode 7 code memory	&7C00	(HIMEM if Master RAM active)
Mode 4 display memory	&6800)	In shadow memory if Master RAM active
	&4000	(HIMEM if Master RAM not active)
ROM vector entry code	&180)	Always in main memory
	&150)	

3.4 Stack Overrun Error.

From the above map it can be seen that the ROM vector entry code is situated between addresses &150 and &180. This is just below the area used by the 6502 processor stack.

In order to protect this area from excessive stack use crashing the code, the Mode 7 ROM continuously checks the 6502 stack pointer.

If the stack strays below &190 a "Stack Overrun" error will be generated and control passed to the current language's error handler.

4.1 Operation of the function keys.

As you may be aware, the Electron has an extended system of function keys that normally produce BASIC keywords. If you are not familiar with this, de-activate the Mode 7 Mk2 unit with CTRL-BREAK then press and hold down the FUNC key (top left, just below ESCAPE) and press A. The BASIC keyword "AUTO" will appear on the screen.

The BBC micro does not have this extended system, but just has 10 function keys, equivalent to FUNC-1 to FUNC-0 on the Electron. Extra functions can be obtained on the BBC micro by pressing SHIFT, CTRL, or CTRL and SHIFT as well as the function keys. Several programs make use of these extra functions, eg. Wordwise-Plus, so when the Mode 7 Mk2 unit is active the keyboard is modified to simulate the BBC micro situation:

the bottom row of function keys (FUNC-Z to FUNC-/) are equivalent to SHIFT-f1 to SHIFT-f0.

the next row of function keys (FUNC-A to FUNC-;) are equivalent to CTRL-f1 to CTRL-f0 (FUNC-: is inhibited).

the row under the numbers (FUNC-Q to FUNC-P) are equivalent to SHIFT-CTRL-f1 to SHIFT-CTRL-f0.

FUNC-= is equivalent to SHIFT-CTRL-COPY.

So if you are running a BBC program that instructs you, for example to "press CTRL-f6" the key you should press is FUNC-H.

Of course, you may be using mode 7 in an Electron program that expects the Electron keyboard functions. In this case you should type:

***EFN <RETURN>**

and the keyboard will return to normal operation. To get back to BBC function mode type:

***BFN <RETURN>**

In some situations you will find it necessary to press **<BREAK>** after these commands to get the expected results.

4.2 Operation of the shifted cursor keys

Just as described in the previous section for function keys, so the cursor and COPY keys in the BBC micro have extra SHIFT and CTRL functions.

When the Mode 7 Mk2 unit is active and a program is running that expects SHIFT-cursor and CTRL-cursor these are correctly interpreted.

The various symbols on the Electron cursor keys will then be accessible instead by pressing CTRL along with a number key (1 to 9):

CTRL	CTRL	CTRL	CTRL	CTRL	CTRL	CTRL	CTRL	CTRL	CTRL
-1	-2	-3	-4	-5	-6	-7	-8	-9	
!	~	£	_	()	^	[]	

To test these characters for yourself, first disable cursor editing by typing:

***FX4,1** or ***FX4,2.**

5.1 Mode 7 Mk2 command summary.

***MODE7ON** followed by **BREAK** activates the unit. **CTRL-M-BREAK** will keep the unit active.

***MODE7OFF** followed by **BREAK** de-activates the unit. So does **CTRL-BREAK**.

***MODE7.** followed by **BREAK** toggles between the two. That is, if the unit is inactive it is interpreted as ***MODE7ON**, and if the unit is active it is interpreted as ***MODE7OFF**.

N.B. the above commands can all be shortened by not typing the central "ODE" section, eg. type:

***M7ON <RETURN> <BREAK>**

and the unit will be activated.

***EFN** Interpret function keys as Electron function keys. (See section 4.1).

***BFN** Interpret function keys as BBC micro SHIFT/CTRL function keys (See section 4.1) - this is the default when the Mode 7 Mk2 unit is active.

***GREEN** Select Green Screen Monitor mode, which will remain active until the next mode change.

5.2 BBC commands when Mode 7 Mk2 unit active.

MODE 7 (!) In addition to the other 7 MODE commands (0-6) this command is now correctly interpreted.

***TV** Alters the vertical position of the mode 7 display. Type:

***TV1 <RETURN>**

to move the display up one line, and:

***TV254 <RETURN>**

to move the display down one line. Note that the position of the display on the Electron can not be changed, so lines will be lost at the top or bottom of the display when this command is used. Unlike on the BBC micro, this command will take effect at the next clear screen (CLS) instruction and not wait for a mode change.

INKEY Negative INKEY commands in BASIC that test the 10 function keys and the TAB key will now return the correct values if <FUNC> + <0> to <9> are pressed or if <CTRL> + <ID>, i.e. TAB, is pressed. The INKEY numbers are (-97) for TAB and (-33), (-114), (-115), (-116), (-21), (-117), (-118), (-23), (-119) and (-120) for f0 to f9 respectively.

6. Teletext control codes.

It is assumed that anyone using the Mode 7 Mk2 unit is already familiar with the use of mode 7 on the BBC micro. For this reason only a cursory description of the teletext control codes will be given here. Anyone requiring a fuller introduction to them is referred to the excellent Chapter 28 in the BBC micro User Guide. There is also a brief tutorial on their use in the screen editor demonstration pages (*MED).

Teletext control codes affect all characters following them until another code occurs, or the end of a line, at which point the display reverts to alphanumeric white. If the same effects are required on following lines the codes must be repeated for each line.

They are inserted into text using either the PRINT CHR\$ command or the VDU command, eg. PRINT CHR\$(129) or VDU134. A list of codes follows:

Alphanumeric		Graphic	
129	Red	145	Red
130	Green	146	Green
131	Yellow	147	Yellow
132	Blue	148	Blue
133	Magenta	149	Magenta
134	Cyan	150	Cyan
135	White	151	White
Start Effect		Clear Effect	
136	Flash	137	Steady
141	Double Height	140	Normal Height
154	Separated Graphics	153	Contiguous Graphics
157	New Background	156	Black Background
158	Hold Graphics	159	Release Graphics

Direct Keyboard Entry.

If you are in BBC function key mode (see section 4.1) you can enter codes 129 to 137 directly. FUNC-Z (SHIFT-f1) corresponds to 129, FUNC-A (SHIFT-f2) corresponds to 130, and so on up to FUNC-I (SHIFT-f9) which corresponds to 137.

Graphics Characters.

Following a graphics control code all lower case and numeric characters are printed as graphics instead. Each graphics character takes up as much space as that allocated to an alphanumeric character and is split up into six blocks. The code for any particular character is calculated by assigning a number to each block, adding up the numbers for the blocks required and adding 160 to that.

The numbers are:

1	2
4	8
16	64

so the code for:



would be 186.

For example, to get a green copy of this shape type:

VDU146,186:PRINT <RETURN>.

7.1 *MCOMM - The Prestel Terminal.

This software allows the Electron to be used as a 1200/75 baud viewdata terminal. When used with an RS423 adaptor, a modem and a telephone, services such as Prestel and viewdata Bulletin Boards run by enthusiasts around the country, can be dialled up.

With the RS423 adaptor, modem and telephone connected, activate the Mode 7 Mk2 unit and type ***MCOMM <RETURN>**. The menu screen will be displayed. Press **<ESCAPE>** and the screen will clear. Dial the Prestel or Bulletin Board number and when you hear a high-pitched whistle press the DATA button on your Modem.

Pages are normally accessed by typing a sequence ending in #. The **<RETURN>** key has been programmed to send a #, so to access for example page 800 you should type:

***800 <RETURN>**

Pressing **<ESCAPE>** will return to the menu screen (but remember your phone bill!). From the menu you can enter the following commands:

- * allows you to enter operating system * commands. When you have finished, type **<RETURN>** or **<ESCAPE>** to return to the menu.

- L Loads in a function key file called KEYS. This will have been created by entering *KEY commands to program the keys and then typing:

***SAVE KEYS 800 C00.**

Press **<RETURN>** or **<ESCAPE>** to return to the menu.

You may wish to program function keys with numbers of regularly used pages. The normal IM sequence can be used to represent the **<RETURN>** key, eg. ***KEY1"*800;M"**. If you include your Prestel ID number and password take great care over the security of your disc.

While you are on the terminal screen various facilities are available from the function keys. If you press the CTRL function keys (FUNC-A to FUNC-;) then the *KEY strings that you have programmed will be sent.

The function keys have the following effects:

- f1** stores the number of the current page in the 'tag' store so that it can be recalled later. A bleep will sound when the operation is complete. The tag store is 256 bytes long and wraps round on itself.
- f2** fetch the next page from the tag store by sending its number. If the tag store is empty a bleep will sound. The fetch operation wraps round from the last page tagged back to the first.
- f3** clear the tag store. A bleep will sound when the operation is complete.
- f4** reveal any hidden text on quiz pages by removing any conceal control codes.
- f5** download telesoftware onto disc. This should only be used when instructed on the displayed page. The number of pages to be received will be checked, then you will be given the option of changing the filename to be used. If you wish to use a different filename press N then follow the prompts. While downloading, pages of what look like garbage surrounding readable text will appear. As each page is received the lower case suffix letter to the page number will increment. If there are any errors in the page it will be repeated up to six times and then the download will abort and an error message will be printed.
Note that after an error the page that prompted you to press f5 will be displayed. This is not necessarily the last page that was sent, so you should press f8 to repeat the last page sent before continuing.

f6 toggles the programming of the <RETURN> key between # and actual <RETURN>. This is to allow the use of any 'Gateways' from Prestel which require <RETURN> at the end of an input instead of #. The new character will be sent when f6 is pressed, then <RETURN> can be used again. If you press <RETURN> and do not get the expected result, try re-programming it with f6.
The re-programming also applies to the !M sequence in function key strings.

f7 sends an Escape code (decimal 27, hex &1B). This can not be done with the Escape key because the terminal uses it to change to the menu.

f8 repeat the current page by sending the *00 command.

f9 request the previous page by sending the ** command.

f0 log off by sending the *90# command.

COPY saves the current screen on disc. You will be prompted for a filename.

7.2 *MED - The Demonstration Screen Editor.

This program is a demo of a complete editor display suite that is available for £10 from Jafa Systems. Note that the complete program requires a Master RAM Board.

When it is entered, a selection of four timed example screens will appear. You can then press:

<RETURN> to go quickly to the next screen.

<COPY> to edit the displayed screen. Use the cursor keys and watch the top status line.

<DELETE> to edit a blank screen.

Editing is finished by pressing <RETURN> and you have the option of saving the page. The editor function key overlay diagram is printed on the back cover of this manual.

8.1 Using the Mode 7 Mk2 unit with WORDWISE.

It is possible to use WORDWISE without the Master RAM board. However, because of the way WORDWISE moves text around during editing, it has to be possible to fit the entire text into the free 5000 bytes between &6800 and &7C00 shown in the memory map in section 3.3. This sets a natural limit to the size of text that can be written.

Any serious use requires a Master RAM board and WORDWISE will then work normally.

WORDWISE-PLUS has the built in printer commands US and DS, Underline start and Double Strike start. These normally show up on the screen during preview and printing. This is done by direct POKes to the screen. However, because of the RAM requirements of the Mode 7 Mk2 unit and the Master RAM switching, these commands cause crashes to occur. Therefore, **US and DS should not be used.** If they are present in existing files they should be Globally Replaced by using OC with the appropriate codes for your printer. For example, to print this text US was replaced with OC27,45,1.

Note that WORDWISE does not know about Master RAM boards. So if the text extends above &4000 it will still switch to mode 7 instead of mode 3 when previewing and printing, despite the fact that the screen is in shadow memory.

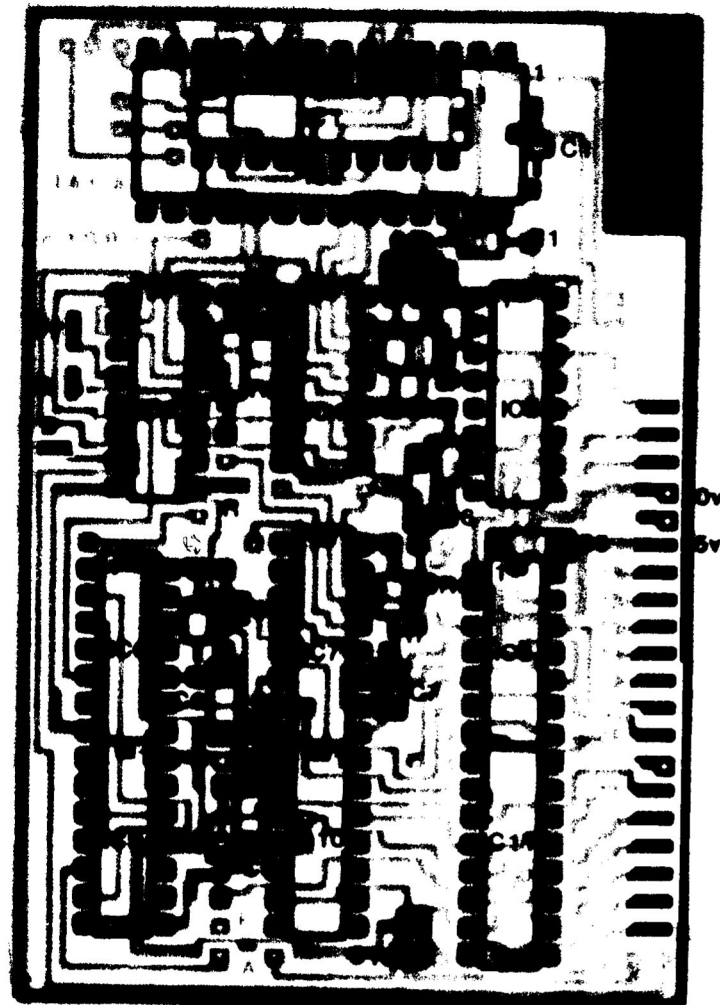
8.2 Using the Mode 7 Mk2 unit with TELETEXT.

To receive TELETEXT you will require a Master RAM board, a User Port and a Morley Teletext Adaptor with separate power supply. Jafa Systems will alter the Morley ROMs free of charge to use Electron User Port addresses, although only the ATS ROM has been tested with the Mode 7 Mk2 unit. The rest of this section refers to the ATS ROM.

Connect up the User Port, TELETEXT adaptor and TV aerial, but do not plug the adaptor into the mains. Switch on the computer, activate the Mode 7 Mk2 unit, then enter *TELETEXT <RETURN>. The screen should go blank and the message BBC1 appears in the top left corner. Now plug the TELETEXT Adaptor into the mains and press <BREAK>. Follow the instructions in the ATS manual for tuning. Note that the tuning process is faster if you press <SHIFT> as well as the cursor keys.

The system will now work exactly as described in the ATS manual, but note that as the Electron has no TAB key you should use CTRL-I instead.

Rear



Front

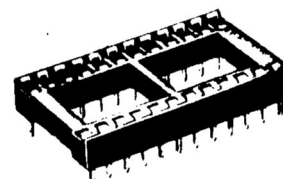
IC1 74LS273	R1,2,7 470	C1,5,6,8,10 100nF
IC2 SAA5050	R3,4,5 4k7	C2 220pF
IC3 74LS157	R6 120	C3,7 150pF
IC4 74LS86	R8 680	C4 10nF
IC5 74LS174	R9 390	C9 22nF
IC6,9 74LS74	R10 1k	D1 1N4148
IC7 74LS163		
IC8 74LS32	NB. IC9,10,11 and R10 and C8,9,10 are <u>mounted under</u> the board.	
IC10 74LS14		
IC11 74LS138	IC11 is opposite way round.	
Plus cable as specified in Appendix 2.		

APPENDIX 1. Construction Notes.

Before starting construction you should read this and the next appendix thoroughly. **Do not continue if you are not sure of your ability.** JAFAs Systems accept NO responsibility for any mistakes you may make, or for any faults that may arise from your attempts. **The fitting service is not available for kits.** If you decide not to continue, contact JAFAs Systems to arrange the fitting of a complete unit.

Construction is straightforward providing you have a fine tipped soldering iron. You will also need a multimeter to check the board for short circuits.

The component layout and parts list for the larger board are shown opposite. Note carefully the orientation of the IC's and diode. Apart from IC2, the SAA5050, none of the IC's should be socketed.

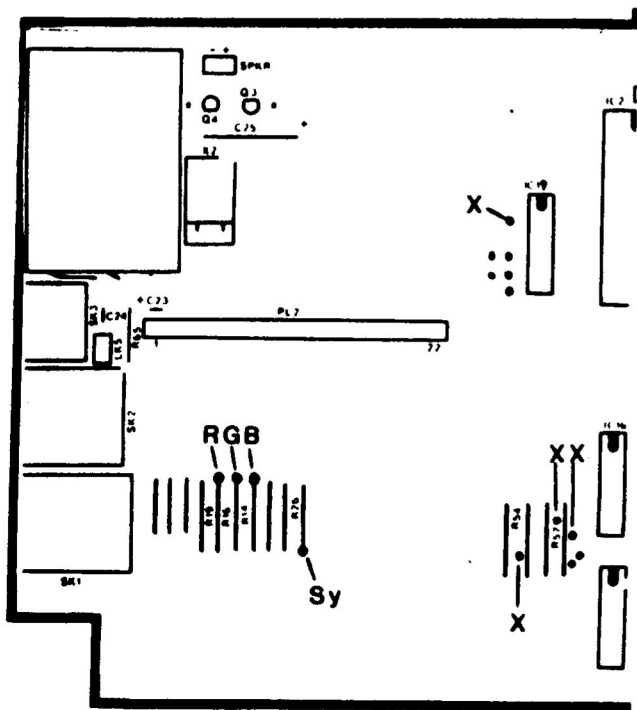


The 28 pin socket for IC2 should be the open variety as shown alongside. This picture is from RS components' catalogue, but Maplins have a similar product in their catalogue. Solder in IC1 first. Then cut out the cross bar from the socket and fit the socket onto the board, around IC1.

The resistors are all 0.25 watt and the capacitors are all subminiature ceramic types with tolerances of + or - 10% or 20% and dimensions in the 6 to 7 mm range. If you have difficulty obtaining the SAA5050, JAFAs Systems can supply one for £10 including postage.

Note that components at the front of the board, as listed opposite, are mounted underneath the board.

When you have completed the board use the multimeter to check each of the 20 edge contacts for shorts to each of the others, especially to the 0v and 5v contacts.



Unscrew the four Philips screws holding the board, and remove the board from the Electron.

In the front right hand quarter of the board you will find the Acorn logo together with an 'issue' number. If your board is issue 2 or 4 then use the top diagram on page 18. if issue 6 use the bottom diagram.

The diagrams on page 18 show four holes marked 'X' on the top of the board. These are alongside R5 and under IC4 on issues 2 and 4, and alongside IC19, R57 and R54 on issue 6.

Turn the board over and identify the holes on the underside of the board. The track must be cut at these points and the easiest way to do it is to 'counter sink' the solder pads with a small drill bit. Alternatively a sharp knife may be used. **Make sure you drill the right holes!**

Take the smaller of the Mode 7 Mk2 boards and lay it on the under side of the Electron board so that the holes in it fit over the pins of the ULA. The Jafa Systems text should be towards the Electron board and the tracks on the Mode 7 board should be visible with the edge contacts towards the side edge of the Electron board.

The Mode 7 board must be as close to the Electron board as possible. Two holes in the Mode 7 board fit over the pins of the decoupling capacitor alongside the ULA on issues 2 and 4 boards. However, on issue 6 boards, some cutting and resoldering of leads from surrounding components may be necessary. Also for issue 6 boards you will have to put insulating tape over the Jafa Systems text to avoid shorting out bare pads on the Electron board.

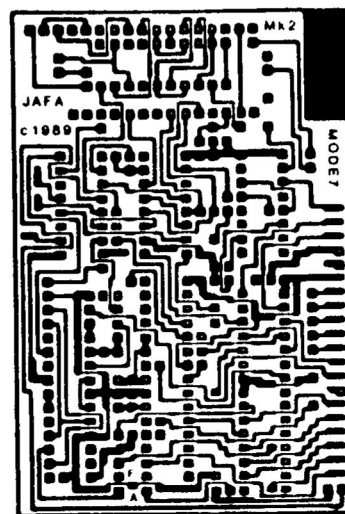
Once the two boards are fitting as snugly as possible, examine the pins of the ULA or its socket coming through the holes in the Mode 7 board.

If the tip of your soldering iron can touch all the pins you can now solder the board in. Only solder where there are pads on the board and let solder flow into the holes to form a good contact between the pins and the pads.

If the pins do not protrude far enough to contact them, then you must remove the Mode 7 board and solder short lengths of fine wire (eg. wire wrap wire) to the 20 pins of the ULA **that have corresponding pads on the Mode 7 board**. Then fit the board over the wires and proceed as in the last paragraph before trimming off the wires.

Now solder the 20 way ribbon cable onto the Mode 7 board edge contacts. Keep the cable as flat as possible against the Electron board and ensure that the solder connections are as flat as possible.

Note that if you are not using the specified ribbon cable, the type you use should be reasonably stiff and springy as it will help to support the main board. Jafa Systems can supply a length of the specified cable for £1.50 including postage and packing.



Now solder the larger board onto the other end of the cable, as shown in this diagram. Use the multimeter to ensure the absence of shorts between all combinations of the edge pads.

