JAFA SYSTEMS

USER GUIDE

for the

MODE 7 Mk 2
DISPLAY
UNIT

(Including kit Construction Notes)
(and fitting instructions.   )

This manual is published by:

JAFA Systems
9, Lon-y-Gara. Caerphllly.
Mid-Glamorgan. Wales CF8 1NL

Please note that, within t:his text, the term Electron is a registered tradename of Acorn Computers Ltd, All references to the BBC microcomputer refer to the computer produced for the British Broadcasting Corporation by Acorn Computers Ltd.
Wordwise and Wordwise-PLUS are designed and distributed by Computer Concepts. The Master RAM Board is produced by Slogger Computers Ltd.

The product described in this manual is subject to continuous development and improvement. All information of a technical nature and particulars of the product and its use are given in good faith. However the publisher can accept no responsibility for any errors or omissions. Neither is any liability assumed for damages resulting from the use of thp product described herein or the information contained within.

The Mode 7 Mark 2 unit is guaranteed against defect due to manufacture for a period of 6 months from date of purchase. Any mis-use 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 MARK 2 display unit.

CONTENTS

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 JAFA Systems Mode 7 Adapter 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 Adapter because it dispenses with the memory scanning sections, The ROM, which is an extension of the Adapter 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. <u>Installing the ROM.</u>

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

In order to fit your ROM you require a ROM expansion unit, if you use the socket in the JAFA 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 JAFA Systems immediately.

Once everything seems in order, type:

*MODE7ON <RETURN> <BREAK>

The MODE 7 break screen will then appear.

3.1 <u>Updating the display.</u>

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 OSWRCH 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 <u>Scrolling.</u>

Normally, the time taken to scroll the screen, i.e. 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, e.g., disc operation, will affect the updating process.

3.3 <u>Mode 7 Memory Map.</u>

Display pointer variables	&7FFF) &7FE8) Always in main
Mode 7 code memory	) 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 &150) main memory

3.4 <u>Stack Overrun Error.</u>

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 Mk2 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 <u>Operation of the function keys.</u>

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, e.g., 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 key 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 <u>Operation of the shifted cursor keys</u>

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

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

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

5.1 <u>Mode 7 Mk2 command summary.</u>

---

*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, e.g., 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 Hk2 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> + <I>, 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. <u>Teletext control codes.</u>

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.

e.g. **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-X (SHiFT-f2) corresponds to 130, and so on up to FUNC-. (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:
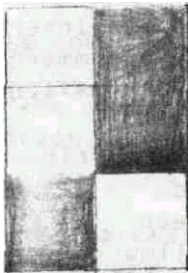
would be 186.

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 adapter, 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 adapter, 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 B00 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 |M sequence can be used to represent the <RETURN> key, e.g., ***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 he 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 +he 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 <u>Using the Mode 7 Mk2 unit with WORDWISE.</u>

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.
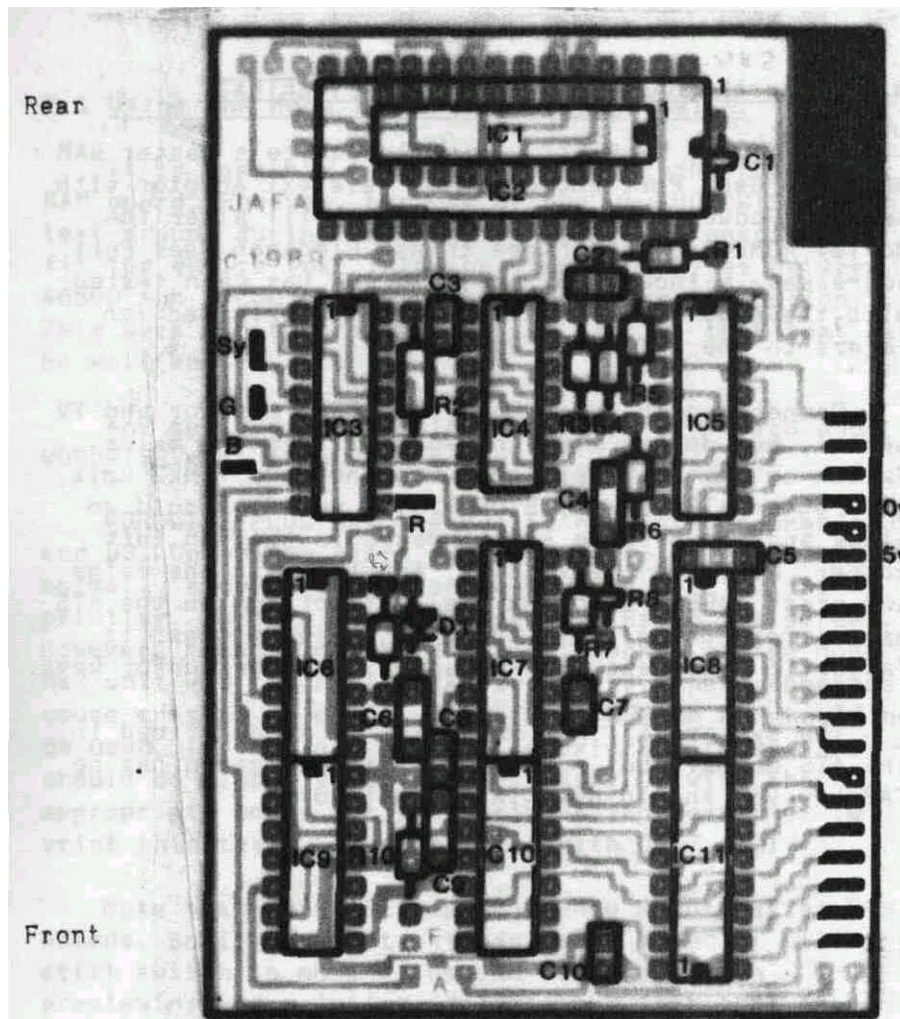

Note that WORDWISE does not know about Master RAM boards, so if the text extends above &4000 it will still switch to mode 7 instead of mode 3 when previewing and printing, despite the fact that the screen is in shadow memory.

8.2 <u>Using the Mode 7 Mk2 unit with TELETEXT.</u>

      To receive TELETEXT you will require a Master RAM board, a User Port and a Morley Teletext Adapter 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 adapter and TV aerial, but do not plug the adapter 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 Adapter 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.

|		
IC1 74LS273	R1,2,7 470R	C1,5,6,8,10 100nF
IC2 SAA5050	R3,4,5 4K7	C2 220pF
IC3 74LS157	R6 120R	C3,7 150pF
IC4 74LS86	R8 680R	C4 10nF
IC5 74LS174	R9 390R	C9 22nF
IC6,9 74LS74	R10 1K	DI 1N4148
IC7 74LS163		
IC8 74LS32	**NB. IC9,10,11 and R10 and C8,9,10**	
IC10 74LS14	**are mounted under the board.**	
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**. JAFA 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 JAFA 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.
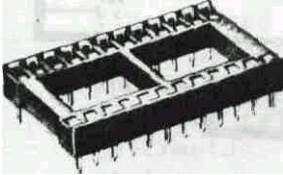
The resistors are all 0.25 watt and the capacitors are all sub miniature ceramic types with tolerances of + or - 10% or 20% and dimensions in the 6 to 7 mm range, If you have difficulty obtaining the SAA5050, JAFA Systems can supply one for £10 including postage.

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.
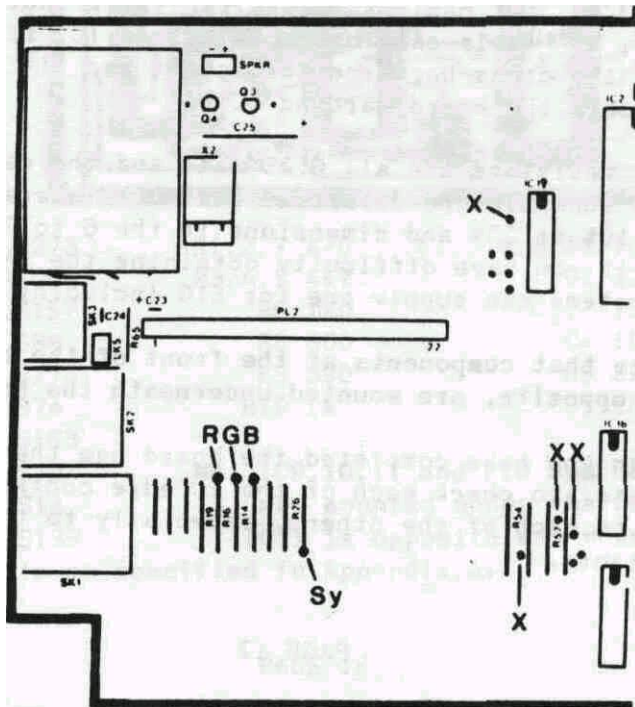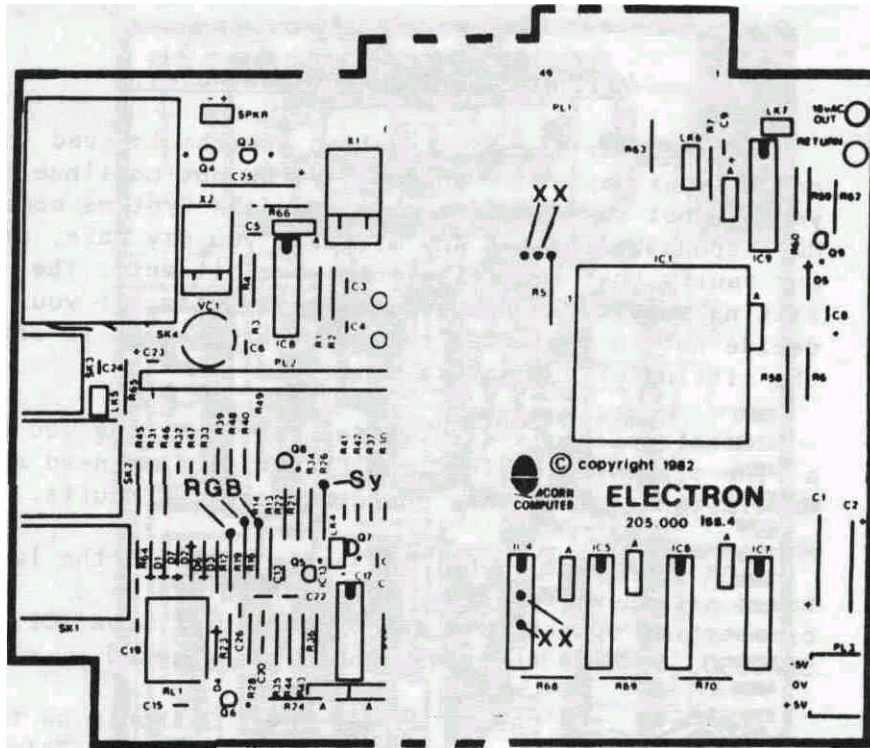
APPENDIX 2. Fitting Instruction.

Before starting to fit the Mode 7 Mk2 unit read this Appendix carefully**. Do not proceed if you are not sure of your ability.** JAFA 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 partially assembled systems**, although repairs will be undertaken, if possible, at a cost dependent on the fault. If you decide not to continue, contact JAFA Systems to arrange the fitting of a complete unit.

<< Opposite. Electron main board (part of).
     Upper – Issues 2 and 4.   Lower – Issue 6.

To fit the unit you will require:

'inter-board jumper (ribbon) cable' 85mm by 20 way, RS/Electromail stock number 358-163. or equivalent stiff ribbon cable, plus a small Philips screwdriver, a fine tipped soldering iron, either a sharp knife or a small drill bit (approx- 1/10 inch or smaller), four approx, 8 inch lengths of insulated wire (preferably coloured red, blue, green and yellow), and a multimeter. You may also need approx. 6 inches of miniature solid wire, e.g., wire wrap wire.

Before and during the operation, ensure that you have not picked up any static charge by regularly touching some earthed metalwork.

To open up your Electron, first of all remove the Plus 1. ROMbox Plus, Plus 3, and any other add-ons. Turn the Electron upside down and remove the four small Philips head screws, two recessed in the front corners and two alongside the edge connector, Turn the Electron over, lift up the keyboard and pull the keyboard connector off its contact strip.

Disconnect the loudspeaker plug, the three pin +5V/0V/-5V connector and the two 18Vac 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 (e.g., 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.
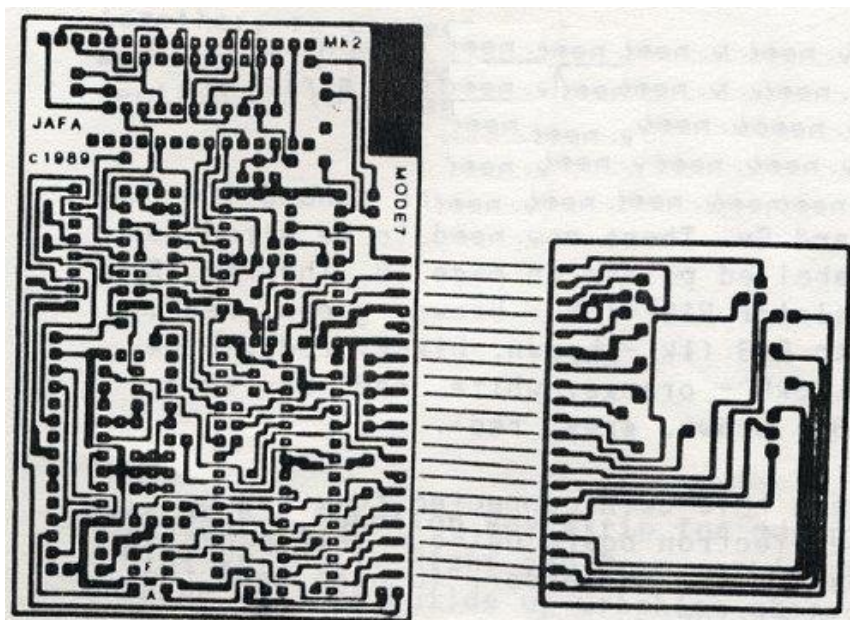
Now rep]ace the Electron board in the base of the computer, bending the ribbon cable up at right angles round the edge of the board.

Look at the ULA, If it is mounted in a socket it is probably a 'Ferranti' type (F). If it is soldered straight in it is probably an 'Aberdeen' type (A).

There are three holes near the front left hand edge of the larger Mode 7 board, They are labelled thus:

o F

o A o

If you have a Ferranti ULA, the front left hand hole must be linked to the rear hole (F). If you have an Aberdeen ULA the front left hand hole should be linked to the front right hand hole (A). Make sure that the links do not short to the nearby track.

Now stick the foam strips provided onto the Mode 7 board. The longer strip goes alone the top front, edge, of the board, over the pins of IC's 9-11. The shorter strip goes under the board, under IC's 6 and 7.

Push the board down, folding the ribbon cable in a 'Z' shape under it, until the lower foam strip is resting on the ULA.

The diagram on page 16 shows 4 pads around IC3 marked R, G, B and Sy. These now need to be wired to the similarly labelled points on page 18. The red (R) lead goes to resistor R19 (1k5 - brown, green, red). green (G) goes to R16 (1k - brown, black, red), blue (B) goes to R14 (3k9 - orange, white, red) and sync (Sy) to R26 (lk8 - brown, grey, red).

Once the wires have been connected they can be clamped onto the Electron board using a self adhesive clip or tie close to the processor, to help hold the Mode 7 board in position.

The Electron board can now be screwed down and the four connectors re-fitted, Push the keyboard connector onto its contact strip.

Position the top of the computer onto the base, noting that the pressure of the keyboard on the front strip of foam will keep the Mode 7 board in position.

Before screwing the case together, connect a monitor and switch the computer on. **If you do not get the normal display, switch off immediately** and check all your work for signs of shorts or bad contacts. If you cannot find the fault, contact JAFA Systems.

When the computer is working, screw the case back together, re-connect your add-ons, and follow the main section of this manual.

Over page - Function key strip for editor demo (*MED)
Line Up, Left, Right and Down require two presses.
Shape Definer builds up Graphics characters.

1	2	3	4	5	6	7	8	9	0	-	=
Alpha Red	Alpha Green	Alpha Yellow	Alpha Blue	Alpha Magenta	Alpha Cyan	Alpha White	Flash On	Flash Off	Block		

Q	W	E	R	T	Y	U	I	O	P
Graphic Red	Graph Green	Graph Yellow	Graph Blue	Graphic Magenta	Graph Cyan	Graph White	Line Up	Line Full Graphic	Block Block Window Graphic

A	S	D	F	G	H	J	K	L	+
Background Off	Overlap On	On	Double Height Off	Off	Line On	Line Left	Right		

Z	X	C	V	B	N	M	<	>	?
Screen Top	Screen Left	Tab Left	Tab Right	Screen Right	Screen Bottom	Line Down			Shape Definer