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Information can also be obtained from the Acorn Support Information Database (SID). This is an on-line viewdata system available to registered SID users. Initially, access SID on Cambridge (0223) 243642: this will allow you to inspect the system and use a response frame for registration.

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    A3000 final assembly diagram
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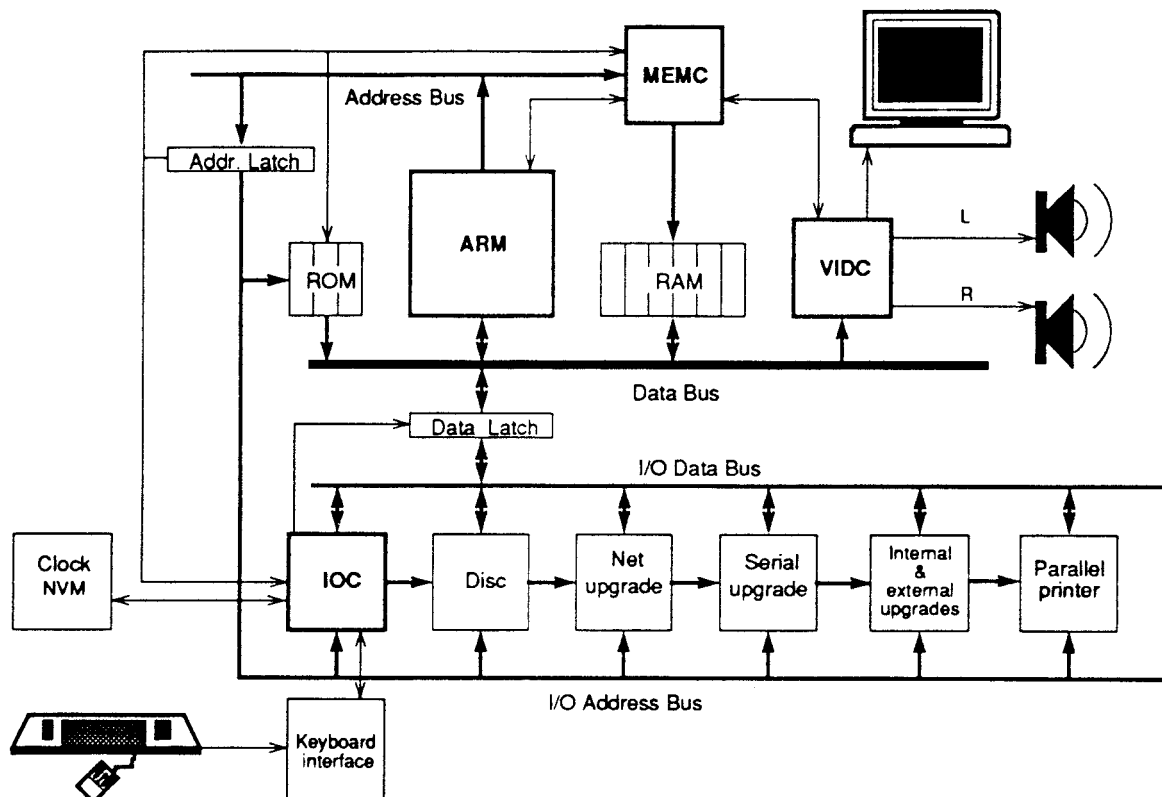   Main PCB bottom assembly diagram   )   separately

System description

Introduction

The A3000 computer is built around the ARM chip set, comprising the Acorn Risc Machine (ARM) itself, the Memory Controller (MEMC), Video Controller (VIDC) and Input Output Controller (IOC).

A block diagram of the A3000 is shown below:

General

The ARM IC is a pipelined, 32-bit reduced instruction set microprocessor which accepts instructions and manipulates data via a high speed 32-bit data bus and 26-bit address bus, giving a 64 Mbyte uniform address space. The ARM supports virtual memory systems using a simple but powerful instruction set with good high-level language compiler support.

MEMC acts as the interface between the ARM, the Video and I/0 Controllers, Read-Only Memory (ROM) and Dynamic memory devices (DRAM), providing all the critical system timing signals including processor clocks.

1 or 2 Mbyte of DRAM is connected to MEMC which provides all signals and refresh operations. A Logical to Physical Translator maps the Physical Memory into a 32 Mbyte Logical address space (with three levels of protection) allowing Virtual Memory and Multi-Tasking operations to be implemented. Fast page mode DRAM

accesses are used to maximise memory bandwidth. VIDC requests data from the RAM when required and buffers it in one of three FIFOs before using it. Data is requested in blocks of four 32-bit words, allowing efficient use of paged-mode DRAM without locking the system data bus for long periods.

MEMC supports Direct Memory Access (DMA) operations with a set of programmable DMA Address Generators which provide a circular buffer for Video data, a linear buffer for Cursor data and a double buffer for Sound data.

The Input Output Controller (IOC) controls the I/O bus and expansion cards, and provides basic functions such as the keyboard interface, system timers, interrupt masks and control registers. It supports a number of different peripheral cycles, and all I/O accesses are memory mapped.

VIDC takes video data from memory under DMA control, serialises it and passes it through a colour look-up palette, then converts it to analogue signals for driving the CRT guns. VIDC also controls all the display timing parameters and controls the position and pattern of the cursor sprite. In addition, it

incorporates an exponential Digital to Analogue Converter (DAC) and stereo image table for the generation of high quality sound from data in the DRAM.

VIDC is a highly programmable device, offering a very wide choice of display formats. The colour look-up palette which drives the three on-chip DACs is 13 bits wide, offering a choice from 4096 colours or an external video source.

The cursor sprite is 32 pixels wide and any number of rasters high. Three simultaneous colours (again from a choice of 4096) are supported and any pixel can be defined as transparent, making possible cursors of many shapes. It can be positioned anywhere on the screen.

The sound system implemented on the device can support up to 8 channels, each with a separate stereo position.

The I/O system

The I/O system is controlled by the I/O Controller (IOC) and the Memory Controller (MEMC). The I/O Bus supports all the internal peripherals and the expansion cards. Details of the expansion bus can be found in the chapter entitled 'A3000 expansion'.

This section is intended to give the reader a general understanding of the A3000 I/O system and should not be used to program the I/O system directly. The implementation details are liable to change at any time and only the published software interfaces should be used to manipulate the I/O system. Future systems may have a different implementation of the I/O system, and in particular the addresses (and number) of expansion card locations may move. For this reason, and to ensure that any device may be plugged into any slot, all driver code for expansion cards must be relocatable. References to the direct expansion card addresses should never be used. It is up to the machine operating system, in conjunction with the expansion card ID, to determine the address at which an expansion card should be accessed. To this extent, some of the following sections are for background information only.

The I/O system
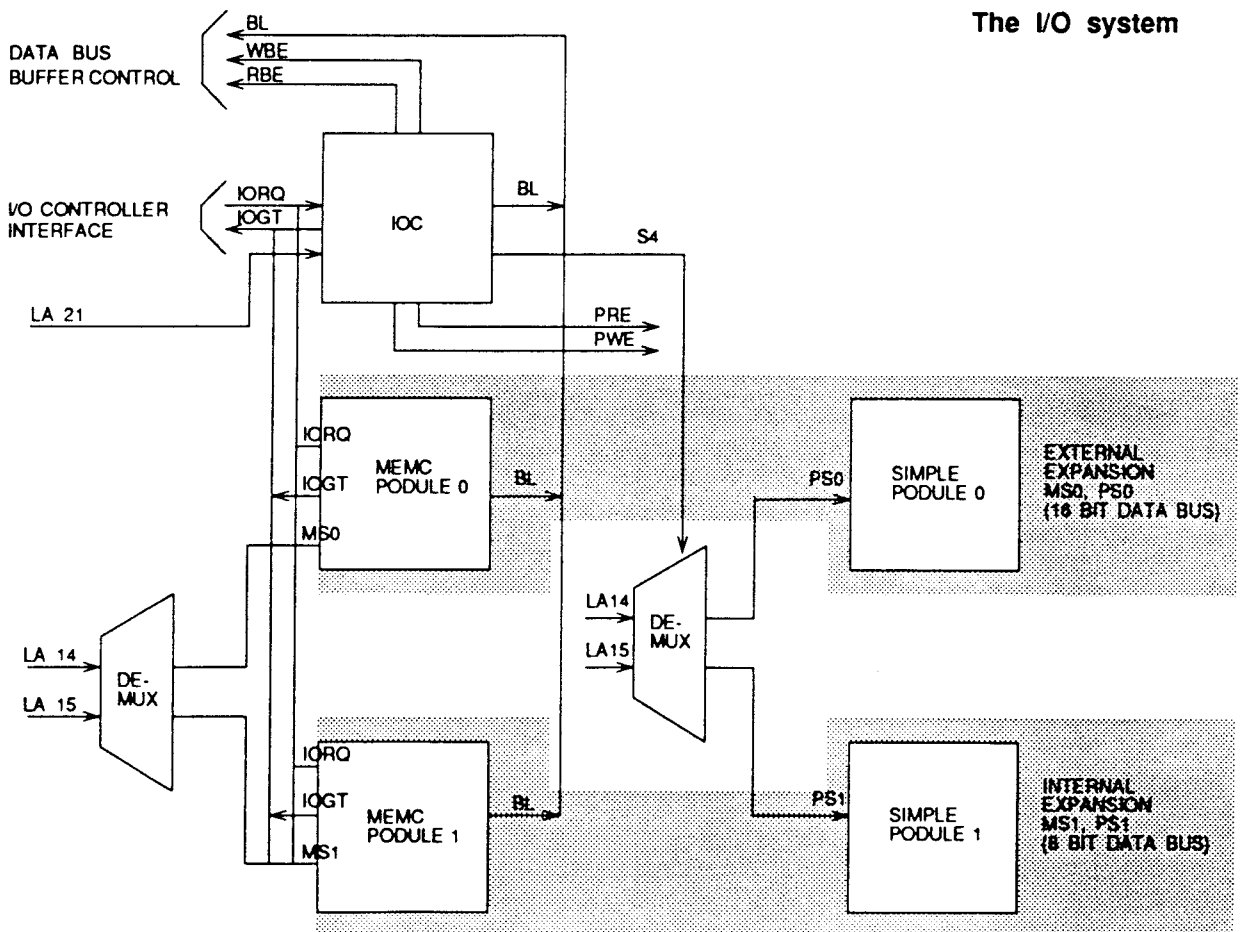
System architecture

The I/O system (which includes expansion card devices) consists of a 16-bit data bus (BD[0:15]) a buffered address bus (LA[2:21]) and various control and timing signals. The I/O data bus is independent of the main 32-bit system data bus, being separated from it by bidirectional latches and buffers. In this way the I/0 data bus can run at much slower speeds than the main system bus to cater for slower peripheral devices. The latches between the two buses, and hence the I/O bus timing are controlled by IOC. IOC caters for 4 different cycle speeds (slow, medium, fast and synchronous).

A typical A3000 I/O system is shown in the diagram on the previous page. For clarity, the data and address buses are omitted from this diagram.

System memory map

The system memory map is defined by the MEMC, and is shown below. Note that all system components, including I/O devices, are memory mapped.

I/O space memory map

This IOC-controlled space has allocation for simple expansion cards and MEMC expansion cards.

Data bus mapping

The I/O data bus is 16 bits wide (8 bits wide for the internal expansion card interface). Bytewide accesses are used for 8-bit peripherals. The I/O data bus (BD[0:15]) connects to the main system data bus (D[0:31]) via a set of bidirectional data latches.

The mapping of the BD[0:15] bus onto the D[0:31] bus is as follows:

During a WRITE (ie ARM to peripheral) D[16:31] is mapped to BD[0:15].

During a READ (ie peripheral to ARM) BD[0:15] is mapped to D[0:15].

Byte accesses

To access bytewide expansion cards, byte instructions are used. A byte store instruction will place the written byte on all four bytes of the word, and will therefore correctly place the desired value on the lowest byte of the I/O bus. A byte or word load may be used to read a bytewide expansion card into the lowest byte of an ARM register.

Half-word accesses

To access a 16-bit wide expansion card, half-word instructions are used. When storing, the half-word is placed on the upper 16 bits, D[16:31]. To maintain upwards compatibility with future machines, half-word stores replicate the written data on the lower half-word, D[0:15]. When reading, the upper 16 bits are undefined.

Expansion card identification

It is important that the system is able to identify what expansion cards (if any) are present, and where they are. This is done by reading the Podule (expansion card) Identification (PI) byte, or bytes, from the Podule Identification Field.

System memory map

Read	Write	Hex address
		3FFFFFF
ROM (high)	Logical to Physical address translator	
		3800000
ROM (low)	DMA address generators	3600000
	Video Controller	3400000
Input/Output Controllers		3000000
Physically mapped RAM		
		2000000
Logically mapped RAM		
		0000000

I/O address memory mapping

All I/O accesses are memory mapped. IOC is connected as detailed in this table:

IOC	ARM
CS	LA[21]
T[1]	LA[20]
T[0]	LA[19]
B(2)	LA[18]
B[1]	LA[17]
B[0]	LA[16]

Internal register memory map

Address	Read	Write
3200000H	Control	Control
3200004H	Serial Rx Data	Serial Tx Data
3200008H	-	-
320000CH	-	-
3200010H	IRQ status A	-
3200014H	IRQ request A	IRQ clear
3200018H	IRQ mask A	IRQ mask A
320001CH	-	-
3200020H	IRQ status B	-
3200024H	IRQ request B	-
3200028H	IRQ mask B	IRQ mask B
320002CH	-	-
3200030H	FIQ status	-
3200034H	FIQ request	-
3200038H	FIQ mask	FIQ mask
320003CH	-	-
3200040H	T0 count Low	T0 latch Low
3200044H	T0 count High	T0 latch High
3200048H	-	T0 go command
320004CH	-	T0 latch command
3200050H	T1 count Low	T1 latch Low
3200054H	T1 count High	T1 latch High
3200058H	-	T1 go command
320005CH	-	T1 latch command
3200060H	T2 count Low	T2 latch Low
3200064H	T2 count High	T2 latch High
3200068H	-	T2 go command
320006CH	-	T2 latch command
3200070H	T3 count Low	T3 latch Low
3200074H	T3 count High	13 latch High
3200078H	-	T3 go command
320007CH	-	T3 latch command

Peripheral address

Cycle Type	Bk	Base Address	IC	Use
Fast	1	&3310000	1772	Floppy disc controller
Sync	2	&33A0000	6854	Econet controller*
Sync	3	&3380000	6551	Serial line controller*
Med.	5	&32D0000	HD63463	Hard disc**
Med.	5	&32D0020	HD63463	Hard disc**
Med.	5	&32D0008	HD63463	Hard disc**
Med.	5	&32D0028	HD63463	Hard disc**
Fast	5	&3350010	HC374	Printer Data
Fast	5	&3350018	HC574	Latch B
Fast	5	&3350040	HC574	Latch A
	6	-	-	Reserved
Slow	4	&3244000	Podule	Internal expansion
Med.	4	&32C4000	Podule	Internal expansion
Fast	4	&3344000	Podule	Internal expansion
Sync	4	&33C4000	Podule	Internal expansion
Slow	4	&3240000	Podule	External expansion
Med.	4	&32C0000	Podule	External expansion
Fast	4	&3340000	Podule	External expansion
Sync		&33C0000	Podule	External expansion
Slow	7	&3270000	Podule	Extended ext expansion

*If fitted⟁
**not fitted

I/O programming details

External latch A

External Latch A is a write only latch used to control parts of the floppy disc sub-system:

7	6	5	4	3	2	1	0
DE/CR	IU	MOO	SS	US3	US2	US1	US0

- Floppy disc 0
- Floppy disc 1
- Floppy disc 2
- Floppy disc 3
- Side select
- Motor on/off
- In Use control
- Not used

Bit	Name	Function
0-3	Floppy disc sel.	These bits select the floppy disc drive 0 through 3 when written LOW. Only one bit should be LOW at any one time.
4	Side select	This controls the side select line of the floppy disc interface. 0 = Side 1 (upper) 1 = Side 0 (lower)
5	Floppy motor	This bit control the floppy disc on/off control motor line. Its exact use depends on the type of drive.
6	In Use	This bit controls the IN USE line of the floppy disc. Its exact use depends on the type of drive.
7		Not used.

External latch B

The External Latch B is a write only register shared between several users who must maintain a consistent RAM copy. Updates must be made with IRQ disabled.

7	6	5	4	3	2	1	0
HS3	AUX2	AUX1	PS	FDCR	CD2	CD1	CD0

- Reserved = 0
- Data Separator control
- Reserved = 0
- FD controller reset
- Printer strobe
- Not used
- Not used
- Not used

Bit	Name	Function
0-2	CD [0:2]	CD[0:2] should be programmed CD[0:2] LOW for future compatibility. CD[1] controls the floppy disc data separator format. CD[1] = 0 Double Density CD[1] = 1 Single Density
Bit 3	FDCR	This controls the floppy disc controller reset line. When programmed LOW, the controller is RESET.
Bit 4	Printer Strobe	This used to indicate valid data on the printer outputs. It should be set HIGH when valid data has been written to the printer port and LOW after about 5μs.
Bit [5:6]	AUX [1:2]	Not used..
Bit 7	HS3	Not used.

Interrupts

The I/O system generates two independent interrupt requests, IRQ and FIQ. Interrupt requests can be caused by events internal to IOC or by external events on the interrupt or control port input pins.

The interrupts are controlled by four types of register: status, mask, request and clear. The status registers reflect the current state of the various interrupt sources. The mask registers determine which sources may generate an interrupt. The request registers are the logical AND of the status and mask registers and indicate which sources are generating interrupt requests to the processor. The clear register allows clearing of interrupt requests where appropriate. The mask registers are undefined after power up.

The IRO events are split into two sets of registers, A and B. There is no priority encoding of the sources.

Internal Interrupt Events:

- Timer interrupts TM[0:1]
- Power-on reset POR
- Keyboard Rx data available SRx
- Keyboard Tx data register empty STx
- Force interrupts 1.

External Interrupt Events

- IRQ active low inputs IL[0:7] wired as (0-7 respectively) PFIQ, SIRQ, SLC1,NOT USED, DCIRQ, PIRQ, PBSY and RII.
- IRQ falling-edge input IF wired as PACK
- IRQ rising-edge input IR wired as VFLY
- FIQ active high inputs FH[0:1] wired as FFDQ and FFIQ
- FIQ active low input FL wired as EFIQ
- Control port C[3:5].

IRO status A
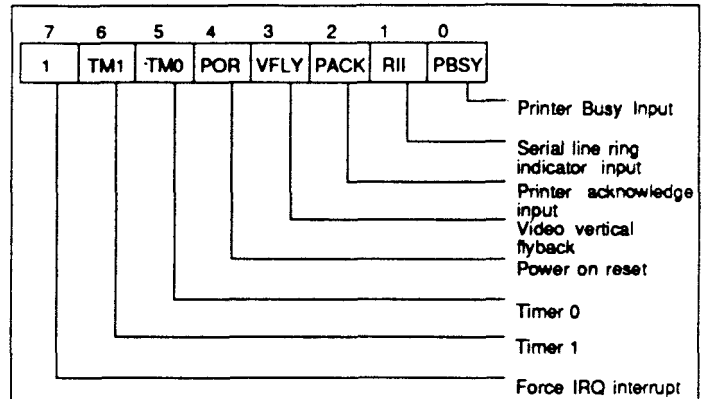
Bit	Name	Function
0	PBSY	This bit indicates that the printer is busy.
1	RII	This bit indicates that a Ringing Indication has been detected by the serial line interface.
2	Printer Ack	This bit indicates that a printer acknowledgement bit has been received.
3	Vertl Flyback	This bit indicates that a vertical flyback has commenced.
4	Power-on reset	This bit indicates that a power-on reset has occurred.
[5:6]	Timer 0 and Timer 1 events	These bits indicate that events have occurred. Note: latched interrupt.
7	Force	This bit is used to force an IRQ request. It is usually owned by the FIQ owner and is used to downgrade FIQ requests into IRQs.

IRQ status B

7	6	5	4	3	2	1	0
SRx	STx	PIRQ	DCIRQ	WIRQ	SLCI	SIRQ	PFIQ

- Podule FIQ request
- Sound buffer reload request
- Serial line controller interrupt
- Winchester interrupt request
- Disc changed interrupt request
- Podule IRQ request
- Keyboard Serial Tx event
- Keyboard Serial Rx event
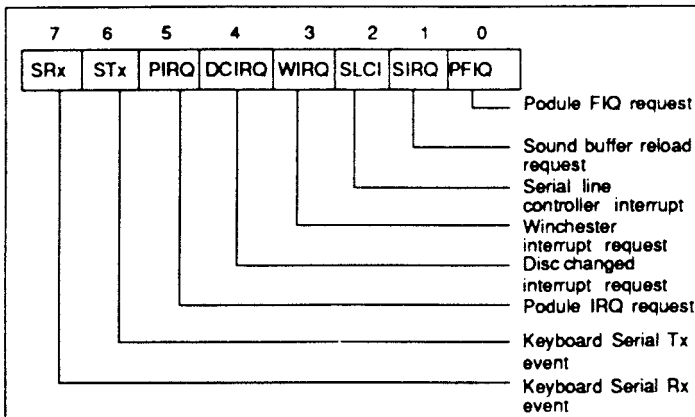
Bit	Name	Function
0	Podule FIQ req	This bit indicates that a Podule FIQ request has been received. It should usually be masked OFF.
1	Snd buffr swap	This bit indicates that the MEMC sound buffer pointer has been relocated.
2	Serial line ctrlr	This bit indicates that 65C51 serial line controller interrupt has occurred.
3	H disc interrupt	This bit indicates that a hard disc interrupt has occurred.
4	Disc changed Interrupt	This bit indicates that the floppy disc has been removed.
5	Pod. interr req	This bit indicates that a Podule IRQ request has occurred.
6	Keyb Tx event	This bit indicates that the keyboard transmit register is empty and may be reloaded.
7	Keybd Rx event	This bit indicates that the keyboard reception register is full and may be read.

Interrupt status FIQ

7	6	5	4	3	2	1	0
1	PFIQ	x	x	x	EFIQ	FFIQ	FFDQ

- Floppy disc data request
- Floppy disc interrupt request
- Econet interrupt request
- See IOC datasheet
- Podule FIQ request
- Force FIQ request
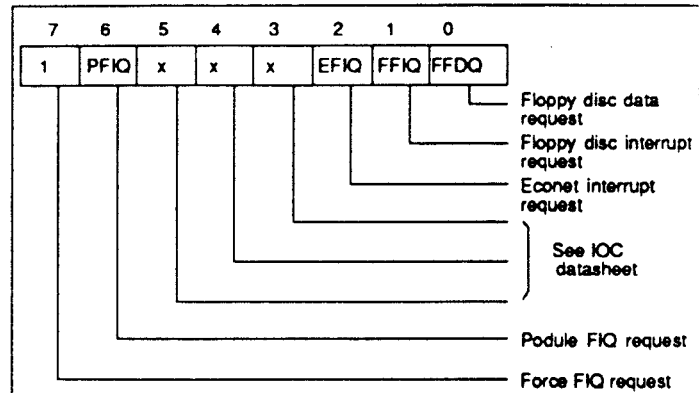
Bit	Name	Function
0	Floppy disc data request	This bit indicates that a Floppy Disc Data Request has occurred.
1	Floppy disc interrupt request	This bit indicates that a Floppy Disc Interrupt Request has occurred.
2	Econet Interrupt request	This bit indicates that an Econet Interrupt Request has occurred.
3-5	C[3:5]	See IOC data sheet for details.
6	Podule FIQ req	This bit indicates that a Podule FIQ Request has occurred.
7	Force	This bit allows an FIQ interrupt request to be generated.

Control port

The control register allows the external control pins C[0:5] to be read and written and the status of the PACK and VFLY inputs to be inspected. The C[0:5] bits manipulate the C[0:5] I/0 port. When read, they reflect the current state of these pins. When written LOW the output pin is driven LOW. These outputs are open-drain, and if programmed HIGH the pin is undriven and may be treated as an input.

On reset all bits in the control register are set to 1.


```
  7    6    5    4    3    2    1    0
VFLY PACK SMUTE          FDR  SCL  SDA
```

- I2C serial bus data
- I2C serial bus clock
- Floppy disc ready*
- Reserved*
- Aux IO connector*
- Sound mute
- PACK & Test Mode*
- Video vert flyback*

*must be written '1'

Bit	Name	Function
C[7]	VFLYBK and Test Mode	Allows the state of the (VFLYBK) signal to be inspected. This bit will be read HIGH during vertical flyback and LOW during display. See VIDC datasheet for details. This bit MUST be programmed HIGH to select normal operation of the chip.
C[6]	PACK & Test Mode	Allows the state of the parallel printer acknowledge input to be inspected. This bit MUST be programmed HIGH to select normal operation of the the chip.
C[5]	SMUTE	This controls the muting of the internal speaker. It is programmed HIGH to mute the speaker and LOW to enable it. The speaker is muted on reset.
C[4]		Available on the Auxiliary I/O connector.
C[3]		Reserved and should be programmed HIGH.
C[2]	READY	Used as the floppy disc (READY) input and must be programmed HIGH.
C[1:0]	SDA, SCL the I2C bus	The C[0:1] pins are used to implement the bi-directional serial I2C bus to which the Real Time Clock and battery-backed RAM are connected.

The sound system

The sound system is based on the VIDC stereo sound hardware. External analogue anti-alias filters are used which are optimised for a 20 kHz sample rate. The high quality sound output is available at a 3.5mm stereo jack socket at the rear of the machine which will directly drive personal stereo headphones or alternatively an amplifier and speakers. Two internal speakers are fitted, to provide stereo audio.

VIDC sound system hardware

VIDC contains an independent sound channel consisting of the following components: A four-word FIFO buffers sixteen 8-bit sound samples with a DMA request issued whenever the last byte is consumed from the FIFO. The sample bytes are read out at a constant sample rate programmed into the 8-bit Audio Frequency Register. This may be programmed to allow samples to be output synchronously at any integer value between 3 and 255 microsecond intervals.

The sample data bytes are treated as sine plus seven-bit logarithmic magnitude and after exponential digital to analogue conversion, de-glitching and sign-bit steering, are output as a current at one of the audio output pins to be integrated and filtered externally.

VIDC also contains a bank of eight stereo image position registers each of three bits. These eight registers are sequenced through at the sample rate with the first register synchronised to the first byte clocked out of the FIFO. Every sample time is divided into eight time slots and the three bit image value programmed for each register is used to pulse width modulate the output amplitude between the LEFT and RIGHT audio current outputs in multiples of time slot subdivisions. This allows the signal to be spatially positioned in one of seven stereo image positions.

MEMC sound system hardware

MEMC provides three internal DMA address registers to support Sound buffer output; these control the DMA operations performed following Sound DMA requests from VIDC. The registers allow the physical addresses for the START, PNTR (incremental) and END buffer pointers to a block of data in the lowest half Megabyte of physical RAM to be accessed. These operate as follows: programming a 19-bit address into the PNTR register sets the physical address from which sequential DMA reads will occur (in multiples of four words) and programming the END pointer sets the last physical address of the buffer. Whenever the PNTR register increments up to this END value the address programmed into the START register is automatically written into the PNTR register for the DMA to continue with a new sample buffer in

memory. A Sound Buffer Interrupt (SIRQ) signal is generated when the reload operation occurs which is processed by IOC as a maskable interrupt (IRQ) source.

The Memory Controller also includes a sound channel enable/disable signal. Because this enable/disable control signal is not synchronised to the sound sampling requests will normally be disabled after the waveforms which are being synthesised have been programmed to decay to zero amplitude; the last value loaded into the Audio data latch in the VIDC will be output to each of the Stereo image positions at the current Audio Sample rate.

IOC sound system hardware

IOC provides a programmed output control signal which is used to turn the internal speaker on or off, as well as an interrupt enable/status/reset register interface for the Sound Start Buffer reload signal generated by MEMC.

The internal speakers may be muted by the control line SMUTE which is driven from the IOC output C5. On reset this signal will be taken high and the internal speakers will be muted.

The stereo output to the headphone socket is not muted by SMUTE and will always reflect the current output of the DAC channels.

The keyboard and mouse

The Keyboard and mouse connection to the ARM is via a keyboard controller and a serial link to the IOC. The ARM reads and writes to the KART registers in the IOC. The protocol is essentially half duplex, so in normal operation the keyboard controller will not send a second byte until it has received an ACK. The only exception to this is during the reset protocol used to synchronise the handshaking, where each side is expecting specific responses from the other, and will not respond further until it has those.

In addition to this simple handshaking system, the keyboard controller will not send mouse data unless specifically allowed to, as indicated by Ack Mouse, which allows the transmission of one set of

accumulated mouse coordinate changes, or the next move made by the mouse. While it is not allowed to send mouse changes the keyboard controller will buffer mouse changes.

A similar handshake exists on key changes, transmitted as key up and key down, and enabled by Ack Scan. At the end of a keyboard packet (two bytes) the operating system will perform an Ack Scan as there is no protocol for re-enabling later. Mouse data may be requested later by means of Request Mouse Position (ROMP).

Key codes

The keyboard controller identifies each key by its row and column address in the keyboard matrix. Row and column codes are appended to the key up or down prefix to form the complete key code.

For example, Q key down — the complete row code is

11000010 (C2 hex) and the column code is 11000111 (C7 hex).
Note: Eight keys have N key roll over. The operating system is responsible for implementing two-key roll-over, therefore the keyboard controller transmits all key changes (when enabled). The keyboard controller does not operate any auto-repeat; only one down code is sent, at the start of the key down period.

Data protocol

Data transmissions from the keyboard are either one or two bytes in length. Each byte sent by the keyboard controller is individually acknowledged. The keyboard controller will not transmit a byte until the previous byte has been acknowledged, unless it is the HRST code indicating that a power on or user reset occurred or that a protocol error occurred; see below.

Reset protocol
The keyboard controller restarts when it receives a HardReSeT (HRST) code from the ARM. To initiate a restart the keyboard controller sends a HRST code to the ARM, which will then send back HRST to command a restart.

The keyboard controller sends HRST to the ARM if :
• A power-on reset occurs
• A user reset occurs
• A protocol error is detected.
After sending HRST, the keyboard controller waits for a HRST code. Any non HRST code received causes the keyboard controller to resend HRST.

The pseudo program below illustrates the reset sequence or protocol:

```
START reset
ON error Send HRST code to ARM then wait for code from ARM.
IF code - HRST THEN restart ELSE error
ON restart    clear mouse position counters
              set mouse mode to data only in response to an RMPS request.
              stop key matrix scanning and set key flags to up
              send HRST code to ARM
Wait for next code
IF code - RAK1 THEN send RAK1 to ARM      ELSE error
Wait for next code
IF code - RAK2 THEN send RAK2 to ARM      ELSE error
Wait for next code
IF code    SMAK THEN mouse mode to send if not zero and enable key scan
ELSE IF code - SACK THEN enable key scanning
ELSE IF code - MACK THEN set mouse mode to send when not zero
ELSE IF code NACK THEN do nothing         ELSE error
END reset


Reset sequencing
Direction   Code       Expected           Action on Action on Action if
                       reply          wrong reply timeout    unexpected
                                      (Sender)    (Sender)   (Receiver)

ARM -> kb Hard reset Hard reset Resend              Resend   Hard reset
Kb -> ARM Hard reset Reset Ack 1 Resend             Nothing  Hard reset
ARM -> Kb       Reset Ack 1 Reset Ack 1 Hard reset Hard reset Hard reset
Kb -> ARM Reset Ack 1 Reset Ack 2 Nothing           Nothing  Hard reset
ARM -> Kb       Reset Ack 2 Reset Ack 2 Hard reset Hard reset Hard reset
```

Note, the on/off state of the LEDs does not change across a reset event, hence the LED state is not defined at power on. The ARM is always responsible for selecting the LED status. After the reset

sequence, key scanning will only be enabled if a scan enable acknowledged (SACK or SMAK) was received from the ARM.

Data transmission

When enabled for scanning, the keyboard controller informs the ARM of any new key down or new key up by sending a two byte code incorporating the key row and column addresses. The first byte gives the row and is acknowledged by a byte acknowledge (BACK) code from the ARM. If BACK was not the acknowledge code then the error process (ON error) is entered. If the BACK code was received the keyboard controller sends the column information and waits for an acknowledge. If either a NACK, SACK, MACK or SMAK acknowledge code is received, the keyboard controller continues by processing the ACK type and selecting the mouse and scan modes implied. If the character received as the second byte acknowledge was not one of NACK/MACK/SACK/SMAK then the error process is entered.

Mouse data

Mouse data is sent by the keyboard controller if requested by a ROMP request from the ARM or if a SMAK or MACK have enabled transmission of nonzero values. Two bytes are used for mouse position data. Byte one encodes the accumulated movement along the X axis while byte two gives Y axis movement.

Both X and Y counts must be transferred to temporary registers when data transmission is triggered, so that accumulation of further mouse movement can occur. The X and Y counters are cleared upon each transfer to the transmit holding registers. Therefore, the count values are relative to the last values sent. The ARM acknowledges the first byte (Xcount) with a BACK code and the second byte (Ycount) with any of NACK/MACK/SACK/SMAK. A protocol failure causes the keyboard controller to enter the error process (ON error).

When transmission of non-zero mouse data is enabled, the keyboard controller gives key data transmission priority over mouse data except when the mouse counter over/underflows.

Acknowledge codes

There are seven acknowledge codes which may be sent by the ARM. RAK1 and RAK2 are used during the reset sequence. BACK is the acknowledge to the first byte of a two byte keyboard data set. The four remaining types, NACK/MACK/SACK and SMAK, acknowledge the final byte of a data set. NACK disables key scanning and therefore key up/down data transmission as well as setting the mouse mode to send data only on ROMP request. SACK enables key scanning and key data transmission but disables unsolicited mouse data. MACK disables key scanning and keydata transmission and enables the transmission of mouse count values it either X or Y counts are non-zero. SMAK enables key scanning and both key and mouse data transmission. It combines

Code values

Mnemonic	msb	lsb	Comments
HRST	1111	1111	One byte command, keyboard reset
RAK1	1111	1110	One byte response in reset protocol
RAK2	1111	1101	One byte response in reset protocol
RQPD	0100	xxxx	One byte from ARM, encodes four bits of data
PDAT	1110	xxxx	One byte from keyboard, echoes four data bits of RQPD
RQID	0010	0000	One byte ARM request for keyboard ID
KBID	10xx	xxxx	One byte from keyboard encoding keyboard ID
KDDA	1100	xxxx	New key down data. Encoded Row (1st byte) and column (2nd byte) numbers
KUDA	1101	xxxx	Encoded Row (1st byte) and column (2nd byte) numbers for a new key up
RQMP	0010	0010	One byte ARM request for mouse data
MDAT	Oxxx	xxxx	Encoded mouse count, X (byte1) then Y (byte2). Only from ARM to keyboard
BACK	0011	1111	Ack for first keyboard data byte pair
NACK	0011	0000	Last data byte ack, selects scan/mouse mode
SACK	0011	0001	Last data byte ack
MACK	0011	0010	Last data byte ack
SMAK	0011	0011	Last data byte ack
LEDS	0000	Oxxx	Bit flag to turn LED(s) on/off
PRST	0010	0001	From ARM, one byte command, does nothing

x is a data bit in the Code; e.g. xxxx is a four bit data field

the enable function of SACK and MACK.

While key scanning is suspended (after NACK or MACK) any *new* key depression is ignored and will not result in a key down transmission unless the key remains down after scanning resumes following a SACK or SMAK. Similarly a key release is ignored while scanning is off.

Commands may be received at any time. Therefore, commands can be interleaved with acknowledge replies from the ARM. For example, keyboard sends KDDA (1st byte), keyboard receives command, keyboard receives BACK, keyboard sends KDDA (2nd byte), keyboard receives command, keyboard receives SMACK. If the HRST command is received, the keyboard immediately enters the restart sequence, (ON restart). The LEDS and PRST commands may be acted on immediately. Commands which require a response are held pending until the current data protocol is complete. Repeated commands only require a single response from the keyboard.

ARM commands

Mnemonic	Function
HRST	Reset keyboard
LEDS	Turns key cap LEDs on/off. A three bit field indicates which state the LEDs should be in. Logic 1 is ON, logic 0 (zero) OFF. DO controls CAPS LOCK D1 controls NUM LOCK D2 controls SCROLL LOCK
RQM	Request mouse position (X,Y counts)
RQID	Request keyboard identification code. The computer is manufactured with a 6 bit code to identify the keyboard type to the ARM. Upon receipt of ROID the keyboard controller transmits KBID to the ARM
PRST	Reserved for future use, the keyboard controller ignores this command
RQPD	For future use. The keyboard controller will encode the four data bits into the PDAT code data field and then send PDAT to the ARM.

Mouse interface

The mouse interface has three switch sense inputs and two quadrature encoded movement signals for each of the X axis and Y axis directions. Mouse key operations are debounced and then reported to the ARM using the Acorn key up / key down protocol. The mouse keys are allocated unused row and column codes within the main key matrix.

Switch 1 (left)	*Row* code - 7	Column code -0
Switch 2 (middle	Row code - 7	Column code - 1
Switch 3 (right)	Row code - 7	Column code - 2

For example, switch 1 release would give 11010111 (D7 hex) as the complete row code, followed by 11010000 (DO hex) for the column code.

Note: Mouse keys are disabled by NACK and MACK acknowledge codes, and are only enabled by SACK and SMAK codes, ie they behave in the same way as the keyboard keys.

The mouse is powered from the computer 5 V supply and may consume up to 100 mA.

Movement signals

Each axis of movement is independently encoded in two quadrature signals. The two signals are labelled REFerence and DIRection (e.g. X REF and X DIR). The table below defines the absolute direction of movement. Circuitry in the keyboard decodes the quadrature signals and maintains a signed 7 bit count for each axis of mouse movement.

Ink al State		Next State		
REF	**DIR**	**REF**	**DIR**	
1	1	1	0	
1	0	0	0	Increase count by one
0	0	0	1	for each change of state.
0	1	1	1	
1	1	0	1	
0	1	0	0	Decrease count by one
0	0	1	0	for each change of state.
1	0	1	1	

When count overflow or underflow occurs on either axis both X and Y axis counts lock and ignore further mouse movement until the current data has been sent to the ARM.

Overflow occurs when a counter holds its maximum positive count (0111111 binary). Underflow occurs when a counter holds its maximum negative count (1000000 binary).

Keyswitch mapping

Key Size	Key Name	Row code	Col. code	Notes
1	Esc	0	0	1
1	F1	0	1	2
1	F2	0	2	2
1	F3	0	3	2
1	F4	0	4	2
1	F5	0	5	2
1	F6	0	6	2
1	F7	0	7	2
1	F8	0	8	2
1	F9	0	9	2
1	F10	0	A	2
1	F11	0	B	2
1	F12	0	C	2
1	Print	0	D	1,3
1	Scroll	0	E	1
1	Break	0	F	1
1	`	1	0	
1	1	1	1	
1	2	1	2	
1	3	1	3	
1	4	1	4	
1	5	1	5	
1	6	1	6	
1	7	1	7	
1	8	1	8	
1	9	1	9	
1	0	1	A	
1	-_	1	B	
1	=+	1	C	
1	£	1	D	
1	Backspc	1	E	1
1	Insert	1	F	1
1	Home	2	0	1,3
1	Pgup	2	1	1
1	Numlock	2	2	1,4
1	/	2	3	1
1	*	2	4	1
1	#	2	5	1

Key Size	Key Name	Row code	Col. code	Notes
1.5	Tab	2	6	1
1	Q	2	7	
1	W	2	8	
1	E	2	9	
1	R	2	A	
1	T	2	B	
1	Y	2	C	
1	U	2	D	
1	I	2	E	
1	O	2	F	
1	P	3	0	
1	[{	3	1	
1	]}	3	2	
1.5	\	3	3	
1	Delete	3	4	1
1	Copy	3	5	1
1	Pgdwn	3	6	1
1	7	3	7	
1	8	3	8	
1	9	3	9	
1	-	3	A	1
1.75	Ctrl	3	B	1,3
1	A	3	C	
1	S	3	D	
1	D	3	E	
1	F	3	F	
1	G	4	0	
1	H	4	1	
1	J	4	2	
1	K	4	3	
1	L	4	4	
1	;:	4	5	
1	,*	4	6 •	
2.25	return	4	7	1
1	4	4	8	
1	5	4	9	
1	6	4	A	
1	+	4	B	1

Row and column codes are in Hexadecimal.

Notes:
1. Key colour - dark grey
2. Key colour - red
3. Key position with N key roll over.
4. Green light emitting diode under key cap.

Key Size	Key Name	Row code	Col. code	Notes
2.25	shift	4	C	1,3
1	Z	4	E	
1	X	4	F	
1	C	5	0	
1	V	5	1	
1	B	5	2	
1	N	5	3	
1	M	5	4	
1	,<	5	5	
1	.>	5	6	
1	/?	5	7	
2.75	shift	5	8	1,3
1	crsrUp	5	9	1
1	1	5	A	
1	2	5	B	
1	3	5	C	
1.5	Caps	5	D	1,4
1.5	Alt	5	E	1,3
7.0	Space	5	F	
1.5	Alt	6	0	1,3
1.5	Ctrl	6	1	1,3
1	crsrLt	6	2	1
1	crsrDn	6	3	1
1	crsrRt	6	4	1
2.0	0	6	5	
1		6	6	
2.0	Enter	6	7	1

Row and column codes are in Hexadecimal.

Notes: 1 Key colour - dark grey
         2 Key colour - red
         3 Key position with N key roll over.
         4 Green light emitting diode under key cap.

Floppy disc drive

The floppy disc drive used on the A3000 computer is a one-inch high drive, taking 3.5 inch floppy discs.

Performance

Capacity	1 MB (unformatted)
Track to track step rate	3ms
Seek settle time	15ms
Write to read timing	1200μs
Power-on to drive ready	1000ms
Power supply	+5Vdc (+1- 5%)
Noise bandwidth	0 - 30 MHz
Maximum power	2 Watts (continuous)

Power connector

The power connector is a 4-pin, 25mm pitch type. The LED is ON when Drive Select and In Use are low or when Drive Select is low.

Pin	Signal
1	+5V
2	Ground
3	Ground
4	No connection

Interface connector

The interface connector is a 34-way 2 row, 0.1 inch pitch type, with pinouts as shown below:

Pin		Signal	Dir
Retn	Signal		(pcb)
1	2	Disc change	I
3	4	In use	I
5*	6	Drive select 3	O
7*	8	Index	I
9*	10	Drive select 0	O
11*	12	Drive select 1	O
13	14	Drive select 2	O
15	16	Motor ON	O
17	18	Direction	O
19	20	Step/Dsc chg rst	O
21	22	Write data	O
23	24	Write gate	O
25	26	Track 0	I
27	28	Write protect	I
29	30	Read data	I
31	32	Side 1 select	O
33	34	Ready	I

*Optionally 5V

Power supply

Performance characteristics

Performance	Min	Nom	Max	Units
Input voltage (47-53 Hz)	198	220/ 240	264	Vac
Input voltage (57-63 Hz)	99	115	130	Vac
Output voltage V01	4.9	5	5.1	Vdc
Output current 101	0.5	-	4.4	Amps dc
Output ripple and noise VO1				50mV pk-pk BW 0-50MHz
Overshoot VO1				0.1Vdc
Over voltage plot VO1 (thrshld)	5.8		7.0	Vdc
Surge output current 101	-	-	5.8	Amps dc
Surge output current duration	-	-	1.0	Sec
Efficiency	65	-	-	%@max Id
Total output power	-	-	22	Watts cont 29 Watts srge

Input voltage is selected by means of a link wire connected either to the pin marked '240' on the left-hand side of the power supply (when facing the front of the computer), or to the pin marked '120' in the top centre of the PSU. If the input voltage is changed, it is strongly recommended that a label, indicating the new voltage to which the computer has been set, is fixed to the outside of the case. A mains plug appropriate to the new supply should also be fitted, to prevent the computer from being powered up at the wrong voltage.

> **DANGER**
> **DANGEROUS VOLTAGES ARE EXPOSED INSIDE THE CASE OF THE COMPUTER WHEN THE COVER IS REMOVED. THE COMPUTER SHOULD BE DISCONNECTED FROM THE MAINS SUPPLY BEFORE THE COVER IS REMOVED.**

Floppy disc power connector

Pin	Signal
1	+5 V
2	0V
3	N.C.
4	N.C.

Links

Link	Fitted	Effect	Default
LK22	Yes	Connection point for left channel audio speaker. P1 0V, P2 signal.	None
LK23	Yes	Connection point for right channel audio speaker. P1 0V, P2 signal.	None
LK5	No	Connection point for an external battery. (Only used if supply of on board NiCad becomes a problem.)	None
LK20	Yes	Used in conjunction with LK19 to select size of ROM devices.	Shunt 2-3
LK19	Yes	Used in conjunction with LK20 to select size of ROM devices. ROM LK19 LK20 512K 2-3 2-3 1M 2-3 2-3 2M 1-2 2-3 4M 1-2 1-2	Shunt 2-3 ie 1M
LK25	Yes	Used to configure P5 of SK14 (RGB Video Socket) to be either 'VSync' or 'Mode'. Fit shunt for 'VSync' NF shunt for 'Mode' (Mode is required by some SCART TVs.)	Shunt NF ie 'Mode'
LK24	Yes	Used to configure P4 of SK14 (RGB Video Socket) to be either 'HSync' or 'CSync'. Shunt , 1-2 for 'HSync' Shunt , 2-3 for 'CSync'	Shunt 2-3 ie 'CSync'
LK27	Yes	Used to invert 'VSync'. Shunt fitted , VSync* Shunt NF, VSync	Shunt NF ie 'VSync'
LK26	Yes	Used to invert 'HSync'. Shunt fitted , HSync* Shunt NF, HSync	Shunt NF ie 'HSync'
LK7	No	Test point for Non Volatile Memory clock frequency. P1 OV P2 32.768KHz	None
LK30	Not	Used in conjunction with LK29 and LK28 (&. 31 on Iss1) to provide the necessary signals **for** a Genlock interface circuit. P1 VS* P2 HS*	None
LK28	Not	P1 Ckvidc P2 Clksys*	Trk 1-2 (Shunt on Iss1)
LK29	Not	P1 0V P2 Sink	Trk 1-2 (Shunt on Iss 1)
LK31	Not	P1 'Sup' P2 0V	None
LK6	No	Test point for Non Volatile Memory battery voltage. P1 0V P2 1.2V +/- 0.2V	None

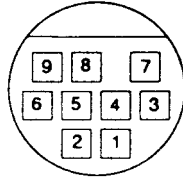| Link	Fitted	Effect	Default
LK8	No		
LK9	No		
LK10	No	Used to set nationality id of the keyboard.	LK12 Trk ie UK
LK11	No		
LK12	No		
LK13	No		
LK1	No	Used to optionally link 0V to the RFI Shield (Earth).	NF
LK2	No		NF
LK3	No	Connection point for a design backup, self contained keyboard. P1 Krst * Keyboard reset P2 NC P3 0V P4 5V P5 Krx' From keyboard PS K u' To keyboard	NF
LK4	No	Connection point for design backup, mouse to keyboard link. P1 Xr X ref P5 Sw(1) Switch 1 P2 Xd X dir P6 Sw(2) Switch 2 P3 Yr Yref P7 Sw(3) Switch 3 P4 Yd Ydir P8 0V	NF
LK17	N o t	Used in conjunction with LK18 . to select ROM device type.	Trk 1-2 (Shunt on Iss1)
LK18	Not	Used in conjunction with LK17 to select ROM device type. ROM LK17 LK18 512K EPROM 1-2 1-2 Non JEDEC 1 M ROM 1-2 1-2 Non JEDEC 1M EPROM 1-2 1-2 JEDEC 1/214M ROM/ EPROM 1 — 1 2 — 2	Trk 1-2 ie Non JEDEC (Shunt on Iss1)
LK16	No	Used to select the design backup keyboard. **See** LK3. 1-2 Selects backup keyboard 2-3 Selects main keyboard	Trk 2-3 ie Main K/B
LK21	No	Selects the +5V power feed to the floppy disc drive to be via the data cable or by separate feed with PLS. 1-2 +5V via data cable 2-3 +5V via separate cable	Trk 2-3 ie not via data cable
LK14	No	Used in conjunction with LK15 to select the keyboard uC device type. Device Type LK14 LK15 8051 (NMOS) 1-2 1-2 80051 (CMOS) O/C 2-3	Trk 1-2
LK15	No		Trk 1-2 ie NMOS
LK32	No	Provides access to RGB interface signals (Issue 1 only): 1 - Red **4 -** I-VCSYNCH 2 - Green 5 - VSYNC/MODE 3 - Blue 6 - 0V	NF

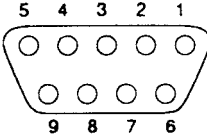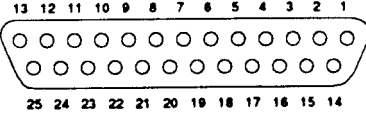| Notes:	NF - Not Fitted
	P1 - Pin 1
	0/C - Open Circuit
	Trk - Tracked
	* Active low
*	t Fitted on Issue 1 PCB

Plugs

Plug	Fitted	Function/Specification
PL5	No	Floppy Disc Power Connector. If the power to the disc drive is to be supplied via the data cable, then PL5 must be fitted and the PSU free disc power socket must be connected to this plug with LK21. P1 NC P2 OV P3 OV P4 +5V
PL6	No	Floppy Disc Drive Data Connector. 34 way Box Header containing all the signals required by the internal floppy disc drive. This interface is identical to that of the Archimedes, except that the drive strength of some of the signals has been reduced as only one drive is supported. The pin numbering has been altered due to the incorrect orientation of the Archimedes layout. Default powering is via a separate power connector from the PSU (ie not up the data cable).
PL1	Yes	Faston tab for connection of Earth from the power supply.
PL3	Yes	Faston tab for connection of OV from the power supply.
PL4	Yes	Faston tab for connection of +5V from the power supply.
PL2	Yes	Serial Port (IBM PC-AT Pinout) 9 Way D-type plug. Although the plug is fitted, the interface electronics are an upgrade consisting of:

PL6 pin table:

Pin	Signal	Pin	Signal
2	Dcirq*	20	Step*
4	In use*	22	Writedata*
6	Sel(3)*	24	Writegate*
8	Index'	26	Track00*
10	Sel(0)*	28	Writeprot*
12	Sel(1)*	30	Readdata*
14	Sel(2)*	32	Side1*
16	W o r m '	34	Ready'
18	Dirin*		

1,3,13,15,17,19,21,23,25,27,29,31,33 all OV
(5,7,9,11 OV via LK21)

PL2:

IC 7   LT1133
IC 1   65C51

Pin	Signal	Pin	Signal
I	Dcd	6	Dsr
2	Rxd	7	Rts
3	Txd	8	Cts
4	Dtr	9	Ri
5	OV		

No.	Fitted	Function/Specification
SK1	Yes	Mouse Port. 9-way MiniDin socket providing interface to a standard Acorn (Archimedes style) mouse.
SK4	Yes	Econet Upgrade Module Socket. 17-way header used in conjunction with SK5 to provide the electrical connection point for the internal Econet upgrade module. This module is identical to that used in the BBC Master series and Archimedes computers.
SK16	Yes	Ram Upgrade Connector. A 60-way SIL pin row, providing all the necessary signals for the Acorn 1MByte Ram upgrade card.
SK3	Yes	Internal Expansion. These connectors jointly form the internal expansion facility and are in the form of two 17-way headers for SK3 & 11 and two 5-way headers for SK8 & 9. SK3 & SK11 form an 8-bit 'simple' podule bus SK3, 11, 8 & 9 form an 8-bit MEMC podule bus. A full specification of this expansion interface is provided in the chapter headed 'A3000 Expansion'.
SK11	Yes	
SK8	Not†	
SK9	Not†	
SK6	Yes	Keyboard Interface. Two 20-way 'flexible PCB' connectors providing an interface to the keyboard.
SK7	Yes	

SK1 Mouse Port pin table:

Pin	Signal	
1	Xr	X direction reference
2	Sw(1)	Switch 1
3	Sw(2)	Switch 2
4	OV	OV
5	Xd	X direction
6	+5V	+5V
7	Yr	Y direction reference
8	Sw(3)	Switch 3
9	Yd	Y direction

Notes:

† Fitted to Issue 1 PCBs

Socket diagrams are viewed from outside the computer

Sockets (contd)

No.	Fitted	Function/Specification
SK14	Yes	RGB Video Socket. 9 way D type socket providing an interface to analogue RGB monitors and Scart TVs. Links 24, 25, 26 & 27 can be used to alter the polarity and type of synchronisation signals present to suit a variety of monitors. RGB Video levels , 0.7V Pk–Pk into 75 Ohm Sync Voltage levels , >= 2.0V (TTL)

```
      5   4   3   2   1
    ⎛  O   O   O   O   O  ⎞
     ⎝   O   O   O   O   ⎠
         9   8   7   6
```

Pin	Signal (IBM PC PGA pinning)
1	Red
2	Green
3	Blue
4	H/Csync
5	Vsync/Mode
6,7,8,9	0V

No.	Fitted	Function/Specification
SK13	Yes	Monochrome Video Output. Phono socket providing a monochrome composite video signal of 1V Pk–Pk (0.7V video, 0.3V Sync) into a 75 Ohm load. Negative sync, positive video.
SK12	Yes	Stereo Headphone Output. 3 way 3.5mm stereo jack socket providing output to personal stereo type 32 Ohm stereo headphones. Output voltage = 1V Pk–Pk into 32 Ohm load.
SK15	Yes	External Podule Expansion. 64 Way DIN41612 socket providing an interface connection to a single, host powered, external Podule. This Podule may be a "MemC" or "Simple" type but not a Co-processor. For a full spec of this interface see the chapter headed "A3000 expansion"
SK10	Yes	Parallel Printer Port. 25 way D-type socket providing a parallel printer interface.

```
   13 12 11 10 9  8  7  6  5  4  3  2  1
  ⎛ O  O  O  O  O  O  O  O  O  O  O  O  O ⎞
   ⎝  O  O  O  O  O  O  O  O  O  O  O  O  ⎠
     25 24 23 22 21 20 19 18 17 16 15 14
```

Pin	Signal	Pin	Signal	Pin	Signal
1	Stb*	8	Pd(6)	15	nc
2	Pd(0)	9	Pd(7)	16	nc
3	Pd(1)	10	Ack*	17/25	0V
4	Pd(2)	11	Bsy		
5	Pd(3)	12	nc		
6	Pd(4)	13	nc		
7	Pd(5)	14	nc		

No.	Fitted	Function/Specification
SK2	Yes	Econet Socket. 5 way Din socket for connection to Econet local area network. Note, this interface is an upgrade.

```
          ⎛   □   ⎞
      3 ⎛ O       O ⎞ 1
         ⎜   O       ⎟
       5 ⎝   O   O   ⎠ 4
             2
```

Pin	Signal
1	Data
2	0V
3	Clock*
4	Data*
5	Clock

No.	Fitted	Function/Specification
SK5	Yes	Econet Upgrade Module Socket. 5 way header used in conjunction with SK4 to provide electrical connections for the Econet upgrade module. This module is identical to that used on BBC Master series and Archimedes computers.

Changes between Issue A and Issue 1 PCBs

This manual covers A3000s produced with both Issue A and Issue 1 PCBs, and drawings for both versions are included. This section summarises the changes made during the production of Issue A boards, and the design changes made for Issue 1.

Modifications to Issue A PCBs

Component value changes

The chart below summarises the component value changes made during the production of Issue A PCBs, showing the first serial number changed.

(Unless otherwise stated, resistors are 5% SMD.)

Comp.	Issue A	Changed to	Serial no.
R67	**68R**	22R	1000051
R68	68R	22R	1000051
R69	68R	22R	1000051
R70	**68R**	22R	1000051
R71	68R	22R	1000051
R81	**33K**	3K3	1000013
R82	150K 1%	**22K** 1%	1000013
R85	**33K**	3K3	1000013
R86	150K 1%	22K 1%	1000013
R88	33K	3K3	1000013
R89	33K	3K3	1000013
R91	150K 1%	**22K** 1%	1000013
R92	**33K**	**3K3**	1000013
R93	150K 1%	**22K** 1%	1000013
R95	150K 1%	22K 1%	1000013
R97	150K 1%	**22K** 1%	1000013
R98	150K 1%	22K 1%	1000013
R99	150K 1%	22K 1%	1000013
R101	**33K**	**3K3**	1000013
R105	470R	**680R**	1000051
R129	33R	22R	1000051
R130	33R	22R	1000051
R131	**33R**	22R	1000051
R132	**33R**	22R	1000051
R133	33R	22R	1000051
R137	100K	10K	1000051
R502	6K8	4K7	1000013
R530	22K	1K	1004150
C75	100p CPLT	2n2 CPLT 10%	1000013
C77	2n7 CPLT	**22n** MPSTR 10%	1000013
C80	**22n MPSTR**	100n MPSTR 10%	1000013
C81	**330p**	**2n2** CPLT	1000013
C82	330p	**2n2** CPLT	1000013
C86	**330p**	**2n2** CPLT	1000013
C88	22n MPSTR	100n MPSTR 10%	1000013
C90	**100p** CPLT	2n2 CPLT 10%	1000013
C91	330p	**2n2** CPLT	1000013
C92	2n7 CPLT	22n MPSTR 10%	1000013

The following additional modifications were made during the production of Issue A PCBs:

Serial interface

10K resistor (5%, conventional type) was added as a 'pullup' to the rear of the PCB, connected between the signal Rii* (IC7 pin 18) and +5V (from serial number 1000001).

Video genlocking

The tracks on the underside of the PCB, between the pins of both LK28 and LK29, were cut. 2-pin wafers were fitted to LK28, 29 & 30, and shunts to LK28 and 29 (but not LK30) (from 1000251).

I^2C-bus access

Two 5-way headers (0800,486) were fitted to SK8 and SK9 (from 1000251).

JEDEC & non-JEDEC EPROMs

To permit the use of JEDEC and non-JEDEC EPROMs, tracks on the PCB, between the pins of both LK17 and LK18, were cut. 2-pin wafers were fitted to LK17 & 18, and shunts fitted to LK17 and 18 (from 1000251).

Fixing of 64W connector

Two rivets (Avdel 11070312) were added to the mounting holes of the 64-way expansion connector.

Design changes made between Issue A and Issue 1 PCBs

Serial interface

The 'strapped on' resistor (see above) was replaced by a permanent resistor (10K SMD 5%) — R144.

Signal conditioning

R141, R142 and R143 have been added (22R SMD 5%) to REF8M, RA9 and IORQ. R134 has been moved to accomodate these.

A capacitor C116 (2n7) has been added between SW3 and OV.

Video genlocking

LK28 & 29 tracks have been deleted (see above). LK 28, 29 & 30 moved.

LK31 has been added. This allows access to the VIDC supremacy bit (pin 28) and GND.

JEDEC & non-JEDEC EPROMs

The tracks between the pins of LK17 & 18 have been deleted (see above).

RGB & SYNC

A 6-way connector (LK32, not fitted) has been added
to RGB & SYNC for internal access.

Production changes

The components R550, C55, C78, C500, C501 and
C504 have been moved to facilitate production.

R145 (4K7 SMD 5%) has been added between 1C2 pin
31 and +5V to accomodate ATE.

Test points have been added to the following lines:

ARM20-MEMC3
MEMC38
MEMC39
MEMC40
MEMC41
MEMC42
(R129-R132 have been moved to accomodate these
test points.)

A3000 expansion

Internal expansion

> DANGER
> DANGEROUS VOLTAGES ARE EXPOSED INSIDE
> THE CASE OF THE COMPUTER WHEN THE
> COVER IS REMOVED. THE COMPUTER SHOULD
> BE DISCONNECTED FROM THE MAINS SUPPLY
> BEFORE THE COVER IS REMOVED.

The following internal upgrades are currently available for the A3000 computer:

• User port / MIDI internal expansion card

• 1 Mb Ram upgrade

• Serial port

• Econet module

Internal upgrades must be fitted by an Acorn Dealer or Approved Service Centre.

Interface

The electrical signals available on the internal expansion are a subset of those described in 'A Series podules', available from Acorn Customer **Service as an** Application Note, or on the SID system (Doc Ref 0310101).

The connection is via two 17-way 0.1 inch pitch connectors and two 5-way 0.1 inch connectors (the latter fitted as standard to Issue 1 PCBs and later). Expansion cards should use 0.025 in square pin headers.

Expansion bus connectors

Pin no	SK3	SK11	SK8	SK9
1	+5V	0V	C[0]	0v
2	PWE*	+5v	C[1]	REF8M
3	PS1*	PRE*	BI	PFIQ*
4	CLK2	PR/nW	IORQ*	Ms[1]*
5	LA[2]	LA[4]	IOGT	+5V
6	LA[3]	LA[5]		
7	BD[0]	LA[6]		
8	BD[1]	LA[7]		
9	BD[2]	0V		
10	BD[3]	LA[8]		
11	BD[4]	LA[9]		
12	BD[5]	LA[10]		
13	BD[6]	LA[11]		
14	BD[7]	LA[12]		
15	RST*	LA[13]		
16	0V	PIRQ*		
17	+5V	0V		

Note: Pin 1 is at the righthand end when viewed from the front of the computer.

The interface is configured as 'Podule 1, Module 1'.

It is recommended that the load on each signal does no exceed 3HCT gates or that stated in 'A Series podules'. Any upgrade must be able to drive at least 7 HCT and 3 TTL loads on the data bus.

Power supply

The maximum power available from the +5V rail is 600 mA. The maximum dissipation inside the case is 0.5W (100mA).

Mechanical

The rear panel required is shown in the drawing at the back of this manual. The size of the User Port/MIDI expansion card PCB and position of the connectors are also shown in the drawing at the back of the manual.

User port/MIDI expansion card (UPM)

Introduction

The A3000 User Port / MIDI expansion card fits inside the computer, and provides:

• An 8-bit User Port, largely compatible with the User Port interface on the BBC Model B and Master 128 microcomputers (and with the User Port on the Archimedes I/O expansion card).

MIDI (Musical Instrument Digital Interface), with IN, OUT and THRU connections, compatible with the International MIDI Association specification.

Main components

• 65C22 VIA for the User Port

• 2691 UART for the MIDI

• 27128 EPROM containing firmware and ID byte.

UPM block diagram
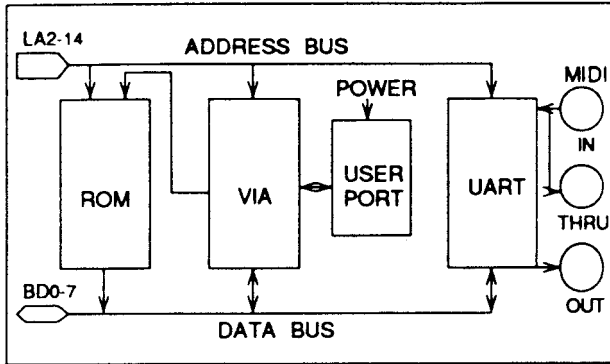
Comparison with Archimedes expansion cards

ARCHIMEDES I/O EXPANSION CARD

- The VIA is at the same address and clocked at the same speed. Port A PA<0..2.> is used to page ROM. These are the same as the UPM when set for 2764/27128.

- The User port is the same (Port B). The VIA interrupts go through a link, which is not normally fitted.

- The MIDI section is not the same.
- The ADC and 1 MHz bus are not fitted to the UPM.

MIDI EXPANSION CARD

- The UART is the same (Signetics 2691), but is at a different address (see below).
- The ROM page latch is not the same.

	LA13	LAl2	offset address
MiDi Podule	1	0	82000
UPM upgrade	1	1	83000

Addresses of main system components

Address	Component
&0000-1FFC	ROM/EPROM 271 28 as standard (16k x 8 bit). Larger EPROMS can be fitted if the links marked X are cut between pins 1 & 2, and relinked 2 to 3.

Eprom size	LK 1	LK 2	LK3	LK4
2764				
27128				
27256			X	
27512	X		X	
1M bit (JEDEC)	X		X	
2m bit	X	X	X	
4m bit	X	X	X	X

Address	Component
	Contains the iD byte 63 (dec). The start-up information must be at the top of the ROM.
&2000-2FFC	VIA 65C22 - 2Mhz part. Port A PA<7..0> used to page the ROM. CAs Not Used. Port B PB<7..0>, CB1 and CB2 for the User Port. Use 2Mhz synchronous cycle to access the VIA. The interrupt output connects directly to PIRQ*. No User Port interrupt handler provided.
&3000-3FFC	UART 2691 - For the MiDi interface.

Fitting an Internal expansion card

This procedure covers the fitting of an internal
expansion card, such as the User Port / MIDI
expansion card. This work should only be carried by
Acorn Dealers or Approved Service Centres:

1 Follow the procedure for removing the cover of the
  computer given in the next chapter.

2 Unscrew the two machine screws holding the rear
  blanking plate in place, and remove the plate:

BLANKING
PLATE
FIXING
SCREWS
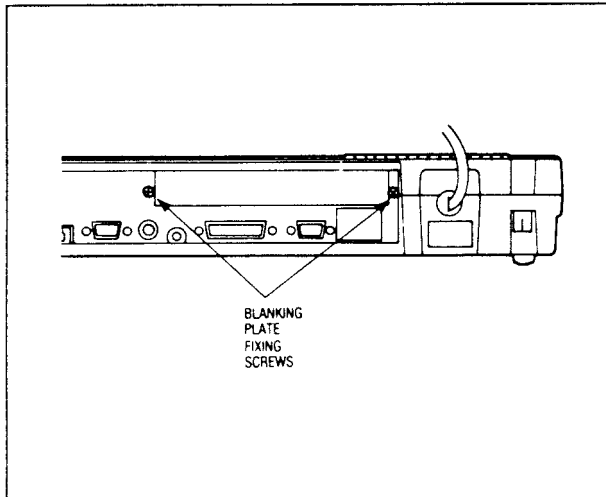
3 Plug the expansion card into the connectors on the
  PCB, and press firmly home:

UP/M EXPANSION
CARD CONNECTORS
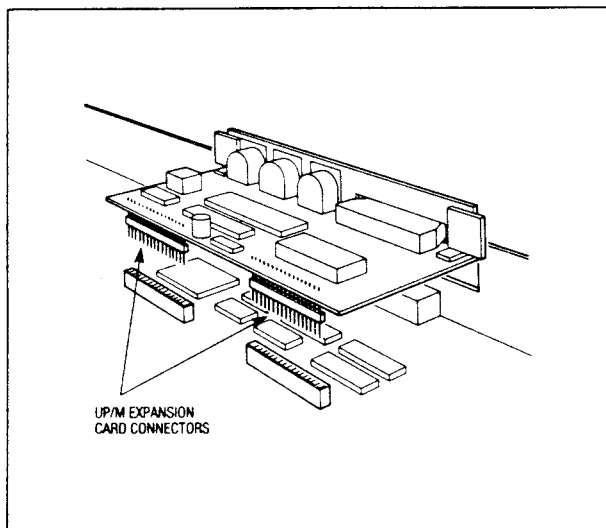
4 Replace the two screws holding the expansion card
  backplate, and secure firmly.

5 Replace the cover of the computer.

6 Run the dealer test software to test the correct
  function of the computer and the upgrade, and of
  any other upgrades fitted.

Keep the rear panel blanking plate with the computer, in
case the expansion card is removed later.

1Mb RAM upgrade

The A3000 computer RAM can be upgraded from 1Mb
to 2 Mb by the addition of a 1Mb RAM module which
plugs into the main PCB.

Fitting a RAM upgrade

1 Follow the procedures detailed in the next chapter
  for the removal of the computer cover and the
  keyboard.

2 To fit earlier RAM upgrades with securing lugs,
  remove two PCB retaining screws and plug the
  upgrade module, in a vertical position, into the
  board. Later upgrades, with no fitting lugs, simply
  push into the connectors on the PCB:

PCB
RETAINING
SCREWS
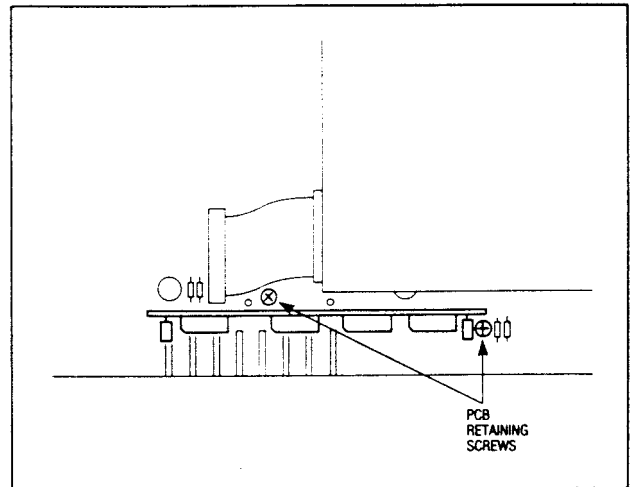
3 Replace the screws securing the PCB and the
  upgrade module.

4 Replace the keyboard and the cover of the
  computer.

5 Run the dealer test software to test the correct
  function of the computer and the upgrade, and of
  any other upgrades fitted.

Serial port upgrade

Introduction

The A3000 computer is fitted with a 9-way D-type serial connector on the back panel, but this is not functional until a serial port upgrade kit has been fitted by an Acorn Dealer or Approved Service Centre. Only Acorn Serial Port Upgrade kits should be used.

The A3000 serial port upgrade consists of a serial processor chip and a line driver chip, which fit into existing sockets on the PCB.

Connector pinouts

Pin	Signal	Pin	Signal
1	DCD	6	DSR
2	RXD	7	RTS
3	TXD	8	CTS
4	DTR	9	RI
5	0V		
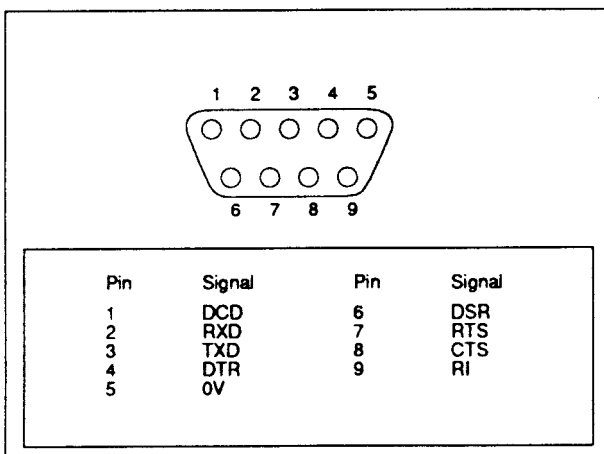
Fitting the Acorn A3000 serial port upgrade

WARNING: It is a recommended requirement that anti-static precautions should be utilised at all levels of servicing, ie antistatic matting and wrist-straps.

1 Follow the procedures in the next chapter for the removal of the cover and the keyboard.
2 Remove the Econet module and the User Port / MIDI expansion card, if fitted.
3 Insert the 28-pin IC 65C51 into socket IC1, and the 24-pin IC LT1133 into socket IC7. The notched ends of the ICs should face towards the left hand side of the PCB (viewed from the front of the computer) :
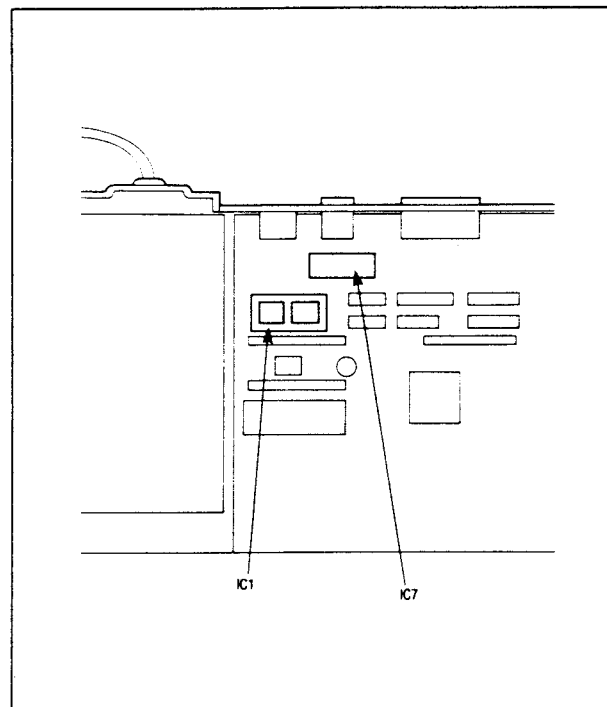
4 Fit the serial number label to the PCB near the upgrade ICs.
5 Refit any modules and expansion cards removed in step 2 above, and replace the cover of the computer.
6 Remove the label 'Serial not fitted' from the rear panel.
7 Run the dealer test software to test the correct function of the computer and the serial port, and of any other upgrades disturbed during this installation.

Fitting an Econet module

1 Follow the procedure in the next chapter for
  removing the cover of the computer.

2 Plug the module onto the PCB connectors:

3 Replace the cover of the computer.

4 Run the dealer test software to test the correct
  function of the computer and the Econet module,
  and of any other upgrades fitted. Refer to the
  appropriate Econet file server Manager's Guide for
  instructions on setting the station id.

External expansion

Interface

introduction

The A3000 computer supports an external expansion
card (podule) interface, although with some minor
differences from other ARM based systems:

*   Single +5Volt power supply rail, rated at a maximum of
    1 Amp (no +12 or –5 Volt rails provided)
*   No support for Co-Processor type cards
*   The external expansion card is in software slot 0
*   The podule must be capable of driving 3 TTL and
    7HCT loads on the data bus.

Refer to the application note 'A series podules' (
referenced at the start of this chapter) for a full
podule interface specification.

Physical dimensions

As the podule is external to the computer enclosure there
is no real limit on the size of the unit. Care should be
taken not to block off any of the other expansion ports on
the rear of the computer.

Fitting an expansion card

> WARNING
>
> Power down the computer before fitting or removing
> an external expansion card.

It is anticipated that expansion cards will be fitted into a
suitable external expansion card unit. Slots are provided
underneath the case of the computer, into which a
tongue in the case of the expansion card unit can locate.
Tapped holes are provided in the backplate of the
computer to enable the expansion unit to be secured to
the computer with two M6 screws.

Connector

The podule interface is provided via a 64-way DIN
A+C 41612 socket fitted at the rear of the computer:

(Connector viewed from the back of the computer)

The connections to the interface are shown overleaf.

External expansion connections

Pin	ROW A	ROW C	Row C description
1	0V	0V	Ground
2	LA[15]	reserved	
3	LA[14]	0V	Ground
4	LA[13]	0V	Ground
5	LA[12]	reserved	
6	LA[11]	MS[0]*	MEMC Podule select
7	LA[10]	reserved	
8	LA[9]	reserved	
9	LA[8]	reserved	
10	LA[7]	reserved	
11	LA[6]	reserved	
12	LA[5]	FIST*	Reset (see note below)
13	LA[4]	PR/W*	Read/not write
14	LA[3]	PWE*	Write strobe
15	LA[2]	PRE*	Read strobe
16	BD[15]	PIRQ*	Normal interrupt
17	BD[14]	PFIQ*	Fast interrupt
18	BD[13]	S[6]*	
19	BD[12]	C[1]	12C serial bus clock
20	BD[11]	C[0]	I2C serial bus data
21	BD[10]	S[7]*	External Podule select
22	BD[9]	PS[0]	Simple Podule select
23	BD[8]	IOGT*	MEMC Podule handshake
24	BD[7]	IORO	MEMC Podule request
25	BD[6]	BL*	VO data latch control
26	BD[5]	0V	Supply
27	BD[4]	CLK2	2MHz Synchronous clock
28	BD[3]	CLK8	8MHz Synchronous clock
29	BD[2]	REF8M	8MHz Reference clock
30	BD[1]	+5V	Supply
31	BD[0]	reserved	
32	+5V	reserved	

Note: The RST* signal is the system reset signal, driven by IOC on power-up or by the keyboard reset switch. It is an open-collector signal, and expansion cards may drive it also if this is desirable. The pulse width should be at least 50ms.

Disassembly and reassembly

```
DANGER
DANGEROUS VOLTAGES ARE EXPOSED INSIDE
THE CASE OF THE COMPUTER WHEN THE
COVER IS REMOVED. THE COMPUTER SHOULD
BE DISCONNECTED FROM THE MAINS SUPPLY
BEFORE THE COVER IS REMOVED.
```

Removing the cover

To remove the cover from the computer, follow this procedure:

1 Disconnect all peripherals and unplug the computer from the mains supply.

2 Unplug the mouse connector from the underside of the computer.

3 Remove the centre fixing screw on the underside of the case:

CENTRE
FIXING
SCREW
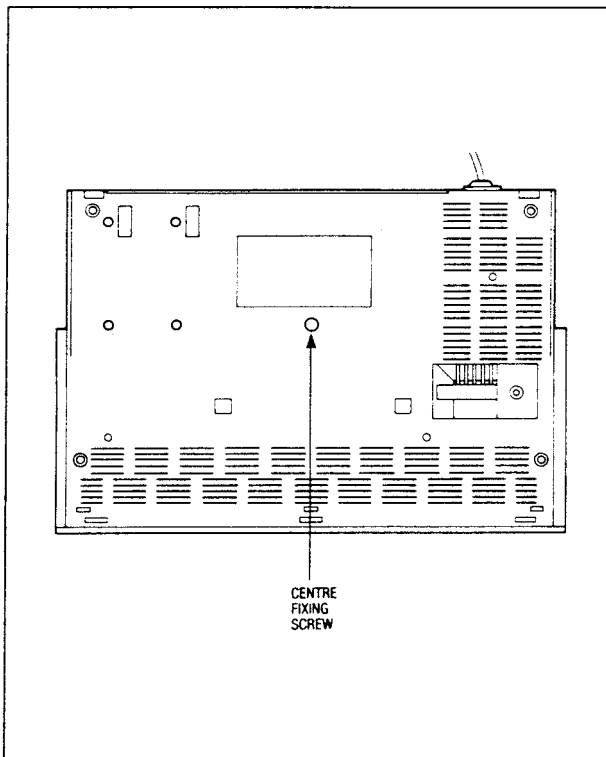
4 Remove the two screws from the clips at the rear of the computer:

FIXING
CLIPS
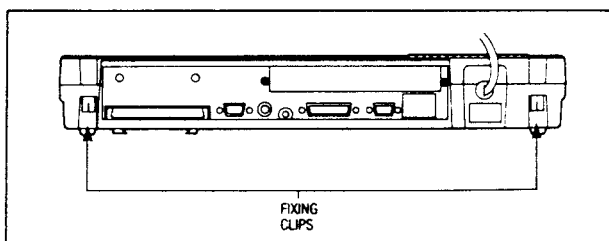
5 Unhook the two clips and slightly lift up the back of the cover, pivoting on the front.

6 Locate the three rectangular holes on the front underside of the case. Insert a screwdriver into the rear edge of each of these holes in turn. Push and twist until the catch comes free of the lower case.

7 Repeat this procedure for the other two holes until the cover lifts clear.

Fitting is the reverse of the above procedure, ignoring step six.

Removing the keyboard

```
WARNING
The keyboard connector can be damaged by
incorrect handling. Hold it by the white plastic
strengthening strip only. Do not touch the track
faces or apply pressure to the cable itself.
```

1 Follow the procedure for removing the cover.
2 Unplug the keyboard connector, and lift the keyboard out from the lower case.
Fitting is the reverse of the above procedure.

Removing the floppy disc drive

1 Follow the procedure for removing the cover.
2 Disconnect the power supply cable from the drive, and the ribbon cable from the PCB.
3 Remove the keyboard (see above).
4 Turn the lower case upside down and support the drive on a foam pad.
5 Remove the four recessed drive fixing screws:

FLOPPY DRIVE
FIXING SCREWS
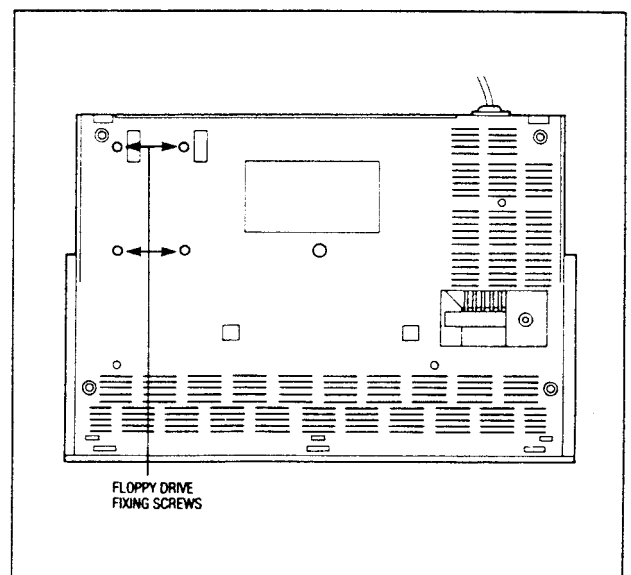
6 Tturn the case back up again. Lift the drive clear.
Fitting is the reverse of the above procedure.

Removing the PSU

1 Follow the procedures for removing the cover and the
   keyboard (above).
2 Disconnect the two faston connectors from the PCB, the
   connector on the PSU and the power cable to the disc
   drive.
3 Remove the warning sticker on top of the PSU cover. If
   the PSU is held in place by a plastic rivet, release the
   rivet jaws by pushing the pin in the centre of the jaw
   down, and then push the rivet itself down. If a self-
   tapping retaining screw is fitted, this should be should
   be unscrewed. The PSU and its cover will then lift out:
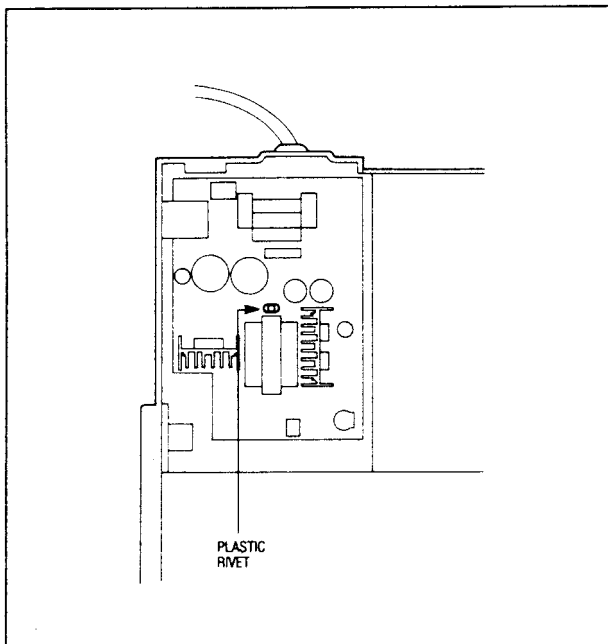
PLASTIC
RIVET

Replacing the PSU

When replacing the PSU, ensure that the plastic
insulating film is replaced underneath the PSU, and
that the the cover is correctly located. Take care not to
overtighten the self-tapping screws.

Removing the PCB

1 Follow the procedures above for the removal of the
   cover, the keyboard, floppy disc drive and the
   1MByte RAM, if fitted.
2 Remove the power leads at the point where they
   connect to the PCB (red +5V and black OV).
3 Disconnect the two speaker leads, and remove the
   RH speaker (viewed from the front).
4 Unscrew the three self-tapping screws retaining the
   PCB, and the PCB and rear panel will lift out of

the case:

PCB
RETAINING
SCREWS
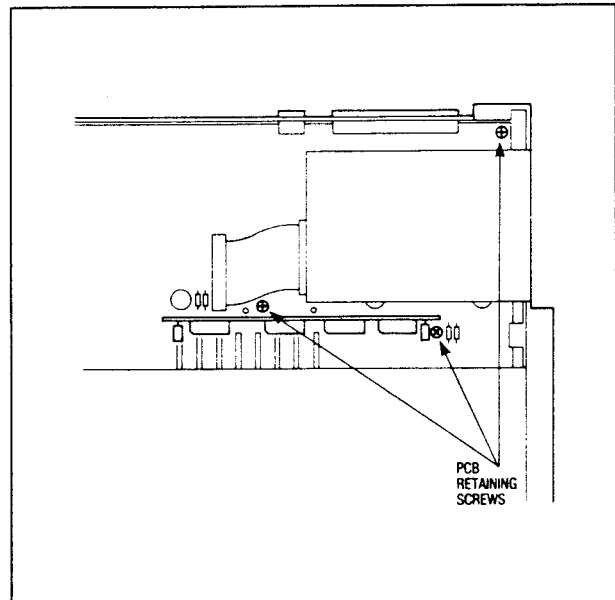
Fitting is the reverse of the above procedure — insert the
PCB into the clips at the front edge of the case before
lowering into place. Care should taken to ensure that the
RESET key is not damaged.

Replacing the battery

The battery providing current to the real-time clock and
battery-backed RAM is soldered to the PCB:

BATTERY
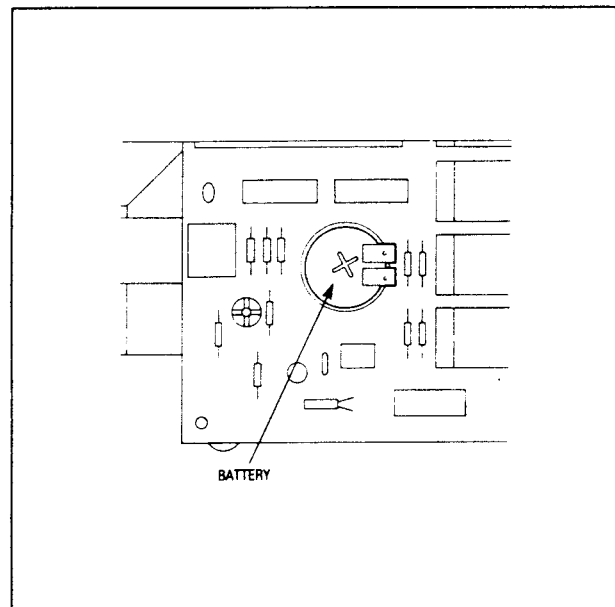
If this needs replacing, it will have to be removed using a
soldering iron and a desoldering gun. Repair sites lacking
the equipment and experience in this type of work should
not attempt to carry it out, or damage to the PCB may
result. Care should be taken to avoid shorting the battery
— connecting the positive and negative terminals —
even on a battery being discarded.

Fault diagnosis

Introduction

This chapter is a guide to the diagnosis and repair of basic faults in the A3000 computer system.

It consists of algorithms to enable you to trace & remedy faults in a 'dead' computer, followed by instructions for running the functional test software, designed to isolate faults in a computer which is working.

The next chapter 'Main PCB fault diagnosis and repair' is designed to help those repair centres equipped to do so, to diagnose and repair faults at component level on the main PCB.

Test equipment required:
- 100 MHz oscilloscope.
- DC Voltmeter.
- Earth Continuity tester.
- Serial port loopback plug (part number 0280,087). See the Appendix for details of the plug.
- 32 ohm impedance headphones.
- IC extraction tools.
- Antistatic matting and wrist straps.
- Standard hand tools.

DANGER

AFTER REFITTING OR FITTING A REPLACEMENT ASSEMBLY, CARRY OUT EARTH CONTINUITY TESTING ON THE ASSEMBLED COMPUTER ACCORDING TO THE PROCEDURE GIVEN IN APPENDIX B.

WARNINGS
- Repairs to multi-layered PCBs:
  The main PCB is a four-layer board. Components should only be removed from the board using equipment specifically designed for this purpose. For details of suitable equipment available, contact Acorn Customer Service.
- Repairs to surface-mounted devices:
  The ARM, MEMC, IOC AND VIDC ICs on the A3000 PCB are surface-mounted components. Do not attempt to remove them from the board and replace them unless you have the experience and the correct equipment to do so.
- System clock failure:
  If the computer is powered on for more than a few seconds and there is no system clock, there is a risk that all four ARM chips may be damaged, as well as the RAM.
- Faulty MEMC:
  if MEMC is faulty or the RAS/CAS signals are not being generated, the RAM may be damaged if the machine is left on too long. If you suspect a fault in these areas, scope the RAS and CAS lines for a few seconds in order to make sure that they are still active, then turn the machine off. Do not leave the computer on for more than a few seconds at a time.
- Antistatic precautions:
  It is a recommended requirement that anti-static precautions should be utilised at all levels of servicing, ie antistatic matting and wrist-straps.

Checking a 'dead' computer

```
                    ( START )
                        |
                        |←──────────────────────────────────────────────────────────────────┐
                        ↓                                                                      │
                   ╱ IS ╲      YES    ┌──────────────────┐                                     │
                  ╱COMPUTER╲─────────→│ PERFORM 'DELETE'  │────────────────────────────────────┤
                  ╲ DEAD ? ╱          │   POWER ON        │                                     │
                   ╲    ╱             └──────────────────┘                                      │
                     │NO                                                                        │
                     ↓                                                                          │
                   ╱ IS ╲      NO     ┌──────────────────┐                                      │
                  ╱  PSU  ╲──────────→│ CHECK MAINS       │──────────────────────────────────┤
                  ╲CLICKING╱          │ LEAD / FUSE       │                                     │
                   ╲  ?  ╱            └──────────────────┘                                      │
                     │YES                                                                       │
                     ↓                                                                          │
                  ╱ ARE ╲       NO   ┌──────────────┐   ╱ OK ╲   NO  ┌────────────┐  ╱ PCB ╲ YES ┌─────────┐
                 ╱ PL3 = 0V╲────────→│ DISCONNECT   │─→╱ NOW ╲──────→│ TEST PCB FOR│→╱  OK  ╲────→│ REPLACE │
                 ╲ PL4 = 5V╱         │FLOPPY DISC   │  ╲  ?  ╱       │SHORT CIRCUIT│ ╲  ?  ╱      │  PSU    │
                  ╲  ?  ╱            │  DRIVE       │    ╲ ╱         └────────────┘   ╲ ╱         └─────────┘
                     │YES           └──────────────┘    │YES                          │NO
                     ↓                                   ↓                            ↓
            ┌──────────────────┐              ┌──────────────┐            ┌─────────────┐
            │ FIT GOOD ROMS    │              │   REPLACE    │            │   REPLACE   │
            │ & PERFORM 'DELETE'│              │   FLOPPY     │            │    PCB      │
            │   POWER ON       │              └──────────────┘            └─────────────┘
            └──────────────────┘
                     │
                     ↓
                  ╱ WHITE ╲    NO    ┌──────────────┐   ╱ OK? ╲  NO   ┌────────────┐
                 ╱DISPLAY ╲─────────→│ CHECK SKT 14 │─→╱       ╲─────→│ CARRY OUT   │
                 ╲ OK? ╱             │ PINS 1,2,3   │  ╲       ╱      │ VIDEO CHECKS│
                  ╲   ╱              │ FOR 1 VOLT   │    ╲   ╱        └────────────┘
                     │YES           └──────────────┘      │YES
                     ↓                                     ↓
                                                 ┌──────────────┐
                                                 │REPLACE MONITORS│
                                                 │   & LEADS     │
                                                 └──────────────┘
                  ╱ DOES ╲     NO    ┌──────────────┐
                 ╱KEYBOARD ╲────────→│  REPLACE     │
                 ╲RESPOND ?╱         │  KEYBOARD    │
                  ╲     ╱            └──────────────┘
                     │YES
                     ↓
                  ╱ DOES ╲    NO     ┌──────────────┐
                 ╱CTRL 'G'╲─────────→│  CARRY OUT   │
                 ╲MAKE A  ╱          │ SOUND CHECKS │
                 ╲NOISE? ╱           └──────────────┘
                     │YES
                     ↓
            ┌──────────────┐
            │  CARRY OUT   │
            │  PCB TESTS   │
            └──────────────┘
                     │
                 ( END )
```

Notes:

1 For the VIDEO CHECKS see the section entitled 'Video faults' in the Chapter 'Main PCB fault diagnosis & repair'.

2 For the SOUND CHECKS see the algorithm overleaf.

3 If the WHITE DISPLAY is not OK, check that all the links have been correctly set before checking SKT 14.

Checking the sound system for faults

Note: Both SoundDMA and SoundChannel modules
must be active (ie, not unplugged) before starting this
test.
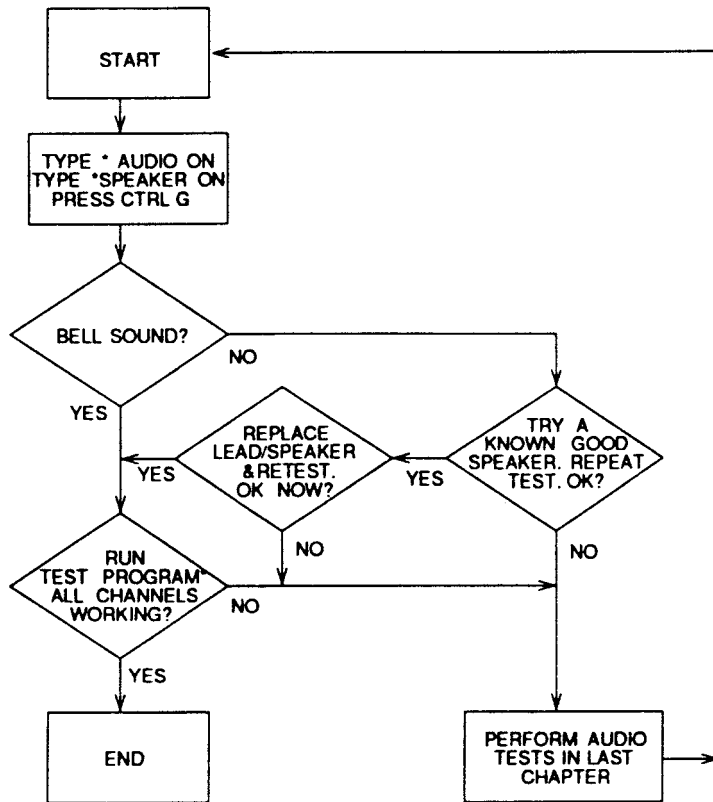
*TEST PROGRAM

```
10 REM > Check all channels
20 VOICES 8
30 FOR channel-1 TO B
40 OSCLI("Channelvoice "+STRS(channel)+" "+STR$(2))
50 NEXT
60 FOR channel - 1 to 8
70 SOUND channel, -15, 100,24
80 PRINTchannel
90 k-GET
100 NEXT
```

RUN PROGRAM.
PRESS A KEY AND REPEAT EIGHT TIMES.
PRiNTS CHANNEL NUMBER TO THE SCREEN
AND PLAYS VOICE 2 FOR EACH CHANNEL.

Functional tests

> Notes:
> - Please read the following section 'General test procedure' before you carry out any of the tests.
> - For details of how to repair the main PCB, *see* Main functional test.

Introduction

The A3000 test disc enables the engineer to test the functionality of the computer and Acorn upgrades, and to isolate any faults which may appear. The functional test cannot of course be run on a 'dead' computer — see the previous section for advice on diagnosing faults in 'dead' computers.

General test procedure

> The A3000 computer, mouse, expansion cards, Test disc, Port Tester assembly and Econet cables are designed and specified by Acorn Computers Ltd and may not be changed without written consent from
>
> Acorn. All items should be complete with the correct cables so that you can connect them to the A3000 computer.

Equipment required
- A3000 computer to be tested
- Mouse
- 3.5 inch Test disc, part number 0280,032
- Two ADFS 800k 'D' formatted, write enabled, 3.5 inch discs, to be labelled Scratch Disc and Data disc.
- Serial port loopback' plug for A3000 (Acorn part number (0280,087). See the Appendix for details.
- Epson FX80 or Olivetti JP101 printer
- Pair of 32 ohm stereo headphones
- Mono monitor
- Analogue RGB monitor.

Note: You can replace the specified printers with any other manufacturer's direct functional equivalent (in terms of BOTH hardware interface and software).

Removing the top cover of the computer main unit

Remove the top cover of the A3000 computer as detailed in the previous chapter 'Disassembly and Assembly'.

Connecting up the equipment
Connect the:
- serial port 'loopback' plug to the 'SERIAL' socket
- printer to the 'PARALLEL PRINTER' port

- headphones to the 'Headphones 32 ohm' socket
- monochrome monitor to the 'MONO VIDEO' socket
- analogue RGB monitor to the 'ANALOGUE RGB' socket
- monitors to the mains supply
- A3000 computer to the mains supply.

Connecting and disconnecting the power
- You must CONNECT the power only when you have made all the other connections
- You must DISCONNECT the power before removing any other connections.

Validating the test equipment
Before carrying out any of the tests in this section, validate the test equipment using a known good system. If the test equipment fails, you should repair the test equipment and retest on a known good part.

Before you start
Before the start of each day or testing session, you must first:
- Adjust the colour monitor to ensure adequate contrast and brightness
- Inspect all the mechanical parts of the test equipment and replace any parts as necessary.

Also, if required:
- Ensure that the printer has sufficient paper
- Connect the printer to the mains supply. Do NOT turn on.

Saving and restoring the CMOS RAM
The tests alter the contents of the battery backed RAM that holds the A3000's configuration data. These must be saved before any of the tests is run, and restored when the last test is over.

1 Insert the Test disc into the floppy disc drive.
2 Switch on the monitors and computer.
3 Type F12 to get to the command line prompt.
4 At the RISC OS supervisor prompt (an asterisk) type the following;
   DRIVE 0
   CMOSLS
5 When prompted, replace the Test disc with an ADFS 800k write enabled disc, the Data disc.
6 Type 'S' to save the contents of the RAM, or 'L' to load a previously saved copy of the RAM.
7 Type the filename to use.
8 When prompted, replace the Test disc in the drive and press the *space* bar to continue.
9 Put the data disc in a safe place. Do NOT use this disc for the later floppy disc test.
10 Type 'Q' to quit this option.

Carrying out the tests

There are two types of tests – subjective and non subjective. The test program passes or fails the equipment on the non-subjective tests; however, you must judge whether the equipment passes or fails the subjective tests. It is a good idea for testers to

familiarise themselves with the correct results given

by a known good computer. In this way they will be in a better position to judge faulty results.

Performing soak tests

At the successful completion of a main PCB functional test, you should carry out a soak test. To do this, select the relevant option and then insert the scratch disc when prompted. The test runs for 12 hours. When the test is running the Caps Lock and Num Lock LEDs will flash, provided that no error has occurred. If a disc error occurs all the LEDs will be off (*see* table below); the disc error is also displayed on the screen. If the test is completed without an error then the Scroll Lock LED will flash and the Caps Lock and Num Lock LEDs will be extinguished.

	Num Lock	Caps Lock	Scroll Lock	Screen
No errors	Flashing	Flashing	Off	Running
Error	Off	Off	Off	Fail
Finished	Off	Off	Flashing	Pass

Warning

During the soak test the unit under test should not be subjected to mechanical shock or movement. The unit shall not be turned off unless the test has terminated – the pass or fail message will be displayed.

Safety check

After repairing a unit, and after the soak test, you should carry out the earth continuity check mentioned at the start of the chapter, followed by a further run-through of the functional test, in case the earth check causes malfunction in the computer.

Repairing faults

When repairing an A3000 computer, you should repair the faults in the order in which they occurred during the test (ie repair the first recorded failure FIRST).

For further information on checking for faults and carrying out repairs, refer to the appropriate section of this manual.

Restoring the CMOS RAM

After passing the soak test, the unit under test needs to be restored to the customer's configuration. This is carried out by reloading the CMOS RAM from the data disc saved earlier, by selecting the Load/Save CMOS RAM option from the main menu. Then select the Load option after inserting the Data disc when

prompted. See 'Saving and restoring the CMOS RAM' above for details of the test procedure.

Packing

After servicing, repack the A3000 computer in its box. To avoid damage, do NOT send the computer through the post or by courier unless it is in its original packaging. The original packaging should be checked for damage to the outer casing and poly inserts.

Main computer tests

Running the test

Run the main functional test software as follows:

Ensure that CMOS RAM contents have been saved to disc by using the `Load/Save CMOS RAM` option described above. Then restart the system with a delete-power-on. To perform a delete-power-on, do the following: Whilst holding down the <Delete> key, turn the computer on. Note that the <Delete> key needs to be held down for several seconds. The *screen* should display the DESKTOP environment.

Note: A useful indication of the success of the delete-power-on sequence is the momentary appearance of a red border area on the screen.

Insert the Test disc. Hold down Ctrl, Shift and *, then press Break. The program will load from disc.

The 'Dealer Test Menu' is displayed:

```
          A3000 Dealer Test Menu
  1 Main Computer
  2 Upgrades
  3 Load/Save CMOS RAM
  4 Soak Test
  5 Quit
          SELECT OPTION :
```

Machine identification test

Select the option `Main computer`.

After selecting and loading the required test program, the A3000 computer cycles through a series of tests beginning with the computer type/model test. This test is extremely fast and the type and model number of the computer is displayed immediately:

```
          This computer is a
            BBC A3000
          CHECK DESCRIPTION
        THEN PRESS <SPACE> TO CONTINUE
```

You should:

1 Check that the description displayed on the screen is correct.
2 If `Unknown UUT` is displayed then there is a memory fault.

Action If test falls

Change the main PCB, or see the next chapter for

repair.

If an RS232 or 1Mb RAM upgrade is fitted but not mentioned, switch off the unit under test, remove the upgrade and then continue the test. When the computer has passed the main test sequence, power down the unit and re-install the upgrade and then run the relevant upgrade test.

If the description is the same, press the space bar to continue to the next test.

Test options

```
          TEST
                OPTIONS
  A AllTests Except Printer
  B AllTests and Epson Printer
  C AllTests and JP101 Printer
          SELECT
                OPTION
```

Select the test appropriate to the printer fitted. If you do not want to test the printer and do not need a printout of the results, you can select the 'All Tests Except Printer' option.

Memory

The functional test continues by testing the memory. The screen clears and displays the following messages:

```
          Memory test

  Phase one: incrementing pattern ....

  Phase two: TRUE hierarchy ............

  Phase three: FALSE hierarchy ........


  Phase four: Cycling bits ............


  PASSED/FAILED message
  Press SPACE to continue.
```

A failed message will end the tests.

Action if test falls

Change the main PCB, or run the main memory test in the next chapter, and repair as necessary.
If the test has PASSED, press the Space Bar to continue the test.

Battery backed RAM

The test continues by testing battery backed RAM. The following message is displayed on the screen:

```
Battery Backed Ram  (BBR) test running.

Reading BBR into main memory.

Checking read/write function of BBR.

Re-loading configuration parameters.

PASSED/FAILED message

PRESS <SPACE> TO CONTINUE
```

Press the Space Bar to continue the test.
Action if test falls
Check battery and connections, and check battery is charged. Re run the test. if the test still fails, replace the main PCB, or see the NVM and RTC tests in the next chapter, and repair as necessary.

Time

The functional test continues by testing the time and date settings. A series of options is displayed on the screen:

```
DO YOU WANT TO ?


1. CHECK THE DATE AND TIME
2. SET THE DATE AND TIME
3. CHECK THEN SET THE DATE AND TIME
PRESS 1 OR 2 OR 3
```

The normal procedure is to select option 1. If you want to reset the time or date you would select 2 or 3. For example, you can:

1 Type 1 to check the date and time.
2 Check that the time is correct and the seconds are incrementing correctly.
3 To continue with the test, press the Space Bar.

Loudspeaker

The functional test continues by testing the operation of the loudspeakers. A short repeating sequence of four notes is played, first through the left and then the right speaker. The following message is displayed:

```
            LOUDSPEAKER TEST
         LISTEN AND CHECK SOUND
      THEN PRESS <SPACE> TO CONTINUE
```

You should:
1 Listen to the sequence of notes.
2 Check that the first four notes come from the left speaker and the second four from the right.
3 Check that the sound produced is correct. This is a subjective test, so if you detect any deviation, make a note of the fault.

Action if test falls
If no sound, or sound from one speaker only, then check speaker connections. If it still fails, substitute known good speakers and re-test. If the sound comes from one speaker only check that the headphone plug is inserted correctly. If test still fails, replace the main PCB, or carry out the Audio test in the next chapter, and repair as necessary

To continue with the test, press the space bar.

Headphones

The Functional test continues by testing the operation of the headphones. The following message is displayed as the test proceeds:

```
HEADPHONE TEST RUNNING
LISTEN AND CHECK SOUND
THEN PRESS <SPACE> TO CONTINUE
```

The test consists of a repeating sequence of eight musical notes. The first four notes are played on one headphone and the next four notes on the other headphone.

1 Put on the headphones.
2 Listen to the sequence of notes.
3 This is a subjective test, so if you detect any deviation in either headphone, note down the fault.

Action if test falls
If no sound or poor/faulty sound on known good headphones, replace the main PCB, or carry out the Audio test in the next chapter, and repair as necessary. Ensure the headphones are plugged in correctly.

To continue with the test, press the Space Bar.

Standard colour monitor

This test consists of a series of screen displays. You proceed through the test at your own pace.

The first display consists of a series of white lines radiating from the top lefthand corner. A cursor, in the shape of a bird, travels across the screen, starting from the bottom left and finishing at the top right. The features to check are:

•   the accuracy of the lines
•   the movement and integrity of the cursor.

This is a subjective test, so make a note of any faults. When you have finished looking at the screen display, press the Space Bar to move to the next display.

The next screen displays consist of four test cards. There is a test card for each of the three colour guns, and a 'grey scale' to test the three guns. The four test cards are:

• Red scale
• Green scale
• Blue scale
• Grey scale.

Each test card consists of 16 concentric circles beneath a horizontal band which is divided into 16 sections. A pale border highlights the left most eight sections of the band in order to distinguish the band from the background. The whole test card is surrounded by a contrasting border.

The purpose of the cards is to display 16 shades with the shade of the border as the middle of the range. You should observe:

• the 16 shades displayed
• the mid-coloured border
• the quality of the 'grey scale' display
• the integrity of each test card.

This is a subjective test, so make a note of any faults which you detect and when you are ready to continue press the Space Bar.

Action If test falls

if display rolls or is unstable, perform a Delete Power-on until the correct default value is obtained. The computer may have lost its configuration value for SYNC. Type at the keyboard:

•CON. **SYNC** 1 (RETURN)

Press RESET and see if if any change occurs. If no improvement is visible, change the main PCB, or perform the Video tests in the next chapter, and repair as necessary.

Keyboard Functional test

LEDs

This test checks that the LEDs (Caps Lock, Scroll Lock and Num Lock) are working.

Keys stuck

During this test, any keys or mouse buttons which are in a permanently closed position (ie stuck down; are displayed on the screen. If any keys are permanently closed, then it will be impossible to continue the test.

If everything is normal and no keys are stuck, then the last key pressed clears the screen and the Test program passes straight on to the next test.

To carry out this test:

1 Follow the instructions which appear on the screen. These tell you when to check that each LED is ON and OFF.

2 Note down any LED failures before continuing the test. These are not recorded.

3 After each set of instructions press Break to move to the next instruction.

Mouse

This tests the three buttons on the mouse and the movement of the mouse to the left, right, up and down. Each of the mouse buttons (ie left, middle, right) are displayed on the screen in turn, together with a pointer. You should:

1 Move the mouse, until the pointer is within the box on the screen, then press the button displayed on the screen.

2 The box displayed on the screen should disappear and the next button appear.

If the button cannot be made to disappear then it will be IMPOSSIBLE to continue the test. You should repeat the test with the known good mouse to isolate the fault to either the keyboard or the mouse. Replace faulty components, then retest.

If everything is normal, the program moves on automatically to the next test.

Keys

The screen clears to show a representation of the keys in the main keyboard area. You need to test each key in turn in the correct order, ie work from the bottom line of the keyboard and from left of the keyboard to the right:

1 Press Caps Lock.
2 Check that the picture of the Caps Lock key disappears from the screen.

3 Press Alt and check that the picture of the Alt key disappears from the screen. If the picture of the key does not disappear from the screen then leave a small delay before pressing the next key.

If the screen stops clearing the characters as you press the keys, go back to the lowest, leftmost key remaining on the screen and start again from there.

4 Continue working along the bottom line. Then start working from left to right along the next line up.

Note: If you accidentally press two keys together, you will see both keys displayed on the screen. You should press Break to continue.

If the same fault occurs repeatedly or the picture of the depressed key refuses to disappear, then it will be IMPOSSIBLE to continue the test. You should replace the keyboard and start the whole test again.

5 When all keys in the main keyboard area have been pressed successfully, the screen clears and displays a diagram of the rest of the keyboard area. Again, press each key in turn, following the guidelines above.

6 When all the keys have been successfully pressed, the screen dears and displays the following message:

```
        MOUSE TEST - PASSED

     MAIN KEYBOARD TEST - PASSED

   NUMERIC KEYPAD TEST - PASSED

   PRESS RESET BUTTON TO END TEST
```

Press the RESET button on the side of the unit. You have now finished the keyboard functional test.

Action if tests fall

Make sure that the configuration items 'DELAY' and 'REPEAT are set to sensible values, such as Delay 32 and Data 4 — see the User Guide for details.

If the keyboard PCB is replaced, re-run the keyboard functional test.

Floppy disc drive

The Floppy disc drive test consists of two parts. The first part of the test checks the write protect

mechanism. The test disc must be write protected for this test to work. If the A3000 disc drive passes, the following message is displayed:

```
        FLOPPY DISC DRIVE TESTS
        Checking write protect
         PASSED Write Protect


          Insert Scratch Disc
           Then press SPACE
```

Replace the Test disc with an ADFS D format write enabled disc, the scratch disc. Any data already on this disc may be destroyed, so it is best to use a blank formatted disc.

The test continues with disc Read, Write and Erase tests. Each test gives a PASSED/FAILED message.

Action if test falls

If the test fails, check that the configuration for 'STEP' and 'FLOPPIES' is correct. Check the disc drive ID switch is set to the correct position — normally '0' for single floppy drive, '1' for second floppy drive.

Swap the cable and drive for known good examples. Check power to to drive. If fault persists, change the main PCB.

RS 232

Ensure the A3000 RS232 test plug is fitted before carrying out this test (see the Appendix for details).

Action:

if the test fails, make sure that the configuration items 'BAUD' and 'DATA' are set to sensible values (Baud 4 and Data 4 for example). If the test still fails, after you have ensured that the loopback plug is functional on another unit, change the main PCB, or carry out the 'Serial socket' checks in the next chapter.

Printer

If one of the printer options was set, a test pattern is sent to the printer. The pattern comprises a repeated series of stepped lines each representing bits 0 to 7. You should look for missing or corrupted pattern. As this is a subjective test, make a note of any faults that you detect.

Action If test fails

if the test fails with a known good printer and cable connected, check the configuration settings for 'PRINTER' and 'IGNORE' are correct. If the fault still persists, change the main PCB, or see the next chapter for repair information.

On completing the tests

On completing the tests the screen displays:

```
TESTS COMPLETE
    TESTS COMPLETE
        TESTS COMPLETE
            TESTS COMPLETE
                TESTS COMPLETE
                    TESTS COMPLETE
```

and outputs a message to the printer. This indicates that the A3000 computer has passed all the non-subjective tests. However, the message Tests Complete should NOT necessarily be interpreted as a PASS, since you may wish to fail the computer on one of the subjective tests.

If a failure has been found during the non-subjective tests, the screen displays a FAILED message and lists the failures on the printer, assuming that the printer is functioning and that you did not select the 'All Tests Except Printers' option from the menu. Insert the Test Disc and press 'space' to return to the main menu.

Upgrade tests

To test Upgrades fitted to the computer, follow the procedure detailed at the start of the 'Main functional test' section for loading and running the software, then select option 2 from the main Dealer Test Menu. The Upgrades menu will appear:

```
   A3000 Upgrades Test Menu

1 Midi
2 1M Byte Memory
3 RS232
4 Main Menu

     SELECT OPTION:
```

Introduction

Type in the number of the test you wish to run; if it fails, substitute a known good upgrade. If the test still fails, replace the main PCB, or see the next chapter for repair information.

A3000 User Port MIDI Upgrade

Introduction

The UPM Upgrade functional test should be carried out whenever you install, repair or replace a UPM Upgrade. The suite of programs provide assistance when fault finding, by providing continuous looping.

Note: The MIDI Thru' port is NOT tested.

Equipment required

In order to carry out the test, you will require the following equipment:

*   UPM Upgrade to be tested, which should have been installed

*   A3000 Computer
*   3.5 inch Test Disc, write protected
*   Monochrome or analogue RGB monitor.
*   Acorn Econet cable
*   User port loopback plug (wired as in the diagram below)

*   Dual trace oscilloscope, if you are fault finding.

UPM Upgrade loopback plug (20 way IDC)
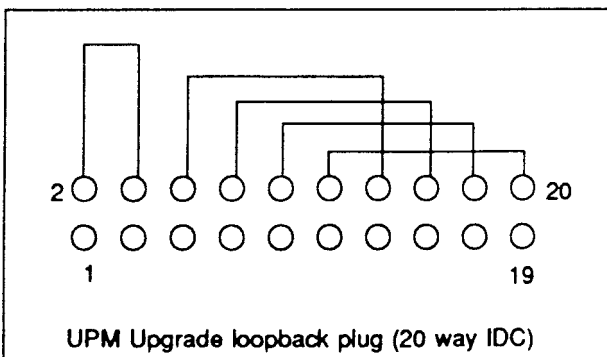
Connecting the equipment

Connect the:
*   Computer to the monitor
*   MIDI IN socket to the MIDI OUT socket, using the Econet cable
*   User port loopback plug to the User port
*   Monitor to the mains supply
*   A3000 to the mains supply.

Running the test

When you have selected Midi from the Upgrades menu, the UPM test menu will appear:

```
   A3000 UPM UPGRADE DEALER TESTS


  1Functional test.

  2Functional test soak.

  3Services routines.

     Enter choice
```

Select the appropriate test from the menu; all tests load automatically.

Selections 1 and 2 give a PASSED or FAILED message.

Selections 3 gives a further choice, after which a ' Running message indicates that the selected routine is functioning and the associated signals can be traced with an oscilloscope.

Action if test falls

Check that the test leads are working and are plugged into the correct sockets. if the test still fails then try using a known working PCB. If this passes then replace the MIDI podule under test, or else replace the main PCB.

1 Mbyte DRAM Expansion Test

Selecting 1M Byte Memory from the Upgrades test menu runs the memory upgrade test, which records its progress on the screen:

```
        1 Mbyte Dram Expansion Test


   Phase one: incrementing pattern ....

   Phase two: TRUE hierarchy ............

   Phase three: FALSE hierarchy ........

   Phase four: Cycling bits ............



   PASSED/FAILED message
   Press SPACE to continue.
```

Action if test falls

If the computer fails the test, restart the system with a delete-power-on and run the test again. If the test still fails, check the connection between the main PCB and the memory expansion card. If test fails yet again, try a known working memory card. If this fails, then replace the main PCB, else replace the faulty memory card.

RS 232 test

When it has been selected, this test will automatically run and give a PASSED or FAILED message.

Action

If the test fails, make sure that the configuration items ' BAUD' and 'DATA' are set to sensible values (BAUD 4 and DATA 4, for example). If the test still fails, after you have ensured that the loopback plug is functional on another unit, change the main PCB. A diagram for the loopback plug is included in the Appendices.

Main PCB fault diagnosis & repair

Introduction

This chapter deals with fault diagnosis and repair of the main PCB at component level.

See the previous chapter for basic fault diagnosis before proceeding to this chapter.

Tools required

The suggested tools for fault diagnosis and repair of the A3000 PCB are as follows:
- 100 MHz oscilloscope
- DC voltmeter
- Earth continuity tester (see Appendix B)
- Chip extraction tools (68/84 pin)
- Soldering/desoldering workstations, capable of handling both conventional and surface-mounted devices
- Standard handtools.

It is a recommended requirement that anti-static precautions should be utilised at all levels of servicing, ie antistatic matting and wrist-straps.

DANGER

AFTER REFITTING OR FITTING A REPLACEMENT ASSEMBLY, CARRY OUT EARTH CONTINUITY TESTING ON THE ASSEMBLED COMPUTER ACCORDING TO THE PROCEDURE GIVEN IN APPENDIX B.

WARNINGS
- Repairs to multi-layered PCBs:
  The main PCB is a four-layer board. Components should only be removed from the board using equipment specifically designed for this purpose. For details of suitable equipment available, contact Acorn Customer Service.
- Repairs to surface-mounted devices:
  The ARM, MEMC, IOC AND VIDC ICs on the A3000 PCB are surface-mounted components. Do not attempt to remove them from the board and replace them unless you are appropriately trained in surface-mount technology and have the correct equipment to do so. f in doubt contact Acorn Customer Services.
- System clock failure:
  f the computer is powered on for more than a few seconds and there is no system clock, there is a risk that all four ARM chips may be damaged, as well as the RAM.
- Faulty MEMC:
  f MEMC is faulty or the RAS/CAS signals are not being generated, the RAM may be damaged if the machine is left on too long. If you suspect a fault in these areas, scope the RAS and CAS lines for a few seconds in order to make sure that they still active, then turn the machine off. Do not leave the computer on for more than a few seconds at a time.
- Antistatic precautions:
  It is a recommended requirement that anti-static precautions should be utilised at all levels of servicing, ie antistatic matting and wrist-straps.

System failure

If the system appears to be dead, proceed as follows:

> WARNING: System clock failure
>
> f the computer is powered on for more than a few seconds and there is no system dock, there is a risk that all four ARM chips may be damaged, as well as the RAM, due to lack of refresh on the DRAM:
>
> 1 Check RAS and CAS on R133, R129-132.
> 2 Check IC41 pin 19 and IC37 pins 1 and 2 for clock signals.
> 3 Check for a RAS signal on pin 5 of all the DRAMS.

1 Check for system RESET — look for a delayed signal on power on (on IC13 pin 29).

2 Check that the signal RST driving IC 44 pin 44 and IC 37 pin 9 is not stuck high.

3 Check for main system clock of 24 MHz on LK28. f absent, check again on IC47, pins 3, 4, 5 and 6, and change IC47 if required. Finally, change the crystal X3.

4 Check SKT 15 for the following: 27C to be CLK 2, 28C to be CLK 8 and 29C to be Ref 8.

5 Check for clocks on IC44 pin 67 and IC41 pin 19.

6 Check for the presence and validity of the processor addresses and PHI 1 clock. This can be done by examining the signals on IC 29 pins 12 to 19, IC 30 pins 12 to 19 and IC 31 pins 12 to 15, whilst holding down the RESET button (RESET can be activated by pressing the RESET key, or by short-circuiting SKT3 pin 15 and 16). When RESET is held down, the address lines will increment (not AO and AI). Should none of the signals toggle, check for the PHI 1 clock on the appropriate IC, at its source on IC 44 pin 66, and on R135. Also check to see that addresses are being presented to the inputs of the above devices. Change ICs 29, 30 or 31 as appropriate, or if no addresses are present, change the ARM — IC 37.

7 Check for all address lines on MEMC, 1C44, again with RESET held down.Check for the presence of LA2 to LA6 and LA16 to LA21 on 1OC IC13.

8 The data bus can be inspected by probing on resistors R49 to R65, R115 to R128 and R87. Note that MEMC1A will not enable the ROMs whilst RESET is activated. By their nature, it is difficult to interpret the signals seen, so just check for the ability of the signals to move between logic states. None of these lines should be stuck permanently high, low or in a midrail state. Any of these resistors may be removed in order to isolate the DRAM bank from the CPU, thus easing the tracing of shorts, etc. Also check for short or open circuits on the BDATA bus, IC 43 pins 12 to 19 and IC 46 pins 12 to 19.

9 Check for shorts on the DRAM address bus, either on the DRAMS themselves or on IC 44 pins 28 to 37. Check all data signals on IC41.

10 Check for Data and Address signals on all four of the ROMs. This is especially important if a ROM change has been carried out, as misuse of a screwdriver during ROM removal may have

   damaged or broken PCB tracks, socket or ROM legs (an IC extraction tool should have been used).

11 Check the processor interrupt lines FIO and IRO pins 8 and 7 on ARM IC 37. Neither of these should be stuck low. IRO can be expected to pulse low, FIO should be high. These interrupts should also be checked at their source on IOC IC13 pins 50 and 51. Should these also be low, the interrupt source can be traced by examining all interrupt inputs to IOC IC 13 on pins 30 to 42 (note that pins 30, 31 and 42 are active high logic).
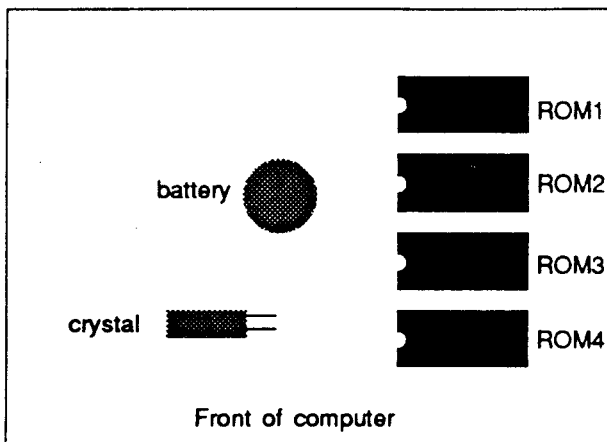
Test ROMs

The A3000 Test ROMs are designed to assist in the repair of all A3000 systems where 'Failure to Initialise' faults are present – ie the machine appears to be 'dead' on power-up.

The ROMs contain software which can be categorised in two sections:

1 Main memory test routines
2 Test routines for use under repetitive reset.

To install the test ROMs, carefully remove the RISC OS ROM set, ICs 14, 15, 16 and 17, and replace them with the test ROMs, 1, 2, 3 and 4 respectively:

The test ROMs use the bare minimum of hardware to run the system – remove/disconnect all peripherals not needed for the tests, although a keyboard is needed. A printer can also be connected if required.

Main memory test

Providing that the ARM, MEMC and VIDC are functioning, the test ROMs will auto-boot into the menu-driven display below. At any point in the operation of the test ROMs, pressing the RESET key or re-powering the machine will re-start the program and re-display the menu:

```
01234567890123456789012345678901234567890123456789012345678901234!

A1 DIAGNOSTIC TEST ROMS MEMORY SIZE -&0XX00000 BYTES


1.  CYCLIC MEMORY TEST WITH PRINTOUT

2.  CYCLIC MEMORY TEST


SELECT:
```

The memory test checks memory according to memory size selected.

It is possible that faulty memory may lie in the region

designated as 'screen memory'. f this occurs, the video display may become unreadable. For this reason, the sequence 0123456789 is repeated across the top line of the display. Every 4 digits represent a 32-bit word. Watch for missing or corrupted display.

As the start of the screen memory is known to be at physical address &2000000, it should be possible to determine the exact device that is faulty by examining the corruption pattern on the display.

The default 'memory size' is &100000 bytes (1 Mbyte), however this may be cycled through 0.5, 1, 2 and 4 Mbyte memory sizes by pressing the 'M' key.

When using the ROMs on a machine having memory content other than 1 Mbyte, the video display may at first appear out of line or incorrect. In this instance press the M key repeatedly until the required memory size has been selected.

The memory test is cyclic and on completion of each full memory test a full stop (.) will be displayed until it completes one line of the screen. The next completed cycle will move the lefthand full stop down one pixel, and then in sequence across the screen. The 0.5 Mbyte test takes between 3 and 4 seconds to complete whilst the 4 Mbyte test takes about 29 seconds.

If for some reason the video display is completely blank or unreadable (eg because of a video fault), a printed output may be obtained by selecting option 1, the output being produced at the printer port as well as on the VDU.

If an error is found in the memory, the display will show:

```
AT ADDRESS &nnnnnnnn WROTE &pppppppp READ xxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxx
```

(The message will be displayed on one line) where nnnn is the faulty address, pppp is the data written to that address and xxxxxxx is the data read back from that address in binary form. The least significant bit is the righthand bit.

The memory tests do not terminate unless an error is found, in which case after reporting 8 or 9 errors, the test will terminate. Any error will have a cascading effect, so it is good practice to repair the first error displayed first.

Note: An additional check is made on the state of CMOS RAM control lines CO and C1 at the beginning of the test, before the display. If either of these lines are short-circuit to 0 Volts, the Test ROMs will indicate this on power-up.

Memory map

Physical Address	IC Numbers
&2000000	IC21 IC20
&2000001	IC22 IC23
&2000002	IC24 IC25
&2000003	IC26 IC27
repeat until	
&20FFFFF	
8 2100000	upgrade
to	
&21FFFFF	

Repetitive reset test

This section of test code is intended for use when the main memory test menu fails to initialise.

To make use of this section of the ROMs the following test equipment is required:

• Oscilloscope
• Signal or pulse generator

The purpose of the code is to produce certain signals around specific areas of the PCB. These signals may then be monitored using the oscilloscope to assess the operation of that area of the circuit.

A suitable square wave or, preferably, a negative-going pulse generator output at 10 kHz should be connected to the reset line via a component connected to SKT3 pin 13.

After setting the border colour to white, the signals should be observable in the following order, which checks the output selection of IC13 (IOC):

SVPMD	low		
SVPMD	low	IC44 pin 52	
SVPMD	low	and IC37 pin 10	
OC CS & S1	hi	IC13 pin 67	+ pin 63
OC CS & S2	hi		+ pin 62
OC CS & S3	hi		+ pin 61
OCCS&S4	hi		+ pin 59
OCCS&S5	hi		+ pin 58
OCCS&S6	hi		+ pin 57
OC CS & S7	hi		+pin 56
nB/W	low		
nB/W	low	IC44 pin 63	
nB/W	low	and IC37 pin 84	
IOC CS & CO	hi	IC13 pin 67	+ pin 44
IOC CS & C1	hi		+ pin 45
IOC CS & C2	hi		+ pin 46
10C CS & C3	hi		+ pin 47
IOC CS & C4h	hi		+ pin 48
IOC CS & C5	hi		+ pin 49
IOC CS	hi		

Repetitive reset test assembler listing

```
        LDRT                                                ;SVPMD pin low          )
                r0,     [r5]                                                        )continual toggle of:-
        LDRT    r0,     [1-5]                               ;                       )
        LDRT    r0,     [r5]                                ;
        LDR     r1,     iocmof                              ;re—load ioc base addr. —offset



        LDR     1-0,    [r1,r6]!                            ;SVPMD pin high
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;S1 ioc hi
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;S2 ioc hi
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;S3 ioc hi
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;S4 ioc hi
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;S5 ioc hi
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;56 ioc hi
        LDR     r0,     [r1, r6]!                           ;IOC CS pin high        ;S7 ioc hi

        LDRB    r0,     [r5]                                ;nB/W pin high          )
        LDRB    r0,     [r5]                                ;nB/W pin high          ]
        LDRB    r0,     [r5]                                ;nB/W pin high          )
        MOV     r1      #&FE0000                            ;
        STR     r1,     [r7]                                ;  set C0               )
        MOV     r1      #&FD0000                            ;                       ]
        STR     r1,     [r7]                                ;  set C1               ]
        MOV     r1      #&FB0000                            ;                       )
        STR     r1,     [r7]                                ;  set C2               )
        MOV     r1      #&F70000                            ;                       ) I.O.C.
        STR     r1,     [r7]                                ;  set C3               )
        MOV     r1      #&EF0000                            ;                       )
        STR     r1,     [r7]                                ;  set C4               )
        MOV     r1      #&DF0000                            ;                       )
        STR     r1,     [r7]                                ;  set C5               )
        MOV     r1      #&FF0000                            ;
        STR     r1,     [r7]                                ;  reset all
```

Video faults

Video failure

1 Check for +5 V on both ends of L18. If open circuit then check C100 for a short circuit. Replace L18 and C100 as appropriate. Also check for 3.5 Volts (approx.) on IC 41 pin 43. Should this not be present then check R109, D16 and C93.

2 Check for a 24 MHz clock on IC41 pin 19. f missing then check continuity to and through LK28 and R138.

3 Check for video data on IC41 pins 39, 40 and 41. f not present, check power supply to IC41.

4 Check for short circuits on signals VIDRQ and VIDAK.

5 Check connection of all data lines to VIDC (IC41).
6 Finally, change IC41.

Unstable or scrolling display

The computer may have lost its configuration value for SYNC. Type at the keyboard:

*CON. SYNC 1 (RETURN)

Press reset RESET and see if if any change occurs. Investigate configuration failure.

Check for CSYNC signal on SK14 pin 4. If not present, trace back through LK24, R535 and IC40, finally changing VIDC 1041.

Check settings of LK24 and LK27 (see Links table).

Corrupted display

If the display breaks up around its edges and spurious characters appear then investigate the system oscillator. Suspect IC47or X3.

Check DRAM using the memory test routines.

Colours incorrect or missing

With a full white screen, VIDC IC41 pins 39, 40 and 41 should all have the same signal on them. f not, check pin 43, which should show approximately 3.5V; if not, check R109, C93 and D16. Finally, change VIDC, IC41.

Trace each signal through the periphery circuitry and out to SK14, where the voltage on R, G and B should be the same.

Audio

Test the audio with both headphones and internal speakers. Do not forget to issue *SPEAKER ON and *VOLUME 127 commands, if required, making sure that the sound modules are active (see the 'No sound'

algorithm in the previous chapter).

If either of the speakers fail, but the headphone socket functions normally, check connections to the main PCB via LK22 and LK23, and check IC32 or 1C38 pin 5 for a signal of 2-3 V amplitude. If no signal is present on pin 5 but can be found on pin 3, change IC32 or 38. Check continuity through R76 and R45 and check that IC13 pin 49 is not stuck high.

If there is no audio at all, first check for +5 V on both ends of L19. f this is open circuit, check the condition of C108 before replacement. Check for about 3 V on VIDC IC41 pin 12. f there is no voltage or a different one, check R500, C107 and C108.

A low amplitude signal should be found on VIDC IC41 pins 13, 14, 15 and 16. f not, change VIDC. These signals can be traced through the peripheral circuitry and out to 011 and 012. The signal amplitude at these points should be about 1.3 V pk-to-pk.

Check for short or open circuit on signals SNDAK and SNDRQ on VIDC IC41 pins 9 and 24.

Configuration, NV memory and RTC

If the NVM suffers data retention problems and the RTC fails, then, with the computer power off, check for about 1.1 V on IC6 pin 8. If this voltage is not present, check R3 and R7. If less then 1V, change the battery B1 and check the operation of D2 and C15.

If the NVM IC6 consistently fails on the same data bits, change the device.

If the clock fails to run or runs inaccurately, check and if necessary replace X2. LK7 allows access to the clock signal.

Peripheral faults

Keyboard and mouse

Make sure that the configuration items DELAY and REPEAT are set to sensible values - see the A3000 User Guide.

Check computer interface by swapping to a known good keyboard or mouse.

Floppy disc drive

Make sure that the configuration items STEP and FLOPPIES are correctly set. Check that the disc drive ID selection switch is in the zero position. Swap the disc drive for a known good drive and cable. f this also fails, check the power supply connection for +5 V and 0 V.

If the computer is not recognising the drive, check that all cables are connected both to the drive and to the PCB, and that power is present on the power cable. Also check that the drive ID plate has not fallen off inside the drive and jammed it.

Printer

Make sure that the configuration items for IGNORE and PRINT are set to sensible values. Swap the printer for a known good printer and cable.

If the printer fails completely, check for a STROBE signal on Q1 collector; trace back through R36 and IC18. Also check for shorts or open circuits on PACK and PBSY on pins 2 and 4 of 1C9, and 11 and 13 of IC8.

If the data printed is incorrect, check the continuity of the data lines into and out of IC 11, though the series resistors and onto SK 10.

If both the printer and the floppy disc drive fail, change IC 18.
Capacitors C23 to C33 on the printer port occasionally go open circuit. These should be checked if printer problems are being experienced.

Serial port (upgrade)

Check that the upgrade has been correctly installed. Make sure that the configuration items BAUD and DATA are set to sensible values. Check for =+10V on IC7 pin 1 and =-10V on pin 24.
Check for the clock on IC 1 pins 6 and 7; change X1 if faulty. f OK, change IC1 and IC7.

Expansion cards

Run the relevant expansion card test; if it fails, substitute a known good expansion card. f the test still fails, check through System failure, tracing all signals through to the expansion card socket SK15 (external) or SK3 and 11 (internal). f necessary, replace expansion card backplane.

WARNING
Power down the computer before fitting or removing an external expansion card.

Parts lists

The parts lists in this chapter detail the components used in the manufacture of the computer and its upgrades. Contact the Spares Department of Acorn Computers Limited (account holders only), or its authorised dealers and Approved Service Centres, for information as to which parts are available as spares.

Final assembly parts list

	Part no.	Description	Qty
1	0060,000/A	FINAL ASSEMBLY DRAWING	1*
3	0176.005	DISC DRIVE CABLE ASSY	1
4	0276,038	'NO ECONET' LABEL	1
5	0276,106	RESET BUTTON	1
7	0180,000	AVON MAIN PCB ASSY	1
8	0180.010	22W 240V PSU	1
9	0160,011	KEYBOARD (UK)	1
10	0180,012	MAINS CABLE ASSY	1
11	0180,081	SPEAKER ASSEMBLY	2
12	0183,004	3.5x1" 1MB DISC DRIVE	1
14	0260,061	LOWER MOULDING	1
15	0260.062	UPPER MOULDING	1
16	0260.063	BATTERY COVER	1
17	0280.073	BLANKING PANEL	1
18	0260,074	LOCK PLATE	2
19	0260,075	CABLE RESTRAINT PLATE	1
20	0260,077	PSU COVER	1
21	0280,078	PSU INSULATION SHEET	1
23	0480,041	BBC/LED LABEL	1
24	0480,042	BASE LABEL	1
25	0480,043	'NO SERIAL' LABEL	1
26	0480,044	REAR MAINS LABEL	1
27	0480,047	ACORN LOGO LABEL	1
29	0860,024	GMAT CBL RND 7,4Dx4T BLK	1
30	0940,007	ADH HOT-MELT	A/R
31	0882,770	SCW No2x1/4" PLST PAN POS	1
32	0882,716	SCW No4x1/4" PLST PAN POS	2
33	0662,111	SCW M2.5x6 PAN HD POSI	4
34	0662,121	SCW M3x6 PAN HD POSI	4
35	0862,711	SCW No4x3/4" PLST PAN POS	1
36	0682,730	SCW No6x3/8" PLST PAN POS	1
37	0882,971	WSHR M2,5 SPRF IT STL	2
38	0884,048	RIVET PLST DOME 3,1Dx4THK	1
39	0691,026	LABEL HiVOLT40mmSq MAX SA	1
40	0890,013	FOOT S/A RUBR 8Dx2.5Hmm	2

'per batch

PCB assembly parts list

Item	Part no.	Description	Qty
1	0260,000	BARE PCB	1
2	0160.000/A	AVON PCB ASSEMBLY DWG	1*
3	0180,000/C	AVON PCB CIRCUIT DIAGRAM	1*
6	0280,072	PCB BACK PANEL	1
9	0800,070	CONR 2W SHUNT 0.1" (FITTED TO LK17-20,24-29)	10
10	0800,126	SKT IC 24/0.3" NORM (IC7)	1
11	0800,128	SKT IC 28/0.6" NORM (IC1)	1
12	0600,132	SKT IC 32/0.6" SUPA (IC14-17)	4
13	0800,140	SKT IC 40/0.6" NORM	11C2
15	0870,422	WIRE 25SWG CPR TIN A/R (X1,X2,X3)	
17	0902,004	LABEL SERIAL PCB 15x50mm	1
19	xxxx,xxx	RIVET AVDEL 11070312 (SKIS)	2
R1	0521,102	RES 1K0 SW 5% 0W25 1206	1
R2	0521.102	RES 1 K0 SMD 5% 0W25 1206	1
R3	0521,181	RES 160R SMD 5%0W25 1206	1
R4	0521,331	RES 330R SMD 5% 0W25 1206	1
R5	0521,271	RES 270R SMD 5% 0W25 1206	1
R6			N/F
R7	0521,181	RES 160R SMD 5%0W25 1206	1
R6	0521.101	RES 100R SMD 5% 0W25 1206	1
R9	0521223	RES 22K SMD 5% 0W25 1206	1
R10	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R11	0521,102	RES 1 K0 SMD 5% 0W25 1206	1
R12	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R13	0521,472	RES 4K7 SW 5%0W25 1206	1
R14	0521,331	RES 330R SMD 5% 0W25 1206	1
R15	0521,222	RES 2K2 SMD 5% 0W25 1206	1
R16- R24	0521,220	RES 22R SW 5% 0W25 1206	9
R25- R28	0521,472	RES 4K7 SW 5%0W25 1206	4
R29	0521,102	RES 1K0 SW 5% 0W25 1206	1
R30	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R31	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R32	0521,103	RES 10K SMD 5% 0W25 1206	1
R33	0521,103	RES 10K SMD 5% 0W25 1206	1
R34	0521,331	RES 330R SW) 5% 0W25 1206	1
R35	0521,331	RES 330R SW) 5% 0W25 1206	1
R36	0521,102	RES 1K0 SW 5% 0W25 1206	1
R37	0521,104	RES 100K SMD 5% 0W25 1206	1
R36	0521,104	RES 100K SMD 5% 0W25 1206	1
R39	0521,104	RES 100K SMD 5% 0W25 1206	1
R40	0521,103	RES 10K SMD 5% 0W25 1206	1
R41	0521,104	RES 100K SMD 5% 0W25 1206	1
R42	0521,104	RES 100K SMD 5% 0W25 1206	1
R43	0521,102	RES 1K0 SMD 5% 0W25 1206	1
R44	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R45	0521,562	RES 5K6 SMD 5% 0W25 1206	1
R46	0521,681	RES 680R SW 5%0W25 1206	1
R47	0521,100	RES 10R SW 5% 0W25 1206	1
R48	0521,122	RES 1K2 SMD 5% 0W25 1206	1
R49- R65	0521,680	RES 66R SMD 5% 0W25 1206	17
R66	0521,331	RES 330R SMD 5% 0W25 1206	1
R67- R71	0521,220	RES 22R SMD 5% 0W25 1206	5
R72- R75	0521,472	RES 4K7 SMD 5% 0W25 1206	4
R76	0521,562	RES 5K6 SW 5% 0W25 1206	1
R77	0521,681	RES 660R SMD 5% 0W25 1206	1
R76	0521,100	RES 10R SMD 5% 0W25 1206	1
R79	0506,250	RES 332R MF 1%0W25 E96	1
R80	0521,330	RES 33R SMD 5% 0W25 1206	1
R61	0521,332	RES 3K3 SMD 5%0W25 1206	1
R82	0507,223	RES 22K MF 1% 0W25	1
R83	0506250	RES 332R ME 1% 0W25 E96	1
R84	0521,560	RES 56R SMD 5% 0W25 1206	1
R85	0521,332	RES 3K3 SMD 5% 0W25 1206	1
R86	0507,223	RES 22K MF 1% 0W25	1
R87	0521,680	RES 68R SMD 5% 0W25 1206	1

Item	Part no.	Description	Qty
R88	0521,332	RES 3K3 SMD 5% 0W25 1206	1
R89	0521,332	RES 3K3 SMD 5% 0W25 1206	1
R90	0521,560	RES 56R SMD 5% 0W25 1206	1
R91	0507,223	RES 22K MF 1% 0W25	1
R92	0521,332	RES 3K3 SMD 5% 0W25 1206	1
R93	0507,223	RES 22K MF 1% 0W25	1
R94	0521,560	RES 56R SMD 5% 0W25 1206	1
R95	0507,223	RES 22K MF 1% 0W25	1
R96	0506,250	RES 332R MF 1% 0W25 E96	1
R97	0507,223	RES 22K MF 1% 0W25	1
R96	0507,223	RES 22K MF 1% 0W25	1
R99	0507,223	RES 22K MF 1% 0W25	1
R100	0521,330	RES 33R SMD 5% 0W25 1206	1
R101	0521,332	RES 3K3 SMD 5% 0W25 1206	1
R102	0506,161	RES 43R2 MF 1% 0W25 E96	1
R103	0506,161	RES 43R2 MF 1% 0W25 E96	1
R104	0506,161	RES 43R2 MF 1% 0W25 E96	1
R105	0521,681	RES 680R SW 5%0W25 1206	1
R106	0521,103	RES 10K SMD 5%0W25 1206	1
R107	0521,103	RES 10K SMD 5% 0W25 1206	1
R108	0521,331	RES 330R SMD 5% 0W25 1206	1
R109	0521,103	RES 10K SMD 5% 0W25 1206	1
R110-			
R115	0506,300	RES 1K00 MF 1% 0W25 E96	4
R114	0521,122	RES 1K2 SMD 5% 0W25 1206	1
R115-			
R128	0521,680	RES 68R SMD 5% 0W25 1206	14
R129-			
R133	0521,220	RES 22R SMD 5% 0W25 1206	5
R134	0521,122	RES 1K2 SMD 5% 0W25 1206	1
R135	0521,330	RES 33R SMD 5% 0W25 1206	1
R136	0521,221	RES 220R SMD 5% 0W25 1206	1
R137	0521,103	RES 10K SMD 5% 0W25 1206	1
R138	0521,680	RES 68R SMD 5% 0W25 1206	1
R139	0521,680	RES 68R SMD 5% 0W25 1206	1
R140	0521,680	RES 68R SMD 5% 0W25 1206	1
R141	0521,220	RES 22R SMD 5% 0W25 1206	1
R142	0521,220	RES 22R SMD 5% 0W25 1206	1
R143	0521,220	RES 22R SMD 5% 0W25 1206	1
R144	0521,103	RES 10K SMD 5% 0W25 1206	1
R145	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R500	0521,333	RES 33K SWD 5% 0W25 1206	1
R501	0521,103	RES 10K SMD 5% 0W25 1206	1
R502	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R503-			
R518	0521,680	RES 68R SMD 5% 0W25 1206	16
R519-			
R529	0521,104	RES 100K SMD 5%0W25 1206	11
R530	0521,102	RES 1K0 SMD 5% 0W25 1206	1
P531	0521,181	RES 180R SMD 5%0W25 1206	1
R532	0521,820	RES 82R SMD 5% 0W25 1206	1
R533	0521,331	RES 330R SMD 5% 0W25 1206	1
R534	0521,680	RES 68R SMD 5% 0W25 1206	1
R535	0521,680	RES 68R SMD 5% 0W25 1206	1
R536	0521221	RES 220R WO 5% 0W25 1206	1
R537	0521,680	RES 68R SMD 5% 0W25 1206	1
R538	0521,221	RES 220R SMD 5% 0W25 1206	1
R539	0521,680	RES 68R SMD 5% 0W25 1206	1
R540	0521,221	RES 220R SMD 5% 0W25 1206	1
R541	0521,680	RES 68R SW) 5% 0W25 1206	1
P542	0521,221	RES 220R SMD 5% 0W25 1206	1
R543-			
R546	0521,102	RES 1 K0 SMD 5% 0W25 1206	4
R547	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R548	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R549	0521,104	RES 100K SMD 5% 0W25 1206	1
R550	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R551	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R552	0521,472	RES 4K7 SMD 5% 0W25 1206	1
R553	0521221	RES 220R SMD 5% 0W25 1206	1
P554	0521,103	RES 10K SMD 5% 0W25 1206	1
R555			N/F
R556			N/F
P557	0521,473	RES 47K SMD 5% 0W25 1206	1
R558			N/F
R559			N/F
R560	0521,331	RES 330R SMD 5% 0W25 1206	1
R561	0521,271	RES 270R SW 5% 0W25 1206	1

Item	Part no.	Description	Qty
R562			N/F
R563			N/F
R564	0521,473	RES 47K SW 5% 0W25 1206	
R565	0521,473	RES 47K SMD 5% 0W25 1206	1
R566			
R567-			N/F
R571	0521,473	RES 47K SMD 5% 0W25 1206	5
R572	0521,221	RES 220R SMD 5% 0W25 1206	1
R573-			
R579			N/F
CI	0681,001	PCPCTR DCPLR 33n SMD 1210	1
C2	0631.033	CPCTR CPLT 33p 30V 2%	1
C3	0640,473	CPCTR CER 47n 30V 80%	1
C4	0610,010	CPCTR TANT 10u 10V 20%	1
C5	0681,001	CPCTR DCPLR 33n SMD 1210	1
C6-			
C10	0635,100	CPCTR ALEC 10u 16V RAD	5
C11	0681,001	CPCTR DCPLR 33n SMD 1210	1
C12	0635230	CPCTR ALEC 220u 16V RAD	1
C13	0610,010	CPCTR TANT 10u 10V 20%	1
C14	0635,230	CPCTR ALEC 220u 16V RAD	1
C15	0635,470	CPCTR ALEC 47u 16V RAD	1
C16	0631,012	CPCTR CPLT 12p 30V 2%	1
C17	0681,001	CPCTR DCPLR 33n SMD 1210	1
C18	0681,001	CPCTR DCPLR 33n SMD 1210	1
C19	0635,100	CPCTR ALEC 10u 16V RAD	1
C20	0681,001	CPCTR DCPLR 33n SMD 1210	1
C21	0681,001	CPCTR DCPLR 33n SMD 1210	1
C22	0610,010	CPCTR TANT 10u 10V 20%	1
C23	0631,100	CPCTR CPLT 100p 30V 2%	1
C24-			
C31	0630,220	CPCTR CPLT 2n2 30V 10%	8
C32	0631,100	CPCTR CPLT 100p 30V 2%	1
C33	0631,100	CPCTR CPLT 100p 30V 2%	1
C34	0610,010	CPCTR TANT 10u 10V 20%	1
C35	0681,001	CPCTR DCPLR 33n SMD 1210	1
C36	0681,001	CPCTR DCPLR 33n SMD 1210	1
C37	0681,001	CPCTR DCPLR 33n SMD 1210	1
C38			N/F
C39	0621,470	CPCTR ALEC 47u 10V AX	1
C40-			
C47	0681,001	CPCTR DCPLR 33n SMD 1210	8
C48	0681,003	CPCTR DCPLR 100n SMD 1210	1
C49	0681,003	CPCTR DCPLR 100n SMD 1210	1
C50-			
054	0681,001	CPCTR DCPLR 33n SMD 1210	5
C55	0610,010	CPCTR TANT 10u 10V 20%	1
C56	0681,003	CPCTR DCPLR 100n SMD 1210	1
C57	0610,010	CPCTR TANT 10u 10V 20%	1
C58	0681,003	CPCTR DCPLR 100n SMD 1210	1
C59	0681,001	CPCTR DCPLR 33n SMD 1210	1
C60	0635,470	CPCTR ALEC 47u 16V RAD	1
C61	0635,230	CPCTR ALEC 220u 16V RAD	1
C62	0640,473	CPCTR CER 47n 30V 80%	1
C63	0635,470	CPCTR ALEC 47u 16V RAD	1
C64	0681,001	CPCTR DCPLR 33n SMD 1210	1
C65	0642,103	CPCTR ALEC 100u 25V RAD	1
C66	0635,230	CPCTR ALEC 220u 16V RAD	1
C67	0635,047	CPCTR ALEC 4u7 16V RAD	1
C68	0640,473	CPCTR CER 47n 30V 80%	1
C69	0635,230	CPCTR ALEC 220u 16V RAD	1
C70	0642,103	CPCTR ALEC 100u 25V RAD	1
C71	0681,003	CPCTR DCPLR 100n SMD 1210	1
C72	0681,003	CPCTR DCPLR 100n SMD 1210	1
C73	0681,003	CPCTR DCPLR 100n SMD 1210	1
C74	0640,473	CPCTR CER 47n 30V 80%	1
C75	0630,220	CPCTR CPLT 2n2 30V 10%	1
C76	0681,001	CPCTR DCPLR 33n SMD 1210	1
C77	0650223	CPCTR MPSTR 22n 50V 10%	1
C78	0610,010	CPCTR TANT 10u 10V 20%	1
C79	0630,100	CPCTR CPLT 1n 30V 10%	1
C80	0650,106	CPCTR MPSTR 100n 50V 10%	1
C81	0630,220	CPCTR CPLT 2n2 30V 10%	1
C82	0630,220	CPCTR CPLT 2n2 30V 10%	1
C83	0621,470	CPCTR ALEC 47u 10V AX	1
C84	0681,003	CPCTR DCPLR 100n SMD 1210	1

Item	Part no.	Description	Qty
C85	0630,100	CPCTR CPLT 1n 30V 10%	1
C86	0630,220	CPCTR CPLT 2n2 30V 10%	1
C87	0681,001	CPCTR DCPLR 33n SW) 1210	1
C88	0650,106	CPCTR MPSTR 100n 50V 10%	1
C89	0610,010	CPCTR TANT 10u 10V 20%	1
C90	0630,220	CPCTR CPLT 2n2 30V 10%	1
C91	0630,220	CPCTR CPLT 2n2 30V 10%	1
C92	0650,223	CPCTR MPSTR 22n 50V 10%	1
C93	0635,100	CPCTR ALEC 10u 16V RAD	1
C94	0610,010	CPCTR TANT 10u 10V 20%	1
C95	0635,470	CPCTR ALEC 47u 16V RAD	1
C96	0640,473	CPCTR CER 47n 30V 80%	1
C97	0635,100	CPCTR ALEC 10u 16V RAD	1
C98	0681,001	CPCTR DCPLR 33n SW) 1210	1
C99	0681,001	CPCTR DCPLR 33n SW) 1210	1
C100	0610,010	CPCTR TANT 10u 10V 20%	1
C101			N/F
C102			N/F
C103			N/F
C104			N/F
C105	0681,001	CPCTR DCPLR 33n SMD 1210	1
C106	0681,001	CPCTR DCPLR 33n SW) 1210	1
C107	0640,473	CPCTR CER 47n 30V 80%	1
C108	0610,010	CPCTR TANT 10u 10V 20%	1
C109	0621,470	CPCTR ALEC 47u 10V AX	1
C110	0621,470	CPCTR ALEC 47u 10V AX	1
C111	0610,010	CPCTR TANT l0u 10V 20%	1
C112	0635,230	CPCTR ALEC 220u 16V RAD	1
C113	0681,001	CPCTR DCPLR 33n SMD 1210	1
C114	0631,010	CPCTR CPLT 10p 30V 2%	1
C115	0631,033	CPCTR CPLT 33p 30V 2%	1
C116	0630,270	CPCTR CPLT 2n7 30V 10%	1
C500-0506	0681,001	CPCTR DCPLR 33n SMD 1210	7
IC1			N/F
IC2	0280,022	IC KBD CNTRLR (0708,051)	1
IC3	0740,038	IC 7438 TTL 14/0.3"	1
IC4	0742,145	IC 74LS145 TTL 16/0.3	1
ICS	0742,145	IC 74LS145 TTL 16/0.3	1
IC6	0708,583	IC 8583 RTC RAM 8/0.3"	1
IC7			N/F
IC8	0749,014	IC 74HCT14 CMOS 14/0.3"	1
IC9	0747,004	IC 74HC04 CMOS 14/0.3"	1
IC10	0747,074	IC 74HC74 CMOS 14/0.3"	1
IC11	0742,374	IC 74LS374 TTL 20/0.3'	1
IC12	0747,138	IC 74HC138 CMOS 16/0.3"	1
IC13	2201,368	IC 10C (PLSTC)	1
IC14	0283.022	RISC OS ROM 1 V2.0	1
IC15	0283,023	RISC OS ROM 2 V2.0	1
IC16	0283,024	RISC OS ROM 3 V2.0	1
IC17	0283,025	RISC OS ROM 4 V2.0	1
IC18	0747,574	IC 74HC574 CMOS 20.0.3"	1
IC19	0747,574	IC 74HC574 CMOS 20.0.3"	1
IC20-IC27	0704,118	IC DRAM 256Kx4 120n 20ZIP	8
IC28	0747,139	IC 741HC139 CMOS 16/0.3"	1
IC29	0747,573	IC 74HC573 CMOS 20/0.3"	1
IC30	0747,573	IC 74HC573 CMOS 20/0.3"	1
IC31	0747,573	IC 74HC573 CMOS 20/0.3"	1
1C32	0770,386	IC LM386 AUDIO AMP	1
IC33	0747,139	IC 74HC139 CMOS 16/0.3"	1
IC34	0747,000	IC 74HC00 CMOS 14/0.3"	1
IC35	0740,006	IC 7406 TTL 14/0.3"	1
	0740,016	IC 7416 TTL 14/0.3" (OPTION)	
IC36	0701,772	IC 1772 FDC 28/0.6'	1
IC37	2201,365	IC ARM Rum PLSTC)	1
IC38	0770,386	IC LM386 AUDIO AMP	1
IC39	0770,324	IC LM324 QUAD OP AMP	1
1C40	0750,086	IC 74AC86 CMOS 14/0.3"	1
IC41	2201,367	IC VIDC 1A (PLSTC)	1
IC42	0749,573	IC 74HCT573 CMOS 20/0.3"	1
IC43	0747,573	IC 74HC573 CMOS 20/0.3"	1
IC44	2201,375	IC MEMC 1 A {PLSTC-8MHz)	1
IC45	0749,573	IC 74HCT573 CMOS 20/0.3'	1
IC46	0747,573	IC 74HC573 CMOS 20/0.3"	1
IC47	0747,004	IC 74HC04 CMOS 14/0.3"	1

Item	Part no.	Description	Qty
01	0780,241	TRANS 8C239 NPN 0.2"P LDS	1
02-010	0783,907	TRANS 2N3906 PNP .2"P LDS	9
011	0780,241	TRANS BC239 NPN 0.2"P LDS	1
012	0780,241	TRANS BC239 NPN 0.2-P LDS	1
D1			N/F
02	0794,005	DIODE SI 1N4005 600V 1A	1
D3-D16	0794,148	DIODE SI 1N4148	14
B1	0817,013	BAT NICAD 1V2 280mAH PCB	1
L1-L14	(0500,000	RES ZERO-OHM 0W25 (0.6"ptch	14
	(0870,420	WIRE 22SWG TIN (OPTION)	
L15			N/F
L16	0860,015	CHOKE RF FE BEAD	1
L17	0860,015	CHOKE RF FE BEAD	1
L18	0860,012	CHOKE RF 2u2H AX 0-30	1
L19	0860,005	COIL RF 33uH AX 0-45	1
L20	0860,015	CHOKE RF FE BEAD	1
L21	0860,015	CHOKE RF FE BEAD	1
LK 1-LK16			N/F
LK17	0800,050	CONR 2W WAFR 0.1" ST PCB	1
LK18	0800,050	CONR 2W WAFR 0.1" ST PCB	1
11(19	0800,051	CONR 3W WAFR 0.1" ST PCB	1
LK20	0800,051	CONR 3W WAFR 0.1' ST PCB	1
LK21			N/F
LK22	0800,458	CONR 2W WAFR 0.1" ST LK	2
LK23	0800,458	CONR 2W WAFR 0.1" ST LK	2
LK24	0800,051	CONR 3W WAFR 0.1" ST PCB	1
LK25	0800,050	CONR 2W WAFR 0.1" ST PCB	1
1K26	0800,050	CONR 2W WAFR 0.1" ST PCB	1
LK27	0800,050	CONR 2W WAFR 0.1" ST PCB	1
LK28	0800,050	CONR 2W WAFR 0.1" ST PCB	1
LK29	0800,050	CONR 2W WAFR 0.1" ST PCB	1
LK30	0800,050	CONR 2W WAFR 0.1" ST PCB	1
LK31	0800,050	CONR 2W WAFR 0.1" ST PCB	1
PL 1	0180,013	EARTH STRAP {PCB/PSU}	1
PL2	0800,291	CONRD 9W PLG RAPCB+RFI+LI	1
PL3	0800,203	FSTN TAB 6,3mmx0,8 ST PCB	1
PL4	0800,203	FSTN TAB 6,3mmx0,8 ST PCB	1
PL5			N/F
PL6	0803,102	CONR 34W BOX IDC LP ST	1
SKI	0800,920	CONR 9W MINDIN RA PCB	1
SK2	0800,004	CONR SW SKT DIN RA PCB	1
SK3	0800,487	CONR 17W SKT 0.1" PCB	1
SK4	0800,487	CONR 17W SKI' 0.1" PCB	1
SK5	0800,481	CONR 5W SKT HSNG 0.1" PCB	1
SK6	0801,202	CONR 20W 0.1" FLXPCB SKT	1
SK7	0801,202	CONR 20W 0.1" FLXPCB SKT	1
SK8	0800,486	CONR 5W SKT 0.1" PCB	1
SK9	0800,486	CONR 5W SKT 0.1" PCB	1
SK10	0800,293	CONRD 25W SKT RAPCB+RFI+L	1
SK11	0800,487	CONR 17W SKT 0.1" PCB	1
SK12	0800,642	CONR JKSKT 3W 3,5mm RAPCB	1
SK13	0800,611	CONR PHONO SKT RA PCB	1
SK14	0800,292	CONRD 9W SKT RAPCB+RFI+LI	1
SKIS	0800,411	CONR 64W SKT RA AC PCB	1
SK16	0800,476	CONR 20W WAFR 0.1 ST 10mm	3
SW1	0805,704	SW 2P MOM CO P/B RA PCB	1
X1	0820,019	XTAL 1.8432MHz HC18	1
X2	0821,327	XTAL 32.768KHz CC 0.05'	1
X3	0820240	XTAL 24.00MHz HC18	1

2Mb RAM upgrade

Item	Part no.	Description	thy
1	0280,200	BARE PCB	1
2	0180,200/A	ASSEMBLY DRAWING	1*
3	0180,200/C	CIRCUIT DIAGRAM	1*
C 1-C8	0680,102	CPCTR DCPLR 100n **AXA** 25V	8
C9	0635,470	CPCTR 47u ALEC 16V RAD	1
C10	0635,470	CPCTR 47u ALEC 16V RAD	1
IC1-1C8	0704,118	IC DRAM 256Kx4 120n 20ZIP	8
SK1	0800,488	CONR 20W SKT 0 . r RA PCB	1
SK2	0800,488	CONR 20W SKT 0.1" RA PCB	1
SK3	0800,488	CONR 20W SKT 0.1" RA PCB	1

•per batch

User Port MIDI upgrade

Item	Part no.	Description	Qty
2	0180,300/A	ASSEMBLY DRAWING	1 "
3	0180,300/C	CIRCUIT DIAGRAM	1*
6	0280,360	PCB REAR PANEL	1
9	0800,128	SKT IC 28/0.6" NORM	11C3
11	0884,042	RIVET POP DOME 3,2D & THK (USE ON ITEM 6)	2
L1 -L18	0500,000	RES ZERO R 0W25	18
R1	0502.222	RES 21(2 C/MF 5% 0W25	1
R2	0502222	RES 21(2 C/MF 5% 0W25	1
R3	0502,221	RES 220R C/MF 5% 0W25	1
R[4]	0502,221	RES 220R C/MF 5% 0W25	1
R5	0502,221	RES 220R C/MF 5% 0W25	1
R6	0502,221	RES 220R C/MF 5% 0W25	1
R7	0502,102	RES 1K0 C/MF 5% 0W25	1
R8	0502,222	RES 2K2 C/MF 5% 0W25	1
R9	0502,222	RES 2K2 C/MF 5% 0W25	1
RI0	0502,221	RES 220R C/MF 5% 0W25	1
R11	0502,103	RES 10K C/MF 5%0W25	1
R12	0502,103	RES 10K C/MF 5%0W25	1
C1	0635,230	CPCTR 220u ALEC 16V RAD	1
C2-C8	0680,002	CPCTR DCPLR 33/47n 0.2"	7
IC 1	0706,525	IC 65C22 VIA CMOS 2MHz	1
IC2	0799,504	OPTO ISOL 6N138 8/0.3"	1
IC3	0280,320	ROM (0727,128/9 TBP)	1
IC4	0740,006	IC 7406 TTL 14/0.3"	1
ICS	0732,691	IC 2691 UART CMOS 24/0.3"	1
IC6	0747,139	IC 74HC139 CMOS 16/0.3"	1
D1	0794,148	DIODE 1N4148 SI	1
LK 1-LK4			N/F
SK1	0800,009	CONR 20W HDR IDC RA 4WALL	1
SK2	0800,004	CONR SW SKT DIN RA PCB	1
SK3	0800,004	CONR 5W SKT DIN RA PCB	1
SK4	0800,004	CONR 5W SKT DIN RA PCB	1
SK5	0800,475	CONR 17W WAFR 0.1 23,5mmL	1
SK6	0800,475	CONR 17W WAFR 0.1 23,5mmL	1

• per batch

Appendix A: Serial port loopback plug

Serial port loopback plug

← 0.1" →

wire link

direction of copper strips

5 4 8 3 7 2 6 1
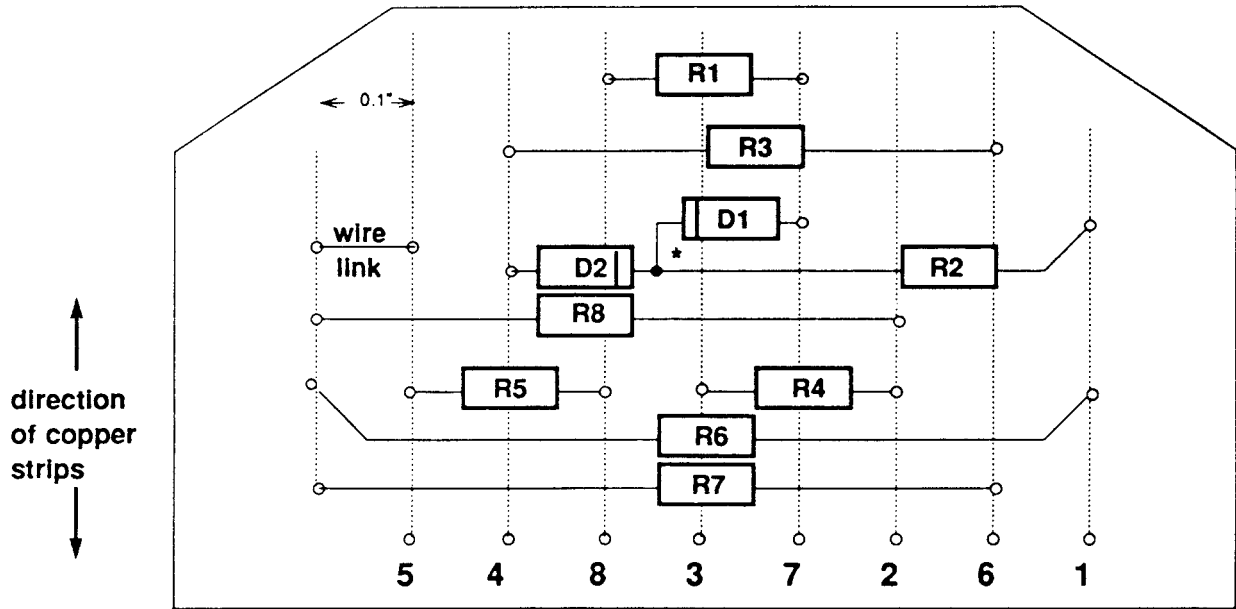
○ hole

* components join above the board surface

Parts list*

Item	Part no.	Description	Qty
1	0276.081	CIRCUIT 8 ASSEMBLY DRAWING	1'
3	0800,288	CONR 9W SCKT 'D' ST MS SB	1
5	0800,991	CONR 9W SHELL D' + SCREWS	1
R1	0502,122	RES 1K2 C/MF 5% 0W25	1
R2	0502,122	RES 1K2 C/MF 5% 0W25	1
R3	0502,122	RES 1K2 C/MF 5%0W25	1
R4	0502,122	RES 1K2 C/MF 5% 0W25	1
R5	0502,472	RES 4K7 C/MF 5% 0W25	1
R6			N/F
R7	0502,472	RES 4K7 C/MF 5% 0W25	1
R8	0502,472	RES 4K7 C/MF 5% 0W25	1
D1	0790,085	DIODE BAT85 SBL	1
D1	0790,085	DIODE BAT85 SBL	1

per batch

Assembly notes

Assemble the components onto 'Veroboard', and fit item 5 (the shell) to protect the assembly

Appendix B: Earth continuity testing

Equipment required

An earth continuity tester capable of sourcing 25A derived from an AC source with a no-load voltage not exceeding 12V.

It is recommended that the calibration and operation of the instrument be checked frequently enough to assure its accuracy.

Test Procedure

DANGER

THE FOLLOWING TESTS INVOLVE HIGH CURRENTS BUT LOW VOLTAGES. ALL NECESSARY PRECAUTIONS MUST BE TAKEN TO ENSURE OPERATOR SAFETY DURING TESTING.

DANGER

SWITCH OFF THE COMPUTER, DISCONNECT IT FROM THE MAINS SUPPLY, AND DISCONNECT ANY PERIPHERALS BEFORE CARRYING OUT THIS TEST.

The test should be performed on a fully assembled computer.

Using the Earth continuity tester, check the continuity between the power supply cord 13A plug earth pin and the following points:-

1 the rear panel internal expansion card fixing screws

2 both printer/parallel port D-type fixing bolts.

The resistance measured between the earth pin and

each of the above test points shall not exceed 0.15 a This value includes an allowance for the resistance of the mains cable. The duration of each test shall not exceed 10 seconds. No waiting period between tests is necessary.