FileStore Service Manual

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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.

Within this publication the term 'BBC' *is* used as an abbreviation for 'British Broadcasting Corporation'.

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Contents

Introduction

This manual is designed to provide the information required to diagnose and repair faults on the FileStore E01 and E20 units and the Stacking FileStore E01S, E40S and E60S units, developed by Acorn Computers Limited of Cambridge, England.

The information contained in this manual is for the use of engineers who will be servicing the above units. It includes a specification of each unit, circuit descriptions, disassembly and assembly details and faultfinding procedures.

The manual is divided into four parts:

- Part 1 covering the FileStore E01 twin floppy-disc unit
- Part 11 covering the FileStore E20 hard disc unit
- Part 111 covering the Stacking FileStore E01S twin floppy-disc unit
- Part IV covering the Stacking FileStore E40S and E60S hard disc units.

The Appendices at the back of the manual contain:

- An Appendix describing the test software that can be used for testing all possible combinations of FileStore types.
- An Appendix containing the parts lists for FileStore and Stacking FileStore units.
- An Appendix containing the relevant drawings and diagrams for FileStore and Stacking FileStore units.

Part I: FileStore E01

1. Introduction to the E01 unit

1.1 Equipment description

FileStore E01 is The twin floppy-disc version of the FileStore file server. There are two versions of the FileStore E01, the Master version used with Acorn and BBC computers (Part number 0354,002) and the Communicator version supplied for use with the Acorn Communicator intelligent Videotex terminal (Part number 0354,000).

The differences between these two versions are confined to the colour finish of the case and plastic parts, and the software supplied with the unit.

1.2 Function

To provide a mass storage facility for Econet users. When connected to the Econet, the FileStore will provide an Econet clock if one is not present. Also present is a Real Time Clock and a printer output for use as a printer server. An upgrade path to the hard disc FileStore E20 is also provided.

1.3 Prerequisites for use

The E01 unit is used by connecting it to one of the following:

- Econet Network
- BBC Microcomputer
- Acorn Master Series Microcomputer
- Acorn Cambridge Workstation (ACW)
- Acorn Communicator
- Acorn Archimedes Workstation
- Acorn R140 RISC ix Workstation
- Acorn A3000 Microcomputer
- Other Econet network stations.

1.4 Enhancements

The following items may be connected to the E01 to provide additional functions:

- Printers
- Hard disc FileStore E20
- Econet bridges

2. E01 Specification

This chapter gives details of the main features of the E01 unit, including electrical specifications for the interface ports.

2.1 General specification

Within the E01 unit are two *3.5"* floppy disc drives, a switch mode power supply unit (PSU) and a Fileserver disc drive PCB. The PSU supplies +5V and +12V rails and meets BS5850.

The file server disc drive PCB contains 64K of RAM and 64K of ROM .(two 27256 EPROMs), a Real Time Clock with battery backup, a floppy disc controller, an Econet Interface and a printer interface. The microprocessor is a 65C102 device, running at 2MHz, which provides the processing required.

The ROM contains the operating system, filing system and Econet code needed to run the file server. The 64K of RAM and ROM are never in the memory map at the same time. On power up the ROM is read and it copies its file server code into the memory map. At the completion of this exercise the memory map is almost totally resident in RAM.

Two *3.5"* discs are also supplied with the unit: the Master lib disc (containing programs used to run FileStore) and the data disc (for users' own files).

A Real Time Clock circuit incorporating the 146818 RTC is used to provide the information to allow date stamping of files and also to offer the facility of the Time and Date commands to users. The RTC is battery backed-up by a rechargeable nickel cadmium cell.

The Econet Interface is based upon the Acorn Econet module. Collision detection and an internal line biasing circuit are fitted. An Econet clock is generated if no clock is present.

The floppy disc interface is based upon the 2793 disc controller to provide a SA400 interface.

A Centronics-compatible printer interface is driven by a VIA.

A door flap switch (an optical sensor) is used to inform the processor when a disc is about to be changed and whether to power up in user mode or maintenance mode.

During normal operation, when a user opens the door flap, the processor needs to save the complete disc maps (held in memory) on the discs before they are removed. It is therefore essential that when users remove a disc, they first wait until the drive motors have stopped, indicating that the maps have been stored.

FileStore will normally only accept network filing system commands. To format discs and issue direct commands to the disc, you must put FileStore into a different mode: 'maintenance mode'. (This is to prevent users erasing and formatting discs by mistake.) To enter maintenance mode, you can either power up with the access flap open, or use the *FSMODE M command from a user station (see the *FileStore Network Manager's Guide* for further details).

For connection to the E20 unit a FileStore expansion bus interface, similar to the BBC microcomputer 1MHz bus interface, but running at 2MHz, is fitted to the rear of the unit.

The following ports are provided:

FileStore Expansion Bus:	34 way IDC - Rear Panel
Printer:	26 way IDC - Rear Panel
Econet:	5 pin DIN - Rear Panel
Mains in:	Permanently attached cable through grommet in rear panel

2.2 Physical

2.2.1 E01 unit

Dimensions:	length 333mm width 351mm height 78.8mm
Colour:	Acorn Specification 0920,208 (Pantone 537)
Material:	Acorn Part No. 900.000 (ABS Cycolac) Mild Steel Chassis
Finish:	Vapour blast
Net weight:	5kg

2.2.2 E01 packaging

Material:	Neopolene Inner, Triwall cardboard outer
Overall dimensions:	length 545mm width 500mm height 230mm
Weight (gross):	7kg

2.3 Operation

Upon power up (with the front door closed), the FileStore starts itself up into network mode ready for use over the network. If the door is open, the unit will accept requests via the network to allow maintenance and disc formatting.

2.3.1 Indicators

Green LED:	Power on indicator
Red LED:	Mode indicator

2.3.2 Controls

Mains switch	Mounted on rear panel
Front door flap	Actuates door open/closed sensor, also controlling the operating mode

2.4 Signal connectors

2.4.1 FileStore E01 expansion bus pinouts

Connector Type: 34 way IDC male. The pin allocations are as follows:

Pin 1	Gnd
Pin 2	R/not W
Pin 3	Gnd
Pin 4	I2 (2MHz Clock)
Pin 5	Gnd
Pin 6	not NMI
Pin 7	Gnd
Pin 8	not IRQ
Pin 9	Gnd
Pin 10	Not WENCH
Pin 11	Gnd
Pin 12	Not Used
Pin 13	Gnd
Pin 14	Not RST
Pin 15	Gnd
Pin 16	Not Used
Pin 17	Gnd
Pin 18	D0
Pin 19	D1
Pin 20	D2
Pin 21	D3
Pin 22	D4
Pin 23	D5
Pin 24	D6
Pin 25	D7
Pin 26	D8
Pin 27	A0
Pin 28	A1
Pin 29	Gnd
Pin 30	Gnd
Pin 31	Gnd
Pin 32	Gnd
Pin 33	5v
Pin 34	Gnd

2.4.2 Econet port

Data rate of up to 200 Kbps (determined by the Econet clock rate)

Connector type: *5* pin, 180 degree DIN socket.

Econet port pinouts are as follows:

Pin 1	DATA+	Data positive
Pin 2	GND	Ground
Pin 3	CLK-	Clock negative
Pin 4	DATA-	Data negative
Pin 5	CLK+	Clock positive

2.4.3 Printer port

Connector type: 26 way IDC connector

Standard Centronics - compatible port with control signals STRB, ACK, BUSY, SELECT (all active low).

Printer port pinouts are as follows:

Pin 1	Data ready strobe	notSTRB
Pin 3	Data 0	D0
Pin 5	Data 1	D1
Pin 7	Data 2	D2
Pin 9	Data 3	D3
Pin 11	Data 4	D4
Pin 13	Data 5	D5
Pin 15	Data 6	D6
Pin 17	Data 7	D7
Pin 19	Data acknowledge	notACK
Pin 21	N/C	N/C
Pin 23	N/C	
Pin 25	N/C	N/C
Pins 2-22 even	0V	GND
Pin 24	N/C	
Pin 26	N/C	

2.5 Power input

2.5.1 Power input requirements

The power input requirements are as follows:

	Minimum	**Nominal**	**Maximum**	**Units**
Voltage	198	220/240	264	V AC
Frequency		50		Hz
Power		25		Watts

2.5.2 Mains interruptions (‘Brown out’)

The equipment has been designed to operate without malfunction during mains interruptions as detailed below. The mains is assumed to be at nominal at all other times.

Voltage [V]	**Duration [msec]**	**Frequency [Hz]**
0	20	0.2
50%	50	0.2

2.5.3 Power input plug and cable description

Plug type:	BS1363A , sleeved L+N pins BSI Kitemake and/or ASTA Diamond marked
No. of pins/connectors:	3
Fuse Value:	3A to BS1362 ASTA approved
Cable type:	To BS6500 Table 16 (BASEC and/or CENELEC harmonised and marked)
No. of conductors:	3
Length of cable:	2m

2.6 Power supply

2.6.1 Power required

		nominal	max
pcb	5V	1.3A	1.7A
Drives	5V	32OmA	560mA
	12V	l4OmA	
Drive start	12V	14OrnA	1.0A (400msec)
Fan	5V	250mA	

2.6.2 Specification

5-5.25V	0-2A
5-5.25V	0.05-0.6A
11.4-12.6V	0-0.4A
	0-1A

2.7 Safety standards

The equipment is designed and manufactured *to* comply with the following standards:

- BS415
- BS5850
- BS6204

2.8 Electromagnetic interference

2.8.1 Standards

The equipment is designed and manufactured to comply with BS6527 Class B.

2.8.2 Mains transients

The equipment functions and is undamaged in the presence of mains borne interference having voltage spikes detailed as follows:

Frequency:	0.2 times mains frequency
Risc Time:	5ns

Half-Pulse width duration:	5Ons
Polarity:	+ve or -ve
Phase Angle:	Free non-synchronous
Peak Voltage:	1000V shall not cause malfunction (soft errors) 1500V shall not cause physical damage, but visible malfunction is permitted

2.8.3 Electrostatic discharge

The equipment function is undamaged when subjected to a discharge (at both +ve and -ve polarity) from a 5pF capacitor charged to a voltage specified below, limited by a 150Ω resistor. The discharge is applied to any user accessible points, interconnecting cables and also the ground reference plane adjacent to the equipment.

Discharge Voltage:	6kV shall not cause malfunction (soft errors) 12kV shall not cause physical damage, but visible malfunction is permitted

2.9 Environment

2.9.1 Operating

The equipment operates and functions to specification while under the following environmental conditions:

Temperature	10 to +35°C
Relative Humidity	10 to 80% non-condensing
Mechanical Shock	Not operating: 40g ½ sinusoid l0ms maximum repetition rate 1 every 10 seconds. 10 shocks on all six faces. Operating: 5g ½ sinusoid l0ms, maximum repetition rate 1 every 10 seconds. 10 shocks on all six faces
Vibration	To BS2011 Part 2Fd, vibration in each plane (X,Y and Z). (Time limit for each test 90 minutes) Operating: 20 to 500Ff, O.5G max (20 to 500Hz at 0.0005 G sq/Hz) Not operating: 10Hz to 200 Hz at 20G max (10Hz to 200 Hz at 0.02G sq/Hz)

2.9.2 Storage and shipping

The packaged equipment is designed end manufactured to withstand the following conditions:

Temperature	-40 to c60^{0}C
Relative Humidity	5 to 90% non-condensing
Thermal Shock	20°C per hour within the range –20 +60°C
Mechanical Shock	Will withstand a drop of 1 metre on each face and on the most susceptible corner

2.10 Operational lifetime

The equipment has been designed to provide an operational lifetime of 3 years (26,208 hours, based on a 24 hour day, 7 days-a week).

3. E01 Disassembly and assembly

DANGER
Removing the cover of an E01 unit exposes dangerous *voltages.* Ensure that the unit is switched off and the plug removed from the mains supply before removing the cover.

WARNING
A number of components within the units are STATIC SENSITIVE. It *is* possible that these components may be damaged if subjected to a static discharge. Avoid contact with the components of the PCBs except where necessary to perform the exchange or faulty components. When exchanging components, take appropriate anti-static precautions.

3.1 Disassembly procedure

(1) Power down the FileStore unit for disassembly.

(2) Disconnect the unit from the mains.

(3) Unclip the front and rear mouldings.

(4) Unclip the side mouldings.

(5) Remove the four screws holding the top metal wrap to the unit and slide it off backwards.

If you want to access the circuit board or remove the drive(s) then remove the top shield from the drive(s) and remove the mounting screws in the base plate. Disconnect the (data) ribbon and power connectors. This allows the drive to be removed, up and backwards.

The floppy disc units are not a serviceable item, and in the event of failure should be replaced by a new or reconditioned unit.

The floppy disc interface is contained on the E0l main processor board. If the interface is suspected to be faulty, refer to Appendix A - *Test Equipment,* which contains a suitable test of the floppy disc interface.

3.2 Assembly procedure

To reassemble the unit, simply reverse the above procedure.

When reassembling the unit, ensure that full earth testing has been satisfactorily completed.

4. E01 Circuit description

Read this chapter in conjunction with the circuit diagrams for FileStore E01, in Appendix B at the back of this manual.

4.1 Timing

The master system clock is 8MHz, generated by IC3 together with X2, C4, C5, and R11. This is internally divided down by four to produce the 2MHz phase related timing clocks 02 and 04, output on pins 39 and 3 of IC3 respectively.

4.2 Sequential circuits

There are four sequential circuits in FileStore:

- RAM refresh
- ROM/RAM latch
- Inton/intoff
- Econet clock

These are described below.

4.2.1 RAM refresh

RAM Access and Refresh are handled by IC6, IC31, IC34, IC7 and IC32.

In Normal Access, RAS pulse is off at 04 and CAS is low on the rising edge at 02.

Refresh is generated by a CAS before RAS, using the internal counters in the 4464 RAM chips. IC6 divides 02 by 60. On the next instruction fetch (synch), the processor wait state and CAS low are asserted.

The RAS is pulsed, then after one more cycle CAS is restored and the wait state is released.

4.2.2 ROM/RAM latch

This is performed by IC7, IC31, IC34 and IC35. In its initial state, all reads are made from ROM and all writes are made to RAM.

4.2.3 INTON/INTOFF

Non-maskable interrupts (NMIs) are performed by IC17, IC30 and IC35. Disable is at FC24 and enable at FC28. Econet network NMI is normally enabled, but is disabled during disc access.

4.2.4 Econet clock generation

IC16, IC28 and IC26 generate the Econet clock signal with selectable speed and mark space ratio. Links 3 and 4 select 1µs or 2µs clock rates, derived from 0.5µs 02. IC28 is a pre-loadable counter, links *5, 6* and *7* selecting loaded count 1, 2 and 4. The optimum setting is 200kHz. 1µs loaded count = 4. IC26 is the clock transmitter, enabled by CB2 on IC21.

4.3 The RESET circuitry

A simple reset is supplied by the components IC24, D6, R9 and C6 which provides an extended low level on the system reset line when power is applied, to allow time for the 5 Volt rail to become established and the IC2, IC3 and IC20 id reset correctly.

4.4 Battery backup

Some system variables are maintained in the CMOS *RAM* contained within IC2. The supply to this RAM is produced during power down conditions by BT1. BT1 is charged by a constant current source circuit (consisting of *Q5,* D3, N, R1 and R2) during power on conditions. IC2's supply is switched between the *5* Volt rail and BT1 by Dl and D5.

4.5 The central processor

The processing power of the machine is provided by a 65C102 (IC3), an enhanced CMOS version of the 6500 series microprocessor with its own system clocks. This processor uses 8 bit architecture.

Interrupts to the processor occur when either of the inputs IRQ or NM1 are low. Interrupts can occur from the following sources:

- IRQs from the hard disc Filestore E20 port
- NMIs from the floppy disc controller
- NMIs from the Econet Network IRQs from the RTC
- IRQs from the printer port.

Interrupts can be disabled within the RTC by writing to the interrupt enable bits in register B (0 disables, 1 enables). Interrupts from the printer can be disabled by writing to the relevant register within the 65C22.

4.6 Random access memory (RAM)

There are two types of RAM in the unit..

Main memory is two 4464s (IC12 and IC13), these are organised as 64K by 4 bits per device and together provide a 64K by 8 bit map.

The second type of RAM is the CMOS RAM contained within the RTC (IC2), which is organised as 64 by 8 bits. The first 14 bytes are used by the RTC for time, date and other storage etc. The remaining 50 bytes are partly used by the system software for configuration and error recording.

4.7 Read-only memory (ROM)

Two 27256 EPROMs are fitted (IC4 and IC5), organised as 32K by 8 bits per device. These contain the operating system and file server code respectively. These two devices are only accessed following a power up, when their contents is copied into main memory; execution is then transferred to the copy in RAM.

4.8 The Econet port

4.8.1 The Econet network

Econet is the Acorn local area network (LAN) for microcomputers. It uses inexpensive 5 core screened cable, which carries the differential clock, data lines and ground. Data rates up *to* 200Kbps are possible. The clock pair are terminated passively at each end with the TX/RX clock being centrally connected. The clock data pair passive are passively terminated at each end with a central active termination or alternatively with a passive at one end and with a active/ passive at the other.

It is possible to connect up to *254* stations to a network, which may be computers or (in this case) the E01. It is possible to send messages between stations and access other stations' memory. etc. Protection is provided against unwelcome access by a remote station.

4.8.2 Econet module

The majority of the Econet hardware is provided on a removable PCB module which connects to the main PCB via SK10 and SK1l. SK10 provides an interface to a standard Econet port, presented as a 5-pin 180 degree DIN socket. The Econet PCB module contains the 68B54 high speed data link controller and its associated buffer circuitry. The data link controller and its under the control of the main processor using NMI. The module provides the following functions:

- Data transmission
- Data reception
- Clock reception and detection
- Collision detection
- Error detection
- On-board circuits provide the Econet clock and termination.

4.8.3 Econet clock and active terminator

An on board clock is implemented using the master system clock at 2MHz divided down by IC16 and ICV28.This is passed to a differential line driver IC26 and thence to the clock lines. Q6 and Q7 implements an active terminator which generates a 0.2V differential across the data lines. The control lines for these two circuits are from IC21 PIN 19. The insertion of the clock and terminator is automated to the extent that if a error in transmission or reception occurs, the circuit is enabled. It will also be enabled if on power up the processor detects the absence of the insertion of the DCD signal on the Econet module.

The frequency of the Econet clock is adjusted by links 3 and 4. See the Link Survey for selection detail.

4.9 The disc interface

The disc interface is controlled by IC20, IC29, IC8, IC30 and IC19. Drive selection is carried out by IC19. Data request and IRQ lines cause an NMI.

All floppy disc I/O is handled by a 2793 Floppy Disc Controller (IC20). For exact details of this operation refer to the manufacturer's data sheet

In this application it is programmed to support 250Kbps data transfer and MFM encoding. C14 and C15 are used to adjust the on chip voltage controlled oscillator. The frequency produced (on TP2) should be 250kHz *+1-* 12.5% when the FDC is in test mode (see the manufacturer's data sheet).

4.10 The printer/VIA circuitry

IC23 and IC21 control the printer interface. Port A of this device is used to generate a Centronics parallel type interface with data buffering by IC23 and strobe by IC35 and IC31, acknowledge going directly to CA1. Only CB2 of port B is used, as an output to control the state of the Econet TX/RX clock Terminator circuit.

4.11 The real-time clock (RTC)

This is a 146818-type fully programmable battery-backed device that provides time and calculation information via its multiplexed address/data bus. The bus condition is controlled by the logic level IC2's CE, R/W, DS and AS pins (13, 15, 17 and 14 respectively).

The frequency of the internally generated time base is controlled by the crystal (X1) and the components R3, C2, C3 and R4. In test mode, TPI is used to the frequency. Fine adjustment is provided by SOT12 and SOTI3. An internal timer is programmed by system to generate regular interrupts for the operating system service routines.

4.12 The FileStore Expansion bus and E20 interface

The FileStore expansion bus is handled by IC15, IC27 and IC33. It is a buffered 2MHz processor internally addressed at FC30 and externally strapped at FC40 (Acorn 1MHz bus). The data is buffered to IC15 with direction being controlled by the R/W line from the processor.

Expansion bus signals are as follows:

D0-7
R/ W
A0-A1
RST
NMI
IRQ
ENABLE
Ø2

4.12.1 Termination

The FileStore expansion bus is terminated by a resistor pack RP1 in the E01.

For more information about the operational phases of the FileStore expansion bus, refer to the later section entitled *Bus phases i*n Chapter 4 - *Circuit Description* in Part II of this manual.

4.13 Main signal paths

4.13.1 Data bus

This is a 8 bit bi-directional bus emanating from the central processor going to all the major devices. The direction of the data flow is controlled by the CPU's R/W line, a high level indicating a read by the processor.

4.13.2 Address bus

This is a 16 bit uni-directional bus emanating from the central processor.

4.13.3 Address decoding

The main decoding component are IC11, IC14, IC18 and IC1. These supply the decoding to support the software activity as follows.

The layout of the file server memory map is as follows:

From	To	Function
0	&FF	Zero page, see suballocation below
&100	&1FF	Hardware stack
&200	&3FF	MOS workspace
&400	&7BFF	file server and print server code if loaded
&7C00	&E7FF	file and print server workspace
&E800	&FBFF	MOS code
&FC00	&FCFF	Memory mapped I/O, see suballocation below
&FD00	&FFE2	MOS code
&FFE3		OSASCI entry
&FFE7		OSNEWL entry
&FFEE		OSWRCH entry
&FFF1		OSWORD entry
&FFF4		OSBYTE entry
&FFFA		NMI vector
&FFFC		RST vector
&FFFE		IRQ vector

Page zero is suballocated as follows:

From	To	Function
&00	&1F	spare (some locations used if debug options enabled in MOS)
&20	&8F	file server/ print server workspace
&90	&9F	spare at present, but may be allocated to file server
&A0	&AF	Econet driver workspace
&B0	&BF	file server workspace
&C0	&DF	Econet driver workspace
&E0	&FF	Disc handler workspace

Page &FC (the memory mapped I/O page) is suballocated as follows:

&FC00[-&FC03]	146818 RTC address register
&FC04[-&FC07]	146818 RTC data register
&FC08[-&FC0B]	(read) ROM/RAM memory access latch (currently will always will select RAM, but moving a jumper makes it toggle).
&FC08[-&FC0B]	(write) miscellaneous function latch
&FC0C-&FC0F	2793 floppy Disc Controller
&FC10-&FC1F	6522 Versatile Interface Adaptor
&FC20-&FC23	6854 Econet interface disabled
&FC24[-&FC27]	Econet interrupt disable
&FC28[-&FC2B]	Econet interrupt enable
&FC2C[-&FC2F)	floppy drive door switch state
&FC30-&FC33	FileStore expansion bus interface. Strapped to emulate bus address &40. The bottom two bits of the &FC3x address indicate bus &4x.

Higher values in this page will access the same registers as above if taken modulo &40. Values in square brackets above are also alternate addresses for the various registers. Note that addresses are subject to change, and this should be borne in mind when designing software to address these registers.

4.13.4 Machine Operating System function calls

The file server MOS provides a subset of the BBC MOS interface. It is not necessarily the case that any test programs running in place of the file server *will* be able to obtain all the *desired* support from the MOS. Such test programs should however be written with an awareness of the MOS in mind. In particular, it is recommended that the contents of the hardware registers and interrupt vectors are saved and restored over the execution of a test program, and the stack pointer restored to its value on entry.

The file server MOS provides the following functions, at the standard addresses:

OSASCI, OSNEWI, OSWRCH

These have the same specification as for the BBC MOS, except that the character in A is always inserted into the printer output buffer, not the current output stream buffer. If the buffer is full, these routines wait until there is room to store the character.

OSWORD

The following OSWORD functions are supported *(X/Y* point to the data block):

A=l Read date/time from RTC chip.
A=2 Write date/time to RTC chip.
The date and time *are* in the file server format, which is:
byte 0: date in month
byte 1: years since 1981 / month (4 bits each)
byte 2: hours (24 hour clock)
byte 3: minutes
byte 4: seconds

A=3 Read timer interval.
A=4 Write timer interval.
The timer is a 5 byte value counting in 1/100 seconds, however *as* it is driven from the RTC in increments in steps of 1 second. There are no 'events' *in* the machine, the caller must poll the time regularly to see if an interval expires.

A=5 Read non-volatile memory in RTC.
A=6 Write non-volatile memory in RTC.
One byte is transferred between the address at (X/Y)+4 and the RTC chip address indicated by the bottom six bits of the byte at (X/Y). Note that the first 14 locations are used by the RTC itself, and the remainder allocated as follows for non-volatile use by the file server and print server:
14-15 station ID + ones complement
16-19 reserved for use by MOS
20-24 internal error logout area
25 MAXUSERS setting
26 MAXDRIVE setting
27-32 alternative POLLPS name for printer

Test routines are recommended to start from 63 downwards if they wish to use the RTC storage.

A=16 Econet TRANSMIT – as BBC
A=17 Econet RECEIVE – as BBC
A maximum of one transmit block and eighteen receive blocks may be active at a time.

A=19 Station information - function codes available are:
1 - write file server number
5 - write protection mask

A=114 Read/write block. Function codes available are:
&08 read block(s)
&0A write block(s)
&0D set drive parameters
&0F format drive

OSBYTE

The following OSBYTE functions are supported:

A=50	POLL TRANSMIT – as BBC
A=51	POLL RECEIVE – as BBC
A=52	Delete RECEIVE – as BBC
A=128	X=0: Read COMMAND/ USER and Floppy drive door switch states, returns 2 if drive 2 open, 1 if in COMMAND mode X=252: Read free bytes in printer output buffer.
A=132	Read address of top of workspace area to X/Y. The value returned is the current base of the MOS.
A=l37	LED control. X=0 will turn off the programmable led, X=1 will turn it on.

4.14 Link survey

Link functions are as follows:

LINK	Function
1	I/O IRQs on/off (made = on)
2	A15 addressing on/off (made = on)
3	1us. Net clock enable
4	2us net clock enable
5	Net clock divide by 2 enable
6	Net clock divide by 4 enable
7	Net clock divide by 8 enable
8	Net NMIs enable/ disable (made = enable)
9	0 to &7FFF addressing disable (unmade = enable)
10	Rom latch enabled/ disabled (made = enabled)

5. E01 Fault finding

The following chapter describes the suggested methods of fault finding on a FileStore E01 unit when the fault is not clearly in a specific area.

When the FileStore E01 is powered up, the following sequence of operations, should take place, as indicated by various activity indicators on the FileStore:

(1) On initial power up, the power indicator and mode/activity indicator should light up.
(2) The disc drive activity light for any connected FileStore E20 will flicker
(3) The floppy disc drive indicator for the FileStore ECU will light up.
(4) All indicator lights should then extinguish, except the power indicator lights. The FileStore E01 is now ready for use.

If the power on routine fails, then the File-Store is faulty.

Follow the fault finding procedures outlined below. These should help you to discover any basic fault with the FileStore. The procedure consists of disco discrete stages, which should be followed in the order they are described.

5.1 Stage 1: Initialisation

If you have a suitable printer available, plug it into the unit and turn it on. Open the unit's Access flap and then turn the unit on, while observing the printer. If the printer performs a line feed, proceed with stage 2

If the printer does not perform a line feed, check the following with an oscilloscope:

Processor clock:	2MHz on pin 3 and 39 of IC3
NMI line:	High end pin 6 of IC3
RTC frequency:	1024 kHz at TPI (at IC2)
Address lines:	for activity (at IC3)
Darn lines:	for activity (at IC3)

5.2 Stage 2: Net link

If it appears that the link to the network is failing, the most common causes are:

Symptom	action
Net module faulty	Replace it
No clock	Check clock path and enable
Line jammed	Check for approximately 0.3V across the data pair

5.3 Stage 3: Final checks

If the procedure outlined above fails to uncover the fault, then as a final check, you should refer to Appendix A - *Test Equipment at* the back of this manual, which contains more thorough tests of the FileStore.

The tests to run and the order in which to run them are as follows:

- Run all the tests in FServTest
- Run FServFmt on each disc
- Run FServInit on each disc
- Run FServSoak, running all the test patterns on each disc.

Part II : FileStore E20

1. Introduction to the E20 unit

The FileStore E20, Acorn part no. 0354,407 for the Master version, and 0354,005 for the Communicator version, is an expansion of the FileStore E01 unit providing Econet users with increased mass storage.

It is a self-contained mains-powered unit, providing approximately 20MByte of storage.

The E20 has a daisy-chain 2MHz connector, for adding other 2MHz bus devices to the E0l Unit.

1.1 Packaging

The E20 unit is provided in a two-part cardboard and neapolene package, also including the cable required to connect it co the E01 unit.

1.2 Identification

The E20 unit is uniquely identified by a serial number at the rear of the case.

Chapter 2

2. E20 Specification

This chapter gives details of the main features of the FileStore E20 hard disc file server.

2.1 General specification

2.1.1 Hardware components

Within the box is a switch mode power supply, 3.5” 20 Mbyte hard disc with onboard SCSI controller, and an E20 host adaptor. The E20 host adaptor performs the function of converting the 2MHz FileStore Expansion Bus from the E01 unit to the SCSI bus. The hard disc contains a pcb to provide read/write and head selection, motor speed control, data serialiser/ deserialiser, dual port sector buffer, ECC generation/correction, and SCSI bus interface.

2.1.2 Software components

The hard disc is already formatted (as an ADFS disc), initialised as a file server and contains a variety of management and user utilities. There are no other software components; the filing system software is contained in the E01 unit.

2.2 Physical

2.2.1 E20 unit

Case Dimensions	length 333mm width 351mm height 78.8mm
Case colour	Acorn Specification 0920,208
Case material	Acorn Pan No. 900,000 (ABS Cycolac) Mild Steel Chassis
Case Finish	Vapour Blast
Net weight	5kg

2.2.2 E20 packaging

Packaging material	Neopolene Inner Triwall cardboard outer Tray to hold expansion cable
Package dimensions	length 545mm width 500mm height 230mm
Gross weight	7kg

2.3 Operation

When the E20 is connected to a FileStore E01 and powered up, the FileStore E01 recognises the hard disc. The FileStore unit, comprising the FileStore E01 and E20, then starts up in network mode, ready for use.

2.3.1 Controls

Power on/off switch	On rear panel

2.3.2 Indicators

Green LED	Power on indicator
Red LED	Drive active

2.4 Host Adaptor

SCSI to 2MHz FileStore expansion bus

2.5 FileStore E20 Expansion Input/ Output Ports

FileStore Expansion Bus	37 way D-Type Rear Panel 2 off
Mains in	Hard wired-in connection
SCSI Interface	Internal

2.5.1 The FileStore E20 expansion bus connector

The E20 unit is equipped with two expansion bus connectors, for connecting to the E01 and an (optional) second 2MHz bus device. The connection to the E01 unit is made with the supplied FileStore Expansion Bus Cable.

The connectors are 34-way DC male sockets, wired as below:

Pin	Signal Comments
1	Gnd
2	R/notWrite
3	Gnd
4	*12 2MHz Clock*
5	Gnd
6	Not MNI
7	*Gnd*
8	Not IRQ
9	Gnd
10	not WENCH
11	Gnd
12	Not Used
13	Gnd
14	Not RST
15	Gnd
16	Not Used
17	*Gnd*
18	D0
19	D1
20	D2
21	D3
22	D4
23	D5
24	D6
25	*D7*
26	D8
27	A0
28	A1
29	Gnd
30	Gnd
31	Gnd
32	Gnd
33	5V
34	Gnd

If the second connector is used, the E20 device must be modified by removing resistor packs, as described in *Termination,* at the end of the chapter entitled *Circuit Description.*

2.6 Power input

2.6.1 Power in put requirements

The power input requirements arc as follows:

	Minimum	Nominal	Maximum	Units
Voltage	198	220/240	264	V AC
Frequency		50		Hz
Power		40		Watts

2.6.2 Mains interruptions (‘Brown out’)

The equipment has been designed to operate without malfunction during mains interruptions as detailed below. The mains is assumed in be at nominal at all other times.

Voltage [V]	Duration [ms]	Frequency [Hz]
0	20	0.2
50%	50	0.2

2.6.3 Power input plug and cable description

Plug type	BS1363-Sleeved L+N pins, BSI Kitemarked and/or ASTA Diamond marked
No. of pins/connectors	3
Fuse Value	3A to BS1362 ASTA approved
Cable type	To BS6500 Table 16 (BASEC and/or CENELEC harmonised and marked)
No. of conductors	3
Conductor cross section	0.75mm^2 each
Length of cable	2m

2.7 Power supply

2.7.1 Power required

		nominal	max
Drive	5V	0.95A	1.2A
	12V	0.67	0.9
Drive start	12V		
Fan	5V	250mA	

2.8 Safety standards

The equipment is designed and manufactured to comply with the following Standards:

- BS415
- BS5850
- BS6204

2.9 Electromagnetic interference

2.9.1 Standards

The equipment is designed and manufactured to comply with the following Standards:

Agency	Country	Standard	Comments
BSI	U.K.	BS6527	Class B

2.9.2 Mains Transients

The equipment functions and is undamaged in the presence of mains-borne interference having voltage power spikes detailed as follows:

Frequency	0.2 times mains frequency
Rise Time	5ns
Half-Pulse width duration	50ns
Polarity	+ve or -ve
Phase Angle	Free, non-synchronous
Peak Voltage	1000V shall not cause malfunction (soft errors) 1500V shall not cause physical damage, but may cause visible malfunction

2.9.3 Electrostatic discharge

The equipment functions/is undamaged when subjected in discharge (at both –ve and +ve polarity) from 5pF capacitor charged to a voltage specified below, limited by 150Ω resistor. The discharge is applied to any user accessible points, interconnecting cables and also the ground reference plane adjacent to the equipment.

Discharge Voltage:	6kV shall not cause malfunction (soft errors) 12kV shall not cause physical damage, but visible malfunction is permitted.

2.10 Environment

2.10.1 Operating

The equipment operates end functions to specification continuously while under the following environmental conditions:

Temperature	+10 to +35°C
Relative Humidity	10 to 80% non-condensing
Thermal Shock	10^0C per hour maximum

Mechanical Shock	Not operating: *35g* 1(2 sinusoid l0ms, maximum repetition rate once every 10 seconds. 10 shocks on all six faces Operating: l0g 1/2 sinusoid l0ins, maximum repetition rate once every 10 seconds. 10 shocks on all six faces
Vibration	To BS2011 Part 2Fd, vibration in each plane (X, Y and Z). (Time limit for each test 90 minutes.) Operating: 10g peak acceleration, 20Hz to 500Hz (20 to 500Hz at 0.0050G sq/Hz) Not operating: 2.0g peak acceleration, 10Hz to 200Hz (10 to 200Hz at 0.02 sq/Hz)

2.10.2 Storage and shipping

The packaged equipment is designed and manufactured to withstood the following conditions:

Temperature	-20 to +60^{0}C
Relative Humidity	10 to 80% non-condensing
Thermal Shock	20^{0}C per hour maximum
Mechanical Shock	Will withstand a drop of 1 metre on each face and on the most susceptible corner

2.11 Emitted Acoustic Noise

*54dB*A (continuous maximum) at 1m from nearest point on the drive.

2.12 Operational lifetime

The equipment has been designed to provide the following operational lifetime; 26,208 hours or 3 years (Based on 24-hour day, 7 days a week)

To ensure trouble-free operation of the disc drives, the E01 and E20 should not be exposed to Excessive heat, moisture, direct sunlight or vary dusty conditions.

3. E20 Disassembly and assembly

DANGER
Removing the cover of an E20 unit exposes dangerous voltages. Ensure that the unit is switched off and the plug removed from the mains supply before removing the cover.

WARNING
A number of components within the units are STATIC SENSITIVE. It is possible that these components may be damaged if subjected to a static discharge. Avoid contact with the hard disc at all times without taking adequate precautions against static.

WARNING
When the hard disc drive is removed for service work, great care must be taken not to drop, jar or shock the unit in any way. Under no circumstances should the drive itself be opened to expose the head mechanism: this can only be done by the manufacturer in a special ultra-clean room.

3.1 Disassembly procedure

(1) Power down the unit for disassembly.
(2) Disconnect the unit from the mains.
(3) Unclip the front and rear mouldings.
(4) Unclip the side mouldings.
(5) Remove the four screws holding the top metal wrap to the unit and slide it off backwards.

3.2 Serviceable parts

The only dealer-serviceable part of the E20 unit is the Host Adaptor printed circuit board. Faults detected in the disc drive, disc controller board or power supply mean that the faulty part must either be returned for repair or replaced. Dealers may hold stock of these items and should refer to information provided by their supplier for service procedures for these units.

3.3 Assembly procedure

To reassemble the unit, simply reverse the above procedure.

When reassembling the unit, ensure that full earth testing has been satisfactorily completed.

4. E20 Circuit description

Read this chapter in conjunction with the circuit diagrams for FileStore E20, in Appendix C at the back of this manual.

The only part of the E20 unit which *is* serviceable by Acorn dealers is the Host Adaptor pcb (see circuit diagram) and its connectors, cables, etc. This provides an interface between the asynchronous SCSI interface the disc controller board, and the synchronous 2MHz expansion bus interface on the E01 unit.

The following circuit description will provide enough information about the disc controller board and the2MHz expansion bus to allow a full understanding of the operation of the Host Adaptor board. For a full specification of the SCSI interface see the ANSI SCSI specification (X3.131 1986 SCSI standard and CCS document Revision 4b.)

4.1 The disc controller board

The disc controller used in the E20 unit is a device which will send or accept parallel (byte) data to or from the host system i.e. E01 unit (via 2MHz bus and Host Adaptor), and will read or write this data serially to or from the hard disc.

4.2 SCSI control and data lines

The 8 control and 8 data lines on the SCSI side of the controller (shown on the right side of the Host Adaptor circuit (the initiator) diagram in the appendix) are all active-low open collector, and are as follows:

SELECT (SEL, pin 44)
Is an open collector signal which is asserted by the initiator as the first step in any transfer of data through the interface.

BUSY (BSY, pin 36)
Is an open collector signal which is asserted by the disc controller (the target) to indicate that the data bus is in use. This is the first response of the target to the initiator's assertion of SEL, and the SEL/BSY handshake is the first communication in any Winchester filing system operation.

CONTROL/DATA (C/D, pin 46)
Is asserted by the target when the bus carries control information, and is deasserted when the bus carries data.

INPUT/OUTPUT (I/O, pin 50)
Controls the direction of data flow, and is asserted by the target to indicate input to the initiator (disc to computer), and is deasserted to indicate output to the target (computer to disc).

REQUEST (REQ, pin 48)
Is asserted by the target to indicate a request for a REQ/ACK data transfer handshake.

ACKNOWLEDGE (ACK, pin 38)
Is asserted by the initiator to indicate acknowledgement of a REQ/ACK data transfer handshake. The REQJACK handshake provides the asynchronous timing of all data transfer between initiator and target.

RESET (RST, pin 40)
Is asserted by the initiator on power-up and when the host microcomputer's BREAK key is pressed (if connected direct to a microcomputer). It causes the "reset condition It which immediately clears the bus and resets the system.

MESSAGE (MSG, pin 42)
Is asserted by the target when it issues a message byte to notify completion of a command. See Bus phases, below.

DATA BUS (DB0 to DB7, pins 2,4,6,8,10,12,14 and 16)
Is a parallel data bus consisting of 8 signals from DB0 (least significant) to DB7 (most significant). 1 byte of information is transferred across the bus with each REQ/ACK handshake. It is important to remember that the data lines are active-low and therefore are inverted in both directions when communicating with the host microcomputer.

4.2.1 Other pins
All odd numbered pins are 0V, and pin 34 is +5V.

4.2.2 SCSI connector pinout (PL2 and J4)
SCSI pinouts are as follows:

Signal	Pin	Pin	Signal
0V	1	2	DB0
0V	3	4	DB1
0V	5	6	DB2
0V	7	8	DB3
0V	9	10	DB4
0V	11	12	DB5
0V	13	14	DB6
0V	15	16	DB7
0V	17	18	}
0V	19	20	}
0V	21	22	}
0V	23	24	} For future expansion
0V	25	26	}
0V	27	28	}
0V	29	30	}
0V	31	32	}
0V	33	34	+5V to supply test equipment
0V	35	36	BSY
0V	37	38	ACK
0V	39	40	RST
0V	41	42	MSG
0V	43	44	SEL
0V	45	46	C/D
0V	47	48	REQ
0V	49	50	I/O

4.3 Bus phases
The bus has several distinct operational phases and cannot be in more than one of these phases at any given lime.

Bus phases occur in a prescribed sequence. The reset condition can interrupt any phase and is always followed by bus free. Any other phase can also be followed by the bus free phase.

The prescribed sequence is from bus free to selection to one or more of the information transfer phases to bus free again.

There are no restrictions on the order of information transfer phases, and a phase *will* often follow itself, e.g. two data phases one after the other.

A typical sequence would be:

- bus free
- select controller - selection phase
- transfer command bytes - command phase
- transfer data bytes (if necessary) - data in/out phase
- status phase
- message phase

The phases are as follows:

4.3.1 Bus free phase

Indicates that the bus is available for use. The bus free phase is indicated by all control signals described in the previous section being deasserted. If SEL and BSY and RST are not asserted, that is sufficient to guarantee bus free.

4.3.2 Selection phase

Allows the initiator to select the target. After detecting bus free, the initiator asserts SEL. The target detects SET asserted and BSY and I/O deasserted, and responds by asserting BSY. The initiator deselects SET and may then change the data signals.

4.3.3 Information transfer phases

Allow transfer of information across the bus. There are several different types of information transfer phase, and the type is determined by, MSG, C/D and I/O. The information transfer phase is shown below:

Signals

MSG	C/D	I/O	Phase name	Direction of information transfer
1	1	1	data out phase	initiator to target
1	1	0	data in phase	target to initiator
1	0	1	command phase	initiator to target
1	0	0	status phase	target to initiator
0	0	1	message out phase	initiator to target (not used)
0	0	0	message in phase	target to initiator

All signals active-low: 0=assertion
1=deassertion

The information transfer phases use the REQ/ACK handshake to control information transfer each REQ/ACK allows the transfer of 1 byte. The handshake sequence is:

(1) Target asserts REQ to request data transfer

(2) Initiator asserts ACK when data is valid on bus
(3) Target deasserts REQ when darn has been transferred
(4) Initiator deasserts ACK ready for next handshake

Prior to and during information transfer, the I/O signal determines the direction of the transfer.

Before each information transfer phase the target will set up the MSG C/D and I/O lines in such a *way* that these control signals are stable for 450ns before the REQ of the first handshake, and remain valid until the deassertion of ACK at the end of the last handshake.

During each information transfer phase the BSY line remains asserted and SEL deasserted.

Each information transfer phase is now described in turn.

Command phase
Allows the initiator to direct the subsequent action of the target by transferring command bytes. The target asserts C/D and deasserts MSG and I/O.

Status phase
Allows the initiator to read the target's status information. The target asserts C/D and I/O and deasserts MSG.

Data out phase
Allows data to be transferred from initiator to target. The target deasserts par MSG, C/D and I/O.

Data in phase
Allows data to be transferred from target in initiator. The target asserts I/O and deasserts MSG and C/D.

Message out phase
Not used by the system - available for future expansion.

Message in phase
Allows the target to send a message byte to notify completion of a command.

4.4 The reset condition

The reset condition is caused by the assertion of RST, and immediately clears the bus and resets the system. Regardless of the prior bus phase, the bus resets to the bus free phase. The hard disk controller reads the drives parameters off the disc.

Reset can only occur in the E01/E20 system at power-up rime.

4.5 The 2MHz bus

The following is a description of the 2MHz expansion bus signals used by the Winchester Disc Host Adaptor.

R/NW (read/not-write, pin 2) is the system read/write line.

NIRQ (not-IRQ, pin 8) is the interrupt request line which is open collector and asserted by a device pulling it low. IRQ is level triggered active-low.

NEST (not-reset, pin 14) is output only active-low system reset line. It is active on power-up.

NPGFC (not-page &FC, pin 10) is a signal decoded from the top 8 system address lines (A8 to A15). NPGFC is an active-low signal which is low when the address high byte is &FC, i.e. when the full address is &FC00 to &FCFF. Four locations in this range are used by the Winchester system: &FC40 to &FC43 inclusive, see section 11.6.1.

A0 to A7 (address low, pins 27 to 34) are the bottom 8 system address lines.

D0 to D7 (system data bus) are the bi-directional *data* lines. Direction determined by R/NW. The data lines use buffered, and the buffer enabled only when NPGFC is active.

Pins 1,3,*5,7,9,*11,13,15,17 and 26 are 0V.

2MHz Bus Connector pinouts are as follows:

Signal	Pin	Pin	Signal
0V	1	2	R/NW
0V	3	4	2MH2E
0V	5	6	For other applications
0V	7	8	NIRQ
0V	9	10	NPGFC
0V	11	12	For other applications
0V	13	14	NRST
0V	15	16	For other applications
0V	17	18	D0
0V	19	20	D2
0V	21	22	D4
0V	23	24	D6
0V	25	26	0V
0V	27	28	A1
0V	29	30	A3
0V	31	32	A5
0V	33	34	A7

4.6 Winchester Disc Host Adaptor

In conjunction with the following description, reference should do made to the Winchester Disc Host Adaptor circuit diagram in the appendix.

The Winchester Disc Host Adaptor is an interface between the SASI/SCSI interface and the 2MHz expansion Bus. It consists of address decoding and handshake control, buffering of the signals in either direction, and termination.

4.6.1 Address decoding and handshaking

The Host Adaptor decodes 4 locations in the host microcomputer's page FC I/O space. Those four locations are as follows:

Address	Read	Write
&FC40	data	data (direction determined by R/NW)
&FC41	status	-
&FC42	-	select
&FC43	-	enable IRQ

Page FC is decoded in the host system and this is available to the Host Adaptor as NPGFC (not-page FC). NPGFC is synchronised with 2MHzE by de-glitch circuit (half of IC10) and the clean signal is labelled CNPGFC (pin *5,* IC10).

The low order address lines A0 to A7 are buffered through IC5.

IC6, a 3 to 8 line decoder with three enable inputs, decodes the low order addresses &40 to &43, i.e output pin 15 goes low when the low order address is &40, &41, &42 or &43.

IC7 is another 3 to 8 line decoder which takes the output from IC6 and CNPGFC and 2MhzE as enable inputs. The 2 least significant address bits A0 and Al are decoded along with R/NW into the required 5 separate signals shown above.

(1) Y0 (pin 15) Is read data (R/NW = 1)
(2) Y4 (pin 11) is write data (R/NW = 0)
(3) Y1 (pin 14) is status
(4) Y6 (pin 9) is select
(5) Y7 (pin 7) is enable IRQ

All these outputs are active-low.

When either *of* the two data transfer paths is selected (Y0 or Y4) an ACK signal is generated by clocking a D-type flip-flop (half of IC1l). This flip-flop is cleared direct from the REQ line, and thus the REQ/ACK handshake is facilitated.

The other half of IC1l facilitates the SEL/BSY handshake. The D-type is clocked by Y6 to generate select and is cleared by BSY.

When Y7 is selected, the least significant bit on the data bus (D0) is clocked into a D-type flip-flop (half of *IC* 10). If this value is a 1 then the latch (2 NANDs of IC12) is enabled and an IRQ will be generated at the next failing edge of REQ. To disable interrupts Y7 is selected with ad on D0. IR*Qs* are enabled only for a very short time (around l0ms) when ensuring a sequential file buffer.

4.6.2 Buffering

The data bus (D0 to D7 of host system, DB0 to DB7 of SCSI interface) is buffered in the write direction by an octal 3-state buffer IC1 and an octal transparent latch (IC2). IC2 is enabled by Y4 of IC7 which is the write data signal. Because IC2 is a transparent latch, *data* will remain valid on the output side when the enable is deasserted. The outputs from IC2 are gated through 8 open collector NAND buffers which are enabled from the I/O control line of the SCSI interface and which invert the bus signals. To write data across the Host Adapter requires that both R/NW = 0 and I/O = 1.

The data bus is buffered and inverted in the read direction by an octal 3-state inverting buffer which is enabled by Y0 of IC7 which is the read data signal, see previous subsection.

The control signals need by the SCSI interface are available for rending by the host system. They can be latched onto IC4, an octal transparent latch, which when it is enabled by Y1 of IC7. The control signals appear on the data bus as shown in the following table:

D0	MSG
D1	BSY
D2	0
D3	0
D4	NIRQ (see 11.6.1)
D5	REQ
D6	I/O
D7	C/D

All these control signals are inverted either by IC15 or IC9 prior to being latched, so all values read from the data bus are active high.

4.6.3 Termination

The Host Adaptor pcb carries 4 resistor packs, RP1 to RP4 which are used for *terminating* the various buses and control lines.

RP1 terminates the SCSI lines from the hard disk controller board.

IMPORTANT

RP2, RP3, and RP4 terminate the 2MHz bus lines and are fitted if the E20 unit is the only or last peripheral on the 2MHz bus. If another peripheral is attached to the 2MHz bus through the E20 unit, then these terminators should be removed and retained.

5. E20 Fault finding

The following chapter describes the suggested methods of fault finding on a FileStore E20 unit when the fault is not clearly in a specific area.

When the FileStore E20 is powered up, the following sequence of operations, should take place, as indicated by various activity indicators on the FileStore:

(1) On initial power up, the power indicator and mode/activity indicator should light up.

(2) The hard disc will spin up to speed in about 10 seconds. This process produces a rising pitch humming noise which means that the hard disc is spinning. If the disc is not spinning, then check the power supply and connections.

(3) The floppy disc drive indicator for the FileStore E01 will light up.

(4) All indicator lights should then extinguish, except the power indicator lights, on the FileStore E01 and the connected E20. The FileStore E20 is now ready for use.

If the above power on routine fails, then the FileStore is faulty. Follow the fault finding procedures outlined below. These should help you to discover any basic fault with the FileStore.

The E20 unit consists of three major components:

- the hard disc drive
- the Host Adaptor board
- the switch-mode power supply

5.1 Power supply

The E20 unit is powered by a switch mode power supply. The power supply output cables are colour-coded as follows:

black	ground
red	+5V
orange	+12V

The power supply can be tested by measuring the +5 voltage between the black and red cables, and the +12 voltage between the black and orange cables. The allowable voltage ranges are as follows:

+5V (black and red)	4.9 V to 5.2V
+12V (black and orange)	11.4V to 12.6V

These measurements should be made with all connectors in place.

Next measure the current drawn by each of components specified above from the +5V and +12V supplies. The current measurement should be series with either the red cable (+5V) or the orange cable (+12V). The connections to the meter to do this must be made with the power switched off. The measurements must be made after power-up as some of the circuitry, when working correctly, will alter its current consumption with time as show below. The current drawn by each component from each voltage rail should be as follows:

The hard disc unit:

+5V	around 1 to l.5A
+12V	up in 4.5A, falling to around 2A when up to speed.

Host Adaptor board:

+5V	around 500mA
+12V	zero (not used)

The above figures are approximate and will enable checks to be made for open/short circuits and malfunctioning components.

5.2 Address decoding

To test the address decoding, execute a program to access the relevant memory location. This is done by the SCSI interface tests in the FServTest program of the FileStore test software. See Appendix A – *Test Equipment* at the back of this manual for further details.

5.3 Hand shaking

To test the SEL/BSY handshake, use the handshake test of the SCSI interface tests in the FservTest program of the FileStore test software. See Appendix A – *Test Equipment,* for further details.

5.4 Bus lines

When the buses are not being asserted by the host system, i.e. in the bus free phase, all bus lines will float according to the values of their terminating resistors.

Measure the voltage of each bus line in turn and make sure that none of them is stuck at +5V, which would indicate a short circuit, or at 0V, which would indicate that there was a short circuit. The correct voltages are as follows:

2 MHz expansion bus D0 to D7 and A0 to A7 should all be 2.5V.

If for example, D0 to D7 are all at 0V or a mixture of 0V and 2.5V, then one of the buffers is probably enabled.

5.5 Final checks

If the procedures outlined above fail to uncover the fault, then as a final check you should refer to Appendix A - *Test Equipment,* which contains more thorough tests of the FileStore.

The tests to run and the order in which to run them are as follows:

- Run all the tests in FServTest
- Run FServFmt on each disc
- Run PServInit on each disc
- Run FServSoak, running all the test patterns on each disc.

Part III : FileStore E01S

1. Introduction to the E01S unit

1.1 Equipment description

E01S is the twin floppy disc FileStore base unit

1.2 Function

FileStore E01S provides a mass storage facility for Econet users. In addition to its own disc storage, it also allows the addition of up to four E40S and/or E60S hard disc FileStore units. When connected to the Econet, the FileStore provides an Econet clock for use on “one-room” networks if one is not present. A Real Time Clock is also provided, together with a printer output to enable FileStore to be used as a printer server. A SCSI interface for hard disc and tape archive devices is also provided.

1.3 Prerequisites for use

The E0lS may be connected to an Econet network, or directly to one of die following:

- Econet network
- BBC Microcomputer
- Acorn Master Series Microcomputer
- Acorn Cambridge Workstation (ACW)
- Acorn Communicator
- Acorn Archimedes Workstation
- Acorn R140 RISC iX Workstation
- Acorn A3000 Microcomputer
- Other Econet network stations.

1.4 Enhancements

The following components may be connected to the E01S to provide additional functions:

- Any combination of FileStore E40S or E60S units, to a maximum of four in all
- Printers
- Econet bridges.

2.E01S Specification

This chapter gives details of the main features of the E01S, including electrical specifications for the interface ports.

2.1 General specification

The E01S unit has two 3.5” floppy disc drives, a switch mode power supply unit (psu) and a fileserver disc drive pcb. The psu supplies +5V and +12V rails and meets BS5850 (IEC380).

The file server disc drive pcb contains 64k of RAM and ROM (one 27512 EPROM), a Real Time Clock with battery backup, a floppy disc controller, an Econet Interface and a printer interface. The microprocessor is a 65C102 device, running at 2MHz, which provides all the processing required.

The ROM contains operating system, filing system and Econet code needed to run the file server. The 64k of RAM and ROM are never in the memory map at the same time. On power up the ROM is read and it copies its file server code into in RAM. At the completion of this exercise the memory map is almost totally resident in RAM.

A Real Time Clock circuit incorporating the 146818 RTC is used to provide the information to allow date stamping of files and also to offer the facility of the Time and Date commands to users. The RTC is battery backed-up by a rechargeable nickel cadmium cell.

The Econet Interface is based upon the Acorn Econet module. An Econet clock is generated if no clock is present.

The floppy disc interface is based upon the 2793 disc controller to provide an SA400 interface.

A Centronics-compatible printer interface is driven by a VIA which also reads the door flap switch in order to inform the processor

- when a disc is about to be changed
- whether to power up in user mode or maintenance mode.

A front door flap switch (an optical sensor) is used to inform the processor when a disc is about to be changed and whether to power up in user mode or maintenance mode.

During normal operation, when a user opens the door flap, the processor needs to save the complete disc maps (held in memory) on the discs before they are removed. It is therefore essential that before removing a disc, the user first waits until the drive motors have stopped, indicating that the maps have been stored.

FileStore will normally only accept network filing system commands. To format discs and issue direct commands to the disc, you must put FileStore into a different mode; “maintenance mode”. (This is to prevent users erasing and formatting discs by mistake.) To enter maintenance mode, either power up with the access flap open, or use the *FSMODE M command from a user station (see the FileStore Network Manager’s Guide for further details).

For connection to the E40S or E60S units, a FileStore expansion bus interface, similar to the BBC microcomputer 1MHz bus interface, but running at 2MHz, is fitted to the rear of the unit.

A terminator plug is supplied with the unit and is used to terminate the FileStore expansion bus when the E01S is connected to a FileStore E40S or E60S hard disc unit.

The following ports are provided:

FileStore expansion Bus:	*50-way Delta* - rear panel
Printer:	24 way Delta Connector- rear panel
Econet:	5 pin DIN - rear panel
Mains in:	Permanently attached cable through grommet in rear panel
Mains out:	IEC320-6 socket - rear panel
Disc interface:	Internal

2.2 Physical

2.2.1 E01S unit

Dimensions:	length 333mm width 351mm height: 78.8mm
Colour:	Acorn Specification 0920,000
Material:	Acorn Part No. 900,000 (ABS Cycolac) Mild Steel Chassis
Finish:	Vapour blast
Net weight:	5kg

2.2.2 E0lS packaging

Material:	Neopolene Inner, Triwall cardboard outer
Overall dimensions:	length 545mm width 500mm height 230mm
Weight (gross):	7kg

2.3 Operation

Upon power up (with the front door closed), the FileStore starts itself up into network mode ready for use over the network. If the door is open the unit will accept requests via the network to allow maintenance and disc formatting.

2.3.1 Indicators

Green LED:	Power on indicator
Red LED:	Mode indicator

2.3.2 Controls

Mains switch	Mounted on rear panel
Front door flap	Actuates door open/closed sensor and controls the operating mode

2.4 Signal connectors

2.4.1 FileStore E01S expansion bus pinouts

Connector Type: 50-way ‘Type 57’ (Delta) male. The pin allocations are as follows:

Pins 1-12	Gnd
Pin 13	Leave open
Pins 14-25	Gnd
Pin 26	-DB(0)
Pin 27	-DB(1)
Pin 28	-DB(2)
Pin 29	-DB(3)
Pin 30	-DB(4)
Pin 31	-DB(5)
Pin 32	-DB(6)
Pin 33	-DB(7)
Pin 34	-Not connected
Pin 35	Gnd
Pin 36	Gnd
Pin 37	Gnd
Pin 38	Not connected
Pin 39	Gnd
Pin 40	Gnd
Pin 41	Not connected
Pin 42	Gnd
Pin 43	-BSY
Pin 44	-ACK
Pin 45	-RST
Pin 46	-MSG
Pin 47	-SEL
Pin 48	-C/D
Pin 49	-REQ
Pin 50	-I/O

2.4.2 Econet port

Data rate of up to 200 Kbps (determined by the Econet clock rate)

Connector type: 5 pin, 180 degree DIN socket.

Econet port pinouts are as follows:

Pin 1	DATA+	Data positive
Pin 2	GND	Ground
Pin 3	CLK-	Clock negative
Pin 4	DATA-	Data negative
Pin 5	CLK+	Clock positive

2.4.3 Printer port

Connector type: 24 way Delta connector

Standard Centronics-compatible port with control signals STRB,ACK, BUSY,SELECT (all active low).

Printer port pinouts are as follows:

Pin 1	Data ready strobe	notSTRB
Pin 3	Data 0	D0
Pin 5	Data 1	D1
Pin 7	Data 2	D2
Pin 9	Data 3	D3
Pin 11	Data 4	D4
Pin 13	Data 5	D5
Pin 15	Data 6	D6
Pin 17	Data 7	D7
Pin 19	Data acknowledge	notACK
Pin 21	N/C	N/C
Pin 23	N/C	
Pin 25	N/C	N/C
Pins 2-22 even	0V	GND
Pin 24	N/C	
Pin 26	N/C	

2.5 Power input

2.5.1 Power input requirements

The power input requirements are as follows:

	Minimum	**Nominal**	**Maximum**	**Units**
Voltage	198	220/240	264	V AC
Frequency		50		Hz
Power		25		Watts

2.5.2 Mains interruptions (‘Brown out’)

The equipment has been designed to operate without malfunction during mains interruptions as detailed below. The mains is assumed to be at nominal at all other times.

Voltage [VI]	**Duration [ms]**	**Frequency [Hz]**
0	20	0.2
50%	50	0.2

2.5.3 Power input plug and cable description

Plug type:	BS1363A sleeved L+N pins, BSI Kitemarked and/or ASTA Diamond marked
No of pins/connectors:	3
Fuse Value:	5A to B51362 ASTA approved
Cable type:	To B56500 Table 16 (BASEC and/or CENELEC harmonised and marked)
No. of conductors:	3
Conductor cross section	0.75 mm^2 each
Length of cable:	2m

2.6 Power supply

2.6.1 Power required

		nominal	**max**
pcb	5V	1.3A	1.7A
Drives	5V	320rnA	560mA
	12V	l40mA	
Drive start	12V	840mA	1.0A (400msec)
Fan	5V	l20mA	

2.6.2 Specification

	5-5.25V	0-2A
	5-5.25V	0.05-0.6A
	11.4-12.6V	0-0.4A
		0-lA

2.7 Safety Standards

The equipment is designed and manufactured to comply with the following standards:

- BS415
- BS5850

2.8 Electromagnetic interference

2.8.1 Standards

The equipment is designed and manufactured to comply with BS6527 Class B.

2.8.2 Mains transients

The equipment functions and is undamaged in the presence of mains-borne interference having voltage spikes detailed as follows:

Frequency:	0.2 times mains frequency
Rise Time:	5ns
Half-Pulse width duration:	50ns
Polarity:	+ve or-ve
Phase Angle:	Free, non-synchronous
Peak Voltage:	1000V does not cause malfunction (soft errors) 1500V does not cause physical damage, but visible malfunction is permitted

2.8.3 Electrostatic discharge

The equipment function is undamaged when subjected to a discharge (at both +ve and -ve polarity) from a 5pF capacitor charged to a voltage specified below, limited by a 150Ω resistor. The discharge is applied to any user accessible points, interconnecting cables and also the ground reference plane adjacent to the equipment.

Discharge Voltage:	6kV does not cause malfunc6on (soft errors) 12kV does not cause physical damage, but visible malfunction is permitted

2.9 Environment

2.9.1 Operating

The equipment operates and functions to specification while under the following environmental conditions:

Temperature	l0 to +35ºC
Relative Humidity	10 to 80% non-condensing
Mechanical Shock	Not operating: .40g 1/2 sinusoid l0ms, maximum repetition rate 1 every10 seconds. 10 shocks on all six faces
Operating:	5g 1/2 sinusoid l0ms, maximum repetition rate 1 every 10 seconds. 10 shocks on all six faces
Vibration	To BS2011 Part 2Fd, vibration in each plane (X,Y and Z). (Time limit for each test 90 minutes) Operating: 20 to 500Hz, 0.5G max (20 to 500Hz at 0.0005G sq/Hz) Not operating: 10Hz so 200 Hz, 2.0G max (10 to 200Hz at 0.02G sq/Hz)

2.9.2 Storage and shipping

The packaged equipment is designed and manufactured to withstand the following conditions:

Temperature	-40 to +60^{0}C
Relative Humidity	5 to 90% non-condensing
Thermal Shock	20^{0}C per hour within the range -20 to +60^{0}C
Mechanical Shock	Will withstand a drop of 1 metre on each face and on the most susceptible corner

2.10 Operational lifetime

The equipment has been designed to provide an operational lifetime of 3 years (26,208 hours, based on a 24 hour day, 7 days a week).

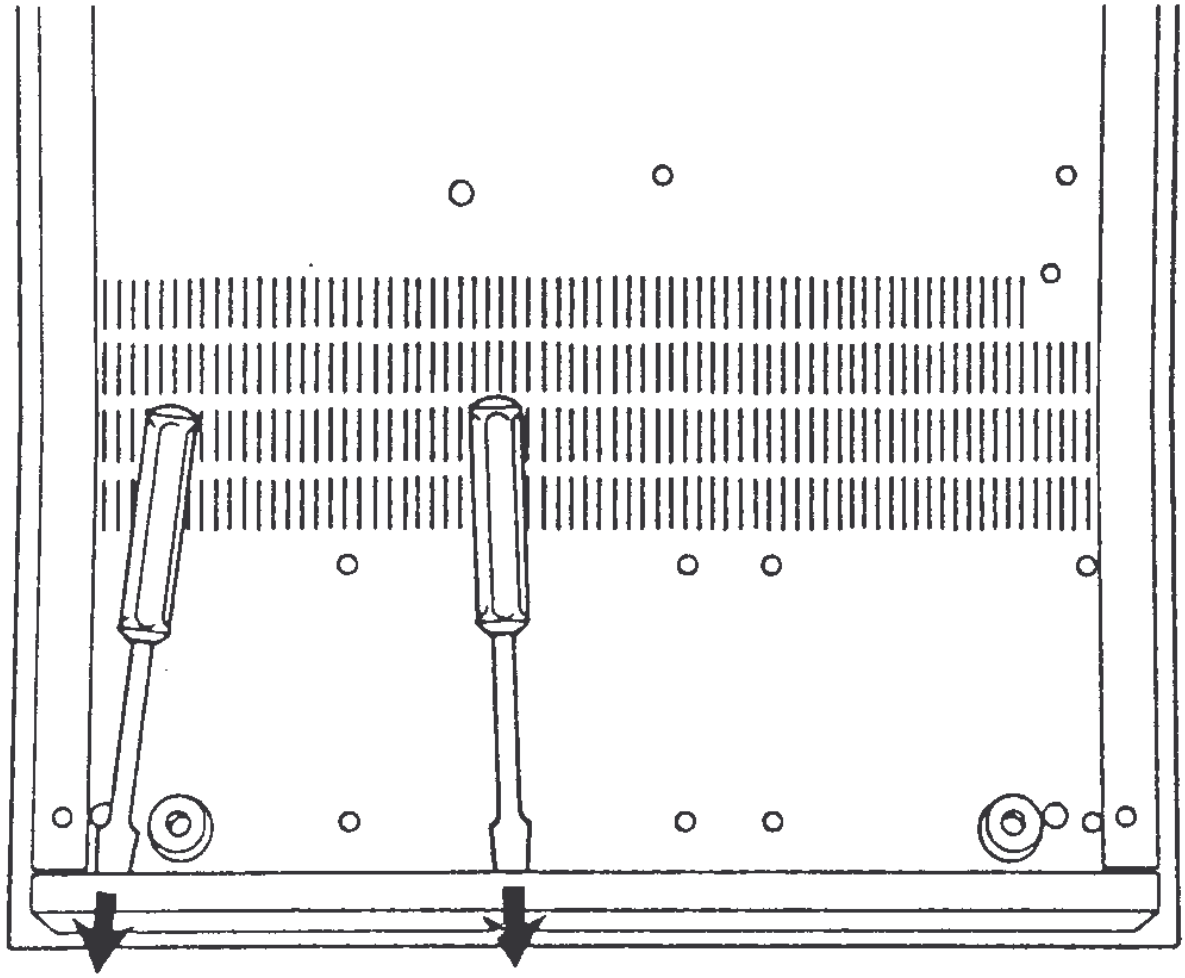


Figure 1: Rear plastic removal

(10) Remove the floppy drives (Item 50).

- Each of the floppy drives stands off the base on four pillars (Item 10). To remove the floppy drives along with the pillars from the base metalwork, turn the FileStore unit on its side.
- Support the floppy drives while unscrewing the eight Posidriv screws (Item 62).
- Remove the two ribbon cable assemblies and power cable from the rear of the floppy drives.
- Slide both drives back from the front panel until adequate clearance is achieved to allow them to be lifted clear.
- The mounting pillars can then be unscrewed.

(11) Remove Power Supply (Item 37).

- The upper surface of the psu is covered by an insulating material (Item 36) fixed by four Posidriv screws (Item 63) to the psu. Unscrew these four screws and remove the insulator.
- Between the insulator and the psu are four small plastic spacers (Item 11) used to ensure the pcb does not pierce the insulator. Remove these.
- The psu is now held by various cable assemblies. Unplug the 4-way disc drive power cable from the floppy drives.

- Unplug the psu output cable assembly (Item 24) from the psu.
- Remove the mains input cable assembly (Item 25) by pulling the faston receptacles free from the mains-switch.
- The earth wire can then be removed from the central earth point using a ring socket spanner.
- The psu should now lift clear.

(12) Remove the fan (Item 34) Note that the psu needs to be removed to allow access to the fan. Remove the four fixing screws (Item 62) to free the fan guard (Item 74). The fan is part of the psu output cable assembly and should be replaced as a complete assembly, if it is found to be faulty.

(13) Remove the pcb (Item 22).

- Unscrew the bail-locks from the rear panel with a flat screwdriver and spanner.
- Unclip the printer cable (Item 28) from the latched connector on the pcb.
- Remove the earth (Item 35) and psu output cable assemblies (Item 24) by pulling the faston receptacles free from the pcb.
- Finally remove the six fixing screws, slide the pcb forward and it should now come free.

3.2 Assembly procedure

To reassemble the unit, simply reverse the above procedure.

When reassembling the unit, ensure that full earth testing has been satisfactorily completed.

4.E01S Circuit description

Read this chapter in conjunction with the circuit diagrams for Stacking FileStore E01S in Appendix D at the back of this manual.

4.1 The Central Processor

The processing power of the machine is provided by the 65C102 (IC16), an enhanced CMOS version of the 6500 series microprocessor with its own system clocks ϕ2 and φ4. This processor uses 8-bit architecture and runs at 2MHz.

Interrupts to the processor occur when either of the inputs IRQ or NMI are low. Interrupts occur from the following sources:

- IRQs from the Hard disc
- NMIs from the floppy Disc Drive
- NMIs from the Econet Network
- IRQs from the RTC
- IRQs from a printer, if connected.

The processor has no control over the first two of these interrupts, but can disable the Econet NMIs during disc access, under software control.

Interrupts can be disabled within the RTC by writing to the interrupt enable bits in register B (0 disables, 1 enables). Interrupts from the printer can be disabled by writing to the relevant register within the 65C22.

The processor provides two clocks 90 degrees out of phase of each other – φ2 and φ4.

4.2 Random access memory (RAM)

Main memory is provided by two 4464s (IC9 and IC10). These are organised as 64K by 4 bits per device and together provide a 64K by 8 bit map.

4.3 Timing

The master system clock is 8MHz, generated by IC16 together with X2, C6, CS and R16. This is internally divided by four to produce the 2MHz phase-related timing clocks φ2 and φ4, output on pins 39 and 3 of IC l6 respectively.

4.3.1 The Real-Time Clock (RTC)

This is a 6818 fully programmable battery-backed device that holds FileStore system information (User id, station number, time and date etc).

The device has a multiplexed address/data bus connected directly onto the processor bus. Data and address information is strobed in and out of the device by use of the /CE, R/W, AS and DS signals.

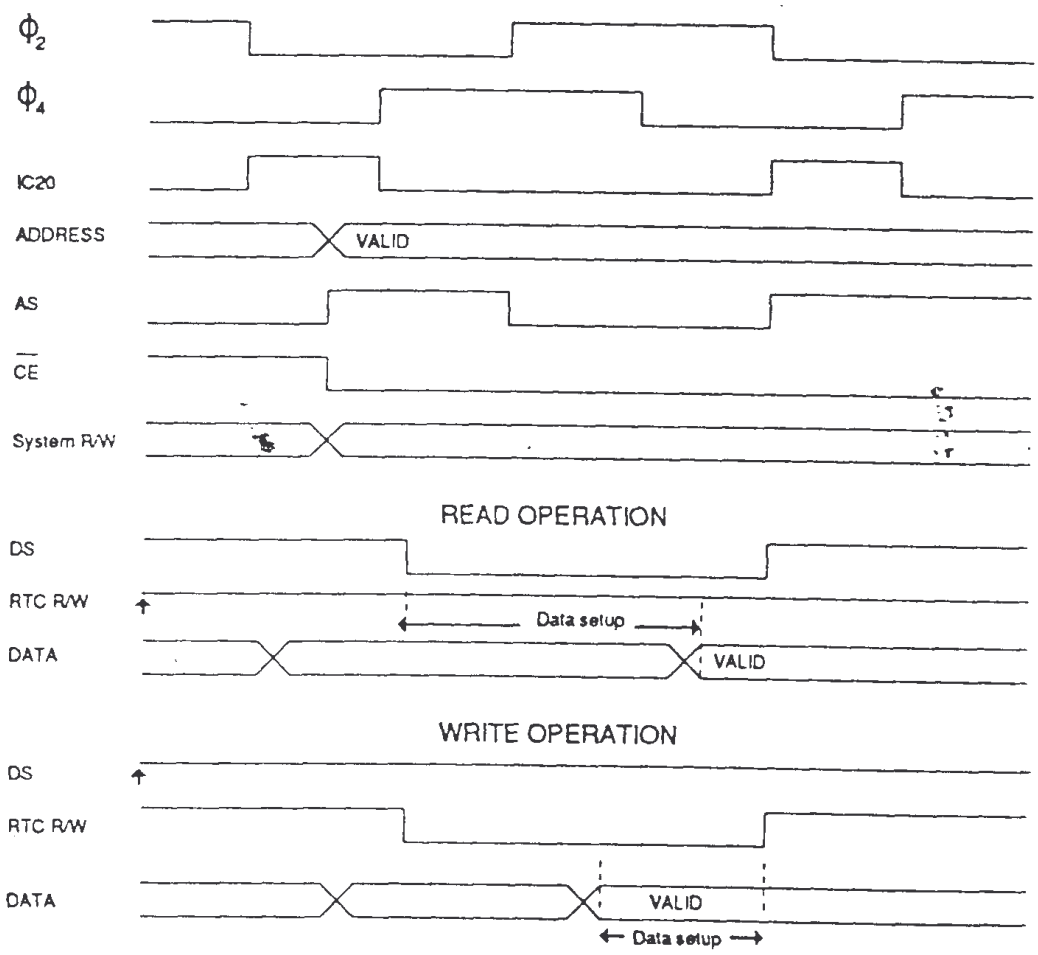
When the FileStore is powered down, the /CE pin is held high by the battery backup circuitry. This Ceases the address/data bus, AS, DS and R/W to be disconnected within the device from the rest of the system, hence reducing the current taken from the battery.

After the system is powered-up, whenever the device is accessed the ,CE is taken low when the address strobe (AS) is valid (high) /CE is initialised by the write-only latch at &FC08 IC14 pin 15. The address strobe is decoded as &FC00 from 12 and IC17. The memory address is latched in on the falling edge of the AS.

When reading from the CMOS RAM within the 6818 (IC1) the RTC R/W line is held high and the data is read on the rising edge of DS. DS is decoded as &FC04 by IC12 and IC17. The /CE is removed at the end of the access by IC14 pin 15 going low and clearing the base of Q2 low, hence /CE goes high.

When writing the only difference from the read cycle is that DS is held high while R/W is strobed, allowing data to be written to the CMOS RAM in the 6818 (IC1) on the rising edge of R/W. Refer to Fig 2 for details.

Figure 2: RTC Read/Write timing



The frequency of the internally-generated time base is controlled by the crystal (X1) and the components R3, R6, C1, C3 and C4. In test mode TP1 is used to set the frequency. Fine adjustment is provided by C2. An internal timer is programmed by system software to generate regular interrupts for operating system service routines.

NOTE

A modification has been made to the circuit that prevents spurious writes to the memory of the RTC. This is implemented by gating /CE off the rising edge of AS so that /CE IC1 pin 13 only goes low when AS goes high. The synchronising of /CE and AS is carried out by ICmod.

4.4 Sequential Circuits

There are four sequential circuits in FileStore:

- RAM refresh
- ROM/RAM latch
- Inton/Intoff
- Econet Clock

These are described below.

4.4.1 RAM Refresh

During every op-code fetch the processor activates (high) the Sync line IC16 pin 7. This has the effect of turning IC21 output pin 11 into the inverse of IC11 pin 8. IC11, the LS57, is wired as a divide by 60 frequency counter. Upon receipt of 30 φ2 cycles, the QC output goes high, changing on the falling edge of φ2. This change occurring with sync high will make the K input of the JK IC6 low. Upon receipt of the falling edge of the not φ2 clock, the Ready signal to the processor will go low and the clear signal to the LS57 will go high. This causes two operations to occur: one is that when the processor sees Ready going low during the same cycle as sync going high the processor will wait in its current state and will remain in that state until Ready goes high. The second operation that occurs is that the Clear pin of the frequency divider has become active (high). This means that the counting of the following 30 cycles of φ2 before changing state (high for 30 cycles, low for 30 cycles – divide by 60) is stopped and the QC output is taken low which in turn takes the K input of IC6 high. On the falling edge of not φ2 Ready goes high and the processor is running again.

The effect of all this on CAS is that the two open collector outputs from IC21 pins 8 and 11 swap control of the CAS signal during this process. At the start of the cycle IC21 pin 8 is low due to φ2. As φ2 goes low QC of IC11 is clocked high which, along with a high sync, IC21 pin 11 will go low. On the next rising edge of φ2 the Ready signal on the processor will go low. At the same time IC11 will be cleared which will take IC21 pin 11 high. The same rising edge of φ2 will cause IC21 pin 8 to go low. See Fig 3 for details.

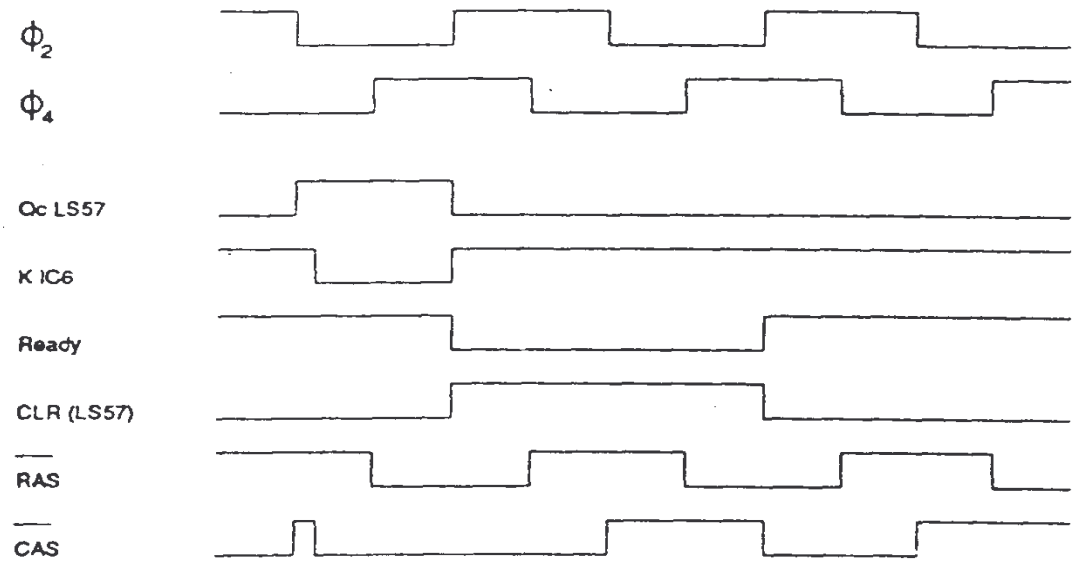


Figure 3: RAM Refresh (every 30 cycles of Φ2)

During refresh control (i.e. when an op-code fetch occurs from RAM) the processor is reading hence pin 10 IC21 is always high. For further control of pin 10 IC21 see Memory read/write below.

The RAS signal is generated from φ4. The purpose of the resistor capacitor network R17, C9 and R18, C8 is to alter the rise and fall times (i.e. stretch) of φ4, hence producing RAS.

Refresh utilises the CAS before RAS refresh cycle of the 4464 DRAM which allows the CAS signal to be held high while the RAS signal continues to cycle. Within the 4464 DRAM is a counter for strobing the individual internal addresses of The DRAM.

- RAS occurs every 500ns.
- The LS57 counts 30 cycles then holds the processor.
- Consequently, a refresh cycles occurs every 500ns x 30 = l5us.
- The DRAM requires 256 cycles in 4rns l5us x 256 = 3.84ms

4.4.2 Memory read / write

IC9 and 10 are 64k by 4 bit DRAMs with an access time of 120ms. Together they provide 64k bytes of memory. The RAS signal is generated from φ4 by utilising IC20 as an inverter. The CAS signal comes from φ2 and is factored with the output of IC22 pin 10. During RAM accesses pin 8 of IC6 (the ROM enable latch) will be low, causing pin 9 of IC6 to disable the ROM from the memory map. Due to pin 8 IC6 being low, the output of IC21 pin 3 will be high. IC3 decodes page &FC the IO page which is not allocated within the DRAM, hence during the DRAM read/ writes pin 8 IC3 will be high (not page &FC) therefore making pin 10 IC21 high. Due to pin 10 IC21 being high the CAS signal will always be the inverse of φ2.

The row and column addresses are strobed into the DRAM by use of IC2 and IC8. The DRAM internal row address is strobed in on the falling edge of /RAS with A0-7 on the outputs of IC2 and IC8. The row address being on the bus after /RAS goes low for a time caused by the propagation delay of IC18, IC5, IC2 and IC8. The DRAM internal column address is strobed into the DRAM on the falling edge of /CAS with A8-15 on the outputs of IC2 and IC8.

For read operations the data is read from the DRAM on the rising edge of /CAS with the DRAM output enable low and the processor R/W high. The output enable is controlled from IC12 pin 7. Pin 1 IC12 will be enabled (low) when either φ2 or φ4, or both, are high. To provide the correct input for pin 7 to go low the processor R/W needs to be high, (read) along with pin 11 IC12. Pin 11 IC12 will be high, provided the read is not if page &FC, which is decoded by IC3 and IC17. See Fig 4 for details.

For write operations, the data is written to the DRAM on the falling edge of the /CAS signal with the DRAM output enable high and the processor R/W low. The DRAM output enable will always be high due to the processor R/W line preventing pin 7 IC12 from going low. See Fig 5 for details.

4.4.3 ROM CONTROL

A 27512 EPROM is fitted as IC7, organised as a 64k by 8bit device. It contains the operating system and the fileserver code. This device is only accessed following a power-up, when its contents are copied into main memory. Execution is then transferred to the copy in RAM.

On power-up C13 is charged from the supply rail via R45 and D7. As power is first applied, the JK latch IC6 is cleared and the EPROM IC7 is enabled. The processor is reset and hence jumps to vector &FFFC and &FFFD. The contents of the EPROM are them copied into the DRAM up to page &FC. When address &FC is encountered, the output of IC3 pin 8 will go low, causing IC17 to be enabled. At address &FC08 pin 10 IC12 will go low, which in turn will cause pin 11 IC13 to go low. The result of pin 11 going low will cause a negative edge to clock IC6 pin 9 high and disable the EPROM. The output enable of the EPROM is controlled by pin 7 IC13, which decoded a read to memory locations outside page &FC. Data is

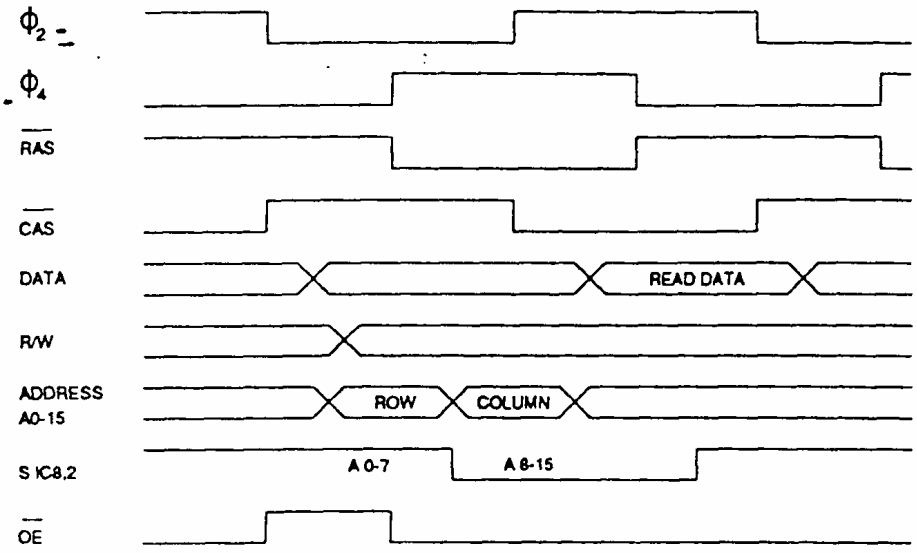


Figure 4: DRAM Read

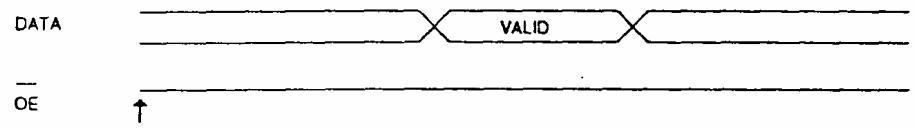


Figure 5: DRAMwrite

read from the EPROM when the /OE and /CE are both low.

4.4.4 INTON/INTOFF

Non-maskable interrupts (NMIs) are generated from two sources - the disc drive interface or the Econet network interface.

Interrupts from the floppy disc controller function in the following manner;

Upon start-up IC 19 pin 9 is cleared by the reset, causing pin 11 IC23 to be high, hence the NMI is high (inactive). If either the Data Request (DRQ) pin 38 or the Interrupt Request (IRQ) pin 39 of IC 26 of the Floppy Disc Controller go high, an NMI will be produced. For information on the cause of these and how to clear them refer to the manufacturer's data sheet. When pins 38 and 39 are cleared low, the low on pin 12 IC19 will be clocked through by φ2 and the NMI will go high, provided that pin 9 or pin 10 of IC23 is low.

When an interrupt is generated from the Econet network, pin 1 of the Econet module will go low which will take pin 6 IC22 high. IC19 pin 6 determines whether this causes an active NMI to the processor. Pin 3 IC19 is decoded by IC17 to be &FC28, which is used as the Econet Interrupt Enable, hence when this goes low pin 9 IC23 will go high and provided that TR0 (pin 1 Econet Module) is low the NMI on the processor will be low. Pin 5 IC17 decodes to &FC24 the Econet Interrupt Disable which will set pin 9 IC23 low, hence causing changes on pin 10 IC23 to have no effect on the processor NMI pin.

4.4.5 Econet Clock Generation

IC15, IC27 and IC22 generate the Econet clock signal with selectable speed and mark space ratio. Links 6 and 7 select –l µs or 2 µs clock rates, derived from 0.5µs ϕ2. IC27 is a preloadable counter, links *5, 4* and 3 selecting loaded count 1, 2 and 4. The optimum setting is 200kHz. 1µs loaded count = 4. IC26 is the clock transmitter, enabled by CB2 on IC31.

4.5 Battery backup

Some system variables are maintained in the CMOS RAM contained within IC1. The supply to this RAM is produced during power down conditions by B1. B1 is charged by a constant current source circuit (consisting of Q1, D1, D2, R4 and R5) during power on conditions. IC1's supply is switched between the 5 Volt rail and B1 by D4 and D5.

4.6 The Econet port

4.6.1 Econet module

Most of the Econet hardware is provided on a removable PCB module which connects to the main PCB via SK10 and SK1l. SK10 provides an interface to a standard Econet port, presented as a 5-pin 180 degree DIN socket. The Econet PCB module contains the 68B54 high speed data link controller and its associated buffer circuitry. The data link controller is under the control of the main processor using NMI. The module provides the following functions:

- Data transmission
- Data reception
- Clock reception and detection
- Collision detection
- Error detection

On-board circuits provide the Econet clock and termination.

4.6.2 Econet clock and active terminator

An on board clock is implemented using the master system clock at 2MHz divided down by IC15 and IC27.This is passed to a differential line driver IC28 and thence to the clock lines. Q6 and Q7 implements an active terminator which generates a 0.2V differential across the data lines. The control lines for these two circuits are from IC31 PIN 19. The insertion of the clock and terminator is automated to the extent that if a error in transmission or reception occurs, the circuit is enabled. It will also be enabled if on power up the processor detects the absence of the insertion of the DCD signal on the Econet module.

The frequency of the Econet clock is adjusted by links 3 and 4. See the Link Survey for selection detail.

4.7 The disc interface

The disc interface is controlled by IC26, IC25, IC14, IC24 and IC23. Drive selection is carried out by IC14. Data request and IRQ lines cause an NMI.

All floppy disc I/O is handled by a 2793 Floppy Disc Controller (IC26). For exact details of this operation refer to the manufacturer's data sheet

In this application it is programmed to support 250kbps data transfer and MFM decoding. Cl1 and Cl2 are used to adjust the on-chip voltage controlled oscillator. The frequency produced (on TP2) should 250KHz +/- 12.5% when the FDC is in test mode (see the manufacturers data sheet).

4.8 The printer /VIA circuitry

IC31 and IC32 control the printer interface. Port A of this device is used to generate a Centronics parallel type interface with the data buffering by IC32 and strobe by IC21 and IC22, acknowledge going directly to CA1. Only CB2 of port B is used, as an output to control the state of the Econet TX/RX clock and terminator circuit. Busy high indicates that the printer is unable to accept data.

4.9 The FileStore expansion bus and E40S/E60S interface

The FileStore expansion bus appears between locations &FC30 and &FC33. Page &FC is decoded by 1C23 and IC17. When page &FC is selected a buffer in the data bus (IC30) is enabled. The direction of this buffer is determined by the read/write line. The read/write line also selects which set of four outputs on IC35 are used. Page &FC is further decoded into &FC30 to &FC33 by IC29, IC34 and IC35. The four locations are as follows.

Address	Read	Write
&FC30	data	data
&FC31	status	-
&FC32	-	select
&FC33	-	enable IRQ

The outputs of IC35 are as follows:

- **Y0(pin 15) low - read data or Y4(pin 11) low - write data**

  Due to the action of Y0 going low IC40 and IC41 will clock a D-type IC33 causing an acknowledge Signal, this D-type IC33 will be cleared by a request signal returning from the hard disc drive. The Request / Acknowledge handshake cycle is then complete.

- **Y1(pin 14) low - read status** When &FC31 is selected, Y1 will go low which enables the Status Register IC36. All these control signals are inverted by either IC41 or IC42 prior to being latched, so all values read from the data bus are active high. The control signals appear in the following table:

DB0	Message
DB1	Busy
DB2	0v
DB3	0v
DB4	NIRQ
DB5	Request
DB6	Input/ Output
DB7	Command/ Data

- **Y2(pin 13), Y3(pin 12), Y5(pin 10) are not used.**

- **Y6(pin 9) low - select**

The action of Y6 going low will clock the other half of IC33 causing the select signal to be produced. This D-type IC33 will be cleared via IC40 and IC41 by the hard disc producing a busy signal.

- **Y7(pin 7) low - enable IRQ**

When Y7 is selected, the least significant bit of the data bus (D0) is clocked into a D-type flip-flop (half of IC34). If this value is a one then the latch (2 NANDs of IC40) is enabled and an IRQ will be generated at the next falling edge of REQ. To disable Interrupts Y7 is selected with a 0 on D0. IRQs are enabled only for a very short time (around l0ms) when ensuring a sequential file buffer.

4.9.1 Buffering

The data bus (DB0-DB7) is buffered in the write direction by the octal transparent latch IC38. IC38 is enabled by Y4 of IC35 which is the write data signal. Due to IC38 being a transparent latch, data will remain valid on the output side when the enable is deasserted. The outputs from IC38 are gated through 8 open collector NAND buffers which are enabled from the I/O control line of the FileStore expansion bus and which invert the bus signals.

The data bus is buffered and inverted in the read direction by an octal 3-state inverting buffer which is enabled by Y0 of IC35 which is the read data signal.

4.9.2 Termination

The FileStore expansion bus is terminated by a resistor pack RP1 in the E01S and by an external Termination pack placed in the FileStore expansion bus port of the unit at the other end of the bus.

For more information about the operational phases of the FileStore expansion bus, refer to the section entitled *Bus phases* in Chapter 4 - Circuit Description in Part IV of this manual.

4.10 Main signal paths

4.10.1 Data bus

This is a 8 bit bi-directional bus emanating from the central processor, going to all the major devices. The direction of the data flow is controlled by the CPU R/W line, a high level indicating a read by the processor.

4.10.2 Address bus

This is a 16 bit uni-directional bus emanating from the central processor.

4.10.3 Address decoding

The main decoding components are IC3, ICl2, ICl3, and 1C17. These supply the decoding to support the software activity as described below.

The layout of the file server memory map is as follows:

From	To	Function
0	&FF	Zero page, see suballocation below
&100	&1ff	Hardware stack
&200	&3FF	MOS workspace
&400	&7BFF	File server and print server code if loaded
&7C00	&E7FF	File server and print server workspace
&E800	&FBFF	MOS code
&FC00	&FCFF	Memory mapped 1/0, see suballocation below
&FD00	&FFE2	MOS code

&FFE3	OSASCI entry
&FFE7	OSNEWL entry
&FFEE	OSWRCH entry
&FFF1	OSWORD entry
&FFF4	OSBYTE entry
&FFFA	NMI vector
&FFFC	RST vector
&FFFE	IRQ vector

Page zero is suballocated as follows:

From	To	Function
&00	&1F	Spare (some locations used if debug options enabled in MOS)
&20	&8F	File server/print server workspace
&90	&9F	Spare at present, but may be allocated to file server
&A0	&AF	Econet driver workspace
&B0	&BF	File server workspace
&C0	&DF	Econet driver workspace
&E0	&FF	Disc handler workspace

Page &FC (the memory mapped I/O page) is suballocated as follows:

&FC00[-&FC03]	146818 RTC address register
&FC04[-&FC07]	146818 RTC data register
&FC08[-&FC0B]	(read) ROM/RAM memory access lamb (currently will always select RAM).
&FC08[-&FC0B]	(write) miscellaneous function latch
&FC0C-&FC0F	2793 Floppy Disc Controller
&FC10-&FC1F	6522 Versatile Interface Adaptor
&FC20-&FC23	6854 Econet interface
&FC24[-&FC27]	Econet interrupt disable
&FC28[-&FC2B]	Econet interrupt enable
&FC2C[-&FC2F]	Floppy drive door switch state
&FC30-&FC33	FileStore expansion bus interface. Strapped to emulate bus address &40, the bottom two bits of the &FC3x address indicate bus &4x.

Higher values in this page will access the same registers as above if taken modulo &40. Values in square brackets above are also alternate addresses for the various registers. Note that addresses are subject to change, and this should be borne in mind when designing software to address these registers.

4.10.4 Machine Operating System function calls

The file server MOS provides a subset of the BBC MOS interface. It is not necessarily the case that any test programs running in place of the file server will be able to obtain all the desired support from the MOS. Such test programs should however be written with an awareness of the MOS in mind. In particular, it is recommended that the contents of hardware registers and interrupt vectors are saved and restored over the execution of a test program, and the stack pointer restored to its value on entry.

The file server MOS provides the following functions, at the standard addresses:

OSASCI, OSNEWL, OSWRCH

These have the same specification as for the BBC MOS, except that the character in A is always inserted into the printer output buffer, not the current output stream buffer. If the buffer is full, these routines wait until there is room to store the character. OSWORD

The following OS WORD functions are supported (X/Y point to the data block):

A=1 Read date/time from RTC chip.
A=2 Write date/time to RTC chip.
The date and time are in the file server format, which is:
byte 0: date in month
byte 1: years since 1981 / month (4 bits each)
byte 2: hours (24 hour clock)
byte 3: minutes
byte 4: seconds

A=3 Read timer interval.
A=4 Write timer interval.
The timer is a 5 byte value counting in 1/100 seconds, however as his driven from the RTC it increments in steps of 1 second. There are no 'events' in the machine; the caller must poll the time regularly to see if an interval expires.

A=5 Read non-volatile memory in RTC.
A=6 Write non-volatile memory in RTC.
One byte is transferred between the address at (X/Y)+4 and the RTC chip address indicated by the bottom six bits of the byte at (X/Y). Note that the first 14 locations are used by the RTC itself, and the remainder allocated as follows for non-volatile use by the file server and print server:
14-15 station ID + ones complement
16-19 reserved for use by MOS
20-24 internal error logout area
25 MAXUSERS setting
26 MAXDRIVE setting
27-32 alternative POLLPS name for printer

Test routines are recommended to start from 63 downwards if they wish to use the RTC storage.

A=16 Econet TRANSMIT- as BBC
A=17 Econet RECEIVE - as BBC
A maximum of one transmit block and eighteen receive blocks may be active at a time.

A=19 Station information - function codes available are:
1 - write file server number
5 - write protection mask

A=114 Read/write block. Function codes available are:
&08 read block(s)
&0A write block[s]
&0D set drive parameters
&0F format drive

OSBYTE

The following OSBYTE functions are supported:

A=50	POLL TRANSMIT - as BBC
A=51	POLL RECEIVE - as BBC
A=52	Delete RECEIVE - as BBC
A=128	X=O: Read COMMAND/USER and Floppy drive door switch states, returns 2 if drive door open, 1 if in COMMAND mode X=252: Read free bytes in primer output buffer.
A=132	Read address of top of workspace area to X/Y. The value returned is the current base of the MOS.
A=137	LED control. X=0 will turn off the programmable led, X=1will turn it on.

4.11 Link survey

Link survey functions are as follows:

Link	**Function**
7	1µs net clock enable
6	2µs net clock enable
5	Net clock divide by enable
4	Net clock divide by 4 enable
3	Net clock divide by 8 enable

5. E01S Fault finding

The following chapter describes the suggested methods of fault finding on a Stacking FileStore E01 unit when the fault is not clearly in a specific area.

When the E01S unit is powered up, the following sequence of operations, should take place, as indicated by various activity indicators on the FileStore:

(1) On initial power up, the power indicator and mode/activity indicator should light up.
(2) The disc drive activity light for any connected Stacking FileStore units will flicker in turn.
(3) The floppy disc drive indicator for the FileStore E01S will light up.
(4) All indicator lights should then extinguish, except the power indicator lights, for all connected FileStore units. The FileStore E01S is now ready for use.

If the power on routine fails, then the FileStore is faulty. Follow the fault finding procedures outlined below. These should help you to discover any basic fault with the FileStore.

The E01S unit consists of three major components:

- the pcb
- two floppy disc drives
- the switch-mode power supply.

5.1 Power supply

The EO1 power unit is powered by a switch mode power supply. The power supply has two outputs. The 5V power supply cables are colour-coded as follows:

Black	ground
Red	+5V

The power supply can be tested by measuring the +5V voltage between the black and red cables. The allowable voltage ranges are as follows:

+5V (black and red)	5.0V to 5.25V

The measurements should be made with all connectors in place.

Next, measure the current drawn by the pcb from the +5V supply. The current measurement should be made in series with the red cable. The connections to the meter to do this must be made with the power switch off. The measurements must be made after power-up as some of the circuitry when working correctly, will alter its current consumption with time. Also ensure that:

- the Econet module is fitted
- the SCSI interface is disconnected from other devices, but still have the SCSI terminator fitted
- The front flap should be closed.

The current drawn should be as follows:

The pcb:

+5V	0.9A to 1.2A min, 1.5A max

Following start up, after the EPROM has been copied into RAM, the current should drop by about l00mA just before the discs are accessed.

The second output supplies the floppy disc drives. It is daisy-chained from the power supply to the disc drive. Looking down on to the top of the disc drive with the bezel towards you, the power supply pinouts are orientated as shown below:

*	*	*	*
+5V	Gnd	Gnd	+12V

Alternatively, some connectors are labelled 1 to 4, hence the supply would be shown:

1	2	3	4
*	*	*	*
+5V	Gnd	Gnd	+12V

The output can be tested by measuring the +5V and +12V voltage between the relevant pin and ground. The allowable voltage ranges are as follows:

+5v	500V to 5.25 V
+12V	11.4V to 12.6V

In order to measure the currents drawn by the disc drives it would be necessary to make up a small board that could be placed in-line between the power supply socket on the flying lead and the disc drive plug. This board would need to have links which can be made or broken depending on which line the current is being measured in. See- Fig 6 for details.

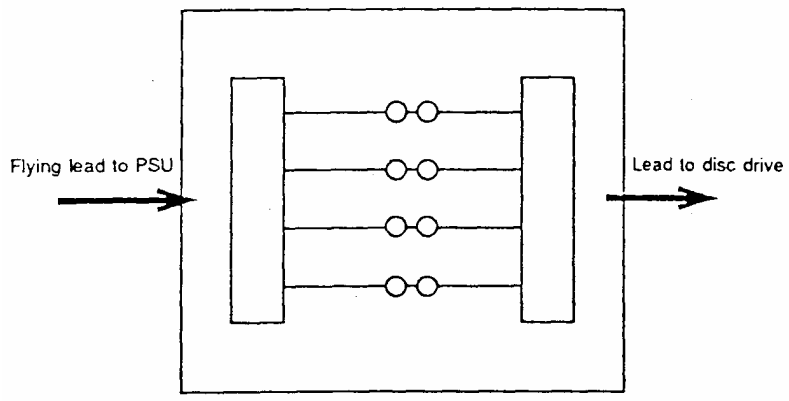


Figure 6: Board layout

Tale care not to cause any short circuits between the power supply pins and also between the board and the top of the disc drives and other components in the FileStore, i.e. the power supply pcb.

The measured values should be:

+5V	Standby	50mA nominal
	R/W	275mA nominal
+12V	Motor or start up	500mA nominal
	Seek	140mA
	R/W	90mA

See Fig. 7 for a diagram of the typical waveform produced:

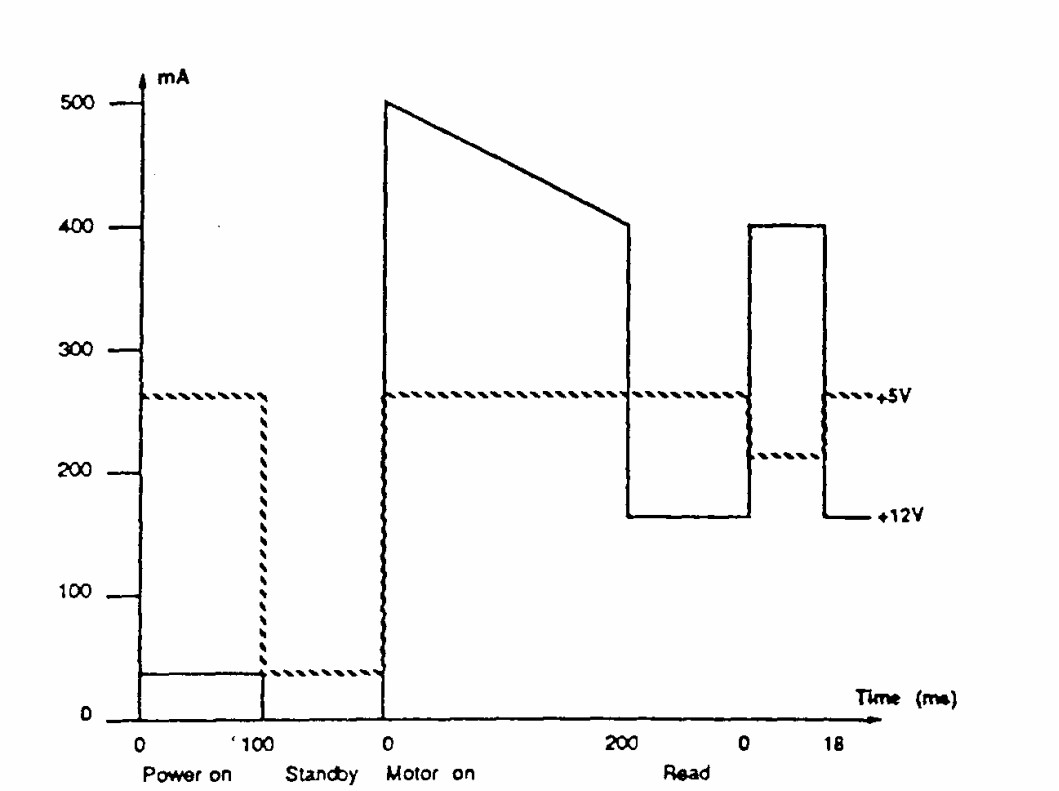


Figure 7: E01S start-up waveform

NOTE
The above figures are per drive. Also note that the quality of diskette and type of drive used can affect the values given.

5.2 Initialisation

If you have a suitable printer available, plug it into the unit and turn it on. Open the units Access flap and then turn the unit on, while observer the printer as you turn it on. If the printer performs a line feed, refer to section 5.3 Net Link.

If the printer does not perform a line feed, check the following with an oscilloscope:

Test	**For**
Processor clock:	2MHz on pin 3 and 39 of IC16
NMI line:	High on pin 6 if IC16
RTC frequency:	1024 Khz at TPI (at IC1)
Address lines:	for activity (at IC16)
Data lines:	for activity (at IC16)

5.3 Net link

If it appears that the link to the network is failing, the most common causes are:

Symptom	Action
Net module faulty	Replace net module
No clock	Check clock path and enable
Line jammed	Check for approximately 0.3V across the data pair

5.4 Final checks

If the procedures outlines above fail to uncover the fault, then as a final check you should refer to Appendix A – *Test Equipment* at the back of this manual, which contains more thorough tests of the FileStore.

The tests to run and the order in which to run them are as follows:

- Run all the tests in FServTest
- Run FServFmt on each disc
- Run FServInit on each disc
- Run FServSoak, running all the test patterns on each disc.

Part IV: FileStore E40S and E60S

1. Introduction to the E40S and E60S

The E40S and E60S provide increased mass storage on hard discs for Econet users, of 40Mb and 60Mb respectively. They are used in conjunction with the E01S floppy disc FileStore; up to four E40S or E60S units may be linked to a single E01S in any combination.

2. E40S/ E60S Specification

This chapter gives details of the main features of the FileStore E40S and E60S hard disc.

2.1 General specification

2.1.1 Hardware components

Within the box is a switch mode power supply, 3.5” 40Mb hard disc (or for the E60S with an onboard SCSI controller.

2.1.2 Software components

The hard disc is already formatted (as an ADFS disc), initialised as a fileserver and management and user utilities. There are no other software components; the filing contained in the E01S unit.

2.2 Physical

2.2.1 E40S and E60S units

Dimensions	length 333mm width 351mm height 78.8mm
Colour	Acorn Specification 0920,000
Material	Acorn Part No. 900,000 (ABS Cycolac) Mild Steel Chasis
Finish	Vapour Blast
Net weight	5kg

2.2.2 E40S/E60S packaging

Packaging material	Neopolene Inner Triwall cardboard outer Tray to hold expansion cable
Packaging dimensions	length 545mm width 500mm height 230mm
Gross weight	7kg

2.3 Operation

When the E40/E60S is connected to a FileStore E01S and powered up, the FileStore hard disc. The FileStore unit, comprising the FileStore E01S and E40S/E60S, then mode, ready for use.

2.3.1 Controls

Power on/off switch	On rear panel
Drive id switch	On rear panel

2.3.2 Indicators

Green LED	Power on indicator
Red LED	Drive active

2.4 Expansion input/output ports

FileStore expansion bus:	2 *x 50-way* 'Type *57'* (Delta) connectors, one male, one female, daisy-chained.
Mains in	IEC320: flying lead with plug for 'In' daisy-chained to panel-mounted socket for 'Out'
FileStore expansion bus	Rear Panel

2.4.1 FileStore E40S/E60S expansion bus connector

The E40S/E60S unit is equipped with two expansion bus connectors, for connecting to the E01S and an (optional) second FileStore expansion bus device. The connection to the E01S unit is made with the supplied FileStore expansion Bus Cable, Acorn part number 154,728.

The Connectors are 50-way IDC male sockets, wired as below:

Pins 1-12	Gnd
Pin 13	Leave open
Pins 14-25	Gnd
Pin 26	-DB(0)
Pin 27	-DB(1)
Pin 28	-DB(2)
Pin 29	-DB(3)
Pin 30	-DB(4)
Pin 31	-DB(5)
Pin 32	-DB(6)
Pin 33	-DB(7)
Pin 34	NC
Pin 35	Gnd
Pin 36	Gnd
Pin 37	Gnd
Pin 38	TERMPWR
Pin 39	Gnd
Pin 40	Gnd
Pin 41	NC
Pin 42	Gnd
Pin 43	-BSY
Pin 44	-ACK
Pin 45	-RST
Pin 46	-MSG
Pin 47	-SEL
Pin 48	-C/D
Pin 49	-REQ
Pin 50	I/O

2.5 Power input

2.5.1 Power input requirements

Power input requirements are as follows:

	Minimum	Nominal	Maximum	Units
Voltage	198	220/240	264	VAC
Frequency		50		Hz
Power		40		Watts

2.5.2 Mains interruptions ('Brown out')

The equipment has been designed to operate without malfunction during mains interruptions as detailed below. The mains is assumed to be at nominal at all other times.

Voltage [V]	Duration [ms]	Frequency [Hz]
0	20	0.2
50%	50	0.2

2.5.3 Power input plug and cable description

Plug type	IEC320
No of pins/connectors	3
Cable type	To BS6500 Table 16 (BASEC and/or CENELEC harmonised and marked)
No. of conductors	3
Conductor cross section	0.75mm^2 each
Length of cable	350mm

2.6 Power supply

2.6.1 Power required

		nominal	max
Drives	5V	0.7A (0.6A standby)	0.8A (0.65A standby)
	12V	0.5A (0.4A standby)	0.9A (0.45A standby)
Drive start	12V		2.5A for 2 seconds
Fan	5V	l20mA	

2.7 Safety standards

The equipment is designed and manufactured *to* comply with the following Standards:

- BS415
- BS5850

2.8 Electromagnetic interference

2.8.1 Standards

The equipment is designed and manufactured to comply with the following Standard:

Agency	Country	Standard	Comments
BSI	UK	BS6527	Class B

2.8.2 Mains transients

The equipment functions and is undamaged in the presence of mains-borne interference having voltage spikes detailed as follows:

Frequency	0.2 times mains frequency
Rise Time	5ns
Half-Pulse width duration	50ns
Polarity	+ve or -ve
Phase Angle	Free, non-synchronous
Peak Voltage	1000V does not cause malfunction (soft errors) 1500V does not cause physical damage, but *may* cause visible malfunction

2.8.3 Electrostatic discharge

The equipment functions/is undamaged when subjected to discharge (at both –ve and –ve polarity) from 5pF capacitor charged to a voltage specified below, limited by 150Ω resistor. The discharge is applied to any user accessible points, interconnecting cables and also the ground reference plane adjacent to the equipment.

Discharge Voltage.	6kV does not cause malfunction (soft errors) 12kV does not cause physical damage, but visible malfunction is permitted

2.9 Environment

2.9.1 Operating

The equipment operates and functions to specification continuously while under the following environmental conditions:

Temperature	+10 to +35°C
Relative Humidity	10 to 80% non-condensing
Thermal Shock	10°C per hour maximum
Mechanical Shock	Not operating: 35g ½ sinusoid l0ms, maximum repetition rate once every 10 seconds.10 shocks on all six faces

	Operating: 10g ½ sinusoid 10ms, maximum repetition rate once every 10 seconds. 10 shocks on all six faces.
Vibration	To BS2011 Part 2Fd, vibration in each plane (X, Y and Z). (Time limit for each test 90 minutes)
	Operating: 1.0g peak acceleration, 20Hz to 500Hz (20 to 500Hz at 0.005G sq/Hz)
	Not operating: 2.0g peak acceleration, 10Hz to 200Hz (10 to 200Hz at 0.02 sq/Hz)

2.9.2 Storage and shipping

The packaged equipment is designed an manufactured to withstand the following conditions:

Temperature	-20 to +60°C
Relative Humidity	10 to 80% non-condensing
Thermal Shock	20°C per hour maximum
Mechanical Shock	Will withstand a drop of 1 metre on each face and on the most susceptible corner

2.10 Emitted acoustic noise

54dBA (continuos maximum) at 1m from the nearest point on the drive.

2.11 Operating lifetime

The equipment has been designed to provide the following operational lifetime: 26,208 hours, or 3 years (Based on a24-hour day, 7 days a week).

To ensure trouble-free operation of the disc drives, the E01S and E40S/ E60S should not be exposed to excessive heat, moisture, direct sunlight or very dusty conditions.

3. E40S/E60S Disassembly and assembly

DANGER
Removing the cover of an E40S or E60S unit exposes dangerous voltages. Ensure that the unit is switched off and the plug removed from the mains supply before removing the cover.

WARNING
A number of components within the units are STATIC SENSITIVE. It is possible that these components may be damaged if subjected to a static discharge. Avoid contact with the hard disc at all times without taking adequate precautions against static.

WARNING
When the hard disc drive is removed for service work, great care must be taken not to drop, jar or shock the unit in any way. Under no circumstances should the drive itself be opened to expose the head mechanism: this can only be done by the manufacturer in a special ultra-clean room

3.1 Disassembly procedure

The numbered items mentioned in the following procedure refer to the E40S/E60S final assembly drawing in Appendix C.

(1) Power down the unit for disassembly.
(2) Disconnect the unit from the mains.
(3) Remove the unit from the stack.
(4) Remove the rear p1astic moulding (Item19) by levering the top up and back. The p1astic mouldings are fixed to the FileStore box by locating lugs on the inner top and bottom faces. These lugs are about 10mm wide by 2mm thick.

- Remove the front plastic moulding (Item 13). Care must be taken not to damage the cable assemblies fixed to the front plastic.
- Turn the FileStore unit over so that it rests on its top cover and the top faces of the plastics.
- Insert a flat screwdriver between the base of the metalwork and upper face of the plastic approx. 25mm from one corner. Exert a small force to lift the plastic away from the metal.
- With a second flat screwdriver repeat this action at the centre. See Fig 8.
- Remove the first screwdriver and repeat the exercise at the remaining corner. The plastic will still be connected to the FileStore by flying leads to the LEDs.
- Remove the side plastic (Item 18).
- Turn the FileStore unit the correct way up.
- Lever the top of the plastic away from the metal.

(5) Remove the top cover (Item 14). This is fixed by six Posidriv screws (Item 61) through the base of the unit.

Warning
Before continuing disassembly of the rest of the unit ensure that full anti-static procedures are taken.

(6) The top cover will now slide off the rear of the unit.

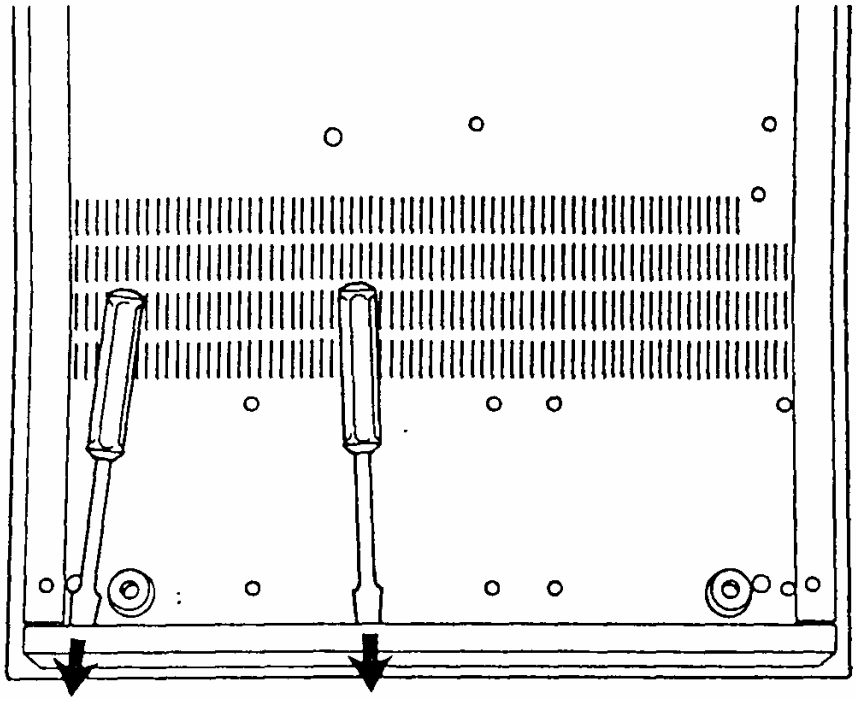


Figure 8: Rear plastic removal

(7) Remove the hard disc drive (Item 40).

- The drive stands off the base on four pillars (Item 8). To remove the drive along with the pillars from the base metalwork, turn the FileStore unit on its side.
- Support the drive while unscrewing the four Posidriv screws (Item 61).
- Remove the two ribbon cable assemblies, earth wire and power cable from the rear of the hard disc drive.
- The mounting pillars can then be unscrewed. After the drive has been removed, ensure that it is still kept free of static discharges.

(8) Remove Power Supply (Item 38).

- The upper surface of the psu is covered by a insulating material (Item *25)* fixed by four Posidriv screws (Item 62) to the psu. Unscrew these four screws and remove the insulator.
- Between the insulator and the psu are four small plastic spacers (Item 11) used to ensure the pcb does not pierce the insulator. Remove these.
- The psu is now held by various cable assemblies. Unplug the 13 way cable assembly (Item 34). It should now be possible to unplug the mains cable assembly (Item 10) from the component side of the psu. The Earth wire is fixed by a faston receptacle which can be pulled clear.

- The psu should now be free of the FileStore unit.

(9) Remove Fan (Item 34). Note that the psu needs to be removed to allow access to the fan. Remove the four fixing (Item 63) to free the fan guard (Item 74) and fan. The fan is part of the psu Output cable assembly and should be replaced as a complete assembly, if it is found to be faulty.

3.2 Parts not serviceable

Faults detected in the disc drive, disc controller board or power supply, mean that the faulty part must either be returned for repair or replaced. Dealers may hold stock of these items and should refer to information provided by their supplier for service procedures for these units.

3.3 Assembly procedure

To reassemble the unit, simply reverse the above procedure.

When reassembling the unit, ensure that full earth testing has been satisfactorily completed.

4.E40S/E60S Circuit description

Read this chapter in conjunction with the circuit diagrams for Stacking FileStore E40S and E60S in Appendix E at the back of this manual.

4.1 Bus phases

The bus has several distinct operational phases and cannot be in more than one of these phases at any given time.

Bus phases occur in a prescribed sequence. The reset condition can interrupt any phase and is always followed by bus free. Any other phase can also be followed by the bus free phase.

The prescribed sequence is from bus free to selection to one or more of the information transfer phases to bus free again.

There are no restrictions on the order of information transfer phases, and a phase will often follow itself, that is there will be two data phases, one after the other.

A typical sequence would be:

- bus free
- select controller - selection phase
- transfer command bytes - command phase
- transfer data bytes (if necessary) - data in/out phase
- status phase
- message phase

The phases are as follows:

4.1.1 Bus free phase

Indicates that the bus is available for use. The bus free phase is indicated by all control signals described in the previous section being deasserted. If SEL, BSY and RST are not asserted, that is sufficient to guarantee bus free.

4.1.2 Selection phase

Allows the initiator to select the target. After detecting bus free, the initiator asserts SEL. The target detects SEL asserted, and BSY and I/O deasserted, and responds by asserting BSY. The initiator deasserts SEL and may then change the data signals.

4.1.3 Information transfer phases

Allow transfer of information across the bus. There are several different types of information transfer phase, and the type is determined by MSG, C/D and I/O.

The information transfer phase is as follows:

Signals Msg	C/D	I/O	Phase name	Direction of information transfer
1	1	1	data out phase	initiator to target
1	1	0	data in phase	target to initiator
1	0	1	command phase	initiator to target
1	0	0	status phase	target to initiator
0	0	1	message out phase	initiator to target
0	0	0	message in phase	target to initiator

All signals active-low: 0 = assertion
1= deassertion

The information transfer phases use the REQ/ACK handshake to control information transfer: each REQ/ACK allows the transfer of 1 byte. The handshake sequence is:

(1) Target asserts REQ to request data transfer
(2) Initiator asserts ACK when data is valid on bus
(3) Target deasserts REQ when data has been transferred
(4) Initiator deasserts ACK ready for next handshake.

Prior to and during information transfer, the I/O signal determines the direction of the transfer.

Before each information transfer phase the target will set up the MSG, C/D and I/O lines in such a way that these control signals are stable for 450ns before the REQ of the first handshake, and remain valid until the deassertion of ACK at the end of the last handshake.

During each information transfer phase the BSY line remains asserted and SEL deasserted.

Each information transfer phase is now described in turn:

- **Command phase**
  Allows the initiator to direct the subsequent action of the target by transferring command bytes. The target asserts C/D and deasserts MSG and I/O.

- **Status phase**
  Allows the initiator to read the target's status information. The target asserts C/D and I/O and deasserts MSG.

- **Data out phase**
  Allows data to be transferred from initiator to target. The target deasserts MSG, C/D and I/O.

- **Data in phase**
  Allows data to be transferred from target to initiator. The target asserts I/O and deasserts MSG and C/D.

- **Message out phase**
  Not used by the system - available for future expansion.

- **Message in phase**
  Allows the target to send a message byte to notify completion of a command.

4.1.4 Termination

An external termination pack is provided with the E01S unit to terminate the expansion bus of E40S/E60S units. The pack is placed in the expansion bus port of the unit at the end of the bus.

5. E40S/E60S Fault finding

The following chapter describes the suggested methods of fault finding on a FileStore E40S/E60S when the fault is not clearly in a specific area.

When the FileStore E40S/E60S is powered up, the following sequence of operations, should take place, as indicated by various activity indicators on the FileStore:

(1) On initial power up, the power indicator and mode/activity indicator should light up.
(2) The hard disc will spin up to speed in a few seconds. This process produces a rising pitch humming noise which means that the hard disc is spinning, If the disc is not spinning, then check the power supply and connections.
(3) Each hard disc is then accessed in turn, as indicated by the drive indicator.
(4) The floppy disc drive indicator for the FileStore E01S will light up.
(5) All indicator lights should then extinguish, except the power indicator lights, on the FileStore E01 and any connected E40S/E60S units. The FileStore E4OS/E60S is now ready for use.

If the above power on routine fails, then the FileStore is faulty. Follow the fault finding procedure outlined below. This should help you to discover any basic fault with the FileStore.

The F40S/E60S unit consists of two major components:

- the hard disc drive
- the switch-mode power supply.

5.1 Power Supply

The E40S/E60S is powered by a switch mode power supply. The power supply output cables are colour- coded as follows

black	**ground**
red	+5V
orange	+12V

The power supply can be tested by measuring the *+5* voltage between the black and red cables, and the +12 voltage between the black and orange cables. The allowable voltage ranges are as follows:

+5V (black and red) 4.9V to 5.2V
+12V (black and orange) 11.4V to 12.6V

These measurements should be made with all connectors in p1ace.

Next measure the current drawn by the components specified above from the .5V and +12V supplies. The current measurement should be made in Series with either the red cable (+5V) or the orange cable (+12V). The connections to the meter to do this must be made with the power switch off. The measurements must be made after power-up as some of the circuitry, when working correctly, will alter its current consumption with time as shown below. The current drawn by each component from each voltage rail should be follows:

+5V	0.7 to lA
+12V	up to 2.*5A,* falling to around 0.4 to 0.9A when up to speed, in approximately two seconds.

See Fig 9 for a diagram of the typical waveform produced:

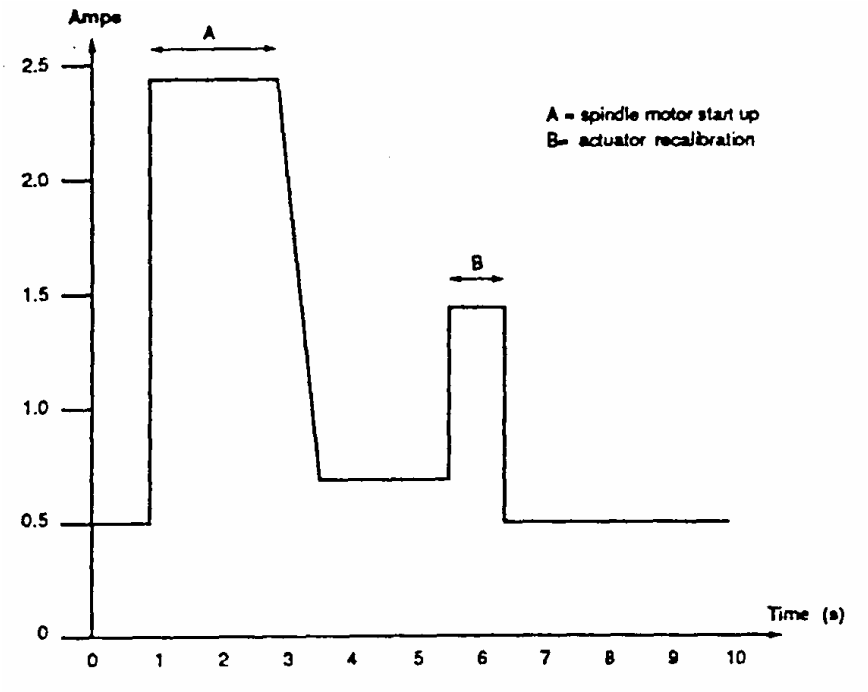


Figure 9: E40S/ E60S start-up waveform

The above figures are approximate and will enable checks to be made for open/short Circuits and malfunctioning components.

5.2 Address decoding

To test the address decoding, execute a program to access the relevant memory location. This is done by the SCSI interface tests in the FServTest program of the FileStore test software. See Appendix A - *Test Equipment* at the back of this manual for further details.

5.3 Hand shaking

To test the SEL/BSY handshake, use the handshake test of the SCSI interface tests in the FServTest program of the FileStore test software. See Appendix A - *Test Equipment,* for further details.

5.4 Bus lines

When the buses are not being asserted by the host system, ie in the bus free phase, all bus lines will float according to the values of their terminating resistors.

Measure the voltage of each bus line in turn and make sure that none of them is stuck at +5V, which would indicate a short circuit, or at 0V, which would indicate that there was a short circuit.

The correct voltages are as follows:

- 2 MHz expansion bus D0 to D7 and A0 to A7 should all be 2.5V.

If for example, D0 to D7 are all at 0V or a mixture of 0V and 2.5V, then one of the buffers is probably enabled.

5.5 Final checks

If the procedure outlined above fail to uncover the fault, then as a final check, you should refer to Appendix A - *Test Equipment,* which contains more thorough tests of the FileStore.

The tests to run and the order in which to run them are as follows:

- Run all the tests in FServTest
- Run FServFmt on each disc
- Run FServInit on each disc
- Run FServSoak, running all the test patterns on each disc.

Appendix A. Test Equipment

This appendix describes the equipment required and the procedures used to test the FileStore E01 and E20 units and the Stacking FileStore E01S, E40S and E60S units.

The test software is supplied on a 5.25” disc and provides a set of programs to test individual areas of the FileStore unit. To facilitate their use, the programs contain the following common features:

- the design of the user interface
- the concept of the current drive
- timeout characteristics for network operations.

Equipment required

The FileStore dealer test software requires the following hardware and software:

- An Acorn Master 128 Microcomputer with ADFS and a 5.25 floppy disc drive
- A network connected to the FileStore to be tested, known as the unit under test or UUT. (The network connection may be via a Bridge.)
- An Econet Test Box (Acorn part no. 0003,012)
- FileStore dealer test disc (Acorn part no. 0282,030)

Setting up

DANGER
PERSONNEL ARE EXPOSED TO MAINS VOLTAGES WHEN THE TOP COVER IS REMOVED AND MAINS POWER APPLIED.

DANGER
AT ALL TIMES DURING THE TEST PROCEDURE THE POWER MUST BE THE LAST CONNECTION TO MADE BEFORE THE TEST COMMENCES, AND THE FIRST CONNECTION REMOVED WHEN THE TESTING HAS BEEN COMPLETED.

Connecting the test station

Make the following connections:

- From: Master 128, ‘User port’
  To: Test Box, central (unlabelled) socket
  Using 20 way parallel connector cable

- From: Test Box, ‘Tester’ socket
  To: the Econet containing the Master 128
  Using: Econet cable

Connecting the UUT

Make the following connections:

- From: Test box, ‘UUT’ socket
  To: the Econet containing the FileStore
  Using: Econet cable

Any of the above connections should not be made on a network that is in active use. For example, one of the purposes of the Econet test box is to simulate a poor Econet connection by transmitting noise on the line. This would annoy other users.

Test procedure

Insert the dealer test software disc into the disc drive of the Master 128 and press <Shift>—<Break>.

You are prompted to specify which FileStore you wish to test. Type in a station number - either the number of a station on the local network, or else a net number followed by a full stop and a station number on that network (if you are using a network bridge).

You will be logged onto that station, if possible, and be offered a menu (FServMenu) containing the test programs of the suite:

```
            Main menu - logged on to station station number

C Copy disc sector by sector
E Edit file server disc structure
F Format disc, ready for initialisation
H Help, prints this message
I Initialise disc, ready for use in the FileStore
L Logon to a new station
N Non—volatile RAM editor
Q Quit this program suit
S Soak test discs
T Test main board
* Execute a star command

Option:
```

If you fail to log on to the station specified, an error message is printed, and a truncated menu of just ‘Help’, ‘Logon’, ‘Quit’ and ‘Star commands’ will be offered, so that you can take whatever corrective action is needed.

Menus

All programs in the suite use the FileStore chosen when FServMenu starts up. This may be changed by the ‘Logon to new station’ (‘L’) option in FServMenu. The programs all share the idea of the ‘current drive’ which may be changed by the ‘Select drive’ (‘D’) option and examined by the ‘Drive information’ (‘I’) option (in those program for which it is relevant).

All programs also have menus containing a (‘Q’) option, ‘which takes you back to FServMenu (or from FServMenu back to the BASTC prompt) and a ‘Help’(‘H’) option, which prints the option list.

Selecting menu entries

Menu entries are selected, and yes/no questions are answered, by a single key-press only. An invalid choice a has no effect. When you choose a menu option, Space bar and <CR> are both equivalent to ‘Help’ (‘H’).

Numerical input may be given in decimal or hexadecimal (preceded by a ‘&’): some questions supply a ‘&’ after the prompt automatically: this may be deleted if you wish to give the number in decimal.

The following sections describe each of the options that can be selected from FServMenu.

FservCopy

Select ‘C’ from the FServMenu. This invokes FservCopy, the disc copying utility and displays the following menu:

```
Copy disc from drive source to drive target
C Copy source disc to target disc (DESTROY ALL DATA)
D Change target drive
H Help, display this message
I Target drive information
J Source drive information
Quit back to main menu
S Change source drive
```

Using the options from the above menu, you can copy the entire contents of a disc from one drive to another. The discs must both be the same ‘shape’ i.e., the same number of sectors, divided into the same number of cylinders, heads and tracks (this is checked by the program), and the target disc must be formatted (but it need not be initialised, as the initialisation data will be copied as well).

The copy is done sector by sector, and sectors of the disc that are not used by any file are not copied, for efficiency. The result is an exact duplicate of the original disc. The title should be changed before it is used in a FileStore, as it will be the same as the disc from which the copy was made. This can be done using the FServEdit, or the FileStore command FSNamedisc.

To duplicate a disc onto a disc of a different shape, the utility NetMgr (supplied with the FileStore) should be used: this copies the files and directories individually.

FServEdit

Select E' from FServMenu, this invokes FServEdit, the sector-by-sector disc structure editor and displays the following menu:

```
          Edit FileStore structures on drive drive
A Add directory entry    K Compare bit maps     V Validate disc
C List map chain         L List directory       X Remove directory entry
D Change drive           M List bit map blocks  Y Re-validate bit maps
E Edit sector            Q Quit this program    Z Change disc name
H Display help message   R Read sector
I Show disc information  T Print tree
```

Using the options from the above menu you can edit the structure of a disc sector-by-sector, making any kind of modification to the structure of a disc.

WARNING
It cannot be emphasised too strongly that FServEdit is completely 'insecure' in that it lets you do anything to any sector, with no consistency checking unless you explicitly ask for it. It is very easy to delete data from sectors, or alter directories so that they no longer refer to files, Of course, without this flexibility it would be less useful than it is.

The main features of FileStore discs that FServEdit knows about are:

- Directories
- Map chains
- Sectors
- The cylinder allocation bitmaps
- The disc name.

A FileStore directory contains, along with the catalogue information about a file, the sector number (called the System Internal Number (SIN)) of an object called a 'map chain' which is a list of sector numbers where the data for the file can be found. This also applies to directories. To refer So a file, you refer to the SIN of its map chain.

Each disc has a boot sector (and a redundant copy of this). FServEdit can list the contents of the boot sector: this contains the SIN of the root directory, $ (really, the SIN of the map chain that refers it).

Directories can be listed ('List directory' 'L') and entries can be added to them ('Add entry', 'A') and removed ('Remove entry', 'X').

Map chains can be listed ('List map chain, 'C').

The contents of sectors can be edited: there is screen editor to allow the user to alter the contents of any disc sector, using the command 'Edit sector' ('E') or 'Read sector' ('R').

The cylinder allocation bitmaps can be listed ('List bitmap blocks', 'M') and checked: 'Validate disc ('V') makes a new allocation bitmap (in an ordinary disc file), by following the directory entries on disc, without reference to the bitmaps on the disc; then 'Compare bitmaps' (K') can be used to compare the bitmaps on the disc with the contents of this file, and 'Revalidate bitmaps' ('Y') to replace the bitmaps on the disc with the ones from the file, in the case that they are different.

The name of the disc: 'Change disc name' ('Z') is equivalent to the FileStore command FSNamedisc.

FServFmt

Select ‘F’ from FServMenu. This invokes FServFmt, a general formatting program for formatting Acorn hard disc drives used in FileStore units (Rodime R0650 and RO3000 series). The following menu is displayed:

```
   Format disc - current drive is drive
Q Quit                              F Format disc (DESTROY ALL DATA)
M Change format parameters          A Add defects at logical block
C Change the drive parameters       P Print disc controller page
U Initialise maintenance pages      T Type the defect list
V Verify area of disc               W Write ADFS structure
3 Certify                           R Change error recovery
E Enquiry                           4 Sector error read/ write tests
I Drive information                 D Change drive
H Help                              S Self test
? Error Log
```

Using the options from the above menu, you can carry out all the operations necessary to preparing a hard disc for formatting.

The disc controller pages may be examined (‘Print disc controller page’ ‘F’), and the contents of user pages A, B may be written (‘Initialise maintenance pages’ ‘U’): for Acorn drives, these must contain the eight characters ‘(C) Acorn’. Note that near page B is ‘write-once:’ after it has bane written, another attempt is an error. The error recovery parameters of the drive may be changed (‘Change error recovery’, ‘R’). See the Rodime User Manuals for full details.

The numbers of heads and cylinders can be specified, if they can’t be read from the drive. (‘Change drive parameters ‘C’).

The Rodime self-test facility may be invoked (‘Self test’, ‘S’). Again, see the Rodime manual.

The defect list may be examined (‘Type the defect list’, ‘T’) and changed (‘Add defects at logical block’, ‘A’).

There is a testing facility (‘Sector read/ write tests’, ‘4’) (with error log, ‘?’) similar to the soak test provided in FServSoak.

The main purpose of inn program is to format the disc (‘F’). After formatting, it writes an ADFS partition, and will then optionally verify or certify the disc automatically, under the control of ‘Change format parameters (‘M’). The interleave factor may be changed: the default is 8, which is believed to be optimal over a range of usable types if FileStores.

Also, the ADFS partition may be written without first formatting the disk (‘W’). The ADFS partition is on cylinder 0 and it contains the disc parameters in the form that the ADFS understands. This allows the disc to be initialised by FServInit (it is not suitable for use as a FileStore disc at this point).

Verification (checking by reading each sector, ‘V’) and certification (checking by reading and writing each sector, ‘3’) are also available as separate options.

FServInit

Select ‘I’ from FServMenu. This invokes FServInit, the FileStore disc initialiser and displays the following menu:

```
     Initialise disc structures on drive drive
D Change drive number
H Help, display this message
I Drive information
Q Quit back to main menu
W Write directory and initialise FileStore
```

Using the options from the above menu, you can use FServInit to modify the ADFS partition (on cylinder 0) and the FileStore partition (on cylinder 1) for a disc, based on an existing ADFS partition put in place by FServFmt. After this has been done, the disc is ready for use in a FileStore.

FServCMOS

Select ‘N’ from FServMenu. This invokes FServCMOS, the FileStore non-volatile (CMOS) RAM editor and displays the following menu:

```
Edit non - volatile RAM
&0E Station number = 254 OK
&14 Last error was &04, X=&84, Y=&00 at &02C0 S.I.N. = &FFFFFF
&1C MaxUser = 80
&1D MaxDrive = 4
&1E Printer is "Puce<00><00>"
&30 PrPage is off
&24 FSUser is "SYST<00><00><00><00><00><00><00>" check is &54 OK

     00  01  02  03  04  05  06  07  08  09  0A  0B  0C  0D  0E  0F  ASCII data
00                                                                FE  01       ..
10   00  00  00  00  04  84  00  C0  02  FF  FF  FF  50  05  50  75  ……….P.Pu
20   63  65  00  00  53  59  53  54  00  00  00  00  00  00  00  54  ce..SYST….T
30   4E  00  00  00  00  04  00  40  20  44  00  00  FC  00  04  00  N……@ D……
```

The editor reads a CMOS RAM address (in the range &E to &3F) and then prompts for a new value, which it writes at that address. It is possible to leave the CMOS RAM in an inconsistent state, as some of the entries are check summed. You are warned if this happens.

Many of the fields of the CMOS RAM have FileStore commands to alter their contents: there are the station number, MaxUsers, MaxDrivers, the printer port name, PrPage, and FSUser.

FServSoak

Select ‘S’ from FServMenu. This invokes FServSoak, the FileStore soak test program and displays the following menu:

```
    Soak test discs
A View activities
B Begin testing
E End testing
F File error log
H Help, print this message
L Load parameters
M Modify parameters
Q Quit
S Save parameters to disc
T View test in progress
? View error log
```

Using the options from the above menu, you can test any combination of discs on a FileStore unit and control the execution of the soak test.

FServSoak does not use the ‘current disc’ that the other programs use. Instead, it provides a list of ‘activities’, which may be examined with the ‘View activities’ (‘A’) option from the secondary menu. The active activities use executed cyclically, and may be changed with ‘Modify parameters’ (‘M’).

The current statue of the parameters (that is, whether or not they are active) may be saved and loaded on disc, using the options ‘S’ and ‘L’ respectively. The initial settings are read from a file called P1, which enables tests ‘Net GdLne IntCk’ (network test with a good line using the FileStore clock) and ‘Gen Net Comm’ (general network communications) only. Note that, if any of the disc tests are started, then the data on those discs will be destroyed.

FServTest

Select ‘T’ from FServMenu. This invokes FServTest, the FileStore main board test program and displays the following menu:

```
     Test main board
C  Continuous read/write of FileStore memory
E  Econet test
F  Floppy disc controller test
H  Help, print this menu
M  Memory test
N  Non—volatile RAM test
O  Optical door sensor test
P  Printer test
Q  Quit this program
R  Read FileStore memory
S  SCSI interface test
T  Real-time clock test
W  Write FileStore memory
X Econet test with external clock
```

Using the options from the above menu, you can test many of the features of the E01 or E01S main circuit board including:

- the RAM (‘C’, ‘M’, ‘R’, ‘W’)
- the non-volatile (CMOS) RAM (‘N’)
- the Econet connection (‘E’, ‘X’)
- the floppy disc controller (‘F’)
- the real-rime clock (‘T’)
- the optical door sensor (‘O’)
- the printer (‘P’)
- the SCSI interface (‘S’)

Some of these tests generate a waveform, which can be checked with an oscilloscope. The tests and the resulting waveform produced for an E01 or E01S unit are detailed below:

FileStore E01

- Printer test - the printer port pin corresponding to the bit number that was selected should show a show a square wave. All other pins should flat signals.
- SCSI interface - read data (‘R’): pin 1 of IC3 should be as shown in Fig 10 (and not stuck either high or low).
- SCSI interface - write data (‘W’): pin 11 of IC2 should be as shown in Fig 10 (and not stuck either high or low).
- SCSI interface - read status (‘?‘): pin 1 of IC4 should be as seen in Fig 10 (and not stuck either high or low).
- SCSI interface - write select (‘S’): pin 11 of IC10 should be as seen in Fig 10 (and not stuck either high or low).
- SCSI interface - write IRQ enable 0 (‘0’): pin 11 of IC10 should be as seen in Fig 10 (and not stuck either high or low). Pin 9 of IC10 should be logic 0.

- SCSI interface - write IRQ enable 1 (‘1’): pin 11 of IC10 should be as seen in Fig 10 (and not stuck either high or low). Pin 9 of Icl0 should now be logic 1.
- SCSI interface - SEL/BSY handshaking (‘H’): the result 2 should be printed. If nothing happens then there is either a loose connection or a fault in the disc controller board. The handshake operates during data transfer. If the hardware for this handshake is faulty, there can be no data transfer.

FileStore E01S

- Printer test - the printer port pin corresponding to the bit number that was selected should show a square wave. All other pins should show flat signals.
- SCSI interface - read data (‘R’): pin 1 of IC37 should be as shown in Fig 10 (and not stuck either high or low).
- SCSI interface - write data (‘W’): pin 11 of IC38 should be as shown in Fig 10 (and not stuck either high or low).
- SCSI interface - read status (‘?’): pin 1 of IC36 should be as seen in Fig 10 (and not stuck either high or low).
- SCSI interface - write select (‘S’): pin 11 of IC33 should be as seen in Fig 10 (and not stuck either high or low).
- SCSI interface - write IRQ enabled 0 (‘0’): pin 11 of IC34 should be as seen in Fig 10 (and not stuck either high or low). Pin 9 of IC10 should now be logic 1.
- SCSI interface - write IRQ enable 1 (‘1’): pin 11 of IC34 should be as seen in Fig 10 (and not stuck either high or low). Pin 9 of IC10 should now be logic 1.
- SCSI interface – SEL/BSY handshaking (‘H’): the result 2 should be printed. If nothing happens then there is either a loose connection or a fault in the disc controller board. The handshake operates during data transfer. If the hardware for this handshake is faulty there can be no data transfer.

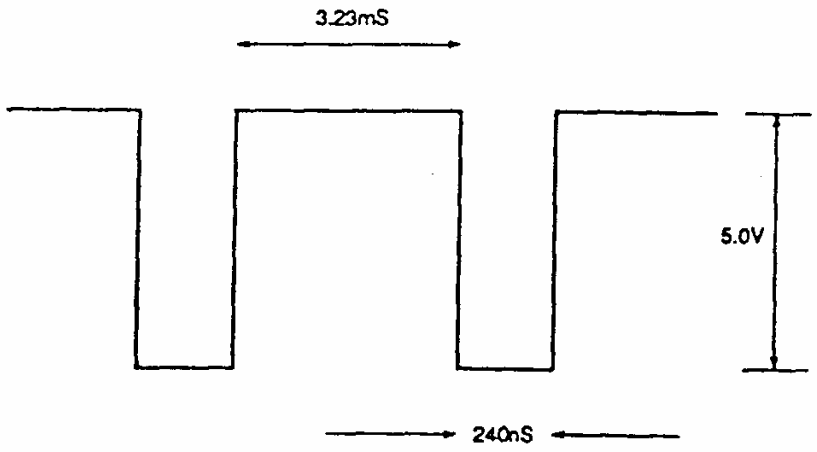


Figure 10: Example waveform

Checking the test equipment (validation)

Equipment required

(1) A known working FileStore.
(2)This document and the equipment called up in *Equipment required*, above.

Validation procedure

(1) Set up the equipment undergoing validation (EUV) as described in *Connecting the test station* above.
(2) Connect the known working FileStore as described in *Connecting the* UUT, above.
(3) Cycle through all the tests in FServTest five times.
(4) If the EUV fails any of the tests it must be repaired and the whole assembly retested from the
(5) beginning of this procedure.
(6) If the EUV passes all the tests it may be considered sound.

Modifying the test software

If it is necessary to modify the programs for any reason, it is most easily done with a Second Processor, connected to the 'Tube' port of the Master Microcomputer. This should be attempted only as a last resort and after Acorn Computers Limited have been contacted.

WARNING
Any changes made to the test software without the written approval of Acorn Computers Limited will not be supported and are carried out entirely at the risk of the modifier.

The programs as provided are in a highly compressed ('crunched') form, so they are not particularly easy to change (although in absence of a second processor, there is no choice). The directory S.source contains the programs as they were before they were crunched along with a file called DoCrunch that generates the compressed versions. (Type '*exec docrunch' - this uses the programs HiBASIC and Crunch from the directory S. Library.)

The test software is provided on a 5.25" disc and contains the following files:

!Boot	Start-up file
ReadMe	A summary of the test software programs
FServMenu	Main menu, used to run the other programs
FServCMOS	CMOS RAM editor
FservCopy	Sector-by-sector disc duplicator
FServEdit	Disc structure editor
FServFmt	Formatter for FileStore hard discs
FServInit	Initialiser for FileStore hard discs
FServSoak	Disc and Econet soak tester
FServTest	E01S circuit board tester
FSDB	Machine code for use by FServSoak
P1	Parameter file for use by FServSoak
Library	Library containing system utilities
source	Directory containing 'uncrunched' source

Appendix B. Parts lists

This Appendix contains the parts lists for FileStore and Stacking FileStore units.

A summary of the parts lists contained in the Appendix is listed below. The issue number for each parts list is the one that was current at the time of publication:

Title	**Part number**	**Issue**
FileStore E01 Main circuit pcb parts list	0154,000,P	5
FileStore E01 Final assembly parts list	0054.000,P- Communicator	2
	0054,002/P- Master	4
FileStore E20 Main circuit pcb parts list	0127,000/P	
FileStore E20 Final assembly parts list	0054.005/P- Communicator	2
	0054,007/P- Master	3
Stacking FileStore E01 Main circuit pcb parts list	0182,000/P	1
Stacking FileStore E01 Final assembly parts list	0082,000/P	1
Stacking FileStore E40S/E60S Final assembly parts list	0082,200/P - E40S	1
	0082,300/P - E60S	1

FileStore E01 main circuit pcb

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0254, 000	BARE PCB	1	
2	D154,000/A	ASSEMBLY DRAWING	1	PER BATCH
3	0154,000/C	CIRCUIT DIRGRAM 1 PER BATCH		
4				
5				
6	0159,200	ECONET 2 MODULE 1		
7				
8	0800,114	SKT IC 14/0.3” NORM	1	IC29
9	0800,116	SKT IC 16/0.3” NORM	1	IC26
10	0800,120	SKT IC 20/0.3” NORM	1	IC16
11	0800,120	SKT IC 20/0.3” NORM	1	IC23
12	0800,124	SKT IC 24/0.6” NORM	1	IC2
13	0800,128	SKT IC 28/0.6” NORM	1	IC4
14	0800,128	SKT IC 28/0.6” NORM	1	IC5
15	0800,140	SKT IC 40/0.6” NORM	1	IC3
16	0800,140	SKT IC 40/0.6” NORM	1	IC20
17	0800,140	SKT IC 40/0.6” NORM	1	IC21
18				
19	0800,070	CONR 2W SHUNT 0.1”	6	LK1,2,3,7,8,13
20				
21	0884,059	SPCR DBL LATCHED 19mmH	2	NET MODULE
22	0895,081	FOAM PAD S/ADH DBL SIDED	2	UNDER X1 & X2
R1	0502,911	RES 910R C/MF 5% OW25	1	
R2	0502,391	RES 390R C/MF 5% OW25	1	
R3	0502,565	RES 5M6 C/MF 5% OW25	1	
R4	0502,154	RES 150K C/MF 5% OW25	1	
R5	0502,272	RES 2K7 C/MF 5% OW25	1	
R6	0502,272	RES 2K7 C/MF 5% OW25	1	
R7	0502,222	RES 2K2 C/MF 5% OW25	1	
R8	0502,272	RES 2K7 C/MF 5% OW25	1	
R9	0502,103	RES 10K C/MF 5% OW25	1	
R10	0502,272	RES 2K7 C/MF 5% OW25	1	
R11	0502,475	RES 4M7 C/MF 5% OW25	1	
R12	0502,103	RES 10K C/MF 5% OW25	1	
R13	0502,331	RES 330R C/MF 5% OW25	1	
R14	0502,331	RES 33R C/MF 5% OW25	1	
R15	0502,330	RES 33R C/MF 5% OW25	1	
R16	0502,472	RES 4K7 C/MF 5% OW25	1	
R17	0502,472	RES 4K7 C/MF 5% OW25	1	
R18	0502,472	RES 4K7 C/MF 5% OW25	1	
R19	0502,271	RES 270R C/MF 5% OW25	1	
R20	0502,271	RES 270R C/MF 5% OW25	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
R21	0502,271	RES 270R C/MF 5% OW25	1	
R22	0502,271	RES 270R C/MF 5% OW25	1	
R23	0502,102	RES 1K0 C/MF 5% OW25	1	
R24	0502,223	RES 22K C/MF 5% OW25	1	
R25	0502,472	RES 4K7 C/MF 5% OW25	1	
R26	0502,332	RES 3K3 C/MF 5% OW25	1	
R27	0502,681	RES 680R C/MF 5% OW25	1	
R28	0502,152	RES 1K5 C/MF 5% OW25	1	
R29	0502,331	RES 330R C/MF 5% OW25	1	
R30	0502,331	RES 330R C/MF 5% OW25	1	
R31	0502,472	RES 4K7 C/MF 5% OW25	1	
R32	0502,222	RES 2K2 C/MF 5% OW25	1	
R33	0502,560	RES 56R C/MF 5% OW25	1	
R34	0502,472	RES 4K7 C/MF 5% OW25	1	
R35	0502,153	RES 15K C/MF 5% OW25	1	
R36	0502,271	RES 270R C/MF 5% OW25	1	
R37	0502,560	RES 56R C/MF 5% OW25	1	
R38	0502,103	RES 10K C/MF 5% OW25	1	
R56	0502,103	RES 10K C/MF 5% OW25	1	
R57			NOT FITTED	
R58			NOT FITTED	
R59	0502,103	RES 10K C/MF 5% OW25	1	
R60	0502,272	RES 2K7 C/MF 5% OW25	1	
R61	0502,132	RES 1K3 C/MF 5% OW25	1	
R62	0502,152	RES 1K5 C/MF 5% OW25	1	
R63	0502,821	RES 820R C/MF 5% OW25	1	
R64	0502,221	RES 220R C/MF 5% OW25	1	
R65	0502,152	RES 1K5 C/MF 5% OW25	1	
C1	0635,221	CPCTR ALEC 220uF 16V RAD	1	
C2	0631,033	CPCTR CPLT 33pf 30V 2%	1	
C3	0631,033	CPCTR CPLT 33Pf 30V 2%	1	
C4	0631,018	CPCTR CPLT 18Pf 30V 2%	1	
C5	0631,018	CPCTR CPLT 18Pf 30V 2%	1	
C6	0610,100	CPCTR TANT 100Uf 10v 20%	1	
C7			NOT USED	
C8	0631,027	CPCTR CPLT 27pF 30V 2%	1	
C9	0631,047	CPCTR CPLT 47pF 30V 2%	1	
C10	0650,224	CPCTR MPSTR 220n 50V 20%	1	
C11	0610,100	CPCTR TANT 100uF 10V 20%	1	
C14	0631,033	CPCTR CPLT 33pF 30V 2%	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
C15				FITTED ON TEST
SOT12	0631,022	CPCTR CPLT 22Pf 30V 2%	1	
SOT13				FITTED ON TEST
A	0680,002	CPCTR DCPLR 33/47Nf 0.2"	29	
IC1	0744,139	IC 74ALS139 TTL 16/0.3"	1	
IC2	0706,818	IC 6818 RTC CMOS	1	
IC3	0706,103	IC 65C102 PROC	1	
IC4	0254,204	IC E01 MOS ROM	1	
IC5	0254,205	IC R01 FS ROM	1	
IC6	0742,057	IC 74LS57	1	
IC7	0747,073	IC 74HC73 CMOS 14/0,3"	1	
IC8	0747,123	IC 74HC123 CMOS 16/0.3"	1	
IC9	0747,157	IC 74HC157 CMOS 16/0.3"	1	
IC10	0747,157	IC 74HC157 CMOS 16/0.3"	1	
IC11	0747,030	IC 74HC30 CMOS 14/0.3"	1	
IC12	0704,104	IC 4464 DRAM 120Ns 64kx4	1	
IC13	0704,104	IC 4464 DRAM 120Ns 64kx4	1	
IC14	0744,139	IC 74ALS139 TTL 16/0.3"	1	
IC15	0742,245	IC 74LS245 TTL 16/0.3"	1	
IC16	0747,074	IC 74HC74 CMOS 14/0.3"	1	
IC17	0747,074	IC 74HC74 CMOS 14/0.3"	1	
IC18	0744,139	IC 74ALS139 TTL 16/0.3"	1	
IC19	0747,273	IC 74HC273 CMOS	1	
IC20	0701,793	IC TMS2793	1	
IC21	0706,523	IC 6522A VIA NMOS 2MHz	1	
IC22				NOT USED
IC23	0742,244	IC 74LS244 TTL 20/0.3"	1	
IC24	0742,014	IC 74LS14 TTL 14/0.3"	1	
IC25				NOT USED
IC26	0732,630	IC 26LS30 RS422/423 DRVR	1	
IC27	0742,125	IC 74LS125 TTL 14/0.3"	1	
IC28	0747,163	IC74HC163 CMOS 16/0.3"	1	
IC29	0740,016	IC 7416 TTL 14/0.3"	1	
IC30	0740,038	IC 7438 TTL 14/0.3"	1	
IC31	0740,038	IC 7438 TTL 14/0.3"	1	
IC32	0747,002	IC 74HC02 CMOS 14/0.3"	1	
IC33	0742,032	IC 74LS32 TTL 14/0.3"	1	
IC34	0747,000	IC 74HC00 CMOS 14/0.3"	1	
IC35	0741,004	IC 74S01 TTL 14/0.3"	1	
IC36				NOT USED
IC37	0747,125	IC 74HC125 CMOS 14/0.3"	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
Q1				NOT USED
Q2				NOT USED
Q3				NOT USED
Q4	0780,183	TRANS BC183L NPN TO92	1	
Q5	0780,213	TRANS BC213L PNP TO92	1	
Q6	0780,213	TRANS BC213L PNP TO92	1	
Q7	0780,213	TRANS BC213L PNP TO92	1	
D1	0790,047	DIODE GER/SB OA47/BAT85	1	
D2	0790,047	DIODE GER/SB OA47/BAT85	1	
D3	0794,148	DIODE SI IN4148	1	
D4	0794,148	DIODE SI IN4148	1	
D5	0794,148	DIODE SI IN4148	1	
D6	0794,148	DIODE SI IN4148	1	
D7	0794,148	DIODE SI IN4148	1	
SK1	0800,870	CONR 34W WAFR 2ROW 0.1”	1	
SK2	NOT USED			
SK3	0800,004	CONR 5W SKT DIN RA PCB	1	
SK4	0800,870	CONR 34W WAFR 2ROW 0.1”	1	
SK5	0800,008	CONR 26W HDR ICD RA 4WALL	1	
SK6				NOT USED
SK7				NOT USED
SK8	0800,870	CONR 34W WAFR 2ROW 0.1”	1	
SK9				NOT USED
SK10	0800,481	CONR 5WAY PCB NET MODULE	1	
SK11	0800,484	CONR 17WAY PCB NET MOD.	1	
LK1	0800,050	CONR 2W WAFR 0.1” ST PCB	1	
LK2	0800,050	CONR 2W WAFR 0.1” ST PCB	1	
LK3	0800,050	CONR 2W WAFR 0.1” ST PCB	1	
LK4	0800,050	CONR 2W WAFR 0.1” ST PCB	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
LK5	0800,050	CONR 2W WAFR 0.1" ST PCB	1	
LK6	0800,050	CONR 2W WAFR 0.1" ST PCB	1	
LK7	0800,050	CONR 2W WAFR 0.1" ST PCB	1	
LK8	0800,050	CONR 2W WAFR 0.1" ST PCB	1	
LK9				
LK10	0800,050	CONR 2W WAFR 0.1" ST PCB	1	
LK11				
LK12				
LK13	0800,051	CONR 3W WAFR 0.1" ST PCB	1	
LK14				
LK15	0800,054	CONR 8W WAFR 0.1" ST PCB	1	
LK16	0800,051	CONR 3W WAFR 0.1" ST PCB	1	
PL1	0800,200	FSTN TAB 2.8mmx0.5 ST PCB	1	
PL2	0800,200	FSTN TAB 2.8mmx0.5 ST PCB	1	
0V	0800,200	FSTN TAB 2.8mmx0.5 ST PCB	1	
+5V	0800,200	FSTN TAB 2.8mmx0.5 ST PCB	1	
BT1	0817,000	BAT NI-CAD 3.6V	1	
X1	0821,327	XTAL 32.768KHz CC 0.05"	1	
X2	0820,080	XTAL 8.00MHz HC18/U	1	

FileStore E01 Final Assembly – Communicator

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0054,000/A	E01 FINAL ASSEMBLY	1	PER BATCH
2				
3				
4	0154,000	E01 DISC CONTROLLER PCB	1	
5				
6				
7	0154,706	E01 MAINS CABLE DETAIL	1	
8	0154,712	DISC DATA CABLE (SONY)	2	
	0154,621	DISC DATA CABLE (NEC)		OPTION
10	0154,713	E01 PCB TO REAR PL. RIB	1	
11	0154,718	E01 FAN, PCB. TO PSU.	1	
12	0154,719	E01 POWER, MODE TO PCB.	1	
13	0154,720	E01 OPTO, SW TO PCB.	1	
14				
15				
16				
17	0254,401	E01 REAR LABEL	1	
18	0254,402	E01 FRONT LABEL (LEFT)	1	
19	0254,403	E01 FRONT LABEL (CENTRE)	1	
20	0254,404	E01 FRONT LABEL (RIGHT)	1	
21				
22				
23				
24				
25				
26	0254,605	E01 SIDE MOULDING	2	
27	0254,606	E01 REAR MOULDING	1	
28				
29				
30	0254,700	E01 BOX FRONT MOULDING	1	
31	0154,732	E01 FLAP ASSY/ARTWORK	1	
32	0154,711	E01 EARTH CABLE (LONG)	1	
33	0154,714	E01 EARTH CABLE (SHORT)	1	
34	0254,702	E01 LOWER WRAP	1	
35	0254,703	E01 TOP WRAP	1	
36	0254,704	E01 PSU STANDOFF	4	
37	0254,705	E01 PAU INSULATOR	1	
38	0254,709	E01 DISC DRIVE STANDOFF	8	
39	0254,710	E01 PSU MODIFICATION	1	
40	0254,726	E01 PSU SPACER	4	
41				
42	0799,005	OPTO LED REC MTG GRMT	2	
43				
44	0885,208	FAN 5V 62x62x14mm	1	
45	0885,204	FAN GUARD	1	
46	0831,035	DISC DRIVE 3.5”(SONY)	2	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
	0154,740	DISC DRIVE 3.5" (NEC)	1	OPTION
48	0805,900	SW DPST 250V 4A ROC SNP	1	
49				
50				
51				
52	0880,024	CBL GRMT RND 7.4mmD 4CT	1	
53				
54				
55				
56	0882,121	SCW M3x6 PAN HD POSI	20	
57				
58	0882,125	SCW M3x16 PAN HD POSI	11	
59				
60	0882,126	SCW M3x20 PAN HD POSI	4	
61	0882,145	SCW M4x16 PAN HD POSI	6	
62				
63	0882,902	NUT M3 STL FULL Z/PAS	8	
64				
65	0882,985	WSHR M3 PLN NYL 10		
66				
67	0882,962	WSHR M3 PLN STL Z/PAS	10	
68				
69	0882,972	WSHR M3 SPRF IT STL	27	
70				
71	0882,964	WHSR M4 PLN STL Z/PAS	12	
72				
73	0890,006	FOOT SCW RUBR 17.5Dx17.5	4	
74				
75	0890,010	MATL RUBR SEALANT	A/R	
76				
77	0800,222	FSTN TAB 6,3/0,8 M3 45DEG	1	
78				
79				
80				

FileStore E01 Final Assembly – Master

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0054,000/A	E01 FINAL ASSEMBLY	1	PER BATCH
2				
3				
4	0154,000	E01 DISC CONTROLLER PCB	1	
5				
6				
7	0154,706	E01 MAINS CABLE DETAIL	1	
8	0154,712	DISC DATA CABLE (SONY)	2	
	0154,621	DISC DATA CABLE (NEC)		OPTION
10	0154,713	E01 PCB TO REAR PL. RIB.	1	
11	0154,718	E01 FAN, PCB. TO PSU.	1	
12	0154,719	E01 POWER, MODE TO PCB.	1	
13	0154,720	E01 OPTO, SW TO PCB.	1	
14				
15				
16				
17	0254,427	E01 REAR LABEL	1	
18	0254,424	E01 FRONT LABEL (LEFT)	1	
19	0254,425	E01 FRONT LABEL (CENTRE)	1	
20	0254,426	E01 FRONT LABEL (RIGHT)	1	
21				
22				
23				
24				
25				
26	0258,103	B.B. SIDE MOULDING	2	
27	0258,115	B.B. REAR MOULDING	1	
28				
29				
30	0254,735	E01 BOX FRONT MOULDING	1	
31	0154,738	E01 FLAP ASSY/ ARTWORK	1	
32	0154,711	E01 EARTH CABLE (LONG)	1	
33	0154,714	E01 EARTH CABLE (SHORT)	1	
34	0254,702	E01 LOWER WRAP	1	
35	0254,737	E01/E20 TOP WRAP	1	
36	0254,704	E01 PSU STANDOFF	4	
37	0254,705	E01 PSU INSULATOR	1	
38	0254,709	E01 DISC DRIVE STANDOFF	8	
39	0254,710	E01 PSU MODIFICATION	1	
40	0254,726	E01 PSU SPACER	4	
41				
42	0799,005	OPTO LED REC MTG GRMT	2	
43				
44	0885,208	FAN 5V 62x62x14mm	1	
45	0885,204	FAN GUARD	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
46	0831,035	DISC DRIVE 3.5" (SONY)	2	
	0154,740	DISC DRIVE 3.5" (NEC)		OPTION
48	0805,900	SW DPST 250V 4A ROC SNP	1	
49				
50				
51				
52	0880,024	CBL GRMT RND 7.4mmD 4CT	1	
53				
54				
55				
56	0882,121	SCW M3x6 PAN HD POSI	20	
57				
58	0882,125	SCW M3x16 PAN HD POSI	11	
59				
60	0882,126	SCW M3x20 PAN HD POSI	4	
61	0882,145	SCW M4x16 PAN HD POSI	6	
62				
63	0882,902	NUT M3 STL FULL Z/PAS	8	
64				
65	0882,985	WSHR M3 PLN NYL	10	
66				
67	0882,962	WHSR M3 PLN STL Z/PAS	10	
68				
69	0882,972	WSHR M3 SPRF IT STL	27	
70				
71	0882,964	WSHR M4 PLN STL Z/PAS	12	
72				
73	0890,006	FOOT SCW RUBR 17.5Dx17.5	4	
74				
75	0890,010	MATL RUBR SEALANT	A/R	
76				
77	0800,222	FSTN TAB 6,3/0,8 M3 45DEG	1	
78				
79				
80				

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0227,000	BARE PCB	1	
2	0127,000/A	ASSEMBLY DRAWING	1	PER BATCH
3				
4	0502,222	RES 2K2 C/MF 5% OW25	1	R1
5	0572,221	RESNET 220/330R DIL 2%	1	RP1
6	0573,222	RESNET 2K2 DIL 5% 16P	2	RP2,3
7	0571,222	RESNET 2K2 DIL 2% 16P	1	RP4
8	0800,116	SKT IC 16/0.3" NORM	3	RP2,3,4
9				
10	0680,002	CPCTR 33/47n DCPLR 0.2"	16	A
11	0622,220	CPCTR 22u ALEC 16v AX	1	C1
12				
13				
14				
15	0740,007	IC 7407 TTL 14/0.3"	1	IC16
16	0740,014	IC 7414 TTL 14/0.3"	1	IC15
17	0740,038	IC 7438 TTL 14/0.3"	2	IC13,14
18	0742,000	IC 74LS00 TTL 14/0.3"	1	IC12
19	0742,004	IC 74LS04 TTL 14/0.3"	1	IC9
20	0742,014	IC 74LS14 TTL 14/0.3"	1	IC8
21	0742,074	IC 74LS74 TTL 14/0.3"	2	IC10,11
22	0742,138	IC 74LS138 TTL 16/0.3"	2	IC6,7
23	0742,240	IC 74LS240 TTL 20/0.3"	1	IC3
24	0742,244	IC 74LS244 TTL 20/0.3"	2	IC1,5
25	0742,373	IC 74LS373 TTL 20/0.3"	2	IC2,4
26				
27				
28	0800,870	CONR 34W WAFR 2ROW 0.1"	1	PL1
29	0800,871	CONR 50W WAFR 2ROW 0.1"	1	PL2
30				
31				
32	0800,787	FSTN TAB 2,8/0,8 RA 5H	2	0V,5V
33				
34				
35				
36				
37				
38				
39				
40				

FileStore E20 Final Assembly – Communicator

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0054,005/A	E20 FINAL ASSEMBLY	1	PER BATCH
2				
3				
4	0154,005	E20 WINCHESTER HOST PCB	1	
5				
6				
7	0154,706	E01 MAINS CABLE ASSY	1	
8	0154,715	E20 HOST TO REAR PL. RIBB	1	
9	0154,716	E20 WINCH. TO HOST RIBBON	1	
10	0154,721	E20 EARTH TO PSU CABLE	1	
11	0154,722	E20 PSU TO MAINS SW. CABLE	1	
12	0154,723	E20 WINCH. TO PSU CABLE	1	
13	0154,724	E20 HOST ADAT TO PSU CBL	1	
14	0154,725	E20 IND. & FAN TO PSU CBL	1	
15				
16				
17				
18	0254,406	E20 FRONT LABEL	1	
19	0254,408	E20 REAR LABEL	1	
20				
21				
22				
23				
24	0254,603	E20 WINCH. DISC DRIVE	1	
25	0254,604	E20 P.S.U.	1	
26	0254,605	E01 SIDE MOULDING	2	
27	0254,606	E01 REAR MOULDING	1	
28				
29				
30	0254,700	E01 BOX FRONT MOULDING	1	
31	0254,733	E01 FLAP ASSY/ARTWORK	1	
32				
33				
34	0254,703	E01 TOP WRAP	1	
35	0254,704	E01 PSU STANDOFF	4	
36	0254,705	E01 PSU INSULATOR	1	
37	0254,707	E20 WINCH. STANDOFF	4	
38	0254,708	E20 LOWER WRAP	1	
39	0254,726	E01 PSU SPACER	4	
40				
41				
42	0799,005	OPTO LED REC MTG GRMT	2	
43				
44	0880,208	FAN 5V 62x62x14mm	1	
45				
46	0885,204	FAN GUARD	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
47				
48	0805,900	SW DPST 250V 4A ROC SNP	1	
49				
50				
51				
52	0880,024	CBL GRMT RND 7.4mmD 4CT	1	
53	0880,030	CLAMP CBL SF-ADH 6mmD ALU	1	
54				
55				
56	0882,121	SCW M3x6 PAN HD POSI.	14	
57				
58	0882,121	SCW M3x10 PAN HD POSI.	1	
59				
60	0882,126	SCW M3x20 PAN HD POSI.	4	
61	0882,145	SCW M4x16 PAN HD POSI.	4	
62				
63	0882,902	NUT M3 STL FULL Z/PAS	6	
64				
65	0882,985	WSHR M3 PLN NYL	8	
66				
67	0800,983	CNTR JACK SOCKET PR	2	
68				
69	0882,972	WSHR M3 SPRF IT STL	21	
70				
71	0882,964	WSHR M4 PLN STL Z/PAS	12	
72				
73	0890,006	FOOT SCW RUBR 17, 5Dx17,5	4	
74				
75				
76				
77	0800,222	FSTN TAB 6.3/0.8 M3 45DEG	1	
78				
79				
80				

FileStore E20 Final Assembly – Communicator

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0054,005/A	E20 FINAL ASSEMBLY	1	PER BATCH
2				
3				
4	0154,005	E20 WINCHESTER HOST PCB	1	
5				
6				
7	0154,706	E01 MAINS CABLE ASSY	1	
8	0154,715	E20 HOST TO REAR PL.RIBB	1	
9	0154,716	E20 WINCH. TO HOST RIBBON	1	
10	0154,721	E20 EARTH TO PSU CABLE	1	
11	0154,722	E20 PSU TO MAINS SW. CABLE	1	
12	0154,723	E20 WINCH. TO PSU CABLE	1	
13	0154,724	E20 HOST ADAT TO PSU CBL	1	
14	0154,725	E20 IND. & FAN TO PSU CBL	1	
15				
16				
17				
18	0254,430	E20 FRONT LABEL	1	
19	0254,431	E20 REAR LABEL	1	
20				
21				
22				
23				
24	0254,603	E20 WINCH. DISC DRIVE	1	
25	0254,604	E20 P.S.U.	1	
26	0258,103	B.B. SIDE MOULDING	2	
27	0258,115	B.B. REAR MOULDING	1	
28				
29				
30	0254,735	E01 BOX FRONT MOULDING	1	
31	0154,739	E20 FLAP ASSY/ARTWORK	1	
32				
33				
34	0254,737	E01/E20 TOP WRAP	1	
35	0254,704	E01 PSU STANDOFF	4	
36	0254,705	E01 PSU INSULATOR	1	
37	0254,707	E20 WINCH. STANDOFF	4	
38	0254,708	E20 LOWER WRAP	1	
39	0254,726	E01 PSU SPACER	4	
40				
41				
42	0799,005	OPTO LED REC MTG GRMT	2	
43				
44	0885,208	FAN 5V 62x62x14mm	1	
45				
46	0885,204	FAN GUARD	1	

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
47				
48	0805,900	SW DPST 250V 4A ROC SNP	1	
49				
50				
51				
52	0880,024	CBL GRMT RND 7.4mmD 4CT	1	
53	0880,030	CLAMP CBL SF-ADH 6mmD ALU	1	
54				
55				
56	0882,121	SCW M3x6 PAN HD POSI.	14	
57				
58	0882,123	SCW M3x10 PAN HD POSI.	1	
59	0882,125	SCW M3x16 PAN HD POSI.	8	
60	0882,126	SCW M3x20 PAN HD POSI.	4	
61	0882,145	SCW M4x16 PAN HD POSI.	4	
62				
63	0882,902	NUT M3 STL FULL Z/PAS	6	
64				
65	0882,985	WHSR M3 PLN NYL	8	
66				
67	0800,983	CNTR JACK SOCKET PR	2	
68				
69	0882,972	WSHR M3 SPRF IT STL	21	
70				
71	0882,964	WSHR M4 PLN STL Z/PAS	12	
72				
73	0890,006	FOOT SCW RUBR 17.5Dx17.5	4	
74				
75				
76				
77	0800,222	FSTN TAB 6,3mmx0,8 M3 45d	1	
78				
79				
80				

Stacking FileStore E01S Main circuit pcb

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0282,000	BARE PCB	1	
2	0182,000/A	ASSEMBLY DRAWING	1	PER BATCH
3	0182,000/C	CIRCUIT DIAGRAM	1	PER BATCH
4				
5				
6				
7	0159,200	ECONET II MODULE	1	
8				
9				
10				
11	(0282,008)	IC ROM ((0727,512) TBP)	1	IC7
12				
13				
14	0502,102	RES 1K0 C/MF 5% 0W25	1	R14
15	0502,103	RES 10K C/MF 5% 0W25	5	R2,9,31,32,45
16	0502,132	RES 1K3 C/MF 5% 0W25	1	R37
17	0502,151	RES 150R C/MF 5% 0W25	1	R15
18	0502,152	RES 1K5 C/MF 5% 0W25	3	R13,36,38
19	0502,154	RES 150K C/MF 5% 0W25	1	R6
20				
21				
22	0502,221	RES 220R C/MF 5% 0W25	1	R39
23	0502,222	RES 2K2 C/MF 5% 0W25	2	R34,44
24	0502,223	RES 22K C/MF 5% 0W25	1	R24
25	0502,271	RES 270R C/MF 5% 0W25	5	R23,25,26,27,46
26	0502,272	RES 2K7 C/MF 5% 0W25	5	R7,8,11,20,43
27				
28				
29	0502,330	RES 33R C/MF 5% 0W25	1	R19
30	0502,331	RES 330R C/MF 5% 0W25	4	R1,10,17,18
31	0502,332	RES 3K3 C/MF 5% 0W25	1	R12
32	0502,391	RES 390R C/MF 5% 0W25	1	R5
33				
34				
35	0502,472	RES 4K7 C/MF 5% 0W25	6	R21,28,29,30,33,35
36	0502,475	RES 4M7 C/MF 5% 0W25	1	R16
37				
38				
39	0502,560	RES 56R C/MF 5% 0W25	2	R41,42
40	0502,565	RES 5M6 C/MF 5% 0W25	1	R3
41				
42				
43	0502,681	RES 680R C/MF 5% 0W25	1	R22
44				
45				
46	0502,821	RES 820R C/MF 5% 0W25	1	R40

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
47				
48				
49	0502,911	RES 910R C/MF 5% 0W25	1	R4
50				
51				
52	0572,221	RES 220/330R NET DIL 2%	1	RP1
53				
54				
55				
56				
57				
58				
59				
60	0610,100	CPCTR 100UF TANT 10V 20%	2	C10,13
61				
62				
63	0631,018	CPCTR 18pF CPLT 30V 2%	2	C6,7
64	0631,022	CPCTR 22pF CPLT 30V 2%	2	C1,3
65	0631,027	CPCTR 27pF CPLT 30V 2%	1	C9
66	0631,033	CPCTR 33pF CPLT 30V 2%	3	C2,4,12
67	0631,047	CPCTR 47pF CPLT 30V 2%	2	C8,11
68				
69				
70	0635,221	CPCTR 220uF ALEC 16V RAD	1	"B"
71				
72				
73	0650,224	CPCTR 220nF MPSTR 50V 20%	1	C5
74				
75				
76	0680,002	CPCTR 33/47nF DCPLR 0.2"	43	"A"
77				
78				
79				
80				
81	0701,793	IC 2793 FDC 40/0.6"	1	IC26
82				
83	0704,104	IC 4464 DRAM 120nS 64Kx4	2	IC9,10
84				
85	0706,103	IC 65C102 CPU CMOS 2MHz	1	IC16
86				
87	0706,525	IC 65C22 VIA CMOS 2MHz	1	IC31
88				
89	0706,818	IC 6818 RTC CMOS	1	IC1
90				
91	0732,630	IC 26LS30 RS422/432 DRVR	1	IC28

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
92				
93	0740,007	IC 7407 TTL 14/0.3″	1	IC39
94	0740,014	IC 7414 TTL 14/0.3″	1	IC42
95	0740,016	IC 7416 TTL 14/0.3″	1	IC25
96	0740,038	IC 7438 TTL 14/0.3″	1	IC21,23,43,44
97				
98	0741,004	IC 74S04 TTL 14/0.3″	1	IC22
99				
100				
101	0742,032	IC 74LS32 TTL 14/0.3″	1	IC18
102	0742,057	IC 74LS57 TTL 8/0.3″	1	IC11
103	0742,123	IC 74LS123 TTL 16/0.3″	1	IC24
104	0742,163	IC 74LS163A TTL 16/0.3″	1	IC27
105	0742,240	IC 74LS240 TTL 20/0.3″	1	IC37
106	0742,244	IC 74LS244 TTL 20/0.3″	1	IC32
107	0742,245	IC 74LS245 TTL 20/0.3″	1	IC30
108	0742,373	IC 74LS373 TTL 20/0.3″	2	IC36,38
109				
110	0744,139	IC 74ALS139 TTL 16/0.3″	3	IC12,13,17
111				
112	0749,000	IC 74HCT00 CMOS 14/0.3″	2	IC5,40
113	0749,002	IC 74HCT02 CMOS 14/0.3″	1	IC20
114	0749,004	IC 74HCT04 CMOS 14/0.3″	2	IC29,41
115	0749,030	IC 74HCT30 CMOS 14/0.3″	1	IC3
116	0749,073	IC 74HCT73 CMOS 14/0.3″	1	IC6
117	0749,074	IC 74HCT74 CMOS 14/0.3″	5	IC15,19,33,34+MOD
118	0749,138	IC 74HCT138 CMOS 16/0.3	1	IC35
119	0749,157	IC 74HCT157 CMOS 16/0.3″	2	IC2,8
120	0749,273	IC 74HCT273 CMOS 20/0.3″	1	IC14
121				
122	0780,183	TRANS BC183L NPN TO93	1	Q2
123	0780,213	TRANS BC213L PNP TO93	3	Q1,3,4
124				
125	0790,047	DIODE OA47/BAT85 GER/SB	2	D3,5
126	0794,148	DIODE IN4148 SI	5	D1,2,4,6,7
127				
128				
129				
130				
131				
132				
133				
134				
135				

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
136	0800,004	CONR 5W SKT DIN RA PCB	1	SK3
137	0800,020	CONR 26W HDR IDC ST 4WALL	1	SK5
138	0800,031	CONR 34W HDR IDC ST 4WALL	2	SK1,8
139	0800,050	CONR 2W WAFR 0.1" ST PCB	5	LK3,4,5,6,7
140	0800,053	CONR 7W WAFR 0.1" ST PCB	1	SK2
141	0800,070	CONR 2W SHUNT 0.1"	2	USE WITH LK3,7
142				
143				
144	0800,117	SKT IC 16/0.3" SUPA	2	USE WITH IC28,RP1
145	0800,121	SKT IC 20/0.3" SUPA	1	USE WITH IC30
146	0800,125	SKT IC 24/0.6" SUPA	1	USE WITH IC1
147	0800,129	SKT IC 28/0.6" SUPA	1	USE WITH IC7
148				
149				
150				
151				
152				
153	0800,203	FSTN TAB 6,3mmx0.8 ST PCB	3	+5V,0V,CHASSIS
154				
155				
156				
157				
158	0800,371	CONTRDL 50W SKT RA PCB RFI	1	PL1
159				
160				
161	0800,481	CONR 5W SKT HSNG 0.1" PCB	1	SK10
162	0800,484	CONR 17W SKT HSNG .1" PCB	1	SK11
163				
164				
165				
166				
167	0817,000	BAT NiCAD 3V6 100mA BTN	1	B1
168				
169				
170				
171				
172	0820,080	XTAL 8.00MHz HC18	1	X2
173				
174				
175				
176				
177	0821,327	XTAL 32.768KHz CC 0.05"P	1	X1
178				
179				
180 (MOD)	0870,412	WIRE 30AWG W.WRAP	A/R	USE WITH I117

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
181				
182	0870,422	WIRE 25SWG SPR TIN	A/R	USE WITH X1,X2
183				
184				
185				
186				
187	0882,693	SCW M3x8 PAN POSI ST	2	USE WITH PL1
188	0882,902	NUT M3 STL FULL Z/PAS	2	USE WITH PL1
189	0882,962	WSHR M3 PLN STL Z/PAS	2	USE WITH PL1
190				
191				
192				
193				
194	0884,059	SPCR DBL LATCHED 19mmH	2	USE WITH ECONET MODULE
195				
196				
197				
198				
199				
200				

Stacking FileStore E01S Final Assembly

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0082,000/A	FINAL ASSEMBLY DRAWING	1	PER BATCH
2	0082,000/WD	WIRING DIAGRAM	1	PER PATCH
3				
4				
5	0254,424	M SERIES E01 LABEL LEFT	1	
6	0254,425	M SERIES E01 LABEL CENTRE	1	
7				
8				
9	0254,704	E01 PSU STANDOFF	4	
10	0254,709	DISC DRIVE STANDOFF	8	
11	0254,726	FILESTORE PSU SPACER	4	
12	0254,735	M SERIES FRONT MOULDING	1	
13	0254,737	M SERIES TOP WRAP	1	
14				
15				
16				
17	0258,103	B.B. SIDE MOULDING	2	
18	0258,115	B.B. REAR MOULDING	1	
19				
20				
21				
22	0182,000	FILESTORE II PCB BOM	1	
23	0182,001	DISC DATA CABLE ASSY	1	
24	0182,002	PSU OUTPUT CABLE ASSY	1	
25	0182,003	IEC SKT TO SW. CABLE ASSY	1	
26	0182,004	IEC EARTH CABLE ASSY	1	
27	0182,005	OPTO CABLE ASSY	1	
28	0182,006	INT. PRINTER ASSY	1	
29	0182,007	E01S MAINS CABLE ASSY	1	
30				
31				
32	0282,010	E01S LOWER WRAP	1	
33	0282,011	E01A REAR LABEL 1	1	
34	0182,012	E01S FRONT FLAP	1	
35	0182,023	PCB EARTH CABLE ASSY	1	
36	0282,014	PSU INSULATOR	1	
37	0182,015	E01S PSU	1	
38	0282,016	BASE LABEL	1	
39	0254,426	E01S LABEL RIGHT	1	
40	0282,018	E01S REAR LABEL 2	1	
41				
42				
43	0799,005	OPTO LED REC MTG GRMT	2	
44				
45				
46				

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
47	0805,900	SW DPST 250V 4A ROC SNP	1	
48				
49				
50	0831,035	DISC DRIVE (SONY)	2	
	0154,740	DISC DRIVE (NEC)		OPTION
52				

53				
54	0865,902	PWR SKT PNL SCW IEC	1	
55	0865,904	PWR SKT PLSTC BOOT	1	
56				
57				
58	0800,020	CBL GRMT RND 7.4mmD 2.5CT	1	
59	0880,101	CBL TIE LK 97mmL	4	
60	0880,100	CBL TIE LK 140mmL	1	
61				
62	0882,121	SCW M3x6 PAN HD POSI	24	USED ON ITEMS 13,22,37,50
63	0882,123	SCW M3x10 PAN HD POSI	4	USED ON ITEM 37
64	0882,127	SCW M3x25 PAN HD POSI	5	USED ON ITEMS 24, EARTH
65	0882,145	SCW M4x16 PAN HD POSI	4	USED ON ITEM 77
66	0882,223	SCW M3x10 CSK HD POSI	2	USED ON ITEM 54
67	0882,902	NUT M3 STL FULL Z/PAS	8	USED ON ITEMS 64,66
68	0882,962	WSHR M3 PLN ST Z/PAS	16	USED ON ITEMS 62,64
69	0882,964	WSHR M4 PLN ST ST Z/PAS	12	USED ON ITEM 65
70	0882,972	WSHR M3 SPRF IT STL	25	USED ON ITEMS 62,64,66
71	0882,985	WSHR M3 PLN NYL	10	USED ON ITEMS 62,63
72				
73				
74	0885,204	FAN GUARD	1	
75				
76				
77	0890,006	FOOT SCW RUBR 17.5Dx17.5	4	
78	0890,010	MATL RUBR SEALANT	A/R	
79				
80				

Stacking FileStore E40S Final Assembly

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0082,100/A	FINAL ASSEMBLY DRAWING	1	PER BATCH
2	0082,100/WD	WIRING DIAGRAM	1	PER BATCH
3				
4				
5	0254,430	M SERIES E20 FRONT LABEL	1	
6				
7	0254,704	PSU PILLARS	4	
8	0254,707	WINCHESTER PILLARS	4	
9	0154,721	EARTH TO PSU ASSY	1	
10	0154,722	PSU TO SW CABLE ASSY	1	
11	0254,726	FILESTORE PSU SPACER	4	
12	0254,727	E20 FRONT LABEL BACKING	1	
13	0254,735	M SERIES FRONT MOULDING	1	
14	0254,737	M SERIES TOP WRAP	1	
15				
16				
17				
18	0258,103	B.B. SIDE MOULDING	2	
19	0258,115	B.B. REAR MOULDING	1	
20				
21				
22				
23	0182,003	IEC SKT TO SW. CABLE ASSY	1	
24	0182,004	IEC EARTH CABLE ASSY	1	
25	0282,014	PSU INSULATOR	1	
26	0282,016	M SERIES BASE LABEL	1	
27				
28				
29	0282,110	SCREEN CLAMP BAR	1	
30	0282,100	LOWER WRAP	1	
31	0182,101	SCSI CABLE ASSY	1	
32	0182,102	MAINS INPUT CABLE ASSY	1	
33	0182,203	WINI DRIVE NO. CABLE ASSY	1	
34	0182,104	PSU OUTPUT CABLE ASSY	1	
35	0182,107	WINI EARTH CABLE ASSY	1	
36	0282,111	E20S REAR LABEL 1	1	
37	0182,212	E40S FRONT FLAP	1	
38	0182,115	E20S PSU	1	
39	0182,118	E20S REAR LABEL 2	1	
40	0182,219	E40S WINCHESTER D.D.	1	
41				
42	0799,005	OPTO LED REC MTG GRMT	2	
43				
44				
45				
46				

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
47	0805,900	SW DPST 250V 4A ROC SNP	1	
48				
49				
50				
51	0865,902	PWR SKT PNL SCW IEC	1	
52	0865,904	PWR SKT PLSTC BOOT	1	
53				
54				
55				
56	0880,020	CBL GRMT RND 7.4mmD 2.5CT	1	
57	0880,101	CBL TIE LK 97mmL	3	
58	0880,100	CBL TIE LK 140mmL	1	
59				
60				
61	0882,121	SCW M3x6 PAN HD POSI	16	USED ON ITEMS 14,29,38,39
62	0882,123	SCW M3x10 PAN HD POSI	4	USED ON ITEMS 25,38
63	0882,127	SCW M3x25 PAN HD POSI	5	USED ON ITEMS 34, EARTH
64	0882,145	CSW M4x16 PAN HD POSI	4	USED ON ITEM 78
65	0882,223	SCW M3x10 CSK HD POSI	2	USED ON ITEM 51
66	0882,902	NUT M3 STL FULL Z/PAS	8	USED ON ITEM 63,65
67	0882,962	WSHR M3 PLN ST Z/PAS	8	USED ON ITEM 63
68	0882,964	WSHR M4 PLN ST Z/PAS	12	USED ON ITEM64
69	0882,972	WSHR M3 SPRF IT STL	23	USED ON ITEMS 61,63,62,65
70	0882,985	WSHR M3 PLN NYL	4	USED ON ITEM 62
71				
72				
73				
74	0885,204	FAN GUARD	1	
75				
76				
77				
78	0890,006	FOOT SCW RUBR 17.5Dx17.5	4	
79	0890,010	MATL RUBR SEALANT	A/R	
80				

Stacking FileStore E60S Final Assembly

ITEM	PART NO	DESCRIPTION	QTY	REMARKS
1	0082,100/A	FINAL ASSEMBLY DRAWING	1	PER BATCH
2	0082,100/WD	WIRING DIAGRAM	1	PER BATCH
3				
4				
5	0254,430	M SERIES E20 FRONT LABEL	1	
6				
7	0254,704	PSU PILLARS	4	
8	0254,707	WINCHESTER PILLARS	4	
9	0154,721	EARTH TO PSU CABLE ASSY	1	
10	0154,722	PSU TO SW CABLE ASSY	1	
11	0254,726	FILESTORE PSU SPACER	4	
12	0254,727	E20 FRONT LABEL BACKING	1	
13	0254,735	M SERIES FRONT MOULDING	1	
14	0254,737	M SERIES TOP WRAP	1	
15				
16				
17				
18	0258,103	B.B. SIDE MOULDING	2	
19	0258,115	B.B. REAR MOULDING	1	
20				
21				
22				
23	0182,003	IEC SKT TO SW. CABLE ASSY	1	
24	0182,004	IEC EARTH CABLE ASSY	1	
25	0282,014	PSU INSULATOR	1	
26	0282,016	M SERIES BASE LABEL	1	
27				
28				
29	0282,110	SCREEN CLAMP BAR	1	
30	0282,100	LOWER WRAP	1	
31	0182,101	SCSI CABLE ASSY	1	
32	0182,102	MAINS INPUT ASSY	1	
33	0182,203	WINI DRIVE NO. CABLE ASSY	1	
34	0182,104	PSU OUTPUT CABLE ASSY	1	
35	0182,107	WINI EARTH CABLE ASSY	1	
36	0282,111	E20S REAR LABLE 1	1	
37	0182,312	E60S FRONT FLAP	1	
38	0182,115	E20S PSU	1	
39	0182,118	E20S REAR LABEL 2	1	
40	0182,319	E60S WINCHESTER D.D.	1	
41				
42	0799,005	OPTO LED REC MTG GRMT	2	
43				
44				
45				
46				

Appendix C. Diagrams

This appendix contains all the relevant drawings and diagrams for FileStore and Stacking FileStore units.

A summary of the diagrams contained in the Appendix is listed below. The issue number given for each diagram is the one that was current at the time of publication:

Title	Part number	Issue
FileStore E01		
Main circuit pcb diagram	0154,00/C	5
Main circuit pcb layout	0154,000/A	4
Main circuit pcb silk screen	0254,000/SS	3
Final assembly diagram	0054,000/A	5
Wiring diagram	0054,000/WD	2
FileStore E20		
Main circuit pcb diagram	0127,000/C	1
Main circuit pcb silk screen	0227,000/SS	3
Final assembly diagram	0054,005/A	4
Wiring diagram	0054,005/WD	1
FileStore E01S		
Main circuit pcb diagram	0182,000/C	4
Main circuit pcb layout	0282,000/SS	2
Final assembly diagram	0082,000/A	1
Wiring diagram	0082,000/WD	1
FileStore E40S/E60S		
Final assembly diagram	0082,100/A	1
Wiring diagram	0082,100/WD	1