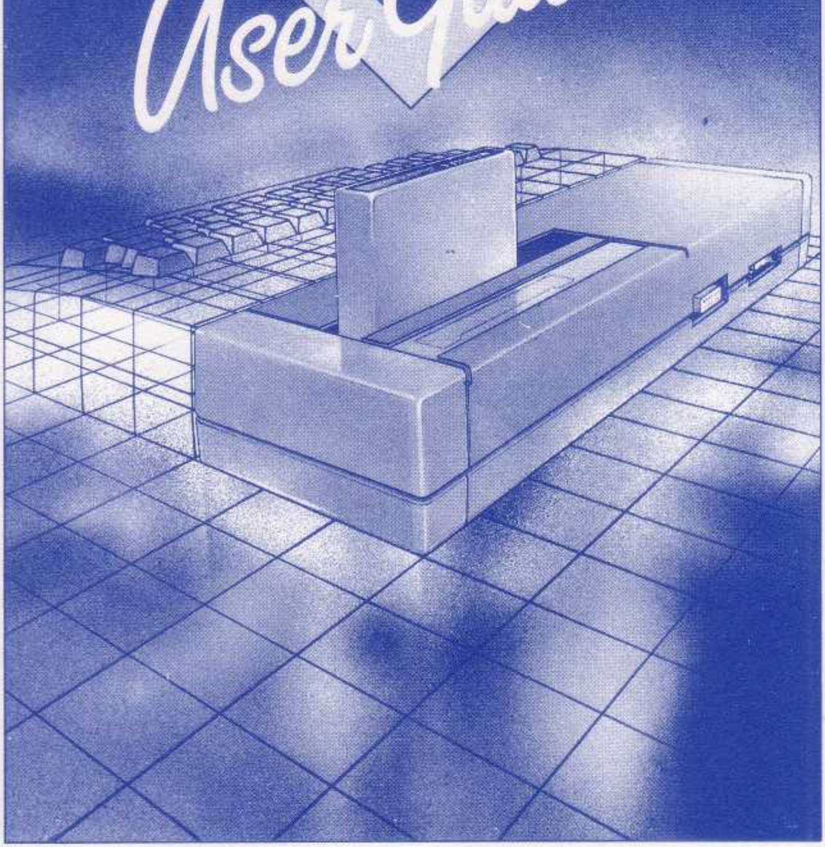
acorn electron

PLUS 1

User Guide



acorn electron plus 1 expansion unit

The Electron Plus 1
User Guide

Exposure

Like most electronic equipment, the Electron Plus 1 should not be exposed to direct sunlight or moisture for long periods.

The product described in this manual and products for use with it are subject to continuous development and improvement. All information of a technical nature and particulars of the product and its use (including the information and particulars in this manual) are given by P.R.E.S. in good faith. However, it is acknowledged that there may be errors or omissions in this manual. In this event a list of details of any amendments or revisions to this manual can be obtained from P.R.E.S. Ltd. PRES welcome comments and suggestions relating to this product and this manual.

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Contents

1 Introduction

The Acorn Electron Plus 1 adds the following capabilities to your Acorn Electron computer:

- Four 8-bit analogue to digital input channels, to allow the use of up to two joysticks or four games paddles, or measurement of up to four analogue voltages.
- A parallel port for connecting a printer with a Centronics° compatible interface.
- Two cartridge slots for installing Acorn Electron approved games, utility, application or language ROMs, or additional expansion devices. The ROMs may either hold files as a ROM filing system or be paged 'sideways' language ROMs.

All of these facilities are accessed using simple BASIC or machine operating system (MOS) commands, which are compatible with BBC BASIC.

The different typefaces used

You will notice that some letters, words and phrases in this manual have been printed differently from the rest of the text. This is to help you tell the difference between explanatory text, words which appear on the screen and certain keys on the computer keyboard.

- Ordinary text appears like this, or *like this* for emphasis.
- Text typed in at the computer or displayed on the screen appears `like this`.
- Words like **RETURN** mean that you press the key marked RETURN rather than actually type the letters R E T U R N.

2 Setting up

Installing the Electron Plus 1

Unplug your Electron computer from the mains (turn off the mains socket, remove the mains plug and then the power cable from the side of the Electron). You may also find it convenient to unplug any other cables (to the television or cassette drive) from your Electron, to make installation easier.

Warning: Never install or remove the Electron Plus 1 with the power to the Electron turned on.

Turn the Electron upside down with the expansion connector (at the rear of the computer) towards you and remove the plastic cover from the connector, to expose the edge connector fingers.

Take the Electron Plus 1 out of its packaging and check that the threaded ends of the two large screws are not protruding through the base of the Plus 1; if they are, press them down so that the threaded ends are flush with the base. Turn the Plus 1 upside down and locate the Electron's expansion connector in the mouth of the edge connector socket on the Plus 1, and push them together firmly.

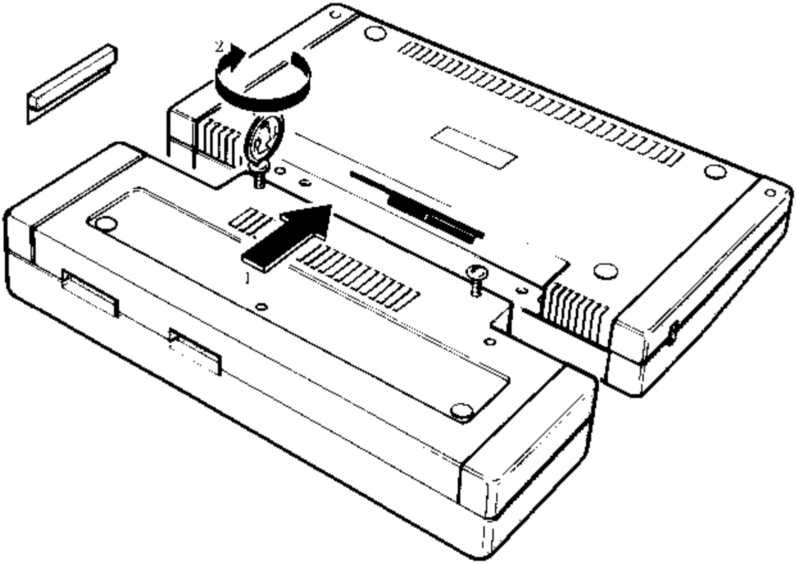

Figure 1 Fitting the Plus 1 to the Electron

Using a small coin or screwdriver, screw the two large screws in the Plus 1 into the Electron. *Do not overtighten.* If the screws do not engage in the threads in the base of the Electron, try reseating the Plus 1 on the Electron's expansion connector.

The Plus 1 should now be firmly attached to your Electron. Turn the Electron over and plug the power supply (and any other cables you may have removed) into the Electron and turn it on. Check that the Electron still works normally, by loading and running a small program which you know has run successfully before. If all is not well, refer to chapter 6.

Now you have fitted the Plus 1 to the Electron and checked that the system works, you can connect your printer, joysticks, games paddles or cartridges.

Using a printer

To connect a printer, you will need an extra mains socket (or an adapter) to power the printer and an interface cable to connect the printer to the Plus 1. You should be able to obtain a suitable cable from your dealer.

Put the printer on a stable, flat surface near enough to your Electron so that the interface cable can reach. Turn both the Electron and the printer off. Connect the printer cable to the printer as instructed in the printer manual, then connect the other end of the cable to the Plus 1 as follows:

—The printer socket is the wide rectangular socket at the rear of the Plus 1 to the right of the analogue input socket (viewed from the rear). Insert the printer cable plug in this socket so that the triangular mark on the socket housing lines up with the similar mark on the plug.

—Turn the printer and Electron on again.

You are now ready to use the printer for simple printing tasks. To turn printing on, type **CTRL** B or execute `VDU 2` in a program; all output displayed on the screen will then be sent to the printer as well. To turn printing off, type **CTRL** C or execute `VDU 3` in a program. For full details of using a printer, see chapter 4.

Using games paddles or joysticks

Only use games paddles or joysticks which are compatible with the Plus 1 (ask your dealer or see chapter 3). Turn the Electron off and plug the cable into the Plus 1 'analogue in' socket, which is the smaller socket at the rear to the left of the printer socket. The plug and socket are shaped so they will only fit together one way up. Turn the Electron on again and the joysticks or games paddles are now ready for use with suitable games or can be read from BASIC – see chapter 3 for further details.

Using cartridges

To use a cartridge produced by Acorn for the Plus 1, you must first plug it into either of the two shuttered slots in the top of the Plus 1. Insert the cartridge with its label towards you (ie facing the keyboard), pushing it into the slot so that the right-hand end makes contact first, then pressing it home until you hear it click into place. The cartridges are designed so that it is very difficult to insert them the wrong way round.

With a cartridge inserted correctly, either press **BREAK** (if the Electron was turned on) or turn the Electron on. Instructions in the use of the cartridges vary; full details will be supplied with any cartridge you purchase.

Using tape cassettes with the Plus 1

Whenever you use `LOAD`, `SAVE`, `CHAIN`, `*LOAD`, `*RUN` or `*EXEC`, the Plus 1 printer port and analogue interface are automatically disabled for the duration of that command. If you are using the `BPUT#`, `BGET#`, `INPUT#` or `PRINT#` commands in a program, you should use the `*FX163,128,1` command to explicitly disable the printer port and analogue interface before using the tape, and re-enable them afterwards using `*FX163,128,0`.

Disconnecting the Plus 1

If you should need to disconnect the Plus 1 for any reason, be careful to turn off the Electron first, then reverse the sequence of actions used to attach it. Note that the Plus 1 should not be disconnected and reconnected repeatedly, as this will cause wear of the expansion connector contacts.

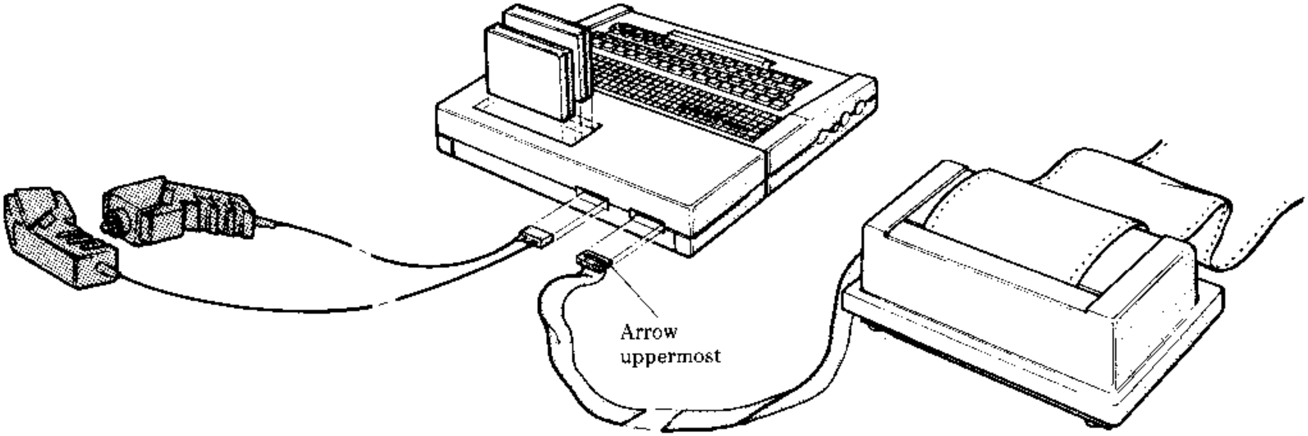

Figure 2 A typical expanded Acorn Electron system

3 The analogue interface

The analogue interface is used to measure smoothly varying voltages (analogue inputs) produced outside the computer, converting them into numbers (digital information) which the Electron can then use like any other numerical input. This conversion is performed by a circuit known as an 'analogue to digital converter', or ADC. The analogue inputs are connected via the ' analogue in' socket which is the left-hand socket when viewed from the rear of the Plus 1. This socket also allows you to detect the position of two two-way switches, normally connected as the 'fire' buttons on joysticks or games paddles.

Although the analogue interface is most often used for connecting games paddles or joysticks, it may also be used to measure voltages from other devices such as light-sensitive or heat-sensitive transducers, as long as they are electrically compatible (see 'Choosing other analogue peripherals', below). The analogue interface has a resolution of 8 bits (ie 1 in 256), but generates numbers in the range 0 to 65280 for compatibility with BBC BASIC.

The Plus 1 can continuously measure up to four voltages, allowing the use of up to four games paddles, two joysticks, or four separate external voltages at a time. Wherever the analogue inputs originate, they are treated exactly the same by the analogue interface and computer.

Connecting to the 'analogue in' socket

Analogue peripherals which have been manufactured by Acorn for the Electron may simply be plugged into the 'analogue in' socket. Before connecting other peripherals, check that they are electrically compatible (dealt with separately for each type, below) and that the cable used is wired correctly, ending in a 15-way D-type connector, wired as follows:

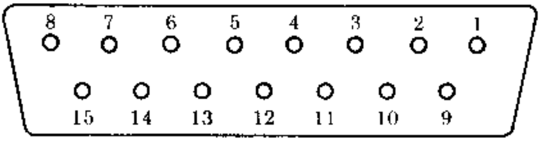

Figure 3 The 'analogue in' socket (viewed from outside case)

Pin number	Signal name	Description
1	+5 V	5 volt power for digital circuit
2	0V	0 volt power for digital circuit
3	0V	0 volt power for digital circuit
4	CH3	Analogue input 3
5	Analogue Gnd	0 volt for analogue circuit
6	0V	0 volt power for digital circuit
7	CH1	Analogue input 1
8	Analogue Gnd	0 volt for analogue circuit
9		Not connected
10	PB1	Pushbutton 1 (digital input)
11	VREF	Voltage reference for analogue circuit (1.8V)
12	CH2	Analogue input 2
13	PB0	Pushbutton 0 (digital input)
14	VREF	Voltage reference for analogue circuit (1.8V)
15	CH0	Analogue input 0

Choosing a games paddle

Games paddles usually consist of a small box with a single rotating knob, providing the computer with a voltage indicating how far the knob has been rotated. A games paddle can therefore only provide a single dimension of information to a game, such as a position in the horizontal or vertical axis of the screen. The games paddle may also have a small pushbutton switch or 'fire button', providing the computer with a digital 'pressed/not pressed' signaL

The games paddle should have an impedance of at least 10k ohms to match the analogue circuitry of the Plus 1 and be wired as described above (see `Connecting to the 'analogue in' socket').

Check the paddle for ease of use and comfort, ideally by connecting it to an Electron in the shop and using it with the type of game or other program that you will want to use at home.

Choosing a joystick

Joysticks usually consist of a small box with a lever protruding from the top, which is free to move up to approximately 30 degrees in any direction about a pivot at its base. This position of the joystick lever is translated into two voltages (one for front/back, one for left/right), so that a joystick provides two dimensions of information to the software that is using it. Joysticks will usually also have a small pushbutton switch or 'fire button', providing the computer with a digital 'pressed/not pressed' signaL

To make the best use of the analogue interface, you should buy a high resolution joystick with an impedance of at least 10k ohms, wired as described above (see `Connecting to the 'analogue in' socket').

Check the joystick for ease of use and comfort, ideally by connecting it to an Electron in the shop and using it with the type of game or other program that you will want to use at home. You will probably find a self-centering design more suitable for games playing, but less convenient for general purpose use.

The model ANH01 joysticks provided by Acorn are ideally suited for use with the Electron Plus 1.

Choosing other analogue peripherals

Devices other than joysticks and games paddles may be connected to the analogue interface, provided that they are electrically compatible with it and are wired as described above (see ' Connecting to the 'analogue in' socket'). The peripheral may either generate a DC voltage in the correct range itself which is proportional to the measurement, or may take the reference voltage (VREF) from the interface and return a fraction of it which is proportional to the measurement (ie may act as a potential divider).

If the peripheral uses the reference voltage from the interface:
Minimum impedance of 10k ohms

If the peripheral generates its own voltage:
DC voltage: 0 to 1.8 volts

Current drive: 1 milliamp minimum

The maximum resolution of the analogue to digital conversion is 8 bits (ie the analogue input will be converted into one of 256 different numbers, depending on the input voltage).

If you wish to measure absolute voltages, you must first calibrate the system against a reliable voltage reference.

Using the analogue interface from BASIC

The four analogue voltages being read by the Electron are assigned 'channel numbers' in the range 1 to 4: to read the voltage on a channel, use the BASIC function ADVAL (minimum abbreviation AD., token = &96). For example

```
horizontal = ADVAL(1) : vertical = ADVAL(2)
```

The variables horizontal and vert i ca l will now contain integers in the range 0 to 65280, proportional to the voltages measured on channels 1 and 2, with OV being read as approximately 0 and 1.8V as approximately 65280. The number returned by ADVAL increases by steps of 256 rather than by 1 (ie 0, 256, 512 . . . 65280), to allow for future expansion in the resolution of the conversion process.

To determine whether the fire buttons on the paddles/joysticks are being pressed, use ADVAL with a channel number of 0, for example

```
buttons = ADVAL(0) AND 3
```

The value of the variable buttons then tells you which buttons are being pressed as follows:

buttons = 0 means no buttons are being pressed
buttons=1 means that push button 0 is being pressed
buttons = 2 means that push button 1 is being pressed
buttons = 3 means both push buttons are being pressed

Each analogue input is sampled in turn and converted to the digital result returned by ADVAL, in order of decreasing channel number. The conversion process takes 10mSec (ie one hundredth of a second) per active channel, so with all four channels operating, there will be a delay of 40mSec between changes in the readings. To reduce this delay, you should turn off channels you are not using, with the *FX16 command, as follows:

*FX16,0 turns all the analogue channels off
*FX16,1 turns channel 1 on and channels 2 to 4 off
*FX16,2 turns channels 1 and 2 on and channels 3 and 4 off
*FX16,3 turns channels 1 to 3 on and channel 4 off
*FX16,4 turns all four channels on

To force a particular channel to be sampled and converted next, use *FX17, <channel>, as follows:

```
2010 *FX17,3
2015 REM force sampling and conversion for channel 3
2020 REPEAT : UNTIL ADVAL(0) DIV 256 = 3 : REM wait till
finished channel 3
2030 reading = ADVAL(3):REM get reading from channel 3
```

Note that the *FX17 command forces sampling and conversion for all channels from that specified down to 1, even if they have been turned off with *FX16.

ADVAL(0) DIV 256 returns the number of the last channel to complete sampling and conversion, or 0 if no channel has yet completed conversion since the last *FX16 or *FX17 command.

Using the analogue interface from assembly language

The functions of the ADVAL keyword in BASIC are provided by calling OSBYTE with A = &80 (128 decimal) and X = a number in the range 0 to 4, which determines the function performed as follows:

X = 0: on exit Y will contain the number of the last channel sampled and converted, or 0 if no conversion has yet completed (since the last *FX16 or *FX17 call).

X = 1 to 4: on exit X and Y will contain the last value sampled and converted for the channel number specified in X; X contains the least significant eight bits and Y contains the most significant eight bits. The range and significance of this 16-bit integer is as for the value returned by ADVAL (see 'Using the analogue interface from BASIC').

*FX commands can be performed in assembly language in the usual way, by a call to OSBYTE (&FFF4). Thus, to set the number of analogue input channels, instead of using *FX16, <number>, load A with &10 and X with the number, then call OSBYTE; to force a channel to be sampled and converted (*FX17, < channel>), load A with &11 and X with the channel number, then call OSBYTE.

Each time the sampling and conversion of an analogue signal is completed, an 'event' is generated. If you wish to detect and act on this event, you must first place the address of the code to handle it (and any other events you are going to enable) at location &220 and then enable the event using `*FX14,3` or the equivalent assembly language code (`LDA#&E: LDX#3: JSR OSBYTE`). The event code passed to your routine for this event (in A) is 3. For further information, refer to 'Events' in chapter 29 of the *Electron User Guide*. To disable handling of this event, use `*FX13,3` or the equivalent assembly language code (`LDA#&D: LDX#3: JSR OSBYTE`).

4 Using a printer

Choosing a printer

The Electron Plus 1 will work with a wide range of printers using a Centronics® compatible parallel interface. If in doubt about the suitability of a particular printer, consult your dealer.

A helpful and impartial booklet on choosing printers, entitled `USPEC 32a' is available free from the Council for Educational Technology, 3 Devonshire Street, London W1N 2BA.

Connecting a printer

To connect a parallel printer to the Plus 1 you will need a suitable cable. These are available from your dealer as Acorn part number ANG04.

The connections in the cable are as follows:

Signal name	**36-way plugpin number**	**26-way plugpin number**
Strobe	1	1
Data°	2	3
Datal	3	5
Data2	4	7
Data3	5	9
Data4	6	11
Data5	7	13
Data6	8	15
Data?	9	17
Acknowledge	10	19
Ground	19 to31	Even numbers 2 to 24

Turn the printer and Electron off and connect the printer to the printer socket (the right-hand socket when viewed from the rear of the Plus 1), being careful to insert it the right way up (with the arrow head on the plug facing upwards). Turn the printer and Electron on and you are now ready to start printing — see `Setting printer characteristics', below.

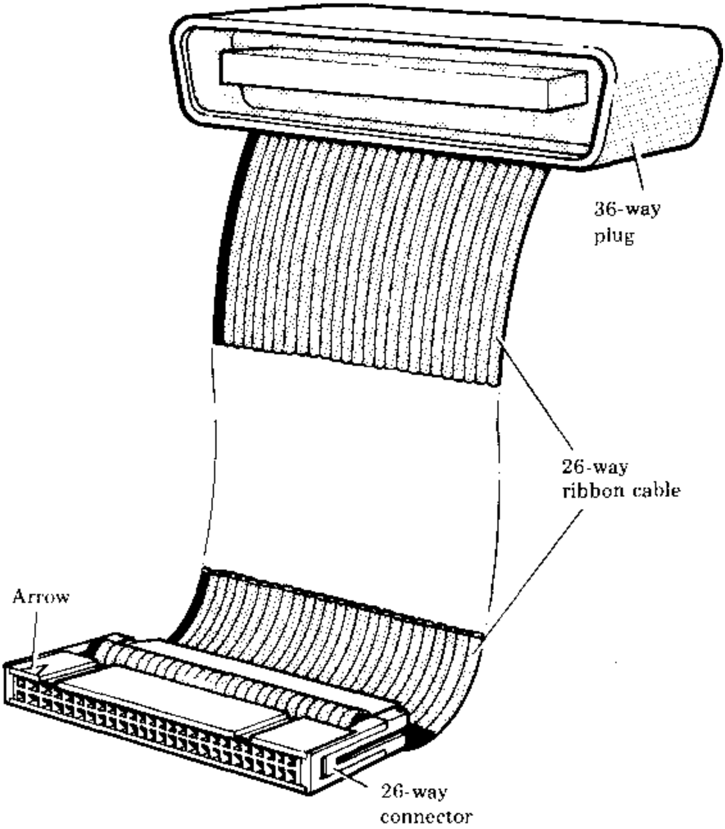

Figure 4 The completed printer cable

Setting printer characteristics

Whenever you switch the Electron on, it will return to its default printer characteristics, which may be changed as follows:

Output for the printer is sent to it by software known as a printer driver, which handles tasks such as queueing text for printing and checking that the printer is ready for another character before sending it. When you first switch on, the standard printer driver is selected, which sends output for printing to the printer port. You may switch between using this driver and another known as the 'printer sink', with the *FX5 command as below:

*FX5,0 selects the 'printer sink', which causes output for the printer to be ignored — this is useful when printed output is not required or a printer is not connected.

*FX5,1 selects the standard printer driver.

The printer driver will ignore the line feed at the end of text lines and just send a carriage return to the printer port. If your printer requires a line feed at the end of each line, you can restore it by using *FX6,0. The *FX6 command actually sets the 'printer ignore character', ie ***FX6,** <ASCII code> can be used to stop that single character being sent to the printer. If output to both printer and screen is selected (see 'Printing from BASIC'), you can get a 'printer ignore character' out to the printer by sending it immediately after executing a VDU 1 command or typing **CTRL A**.

Printing from BASIC

When you first switch on, all output will be sent to the screen; to get printed output, type **CTRL** B or execute the command VDU 2 to send the output to the current printer driver as welL To stop sending output to the printer driver, either type **CTRL** C (outside a program) or execute the command VDU 3**.** To alter the way that output is routed, use the ***FX3** command as follows:

	Output to current printer	**Output to screen**
*FX3,0	Y	Y
*FX3,10	Y	N
*FX3,4	N	Y
*FX3,6	N	N

With the printer only selected (after *FX3,10**),** all output will be sent to the printer and **CTRL** B and **CTRL** C will have no effect.

With both screen and printer selected (after switching on or using *F**X3,0),** a single character can be sent to the printer but not to the screen by preceding it with **CTRL** A or VDU 1 (in a program). Use this method to send the 'printer ignore character' or any codes that might have unwanted effects if sent to the screen — it is probably simplest to use **CTRL** A or **VDU 1** before any ASCII code in the range 0 to 31.

The internal printer buffer

Text sent to the printer is first stored in an area of computer memory known as the internal printer buffer, and only sent on to the printer when the printer can handle it, usually a line or a character at a time. If you wish to remove all remaining text from the buffer, you can usually either press **ESCAPE** (which empties all the buffers on the system) or use the command `*FX21, 3` (which empties the printer buffer only). You can disable the emptying of all buffers on pressing **ESCAPE** with the command `*FX230,1` and enable it again by `*FX230, 0`.

Your printer may also have its own printer buffer so that printing may continue for a short while after using **ESCAPE.**

Printing from assembly language

The `*FX` commands given above may be accessed from assembly language in the usual way, ie by loading A with the command number and X with the number following the comma, then calling OSBYTE (&FFF4), eg to flush the printer input buffer (* F X21,3):

```
LDA#&15
LDX#3
JSR &FFF4
```

Text is printed by selecting printed output (with the assembly language equivalents of `*FX3,0` or `*FX3,10`) and then sending the characters to be printed, one at a time, by loading the accumulator with the ASCII code and calling OSWRCH (&FFEE) for each character in turn. If output to screen and printer is selected (`*FX3,0`), the text to be printed must be preceded by ASCII 2 (**CTRL** B) and followed by ASCII 3 (**CTRL** C) as when using BASIC.

5 Using cartridges

The Plus 1 has two sockets in its upper surface into which a variety of cartridges can be plugged. These cartridges can provide games, languages, utilities, application programs or other facilities. Contact your local dealer for a list of cartridges currently available.

Full instructions in the use of these cartridges will be provided with the individual cartridges.

Cartridges should not be installed or removed with the Electron switched on. If you remove or install a cartridge with the computer turned on, you will need to press **BREAK** or **CTRL BREAK** to restore normal operation.

Games and applications cartridges will usually behave quite differently from language cartridges, so they are described separately below.

Games and applications: ROM file cartridges

These cartridges are usually designed to load and run the software they contain automatically, taking over operation of the Electron when it is turned on or after pressing **CTRL BREAK,** so that the Electron behaves as a machine dedicated to running that program while the cartridge is plugged in. To defeat this mechanism, you should press **CTRL BREAK,** wait about one second, and then press **ESCAPE**.

If you have two games/applications cartridges plugged in, the one at the front (nearest the keyboard) will be the one that 'takes over' the Electron.

The programs alid data used by these cartridges are contained in ROMs, accessed by a filing system similar to the cassette tape filing system you are used to, but much faster and restricted to reading information only. This is called the ROM filing system.

When you break out of a game, the ROM filing system will be active instead of the cassette filing system. The commands available are `*CAT, LOAD` and `CHAIN`**,** which have identical functions to their cassette equivalents, but work with the ROM files.

To use the cassette filing system, select it by typing `*TAPE`**;** to use the ROM filing system again, type `*R0M.`

With two ROM file cartridges plugged in, to use the software in the cartridge further from the keyboard, list the files in the ROMs using `*CAT` and try `CHAINing` the file listed after !`BOOT` for that cartridge.

Languages: paged ROM cartridges

Language cartridges contain alternative programming languages (eg LISP) or other utilities which the Electron can use instead of the more familiar BASIC language. These ROMs are called 'paged' ROMs, and are switched by the Electron into the same address range (&8000 to &C000) as the BASIC ROM they are replacing. This is a very effective way of increasing the power of your Electron system without using up more RAM memory space.

When you first switch on, if there are no games or applications cartridges plugged in, any language ROM will be selected in preference to BASIC; if there are two languages, the one nearer the keyboard will take priority.

To switch between language cartridges and BASIC, use the language name preceded by an asterisk, eg `*BASIC` or `*LISP`.

6 Dealing with problems

The following is a brief guide to diagnosing problems that may occur when using the expansion interface, and details of solutions which can be reached without technical assistance or voiding the warranty. Do not open the Electron computer or Plus 1 cases, as any modifications you make to this equipment may void the warranty. If in doubt, consult your dealer.

Improving processing speed

With the Plus 1 attached, the Electron has considerable extra processing to do, supervising the extra facilities. This will usually not be noticeable, but the following steps may be useful to minimise the speed decrease:

– Use MODE s 4 to 6, as advised in the *Electron User Guide*.

– Turn off any ADC channels that are not needed (see 'Using the analogue interface from BASIC', chapter 3).

– Disable all servicing of input and output via the Plus 1, using `*FX163,128,1` and re-enable servicing with `*FX163,128,0` when required.

Problems which may not be faults

Tape filing system commands aren't working– you must switch to the tape filing system (*TAPE **RETURN**) after using cartridges (see chapter 5).

Tape loading error – to reduce data errors, avoid using MODEs 0 to 3 while loading and saving to tape. If you are using the tape for data storage `(PRINT#, INPUT#, BPUT#, BGET#`), try the suggestions for improving processing speed given above, for the duration of the tape operations.

Cannot return to BASIC from a cartridge – some cartridges are protected against piracy by disabling the **BREAK** key. To use BASIC, remove the cartridge and then press **BREAK**. See chapter 5 for further details.

Programs that cannot run with the Plus 1, but work without it – try the suggestions for improving processing speed, above.

Electron malfunctioning

Disconnect the Plus 1. If the computer still does not work, check the power, then take the Electron and the Plus 1 to your dealer, if the computer works, continue reading.

Clean the edge connector fingers at the rear of the Electron using a nonabrasive rubber and a soft cloth, then try reconnecting the expansion interface with all the peripherals disconnected. If the computer still does not work, take the Plus 1 to your dealer, otherwise continue reading.

Reconnect each peripheral (including cartridges) in turn until the original fault returns, cleaning any contacts that seem dirty or tarnished. If the fault does not return, you have probably removed it by cleaning and reconnecting the connectors; if the fault does return, continue reading.

Check the offending peripheral for obvious faults – bent pins in the connector. breaks in cables, bad seating in the sockets. Try the suggestions under `Peripherals malfunctioning', below. Return the item to your dealer with a description of the fault.

Peripherals malfunctioning

Check the orientation and seating of the connectors.

If the peripheral has worked before, check if it still works in that situation (eg with the same software) – if not, try cleaning and reseating the connectors. If the peripheral does work in the original situation, check the things that are different in the fault situation.

If the peripheral has not worked before, check that you have connected and initialised it correctly. Try swapping it with another borrowed from a friend or dealer and try it with other software. If other peripherals work, yours is probably incompatible or faulty (return to dealer); if other software works with your peripheral, change your software; if changing peripherals and software does not work, try cleaning the connectors as described above (`Electron malfunctioning'). Perhaps your peripheral requires special software before it will work correctly, such as a printer driver.

Appendix A

Summary of new and changed *FX commands and OSBYTE calls

This Appendix provides a summary of the *F X commands available to users of the Electron with an expansion unit fitted which either are not documented in the *Electron User Guide,* or are documented incompletely. These commands may also be used in assembly language by a call to OSBYTE; commands which can only be used from assembly language are summarised at the end of this Appendix.

***FX3,X**

Selects the device to which printed output is sent, as follows:

`*FX3,0` - To screen and printer

`*FX3,10` - To printer only

`*FX3,4` - To screen only

`*FX3,6` - To neither device

***FX5,X**

Selects the printer driver, as follows:

`*FX5,0` — To 'printer dump'

`*FX5,1` — To printer port

***FX6,X**

Selects the 'printer ignore character', specified by the ASCII code X.

***FX16,X**

Selects the number of analogue to digital conversion channels, where X is a number in the range 0 (no channels) to 4 (all four channels).

***FX17,X**

Forces analogue to digital conversion to restart for channels X to 1.

***FX21,X**
Flushes (empties) the buffer specified by the second parameter, as follows:
*FX21,0 – flushes the keyboard buffer
*FX21,3 — flushes the printer output buffer
*FX21,4-7 — flush sound output buffer number 0, 1, 2 or 3

***FX140,X**
Selects the cassette filing system, with any value of X.

***FX163,128, X**
Enables or disables input/output through the Plus 1:
*FX163,128,0 – enables printer and ADCs
*FX163,128,1 — disables printer and ADCs

***FX225, X**
Changes the effect of typing the user-defined function keys as follows:
*FX225,0 – ignores the function keys
*FX225,1 — the function keys will generate the character string defined by the user
*FX225,2-255 — the function keys will generate an ASCII code based on the second parameter: f1 generates a code one more than the second parameter, **f2** a code two more, etc

***FX226,X**
Changes the effect of typing function keys in the range A to P, as follows:
*FX226,0 — ignores function keys in this range
*FX226,1 — function keys in this range will generate the BASIC keywords marked on their keycaps
*F X226,2-255 — function keys in this range will generate an ASCII code based on the second parameter. **FUNC A** produces a code the same as the second parameter, FUNC B a code one higher, etc

***F X227, X**

Changes the effect of typing the remaining function keys (Q to Z plus : ; , /), as follows:

`*FX227,0` — ignores function keys in this range
`*FX227,1` — function keys in this range will generate the BASIC keywords marked on their keycaps

`*FX227,2-255` — function keys in this range will generate an ASCII code based on the second parameter. FUNC Q produces a code the same as the second parameter, FUNC R a code one higher, etc

***FX229, X**

Alters the effect of pressing the ESCAPE key as follows:

*FX229,0 — pressing ESCAPE will interrupt the BASIC program

*FX229,1 — pressing ESCAPE will not interrupt the BASIC program, but generate ASCII code 27 (decimal)

***FX230,X**

Enables or disables the normal action of the ESCAPE key, as follows:

`*FX230,0` – enables ESCAPE

`*FX230,1` – disables ESCAPE

From assembly language only

The following OSBYTE function is only accessible from assembly language, not as a * **F X** command:

To read the analogue inputs, call OSBYTE with A = 128 decimal and X = 0 to 4, as follows:

X = 0: returns number of last channel sampled and converted in Y
X = 1-4: returns last reading from channel specified in X, as 16- bit integer in X (low byte) and Y (high byte)

Other PRES products to enhance your Electron & Plus 1

Advanced ROM Adaptor 2

A standard size, Acorn approved cartridge (the same as Electron View & ViewSheet) but fully enclosed; no protruding ROMs to catch on the slot flaps or exposure to pontential dangers. Any 8k or 16K ROMs or EPROMs containing compatible software can be used to utilise socket nos. 0 & 1 or 2 & 3. Also, unlike some cheaper products, our PCBs only use gold plated connectors for maximum reliability. In line with our policy of compatibility, these cartridges/adaptors are designed for use on the Master 128. "The best ROM cartridge is by far the ARA 2" .... A & B Computing

** Advanced Plus 2 ROM

Possibly the best, low cost, addition produced for the Electron & +1 user, ideal for Plus 3, AP3 & ABR users. With this easy to fit upgrade you have instant access to the popular ADFS & sideways RAM utilities: now it is simplicity itself when you want to Format/Verify a disc, Build a !BOOT file or Lock/unlock/Load a ROM image into ABR - PLUS much more... the ideal companion from the company that produces the Acorn Plusl.
"The AP2 is the definitive Plus 1 ROM...like all of PRES's other products it's been well worth waiting for" Electron User *July* '88

** Advanced Plus 6

a fully buffered, internal ROM/RAM upgrade for the Plus 1. Will allow 6 ROMs or 4 ROMS & 2 RAMs to be fitted. Can easily be fitted into a PRES AP1 or with soldering experience into an original Acorn Plus 1. A fitting service *is* available if required. Now fit your most used ROMs internally and leave the two Plus 1 slots free for other expansions. A professional approach to ROM/RAM upgrade with all your valuable ROM software safely out of harms way! (also allows battery-backed RAM upgrade - AP7- to be fitted inside the Plus 1).

** The Advanced Plus 3

now you can turn your Electron & +1 into a full disc system - no more waiting for tape loading or 'bad block' / 'data ?' messages. A.P.3. *gives* you ...

1) a fully Acorn compatible 1770 interface
2) 80 track 3 1/2" disc drive, as used by Acorn (320k capacity)
3) Seperate PSU
4) Acorn ADFS
5) Welcome disc
6) Utilities
7) Full documentation.
8) All the advantages of the original Plus 3 PLUS extra ROM socket

Remember - 2nd. drives (3 1/2 or 5 1/4) can be added and the AP3 drive can be used on a BBC or Master computer! Also most Electron disc-based software is supplied on 3 1/2" ADFS discs.
The ONLY fully compatible disc upgrade running Acorn's own preferred filing system(supplied on:Plus3. Master128. Master Compact and now the Archimedes)

EXTRA BONUS... 3 disc-based games - SNAPPER - DRAUGHTS - REVERSI

** Advanced Plus 5

A unique interface for those wanting the maximum expansion from just one slot in the PLUS 1. AP5 contains:- a User port for connecting peripherals such as a mouse, 1 MHz bus allowing Music 5000(E), prommers and various control devices to be added, Tube interface for connecting an Acorn 2nd. processor or even a Master Turbo board (through a 'Co-Pro Adaptor') - & TWO spare ROM sockets (1 high priority). All hardware connections are Acorn compatible thereby allowing many BBC products to be added (remember that *some* software modification maybe necessary for the Electron). So although some expansion options mt appear expensive on an Electron you do have upward compatibility.

** Advanced Battery-backed RAM

A standard Acorn approved cartridge but containing 32K (2 X 16K) of sideways RAM. The added bonus is the battery-backed feature that holds the RAM contents when the power is switched off! Different ROM images can be loaded into either bank from ROM images previously saved. The banks can also be locked to imitate ROM use. Now it is possible to have View & ViewSheet in one cartridge every time you switch on. Other uses include 8E00 ADFS, printer buffer, ROM software development. The use of ABR is simplified by the newly written PRES software utilities which include:- SaveROM. LoadROM. Lock, Unlock. Printer Buffer. Zero and MakeROM a new utility to put your own software from disc or tape into ABR 8 use the ROM filing system. All software is supplied in ABR with a simple menu to transfer the utilities to your own media. No hardware switching - totally software controlled. Instructions for using supplied software and necessary
information for users developing their own applications. "It's a superb add-on and a must for all serious Electron users" ...... Electron User

** Advanced QtrMeg RAM

A quarter megabyte is a whole 256K of extra sideways RAM. AQR provides this in a standard size, Acorn approved cartridge. Although ROM images can be loaded (with the appropriate software) into the various 16 banks of 16K RAM; AQRs primary and best use is as a RAM DISC. On an Electron this is acheived by using our ADFS 1.1 or ADFS &E00, both supplied with the necessary initialisation software to configure AQR as a 256K RAM DISC (the latter also regains 3.75K of main user memory on a Plus 3 system)

** User Port

a new low cost unit for those who just require a user port interface. Supplied in a standard size, Acorn approved cartridge, with the standard connector on top. Inside is a spare ROM socket which can also be configured for high priority use such as mouse software.

** 1 MHz Bus

a new low cost unit for those who just require a 1 MHz Bus interface. Supplied in a standard size. Acorn approved cartridge, with the standard connector on top. Inside is a spare ROM socket for any application ROM software.

** Advanced Plus 7 ...

an internal battery-backed RAM upgrade for the Advanced Plus 6. TWO 16K pages of Sideways RAM, battery-backed and featuring full write protect facility. Just like ABR but fitted internaly & vacating a +1 slot.

** Advanced Basic Editor +

an exciting new product based on Acorn's original Basic Editor. It contains all the original features plus enhancements that make it one of the most powerful basic editors available. Supplied as a 32K ROM module or a cartridge with spare ROM socket

Advanced Plus 2 ROM
(when fitted)

This is a ROM to replace the resident ROM in the Plus 1. (NB when fitting ROM, please make sure the notch is correctly aligned -same *as* existing one). When power *is* applied it boots the Basic ROM. which may thereafter be configured to any other language for all subsequent CTRL BREAKs or BREAKS using *LANG. The default language is indicated on *ROMS.

All commands can be abbreviated, be in mixed case, and prefixed with a 'P' to avoid name clashes (although AP2 ROM should get the command first anyway).

A help routine has been included to Acorn standard, for all the * commands & showing their parameters. This is called with <*HELP/*H. +1>. The * commands in AP2 ROM are:-

*AQRPAGE selects the specified page in *any* AQR present & then checks the images being presented to the OS to cater for any images which may have changed
syntax - *AQRPAGE <page>

*BUILD creates a text file which may subsequently used by *EXEC.
syntax - *BUILD <filename>

*DUMP to view file contents. Width of display adjusts automatically to current screen mode. 16 across in 80 chr mode, 8 in 40, and 3 in 20.
syntax - *DUMP <filename>

*FORMAT to format ADFS discs. Size defaults to M. If the user has ADFS 1.00 the ZYSysHelp file will be produced.
syntax - *FORMAT <ADFS drive> (<S|M|L>). ADFS only.

*INSERT to 'insert' a previously unplugged ROM bank. Although the restoration is immediate. BREAK may have to be pressed to let certain ROMs, like FSs, to initialise. A warning message is displayed to that effect.
syntax - *INSERT <bank>

*KILL is a replacement for *UNPLUG for the Plus 1. Allowing *UNPLUG to partially disable the Plus 1 could be catastrophic, so this command does the job completely. It first asks the user to confirm that they are serious, then resets the machine to make sure all ROM's are inserted.
Officially the only way back is to re-apply power.

*LANG selects the default language to be booted on a CTRL-BREAK. It is set to Basic (bank B) on power up. The default language is indicated by a * instead of a : in *ROMS just after the bank number. *LANG will only allow Language ROMs (excluding the Plus 1 ROM) to be specified, and will start the language up as well.
syntax - *LANG <bank>

*LIST displays a numbered listing of a file such as !BOOT
syntax - *LIST <filename>

*LOADROM to load a ROM image from the current FS, and attempt to install it in a ram bank (which can be specified by the user).

syntax - *LOADROM <filename> (<bank>) (L)

CLOCK locks a RAM bank. After deciding whether it is an odd or even socket it then accesses the appropriate locations for an ACM, ABR, ASR or AP7

Syntax CLOCK <bank>. See also *LROMS.

*LROMS locks all RAM banks, and then produces a *ROMS display.

*ROMS displays all the enabled and unplugged ROM images resident in the computer. The default language is indicated by a * instead of a : after the bank number. Unoccupied RAM banks will also be shown. The characters within brackets have the following possible values :

```
1st chr S=Active Service ROM,       U=Unplugged Image,    ' '=No Svce entry
2nd chr L=Active Language ROM, ' '=No Language entry
3rd chr R=This is a RAM bank,       ' '=Failed RAM test.
```

*SAVEROM saves a copy of a ROM image to the current filing system.

syntax - *SAVEROM <file> <bank>

*TYPE displays a file on the screen, without line numbers.

syntax - *TYPE <filename>

*UNLOCK unlocks a RAM bank. After deciding whether it is an odd or even bank it will access the AQR, ABR, ASR and AP7 locations

Syntax *UNLOCK <bank>. See also *UROMS.

*UNPLUG disables a ROM image. The user is not allowed to unplug the default language, nor the Plus 1 ROM. To unplug default lang., alter the CLANG setting first, to unplug Plus1 use *KILL instead. UNPLUGged images are detected and shown on *ROMS, even though they are inactive. UNPLUG will attempt to disable images immediately, but a BREAK may be needed to sort out the more 'integrated' programs. A warning message is displayed to that effect.

syntax - *UNPLUG <bank>

*UROMS unlocks any RAM banks, and then produces a *ROMS display.

*VERIFY reads every sector of an ADFS disc to test it. Since *VERIFY is a popular command name this routine will only respond if ADFS is the current filing system,

syntax - *VERIFY <ADFS DRIVE>. ADFS only.

*VFORMAT is a *FORMAT followed by a *VERIFY on the drive.

*ZERO (from v.1.18) this will clear the necessay bytes in a RAM bank so the MOS 'sees' an empty or ZERO position

syntax - *ZERO <bank>

Notes

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