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General information on Ethernet cards for RISC OS computers

This application note details some of the less well known features of the Ethernet cards which Acorn supplies to its customers. At the present time Acorn cards are manufactured by ANT Ltd and I³ and as a consequence the information in this application is of direct relevance to cards produced by these manufacturers. However, much of the information concerning the interpretation of statistical information can also be applied to cards by other manufacturers.

This application note also examines the installation and use of Acorn Access cards in AUN Gateways and TCP/IP sites.

Applicable Hardware :	All RISC OS based computers fitted with RISC OS 3.10 or later.	Related Application Notes:	None

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Introduction.

This application note will provide the more inquisitive user of Acorn Ethernet networks with information concerning the setup and configuration options of the cards supplied by Acorn. This application note is not intended to guide the reader through the process of setting up an Ethernet net. Those readers who require this information should refer to the documentation supplied with either the Ethernet card(s) and the appropriate network software.

Diagnostics and Self Test.

All cards supplied by Acorn are capable of performing a self test the first time they are powered up. In the case of the Ethernet III card the subsequent self test behaviour is configurable by the user. See the section: Ethernet III configuration options. The I³ is not configurable in this respect.

The following describes the basic tests performed by the I³ card:

On power up or after a reset the software will perform a self test and cable check.

On board buffer memory is tested.

Internal and external loopback on NIC is used to test:

DMA
CRC generation and checking
address recognition
serializer/deserializer
transmit and receive paths
network interface

External loopback tests the integrity of the cable and termination.

Fault conditions are detected, diagnosed and reported.

Errors which are detected are usually reported at boot time or are accessible from the *Netstat command. For example the Ethernet III card will generate the following information on power up when in test mode:

```
Locate controller . . . . . . . . . 16 bit SEEQ controller
Testing for stuck interrupts  . . . PASSED
Testing controller registers  . . . PASSED
Testing individual interrupts . . . PASSED
Testing buffer memory . . . . . . . PASSED
Loopback test with correct CRC  . . PASSED
Loopback test with incorrect CRC  . PASSED
Loopback test with controller CRC . PASSED
Live test with correct CRC  . . . . FAILED
Warning: No access to network; restart computer to clear
```

or

```
*Netstat
Warning: No access to network; restart computer to clear
```

Ethernet III card configuration

Setting the configuration

If the configuration of a card is stored in CMOS RAM (as is the case for all podules or cards that fit in network slots) then the card configuration is set using the *Configure command. The configuration command takes the form:

```
*Configure EtherX <option> [<n>]
```

Where X represents the type of driver (eg Ether3 or EtherB) and <option> is the configuration option the user wishes to set. For drivers that support multiple cards (i.e. drivers for podules rather than netcards) there is an optional numeric parameter [<n>] to choose which podule slot is to be configured. If this parameter is omitted then the configuration will be set on all suitable cards installed in the computer at the time.

Configuration options

Disable | *Enable*

Configure ‘Enable’ if you wish to use the card. When configured to ‘Disable’ the card will not be self-tested nor will it transmit or receive any packets.

OldInet | *NewInet*

Configure the Ethernet card to ‘NewInet’ unless you are using versions of the AUN modules “Internet” or “InternetA” prior to 2.00. This configuration enables faster data transfers when NewInet is supported. Later issues of the driver software set this configuration by default; older ones may not.

Strict | *Ignore*

If the interface is configured to be ‘Strict’ then should the interface fail its selftest it will return an error and not activate itself for network accesses. If the unit is configured to ‘Ignore’ the selftest result then the unit will activate itself even if the selftest fails. The card should always be in a ‘Strict’ state for normal operation.

NoLiveWireTest | *LiveWireTest*

These configurations determine whether the Ethernet network cabling is tested during the card’s self-test sequence. When configured to ‘LiveWireTest’ both valid and erroneous packets are generated onto the network and tests performed to see that they are correctly received. Configuring ‘NoLiveWireTest’ prevents the cabling test from being performed.

Terse | *Verbose*

When configured ‘Terse’ the EtherX driver will only report information to the user when there is a need. The selftest of a card will happen silently unless there is an error to report and the information command (EXInfo) will only report statistics collected for the interface if the statistic count is non-zero. If the unit has been configured to be ‘Verbose’ then all the stages of the self test will cause a message to be printed and all the statistics for the interface will be listed even when the count is zero.

Default

Configuring an interface to the ‘Default’ state will set all five configuration switches to the default settings. For production versions of the software the default state is:

`Enable, OldInet[1], Strict, NoLiveWireTest, Terse.`

[1] Old software only

Configuring the Pocket Ethernet Adaptor (PEA)

For cards that fit externally to the host machine, such as the PEA, the configuration for the unit is stored in a system variable. A system variable of the form Ether<X>$Options is looked for on startup and if it is found the content is parsed. The content of the variable should be a list of the options described above separated by spaces and/or comers. Any options that are not set are assumed to be in the default state. If any option is set more than once the rightmost setting takes precedence. This variable is usually set in the !Configure file of a !Internet or !BootNet application. For example the setting for a pocket Ethernet adaptor might be:

```
*Set EtherP$Options "Strict, LiveWireTest, Verbose"
```

Ethernet card driver information

Statisitcal information can be derived from ethernet cards using a command such as ***E3Info.** This is this command for Ether3 (AEH54) cards. RiscPC ethernet cards and A3020 cards from Acorn use the command ***EBInfo** and ***EHInfo** respectively.
The statistical information varies from manufacturer, but once understood it is possible to easily identify the appropriate elements from any manufacturers card. eg.

```
*E3info
Ether3 interface statistics

ea0: bussize 16 (1a), slot 0, enabled, hardware address 00:02:07:dd:ee:ae

packets received = 57368             packets transmitted = 12954
bytes received = 7306050             bytes transmitted = 3656228
receive interrupts = 57274           transmit interrupts = 12952
interrupts = 68569

Frame types recognised: 0x0800, 0x0806, 0x8035.
```

Or alternatively:

```
*ehinfo
DCI Version         2

Card Info:-         i-cubed ltd, EtherLan 200 Ethernet interface
                    Ethernet address=00:c0:32:00:0a:3c
                    i-cubed 10Base2 MAU adaptor connected.

I/O Stats:-         Rxframes=20, Rxerrs=0, Txframes=18, Txerrs=0
                    Collisions=0, Rejects=0
```

Description of statistical information from E<n>Info

The information will be categorised according to the headings used in each cards statistics. The headings are structured Ethernet III card / I^3 card.

Packets received/Rxframes

A count of the number of packets which have been received by the station.

Not provided/Rxerrs

A count of the number of packets which were received in an incomplete or corrupted state. Normally this value should be 0. If it is not then there is a fault on the network. Faults are reported as an additional line indicating the type of error(s).

Packets transmitted/Txframes

A count of the number of packets which have been transmitted by the station.

Not provided/Txerrs

A count of the number of packets which were transmitted by the station and received by the destination station in an incomplete or corrupted state. Normally this value should be 0. If it is not then there is a fault on the network. Faults are reported as an additional line indicating the type of error(s).

Bytes received/Not provided

The total number of data bytes contained in the packets received by the station.

Bytes transmitted/Not provided

The total number of data bytes contained in the packets transmitted by the station.

Receive interrupts/Not provided

The total number of interrupts generated by the card for the purpose of receiving data.

Transmit interrupts/Not provided

The total number of interrupts generated by the card for the purpose of transmitting data.

Interrupts/Not applicable

The total number of interrupts generated by the card.

Not applicable/Collisions

A count of the number of times the computer has attempted to access the network simultaneously with another.

Not applicable/Rejects

A count of the number of packets addressed to the computer but which were not understood. On a pure AUN network this should always be 0.

The format of the **Netstat** information remains constant irrespective of the manufacturer. The statistics from this command are displayed as shown below:

```
*Netstat a

Interface         ea
AUN Station       128.52
Full address      136.170.128.52
Broadcast         136.170.135.255

Known nets        128   129   130   131

TX stats          Data=1186, Immediate=2, Imm_Reply=2, Retry=150
                  Error=0, Data_Ack=1194, Data_Rej=283, Broadcast=935
                  (local=0, global=935)

RX stats          Data=1477, Immediate=2, Broadcast=21156, Discard=0
                  Retry=279, Error=0, Data_Ack=1031, Data_Rej=155
                  Imm_Reply=2, Reply_Rej=0

Module status     01
```

The most useful terms are generalised below:

TX stats

Immediate The number of times the Econet_<xxx>Immediate SWI calls have been issued.

Imm-reply Number of responses to the Econet_<xxx>Immediate SWI calls.

Retry Number of times the station has had to re-send data due to the packets being rejected by the receiving station. Data_rej should correlate with this value.

Error Number of transmission errors reported by the IP software.

Data_Ack Number of successful packets sent

Data_rej Number of times transmissions have been rejected. (See Retry.)

Broadcast Number of broadcasts sent.

Local	- restricted to the subnet
Global	- restricted to the site

RX stats

Unless specifically mentioned all statistics have the same meaning as above but refer instead to receiving data.

Discard A count of the number of packets received which the interface software does not understand.

Possible hardware faults

IMPORTANT: Most electronic devices can be damaged by static electricity. To reduce the possible adverse effects of static electricity note the following points when installing any component(s) or upgrade:

- preferably work on an earthed antistatic mat, with an earthing bracelet one you wrist
- avoid working in areas where there are man-made fibres, such as nylon carpets and nylon clothing
- avoid touching the pins of components during fitting, unless you have first discharged any static electricity you may have attracted.

A3000 computers

The procedures outlined below do not apply to A3000 computers. The network interface card on an A3000 is intended to be fitted by an Acorn Authorised Dealer, who will install and test the upgrade. A charge may be levied by the dealer for installing the upgrade; such a charge shall be entirely at the discretion of the dealer concerned.

In order to minimise the effects of static we recommend the following procedure:

- dismantle the computer as described in the appropriate fitting instructions
- Reconnect the computer to the mains, but **do not** switch on.

  While the computer is connected to the wall socket:

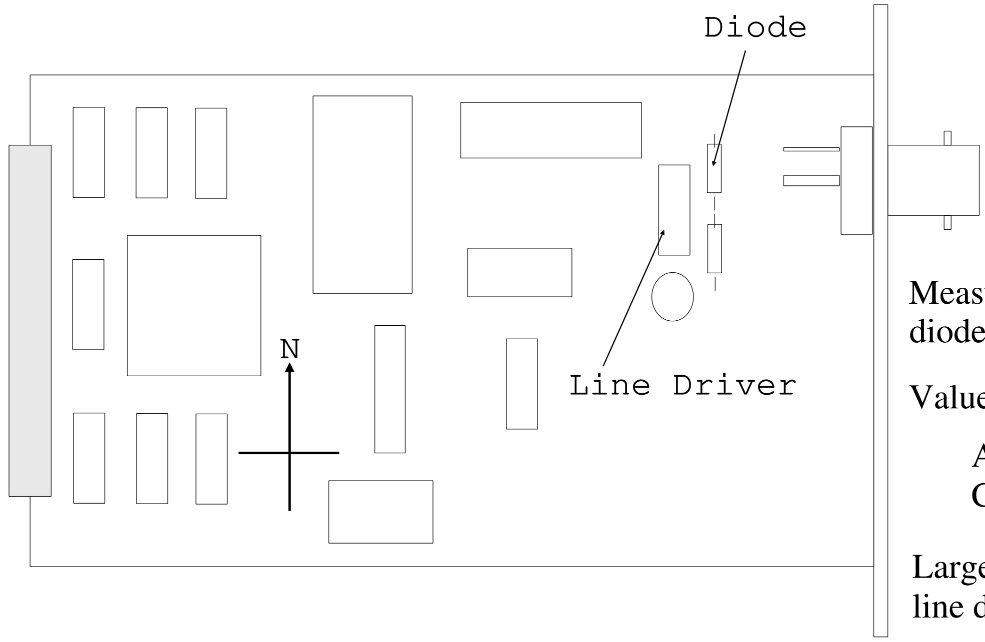
  Do not switch on the computer.

  Do not switch on power at the wall socket.

- Touch the power supply unit or the metalwork of the case to discharge any static electricity that you may have attracted. (If you are statically-charged, you may feel a tingling sensation when you do this.)

- Complete the removal/fitting of the interface as described in the appropriate instructions.

If you are suspicious that the line driver may be damaged by exposure to static electricity then it is possible to test the integrity of the line driver with a multi-meter. The design of the A3020 and A4000 network slot cards prevent access to the necessary components in order to perform the following test. In this instance these cards must be returned to your supplier.



Measure the resistance across the diode in both directions.

Values should be:

Anode-Cathode	Infinity
Cathode-Anode	500Kohms

Large deviation in value indicates line driver damage.

Ethernet III card showing line driver and diode protection.

Should the line driver be damaged it will require returning to your supplier for the line driver to be replaced.

I³ Ethernet cards are fitted with a small fuse which will protect the computer from damage in the event of a failure. This fuse can be damaged by static and consequently may need replacing. If you are suspicious that the fuse may have failed it can be tested using a multi-meter. Identify the component marked F1; it is normally a round device rather like a capacitor is shape. Using a meter measure the resistance across the two pins. If the value is greater than 0 ohms then the fuse is damaged.

Note: **This fuse must be replaced with one of the same rating and type. Do not fit a fuse of a different specification. If in doubt contact your supplier before proceeding.**

Acorn Access Ethernet cards

This section details some of the issues surrounding the use of Acorn Access cards in different situations.

When an AUN Ethernet III card is placed into a machine the bulk of the software is dormant on power up. This software consists of the following or later modules:

```
Ether3      1.26      *
InternetA   1.13
```

```
NetMsgs     0.02
Net         1.21
BootNet     0.84        *
```

(Modules marked with * are active on power up)

The software is activated or “switched on” by the Bootnet module which provides the * command:

`*configure Bootnet On|Off`

When Bootnet is configured on all the software modules on the card become active.

The Internet module provides the communication centre which allows the Ethernet card hardware to pass data to the computer. In order to ensure that the software could be placed on a convenient sized ROM the Internet module was “cut down” so that it only supported the features required by AUN. This “cut down” Internet is named InternetA. As we shall see there are different versions of the Internet module for different tasks.

!Gateway

It is often necessary to provide communication between two similar or disparate networks. Under AUN this functionality is provided by a Gateway. It was considered to be better for there to be a clear differentiation between client and Gateway stations under AUN and so the Gateway function is achieved by a software application; !Gateway. This requires an enhanced version of the InternetA module; InternetAG, to be present in the computer. In order to prevent a clash between the InternetA and the InternetAG modules it is necessary to “switch off” the AUN client software (*Configure Bootnet off) before running the Gateway application. This results in the InternetAG module been used instead of InternetA.

TCP/IP

In an Internet site (such as Acorn) the client stations may require access to both Internet and AUN services. Provided in the AUN Level 4 Fileserver pack is the !Bootnet application software for such a situation. It is possible to achieve this level of connectivity by simply disabling the AUN client software and running the !Internet and !Bootnet applications in that order. The !Internet software provides a fully functioning version of the Internet module called Internet. When this version of the software is loaded it is not possible to use the !Gateway application, as this is superseded by the gateway functionality provided by the Internet software.

Acorn Access

When an Acorn Access card is placed into a machine the Access software is immediately activated on power up. This software consists of the following modules:

```
Ether3      1.26        *
InternetA   1.13        *
NetMsgs     0.02
Net         1.21
AccMsgs     0.01        *
BootNet     0.84        *
Freeway     0.10        *
ShareFS     2.23        *
```

```
ADFSFiler   0.69        *
```

(Modules marked with * are active on power up)

The presence of the InternetA module at power up normally renders the Acorn Access card unsuitable for use in a Gateway computer or as a client in a full Internet site. This is because the InternetA module is incompatible with the other versions needed by !Gateway and !Internet. In order to provide the necessary alternative the InternetA module needs to be unlinked from the other software before it can be replaced. The links to the other modules then need to be rebuilt.

As you can imagine, this is a somewhat involved and convoluted process. The remainder of this document describes this process and thus enables Acorn Access cards to be used in these environments.

Integrating Acorn Access and TCP/IP.

This is the most straight forward of the different scenarios to get working successfully. It requires the building of a two stage boot sequence which includes a file which is accessed before the desktop is active and a file which is called when the desktop becomes active.

The information provided here assumes that the necessary changes to the !Internet and !BootNet application have been implemented. If a !Boot file; of type Desktop, already exists then rename it as Desktop.

Using !Edit create an Obey file which contains the following lines:

```
RMKill InternetA
RMKill ShareFs
RMKill Freeway
RMKill AccMsgs
Run ADFS::4.$.Apps.tcp_ip.!Internet.!Run
RMReinit AccMsgs
RMReinit Freeway
RMReinit ShareFs
Run ADFS::4.$.Apps.tcp_ip.!BootNet.!Run
Desktop -f ADFS::4.$.Desktop | Used if there is a Desktop file
|Desktop | Used if there isn't a Desktop file.
```

Note: The pathnames to the applications and files may vary according to the disc structure used. The order in which the modules are *RMReinit-ed is vital.

Save this file as `!Boot` and reset the machine.

Integrating Acorn Access and !Gateway.

A two stage boot sequence is required. The information provided here assumes that the necessary changes to the !Internet and !BootNet application have been implemented. If a !Boot file; of type Desktop, already exists then rename it as `Desktop`.

Using !Edit create an Obey file which contains the following lines:

```
RMKill Freeway
RMKill Sharefs
```

```
RMKill InternetA
RMKill AccMsgs
Desktop -f ADFS::4.$.Desktop
```

Note: The pathname to the Desktop file may vary according to the disc structure used.

Save this file as !Boot.

Using !Edit create a file of type Desktop or alternatively add these lines to the very start of an existing Desktop file:

```
Run ADFS::4.$.Network.!GateWay
RMReinit AccMsgs
RMReinit sharefs
RMReinit Freeway
Run ADFS::4.$.Network.!Server | Optional
Run ADFS::HardDisc4.$.Network.!AAServer | Optional
Share ADFS::HardDisc4.$ HardDisc4 | Mandatory for each exported disc
```

Save this file as `$.Desktop`.

Notes:

!Gateway: This must be started after the desktop otherwise the gateway icon will not appear on the icon bar, although the gateway will function correctly.

!AAServer: If this is required on the Gateway machine, as well as Acorn Access, then the reference to -readonly must be removed from the !AAServer.!Config. If this is not done then the error Bad parameters will occur and !AAServer will fail to start.

This has the added side effect of the contents of the !Config file being passed straight to the command line where they are interpreted by Acorn Access. As a consequence they will appear as unprotected Access disc icons, thus preventing them from being accessed by !AAClient computers.

If the !AAServer directory(ies) are exported from the desktop each time then the commands are correctly passed to the !AAServer and exported accordingly.

Share This command is mandatory and is necessary for each of the exported Access discs in order to remind ShareFS of its exports. Failure to do this will result in any saved exports remaining unavailable.