

About This Remade Document

Title: ESG: Econet Data-Link Layer

Last remade: 31-Mar-2025

Repository: <https://github.com/acheton1984/AcornDocsRemade>

This is not quite the beautifully "remastered" document as seen elsewhere, but it is intended to be very similar to the original in an easy-to-read and searchable PDF format.

Reconstruction Notes

Source scan (no longer live):

http://www.andrewgordon.org.uk/ESG_econet_spec.pdf

- * Mention of this was first spotted on a Stardot thread - <https://www.stardot.org.uk/forums/viewtopic.php?p=309184#p309184>
- * Recreated from a scan of the original document.
- * Font sizes, margins, line spacing, and character spacing are only approximate. Some words may appear on different lines, but the overall layout and pagination are preserved.
- * Spelling errors have been corrected where spotted.
- * A title and remade document history page have been added, along with a link to this repository.

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---- original document follows ----

Econet Standards Group

Econet Data-Link Layer

This standard describes the format of data as it is actually placed on the network, and forms the lowest level of data transfer above the physical layer. This layer will be transparent to most users. It is divided into two sub-layers: the lower and upper Data-Link sub-layers.

Remade from a scan of an original document. This PDF hosted at:
<https://github.com/acheton1984/AcornDocsRemade>

The Lower Data-Link sub-layer

Data is sent on the network in frames. A frame has the form:

```

    Preceding flags (optional)
    Opening flag
    Frame Contents
    Closing flag

```

A frame may only be transmitted if the network is idle, or after a turn-round (described below). The network is idle if a sequence of 15 or more consecutive '1's has been sent. A flag consists of the bit sequence '01111110' - adjacent flags may overlap, so that '011111101111110' and '011111100111110' are both legal ways of transmitting two flags. The frame contents are an arbitrary sequence of bits. If this sequence contains five consecutive '1's, a '0' must be inserted after the fifth '1' to distinguish it from a flag, even if another zero immediately follows. For example, if the frame contents were '11111111100', then the total frame would be:

```
'01111110 11111011111000 01111110'
```

(inserted '0's are bold, spaces are used to separate the flags). This insertion of zeroes should be transparent to higher levels, and is assumed for the rest of this standard.

If an error occurs during transmission, the frame may be aborted simply by transmitting 7 '1's. A frame should only be accepted as valid if the closing flag is present.

The flags preceding the opening flag are optional. They are permitted in order that a station may hold the network without transmitting data, which may be necessary after a turn-round. This process is known as flag-fill.

The frame contents are a sequence of bits with the following format:

```

    16 bit destination address
    16 bit source address
    I-field
    16 bit CRC

```

The addresses and CRC are sent least significant bit first. The I-field is an arbitrary sequence of bits. However, it is normally used to hold a sequence of bytes; in this case the bytes are sent in the order presented, least significant bit first.

An address is divided into station number (8 lower bits) and network number (8 upper bits). An address of &FFFF is used to indicate a broadcast. See ESG0002 for further details. The source and destination addresses refer to the rôles of the stations for that specific frame, and not their general rôles in the protocol.

The CRC is generated using the $X^{16}+X^{12}+X^5+1$ polynomial method. A frame with a wrong checksum should be treated as an error.

The I-field depends on the use to which the frame is being put.

Many protocols at higher levels depend on a system of turn-round, as follows. When a frame has been transmitted, the sending station must immediately drop the line. If the protocol in use (which may be indicated by the I-field of the frame) is one which requires a turn-round at this point, then the destination station must claim the net before 15 '1's have passed, by transmitting at least one flag. The protocol will require this station to transmit a frame - this can be delayed by using flag-fill.

The Upper Data-Link sub-layer

The operation of the upper Data-Link sub-layer can be divided vertically into two parts - broadcast and non-broadcast - depending on the destination address.

Non-Broadcast

The first frame in a transaction is called the scout frame. The first two bytes of the I-field of the scout frame define the protocol in use:

Byte 1	Byte 2	Meaning
&00 to &7F	any	Undefined
&80 to &FF	&00	Immediate operations
&80 to &FF	&01 to &FE	Data packet transmission
&80 to &FF	&FF	Undefined

After the scout frame has been transmitted, a turn-round occurs. If the destination station does not wish carry out the protocol, then it must drop the line without transmitting a frame in return.

An acknowledge frame is one with an empty I-field.

The rest of the protocol for a data packet transmission from station A to station B is as follows:

- 1) Station B sends an acknowledge frame to station A.
- 2) A turn-round takes place.
- 3) Station A sends a frame to station B, with the data sent forming the I-field.
- 4) A turn-round takes place.
- 5) If station B received the frame correctly and in good order, then it sends an acknowledge frame to station A. Otherwise it must drop the line without transmitting a frame in return¹.

The control byte and port number of the data packet form the I-field of the scout frame, in that order. The I-field must be exactly two bytes long.

Immediate operations are not defined further in this standard.

¹ Annotated 'N.B. B accepts data even if Tx ACK FAILS'

Broadcast

All transactions consist of a single frame, called the scout frame for compatibility with the non-broadcast form. The first two bytes of the I-field of the scout frame define the protocol in use:

Byte 1	Byte 2	Meaning
&00 to &7F	any	Undefined
&80 to &FF	&00	Undefined
&80 to &FF	&01 to &FE	Data packet transmission
&80 to &FF	&FF	Undefined

With a data packet transmission, the I-field must be between three and eight² bytes long. The first byte is the control byte, the second byte is the port number, and the rest of the I-field is the actual data.

Approval

² Crossed out and changed to 'ten'.