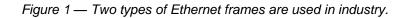**ETHERNET FRAMES**

The two types of Ethernet frames used in industry are similar. The DIX V2.0 frame, frequently referred to as the Ethernet II frame, consists of an eight-byte preamble, six-byte source and destination addresses, a two-byte type field used to identify higher layer protocols, a variable data byte field followed by a four-byte frame check sequence (FCS) field. The IEEE 802.3 frame divides the preamble into a seven-byte preamble followed by a single byte start of frame delimiter (SFD). The two-byte type field now becomes a two-byte length field. The data field now includes an 802.2 Logical Link Control (LLC) field that precedes the actual data. The FCS remains the same.

Ethernet II DIX Frame						
64 bits	48 bits		48 bits	16 bits	368 to 12000 bits (46 to 1500 bytes)	32 bits
Preamble	Individual / Group Address Bit	Destination Address	Source Address	Type	Data	Frame Check Sequence

IEEE 802.3 Frame							
56 bits	8 bits	48 bits			48 bits	16 bits	368 to 12000 bits (46 to 1500 bytes)	32 bits
Preamble	SFD	Individual/ Group Address Bit	Globally/ Locally Administered Address Bit	Destination Address	Source Address	Length	LLC/Data	Frame Check Sequence

Figure 1 — Two types of Ethernet frames are used in industry.

Preamble

The DIX preamble consists of 64 bits of alternating "1s" and "0s", but ending with two "1s" to indicate that a valid frame is to begin. This creates a 10 MHz signal that synchronizes the receivers on the network before actual data arrives. Ethernet uses Manchester encoding.

The IEEE redefined the preamble to be seven bytes of preamble, the same as the DIX preamble, followed by a one-byte start of frame delimiter (SFD) which looks like the last byte of the DIX preamble. There is no change in operation between the DIX preamble and the IEEE preamble and SFD byte. Both preambles are considered not part of the frame when calculating the size of the overall frame.

Destination Address

In the DIX standard, the first bit of the 48-bit destination address indicates whether the address is a multicast address or a physical address. A "0" indicates a unicast transmission to the indicated destination and a "1" indicates a multicast or group address.

The IEEE standard further defines the second bit of the 48-bit destination to indicate whether the address is locally administered or globally administered. This bit is a "0" when the address is globally administered; that is, assigned by the Ethernet interface manufacturer.

A 48-bit address of all "1s" is a broadcast address in both DIX and IEEE formats, indicating that the transmission is directed to all devices on the network.

Source Address

The 48-bit source address is appended to the transmission as an aid to the higher layer protocols. It is not used for medium access control. To avoid duplicate node IDs for global addresses, the Ethernet adapter manufacturer obtains an Organizationally Unique Identifier (OUI) from the IEEE (for an administration fee). The OUI is 24-bits long and is used as the most significant portion of the 48-bit address. The manufacturer, using good record keeping, will assign sequential numbers to each adapter card he makes thereby creating a worldwide unique address. With 24-bits to work with, a lot of adapters can be produced from a single manufacturer. A list of OUI assignments can be found on the Internet.

Type and Length Field

The original intention of Ethernet was never to use its data link layer as the means for providing guaranteed delivery of data. It was always the intent that a higher layer protocol would do that service. Therefore, it was only necessary to identify by number which higher layer protocol was being used through the two-byte field in the DIX frame. Originally, Xerox maintained the assignments and now IEEE provides the administration.

The 802.3 standard does not include the type field but instead defines it as a length field. Per the 802.3 standard, a value in this field of 1518 or less indicates the length of the data field, while values above this may be ignored, discarded or used in a private manner. These out of bound values could then be used to identify higher layer protocols just like DIX frames.

What is important here is that since DIX and IEEE frames are identical in terms of the number of bits and length of fields, both frames can coexist on the same network but may not be able to communicate to one another. Much of the existing TCP/IP software that binds to Ethernet uses DIX frames and not 802.3 frames, so care must be exercised when selecting or developing software or claiming interoperability.

Data Field

A raw Ethernet frame (no encapsulated protocol or LLC) can be up to 1500 bytes long but no less than 46 bytes. This is the DIX frame.

Although the total available length of the IEEE data field is the same as the DIX frame, the LLC header reduces the amount of field available for actual data or payload as it is sometimes known. If the LLC header and actual payload are less than 46 bytes, the data field must be padded to 46 bytes to ensure that the transmission is not interpreted as a runt packet or packet fragment.

Frame Check Sequence

Both the DIX and IEEE standard use four bytes to hold the CRC-32 check on the complete frame from destination address all the way to the end of the data field. The receiving station calculates its own CRC-32, checks on the received data and compares the results with the transmitted CRC-32 value for a match indicating a successful reception. Note that there is no inherent mechanism in the Ethernet data link layer protocol to inform the source node that a reception was accepted or rejected due to a failed CRC-32 check. That task is left to the higher layer protocol.