



**AM-TR-NIS-000096**

## **Host Interconnect Service Interface Specification**

To: All Interested Parties

Effective Date: July, 1992

Issue Date: Issue 2, July, 1992

Expires On: N/A

Related Documents: N/A

Canceled Documents: N/A

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## 1. PURPOSE

This document describes a single mode fiber, User Network Interface specification for Ameritech's proposed Host Interconnect Service.

## 2. CHANGE AND REISSUE

This is a second issue of this document. It has been modified to reflect certain technical enhancements that increase the flexibility of the interface.

## 3. GENERAL

The Host Interconnect Service provides high-speed, optical fiber-based transmission of the ESCON XDF™ (Trademark of International Business Machines Corporation (IBM).) (Enterprise System CONnection eXtended Distance Feature) protocol. This protocol is used to connect mainframe computing environments to both CPUs and peripherals. Although, the ESCON (Trademark of International Business Machines Corporation (IBM).) protocol is primarily used in an IBM™ (Trademark of International Business Machines Corporation (IBM).) based environment (in support of IBMs Enterprise System Architecture/390™ (Trademark of International Business Machines Corporation (IBM).)), this published protocol may be supported by other vendors, either to connect their peripherals to mainframes or to interconnect their own mainframes.

The service will be marketed as a private dedicated optical circuit. It will allow customers to extend their host ESCON channels beyond the confines of the customers' own premises. With the service, mainframe computers using a channel architecture and their peripherals will no longer be limited to a single premise or intracampus applications. It permits a user of ESCON compatible hardware to extend the operating range of host to peripheral or host to host applications.

## 4. HOST INTERCONNECT SERVICE CHARACTERISTICS

The Host Interconnect Service supports a transmission rate of 200 Mbps over dedicated, single-mode, optical fiber pairs. One pair is required for each ESCON I/O channel supported. Two basic configurations are supported, point-to-point and multipoint. In a point-to-point configuration the service will link two customer locations with a dedicated connection. In a multipoint configuration the service will support ESCON connections between multiple customer locations. These configurations are explained in Section 5.

The Host Interconnect Service provides transmission of the ESCON protocol. ESCON allows channel connections between mainframes and peripheral devices such as Direct Access Storage Devices (DASD), Tape Controllers, and Communications Front End Processors (FEPs) or other CPUs to be extended beyond the limit of 200 Meters provided by copper channel ("bus

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and tag”) cables. ESCON XDF which is IBM’s single mode fiber host connection allows the channel to be extended beyond the vicinity of the main frame up to 60 Kilometers.

Communications architectures based on ESCON protocols may have stringent distance limitations. These fall into two categories, those based upon attenuation of the optical signal due to the length of the link, and those due to timing interactions between the applications supported by the computing equipment at either end of the channel. The maximum link loss for a single mode ESCON link is limited to 14 dB. Ameritech’s Host Interconnect Service will provide a link loss of no more than 12.5 dB of the receive fiber of any link at the network interface. (See Section 3.3 of IBM’s Enterprise Systems Architecture / 390- ESCON VO Interface, Physical Layer document, references as primary reference [1] of Section 7.1 of this document.)

The timing limitations provide constraints on the entire length of any ESCON channel, which are largely dependent upon the specific hardware supported on either end of the channel. Ameritech, in engineering the service, will need to know the specific hardware and the timing/distance limitations at each end of the channels being transported. This information will be used to engineer the Host Interconnect Service transport link for channels so that they do not violate the known distance limitations of the configuration being supported. Because of specific internal configurations of Ameritech’s network, there may be some configurations that may be supported because of these timing/distance limitations. Since the maximum allowed length of a channel refers to its total length, the entire configuration of the channel, both on the customer premises and in the Ameritech network, will need to be considered in designing a Host Interconnect Service link for any customer.

Examples of such timing/distance limitations from IBM’s documentation are: (See Section 7.1 Secondary Reference [1]. These values are subject to change by the CPE vendor.

IBM CPU to IBM ESCON compatible DASD	9 Kilometers (Km)
IBM CPU to IBM ESCON compatible Tape	23Km
IBM CPU to IBM ESCON compatible Front End	43Km
IBM CPU to IBM CPU	60Km
IBM CPU to IBM BUS/TAG CONVERTER	3Km

Equipment from other vendors may have different timing/distance limitations.

## 5. HOST INTERCONNECT SERVICE ARCHITECTURE

Two configurations are supported for providing the transport for the ESCON XDF channel, 1) point-to-point, and 2) multipoint. The configurations are illustrated in Figures 1 and 2.

An ESCON XDF channel can be made up of the following components.

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- Pairs of half duplex fiber links supporting a transport rate of 200 Mbps.
- Customer owned processor channels on the CPU which terminate the ESCON channels.
- Up to two “Directors” (“Director” is IBM’s terminology for any device which provides, switching, optical regeneration, or conversion from single mode to multi mode transport for an ESCON channel.) which provide signal regeneration and switching for the channel.
- Regenerators which provide signal regeneration for the channel.
- A channel termination at the peripheral devices (or remote CPU) for ESCON protocols.

The network interface between Ameritech’s Host Interconnect Service will be a fiber connector that links the customer’s single-mode fiber to Ameritech’s fiber. The “receive” fiber is always “lit” by the Director or Regenerator in Ameritech’s Network, while the “transmit” fiber is always “lit” by the customer’s CPE. (See Figure 3).

The Host Interconnect Service architecture requires a minimum of one Director or Regenerator in the Ameritech Network to support management of the service. There can, however, be at most two Directors in any path between any ESCON link, and there can be only one switchable Director in the link. Because of the limitations on the number of Directors that can be placed on a channel, customers need to take this into account. This will affect the overall configurations in general and the number of customer owned Directors in particular.

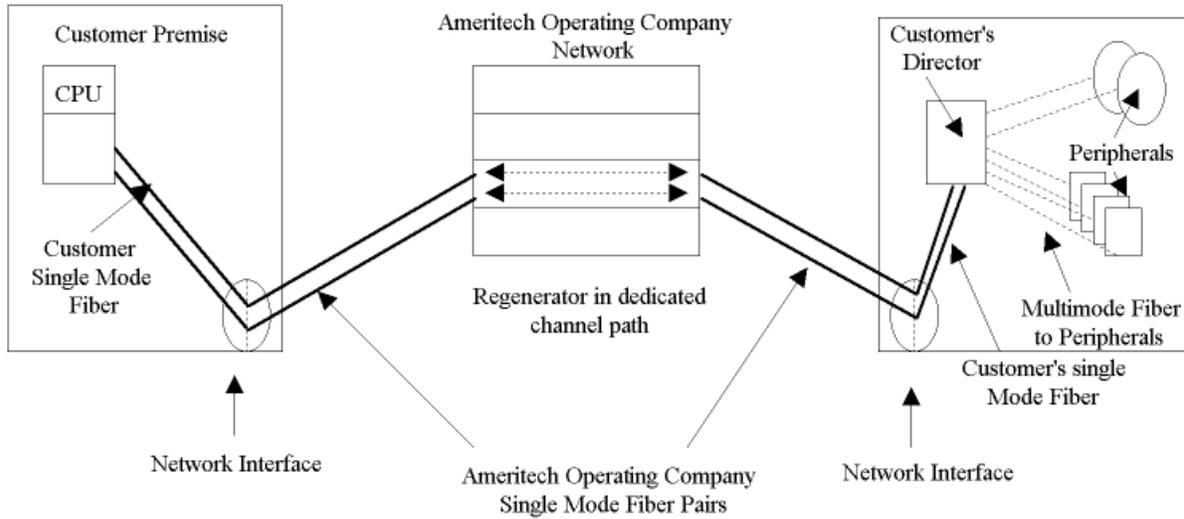
In Figure 1, point-to-point architecture, the Regenerator in Ameritech’s network is passive, in that it provides regeneration and network management functionality only. Any switching will be performed by a customer’s Director. Since a Regenerator will be used within Ameritech’s network the customer may place up to two Directors in the channel as fits the customer’s requirements.

In Figure 2 - multipoint configuration, the messages sent over the channel, will be routed via a network based “Director” to the appropriate destination point/s. This routing will occur on a message by message basis depending on routing information carried in the message as defined in the ESCON protocols. The Director for multipoint configuration in Ameritech’s network performs the switching functions, and since there can be only one switchable Director on the link, a second Director, which is customer owned, cannot be configured to switch the channel messages.

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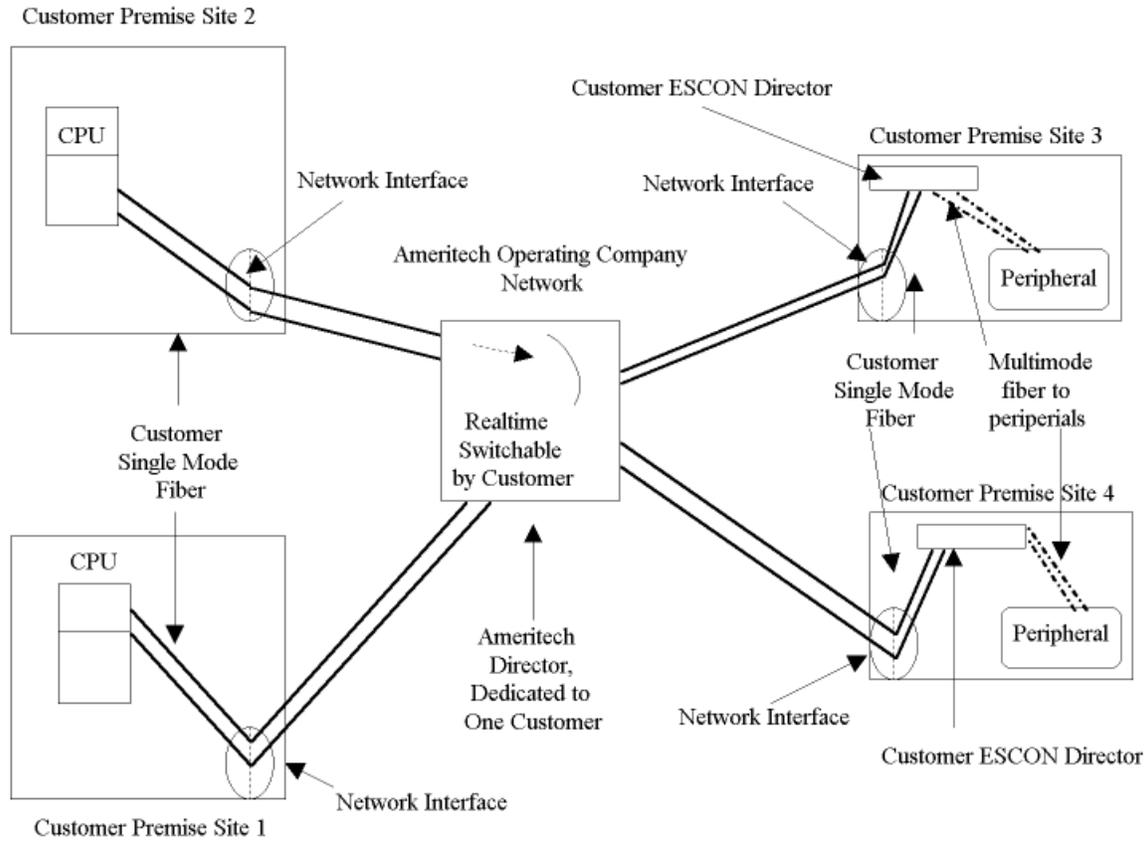
Figure 1. Host Interconnect Point-to-Point Service



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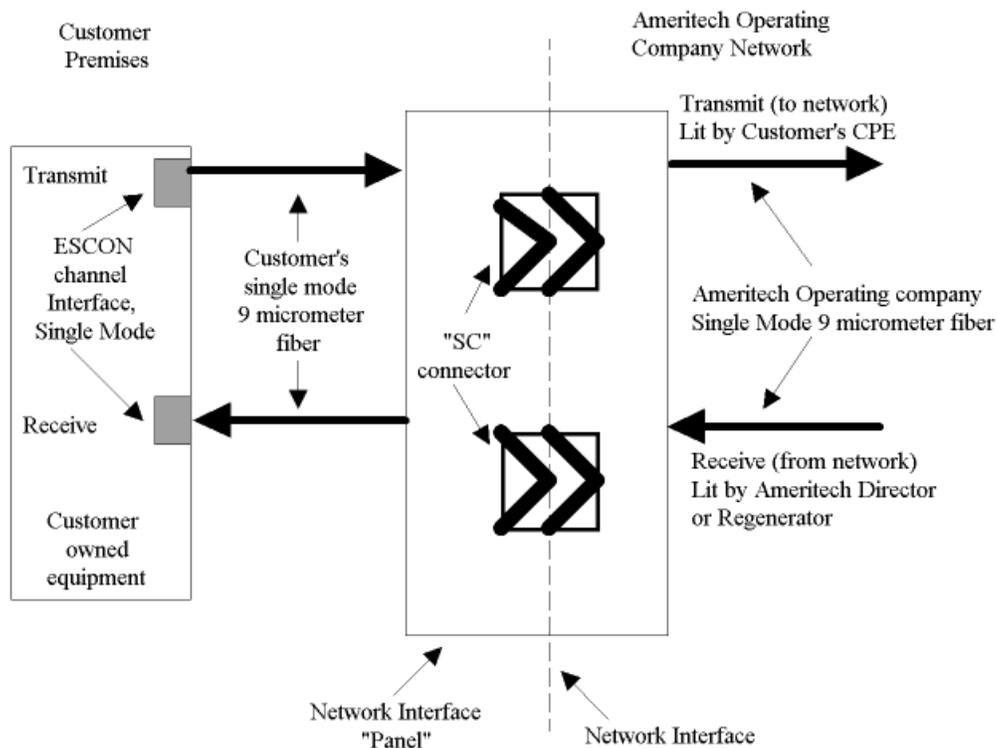
Figure 2. Host Interconnect Service Multipoint Service



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Figure 3. Network Interface For Host Interconnect Service A Schematic Representation



## 6. USER NETWORK INTERFACE

The ESCON protocol is not based upon the International Standards Organization (ISO) seven layer model of data communications, instead it can be divided into three *levels*. The *physical level* which defines the actual transmission of the information over the fiber medium. A *link level* which defines those messages which are involved in the control of the link (channel processor, control units and Directors) which carry the channel and a *device level* which defines the messages required to control operations to and from a specific I/O device.

The ESCON protocols as defined by IBM support both multimode and single mode fiber. (See References [1] and [2] of Primary References - Section 7.1) Single mode optical transport is referred to in IBM's documentation as the Extended Distance Feature (XDF). The Ameritech Host Interconnect Service will only transport the single mode "XDF" version of the protocol. The maximum length allowed for any span of single mode cable is 20Km. Shorter lengths may be

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required for certain applications, and multiple spans may be required for other ESCON applications.

The physical level Network Interface (NI) offered by Ameritech in this specification is 9 micrometer single mode fiber.

The NI between the customer's fiber (This constitutes the Network Interface indicated in Figures 1, 2 and 3.) and Ameritech's network will be a pair of SC fiber connectors as described in Primary Reference [3] in Section 7.1 on each member of the pair of fibers. Converter cables to convert to other standard connectors such as FC terminations which may be required to connect the termination to vendor customer premise cabling are readily available commercially.

If customers require multimode fiber on their premises, they have two options:

1. Convert Ameritech's single mode fiber interface to multimode via customer owned equipment.
2. Use the Ameritech Host Interconnect - Multimode Interface described in AM TR-NIS-000107. In this configuration of the Host Interconnect Service the customer interface described in this document will be used on one end of a customer's link and the interface described in Ameritech's Network Interface AM TR-NIS-000107 on the other end.

The specific architecture of any instance of the Host Interconnect Service will be based upon customer needs and Ameritech's engineering of the HIS service.

The physical layer over the interface outlined in this document is that described in IBM's documentation, *Enterprise Systems Architecture/390- ESCON I/O Interface, Physical Layer*, Chapters 1 and 3 (See Reference [1] of Primary Reference Section 7.1 of this document. Section 3.4 of the Primary Reference [1] (labeled Single-Mode interface Connection) does not apply to our interface.). Figure 3 provides a schematic view of the physical connection to the Host Interface Service link.

An Overview of the use of the link level and device level protocols in an IBM based computing environment is provided in the following IBM documentation:

- Introducing the Enterprise Systems Connection
- Planning for the Enterprise System Connection Link (These documents are listed in the network disclosure for illustrative purposes only.)

See Section 7.1 Secondary References [1] & [2]

The protocols defined in the above document allow a "channel processor" on the host computer to communicate with a peripheral "control unit" of another processor at the far end of the ES-

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CON fiber link. The messages are sent as a serial synchronous bit stream protocol using an 8binary/10binary (8B10B) encoding defined in the IBM's documentation. Each frame contains addressing information, control information, and data. The addressing information is used by the Directors, and the computing equipment to route the messages. The control information is used to change the state of the channel processor or the control unit. The data fields contain the transmitted payload of information. Frame size can vary from 7 bytes to a maximum of 1035 bytes. The specific messages defined for the ESCON protocol, their layout, and function are described in IBM's documentation.

## **7. REFERENCES**

### **7.1. Primary References**

- [1] *Enterprise Systems Architecture/390, ESCON I/O Interface, Physical Layer*, SA23-0394-00, First Edition, December 1991 (Cost = \$13.75)
- [2] *Enterprise Systems Architecture/390, ESCON I/O Interface*, SA22-7202-01, Second Edition, September 1991 (Cost = \$16.00)
- [3] Ameritech SC Connector Specification V.01.

### **7.2. Secondary References**

- [1] *Introducing Enterprise Systems Connection*, GA23-0383-01, Second Edition, September 1991.
- [2] *Planning for Enterprise System Connection Links*, GA23-0367-02, Third Edition, September 1991.
- [3] Ameritech Technical Reference Host Interconnect Service - Multimode Interface Specification AM TR-NIS-000107, Issue 7, July 1992.

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