



DS1 Diverse Service Technical Specifications

NOTICE

This Technical Reference describes DS1 Diverse Service. It describes signals as they appear at the Network Interface (NI), between BellSouth Telecommunications, Inc. (BST) and Customer Installations.

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DS1 Diverse Service Technical Specifications

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DS1 Diverse Service Technical Specifications

1. General

This document provides the technical specifications for DS1 Diverse Service which provides an enhanced transport route diversity arrangement between BellSouth Telecommunications, Inc. (BST) and the Customer Installation (CI).

1.1 Scope

This Technical Reference (TR) provides the technical specifications necessary for compatible operation between BST and customers. The requirements in this document were developed to establish a practical interface. Compliance with these specifications should provide a satisfactory interface in a high percentage of installations. If cases arise that have not been adequately addressed in this document, any resulting problems should be resolved through the cooperation of the user, BST and suppliers. BST encourages customer participation to ensure an orderly, functional and mutually trouble-free interface at all locations.

This document provides Network Interface (NI) compatibility requirements and is not an equipment specification. The NI information in this document complements the equipment information in Part 68, Subpart D, of the FCC Rules and Regulations which contains requirements for the registration of customer-installation equipment to protect the network from harm. Tariffs, contracts, or regulatory acts in various jurisdictions may contain more stringent requirements than those in this document.

The physical connection of customer-provided equipment is addressed in the paragraphs of this TR that describe the mechanical interface and in Part 68, Subpart F, of the FCC Rules and Regulations as supplemented by Public Notice 2526 (February 1986) and in Committee T1 Technical Report Number 5.

2. Service Description

DS1 Diverse Service is a premium service that provides a 1.544 Megabit per second digital bit stream (DS1) for simultaneous two-way transmission. Local and Interoffice Channels are provided via fiber based transport links.

DS1 Diverse Service provides local loop transport between a customer's location and its normal Serving Wire Center (SWC) over structurally diverse fiber based facilities with high performance and reliability parameters designed to limit single points of failure. DS1 Diverse is available to customer locations where existing facilities are fiber based and utilize structurally diverse loop routes. For locations where facilities are not available to satisfy customer requests for DS1 Diverse Service, special construction charges as set forth in the applicable BST tariff will apply.

DS1 Diverse Service is furnished on a link (partial) basis for connection at the normal SWC. Connectivity is available from a DS1 Diverse Local Channel to another DS1 Diverse Service Local or Interoffice Channel, an interstate DS1 (a.k.a. BellSouth SPA DS1) Service Basic Channelization System, ESSX[®] Service, Flexserv[®] (a.k.a. BellSouth SPA Customer Reconfiguration) Service, LightGate[®] (a.k.a. BellSouth SPA Point to Point Network) Service, Managed Shared Network Service, Expanded Interconnection Service, SMARTGate[®] (a.k.a. BellSouth SPA Managed Shared Ring Network) Service, SMARTRing[®] (a.k.a. BellSouth SPA Dedicated Ring) Service, Connectionless Data Service (a.k.a. BellSouth Exchange Access Connectionless Data Service), BellSouth Exchange Exchange Frame Relay Service (XAFRS) or BellSouth Exchange Access Asynchronous Transfer Mode Service (XAATMS).

The Marketing representative has additional details on these services.

BellSouth DS1 Diverse Local and Interoffice Channels may not be connected to a DS1 (a.k.a. BellSouth SPA DS1) Service Local or Interoffice Channels.

3. DS1 Interface

This section defines the DS1 Network Interface (NI) requirements. It denotes existing documentation that details electrical and signal specifications and provides BST variations and clarifications. The physical layer of the DS1 NI is delineated in the following specifications.

ANSI T1.403–1995 *Network–to–Customer Installation – DS1 Metallic Interface*

GR–342–CORE *High–Capacity Digital Special Access Service Transmission
Parameter Limits and Interface Combinations*

ANSI T1.403 applies to end–user interfaces and GR–342–CORE applies to Carrier interfaces.

A sketch of the DS1 NI is shown in Figure 1. The signal delivered to the NI by BST is identified as the BST signal, and the signal delivered to the NI by the customer is identified as the CI signal.

3.1 Framing Format

The DS1 signal must be framed, and it is strongly recommended that DS1s utilize the Extended Superframe Format (ESF) described in ANSI T1.403.

3.2 Clear Channel

BST uses the Bipolar with Eight Zero Substitution (B8ZS) method to provide a Clear Channel Capability (CCC). This supports transport of a framed DS1 signal with unconstrained payload information bits. BST does not support the Zero–Byte Time Slot Interchange (ZBTSI) method of providing CCC.

3.3 Maintenance Signals

Maintenance signals are transmitted in–band and in the data link of the ESF format. ANSI T1.403 provides additional information regarding specific maintenance, alarm and loopback signals.

3.4 End–User Interface

DS1 end–user (EU) interface requirements are defined in ANSI T1.403. At an EU customer NI, some of the electrical requirements for the BST signal differ from corresponding requirements for the CI signal.

3.4.1 BST Signal at Network Interface

The signal requirements will be met at the signal regenerator output nearest the NI. A normalized and isolated pulse shall fit the (template) mask shown in Figure 2. An isolated pulse will have a peak–to–base amplitude of between 2.25 and 3.6 volts. At the NI, the pulse characteristics will be those of this BST standard pulse transmitted through a cable pair with a loss in the range of 0 to 16.5 dB at 772 kHz between 100 ohm terminations as shown in Figure 1.

3.4.2 Customer Signal at Network Interface

The signal requirements will be met at the output of the customer Network Channel Terminating Equipment (NCTE) when its Line Buildout (LBO) is set to 0 dB. A normalized and isolated pulse shall fit the (template) mask shown in Figure 2. An isolated pulse shall have a peak–to–base amplitude of between 2.4 and 3.6 volts. At the NI, the pulse characteristics shall be those of a standard pulse transmitted through a cable pair with a loss in the range of 0 to 5.5 dB at 772 kHz between 100 ohm terminations as shown in Figure 1. When additional customer attenuation is required, it may be inserted by selecting the appropriate LBO setting in the customer NCTE (0, 7.5, 15 dB). The NCTE LBO should be set to zero, unless the customer is advised otherwise by BST. It is the customer's responsibility to properly option the NCTE to provide the required LBO setting. Failure to provide the specified LBO will jeopardize performance of the customer's service and has the potential to adversely impact the performance of other BST provided services.

3.4.3 Mechanical Interface

One balanced twisted pair shall be used for each direction of transmission. Interconnection at the DS1 End–User NI is through one of four Universal Service Order Code (USOC) connectors, RJ48C, RJ48X, RJ48M, RJ48H, as shown in ANSI T1.403 and Part 68 of the FCC Rules and Regulations as revised by Public Notice Numbers 4609 (September 21, 1988) and 4572 (October 3, 1988). The RJ48C or RJ48X jack is used for single DS1 line installations, and the RJ48M (8 DS1s) or RJ48H (12 DS1s) may be used for multiple circuit installations. These have a jack to the network and a plug from the CI installation and are shown in Figures 3, 4, 5, and 6.

Alternatively, an appropriate DS1 rate digital cross connect panel may function as the interconnection arrangement at the NI.

3.4.4 Customer Responsibility

The customer is required to provide registered equipment that provides network protection, signal recovery, Line Buildout (LBO) and test access functionality. These NCTE functions are normally included in a device called a Channel Service Unit (CSU).

3.5 Carrier Interface

DS1 Carrier interface requirements are contained in Bellcore GR–342–CORE. BST and Carrier signals at the NI shall be those of a standard DSX–1 cross–connect pulse.

3.5.1 Mechanical Interface

One balanced twisted pair shall be used for each direction of transmission. Interconnection at the DS1 Carrier NI is through an appropriate DS1 rate digital cross-connect panel. Alternatively, suitable mechanical connecting arrangements may be the RJ48C, RJ48X, RJ48M, or RJ48H connectors.

4. Powering Arrangements

Direct-current power shall not be delivered to the NI by either BST or the CI. The CI shall not apply voltages to the NI other than those described in this specification.

5. Synchronization

To insure proper operation when connected to the BST digital network, channelized DS1 circuits should follow the guidelines of Bellcore GR-436-CORE, *Digital Network Synchronization Plan*. Timing information may be transmitted as part of the DS1 signal. Improper timing can result in transmission impairing slips which can cause loss of data information.

End-User synchronization may be achieved by deriving timing from a BST channelized DS1, by deriving timing from a different DS1 traceable to a Primary Reference Source (PRS) and timing all other facilities from it, or by providing timing traceable to a PRS. For BST services with central office channelization, it has been recommended that the customer equipment be loop-timed (slaved) to the incoming bit stream from the network.

It is important to note that Synchronous Optical Network (SONET) facilities may be used to transport DS1 Diverse Service. SONET facilities may introduce DS1 phase transients as a result of pointer adjustments. Characteristics of the phase transients at the Network Interface have been addressed in the latest version of ANSI T1.403. Customer equipment must be capable of accommodating these phase transients. Further information about phase transients due to SONET pointer adjustments is contained in ANSI T1.403.

6. Performance

The performance of DS1 Diverse Service is stated in terms of Error Free Seconds (EFS), Severely Errored Seconds (SES), and Service Availability as defined in ANSI T1.510.

6.1 Error Free Seconds

An EFS is defined as any second in which there is no bit errors. Conversely, an Errored Second (ES) is one in which there is one or more bit errors. ES are typically transient in nature, arise from a variety of causes, and have a small probability of occurring at any given time. EFS objectives are long term, i.e. 30 days or more.

6.2 Severely Errored Seconds

A SES is defined as any second in which the Bit Error Ratio (BER) is 1×10^{-3} or worse. BER is the ratio of the number of logical bit errors received to the total number of bits transmitted in a given time interval. The SES objectives are long term.

6.3 Annual Service Availability

Circuit Availability is a measure of the amount of time that the service is “usable” by the customer. According to the American National Standards Institute (ANSI) a service is assumed to be in the available state unless a transition to the unavailable state is observed without a subsequent transition to the available state. The transitions between the available and unavailable states are:

- Transition to the unavailable state occurs at the beginning of 10 consecutive SES.
- Transition to the available state occurs at the beginning of 10 consecutive seconds, none of which is a SES.

6.4 Quality Objectives

Service quality objectives on the network side of the End–User (EU) NI are stated in terms of: Error Free Seconds (EFS), Severely Errored Seconds (SES) and Annual Service Availability. DS1 performance objectives for DS1 Diverse are contained in Table 6–1.

**Table 6–1 DS1 Diverse Service Quality Objectives
(DS1 Long– Term Performance)**

Performance Parameter	Objectives (Long–Term)
%Error Free Seconds (%EFS)	EFS > 99.95%
%Severely Errored Seconds (%SES)	SES < 0.010%
%Annual Service Availability	Availability > 99.98%

7. Operational Maintenance

Maintenance of BellSouth provided DS1 circuits on the network side of the NI is the responsibility of BellSouth. In the event of reported trouble, an attempt to diagnose and isolate the source of the trouble will be made with a variety of verification and testing techniques. Once the trouble has been confirmed and isolated a dispatch will be made to correct it.

The greatest difficulty occurs in situations where trouble reports cannot be confirmed by remote diagnostics. The company will offer to dispatch to the customer’s premises for additional testing, but with the understanding that maintenance charges may apply. The trouble resolution process will be slowed considerably.

This situation is of course frustrating to the customer as well as to the telephone company. It is in the customer’s interest to try to avoid requesting the telephone company to expend time attempting to isolate a problem that may exist in the customer’s equipment.

Customer provided NCTE with ANSI T1.403 ESF capabilities in conjunction with proper test equipment supports improved testing, maintenance and in–service performance monitoring capabilities. This enhances the likelihood of achieving the circuit quality objectives.

8. Maintenance Signals

Maintenance signals are transmitted in-band in the SF format and in the data link of the ESF format. In the SF format, the following framed codes may be used within the Network to support out-of-service maintenance operations. These codes are used in repetitive pulse patterns of at least 5 seconds. Network equipment may block customer transmission of long sequences of these patterns:

11000 (2 in 5)
11100 (3 in 5)
10100

8.1 Remote Alarm Indication

The Remote Alarm Indication (RAI) is widely known in the industry as a yellow alarm. The RAI/Yellow signal shall be transmitted in the outgoing direction when DS1 terminal equipment located in either the network or the CI determines that it has effectively lost the incoming signal. An RAI/Yellow signal shall be transmitted to the NI in the following forms:

Superframe Format: For the duration of the alarm condition, but for at least one second, bit two in every eight-bit channel time-slot shall be a zero. This arrangement shall be used even if the payload is not channelized.¹

Extended Superframe Format: For the duration of the alarm condition, but for at least one second, a repeating 16 bit pattern consisting of eight “ones” followed by eight “zeros” shall be transmitted continuously on the ESF data link, but may be interrupted for a period not to exceed 100 milliseconds per interruption (see ANSI T1.403).

Both Formats: For either framing format, the minimum time between the end of one transmission of RAI/Yellow and the beginning of another transmission of RAI/Yellow shall be one second. Certain services provided by the network may require longer time intervals than these minimum values, or may require unequal “on” and “off” intervals, or both longer intervals and unequal “on” and “off” intervals.

8.2 Alarm Indication Signal (AIS)

The AIS shall be an unframed, all-ones signal. An AIS should be transmitted to the NI upon a loss of originating signal, or when any action is taken that would cause a signal disruption (e.g., line loopback). The AIS is removed when the condition triggering the AIS is terminated.

8.3 Loopbacks

Loopbacks are used by Carriers and end-users as a maintenance tool to aid in problem resolution. The codes and protocols described in ANSI T1.403 may be used by the Carrier for trouble isolation or by the end-user for CI-to-CI testing.

¹ It is recognized that some existing unchannelized equipment does not transmit the RAI/Yellow signal.

Two types of loopbacks are defined in ANSI T1.403, line and payload loopback. Both are applicable for signals using the ESF format; only the line loopback is applicable for signals using the SF format. Line loopbacks result in a full 1.544 Mbit/s loopback of the signal received by the CI from the NI. Payload loopbacks result in a 1.536 Mbit/s loopback of the payload of the signal received by the CI from the NI maintaining bit–sequence integrity² for the information bits.

8.3.1 Loopback Control Signaling in the SF Format

The protocol currently in use by the carriers for network access to the CI line loopback feature is in–band signaling control. Only the CI may respond to the in–band control line loopback codes.

Activation Signal: The in–band activation signal for a line loopback shall be a framed DS1 signal consisting of repetitions of four “zeros” followed by one “one”, lasting for at least 5 seconds, with the framing bits replacing bits of the pattern.

Deactivation Signal: The in–band deactivation signal for a line loopback shall be a framed DS1 signal consisting of repetitions of two “zeros” followed by one “one”, lasting for at least 5 seconds, with the framing bits replacing bit of the pattern.³

8.3.2 Loopback Control Signaling in the ESF Format

The activation signal for a line loopback shall be by means of the ESF data–link messages specified for that purpose in ANSI T1.403.⁴ Line loopback activate codes shall not be returned to the NI in response to line loopback activation signaling (e.g., by the requested loopback).⁵ Accordingly, signaling for line loopback activation shall be a two step process as follows:

Activation Signal: The line loopback activation code shall be sent as a preamble to line loopback request. The end of the transmission of the preamble shall constitute a request for line loopback activation. The activation signal for a payload loopback shall be by means of the ESF data–link message specified in ANSI T1.403.

Deactivation Signal: Signaling for line loopback deactivation and payload loopback deactivation may be accomplished in several ways. First, deactivation shall be signaled by the use of the deactivation codes specified in ANSI T1.403. In addition, deactivation of both line loopback and payload loopback shall be signaled by any of the following:

- Universal loopback deactivate codeword defined in ANSI T1.403
- AIS
- A data–link signal consisting of two occurrences of the one per second PRM separated by uninterrupted idle code.

² This requires that the timing of the transmitted signal be synchronized with the timing of the received signal.

³ Embedded network equipment exists which may react to the line loopback deactivate code and block the code from reaching the CI. When this occurs, manual intervention is required to deactivate the CI line loopback.

⁴ Some embedded CI equipment uses either framed or unframed in–band codes to activate and deactivate ESF line loopbacks.

⁵ Some embedded CI equipment for ESF operation activates loopback immediately upon identification of the loopback activation codeword and does not delay actual loopback until either transmission of the loopback activation codeword ceases, or is replaced by the loopback retention codeword.

8.4 DS1 Idle Signal

Generation and detection of the DS1 Idle Signal is optional. If provided, the DS1 Idle Signal shall meet the requirements defined in Annex D of ANSI T1.403. The Idle Signal indicates that the normal signal source is not present. The DS1 Idle Signal is not to be confused with the ESF data link idle code.

9. Interface Descriptions

This section provides information on Network Channel Interface (NCI) codes including interface descriptions. The NCI code describes the number of conductors, protocol, impedance, protocol options and transmission level point(s) reflecting characteristics at the Network Interface (NI)/Point of Termination (POT). Existing Network Channel (NC) codes will be used for DS1 Diverse Service. The appropriate interface ordering procedures which use these codes are covered in other publications such as Bellcore SR–STS–000307 and the NC/NCI Decoder.

9.1 Network Channel Interface (NCI) Code Components

The electrical characteristics of the interface are identified by an NCI code. Compatible NCI codes for the service desired must be specified by the customer when ordering DS1 Diverse Service and other network special access services. Definitions of specific NCI codes that apply to DS1 Diverse Service are covered in this section. Descriptions of the component parts of the NCI code are provided to aid the customer in understanding the relationship of these codes to the electrical characteristics of the interface.

The components of an NCI code furnish the information concerning the electrical characteristics for the Network Interface at the POT. Positions 1 and 2 of the NCI code are numeric characters indicating the total number of conductors at the interface. Positions 3 and 4 are two alphabetic characters indicating the protocol code. Position 5 indicates the reference impedance. Position 6, if used, is a delimiter and indicates the start of the protocol option code. Positions 7, 8, and 9, if used, indicate options available for the protocol code in use. The component parts of the NCI codes and their definitions are listed in the Tables in this Section. Additional information about Network Channel Interface Codes may be found in Bellcore SR–STS–000307.

9.1.1 Number of Conductors

This component describes the number of conductors required to provide the service. Table 9–1 lists some of the allowable entries for this component. For DS1 Diverse Service code 04 would be used to indicate 4 conductors.

Table 9–1 Number of Conductors⁶

Number of Conductors	Code
2	02
4	04

9.1.2 Protocol Code

The protocol code is the most significant component of the NCI code, since it is associated with the basic electrical function of the interface. The protocol code broadly describes the technical capabilities of the interface at the EU–POT, CXR–POT or serving wire center.

The protocol code combinations specified for the CXR–POT and the EU–POT may be the same or different. However, only certain combinations are technically possible. Table 9–2 lists the protocol codes that apply to DS1 Diverse Service.

Table 9–2 Selected Protocol Codes and Options⁷

Code	Option	Definition
DS1 Digital Hierarchy Interface at the CXR–POT		
DS	1 K	1.544 Mbit/s (DS1) “ANSI” T1.403 Extended Superframe (ESF) format
DS	1 S	1.544 Mbit/s (DS1) “ANSI” T1.403 Extended Superframe (ESF) format and B8ZS Clear Channel Capability
DS	15 B	1.544 Mbit/s (DS1) Superframe (SF) format
DS	15 B	1.544 Mbit/s (DS1) Superframe (SF) format and B8ZS Clear Channel Capability
DS1 Digital Hierarchy Interface at EU–POT		
DU	1 K N	1.544 Mbit/s (DS1) “ANSI” T1.403 Extended Superframe (ESF) format without line power
DU	1 S N	1.544 Mbit/s (DS1) “ANSI” T1.403 Extended Superframe (ESF) format and B8ZS Clear Channel Capability without line power
DU	BN	1.544 Mbit/s (DS1) Superframe (SF) format without line power
DU	DN	1.544 Mbit/s (DS1) Superframe (SF) format and B8ZS Clear Channel Capability without line power

⁶ Wire Code is in Character Positions 1 & 2.

⁷ Protocol Code is in Character Positions 3 & 4.

Option Code is in Character Positions 7, 8, & 9.

9.1.3 Nominal Reference Impedance

The nominal reference impedance is the third component of the NCI code. This is the impedance at which the customer will terminate the service for the purpose of evaluating transmission performance. Table 9–3 lists some allowable values. For DS1 Diverse Service interfaces the appropriate code is code 9 – 100 ohms.

Table 9–3 Reference Impedance Code⁸

Impedance Value ⁹	Code
75	6
100	9
Fiber	F

9.2 Compatible NCI Code Combinations

NCI code selection for DS1 Diverse Service should be coordinated between the customer and BST during the initial service order discussion. Table 9–4 lists compatible DS1 Diverse Service NCI interface combinations. For codes associated with interconnecting High Capacity Digital Access services consult existing technical publications or a Marketing Representative.

The following is a current listing of the NCI codes for DS1 Diverse Service.

Table 9–4 NCI Interface Combinations

04DS9.15	DS1 Electrical (SF & AMI) – DSX–1 Interface
04DS9.1K	DS1 Electrical (ESF & AMI) – DSX–1 Interface
04DS9.1S	DS1 Electrical (ESF & B8ZS) – DSX–1 Interface
04DS9.15B	DS1 Electrical (SF & B8ZS) – DSX–1 Interface
04DU9.BN	DS1 Electrical (SF & AMI) – Smart Jack Interface
04DU9.1KN	DS1 Electrical (ESF & AMI) – Smart Jack Interface
04DU9.1SN	DS1 Electrical (ESF & B8ZS) – Smart Jack Interface
04DU9.DN	DS1 Electrical (SF & B8ZS) – Smart Jack Interface
04CS9.10R	DS1/DS0 FlexServ Termination in Central Office
04CS9.11R	DS1/DS1 FlexServ Termination in Central Office
04QB9.11	DS1 to DS1 Interconnection

⁸ Reference Impedance Code is in Character Position 5.

⁹The reference impedance is the impedance the customer is expected to use to terminate the channel for the purpose of evaluating transmission performance.

10. Acronyms

AIS	Alarm Indication Signal
ANSI	American National Standards Institute
APS	Automatic Protection Switching
ATM	Asynchronous Transfer Mode
B8ZS	Bipolar with Eight-Zero Substitution
BV	Bipolar Violation
CCC	Clear Channel Capability
CI	Customer Installation
CRC	Cyclic Redundancy Check
CXR	Carrier
DSO	Digital Signal Level 0
DS1	Digital Signal Level 1
DSX-1	Cross Connect for DS1 Signals
EU	End User
FDDI	Fiber Distributed Data Interface
FEBE	Far End Block Error
FERF	Far End Receive Failure
IEC	Interexchange Carrier
ITU/TS	International Telecommunication Union/Telecommunication Standardization Sector
LEC	Local Exchange Carrier
REI	Remote Error Indication
RFI	Remote Failure Indication (Formerly Yellow)
SONET	Synchronous Optical Network
TA	Technical Advisory
TR	Technical Requirement
VT1.5	Virtual Tributary at 1.5 Mb/s

11. References

- TR 53545 SynchroNet[®] Service Network Interface Specifications, Issue B, October 1990. SynchroNet service is a registered trademark of BellSouth Corporation.
- TR 73590 Broadband Exchange Line Service Interface & Performance Specifications, April 1995.
- ANSI T1.101–1994 American National Standard for Telecommunications – Synchronization Interface for Digital Networks
- ANSI T1.102–1993 American National Standard for Telecommunications – Digital Hierarchy – Electrical Interfaces
- ANSI T1.105–1995 American National Standard for Telecommunications – Synchronous Optical Network (SONET) – Basic Description including Multiplex Structure, Rates, and Formats
- ANSI T1.105.01–1995 American National Standard for Telecommunications – Synchronous Optical Network (SONET) – Automatic Protection Switching
- ANSI T1.105.02–1995 American National Standard for Telecommunications – Synchronous Optical Network (SONET) – Payload Mappings
- ANSI T1.105.03–1994 American National Standard for Telecommunications – Synchronous Optical Network (SONET) – Jitter at Network Interfaces
- ANSI T1.105.03a–1995 American National Standard for Telecommunications – Synchronous Optical Network (SONET) – Jitter at Network Interfaces – DS1 Supplement
- ANSI T1.107–1995 American National Standard for Telecommunications – Digital Hierarchy – Formats Specifications
- ANSI T1.403–1995 American National Standard for Telecommunications – Network-to-Customer Installation – DS1 Metallic Interface
- ANSI T1.404–1994 American National Standard for Telecommunications – Network-to-Customer Installation – DS3 Metallic Interface Specification
- ANSI T1.404a–1996 American National Standard for Telecommunications – Network-to-Customer Installation – DS3 Metallic Interface Specification (supplement)
- ANSI T1.408–1990 Integrated Services Digital Network (ISDN) Primary Rate – Customer Installation Metallic Interfaces Layer 1 Specifications.
- ANSI T1.510–1994 American National Standard for Telecommunications - Network Performance Parameters for Dedicated Digital Services Specifications
- ANSI Z136.2–1988 American National Standard for the Safe Use of Optical Fiber Communications Systems Utilizing Laser Diode and LED Sources
- IEC 825–1 Safety of Laser Products, Part 1: Equipment classification, requirements and user's guide, First Edition, 1993–11
- IEC 825–2 Safety of Laser Products, Part 2: Safety of optical fiber communication systems, First Edition, 1993–09
- T1 Technical Report No.5, Carrier to Customer Installation Interface Connector Wiring Configuration Catalog, 1990
- Code of Federal Regulations, Title 47, FCC Rules and Regulations, Part 68, Revised December, 1987

CCITT, Red Book, Fascicle VI Recommendation Q.921, ISDN User–Network Interface Data Link Layer Specification.

Rules and Regulations, Part 68, Federal Communications Commission.

IEC and ANSI documents can be ordered from:

Global Engineering Documents

15 Inverness Way East
Englewood, CO 80112–5704
(800) 854–7179

GR–20–CORE	Generic Requirements for Optical Fiber and Optical Fiber Cables, Issue 1, December, 1994
GR–253–CORE	Synchronous Optical Network (SONET) Transport Systems: Common Criteria Physical Layer, Issue 1, December 1994
GR–342–CORE	High–Capacity Digital Special Access Service Transmission Parameter Limits and Interface Combination, Issue 1, December, 1995
GR–436–CORE	Digital Network Synchronization Plan, Issue 1, June 1994
GR–1365–CORE	SONET Private Line Service Interface Generic Criteria for End Users, Issue 1, December 1994
TR–TSY–000191	Alarm Indication Signals Requirements and Objectives, Issue 1, May, 1986
SR–STS–000307	NC/NCI Code Dictionary, Issue 8, April, 1997
NC/NCI Decoder	PC based application with a 1–year subscription for the NC/NCI codeset, Issue 3Q, September 1998

Bellcore Technical References and Documents may be ordered by contacting:

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8 Corporate Place – Room 3A–184
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1–800–521–2673

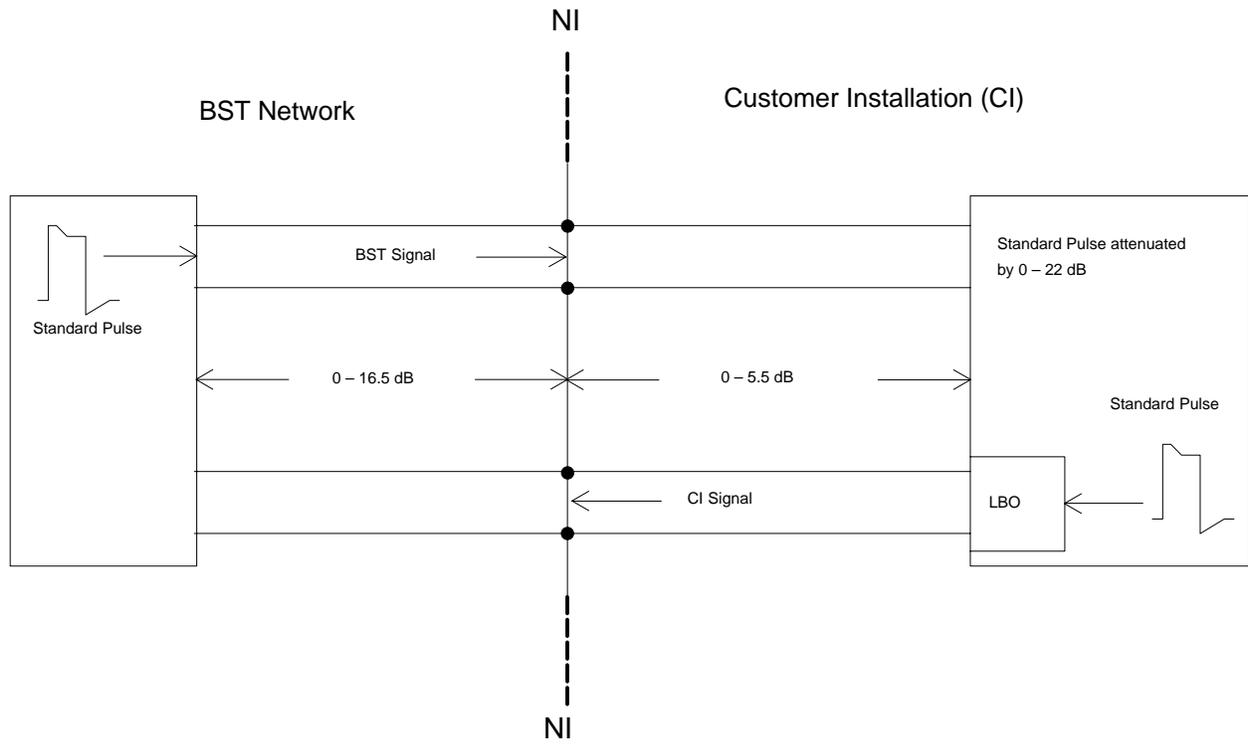
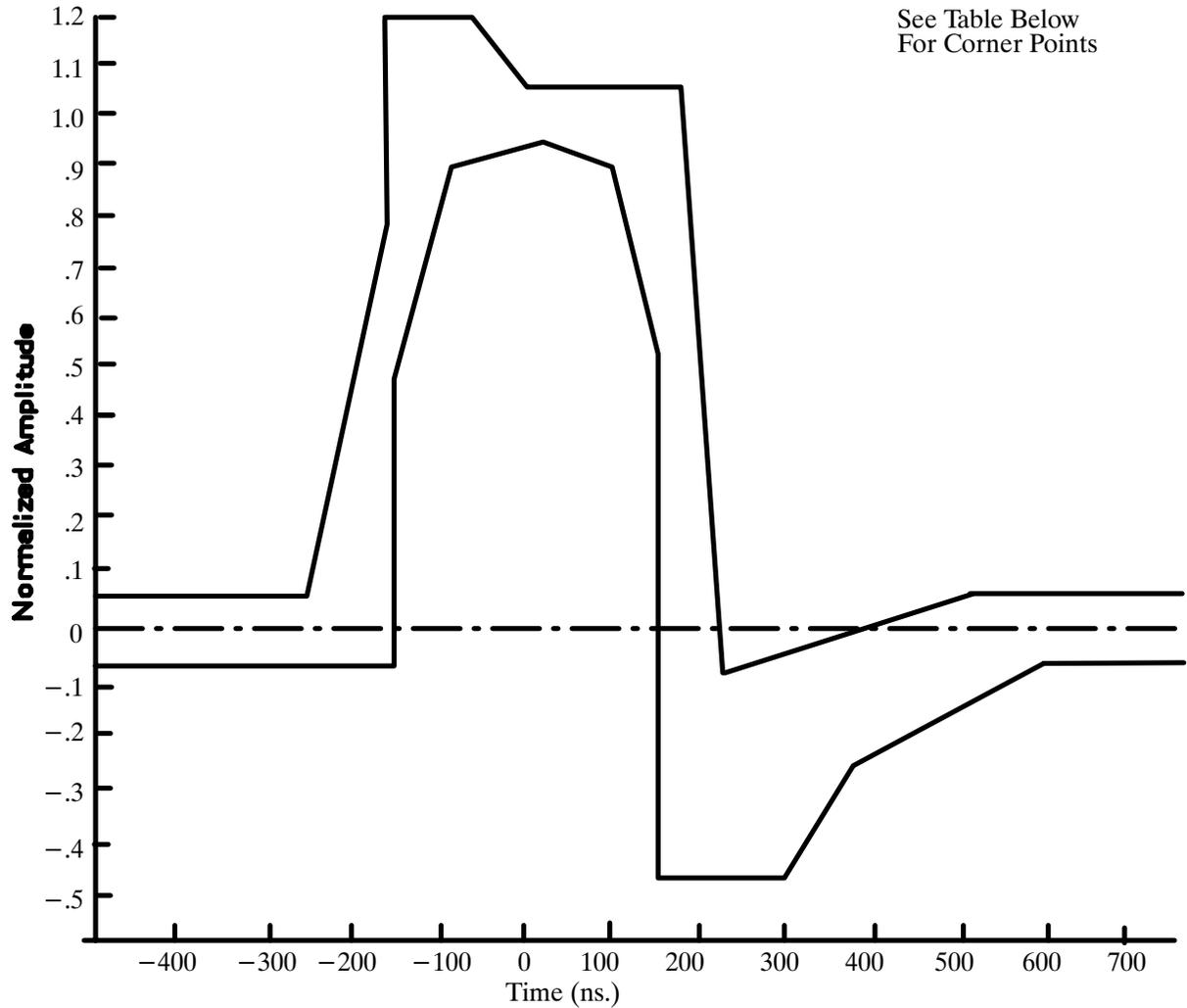


Figure 1 – DS1 Network Interface



Maximum Curve

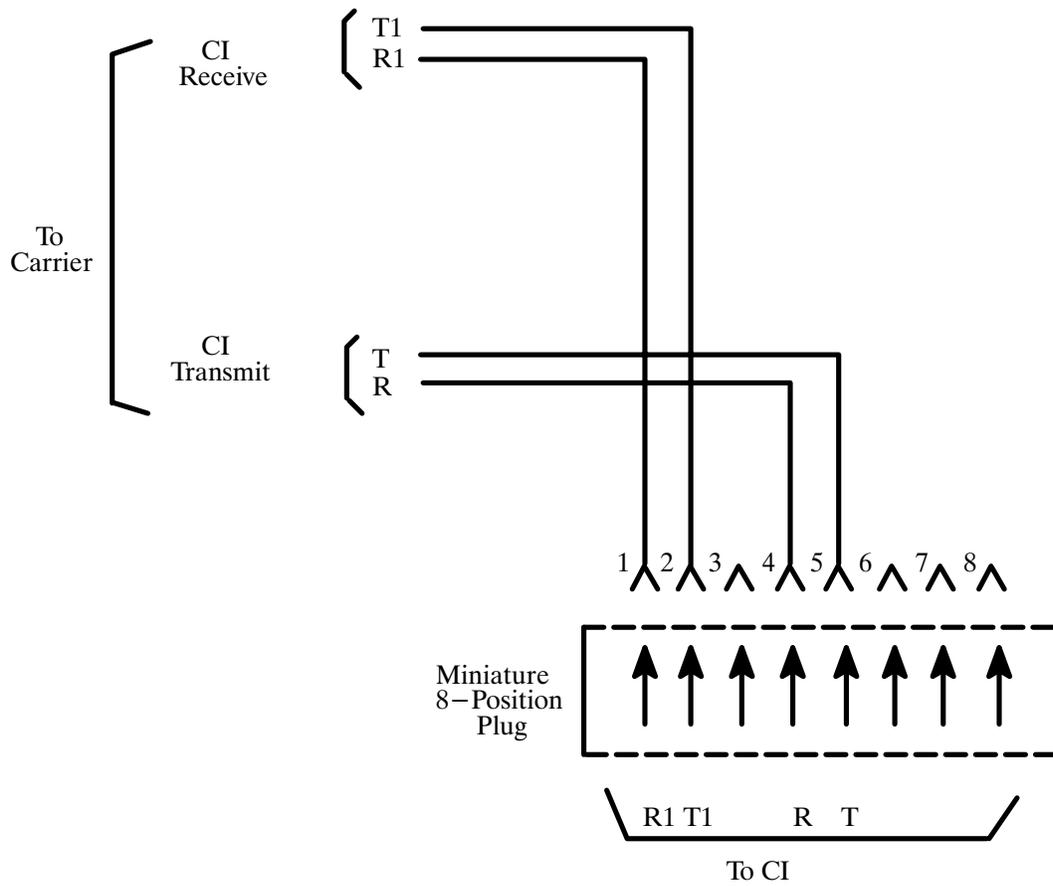
	Nanoseconds	-500	-250	-175	-175	-75	0	175	220	500	750	-	-
TIME	Unit Intervals	-.77	-.39	-.27	-.27	-.12	0	.27	.34	.77	1.16	-	-
NORMALIZED AMPLITUDE		.05	.05	.80	1.20	1.20	1.05	1.05	-.05	.05	.05	-	-

Minimum Curve

	Nanoseconds	-500	-150	-150	-100	0	100	150	150	300	396	600	750
TIME	Unit Intervals	-.77	-.23	-.23	-.15	0	.15	.23	.23	.46	.61	.93	1.16
NORMALIZED AMPLITUDE		-.05	-.05	.5	.9	.95	.9	.5	-.45	-.45	-.26	-.05	-.05

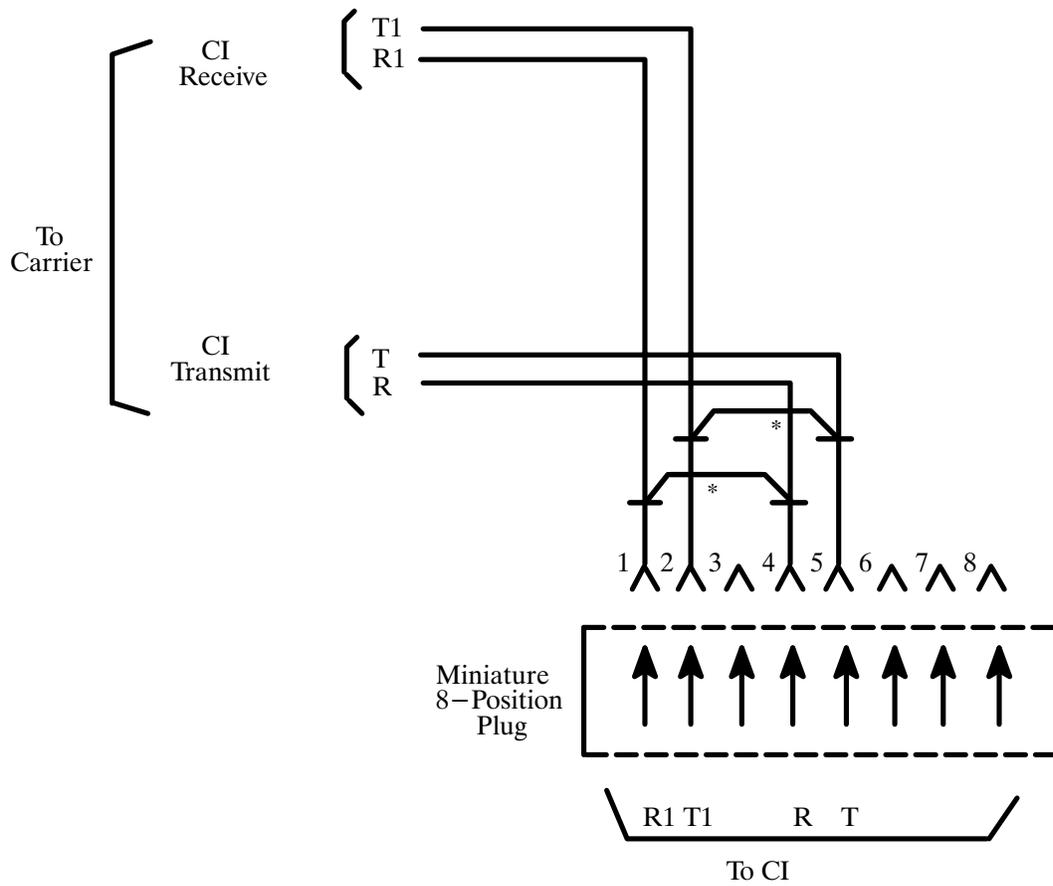
Note: 1 Unit Interval = 648 Nanoseconds

Figure 2 – Isolated Pulse Template and Corner Points



Do not connect cable shield to pins of this connector.

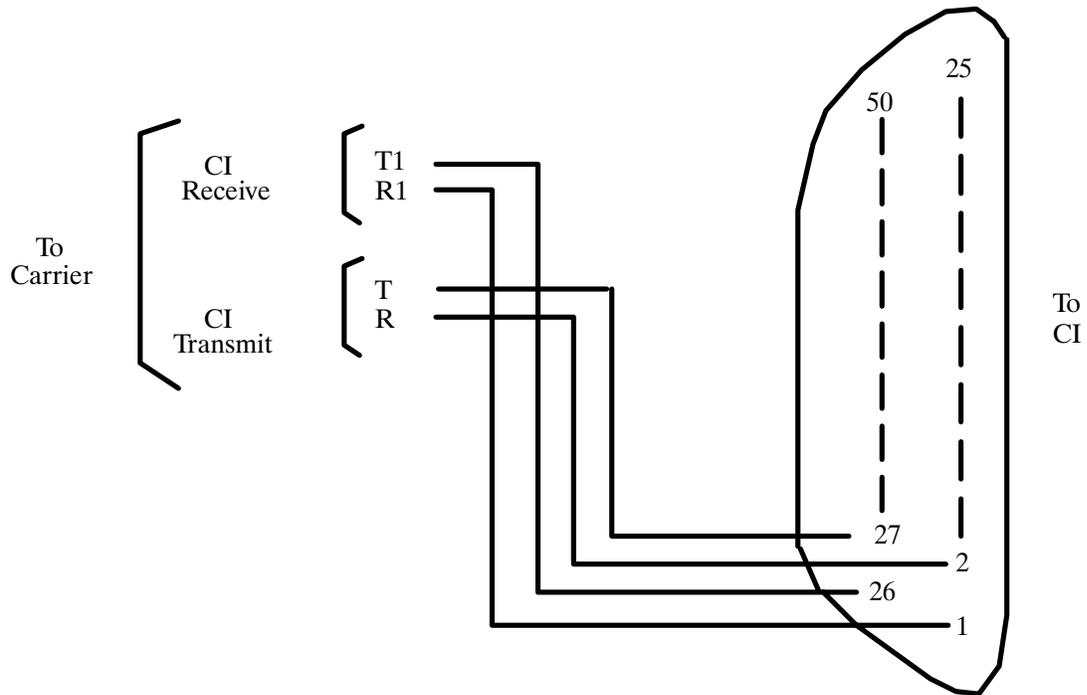
Figure 3 – Connector Pin Assignments (8 Position/RJ48C)



Do not connect cable shield to pins of this connector.

NOTE: *Short removed on insertion of plug.

Figure 4 – Connector Pin Assignments (8 Position/RJ48X)

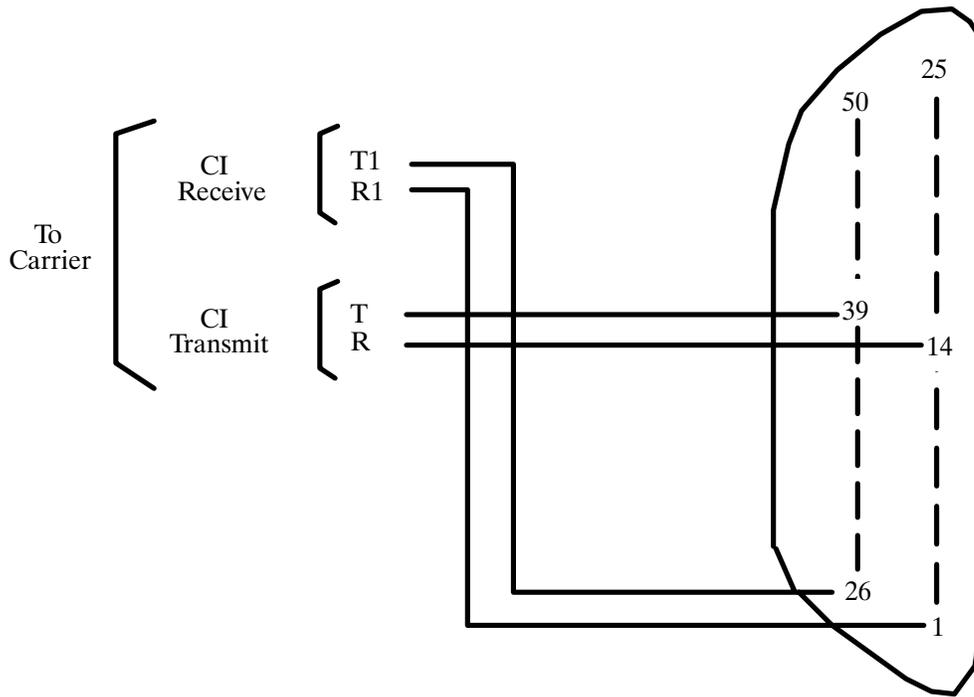


POSITION

<u>LINE</u>	<u>T1</u>	<u>R1</u>	<u>T</u>	<u>R</u>
1	26	1	27	2
2	29	4	30	5
3	32	7	33	8
4	35	10	36	11
5	38	13	39	14
6	41	16	42	17
7	44	19	45	20
8	47	22	48	23

Do not connect cable shield to pins of this connector.

Figure 5 – Connector Pin Assignments (50 Position/RJ48M)



POSITION

<u>LINE</u>	<u>T1</u>	<u>R1</u>	<u>T</u>	<u>R</u>
1	26	1	39	14
2	27	2	40	15
3	28	3	41	16
4	29	4	42	17
5	30	5	43	18
6	31	6	44	19
7	32	7	45	20
8	33	8	46	21
9	34	9	47	22
10	35	10	48	23
11	36	11	49	24
12	37	12	50	25

Do not connect cable shield to pins of this connector.

This is the preferred multi-circuit connector.

Figure 6 – Connector Pin Assignments (50 Position/RJ48H)

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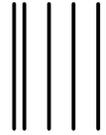
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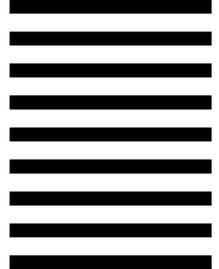
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