

Network Working Group  
Request for Comments: 1406  
Obsoletes: 1232

F. Baker  
Advanced Computer Communications  
J. Watt  
Newbridge Networks Corporation  
Editors  
January 1993

## Definitions of Managed Objects for the DS1 and E1 Interface Types

### Status of this Memo

This RFC specifies an IAB standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "IAB Official Protocol Standards" for the standardization state and status of this protocol. Distribution of this memo is unlimited.

### Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing DS1 Interfaces -- including both T1 and E1 (a.k.a., CEPT 2 Mbit/s) links.

This document entirely replaces RFC 1232, which contains a fundamental error: many objects are encoded as Counters that must be encoded as INTEGERS or Gauges. The magnitude of the change required is sufficient that virtually every object changed. Therefore, the MIB documented in RFC 1232 should not be implemented.

### Table of Contents

1. The Network Management Framework .....	2
2. Objects .....	2
2.1 Format of Definitions .....	3
2.2 Changes from RFC 1232 .....	3
3. Overview .....	4
3.1 Binding between ifIndex and DS1 Interfaces .....	5
3.2 Objectives of this MIB Module .....	7
3.3 DS1 Terminology .....	7
3.3.1 Error Events .....	7
3.3.2 Performance Defects .....	8
3.3.3 Performance Parameters .....	9
3.3.4 Failure States .....	11
3.3.5 Other Terms .....	13
4. Definitions .....	14
4.1 DS1 Near End Group .....	14

4.1.1 DS1 Configuration Table .....	14
4.1.2 DS1 Current Table .....	22
4.1.3 DS1 Interval Table .....	26
4.1.4 DS1 Total Table .....	30
4.2 DS1 Far End Group .....	33
4.2.1 DS1 Far End Current Table .....	34
4.2.2 DS1 Far End Interval Table .....	38
4.2.3 DS1 Far End Total Table .....	41
4.3 DS1 Fractional Group .....	45
4.3.1 DS1 Fractional Table .....	45
5. Acknowledgements .....	47
6. References .....	48
7. Security Considerations .....	50
8. Authors' Addresses .....	50

## 1. The Network Management Framework

The Internet-standard Network Management Framework consists of three components. They are:

STD 16/RFC 1155 [1] which defines the SMI, the mechanisms used for describing and naming objects for the purpose of management. STD 16/RFC 1212 [2] defines a more concise description mechanism, which is wholly consistent with the SMI.

RFC 1156 [3] which defines MIB-I, the core set of managed objects for the Internet suite of protocols. STD 17/RFC 1213 [4] defines MIB-II, an evolution of MIB-I based on implementation experience and new operational requirements.

STD 15/RFC 1157 [5] which defines the SNMP, the protocol used for network access to managed objects.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

## 2. Objects

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) [6] defined in the SMI. In particular, each object has a name, a syntax, and an encoding. The name is an object identifier, an administratively assigned name, which specifies an object type. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the OBJECT DESCRIPTOR, to also refer to the object type.

The syntax of an object type defines the abstract data structure corresponding to that object type. The ASN.1 language is used for this purpose. However, the SMI [1] purposely restricts the ASN.1 constructs which may be used. These restrictions are explicitly made for simplicity.

The encoding of an object type is simply how that object type is represented using the object type's syntax. Implicitly tied to the notion of an object type's syntax and encoding is how the object type is represented when being transmitted on the network.

The SMI specifies the use of the basic encoding rules of ASN.1 [7], subject to the additional requirements imposed by the SNMP.

## 2.1. Format of Definitions

Section 4 contains contains the specification of all object types contained in this MIB module. The object types are defined using the conventions defined in the SMI, as amended by the extensions specified in STD 16, RFC 1212 [2].

## 2.2. Changes from RFC 1232

The changes from RFC 1232 are the following:

- (1) This MIB module contains three groups: DS1 Near End Group which is mandatory, DS1 Far End Group which is optional, and the Fractional Table, which is optional.
- (2) The Far End Group is a new group and contains statistics that are collected from the far end DS1 interface. The Far End Group may only be implemented by DS1 systems that use the facilities data link to exchange this information - both T1.403 and PUB 54016 define ways to exchange this information over data links; vendors may use other proprietary means to do this on various link types.
- (3) ds1CSUIndex has been renamed dsx1LineIndex. This object is the identifier of a DS1 Interface on a device. On a CSU, a single DS1 data stream will cross two DS1 interfaces, which have separate dsx1LineIndex values.
- (4) ds1Index has been renamed dsx1IfIndex. This value for this object is equal to the value of ifIndex from the Interfaces table of MIB II (STD 17, RFC 1213).
- (5) an object has been added (dsx1TransmitClockSource) to indicate the source of transmit clock.

- (6) The ACCESS for objects in the dsxlConfigTable has been set to read-write for items that are configurable.
- (7) Description of test configurations has changed. A new object has been added called dsxlLoopbackConfig, which better describes the loopback capabilities of a DS1 interface on a device.
- (8) The description of line alarm status has changed. A new object has been added called dsxlLineStatus. This object better describes the status (e.g., failure state and loopback state) of a DS1 interface.
- (9) All Counters have been changed to Gauges.
- (10) Information about how applications might use the zero code suppression have been removed; only the actual line coding algorithm is described. For clarity the object was thus renamed to dsxlLineCoding.
- (11) A Line Errored Seconds object has been added to all near end tables and the count of Bipolar Violations (BPVs) was changed to a count of Line Code Violations (LCVs).
- (12) Bursty Errored Seconds (a.k.a., Errored Seconds Type B) and Degraded Minutes objects have been added to all near end tables.
- (13) The Coding Violation error event is now referred to as a Path Coding Violation (PCV) Error Event.

### 3. Overview

These objects are used when the particular media being used to realize an interface is a DS1 physical interface. At present, this applies to these values of the ifType variable in the Internet-standard MIB:

ds1 (18)  
e1 (19)

The definitions contained herein are based on the AT&T T-1 Superframe (a.k.a., D4) and Extended Superframe (ESF) formats [8, 9], the latter of which conforms to ANSI specifications [10], and the CCITT Recommendations [11, 12], referred to as E1 for the rest of this memo.

The various T1 and E1 line disciplines are similar enough that separate MIBs are unwarranted, although there are some differences. For example, Loss of Frame is defined more rigorously in the ESF specification than in the D4 specification, but it is defined in both.

Where it is necessary to distinguish between the flavors of E1 with and without CRC, E1-CRC denotes the "with CRC" form (G.704 Table 4b) and E1-noCRC denotes the "without CRC" form (G.704 Table 4a).

### 3.1. Binding between ifIndex and DS1 Interfaces

Different physical configurations for the support of SNMP with DS1 equipment exist. To accommodate these scenarios, two different indices for DS1 interfaces are introduced in this MIB. These indices are dsx1IfIndex and dsx1LineIndex.

External interface scenario: the SNMP Agent represents all managed DS1 lines as external interfaces (for example, an Agent residing on the device supporting DS1 interfaces directly):

For this scenario, all interfaces are assigned an integer value equal to ifIndex, and the following applies:

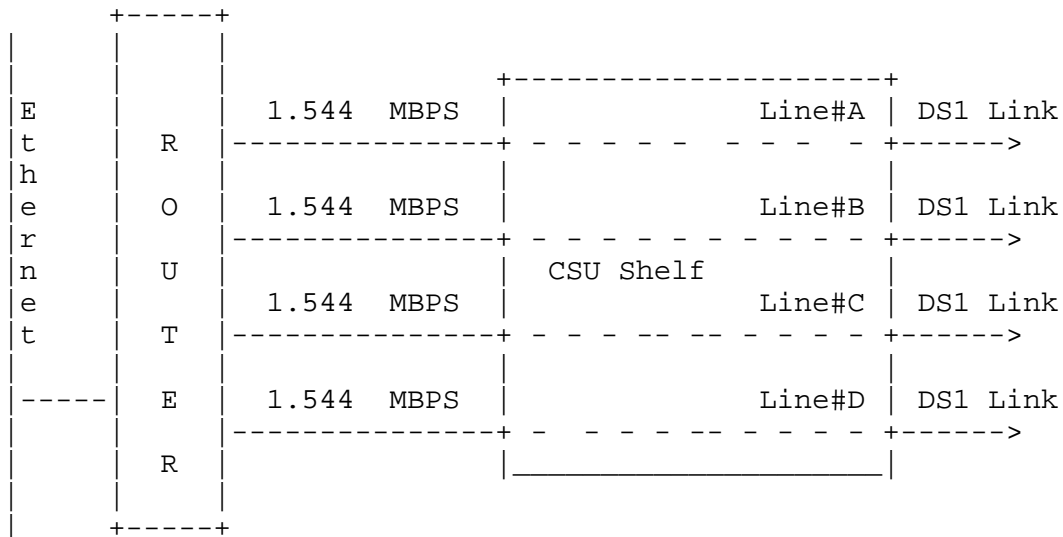
ifIndex=dsx1IfIndex=dsx1LineIndex for all interfaces.

The dsx1IfIndex column of the DS1 Configuration table relates each DS1 interface to its corresponding interface (ifIndex) in the Internet-standard MIB (MIB-II STD 17, RFC 1213).

External & Internal interface scenario: the SNMP Agents resides on an host external from the device supporting DS1 interfaces (e.g., a router). The Agent represents both the host and the DS1 device. The index dsx1LineIndex is used to not only represent the DS1 interfaces external from the host/DS1-device combination, but also the DS1 interfaces connecting the host and the DS1 device. The index dsx1IfIndex is always equal to ifIndex.

Example:

A shelf full of CSUs connected to a Router. An SNMP Agent residing on the router proxies for itself and the CSU. The router has also an Ethernet interface:



The assignment of the index values could for example be:

ifIndex (= dsx1IfIndex)	dsx1LineIndex
1 NA	NA (Ethernet)
2 Line#A Router Side	6
2 Line#A Network Side	7
3 Line#B Router Side	8
3 Line#B Network Side	9
4 Line#C Router Side	10
4 Line#C Network Side	11
5 Line#D Router Side	12
5 Line#D Network Side	13

For this example, ifNumber is equal to 5. Note the following description of dsx1LineIndex: the dsx1LineIndex identifies a DS1 Interface on a managed device. If there is an ifEntry that is directly associated with this and only this DS1 interface, it should have the same value as ifIndex. Otherwise, number the dsx1LineIndices with a unique identifier following the rules of choosing a number greater than ifNumber and numbering inside interfaces (e.g., equipment side) with even numbers and outside interfaces (e.g., network side) with odd numbers.

If the CSU shelf is managed by itself by a local SNMP Agent, the situation would be:

ifIndex (= dsxlIfIndex)			dsxlLineIndex
2	Line#A	Router Side	2
1	Line#A	Network Side	1
4	Line#B	Router Side	4
3	Line#B	Network Side	3
6	Line#C	Router Side	6
5	Line#C	Network Side	5
8	Line#D	Router Side	8
7	Line#D	Network Side	7

### 3.2. Objectives of this MIB Module

There are numerous things that could be included in a MIB for DS1 signals: the management of multiplexors, CSUs, DSUs, and the like. The intent of this document is to facilitate the common management of all devices with DS1 interfaces. As such, a design decision was made up front to very closely align the MIB with the set of objects that can generally be read from DS1 devices that are currently deployed.

### 3.3. DS1 Terminology

The terminology used in this document to describe error conditions on a DS1 interface as monitored by a DS1 device are based on the definitions from the ANSI T1M1.3/92-005R1 draft standard [13]. If the definition in this document does not match the definition in the ANSI T1M1.3/92-005R1 draft document, the implementer should follow the definition described in this document.

#### 3.3.1. Error Events

##### Bipolar Violation (BPV) Error Event

A BPV error event for an AMI-coded signal is the occurrence of a pulse of the same polarity as the previous pulse. A BPV error event for a B8ZS- or HDB3-coded signal is the occurrence of a pulse of the same polarity as the previous pulse without being a part of the zero substitution code.

##### Excessive Zeroes (EXZ) Error Event

An Excessive Zeroes error event for an AMI-coded signal is the occurrence of more than fifteen contiguous zeroes. For a B8ZS coded signal, the defect occurs when more than seven contiguous zeroes are detected.

##### Line Coding Violation (LCV) Error Event

A Line Coding Violation (LCV) is the occurrence of either a Bipolar Violation (BPV) or Excessive Zeroes (EXZ) Error Event.

#### Path Coding Violation (PCV) Error Event

A Path Coding Violation error event is a frame synchronization bit error in the D4 and E1-noCRC formats, or a CRC error in the ESF and E1-CRC formats.

#### Controlled Slip (CS) Error Event

A Controlled Slip is the replication or deletion of the payload bits of a DS1 frame. A Controlled Slip may be performed when there is a difference between the timing of a synchronous receiving terminal and the received signal. A Controlled Slip does not cause an Out of Frame defect.

### 3.3.2. Performance Defects

#### Out Of Frame (OOF) Defect

An OOF defect is the occurrence of a particular density of Framing Error events.

For T1 links, an Out of Frame defect is declared when the receiver detects two or more framing errors within a 3 msec period for ESF signals and 0.75 msec for D4 signals, or two or more errors out of five or fewer consecutive framing-bits.

For E1 links, an Out Of Frame defect is declared when three consecutive frame alignment signals have been received with an error (see G.706 Section 4.1 [17]).

Once an Out Of Frame Defect is declared, the framer starts searching for a correct framing pattern. The Out of Frame defect ends when the signal is in frame.

In-frame occurs when there are fewer than two frame bit errors within 3 msec period for ESF signals and 0.75 msec for D4 signals.

For E1 links, in-frame occurs when a) in frame N the frame alignment signal is correct and b) in frame N+1 the frame alignment signal is absent (i.e., bit 2 in TS0 is a one) and c) in frame N+2 the frame alignment signal is present and correct.

#### Alarm Indication Signal (AIS) Defect

For D4 and ESF links, the 'all ones' condition is detected at a DS1 line interface upon observing an unframed signal with a one's density of at least 99.9% present for a time equal to or greater than T, where 3 ms



$\leq T \leq 75$  ms. The AIS is terminated upon observing a signal not meeting the one's density or the unframed signal criteria for a period equal to or greater than  $T$ .

For E1 links, the 'all-ones' condition is detected at the line interface as a string of 512 bits containing fewer than three zero bits (see O.162 [14] Section 3.3.2).

### 3.3.3. Performance Parameters

All performance parameters are accumulated in fifteen minute intervals and up to 96 intervals (24 hours worth) are kept by an agent. Fewer than 96 intervals of data will be available if the agent has been restarted within the last 24 hours. In addition, there is a rolling 24-hour total of each performance parameter.

There is no requirement for an agent to ensure fixed relationship between the start of a fifteen minute interval and any wall clock; however some agents may align the fifteen minute intervals with quarter hours.

#### Line Errored Seconds (LES)

A Line Errored Second, according to T1M1.3, is a second in which one or more Line Code Violation error events were detected.

While many implementations are currently unable to detect the zero strings, it is expected that interface manufacturers will add this capability in deference to ANSI; therefore, it will become available in time.

In the T1M1.3 specification, near end Line Code Violations and far end Line Errored Seconds are counted. For consistency, we count Line Errored Seconds at both ends.

#### Controlled Slip Seconds (CSS)

A Controlled Slip Second is a one-second interval containing one or more controlled slips.

#### Errored Seconds (ES)

For ESF and E1-CRC links an Errored Second is a second with one or more Path Code Violations OR one or more Out of Frame defects OR one or more Controlled Slip events OR a detected AIS defect.

For D4 and E1-noCRC links, the presence of Bipolar

Violations also triggers an Errored Second.

This is not incremented during an Unavailable Second.

#### Bursty Errored Seconds (BES)

A Bursty Errored Second (also known as Errored Second type B) is a second with fewer than 320 and more than 1 Path Coding Violation error events, no Severely Errored Frame defects and no detected incoming AIS defects. Controlled slips are not included in this parameter.

This is not incremented during an Unavailable Second.

#### Severely Errored Seconds (SES)

A Severely Errored Second for ESF signals is a second with 320 or more Path Code Violation Error Events OR one or more Out of Frame defects OR a detected AIS defect.

For E1-CRC signals, a Severely Errored Second is a second with 832 or more Path Code Violation error events OR one or more Out of Frame defects.

For E1-noCRC signals, a Severely Errored Second is a 2048 LCVs or more.

For D4 signals, a Severely Errored Second is a count of one-second intervals with Framing Error events, or an OOF defect, or 1544 LCVs or more.

Controlled slips are not included in this parameter.

This is not incremented during an Unavailable Second.

#### Severely Errored Framing Second (SEFS)

An Severely Errored Framing Second is a second with one or more Out of Frame defects OR a detected AIS defect.

#### Degraded Minutes

A Degraded Minute is one in which the estimated error rate exceeds 1E-6 but does not exceed 1E-3 (see G.821 [15]).

Degraded Minutes are determined by collecting all of the Available Seconds, removing any Severely Errored Seconds grouping the result in 60-second long groups and counting a 60-second long group (a.k.a., minute) as degraded if the cumulative errors during the seconds present in the group exceed 1E-6. Available seconds are merely those seconds

which are not Unavailable as described below.

#### Unavailable Seconds (UAS)

Unavailable Seconds (UAS) are calculated by counting the number of seconds that the interface is unavailable. The DS1 interface is said to be unavailable from the onset of 10 contiguous SESSs, or the onset of the condition leading to a failure (see Failure States). If the condition leading to the failure was immediately preceded by one or more contiguous SESSs, then the DS1 interface unavailability starts from the onset of these SESSs. Once unavailable, and if no failure is present, the DS1 interface becomes available at the onset of 10 contiguous seconds with no SESSs. Once unavailable, and if a failure is present, the DS1 interface becomes available at the onset of 10 contiguous seconds with no SESSs, if the failure clearing time is less than or equal to 10 seconds. If the failure clearing time is more than 10 seconds, the DS1 interface becomes available at the onset of 10 contiguous seconds with no SESSs, or the onset period leading to the successful clearing condition, whichever occurs later. With respect to the DS1 error counts, all counters are incremented while the DS1 interface is deemed available. While the interface is deemed unavailable, the only count that is incremented is UASs.

A special case exists when the 10 or more second period crosses the 900 second statistics window boundary, as the foregoing description implies that the Severely Errored Second and Unavailable Second counters must be adjusted when the Unavailable Signal State is entered. Clearly, successive GETs of the affected `dsxlIntervalSESS` and `dsxlIntervalUAS` objects will return differing values if the first GET occurs during the first few seconds of the window. This is viewed as an unavoidable side-effect of selecting the presently defined managed objects as a basis for this memo.

#### 3.3.4. Failure States

The following failure states are received, or detected failures, that are reported in the `dsxlLineStatus` object. When a DS1 interface would, if ever, produce the conditions leading to the failure state is described in the appropriate specification.

#### Far End Alarm Failure

The Far End Alarm failure is also known as "Yellow Alarm" in the T1 case and "Distant Alarm" in the E1 case.

For D4 links, the Far End Alarm failure is declared when bit 6 of all channels has been zero for at least 335 ms and is cleared when bit 6 of at least one channel is non-zero for a period T, where T is usually less than one second and always less than 5 seconds. The Far End Alarm failure is not declared for D4 links when a Loss of Signal is detected.

For ESF links, the Far End Alarm failure is declared if the Yellow Alarm signal pattern occurs in at least seven out of ten contiguous 16-bit pattern intervals and is cleared if the Yellow Alarm signal pattern does not occur in ten contiguous 16-bit signal pattern intervals.

For E1 links, the Far End Alarm failure is declared when bit 3 of time-slot zero is received set to one on two consecutive occasions. The Far End Alarm failure is cleared when bit 3 of time-slot zero is received set to zero.

#### Alarm Indication Signal (AIS) Failure

The Alarm Indication Signal failure is declared when an AIS defect is detected at the input and the AIS defect still exists after the Loss Of Frame failure (which is caused by the unframed nature of the 'all-ones' signal) is declared. The AIS failure is cleared when the Loss Of Frame failure is cleared.

#### Loss Of Frame Failure

For T1 links, the Loss Of Frame failure is declared when an OOF or LOS defect has persisted for T seconds, where  $2 \leq T \leq 10$ . The Loss Of Frame failure is cleared when there have been no OOF or LOS defects during a period T where  $0 \leq T \leq 20$ . Many systems will perform "hit integration" within the period T before declaring or clearing the failure e.g., see TR 62411 [16].

For E1 links, the Loss Of Frame Failure is declared when an OOF defect is detected.

#### Loss Of Signal Failure

For T1, the Loss Of Signal failure is declared upon observing 175 +/- 75 contiguous pulse positions with no pulses of either positive or negative polarity. The LOS

failure is cleared upon observing an average pulse density of at least 12.5% over a period of 175 +/- 75 contiguous pulse positions starting with the receipt of a pulse.

For E1 links, the Loss Of Signal failure is declared when greater than 10 consecutive zeroes are detected (see O.162 Section 3.4.4).

#### Loopback Pseudo-Failure

The Loopback Pseudo-Failure is declared when the near end equipment has placed a loopback (of any kind) on the DS1. This allows a management entity to determine from one object whether the DS1 can be considered to be in service or not (from the point of view of the near end equipment).

#### TS16 Alarm Indication Signal Failure

For E1 links, the TS16 Alarm Indication Signal failure is declared when time-slot 16 is received as all ones for all frames of two consecutive multiframes (see G.732 Section 4.2.6). This condition is never declared for T1.

#### Loss Of MultiFrame Failure

The Loss Of MultiFrame failure is declared when two consecutive multiframe alignment signals (bits 4 through 7 of TS16 of frame 0) have been received with an error. The Loss Of Multiframe failure is cleared when the first correct multiframe alignment signal is received. The Loss Of Multiframe failure can only be declared for E1 links operating with G.732 [18] framing (sometimes called "Channel Associated Signalling" mode).

#### Far End Loss Of Multiframe Failure

The Far End Loss Of Multiframe failure is declared when bit 2 of TS16 of frame 0 is received set to one on two consecutive occasions. The Far End Loss Of Multiframe failure is cleared when bit 2 of TS16 of frame 0 is received set to zero. The Far End Loss Of Multiframe failure can only be declared for E1 links operating in "Channel Associated Signalling" mode.

### 3.3.5. Other Terms

#### Circuit Identifier

This is a character string specified by the circuit vendor, and is useful when communicating with the vendor during the troubleshooting process.

## 4. Definitions

```
RFC1406-MIB DEFINITIONS ::= BEGIN
IMPORTS
    Gauge
        FROM RFC1155-SMI
    transmission, DisplayString
        FROM RFC1213-MIB
    OBJECT-TYPE
        FROM RFC-1212;

-- This MIB module uses the extended OBJECT-TYPE macro as
-- defined in RFC 1212.

-- this is the MIB module for the DS1 objects

ds1 OBJECT IDENTIFIER ::= { transmission 18 }

-- note that this subsumes cept (19); there is no separate CEPT MIB

-- The DS1 Near End Group

-- Implementation of this group is mandatory for all systems
-- that attach to a DS1 Interface.

-- The DS1 Near End Group consists of four tables:
--     DS1 Configuration
--     DS1 Current
--     DS1 Interval
--     DS1 Total

-- the DS1 Configuration Table

dsx1ConfigTable OBJECT-TYPE
    SYNTAX SEQUENCE OF Dsx1ConfigEntry
    ACCESS not-accessible
    STATUS mandatory
    DESCRIPTION
        "The DS1 Configuration table."
    ::= { ds1 6 }

dsx1ConfigEntry OBJECT-TYPE
    SYNTAX Dsx1ConfigEntry
    ACCESS not-accessible
    STATUS mandatory
    DESCRIPTION
```

"An entry in the DS1 Configuration table."  
 INDEX { dsx1LineIndex }  
 ::= { dsx1ConfigTable 1 }

Dsx1ConfigEntry ::=  
 SEQUENCE {  
 dsx1LineIndex  
 INTEGER,  
 dsx1IfIndex  
 INTEGER,  
 dsx1TimeElapsed  
 INTEGER,  
 dsx1ValidIntervals  
 INTEGER,  
 dsx1LineType  
 INTEGER,  
 dsx1LineCoding  
 INTEGER,  
 dsx1SendCode  
 INTEGER,  
 dsx1CircuitIdentifier  
 DisplayString,  
 dsx1LoopbackConfig  
 INTEGER,  
 dsx1LineStatus  
 INTEGER,  
 dsx1SignalMode  
 INTEGER,  
 dsx1TransmitClockSource  
 INTEGER,  
 dsx1Fdl  
 INTEGER  
 }

#### dsx1LineIndex OBJECT-TYPE

SYNTAX INTEGER (1..'7fffffff'h)

ACCESS read-only

STATUS mandatory

#### DESCRIPTION

"This object is the identifier of a DS1 Interface on a managed device. If there is an ifEntry that is directly associated with this and only this DS1 interface, it should have the same value as ifIndex. Otherwise, the value exceeds ifNumber, and is a unique identifier following this rule: inside interfaces (e.g., equipment side) with even numbers and outside interfaces (e.g., network side) with odd

```
        numbers."
 ::= { dsx1ConfigEntry 1 }

dsx1IfIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "This value for this object is equal to the
        value of ifIndex from the Interfaces table of
        MIB II (RFC 1213)."
 ::= { dsx1ConfigEntry 2 }

dsx1TimeElapsed OBJECT-TYPE
    SYNTAX  INTEGER (0..899)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of seconds that have elapsed since
        the beginning of the current error-measurement
        period."
 ::= { dsx1ConfigEntry 3 }

dsx1ValidIntervals OBJECT-TYPE
    SYNTAX  INTEGER (0..96)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of previous intervals for which
        valid data was collected. The value will be 96
        unless the interface was brought on-line within
        the last 24 hours, in which case the value will
        be the number of complete 15 minute intervals
        the since interface has been online."
 ::= { dsx1ConfigEntry 4 }

dsx1LineType OBJECT-TYPE
    SYNTAX  INTEGER {
        other(1),
        dsx1ESF(2),
        dsx1D4(3),
        dsx1E1(4),
        dsx1E1-CRC(5),
        dsx1E1-MF(6),
```



```

        dsx1E1-CRC-MF(7)
    }
ACCESS read-write
STATUS mandatory
DESCRIPTION
    "This variable indicates the variety of DS1
    Line implementing this circuit. The type of
    circuit affects the number of bits per second
    that the circuit can reasonably carry, as well
    as the interpretation of the usage and error
    statistics. The values, in sequence, describe:

    TITLE:          SPECIFICATION:
    dsx1ESF          Extended SuperFrame DS1
    dsx1D4           AT&T D4 format DS1
    dsx1E1           CCITT Recommendation G.704
                    (Table 4a)
    dsx1E1-CRC      CCITT Recommendation G.704
                    (Table 4b)
    dsxE1-MF        G.704 (Table 4a) with TS16
                    multiframing enabled
    dsx1E1-CRC-MF   G.704 (Table 4b) with TS16
                    multiframing enabled"

 ::= { dsx1ConfigEntry 5 }

```

```

dsx1LineCoding OBJECT-TYPE
    SYNTAX  INTEGER {
        dsx1JBZS (1),
        dsx1B8ZS (2),
        dsx1HDB3 (3),
        dsx1ZBTSI (4),
        dsx1AMI (5),
        other(6)
    }
ACCESS read-write
STATUS mandatory
DESCRIPTION
    "This variable describes the variety of Zero
    Code Suppression used on the link, which in
    turn affects a number of its characteristics.

    dsx1JBZS refers the Jammed Bit Zero Suppres-
    sion, in which the AT&T specification of at
    least one pulse every 8 bit periods is literal-
    ly implemented by forcing a pulse in bit 8 of
    each channel. Thus, only seven bits per chan-

```

nel, or 1.344 Mbps, is available for data.

dsx1B8ZS refers to the use of a specified pattern of normal bits and bipolar violations which are used to replace a sequence of eight zero bits.

ANSI Clear Channels may use dsx1ZBTSI, or Zero Byte Time Slot Interchange.

E1 links, with or without CRC, use dsx1HDB3 or dsx1AMI.

dsx1AMI refers to a mode wherein no zero code suppression is present and the line encoding does not solve the problem directly. In this application, the higher layer must provide data which meets or exceeds the pulse density requirements, such as inverting HDLC data."

```
::= { dsx1ConfigEntry 6 }
```

dsx1SendCode OBJECT-TYPE

```
SYNTAX  INTEGER {
    dsx1SendNoCode(1),
    dsx1SendLineCode(2),
    dsx1SendPayloadCode(3),
    dsx1SendResetCode(4),
    dsx1SendQRS(5),
    dsx1Send511Pattern(6),
    dsx1Send3in24Pattern(7),
    dsx1SendOtherTestPattern(8)
}
```

ACCESS read-write

STATUS mandatory

DESCRIPTION

"This variable indicates what type of code is being sent across the DS1 interface by the device. The values mean:

dsx1SendNoCode  
    sending looped or normal data

dsx1SendLineCode  
    sending a request for a line loopback

dsx1SendPayloadCode  
    sending a request for a payload loopback

```

dsx1SendResetCode
    sending a loopback termination request

dsx1SendQRS
    sending a Quasi-Random Signal (QRS) test
    pattern

dsx1Send511Pattern
    sending a 511 bit fixed test pattern

dsx1Send3in24Pattern
    sending a fixed test pattern of 3 bits set
    in 24

dsx1SendOtherTestPattern
    sending a test pattern other than those
    described by this object"
 ::= { dsx1ConfigEntry 7 }

```

```

dsx1CircuitIdentifier OBJECT-TYPE
    SYNTAX  DisplayString (SIZE (0..255))
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "This variable contains the transmission
        vendor's circuit identifier, for the purpose of
        facilitating troubleshooting."
    ::= { dsx1ConfigEntry 8 }

```

```

dsx1LoopbackConfig OBJECT-TYPE
    SYNTAX  INTEGER {
        dsx1NoLoop(1),
        dsx1PayloadLoop(2),
        dsx1LineLoop(3),
        dsx1OtherLoop(4)
    }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
        "This variable represents the loopback confi-
        guration of the DS1 interface. Agents support-
        ing read/write access should return badValue in
        response to a requested loopback state that the
        interface does not support. The values mean:

```

**dsx1NoLoop**

Not in the loopback state. A device that is not capable of performing a loopback on the interface shall always return this as it's value.

**dsx1PayloadLoop**

The received signal at this interface is looped through the device. Typically the received signal is looped back for re-transmission after it has passed through the device's framing function.

**dsx1LineLoop**

The received signal at this interface does not go through the device (minimum penetration) but is looped back out.

**dsx1OtherLoop**

Loopbacks that are not defined here."

::= { dsx1ConfigEntry 9 }

**dsx1LineStatus OBJECT-TYPE**

SYNTAX INTEGER (1..8191)

ACCESS read-only

STATUS mandatory

**DESCRIPTION**

"This variable indicates the Line Status of the interface. It contains loopback, failure, received 'alarm' and transmitted 'alarm' information.

The dsx1LineStatus is a bit map represented as a sum, therefore, it can represent multiple failures (alarms) and a LoopbackState simultaneously.

dsx1NoAlarm should be set if and only if no other flag is set.

If the dsx1LoopbackState bit is set, the loopback in effect can be determined from the dsx1LoopbackConfig object.

The various bit positions are:

1	dsx1NoAlarm	No Alarm Present
2	dsx1RcvFarEndLOF	Far end LOF (a.k.a., Yellow Alarm)
4	dsx1XmtFarEndLOF	Near end sending LOF Indication
8	dsx1RcvAIS	Far end sending AIS

16	dsx1XmtAIS	Near end sending AIS
32	dsx1LossOfFrame	Near end LOF (a.k.a., Red Alarm)
64	dsx1LossOfSignal	Near end Loss Of Signal
128	dsx1LoopbackState	Near end is looped
256	dsx1T16AIS	E1 TS16 AIS
512	dsx1RcvFarEndLOMF	Far End Sending TS16 LOMF
1024	dsx1XmtFarEndLOMF	Near End Sending TS16 LOMF
2048	dsx1RcvTestCode	Near End detects a test code
4096	dsx1OtherFailure	any line status not defined here"

::= { dsx1ConfigEntry 10 }

#### dsx1SignalMode OBJECT-TYPE

```
SYNTAX  INTEGER {
    none (1),
    robbedBit (2),
    bitOriented (3),
    messageOriented (4)
}
```

ACCESS read-write

STATUS mandatory

#### DESCRIPTION

"'none' indicates that no bits are reserved for signaling on this channel.

'robbedBit' indicates that T1 Robbed Bit Signaling is in use.

'bitOriented' indicates that E1 Channel Associated Signaling is in use.

'messageOriented' indicates that Common Channel Signaling is in use either on channel 16 of an E1 link or channel 24 of a T1."

::= { dsx1ConfigEntry 11 }

#### dsx1TransmitClockSource OBJECT-TYPE

```
SYNTAX  INTEGER {
    loopTiming (1),
    localTiming (2),
    throughTiming (3)
}
```

ACCESS read-write

STATUS mandatory

#### DESCRIPTION

"The source of Transmit Clock.

'loopTiming' indicates that the recovered receive clock is used as the transmit clock.

'localTiming' indicates that a local clock source is used.

'throughTiming' indicates that recovered receive clock from another interface is used as the transmit clock."

::= { dsx1ConfigEntry 12 }

#### dsx1Fdl OBJECT-TYPE

```
SYNTAX  INTEGER {
    other(1),
    dsx1Ansi-T1-403(2),
    dsx1Att-54016(4),
    dsx1Fdl-none(8)
}
```

ACCESS read-write

STATUS mandatory

#### DESCRIPTION

"This bitmap describes the use of the facilities data link, and is the sum of the capabilities:

'other' indicates that a protocol other than one following is used.

'dsx1Ansi-T1-403' refers to the FDL exchange recommended by ANSI.

'dsx1Att-54016' refers to ESF FDL exchanges.

'dsx1Fdl-none' indicates that the device does not use the FDL."

::= { dsx1ConfigEntry 13 }

-- the DS1 Current Table

-- The DS1 current table contains various statistics being  
-- collected for the current 15 minute interval.

#### dsx1CurrentTable OBJECT-TYPE

```
SYNTAX  SEQUENCE OF Dsx1CurrentEntry
```

ACCESS not-accessible

STATUS mandatory

## DESCRIPTION

"The DS1 Current table."

::= { ds1 7 }

## dsx1CurrentEntry OBJECT-TYPE

SYNTAX Dsx1CurrentEntry

ACCESS not-accessible

STATUS mandatory

## DESCRIPTION

"An entry in the DS1 Current table."

INDEX { dsx1CurrentIndex }

::= { dsx1CurrentTable 1 }

Dsx1CurrentEntry ::=

SEQUENCE {

dsx1CurrentIndex

INTEGER,

dsx1CurrentESS

Gauge,

dsx1CurrentSESS

Gauge,

dsx1CurrentSEFSS

Gauge,

dsx1CurrentUASS

Gauge,

dsx1CurrentCSSs

Gauge,

dsx1CurrentPCVs

Gauge,

dsx1CurrentLESS

Gauge,

dsx1CurrentBESS

Gauge,

dsx1CurrentDMS

Gauge,

dsx1CurrentLCVs

Gauge

}

## dsx1CurrentIndex OBJECT-TYPE

SYNTAX INTEGER (1..'7fffffff'h)

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The index value which uniquely identifies the DS1 interface to which this entry is applicable. The interface identified by a particular

value of this index is the same interface as identified by the same value as a dsx1LineIndex object instance."  
 ::= { dsx1CurrentEntry 1 }

dsx1CurrentESSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Errored Seconds, encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1CurrentEntry 2 }

dsx1CurrentSESSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Severely Errored Seconds encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1CurrentEntry 3 }

dsx1CurrentSEFSSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Severely Errored Framing Seconds encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1CurrentEntry 4 }

dsx1CurrentUASs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Unavailable Seconds encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1CurrentEntry 5 }



```
dsx1CurrentCSSs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Controlled Slip Seconds encountered by a DS1 interface in the current 15 minute interval."
    ::= { dsx1CurrentEntry 6 }

dsx1CurrentPCVs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Path Coding Violations encountered by a DS1 interface in the current 15 minute interval."
    ::= { dsx1CurrentEntry 7 }

dsx1CurrentLESSs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Line Errored Seconds encountered by a DS1 interface in the current 15 minute interval."
    ::= { dsx1CurrentEntry 8 }

dsx1CurrentBESs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in the current 15 minute interval."
    ::= { dsx1CurrentEntry 9 }

dsx1CurrentDMs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
```

## DESCRIPTION

"The number of Degraded Minutes (DMS) encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1CurrentEntry 10 }

## dsx1CurrentLCVs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The number of Line Code Violations (LCVs) encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1CurrentEntry 11 }

-- the DS1 Interval

-- The DS1 Interval Table contains various statistics  
 -- collected by each DS1 Interface over the previous 24 hours of  
 -- operation. The past 24 hours are broken into 96 completed  
 -- 15 minute intervals.

## dsx1IntervalTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dsx1IntervalEntry

ACCESS not-accessible

STATUS mandatory

## DESCRIPTION

"The DS1 Interval table."

::= { ds1 8 }

## dsx1IntervalEntry OBJECT-TYPE

SYNTAX Dsx1IntervalEntry

ACCESS not-accessible

STATUS mandatory

## DESCRIPTION

"An entry in the DS1 Interval table."

INDEX { dsx1IntervalIndex, dsx1IntervalNumber }

::= { dsx1IntervalTable 1 }

Dsx1IntervalEntry ::=

```
SEQUENCE {
    dsx1IntervalIndex
        INTEGER,
    dsx1IntervalNumber
```

```

        INTEGER,
dsx1IntervalESs
    Gauge,
dsx1IntervalSESSs
    Gauge,
dsx1IntervalSEFSs
    Gauge,
dsx1IntervalUASs
    Gauge,
dsx1IntervalCSSs
    Gauge,
dsx1IntervalPCVs
    Gauge,
dsx1IntervalLESSs
    Gauge,
dsx1IntervalBESSs
    Gauge,
dsx1IntervalDMS
    Gauge,
dsx1IntervalLCVs
    Gauge
}

dsx1IntervalIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The index value which uniquely identifies the
        DS1 interface to which this entry is applica-
        ble. The interface identified by a particular
        value of this index is the same interface as
        identified by the same value as a dsx1LineIndex
        object instance."
    ::= { dsx1IntervalEntry 1 }

dsx1IntervalNumber OBJECT-TYPE
    SYNTAX  INTEGER (1..96)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "A number between 1 and 96, where 1 is the most
        recently completed 15 minute interval and 96 is
        the least recently completed 15 minutes inter-
        val (assuming that all 96 intervals are
        valid)."
    ::= { dsx1IntervalEntry 2 }

```

**dsx1IntervalESS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Errored Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 3 }

**dsx1IntervalSESS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Severely Errored Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 4 }

**dsx1IntervalSEFSS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Severely Errored Framing Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 5 }

**dsx1IntervalUASS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Unavailable Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 6 }

**dsx1IntervalCSSs OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The number of Controlled Slip Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 7 }

## dsx1IntervalPCVs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The number of Path Coding Violations encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 8 }

## dsx1IntervalLEsS OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The number of Line Errored Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 9 }

## dsx1IntervalBESs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1IntervalEntry 10 }

## dsx1IntervalDMs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

## DESCRIPTION

"The number of Degraded Minutes (DMs) encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

```
::= { dsx1IntervalEntry 11 }
```

```
dsx1IntervalLCVs OBJECT-TYPE
```

```
    SYNTAX Gauge
```

```
    ACCESS read-only
```

```
    STATUS mandatory
```

```
    DESCRIPTION
```

```
        "The number of Line Code Violations (LCVs) encountered by a DS1 interface in the current 15 minute interval."
```

```
::= { dsx1IntervalEntry 12 }
```

```
-- the DS1 Total
```

```
-- The DS1 Total Table contains the cumulative sum of the
-- various statistics for the 24 hour period preceding the
-- current interval.
```

```
dsx1TotalTable OBJECT-TYPE
```

```
    SYNTAX SEQUENCE OF Dsx1TotalEntry
```

```
    ACCESS not-accessible
```

```
    STATUS mandatory
```

```
    DESCRIPTION
```

```
        "The DS1 Total table. 24 hour interval."
```

```
::= { ds1 9 }
```

```
dsx1TotalEntry OBJECT-TYPE
```

```
    SYNTAX Dsx1TotalEntry
```

```
    ACCESS not-accessible
```

```
    STATUS mandatory
```

```
    DESCRIPTION
```

```
        "An entry in the DS1 Total table."
```

```
    INDEX { dsx1TotalIndex }
```

```
::= { dsx1TotalTable 1 }
```

```
Dsx1TotalEntry ::=
```

```
    SEQUENCE {
```

```
        dsx1TotalIndex
```

```
        INTEGER,
```

```
        dsx1TotalESS
```

```
        Gauge,
```

```
        dsx1TotalSESS
```

```
        Gauge,
```

```
        dsx1TotalSEFSS
```

```
        Gauge,
```

```

    dsx1TotalUASs
        Gauge,
    dsx1TotalCSSs
        Gauge,
    dsx1TotalPCVs
        Gauge,
    dsx1TotalLESS
        Gauge,
    dsx1TotalBESS
        Gauge,
    dsx1TotalDMS
        Gauge,
    dsx1TotalLCVs
        Gauge
}

dsx1TotalIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The index value which uniquely identifies the
        DS1 interface to which this entry is applica-
        ble. The interface identified by a particular
        value of this index is the same interface as
        identified by the same value as a dsx1LineIndex
        object instance."
    ::= { dsx1TotalEntry 1 }

dsx1TotalESSs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Errored Seconds encountered by a
        DS1 interface in the previous 24 hour interval"
    ::= { dsx1TotalEntry 2 }

dsx1TotalSESSs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Severely Errored Seconds encoun-
        tered by a DS1 interface in the previous 24
        hour interval."

```

```
::= { dsx1TotalEntry 3 }
```

dsx1TotalSEFSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Severely Errored Framing Seconds encountered by a DS1 interface in the previous 24 hour interval."

```
::= { dsx1TotalEntry 4 }
```

dsx1TotalUASs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Unavailable Seconds encountered by a DS1 interface in the previous 24 hour interval."

```
::= { dsx1TotalEntry 5 }
```

dsx1TotalCSSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Controlled Slip Seconds encountered by a DS1 interface in the previous 24 hour interval."

```
::= { dsx1TotalEntry 6 }
```

dsx1TotalPCVs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Path Coding Violations encountered by a DS1 interface in the previous 24 hour interval."

```
::= { dsx1TotalEntry 7 }
```



```
dsx1TotalLESSs OBJECT-TYPE
    SYNTAX Gauge
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of Line Errored Seconds encountered
        by a DS1 interface in the previous 24 hour in-
        terval."
    ::= { dsx1TotalEntry 8 }
```

```
dsx1TotalBESSs OBJECT-TYPE
    SYNTAX Gauge
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of Bursty Errored Seconds (BESS)
        encountered by a DS1 interface in the previous
        24 hour interval."
    ::= { dsx1TotalEntry 9 }
```

```
dsx1TotalDMs OBJECT-TYPE
    SYNTAX Gauge
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of Degraded Minutes (DMs) encoun-
        tered by a DS1 interface in the previous 24
        hour interval."
    ::= { dsx1TotalEntry 10 }
```

```
dsx1TotalLCVs OBJECT-TYPE
    SYNTAX Gauge
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The number of Line Code Violations (LCVs) en-
        countered by a DS1 interface in the current 15
        minute interval."
    ::= { dsx1TotalEntry 11 }
```

-- The DS1 Far End Group

-- Implementation of this group is optional for all systems  
-- that attach to a DS1 Interface.

```
-- The DS1 Far End Group consists of three tables:
--   DS1 Far End Current
--   DS1 Far End Interval
--   DS1 Far End Total

-- The DS1 Far End Current Table

-- The DS1 Far End Current table contains various statistics
-- being collected for the current 15 minute interval.
-- The statistics are collected from the far end messages on the
-- Facilities Data Link. The definitions are the same as
-- described for the near-end information.
```

```
dsx1FarEndCurrentTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF Dsx1FarEndCurrentEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "The DS1 Far End Current table."
    ::= { ds1 10 }
```

```
dsx1FarEndCurrentEntry OBJECT-TYPE
    SYNTAX  Dsx1FarEndCurrentEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "An entry in the DS1 Far End Current table."
    INDEX   { dsx1FarEndCurrentIndex }
    ::= { dsx1FarEndCurrentTable 1 }
```

```
Dsx1FarEndCurrentEntry ::=
    SEQUENCE {
        dsx1FarEndCurrentIndex
            INTEGER,
        dsx1FarEndTimeElapsed
            INTEGER,
        dsx1FarEndValidIntervals
            INTEGER,
        dsx1FarEndCurrentESs
            Gauge,
        dsx1FarEndCurrentSESSs
            Gauge,
        dsx1FarEndCurrentSEFSSs
            Gauge,
        dsx1FarEndCurrentUASSs
            Gauge,
        dsx1FarEndCurrentCSSSs
```

```

        Gauge,
    dsx1FarEndCurrentLESS
        Gauge,
    dsx1FarEndCurrentPCVs
        Gauge,
    dsx1FarEndCurrentBESS
        Gauge,
    dsx1FarEndCurrentDMs
        Gauge
    }

dsx1FarEndCurrentIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The index value which uniquely identifies the
        DSL interface to which this entry is applica-
        ble. The interface identified by a particular
        value of this index is the same interface as
        identified by the same value an dsx1LineIndex
        object instance."
    ::= { dsx1FarEndCurrentEntry 1 }

dsx1FarEndTimeElapsed OBJECT-TYPE
    SYNTAX  INTEGER (0..899)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of seconds that have elapsed
        since the beginning of the far end current
        error-measurement period."
    ::= { dsx1FarEndCurrentEntry 2 }

dsx1FarEndValidIntervals OBJECT-TYPE
    SYNTAX  INTEGER (0..96)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of previous far end intervals
        for which valid data was collected. The
        value will be 96 unless the interface was
        brought online within the last 24 hours,
        in which case the value will be the number
        of complete 15 minute far end intervals
        since the interface has been online."

```

```
::= { dsx1FarEndCurrentEntry 3 }
```

```
dsx1FarEndCurrentESSs OBJECT-TYPE
```

```
SYNTAX Gauge
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

```
"The number of Far Far End Errored Seconds en-
countered by a DS1 interface in the current 15
minute interval."
```

```
::= { dsx1FarEndCurrentEntry 4 }
```

```
dsx1FarEndCurrentSESSs OBJECT-TYPE
```

```
SYNTAX Gauge
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

```
"The number of Far End Severely Errored Seconds
encountered by a DS1 interface in the current
15 minute interval."
```

```
::= { dsx1FarEndCurrentEntry 5 }
```

```
dsx1FarEndCurrentSEFSSs OBJECT-TYPE
```

```
SYNTAX Gauge
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

```
"The number of Far End Severely Errored Framing
Seconds encountered by a DS1 interface in the
current 15 minute interval."
```

```
::= { dsx1FarEndCurrentEntry 6 }
```

```
dsx1FarEndCurrentUASSs OBJECT-TYPE
```

```
SYNTAX Gauge
```

```
ACCESS read-only
```

```
STATUS mandatory
```

```
DESCRIPTION
```

```
"The number of Unavailable Seconds encountered
by a DS1 interface in the current 15 minute in-
terval."
```

```
::= { dsx1FarEndCurrentEntry 7 }
```

`dsx1FarEndCurrentCSSs OBJECT-TYPE``SYNTAX Gauge``ACCESS read-only``STATUS mandatory``DESCRIPTION`

"The number of Far End Controlled Slip Seconds encountered by a DS1 interface in the current 15 minute interval."

`::= { dsx1FarEndCurrentEntry 8 }``dsx1FarEndCurrentLESSs OBJECT-TYPE``SYNTAX Gauge``ACCESS read-only``STATUS mandatory``DESCRIPTION`

"The number of Far End Line Errored Seconds encountered by a DS1 interface in the current 15 minute interval."

`::= { dsx1FarEndCurrentEntry 9 }``dsx1FarEndCurrentPCVs OBJECT-TYPE``SYNTAX Gauge``ACCESS read-only``STATUS mandatory``DESCRIPTION`

"The number of Far End Path Coding Violations reported via the far end block error count encountered by a DS1 interface in the current 15 minute interval."

`::= { dsx1FarEndCurrentEntry 10 }``dsx1FarEndCurrentBESSs OBJECT-TYPE``SYNTAX Gauge``ACCESS read-only``STATUS mandatory``DESCRIPTION`

"The number of Bursty Errored Seconds (BESSs) encountered by a DS1 interface in the current 15 minute interval."

`::= { dsx1FarEndCurrentEntry 11 }``dsx1FarEndCurrentDMs OBJECT-TYPE``SYNTAX Gauge``ACCESS read-only`

STATUS mandatory

DESCRIPTION

"The number of Degraded Minutes (DMS) encountered by a DS1 interface in the current 15 minute interval."

::= { dsx1FarEndCurrentEntry 12 }

-- The DS1 Far End Interval Table

-- The DS1 Far End Interval Table contains various statistics  
 -- collected by each DS1 interface over the previous 24 hours of  
 -- operation. The past 24 hours are broken into 96  
 -- completed 15 minute intervals.

dsx1FarEndIntervalTable OBJECT-TYPE

SYNTAX SEQUENCE OF Dsx1FarEndIntervalEntry

ACCESS not-accessible

STATUS mandatory

DESCRIPTION

"The DS1 Far End Interval table."

::= { ds1 11 }

dsx1FarEndIntervalEntry OBJECT-TYPE

SYNTAX Dsx1FarEndIntervalEntry

ACCESS not-accessible

STATUS mandatory

DESCRIPTION

"An entry in the DS1 Far End Interval table."

INDEX { dsx1FarEndIntervalIndex,  
 dsx1FarEndIntervalNumber }

::= { dsx1FarEndIntervalTable 1 }

Dsx1FarEndIntervalEntry ::=

SEQUENCE {

dsx1FarEndIntervalIndex

INTEGER,

dsx1FarEndIntervalNumber

INTEGER,

dsx1FarEndIntervaleSSs

Gauge,

dsx1FarEndIntervalSESSs

Gauge,

dsx1FarEndIntervalSEFSSs

Gauge,

dsx1FarEndIntervalUASSs

Gauge,

```

    dsx1FarEndIntervalCSSs
        Gauge,
    dsx1FarEndIntervalLESSs
        Gauge,
    dsx1FarEndIntervalPCVs
        Gauge,
    dsx1FarEndIntervalBESSs
        Gauge,
    dsx1FarEndIntervalDMSs
        Gauge
}

dsx1FarEndIntervalIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The index value which uniquely identifies the
        DS1 interface to which this entry is applica-
        ble. The interface identified by a particular
        value of this index is the same interface as
        identified by the same value as a dsx1LineIndex
        object instance."
    ::= { dsx1FarEndIntervalEntry 1 }

dsx1FarEndIntervalNumber OBJECT-TYPE
    SYNTAX  INTEGER (1..96)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "A number between 1 and 96, where 1 is the most
        recently completed 15 minute interval and 96 is
        the least recently completed 15 minutes inter-
        val (assuming that all 96 intervals are
        valid)."
    ::= { dsx1FarEndIntervalEntry 2 }

dsx1FarEndIntervaleSSs OBJECT-TYPE
    SYNTAX  Gauge
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The number of Far End Errored Seconds encoun-
        tered by a DS1 interface in one of the previous
        96, individual 15 minute, intervals."
    ::= { dsx1FarEndIntervalEntry 3 }

```

**dsx1FarEndIntervalSESS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Severely Errored Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 4 }

**dsx1FarEndIntervalSEFSS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Severely Errored Framing Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 5 }

**dsx1FarEndIntervalUASS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Unavailable Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 6 }

**dsx1FarEndIntervalCSSs OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Controlled Slip Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 7 }

**dsx1FarEndIntervalLESS OBJECT-TYPE**

SYNTAX Gauge

ACCESS read-only



STATUS mandatory

DESCRIPTION

"The number of Far End Line Errored Seconds encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 8 }

dsx1FarEndIntervalPCVs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Path Coding Violations reported via the far end block error count encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 9 }

dsx1FarEndIntervalBESs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Bursty Errored Seconds (BESs) encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 10 }

dsx1FarEndIntervalDMs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Degraded Minutes (DMs) encountered by a DS1 interface in one of the previous 96, individual 15 minute, intervals."

::= { dsx1FarEndIntervalEntry 11 }

-- The DS1 Far End Total Table

-- The DS1 Far End Total Table contains the cumulative sum of the  
-- various statistics for the 24 hour period preceding the  
-- current interval.

```

dsx1FarEndTotalTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF Dsx1FarEndTotalEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "The DS1 Far End Total table."
    ::= { ds1 12 }

```

```

dsx1FarEndTotalEntry OBJECT-TYPE
    SYNTAX  Dsx1FarEndTotalEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "An entry in the DS1 Far End Total table."
    INDEX   { dsx1FarEndTotalIndex }
    ::= { dsx1FarEndTotalTable 1 }

```

```

Dsx1FarEndTotalEntry ::=
    SEQUENCE {
        dsx1FarEndTotalIndex
            INTEGER,
        dsx1FarEndTotalESSs
            Gauge,
        dsx1FarEndTotalSESSs
            Gauge,
        dsx1FarEndTotalSEFSSs
            Gauge,
        dsx1FarEndTotalUASSs
            Gauge,
        dsx1FarEndTotalCSSs
            Gauge,
        dsx1FarEndTotalLESSs
            Gauge,
        dsx1FarEndTotalPCVs
            Gauge,
        dsx1FarEndTotalBESSs
            Gauge,
        dsx1FarEndTotalDMs
            Gauge
    }

```

```

dsx1FarEndTotalIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
        "The index value which uniquely identifies the

```

DS1 interface to which this entry is applicable. The interface identified by a particular value of this index is the same interface as identified by the same value an dsx1LineIndex object instance."

::= { dsx1FarEndTotalEntry 1 }

dsx1FarEndTotalESS OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Errored Seconds encountered by a DS1 interface in the previous 24 hour interval."

::= { dsx1FarEndTotalEntry 2 }

dsx1FarEndTotalSESS OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Severely Errored Seconds encountered by a DS1 interface in the previous 24 hour interval."

::= { dsx1FarEndTotalEntry 3 }

dsx1FarEndTotalSEFSS OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Severely Errored Framing Seconds encountered by a DS1 interface in the previous 24 hour interval."

::= { dsx1FarEndTotalEntry 4 }

dsx1FarEndTotalUASS OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Unavailable Seconds encountered by a DS1 interface in the previous 24 hour in-

```
        erval."
 ::= { dsx1FarEndTotalEntry 5 }
```

dsx1FarEndTotalCSSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Controlled Slip Seconds encountered by a DS1 interface in the previous 24 hour interval."

```
 ::= { dsx1FarEndTotalEntry 6 }
```

dsx1FarEndTotalLESSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Line Errored Seconds encountered by a DS1 interface in the previous 24 hour interval."

```
 ::= { dsx1FarEndTotalEntry 7 }
```

dsx1FarEndTotalPCVs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Far End Path Coding Violations reported via the far end block error count encountered by a DS1 interface in the previous 24 hour interval."

```
 ::= { dsx1FarEndTotalEntry 8 }
```

dsx1FarEndTotalBESSs OBJECT-TYPE

SYNTAX Gauge

ACCESS read-only

STATUS mandatory

DESCRIPTION

"The number of Bursty Errored Seconds (BESSs) encountered by a DS1 interface in the previous 24 hour interval."

```
 ::= { dsx1FarEndTotalEntry 9 }
```

```

    dsx1FarEndTotalDms OBJECT-TYPE
        SYNTAX Gauge
        ACCESS read-only
        STATUS mandatory
        DESCRIPTION
            "The number of Degraded Minutes (Dms) encountered by a DS1 interface in the previous 24 hour interval."
        ::= { dsx1FarEndTotalEntry 10 }

-- the DS1 Fractional Group

-- Implementation of this group is mandatory for those
-- systems dividing a DS1 into channels containing different
-- data streams that are of local interest. Systems which
-- are indifferent to data content, such as CSUs, need not
-- implement it.

-- The DS1 fractional table identifies which DS1 channels
-- associated with a CSU are being used to support a
-- logical interface, i.e., an entry in the interfaces table
-- from the Internet-standard MIB.

-- For example, consider an application managing a North
-- American ISDN Primary Rate link whose division is a 384 kbit/s
-- H1 "B" Channel for Video, a second H1 for data to a primary
-- routing peer, and 12 64 kbit/s H0 "B" Channels. Consider that
-- some subset of the H0 channels are used for voice and the
-- remainder are available for dynamic data calls.

-- we count a total of 14 interfaces multiplexed onto the DS1
-- interface. Six DS1 channels (for the sake of the example,
-- channels 1..6) are used for Video, six more (7..11 and 13)
-- are used for data, and the remaining 12 are in channels
-- 12 and 14..24.

-- Let us further imagine that ifIndex 2 is of type DS1 and
-- refers to the DS1 interface, and that the interfaces layered
-- onto it are numbered 3..16.

-- We might describe the allocation of channels, in the
-- dsx1FracTable, as follows:

-- dsx1FracIfIndex.2. 1 = 3      dsx1FracIfIndex.2.13 = 4
-- dsx1FracIfIndex.2. 2 = 3      dsx1FracIfIndex.2.14 = 6
-- dsx1FracIfIndex.2. 3 = 3      dsx1FracIfIndex.2.15 = 7
-- dsx1FracIfIndex.2. 4 = 3      dsx1FracIfIndex.2.16 = 8

```

```

-- dsx1FracIfIndex.2. 5 = 3      dsx1FracIfIndex.2.17 = 9
-- dsx1FracIfIndex.2. 6 = 3      dsx1FracIfIndex.2.18 = 10
-- dsx1FracIfIndex.2. 7 = 4      dsx1FracIfIndex.2.19 = 11
-- dsx1FracIfIndex.2. 8 = 4      dsx1FracIfIndex.2.20 = 12
-- dsx1FracIfIndex.2. 9 = 4      dsx1FracIfIndex.2.21 = 13
-- dsx1FracIfIndex.2.10 = 4      dsx1FracIfIndex.2.22 = 14
-- dsx1FracIfIndex.2.11 = 4      dsx1FracIfIndex.2.23 = 15
-- dsx1FracIfIndex.2.12 = 5      dsx1FracIfIndex.2.24 = 16

```

```

--      For North American (DS1) interfaces, there are 24 legal
--      channels, numbered 1 through 24.

```

```

--      For G.704 interfaces, there are 31 legal channels,
--      numbered 1 through 31. The channels (1..31) correspond
--      directly to the equivalently numbered time-slots.

```

```

dsx1FracTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF Dsx1FracEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "The DS1 Fractional table."
    ::= { ds1 13 }

```

```

dsx1FracEntry OBJECT-TYPE
    SYNTAX  Dsx1FracEntry
    ACCESS  not-accessible
    STATUS  mandatory
    DESCRIPTION
        "An entry in the DS1 Fractional table."
    INDEX   { dsx1FracIndex, dsx1FracNumber }
    ::= { dsx1FracTable 1 }

```

```

Dsx1FracEntry ::=
    SEQUENCE {
        dsx1FracIndex
            INTEGER,
        dsx1FracNumber
            INTEGER,
        dsx1FracIfIndex
            INTEGER
    }

```

```

dsx1FracIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..'7fffffff'h)

```

```

ACCESS   read-only
STATUS   mandatory
DESCRIPTION
    "The index value which uniquely identifies the
    DS1 interface to which this entry is applica-
    ble. The interface identified by a particu-
    lar value of this index is the same interface as
    identified by the same value an dsx1LineIndex
    object instance."
 ::= { dsx1FracEntry 1 }

```

```

dsx1FracNumber OBJECT-TYPE
    SYNTAX   INTEGER (1..31)
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
        "The channel number for this entry."
    ::= { dsx1FracEntry 2 }

```

```

dsx1FracIfIndex OBJECT-TYPE
    SYNTAX   INTEGER (1..'7fffffff'h)
    ACCESS   read-write
    STATUS   mandatory
    DESCRIPTION
        "An index value that uniquely identifies an inter-
        face. The interface identified by a partic-
        ular value of this index is the same interface
        as identified by the same value an ifIndex ob-
        ject instance. If no interface is currently us-
        ing a channel, the value should be zero. If a
        single interface occupies more than one time
        slot, that ifIndex value will be found in mul-
        tiple time slots."
    ::= { dsx1FracEntry 3 }

```

END

## 5. Acknowledgements

This document was produced by the Trunk MIB Working Group:

Tracy Cox	Bellcore
Fred Baker	Advanced Computer Communications
James Watt	Newbridge
Bill Versteeg	Versteeg Codeworks
Steve Buchko	Newbridge

Greg Celmainis    Newbridge  
Kaj Tesink        Bellcore  
Al Bryenton       Bell Northern Research  
Tom Easterday     CIC  
John Labbe        Merit Corporation  
Chris Sullivan    Gandalf Ltd  
Grant Hall        Gandalf Ltd  
Laurence V. Marks, IBM Corp.  
Kurt Hall, Clear Communications Corp.  
Myron Hattig, ADC Kentrox

Tracy Cox, Bill Versteeg, Myron Hattig, Kurt Hall and Laurence Marks especially worked to make the document what it is.

## 6. References

- [1] Rose M., and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based internets", STD 16, RFC 1155, Performance Systems International, Hughes LAN Systems, May 1990.
- [2] Rose, M., and K. McCloghrie, Editors, "Concise MIB Definitions", STD 16, RFC 1212, Performance Systems International, Hughes LAN Systems, March 1991.
- [3] McCloghrie K., and M. Rose, "Management Information Base for Network Management of TCP/IP-based internets", RFC 1156, Hughes LAN Systems, Performance Systems International, May 1990.
- [4] McCloghrie K., and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets", STD 17, RFC 1213, Performance Systems International, March 1991.
- [5] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, SNMP Research, Performance Systems International, Performance Systems International, MIT Laboratory for Computer Science, May 1990.
- [6] Information processing systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1), International Organization for Standardization, International Standard 8824, December 1987.
- [7] Information processing systems - Open Systems Interconnection - Specification of Basic Encoding Rules for Abstract Notation One (ASN.1), International Organization for Standardization, International Standard 8825, December 1987.



- [8] AT&T Information Systems, AT&T ESF DS1 Channel Service Unit User's Manual, 999-100-305, February 1988.
- [9] AT&T Technical Reference, Requirements for Interfacing Digital Terminal Equipment to Services Employing the Extended Superframe Format, Publication 54016, May 1988.
- [10] American National Standard for Telecommunications -- Carrier-to-Customer Installation - DS1 Metallic Interface, T1.403, February 1989.
- [11] CCITT Specifications Volume III, Recommendation G.703, Physical/Electrical Characteristics of Hierarchical Digital Interfaces, July 1988.
- [12] CCITT Specifications Volume III, Recommendation G.704, Synchronous frame structures used at primary and secondary hierarchical levels, July 1988.
- [13] American National Standard for Telecommunications -- Layer 1 In-Service Digital Transmission Performance Monitoring T1M1/92-0xx, T1M1.3/92-005R1, April 1992.
- [14] CCITT Specifications Volume IV, Recommendation O.162, Equipment To Perform In Service Monitoring On 2048 kbit/s Signals, July 1988
- [15] CCITT Specifications Volume III, Recommendation G.821, Error Performance Of An International Digital Connection Forming Part Of An Integrated Services Digital Network, July 1988.
- [16] AT&T Technical Reference, Technical Reference 62411, ACCUNET T1.5 Service Description And Interface Specification, December 1990.
- [17] CCITT Specifications Volume III, Recommendation G.706, Frame Alignment and Cyclic Redundancy Check (CRC) Procedures Relating to Basic Frame Structures Defined in Recommendation G.704, July 1988.
- [18] CCITT Specifications Volume III, Recommendation G.732, Characteristics Of Primary PCM Multiplex Equipment Operating at 2048 kbit/s, July 1988.

## Security Considerations

Security issues are not discussed in this memo.

## Authors' Addresses

Fred Baker  
Advanced Computer Communications  
315 Bollay Drive  
Santa Barbara, California 93117

Phone: (805) 685-4455  
EMail: fbaker@acc.com

James Watt  
Newbridge Networks Corporation  
600 March Road  
Kanata, Ontario  
Canada K2K 2E6

Phone: (613) 591-3600  
EMail: james@newbridge.com