T1/E1 Interface Card
for
Loop-V 4200 9-Port Series
User's Manual

LOOP TELECOMMUNICATION INTERNATIONAL, INC.
8F, NO. 8, HSIN ANN RD
SCIENCE-BASED INDUSTRIAL PARK
HSINCHU, TAIWAN
Tel: +886-3-578-7696
Fax: +886-3-578-7695

P/N: 51.LV4200.10E
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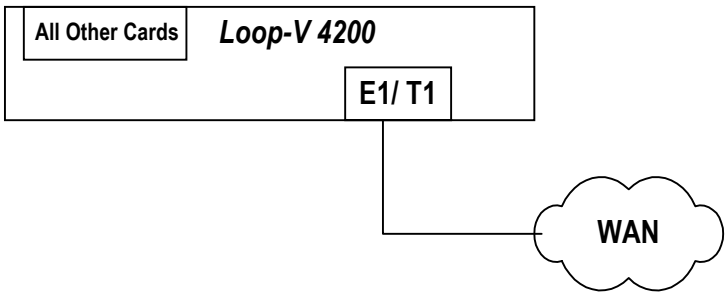
1 PRODUCT DESCRIPTION

1.1 Overview

Loop Telecom's T1/E1 plug-in cards consist of modules designed for the Loop-V 4200 series. They allow each DS0 time slot in T1 or E1 interfaces to be interchanged and multiplexed onto a digital network. Clear channel (32 DS0 channels) is also available.

Continuous error checking, performance polling, and in-service diagnostics are provided through the main controller of the Loop-V 4200 series. In addition, an LED on the module provides a status indication.

1.2 Applications



1.3 Specifications

Network Line Interface (T1)

Line Rate	1.544 Mbps ± 32 ppm	Framing	D4/ESF
Line Code	AMI/B8ZS	Connector	DA15S or RJ48C
Input Signal	DSX-1 0dB to –30dB w/ALBO	Output Signal	DSX-1 w/0, -7.5, -15 dB LBO
Jitter	AT&T TR 62411	Pulse Template	AT&T TR 62411
Data Rate	n * (56 or 64) Kbps (n=1-24)		
Surge Protection	FCC Part 68 Sub Part D		

Network Line Interface (E1)

Line Rate	2.048 Mbps ± 50 ppm	Framing	ITU G.704
Line Code	AMI/HDB3	Connector	BNC or DB15P and RJ48C
Input Signal	ITU G.703	Output Signal	ITU G.703
Jitter	ITU G.823	Electrical	75Ω coax/120Ω twisted pair
Data Rate	n * (56 or 64) Kbps (n = 1 - 32)		

2 INSTALLATION

2.1 Mechanical Installation

The E1/T1 interface module can be plugged into any of the available slots in the V 4200 chassis. Note that slot A is usually reserved for a T1/E1 line connection because that slot has line monitoring jacks.

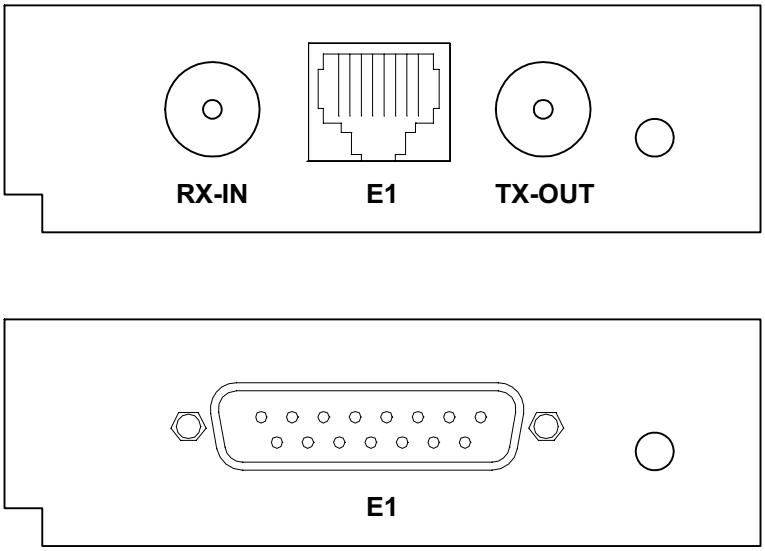


Figure 2- 1 Rear Panel of E1 interface - two versions

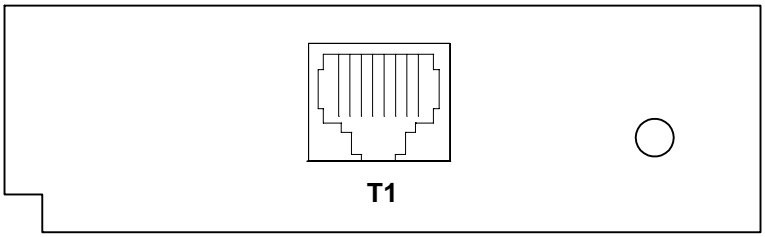


Figure 2- 2 Rear Panel of T1 interface

2.2 Configuration Setting

2.2.1 Hardware Configuration Setting

Other than exceptions noted below, most configurations are software programmable. It should not be necessary to remove any modules for modifications other than mentioned below. The only user modifiable hardware configurations are as follows:

On the E1 plug-in card, selection of a balanced or unbalanced interface for E1 lines is available. If the factory setting, which can be specified on the order, needs to be changed, slide out the printed circuit board and move the necessary jumpers.

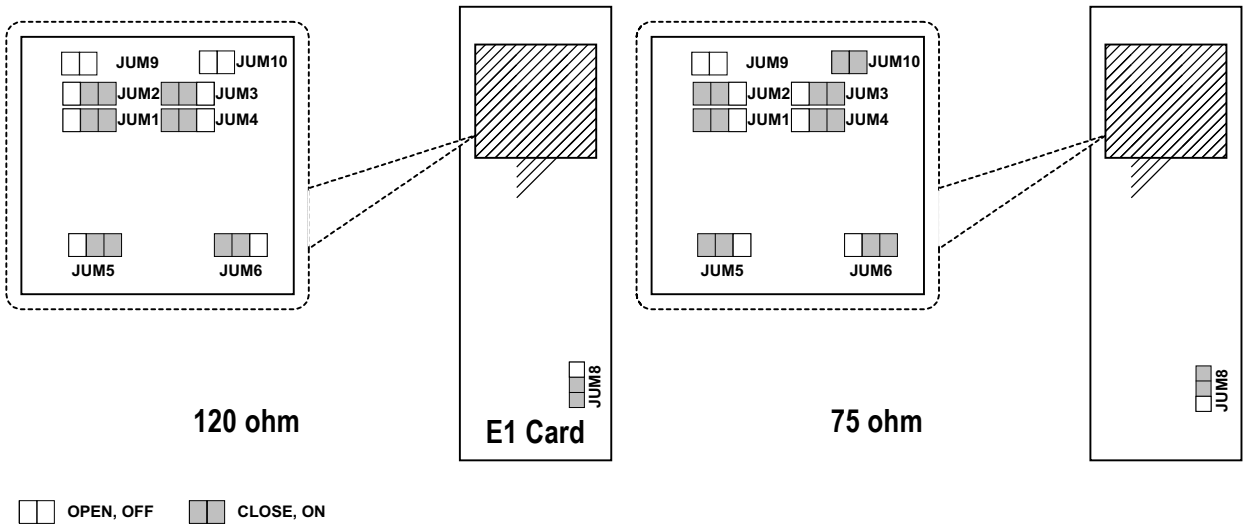


Figure 2- 3 Jumper Locations for E1 Card

NOTE:

For a 75 ohm E1 card, the BNC connector is set to Chassis Ground.

NOTE:

For a 120 ohm E1 card, jumper 9 can be OPEN or ON. If jumper 9 is OPEN, pint 7 and pin 8 of the RJ48C connector is set to Unassigned. If jumper 9 is ON, pin 7 and pin 8 of the RJ48C connector is set to Chassis Ground.

NOTE:

BNC is open if jumper 10 is opened, BNC is grounded if jumper 10 is closed.

Table 2- 1 E1/RJ 48C Line Connector

Pin Number	Signal	Signal Direction
1	Receive Ring	Input to 4200
2	Receive Tip	Input to 4200
4	Transmit Ring	Output from 4200
5	Transmit Tip	Output from 4200
7	See NOTE above	
8	See NOTE above	

Table 2- 2 Default Software Configuration

T1 Line Items	Default
Frame Format Mode	ESF
Line Code Mode	B8ZS
Line Build Out	0 dB
Yellow Alarm	ON
Inband Signalling	OFF
Alarm Indication Signal	FRAMED
Channel Associated Signalling	OFF
Carrier Group Alarm	NORM
Out Of Service	BUSY
Interface	LONG HAUL
Idle Code	FF
Time slot assignments	All idle

E1 Line Items	Default
Line Type	120 Ohm Balanced (Hardware)
Frame Format Mode	ON
Line Code Mode	HDB3
CRC	ON
RAI	ON
Alarm Indication Signal	FRAMED
Channel Associated Signalling	OFF
Carrier Group Alarm	NORM
Out Of Service	BUSY
FDL	OFF
Sa_bit	Sa4
Idle Code	D5
Interface	120 Ohm (Hardware)
Time slot assignments	All idle

3 OPERATION

This chapter describes the Loop-V 4200 MuxMaster configuration options and operational functions in relation to the T1/E1 cards. Refer to CHAPTER 5: FRONT PANEL OPERATION, and CHAPTER 6: TERMINAL OPERATION for detailed operational procedures.

3.1 DS1 Network Line Configuration

A detailed option list for E1/T1 line configuration is shown in the following tables. The following paragraphs will describe each item.

3.1.1 Frame Format

For the E1 line interface, the frame format is ITU G.704. Either a 2-frame, or 16-frame structure can be selected. Only the 16-frame provides CRC. For the T1 line interface, either the D4 or ESF frame format is available. In ESF frame format mode, either AT&T or ANSI facility data link protocol can be chosen. ESF & T1.403 chooses the ANSI ESF data link protocol and a one second performance report will automatically be sent to the network every second. Also, ANSI and AT&T data link messages are acceptable in ANSI ESF frame format mode. However, the AT&T ESF frame format mode can only accept the AT&T ESF data link protocol. The T1 supports G.802 mode, called T1 FRAME NONE mode, which can only map to a T1 in the same mode, or an E1 port full channel map. E1 supports clear channel mode, called E1 FRAME OFF mode, which can map to an E1 in the same mode or a DTE port (full 32-channel map).

3.1.2 Line Code

For the T1 line interface, either AMI (Alternate Mark Inverting) or B8ZS (bipolar with 8 zero substitution) line code format can be chosen. For theE1 line interface, either AMI (Alternate Mark Inverting) or HDB3 (high density bipolar of length 3) line code format can be chosen. **Be sure this setting matches that of the network.**

See Appendix B for further information.

3.1.3 RAI / YEL

Remote Alarm Indication, or Yellow alarm in T1 parlance, transmits a return signal back out to indicate loss of signal and loss of frame sync at the receiving side of the port. This action can be turned ON or OFF.

Normally, when the yellow alarm is turned ON for a port, that port will activate the alarm dependent on the received signal and independent of other ports. In certain network architectures, it may be desirable to relay the yellow alarm from one port to another port, and this option is available. For example, it may be desirable to have the Loop-V 4200 send the yellow alarm received on Port A to the output of Port B.

3.1.4 Equalization (Line Build-Out)

For the T1 line long haul interface, the transmit LBO (line build-out) can be programmed to either 0 dB, -7.5 dB, or -15 dB.

For the T1 line short haul interface, the equalization can be set to equivalent cable distances up to 655 feet.

3.1.5 CRC

For two frame mode, set CRC to OFF. For multiframe mode, set CRC to ON.

The E1 can be used in two frame or multiframe mode. If CRC is OFF, the 2 frame format will result. If CRC is ON, the 16 frame format will result. For E1, the cyclic redundancy check function can be turned ON or OFF. Unlike bipolar violation, which can monitor only one span, CRC allows error monitoring through multiple spans of DS0 lines. For E1, if CAS is ON, a 16-frame structure is used, which is independent of the 16-frame structure for CRC. A proprietary facility data link is implemented in both modes to facilitate remote system control and performance and statistics monitoring.

For T1, the CRC function is embedded in the ESF frame format, which if chosen, is always on.

3.1.6 Facility Data Link - In-Band Signaling

In all cases, Loop-V 4200 utilizes a proprietary facility data link, FDL for E1, or in-band signaling for T1, to achieve remote system control and performance and statistics monitoring.

3.1.7 AIS

The AIS, alarm indication signal, notifies the far end that a loopback and diagnostic test is in progress, so customer signals are blocked. The AIS can be sent two ways. In the framed mode, all time slots will have all ones sent but the framing pattern will be preserved. In the unframed mode, all ones are sent for all time slots.

When all ones are sent in both directions for a given port, due to the TSI (time slot interchange) within the Loop-V 4200, the corresponding time slots in other ports will also have all ones.

3.1.8 A-law to μ-law Conversion

When time slot from E1 is assigned to time slot in T1, A-law to μ-law conversion is automatic if both are designated as voice channel.

3.1.9 CAS

For voice channels, the signaling information, which included such signals as on-hook, and ring, can be carried by two methods. One is by a completely independent channel managed by the system operator, in which case no action is needed by the local equipment (CAS is OFF). Another is by CAS where the signaling information is carried in the same bit stream as the voice channel. In this second method, for time slot interchange, the signaling bits must be routed along with the voice channels to the proper destination. Thus the Loop-V 4200 must be told, when CAS is used, to turn the CAS option to ON.

For E1, CAS (Channel-Associated Signaling) is a method for sending signaling information where time slot 16 of the E1 format is shared for each of 30 other time slots within the same E1. OFF designation is for CAS disabled. For E1, when disabled, the 256N multiframe is used when time slot 16 is available to the user. The maximum number of time slots available for payload is 31. ON designation is for CAS enabled. When enabled, the 256S multiframe is used when time slot 16 is reserved for the transmission for end-to-end signaling using CAS. The maximum number of times slots available for payload is then 30.

For T1, CAS when ON is where "robbed-bit signaling" takes place. This places the signaling information, once every 6 frames, in bit 7 (least significant bit) of the associated time slot, replacing the information bit at that location. When CAS is OFF, robbed-bit signaling will not take place. When ON, robbed-bit signaling is permitted for voice channels. For channels designated as DATA, robbed-bit signaling is not performed.

See Appendix A for further information.

3.1.10 Interface

The T1 interface can be long haul or short haul. Long haul has higher powered output to drive long lines, while short haul is more appropriate for intra-office connections. The E1 interface only displays 120 Ohm twisted pair or 75 Ohm coaxial cable.

3.1.11 Equalization

Whether long haul or short haul, for T1, further refinements of the output signal can be made using the EQU controls. For long haul, the choices are in dB of inserted loss. For short haul, the choices are in equivalent distances of inserted loss.

3.1.12 Facility Data Link

For T1, the FDL (facility data link) is part of the ESF structure, for E1, this is not part of the standard. The Loop-V 4200 uses a proprietary FDL within the E1 frame structure to facilitate remote control and remote performance and statistics monitoring. This FDL, for E1 only, can be turned ON or OFF. The Sa-bit (Sa4-Sa8) can be set to select FDL channel. In the ITU G.704 specifications, within Time Slot 0 of the E1 format, five bits are designated as "National Bits." These bits can be used by each national networks as appropriate. These bits are called Sa4, Sa5, Sa6, Sa7, and Sa8. For the Loop products, Sa4 is the default bit for use as EOC (embedded operational channel) between any two Loop products. Using this channel, remote configuration commands and performance data are passed between the two units.

3.1.13 Carrier Group Alarm

The Carrier Group Alarm, CGA, is necessary for proper operation of the switched network in the face of possible faults of the transport system. In the "normal" option, when a carrier facility fails, the switching system must be notified so that it should cease to use that facility until repair is made. In the "transparent" option, the signaling bits are left alone in fault conditions.

3.1.14 Out Of Service Signaling

For normal CGA option, when failure of the facility occurs, if there are calls in progress, the billing system should be notified to stop charging the customer at the time of facility failure. The Loop-V 4200 provides several idle/busy sequences to suit the network needs.

3.1.15 Idle Code

Any DS0 time slot, which is not assigned to a DTE port, is an idle time slot. An idle code is transmitted on idle DS0 time slots. The idle time slot may be programmed to any bit pattern from 0x00 to 0xFF. (The prefix 0x is to indicate that hex follows.)

NOTE: Due to ones-density requirement, it is advised that idle code to be set as 0xD5 for E1 and 0xFF for T1, which are the factory defaults. Otherwise, the idle code must be programmed to contain at least two bits of '1'.

3.1.16 Line Configuration Summary and Default Settings

The following tables lists the options available and their factory default settings.

Table 3- 1 E1 Line Default Setting

Item	Options	Default
Frame Format Mode	ON, OFF	FAS (ON)
Line Code Mode	AMI, HDB3	HDB3
RAI	ON, OFF, ON+A, ON+B, ON+C, ON+D (ON+self has no meaning)	ON
CRC	ON, OFF	ON
AIS	FRAMED, Unframed, OFF	FRAMED
CAS	ON, OFF	OFF
Interface	120 Ohm twisted pair, 75 Ohm coaxial cable	Interface is displayed only.
FDL	ON, OFF	OFF
Sa-_bit	Sa4, Sa5, Sa6, Sa7, Sa8, Sa4+Sa5.	Sa4
CGA	Norms, Trans	Norms
OOS	Busy, Idle, Busy-Idle, Idle-Busy,	Busy
Idle Code	0x00 ~ 0xFF	0xD5
Quad FXO	Green Light	At least one port mapped. All ports ON-HOOK.
	Flash Green Light	Any 01, 02, 03, or 04 port OFF-HOOK
	Red Light	No FXO map Loss SYNC

Table 3- 2 T1 Line Default Setting

Item	Options	Default
Frame Format Mode	D4, ESF , ESF&T1.403, None	ESF
Line Code Mode	AMI, B8ZS	B8ZS
Yellow Alarm	ON, OFF, ON+A, ON+B, ON+C, ON+D (ON+self has no meaning)	ON
Inband Signaling	ON, OFF	ON
AIS	FRAMED, Unframed, OFF	FRAMED
CAS	OFF, ON	OFF
Interface	Long haul, Short haul	Long haul
Equalization Line Build Out	Long haul: 0, -7.5, -15 dB	0
	Short haul: 0-133, 133-266, 266-399, 399-533, 533-655 dB	0-133
CGA	NORMS, Trans	NORMS
OOS	Busy, Idle, Busy-Idle, Idle-Busy,	Busy
Idle Code	0x00 - 0xFF	FF
Backup By	None, Port A - F, Port H, Port J	None

3.2 Reports

For E1 and T1 type plug-in cards, the Loop-V 4200 has three sets of performance registers. These are line, user, and far-end. The line performance register tracks the line receiver performance status. The user performance register tracks the line receiver as well, but may be cleared at any time. The far-end performance register tracks the far-end Loop-V 4200 receiver status. The performance parameters are listed in Table 3-6. The user performance register has two additional parameters. One is BPV register to count bipolar violation in both D4 and ESF modes. The other is ESF to track framing error and CRC error in ESF frame format mode only, or CSS (controlled slip second) for E1.

Each performance parameter has ninety six sets of registers to record 24 hours history in 15 minute interval.

Table 3- 3 Performance Parameter List - T1

Performance Parameter	Description	Definition (T1/D4)	Definition (ESF)
ES	Error Second	BPV≥1, OOF≥1, or CS≥1.	CRC ≥ 1, OOF ≥1, or CS ≥1.
BES	Bursty Error Second	1 < BPV < 1544	1 < CRC < 320
SES	Severe Error Second	BPV ≥ 1544, or OOF ≥ 1	CRC ≥ 320, or OOF ≥ 1
CSS	Controlled Slip Second	frame slip ≥ 1	frame slip ≥ 1
OOF	Out of Frame	2 frame bit error in 6 consecutive frame bits	2 frame bit error in 6 consecutive frame bits
LOFC	Loss Of Frame Count	OOF for 2.5 0.5 sec	OOF for 2.5 0.5 sec
UAS	Unavailable Second	10 consecutive SES	10 consecutive SES
BPV	Bipolar Violation	Bipolar Error Count	Bipolar Error Count
ESF	CRC Error, or Out Of Frame	(not used, always 0)	CRC error or OOF

Table 3- 4 Performance Parameter List - E1

Performance Parameter	Description	Definition 2-Frame/Multiframe	Definition 16-Frame/Multiframe
ES	Error Second	BPV≥1, OOF≥1, or CS≥1.	CRC ≥ 1, OOF ≥1, or CS ≥1.
BES	Bursty Error Second	1 < BPV < 2048	1 < CRC < 805
SES	Severe Error Second	BPV ≥ 2048, or OOF ≥ 1	CRC ≥ 805, or OOF ≥ 1
CSS	Controlled Slip Second	Frame slip ≥ 1	Frame slip ≥ 1
OOF	Out of Frame	1 frame sync loss in 6 consecutive frame bits	1 frame sync loss in 6 consecutive frame bits
LOFC	Loss Of Frame Count	OOF for 2.5 ± 0.5 sec	OOF for 2.5 ± 0.5 sec
UAS	Unavailable Second	≥ 10 consecutive SES	≥ 10 consecutive SES
DM	Degraded Minute	BPV ≥ 123	CRC ≥ 47

3.3 LED Operation

The front and rear panel each has 10 LEDs, one for power and one each for each line. Table 3-12 lists each LED and its color and indications. Each plug-in has a rear panel LED, which matches the corresponding front panel LED.

Table 3- 5 Front and Rear Panel LED Table

LED	Color	Indication
DS1 Type Port	Off	Port not alive
	Green	Line frame in sync
	Flashing Green	A line-side test is in progress
	Red	Loss of Frame Sync (LOFS) or Loss of Signal (LOS)
	Amber	Receive yellow alarm from line
	Flashing Amber	Receive AIS from line
	Flashing Red	Line does not connect in unframed mode
	Flashing Red-Green	Line connects in unframed mode

4 MAINTENANCE

4.1 Self-Test

At system power up, a complete self-test routine is run to check all I/O ports, read/write memory, and data paths to validate system integrity. During the system self test, "SELF TEST" message is shown on the upper line of the LCD display. The software release version and date code is shown on the lower line of the LCD display. If an error is found, FAIL is shown in the upper right corner of the LCD display and a dedicated error message is shown on the lower line. Users may press **ESC**, left arrow (<), right arrow (>), and **ENTER** key in this order to read a specific error code. If no error is found, the LCD display will show "PASS" in the upper right corner of the LCD display followed by a Main Menu as FIGURE 5.2. Various system diagnostic methodology can be found in the following paragraphs.

4.2 Diagnostics

Pseudo-random patterns are commonly used for diagnostic tests of digital systems. For E1, a 15-bit register PRBS (pseudo-random binary sequence) pattern is standard practice. For T1, a 20-bit register QRSS (Quasi-Random Signal Sequence) patterns is used. Both patterns are available for testing local Loop-V 4200 system integrity by local loopback test, and for measuring the line quality. The diagnostics scenario is as follows:

1. First, send a remote loopback command to cause the remote facility to loopback DS0 time slots.

2. Then, activate the local PRBS or QRSS diagnostics operation by using the Test command to enable the pattern and choose for test all time slots, or only idle time slots.

3. The FULL diagnostic uses a framed pattern. This is useful for testing full E1 or T1 loopbacks at the far-end.

When the PRBS or QRSS pattern sync is found, a bit error counter tracks total bit errors. It is advised to send the pattern for more than 15-minute interval to evaluate the quality of loop condition and facility reliability.

In both front panel and terminal operation, user may utilize '>' key to inject a single error, '<' key to reset error counter, and '**ESC**' key to terminate the test. User may also read performance report to understand the type of errors that occurs.

4.3 Near End Loopback

The near end loopbacks such as local loopback, line loopback, payload loopback, DTE port loopback, are activated by the local Loop-V 4200. The loopbacks are at the near end facility. The following paragraph describes each loopback in detail.

NOTE: Deactivate the near-end loopbacks from the front panel or the terminal, depending on where it was activated.

4.3.1 Local Loopback

Local loopback is illustrated in Figure 4-1. The outgoing signal is looped back through the T1 PCM transceiver. All DS0 time slots are looped back to the receiver path. This loopback test is activated by the Test command. This loopback test can be used with the PRBS/QRSS diagnostic test pattern to validate the framer and the line interface circuits of any one port. When used with a test set connected to another port, this loopback validates the TSI function. An AIS (Alarm Indication Signal) is sent to the network during the local loopback test. The local loopback test can be activated from the front panel and terminal.

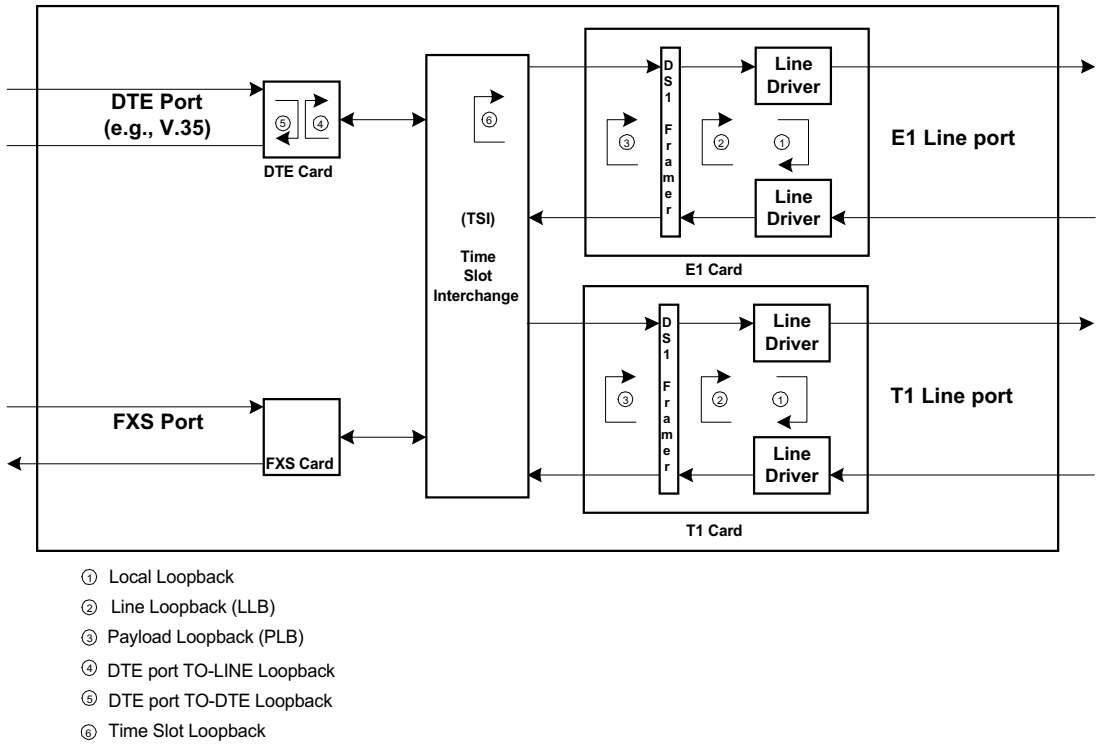


Figure 4- 1 Loopback Block Diagram

4.3.2 Line Loopback

Line loopback is illustrated in Figure 4-1. The incoming line signal is loopback to the outgoing signal before the transceiver framer. This loopback is used to isolate the local equipment from a troubled transmission line. Line loopback test can be activated from the front panel and terminal.

4.3.3 Payload Loopback

Payload loopback is illustrated in Figure 4-1. The incoming signal is loopback to the outgoing line signal after the transceiver framer. This loopback is used to isolate the TSI from the troubled transmission line. Payload loopback test can be activated from the front panel and terminal.

4.3.4 Time Slot Loopback

Each individual time slot from an E1 or T1 line can be looped back towards the line, as shown in Figure 4-1. This is done by use of the time slot interchange function described in Chapter 3, section on Time Slot Interchange. As many time slots can be loped back in this way at the same time.

4.4 Far End Loopbacks

Far-end loopbacks (remote line loopback, remote payload loopback) can be activated by the local Loop-V 4200 to cause a remote facility to perform the loopbacks. Inband codes, AT&T and ANSI FDL protocols, and proprietary codes are utilized to send remoter loopback commands to the far-end facility. For E1, inband codewords are supported by FDL (facility data link) to initiate the loopbacks. When using FDL messages, FDL must be turned ON. For T1, inband codewords are supported by D4, ESF, or ESF&T1.403 framing format. When using AT&T FDL messages, the Line port must be set for ESF or ESF&T1.403 framing format. When using ANSI FDL messages, the Line port must be in ESF&T1.403 framing format. All remote loopback can be activated from the front panel or the terminal.

If the remote facility responds to a remote loopback activate command, a LOOPED message appears in the lower left corner of the display. If the remote facility responds to a remote loopback deactivate command, a NOLOOP message appears. If the remote activation/deactivation fails, an error message appears.

It is best to use remote loopbacks in conjunction with PRBS/QRSS diagnostics testing to measure the network line integrity. The procedure is as follows:

1. Send a remote loopback command to cause the remote facility to perform a loopback.

2. Activate the PRBS/QRSS diagnostics test.

NOTE:

Deactivate the far-end loopbacks from the front panel or the terminal, depending on where it was activated.

Following are descriptions for each type of far-end loopback.

4.4.1 Remote Line Loopback

Remote line loopback is illustrated in Figure 4-1. The remote line loopback is initiated by the remote equipment through FDL inband signal or ESF data link message with AT&T or ANSI protocol. Table 4-1 shows the inband remote line loopback code. Table 4-3 shows the ANSI T1.403 ESF data link remote line loopback code. Remote line loopback test can be activated from the front panel and terminal .

Table 4- 1 In-band Control Codeword

Remote LLB	Codeword
Activate	10000, receive 5+/-0.5 second
Deactivate	100, receive 5+/-0.5 second

4.4.2 Remote Payload Loopback

Remote payload loopback is illustrated in Figure 4-1. The remote payload loopback is initiated by the remote equipment through FDL or ESF data link message with AT&T or ANSI protocol. Table 4-3 shows the AT&T ESF T1.403 ESF data link remote payload loopback code. Remote payload loopback test can be activated from the front panel and terminal .

Table 4 - 1 AT&T ESF Data-Link Codeword

Remote PLB	Codeword
Activate	ESF-DL SX.25 Request Message #1
Deactivate	ESF-DL SX.25 Request Message #2

Table 4 - 2 ANSI T1.403 Bit-Oriented ESF Data-Link Codeword

Remote LLB	Codeword
Activate	0 000111 011111111 repeat at least 10 times
Deactivate	0 011100 011111111 repeat at least 10 times
Remote PLB	Codeword
Activate	0 001010 011111111 repeat at least 10 times
Deactivate	0 011001 011111111 repeat at least 10 times

4.4.3 V.54 Loopback

Loop-V also supports V.54 loopback protocol. See ITU V.54 standards for details. Refer to ANSI T1.403-1995 Annex B.

4.5 Test Pattern

Four test patterns are available to determine faults such as deficient clock recovery, fault ALBO level recovery, inadequate jitter margin, presence of bridge taps, and mis-optioned network interface. These four patterns are framed pattern with proper E1 or T1 (D4 or ESF) frame pattern as described in the following paragraphs.

4.5.1 1-in-8 Pattern

This framed 1-in-8 pattern tests the ability of a circuit to support a pattern having the minimum ones density. It is useful to reveal a timing recovery problem. The bit set to one must be set to bit 2 to avoid false yellow alarm.

Framed 1-in-8 pattern sequence is as follows,

F 01000000 01000000 0100 . . . . . (Left to Right)

F indicates frame alignment bits.

4.6 Verifying Loop-V 4200 Operations

The purpose of this section is not to help the user determine where a possible fault in the network may lie. For this, the user needs to know the exact geometry of the network. Then standard network trouble shooting procedures should be followed, which involve sectionalizing the network and performing loopback tests on pieces of the network.

The purpose here is to help the user determine whether the Loop-V 4200 equipment is at fault after tests have pointed a suspicious finger at this equipment. The procedures outlined here depends on test equipment and other equipment the user may have on hand.

The organization of these procedures start from the simple to the complex. The procedure ends when a definitive conclusion is made that the Loop-V 4200 equipment is at fault. To verify that the Loop-V 4200 equipment is not at fault, specialized equipment such as a BERT (bit error rate test) set is needed.

4.6.1 Quick Test

See if the LCD display on the Loop-V 4200 has normal text. If not, Loop-V 4200 has failed.

Remove all line connections to Loop-V 4200. Remove power. After a few seconds, re-apply power. Observe the power-up self-test sequence. If this fails, then Loop-V 4200 has failed.

See if the LEDs show any abnormal displays. If yes, use the LCD indications to guide the user to test other parts of the network.

Especially during initial installation, excessive errors may be due to (a) incorrect configuration of either Loop-V 4200 or of the equipment at the other end of the line, or (b) due to faulty line installation, which results in excessive noise, cross talk, or impedance mismatch. Especially in electrically noisy environments, such as central offices, use of shielded cables are mandatory.

4.6.2 Substitution

If a spare Loop-V 4200 is available, then replace the working one with the spare. The user must carefully configure the spare exactly as the working one. If the substitution clears the problem, then the original working one is suspect. Note that this is not definitive as other reasons may cause the same symptom. A good practice is to reconfigure the original one and swap once more.

If both units behave the same, then the problem is probably elsewhere.

4.6.3 Using Loopback Plugs

Without a spare, loopback plugs are handy for diagnosis. Note that internal loopback facilities of the Loop-V 4200 does not include the interface circuitry. Thus a set of plugs, one for each of the interfaces types, are needed for complete tests. These plugs are wired such that signals from the Loop-V 4200 are looped back by hard wire to the receive pin of the interface.

Replace the line connector with a loopback plug. Observe if the line is in sync. If not then Loop-V 4200 has failed. Then perform a PRBS/QRSS test towards the line. If this fails, then Loop-V 4200 has failed.

Note that if a far end terminal is available, the first test should be a local line loopback to see if the line is good.

If tests with loopback plugs all pass, then the problem is probably elsewhere.

4.6.4 Using Bert Test Set

If a BERT (bit error rate test) set is a available, such as the Fireberd 6000, then a comprehensive suite of test are available to examine the health of the Loop-V 4200 .

With a BERT, each of the ports of the Loop-V 4200 can be tested individually. The user must configure the BERT in the exact way the Loop-V 4200 is configured. This is easily done by comparing each of the options one by one. After checking that the configuration matches, if any one of the ports fails, then Loop-V 4200 has failed.

5 FRONT PANEL OPERATION

The front panel operation utilizes a two by forty (2 x 40) character LCD display window and four keypads each labeled: **ESC**, **ENTER**, left arrow '<', and right arrow '>', as shown in Figure 5-1.

ENTER key is used to move down the menu tree or to enable a selection.

The arrow keys show other menu items on the same level.

ESC key returns the operation to an upper layer menu up to the main menu.

NOTE: The **ENTER** key must be used to confirm a change. Where YES is shown at the lower right corner, it must be selected to enable a change.

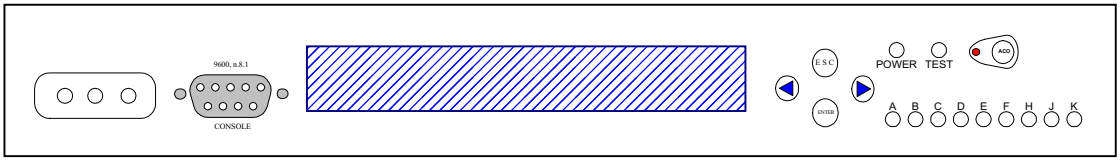


Figure 5- 1 Loop-V 4200 series Front Panel

Each display only shows one menu item. The main menu is shown in the following figures. It is the first menu displayed after power up.

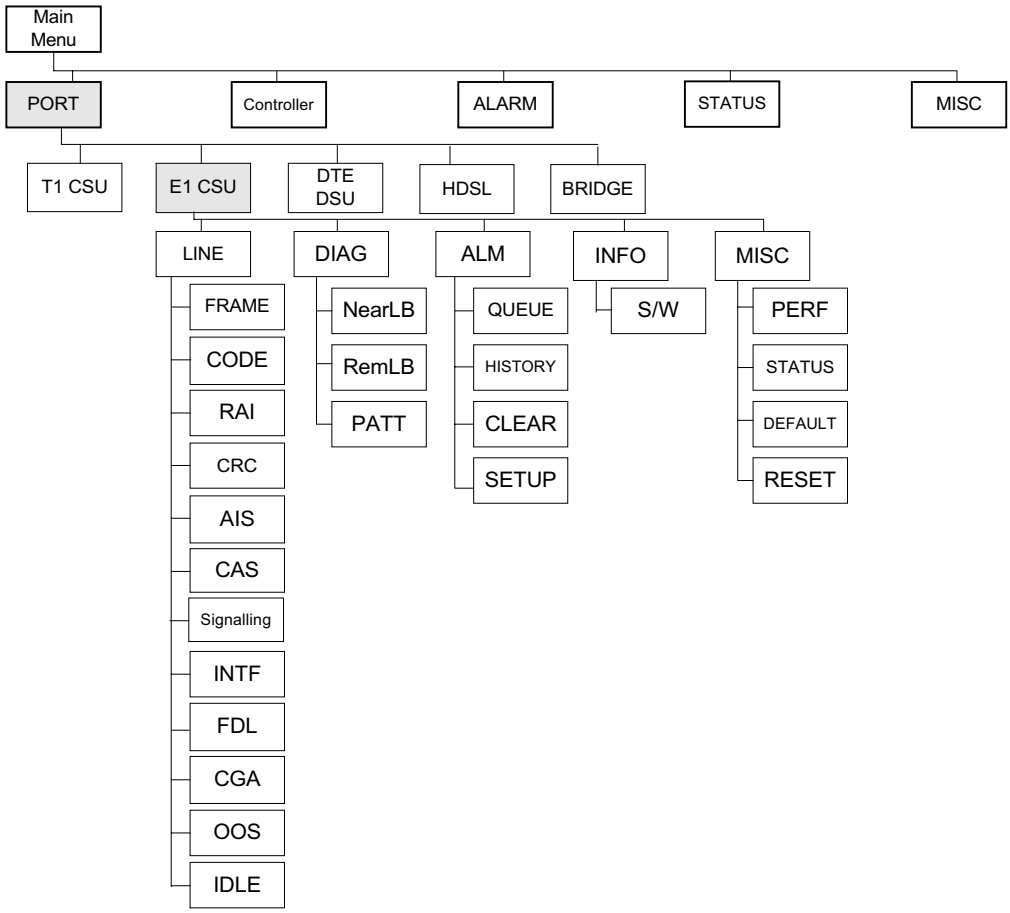


Figure 5- 2 Menu Tree – Part 1

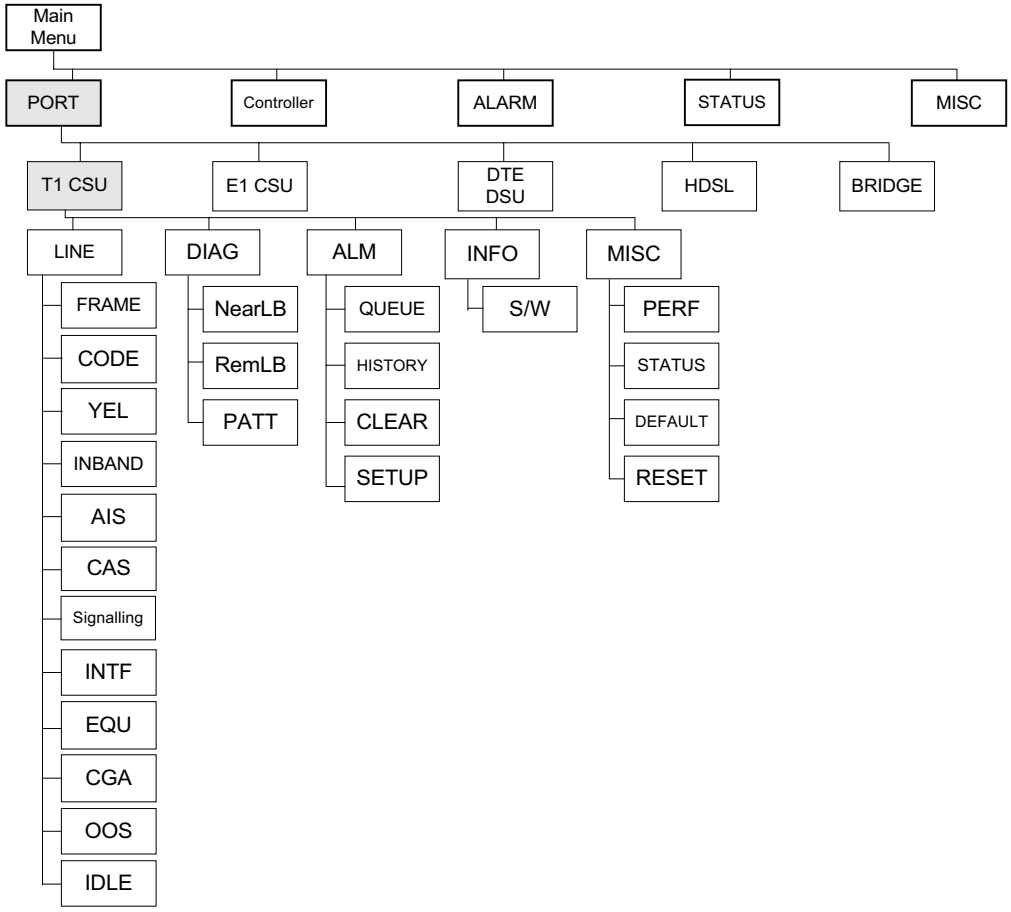


Figure 5- 3 Menu Tree – Part 2

5.1 Main Menu

The main menu, the first menu displayed after power on, is shown below. The main menu includes port, controller, alarm, status, and miscellaneous menus.

```
                Loop V4200-9
<< PORT CONTROLLER ALARM STATUS MISC >>
```

5.1.1 E1 CSU PORT

```
PORT> Select Port: <FE1>
A B C D E F H J K
```

5.1.1.1 LINE

Line menus are used to configure the line operation mode for each port, such as frame format, line code, RAI, CRC, AIS, interface, FDL, CAS, CGA, OOS, and transmission idle code. Using the arrow keys make the selection, and press **ENTER**.

```
_C>LINE DIAG ALM INFO MISC
_C LINE>FRAME CODE RAI CRC AIS CAS
```

5.1.1.1.1 FRAME

Press **ENTER** for the Line Frame menu

The FRAME menu shows the current frame control status: either on or off. An asterisk (*) indicates the currently selected item. Use the arrow keys to change the setting, and press **ENTER**.

```
_C LINE>FRAME CODE RAI CRC AIS CAS
        *ON OFF
```

5.1.1.1.2 CODE

Press **ENTER** for the Line Code menu.

To select the coding scheme, use the arrow keys to cycle to the proper selection and press **ENTER**. Other than AMI, the choices is HDB3 for E1. An asterisk (*) is placed by the currently selected item. Use the arrow keys to change the setting, and press **ENTER**.

```
_C LINE>FRAME CODE RAI CRC AIS CAS
        AMI *HDB3
```

5.1.1.1.3 RAI

Remote Alarm Indication transmits a return signal back out to indicate loss of signal and loss of frame sync at the receiving side of the port. This action can be turned ON or OFF.

Normally, when RAI is turned ON for a port, that port will activate the alarm dependent on the received signal and independent of other ports. In certain network architectures, it may be desirable to relay the remote alarm from one port to another. This option is also available.

```
_C LINE>FRAME CODE RAI CRC AIS CAS
    *ON OFF ON+A +B +C +D +E +F +H +J +K
```

5.1.1.1.4 CRC

The cyclic redundancy check function can be turned ON or OFF. Unlike bipolar violation, which can monitor only one span, CRC allows error monitoring through multiple spans of DS1 lines.

```
_C LINE>FRAME CODE RAI CRC AIS CAS
       ON *OFF
```

5.1.1.1.5 AIS (Alarm Indication Signal)

The AIS menu shows the configuration set for the alarm indication signal. Use the arrow keys to cycle through FRAME, UNFRAME, or OFF, and then press **ENTER**.

```
_C LINE>FRAME CODE RAI CRC AIS CAS
      *FRAME UNFRAME OFF
```

5.1.1.1.6 CAS (Channel Associated Signalling)

Press **ENTER** for the Line Frame menu.

Signaling is either CAS (channel associated signaling) or out-of-band such as CCIS (common channel interoffice signaling). To change the signaling type, use the arrow keys to choose from CAS ON or CAS OFF and press **ENTER**.

```
_C LINE>FRAME CODE RAI CRC AIS CAS
       ON *OFF
```

5.1.1.1.7 SIGNALLING

Move the cursor to the signalling item. Use arrow keys to select "TRANS" or "CD=01". The current selection will be highlight by an asterisk (*).

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
      *TRANS CD=01
```

5.1.1.1.8 INTERFACE

This may be a read only screen, depending on the plug-in card installed. Appropriate cards can provide 120 ohm and 75 ohm.

```
_C LINE>SIGNALLINE INTF FDL CGA OOS IDLE
     *120Ohm 75Ohm
```

5.1.1.1.9 FDL

The FDL menu shows the facility data link. The current selection is highlighted by an asterisk (*). To enable FDL, move cursor to ON and hit **ENTER**. To disable move cursor to OFF and hit **ENTER**.

```
_C LINE>SIGNALLINE INTF FDL CGA OOS IDLE
      *ON OFF
```

5.1.1.1.10 CGA (Carrier Group Alarm)

To configure CGA as NORMAL or TRANSPARENT, use the arrow keys to cycle through to the proper selection and press **ENTER**.

```
_C LINE>SIGNALLINE INTF FDL CGA OOS IDLE
      *NORM TRANS
```

5.1.1.1.11 OOS (Out of Service)

To change the OOS protocol, use the arrow keys to cycle through to the proper selection and Press **ENTER**.

```
_C LINE>SIGNALLINE INTF FDL CGA OOS IDLE
    *BUSY IDLE BUSY_IDLE IDLE_BUSY
```

5.1.1.1.12 IDLE

Press **ENTER** for the Line Idle Code menu.

The Idle menu shows the transmission idle code when a DS0 time slot is in idle mode. To change the idle code, press **ENTER** to cycle through the selections. This operation must be concluded by moving the arrow keys to OK position and pressing **ENTER** to enable the changes.

```
_C LINE>SIGNALLINE INTF FDL CGA OOS IDLE
_C IDLE>Idle Code=0xD5    YES
```

5.1.1.2 Diagnostics

The Diagnostics group includes Near Loopback, Remote Loopback, and Testing Pattern Menus. If a remote loopback is in session, the front panel LED for that port will be flashing green.

```
_C>LINE DIAG ALM INFO MISC
_C DIAG>NearLB RemLB PATT
```

5.1.1.2.1 Near End Loopback

Near Loopback menus are used to control near end E1/T1 line side loopback operations such as local loopback test, payload loopback test, and line loopback test. Under the Unit Diagnostics menu, use the arrow keys to select Near Loopback menu.

```
_C DIAG>NearLB RemLB PATT
      *OFF LOCAL PLB LLB
```

5.1.1.2.2 Remote Loopback

Remote Loopback is used to activate E1/T1 line remote loopback tests. For T1, there are three remote loopback types, INBAND, AT&T-P (AT&T 54016), ANSI-P and ANSI-L (ANSI T1.403). Under Diagnostics menu, use the arrow keys to select Remote Loopback menu. For E1, there are also two remote loopback types, PAYLOAD and LINE.

```
_C DIAG>NearLB RemLB PATT
_C RemLB>ACTIVATE DEACTIVATE
```

```
_C RemLB>ACTIVATE DEACTIVATE
       *PAYLOAD LINE
```

```
_C RemLB>ACTIVATE DEACTIVATE
       *PAYLOAD LINE
```

5.1.1.2.3 Pattern

The test pattern is used to transmit on all 31 channels to the E1 line. Two test patterns are available, PRBS and 1-in-8. To select, move the cursor to the desired pattern and hit **ENTER** to move cursor to the lower line of the display as follows. To activate pattern transmission, move cursor to SEND and hit **ENTER**. To terminate, hit **ESC** key.

```
_C DIAG>NearLB RemLB PATT
_C PATT>PRBS 1-IN-8
```

```
_C PATT>PRBS 1_IN_8
       *OFF FULL
```

```
_C PATT>PRBS 1_IN_8
       *OFF SEND
```

5.1.1.3 ALARM

The Alarm menu is used to view the alarm queue and alarm history, to clear the alarm queue, alarm history, and alarm relay, and setup alarm threshold, etc. as in the following paragraphs.

```
_C>LINE DIAG ALM INFO MISC
_C ALM>QUEUE HISTORY CLEAR SETUP
```

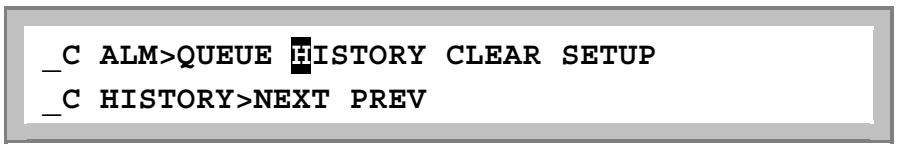
5.1.1.3.1 QUEUE

The Alarm Queue menu is used to view the alarm queue. Under the Alarm menu, use the arrow keys to select Alarm Queue menu. Then press **ENTER**.

The alarm queue is a list of the latest 40 alarms from the unit selected. The upper right shows the alarm sequence and the total number of alarms. The lower left is the alarm type number. The lower right is the date and time of the alarm.

5.1.1.3.2 HISTORY

The Alarm History menu is used to view the alarm history. Under Alarm menu, use the arrow keys to select Alarm History menu.

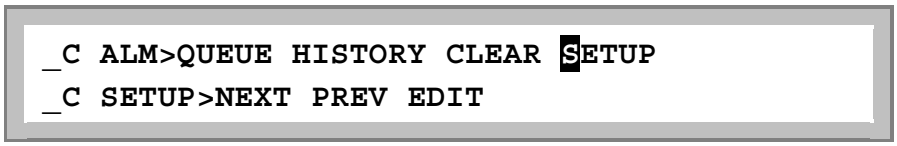


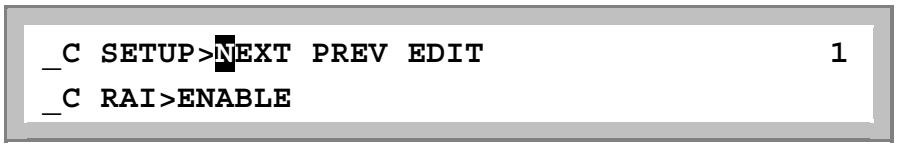
5.1.1.3.3 CLEAR

The Alarm Clear menu is used to clear the alarm queue and history. Under Alarm menu, use the arrow keys to select Alarm Clear menu.

5.1.1.3.4 SETUP

The Alarm Setup menu is used to set up the threshold level of each alarm type, and enable the alarm relay and auto dial out function. Some types of alarms do not have a threshold level. Under the Alarm menu, use the arrow keys to select Alarm Setup menu.





```
_C RAI>ENABLE SAVE
       DISABLE *ENABLE
```

```
_C RAI>ENABLE SAVE
       Change alarm data
```

5.1.1.4 INFORMATION

The Information menu provides the software version. Modifications are not allowed.

```
_C>LINE DIAG ALM INFO MISC
_C INFO>S/W
```

5.1.1.4.1 SOFTWARE

```
_C INFO>S/W
Version:V.055  09/30/1998
```

5.1.1.5 Miscellaneous

The Miscellaneous Menu includes performance, status, return to default, and reset.

```
_C>LINE DIAG ALM INFO MISC
_C MISC>PERF STATUS DEFAULT RESET
```

5.1.1.5.1 Performance

The Performance menu allows viewing of alarms by type (USER) and to reset alarm counts.

```
_C MISC>PERF STATUS DEFAULT RESET
_C PERF>USER RESET
```

From the USER submenu, the alarm counts are displayed for each alarm type.

```
_C PERF>USER RESET
DISPLAY USER PERFORMANCE ....
```

```
_C T>ES  UAS  BES SES CSS   DM
     94   38    4  42  77    2
```

```
_C PERF>USER RESET
Clear Performance Data? YES
```

5.1.1.5.2 STATUS

The Line Status menu is used to view Loop-V E1 line receiver error status report. Under Performance menu, use the arrow keys to select Line Status menu.

```
_C MISC>PERF STATUS DEFAULT RESET
       Show Line Status
```

The menu shows the current error status of line receiver by an asterisk (*). In the example below, line receiver is experiencing loss of frame and a Yellow alarm is being transmitted.

```
_C LINE>LOS LOF RxRAI RxAIS TxRAI TxAIS
          *   *                 *
```

5.1.1.5.3 DEFAULT

This menu item allows the loading of the factory default configuration into the working configuration memory.

A password must be entered to effect this operation. The password is entered best from the terminal. From the common controller panel, the password is entered one letter at a time by first selecting the position of the password. Press **ENTER**. Then use the arrow keys to select the letter for the password. Additional characters are available for the password when the cursor is scrolled to the right end.

```
_C MISC>PERF STATUS DEFAULT RESET
_C DEFAULT>Load Default Configuration
```

```
Enter Password: _____________  YES
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ!"#$
```

5.1.1.5.4 RESET

Select RESET to simulate a power up sequence including a self test of the controller as when power is first turned on. A password is required for this operation.

```
_C MISC>PERF STATUS DEFAULT RESET
_C RESET>Reset Unit
```

```
Enter Password: _____________  YES
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ!"#$
```

5.1.2 T1 CSU PORT

Use the arrow keys to select a port.

```
PORT> Select Port: <FT1>
A B C D E F H J K
```

5.1.2.1 LINE

Line menus are used to configure the line operation mode for each port, such as frame format, line code, yellow alarm transmission, inband loopback code recognition, AIS, signaling format, interface, CGA, OOS, and transmission idle code. Using the arrow keys make the selection, and press **ENTER**.

```
_A>LINE DIAG ALM INFO MISC
_A LINE>FRAME CODE YEL INBAND AIS CAS
```

5.1.2.1.1 FRAME

Press **ENTER** for the Line Frame menu

To change the frame type, use the arrow keys to cycle through to a proper selection and press **ENTER**. For example, ESF&T1.403 indicates ESF frame format is chosen and facility data link message follows ANSI T1.403 standard. While ESF indicates ESF frame format is chosen and facility data link follows AT&T PUB 54016 standard. An asterisk (*) is placed by the currently selected item. Use the arrow keys to change the setting, and press **ENTER**.

```
_A LINE>FRAME CODE YEL INBAND AIS CAS
       D4 *ESF ESF&T1.403  NONE
```

5.1.2.1.2 CODE

Press **ENTER** for the Line Code menu.

To select the coding scheme, use the arrow keys cycle through to a proper selection and press **ENTER**. The choices for T1 are AMI and B8ZS. An asterisk (*) is placed by the currently selected item. Using the arrow keys to change the setting, and press **ENTER**. Be sure that this setting matches that of the network.

```
_A LINE>FRAME CODE YEL INBAND AIS CAS
       AMI *B8ZS
```

5.1.2.1.3 YELLOW ALARM

Press **ENTER** from Line YEL menu

Yellow alarm for T1 shows the current alarm transmission state when the port reports loss of signal or loss of frame sync. To enable this alarm being automatically send out when loss of signal and loss of frame sync, use the arrow keys to cycle through to ON and press **ENTER**. To disable RAI/YEL alarm sending, use the arrow keys cycle through to OFF and press **ENTER**. An asterisk (*) is placed by the currently selected item. Using the arrow keys to change the setting, and press **ENTER**.

```
_A LINE>FRAME CODE YEL INBAND AIS CAS
    *ON OFF ON+A +B +C +D +E +F +H +J +K
```

5.1.2.1.4 INBAND

The INBAND menu shows the remote inband loopback diagnostics code recognition. The current selection is highlighted by an asterisk (*). To enable it, move the cursor to ON and press **ENTER**. To disable it, move the cursor to OFF and press **ENTER**.

```
_A LINE>FRAME CODE YEL INBAND AIS CAS
       ON *OFF
```

5.1.2.1.5 AIS (Alarm Indication Signal)

The AIS menu shows the configuration set for the alarm indication signal. Use the arrow keys to cycle through to FRAME or UNFRAMED and press **ENTER**.

```
_A LINE>FRAME CODE YEL INBAND AIS CAS
      *FRAME UNFRAME OFF
```

5.1.2.1.6 CAS (Channel Associated Signalling)

Press **ENTER** for the Line CAS menu.

Signaling is either CAS (channel associated signalling) or out-of-band such as CCIS (common channel interoffice signalling). To change the signaling type, use the arrow keys to choose from CAS ON or CAS OFF and press **ENTER**.

```
_A LINE>FRAME CODE YEL INBAND AIS CAS
       ON *OFF
```

5.1.2.1.7 SIGNALLING

Move the cursor to the signalling item. Use arrow keys to select "TRANS". The current selection will be highlight by an asterisk (*).

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
      *TRANS
```

5.1.2.1.8 INTERFACE

Finally, the interface can be selected. This is a read only screen, depending on the plug-in card installed. Available cards can provide V.35, EIA530, X.21, RS232, and RS232 with sub-rate data speed (<56Kbps).

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
      *LONG_HUAL SHORT_HUAL
```

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
       LONG_HUAL *SHORT_HUAL
```

5.1.2.1.9 EQU (Equalization)

To change the EQU, use the arrow keys to cycle through to a proper selection and press **ENTER**.

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
    *0dB -7.5dB -15dB
```

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
      Odb *-7.5dB -15dB
```

5.1.2.1.10 CGA (Carrier Group Alarm)

To configure CGA as NORMAL or TRANSPARENT, use the arrow keys cycle through to a proper selection and press **ENTER**.

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
      *NORM TRANS
```

5.1.2.1.11 OOS (Out of Service)

To change the OOS protocol, use the arrow keys cycle through to a proper selection and Press **ENTER**.

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
    *BUSY IDLE BUSY_IDLE IDLE_BUSY
```

5.1.2.1.12 IDLE

Press **ENTER** for the Line Idle Code menu

The Idle menu shows the transmission idle code when a DS0 time slot is in idle mode. To change the idle code, press the **ENTER** key to cycle through the idle code. This operation must be concluded by moving the cursor to the OK position and pressing **ENTER** to enable the changes.

```
_A LINE>SIGNALLING INTF EQU CGA OOS IDLE
_A IDLE>Idle Code=0xFF    YES
```

5.1.2.2 Diagnostics

The Diagnostics group includes Near Loopback, Remote Loopback, and the Testing Pattern Menu. If a remote loopback is in session, the front panel LED for that port will be flashing green.

```
_A>LINE DIAG ALM INFO MISC
_A DIAG>NearLB RemLB PATT
```

5.1.2.2.1 Near End Loopback

The Near Loopback menus are used to control near end E1/T1 line side loopback operations such as local loopback test, payload loopback test, and line loopback test. Under Unit Diagnostics menu, use the arrow keys to select Near Loopback menu.

```
_A DIAG>NearLB RemLB PATT
      *OFF LOCAL PLB LLB
```

5.1.2.2.2 Remote Loopback

Remote Loopback is used to activate the E1/T1 line remote loopback test. For T1, there are three remote loopback types, inband, AT&T 54016, and ANSI T1.403. Under the Diagnostics menu, use the arrow keys to select the Remote Loopback menu.

```
_A DIAG>NearLB RemLB PATT
_A RemLB>ACTIVATE DEACTIVATE
```

To activate or deactivate the remote E1/T1 line loopback, use the arrow keys to cycle through to a desired selection and press **ENTER**. For T1, select INBAND for remote line loopback inband coding, AT&T-P for remote payload loopback AT&T FDL coding, ANSI-P for remote payload loopback ANSI FDL coding, or ANSI-L for remote line loopback ANSI FDL coding.

```
_A RemLB>ACTIVATE DEACTIVATE
       *IN-BAND AT&T-P ANSI-P ANSI-L
```

```
_A RemLB>ACTIVATE DEACTIVATE
       *IN-BAND AT&T-P ANSI-P ANSI-L
```

5.1.2.2.3 Pattern

The test pattern is used to transmit on all 24 channels of the T1 line. Two test patterns, such as QRSS and 1-in-8 are available. To select, move the cursor to a proper pattern and hit **ENTER** to move cursor to the lower line of the display, as follows. To activate pattern transmission, move the cursor to SEND and hit **ENTER**. To terminate, hit **ESC**.

```
_A DIAG>NearLB RemLB PATT
_A PATT>QRSS 1-IN-8
```

```
_A PATT>QRSS 1-IN-8
       *OFF FULL
```

```
_A PATT>QRSS 1-IN-8
       *OFF SEND
```

5.1.2.3 ALARM

The Alarm menu is used to view alarm queue and alarm history, to clear the alarm queue, alarm history, and alarm relay, as well as setup alarm threshold, etc. as in the following paragraphs.

```
_A>LINE DIAG ALM INFO MISC
_A ALM>QUEUE HISTORY CLEAR SETUP
```

5.1.2.3.1 QUEUE

The Alarm Queue menu is used to view the alarm queue. Under the Alarm menu, use the arrow keys to select Alarm Queue menu. Then press **ENTER**.

The alarm queue is a list of the latest 40 alarms from the unit selected. The upper right shows the alarm sequence and the total number of alarms. The lower left is the alarm type number. The lower right is the date and time of the alarm.

```
_A ALM>QUEUE HISTORY CLEAR SETUP
_A QUEUE>NEXT PREV
```

```
_A QUEUE>NEXT PREV
EMPTY
```

5.1.2.3.2 HISTORY

The Alarm History menu is used to view the alarm history. Under the Alarm menu, use the arrow keys to select the Alarm History menu.

```
_A ALM>QUEUE HISTORY CLEAR SETUP
_A HISTORY>NEXT PREV
```

```
_A HISTORY>NEXT PREV                  00/00
YEL ENABLE --->0
```

5.1.2.3.3 CLEAR

The Alarm Clear menu is used to clear the alarm queue and history. Under the Alarm menu, use the arrow keys to select the Alarm Clear menu.

```
_A ALM>QUEUE HISTORY CLEAR SETUP        01
       Clear Unit Alarm?  NO YES
```

5.1.2.3.4 SETUP

The Alarm Setup menu is used to set up the threshold level of each alarm type, and enable alarm relay and auto dial out function. Some types of alarms do not have threshold levels. Under the Alarm menu, use the arrow keys to select Alarm Setup menu.

```
_A ALM>QUEUE HISTORY CLEAR SETUP
_A SETUP>NEXT PREV EDIT
```

```
_A SETUP>NEXT PREV EDIT                  1
_A YEL>ENABLE
```

```
_A YEL>ENABLE SAVE
       DISABLE *ENABLE
```

```
_A YEL>ENABLE SAVE
       Change alarm data
```

5.1.2.4 INFORMATION

The Information item provides the software version. This item is read only.

```
_A>LINE DIAG ALM INFO MISC
_A INFO>S/W
```

5.1.2.4.1 SOFTWARE

```
_A INFO>S/W
Version:V.055  09/30/1998
```

5.1.2.5 Miscellaneous Menu

The Miscellaneous Menu includes performance, status, return to default, and reset options.

```
_A>LINE DIAG ALM INFO MISC
_A MISC>PERF STATUS DEFAULT RESET
```

5.1.2.5.1 Performance Menu

The performance menu allows viewing of alarms by type (USER) and is used to reset alarm counts.

```
_A MISC>PERF STATUS DEFAULT RESET
_A PERF>USER RESET
```

From the USER submenu, the alarm counts are displayed for each alarm type.

```
_A PERF>USER RESET
DISPLAY USER PERFORMANCE ....
```

```
_A T>ES  UAS  BES SES CSS  LOFC   BPV
      0 1698    0   0   0    12 65535
```

The above display shows performance of the current 15-minute interval. Use the arrow keys to cycle to the next or previous 15-minute interval. The number in place of "CURR" counts from the last interval, 01, back to the earliest, 96, or 24 hours previous, as shown below.

```
_A PERF>USER RESET
Clear Performance Data? YES
```

The Reset Performance menu is used to clear the E1 line receiver (user register) performance status report. Under Performance menu, use the arrow keys to select Reset Performance menu. At this menu, press **ENTER** to confirm clear E1 line receiver (user register) performance status report. Otherwise press **ESC** to exit without any action.

5.1.2.5.2 STATUS

The Line Status menu is used to view the T1 line receiver error status report. Under the Performance menu, use the arrow keys to select the Line Status menu.

```
_A MISC>PERF STATUS DEFAULT RESET
       Show Line Status
```

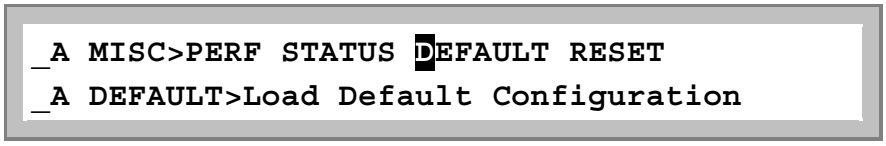
```
_A LINE>LOS LOF RxYEL RxAIS TxYEL TxAIS
         *   *               *
```

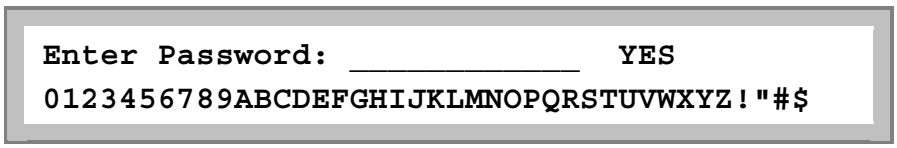
This menu shows the current error status of line receiver by an asterisk (*). In the above example, the line receiver is experiencing loss of frame and a Yellow alarm is being transmitted.

5.1.2.5.3 DEFAULT

This menu item is used to load the factory default configuration into the working configuration memory.

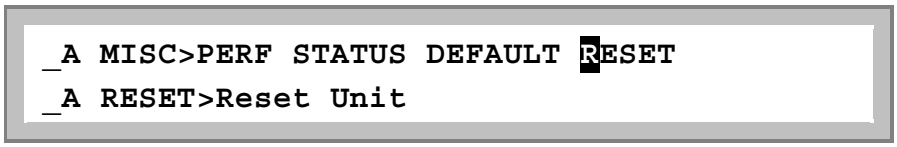
A password must be entered to effect this operation. The password is best entered from the terminal. From the LCD panel, the password is entered one letter at a time by first selecting the position of the password. Press **ENTER**. Then use the arrow keys to select the letter for the password. Additional characters are available for the password when the cursor is scrolled to the right end.

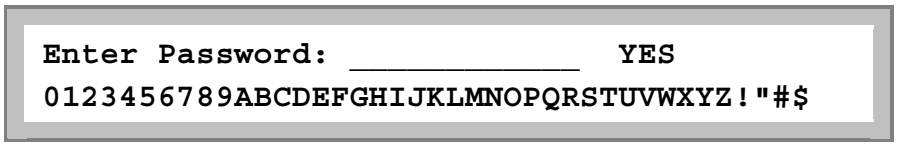




5.1.2.5.4 RESET

Select RESET to simulate a power up sequence including a self test of the controller as when power is first turned on. A password is required to effect this operation.





6 TERMINAL OPERATION

The Loop-V 4200 series provides comprehensive report and enhanced configuration capability through the console port on the front of the main unit. A VT100 type terminal can be connected to the console port, which is a standard RS232 interface. Using single-character commands and arrow keys, the Loop-V 4200 can be configured and monitored. The single-character commands are not case sensitive. On each screen, the available commands and the configurable fields are highlighted. Alarm messages are also sent to the console port and are shown on the top of the screen in a blinking mode. Upon power up, the main menu is shown.

NOTE: On the upper right corner of the screen, a time-of-day display indicates the time the current screen is shown. Any key, other than **ESC**, may be pressed to update the screen.

NOTE: ONLY when FDL is turned ON, or in ESF frame format mode, far-end operation is accessible.

```
LOOP V4200-9                 === Controller Menu ===          10:48:35 03/23/2000
Serial Number: 10001   Connect_port: SUPV_PORT
Version      : HW H/W VER.E SW S3.Q4 05/24/2002
Start Time   : 15:35:17 06/25/2002          PWR1: active    PWR2: active
[Port Status]
A      B      C      D      E      F      H      J      K
FT1    FE1    FE1    FE1    FT1    FT1    FT1    FT1    FT1

[DISPLAY]                                  [SETUP]
C -> Display System Configuration          S -> System Setup
Q -> Alarm Queue Summary                   P -> Password Setup
I -> Information Summary                   M -> System Alarm Setup
                                           L -> Download/Upload Firmware
                                           T -> Download/Upload Configuration
                                           R -> Store/Retrieve Configuration


[LOG]                                      [MISC]
U -> Choose a Unit                         A -> Alarm Cut Off
F -> Log Off [SETUP],[MISC] Menu           X -> Clear Alarm Queue
O -> Log On  [SETUP],[MISC] Menu           Y -> Controller Return to Default
                                           Z -> Controller Reset
                                           K -> Load All Ports Default

>>SPACE key to refresh or enter a command ===>
```

6.1 E1 Port Menu

Press “U” to choose a port. The following screens are for the E1 in Port B.

```
PORT B FE1                      === Port Menu ===              09:25:55 05/05/1999

Version      : SW V1.15  12/18/1998

[Port Status]
A    B    C    D    E    F    H    J    K
FT1  FE1  FE1  FE1  FT1  FT1  FT1  FT1  FT1
[DISPLAY]                                [SETUP]
1 -> Unit 1-Hour Perf. Report            L -> Unit Loopback Setup
2 -> Unit 24-Hour Perf. Report           M -> Unit Alarm Setup
A -> Unit Line Availability              S -> Unit System Setup
C -> Unit Configuration                  X -> Unit Clear Alarm Queue & History
H -> Unit Alarm History                  K -> Unit Clear Performance Data
I -> Unit Status
Q -> Unit Alarm Queue

[LOG]                                    [MISC]
U -> Choose a Port                       Y -> Unit Load Default Config
F -> Log Off [SETUP],[MISC] Menu         Z -> Unit Reset
O -> Log On  [SETUP],[MISC] Menu
E -> Return to Controller Main Menu

>> SPACE bar to refresh, or enter a command --->
```

6.1.1 E1 Port 1-Hour Performance Report

View the E1 port 1-hour performance report by selecting register type.

```
PORT B FE1            === Port 1-Hour Perf. Report ===       09:25:55 05/05/1999
USER
-- Valid Seconds in Current 15-Min Interval : 706 seconds
                                 (ES)   (UAS)  (BES)  (SES)  (DM)   (CSS)
   Current 15-Min Interval     : 0      0      0      0      0      0
   1st Nearest 15-Min Interval : 0      0      0      0      0      0
   2nd Nearest 15-Min Interval : 0      0      0      0      0      0
   3rd Nearest 15-Min Interval : 0      0      0      0      0      0
   4th Nearest 15-Min Interval : 0      0      0      0      0      0

-- Valid 15-Min Intervals in Current 24-Hour Interval: 10
                                 (ES)   (UAS)  (BES)  (SES)  (DM)   (CSS)
   Current 24-Hour Interval    : 9      0      1      6      0      8
   02/09/1999                  : -----  -----  -----  -----  -----  -----
   02/08/1999                  : -----  -----  -----  -----  -----  -----
   02/07/1999                  : -----  -----  -----  -----  -----  -----
   02/06/1999                  : -----  -----  -----  -----  -----  -----
   02/05/1999                  : -----  -----  -----  -----  -----  -----
   02/04/1999                  : -----  -----  -----  -----  -----  -----
   02/03/1999                  : -----  -----  -----  -----  -----  -----


<< TAB key to show Statistics Report >>
<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.1.2 E1 Port 24-Hour Performance Report

View the E1 port 24-hour performance report by selecting register type.

```
PORT B FE1            === Port 24-Hour Perf. Report ===      09:25:55 05/05/1999
USER ES
-- Valid Seconds in Current 15-Min Interval : 718 seconds
-- Valid 15-Min Intervals in Current 24-Hour Interval: 10
                                 (ES)   (UAS)  (BES)  (SES)  (DM)   (CSS)
   Current 15-Min Interval     : 0      0      0      0      0      0
   Current 24-Hour Interval    : 9      0      1      6      0      8

-- USER, ES, Last 96 15-Min Interval :
   01-08 > 0     0     0     0     0     5     4     0
   09-16 > 0     0     -----  -----  -----  -----  -----  -----
   17-24 > -----  -----  -----  -----  -----  -----  -----  -----
   25-32 > -----  -----  -----  -----  -----  -----  -----  -----
   33-40 > -----  -----  -----  -----  -----  -----  -----  -----
   41-48 > -----  -----  -----  -----  -----  -----  -----  -----
   49-56 > -----  -----  -----  -----  -----  -----  -----  -----
   57-64 > -----  -----  -----  -----  -----  -----  -----  -----
   65-72 > -----  -----  -----  -----  -----  -----  -----  -----
   73-80 > -----  -----  -----  -----  -----  -----  -----  -----
   81-88 > -----  -----  -----  -----  -----  -----  -----  -----
   89-96 > -----  -----  -----  -----  -----  -----  -----  -----

<< TAB key to show Statistics Report >>
<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.1.3 E1 Port Line Availability

To view the E1 port line availability screen, press “A” from the port menu.

```
PORT B FE1              === Port Line Availability ===       09:25:55 05/05/1999

-- Line Availability during Last 24-Hour:
   Valid Seconds      : 9724 seconds
   Available Seconds  : 9724 seconds
   Unavailable Seconds: 0 seconds
   Line Availability  : 100.0 %









<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.1.4 E1 Port Alarm History

To view the alarm history report, press “H”. The following screen appears.

```
PORT B FE1                 === Port Alarm History ===          09:25:55 05/05/1999
LOCAL
[ALARM-TYPE]    [THRESHOLD]    [CURR-STATE]    [COUNT]    [ALARM]
RAI                               OK            1         ENABLE
AIS                               OK            0         ENABLE
LOS                               OK            2         ENABLE
LOF                               OK            2         ENABLE
BPV               10E-5           OK            0         ENABLE
ES                1               OK            2         ENABLE
UAS               1               OK            0         ENABLE
CSS               1               OK            2         ENABLE









<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.1.5 E1 Port Status

To view the port status, press “I”. The following screen appears.

```
PORT B FE1                  === Port Status ===            09:25:55 05/05/1999


-- LINE --
   LOS     : NO
   LOF     : NO
   RCV AIS : NO
   RCV RAI : NO
   XMT AIS : NO
   XMT RAI : NO
   BPV ERROR COUNT : 1
   ES  ERROR COUNT : 9

-- TEST --
   PATTERN TRANSMITTED : OFF
   NEAR-END LOOPBACK   : OFF









<< ESC key to return to previous menu, SPACE key to refresh >>
```

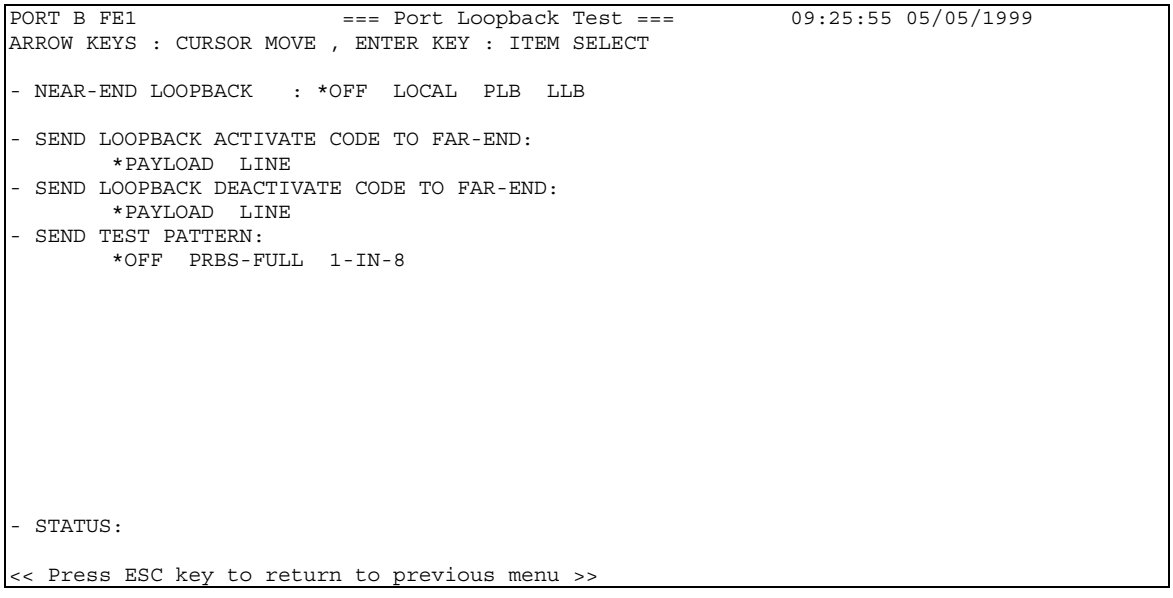
6.1.6 E1 Port Loopback Test

To enter the loopback test menu, press “L”.

```
PORT B FE1                === Port Loopback Test ===         09:25:55 05/05/1999
ARROW KEYS : CURSOR MOVE , ENTER KEY : ITEM SELECT

- NEAR-END LOOPBACK   : *OFF  LOCAL  PLB  LLB

- SEND LOOPBACK ACTIVATE CODE TO FAR-END:
        *PAYLOAD  LINE
- SEND LOOPBACK DEACTIVATE CODE TO FAR-END:
        *PAYLOAD  LINE
- SEND TEST PATTERN:
        *OFF  PRBS-FULL  1-IN-8
```



```
- STATUS:

<< Press ESC key to return to previous menu >>
```

6.1.7 E1 Port Alarm Setup

To enter the alarm setup, press “M”. Use up and down arrow keys to make selections.

```
PORT B FE1                 === Port Alarm Setup ===          09:25:55 05/05/1999
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

[TYPE]     [THRESHOLD] [ALARM]
RAI                    ENABLE
AIS                    ENABLE
LOS                    ENABLE
LOF                    ENABLE
BPV           10E-5    ENABLE
ES              001    ENABLE
UAS             001    ENABLE
CSS             001    ENABLE









<< Press ESC key to return to previous menu >>
```

6.1.8 E1 Port System Setup

For the port system setup, press “S”. The following screen appears.

```
PORT B FE1                === Port System Setup ===          09:25:55 05/05/1999
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

     FRAME     = ON
     CODE      = HDB3
     CRC       = ON
     RAI       = ON
     AIS       = FRAMED
     CAS       = OFF
     SIGNALLING=TRANS
     CGA       = NORM
     OOS       = BUSY
     FDL       = OFF
     Sa_bit    = Sa4
     IDLE      = D5
     INTF      = 120 Ohm









<< Press ESC key to return to previous menu >>
```

6.2 T1 Port Menu

Press “U” to choose a port. The following screens are for the T1 in Port A.

```
PORT A FT1                    === Port Menu ===              09:25:55 05/05/1999

Version      : SW V1.15  12/18/1998

[Port Status]
A    B    C    D    E    F    H    J    K
FT1  FE1  FE1  FE1  FT1  FT1  FT1  FT1  FT1
[DISPLAY]                                [SETUP]
1 -> Unit 1-Hour Perf. Report            L -> Unit Loopback Setup
2 -> Unit 24-Hour Perf. Report           M -> Unit Alarm Setup
A -> Unit Line Availability              S -> Unit System Setup
C -> Unit Configuration                  X -> Unit Clear Alarm Queue & History
H -> Unit Alarm History                  K -> Unit Clear Performance Data
I -> Unit Status
Q -> Unit Alarm Queue

[LOG]                                    [MISC]
U -> Choose a Port                       Y -> Unit Load Default Config
F -> Log Off [SETUP],[MISC] Menu         Z -> Unit Reset
O -> Log On  [SETUP],[MISC] Menu
E -> Return to Controller Main Menu

>> SPACE bar to refresh, or enter a command --->
```

6.2.1 T1 Port 1-Hour Performance Report

View the T1 port 1-hour performance report by selecting register type.

```
PORT A FT1            === Port 1-Hour Perf. Report ===       09:25:55 05/05/1999



>> Select Register Type ? *USER  LINE
```

```
PORT A FT1            === Port 1-Hour Perf. Report ===       09:25:55 05/05/1999
USER
-- Valid Seconds in Current 15-Min Interval : 325 seconds
                                (ES)   (UAS)  (BES)  (SES)  (CSS)  (LOFC)
   Current 15-Min Interval     : 0      325    0      0      0      1
   1st Nearest 15-Min Interval : -----  -----  -----  -----  -----  -----
   2nd Nearest 15-Min Interval : -----  -----  -----  -----  -----  -----
   3rd Nearest 15-Min Interval : -----  -----  -----  -----  -----  -----
   4th Nearest 15-Min Interval : -----  -----  -----  -----  -----  -----

-- Valid 15-Min Intervals in Current 24-Hour Interval: 0
                                (ES)   (UAS)  (BES)  (SES)  (CSS)  (LOFC)
   Current 24-Hour Interval    : -----  -----  -----  -----  -----  -----









<< TAB key to show Statistics Report >>
<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.2.2 T1 Port 24-Hour Performance Report

When the T1 port 24-hour performance report is selected, the following screen is displayed.

```
PORT A FT1            === Port 24-Hour Perf. Report ===      09:25:55 05/05/1999
USER ES
-- Valid Seconds in Current 15-Min Interval : 335 seconds
-- Valid 15-Min Intervals in Current 24-Hour Interval: 0
                               (ES)   (UAS)  (BES)  (SES)  (CSS)  (LOFC)
   Current 15-Min Interval     : 0      335    0      0      0      1
   Current 24-Hour Interval    : -----  -----  -----  -----  -----  -----

-- USER, ES, Last 96 15-Min Interval :
   01-08 > ----- ----- ----- ----- ----- ----- ----- -----
   09-16 > ----- ----- ----- ----- ----- ----- ----- -----
   17-24 > ----- ----- ----- ----- ----- ----- ----- -----
   25-32 > ----- ----- ----- ----- ----- ----- ----- -----
   33-40 > ----- ----- ----- ----- ----- ----- ----- -----
   41-48 > ----- ----- ----- ----- ----- ----- ----- -----
   49-56 > ----- ----- ----- ----- ----- ----- ----- -----
   57-64 > ----- ----- ----- ----- ----- ----- ----- -----
   65-72 > ----- ----- ----- ----- ----- ----- ----- -----
   73-80 > ----- ----- ----- ----- ----- ----- ----- -----
   81-88 > ----- ----- ----- ----- ----- ----- ----- -----
   89-96 > ----- ----- ----- ----- ----- ----- ----- -----

<< TAB key to show Statistics Report >>
<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.2.3 T1 Port Line Availability

To view the T1 port line availability screen, press “A” from the port menu.

```
PORT A FT1              === Port Line Availability ===       09:25:55 05/05/1999

-- Line Availability during Last 24-Hour:
   Valid Seconds      : 345 seconds
   Available Seconds  : 0 seconds
   Unavailable Seconds: 345 seconds
   Line Avaliability  : 0.0 %









<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.2.4 T1 Port System Setup

For the port system setup, press “C”. The following screen appears.

```
PORT A FT1                === Port System Setup ===          09:25:55 05/05/1999


     FRAME      = ESF
     CODE       = B8ZS
     YEL        = ON
     AIS        = FRAMED
     CAS        = OFF
     SIGNALLING= TRANS
     CGA        = NORM
     OOS        = BUSY
     INBAND     = OFF
     IDLE       = FF
     INTF       = LONG HAUL
     LBO        = 0 dB









<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.2.5 T1 Port Alarm History

To view the alarm history report, press “H”. The following screen appears.

```
PORT A FT1                === Port Alarm History ===         09:25:55 05/05/1999
LOCAL
[ALARM-TYPE]    [THRESHOLD]    [CURR-STATE]    [COUNT]    [ALARM]
RAI                               OK              0         ENABLE
AIS                               OK              0         ENABLE
LOS                               ALM             1         ENABLE
LOF                               ALM             1         ENABLE
BPV                10E-5          OK              0         ENABLE
ES                 1              OK              0         ENABLE
UAS                1              OK              0         ENABLE
CSS                1              OK              0         ENABLE









<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.2.6 T1 Port Status

To view the port status, enter “I”. The following screen appears.

```
PORT A FT1                    === Port Status ===             09:25:55 05/05/1999


-- LINE --
   LOS      : YES
   LOF      : YES
   RCV AIS  : NO
   RCV YEL  : NO
   XMT AIS  : NO
   XMT YEL  : YES
   BPV ERROR COUNT : 0
   ES  ERROR COUNT : 0

-- TEST --
   PATTERN TRANSMITTED : OFF
   NEAR-END LOOPBACK   : OFF









<< ESC key to return to previous menu, SPACE key to refresh >>
```

6.2.7 T1 Port Loopback Test

To enter the T1 loopback test menu, press “L”. To initiate the loopback test, select the desired options and press **ENTER** key to start.

```
PORT A FT1                 === Port Loopback Test ===         09:25:55 05/05/1999
ARROW KEYS : CURSOR MOVE , ENTER KEY : ITEM SELECT

- NEAR-END LOOPBACK   : *OFF  LOCAL  PLB  LLB

- SEND LOOPBACK ACTIVATE CODE TO FAR-END:
        *IN-BAND  AT&T-P  ANSI-P  ANSI-L
- SEND LOOPBACK DEACTIVATE CODE TO FAR-END:
        *IN-BAND  AT&T-P  ANSI-P  ANSI-L
- SEND TEST PATTERN:
        *OFF  QRSS-FULL  1-IN-8









- STATUS:

<< Press ESC key to return to previous menu >>
```

6.2.8 T1 Port Alarm Setup

To enter the alarm setup, press “M”. Use up and down arrow keys to make the selection.

```
PORT A FT1                 === Port Alarm Setup ===          09:25:55 05/05/1999
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

[TYPE]     [THRESHOLD] [ALARM]
RAI                    ENABLE
AIS                    ENABLE
LOS                    ENABLE
LOF                    ENABLE
BPV           10E-5    ENABLE
ES              001    ENABLE
UAS             001    ENABLE
CSS             001    ENABLE









<< Press ESC key to return to previous menu >>
```

6.2.9 T1 Port System Setup

To view the system setup, press “S”. Use up and down arrow keys to make the selection.

```
PORT A FT1                === Port System Setup ===          09:25:55 05/05/1999
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

     FRAME      = ESF
     CODE       = B8ZS
     YEL        = ON
     AIS        = FRAMED
     CAS        = OFF
     SIGNALLING= TRANS
     CGA        = NORM
     OOS        = BUSY
     INBAND     = OFF
     IDLE       = FF
     INTF       = LONG HAUL
     LBO        = 0 dB









<< Press ESC key to return to previous menu >>
```

7 Appendix A - Channel Associated Signaling

Signaling is the exchange of information needed for facilities to setup, maintain and terminate switched voice connections. There are two methods of handling signaling information: (1) CCIS, an external method, which sends the signaling information through lines separate to the voice information, and (2) CAS an internal method, which sends the signaling information along with the voice information. This paper will discuss CAS, as Loop products treats CCIS as data.

The second method, referred to as Channel Associated Signaling (CAS), is used only in voice communications to handle issues like Ring and On/Off hook. This signaling information is contained in the data stream and is carried in different ways between switching locations.

Signaling information uses 4 bits, which are labeled A, B, C, and D. Today, only bits A and B are commonly used. Bits A and B are usually used for On/Off hook and the Ring signals.

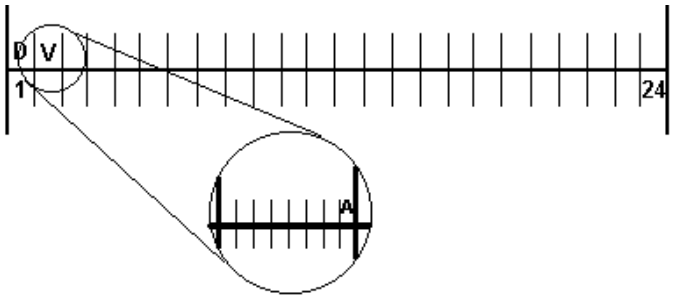
The following table shows the North American Standard for usage of the A and B bits. The European ITU/CCITT has no standard, and each country may have a different designation for the signaling bits.

	A	B
On hook	0	1
Off hook	1	1
No ring	-	1
Ring	0	0

Some equipment can take advantage of the remaining C and D bits to perform tasks such as remote management of devices, but this is out of the realm of this discussion.

T1

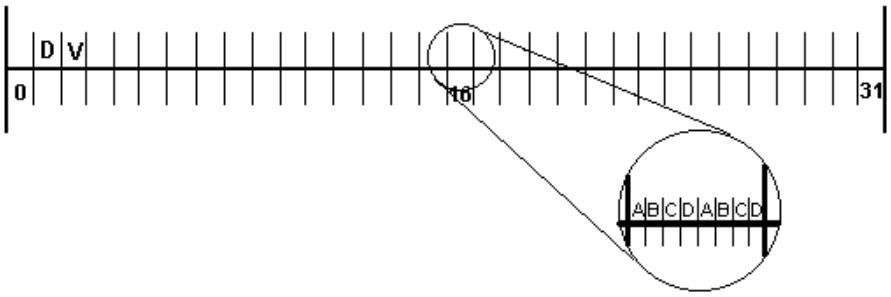
T1 services use a system called “Robbed Bit Signaling.” This method uses the 8th bit in every time slot of the 6th, 12th, 18th and 24th frame. Therefore every Extended Super Frame (ESF, 24 frames) contains all of the necessary signaling information. Voice communication is robust enough to allow a missing bit every 6 frames. If data is sent, the 8th bit cannot be used for signaling, else errors result. Therefore, in the setup, the time slot must be designed voice "V" or data "D".



The 6th T1 frame, containing the A bit in the 8th bit of the voice channel.
The 12th frame will have the B bit, the 18th, the C bit, and the 24th, the D bit.

E1

E1 services use time slot 16 in every frame for signaling information. Since this time slot contains 8 bits, all four signaling bits can be contained (twice) in time slot 16. The first 4 bits support the first time slot, and the next four support the second time slot. The next signaling bits in the next frames will support the next time slots all the way to time slot 31. Therefore, an E1 ESF is 16 frames.



Time slot 16 of an E1 frame showing the signaling bits.

Because the entire 16th time slot is used for signaling information to support the voice channels, that channel is unavailable for data usage. It is possible that an E1 service company will sell time slot 16 to another customer. If this is done, that channel will be unavailable to provide signaling information to voice customers, and the entire frame must consist of data.

The signaling bits in time slot 16 of an E1 frame cover two time slots per frame. Therefore, if a channel is not a voice channel, time slot 16 holds idle information for that channel.

Even though no voice bits are "robbed", the designation voice or data are still recommended to avoid conflicts with CAS and T1/E1 conversion.

T1/E1 Conversion

Devices exist which convert T1 to E1 and visa versa. These devices take the signaling information from the one and convert it properly to the other. For example, conversion from a T1 to an E1 will wait for the entire T1 super frame before transferring the signaling bits to the next E1 super frame. Once the A, B, C & D bits are received, they are transferred to the appropriate time slot/frame of the E1 super frame.

This causes a delay only in signaling information (on/off hook & ring/no ring), not in the actual voice information.

When utilizing equipment in telecommunications that handles T1/E1 lines, it is vital to maintain CAS consistency. When a T1 channel containing voice is mapped to another T1 channel, both T1 devices must support CAS. In addition, if a T1 channel containing voice is mapped to an E1 channel, that E1 device must have CAS enabled. If CAS is not enabled on a voice channel, the voice channel will not work. Also, if a channel is setup to handle voice, data will not pass through it. If a channel is set up to handle data, both T1 and E1 must designate that channel as data.

Line Code

In addition to CAS, voice channels must take into account line coding. Line code is the protocol that covers the electrical transmission of digital information over a T1/E1 line. There are several line codes that can be used in a telecommunications network.

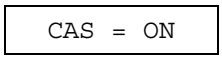
T1	E1
AMI	AMI
B8ZS	HDB3

Line codes available.

Once a line code is implemented, all devices in that network must either follow that standard, or utilize a converter to change the line code. Because AMI is not designed to handle data, B8ZS for T1 or HDB3 for E1 must be used, else the information will not get through, and constant errors will result.

Loop Equipment

There are two places to enable CAS in Loop products. The first is in the individual unit, module or port setup. If the module, such as a T1 or E1, is to be used to support voice channels, it has an option to enable or disable CAS.

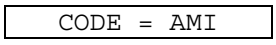


The CAS setup.

The second is in the Time Slot Interchange (TSI) map. Each channel in the TSI map can be assigned as a voice or data channel.

TSI example of a voice channel mapped to Port A, TS1 and a data channel mapped to Port A, TS2.

Line code is setup only in the individual module's setup.



The Line Code setup.

Conclusion

CAS Contains information used in voice data. It is handled in different methods depending on if the information passes through a T1 or E1 line. It is important to maintain a CAS structure properly for a network to run correctly.

In addition to CAS, the line code must be set to the standards for the network. Loop products support both CAS and line code for proper operation of a network.

8 Appendix B - Line Code

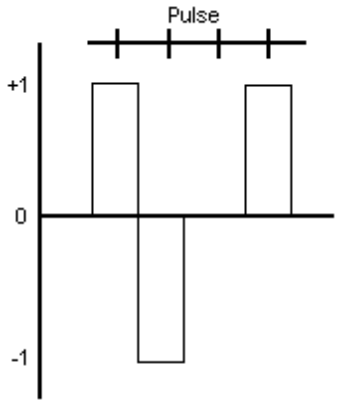
Line code is the protocol that covers the electrical transmission of digital information over a T1/E1 line.

Binary data is noted as 0 or 1. In a digital system, 0 is usually measured as 0 volts, and 1 is measured in +5 volts. That works fine for equipment which is centrally located, but when digital information is sent to distant locations, this measurement can be problematic.

For example, if a string of 1s is sent, the receiving equipment may mistake them for a string of 0s. Then, when the 0s come, an error is listed or the 0s are ignored. When digital transmission was first developed, and digital equipment was in it's preliminary stages, a method was needed to overcome this potential problem.

AMI

Alternate Mark Inversion is a method that transmits the information, not as 0 (0V) and 1 (+5V), but as 0 (no pulse) and 1 (+pulse/-pulse). This means that two 1s are transmitted as a +1 pulse followed by a –1 pulse.



Representation of 4 pulses: 1101

This helps receiving equipment recognize the levels of 1 and 0 as well as recognize the pulse locations.

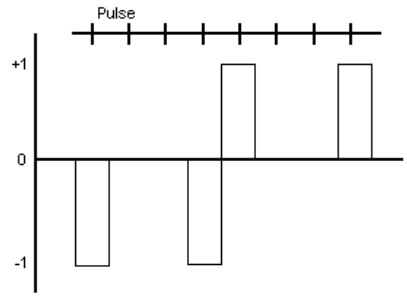
In voice communications, a 1 would mean sound, and a 0 would mean no sound. However, since no sound would be more common than a constant loud sound, AMI inverts the signal so 1s are turned into 0s and visa versa.

A string of 1s, no sound, would be represented by +1, -1, +1, -1, etc, and this would be acceptable to the receiver. If the string contained a string of 0s, loud sound, the line would contain no pulses, which might confuse the receiver. There are two methods that were developed to handle multiple 0s in a string. These methods not only help with voice communications but with data communications as well.

B8ZS

Bipolar with 8 Zero Substation is used in T1 technology. If a string of 8 0s is detected, the system changes those 0s into another format, as follows.

If the previous bit is	Then this pattern substitutes for the 8 0s
+	-00-+00+
-	+00+-00-



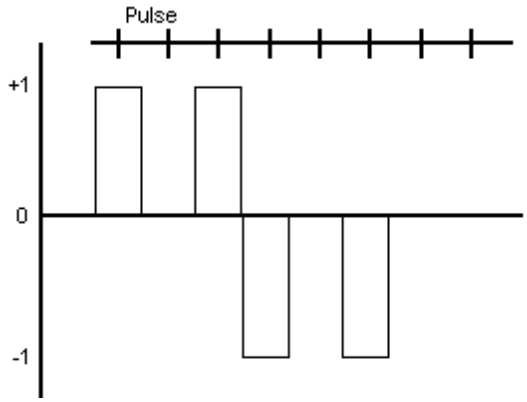
Representation of 8 0s in a row (following a + pulse)

The equipment, which is configured to handle B8ZS can recognize these patterns and will either substitute the patterns for the 8 0s (on the sending side) or substitute 8 0s for the patterns (on the receiving side).

HDB3

Hi Density Bipolar length of 3 bits is used in E1 technology. This method doesn't wait for 8 0s but makes a substitution when 3 0s occur. It is perceived that this method is more stable than one which replaces 8 0s. HDB3 also has two substitutions and they follow each other in sequence.

First substitution: +0+
Next substitution: -0-



Representation of 8 0s in a row

Conclusion

There are several methods to produce data on a digital line, and each of these methods were designed to facilitate the operation of equipment at the beginning of the information revolution. Today, the equipment used can handle many 0s without loosing it's place, so the detailed procedures in these methods are unnecessary.

Generally, equipment can handle two forms of line code, either AMI and B8ZS for T1 or AMI and HDB3 for E1 technology. None of the methods are superior, as all three of them are in use today.