ZHONE™

Z-Plex 10
User's Guide

Model Number: Z-PLEX-10-24-DOC-SC
June 2000
Zhone Technologies

REGULATORY INFORMATION

Federal Communications Commission (FCC) Part 15 Regulation For Telephone Equipment

The product described herein has been tested and found to comply with the limits for a Class "A" Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy, and, if not installed and used according to instructions in this Operations Manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

The authority to operate this equipment is conditioned on the requirement that no modifications will be made to the equipment unless the changes or modifications are expressly approved by the manufacturer.

This equipment was tested with shielded input/output and interface cables. It is recommended that shielded cables be used with the equipment to reduce interference whenever the possibility of interference is suspected.

FCC Part 68 Regulatory Information

Notice to Users of T1 Service

This equipment complies with part 68 of the FCC rules. On the bottom of the chassis is a label that contains, among other information, the FCC certification number of this system. If requested, this information must be provided to the telephone company.

The applicable certification jack (USOC) used on this equipment is the RJ48C. Before connecting your unit, you must inform the telephone company of the following information:

Port ID	REN/SOC	FIC	USOC
W1-1	6.0Y	04DU9-BN	RJ48C
W1-1	6.0Y	04DU9-DN	RJ48C
W1-1	6.0Y	04DU9-1KN	RJ48C
W1-1	6.0Y	04DU9-1SN	RJ48C
W1-1	6.0Y	04DU9-1ZN	RJ48C

This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack that is part 68 compliant. See installation instructions for details. Note that the Ringer Equivalence Number (or REN), is not applicable for this system's T1 digital ports.

If this equipment (Z-Plex 10) causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes to its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice so you can make the necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, or for repair or warranty information, please contact the service center at:

Zhone Technologies, 48664 Milmont Drive, Fremont, CA., 95132, Telephone 510-353-7600

If this equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

In the event of equipment malfunction, all repairs must be performed by the equipment manufacturer, or an authorized agent. It is the responsibility of users requiring service to report the need for service to the equipment manufacturer, or to one of its authorized agents.

Connection to party line service is subject to state tariffs. (Contact the state public utility commission, public service commission or corporation commission for information).

Country-Specific Regulatory Compliance Information
CANADA
Industrie Canada Requirements

NOTICE TO USERS OF THE CANADIAN TELEPHONE NETWORK

The Industrie Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, ensure that it is permissible to connect to the facilities of the local telecommunications company. The equipment must be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION!

Do not attempt to make such connections yourself; contact the appropriate electrical inspection authority, or electrician, as applicable.

The Ringer Equivalence Number (**REN**) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop that is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total **REN** of all the devices does not exceed five (5).

The Ringer Equivalence Number (**REN**) of this equipment is not applicable.

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Chapter 1
Introduction

This chapter introduces you to the features and benefits of the integrated access solution that permits voice and data integration in a single unit. It includes the following topics:

1.1   Product overview

Bundled service deployment is a snap thanks to this product. It allows cost-effective and quick deployment of analog voice and data services on dual T1 access trunks.

The product sports a sleek, low profile chassis which is configured through a command line interface or SNMP. LEDs are provided for monitoring the status of the product under normal operation as well as under test conditions. Maintenance and diagnostics are further enhanced via loopbacks and test patterns. Additionally, a remote office can use networks loopbacks to verify that the unit is operating normally.

network loopbacks can be used to test from a remote office.

The product addresses access needs for sites requiring economical adaptation of FXO/FXS analog voice-based key systems and PBXs to T1 services. The product supports TR-08 as well as ESF and D4 framing. Additionally, the product provides a high speed V.35 port for connecting to routers for bundled service arrangements. For sites needing up to 24 analog lines, with or without data requirements, this product is an ideal solution.

The product's primary function is to allow for remote termination of lines from a centrally-located switch. Data ports are also provided on the unit for those applications where high speed data deployment is required.

The product is complementary to the leading integrated access device systems and solutions.

1.2   Features

- Voice and data channel bank with integral CSU/DSX interface
- Sleek, low profile, one rack unit (1 RU) chassis
- From 12 to 16 FXS analog voice ports
- Up to 8 FXO ports
- One high speed V.35 data port
- Extensive diagnostics
- LED status indicators for maintenance
- TR-08 support

1.3   Benefits

- Minimal installation costs—remote configuration through a command line interface (CLI) or SNMP.
- Flexibility—One RU design allows easy installation in tight spaces. Rack or wall mounting or desktop placement options are available.
- Simplified maintenance—LEDs help monitor equipment status under both normal operation as well as test mode. Loopback access and test pattern availability further enhance maintenance and diagnostics, all simplified and configurable from a network management system.

1.4   TR-08

The TR-TSY-000008 Bellcore™ standard (commonly referred to as TR-08) describes the generic requirements for interfacing between local digital switches and remote digital terminals via the SLC**R** 96 digital loop carrier system.

TR-08 has three operational modes. The Z-Plex supports Mode I:

- Mode I is a non-concentrated, non-blocking configuration where each channel is assigned a dedicated DS0 time slot.
- Mode II is a concentrated configuration (allows blocking) with 48 channels sharing 24 DS0 time slots. Time slots are assigned on a demand basis for the duration of the call.
- Mode III is a non-concentrated mode used for coin and D4 single-circuit channel banks.

The RT channel numbering scheme supported by the product is described in Bellcore publication TR-TSY-0000008.

When a T1 port is configured for TR-08 format, the voice channels assigned to this port are identified by channel number (according to the TR-TSY-000008 document), which may be different from the T1 time slot number. The product supports only Shelf A. The relation between a channel number and corresponding slot number for TR-08 is shown in the following table.

Channel Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Time slots	1	3	5	7	9	11	13	15	17	19	21	23	2	4	6	8	10	12	14	16	18	20	22	24

1.5   Managing the Z-Plex

The Z-Plex provides the following interfaces to configure the unit:

- Serial (craft)—An out-of-band RS232 serial interface.
- DS0—The DS0 management channel encapsulates IP traffic in HDLC frames using DS0 24.
- Ethernet —You can telnet to the Z-Plex over the Ethernet to manage the unit.
- IP over FDL —The Z-Plex unit supports IP over FDL as a way to configure the system via the CLI. The IP over FDL connection is different than the standard FDL interface which provides error checking for T1 interfaces. The two FDL interfaces cannot be used at the same time.

You can configure the Z-Plex using any of the following methods:

- SNMP
- CLI
- TFTP

1.5.1   SNMP

The Z-Plex supports Simple Network Management Protocol (SNMP) version 1 and version 2 for system management. Network object variables are management information base II (MIB-II) compliant.

SNMP can be accessed over a number of IP interfaces, including IP over FDL, the DS0 24 management channel, or the Ethernet interface. The SNMP agent on the Z-Plex uses to port 161 of UDP for management traffic and UDP port 162 for error events and SNMP traps.

The MIBs for the Z-Plex control the following:

- T1 configuration, performance statistics, alarm conditions, and diagnostics.

- FXS/FXO configuration, status, and diagnostics.

- Data port configuration, status, and diagnostics.

- General chassis management, field upgrades, and alarms.

1.5.2 CLI

The CLI is an easy-to-use interface that is functionally similar to SNMP. The CLI commands are equivalent to SNMP get and set commands and allow you to quickly configure the unit. The interface is accessible both via telnet and through a local serial port. You can configure the same elements with the CLI as you can with SNMP.

1.5.3 TFTP

Trivial File Transport Protocol (TFTP) is used by the Z-Plex perform bulk downloads of configuration information and to support field software upgrades. TFTP is accessible through telnet only.

1.6 Product specifications

Chassis Specification	Height	1.75 inches; with feet, 2 inches (44.45 mm; with feet, 50.8 mm)
	Width	17.25 inches (438.15 mm)
	Depth	9 inches (228.6 mm)
	Weight	Approximately 10 pounds (4.54 kg)
Installation		Desktop
		Wall mount
		Rackmount
Power Supply		90 - 260 VAC, 50-60 Hz
		42 - 56 VDC
		Integrated AC/DC converter and ringing generator
Ring Generator		Nominal 86 VRMS
		Frequency 16.7, 20, 25, 50 Hz
		DC Component: -48 volts DC nomial
		Crest factor cf, where $1.2=<cf=<1.6$
		Ringing Capability: 40 VRMS across 1 REN at the end of a 400 ohms loop
Environment	Operating Temperature	-5^0c to $+50^0$c (23^0F to 122^0F)
	Storage Temperature	-40^0c to $+70^0$c (-40^0F to 158^0F)
	Relative Humidity	5 to 95% Humidity, Non-condensing
Regulatory Compliance		FCC Part 15 Class A
		UL 1950 and CSA 950
		FCC Part 68 and Industry Canada CS-03
FCC Reg #		6RTUSA-35287-DE-N

T1 interface	Physical	Two RJ48
	Frame format	D4, ESF, SLC96 (TR-08)
	Line code	AMI, B8ZS
	Line equalization	0 to 133 ft., 134 to 266 ft., 267 to 533 ft., 534 to 655 ft.
	CSU line buildOut (LBO)	0 dB, -7.5 dB, -15.0 dB, -22.5 dB, automatic receive sensitivity
	DSX line length	0.6 dB for 0 - 250 ft, 1.8 dB for 251 - 500 ft, 3.0 dB for 501 - 700 ft
	Clocking	Internal Stratum 4, line
	FDL	Per ANSI T1.403, AT&T Pub TR62411
	Input level	+3.0dB to -36dB
	TR08 support	Universal voice grade (UVG), single-party (SP) signaling
	Diagnostics	QRSS, line loopback, CSU LB detection, performance statistics over FDL, bantam jacks for in-session T1 monitoring
FXS interface	Physical	One 50-pin female amphenol, up to 24 ports
	FXS supervision mode	FXS, FXS-DN, FXS-DN-Wink, TR-08
	FXS signaling	Loop Start, Ground Start, Loop Start with forward Disconnect, Ground Start Immediate, Ground Start Automatic, Universal Voice Grade, Universal Voice Grade Automatic, Single-Party
	TLP	Increments of 1dB, -3dB to +9dB on transmit; -9dB to +3dB on receive
	Impedance	600 Ohm
	Ringing voltage	50 VRMS, on hook transmission for Caller ID support
	Loop length	At least 800 Ohms external resistance including set
	Others	CLASS features (distinctive ringing, Caller ID) compatibility with V.34 and V90 modem standards
FX0 interface	Physical	One 50-pin female amphenol, up to 8 ports
	FXO supervision mode	FXO, dial pulse termination
	FXO signaling	Loop Start, Ground Start, Loop Start with forced Disconnect, Ground Start with forced Disconnect, DPT
		Increments of 1dB, -3dB to +9dB on transmit; -9dB to +3dB on receive
	TLP	600 Ohm
	Loop length	At least 800 Ohms external resistance including set
	Others	CLASS features (distinctive ringing, Caller ID) compatibility with V.34 and V90 modem standards
Data interface	Physical	One V.35 port (female DB25)
	Frame format	Transparent HDLC (NRZ, NRZI)
	Data Rate	Nx56K, Nx64K (N=1-24)
	Gender	DCE
	Hardware signaling	RTS/CTS with on, off, auto RTS/CTS programmable delay from 0 to 100msec
	Diagnostics	Local and line loopbacks.
10Base-T interface	Physical	One RJ45
	Frame format	Ethernet IEEE802.3
	Interface speed	10Mbps
	Protocols	IP, SNMP and telnet
	Diagnostics	SNMP and telnet management, alarm traps
Serial port	Physical	One female DB9
	Electrical	RS232
	Interface speed	9600, 19,200, 38,400 bps. The default is 9600
	Protocols	Asynchronous
Diagnostics		Extensive power-up self test LED Indicators QRSS Test Pattern on T1; 2047 Test Pattern on Data ports Loopbacks for FXO/FXS, T1 and Data ports CSU Loopback detection Performance statistics over FDL Bantam jacks for in-session T1 monitoring and line testing
Alarm contacts		The alarm connector is OPEN during NORMAL operating conditions Alarm connector CLOSES for duration of major alarms only. The contacts close both alarm connector and 25th pair of Amphenol connector.

Chapter 2
Installing the Z-Plex

This chapter gives you quick, simple instructions to get you up and running. You will also learn how to install and mount the product. This chapter includes the following topics:

2.1   Product description

The Z-Plex multiplexor is a compact, next-generation multi-service access device that can be deployed today in a TDM network to provide support for traditional legacy services. It is cost-effective T1 channel bank, capable of multiplexing up to 24 FXS channels and one data port onto a single T1 interface. All configurations are accessible by SNMP based network management, CLI, and by a local serial interface.

2.1.1   Back panel

The back panel of the Z-Plex provides connectors for the network interfaces and power supplies.
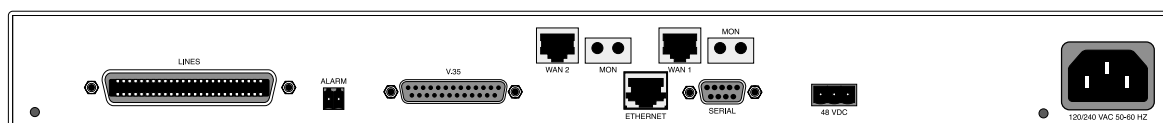
2.1.2   Front panel

The Z-Plex front panel provides LEDs for monitoring the status of the unit.
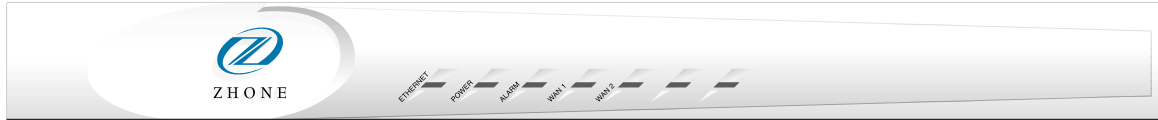
2.2   Unpacking the product

This product is shipped as a complete package that includes this user's guide. After unpacking the carton, check to ensure that all items are included in the box by reviewing against the Kit of Parts list shown below. In the event any items are missing, contact your distributor for further instructions.

2.2.1   Packing materials

Keep all the packaging materials for future use in case the unit has to be returned for maintenance and/or replacement.

2.2.2   Kit of parts

- 2 Mounting brackets
- A 3-Conductor DC power plug
- A 2-Conductor external alarm plug
- 6 #6 x 5/16" Type B Flat-head screws
- 8 #6 Pan-head screws
- 1 AC power cord
- CD with User's Guide

2.2.3   Product user's guide

This guide contains instructions for common tasks: configuration, installation, maintenance, and testing of the unit.

2.2.4   Hardware, cabling, and optional accessories

The product comes packaged with an AC power cord to provide power to the unit. It is also shipped with two angle brackets and screws for rack mounting.

2.2.5   Who to call for help

Contact your distributor if any items are missing, or if you want to order another unit.

2.3   Installing the product

The product can be installed in a rack, on a desktop, or attached to a wall using appropriate wall anchors and brackets. It is necessary to read the information that follows to ensure proper reliability of the unit.

2.3.1   Choosing a site for the product

When choosing a site for the product, make sure that you follow the installation instructions. Provide adequate ventilation and ample room for cable routing.

2.3.2   Temperature specifications

- Shipping and storage: -40°c to $+70^{o}$c (-40°F to 158°F)

- Operating range: -5°c to $+50^{o}$c (23°F to 122°F)

- Relative Humidity: 5% to 95% non-condensing

Note: *The product is equipped with a fan to ensure proper cooling and reliability. In the event that the installation environment temperature exceeds the temperature specifications, it is recommended that adjustments be made. Improper operation outside of these temperatures may result in performance degradation.*

2.3.3   Important Safety Instructions

There are several precautions to take before installing and/or servicing the product.

Read and follow all warning notices and instructions marked on the product or included in this guide.

1. Never install telephone wiring during a lightning storm.

2. Never install this product in a wet location.

3. Never install telephone jacks in wet locations unless the jack is specifically designed for this purpose only.

4. Never touch uninsulated telephone wires or terminals unless the telephone line has first been disconnected at the network interface.

5. Use caution when installing or modifying telephone lines.

6. Never attempt to service this product unless you are an authorized service technician. Doing so can result in injury or damage to the unit and void all warranties.

7. This product is intended for use with a three-wire grounding type plug. This is a safety feature. Equipment grounding is vital to ensure safe operation. Do not defeat the purpose of the grounding type plug by modifying the plug or using an adapter.

8. Prior to installation use an outlet tester or a voltmeter to check the AC receptacle for the presence of earth ground. If the receptacle is not properly grounded, the installation must not continue until a qualified electrician has corrected the problem. In addition, a connection for earth or safety grounding is provided on the chassis. It is a #6 threaded stud located next to the AC inlet receptacle.

9. Slots and openings in the product are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, these slots and openings must not be blocked or covered.

10. **DO NOT** allow anything to rest on the power cord and do not locate the product where persons could step or walk on the power cord.

11. **DO NOT** attempt to service this product yourself. To avoid exposure to dangerous high voltage points or other risks, refer all servicing to qualified service personnel.

12. Special cables, which may be required by the regulatory inspection authority for the installation site, are the responsibility of the buyer.

13. When installed in the final configuration, the product must comply with the applicable Safety Standards and regulatory requirements of the country in which it is installed. If necessary, consult with the appropriate regulatory agencies and inspection authorities to ensure compliance.

14. A rare phenomenon can create a voltage potential between the earth grounds of two or more buildings. If products installed in separate buildings are interconnected, the voltage potential may cause a hazardous condition. Consult a qualified electrical consultant to determine whether or not this phenomenon exists and, if necessary, implement corrective action prior to interconnecting the product.

2.4   Rack mounting

The product chassis comes with brackets for rack mounting; and the chassis is designed to accommodate brackets for front center or rear mounting. The installation site for rack mounting should provide proper room for ventilation and cable routing.

Note: *Check all grounding instructions when installing the unit in a rack. Proper grounding is mandatory at all times.*

Figure 2-1 depicts a 19 inch rack mount configuration.

Figure 2-1. Rack mounting the Z-Plex
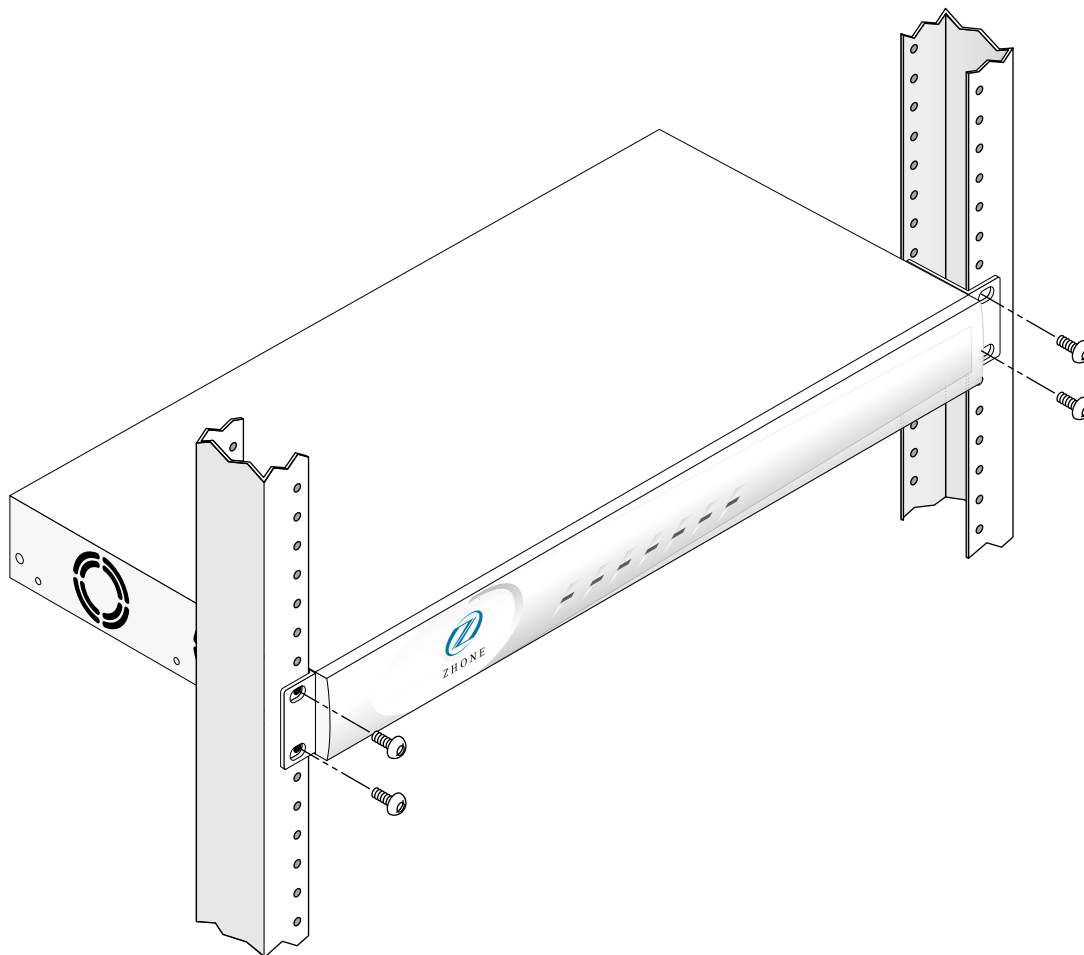
2.5 Locating the product on a desktop

Each unit can be easily set on top of a desk or table. A stable environment is necessary for peak performance of each unit. The chassis should be placed on a flat, smooth surface, such as a table, that is free of contaminants. This surface should be capable of supporting a fully equipped chassis. Be sure to allow enough clearance above and below the chassis for proper air circulation. The metal brackets and feet furnished with the chassis must be used for this purpose.

2.6 Wall mounting

Prior to wall mounting check to see if the environment is stable and free from any extreme temperatures, humidity or vibrations of any sort. The unit should be mounted with the fan to the top with at least 2 inches of clear space on the sides, above, and below for adequate air flow. Allow at least 6 inches for cable clearance.

When attaching unit(s) to a wall make sure that appropriate fasteners such as masonry anchors, heavy duty wood screws or expansion bolts are used for heavy objects.

Note: *Additional support hardware may be necessary (not included with unit) to secure the unit properly to the wall. If the surface is not solid enough to hold the unit and attached cabling, it is recommended that a small piece of 3/4" plywood be fastened to the wall before attaching the unit. This will help ensure a more stable environment.*

Chapter 3
Electrical Installation

When you are ready to go beyond the basics of the product, use this chapter to learn specifics on grounding, cabling, and the necessary power requirements for operation. It includes the following topics:

3.1   Connector type

The product is equipped with several types of electrical connections to the network and power sources. The table below lists each one of the connectors along with their functionality.

Table 3-1. Backpanel connectors

Connector Name	Connector Type	Description
FXS/FXO lines	50 pin amphenol	Up to 24 FXS/FXO Tip-and-Ring pair Signals: TIP, RING for FXS.
Alarm	2 position (plug included with kit of parts)	A relay closure that sends alarms out to an external alarm system.
V.35	DB25 female	V.35 data port signals.
RS-232 serial	DB9	Asynchronous craft port for local management.
10BaseT Ethernet	RJ45	Ethernet port for remote management over IP.

Table 3-1. Backpanel connectors (Continued)

Connector Name	Connector Type	Description
WAN 1 line	RJ48	Transmit and receive pairs for T1 network access.
WAN 2 line	RJ48	Transmit and receive pairs for T1 network access.
Dual bantam jack (monitor jacks) for both WAN lines		For bridged access onto the T1 transmit and receive pairs; used for test.
42-56VDC (+-G) 0.9A Max	3-position (plug included with kit of parts)	For DC power input.
90-260VAC 0.6A 50/60Hz	AC receptacle	Power input when external AC voltage is used to power the unit.
⏚	Earth Ground	Permanent Earth Ground Connection (**Note**: FXS GND must be connected to earth ground regardless of powering method used.)

3.2   Data port connector pinouts

Table 3-2 describes the signals and pins for the V.35 data port. The pin assignments are associated with the use of Zhone cable part number PRM-000-01261M (F).

Table 3-2. DCE DB25 data port female connector

Pin	Signal	Source	V.35
1	Shield		A
2	Transmit Data A	DTE	P
3	Receive Data A	DCE	R
4	Request to Send	DTE	C
5	Clear to Send	DCE	D
6	Data Set Ready	DCE	E
7	Ground		B
8	Receive Line Signal Detector	DCE	F
9	Receive Timing A	DCE	X
10	Not Connected		
11	Terminal Timing B	Not Used	
12	Transmit Timing A	DCE	AA

Table 3-2. DCE DB25 data port female connector (Continued)

Pin	Signal	Source	V.35
13	Not Connected		
14	Transmit Data B	DTE	S
15	Transmit Timing B	DCE	Y
16	Receive Data B	DCE	T
17	Receive Timing B	DCE	V
18	Not Connected		
19	Not Connected		
20	Data Terminal Ready	DTE	H
21	Remote Loopback	DTE	N
22	Local Loopback	DTE	J
23	Not Connected		
24	Terminal Timing A	Not Used	U
25	Test Mode	DCE	NN

Note: *For purposes of connection and function, the product should be considered a DCE.*

3.2.1   FXO/FXS connectors

Table 3-3 lists the FXS/FXO connector pinouts.

Table 3-3. 25-pair female amphenol connector

Port	Designation	Pin	Port	Designation	Pin
1	T	26	13	T	38
1	R	1	13	R	13
2	T	27	14	T	39
2	R	2	14	R	14
3	T	28	15	T	40
3	R	3	15	R	15
4	T	29	16	T	41
4	R	4	16	R	16
5	T	30	17	T	42
5	R	5	17	R	17
6	T	31	18	T	43
6	R	6	18	R	18
7	T	32	19	T	44
7	R	7	19	R	19
8	T	33	20	T	45
8	R	8	20	R	20

Table 3-3. 25-pair female amphenol connector (Continued)

Port	Designation	Pin	Port	Designation	Pin
9	T	34	21	T	46
9	R	9	21	R	21
10	T	35	22	T	47
10	R	10	22	R	22
11	T	36	23	T	48
11	R	11	23	R	23
12	T	37	24	T	49
12	R	12	24	R	24
				Alarm contact 2	50
				Alarm contact 1	25

3.2.2   RJ48 connector

Table 3-4 lists the T1 RJ48 connector pinouts.

Table 3-4. T1 connector pinouts

RJ-48(F) Pin	Signal
1	R1
2	T1
4	R
5	T
3, 6, 7, 8	Not assigned

3.3   Power requirements

The installation site should have a 90-260VAC power receptacle readily available to power up the unit. The unit can also be powered by -42 to 56VDC. The power receptacle should not be controlled by a light switch.

3.3.1   Power installation

3.3.1.1   AC power installation

This product is equipped with an AC receptacle located on the back of the unit.

3.3.1.2   DC power installation

When wiring to an external power source, such as a battery rack, fuse panel, or circuit breaker, make sure that the correct rating of wire is used. It is recommended you use 20 to 18 gauge wire.

Note: *The product can have both an AC and DC power source connected to it at the same time. These two power inputs will share the power load. However, if one fails the other will carry the full load.*

Note: *Note that the DC Power Plug is orange in color, matching the reciprocal orange rear panel receptacle.*

Figure 3-1. CD power plug
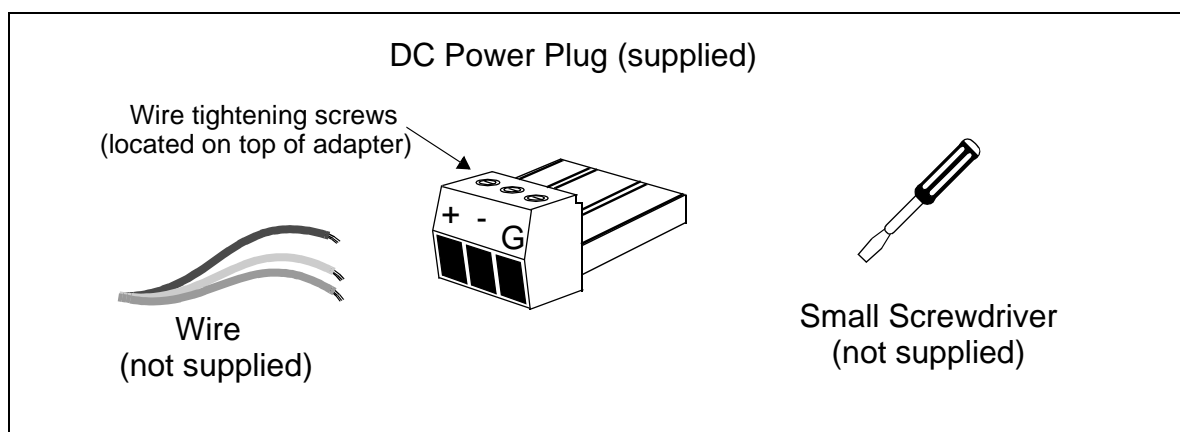
3.4   Alarm

The product is equipped with an external alarm connector (located on the rear panel of the unit) that will close in the event of an alarm condition such as: T1 failure, internal failure, or power failure. A Red alarm is detected by the T1 interface and responded to by issuing the yellow alarm signal on the T1. The figure below illustrates the alarm connector. It is recommended you use 26 to 24 gauge twisted-pair wire.

Note: *Note that the External Alarm Plug is black in color, matching the reciprocal black rear panel receptacle.*

Figure 3-2. Alarm closure plug
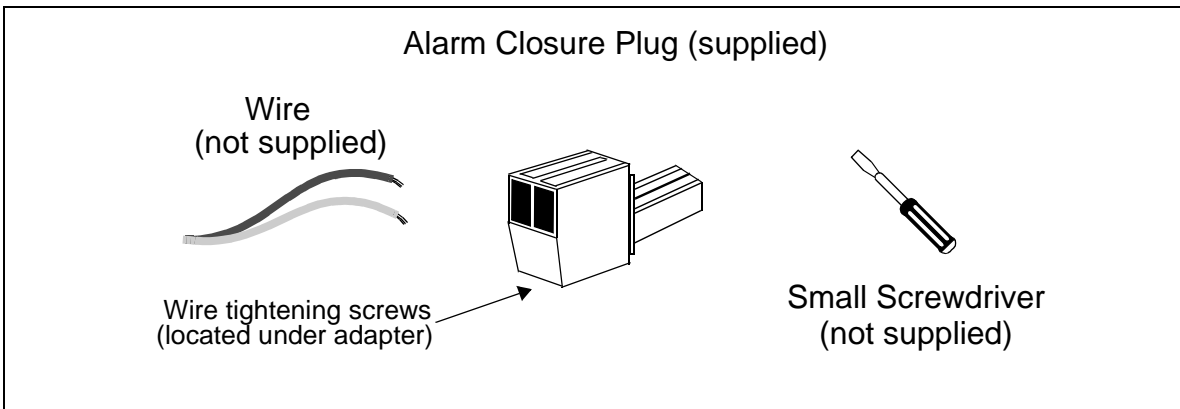
3.5   Grounding requirements

Due to the UL regulatory requirements, a mounting stud is required for connection of the AC input earth ground lead to the product chassis. The ground lead must be connected to the chassis using a No. 6 nut and lock washer combination. The mounting location is labeled with the IEC 417 No. 5019 symbol (⏚) to identify this as the AC earth ground connection point. This mounting stud is located next to the IEC 320 AC input connector.

The loop battery return and the FXS digital and analog circuitry must share a common ground. The access point on the back panel of the product allows connection to an external battery return lead which will be physically connected to the FXS circuit ground. This access point is provided as part of the DC power input connector.

Figure 3-3. Grounding the unit
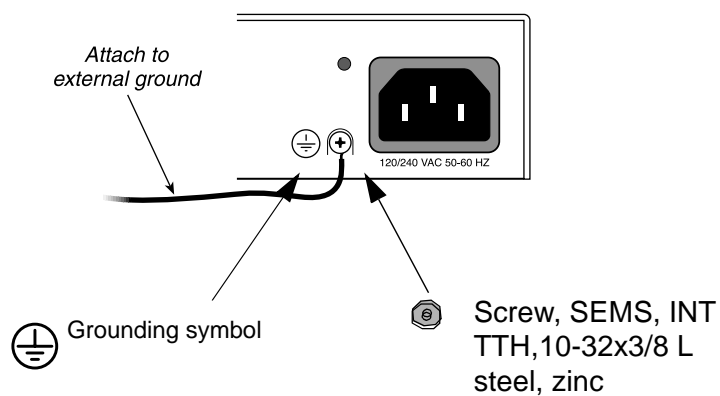
3.6   Cabling

Table 3-5 describes the cables recommended for use with the Z-Plex unit.

Table 3-5. Recommended cables

Cable	Used for	Manufacturer Part Number	Description
Voice	FXS/FXO ports	800-00060-01	50-pin Amphenol (M) to 50 pin Amphenol (M) (5')
Data	Data Port V.35	CBL-DB25M-V35-ST	DB25M to M34F (Straight through) (5')
AC Power	AC Power Input	200-00009-01	AC Power Cable (6')

Chapter 4
Configuring the Z-Plex

In this chapter you will learn how to configure the Z-Plex unit using the CLI. It includes the following topics:

4.1   Using the command line interface

The CLI commands use the following format:

SET *group:parameter:index:value* to change the value of a read/write parameters.

GET *group:parameter:index:value* for read-only parameters or to view the current configuration of a parameter without making any changes.

- *group* identifies the configuration grouping of the parameter. For example, T1CFG.

- *parameter* identifies the actual configuration element. For example, FRAME.

- *index* identifies the physical index of the element you want to configure. Most elements have an index of 1. T1 lines have 2 indexes, which correspond to the 2 WAN interfaces.

For example, to activate the first T1 line, enter the following command:

```
SET T1CFG:STATE:1:ACTV
```

To read the current frame slips on the first T1 line, enter the following command:

```
GET PMCUR:SLIP:1
```

Keep in mind the following important information:

- The CLI is case sensitive.
- Keywords must be entered completely. There are no keyboard shortcuts.
- The backspace and delete keys are supported.
- Command history is supported.

For complete information about the CLI parameters and syntax, see Appendix A, "Alphabetic Reference."

4.2   Quick start system configuration

You must perform the initial configuration of the system via the serial (craft) interface. After you have completed the initial configuration, you can manage the Z-Plex unit using any of the methods described in "Configuring a management interface" on page 4-4.

To access the serial port, you must configure your terminal interface software with the following settings:

- 9600bps
- 8 stop bits
- No party
- 1 data bit

After the system boots up, perform the following procedures from the serial interface:

1. Log into the system (the default user name is "user", the default password is "password"):

   ```
   login> user
   login> ********
   user>
   ```

2. Assign the system an IP address and a netmask. For example:

   ```
   user> SET CPUCFG:MASK:1:255.255.255.252
   user> SET CPUCFG:IP:1:192.168.8.21
   ```

3. Change the default user password. For example:

   ```
   user> SET USER:PASSWD:zplex321
   ```

   The password can be from 7 to 12 characters long. The password is used any time you log into the Z-Plex unit to manage it.

4. Configure SNMP agent addresses, community strings, and enable traps, if necessary. For example:

   ```
   user> SET CPUCFG:IPHOST1:1:192.168.10.21
   user> SET CPUCFG:IPHOST2:1:192.168.10.22
   user> SET CPUCFG:RDCOMSTRING:1:W23rw
   user> SET CPUCFG:WTCOMSTRING:1:q34mw
   ```

5. Configure a management interface, either DS024, Ethernet, or IP over FDL. (FDL over typically used only for a connection to a Premisys IMACs). For example, the following commands configure a DS0 management interface:

   ```
   user> SET T1CFG:DS0:1:ON
   user> SET CPUCFG:MASKHDL:1:255.255.255.252
   user> SET CPUCFG:IPHDL:1:192.168.8.22
   ```

6. Assign static routes if necessary. For example, the following command configures a static host route to 62.6.5.34 with a gateway of 192.168.8.21 (the IP address of the Z-Plex Ethernet interface):

   ```
   SET ROUTE:ADDHOSTRT:10:62.6.5.34:192.168.8.21
   ```

   Static routes might be necessary to telnet into the Z-Plex to manage it.

7. Set the date on the system. For example, the following commands prompt you for the system date:

   ```
   user> SET DATE
   ```

   The system prompts you for the date in mm:dd:yyyy hh/mm/ss format.

8. Configure basic system contact information such as name, location, and contact.

   ```
   user> SET SYSTEM:SYSCONTACT:Scott_Berman
   user> SET SYSTEM:SYSNAME:ZPlex-10-2-1
   user> SET SYSTEM:SYSLOCATION:10th_flr-rack_2-unit_1
   ```

9. Reboot the system:

   ```
   user> REBOOT
   ```

The first time you configure an IP address, you must reboot the system.

4.2.1   Logging in and out of the system

You must log into the system to manage it. Note that only one administrative user can be logged into the Z-Plex unit at a time. The default username is "user", the default password is "password".

For example, to log into the system:

```
login> user
login> ********
user>
```

To log out of the system, enter the logout command:

```
user> logout
```

Users are automatically logged out of the system under the following circumstances:

- If a user is logged into the serial interface and another user logs in via telnet or another interface.
- After 10 minutes, inactive sessions are automatically logged out.

4.2.2   Setting the date

Use the DATE command to set the date on the system. For example, the following command sets the system date to 1:30 PM, May 1, 2000:

```
user> SET DATE:05/01/2000 13:30:00
```

4.2.3   Configuring a management interface

You can configure the Z-Plex over the following interfaces:

- Local
- DS0
- Ethernet
- IP over FDL

The following sections describe how to configure each of these interfaces.

Configuring the local management channel

The Z-Plex unit provides an out-of-band RS232 serial (craft) interface for managing the unit. To access the serial port, configure your terminal interface software with the following settings:

- 9600bps
- 8 stop bits
- No party
- 1 data bit

Configuring the DS0 management channel

The DS0 management channel encapsulates IP traffic in HDLC frames using DS0 24. The following command enables the DS0 management channel:

```
SET T1CFG:DS0:1:ON
```

The next series of example commands configures the IP information for the DS0 interface:

```
user> SET CPUCFG:MASKHDL:1:255.255.255.252
user> SET CPUCFG:IPHDL:1:192.168.8.22
```

If you are connecting to an IMACs unit over the DS0 management channel, you must turn off the HDLC headers that the Z-Plex unit normally uses to encapsulate the management traffic. Note that only WAN 2 supports the DS0 management channel.

Configuring the Ethernet management channel

You can telnet to the Z-Plex over the Ethernet to manage the unit. You must first configure an IP address and a netmask for the unit, as in the following example:

```
user> SET CPUCFG:MASK:1:255.255.255.252
user> SET CPUCFG:IP:1:192.168.8.21
```

After you have configured the IP address of the unit, you can telnet into it and configure it with the CLI.

Configuring the IP over FDL management channel

The Z-Plex unit supports IP over FDL as a way to configure the system via the CLI. The IP over FDL connection is different than the standard FDL interface which provides error checking for T1 interfaces. The two FDL interfaces cannot be used at the same time.

The following example configures the IP over FDL interface:

```
user> SET CPUCFG:MASKFDL:1:255.255.255.252
user> SET CPUCFG:IPFDL:1:192.168.8.22
```

For most applications, the default MTU of 1500 is appropriate. If you need to change it, use the MTUFDL command as in the following example:

```
user> SET CPUCFG:MTUFDL:1:1200
```

4.2.4   Configuring system contact information

The following example configures system contact and description information:

```
user> SET SYSTEM:SYSCONTACT:Scott_Berman
user> SET SYSTEM:SYSNAME:ZPlex-10-2-1
user> SET SYSTEM:SYSLOCATION:10th_flr-rack_2-unit1
```

4.3   Configuring SNMP

You can configure the Z-Plex unit using SNMP as well as specify SNMP trap recipients. The Z-Plex sends traps when the following major alarms occur: resets, red alarms, or yellow alarms.

To configure SNMP on the Z-Plex you must:

- Configure the IP addresses of the SNMP trap recipients
- Specify SNMP community strings
- Specify whether traps are enabled

The following example configures SNMP on the Z-Plex unit:

1. Configure SNMP read/write and read community strings:

   ```
   user> SET CPUCFG:RDCOMSTRING:1:publicpassword
   ```

   ```
   user> SET CPUCFG:WTCOMSTRING:1:2Ws34rt
   ```

2. Enable SNMP traps (if necessary):

   ```
   user> SET CPUCFG:SNMPTRAP:1:ON
   ```

3. Configure up to 3 SNMP traps recipients (if necessary):

   ```
   user> SET CPUCFG:IPHOST1:1:192.168.21.23
   ```

```
user> SET CPUCFG:IPHOST2:1:192.168.21.24

user> SET CPUCFG:IPHOST3:1:192.168.21.25
```

4.4   Configuring T1 interfaces

The two T1 interfaces on the Z-Plex unit can be used for either voice or data, with the following restrictions:

- 24 voice ports are supported, and can be from either T1 line
- 24 data ports are supported, and must be from only one T1 line

The following example configures the first T1 interface:

1. Activate the line:

   ```
   user> SET T1CFG:STATE:1:ACTV
   ```

2. Specify the type of interface (CSU or DSX):

   ```
   user> SET T1CFG:TYPE:1:CSU
   ```

3. Specify the framing:

   ```
   user> SET T1CFG:FRAME:1:ESF
   ```

4. Specify the encoding:

   ```
   user> SET T1CFG:CODE:1:B8ZS
   ```

5. Specify the line length (for DSX interfaces) or the buildout (for CSU interfaces):

   ```
   user> SET T1CFG:LINELEN:1:N15
   ```

6. Specify the clock source:

   ```
   user> SET T1CFG:CLKSRC:1:WAN1
   ```

7. Specify what type of standard FDL you will use:

   ```
   user> SET T1CFG:FDL:1:ANSI
   ```

   Note that if you enable standard FDL, you cannot use the IP over FDL interface for management. FDL is not supported on WAN 2.

8. Enable IP over FDL (if necessary):

   ```
   user> SET T1CFG:FDL_IP:1:OFF
   ```

9. Enable the DS0 management channel (if necessary):

```
user> SET T1CFG:DS0:1:OFF
```

4.5 Configuring a T1 drop and insert interface

A T1 drop and insert takes some channels from an incoming T1 interface and drops some of them out to a PBX and the rest to an outgoing data path. The drop and insert interface must be configured as a DSX.

Configuring a T1 drop and insert interface requires that you activate the interface and specify the channels you want to drop out to a PBX. The following commands configure a drop and insert interface and specify that the first four T1 time slots are sent to a PBX:

```
user> SET DICFG:STATE:ACTV
user> SET DICFG:TS:0000000f
```

To specify time slots, use a hexadecimal map of the form ffffffff, where each digit represents the hexadecimal value of 4 time slots, with a 1 in each channel you want to drop and insert. For more information about configuring the TS parameter, see "TS (data port)" on page A-24.

4.6 Configuring FXS ports

Foreign Exchange Station (FXS) enables users to connect the Z-Plex unit to a two-way (both inbound and outbound calls) PBX trunk or a key system trunk. The FXS ports encode analog (voice, VF) signals to a digital bitstream at the local system for transmission over a T1 or E1 network. It also decodes the digital signals to analog at the remote system.

The following example configures the first FXS port and specifies that the DS0s come in on the first T1 interface (WAN 1):

1. Before making configuration changes to an FXO/FXS port, set it to STDBY mode:

   ```
   user> SET FXSCFG:STATE:1:STDBY
   ```

2. Specify the FXS mode:

   ```
   user> SET FXSCFG:MODE:1:FXSDN
   ```

3. Specify the FXS port:

   ```
   user> SET FXSCFG:WAN:1:1
   ```

4. Specify the T1 time slots used for the FXS ports:

   ```
   user> SET FXSCFG:TS:1:1-6
   ```

5. Specify the FXS type:

```
user> SET FXSCFG:TYPE:1:LSFD
```

6. Specify whether trunk conditioning is being used:

```
user> SET FXSCFG:TRNKC:1:ON
```

7. Specify whether you want the Z-Plex unit to provide ringback.

```
user> SET FXSCFG:RNGBK:1:ON
```

The default of OFF is appropriate for cases when the network service does not provide an audible ringing tone to the calling party.

8. Specify the Transmit TLP setting, which controls the amount of gain or loss added to a voice signal from the CPE before it is encoded to digital PCM:

```
user> SET FXSCFG:TTLP:1:-3
```

9. Specify the Receive Transmission Level Point (TLP), which controls the amount of gain or loss added to the incoming signal after it is decoded to analog:

```
user> SET FXSCFG:RTLP:1:-8
```

10. Activate the port:

```
user> SET FXSCFG:STATE:1:ACTV
```

4.7   Configuring FXO ports

Foreign Exchange Office (FXO) ports manage the flow of FXO voice traffic over the network. The FXO port translates an analog signal to a digital bitstream at the local system and digital to analog at the remote system. All FXO ports have a two-wire interface.

The following example configures the first FXO port and specifies that the DS0s come in on the second T1 interface (WAN 2):

1. Before making configuration changes to an FXO/FXS port, set it to STDBY mode:

```
user> SET FXOCFG:STATE:2:STDBY
```

2. Specify the FXO mode:

```
user> SET FX0CFG:MODE:2:FXSDN
```

3. Specify the WAN line used for the FXO ports:

```
user> SET FX0CFG:WAN:2
```

4. Specify the T1 time slots used for the FXO ports:

```
user> SET FX0CFG:TS:2:7-15
```

5. Specify the FXO type:

```
user> SET FX0CFG:TYPE:2:LS
```

6. Specify whether you want the Z-Plex unit to provide ringback. For example:

```
user> SET FXOCFG:RNGBK:2:ON
```

The default of OFF is appropriate for cases when the network service does not provide an audible ringing tone to the calling party.

7. Specify whether trunk conditioning is being used:

```
user> SET FX0CFG:TRNKC:2:ON
```

8. Specify the Transmit TLP setting, which controls the amount of gain or loss added to a voice signal from the CPE before it is encoded to digital PCM.

```
user> SET FX0CFG:TTLP:2:-3
```

9. Specify the Receive Transmission Level Point (TLP), which controls the amount of gain or loss added to the incoming signal after it is decoded to analog. For example:

```
user> SET FX0CFG:RTLP:2:-8
```

10. Activate the port:

```
user> SET FX0CFG:STATE:2:ACTIVE
```

4.8   Configuring the V.35 data port

The Z-Plex unit uses the V.35 port to interface directly with Data Service Units/Channel Service Units (DSU/CSUs) supporting data traffic up to and including 64 kbps. A four-wire circuit can connect the V.35 port to a DSU/CSU up to four miles away. In the switched 56 kbps mode, customers access the network on an as-needed basis via dial-up commands. The system must be equipped to provide -48 VDC power to fully support the V.35 port.

The following is an example of configuring the V.35 port:

1. Specify the data rate of the port:

```
user> SET DPCFG:RATE:1:64K
```

2. Specify the clocking for the port:

```
user> SET DPCFG:CLK:1:NORMAL
```

3. Specify the T1 interface the data is coming in on:

   ```
   user> SET DPCFG:WAN:1:2
   ```

4. Specify the number of channels:

   ```
   user> SET DPCFG:NCHAN:1:24
   ```

5. Specify the start channel:

   ```
   user> SET DPCFG:SCHAN:1:1
   ```

6. The remaining commands specify the operation control leads of the V.35 port. By default, all the port leads are off. If your configuration requires you to change them, use the following commands:

   ```
   user> SET DPCFG:TM:1:(ON/OFF)
   user> SET DPCFG:DSR:1:ON
   user> SET DPCFG:RLSD:1:(ON/OFF)
   user> SET DPCFG:CTS:1:(ON/OFF)
   user> SET DPCFG:CTSDELAY:1:(0-100)
   ```

7. If you've made changes to the WAN, SCHAN, or NCHAN parameters, the system automatically sets the port to STDBY mode. You must then re-activate it as follows:

   ```
   user> SET DPCFG:STATE:1:ACTV
   ```

4.9   Adding and deleting routes

You can create up to 16 static host routes and 16 static network routes. Static routes in the Z-Plex enable it to reach management stations.

4.9.1   Adding and deleting network routes

To add a network route, enter the following command:

```
user> SET ROUTE:ADDNETRT:x:destination:gateway
```

Where x is the number of the route, *destination* is the destination address, and *gateway* is the gateway address. For example, the following command creates a network route (route number 1) to the 192.168.0.0 network using the gateway 128.23.21.1:

```
user> SET ROUTE:ADDNETRT:1:192.168.0.0:128.23.21.1
```

To delete a network route, enter the following command:

```
user> SET ROUTE:DLTNETRT:x:destination:gateway
```

For example, the following command deletes a network route (route number 2) from the 192.168.0.0 network using the gateway 128.23.22.1:

```
user> SET ROUTE:DLNETRT:1:192.168.0.0:128.23.22.1
```

4.9.2   Adding and deleting host routes

To add a host route, enter the following command:

```
user> SET ROUTE:ADDHOSTRT:x:destination:gateway
```

Where *x* is the number of the route, *destination* is the destination address, and *gateway* is the gateway address. For example, the following command creates a host route (route number 1) from 192.168.8.21 using the gateway 128.23.21.1:

```
user> SET ROUTE:ADDHOSTRT:1:192.168.8.21:128.23.21.1
```

To delete a network route, enter the following command:

```
user> SET ROUTE:DLTHOSTRT:x:destination:gateway
```
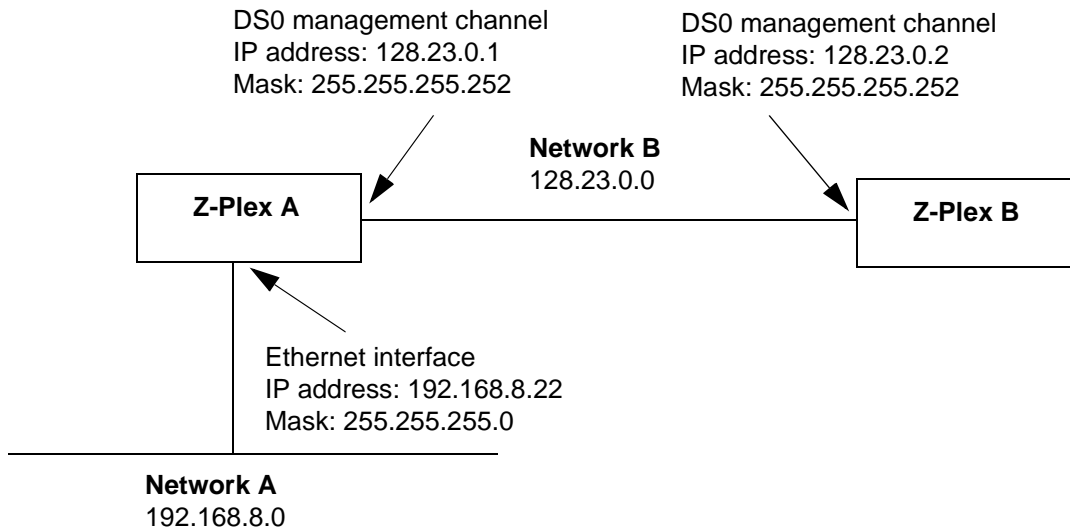
For example, the following command deletes a host route (route number 2) from 192.168.9.21 using the gateway 128.23.22.1:

```
user> SET ROUTE:DLHOSTRT:1:192.168.9.21:128.23.22.1
```

4.9.3   Example routing configuration

Figure 4-1 on page 4-13 provides an example routing configuration for the Z-Plex.

Figure 4-1. Example routing configuration

DS0 management channel
IP address: 128.23.0.1
Mask: 255.255.255.252

DS0 management channel
IP address: 128.23.0.2
Mask: 255.255.255.252

Network B
128.23.0.0

Z-Plex A

Z-Plex B

Ethernet interface
IP address: 192.168.8.22
Mask: 255.255.255.0

Network A
192.168.8.0

In the example network in Figure 4-1, the Z-Plex unit A has two IP interfaces: a DS0 management interface with an address of 128.23.0.1; and an Ethernet interface with an address of 192.168.8.22 and a netmask of 255.255.255.252. The Z-Plex unit B has a DS0 management interface with the address of 128.23.0.2.

When you configure an Ethernet address and a DS0 address on Z-Plex unit A, the Z-Plex creates the route from network A to network B. However, in order for the Z-Plex unit B to route IP traffic back to network A, you must create a network route on unit B. This network route uses the IP address of unit A the gateway. You can configure this route as follows:

```
user> SET ROUTE:ADDNETRT:1:192.168.0.0:128.23.0.1
```

Alternatively, you can create a default route and specify the IP address of the unit A as the gateway:

```
user> SET ROUTE:ADDNETRT:1:0.0.0.0:128.23.0.1
```

4.9.4   Displaying routes

To display routes for interfaces, enter the following command:

```
user> GET ROUTE:SHOWINTF:1
ROUTE NET TABLE
destination    gateway              flags      Refcnt   Use   Interface

-------------------------------------------------------
128.8.23.0     128.23.0.2           101      0        0      hd0
192.168.8.0    128.23.0.1           3        0        0      hd0
-------------------------------------------------------
ROUTE HOST TABLE
destination    gateway          flags      Refcnt   Use   Interface

-------------------------------------------------------
127.0.0.1      127.0.0.1        5        1        0      lo0
-------------------------------------------------------
```

Table 4-1explains the interfaces in the route table.

Table 4-1. Route Display Values

Field	Explanation
hd0	Time slot 24 management
cpm0	Ethernet management
fdl0	FDL management
lo0	Loopback interface (local)

4.9.4.1   Displaying host routes

To display information about all host routes, enter the ROUTE:HOSTALL:x command. For example:

```
user> GET ROUTE:HOSTALL:1
>Host Destination 1: 192.168.21.32
>Host Gateway     1: 12.12.1.1
>Host Destination 2: 192.168.43.66
>Host Gateway     2: 122.54.1.1
>Host Destination 3: 192.111.87.4
>Host Gateway     3: 165.87.43.1
```

To display information about particular host routes, enter the ROUTE:HOST:x command. For example, the following command displays information about host route 1:

```
user> GET ROUTE:HOST:1
>The Host Destination is: 192.168.21.32
>The Host Gateway    is: 12.12.1.1
```

4.9.4.2   Displaying network routes

To display information about all host routes, enter the ROUTE:NETALL:x command. For example:

```
user> GET ROUTE:NETALL:1
>Net Destination 1: 172.16.0.0
>Net Gateway    1: 12.12.0.0
```

To display information about particular network routes, enter the ROUTE:NET:x command. For example, the following command displays information about host route 1:

```
user> GET ROUTE:NET:1
>The Net Destination is: 172.16.0.0
>The Net Gateway    is: 12.12.0.0
```

4.10   System maintenance commands

This section describes the Z-Plex system maintenance commands.

4.10.1   Rebooting the system

To reboot the system, enter the following command:

```
user> REBOOT
```

4.10.2   Displaying flash information

To display information about the code images in flash, enter the following command:

```
user> QUERYIMAGE
Original Code
->Software version : EMPTY
->Checksum : 0x0
BANK1
->Software version : ZPLEX10_1.0.0#6
->Checksum : 0x50a78d4c
```

```
BANK2
->Software version : ZPLEX10_1.0.0#6
->Checksum : 0x50a78d4c
Active bank is 1
```

4.10.3 Displaying timeslot usage

To display information about the T1 timeslot usage, enter the following command:

```
user> QUERYTS
TS 24, WAN 1, SERVICE IP
```

4.10.4 Displaying list of alarms

To display information about the active alarms, enter the following command:

```
user> QUERYALARM
There are no Active Alarms
```

4.10.5 Displaying and clearing list of history alarms

To display information about the history alarms, enter the following command:

```
user> QUERYHALARM
17           MINOR        RESET   0:0:0:3 0:0:0:3
17   WAN1   MAJOR          LOF    0:0:9:4 0:0:9:4
18   WAN1   MAJOR          LOF    0:0:9:6 0:0:9:6
3  WAN1   MAJOR         LOS    0:0:8:35 0:0:8:35
4  WAN1   MAJOR         LOF    0:0:8:35 0:0:8:37
5  WAN1   MAJOR         LOF    0:0:8:39 0:0:8:39
6  WAN1   MAJOR         LOF    0:0:8:41 0:0:8:41
7  WAN1   MAJOR         LOF    0:0:8:43 0:0:8:43
8  WAN1   MAJOR         LOF    0:0:8:45 0:0:8:45
9  WAN1   MAJOR         LOF    0:0:8:47 0:0:8:47
10   WAN1   MAJOR          LOF    0:0:8:49 0:0:8:49
11   WAN1   MAJOR          LOF    0:0:8:51 0:0:8:51
12   WAN1   MAJOR          LOF    0:0:8:53 0:0:8:53
13   WAN1   MAJOR          LOF    0:0:8:55 0:0:8:55
14   WAN1   MAJOR          LOF    0:0:8:57 0:0:8:57
15   WAN1   MAJOR          LOF    0:0:8:59 0:0:8:59
```

To clear the history alarms, enter the following command:

```
user> CLEARHALARM
```

4.10.6 Activating code in bank 1

To activate the code in bank 1, enter the following command:

```
user> ACTIVEBANK1
```

4.10.7 Activating code in bank 2

To activate the code in bank 2, enter the following command:

```
user> ACTIVEBANK2
```

4.10.8 TFTP downloading

To download software via TFTP to the Z-Plex unit, enter the following command:

```
user> TFTPDLD
```

This command initiates a TFTP download. It prompts for the IP address of the server, the code bank to download the image to, and the filename of the software image.

Chapter 5
Diagnostics

This chapter describes how to perform loopbacks on the Z-Plex unit interfaces. It also describes the system's LEDs. It includes the following topics:

5.1   T1 loopbacks

The T1 interfaces support local and line (network) loopbacks:

- During a line (network) loopback, the signal is looped back to the network. The receive T1 signal is looped onto the transmit T1within the framer chip.

- During a local loopback, the signal is looped back to the user. The transmit T1 signal is looped onto the receive T1within the LIU.

The Z-Plex unit supports ESF loopback detection sent from remote equipment. These codes are ANSI T1.403 compatible with DS1 networks and allow the unit to detect a latching loopback to remote DS1 equipment. The Z-Plex detects payload loopback (PLB), network loopback (NLB), and line loopback (LLB). The Z-Plex also supports TR 54016 for loop up and loop down cases.

Figure 5-1 on page 5-2 illustrates T1 loopbacks on the Z-Plex unit.

Figure 5-1. T1 loopbacks

T1 Loopback
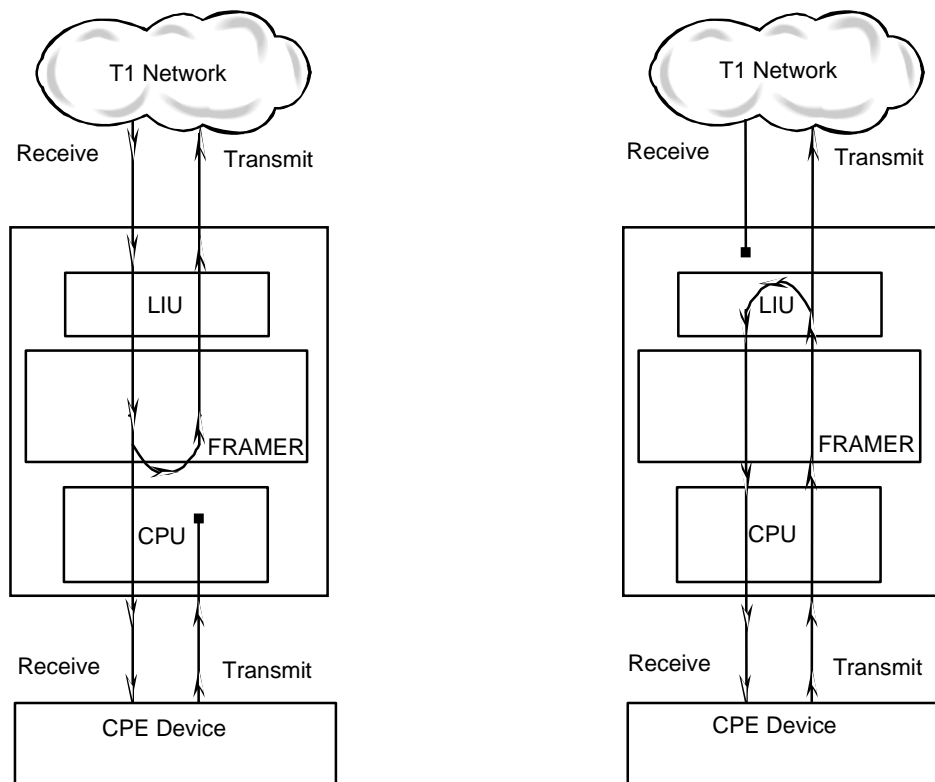
Network or Remote Loopback

The incoming T1 Signal is looped inside the T1 Framer and returned to the T1 Network. This exercises the T1 Line Interface Unit and the T1 Framer with the exception of the HDLC controller and clock switching circuitry.

Local Loopback

The outcoming T1 Signal is looped inside the T1 LIU and returned to the CPE Device. This exercises the T1 Line Interface Unit, T1 Framer, CPU, Data Port Interface, and the FXS Interface with the exception of the HDLC controller.

To activate a loopback, enter the following command:

```
user> SET T1CFG:LOOPBACK:x:(LINEON/LOCALON)
```

where x is the number of the T1 interface to loopback. To end the loopback, enter the following command:

```
user> SET T1CFG:LOOPBACK:x:(LINEOFF/LOCALOFF)
```

5.2   BER testing

The bit error rate (BER) test sends a data pattern and measures the bit error rate on the selected interface. The Z-Plex supports BER tests on entire T1 lines or on individual time slots. The BER test supports the following BER test patterns:

*   Quasi-random signal source (QRSS)

*   ALT (10101010)

*   2047

During a BER test, all connections between either the data ports or the FXS/FXO ports and the T1 interface are broken and a test pattern is transmitted onto the T1 interface. During the test, the WAN LED blinks green.

5.2.1   Activating a BER test for an entire T1 line

To configure a BER test on an entire T1 line, enter the following command:

```
user> SET T1CFG:BERT:x:(QRSS/ALT/2047)
```

where x is the number of the T1 interface to loopback. To end the BER test, enter the following command:

```
user> SET T1CFG:BERT:x:OFF
```

While the BER test is active, you can insert random BIT errors into the test data stream using the following command:

```
user> SET T1BE:ERRINS:x:BIT
```

5.2.2   Activating a BER test for individual time slots

To configure a BER test on single T1 timeslot:

1. Specify the BER test pattern for the test:

    ```
    user> SET T1CFG:BERT:x:(QRSS/ALT/2047)
    ```

where x is the number of the T1 interface to apply the pattern to.

2. Activate the BER test:

    ```
    user> SET T1CFG:TSBERTON:x:(1-24)
    ```

3. To de-activate the BER test:

```
user> SET T1CFG:TSBERTOFF:x:(1-24)
```

5.3   Data port loopbacks

The V.35 port supports line and local loopbacks:

- A line (network) loopback breaks the transmit signal on the network side between the data port and the T1 interface and loops the data port receive signal onto the transmit side.

- A local loopback breaks the receive signal on the network side between the data port and the T1 interface and loops the data port transmit signal onto the receive side.

Figure 5-2 on page 5-5 illustrates data port loopbacks on the Z-Plex unit.

Figure 5-2. Data port loopbacks

Network or Remote Loopback
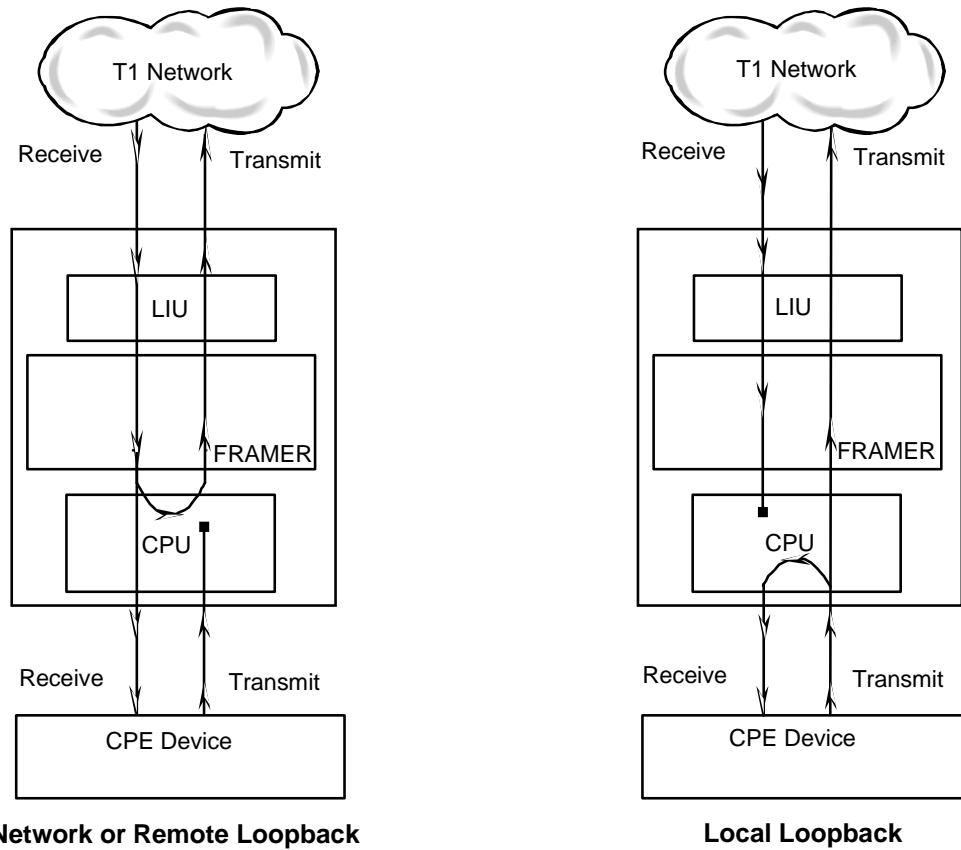
The selected DS0s are looped back
after leaving the Framer and upon
reaching the CPU. The CPU is used
to control this loopback via the TSA.
Subsystems T1 Line Interface Unit,
T1 Framer, and CPU are exercised.

Local Loopback

The Data Port interface signal is
looped inside the CPU and
returned to the data port interface.
Subsystems CPU and the Data
Port Interface are exercised.

To activate a data port loopback, use the following command:

```
user> SET DPCFG:LOOPBACK:1:(LINE/LOCAL)
```

To de-activate a data port loopback, use the following command:

```
user> SET DPCFG:LOOPBACK:1:OFF
```

5.4   Testing FXO and FXS ports

The Z-Plex unit provides the following testing capabilities for FXO and FXS ports:

• Loopbacks

• Setting and viewing the transmit and receive ABCD signaling bits

• Setting the tip and ring leads

• Reading the tip and ring statistics

5.4.1   FXO and FXS ports loopback

The FXO/FXS ports support analog and digital loopbacks:

• During an analog loopback, the decoded analog signal is sent back to the far end after decoding and then re-encoding it.

• During a digital loopback, the incoming digital DS0 signal is sent back to the far end without decoding it.

In the case of unassigned channels, the loopback interface provides an idle termination. Figure 5-3 illustrates FXO/FXS loopbacks.

Figure 5-3. FXO and FXS loopbacks
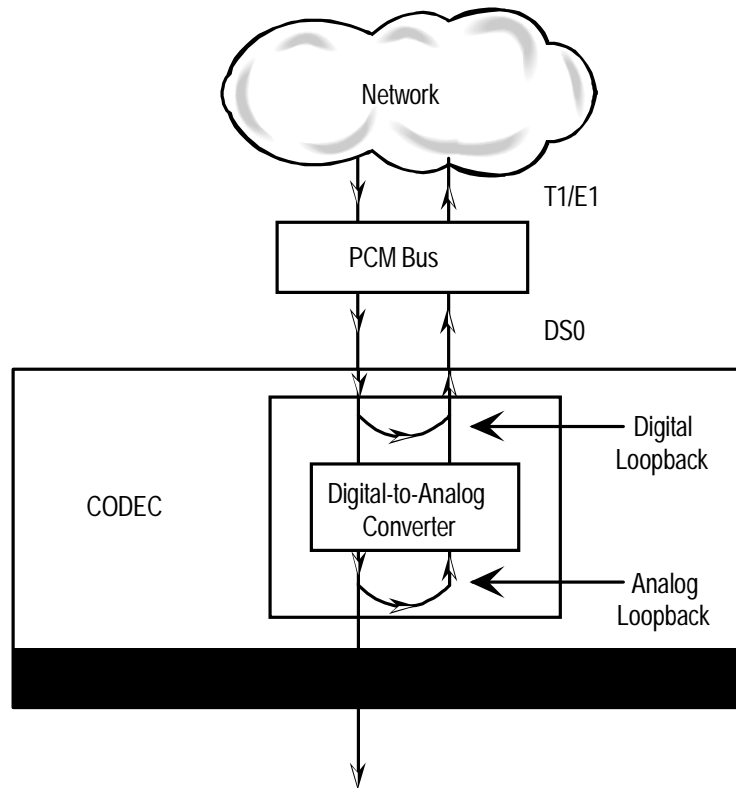
5.4.1.1 Configuring FXO loopbacks

To activate an FXO port loopback, use the following command:

```
user> SET FXOCFG:LOOP:1:(DGTL/ANLG)
```

where x is the number of the port to loopback.

To de-activate an FXO loopback, use the following command:

```
user> SET FXOCFG:LOOP:1:OFF
```

5.4.1.2 Configuring FXS loopbacks

To activate an FXS port loopback, use the following command:

```
user> SET FXSCFG:LOOP:1:(DGTL/ANLG)
```

where x is the number of the port to loopback.

To de-activate an FXS loopback, use the following command:

```
user> SET FXSCFG:LOOP:1:OFF
```

5.4.2   Using test mode on the FXO and FXS ports

FXO and FXS ports can be set to test mode, during which you can:

- Set and view the transmit and receive ABCD signaling bits

- Set the tip and ring leads

- View the tip and ring statistics

To use test mode, you must first enable it. For example, to enable test mode on port 1, enter the following command:

```
user> SET FXSTST:TEST:1:ON
```

To exit test mode, enter the OFF command:

```
user> SET FXSTST:TEST:1:OFF
```

5.4.2.1   Setting or viewing the transmit ABCD signaling bits

The TxAB (Transmit ABCD) parameter enables you to either monitor the status of the ABCD signaling bits being transmitted towards the network or set a specific ABCD pattern for testing the transmit side of the circuit.

To specify a transmit ABCD bit pattern on an FXO port, enter the following command:

```
user> SET FXOTST:TXAB:n:(00/01/10/11)
```

To specify a transmit ABCD bit pattern on an FXS port, enter the following command:

```
user> SET FXSTST:TXAB:n:(00/01/10/11)
```

To view the transmit ABCD bit pattern being used on an FXO port, enter the following command:

```
user> GET FXOTST:TXAB:n
```

To view the transmit ABCD bit pattern being used on an FXS port, enter the following command:

```
user> GET FXSTST:TXAB:n
```

5.4.2.2   Viewing the receive ABCD signaling bits

The RxAB (receive ABCD) setting is a read-only parameter that displays the ABCD pattern for testing the receive side of the circuit.

To view the ABCD receive bit pattern on an FXO port, enter the following command:

```
user> GET FXOTST:RXAB:n
```

To view the ABCD receive bit pattern on an FXS port, enter the following command:

```
user> GET FXSTST:RXAB:n
```

5.4.2.3   Viewing the tip and ring statistics

The Tip and Ring Status information field describes what the attached device is doing with the Tip and Ring leads of the FXO or FXS port.

To view the tip and ring status information for an FXO port, enter the following command:

```
user> GET FXOTST:TRSTAT:n
```

To view the tip and ring status information for an FXS port, enter the following command:

```
user> GET FXSTST:TRSTAT:n
```

5.5   LED indicators

This section explains how to interpret the LED indicator lights located on the front panel of the Z-Plex unit.

5.5.1   Alarm LED

A single tri-color LED indicates the overall system alarm status. Table 5-2 describes the Alarm LED.

Table 5-1. Alarm LED

LED	Description
RED (ON)	System is in an alarm condition.
RED (BLINKING)	System has failed Power-On Self Test (POST).

5.5.2   Ethernet LED

A single green LED indicates the operational status of the Ethernet port. If the LED is blinking, the Ethernet port is connected and transmitting traffic.

5.5.3   WAN LEDs

The WAN LEDs indicate the transmission status of the two T1 interface ports and their loopback status. Both T1 indicators are implemented by two tri-color (green/red/yellow) LEDs. Table 5-2 describes the WAN LEDs.

Table 5-2. WAN LEDs

LED	Description
GREEN (ON)	Normal operation, no alarm.
RED (ON)	Major alarm. No signal or loss of frame. Loss of signal indicates the Rx signal at the T1 port is below a sufficient level. Loss of frame indicates the line cannot recover framing from the Rx signal.
RED (BLINKING)	Returning to normal state after a major alarm.
YELLOW (BLINKING)	Minor alarm. Excessive error rate. This indicates the T1 framer is able to recover framing from the Rx signal, but the measured bit error rate is greater than or equal to allowable limits.
YELLOW (ON)	Minor alarm. Loss of signal or loss of frame on remote side.
GREEN (BLINKING)	WAN test in progress.

5.5.4   Power LED

A single green LED indicates the operational status of the power supply to the unit. If the LED is ON, the power is connected.

Appendix A
Alphabetical Reference

This chapter provides a reference to the Z-Plex CLI parameters, commands, and syntax. It also includes system error messages. It includes the following topics:

Parameter reference	page A-1
Command reference	page A-30
Error messages	page A-31
CLI reference	page A-33

A.1   Parameter reference

This section provides a listing of configuration groups in the Z-Plex CLI and an alphabetic reference of all Z-Plex parameters.

A.1.1   Configuration groups

Table A-1 describes the Z-Plex configuration groups and the parameters in each group.

Table A-1. Configuration groups in the Z-Plex

Group	Index	Description	Parameters
CPUCFG	1	System-level configuration such as system IP address and host IP addresses.	IP IPFDL IPHDL IPHOST1 IPHOST2 IPHOST3 MASK MASKFDL MASKHDL MTUFDL MTUHDL SNMPTRAP WTCOMSTRING

Table A-1. Configuration groups in the Z-Plex (Continued)

Group	Index	Description	Parameters
DPCFG	1	Data port configuration, such as activation and clocking.	LOOP MODE RNGBK RTLP RxAB STATE TEST TRCNTRL TRNKC TRSTAT TS TTLP TxAB TYPE WAN
FARPMCUR	1	Current far end statistics for the T1 interfaces.	ALLFARCUR BES ES LOFC SES SLIP UAS
FARPMTOT	1	Total far end statistics for the T1 interfaces.	ALLFARTOT BES ES LOFC SES SLIP UAS
FXOCFG	A single value between 1 and 24, or a range of values.	FXO port configuration, including state, mode, and type.	LOOP MODE RTLP STATE TRNKC TS TTLP TYPE WAN

Table A-1. Configuration groups in the Z-Plex (Continued)

Group	Index	Description	Parameters
FXOTST	A single value between 1 and 24, or a range of values.	Test mode for FXO ports.	RXAB TEST TRCNTRL TRSTAT TXAB
FXSCFG	A single value between 1 and 24, or a range of values.	FXS port configuration, including state, mode, and type.	LOOP MODE RNGBK RTLP STATE TRNKC TS TTLP TYPE WAN
FXSTST	A single value between 1 and 24, or a range of values.	Test mode for FXS ports.	RXAB TEST TRCNTRL TRSTAT TXAB
PMCUR	1A single value between 1 and 24, or a range of values.	Current statistics for the T1 interfaces.	ALLCUR BES ES LOFC SES SLIP UA
PMINT	A single value between 1 and 24, or a range of values.	Interval statistics for the T1 interfaces.	ALLINT BES ES LOFC SES SLIP UAS\

Table A-1. Configuration groups in the Z-Plex (Continued)

Group	Index	Description	Parameters
PMTOT	A single value between 1 and 24, or a range of values.	Total statistics for the T1 interfaces.	ALLTOT BES ES LOFC SES SLIP UA
SYSTEM	1	System contact information.	SYSCONTACT SYSNAME SYSDESC SYSLOCATION
T1BE	A single value between 1 and 24, or a range of values.	Inserts T1 bit errors during bit error test.	ERRINS
T1CFG	1	T1 line configuration, including state, type, framing, and encoding.	BERT CLKSRC CODE DS0 ERRINS FDL FDL_IP FRAME HDLC LINELEN LOOPBACK PATTERN STATE TSBERTOFF TSBERTON TYPE

A.1.2 Alphabetic reference

This section contains an alphabetic reference to all CLI parameters.

ALLCUR

Displays ES, BES, UAS, SES, SLIP, and LOFC errors for the current 15 minute interval.

Configuration group: PMCUR

Syntax: `GET PMCUR:ALLCUR:x`

ALLFARCUR

Displays ES, BES, UAS, SES, SLIP, and LOFC errors for the current 15 minute interval.

Configuration group: FARPMCUR

Syntax: `GET FARPMCUR:ALLFARCUR:x`

ALLFARTOT

Displays ES, BES, UAS, SES, SLIP, and LOFC errors for the total of each interval.

Configuration group: FARPMTOT

Syntax: `GET FARPMCUR:ALLFARCUR:x`

ALLFARINT

Displays ES, BES, UAS, SES, SLIP, and LOFC errors for the specific 15 minutes interval, when interval is specified.

Configuration group: FARPMINT

Syntax: `GET FARPMINT:ALLFARINT:x`

ALLINT

Displays ES, BES, UAS, SES, SLIP, and LOFC errors for the specific 15 minutes interval, when interval is specified.

Configuration group: PMINT

Syntax: `GET PMINT:ALLINT:x:(0-95)`

ALLTOT

Displays ES, BES, UAS, SES, SLIP, and LOFC errors for the total of each interval.

Configuration group: PMTOT

Syntax: `GET PMTOT:ALLTOT:x`

BERT

Activates a bit error rate test (BERT) on a T1 line. The BER test sends a data pattern and measures the bit error rate on the selected time slot. Possible values are:

- OFF (default): terminates the BER test.
- QRSS (quasi-random signal source): activates the BER test and sends a QRSS pattern during the BER test.
- ALT10: sends a 10101010 pattern during the BER test.
- 2047: sends a 2047 test pattern during the BER test.

Note that you cannot perform a BER test and a loopback test simultaneously.

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:BERT:X:(QRSS/ALT/2047/OFF)`

See also: PATTERN, TSBERTOFF, TSBERTON

BES

BES (bursty errored second): indicates the total number of seconds with more than one and fewer than 320 CRC-6 (ESF), BPV (D4/D-frame), or CRC-4 (E1) errors.

Configuration group: PMCUR, PMTOT, PMINT, FARPMCUR, FARPMTOT, FARPMINT

Syntax: `GET (PMCUR, PMTOT, FARPMCUR, FARPMTOT):x`

Syntax: `GET (PMINT, FARPMINT):x:(0-95)`

CLK

Specifies whether the data port clock is inverted. DTE clocking usually requires a Normal setting. If synchronization problems occur, specify the clock is inverted. Possible values are:

- NORMAL (default)
- INVERTED

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:CLK:1:(NORMAL/INVERTED)`

CLKSRC

Clocking source for T1 line. Possible values are:

- WAN1: Clock for the T1 interface derived from the line receive signal.

- WAN2

- INTERNAL: Clocking received from internal 1.544Mhz Stratum 4 clock.

If the external clock fails, the unit switches to the internal clock. When the external clock is restored, the unit switches back to the external clock source.

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:CLKSRC:x:(WAN1/WAN2/INTERNAL)`

CODE

T1 line encoding. Possible values are:

- B8ZS

- AMI

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:CODE:x:(B8ZS/AMI)`

CTS

The Clear To Send (CTS) setting controls when data is sent. Some DTE equipment must receive a CTS signal before transmitting data. Possible values are:

- ON:

- OFF (default):

- AUTO:

Configuration group: DPCFG

Syntax: `(GET/SET) SET DPCFG:CTS:1:(ON/OFF)`

CTSDELAY

The Clear To Send (CTS) Delay setting delays changes in the CTS signal in the local mode. Enter the value you need in milliseconds. If you do not know what value you need, start with 0 (zero) ms and increase the value gradually until you no longer experience problems. The CTS option above must be set to ON before the CTS DELAY setting has any effect.

Specify a value from 0 to 100ms in multiples of 10.

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:CTSDELAY:1:(0-100)`

CUR

Current T1 near-end statistics. Possible values are:

- ES (errored seconds): indicates the total number of seconds in which one or more frames with CRC-5 errors were detected. This field is read-only.

- SES (severely errored second): indicates the total number of seconds in which the bit error rate exceeded one bit per thousand (1 x 10-3).

- BES (bursty errored second): indicates the total number of seconds with more than one and fewer than 320 CRC-6 (ESF), BPV (D4/D-frame), or CRC-4 (E1) errors.

- UAS (unavailable second): indicates the total number of seconds during which service is unavailable. An unavailable signal state is declared after ten consecutive SESs are logged. An unavailable state is cleared after ten consecutive non-SESs are logged. Unavailable Seconds are also accumulated if the card has an out-of-service (OOS) condition.

- LOFC (loss of frame count): indicates the total number of times a Loss Of Frame (LOF) is declared. An LOF is declared after 2.5 seconds of a continuous Loss Of Synchronization (LOS) or Out-Of-Frame (OOF) condition. The LOF is cleared after no more than 15 consecutive seconds without another LOS or OOF.

- SLIP: (slipped second): indicates the total number of seconds that contain one or more controlled slips. A controlled slip is the deletion or replication of a T1 frame by the receiving equipment.

DS0

Specifies whether the DS0 management interface is enabled. When enabled, the DS0 management channel encapsulates IP traffic in HDLC frames using DS0 24. Possible values are:

- ON
- OFF (default)

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:DS0:X:(ON/OFF)`

DSR

The Data Set Ready (DSR) option allows you to define whether the V.35 port DSR control lead should be held on (high) or off (low).

Possible values are:

*   ON:

*   OFF (default):

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:DSR:1:(ON/OFF)`

ERRINS

Specifies that random bits are inserted while the BERT test is active for the entire T1. The only supported value is BIT.

Configuration group: T1CFG

Syntax: `(GET/SET) T1BE:ERRINS:X:BIT`

ES

The ES (errored seconds) option indicates the total number of seconds in which one or more frames with CRC-5 errors were detected. This field is read-only.

Configuration group: PMCUR, PMTOT, PMINT, FARPMCUR,FARPMTOT, FARPMINT

Syntax: `GET (PMCUR, PMTOT, FARPMCUR, FARPMTOT):ES:x`

Syntax: `GET (PMINT, FARPMINT):ES:x:(0-95)`

FDL

Type of FDL. Possible values are:

*   ANSI
*   ATT
*   OFF (default)

Notes

*   This setting is only required if FRAME is set to ESF.

• WAN 2 does not support FDL.

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:FDL:X:(ANSI/ATT/OFF)`

FDL_IP

Specifies whether the FDL over IP management interface is enabled. FDL is a 4 Kbps channel normally used to manage the T1 link. When the FDL is used to carry management data, it is no longer able to carry T1 management data.

Possible values are:

• ON

• OFF (default)

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:FDL_IP:X:(ON/OFF)`

FRAME

Specifies T1 framing and data link format. ESF frame format requires FDL to be set. Possible values are:

• D4 (No data link selection required with D4 setting)

• ESF (default): If ESF is selected, FDL messaging type must also be selected (and will invoke additional setting options, such as AT&T or ANSI).

• SLC96

Notes

• WAN 2 does not support SLC96.

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:FRAME:X:(D4/ESF/SLC96)`

HDLC

Possible values are:

• HDR_ON (default)

• HDR_OFF

Notes

- If you are connecting to Premisys IMACS on DS0 mgmt channel (time slot 24), set HDLC to HDR_OFF.

- HDR_ON is compatible with the Cisco implementation of HDLC headers.

- Note that DS0 is only valid on WAN 1.

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:HDLC:X:(HDR_ON/HDR_OFF)`

INT

Interval statistics. Possible values are:

- ES
- SES
- BES
- UAS
- LOFC
- SLIP

IP

System IP address.

Configuration group: CPUCFG

Syntax: `(GET/SET) CPUCFG:IP:1:(ip address)`

IPFDL

IP address used for FDL traffic.

Configuration group: CPUCFG

Syntax: `(GET/SET) CPUCFG:IPFDL:1:(ip address)`

IPHDL

IP address used for HDLC traffic over the DS0 management channel.

Configuration group: CPUCFG

Syntax: `(GET/SET) CPUCFG:IPHDL:1:(ip address)`

LINELEN

Specifies the CSU line build out or the DSX line length. For a CSU, possible values are:

- 00 (0dB)

- N75 (-7.5dB)

- N15 (-15.0dB)

- N22 (-22.0dB)

For a DSX, possible values are:

- D0 (0-132 feet)

- 133 (133-265 feet)

- 266 (266-398 feet)

- 399 (399-532 feet)

- 533 (533-654 feet)

- 655 (655-700 feet)

Configuration group: T1CFG

Syntax: (GET/SET)
T1CFG:LINELEN:X:(00/N75/N15/N22/D0/133/266/399/533/655)

LOFC

LOFC (loss of frame count) indicates the total number of times a Loss Of Frame (LOF) is declared. An LOF is declared after 2.5 seconds of a continuous Loss Of Synchronization (LOS) or Out-Of-Frame (OOF) condition. The LOF is cleared after no more than 15 consecutive seconds without another LOS or OOF.

Configuration group: MCUR, PMTOT, PMINT, FARPMCUR,FARPMTOT, FARPMINT

Syntax: GET (PMCUR, PMTOT, FARPMCUR, FARPMTOT):LOFC:x

Syntax: GET (PMINT, FARPMINT):LOFC:x:(0-95)

LOOP (FXO)

Loopback for the FXO port. Possible values are:

- OFF (default)

- DGTL: during an analog loopback, the decoded analog signal is sent back to the far end after decoding and then re-encoding it.

- ANLG: during a digital loopback, the incoming digital DS0 signal is sent back to the far end without decoding it.

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:LOOP:n:(OFF, DGTL, ANLG)`

LOOP (FXS)

Loopback for the FXS port. Possible values are:

- OFF (default)
- DGTL: during an analog loopback, the decoded analog signal is sent back to the far end after decoding and then re-encoding it.
- ANLG: during a digital loopback, the incoming digital DS0 signal is sent back to the far end without decoding it.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:LOOP:n:(OFF, DGTL, ANLG)`

LOOPBACK (V.35)

Loopback for the V.35 port. Possible values are:

- LINE:
- LOCAL:
- OFF (default):

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:LOOPBACK:1:(LINE/LOCAL/OFF)`

LOOPBACK (T1)

Loopback for the T1 line. Loopback tests terminate after 10 minutes. Possible values are:

- LINEOFF: deactivates a line loopback
- LINEON: activates a line loopback
- LOCALOFF: deactivates a line loopback
- LOCALON: activates a local loopback

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:LOOPBACK:X:(LINEOFF/LINEON/LOCALOFF/LOCALON)`

MASK

System network mask.

Configuration group: CPUCFG

Syntax: `(GET/SET) CFG:MASK:1:(net mask)`

MASKFDL

Network mask used for IP over FDL traffic.

Configuration group: CPUCFG

Syntax: `(GET/SET) CPUCFG:MASKFDL:1:(net mask)`

MASKHDL

Network mask used for IP over HDLC traffic.

Configuration group: CPUCFG

Syntax: `(GET/SET) CPUCFG:MASKHDL:1:(net mask)`

MODE (FXO)

Possible values are:

- FXO (default)
- FXODN
- DPT

See Table A-2 for a list of supported MODE and TYPE settings.

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:MODE:n:(FXO,FXODN,DPT)`

Table A-2. Supported MODE and TYPE settings for FXO and FXS ports

Modes	Supported types				
FXS	LS	LSFD	GS	GSA	GSI
FXS-DN	LS	LSFD	GS	GSA	GSI

Table A-2. Supported MODE and TYPE settings for FXO and FXS ports

Modes	Supported types				
FXS-DN WINK	LS	LSFD	GS	GSA	GSI
TR-08	SP	UVG	UVGA		
FXO	LS	LSFD	GS	GSA	
FXODN	LS	LSFD	GS	GSA	
DPT	DPT				

MODE (FXS)

FXS supervision mode. The Mode setting should be determined by the type of equipment to which you are connecting to the port. All options use two-wire balanced connections. Possible values are:

• FXS (default): Foreign exchange subscriber. This option enables you to connect the system to a two-way (both inbound and outbound calls) PBX trunk or a key system trunk. The system requires a ringing generator for this option.

• FXSDN: Foreign exchange subscriber-defined network. This option provides access to new services offered by advanced networks from many major carriers. The system requires a ringing generator for this option.

• FXSDNWINK: Foreign exchange subscriber-defined network wink start operation. This option uses the same type of signaling as FXSDN and provides a 150-millisecond delay, then a 200-millisecond "wink" back to the central office when the FXS port sees an off-hook condition from the central office. The system requires a ringing generator for this option.

• TR08: Frame format signaling and data link as defined in TR-TSY-000008 Mode 1 for circuits using AT&T Subscriber Loop Carriers (SLC-96) facilities. This option connects the port to one-way outgoing trunks from a PBX, CENTREX, key system, or telephone set to an SLC channel. The SLC96 mode also must be active on the associated WAN interface.

See Table A-2 on page A-14 for a list of supported MODE and TYPE settings.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:MODE:n:(FXS,FXSDN,FXSDNWINK,TR08)`

NCHAN

Specifies the number of time slots onto which data from the T1 line will be mapped. Note that starting time slots must also be selected for each data port. Channels must be contiguous. Possible values are from 1 to 24. The default is 0.

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:NCHAN:1:(1-24)`

PATTERN

The Pattern parameter specifies the test pattern for use with a BERT test on a single DS0. Pattern applies to all time slots but you can activate the BER test on any time slot.

Possible values are:

* OFF (default):

* QRSS (quasi-random signal source): sends a QRSS pattern during the BER test.

* ALT10: sends a 10101010 pattern during the BER test.

* 2047: sends a 2047 test pattern during the BER test.

Configuration group: T1CFG

See TSBERTON, TSBERTOFF

Syntax: `(GET/SET) T1CFG:PATTERN:X:( QRSS/ALT/2047/OFF)`

RATE

Rate for the data port. Each port on the V.35 port can be independently configured to operate at speeds of 56Kbps or 64Kbps, where N equals 1 to 24.

Possible values are:

* 64K (the default): Data ports receive and transmit data at multiples of 64Kbps clear channel. If you specify 64Kbps, you must set T1 CODE to B8ZS.

* 56K: Data ports receive and transmit data at multiples of 56Kbps clear channel.

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:RATE:1:(56K/64K)`

RLSD

The Receive Level Signal Detect (RLSD) option allows you to define whether the RLSD control lead is held ON (high) or OFF (low).

Possible values are:

• ON:

• OFF (default):

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:RLSD:1:(ON/OFF)`

RNGBK

Specifies whether a ringback tone is generated by the system and sent towards the network. Possible values are:

• OFF (default): Ringback provided by PBX or switch

• ON: Ringback tones will be sent on the corresponding DS0s for the duration of ringing on the line.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:RNGBK:n:(OFF, ON)`

RTLP (FXO)

The Receive Transmission Level Point (RTLP) setting controls the amount of gain or attenuation added to signals after they are decoded to analog signals. To increase the signal level, set the RTLP setting to a positive number (the larger the number, the more gain is added). To decrease the signal level, set the RTLP setting to a negative number (the more negative the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -3 dBm by setting RTLP to +2 dB.

Possible values are from -9.0dB to 3.0dB. The default is 0dB.

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:RTLP:n:(-9 to 3)`

RTLP (FXS)

The RTLP setting controls the amount of gain or loss added to the incoming signal after it is decoded to analog. To increase the signal level, set the RTLP setting to a positive value (the larger the number, the more gain is added). To decrease the signal level, set the RTLP setting to a negative value (the more negative the number, the more the signal level is decreased).

For example, an incoming signal at -5.0dBm can be increased to -3.0 dBm by setting RTLP to +2 dB. The RTLP range is -9.0dB to 3.0dB.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:RTLP:n:(-9 to 3)`

RxAB (FXO)

The RxAB setting is a read-only parameter that displays the ABCD pattern for testing the receive side of the circuit. Possible values are:

- 00
- 01
- 10
- 11

Configuration group: FXOTST

Syntax: `GET FXOTST:RXAB:n`

RxAB (FXS)

The RxAB setting is a read-only parameter that displays the ABCD pattern for testing the receive side of the circuit. Possible values are:

Possible values are:

- 00
- 01
- 10
- 11

Configuration group: FXSTST

Syntax: `GET FXSTST:RXAB:n`

SCHAN

Specifies the first T1 time slot that data from the data port will be mapped.

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:SCHAN:1:(1-24)`

SES

SES (severely errored second): indicates the total number of seconds in which the bit error rate exceeded one bit per thousand (1 x 10-3).

Configuration group: MCUR, PMTOT, PMINT, FARPMCUR,FARPMTOT, FARPMINT

Syntax: `GET (PMCUR, PMTOT, FARPMCUR, FARPMTOT):SES:x`

Syntax: `GET (PMINT, FARPMINT):SES:x:(0-95)`

SLIP

SLIP: (slipped second): indicates the total number of seconds that contain one or more controlled slips. A controlled slip is the deletion or replication of a T1 or E1 frame by the receiving equipment.

Configuration group: PMCUR, PMTOT, PMINT, FARPMCUR,FARPMTOT, FARPMINT

Syntax: `GET (PMCUR, PMTOT, FARPMCUR, FARPMTOT):SLIP:x`

Syntax: `GET (PMINT, FARPMINT):LOFC:SLIP:x:(0-95)`

STATE (V.35)

State of V.35 ports. Possible values are:

- ACTV
- STDBY (default): Unassigned should be channels be set to STDBY.

Note that the V.35 port must be set to STDBY while you are making configuration changes to the WAN, SCHAN, or NCHAN parameters. After setting the parameters, set the STATE to ACTIVE.

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:STATE:1:(ACTV/STDBY)`

STATE (T1 drop and insert)

State of T1 drop and insert ports. Possible values are:

- ACTV
- STDBY

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:STATE:1:(ACTV/STDBY)`

STATE (FXO)

State of FXO ports. Possible values are:

- ACTV
- STDBY (default): Unassigned should be channels be set to STDBY.

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:STATE:n:(ACTV/STDBY)`

STATE (FXS)

State of FXS ports. Possible values are:

- ACTV
- STDBY (default): Unassigned should be channels be set to STDBY.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:STATE:n:(ACTIVE/STANDBY)`

STATE (T1)

State of T1 ports. Possible values are:

- ACTIVE
- STDBY (default)

Configuration group: T1CFG

Syntax: `(GET/SET) T1CFG:STATE:X:(ACTV/STDBY)`

SYSCONTACT

System contact information. Enter a string of up to 25 characters. Note that spaces are not allowed.

Configuration group: SYSTEM

Syntax: `(GET/SET) SYSTEM:SYSCONTACT:(String)`

SYSDESCR

System description information. Enter a string of up to 25 characters. Note that spaces are not allowed.

Configuration group: SYSTEM

Syntax: `(GET/SET) SYSTEM:SYSDESCR:(String)`

SYSLOCATION

System location information. Enter a string of up to 25 characters. Note that spaces are not allowed.

Configuration group: SYSTEM

Syntax: `(GET/SET) SYSTEM:SYSLOCATION:(String)`

SYSNAME

System name.

Configuration group: SYSTEM

Syntax: `(GET/SET) SYSTEM:SYSNAME:(String)`

SYSUPTIME

100s of seconds since last system reset.

Configuration group: SYSTEM

Syntax: `(GET/SET) SYSTEM:SYSUPTIME:(String)`

TEST (FXO)

Test shows if the port is in the test mode.

Possible values are:

- OFF (default)

- ON

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOTST:TEST:n:(ON/OFF)`

TEST (FXS)

Test shows if the port is in the test mode. Possible values are:

- OFF (default)

- ON

Configuration group: FXSTST

Syntax: `(GET/SET) FXSTST:TEST:n:(ON/OFF)`

TM

Possible values are:

- ON:

- OFF (default):

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:TM:1:(ON/OFF)`

TOT

Current near-end statistics. Possible values are:

- ES

- SES

- BES

- UAS

- LOFC

- SLIP

TRCNTL (FXO)

The Tip and Ring Control information field shows the current status of the Tip and Ring leads of the FXO port from the perspective of the system. The possible values are:

- • LOOP: Tip and Ring leads are tied together.

- • OPEN: Ring lead is not connected to either the Tip or to ground.

- • RING_GND: the Ring lead is grounded.

Configuration group: FXOCFG

TRCNTRL (FXS)

The Tip and Ring Control specifies the tip and ring leads of the FXS port from the perspective of the system.

Possible values are:

- • TgRb (Tip lead is grounded and -48V is applied to the Ring lead)

- • ToRb (Tip lead is open and -48V is applied to the Ring lead)

- • TbRg (-48V is applied to the Tip lead and the Ring lead is grounded)

- • RING (the ringing voltage is applied between tip and ring)

Configuration group: TXSTST

Syntax: `(GET/SET) TXSTST:TRCNTRL:n:(TgRb/ToRb/TbRg/RING)`

TRNKC (FXO)

The Trunk conditioning setting specifies whether the FXO port should send the idle pattern to the network upon declaration of a Carrier Group Alarm (CGA) on the WAN link to which the port is assigned. In most cases, leave the trunk conditioning setting at its default setting.

Possible values are:

- • OFF (default)

- • ON

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:TRNKC:n:(OFF, ON)`

TRNKC (FXS)

The Trunk conditioning setting specifies whether the FXS port should send the idle pattern to the network upon declaration of a Carrier Group Alarm (CGA) on the WAN link to which the port is assigned. In most cases, leave the trunk conditioning setting at its default setting.

Possible values are:

- OFF

- ON (default)

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:TRNKC:n:(OFF, ON)`

TRSTAT (FXO)

The Tip and Ring Status information field describes what the attached device is doing with the Tip and Ring leads of the FXO port.

Possible values are:

- NORMAL

- REVERSE

- OPEN

- RINGING

- TIP_GND

Configuration group: FXOCFG

TRSTAT (FXS)

Read only field. Possible values are:

- LOOP

- OPEN

- RING_GND

Configuration group: FXSCFG

TS (data port)

Specify the time slots for T1 drop and insert. The TS parameter uses the form ffffffff, where each digit corresponds to 4 time slots (0 through 31). Assign a 1 to each time slot you want to be used for drop and insert. Then, for each group of 4 time slots, convert the value to its hexadecimal equivalent.

Figure 5-4 illustrates how to determine the TS value if you want to use the first four time slots for drop and insert (`0000000f`).

Figure 5-4.Time slot assignment for drop and insert

Time slots	31 30 29 28	27 26 25 24	23 22 21 20	19 18 17 16	15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
Time slot assignment	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	1 1 1 1
Hex value	0	0	0	0	0	0	0	f

Configuration group: T1CFG

Syntax: `(GET/SET) FXSCFG:TS:n:(00000000-ffffffff)`

TS (FXO)

Specify the time slots used for FXO service. By default, time slot 1 is mapped to FXO port 2, time slot 2 is mapped to FXO port 2, and so on.

Notes

- Each time slot assignment must be unique, even if the time slots are on different WAN lines.

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:TS:n:(1-24)`

See also: WAN (FXO)

TS (FXS)

Specify the time slots used for FXS service. By default, time slot 1 is mapped to FXS port 2, time slot 2 is mapped to FXS port 2, and so on.

Notes

- Each time slot assignment must be unique, even if the time slots are on different WAN lines.

Configuration group: FXSCFG

Syntax: **(GET/SET) FXSCFG:TS:n:(1-24)**

See also: WAN (FXS)

TSBERTOFF

De-activates a BER test on the specified channel.

Possible values are:

• 1-24

Configuration group: T1CFG

See also: BERT, PATTERN

Syntax: **(GET/SET) T1CFG:TSBERTOFF:X:(1-24)**

TSBERTON

Actives a BER test on the specified channel.

Possible values are:

• 1-24

Configuration group: T1CFG

See also: BERT, PATTERN

Syntax: **(GET/SET) T1CFG:TSBERTON:X:(1-24)**

TTLP (FXO)

Specifies transmit FXO attenuation. Possible values are from 9.0dB to -3.0dB. The default value is 0dB.

Configuration group: FXOCFG

Syntax: **(GET/SET) FXOCFG:TTLP:n:(-3 to 9)**

TTLP (FXS)

The Transmit TLP setting controls the amount of gain or loss added to a voice signal from the CPE before it is encoded to digital PCM. To increase the signal level, set the TTLP setting to a negative value. The more negative the number, the more gain is added. To decrease the signal

level, set the TTLP setting to a positive value (the more positive the number, the more the signal level is decreased). For example, an incoming signal at -5 dBm can be increased to -2 dBm by setting the TTLP to -3 dB. The TTLP range is -9.0dB to 3.0dB. The default is 0dB.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:TTLP:n:(-3 to 9)`

TxAB (FXO)

The TxAB (Transmit ABCD) parameter allows you to either monitor the status of the ABCD signaling bits being transmitted towards the network or set a specific ABCD pattern for testing the transmit side of the circuit. Possible values are:

• 00

• 01

• 10

• 11

Configuration group: FXOTST

Syntax: `(GET/SET) FXOTST:n:(00/01/10/11)`

TxAB (FXS)

The TxAB (Transmit ABCD) parameter allows you to either monitor the status of the ABCD signaling bits being transmitted towards the network or set a specific ABCD pattern for testing the transmit side of the circuit. Possible values are:

• 00

• 01

• 10

• 11

Configuration group: FXSTST

Syntax: `(GET/SET) FXSTST:n:(00/01/10/11)`

TYPE (FXO)

The Type setting matches the signaling behavior of the FXO equipment to the remote switch. Possible values are:

• LOOP (Loop start): used with traditional telephone stations and simple PBX trunks.

- LPFD (Loop start-forward disconnect): Provides disconnect when FXS is connected to voice messaging system.

- GS (Ground start): Used with two-way PBX trunks.

- GSA (Ground start automatic): Used with equipment requiring fast response time to central office (CO).

- DPT

See Table A-2 on page A-14 for a list of supported MODE and TYPE settings.

Configuration group: FXOCFG

TYPE (FXS)

The Type setting matches the signaling behavior of the FXS equipment to the remote switch. Possible values are:

- LS (Loop start): used with traditional telephone stations and simple PBX trunks.

- LSFD (Loop start-forward disconnect): Provides disconnect when FXS is connected to voice messaging system. Typically used when connecting to automated answering equipment.

- GS (Ground start): Used with two-way PBX trunks. This setting helps prevent glaring and call collisions.

- GSA (Ground start automatic): Used with equipment requiring fast response time to central office (CO).

- GSI (Ground start immediate): Used with equipment requiring fast response time to the station or PBX.

- SP (Single party): SLC-96 single party service.

- UVG (Universal voice grade): Toll quality voice for SLC-96.

- UVGA (Universal voice grade automatic): Used with some non-Bell switches for SLC-96.

Changing the Supervision type causes all FXS calls on the affected FXS line groups to be reset to the idle state each time a setting is changed. Any active calls in that FXS line group are dropped.

See Table A-2 on page A-14 for a list of supported MODE and TYPE settings.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:TYPE:n:(LS, LSFD, GS, GSA, GSI, SP, UVG, UVGA)`

TYPE

Type of T1 interface. Possible values are:

- DSX: Z-Plex presents DSX characteristics.
- CSU: (default) Z-Plex presents CSU characteristics.

Configuration group: T1CFG

Syntax: (GET/SET) T1CFG:TYPE:X:(CSU/DSX)

UAS

UAS (unavailable second): indicates the total number of seconds during which service is unavailable. An unavailable signal state is declared after ten consecutive SESs are logged. An unavailable state is cleared after ten consecutive non-SESs are logged. Unavailable Seconds are also accumulated if the card has an out-of-service (OOS) condition.

Configuration group: PMCUR, PMTOT, PMINT, FARPMCUR,FARPMTOT, FARPMINT

Syntax: `GET (PMCUR, PMTOT, FARPMCUR, FARPMTOT):UAS:x`

Syntax: `GET (PMINT, FARPMINT):UAS:x:(0-95)`

WAN

Species the T1 interface whose data is sent out the V.35 port.

Possible values are:

- 1 (default)
- 2

Configuration group: DPCFG

Syntax: `(GET/SET) DPCFG:WAN:1:(1/2)`

WAN (FXO)

The T1 WAN interface used to provide FXO service. The default is WAN 1.

Configuration group: FXOCFG

Syntax: `(GET/SET) FXOCFG:WAN:n:(1/2)`

See also: TS (FXO)

WAN (FXS)

The T1 WAN interface used to provide FXS service. The default is WAN 1.

Configuration group: FXSCFG

Syntax: `(GET/SET) FXSCFG:WAN:n:(1/2)`

See also: TS (FXS)

A.2   Command reference

This section provides a reference for the Z-Plex CLI commands.

ACTIVEBANK1

Activates code in bank 1.

ACTIVEBANK2

Activates code in bank 2.

CLEARHALARM

Clears the history alarm list.

DATE

Prompts for the date and time in the following format: `mm/dd/yyyy hh:mm:ss`.

LOGIN

Prompts for login. The default user name is `user`; the default password is `password`.

QUERYIMAGE

Displays information about the images in flash memory.

QUERYTS

Displays the time slot usage.

QUERYALARM

Displays a list of active alarms.

QUERYHALARM

Displays a list of history alarms.

REBOOT

Reboots the system.

TFTPDLD

This command initiates a TFTP download. It prompts for the IP address of the server, the code bank to download the image to, and the filename of the software image.

A.3   Error messages

Table A-3 describes the error messages.

Table A-3. Error messages

Message	Explanation
FDL mgmt not supported on this wan	Tried to activate FDL on WAN 2. Only WAN 1 supports IP over FDL.
Invalid instance number. Valid range is 1-16	Invalid index for a static route.
Invalid Loopback	Loopback activated while another loop back (either local or remote) is active.
Invalid MTU size valid range is 128-1500	Invalid MTU size.
Invalid parameter value	Invalid parameter value in SET command.
Invalid time slot valid range is 1-24	Tried to assign invalid TS.
Invalid Wan Number	Tried to enter an invalid WAN number.
IP broadcast address cannot be used	User tried to assign broadcast IP address. The Z-Plex unit does not support broadcast IP addresses.

Table A-3. Error messages (Continued)

Message	Explanation
Loopback type mismatch	User tried to deactivate a line loopback while local loopback is active.
NCHAN set to 0 please configure the numbers of channels	User tried to configure the starting channels (SCHAN) without configuring number of channels (NCHAN).
Parameter not found	Invalid parameter in GET or SET command.
Password must be between 7 and 12 character	New password not between 7 and 12 characters.
Please configure IP address for DS0	After activating a DS0 management channel, you must assign it an IP address.
Please configure IP address for FDL mgmt	After activating a IP over FDL management channel, you must assign it an IP address.
Reserved IP address	Tried to assign reserved IP address to an interface.
SLC96 on WAN2 is not supported	Tried to specify SLC96 framing for the WAN 2 interface. SLC 96 framing is only supported on WAN 2.
Subsystem not found	Parameter configuration group not found.
Syntax Error	No argument to the GET or SET command.
Table Index is beyond the limit 0-95	The requested performance interval and enter value is out of range.
TFTP download failed	TFTP download error.
This is not a FXS/FXO Port	Tried to configure an FXS or FXO port when not supported.
TS already taken	Tried to assign an already assigned time slot to another use.

A.4   CLI reference

The basic CLI commands are divided into the following categories:

- Basic control commands
- Movement and searching commands
- Insert and change commands
- Delete commands
- Put and undo commands

The following sections describe these commands.

A.4.1   Basic control commands

Table A-4 describes the basic commands to edit, delete, and enter commands into the system.

Table A-4. Basic control commands

Command	Description
h [size]	Display the shell history if no argument; otherwise set history buffer to the specified size.
ESC	Switch the line editing mode from regular input mode.
ENTER	Enter line and leave edit mode.
CTRL + H	Delete a character (backspace).
CTRL + U	Delete and entire line (in edit mode).
CTRL + L	Redraw a line (in edit mode).
CTRL + D	Complete a symbol name (in edit mode) or end shell session (in input mode).
CTRL + S	Suspend output.
CTRL + Q	Resume output.

A.4.2   Movement and search commands

Table A-5 describes the movement and search commands.

Table A-5. Movement and search commands

Command	Description
*n*G	Go to command *n*.
/*string*	Search for the specified string backward in the history buffer.
?*string*	Search for the specified string forward in the history buffer.
n	Repeats the last search.
*n*k or *n*-	Execute the nth previous shell command.
*n*j or *n*+	Execute the nth next shell command.
*n*h	Move the cursor *n* characters to the left.
*n*l or SPACE.	Move the cursor *n* characters to the right.
*n*w	Move the cursor *n* words forward. (Words are separated by blanks or punctuation.)
*n*W	Move the cursor *n* large words forward. (Large words are separated by blanks only.)
*n*e	Move the cursor to the end of the next nth word. (Words are separated by blanks or punctuation.)
*n*E	Move the cursor to the end of the next nth large word. (Large words are separated by blanks only.)
*n*b	Move the cursor back *n* words. (Words are separated by blanks or punctuation.)
*n*B	Move the cursor back *n* large words. (Large words are separated by blanks only.)
$	Move cursor to end of the current line.

Table A-5. Movement and search commands (Continued)

Command	Description
0	Move cursor to the beginning of the line.
^	Move cursor to the first non-blank character.
f*c*	Search forward for the character *c*.
F*c*	Search backward for the character *c*.

A.4.3   Insert and change commands

Table A-6 describes the insert and change commands.

Table A-6. Insert and change commands

Command	Description
a	Append text.
A	Append text at the end of line.
i	Insert text.
I	Insert text at the end of the line.
*n*s	Change *n* characters.
*n*c SPACE	Change *n* characters.
cw	Change word.
cc or S	Change the entire line.
c$ or C	Change from cursor to end of line.
c0	Change from the cursor to the beginning of the line.
R	Type over characters.

Table A-6. Insert and change commands (Continued)

Command	Description
nrc	Replace following *n* characters with c.
~	Toggle case, lower to upper, or upper to lower.

A.4.4   Delete commands

Table A-7 describes the delete commands.

Table A-7. Delete commands

Command	Description
*n*x	Delete *n* characters, beginning at the cursor.
*n*X	Delete *n* characters to the left of the cursor.
dw	Delete word.
dd	Delete entire line.
d$ or D	Delete text from the cursor to the end of the line.
d0	Delete text from the cursor to the beginning of the line.

A.4.5   Put and undo commands

Table A-7 describes the put and undo commands.

Table A-8. Put and undo commands

Command	Description
p	Put last deletion after the cursor.
P	Put last deletion before the cursor.

Table A-8. Put and undo commands (Continued)

Command	Description
u	Undo last command.

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