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Spectra

Setup and Configuration Guide



SPECTRA



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Table of Contents

List of Figures ..... **xi**

List of Tables ..... **xvii**

About the Setup and Configuration Guide ..... **xix**

What is In This Guide xix

Typographic Conventions xxi

Chapter 1 **Spectra System Overview** **1**

Overview 1

Accessing Program Command Line Switches 2

Launching the Spectra Program 4

System Login Screen 4

Navigating the Spectra System 5

Main Function Selection Screen 6

Main Function Selection Screen Definitions 7

Main Program Functions 15

Checking System Components 17

Component Versions Screen 17

Component Versions Screen Definitions 18

DOS Information Screen 19

Decode Screen 20

Powering Down the Spectra 21

Chapter 2 **Hardware Setup** **23**

Overview 23

Rackmount Spectra Unit 25
Setting Up a Rackmount Unit 29
MegaPAC Unit 29
Portable Spectra Unit 30
Setting Up a Portable Unit 32
Backplane Configuration 33
DSP Board(s) 33
HSL Processing Board(s) 33
Optional Board Configurations 34
DLP Board(s) and SEA Card(s) 36
Installing DLP Boards 37
Installing SEA Card(s) 40
Setting Up the CPU BIOS 44
Setting the MAC Address 45
Physical Interface Pods 46
DS1/E1 V5 Pod 46
DS1/E1 V6 Pod 48
DS0 Pods 50
V.35 Pod 53
RS-449 Pod 56
RS-232 Pod 58
ISDN S/T V2 Pod (BRI S/T) 60
J1 Pod 63

Chapter 3 Software Installation and Upgrades 65

Overview 65
Spectra Installation Specifications 66
Spectra Installation Program Disks Contents 66
Installation Path 66
Upgrading Software and Overwriting Files 67

Accessing the Spectra Installation Program 69
Installing Complete Spectra System Software 71
Installing Custom Spectra System Software 73
Spectra Custom Installation File Structure 76
Setting Product Configuration 78
Editing Product Configuration Options 80
Year 2000 Compliance Testing and Correction Upgrades 81
Year 2000 BIOS Upgrade for Texas Microsystem D486 82
Year 2000 Test and Fix Software 82
Y2K Compliance Testing 83
Y2K Correction Installation 85
Technical Support Services 86
Warranty Period 86
Customer Support Services Agreement 86
Time and Materials 87
Technical Support Processes 88
Receiving and Prioritizing Requests 88
Escalating Requests 89
Upgrades 89

Chapter 4 Setting User Information 91

Overview 91
Password Setup and Control 92
Password Setup Screen Definitions 93
Setting User IDs, Passwords, and Access Restrictions 97
Connecting to Access-Controlled Spectra Systems 98
Logging Out of Access-Controlled Spectra Systems 99

Chapter 5 Setting Up Your Environment 101

Overview 101
Set Database Drive 103

Set Colors 104
Changing Menu Colors 105
Changing Display Message Colors 106
Changing Display Message Colors by Message Type 107
Changing Display Message Colors by Channel 109
Changing Link Status Colors 110
Set Time 111
Set Date 112
Set Station ID 112
Set Point Code Format 114
Setting Valid Point Code Ranges 115
Chapter 6 Setting Level 1 Parameters 117
Overview 117
Level 1 Parameters Screen 118
Level 1 Parameters Screen Definitions 118
Assigning Level 1 Parameters to Links 128
Chapter 7 SS7 Specific Configuration 135
Overview 135
Level 2 Parameters 137
Level 2 Parameters Screen Definitions 138
Assigning Level 2 Parameters to Linksets 142
Level 3 Parameters 144
Level 3 Emulation Timers 144
Level 3 Emulation Timers Screen Definitions 145
Assigning Timers to Linksets 150
SCCP Parameters 150
SCCP Parameters Screen Definitions 151
Assigning SCCP Parameters 156
SCCP Timers 157

SCCP Timers Screen Definitions 158
Assigning SCCP Timers 159
Network Configurations 160
Network Configuration Screen Definitions 161
Setting Up Your Network Configuration 166
Assigning Virtual Signalling Points 173
Examples of Network Configurations 175
Link To Linkset Definitions 177
Link To Linkset Definitions Screen Definitions 178
Assigning Links to Linksets 179
Link, Linkset, and Node Names 180
Assigning Names to Links 181
Assigning Names to Linksets 182
Assigning Names to Nodes 183
Point Code Names 184
Point Code Names Screen Definitions 185
Assigning Names/Stats Display to Point Codes 186
Congestion/Restriction 187
Congestion/Restriction Screen Definitions 190
Assigning Congestion/Restriction Options 195
Global Title Translation 196
Global Title Translation Screen Definitions 199
Assigning GTT Parameters 201
Linkset To Usergroup 203
Assigning Linksets To Usergroups 204

Chapter 8 ISDN Specific Configuration 207

Overview 207
Level 2 Parameters 209
Link Layer Parameters Screen 210

Link Layer Parameters Screen Definitions 211
Assigning Link Layer Parameters to Links 214
SAPI Assignments Screen 216
SAPI Assignments Screen Definitions 217
Assigning SAPI/Envelope_H Values 219
TEI Assignments Screen 220
TEI Assignments Screen Definitions 221
ISDN SPID\USID Control 223
Assigning Names and Types to TEI/Envelope_L Values ... 224
Timeslot Assignments Screen 226
Timeslot Assignments Screen Definitions 228
Assigning Timeslot Values 229

Chapter 9 X.25 Specific Configuration 231

Overview 231
Level 2 Parameters 233
Link Layer Parameters Screen Definitions 234
Assigning Link Layer Parameters for LAPB 237
Assigning Link Layer Parameters for LAPD 239
Level 3 Parameters 242
Packet Layer Parameters Screen 243
Packet Layer Parameters Screen Definitions 243
Assigning Packet Layer Parameters 246
Virtual Circuit Configuration Screen 247
Virtual Circuit Configuration Screen Definitions 248
Assigning Channels 250
Switch Virtual Circuit Mapping Screen 252
Switch Virtual Circuit Mapping Screen Definitions 253
Making Switch Virtual Circuit Mapping Screen Assignments 255

Chapter 10 Applying, Saving, and Recalling Configurations 257
Overview 257
Apply Configuration 258
Apply & Save Configuration 259
Save Configuration 260
Recall Configuration 261
Appendix A SS7 Overview 263
Overview 263
SS7 Network 264
SS7 Network Definitions 264
SS7 Protocol 266
MTP Level 1 267
MTP Level 2 267
Signal Units 268
Signal Unit Types 269
Fill-In Signal Units 269
Link Status Signal Units 270
Message Signal Units 271
MTP Level 2 Procedures 273
Level 2 Timers 273
Initial Alignment Procedures 274
Alignment Procedure 274
Processor Outage 275
Flow Control 275
Signalling Link Error Monitoring 276
Error Correction 276
MTP Level 3 279
Signalling Message Handling 280
Message Discrimination 280

Message Distribution 280
Routing 280
Signalling Network Maintenance 282
Signalling Network Management 283
Signalling Link Management 283
Signalling Route Management 283
Signalling Traffic Management 287
User Parts (Level 4) 292
Integrated Services Digital Network User Part 292
ISUP Messages 292
Continuity Check Procedure 293
Signalling Connection Control Part 295
Specialized Routing 296
Transaction Capabilities Application Part 296
TCAP Messages and Procedures 296
Appendix B ISDN Overview 305
Overview 305
Circuit Switching 306
Packet Switching 306
Layer 1, Physical Layer 307
Interfaces 307
Layer 2, Data Link Layer 307
Link Access Protocol-D Channel 307
Frame Structure 308
LAPD Commands and Responses 311
Supervisory Format 311
Unnumbered Format 311
Layer 3, Network Layer 312

Appendix C X.25 Overview 319

Overview 319

X.25 Interface and Access Methods 320

Physical Layer 320

Data Link Layer 321

Network Layer 324

Permanent and Switched Virtual Circuits 324

Packet Types 326

Appendix D GSM Overview 327

Overview 327

GSM Network 329

MSC/VLR 331

HLR/AUC 332

AUC 333

EIR 333

VLR 333

GMSC 334

OMC 334

GSM Protocol 334

Appendix E IS41 Overview 337

Overview 337

IS41 Messages 337

SS7 IS41 Message Types 339

IS41 Procedures 339

Intersystem Handoff 339

Handoff Back 341

Handoff to Third 342

Automatic Roaming And Call Delivery 343

Registration Notification and Cancellation 343

Location and Routing Requests 344
Other IS41 Messages 345
Miscellaneous Messages 346
Appendix F Technical Specifications 347
Appendix G Troubleshooting 355
Appendix H Warranty 359
Inet Technologies, Inc. Limited Warranty 359
Appendix I Configurations 362
Glossary 363
Index 403

List of Figures

Figure 1.1 - Spectra System Command Line Switches 2
Figure 1.2 - Password Entry Dialog Box 4
Figure 1.3 - Sample Spectra Screen 5
Figure 1.4 - Main Function Selection Screen 7
Figure 1.5 - Link Status Display Line with 16 Links 9
Figure 1.6 - Component Versions Screen 17
Figure 1.7 - DOS Information Screen (Example) 19
Figure 1.8 - Decode Screen (Example) 20
Figure 1.9 - Exit to DOS Dialog Box 21
Figure 2.1 - Rackmount Spectra Unit 25
Figure 2.2 - Rackmount Unit - Front Panel Unlocked 25
Figure 2.3 - Rackmount Spectra PCI/ISA Unit - DLP Boards, DSP Boards, and HSL Processing Boards Exposed 26
Figure 2.4 - Standard Rackmount Spectra ISA Unit 27
Figure 2.5 - Rear View of Rackmount PCI/ISA Unit 28
Figure 2.6 - Rear View of Rackmount ISA Unit 28
Figure 2.7 - MegaPAC Unit 29
Figure 2.8 - Back View of MegaPAC Unit 30
Figure 2.9 - Portable Spectra Unit 30
Figure 2.10 - Portable Spectra Unit Interface Pod Locations 31
Figure 2.11 - Side View of Portable Spectra Unit 32
Figure 2.12 - Rear View of Portable Spectra Unit 32
Figure 2.13 - Rear View of Rackmount PCI/ISA Unit - DLP Boards in Bank 1 and Bank 2 34
Figure 2.14 - Rear View of Rackmount ISA Unit - DLP Boards in Bank 1 and Bank 2 35
Figure 2.15 - DLP Board Switches 37
Figure 2.16 - 50-pin Connector 39
Figure 2.17 - Ethernet Network Board Switches 41
Figure 2.18 - Rear View of 20-Slot Rackmount Personal Computer - Ethernet Board 43
Figure 2.19 - DS1/E1 V5 Pod 46

Figure 2.20 - DS1/E1 V6 Pod 48
Figure 2.21 - DS0 Pod 50
Figure 2.22 - DS0 Clock Options 51
Figure 2.23 - V.35 Pod 53
Figure 2.24 - RS-449 Pod 56
Figure 2.25 - RS-232 Pod 58
Figure 2.26 - ISDN S/T V2 Pod 60
Figure 2.27 - Cable Suppression Ferrite 62
Figure 2.28 - J1 Pod 63
Figure 3.1 - Spectra Installation Program Main Screen 69
Figure 3.2 - Installation Options Screen 70
Figure 3.3 - Spectra Installation Options Screen 71
Figure 3.4 - Disk Prompt Dialog Box 72
Figure 3.5 - Spectra Installation Options Screen 73
Figure 3.6 - Custom Installation Options Screen 74
Figure 3.7 - Disk Prompt Dialog Box 75
Figure 3.8 - Enter Authorized Password Dialog Box 78
Figure 3.9 - Password Setup Screen 79
Figure 3.10 - Configure Products Screen 79
Figure 4.1 - Enter Authorized Password Dialog Box 92
Figure 4.2 - Password Setup Screen 93
Figure 4.3 - Main Function Selection Screen 99
Figure 5.1 - Set Environment Options Menu 102
Figure 5.2 - Set Database Drive Dialog Box 103
Figure 5.3 - Set Colors Options Menu 104
Figure 5.4 - Change Menu Colors Options Menu 105
Figure 5.5 - Change Display Message Color Options Menu 106
Figure 5.6 - Protocol Options Menu 107
Figure 5.7 - SS7 Colors By Message Type Options Menu 108
Figure 5.8 - Colors by Channel Options Menu 109
Figure 5.9 - Link Status Colors Options Menu 110
Figure 5.10 - Set Time Dialog Box 111
Figure 5.11 - Set Date Dialog Box 112
Figure 5.12 - Set Station ID Dialog Box 112
Figure 5.13 - F2 Run Screen - Station ID 113
Figure 5.14 - Point Code Display Format Dialog Box 114
Figure 5.15 - Set Point Code Format Dialog Box 115
Figure 6.1 - Level 1 Parameters Screen (Example) 118
Figure 6.2 - Spectra System with DS1 Pod on Link 1 Accessing Timeslot Information from a T1/E1/BRI Link 120
Figure 6.3 - Level 1 Parameters Screen (Example) - All Boards Set to Fanout Mode 121
Figure 6.4 - Level 1 Parameters Screen (Example) - Boards 1, 3, and 5 in Fanout Mode 121
Figure 6.5 - Level 1 Termination Setup Examples 126

Figure 6.6 - Type Options Menu 129
Figure 6.7 - Baud Rate Options Menu 129
Figure 6.8 - Mode Options Menu 130
Figure 6.9 - Tip-Ring Options Menu 130
Figure 6.10 - Data/Clock Options Menu 130
Figure 6.11 - Bridged/Term Options Menu 131
Figure 6.12 - Line Code Options Menu 131
Figure 6.13 - Equalization Options Menu 131
Figure 6.14 - Framing Options Menu 132
Figure 6.15 - Local/Loop Options Menu 132
Figure 6.16 - Equalization Options Menu 133
Figure 6.17 - Framing Options Menu 133
Figure 6.18 - Local/Loop Options Menu 133
Figure 7.1 - F1 Setup Menu 136
Figure 7.2 - Protocol Options Menu 136
Figure 7.3 - SS7 Configure Options Menu 137
Figure 7.4 - Level 2 Parameters Screen 138
Figure 7.5 - Protocol Options Menu 142
Figure 7.6 - Error Method Options Menu 142
Figure 7.7 - SS7 Level 3 Parameters Options Menu 144
Figure 7.8 - Level 3 Emulation Timers Screen 145
Figure 7.9 - SCCP Parameters Screen 151
Figure 7.10 - Management Message Sent to Primary Point Code 155
Figure 7.11 - Management Message Sent to Replicated Point Code 155
Figure 7.12 - Broadcast Management Messages 156
Figure 7.13 - SCCP Timers Screen 158
Figure 7.14 - Network Configuration Screen 161
Figure 7.15 - Emulated Node More Parameters Options Menu 162
Figure 7.16 - Sample Settings for an STP Routing Table 165
Figure 7.17 - Network Configuration Screen - Emulated Node Section 167
Figure 7.18 - Assign Linksets Screen 168
Figure 7.19 - More Parameters Options Menu 170
Figure 7.20 - Protocol Options Menu 170
Figure 7.21 - SP/STP Routing Creation Dialog Box 172
Figure 7.22 - Virtual SP Screen 173
Figure 7.23 - Example 1 - Spectra System Network Configuration 175
Figure 7.24 - Example 1 - Network Configuration Settings 176
Figure 7.25 - Example 2 - Spectra System Network Configuration 176
Figure 7.26 - Example 2 - Network Configuration Settings 177
Figure 7.27 - Link To Linkset Definitions Screen 178

Figure 7.28 - Name Linkset Dialog Box 179
Figure 7.29 - Link, Linkset & Node Names Options Menu 180
Figure 7.30 - Link Names Screen 181
Figure 7.31 - Linkset Names Screen 182
Figure 7.32 - Node Names Screen 183
Figure 7.33 - Point Code Names Screen 185
Figure 7.34 - Congestion/Restriction Screen 188
Figure 7.35 - Congestion/Restriction Screen Settings for Level 1 Thresholds on SP1 189
Figure 7.36 - Buffer Capacity Results in Response to Congestion/Restriction Screen Settings 190
Figure 7.37 - Sample IAM Message 192
Figure 7.38 - Sample Settings For Levels 1, 2, and 3 in the Link Buffer 193
Figure 7.39 - Level 3 Network Configuration Screen (Example) ... 194
Figure 7.40 - Global Title Translation Screen 197
Figure 7.41 - Network with Spectra System Emulating an STP 198
Figure 7.42 - Parameter Assignments for 800 Number Global Title Translation 198
Figure 7.43 - Linkset To Usergroup Screen 204
Figure 7.44 - Name User Group Dialog Box 204
Figure 8.1 - F1 Setup Menu 208
Figure 8.2 - Protocol Options Menu 208
Figure 8.3 - ISDN Configure Options Menu 209
Figure 8.4 - ISDN Level 2 Parameters Options Menu 209
Figure 8.5 - Link Layer Parameters Screen 210
Figure 8.6 - Link Layer Parameters Screen 214
Figure 8.7 - SAPI Assignments Screen 217
Figure 8.8 - SAPI Values Options Menu 218
Figure 8.9 - TEI Assignments Screen 221
Figure 8.10 - TEI Assignments for Link 1 Window 225
Figure 8.11 - Timeslot Assignments Screen 227
Figure 8.12 - Timeslot Assignments Screen 229
Figure 9.1 - F1 Setup Menu 232
Figure 9.2 - Protocol Menu 232
Figure 9.3 - X.25 Configure Options Menu 233
Figure 9.4 - Link Layer Parameters Screen 233
Figure 9.5 - LAPB Response Address Dialog Box 237
Figure 9.6 - LAPB Command Address Dialog Box 237
Figure 9.7 - Enter Time Dialog Box 238
Figure 9.8 - Enter Maximum Byte Length Dialog Box 238
Figure 9.9 - Enter Maximum Establishment Retries Dialog Box 238
Figure 9.10 - Enter Time Dialog Box 239
Figure 9.11 - Enter LIC/TEI Value Dialog Box 240

Figure 9.12 - Enter Time Dialog Box....240
Figure 9.13 - Enter Time Dialog Box....240
Figure 9.14 - Enter Time Dialog Box....241
Figure 9.15 - Enter Time Dialog Box....241
Figure 9.16 - Enter Maximum Byte Length....241
Figure 9.17 - Enter Maximum Link Establishment Retries....242
Figure 9.18 - X.25 Level 3 Parameters Options Menu....242
Figure 9.19 - Packet Layer Parameters Screen....243
Figure 9.20 - Enter Time Dialog Box....246
Figure 9.21 - Enter Packet Window Dialog Box....247
Figure 9.22 - Enter Message Ack Time Dialog Box....247
Figure 9.23 - Virtual Circuit Configuration Screen....248
Figure 9.24 - Enter Maximum PVC Channel # Dialog Box....250
Figure 9.25 - Enter Lowest Incoming Channel # Dialog Box....250
Figure 9.26 - Enter Highest Incoming Channel # Dialog Box....251
Figure 9.27 - Enter Lowest Two-Way Channel # Dialog Box....251
Figure 9.28 - Enter Highest Two-Way Channel # Dialog Box....251
Figure 9.29 - Enter Lowest Outgoing Channel # Dialog Box....252
Figure 9.30 - Enter Highest Outgoing Channel # Dialog Box....252
Figure 9.31 - Switch Virtual Circuit Mapping Screen....253
Figure 9.32 - Enter Call Name Dialog Box....255
Figure 9.33 - Enter X.121 Destination Number Dialog Box....255
Figure 9.34 - Enter X.121 Calling Number Dialog Box....256
Figure 10.1 - F1 Setup Menu....258
Figure 10.2 - Enter Configuration Filename Dialog Box....260
Figure A.1 - SS7 Network Components....264
Figure A.2 - Functional Levels of the SS7 Protocol....266
Figure A.3 - Signalling Link Control (Level 2)....267
Figure A.4 - Fill-In Signal Unit....269
Figure A.5 - Sample FISU Message....269
Figure A.6 - Link Status Signal Unit (LSSU)....270
Figure A.7 - Sample LSSU Message....270
Figure A.8 - Message Signal Unit (MSU)....271
Figure A.9 - Sample MSU Message....272
Figure A.10 - Alignment Procedure....275
Figure A.11 - Basic Error Correction Example....278
Figure A.12 - MTP Level 3 Functions....279
Figure A.13 - Point Code Breakdown....281
Figure A.14 - Network Routing Through STPs....281
Figure A.15 - Sample SLTM....282
Figure A.16 - Transfer Restricted Procedure....284
Figure A.17 - Sample TFA Message....285
Figure A.18 - Signalling Route Management Messages....286
Figure A.19 - Sample COO Message....289
Figure A.20 - Changeover and Changeback Procedures....291

Figure A.21 - Sample ISUP Message (IAM Message) 294
Figure A.22 - ISUP Call 295
Figure A.23 - Sample SCCP 800 Query 297
Figure A.24 - Message 1: SCCP 800 Query Requiring GTT (SSP to STP) 299
Figure A.25 - Message 2: SCCP 800 Query After GTT (STP to SCP) 301
Figure A.26 - Message 3: SCCP 800 Response Message (SCP to SSP) 303
Figure B.1 - Frame Format 308
Figure B.2 - Address Field Format 310
Figure B.3 - Control Field Formats 310
Figure B.4 - Common Message Format 313
Figure B.5 - ISDN Call Set-up and Release 315
Figure B.6 - ISDN/SS7 Call Scenario 316
Figure C.1 - X.25 Physical Interface 320
Figure C.2 - I-Frame 321
Figure C.3 - Control Field Formats 322
Figure C.4 - S-Frame 322
Figure C.5 - Establishing a Connection Using Layers of X.25 326
Figure D.1 - GSM System Model 329
Figure D.2 - MSC/VLR and GMSC in the Network 331
Figure D.3 - GSM Network Served by a Single Operator 332
Figure E.1 - Intersystem Handoff 340
Figure E.2 - Handoff Back 341
Figure E.3 - Handoff to Third 342
Figure E.4 - Registration Notification and Cancellation 343
Figure E.5 - Location and Routing Request 344

List of Tables

Table 1.1 - Command Line Switch Functions....3
Table 1.2 - Link Status Displays....9
Table 2.1 - Rackmount Spectra ISA Unit Specifications....27
Table 2.2 - Portable Spectra Unit Specifications....31
Table 2.3 - Level 1 Physical Interface Mode Functions....53
Table 3.1 - Spectra Support Service Offerings (SLAs)....87
Table 4.1 - Read Only Access Category....94
Table 4.2 - Monitor Only Access Category....95
Table 4.3 - Set Filters Access Category....95
Table 4.4 - Network Access Category....96
Table 4.5 - System Administrator Access Category....96
Table 6.1 - Level 1 Physical Interface Mode Functions....124
Table 7.1 - Subsystem Numbers....153
Table 8.1 - Possible SAPI/TEI Combinations for SPID/USID....223
Table A.1 - LSSU Messages....273
Table A.2 - Level 2 Timers....273
Table I.1 - Configurations....362

About the Setup and Configuration Guide

WHAT IS IN THIS GUIDE

This guide contains information you need to prepare the Spectra system for testing and monitoring your current network. Procedures are provided for setting up user information and the Spectra system environment, as well as configuring the Spectra system for three different protocols–SS7, ISDN, and X.25. Protocol overviews are also provided in the appendices of this guide.

The setup procedures discussed in this guide may be accessed using the F1 function key. The following topics are covered:

- Installing Data Link Processor (DLP) boards, Smart Ethernet Adapter (SEA) cards, and physical interface pods
- Setting up user IDs, passwords, and access restrictions

- Setting up the Spectra system environment, including setting screen colors, time, date, station ID, and point code format
- Limiting the Spectra system to run specific configurations and modes
- Configuring Level 1 Parameters
- Configuring the Spectra system for SS7 networks, including Level 2 and Level 3 Parameters
- Configuring the Spectra system for ISDN networks, including Level 2 Parameters
- Configuring the Spectra system for X.25 networks, including Level 2 and Level 3 Parameters
- Applying, saving, and recalling configurations that you set up for the Spectra system

Appendix A through Appendix H provide basic information about the following topics:

- The SS7 network layers and their functions
- The protocols specific to Integrated Services Digital Network (ISDN) that are required for user access to ISDN while utilizing the Spectra system
- The physical, data link, and network layers of the X.25 protocol
- Permanent Virtual Circuits (PVCs) and Switched Virtual Circuits (SVCs)
- The Global System for Mobile Communications (GSM) protocol and its components
- IS41 terminology, messages, and call procedures
- The technical specifications of the Spectra system hardware
- Answers to commonly asked questions about the Spectra system
- The Inet Technologies, Inc. limited warranty

TYPOGRAPHIC CONVENTIONS

This section illustrates and describes the typographic conventions used throughout this guide.

Typeface or Style	Description
Step Action  1. Click the **Inet** icon from the SpImain window.	Procedures begin with a feature description and are followed by step-by-step instructions. Specific items you are to select are displayed in bold text. An icon to the side of the procedure indicates the feature you are activating.

`# cd /inet/opt`
`<file_server_hostname>: 'pwd'`
`FORMAT [CSV/INET]`
	When a procedure consists of entering DOS or UNIX commands and scripts, the command or script is presented in bold Courier text.

Linksets can be dragged and dropped from the Status map.	A note emphasizes supplemental information such as tips about options, functions, and procedures.
Avoid rebooting the system controller. If packages need updating, see directions for stopping and restarting packages. If the system is rebooted improperly, there is a chance the disk will be corrupted beyond the ability of the fsck to repair it.	A caution message indicates you should proceed with caution when attempting the described process, as there are risks involved.

1 Spectra System Overview

OVERVIEW

This chapter provides an overview of the Spectra system, including how to launch the Spectra software, an explanation of the Main Function Selection screen and its options, and how to navigate in the Spectra system.

ACCESSING PROGRAM COMMAND LINE SWITCHES

Prior to launching the Spectra system, program command line switches can be accessed in DOS. These switches provide many different options, effective when the Spectra system is launched.

From a DOS prompt, enter `SPECTRA <-h>` and press the Enter (↵) key. The command line switches are displayed as pictured in **Figure 1.1**.

```
C:\SPECTRA>spectra -h
Usage: C:\SPECTRA\BIN\SPECTRA.EXE [-b][-h][-q][-r][-u][-v]
       -b  Enable remote batch mode
       -h  Show usage
       -q  Quiet.  No beeps
       -r  Reboot enable (on activity timeout)
       -u  MSU Forwarding
       -v  Show version
```

Figure 1.1 - Spectra System Command Line Switches

Table 1.1 lists the available command line switch functions.

Table 1.1 - Command Line Switch Functions

Command Line Switch	Function
-b	Enables remote batch mode operation: The -b command line switch is required to remotely enable the Batch Mode Builder so that the user may configure the Spectra system and start tests from a remote host.
-h	Show usage: Activating this function displays the available command line switches.
-q	Quiet: When this function is activated, the Spectra system operates in a quiet mode (no beeps).
-r	Reboot enable (on activity timeout): If the Spectra system stops processing events and timers for approximately 10 seconds while the Spectra system interrupt is still running, the Spectra system automatically reboots. If the `AUTOEXEC.BAT` file is configured properly, the Spectra system restarts after the reboot timeout.
-u	MSU Forwarding: When this function is activated, the MSU Forwarding feature on the system is automatically restarted without executing the Alt_F command under the F2 Run menu.
-v	Show version: When this function is activated, the current version of the Spectra system is displayed without starting the Spectra program.

LAUNCHING THE SPECTRA PROGRAM

From a DOS prompt, enter `SPECTRA <-n>` (where n equals any desired command line switch listed in **Table 1.1**), and press the Enter (↵) key. The System Login screen displays the Password Entry dialog box.

✍ *To force the Spectra system to launch using a particular command line switch, edit the* `AUTOEXEC.BAT` *file to include the desired command line switch.*

SYSTEM LOGIN SCREEN

If passwords are enabled by the System Administrator, each user must log in before the Spectra system can be accessed. To log in, a pre-defined user ID and password must be entered. User IDs and passwords are assigned by the System Administrator.

✍ *If passwords are disabled, users are not required to log in to access Spectra system functions.*

The User ID and Password fields are case sensitive. Enter the user ID and password in the Password Entry dialog box exactly as the System Administrator assigned them.

The Password Entry dialog box is pictured in **Figure 1.2**.

```
Please Enter User ID:
Please Enter Password:
```

Figure 1.2 - Password Entry Dialog Box

Follow these steps to log in to the Spectra system.

Step	Action
1.	Enter a user identification name in the User ID field of the Password Entry dialog box and press the **Enter** (↵) key.
2.	Enter the corresponding password in the Password field, and press the **Enter** (↵) key.

✍ *Password entries are case sensitive. Be sure to enter the password letters in the proper case format.*

Once the user is logged in, the Main Function Selection screen displays the main program functions of the Spectra system.

If you are unable to log in to the Spectra system, contact the System Administrator to verify your user ID and password.

NAVIGATING THE SPECTRA SYSTEM

All Spectra system screens display the menus and the keystrokes necessary to maneuver through the program. The following information applies to all Spectra system screens (see **Figure 1.3**).

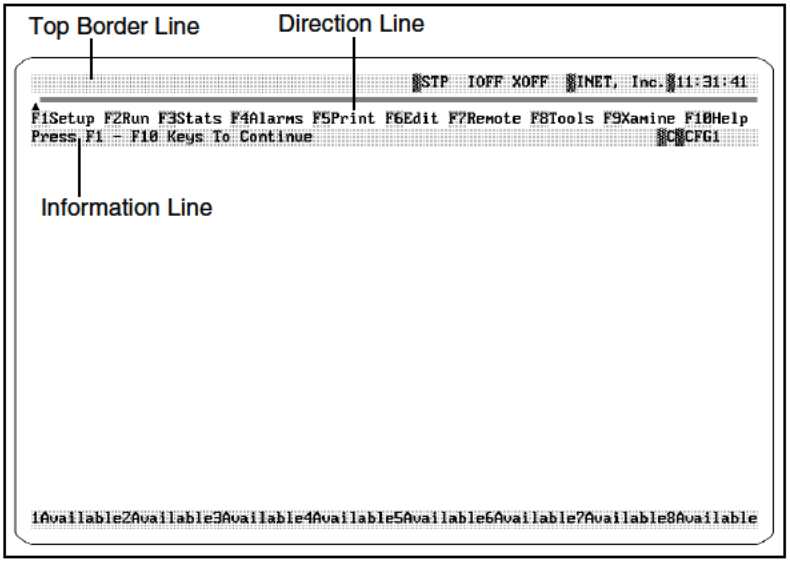


Figure 1.3 - Sample Spectra Screen

Top Border Line
The top border line displays error messages and information about file access.

Information Line
The information line displays information about procedures that can be performed from the current screen.

Direction Line
The direction line displays a list of options available from the current screen.

Moving the Cursor
Press the ↑↓ keys to move the cursor up or down. Press the ←→ keys to move the cursor left or right.

Selecting an Option
Press the Enter (↵) key to select the highlighted option.

Returning To the Previous Menu
Press the Esc key to return to the previous menu.

Accessing a Spectra Feature
Press a function key (F1, F2,..., F10) at any time to access various features.

Printing a Screen
Press the F5 key to print the current screen to a connected printer.

Movable and Hidden Menus
Press and hold the Alt key and use the ↑↓,←→, Home, End, PgUp, or PgDn keys to move the menu. If a menu can be hidden, Alt-H is displayed on the screen. Press the Alt key and the H key to hide the menu. Press any key to display hidden menus.

Accessing Help Screens
Press the F10 key to access help for the feature or screen currently in use.

MAIN FUNCTION SELECTION SCREEN

When the Spectra system program is launched, the System Login screen displays the Password Entry dialog box. Once the user is logged in, the Main Function Selection screen displays the main program functions of the Spectra system.

✍ *From this screen, press the Esc key to log out of the Spectra system (if the password feature is enabled). When the Esc key is pressed, the message "Do You Want To Logout (Y/N):" is displayed. Press the Y key to log out and return to the System Login screen. For more information, see "System Login Screen" on page 4 of this guide.*

Program functions are accessed from this screen (see **Figure 1.4**), but you do not have to return to this screen to change program functions. You can access a function from any screen in the program by pressing the corresponding function key. The mode, station ID, time, and status display line appear on all Spectra system screens.

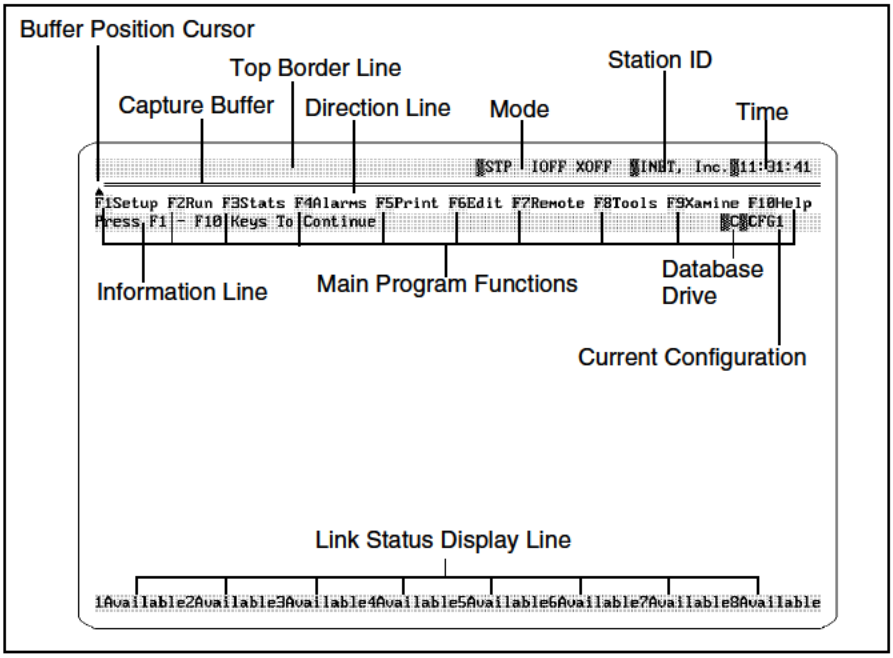


Figure 1.4 - Main Function Selection Screen

Main Function Selection Screen Definitions

Top Border Line
The top border line displays error messages and information about file access.

Mode
The Mode display indicates the current operating mode of each protocol. This area lists SS7, ISDN, and X.25 modes respectively. For example, if you are running SS7 Level 2 Tester, ISDN Call Generator, and X.25 Monitor, the following abbreviations appear in the Mode display:

LVL2 CGEN XMON

The Mode display changes every time a mode starts or stops running. If a protocol is not running a mode, the word OFF is displayed.

Station ID
The station ID identifies the name of the station using the Spectra system.

Time
The time indicates the time according to the computer's system clock.

Buffer Position Cursor
The Buffer Position cursor is a small solid triangle indicating the portion of the capture currently in view. The position of the cursor shifts right to left when paging up or left to right when paging down through the capture buffer.

Capture Buffer
A change in the shading of the capture buffer line indicates the utilization status of the capture buffer. Each position is equal to 1/80th of the capture buffer's size. For example, for a 5 MB capture buffer, each position is equal to 5,000,000/80 (62,500 B).

Direction Line
The direction line displays a list of options available from the current screen.

Information Line
The information line displays information about procedures that can be performed from the current screen.

Database Drive
The database drive indicates where the database of configuration files, signal unit files, test script files, etc. is stored.

Current Configuration
The current configuration indicates the name of the configuration the Spectra system is using. Configurations can be saved and recalled from the F1 Setup menu.

Link Status Display Line

The link status display line indicates the status of each board that is physically in the system (see Figure 1.5). For example, if four boards are in the system, four link status fields are displayed at the bottom of the screen. A maximum of 16 status fields can be displayed at a time. Each mode has different link status displays.

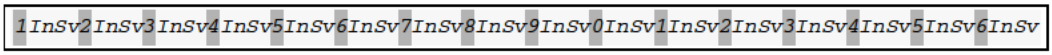


Figure 1.5 - Link Status Display Line with 16 Links

When using the Spectra Trunk Tester, the maximum number of links displayed on the link status display line is 14.

Table 1.2 describes the link status displays that may appear on the link status display line of the Main Function Selection screen.

Table 1.2 - Link Status Displays

Mode(s)	Status Display (8 Links)	Status Display (16 Links)	Description
Monitor Mode	NA	NA	Indicates the link is not present or has been turned OFF
	InService	InSv	Indicates the link is in service
	OutOfService	OOS	Indicates the link is in the initial alignment stage or is not operational
	NoCarrier	NoCa	Indicates no carrier is present
	NoSync	NoSync	Indicates the T1/E1/BRI link has not established synchronization with the opposite end
	NoSignal	NoSig	Indicates the T1/E1 link does not detect a valid signal
	AISAlarm	AISAlm	Indicates the T1/E1 link is receiving an Alarm Indication Signal (AIS) (also called a Blue Alarm)
	RemAlarm	RemAlm	Indicates the T1/E1 link is receiving a Yellow Alarm signal

Table 1.2 - Link Status Displays (Continued)

Mode(s)	Status Display (8 Links)	Status Display (16 Links)	Description
Level 2, 3, and 4 Testers, Intrusive Mode	T1Expired	T1Ex	Indicates the Level 1 timer T1 has expired
	T2Expired	T2Ex	Indicates the Level 2 timer T2 has expired
	T3Expired	T3Ex	Indicates the Level 2 timer T3 has expired
	T6Expired	T6Ex	Indicates the Level 2 timer T6 has expired
	T7Expired	T7Ex	Indicates the Level 2 timer T7 has expired
	SUERM	SUEM	Indicates the Signal Unit Error Rate Monitor (SUERM) threshold was exceeded

Table 1.2 - Link Status Displays (Continued)

Mode(s)	Status Display (8 Links)	Status Display (16 Links)	Description
Level 2, 3, and 4 Testers, Intrusive Mode (Continued)	AERM	AERM	Indicates the Alignment Error Rate Monitor (AERM) threshold was exceeded
	BSNrml	BSNa	Indicates an abnormal Backward Sequence Number (BSN) was detected
	FIBabnrml	FIBa	Indicates an abnormal Forward Indicator Bit (FIB) was detected
	Remote	Rem	Indicates the adjacent signalling point sent an SIOS, SIO, SIE, or SIN message
	L3 Stop	Stop	Indicates Level 3 put the link out of service
	No Carrier	NoCa	Indicates no data/clock is detected on the link
	InService	InSv	Indicates the link is in service
	OutOfService	OOS	Indicates the link is in the initial alignment stage or is not operational
	NoSync	NoSync	Indicates the T1/E1/BRI link has not established synchronization with the opposite end
	NoSignal	NoSig	Indicates the T1/E1 link does not detect a valid signal
	AISAlarm	AISAlm	Indicates the T1/E1 link is receiving an AIS (Blue Alarm)
	RemAlarm	RemAlm	Indicates the T1/E1 link is receiving a Yellow Alarm signal

Table 1.2 - Link Status Displays (Continued)

Mode(s)	Status Display (8 Links)	Status Display (16 Links)	Description
TCAP Generation, TUP/ISUP Generation, STP and SCP Emulation	Available	Avlb	Indicates the link is in service and is ready to transmit/receive messages
	SLTAError	SLTA	Indicates there was not a response to the transmitted Signalling Link Test Message (SLTM)
	OutOfService	OOS	Indicates the link is in the initial alignment stage or is not operational
	NoCarrier	NoCa	Indicates no data/clock is detected on the link
	RemInhibt	RemI	Indicates the link was inhibited remotely
	LocInhibt	LocI	Indicates the link was inhibited locally
	Local PO	LPO	Indicates the link is experiencing a local processor outage
	Remote PO	RPO	Indicates the link is experiencing a remote processor outage
	Congest 1	Cng1	Indicates the link is experiencing Level 1 congestion
	Congest 2	Cng2	Indicates the link is experiencing Level 2 congestion
	Congest 3	Cng3	Indicates the link is experiencing Level 3 congestion
	HW Failure	HW	Indicates the Data Link Processor (DLP) board has failed
	NoSync	NoSync	Indicates the T1/E1/BRI link has not established synchronization with the opposite end
	NoSignal	NoSig	Indicates the T1/E1 link does not detect a valid signal

Table 1.2 - Link Status Displays (Continued)

Mode(s)	Status Display (8 Links)	Status Display (16 Links)	Description
TCAP Generation, TUP/ISUP Generation, STP & SCP Emulation (Continued)	AISAlarm	AISAlm	Indicates the T1/E1 link is receiving an AIS (Blue Alarm)
	RemAlarm	RemAlm	Indicates the T1/E1 link is receiving a Yellow Alarm signal
ISDN Modes	InService	InSv	Indicates the link is in service
	OutOfService	OOS	Indicates the link is in the initial alignment stage or is not operational
	NoSync	NoSync	Indicates the T1/E1/BRI link has not established synchronization with the opposite end
	NoSignal	NoSig	Indicates the T1/E1 link does not detect a valid signal
	AISAlarm	AISAlm	Indicates the T1/E1 link is receiving an AIS (Blue Alarm)
	RemAlarm	RemAlm	Indicates the T1/E1 link is receiving a Yellow Alarm signal

Table 1.2 - Link Status Displays (Continued)

Mode(s)	Status Display (8 Links)	Status Display (16 Links)	Description
X.25 Modes	InService	InSv	Indicates the link is in service
	OutOfService	OOS	Indicates the link is in the initial alignment stage or is not operational
	T1Expire	T1Exp	Indicates the Level 1 timer T1 has expired
	AwtDisest	AwtEst	Indicates the link is awaiting disestablishment
	AwtEst	AwtEst	Indicates the link is awaiting establishment
	NoSync	NoSync	Indicates the T1/E1/BRI link has not established synchronization with the opposite end
	NoSignal	NoSig	Indicates the T1/E1 link does not detect a valid signal
	AISAlarm	AISAlm	Indicates the T1/E1 link is receiving an AIS (Blue Alarm)
	RemAlarm	RemAlm	Indicates the T1/E1 link is receiving a Yellow Alarm signal

MAIN PROGRAM FUNCTIONS

Access each program function by pressing the associated function key. Program functions can be changed without returning to the Main Function Selection screen by pressing the desired function key. The main program functions are as follows.

F1 Setup
The F1 Setup function is where the parameters required for the Spectra system are defined. Use the F1 Setup function to establish Level 1, Level 2, and Level 3 parameters and to customize test modes, filters, capture parameters, menu colors, the date and time, and Spectra system exit features.

F2 Run
The F2 Run function activates the current test mode automatically. Any test scripts established using the F1 Setup function are launched by pressing the F2 key. The Spectra system then provides the option to restart the test. While the Spectra system executes scripts and logs data, it performs search and analysis functions in real time.

F3 Stats
The F3 Stats function provides screens that display the vital statistics for Level 1 through Level 4 messages sent, received, or monitored by the Spectra system. Each statistics screen displays the statistics for each linkset and/or individual links.

F4 Alarms
The F4 Alarms function offers several options for generating alarms and statistics. Enabled alarms are generated automatically by the Spectra system to alert the user to specific testing conditions.

F5 Print
The F5 Print function prints expanded or compressed single-line messages to a file or to a connected printer. You can print the entire log buffer or only certain messages tagged in the F2 Run or F9 Xamine functions.

F6 Edit
The F6 Edit function creates and saves messages into a protocol catalog. Defined messages are used for triggering, filtering, and transmitting messages.

F7 Remote
The F7 Remote function accesses communication software (such as iRemote) that allows the host/remote relationship to take place. Complete Spectra system emulation is possible from a remote terminal running the communication program.

F8 Tools

Link management tools that help create the link state necessary to run specific tests when the Spectra system is in terminated modes are provided in the F8 Tools function. This function also provides transmit-on-demand capability and can be used for simultaneous deactivation of multiple links to simulate linkset failure conditions. Additionally, DOS commands for file management, hardware interface resets, and audio testing capabilities are included in this function.

F9 Xamine

Captured messages can be viewed in a number of ways using the F9 Xamine function. Pressing the F9 key halts all data capture (except when in Batch Test mode) until the F2 key is pressed again.

F10 Help

Help screens are accessed through the F10 Help function. Press the F10 key to access help information about the current screen. For example, pressing the F10 key from the Main Function Selection screen displays the function key definitions. Press the F10 key from any screen to view the related help file.

CHECKING SYSTEM COMPONENTS

Essential system component information for the Spectra system is located in the Component Versions screen, the DOS Information screen, and the Decode screen.

These screens identify the current Spectra software version, system serial numbers, DOS version, available capture memory, disk size, current disk usage, the current decode file, a list of installed decodes, and the decode version number.

This system information can be used as a reference when troubleshooting or documenting program problems.

COMPONENT VERSIONS SCREEN

The Component Versions screen displays the current Spectra system information. Spectra software version, DLP firmware version, the current decode template, and system serial number.

Press the F1 key, select Component Versions, and press the Enter (↵) key to view the Component Versions screen (see **Figure 1.6**).

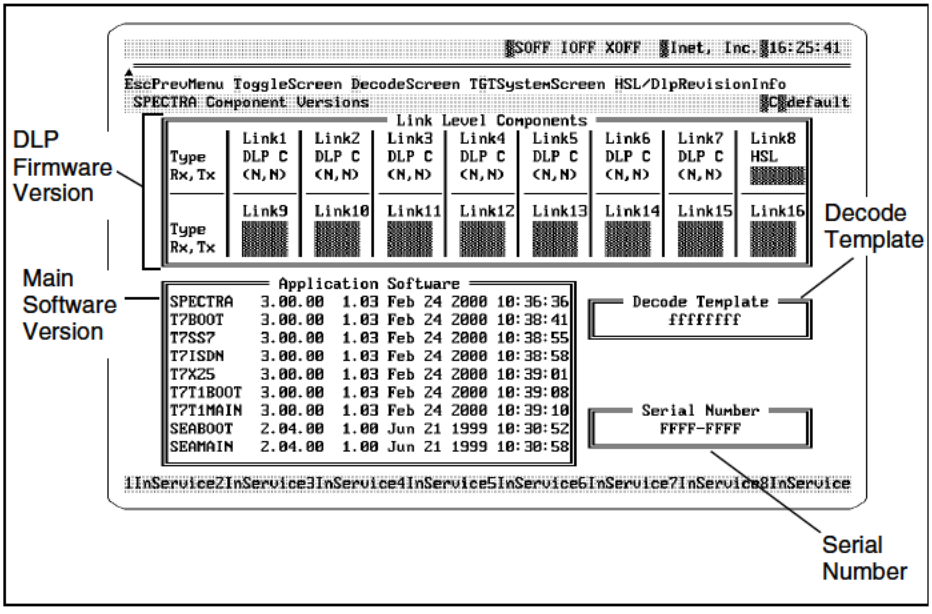


Figure 1.6 - Component Versions Screen

Component Versions Screen Definitions

ToggleScreen
Press the T key to toggle between the Component Versions screen and the DOS Information screen.

DecodeScreen
Press the D key to display the Decode screen.

HSL/DLPRevisionInfo
Press the H key to toggle the Application Software field to HSL Software Versions information. This option is only valid if you have purchased Spectra High Speed Links (HSL). For more information about Spectra High Speed Links, refer to the ***Spectra High Speed Links Guide***.

TGTSystemScreen
Press the G key to view the TGT System Component screen. This option is only valid if you have purchased Spectra Trunk Tester. For more information about Spectra Trunk Tester, refer to the ***Spectra Trunk Tester Guide***.

Link Level Components
This section displays the current firmware version and board type being used by the Spectra system.

Application Software
This section displays the current software files and their respective version numbers.

Decode Template
This section displays the current decode template. All decode functions in the Spectra system are derived from a single file named `TEMPLATE.SS7`. This file resides in the `C:\SPECTRA\DECODE` directory and is the engine that drives data interpretation and presentation within the Spectra system. The `TEMPLATE.SS7` file defines which standard and/or variant protocols are decoded in the Spectra system. This file is installed and shipped with the Spectra system.

Proprietary messages and parameters can be added to existing protocol decode sets through the use of the Protocol Decode Definition Module (PDDM). This is an optional package that can be ordered from Inet. The PDDM allows you to generate a customized `TEMPLATE.SS7` file. For information about creating a customized decode template, refer to the ***Spectra Protocol Decode Definition Module Guide***.

The Spectra system always retrieves the decode information from the `TEMPLATE.SS7` file. Therefore, the version of the decode template used must be named `TEMPLATE.SS7`. If a new `TEMPLATE.SS7` is to be used, rename the current `TEMPLATE.SS7` file (for example, change the name to `TEMPLATE.OLD`) before copying the new file to the `C:\SPECTRA\DECODE` directory. This prevents overwriting of the previous version of the decode template. Restart the Spectra system to invoke the new decode file.

Revert to previous decode versions at any time by renaming the file `TEMPLATE.SS7` and restarting the Spectra system. (Remember to rename the current `TEMPLATE.SS7` template to avoid overwriting it.)

Serial Number
This section displays the current system serial number.

DOS INFORMATION SCREEN

The DOS Information screen displays the Spectra system DOS version, the current available capture memory, the primary and secondary disk size, and the current disk usage. Currently, secondary disk usage is not available. Press the T key on the Component Versions screen to access this screen. The DOS Information screen is pictured in **Figure 1.7**.

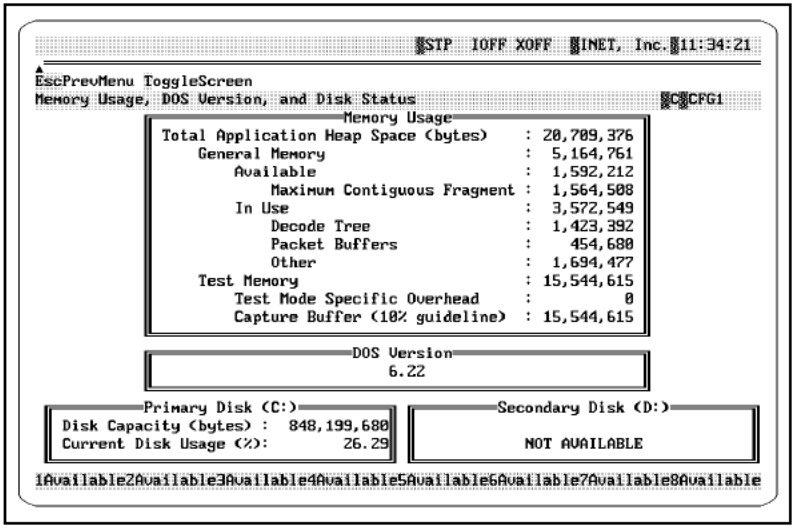


Figure 1.7 - DOS Information Screen (Example)

DECODE SCREEN

The Decode screen displays the name and file size of the current decode file, a list of installed decodes, the decode version number, and the directories from which the decode was created or installed. Press the D key on the Component Versions screen to access this screen. The Decode screen is pictured in Figure 1.8.

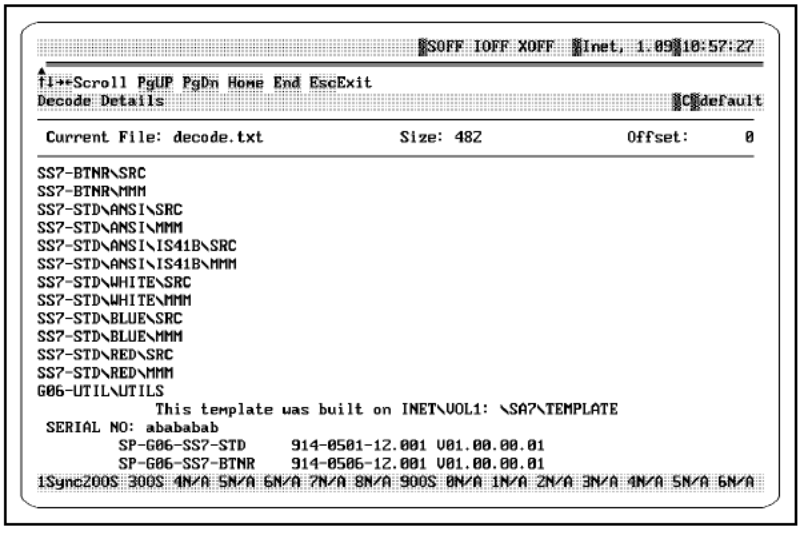


Figure 1.8 - Decode Screen (Example)

POWERING DOWN THE SPECTRA

Exit the Spectra system program and return to DOS before turning the system off.

To exit to DOS, press the F1 key, select EXIT TO DOS, and press the Enter (↵) key. The Exit to DOS dialog box is displayed (see **Figure 1.9**). If the password feature is enabled, only users with a System Administrator access level are allowed to exit to DOS. If the password feature is disabled, access levels do not apply, and any Spectra user can exit to DOS.

```
Exit to DOS? (Y/N)
```

Figure 1.9 - Exit to DOS Dialog Box

✍ *When exiting the Spectra system program, all boards are automatically set to Bridged mode. Board modes can be adjusted in the Level 1 Parameters screen.*

To return to the Spectra system program from DOS, type `SPECTRA` from the DOS prompt and press the Enter (↵) key, or reboot the computer.

✍ *You can type `SPECTRA` from the DOS prompt to return to the Spectra system only if `C:\spectra\bin` is part of the path statement in the* `AUTOEXEC.BAT` *file. If `C:\spectra\bin` is not part of the path statement in the* `AUTOEXEC.BAT` *file, you must type `SPECTRA` from the `C:\spectra\bin` directory to return to the Spectra system.*

After exiting to DOS, power down the Spectra system by turning the ON/OFF switch to OFF.

2 Hardware Setup

OVERVIEW

The Spectra system is packaged in a DOS-based personal computer. Current options include a 48.26 centimeter (19-inch) rackmount unit, a portable unit, or a MegaPAC unit. System setup is minimal; Inet tests and fully integrates each system. Only rackmount units are available with two banks of Data Link Processor (DLP) boards.

Each Signalling System 7 (SS7) and Integrated Services Digital Network (ISDN) link requires the installation of a DLP Printed Wiring Assembly (PWA) board in one of the Spectra system expansion slots. One DLP board can support two X.25 links.

Rackmount Industry Standard Architecture (ISA)\Peripheral Component Interconnect (PCI) units have a different backplane board configuration than previous Spectra systems. These units have two 32-bit Peripheral Component Interconnect (PCI) slots. This special backplane configuration allows up to two PCI boards, either HSL Processing boards or Digital Signalling Processing (DSP) boards, and a maximum of 14 DLP boards for use with the Spectra system.

All Spectra systems are shipped with interface pods. An interface pod, which plugs on to the end of the DLP board from outside of the unit, is required for each physical interface. The interface pod allows the physical interface for each link to be easily changed. The following interface pods are available:

- V.35
- RS449
- DS0
- RS232
- DS1/E1 V5 (120 W balanced)
- DS1/E1 V6 (75 W unbalanced)
- ISDN S/T V2 for Basic Rate Interface (BRI S/T)
- J1

DS1/E1 interfaces require the installation of a Primary Rate Interface (PRI) DS1/E1 daughter PWA on the DLP PWA.

The BRI interface requires the installation of a PRI of Revision E or later. The DLP boards are installed by Inet.

✍ *On systems monitoring RS-449 interfaces, the RS-449 interface pods may not be required.*

RACKMOUNT SPECTRA UNIT

The rackmount unit is shipped with a separate VGA color monitor and keyboard. Rackmount units are available in 2-, 4-, 8-, 12-, and 16-link options (see Figure 2.1).



Figure 2.1 - Rackmount Spectra Unit

Figure 2.2 displays the rackmount Spectra unit with the front panel open.

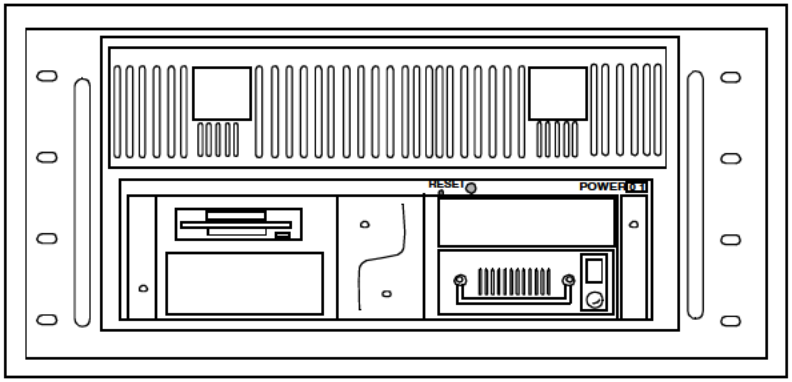


Figure 2.2 - Rackmount Unit - Front Panel Unlocked

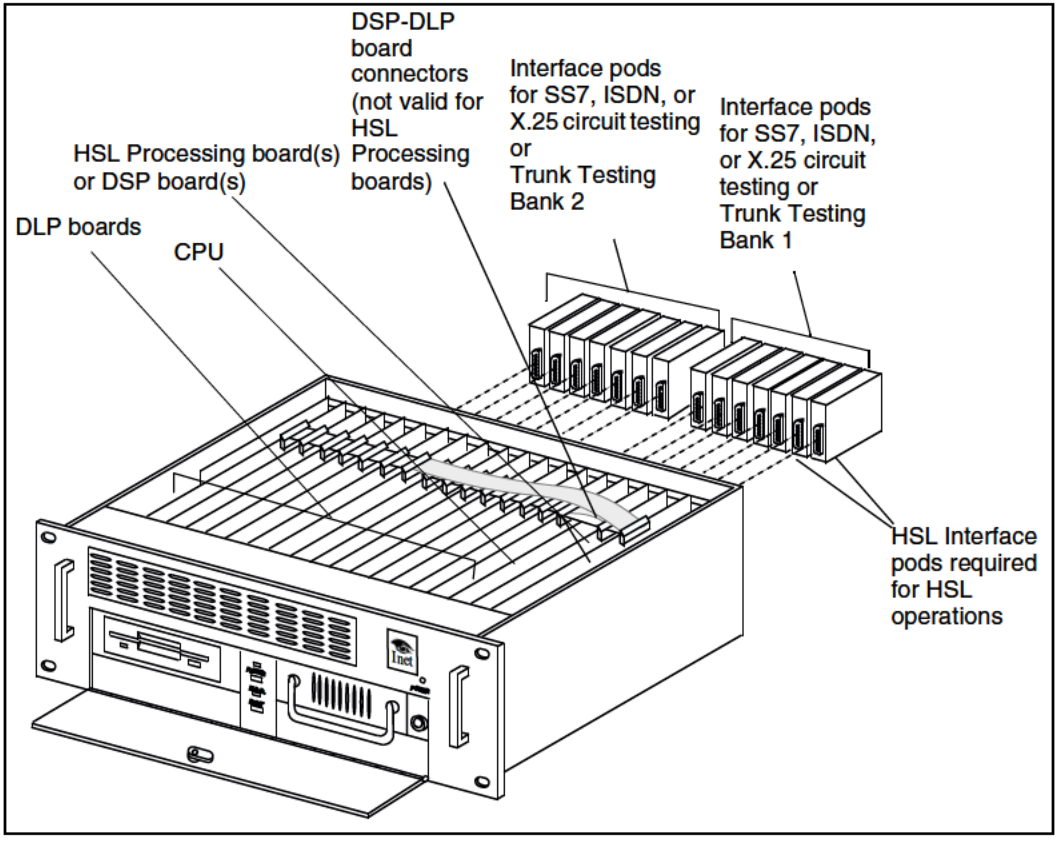


Figure 2.3 - Rackmount Spectra PCI/ISA Unit - DLP Boards, DSP Boards, and HSL Processing Boards Exposed

HSL Processing boards do not use the DSP-DLP board connectors and require one HSL interface pod per HSL Processing board to be connected for HSL operations. For more information about the Spectra system HSL hardware specifications, refer to the ***Spectra High Speed Links Guide***.

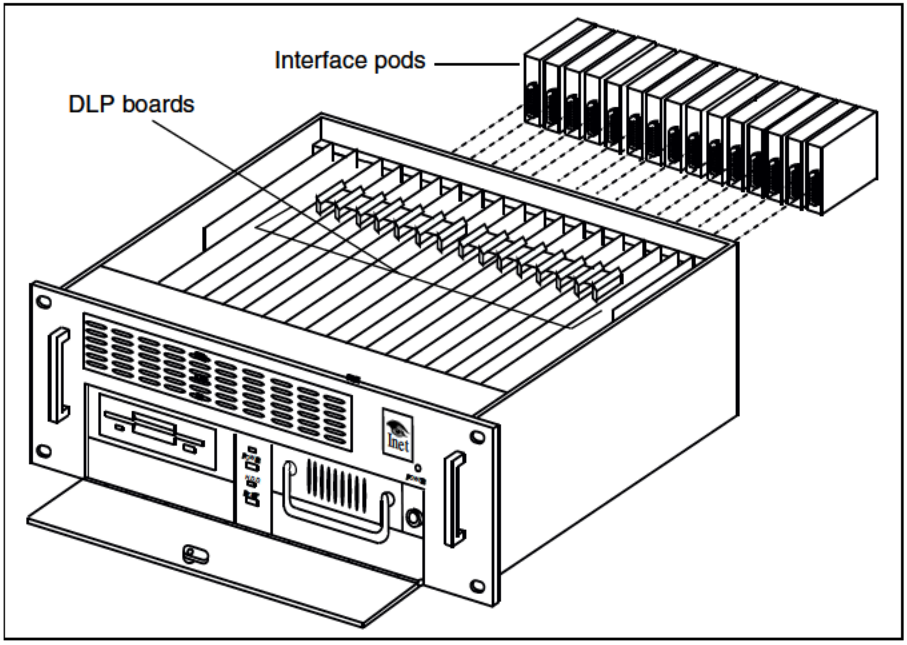


Figure 2.4 - Standard Rackmount Spectra ISA Unit

If you ordered the rackmount Spectra unit, verify that the following items are included in the shipment:

Table 2.1 - Rackmount Spectra ISA Unit Specifications

ITEM NO.	QTY	DESCRIPTION
1	1	Spectra system consisting of the following installed items:
2	1	- Rackmount chassis
3	2-16	- Inet DLP boards
4	1	- Central Processor Unit (CPU) card
5	1	- Disk Controller card
6	1	- VGA Controller card[a]
7	1	- 110/220 V AC power supply
8	1	- VGA color monitor with power cord
9	1	- 48.26 centimeter (19-inch) keyboard
10	1	- Smart Ethernet Adapter (SEA) card

a. Newer systems have a VGA built into the CPU card. An external VGA board must be installed if you are adding an SEA card.

The Power Supply Input Designator switch should be set for the appropriate input power that is used on the system (110/220 V). This switch is located on the back of the unit and is pictured in **Figure 2.5**.

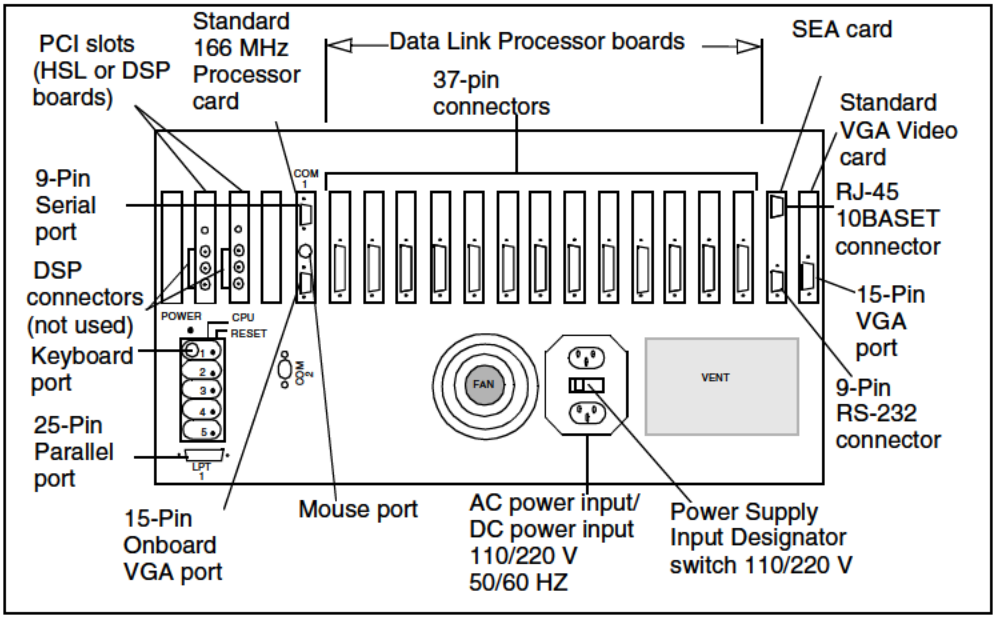


Figure 2.5 - Rear View of Rackmount PCI/ISA Unit

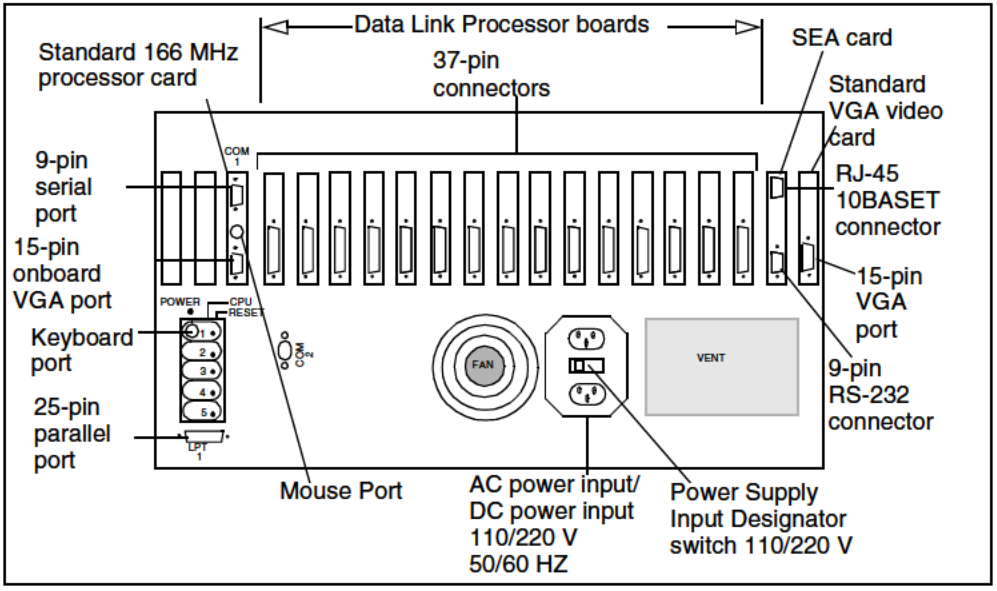


Figure 2.6 - Rear View of Rackmount ISA Unit

SETTING UP A RACKMOUNT UNIT

Follow these steps to set up a rackmount unit.

Step	Action
1.	Plug the keyboard into the keyboard outlet on the rackmount unit.
2.	Connect the VGA monitor to the rackmount unit (a 15-pin DSub connector).
3.	Connect one power cord to the system platform and one power cord to the VGA monitor.

MEGAPAC UNIT

The MegaPAC unit is shipped with a built-in monitor and keyboard. MegaPAC units are capable of supporting either eight links or up to seven links with an SEA (Ethernet) card. To set up the MegaPAC unit, plug in the unit's power cord.

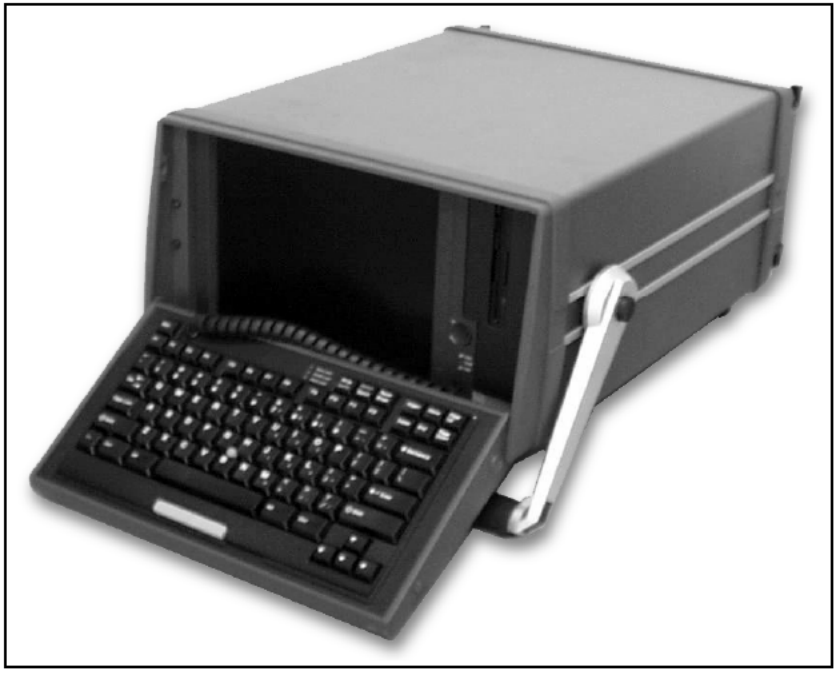


Figure 2.7 - MegaPAC Unit

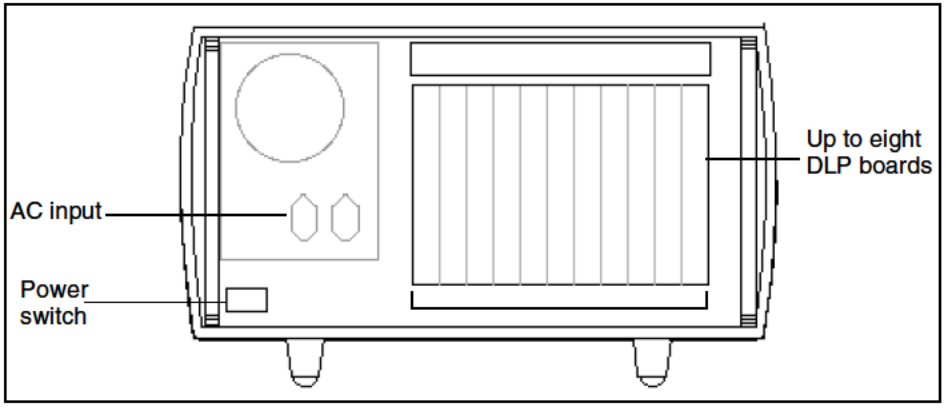


Figure 2.8 - Back View of MegaPAC Unit

PORTABLE SPECTRA UNIT

The portable Spectra unit is shipped with a built-in monitor and keyboard. Portable units are available in two link or four link options.



Figure 2.9 - Portable Spectra Unit

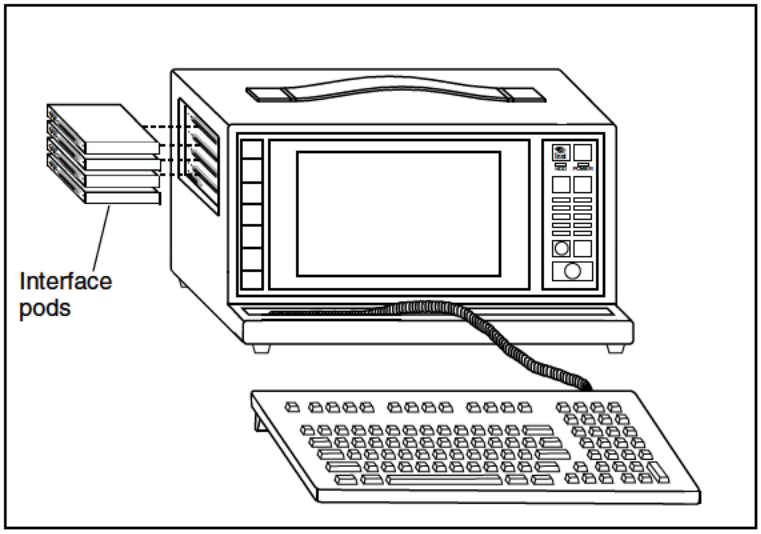


Figure 2.10 - Portable Spectra Unit Interface Pod Locations

If you ordered the portable Spectra unit, verify that the following items are included in the shipment:

Table 2.2 - Portable Spectra Unit Specifications

ITEM NO.	QTY	DESCRIPTION
1	1	Spectra system consisting of the following installed items:
2	1	- Chassis
3	Up to 4	- Inet DLP boards
4	1	- CPU card (located on motherboard)
5	1	- Disk Controller card (located on motherboard)
6	1	- VGA Controller card (located on motherboard)
7	1	- 110/220 V AC power supply
8	1	- Built-in monitor
9	1	- Built-in keyboard
10	1	- Smart Ethernet Adapter (SEA) card (optional)

SETTING UP A PORTABLE UNIT

To set up the portable Spectra unit, plug in the unit's power cord.

The power supply input automatically sets for the input power that is used on the system (110/220 V); therefore, a plug adapter is not needed.

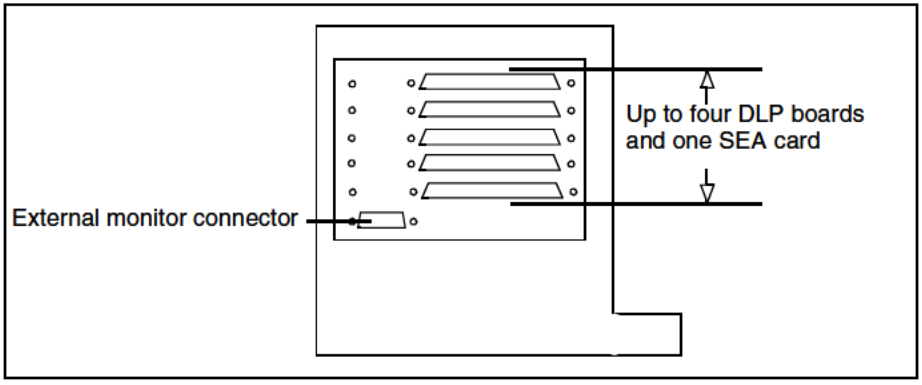


Figure 2.11 - Side View of Portable Spectra Unit

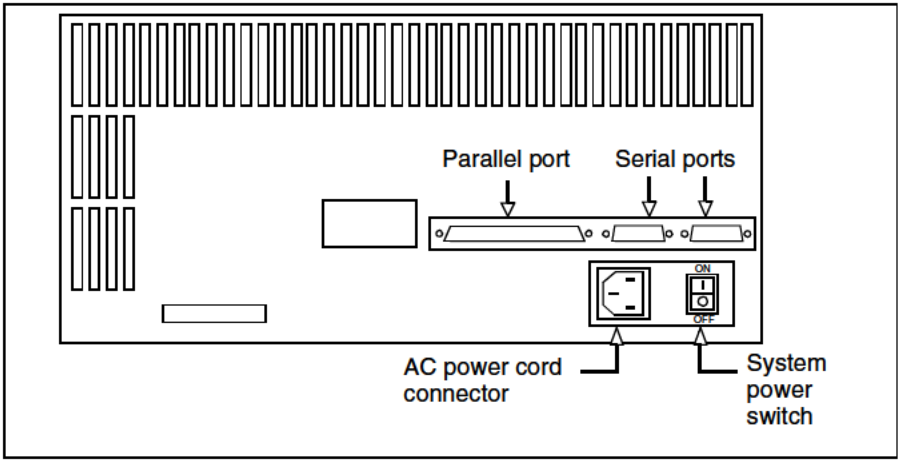


Figure 2.12 - Rear View of Portable Spectra Unit

BACKPLANE CONFIGURATION

Rackmount PCI/ISA units have a different backplane board configuration than previous Spectra systems. These units have two 32-bit PCI slots. This special backplane configuration allows up to two PCI boards, either HSL Processing boards or Digital Signal Processor (DSP) boards, and a maximum of 14 DLP boards for use with the Spectra system.

DSP BOARD(S)

The Trunk Tester uses a DSP board to inject and detect tones. The DSP board is connected into PCI Slot 1 of the backplane for Bank 1 and into PCI Slot 2 for Bank 2. A special DSP-DLP ribbon cable connects each DSP tone board to each bank of DLP boards. The three auto jacks of the DSP are not used by the Trunk Tester. For more information about DSP boards, refer to the ***Spectra Trunk Tester Guide***.

HSL PROCESSING BOARD(S)

HSL processor boards are used for HSL testing for ATM, HDLC, and TALI protocols. An HSL processor board is connected into either of the two PCI slots of the backplane. The interface is automatically determined by reading the code from the interface pod. For more information about HSL Processing boards, refer to the ***Spectra High Speed Links Guide***.

OPTIONAL BOARD CONFIGURATIONS

If an SEA Ethernet card is not utilized, an additional DLP board can be used in the same slot. **Figure 2.13** details Bank 1 and Bank 2 and their positions relative to the PCI slots. **Figure 2.14** on page 35 details Bank 1 and Bank 2 for a Rackmount ISA unit. The numbers that appear on this diagram represent DLP board numbers and do not appear on the back of the unit itself. DLP board numbers are established by setting the DLP board S1 switches located near the top right corner of the DLP board. If desired, the DSP board in the PCI slot for Bank 2 can be renumbered to Board 15 when an SEA Ethernet card is not in use, but this is not required. For more information see "Installing DLP Boards" on page 37 of this guide.

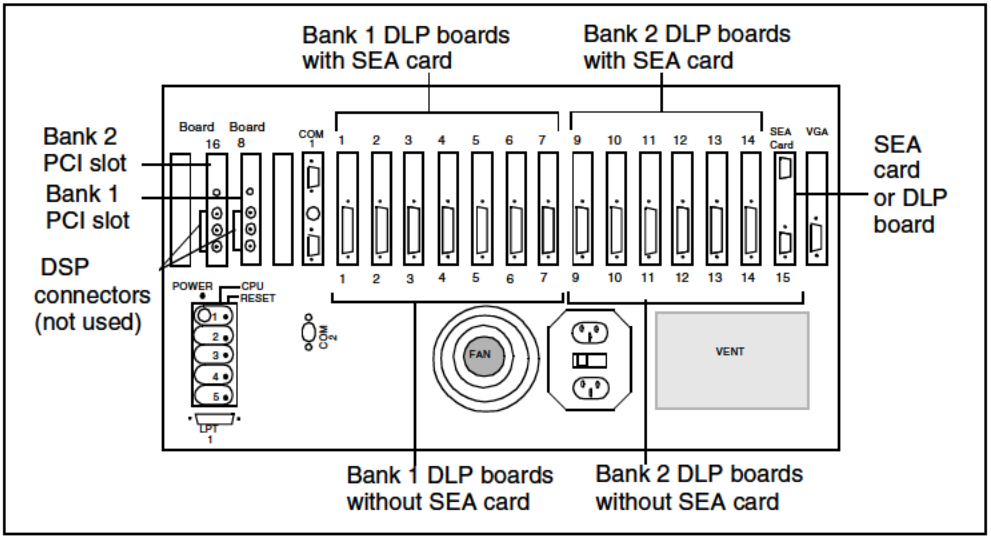


Figure 2.13 - Rear View of Rackmount PCI/ISA Unit - DLP Boards in Bank 1 and Bank 2

*The first DLP board in each bank has a PRI daughter board installed to supply proper system timing. The first DLP board for Bank 1 resides in Slot 1; the first DLP board for Bank 2 resides in Slot 9 (see **Figure 2.13**). For more information about installing PRI daughter boards, see "Installing DLP Boards" on page 37 of this guide.*

Figure 2.14 details Bank 1 and Bank 2 for a Rackmount ISA unit.

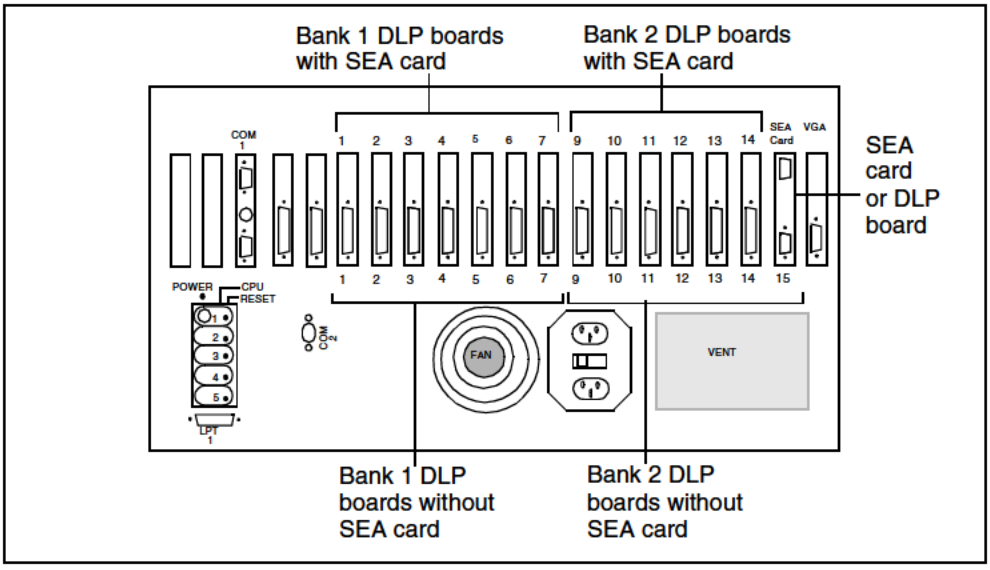


Figure 2.14 - Rear View of Rackmount ISA Unit - DLP Boards in Bank 1 and Bank 2

DLP BOARD(S) AND SEA CARD(S)

The Spectra system has been designed to grow with increased network testing and monitoring needs by adding additional DLP boards. Adding an optional SEA card(s) allows remote workstation access to the system through a Transmission Control Protocol/Internet Protocol (TCP/IP) network. For information about establishing remote access, refer to "TCP/IP Setup" on page 426 of the ***Spectra Features and Functions Guide***.

Integrated systems are shipped with all boards pre-installed and the Dual In-Line Package (DIP) switches configured. The arrangement of the DIP switches determines the board identification number. The DIP switch is arranged so that Board 1 resides in the first slot, Board 2 resides in the second slot, etc. The procedures in the following sections can be used to add new DLP boards or SEA cards in order to add power to the system or to replace/upgrade existing boards or cards.

Use of an SEA card with the Spectra system requires the use of an external VGA board. Systems that have a CPU with a built-in VGA board will need to have an external VGA board installed. Installation and setup of an external VGA board is discussed in "Installing SEA Card(s)" on page 40 of this guide.

The Spectra system can be accessed by a UNIX workstation and other TCP/IP clients through Inet's optional SEA card. Installation of an SEA card requires that the IP address be entered into the current configuration. If the Spectra system is accessed by a workstation that is not on the Local Area Network (LAN), a default gateway also must be designated. For information about establishing a default gateway, see "Default Gateway Setup and Routes" on page 430 of the ***Spectra Features and Functions Guide***.

INSTALLING DLP BOARDS

Follow these steps to install DLP boards.

Always remove power completely prior to accessing bus slots and/or accessing, installing, or removing circuit boards. To ensure that no personal harm occurs, the power cord should be disconnected from the power source. If you are intend to touch or handle any internal components of the system, you must ground yourself to remove all static electricity prior to touching the components. To accomplish this, wear a grounding wrist strap. While out of the unit, the components should be placed on a static dissipative surface or inserted into a static shielding bag.

Step	Action
1.	Remove the personal computer cover by loosening the screws for the access panel on the top of the chassis. Remove the access panel.
2.	Remove the DLP board(s) from their boxes. If the board is used for a DS1/E1 or ISDN BRI, the first board in a bank (Board 1 for Bank 1, Board 9 for Bank 2) must have a PRI daughter board. Boards used for any other interface do not require the PRI board.
3.	If necessary, remove the holding bar from the top of the DLP boards by removing the screws on the right- and left-hand sides of the holding bar.
4.	Locate the DLP boards to be inserted. Make sure each DLP board has a unique switch setting for S1. The S1 switch is located on the top right corner of the DLP board as pictured in Figure 2.15.

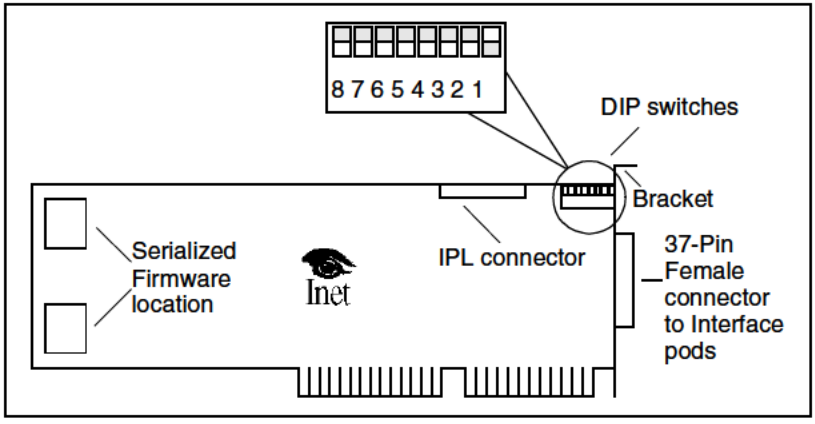


Figure 2.15 - DLP Board Switches

5. Set switches to ON sequentially to define link numbers. For example:

DLP board 1:	[S1 - 1 ON]	Link 1
DLP board 2:	[S1 - 2 ON]	Link 2
DLP board 3:	[S1 - 3 ON]	Link 3
DLP board 4:	[S1 - 4 ON]	Link 4
DLP board 5:	[S1 - 5 ON]	Link 5
DLP board 6:	[S1 - 6 ON]	Link 6
DLP board 7:	[S1 - 7 ON]	Link 7
DLP board 8:	[S1 - 8 ON]	Link 8
DLP board 9:	[S1 - 1 ON]	Link 9
DLP board 10:	[S1 - 2 ON]	Link 10
DLP board 11:	[S1 - 3 ON]	Link 11
DLP board 12:	[S1 - 4 ON]	Link 12
DLP board 13:	[S1 - 5 ON]	Link 13
DLP board 14:	[S1 - 6 ON]	Link 14
DLP board 15:	[S1 - 7 ON]	Link 15
DLP board 16:	[S1 - 8 ON]	Link 16

   Each system must contain a DLP board configured as Link 1. The Link 1 DLP board must contain serialized firmware. If a DS1/E1 or ISDN BRI interface is used, the Link 1 and Link 9 DLP board must also have a PRI daughter board attached.

6. Additional DLP boards can be configured to any link number. Install DLP boards in expansion slots of chassis. It is recommended that the boards be positioned in numerical sequence.

7. While holding the new DLP board by its top, place the board ends into the guide slots inside the chassis. Slide the board down, and firmly (but carefully) push the board edge connector into the bus slot. Repeat this step with all boards to be installed.

8. Once the DLP boards are installed, make sure they are seated firmly in their appropriate slots and secured with a retaining screw at the bracket.

9. Install a ribbon cable across the 50-pin connectors located on the top of each DLP. The ribbon cable connected across DLP boards 1 through 8 (Bank 1) is a straight-through cable. The ribbon cable connected across DLP boards 9 through 16 (Bank 2) has pins 49 and 50 twisted to address it as Bank 2. If there are fewer than 16 boards in the system, leave the remaining connector(s) on the cable disconnected.

If the DLP board that you are adding to the system is Board 9 and it is the only board in Bank 2, a jumper should be added to the 50-pin connector in place of the ribbon cable. The jumper should be placed across pins 49 and 50 (see **Figure 2.16**).

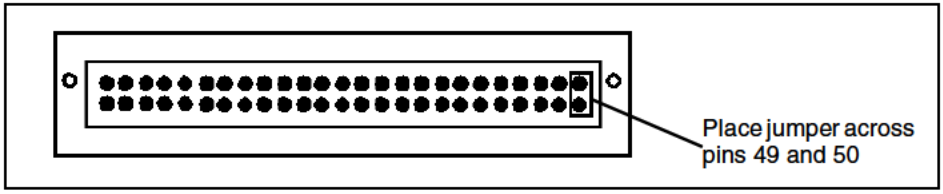


Figure 2.16 - 50-pin Connector

10. Close the personal computer cover.

11. Install the appropriate interface pods. DS1/E1 or ISDN BRI pods may only be installed on links equipped with PRI daughter boards. DLP boards equipped with PRI daughter boards can still be used as V.35, RS-449, or any other interface with the installation of the appropriate interface pod.

12. Fasten both screws in each pod to the DLP board bracket. Pods may be connected to the DLP board through 37-pin one-to-one cables to provide easier access to the pods. The maximum length of the 37-pin cable must not exceed 4 feet.

✍ *Connecting the DS1/E1 pods with an external cable may affect the output pulse template.*

INSTALLING SEA CARD(S)

Follow these steps to install SEA card(s). For more information about the SEA card and SEA related services, see "SEA Card" on page 452 and "SEA Services" on page 453 of the ***Spectra Features and Functions Guide***.



Always remove power completely prior to accessing bus slots and/or accessing, installing, or removing circuit boards. To ensure that no personal harm occurs, the power cord should be disconnected from the power source. If you are tend to touch or handle any internal components of the system, you must ground yourself to remove all static electricity prior to touching the components. To accomplish this, wear a grounding wrist strap. While out of the unit, the components should be placed on a static dissipative surface or inserted into a static shielding bag.

Step	Action
1.	Remove the personal computer cover by loosening the screws for the access panel on the top of the chassis. Remove the access panel.
2.	Remove the SEA network card(s) from their boxes.
3.	If necessary, remove the holding bar from the top of the DLP boards by loosening the screws on the right-hand side of the holding bar.
4.	Remove the existing blank bracket in slot J17 by removing the screw. Keep this screw for use on the network board.

✍ *If an X.25 DLP board resides in slot J17, place the SEA card in slot J18.*

5. Set the DIP switch on the network board to its proper position. If an X.25 DLP board is not present, set switch 1, position 1 to ON. Switch 1 is located on the top right-hand corner of the board. If an X.25 DLP board is present, set switch 1, position 2 to ON.

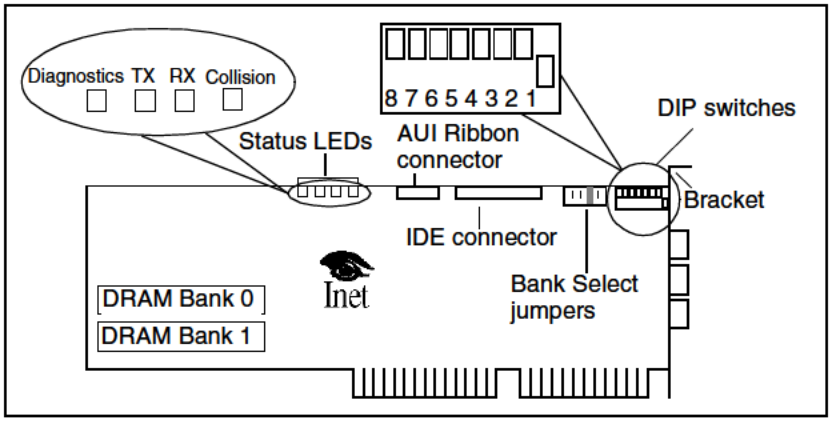


Figure 2.17 - Ethernet Network Board Switches

6. Strap the jumper for Bank 3, as shown in **Figure 2.17**.

7. Install the Single Inline Memory Module (SIMM) in Bank 0, if only one SIMM is provided. The software automatically recognizes all installed Dynamic Random Access Memory (DRAM).

8. While holding the ethernet board by its top, place the board ends into the guide slots inside the chassis in slot J17 (or J18 for systems with an X.25 DLP board in slot J17) of the 20-slot rackmount (any available slot in the portable units). Slide the board down, and firmly (but carefully) push the board edge connector into the bus slot.

Step 9 through **Step 11** explains the installation of an external VGA board.

*If the system monitor is plugged into a VGA connector on the VGA board slot, the system is already using an external VGA board, and you should skip **Step 9** through **Step 11**. If the system monitor is plugged into a VGA connector on the CPU board slot, the system is using an internal VGA board. If you do not have a separate VGA board currently residing in the VGA board slot, follow **Step 9** through **Step 11** to install the VGA board provided.*

9. Remove the VGA board from its box.

10. Remove the existing blank bracket in the VGA slot (J1) by removing the screw. Keep this screw for use on the VGA board.

11. While holding the VGA board by its top, slide the board down. Then firmly (but carefully) push the board edge connector into the bus slot. Replace the screw to secure the VGA board.

✍ *For systems that are not currently using an external VGA board, you also have to disable the internal VGA board and switch the monitor cable from the CPU VGA connector to the external VGA connector. Do not do this until you have completed* ***Step 12*** *through* ***Step 14*** *of this procedure. Be sure to follow the procedures explained in* ***Step 1*** *through* ***Step 8*** *first.*

Step 12 through **Step 14** continue explanation of SEA card installation procedures for all Spectra systems.

12. If necessary, replace the holding bar and tighten the screws on the right-hand side of the holding bar.

13. Replace the top cover and tighten the screws.

14. Attach the 10BASET Ethernet cable to the RJ45 connector on the SEA card, as shown in **Figure 2.18**.

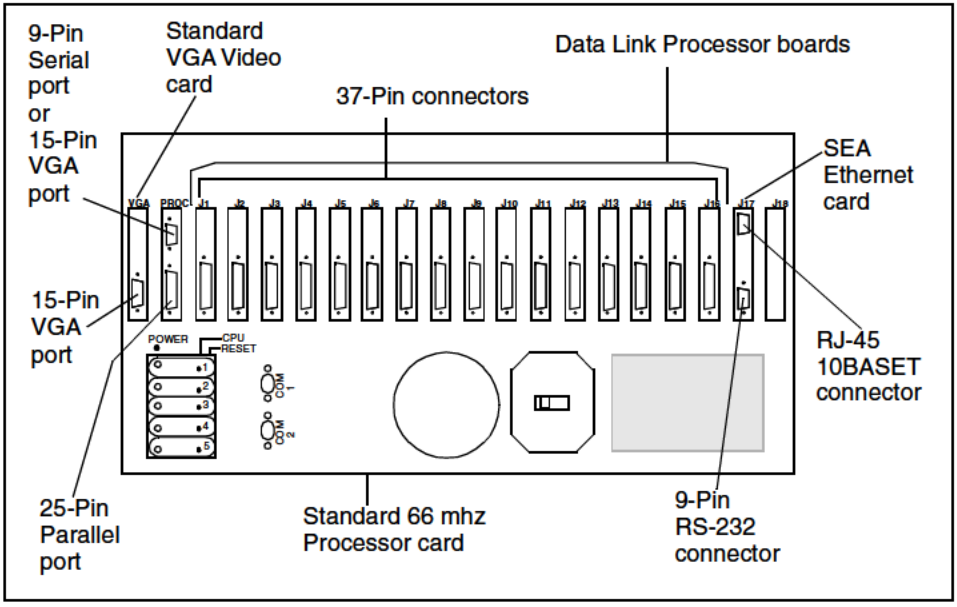


Figure 2.18 - Rear View of 20-Slot Rackmount Personal Computer - Ethernet Board

*In **Figure 2.18**, if the system had an X.25 DLP board in slot J17, the SEA card would be placed in slot J18.*

Refer to "TCP/IP Setup" on page 426 of the ***Spectra Features and Functions Guide*** for information about assigning IP addresses and/or assigning a gateway for the Inet system.

When the system software is running and the ethernet board and cables are properly connected, the DIAG LED on the ethernet board should be ON. If the DIAG LED is blinking, no carrier is detected by the ethernet board.

Setting Up the CPU BIOS

If you have not been using an external VGA board, you need to disable the internal VGA board and set up the external VGA board. Follow these steps to set up the CPU BIOS after you have completed installation of the SEA card and the external VGA board.

✍ *If you have already been using an external VGA board or you have a Pentium 586 or later version, you can skip this procedure.*

✍ *The CPU BIOS must be set up prior to setting the MAC address.*

Step	Action
1.	Power up the Inet system. While the system is booting, hit the **Delete** key to enter BIOS Setup.
2.	In Setup, use the arrow keys to highlight the **Advanced** option, and press the **Enter (↵)** key.
3.	Use the arrow keys to highlight the **Onboard PCI VGA** option, and press the **Enter (↵)** key.
4.	A window with Enabled and Disabled options is displayed. Use the arrow keys to highlight the **Disabled** option and press the **Enter (↵)** key.
5.	Verify that the Onboard PCI VGA option is now disabled.
6.	Press the **Esc** key two times. Save Changes and Exit dialog box is displayed.
7.	Use the arrow keys to highlight the **Save Changes and Exit** option, and press the **Enter (↵)** key. The system now reboots.
8.	While the system is rebooting, unplug the monitor cable from the CPU VGA connector and plug it in to the external VGA board connector. Video then comes up using the external VGA board.

Setting the MAC Address

The ethernet address or Media Access Control (MAC) address for the Spectra system is set automatically for Inet installed SEA cards. These addresses range from 00:20:C4:00:10:00 to 00:20:C4:00:1F:FF. For SEA cards that will be installed by the user, Inet provides a batch file with the SEA card that will automatically set the MAC address.

Follow these steps to set the MAC address of the SEA card.

✍ *Be sure to set up the CPU BIOS prior to setting the MAC address. Refer to "Setting Up the CPU BIOS" on page 44 of this guide for more information.*

Step	Action
1.	Insert the diskette that was provided with the SEA board.
2.	Type `A:\Install` and press the **Enter** (↵) key. The Install program will automatically update the MAC address of the newly installed SEA board.

✍ *The MAC address installation disk assigns a unique MAC address to a single SEA card; do not use the installation disk for more than one SEA card. However, should Inet send a replacement card for a damaged SEA card, you can use the MAC address installation disk provided with the original SEA card to assign the MAC address to the replacement SEA card.*

The ethernet/MAC address is specified in the `C:\SPECTRA\BIN\CONFIG.SEA` text file. Should the ethernet/MAC address need to be manually edited, save a backup of the existing `CONFIG.SEA` file before modifying (for example, save a copy of the file as `CONFIG.OLD` before editing the address). The text editor found under the DOS COMMANDS option in the F8 Tools menu can be used for modifying the file.

PHYSICAL INTERFACE PODS

The following sections describe the interface pods available with the Spectra system.

DS1/E1 V5 POD

The following figure displays the DS1/E1 V5 Pod.

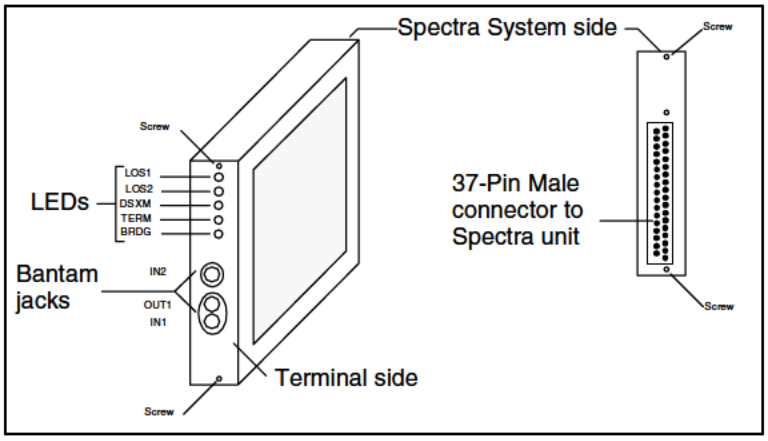


Figure 2.19 - DS1/E1 V5 Pod

LOS1 and LOS2 LEDs
These Light Emitting Diodes (LEDs) represent the signal status of inputs 1 and 2. The LOS1 LED represents the signal received through the IN1 input. The LOS2 LED represents the signal received through the IN2 input. These indicators are only valid when the Spectra system program is running.

LEDs OFF
No signal is detected at the input.

LEDs Blinking
The input signal is detected, but frame synchronization is not found.

LEDs ON
The input signal is present and frame synchronization is established.

DSXM LED
This LED indicates gain circuitry has been activated on the inputs to accommodate for signal loss through Digital System Cross-Connect Frame (DSX) protected monitoring ports. This should be ON in conjunction with the Term LED when the DSX mon termination is selected in the Level 1 Parameter setup. For more information, refer to the"Level 1 Parameters Screen" on page 118 of this guide.

BRDG LED or TERM LED
These LEDs indicate the electrical termination of the receive inputs on the terminal side. Only one of these LEDs is ON at any given time. The Bridged option or Terminated option is assigned in the Spectra system program under the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

The Bridged option or Terminated option assigns the following impedance to the DS1/E1 V5 Pod:

Bridged:	> 2K Ω
Terminated:	75 Ω

IN1, OUT1, and IN2 Jacks
These jacks allow connections for transmit and receive signals.

IN2	Send data input (second receive channel in monitor mode)
OUT1	Send data output (transmit channel in emulation modes)
IN1	Receive data input (receive channel in emulation and monitor modes)

IN1 is connected to OUT 1 when both jacks are unplugged.

Internal and transmit timing is derived from the IN1 received signal when loop timing is selected (in Level 1 Parameters screen). To provide correct internal timing when monitoring only one channel, it must be connected to the IN1 jack.

DS1/E1 V6 POD

The following figure displays the DS1/E1 V6 pod.

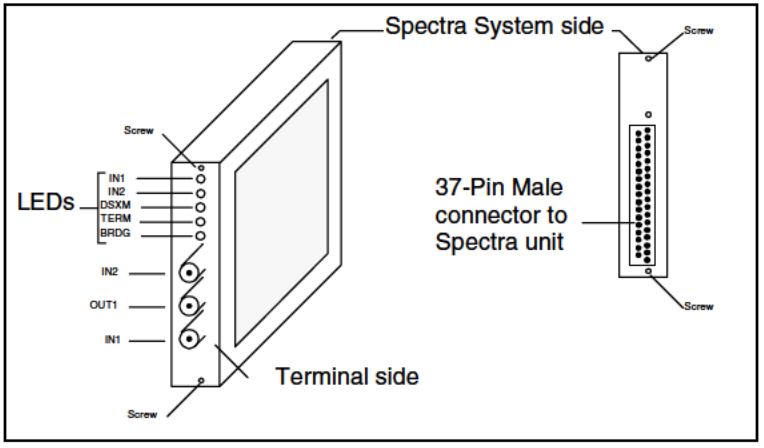


Figure 2.20 - DS1/E1 V6 Pod

IN1 and IN2 LEDs
These LEDs represent the signal status of inputs 1 and 2. IN1 represents the signal received through the IN1 British Naval Connector (BNC) jack and IN2 represents the signal received through the IN2 BNC jack. These indicators are only valid when the Spectra system program is running.

LEDs OFF
No signal is detected at the input.

LEDs Blinking
The input signal is detected, but frame synchronization is not found.

LEDs ON
The input signal is present and frame synchronization is established.

DSXM LED
This LED indicates gain circuitry has been activated on the inputs to accommodate for signal loss through DSX protected monitoring ports. This should be ON in conjunction with the Term LED when the DSX mon termination is selected in the Level 1 Parameter setup. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

BRDG LED or TERM LED
These LEDs indicate the electrical termination of the receive inputs on the terminal side. Only one of these LEDs is ON at any given time. The Bridged option or Terminated option is assigned in the Spectra system program in the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

The Bridged option or Terminated option assigns the following impedance to the DS1/E1 V6 pod.

Bridged:	> 2K Ω
Terminated:	75 Ω

IN1, OUT1, and IN2 Jacks
These jacks allow connections for transmit and receive signals.

IN2	Send data input (second receive channel in monitor mode)
OUT1	Send data output (transmit channel in emulation modes)
IN1	Receive data input (receive channel in emulation and first Rx channel in Monitor modes)

Internal and transmit timing is derived from the IN1 received signal when loop timing is selected (in Level 1 Parameters screen). To provide correct internal timing when monitoring only one channel, it must be connected to the IN1 jack.

IN1 and OUT1 are not internally looped back when a BNC cable is not connected.

DS0 PODS

There are four versions of DS0 pods that are differentiated by their part numbers. The available baud rates are the primary difference between these pods.

- DS0-V3 (Bellcore DS0-A) interface pod - MOD-9112-04-025

  56 Kbps/64 Kbps

- DS0-V3 (Bellcore DS0-A) interface pod - MOD-9112-04-026

  48 Kbps/64 Kbps

- DS0 G.703 interface pod with centralized clock. Also known as Japan CII interfaceMOD-9112-04-027

  56 Kbps/64 Kbps

- DS0 G.703 interface pod with centralized clock. Also known as Japan CII interface; MOD-9112-04-028

  48 Kbps/64 Kbps

The following figure displays a DS0 pod.

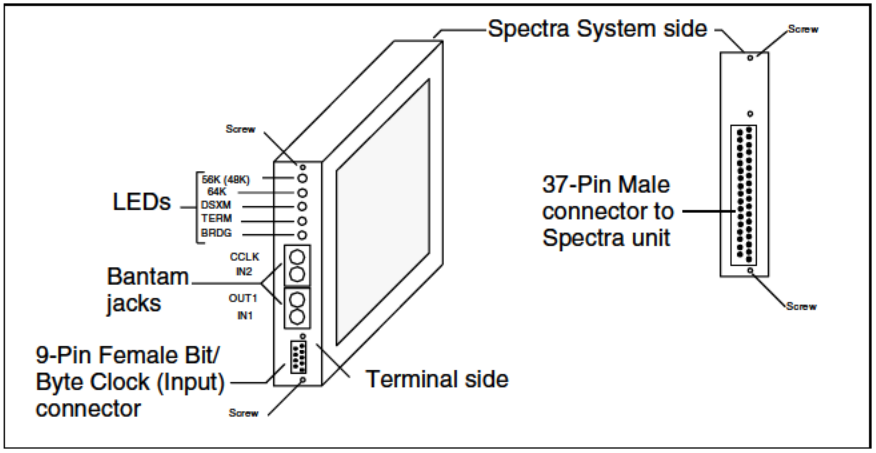


Figure 2.21 - DS0 Pod

56K/48K or 64K LEDs

These LEDs indicate the current data (baud) rate selected in the Spectra system program. (In 56 Kbps mode, the eigth bit of each received byte is ignored. In 48 Kbps mode, the first and eigth bit are ignored).

DSXM LED

This LED indicates gain circuitry has been activated on the inputs to accommodate for signal loss through DSX protected monitoring ports. This should be ON in conjunction with the Term LED when the DSX mon termination is selected in the Level 1 Parameter setup. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

BRDG LED or TERM LED

These LEDs indicate the electrical termination of the receive inputs on the terminal side. Only one of these LEDs is ON at any given time. The Bridged option or Terminated option is assigned in the Spectra system program under the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

The Bridged option or Terminated option assigns the following impedance to the DS0 pods.

Bridged:	> 2K Ω
Terminated:	135 Ω

CCLK (Composite Clock) Jack

This transformer-coupled input provides bit and byte clock timing to internal circuitry (see **Figure 2.22**). This clock should conform to composite clock guidelines as outlined in Bellcore Technical Reference TR-TSY-000458 (DS0-A Systems Interconnection or G.703 depending on the interface pod). The composite clock input provides system timing to all DS0 pods, so only one composite clock is required for the system.

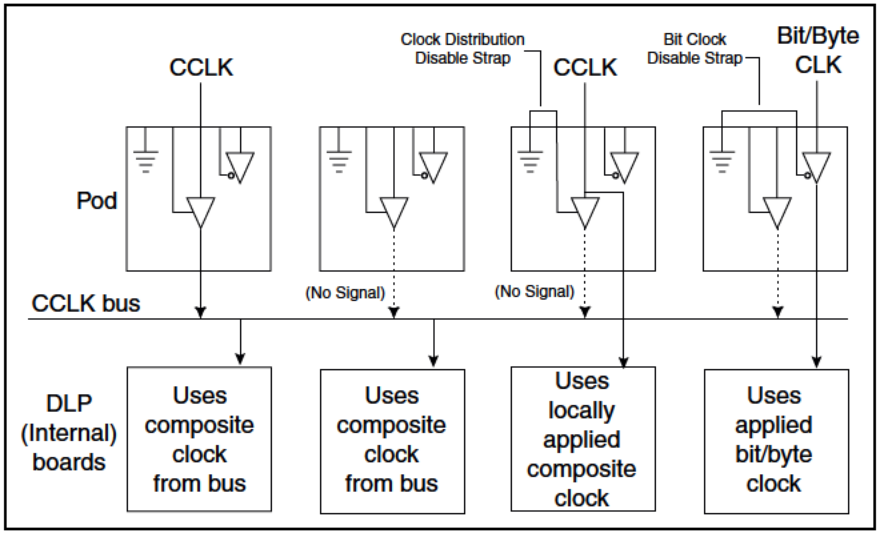


Figure 2.22 - DS0 Clock Options

This clock may be connected to any DS0 pod. If multiple timing sources (composite clocks) are required, the pods can be configured to use individually-applied timing that does not distribute the composite clock to the other modules. This is accomplished by shorting pins 1 and 2 of the 9-pin (bit/byte clock) connector. Any modules left with pins 1 and 2 not connected share the clock signal applied to any one of these pods. Only one clock should be used among these pods.

A separate Transistor Transistor Logic (TTL) bit and byte clock signal may be used as a timing source. These signals are used locally and are not distributed internally to other pods. To use the bit and byte clocks, pin 5 of the 9-pin (bit\byte clock) connector must be shorted to pin 2. Enabling the bit\byte clock in this manner does not disable the distribution of an applied composite clock to other pods; however, the composite clock is disabled for that pod.

IN1, OUT1 and IN2 (Jacks)
These jacks allow connections for transmit and receive signals.

IN2	Send data input (second receive channel in Monitor mode)
OUT1	Send data output (transmit channel in Emulation mode)
IN1	Receive data input (receive channel in Emulation mode and first RX channel in Monitor mode)

Pin Outs	**9 Pin Female D-sub**
1	/Disable Composite Clock distribution
2	Ground
3	Bit Clock - 135 Ω TTL input
4	Byte Clock - 135 Ω TTL input
5	/Enable Bit/Byte Clock input
6	Not Used
7	Not Used
8	Not Used
9	Not Used

V.35 POD

The following figure displays the V.35 pod.

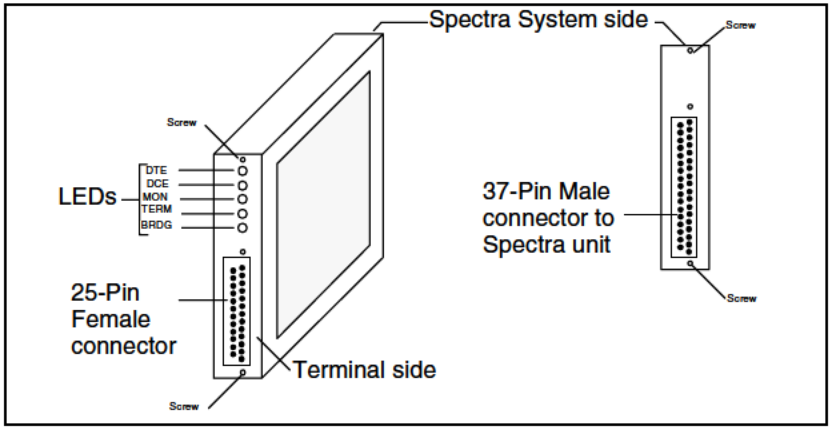


Figure 2.23 - V.35 Pod

DTE LED or DCE LED

These LEDs represent the current mode of operation for the Spectra system link. Only one of these LEDs is ON at any given time. The Data Terminal Equipment (DTE) or Data Communications Equipment (DCE) option is assigned in the Spectra system program under the Level 1 Parameters screen (see **Table 2.3**). For more information about assigning this option, see **Chapter 6** of this guide.

Table 2.3 - Level 1 Physical Interface Mode Functions

Function	DTE	DCE
Send Data	Output	Input
Send Timing (DCE Source)	Input	Output
Receive Data	Input	Output
Terminal Timing (DTE Source)[a]	Output	NA

Table 2.3 - Level 1 Physical Interface Mode Functions (Continued)

Function	DTE	DCE
Carrier Detect (CD)	Input	Output
Request To Send (RTS)	Output	Input
Clear To Send (CTS)	Input	Output
Data Set Ready (DSR)	Input	Output
Data Terminal Ready (DTR)	Output	Input

a. RS-232 interface only

The DTE LED or DCE LED indicates the direction of data flow in the following manner:

DTE SD - Output, RD - Input, ST - Input, RT - Input
DCE SD - Input, RD - Output, ST - Output, RT - Output

MON LED
When the MON LED is ON, the link is running under Monitor mode. The Monitor mode option is assigned in the Spectra system program using the F1 Setup function. For more information about assigning the Monitor mode option, refer to **Chapter 6** of the ***Spectra Features and Functions Guide***.

The LED indicates the direction of data flow in the following manner:

MON SD - Input, RD - Input, ST - Input, RT - Input

BRDG LED or TERM LED
These LEDs indicate the electrical termination of the receive inputs on the terminal side. Only one of these LEDs is ON at any given time. The Bridged option or Terminated option is assigned in the Spectra system program in the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

The Bridged option or Terminated option assigns the following impedance to the V.35 pod:

Bridged:	> 2K Ω
Terminated:	110 Ω

✍ *Pods automatically return to the Bridged state when power is turned OFF.*

Pin Outs	25 Pin Female D-sub	Corresponding 34-Pin M Series V.35 Connector
7	Ground	B
1	Shield	A
2	Send Data - A	P
13	Send Data - B	S
3	Receive Data - A	R
16	Receive Data - B	T
15	Send Timing - A	Y
14	Send Timing - B	AA
17	Receive Timing - A	V
12	Receive Timing - B	X
4	Request To Send	C
5	Ready For Sending	D
6	Data Set Ready	E
8	Receive Line Signal Detect	F
20	Data Terminal Ready	H

RS-449 POD

The following figure displays the RS-449 pod.

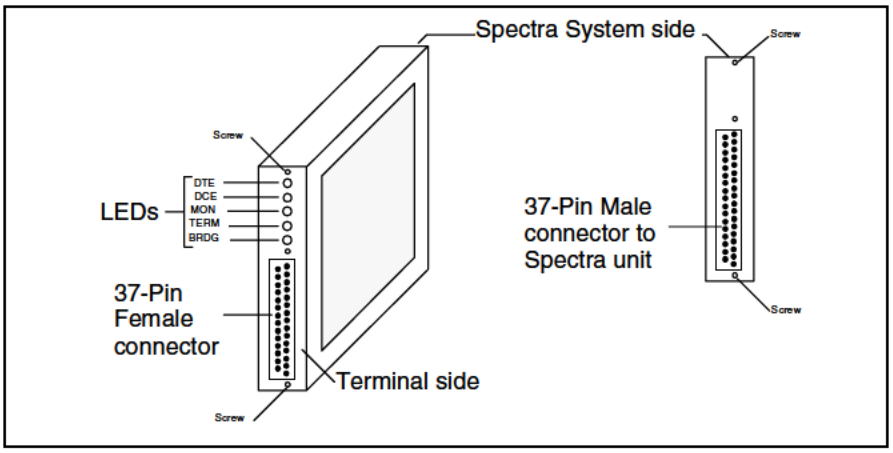


Figure 2.24 - RS-449 Pod

DTE LED or DCE LED
These LEDs represent the current mode of operation for the Spectra system link. Only one of these LEDs is ON at any given time. The DTE or DCE option can be assigned in the Spectra system program in the Level 1 Parameters screen (see **Table 2.3** on page 53). For more information about assigning this option, see **Chapter 6** of this guide

The DTE LED or DCE LED indicates the direction of data flow in the following manner:

DTE	SD - Output, RD - Input, ST - Input, RT - Input
DCE	SD - Input, RD - Output, ST - Output, RT - Output

MON LED
When the MON LED is ON, the link is running under Monitor mode. For more information about assigning the Monitor mode option, refer to **Chapter 6** of the ***Spectra Features and Functions Guide***.

The MON LED indicates the direction of data flow in the following manner:

MON	SD - Input, RD - Input, ST - Input, RT - Input

BRDG LED or TERM LED

These LEDs indicate the electrical termination of the receive inputs on the terminal side. Only one of these LEDs is ON at any given time. The Bridged option or Terminated option is assigned in the Spectra system program in the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

The Bridged option or Terminated option assigns the following impedance to the RS-499 pod:

Bridged:	> 2K Ω
Terminated:	120 Ω

Pods automatically return to the Bridged state when power is turned OFF.

Pin Outs	37 Pin Female D-sub
19	Ground
37	Ground
1	Shield
4	Send Data - A
22	Send Data - B
6	Receive Data - A
24	Receive Data - B
5	Send Timing - A
23	Send Timing - B
8	Receive Timing - A
26	Receive Timing - B
7	Request To Send - A
25	Request To Send - B
9	Clear To Send - A
27	Clear To Send - B
11	Data Mode - A
29	Data Mode - B
12	Terminal Ready - A
30	Terminal Ready - B
13	Receiver Ready - A
31	Receiver Ready - B

RS-232 POD

The following figure displays the RS-232 pod.

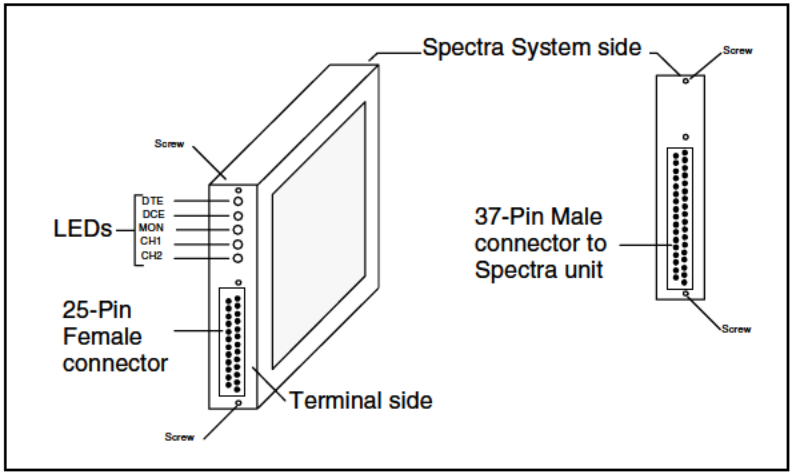


Figure 2.25 - RS-232 Pod

DTE LED or DCE LED
These LEDs represent the current mode of operation for the Spectra system link. Only one of these LEDs is ON at any given time. The DTE or DCE option can be assigned in the Spectra system program in the Level 1 Parameters screen (see **Table 2.3** on page 53). For more information about assigning this option, see **Chapter 6** of this guide.

The DTE LED or DCE LED indicates the direction of data flow in the following manner:

DTE	SD - Output, RD - Input, ST - Input, RT - Input
DCE	SD - Input, RD - Output, ST - Output, RT - Output

MON LED
When the MON LED is ON, the link is running under Monitor mode. The Monitor mode option is assigned in the Spectra system program using the F1 Setup function. For more information about assigning the Monitor mode option, refer to **Chapter 6** of the ***Spectra Features and Functions Guide***.

The LED indicates the direction of data flow in the following manner:

MON	SD - Input, RD - Input, ST - Input, RT - Input

CH1 and CH2 LEDs
These LEDs indicate that the respective channels are enabled.

Pin Outs	25 Pin Female D-sub
7	Ground
1	Shield
2	Transmit Data Ch 1
3	Receive Data Ch 1
15	Transmit Clock (DCE source) Ch 1
17	Receive Clock (DCE source) Ch 1
24	Transmit Clock (DTE source) Ch 1
4	Request To Send Ch 1
5	Clear To Send Ch 1
6	Data Set Ready Ch 1
8	Carrier Detect Ch 1
20	Data Terminal Ready Ch 1
14	Transmit Data Ch 2
16	Receive Data Ch 2
9	Transmit Clock (DCE source) Ch 2
10	Receive Clock (DCE source) Ch 2
23	Transmit Clock (DTE source) Ch 2
19	Request To Send Ch 2
13	Clear To Send Ch 2
11	Data Set Ready Ch 2
12	Carrier Detect Ch 2
18	Data Terminal Ready Ch 2

✍ *No Channel 2 pin outs are used in Spectra system.*

ISDN S/T V2 POD (BRI S/T)

The following figure displays the ISDN S/T V2 pod (BRI S/T).

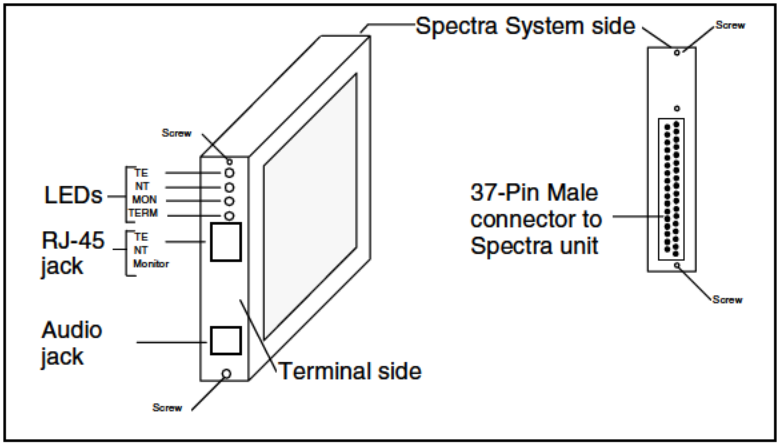


Figure 2.26 - ISDN S/T V2 Pod

TE, NT, and MON LEDs
These LEDs indicate the operating mode of the ISDN S/T pod, as configured in the software. Only one of these LEDs should be ON at any given time.

TE LED ON
This LED indicates the TE emulation mode for connection to NT1 device or to ISDN switch is ON.

NT LED ON
This LED indicates the NT emulation mode for connection to ISDN terminal device (that is, phone) is ON.

MON LED ON
This LED indicates the Monitor mode for receipt of traffic from both switch and terminal is ON.

TERM LED
This LED indicates the electrical termination of the receive and transmit lines on the terminal side. This option can be assigned in the Spectra system program in the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

TERM LED On
This LED indicates transmit and receive lines are terminated with 100 Ω.

TERM LED Off
This LED indicates the line is not terminated.

RJ-45 Jack
The RJ-45 Jack pin definitions vary according to mode. These are described in the following paragraphs.

TE Emulation
This connection is for TE emulation. Connect with standard RJ-45 line cord to NT1 device or other S/T NT port.

Pin	Definitions
1	Not used
2	Not used
3	Transmit +
4	Receive +
5	Receive -
6	Transmit -
7	Not Used
8	Not Used

NT Emulation
This connection is for NT emulation. Connect with standard RJ-45 line cord to TE device(s). A TE is allowed to draw up to 1 W of power from the internal power source.

Pin	Definitions
1	Not used
2	Not used
3	Receive + (and + Power Source)
4	Transmit + (and - Power Source)
5	Transmit - (and - Power Source)
6	Receive - (and + Power Source)
7	Power Source +
8	Power Source -

Monitor
This connection is for the monitoring of an ISDN S/T link. Connect to a line using a Y-cable or splitter.

Pin	Definitions
1	Not used
2	Not used
3	Receive + from TE
4	Receive + from NT
5	Receive - from NT
6	Receive - from TE
7	Not Used
8	Not Used

Cable Suppression Ferrite

The Cable Suppression Ferrite is needed to meet ElectroMagnetic Interference (EMI) specifications in some countries. To use the Cable Suppression Ferrite, clamp it around the RJ-45 cable that you connect to the ISDN S/T V2 pod. Place the Cable Suppression Ferrite on RJ-45 cable less than 3 inches (approximately 8 centimeters) from the connector.

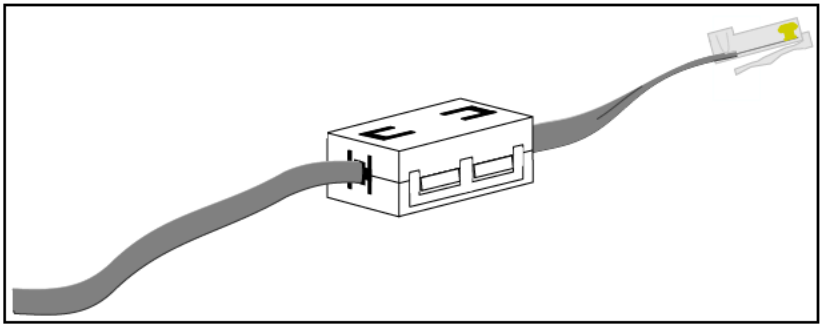


Figure 2.27 - Cable Suppression Ferrite

DC Power

The DC power is used for powering in NT Emulation mode only. No separate connector is needed. The TE draws power through the RJ-45 connector.

Audio Jack

The audio jack is a 4-pin modular jack used for audio interface.

Pin	Definitions
1	Microphone (-)
2	Speaker
3	Speaker
4	Microphone (+)

Audio (Optional)
An optional handset can be used for audio communication through the ISDN S/T pod.

J1 POD

The following figure displays the J1 pod.

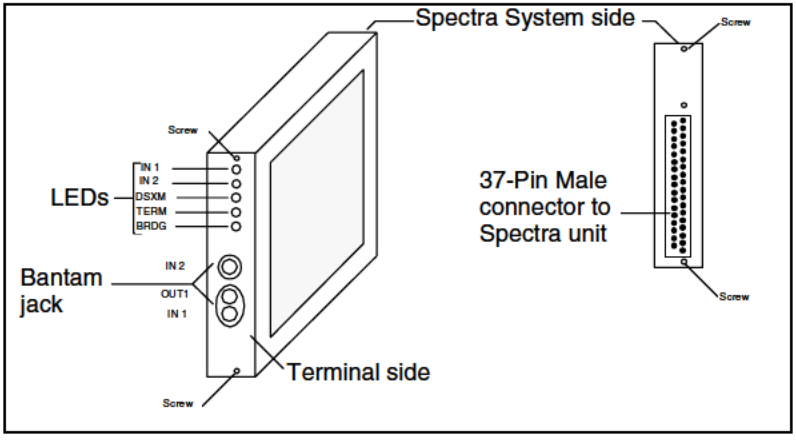


Figure 2.28 - J1 Pod

IN1 and IN2 LEDs
These LEDs represent the signal status of inputs 1 and 2. IN1 represents the signal received through the IN1 bantam jack, and IN2 represents the signal received through the IN2 bantam jack. These indicators are only valid when the Spectra system program is running.

LEDs OFF
No signal is detected at the input.

LEDs Blinking
The input signal is detected, but frame synchronization is not found.

LEDs ON
The input signal is present and frame synchronization is established.

DSXM LED
This LED indicates gain circuitry has been activated on the inputs to accommodate for signal loss through DSX protected monitoring ports. This should be ON in conjunction with the Term LED when the DSX mon termination is selected in the Level 1 Parameter setup. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

BRDG LED or TERM LED
These LEDs indicate the electrical termination of the receive inputs on the terminal side. Only one of these LEDs is ON at any given time. The Bridged option or Terminated option is assigned in the Spectra system program in the Level 1 Parameters screen. For more information, refer to the "Level 1 Parameters Screen" on page 118 of this guide.

The Bridged option or Terminated option assigns the following impedance to the J1 pod:

Bridged:	> 2K Ω
Terminated:	110 Ω

IN1, OUT1, and IN2 Jacks
These jacks allows connections for transmit and receive signals.

IN2	Send data input (second receive channel in Monitor mode)
OUT1	Send data output (transmit channel in Emulation modes)
IN1	Receive data input (receive channel in Emulation mode and first Rx channel in Monitor modes)

IN1 and OUT1 are internally looped back when a BNC cable is not connected.

Internal and transmit timing is derived from the IN1 received signal when loop timing is selected (in Level 1 Parameters screen). To provide correct internal timing when monitoring only one channel, it must be connected to the IN1 jack.

3 Software Installation and Upgrades

OVERVIEW

This chapter includes Spectra Installation program specifications, procedures for accessing the Spectra Installation program and installing the Spectra system software, the minimum installation requirements for a complete Spectra system upgrade, and an outline of the Spectra system custom installation file structure. This chapter also includes procedures and information related to upgrading and maintaining Spectra system software, such as setting product configuration, warranty and support services agreements, and processing of customers' software requests.

SPECTRA INSTALLATION SPECIFICATIONS

The Spectra Installation program is designed to install the Spectra system software. The Spectra Installation program resides on the first of six floppy disks, which contain the Spectra Installation program and the Spectra system software files. The Spectra Installation program disks contain all necessary files for updating and/or installing the Spectra system software.

The following section details the Spectra Installation program specifications that you should be aware of when installing a version of the Spectra system software. Specifically, this section discusses the installation files residing on each of the Spectra Installation program disks, the path of installed files, and files you may not wish to overwrite when updating existing Spectra system software.

SPECTRA INSTALLATION PROGRAM DISKS CONTENTS

There are six Spectra Installation program disks, each containing various compressed Spectra system software files. The Spectra Installation program's `INSTALL.EXE` application resides on Disk 1. During the installation process, you will be prompted to insert each specific disk, so it is not required that you know which files reside on a given disk in order to complete the installation process.

INSTALLATION PATH

All Spectra system software files are installed in the `C:\SPECTRA` directory on your Spectra unit. Any existing Spectra software files in this directory will be overwritten during the installation process unless they are renamed or moved to another directory. If no such directory exists on your Spectra unit, the Spectra Installation program will create this directory and its related subdirectories for the installation of the Spectra system software files. The path information is established by the Spectra Installation program and cannot be modified.

UPGRADING SOFTWARE AND OVERWRITING FILES

If you are updating an existing version of the Spectra system software, it is important to note which files you may not wish to overwrite before beginning the installation of the Spectra system software. The majority of the Spectra system software files should be overwritten in order to update your system software; however, a file cannot be recalled in its original format once it is overwritten. If you use the custom installation option of the Spectra Installation program, you can specifically select which group of files you wish to overwrite.

During installation, the Spectra Installation program creates back-ups of the following files if they are present on your Spectra unit: `CONFIG.SYS` and `AUTOEXEC.BAT`. These files are backed up with a different extension as the new files are installed on your Spectra unit. Typically, there are three additional files that you may wish to retain in their original format: the `SCRIPT.SEA` file (used for remote access), the `CONFIG.SEA` file (used for remote access), and the `TEMPLATE.SS7` file (contains the decode template for all decode functions of the Spectra system). These files are discussed in detail in the following paragraphs.

✍ *You may also wish to back up any customized test scrips or signal units prior to upgrading the Spectra system software.*

AUTOEXEC.BAT
The Spectra Installation program installs an `AUTOEXEC.BAT` file containing a line that automatically launches the Spectra system during start-up. If you have an existing `AUTOEXEC.BAT` file on your Spectra unit, the program creates a back-up of the file, renaming the existing `AUTOEXEC.BAT` file as `AUTOEXEC.BAK`. If you wish to use the old file with the installed Spectra system software, you must rename the back-up file with its original extension and reboot your Spectra unit. (For example, rename the new `AUTOEXEC.BAT` file as `AUTOEXEC.NEW` and rename `AUTOEXEC.BAK` as `AUTOEXEC.BAT` before rebooting your Spectra unit.)

CONFIG.SYS
The Spectra Installation program installs a `CONFIG.SYS` file containing the correct file and buffer settings, as well as a line with the Y2K real-time clock fix, so that settings are not lost while upgrading. If you have an existing `CONFIG.SYS` file on your Spectra unit, the program creates a back-up of the file, renaming the existing `CONFIG.SYS` file as `CONFIG.BAK`. If you wish to use the old file with the installed Spectra system software, you must rename the back-up file with its original extension and reboot your Spectra unit.

CONFIG.SEA
During the installation process, the Spectra Installation program will prompt you to decide whether or not you wish to overwrite an existing `CONFIG.SEA` file. The `CONFIG.SEA` file contains the board number assigned to each SEA board and its ethernet address. If you wish to retain the original `CONFIG.SEA` file, press the N key when prompted during installation. If you are upgrading an existing version of the Spectra system, you will typically want to retain your existing `CONFIG.SEA` file.

SCRIPT.SEA
During the installation process, the Spectra Installation program will prompt you to decide whether or not you wish to overwrite an existing `SCRIPT.SEA` file. If the Spectra system is accessed by a Spectra unit that is not on the LAN, then it is necessary to specify a gateway through which the Spectra system can be reached. The `SCRIPT.SEA` file contains the information which specifies this gateway. You may therefore wish to retain your existing `SCRIPT.SEA` file. If you wish to retain the original `SCRIPT.SEA` file, press the N key when prompted during installation. If you are upgrading an existing version of the Spectra system, you will typically want to retain your existing `SCRIPT.SEA` file.

✍ *If you overwrite the existing `SCRIPT.SEA` file, you may also edit the new file from the F8 DOS Commands function to include the proper IP address after installation is complete.*

TEMPLATE.SS7
The Spectra system always retrieves the decode information from the `TEMPLATE.SS7` file. Therefore, the version of the decode template used must be named `TEMPLATE.SS7`. If a new `TEMPLATE.SS7` is to be installed, rename the current `TEMPLATE.SS7` file (for example, change the name to `TEMPLATE.OLD`) before installing the new file to the `C:\SPECTRA\DECODE` directory. This prevents overwriting of the previous version of the decode template.

✍ *If you have ordered several decode templates, only the `TEMPLATE.SS7` file included on the Spectra Installation Program disks will be installed with the Spectra Installation program. Additional decode templates are contained on separate disks that can be installed individually by typing `A:\Install` from a DOS prompt.*

If there are any additional Spectra system software files that you wish to retain in their previous version, rename the current file before beginning the installation process.

ACCESSING THE SPECTRA INSTALLATION PROGRAM

In order to access the Spectra Installation program, complete the following steps.

Step	Action
1.	Insert Disk 1of the Spectra Installation program disks into your drive A and reboot your Spectra unit. The Spectra Installation program will start automatically. When the Spectra Installation program is initially accessed, the Spectra Installation program main screen is displayed (see **Figure 3.1**).

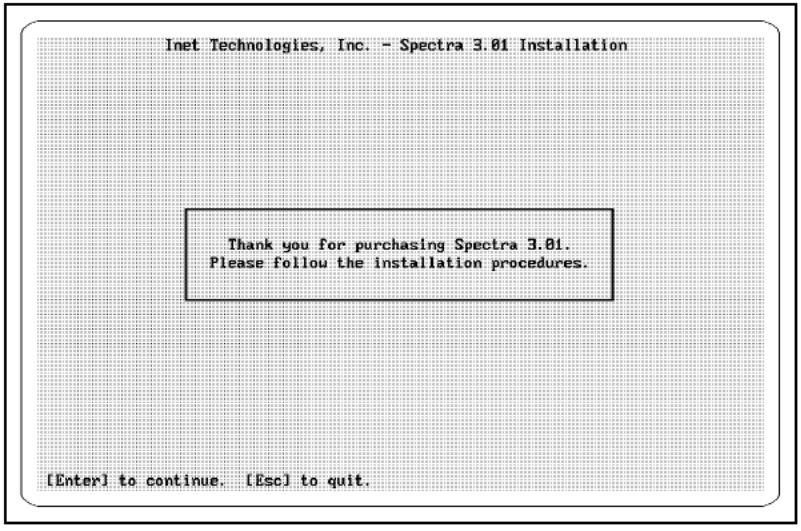


Figure 3.1 - Spectra Installation Program Main Screen

2. From the Spectra Installation program main screen, press the **Enter** (↵) key to access the Installation Options screen (see **Figure 3.2**).

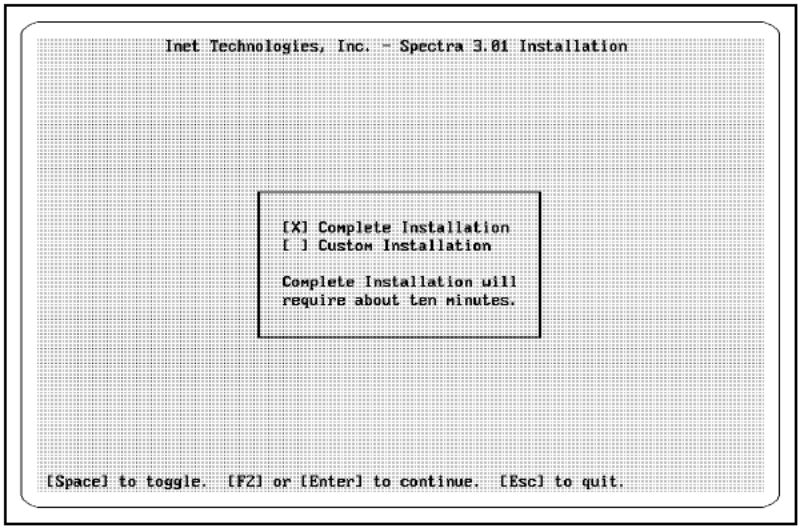


Figure 3.2 - Installation Options Screen

The Installation Options screen allows you to choose between complete installation or custom installation of the Spectra system software. For information about complete installation, refer to "Installing Complete Spectra System Software" on page 71 of this guide. For information about custom installation, refer to "Installing Custom Spectra System Software" on page 73 of this guide.

INSTALLING COMPLETE SPECTRA SYSTEM SOFTWARE

Perform the following steps to install the complete Spectra system software on your Spectra unit. (For information about accessing the Spectra Installation program, refer to "Accessing the Spectra Installation Program" on page 69 of this guide.)

Step	Action

1. When the Spectra Installation Options screen is initially accessed, its default selection is complete installation (see **Figure 3.3**).

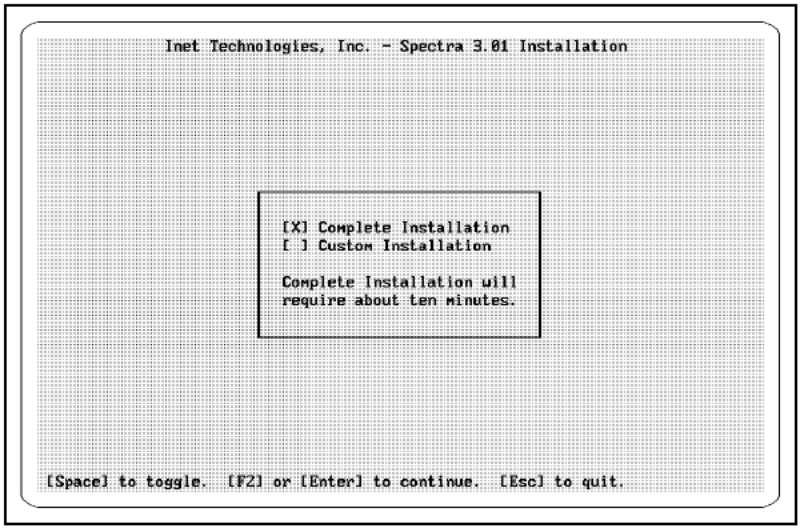


Figure 3.3 - Spectra Installation Options Screen

2. Press the **F2** key or the **Enter** (↵) key to begin complete installation. (If you do not have a `C:\SPECTRA` directory on your Spectra unit, the Spectra Installation program will create the directory.)

✍ *Press the Esc key at any time to quit the installation program.*

3. When prompted, insert each disk of the Spectra Installation program in succession, from 2 through 6, and press the **F2** key or the **Enter** (↵) key

to continue the installation for each disk. An example of the Disk Prompt dialog box is provided in **Figure 3.4**.

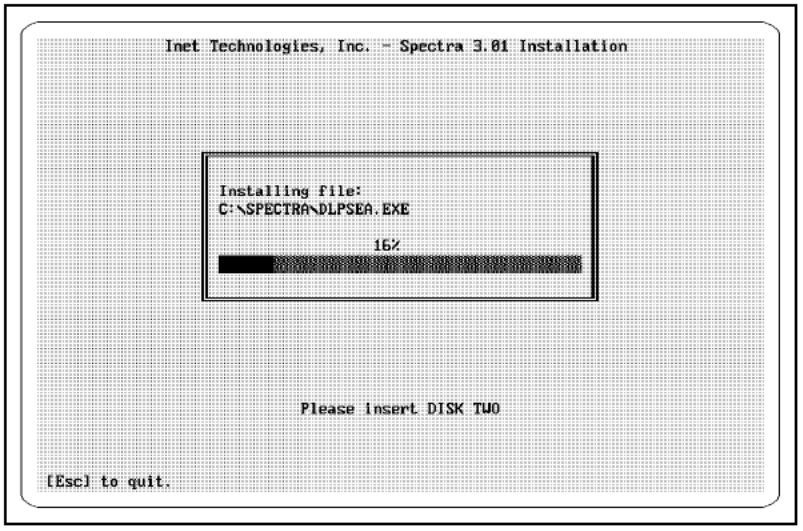


Figure 3.4 - Disk Prompt Dialog Box

4. After the installation is complete, the Spectra Installation program will prompt you to reboot your Spectra unit. Remove any disks from drive A and press the **Enter** (↵) key and then the **Y** key to reboot. After rebooting, the Spectra system will automatically start.

✍ *You may encounter errors if you do not reboot your Spectra unit when prompted by the Spectra Installation program. It is therefore recommended that you reboot your Spectra unit when prompted by the Spectra Installation program.*

For information about retaining existing Spectra software files, see "Upgrading Software and Overwriting Files" on page 67 of this guide.

INSTALLING CUSTOM SPECTRA SYSTEM SOFTWARE

The custom Spectra Installation option is intended primarily for upgrading existing Spectra system software files. The following procedure contains information about the minimum custom installation requirements for a Spectra system upgrade.Perform the following steps to install custom Spectra system software on your Spectra unit. (For information about accessing the Spectra Installation program, refer to "Accessing the Spectra Installation Program" on page 69 of this guide.)

Step	Action

1. When the Spectra Installation Options screen is initially accessed, its default selection is Complete Installation (see **Figure 3.5**).

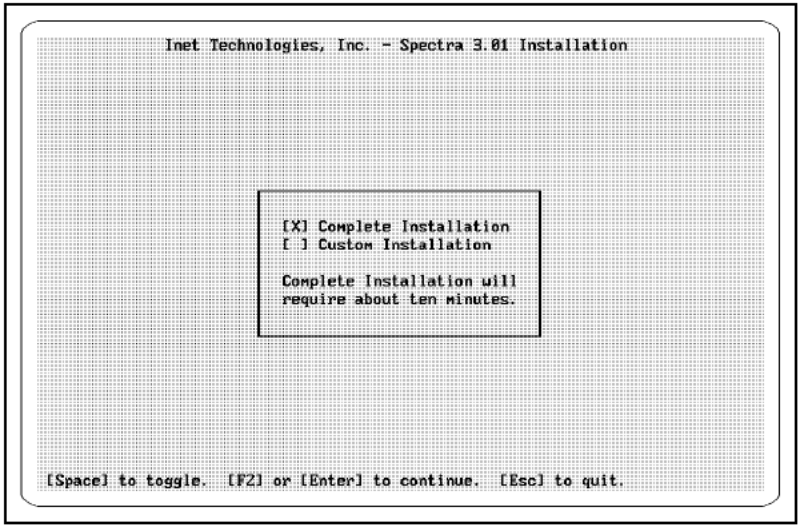


Figure 3.5 - Spectra Installation Options Screen

2. Press the ↓ key to move the cursor to the **Custom Installation** option and press the **Spacebar** to select this option. Press the **F2** key or the **Enter** (↵) key to access the Custom Installation Options screen (see **Figure 3.6**).

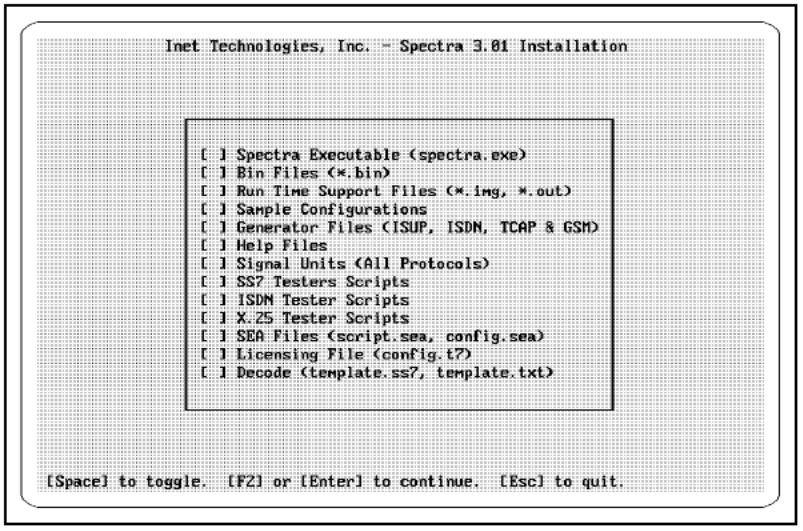


Figure 3.6 - Custom Installation Options Screen

The definitions and specifications of each Spectra custom installation option are provided in "Spectra Custom Installation File Structure" on page 76 of this guide.

3. Press the ↑↓ keys to select the option you wish to install, then press the **Spacebar** to select the option (an "X" will appear next to the selected option). Repeat this step to select any combination of the 13 available options.

4. This step is optional. If you wish to select only the custom installation options necessary for a complete Spectra system upgrade, use the ↑↓ keys to select **Bin Files**, **Run Time Support Files**, and **Spectra Executable**.

   If you wish to ensure that you have the most recent decode, use the ↑↓ keys to select **Decode**; if you have changed or added any Spectra options, use the ↑↓ keys to select **Licensing File** as well.

✍ *If you have ordered several decode templates, only the* `TEMPLATE.SS7` *file included on the Spectra Installation Program disks will be installed with the Spectra Installation program. Additional decode templates are contained on separate disks that can be installed individually by typing* `A:\Install` *from a DOS prompt.*

5. When you have selected the option(s) you wish to install, press the **F2** key or the **Enter** (↵) key to begin custom installation.

✍ *Press the Esc key at any time to quit the installation program.*

6. When prompted, insert the appropriate disk of the Spectra Installation program, and press the **F2** key or the **Enter** (↵) key to continue the custom installation for each disk. An example of the Disk Prompt dialog box is provided in **Figure 3.7**.

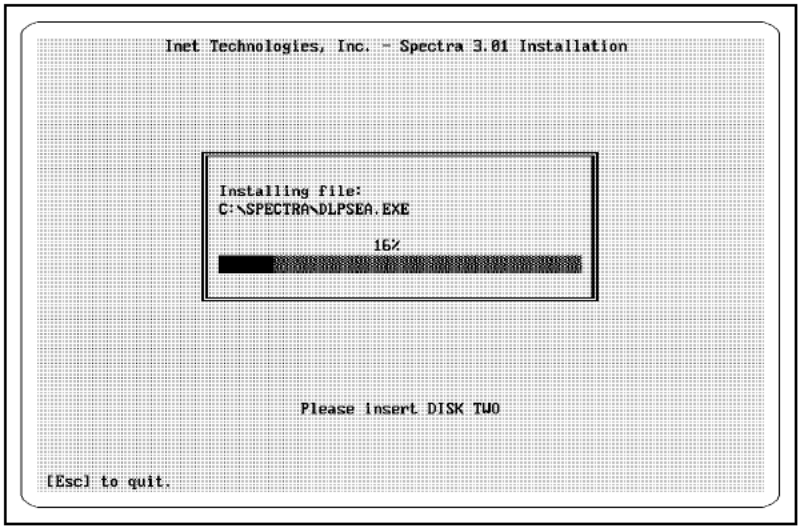


Figure 3.7 - Disk Prompt Dialog Box

7. After the installation is complete, the Spectra Installation program will prompt you to reboot your Spectra unit. Remove any disks from drive A and press the **Enter** (↵) key and then the **Y** key to reboot. After rebooting, the Spectra system will automatically start.

✍ *You may encounter errors if you do not reboot your Spectra unit when prompted by the Spectra Installation program. It is therefore recommended that you reboot your Spectra unit when prompted by the Spectra Installation program.*

For information about retaining existing Spectra software files, see "Upgrading Software and Overwriting Files" on page 67 of this guide.

SPECTRA CUSTOM INSTALLATION FILE STRUCTURE

The following section details the files installed by each of the Spectra Installation program's custom installation options. All of the Spectra custom installation options install files and create subdirectories (if necessary) in the C:\SPECTRA directory on your Spectra unit.

Bin Files
This option installs the main .BIN files, such as the T7.BIN files, into the C:\SPECTRA\BIN subdirectory.

Run Time Support Files
This option installs the CONFIG.SEA file and the .IMG and .OUT files into the C:\SPECTRA\BIN subdirectory. For more information on the installation of the CONFIG.SEA file, refer to "Upgrading Software and Overwriting Files" on page 67 of this guide.

Sample Configurations
This option installs the sample configuration files and creates the following folders in the C:\SPECTRA\CONFIG subdirectory: CONFIGA, CONFIGB, CONFIGC, CONFIGD, FIG_V5_1, FIG_V5_2, TGTDS1, and TGTE1.

Spectra Executable
This option installs the Spectra executable file (SPECTRA.EXE) in the C:\SPECTRA\BIN subdirectory.

Generators Files
This option installs the support files for the ISUP/TUP, ISDN, TCAP, and GSM generators, such as the .SCR, .NUM, .MSR, .BSR, .TMD, and .LMD files (scripts, models, and number databases). This option creates the following folders in the C:\SPECTRA\GENERATE subdirectory: ISUP, ISDN, TUP, TCAP, and GSM.

Help Files
This option installs the Spectra system help files with a numerical extension (for example, HELP.001). This option creates the following folders in the C:\SPECTRA\HELP subdirectory: COMMON, ISDN, SS7, and X25.

Signal Units
This option installs the signal unit files for all the supported Spectra protocols. This option creates the following folders in the C:\SPECTRA\PROTOCOL subdirectory: ABIS, ANSI, ASCII, BTNR, C7_BLUE, C7_RED, C7_WHITE, CCITT, CHINA, DASS, DPNSS, ETSI, IS41, JAPAN7, USER, V5_1, and V5_2.

SS7 Testers Scripts
This option installs the support files (scripts) for the SS7 Testers in the `C:\SPECTRA\SS7` subdirectory.

✍ *This option also creates a TGT folder containing support files for the ISUP/TUP Testers in the `C:\SPECTRA\SS7` directory if you have purchased the Spectra Trunk Tester.*

ISDN Tester Scripts
This option installs the support files (scripts) for the ISDN Tester, such as the `.EMU`, `.SDL`, and `.WRA` files, in the `C:\SPECTRA\ISDN` subdirectory.

✍ *This option also creates a TGT folder containing support files for the ISDN Tester in the `C:\SPECTRA\ISDN` directory if you have purchased the Spectra Trunk Tester with the ISDN protocol option.*

X25 Tester Scripts
This option installs the support files (scripts) for the X.25 Tester, such as `.EMU` and `.WRA`, in the `C:\SPECTRA\X25` subdirectory.

SEA Files
This option installs the `SCRIPT.SEA` file in the `C:\SPECTRA\BIN` subdirectory. For more information on the installation of the `SCRIPT.SEA` file, refer to "Upgrading Software and Overwriting Files" on page 67 of this guide.

Licensing File
This option installs the `CONFIG.T7` file in the `C:\SPECTRA\BIN` subdirectory.

Decode
This option installs the `TEMPLATE.SS7` file and the `TEMPLATE.TXT` file in the `C:\SPECTRA\DECODE` subdirectory. For more information on the installation of the `TEMPLATE.SS7` file, refer to "Upgrading Software and Overwriting Files" on page 67 of this guide.

SETTING PRODUCT CONFIGURATION

If you have recently added options (such as a generator or the Spectra Trunk Tester) to your Spectra system software, the newest options will be listed in the Configure Products screen. However, in order to be able to access these new features, you may need to make sure the option is toggled to Y (ON) in the Configure Products screen, then save and apply the configuration. The following section details the process of accessing and setting product configuration on the Spectra system.

The Password Setup screen allows the System Administrator to restrict the functionality of the entire Spectra system to specific configurations and/or modes. For example, if the System Administrator wants to limit the Spectra system to usage on an SS7 network, all ISDN and X.25 configuration options could be turned OFF in the Configure Products screen. This feature allows the System Administrator to restrict all users of the system to specific functionality. Product configurations set up by the System Administrator can be saved and recalled for later use.

Follow these steps to access the Configure Products screen.

Step	Action
1.	Access the F1 Setup menu, highlight the **Password Setup** option, and press the **Enter** (↵) key. The Enter Authorized Password dialog box is displayed (see **Figure 3.8**).

```
Enter Authorized Password For Entry: **********
```

Figure 3.8 - Enter Authorized Password Dialog Box

2.	Enter the System Administrator's password, and press the **Enter** (↵) key. If the System Administrator needs more information about this password, contact the Inet Customer Support Services department.

✍ *The Password entries are case sensitive. Be sure to enter the password letters in the proper case format.*

The Password Setup screen appears.

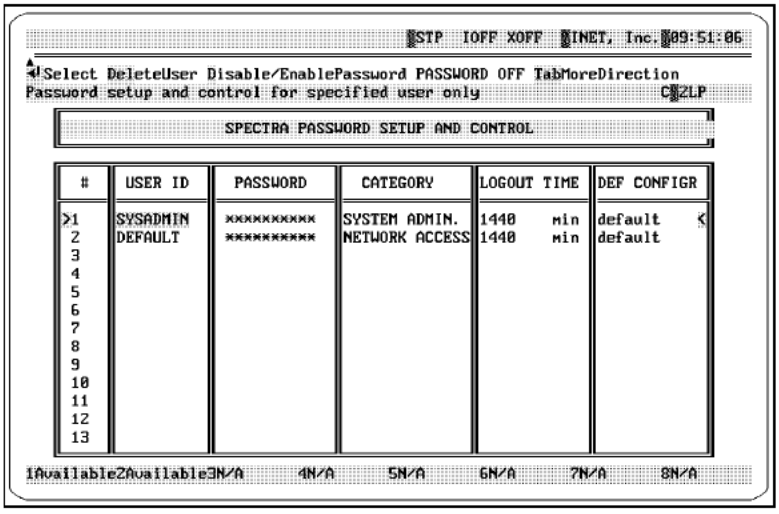


Figure 3.9 - Password Setup Screen

For more information on the Password Setup screen, see "Password Setup Screen Definitions" on page 93 of this guide.

3. From the Password Setup screen, press the **C** key to access the Configure Products screen. This screen is pictured in **Figure 3.10**.

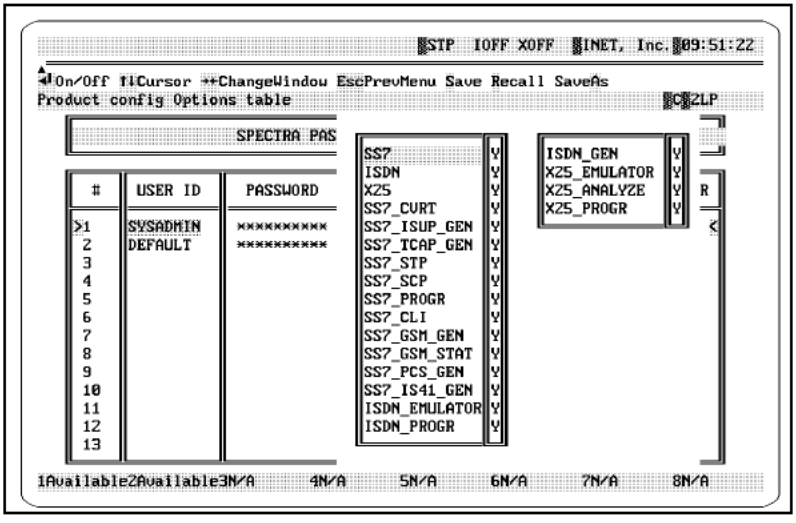


Figure 3.10 - Configure Products Screen

Each available configuration option appears in the Configure Products screen.

EDITING PRODUCT CONFIGURATION OPTIONS

Follow these steps to edit the available Spectra system configuration options.

Step	Action
1.	From the Configure Products screen, press the **R** key to recall the product configuration you want to edit.
2.	Use the ↑↓ keys to highlight the configuration you want to recall, and press the **Enter (↵)** key.
3.	Use the ↑↓ keys to highlight the option you want to modify, and press the **Enter (↵)** key to toggle the option between Y (ON) and N (OFF).

✍ *If an option is set to N (OFF), that option does not run. If an option is set to Y (ON), that option does run. However, modifications do not take effect until the Spectra system has been rebooted.*

4.	Repeat **Step 3** for each option in the configuration you want to modify.
5.	Press the **S** key to save the modified product configuration as the current configuration file name. The Save option overwrites the previous configuration (default configuration is `UCFG.INI`).

✍ *The easiest way to restore your original product configuration is to repeat this procedure setting all configuration options to Y. However, you can also use the Save As feature to store multiple product configurations for later recall. You can recall product configuration files using the Recall feature.*

6.	Enter a file name of up to eight characters, and press the **Enter (↵)** key. The file is saved with an `.INI` extension.
7.	You must reboot your computer before the new configuration takes effect.

✍ *To run a product configuration other than the default (`UCFG.INI`), exit to DOS, change directories to the directory from which you normally launch the Spectra system, and type `SPECTRA -F xxxxxxxx` where `xxxxxxxx` is the name of the product configuration file (`xxxxxxxx.INI`) you want to run.*

For example, if you used the Save As feature to save a product configuration as `SS7ONLY.INI`*, you would type* `SPECTRA -F SS7ONLY`*.*

YEAR 2000 COMPLIANCE TESTING AND CORRECTION UPGRADES

The Spectra system software is Y2K compliant beginning with software version 1.08. However, in some cases, the Spectra system software is run on personal computer (PC) platforms that contain real-time clocks (RTCs), or Basic Input/Output Systems (BIOS) that are not compliant. As a result, Spectra systems may not be fully Y2K compliant due to the PC hardware. In order to detect and correct any Y2K compliance problems of this nature, Inet has two pieces of software available, a BIOS upgrade and a Y2K Test and Fix program. It may be necessary to run both of these applications to make the Spectra system platform completely Y2K compliant. Both of these software applications are available on diskette from your Inet Sales representative or the Inet Customer Support Services department. Procedures for installing and using these software applications are discussed in the following sections. For more information on Inet's Y2K Compliance statement, refer to **Appendix A** of the ***Spectra Features and Functions Guide***.

✍ *A software patch for DOS may be required on Spectra units using a 486 processor in order to make the unit Year 2000 compliant. Spectra units using the Pentium processor should not need the patch.*

YEAR 2000 BIOS UPGRADE FOR TEXAS MICROSYSTEM D486

The BIOS of personal computers contains the buffers for sending information from an application to the actual hardware device that is the information's proper destination. Since the Spectra system operates on a personal computer platform, Y2K upgrades for the BIOS may be necessary.

BIOS 2.4B, dated 2/26/99, contains necessary improvements that will enable the system to operate reliably beyond the year 2000. Any non-compliance is corrected by the y2000_rtc patch available from Inet. If you already have this patch, it does not need to be reinstalled to upgrade the BIOS. For more information about acquiring this patch, contact your Inet Sales representative.



Since this Y2K BIOS upgrade is specific to one motherboard, the Texas Microsystems D486, it is strongly recommended that you be certain that your PC is using the Texas Microsystems D486 motherboard before attempting this upgrade. Every motherboard has a different method of accomplishing this upgrade, and an inappropriate procedure can cause significant damage to your motherboard. For more information on performing the BIOS upgrade and evaluating your need for the upgrade, please contact the Inet Customer Support Services department or your Inet Sales representative.

YEAR 2000 TEST AND FIX SOFTWARE

The Spectra system software is Y2K compliant beginning with software version 1.08; it is highly unlikely that any Y2K issues will be encountered on your Spectra system hardware. The following procedures are included in light of the remote chance that Y2K issues are still a concern on your platform.

In order to correct any Y2K problems and provide a Spectra product that is Y2K compliant, Inet provides the Y2K Test and Fix software on diskette, which is available through your Inet Sales representative or the Inet Customer Support Services department. The Y2K Test and Fix application allows you to quickly and efficiently test the Spectra system platform to determine whether or not it is Y2K compliant. The Y2K Fix portion of the application will make a PC failing the Y2K Test Y2K compliant. This is a small program that is loaded whenever the Spectra system is powered on, automatically and transparently correcting the Y2K problem. Perform the following procedures to test and fix Y2K problems on the Spectra system platform.

Y2K Compliance Testing

Perform the following steps to test the Spectra system platform for Y2K compliance.

Step	Action
1.	Determine whether the Spectra system unit has a Texas Microsystems CPU. With the Spectra system software running, press the **F1** key and select **Exit to DOS** from the F1 Options menu. Reboot the unit by pressing the **Control**, **Alt**, and **Delete** keys simultaneously, or by pressing the **Reset** key. If you have a Texas Microsystems CPU, `Texas Microsystems, Inc.` will be displayed at the top of the screen. This information is necessary to properly complete the Y2K compliance testing.
2.	Insert the diskette containing the Y2K Test and Fix application into the floppy drive of the Spectra system. If the Spectra system software is running, you will need to terminate the program and exit to the DOS operating system, as described in **Step 1**.
3.	At the DOS prompt `C:>`, enter **A:**, then enter **Y2000**. The Y2K Test will run and present you with a keyboard-driven interface to test the PC-based platform. The program will automatically install the necessary files on the hard drive of the Spectra system during testing.
4.	Enter **T** to begin the testing of the platform. The following message is displayed: `Please Note: this software is for SINGLE PC use. Corporates please call your supplier for volume license details.` This message means that each diskette can be used on only one PC. If you have multiple units with the Spectra system software, you will need a separate diskette for each unit. Press any key to clear this message and begin testing. The Y2K Test program performs four tests. The first three tests are listed below. ▪ Test One tests for RTC rollover from 1/31/99 to 1/1/2000 while the PC is running. ▪ Test Two tests for correct leap year dates in the year 2000 (rollover from 2/28/200 to 2/29/2000).

- Test Three tests for correct non-leap year dates in the year 2001 (rollover from 2/28/2001 to 3/1/2001).

After these three tests are completed, the following message is displayed:

```
Please remove all floppies, then press a key.
```

5. Remove the diskette from drive A and press any key. The software modifies the `AUTOEXEC.BAT` file so that the personal computer will reboot into the Y2K Test and Fix software. The following message is displayed:

```
Now amending Autoexec.bat
Done
Waiting a few seconds before
rebooting.....Please wait......
```

If you have a Texas Microsystems CPU, the software is unable to reboot the unit, and testing cannot continue until you manually reboot the unit. If you do not have a Texas Microsystems CPU, you do not need to take any action; the software will reboot the unit.

6. The computer will boot back into the Y2K Test and Fix program and conduct the fourth test. Test Four tests the RTC rollover from 1/31/99 to 1/1/2000 when the PC is rebooted after the millennium changes.

After the reboot is complete, the following message is displayed:

```
Test complete--use cursors to view log--Escape
when done. Log is also saved in C:\Y2000.LOG.
```

Press any key to clear this message.

7. Use the ↑↓ keys to view the test results log. The log lists the four tests and their results, pass or fail. If a failed result is returned, complete these steps, then refer to "Y2K Correction Installation" on page 85 of this guide. After viewing the log, press the **Escape** key to clear the log from the screen.

8. Exit the Y2K Test and Fix software by typing **E**.

✍ *Do not select F to fix the problems at this point in the process.*

Additional information on the testing application and on Y2K issues are contained in the `README.TXT` and `MANUAL.TXT` files located on the Y2K Test and Fix diskette.

Y2K Correction Installation

Perform the following steps to ensure that the Spectra system is Y2K compliant.

Step	Action
1.	If you have tested the Spectra system platform according to the procedure "Y2K Compliance Testing" on page 83 of this guide and determined that the platform has failed to correctly pass the tests, you must run the Y2K Test and Fix program a second time to correct the problem. Run the program from the `A:` prompt, following the directions in **Step 2** through **Step 3** found in the procedure "Y2K Compliance Testing" on page 83 of this guide.
2.	From the menu, enter **F** to run the Fix portion of the program. The following message is displayed: `This option will analyze the results of the last test and install corrective software if needed--Continue y/n`
3.	Press the **Y** key. The following message is displayed `RTC and BIOS will be millennium compliant from next reboot. Press any key.`
4.	Exit the program by pressing the **E** key. You must reboot the unit before it will pass compliance tests.

The Y2K Test and Fix program makes a change to the `CONFIG.SYS` file during its installation to ensure that the Y2K solution is resident whenever the Spectra system is turned on. Future Spectra system software upgrades will retain this fix, so you will not be required to reinstall your Y2K Test and Fix software in order to ensure continued Y2K compliance. However, if you make other changes to our `CONFIG.SYS` file, you may have to reinstall the software.

TECHNICAL SUPPORT SERVICES

Inet provides technical support services and warranty periods for customers using the Spectra system as a part of any purchase of the system. The following section discusses the various routes for technical support, user requests, and upgrade options.

WARRANTY PERIOD

With a new purchase, you will receive an introductory year of Inet Customer Support Services department services. This introductory coverage begins at product shipment and includes 5 x 8 Inet Customer Support Services department remote support, hardware and software support, advanced replacement of hardware components, and software upgrades as required. For more information about Inet's stated limited warranty, refer to **Appendix H** of this guide.

CUSTOMER SUPPORT SERVICES AGREEMENT

At the conclusion of the warranty period, the Inet Customer Support Services department services are available to you through a Customer Support Services Agreement. As part of the Customer Support Services Agreement, you will select a Service Level Agreement (SLA) that best suits your Inet Customer Support Services department service requirements. Refer to **Table 3.1** for a listing of the SLAs and explanation of the services offered.

Table 3.1 - Spectra Support Service Offerings (SLAs)

Program Offering	Standard Support	Premium Support	Plus Support
Hardware Support			
Hardware Technical	X	X	X
Advanced Parts Replacement		X	X
Software Support			
Software Technical	X	X	X
System Configuration Control	X	X	X
Software Upgrades		X	X
Remote Support			
Availability	5 x 8	5 x 8	7 x 24
Priority Support		X	X
Documentation			
Release Notes	X	X	X
Manual Updates	X	X	X

✍ *The Inet Customer Support Services department will contact you prior to the expiration of your warranty period to explain your continuing coverage options.*

TIME AND MATERIALS

If you decide not to enter into a Customer Support Service Agreement at the conclusion of your Warranty period or you allow your existing Customer Support Service Agreement to expire, Inet Customer Support Services department services are still available to you at the current Time and Materials rate. This non-contract support requires a valid customer purchase order and/or a signed "Authorization to Invoice" form before any Inet Customer Support Services department services are rendered. Please note that Time and Materials support services are also subject to limited Priority Level assignments and extended response/resolution times.

TECHNICAL SUPPORT PROCESSES

If you require assistance from the Inet Customer Support Services department, the following technical support processes are in place to receive, prioritize, track, and facilitate your request in a timely manner.

Receiving and Prioritizing Requests

Initial requests for support services may be submitted by e-mail, by fax, or by telephone. To facilitate the resolution process, your initial request should include the following basic information:

- Customer name
- Contact name
- Contact telephone number
- Contact fax number
- Contact e-mail address
- Product serial number
- Brief description of the problem or support service request

✍ *E-mail requests can be submitted to spectraservice@inet.com. An additional resource for e-mail requests is the Customer Support Online Request Forms on Inet's website.*

Once you have made an initial request for support service, the Inet Customer Support Services department will validate your service coverage and assign a unique number to your request. This number will be communicated to you directly. Request numbers are used to track the progress of your request and document all associated activities throughout the resolution process.

Escalating Requests

If the Inet Customer Support Services department is unable to resolve your issue within a reasonable time, it is escalated within the Inet Customer Support Services department. If your issue cannot be resolved by the Inet Customer Support Services department, it is assigned a System Problem Resolution (SPR) number and escalated to Inet's Product Development and Research and Development Departments. The SPR tracking number remains open until the issue is resolved.

Upgrades

Software upgrades are not automatically distributed to existing customers when they are released. Software upgrades are distributed when requested. If you desire the latest version of a software release and are currently under an appropriate service agreement (all Spectra Support Service options except Standard provide software upgrades) or warranty, contact Inet to request an upgrade. Upgrades may be requested by email or phone.

4 Setting User Information

OVERVIEW

This chapter provides an explanation of how to set user information necessary for operating the Spectra system. The proper configuration of user information necessary for operating the Spectra system includes setting user identification names, user passwords, and user access restrictions, as well as connecting to access-controlled Spectra systems. These options are discussed in the material that follows.

PASSWORD SETUP AND CONTROL

The password feature allows the System Administrator to assign individual user IDs and passwords for system login purposes. The System Administrator can use this screen to restrict individual user access to some functions of the Spectra system by assigning various categories for user priority. Passwords and access restrictions can be enabled/disabled from this screen. The current password status is displayed in the upper-right corner of the Password Setup screen.



If passwords have been disabled, the settings in the Password Setup screen have no effect. Users are no longer required to log in or log out and are allowed full access to all Spectra system functions.

The System Administrator can also limit the Spectra system configuration options and prevent all users from modifying certain parameters and from running certain modes.

Follow these steps to access the Password Setup screen.

Step	Action
1.	Access the F1 Setup menu, highlight the **Password Setup** option, and press the **Enter** (↵) key. The Enter Authorized Password dialog box is displayed (see **Figure 4.1**).

```
Enter Authorized Password For Entry: **********
```

Figure 4.1 - Enter Authorized Password Dialog Box

2.	Enter the System Administrator's password, and press the **Enter** (↵) key. If the System Administrator needs more information about this password, contact Inet at 972-578-6180.

✍ *The Password entries are case sensitive. Be sure to enter the password letters in the proper case format.*

The Password Setup screen appears.

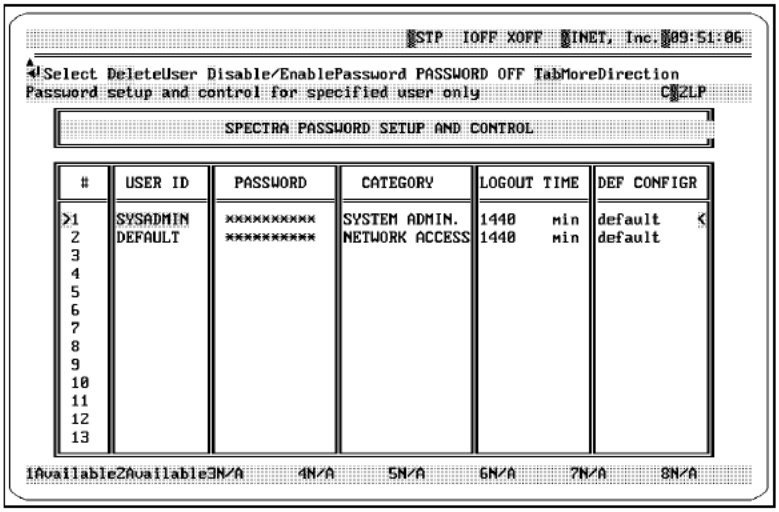


Figure 4.2 - Password Setup Screen

PASSWORD SETUP SCREEN DEFINITIONS

Select
Press the Enter (↵) key to add or edit information in a selected field.

DeleteUser
Press the Delete key to delete the selected user from the Password Setup screen.

Disable/EnablePassword
Press the D key to toggle the Password feature between Enabled (ON) and Disabled (OFF). The current selection is shown in the upper right-hand corner of the Password Setup screen as either Password ON or Password OFF.

Power-up
Press the P key to choose a Spectra system mode that runs when you power up your system. Select the mode and place a checkmark (√) next to it by pressing the Enter (↵) key.

Alt-B Boot
Press the Alt key and the B key to reboot your computer. The following message is displayed: “Are you sure you want to reboot the machine”. Press the Y key for YES. Press the N key for NO.

ConfigureProducts
Press the C key to access the Configure Products screen. The Configure Products screen allows the System Administrator to restrict the functionality of the entire Spectra system to specific configurations and/or modes. Using the Configure Products option is explained in "Setting Product Configuration" on page 78 of this guide.

USERID
This column allows the System Administrator to enter the User Identification Name for a user.

PASSWORD
This column allows the System Administrator to enter the Password for a user.

CATEGORY
This column allows the System Administrator to enter the level of access that a user is allowed. The following access restriction categories are available.

READ ONLY
The user can view screen information and recall current alarms and reports.

Table 4.1 - Read Only Access Category

Options	Access
Set Filters- F1	No
Message Editor- F6	No
Run A Test - F2	No
Apply and Save - F1	No
Set Remote Options - F7	No
Set Report Options - F4	No
Password Setup - F1	No

MONITOR ONLY
In addition to the abilities of the Read Only category, the user is allowed to display messages in expanded format and access the F6 Edit Function.

Table 4.2 - Monitor Only Access Category

Options	Access
Set Filters- F1	No
Message Editor- F6	Yes
Run A Test- F2	No
Apply & Save- F1	No
Set Remote Options- F7	No
Set Report Options- F4	No
Password Setup- F1	No

SET FILTERS
In addition to the abilities of the Monitor Only category, the user is allowed to run tests, build test scripts, modify precapture filters, set View and Search parameters, and send data to the printer or the hard disk.

Table 4.3 - Set Filters Access Category

Options	Access
Set Filters - F1	Yes
Message Editor - F6	Yes
Run A Test - F2	Yes
Apply and Save- F1	No
Set Remote Options- F7	No
Set Report Options- F4	Yes
Password Setup-F1	No

NETWORK ACCESS

In addition to the abilities of the Set Filters category, the user is allowed to use the Remote functions and modify reports, alarms, and statistics traits. The user can also preference and set the color, date, time, and station ID.

Table 4.4 - Network Access Category

Options	Access
Set Filters- F1	Yes
Message Editor - F6	Yes
Run A Test - F2	Yes
Apply and Save - F1	No
Set Remote Options - F7	Yes
Set Report Options - F4	Yes
Password Setup - F1	No

SYSTEM ADMIN

In addition to the abilities of the Network Access category, the user is allowed to exit to DOS and modify user IDs and passwords.

Table 4.5 - System Administrator Access Category

Options	Access
Set Filters - F1	Yes
Message Editor - F6	Yes
Run A Test - F2	Yes
Apply and Save - F1	Yes
Set Remote Options - F7	Yes
Set Report Options - F4	Yes
Password Setup - F1	Yes

LOGOUT TIME
This column allows the System Administrator to enter the log out time for a user. The log out time is the amount of time the system can idle before automatically logging out the user. When the log out time is reached, the Spectra system automatically logs out a user. The entry must be between 0 and 1440 minutes (up to 24 hours). An entry of "0" in this field disables the automatic log out feature.

DEF CONFIGR
This column allows the System Administrator to enter the default configuration for a user. Whenever a user logs in, this feature automatically recalls the designated configuration to the Spectra system.

This column assigns the system configuration file that is automatically associated with the user.

SETTING USER IDS, PASSWORDS, AND ACCESS RESTRICTIONS

When the Password Setup screen is displayed, the System Administrator's password and associated information is already entered in this screen and cannot be deleted, although the logout time and default configuration can be changed.

Follow these steps to set user identification names, user passwords, and user access restrictions.

Step	Action
1.	Select the **USER ID** field you want to edit, and press the **Enter (↵)** key to access the entry field.
2.	Enter the User ID of any system user, and press the **Enter (↵)** key to assign it.

✍ *The User ID must be 10 characters or less.*

3.	Press the → key once to move to the PASSWORD column, and press the **Enter (↵)** key to access the entry field.
4.	Enter the password to be associated with that user, and press the **Enter (↵)** key.

✍ *The password must be 10 characters or less.*

5. Enter the password again in order to verify the entry.

6. Press the → key once to move to the CATEGORY column, and press the **Enter** (↵) key to cycle through the available user access restriction categories. Continue pressing the **Enter** (↵) key until the correct category is displayed.



If passwords have been disabled, users have full access to all Spectra system functions, regardless of any restrictions assigned in the Password Setup screen.

7. Press the → key to move the cursor to the LOGOUT TIME column, press the **Enter** (↵) key to access the numeric entry field.

8. Enter the amount of time the system can idle before automatically logging out the user (1 to 1440 minutes), and press the **Enter** (↵) key again to assign the time.

✍ *An entry of "0" in this field disables the automatic log out feature.*

9. Press the → key to move the cursor to the DEF CONFIGR (Default Configuration) column, press the **Enter** (↵) key to access the Configuration File catalog.

10. Select the configuration file to assign, and press the **Enter** (↵) key to assign it.

11. Repeat **Step 1** through **Step 10** to assign additional user IDs, passwords, and access restrictions.

CONNECTING TO ACCESS-CONTROLLED SPECTRA SYSTEMS

When a connection is established between a UNIX workstation running iRemote and an active Spectra system that has the password feature enabled, the iRemote user will be locked into the access level of the user currently logged on to the Spectra system. Each Spectra system access level—System Admin, Read Only, Monitor Only, Set Filters, and Network Access—has associated restrictions that may prohibit certain configuration changes or tests. It may be necessary for a remote user to log out the current user and log in using the iRemote user ID and password.

LOGGING OUT OF ACCESS-CONTROLLED SPECTRA SYSTEMS

For a user at a UNIX workstation running iRemote to log out a Spectra system user, the iRemote user must press the Esc key from the Main Function Selection screen (see Figure 4.3).

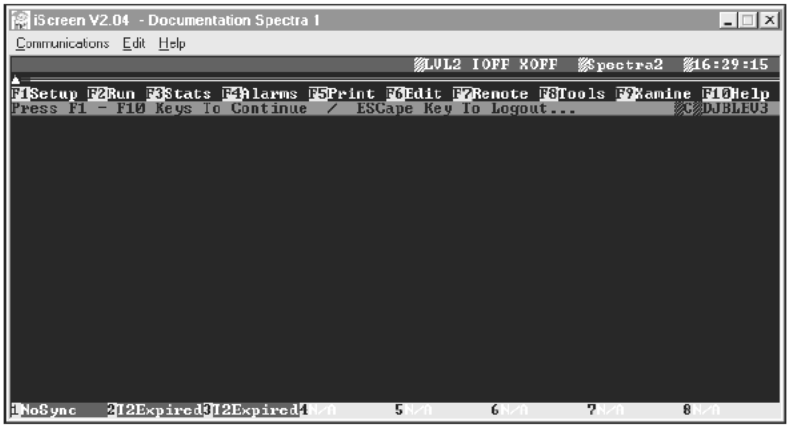


Figure 4.3 - Main Function Selection Screen

For detailed information about establishing user IDs, passwords, and access restrictions, refer to "Password Setup and Control" on page 92 of this guide.

If an iRemote user connects to a Spectra system and sets a System Administrator access level, the Spectra system keyboard shares System Administrator access control. To avoid unauthorized access into the Spectra system, the iRemote user should log out of the Spectra system before closing the iRemote connection.

5 Setting Up Your Environment

OVERVIEW

This chapter provides an explanation of how to set up the Spectra system environment. The procedures in this chapter explain how to make modifications to the Spectra system environment settings, such as database drive, colors, time, date, station ID, and point code format. These options are discussed in the material that follows.

Follow these steps to access the Set Environment options menu.

Step	Action
1.	Press the **F1** key to access the F1 Setup menu.
2.	Highlight the **Set Environment** option, and press the **Enter** (↵) key. The Set Environment options menu is displayed (see **Figure 5.1**).

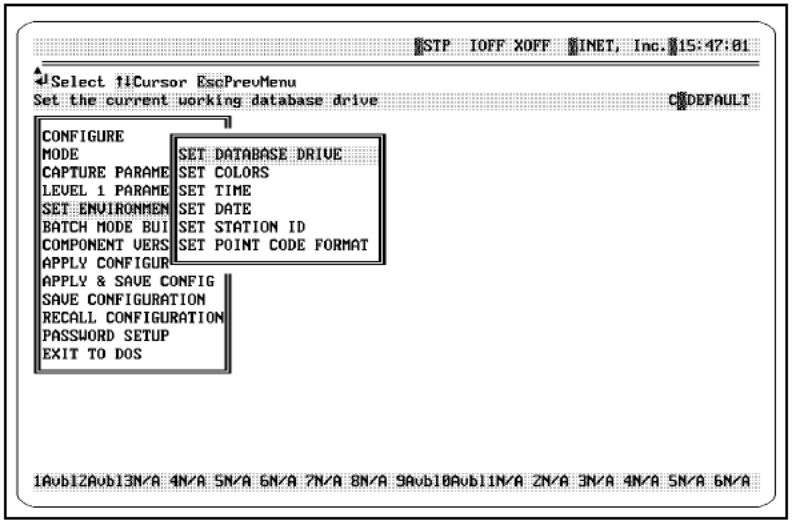


Figure 5.1 - Set Environment Options Menu

✍ *An additional option, Set TGT Tones, is available in the Set Environment options menu if you purchased the Trunk Tester Network or Trunk Tester Switch. For more information on this option, refer to the **Spectra Trunk Tester Guide**.*

The Set Environment options are discussed in the following sections.

SET DATABASE DRIVE

The Set Database Drive option allows you to access information (such as print files and capture buffers) from a specific drive where the database of configuration files, signal unit files, test script files, etc., is stored.

Follow these steps to change the database drive setting.

Step	Action
1.	From the Set Environment options menu, highlight the **Set Database Drive** option, and press the **Enter (↵)** key. The Set Database Drive dialog box is displayed (see **Figure 5.2**).

```
Enter database drive (EX: C:, D:, H:, etc..):
```

Figure 5.2 - Set Database Drive Dialog Box

2.	Enter the database drive, and press the **Enter (↵)** key.

✍ *Drive D is set up as the secondary hard drive and should not be used as the database drive.*

SET COLORS

The Set Colors option allows you to color code functions, messages, and links to make them easily recognizable on the Spectra system screen. This option allows screen colors to be established by menu, channel, or message type.

From the Set Environment options menu, highlight the Set Colors option, and press the Enter (↵) key. The Set Colors options menu is displayed.

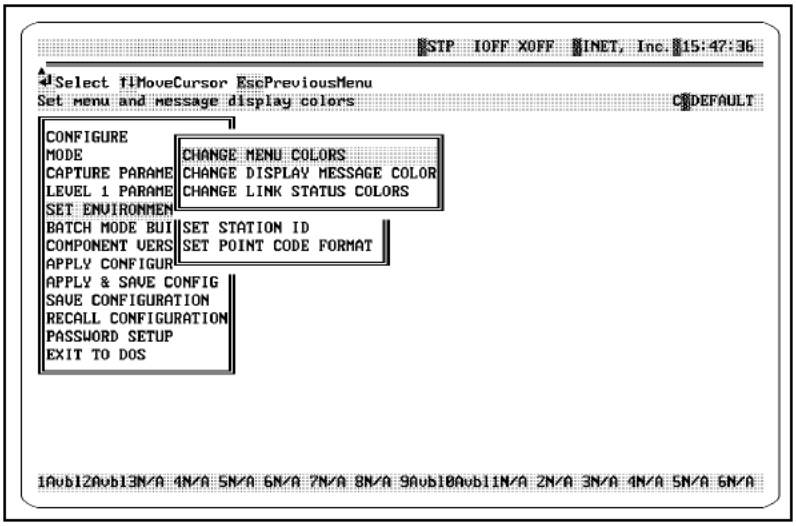


Figure 5.3 - Set Colors Options Menu

The following explanations describe the options in this option menu.

Change Menu Colors
This option allows you to change the color of the menu display on your screen.

Change Display Message Color
This option allows you to change the color of the message display on your screen.

Change Link Status Colors
This option allows you to change the color of the link status displays on your screen.

CHANGING MENU COLORS

This option allows you to change the color of the menu display on your screen.

Follow these steps to change the menu colors.

Step	Action

1. From the Set Colors options menu, highlight the **Change Menu Colors** option, and press the **Enter** (↵) key to access the Change Menu Colors options menu (see Figure 5.4).

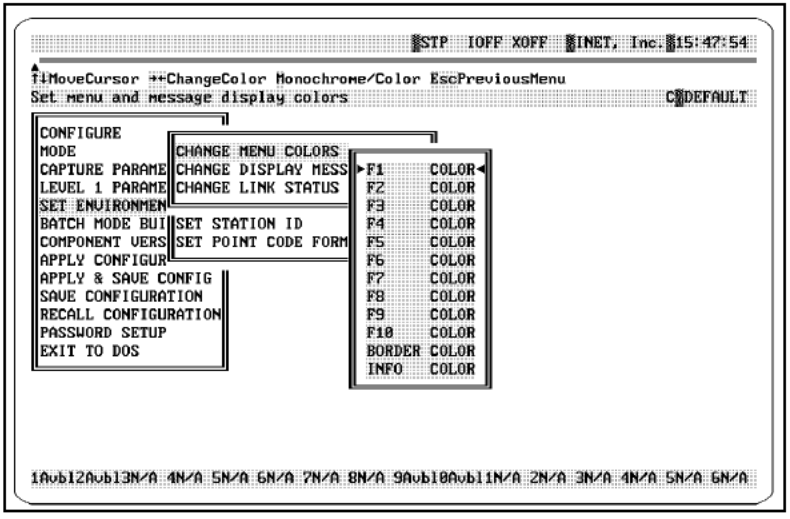


Figure 5.4 - Change Menu Colors Options Menu

2. Press the ↑↓ keys to highlight the menu option you want to set. For example, to change the F1 Setup menu color, highlight the **F1 COLOR** option.

3. Press and hold the →← keys and all 16 foreground colors cycle and display on the current background color. This process then repeats shifting the background color to the next color in sequence until all 16 background colors display. If you want to display the menus in monochrome format, press the **M** key.

4. When the desired color scheme is displayed, press the ↑↓ keys to advance to the next menu option. Repeat the procedure for each option that requires a color assignment.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

CHANGING DISPLAY MESSAGE COLORS

This option allows you to change the color of the message display on your screen.

From the Set Colors options menu, highlight the Change Display Message Color option, and press the Enter (↵) key to access the Change Display Message Color options menu (see **Figure 5.5**).

```
COLORS BY MESSAGE TYPE
COLORS BY CHANNEL
```

Figure 5.5 - Change Display Message Color Options Menu

The following explanations describe the options in the Change Display Message Color options menu.

Colors By Message Type
This option allows you to change the color of the message display (by type) on your screen.

Colors By Channel
This option allows you to change the color of the channel display on your screen.

Changing Display Message Colors by Message Type

Follow these steps to change the display message color by message type.

Step	Action

1. From the Change Display Message Color options menu, highlight the **Colors By Message Type** option, and press the **Enter (↵)** key. The Protocol options menu is displayed (see **Figure 5.6**).



Figure 5.6 - Protocol Options Menu

✍ *The Spectra system provides three protocol options: SS7, ISDN, and X.25. Since these protocols are available as separate options on the Spectra system, your system may have any combination of the three. If you requested only one protocol, no protocol choices are available. If you requested two protocols, only those choices are listed.*

2. Highlight the protocol option for the message type color you want to change, and press the **Enter (↵)** key. The Colors By Message Type options menu is displayed (see **Figure 5.7**).

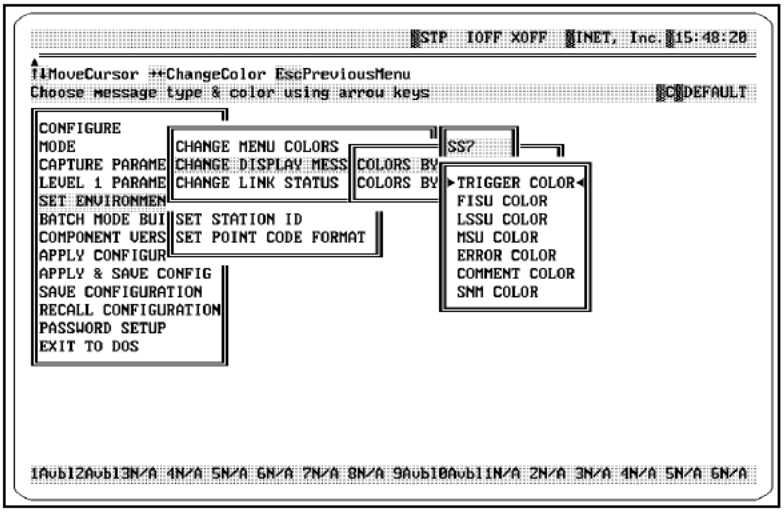


Figure 5.7 - SS7 Colors By Message Type Options Menu

✍ *The SS7, ISDN, and X.25 protocols contain different message types and display different message type options in the Colors By Message Type options menu.*

3. Press the ↑↓ keys to highlight the menu option you want to set. For example, to change the SS7 FISU color, highlight the **FISU COLOR** option.

4. Press and hold the →← keys and all 16 foreground colors cycle and display on the current background color. This process then repeats shifting the background color to the next color in sequence until all 16 background colors display. If you want to display the menus in monochrome format, press the **M** key.

5. When the desired color scheme is displayed, press the ↑↓ keys to advance to the next menu option. Repeat the procedure for each option that requires a color assignment.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

Changing Display Message Colors by Channel

Follow these steps to change the display message color by channel.

Step	Action

1. From the Change Display Message Color options menu, highlight the **Colors By Channel** option, and press the **Enter** (↵) key. The Colors By Channel options menu is displayed (see Figure 5.8).

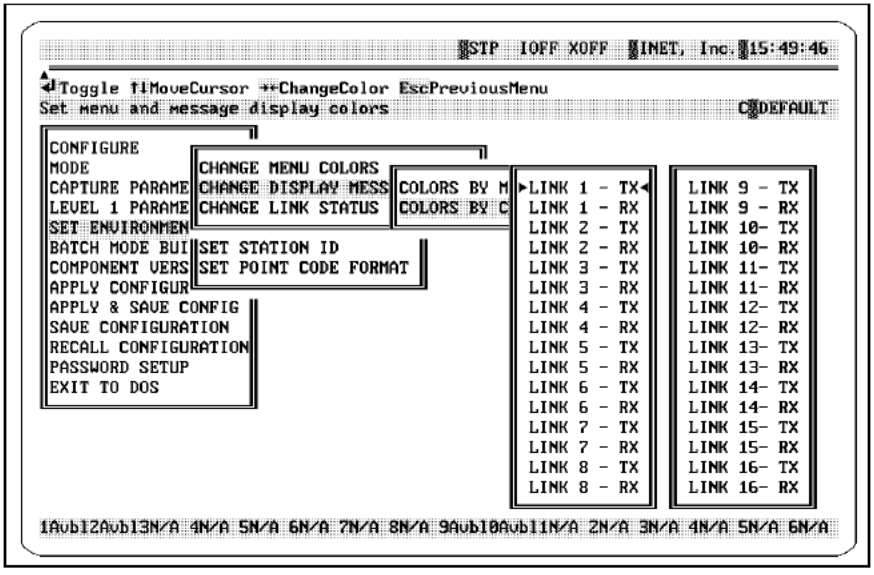


Figure 5.8 - Colors by Channel Options Menu

2. Press the ↑↓ keys to highlight the link (RX or TX) you want to set. For example, if you to change the display message color for Link 1 RX, highlight the **LINK 1 RX** option.

3. Press and hold the →← keys and all 16 foreground colors cycle and display on the current background color. This process then repeats shifting the background color to the next color in sequence until all 16 background colors display. If you want to display the menus in monochrome format, press the **M** key.

4. When the desired color scheme is displayed, press the ↑↓ keys to advance to the next menu option. Repeat the procedure for each option that requires a color assignment.

5. If you are using more than 16 boards in the system, the **Enter** (↵) key can be used to toggle between the link displays.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

CHANGING LINK STATUS COLORS

This option allows you to change the color of the link status displays on your screen.

Follow these steps to change the link status colors.

Step	Action

1. From the Set Colors options menu, highlight the **Change Link Status Colors** option, and press the **Enter** (↵) key. The Link Status Display Colors options menu is displayed (see **Figure 5.9**).

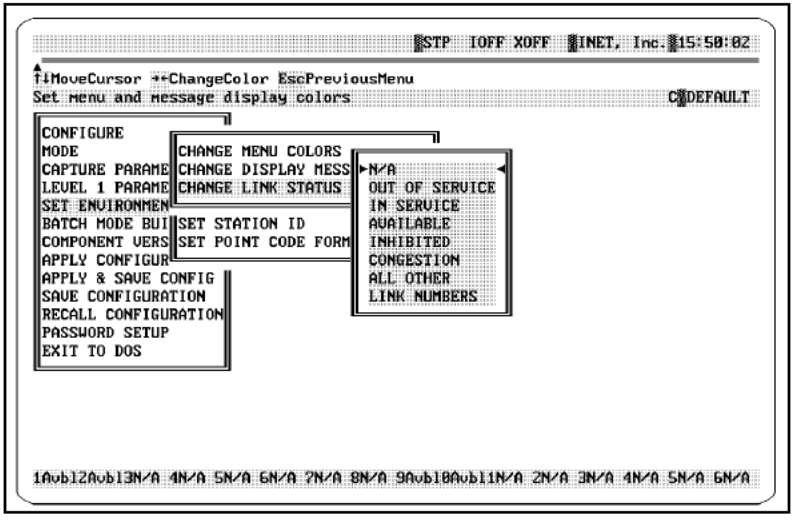


Figure 5.9 - Link Status Colors Options Menu

2. Press the ↑↓ keys to place the cursor on the status link display you want to set (Not Available, Out Of Service, In Service, Available, Inhibited, Congestion, All Other, and Link Numbers).

3. Press and hold the →← keys and all 16 foreground colors cycle and display on the current background color. This process then repeats shifting the background color to the next color in sequence until all 16 background colors display. If you want to display the menus in monochrome format, press the **M** key.

4. When the desired color scheme is displayed, press the ↑↓ keys to advance to the next menu option. Repeat the procedure for each option that requires a color assignment.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

SET TIME

This option allows you to establish the time for the Spectra system.

Follow these steps to set the time for the Spectra system.

Step	Action

1. From the Set Environment options menu, highlight the **Set Time** option, and press the **Enter** (↵) key. The Set Time dialog box is displayed (see **Figure 5.10**).

```
Enter time (HH:MM:SS) :12:00:00
```

Figure 5.10 - Set Time Dialog Box

2. Enter the time (HH:MM:SS format), and press the **Enter** (↵) key.

SET DATE

This options allows you to establish the date for the Spectra system.

Follow these steps to set the date for the Spectra system.

Step	Action
1.	From the Set Environment options menu, highlight the **Set Date** option, and press the **Enter (↵)** key. The Set Date dialog box is displayed (see **Figure 5.11**).

```
Enter date (MM/DD/YY) :12/15/96
```

Figure 5.11 - Set Date Dialog Box

2.	Enter the date (MM/DD/YY format), and press the **Enter (↵)** key.

SET STATION ID

This option allows you to establish the station identification name, or Station ID, for the individual signalling point represented by this terminal. This Station ID is displayed on all printouts generated by the Spectra system.

Follow these steps to set the Station ID.

Step	Action
1.	From the Set Environment options menu, highlight the **Set Station ID** option, and press the **Enter (↵)** key. The Set Station ID dialog box is displayed (see **Figure 5.12**).

```
Enter SPECTRA identification name:
```

Figure 5.12 - Set Station ID Dialog Box

2. Enter the Station ID (up to 10 characters), and press the **Enter** (↵) key.

The Station ID is displayed in the top-right corner of the Spectra system screens. For example, the screen displayed in Figure 5.13 shows INET, Inc. as the Station ID.

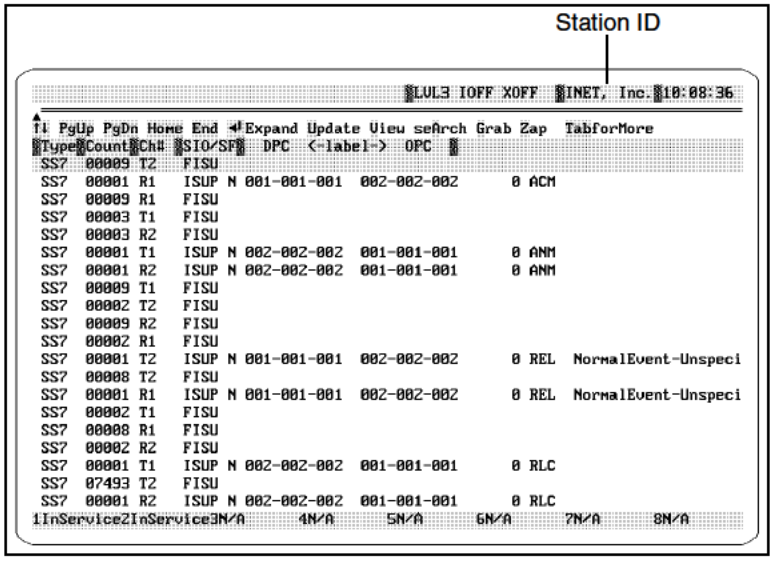


Figure 5.13 - F2 Run Screen - Station ID

SET POINT CODE FORMAT

This option lets you establish the format that is used to display point codes throughout the Spectra system. The user can choose between the following point code display formats (see **Figure 5.14**):

- NETWORK-CLUSTER-MEMBER
- DECIMAL
- AREA-CARRIER-UNIT
- N-C-M (NETWORK-CLUSTER-MEMBER)/JAPAN:HEX-HEX

✍ *Point code formats depend on protocol options purchased.*

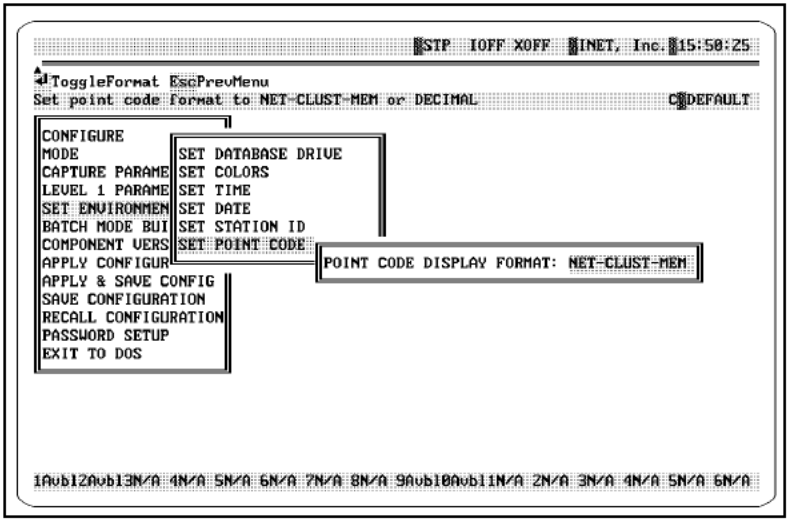


Figure 5.14 - Point Code Display Format Dialog Box

SETTING VALID POINT CODE RANGES

The Spectra system point code ranges are protocol specific. The following items list the point code ranges:

- For ANSI and CHINA Network-Cluster-Member point code format: 0 to 255, 0 to 255, and 0 to 255
- For ITU-T Network-Cluster-Member point code format: 0 to 7, 0 to 255, and 0 to 7
- For JAPAN Area-Carrier-Unit point code format: 0 to 31, 0 to 15, and 0 to 127
- For JAPAN N-C-M HEX/HEX point code format: 0 to 255 and 0 to 255 decimal (0-FF Hex)

✍ *Entering a member number of 0 for point codes representing SSPs (for example, a point code of 255-255-0) may cause network problems.*

Follow these steps to set point code display formats.

Step	Action
1.	From the Set Environment options menu, highlight the **Set Point Code Format** option, and press the **Enter (↵)** key. The Set Point Code Format dialog box is displayed (see **Figure 5.15**).

```
POINT CODE DISPLAY FORMAT: NET-CLUST-MEM
```

Figure 5.15 - Set Point Code Format Dialog Box

2.	Press the **Enter (↵)** key to toggle between the NET-CLUSTER-MEM option and the DECIMAL option. The selected display format appears in the dialog box.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

6 Setting Level 1 Parameters

OVERVIEW

The Level 1 Parameters screen defines the physical aspects of the Spectra system links. The interface is automatically determined by reading the code from the interface pod. This screen displays different fields, depending on the interface pod types connected to the system. These fields are discussed in following material.

LEVEL 1 PARAMETERS SCREEN

Follow these steps to access the Level 1 Parameters screen.

Step	Action
1.	Press the **F1** key to access the F1 Setup menu.
2.	Highlight the **Level 1 Parameters** option, and press the **Enter** (↵) key. The Level 1 Parameters screen is displayed (see **Figure 6.1**).

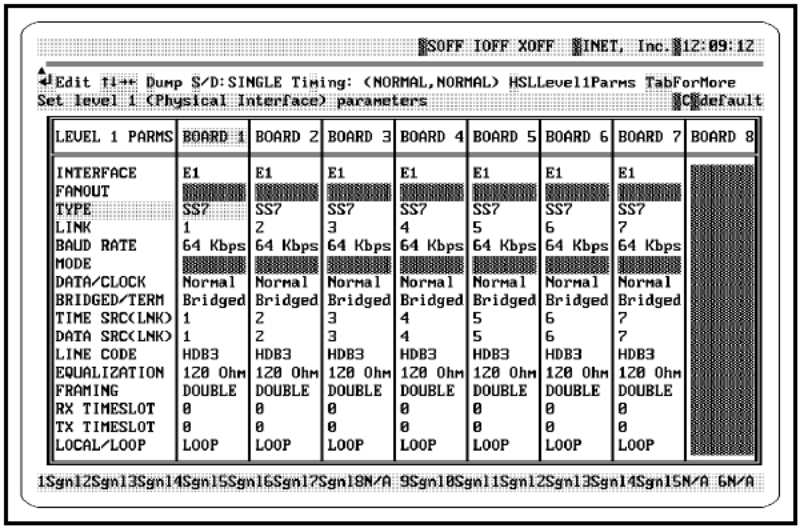


Figure 6.1 - Level 1 Parameters Screen (Example)

Different fields display on this screen depending on the pod types connected to the system.

LEVEL 1 PARAMETERS SCREEN DEFINITIONS

↵Edit
Press the Enter (↵) key to access a field for editing an entry.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

✍ *The left (←) arrow key moves the cursor to the previous existing board (DSP or HSL) or board 1, whichever comes first. The right (→) arrow key moves the cursor to next existing board (DSP or HSL) or board 16, whichever comes first. This is a new feature of the current release of the Spectra system and consequently may affect some recorded macros.*

Dump
Press the D key to dump the Level 1 parameters as they are currently defined to an ASCII text file in the `C:\SPECTRA\PRINTLOG` directory. The files can be viewed with the DOS Commands option within the F8 tools function.

FanoutToggle
To enable Fanout mode, place the cursor on Board 1 or Board 9 in the Level 1 Parameters screen, and press the F key. Pressing the F key when the cursor is on the Board 1 field enables Bank 1 (Board 1 through Board 8) to participate in the Fanout mode. Pressing the F key when the cursor is on the Board 9 field enables Bank 2 (Board 9 through Board 16) to participate in the Fanout mode.

However, you may specify which boards participate in the fanout mode. Boards 2 through 8 and 10 though 16 can individually be toggled ON or OFF for Fanout mode by highlighting a specific board and pressing the F key. If a board is toggled ON for the Fanout mode, the field display for Fanout Mode is ON, and the board participates in the fanout. If a board is toggled OFF, the field display for Fanout Mode is OFF, and the board does not participate in the fanout.

If Bank 1 or Bank 2 is active for the Fanout mode and Fanout mode is ON for all boards, the Level 1 options for link 2 through link 8 change to mimic the settings of link 1, and the Level 1 options for link 10 through link 16 change to mimic the settings of link 9. The Data Src (LNK) field for each link in Bank 1 displays a 1 to indicate that it is processing timeslot information from link 1's physical interface. The Data Src (LNK) field for each link in Bank 2 displays a 9 to indicate that it is processing timeslot information from link 9's physical interface.

The Fanout mode allows multiple channels (timeslots) from a single DS1, E1, or Basic Rate Interface (BRI) to be processed. The Fanout option can be used in either the Monitor or Terminated modes of the Spectra system. If a DS1/E1/BRI pod is connected to link 1, the Spectra system can act as if it has eight DS1/E1/BRI pods connected, which allows up to eight links to be multiplexed into one T1/E1/BRI link so that all information can be consolidated on the one link. If DS1/E1/BRI pods are connected to both link 1 and link 9, the Spectra system can act as if it has 16 DS1/E1/BRI pods connected, allowing up to 16 links to be multiplexed into two T1/E1/BRI links (see **Figure 6.2**).

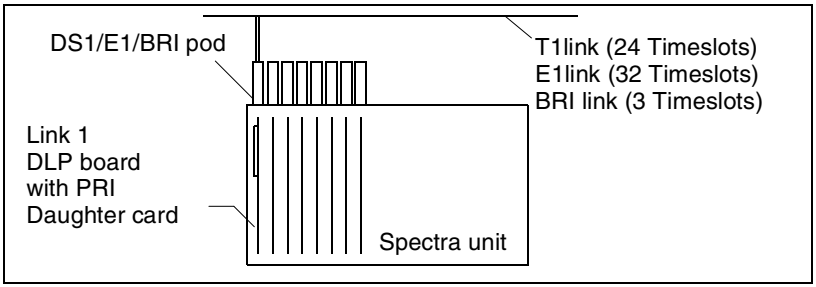


Figure 6.2 - Spectra System with DS1 Pod on Link 1 Accessing Timeslot Information from a T1/E1/BRI Link

In order to run Fanout mode, a DS1/E1/BRI physical interface pod and a Primary Rate Interface (PRI) card must be connected to link 1 or 9. A DS1/E1/BRI pod on link 1 allows links 2 through 8 to become emulated DS1/E1/BRI links; a DS1/E1/BRI pod on link 9 allows links 10 through 16 to become emulated DS1/E1/BRI links. Boards 1 through 8 are known as Bank 1; boards 9 through 16 are known as Bank 2.

The only adjustable parameters in Fanout mode, in links other than link 1 or link 9 are the TX and RX Timeslots. These parameters assign timeslots from the DS1/E1/BRI interface used for that link. The TX and RX Timeslots are discussed in "RX/TX TIMESLOT (DSI/E1, BRI, and J1 Interfaces)" on page 128 in this chapter.

In order to utilize Fanout mode, either Board 1 or Board 9 must be a DS1/E1/BRI. If these conditions do not exist, the FANOUT MODE field appears blocked out.

The following figures show two examples of possible configuration settings on the Level 1 Parameters screen.

Figure 6.3 shows the Spectra system operating in Fanout mode for all boards.

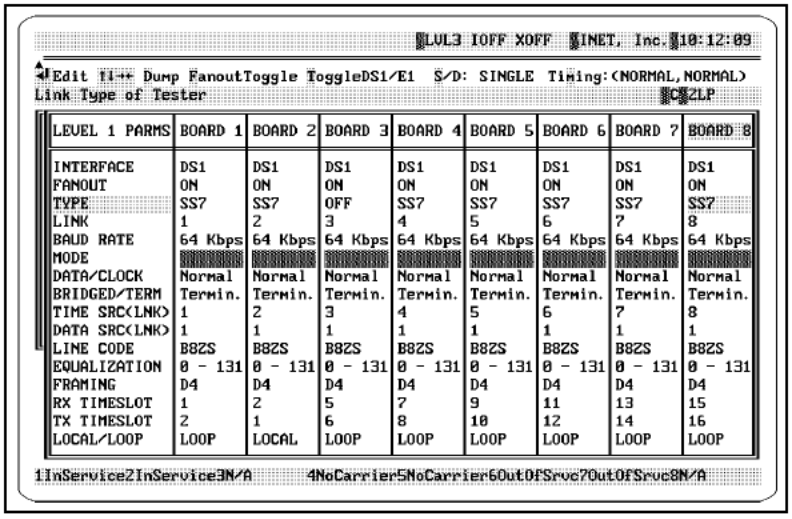


Figure 6.3 - Level 1 Parameters Screen (Example) - All Boards Set to Fanout Mode

Figure 6.4 shows the Spectra system operating in Fanout mode for Boards 1, 3, and 5, with all other boards operating in standard mode.

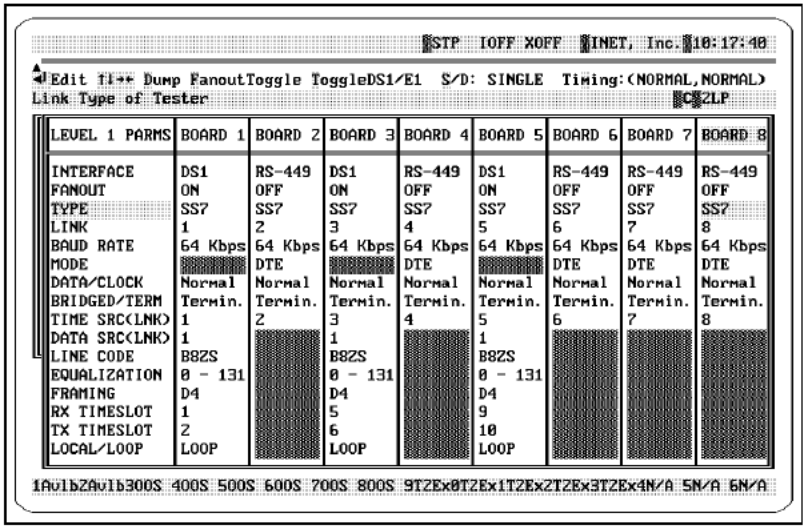


Figure 6.4 - Level 1 Parameters Screen (Example) - Boards 1, 3, and 5 in Fanout Mode

Toggle DS1/E1
Press the T key to toggle the board between the DS1 and E1 interface options. This does not take effect (as with all changed Level 1 parameters) until a test is (re)started by pressing the F2 key.

Dual/Single
The Dual/Single function is used only for DS1/E1interface pods residing in bank controller positions with Fanout mode enabled. The bank controller is Board 1 for Bank 1 and Board 9 for Bank 2. Press the S key to indicate whether TX and RX data are on one input (IN1) or dual inputs (IN1 and IN2). When set to Single, only the IN1 input is monitored. When set to Dual, IN1 and IN2 are monitored.

Timing
Press the M key to toggle Bank 1 and Bank 2 between NORMAL and SYSTEM timing. Boards 1 through 8 are Bank 1; boards 9 through 16 are Bank 2. The bank controller is Board 1 for Bank 1 and Board 9 for Bank 2. The timing is displayed in a Bank 1, Bank 2 format. SYSTEM timing configures boards to receive their timing from the first board (bank controller) in the bank. NORMAL timing configures the individual boards to generate timing internally. The Timing function is used only with DS1/E1 interface pods and/or a BRI pod using a PRI daughter board.

✍ *The SYSTEM timing function is used when boards need to communicate with each other in the audio controller option. For more information about the Spectra system audio controller, see "Audio Controller" on page 489 of the* ***Spectra Features and Functions Guide****.*

ATMLevel1Parms
Press the A key to access the ATM Level 1 Parameters screen. If you have not purchased Spectra High Speed Links, the message "No ATM Links available in the system" is displayed in the upper left corner of the screen when you select this option.

TALILevel1Parms
Press the I key to access the TALI Level 1 Parameters screen. If you have not purchased Spectra High Speed Links, the message "Not a TALI link" is displayed in the upper left corner of the screen when you select this option.

HSLLevel1Parms
Press the H key to access the HSL Level 1 Parameters screen. If you have not purchased Spectra High Speed Links, the message "No HSL Links available in the system" is displayed in the upper left corner of the screen when you select this option.

✍ *For more information about Spectra High Speed Links Level 1 parameters, refer to the* ***Spectra High Speed Links Guide****.*

INTERFACE
This function displays the physical interface of the link as determined by the current pod (J1, DS1/E1, DS0, RS-449, V.35, RS-232, or BRI). The interface cannot be adjusted (except between DS1 and E1 modes)—it is merely a display function.

FANOUT
This function displays the current status of the Fanout mode, either ON or OFF. For more information on the Fanout function, refer to "FanoutToggle" on page 119 of this guide.

TYPE
This function defines how the link is used by the Spectra system. Available options are as follows:

- OFF Link is not used.
- SS7 Link is used for testing SS7 and J7 networks.
- ISDN Link is used for monitoring ISDN networks.
- X.25 Link is used for communications with an X.25 network device.

✍ *If you purchased the Trunk Tester Network or Trunk Tester Switch, an additional Type option, TRUNK, is available. For more information about this option, refer to the* ***Spectra Trunk Tester Guide****.*

LINK
This function defines the physical link number for the board. Generally, this number is the same as the board number; however, it can be changed for special purposes.

BAUD RATE
This function is used to select the data rate for each interface. This option has no function in Data Terminal Equipment (DTE) mode (other than reference) for V.35, RS-449, and RS-232 interfaces. Available settings (in kilobits per second) are as follows:

DS1/E1	48 Kbps, 56 Kbps, and 64 Kbps
DS0	48 Kbps (Japan), 56 Kbps, and 64 Kbps
RS-449	56 Kbps, 64 Kbps
V.35	48 Kbps, 56 Kbps, 64 Kbps
RS-232	110, 150, 220, 269, 300, 400, 600, 1200, 2400, 3600, 4800, 7200, 9600, 14.4 kb/s, 19.2 Kbps, and 38.4 Kbps
BRI	16 Kbps, 56 Kbps, 64 Kbps
J1	16 Kbps, 48 Kbps, 56 Kbps, and 64 Kbps

MODE (V.35, RS-449, RS-232 Interfaces only)
This function allows selection of Data Communications Equipment (DCE) or DTE configuration for V.35, RS-449, and RS-232 interface as shown in **Table 6.1**.

Table 6.1 - Level 1 Physical Interface Mode Functions

Function	DTE	DCE
Send Data	Output	Input
Send Timing (DCE Source)	Input	Output
Receive Data	Input	Output
Terminal Timing (DTE Source)[a]	Output	NA
Carrier Detect (CD)	Input	Output
Request To Send (RTS)	Output	Input
Clear To Send (CTS)	Input	Output
Data Set Ready (DSR)	Input	Output
Data Terminal Ready (DTR)	Output	Input

a. RS-232 interface only

TIP-RING (J1 Interface Only)
This function allows selection of Normal, Invert RX, Invert TX, and Inv All configuration for the J1 interfaces.

DATA/CLOCK
This function allows inversion of clock and data on certain interfaces. Valid settings include the following:

DS1/E1	Normal, InvDATA, InvCLK, InvBOTH
DS0	Normal, InvDATA, InvCLK, InvBOTH
RS-449	Normal, InvDATA, InvCLK, InvBOTH (Clock inversion is only effective in DTE modes.)
V.35	Normal, InvDATA, InvCLK, InvBOTH (Clock inversion is only effective in DTE modes.)
RS-232	Normal, InvDATA, InvCLK, InvBOTH
BRI	Normal, InvDATA, InvCLK, InvBOTH
J1	Normal, InvDATA, InvCLK, InvBOTH

BRIDGED/TERM (Not used with RS-232 Interfaces)
This function sets interface impedance to either Bridged, Terminated, or DSX mon. The actual impedance values for both Bridged and Terminated on each type of interface pod are found in "DLP Board(s) and SEA Card(s)" on page 36 of this guide. Use the Bridged option when directly monitoring a line terminated by another device. Use the Terminated option when the link is the only device terminating the line. Use the DSX mon option when monitoring through a DSX monitor port.

✍ *The DSX mon option is only available with DS1/E1, DS0, BRI, and J1 interfaces.*

Figure 6.5 shows network examples of Bridged, Terminated, and DSX mon options.

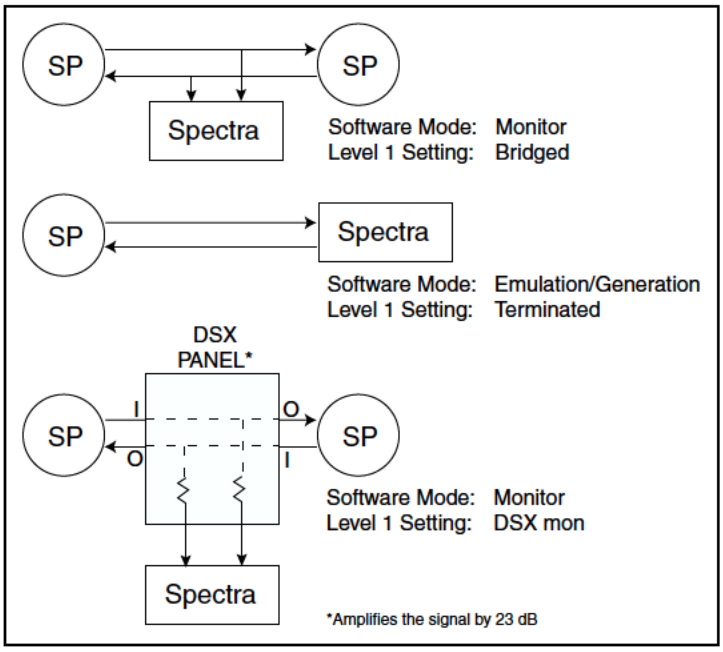


Figure 6.5 - Level 1 Termination Setup Examples

TIME SRC (LNK)
This function selects the source for the transmit timing. This option is only valid when the interface is configured as a DCE.

DATA SRC (LNK) (DSI/E1, BRI Interfaces)
This function indicates the physical interface from which data is being processed. This is equal to the link number when in single channel mode (only one TX and RX timeslot is processed from each DS1/E1/BRI physical interface) and equal to link 1 when in Fanout mode. This option cannot be modified.

LINE CODE (DSI/E1 Interfaces)
This function sets the line code for DS1/E1 interfaces. Available settings are as follows:

DS1:	AMI (Alternate Mark Inversion)
	No ZCS (Zero Code Suppression)
	B8ZS (Bipolar 8 Zero Substitution)
E1:	HDB3 (High Density Bipolar 3)

EQUALIZATION (DSI/E1 Interfaces)
This function sets the transmit equalization according to the transmit distance for DS1 interfaces. These options include:

DS1:	0 feet to 131 feet
	131 feet. to 262 feet
	262 feet to 393 feet
	393 feet to 524 feet
	524 feet to 655 feet
E1:	120 Ω
	75 Ω

FRAMING (DSI/E1 Interfaces)
This function sets the framing format. Supported framing formats include:

DS1:	D4 (12-frame multiframe, F12, D3)
	ESF (Extended Super Frame)
	SLC96 (Remote Switch Mode, F72)
	F4 (4-frame multiframe, Fs bits = 1)
E1:	Double (Double Frame)
	Multi (CRC Multiframe)

RX/TX TIMESLOT (DSI/E1, BRI, and J1 Interfaces)
This option indicates the receive and transmit timeslot number to process in the indicated source link. Entries for DS1 range from 1 to 24; entries for E1 range from 1 to 31; entries for BRI are D, B1, or B2; entries for J1 range from 2 to 32. In terminated modes, the RX Timeslot is processed for receive data, and the TX Timeslot is used for transmit data. In Monitor mode, the RX Timeslot is received as RDx from IN 1, and the TX Timeslot as SDx from IN 2.

✍ *J1 and DS1/E1 receive timeslots are looped back to corresponding unprocessed transmit timeslots (except those used for framing).*

LOCAL/LOOP (DSI/E1 and J1 Interfaces)
This function selects transmit timing source as either local oscillator (+/-50 ppm; local), recovered clock from received signal (loop), or BNC External Clock (NYI).

ASSIGNING LEVEL 1 PARAMETERS TO LINKS

The Level 1 Parameters screen automatically detects the hardware connected to the Spectra system. Depending on the hardware in use, the Level 1 Parameters screen allows you to access only those fields that can be defined for that hardware.

Step 1 through **Step 9** of the following procedure explains the setting of fields that are common to all interfaces. Regardless of the interface in use, you need to complete these steps.

The remaining steps explain the additional fields used for specific pods. **Step 10** through **Step 16** describe setting the fields specific to J1 and DS1/E1 pods with the software set to DS1. **Step 17** through **Step 23** describe setting the fields specific to DS1/E1 pods with the software set to E1. **Step 24** through **Step 25** describe setting the fields specific to BRI S/T pods.

To setup the Level 1 Parameters screen, complete each of these steps that apply to the interface you are using.

Step	Action

1. When the Level 1 Parameters screen is displayed, place the cursor on the Type field under the Board 1 column. Press the **Enter (↵)** key to access the Type options menu (see **Figure 6.6**).

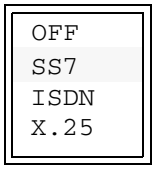


Figure 6.6 - Type Options Menu

2. Press the ↑↓ keys to select an option, and press the **Enter (↵)** key to assign that option to the Board 1 field.

✍ *Select SS7, if the desired protocol option is J7.*

3. Press the ↓ key to move the cursor to the Link field. Press the **Enter (↵)** key to access the entry field. Enter the number (1 through 16) you want the Spectra system to recognize as the physical link. (This number is usually the same as the board number.) Press the **Enter (↵)** key to assign that option.

4. Press the ↓ key to move the cursor to the Baud Rate field. Press the **Enter (↵)** key to access the Baud Rate options menu (see **Figure 6.7**). Press the ↑↓ keys to select an option, and press the **Enter (↵)** key to assign that option.

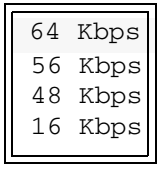


Figure 6.7 - Baud Rate Options Menu

5. Press the ↓ key to move the cursor to the Mode field (except for J1, DS1/E1, DS0, and BRI). Press the **Enter** (↵) key to access the Mode options menu (see **Figure 6.8**). Press the ↑↓ keys to select an option, and press the **Enter** (↵) key to assign that option.

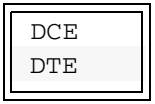


Figure 6.8 - Mode Options Menu

6. For J1 pod only: Press the ↓ key to move the cursor to the Tip-Ring field. Press the **Enter** (↵) key to access the Tip-Ring options menu (see **Figure 6.9**). Press the ↑↓ keys to select an option, and press the **Enter** (↵) key to assign that option.

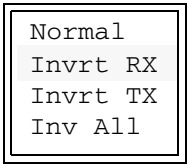


Figure 6.9 - Tip-Ring Options Menu

7. Press the ↓ key to move the cursor to the Data/Clock field. Press the **Enter** (↵) key to access the Data/Clock options menu (see **Figure 6.10**). Press the ↑↓ keys select an option, and press the **Enter** (↵) key to assign that option.



Figure 6.10 - Data/Clock Options Menu

8. Press the ↓ key to move the cursor to the Bridged/Term field. Press the **Enter** (↵) key to access the Bridged/Term options menu (except for

RS-232). Press the ↑↓ keys to select an option, and press the **Enter (↵)** key to assign that option (see **Figure 6.11**).

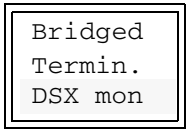


Figure 6.11 - Bridged/Term Options Menu

9. Press the ↓ key to move the cursor to the Time SRC (LNK) field (except for DS1/E1, DS0, and RS-232). Press the **Enter (↵)** key to enter the Time SRC (LNK) entry field. Enter in the number (1 through 16), and press the **Enter (↵)** key to assign that number to the Board 1 field.

Step 10 through **Step 16** describe setting the fields specific to J1 pods and DS1/E1 pods with the software set to DS1.

10. The Data SRC (LNK) field cannot be changed. Press the ↓ key to move the cursor to the Line Code field. Press the **Enter (↵)** key to access the Line Code options menu (see **Figure 6.12**). Press the ↑↓ keys to select an option. Press the **Enter (↵)** key to assign that option.

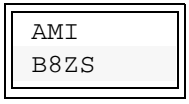


Figure 6.12 - Line Code Options Menu

11. Press the ↓ key to move the cursor to the Equalization field. Press the **Enter (↵)** key to access the Equalization options menu (see **Figure 6.13**). Press the ↑↓ keys to select an option, and press the **Enter (↵)** key to assign that option.

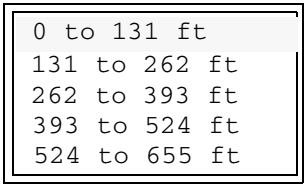


Figure 6.13 - Equalization Options Menu

12. Press the ↓ key one time to move the cursor to the Framing field. Press the **Enter** (↵) key to access the Framing options menu (see **Figure 6.14**). Press the ↑↓ keys to select an option, and press the **Enter** (↵) key to assign that option.

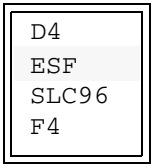


Figure 6.14 - Framing Options Menu

13. Press the ↓ key to move the cursor to the Rx Timeslot field. Press the **Enter** (↵) key to access the Rx Timeslot entry field. Enter the number (1 through 24), and press the **Enter** (↵) key to assign that number.

14. Press the ↓ key to move the cursor to the Tx Timeslot field. Press the **Enter** (↵) key to access the Tx Timeslot entry field. Enter the number (1 through 24), and press the **Enter** (↵) key to assign that number.

15. Press the ↓ key to move the cursor to the Local/Loop field. Press the **Enter** (↵) key to access the Local/Loop options menu (see **Figure 6.15**). Press the ↑↓ keys to select an option. Press the **Enter** (↵) key to assign that option to the Board 1 field.

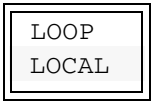


Figure 6.15 - Local/Loop Options Menu

16. Repeat the procedure for all links that require Level 1 parameters (unless the Fanout mode is used). Press the ↑↓↔ keys to move between fields and columns.

Step 17 through **Step 23** describe setting the fields specific to DS1/E1 pods with the software set to E1.

17. The Data SRC (LNK) field cannot be changed. Press the ↓ key to move the cursor to the Line Code field. Press the **Enter** (↵) key to access the Line Code options menu. Press the ↑↓ keys to select an option (HDB3 for E1). Press the **Enter** (↵) key to assign that option.

18. Press the ↓ key to move the cursor to the Equalization field. Press the **Enter** (↵) key to access the Equalization options menu (see **Figure 6.16**). Press the ↑↓ keys to select an option, and press the **Enter** (↵) key to assign that option.

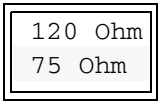


Figure 6.16 - Equalization Options Menu

19. Press the ↓ key to move the cursor to the Framing field. Press the **Enter** (↵) key to access the Framing options menu (see **Figure 6.17**). Press the ↑↓ keys to select an option, and press the **Enter** (↵) key to assign that option. (Not valid with the J1 pod.)

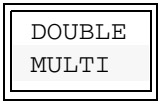


Figure 6.17 - Framing Options Menu

20. Press the ↓ key one time to move the cursor to the Rx Timeslot field. Press the **Enter** (↵) key to enter the Rx Timeslot entry field. Enter the number (1 through 31), and press the **Enter** (↵) key to assign that number.

21. Press the ↓ key one time to move the cursor to the Tx Timeslot field. Press the **Enter** (↵) key to enter the Tx Timeslot entry field. Enter the number (1 through 31), and press the **Enter** (↵) key to assign that number.

22. Press the ↓ key one time to move the cursor to the Local/Loop field. Press the **Enter** (↵) key to access the Local/Loop options menu (see **Figure 6.18**). Press the ↑↓ keys to select an option, and press the **Enter** (↵) key to assign that option.

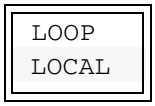


Figure 6.18 - Local/Loop Options Menu

23. Repeat the procedure for all links that require Level 1 parameters (unless the Fanout mode is used). Press the ↑↓↔ keys to move between fields and columns.

Step 24 through **Step 25** describe setting the fields specific to BRI S/T pods.

✍ *If the BRI S/T pods are used with the Audio Controller feature supporting bank controller cards, the Timing option in the command line must be set to SYSTEM for the Bank used. Timing is displayed in Bank 1, Bank 2 format. For more information about the Spectra system Audio Controller feature, see "Audio Controller" on page 489 of the **Spectra Features and Functions Guide**.*

24. The Data SRC (LNK) field cannot be changed. Press the ↓ key to move the cursor to the Rx Timeslot field. Press the **Enter** (↵) key to access the Rx Timeslot entry field. Press the ↑↓ keys to select an option (B1, B2, or D), and press the **Enter** (↵) key to assign that option.

25. Repeat the procedure for all links that require Level 1 parameters (unless the Fanout mode is used). Press the ↑↓↔ keys to move between fields and columns.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

7 SS7 Specific Configuration

OVERVIEW

Using the Spectra system with the SS7 protocol requires some protocol-specific configuration. This chapter explains the setup of these parameters.

Follow these steps to access the SS7 Configure options menu.

Step	Action

1. Press the **F1** key to access the F1 Setup menu (see **Figure 7.1**).

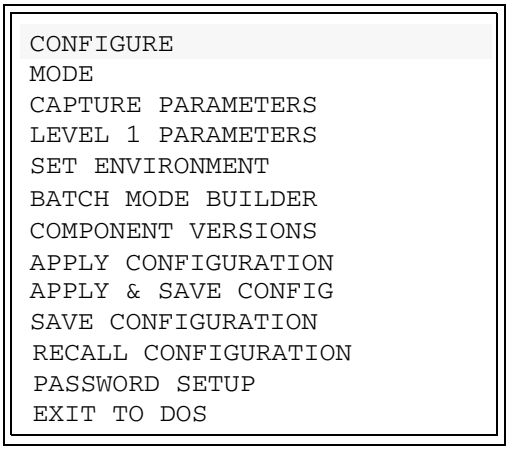


Figure 7.1 - F1 Setup Menu

2. Use the ↑↓ keys to highlight the Configure option, and press the **Enter (↵)** key. The Protocol options menu is displayed (see **Figure 7.2**).



Figure 7.2 - Protocol Options Menu

✍ *The Spectra system provides three protocol options: SS7, ISDN, and X.25. Since these protocols are available as separate options on the Spectra system, your system may have any combination of the three. If you requested only one protocol, no protocol choices are available. If you requested two protocols, only these choices are listed. If you purchased Spectra High Speed Links (HSL), two additional protocols, ATM and TALI are available. For more information on these protocols, refer to the* ***Spectra High Speed Links Guide****.*

3. Press the ↑↓ keys to highlight the SS7 option, and press the **Enter** (↵) key. The SS7 Configure options menu is displayed (see **Figure 7.3**).

```
FILTERS
AUTOMATIC RESPONSES
LEVEL 3 PARAMETERS
LEVEL 2 PARAMETERS
```

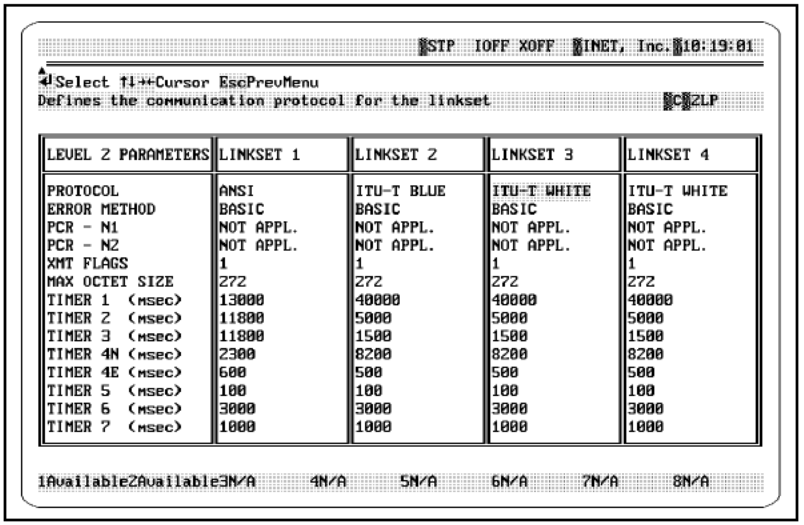
Figure 7.3 - SS7 Configure Options Menu

LEVEL 2 PARAMETERS

The Level 2 Parameters screen offers options to specify the parameters for Level 2 emulation testing. These parameters include the following options:

- Protocol
- Error Correction Method
- Thresholds for Preventative Cyclic Retransmission (PCR) Error Correction Method
- Maximum Intermessage Transmit Flag Count
- Maximum MSU Octet Size (used for declaring long SU detection)
- Timers T1 through T7
- Error Interval Monitor (EIM) Timer
- Link Status Signal Unit (LSSU) Timer
- Fill In Signal Unit (FISU) Timer
- TX Window Size
- LSSU Length

From the SS7 Configure options menu, highlight the Level 2 Parameters option, and press the Enter (↵) key. The Level 2 Parameters screen is displayed (see **Figure 7.4**).



```
                                    STP  IOFF XOFF  INET, Inc. 10:19:01
 Select ↑↓↔Cursor EscPrevMenu
Defines the communication protocol for the linkset                 C ZLP
```

LEVEL 2 PARAMETERS	LINKSET 1	LINKSET 2	LINKSET 3	LINKSET 4
PROTOCOL	ANSI	ITU-T BLUE	ITU-T WHITE	ITU-T WHITE
ERROR METHOD	BASIC	BASIC	BASIC	BASIC
PCR - N1	NOT APPL.	NOT APPL.	NOT APPL.	NOT APPL.
PCR - N2	NOT APPL.	NOT APPL.	NOT APPL.	NOT APPL.
XMT FLAGS	1	1	1	1
MAX OCTET SIZE	272	272	272	272
TIMER 1 (msec)	13000	40000	40000	40000
TIMER 2 (msec)	11800	5000	5000	5000
TIMER 3 (msec)	11800	1500	1500	1500
TIMER 4N (msec)	2300	8200	8200	8200
TIMER 4E (msec)	600	500	500	500
TIMER 5 (msec)	100	100	100	100
TIMER 6 (msec)	3000	3000	3000	3000
TIMER 7 (msec)	1000	1000	1000	1000

```
1Available2Available3N/A     4N/A     5N/A     6N/A     7N/A     8N/A
```

Figure 7.4 - Level 2 Parameters Screen

LEVEL 2 PARAMETERS SCREEN DEFINITIONS

↵Select
Press the Enter (↵) key to access a field for editing an entry.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

PROTOCOL
This field defines the method or language of communication used. The following options are available:

- ANSI
- ITU-T RED
- ITU-T BLUE
- ITU-T WHITE

- CHINA
- BTNR
- JAPAN

JAPAN 4-BIT protocol is the default selection using the JAPAN protocol. JAPAN 5-BIT and JAPAN 9-BIT protocols are selected using the Level 3 parameters, Network Configuration, More Parms, and SLS Bit Number. Refer to "SLS Bit Number" on page 164 of this guide for information about selecting JAPAN 5-BIT and JAPAN 9-BIT. (The Level 2 parameters automatically reflect changes in the JAPAN protocol.)

ERROR METHOD
This field provides both Basic and PCR error correction methods.

BASIC
When this option is used, PCR - N1 and PCR - N2 fields cannot be applied.

PCR
The PCR error correction method is normally used when there is a substantial distance between signalling points, such as with satellite transmission of the signal. Inet's proprietary PCR filtering algorithm provides error-free, real-time PCR filtering without signal unit acquisition problems.

PCR-N1
This timer defines the maximum number of Message Signal Units (MSUs) available for retransmission.

PCR-N2
This timer defines the maximum number of MSU octets available for retransmission.

XMT FLAGS
This field sets the maximum number of flags transmitted between two messages. This field is only valid in Emulation and Manipulation (Level 2 and Level 3) modes.

MAX OCTET SIZE
This field defines the maximum size of a message before it causes an error (long SU error).

TIMERS 1-7
These timers define the timing parameters for bringing links in and out of service.

✍ *Recommended ranges for Timers 1 through 7 for China, BTNR, and JAPAN protocols follow the ITU-T specification recommended ranges.*

T1
This timer is an aligned/ready timer (recommended value for ANSI is 13000 milliseconds; recommended range for ITU-T is 40000-50000 milliseconds).

T2
This timer is a not aligned timer (recommended value for ANSI is 11800 milliseconds; recommended range for ITU-T is 5000-15000 milliseconds).

T3
This timer is an aligned timer (recommended value for ANSI is 11800 milliseconds; recommended range for ITU-T is 1000-1500 milliseconds).

T4N
This timer is a proving period timer (recommended value for ANSI is 2300 milliseconds; recommended range for ITU-T is 7500-9500 milliseconds).

T4E
This timer is a proving period timer (recommended value for ANSI is 600 milliseconds; recommended range for ITU-T is 400-600 milliseconds).

T5
This timer is a sending status indication BUSY timer (recommended range for ANSI is 80-120 milliseconds; recommended range for ITU-T is 80-120 milliseconds).

T6
This timer is a remote congestion timer (recommended range for ANSI is 3000-6000 milliseconds; recommended range for ITU-T is 3000-6000 milliseconds).

T7
This timer is an excessive delay of acknowledgment timer (recommended range for ANSI is 500-2000 milliseconds; recommended range for ITU-T is 500-2000 milliseconds).

EIM TMR through LSSU Length

Spectra system Level 2 parameters EIM TMR through LSSU Length have different values for the JAPAN J7 protocol. Level 2 protocol sections other then JAPAN J7 use default values.

EIM TMR

This timer defines the EIM of the Spectra system. The EIM is an alternate method of error rate monitoring used by certain variants of SS7. By setting this timer, the user sets the error detection method used by the Spectra system. If the EIM Timer is set to 0, the Spectra system uses Signal Unit Error Method (SUERM) for error detection. If the EIM is set to a non zero, the Spectra system uses the EIM error detection. The EIM checks for errors at the specified time interval as defined by the EIM Timer.

LSSU TMR

This value defines the rate at which LSSUs are transmitted by the Spectra system.

FISU TMR

This value defines the rate at which FISUs are transmitted by the Spectra system.

TX WINDOW SIZE

This value defines the maximum number of transmitted messages allowed by the Spectra system with out receiving an acknowledgment message.

LSSU LENGTH

This field defines the LSSU byte length.

ASSIGNING LEVEL 2 PARAMETERS TO LINKSETS

Follow these steps to assign Level 2 parameters to linksets.

Step	Action

1. When the Level 2 Parameters screen is displayed, the cursor is automatically placed on the Protocol field under the Linkset 1 column. Press the **Enter (↵)** key to access the Protocol options menu (see **Figure 7.5**).



Figure 7.5 - Protocol Options Menu

2. Press the ↑↓ keys to highlight an option, and press the **Enter (↵)** key to assign that option.

3. Press the ↓ key to move the cursor to the Error Method field, and press the **Enter (↵)** key to access the Error Method options menu (see **Figure 7.6**). Press the ↑↓ keys to highlight an option, and then press the **Enter (↵)** key to assign that option.

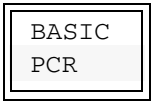


Figure 7.6 - Error Method Options Menu

✍ *If the BASIC Error Method is assigned, the PCR - N1 and PCR - N2 fields are not accessible. If you assigned the BASIC Error Method, you can skip to* ***Step 6****.*

4. Press the ↓ key to move the cursor to the PCR - N1 field, and press the **Enter (↵)** key. Enter a value between 2 and 127, and press the **Enter (↵)** key to assign that value to the PCR - N1 field.

5. Press the ↓ key to move the cursor to the PCR - N2 field, and press the **Enter** (↵) key. Enter a value between 1 and 9999, and press the **Enter** (↵) key to assign that value to the PCR - N2 field.

6. Press the ↓ key to move the cursor to the Xmt Flags field, and press the **Enter** (↵) key. Enter a value between 1 and 255, and press the **Enter** (↵) key to assign that value to the Xmt Flags field.

7. Press the ↓ key to move the cursor to the Max Octet Size field, and press the **Enter** (↵) key. Enter a value between 4 and 280, and press the **Enter** (↵) key to assign that value to the Max Octet Size field.

8. Press the ↓ key to move the cursor to the Timer 1 field, and press the **Enter** (↵) key. Enter a value, and press the **Enter** (↵) key to assign that value to the Timer 1 field.

9. Repeat **Step 8** for Timer 2 through Timer 7.

10. If the protocol selected requires EIM TMR through LSSU Length settings other then the default settings, press the ↓ key to move the cursor into the proper field and press the **Enter** (↵) key. Enter the values, and press the **Enter** (↵) key to assign the values.

11. Repeat **Step 1** through **Step 10** for all linksets that require Level 2 parameters. Press the ↑↓↔ keys to move between fields and columns.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

LEVEL 3 PARAMETERS

The Level 3 parameters options are used to define routing parameters. From the SS7 Configure options menu, highlight the Level 3 Parameters option, and press the Enter (↵) key. The Level 3 Parameters options menu is displayed (see **Figure 7.7**).

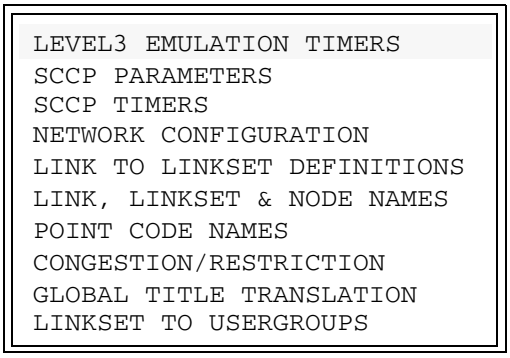


Figure 7.7 - SS7 Level 3 Parameters Options Menu

✍ *If you purchased the Trunk Tester Network or Trunk Tester Switch, two additional options, TGT SYSTEM MAPPING and TGT CIC-TS MAPPING, are available. For more information about these options, refer to the* ***Spectra Trunk Tester Guide****.*

The only two choices that are necessary for the Monitor mode are Link To Linkset Definitions and Point Code Names. Link to linkset definitions must be defined in the Monitor mode to correctly apply filters and other options; however, the Signalling Link Code (SLC) parameters in the Link to Linkset Definitions screen do not require settings for Monitor mode. This screen is discussed in "Link To Linkset Definitions" on page 177 of this guide. Point code names must be defined if you want to view point code statistics. The Point Code Names screen is described in "Point Code Names" on page 184 of this guide. If you are using the SS7 portion of the Spectra system for monitoring only, you can skip all other Level 3 Parameter screens.

LEVEL 3 EMULATION TIMERS

This screen defines the timers associated with Message Transfer Part (MTP) Level 3 procedures. These timers are used to control the Spectra system Level 3 functions. Timer intervals in this screen display in milliseconds. The recommended ranges for the timers are protocol specific.

From the Level 3 Parameters options menu, highlight the Level 3 Emulation Timers option, and press the Enter (↵) key. The Level 3 Emulation Timers screen is displayed (see **Figure 7.8**).

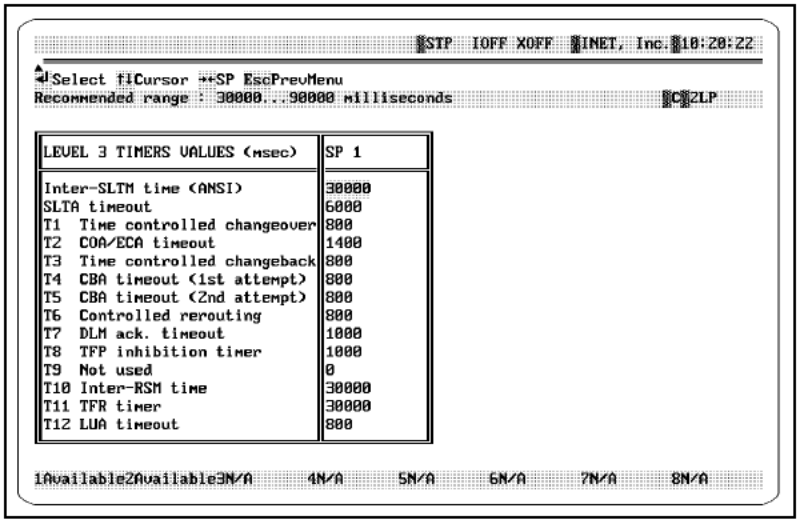


Figure 7.8 - Level 3 Emulation Timers Screen

Level 3 Emulation Timers Screen Definitions

↵Select
Press the Enter key to access a field for editing an entry.

↑↓Cursor
Press the ↑↓ keys to move the cursor to a particular field.

→←Sp
Press the →← keys or the + - keys to display the timers.

LEVEL 3 TIMERS VALUES
This list of timers controls the Spectra system's MTP Level 3 functions. The timer message options are defined as follows.

> **Inter-SLTM time (Protocol)**
> In any of the emulation modes, the Spectra system can generate Signalling Link Test Messages (SLTMs). SLTM generation by the Spectra system is disabled when this field is set to 0. Any other value instructs the Spectra system to generate SLTM messages on all active links in that signalling mode.

SLTA timeout
In any of the emulation modes, the Spectra system automatically responds to SLTM messages by sending Signalling Link Test Acknowledgment (SLTA) messages. The time entered is used by the Spectra system as the maximum time to respond to incoming SLTM messages.

Inter-SRT time (Japan only)
In the Japan emulation mode, the Spectra system can generate Signalling Route Test (SRT) signals. SRT generation by the Spectra system is disabled when this field is set to 0. Any other value instructs the Spectra system to generate SRT signals on all active links in that signalling mode.

SRA timeout (Japan only)
In the Japan emulation mode, the Spectra system automatically responds to SRT signals by sending Signalling Route Acknowledgments (SRAs). The time entered is used by the Spectra system as the maximum time to respond to incoming SRT signals.

T1 Time Controlled Changeover
This timer delays the system to avoid message mis-sequencing on changeover.

T2 COA/ECA Timeout
This timer requests the system to wait for a changeover acknowledgment.

T3 Time Controlled Changeback
This timer indicates a time controlled diversion—a delay to avoid mis-sequencing on changeback.

T4 CBA Timeout (1st attempt)
This timer requests the system to wait for changeback acknowledgments.

T5 CBA Timeout (2nd attempt)
This timer requests the system to wait for a changeback acknowledgment second attempt.

T6 Controlled Rerouting
This timer delays the system to avoid message mis-sequencing on controlled rerouting.

T7 DLM Ack. Timeout
This timer requests the system to wait for a signalling data link connection acknowledgment.

T8 TFP Inhibition Timer
This is a transfer-prohibited inhibited timer, with transient solution.

T9
This timer is not used.

T10 Inter-RSM Time
This timer requests the system to wait prior to repeating a signalling route set test message.

T11 TFR timer
This is a Transfer-restricted timer.

T12 LUA Timeout
This timer requests the system to wait for an uninhibit acknowledgment.

T13 LFU Response Timeout
This timer requests the system to wait for a force uninhibit acknowledgment.

T14 LIA Timeout
This timer requests the system to wait for an inhibition acknowledgment.

T15 RCT delay
This timer requests the system to wait prior starting a signalling route set congestion test.

T16 RCT Response Timeout
This timer requests the system to wait for a route set congestion status update.

T17 Link Restart Delay
This timer requests the system to delay to avoid oscillation of initial alignment failure and link restart.

Timers T18 to T24 differ in ITU-T and BTNR protocols. For information about ITU-T and BTNR Timers T18 through T24, refer to "ITU-T and BTNR Timers T18 through T24" on page 149 of this guide.

T18 Repeat TFR once by resp
This timer requests the system to repeat a TFR once by response method.

T19 Failed link craft refer
This is a failed link craft referral timer.

T20 Wait to repeat LLI
This timer requests the system to wait prior to repeating a local inhibit test.

T21 Wait to repeat LRI
This timer requests the system to wait prior to repeating a remote inhibit test.

T22 SP wait for signal link available
This timer indicates the timer at restarting SP is waiting for signalling links to become available. This setting is network dependent.

T23 SP wait for TRA
This timer indicates the timer at restarting SP (started after T22) is waiting to receive all traffic restart allowed messages. This setting is network dependent.

T24 STP wait for all TRAs sent
This timer indicates the timer at restarting SP with transfer function (started after T23) is waiting to broadcast all traffic restart allowed messages. This setting is network dependent.

T25 SP adj to restart SP, TRA
This timer indicates the timer at adjacent SP to restarting SP is waiting for traffic restart allowed message.

T26 Restart SP wait TRW
This timer indicates the timer at restarting SP is waiting to repeat traffic restart waiting message.

T27 Min unavail full restart
This timer indicates the minimum duration of unavailability for full restart.

T28 SP adj to restart SP
This timer indicates the timer at SP adjacent to restarting SP is waiting for traffic waiting message.

T29 TRA to unexpect TRA or TRW
This timer is started when TRA is sent in response to an unexpected TRA or TRW message.

T30 Limit send of TFP/TFR
This timer limits the sending of TFPs and TFRs in response to unexpected TRA or TRW messages.

T31 False Link Congestion
This timer is a false link congestion detection timer.

T32 Link osc. timer Proc-A
This timer is a link oscillation timer for Procedure A.

T33 Probation timer link osc.
This timer is a link oscillation timer for Procedure B.

T34 Suspension link osc. timer Proc-B
This timer is a suspension timer for link oscillation used for Procedure B.

ITU-T and BTNR Timers T18 through T24

T18 STP Restarting, Links (ITU-T and BTNR)
This timer indicates the timer at restarting signalling transfer point is waiting for signalling links to become available.

T19 STP Restarting, TRAs (ITU-T and BTNR)
This timer indicates the timer at restarting signalling transfer point (started after T18) is waiting to receive all traffic restart allowed messages.

T20 STP Restarting, send TRAs (ITU-T and BTNR)
This timer indicates the timer at restarting signalling transfer point (started after T19) is waiting to broadcast traffic restart allowed messages, and restart remaining traffic.

T21 Wait for one TRA (ITU-T and BTNR)
This timer indicates the following:

- The timer at the restarting signalling point (having no signalling transfer point function) is waiting to restart traffic routed through adjacent signalling point.
- The timer at the signalling transfer point adjacent to the restarting signalling transfer point is waiting for traffic restart allowed message.
- The timer at the signalling point (having no signalling transfer point function adjacent to restarting signalling point) is waiting to restart any traffic to route through adjacent signalling point.

T22 Inter-LLT Time (ITU-T and BTNR)
This is a local inhibit test timer.

T23 Inter-LRT Time (ITU-T and JAPAN)
This is a remote inhibit test timer.

T24 Stabilizing Time after LPO (ITU-T and BTNR)
This timer, used in LOP latching to RPO, indicates the system stabilizing after removal of local processor outage.

Assigning Timers to Linksets

Follow these steps to assign timers to linksets.

Step	Action
1.	When the Level 3 Emulation Timers screen is displayed, the cursor is automatically placed on the Inter-SLTM time option under the SP 1 column. Press the ↑↓ keys to highlight the timer option to be modified.
2.	Press the **Enter** (↵) key to access the numeric entry field.
3.	Enter the time (in milliseconds), and press the **Enter** (↵) key to assign the entry as a timer to the selected signalling point.
4.	Repeat **Step 1** through **Step 3** for each timer that requires timer assignments for that signalling point.
5.	Repeat **Step 1** through **Step 4** for all signalling points that need to be modified. Press the **+** or **-** keys move between signalling points.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

SCCP PARAMETERS

This screen assigns subsystem numbers, management messages, and Destination Point Codes (DPC) for TCAP level messages. These parameters help ensure smooth communication when handling messages containing TCAP information.

✍ *The SCCP Parameters screen is only necessary in SCP Emulator, TCAP Generator, or GSM Generator mode. If these modes are handling Signalling*

Connection Control Point (SCCP) information and no assignments have been made in this screen, the application gets an error because the proper settings have not been assigned.

From the Level 3 Parameters options menu, highlight the SCCP Parameters option, and press the Enter (↵) key. The SCCP Parameters screen is displayed (see Figure 7.9).

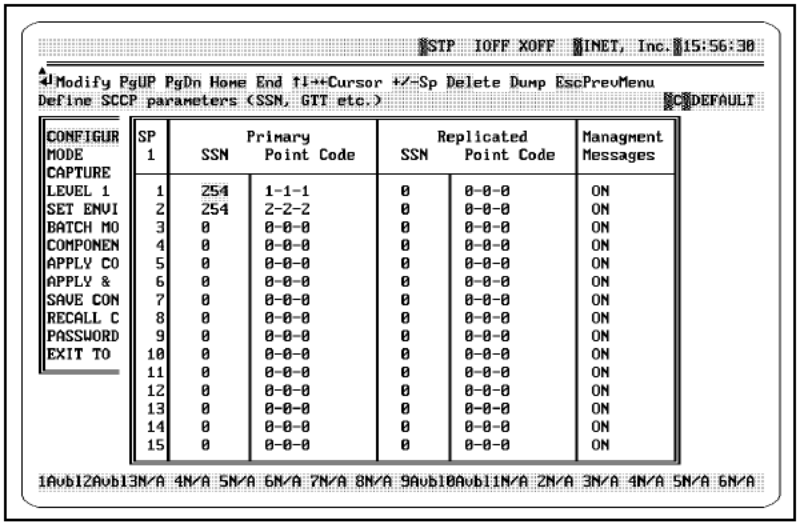


Figure 7.9 - SCCP Parameters Screen

SCCP Parameters Screen Definitions

↵Modify
Press the Enter (↵) key in order to access a highlighted field for editing.

PgUp/PgDn
Press the PgUp or PgDn keys to scroll through the entries in the SCCP Parameters screen.

Home/End
Press the Home or End keys to move to the beginning or the end of the list of entries.

↑↓→←Cursor
Press the ↑↓↔ keys to move the cursor to a particular field on the screen.

+/-Sp
Press the + or - key to display the SCCP parameters for the next or previous emulated signalling point or signalling transfer point.

Delete
Press the Delete key to reset all fields on that row. The Subsystem Number (SSN) and Point Code fields are set to zero; the Management Messages field is set to ON.

Dump
Press the D key to dump the current SCCP parameters that are currently being defined to an ASCII disk file in the `C:\SPECTRA\PRINTLOG` directory under the test name with a `.PRT` extension. The files can be viewed using the DOS Commands option under the F8 Tools menu.

SSN

The Subsystem Number identifies a particular application within a certain signalling point, signalling transfer point, or signalling control point. **Table 7.1** displays ANSI, ITU-T, CHINA, BTNR, and JAPAN Subsystem Number assignments.

Table 7.1 - Subsystem Numbers

SSN	ANSI Subsystem Description	ITU-T, CHINA, BTNR, and JAPAN Subsystem Description
00	SSN not known/not used	SSN not known/not used
01	SCCP Management	SCCP Management
02	Telephone User Part (TUP)	(Reserved for ITU-T allocation)
03	ISDN User Part	ISDN User Part
04	Operation, Admin. & Maintenance Part	Operation, Admin. & Maintenance Part
05	MAP-IS41 Mobile Application Part	MAP - Mobile Application Part PDC - Personal Digital Cellular (Japan only)
06	HLR-IS41 Home Location Register	HLR - Home Location Register
07	VLR-IS41 Visitor Location Register	VLR - Visitor Location Register
08	MSC-IS41 Mobile Switching Center	MSC - Mobile Switching Center
09	EIR-IS41 Equipment Identification Register	EIR - Equipment Identity Register
10	AC-IS41 Authentication Center	AC - possible Authentication Center
11-250	(spare)	(spare)

Table 7.1 - Subsystem Numbers (Continued)

SSN	ANSI Subsystem Description	ITU-T, CHINA, BTNR, and JAPAN Subsystem Description
251	CLASS	(spare)
252	PVN Private Virtual Network	(spare)
253	LIDB Query	BSS - Operations And Maintenance
254	800 Number Translation	BSS - Radio Subsystem Application Part
255	(Reserved for expansion)	(Reserved for expansion)

✍ *Table 7.1 is not intended to be a comprehensive listing of subsystem numbers. For more information about Subsystem numbers, refer to the protocol specifications.*

Point Code

The primary point code is the primary location of the subsystem. The replicated point code is a secondary location of a subsystem. If the Spectra system receives a Subsystem Prohibited (SSP) message from the Primary SSN/point code, the Spectra system attempts to contact the Replicated SSN/point code.

Management Messages

The Management Messages field determines the TCAP handshaking protocol option to be used for each subsystem.

The Enter (↵) key toggles the option between ON, B-CAST, and OFF. These options are described in the following paragraphs.

- An ON setting enables subsystem verification. At 15-second intervals, the Spectra system transmits Subsystem Test (SST) messages to the point codes specified in the SCCP Parameters screen, as shown in **Figure 7.10**. After a signalling point returns a Subsystem Allowed (SSA) message, the Spectra system no longer sends SST messages to that signalling point and will process TCAP messages directed to the verified subsystem.

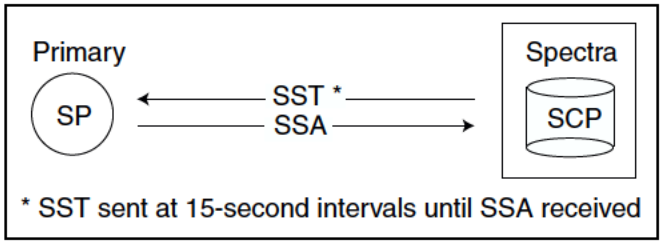


Figure 7.10 - Management Message Sent to Primary Point Code

- If the Spectra system receives a Subsystem Prohibited (SSP) message from the Primary SSN/point code, the Spectra system transmits an SST message to the Replicated SSN/point code.

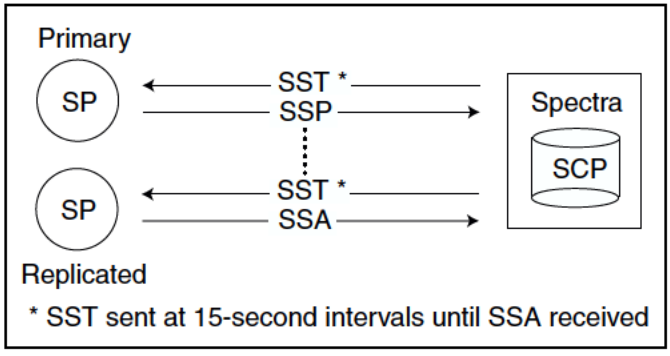


Figure 7.11 - Management Message Sent to Replicated Point Code

- A B-CAST setting enables subsystem verification broadcasting. When the Spectra system receives a Subsystem Allowed (SSA) message from a connected node, Subsystem Allowed messages are broadcast to all nodes connected to the Spectra system to inform them that the subsystem is allowed, eliminating the need for individual nodes to transmit SST messages for that subsystem.(See **Figure 7.12**).

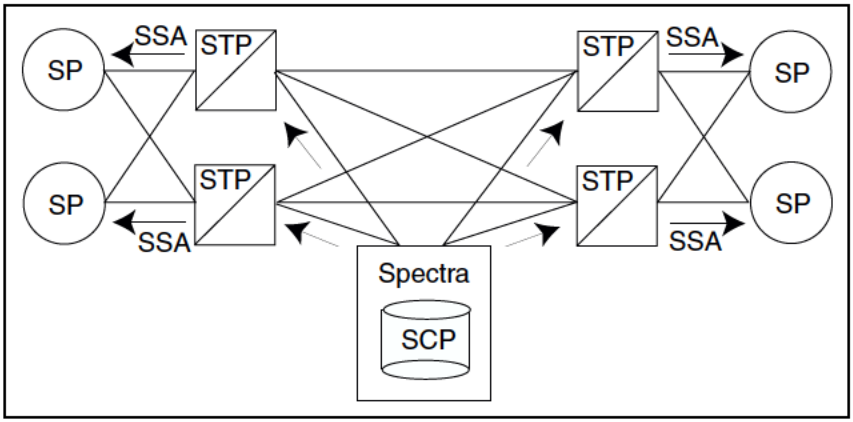


Figure 7.12 - Broadcast Management Messages

- An OFF setting assumes that the associated subsystem is available and does not transmit SST messages to the related point code.

Assigning SCCP Parameters

Follow these steps to assign the SCCP parameters.

Step	Action
1.	When the SCCP Parameters screen is displayed, the cursor is automatically placed on the first row under the SSN column of the Primary option for SP1.

✍ *When parameters are assigned, each signalling point is assigned the SP number appearing in the first column of the SCCP Parameters screen.*

2.	Press the **Enter** (↵) key to access the SSN data entry field for the Primary option.

3. Enter the subsystem number (1 through 255), and press the **Enter** (↵) key to assign the subsystem number (this number is network specific).

✍ *The assignments made in the Primary option are primary routes for that entry. If any of these subsystems are unavailable, the Spectra system references the parameters assigned with the Replicated option.*

4. Press the → key to move the cursor to the Point Code field, and press the **Enter** (↵) key to access the data entry field.

5. Enter the point code, and press the **Enter** (↵) key to assign the number.

6. If necessary, repeat **Step 1** through **Step 5** for the Replicated option to provide secondary reference subsystems for the entry.

7. Repeat **Step 1** through **Step 6** for all entries you want to make for that signalling point. A maximum of 64 entries are allowed per signalling point.

8. Repeat **Step 1** through **Step 7** for other signalling points (if necessary). Press the **+** or **-** keys to move between signalling points.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

SCCP TIMERS

This screen defines the timers associated with SCCP. Timers are used to control SCCP functions in the GSM Generator mode. Time intervals in this screen display in milliseconds.

From the Level 3 Parameters options menu, highlight the SCCP Timers option, and press the Enter (↵) key. The SCCP Timers screen is displayed (see **Figure 7.13**).

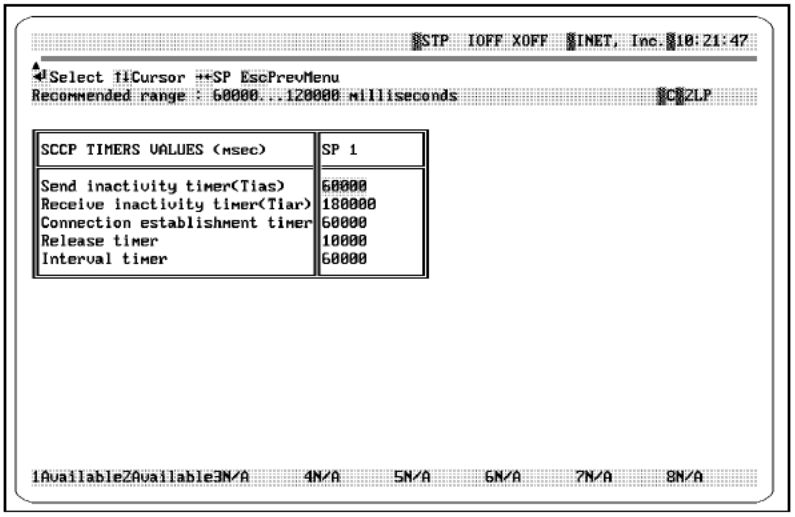


Figure 7.13 - SCCP Timers Screen

SCCP Timers Screen Definitions

↵Select
Press the Enter key to access a field for editing an entry.

↑↓Cursor
Press the ↑↓ keys to move the cursor to a particular field.

→←Sp
Press the →← keys to display the timers.

SCCP TIMER VALUES
This list of timers controls the Spectra system's SCCP functions. The timer message options are defined as follows.

> **Send Inactivity Timer (Tias)**
> This timer requests the system to delay before sending an Inactivity Test—timer is reset any time a message is sent. The recommended range is 60000 to 120000 milliseconds.

Receive Inactivity Timer (Tiar)
This timer requests the system to delay before connection release procedure is initiated—timer is reset any time a message is received. The recommended range is 180000 to 360000 milliseconds.

Connection Establishment Timer
This timer indicates the system is waiting for a connection confirm message after sending a connection request message. The recommended range is 60000 to 120000 milliseconds.

Release Timer
This timer indicates the system is waiting for a connection to be released by reception of a release complete. The recommended range is 10000 to 20000 milliseconds.

Interval Timer
After the release timer has expired, this timer sets an interval for the sending of the release message which repeats every 4 to 15 seconds for the duration of the Interval Timer. The recommended range is 1 to 60000 milliseconds.

Assigning SCCP Timers

Follow these steps to assign the SCCP timers.

Step	Action
1.	When the SCCP Timers screen is displayed, the cursor is automatically placed on the Send Inactivity Timer (Tias) option under the SP 1 column. Press the ↑↓ keys to highlight the timer option to be modified.
2.	Press the **Enter** (↵) key to access the timer's numeric entry field.
3.	Enter in the time (in milliseconds), and press the **Enter** (↵) key to assign the entry.
4.	Repeat **Step 1** through **Step 3** for the other timers that need to be modified for that signalling point.

5. Repeat the entire procedure for each signalling point that requires timer assignments. Press the →← keys to move between signalling points.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

NETWORK CONFIGURATIONS

The Network Configuration screen assigns specific configuration information for your network. The entries in this screen define the behavior of the Spectra system. The Spectra system can emulate up to 16 individual signalling nodes (SP/SSP/SCP/STP) or a combination of nodes. The Network Configuration screen can be used to do the following actions:

- Assign links to linksets
- Assign linksets to signalling nodes
- Define specific signalling point information, such as Network Indicators, MSU Priorities, Node Types, Protocols, Decode, and Signalling Link Selection (SLS) Bit settings

✍ *The SLS Bit settings are used to select JAPAN 5-BIT and JAPAN 9-BIT protocols.*

- Define the nodes that are adjacent to the Spectra system—the neighboring signalling points/signalling transfer points in the network
- Establish routing information—multiple routes can be assigned to allow back-up routes in the event original routes are unavailable
- Assign virtual signalling points that allow the Spectra system to emulate additional signalling points
- Assign virtual C-Links between an emulated STP pair

By setting the Network Configuration screen field entries to correspond to your actual network setup, the Spectra system can accurately simulate network communication scenarios.

From the Level 3 Parameters options menu, highlight the Network Configuration option, and press the **Enter** (↵) key. The Network Configuration screen is displayed (see **Figure 7.14**).

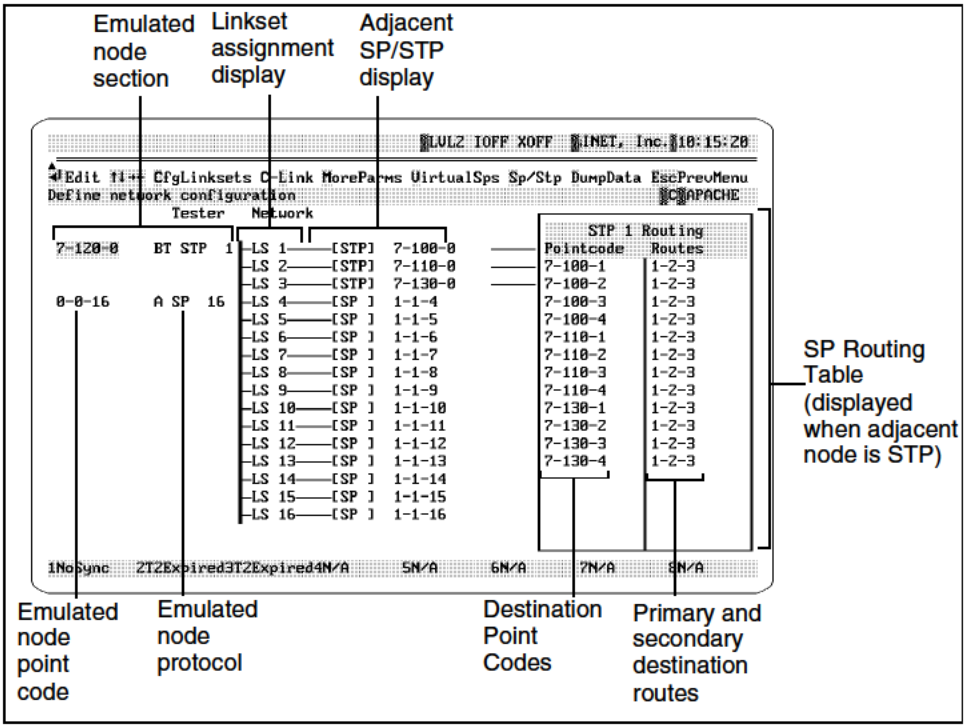


Figure 7.14 - Network Configuration Screen

✍ *Default point codes used for JAPAN are in 2-digit hexadecimal format.*

Network Configuration Screen Definitions

Cfg Linksets

The Configure Linksets option assigns up to 16 linksets to the Spectra system's 16-emulated signalling nodes. This process allows various network configurations to be simulated for testing purposes. For example, all 16 linksets may be assigned to one signalling point, or one linkset can be assigned to each of the 16 signalling points. When the C key is pressed, the Assign Linksets option is displayed. This option is explained in detail in "Assigning Names to Linksets" on page 182 of this guide.

C-Link
This option is used to assign a virtual C-Link between STP 1 and STP 2 when they are emulated by the Spectra system. A C-Link is the standard link used between two mated STPs. The Spectra system can emulate a C-Link to provide a lowest-priority route for message traffic when a physical link route is unavailable. When the L key is pressed with the cursor in the STP 1 field, a yellow line is displayed connecting STP 1 and STP 2 in the Network Configuration screen. This indicates that the virtual C-Link is active between the two STPs.

More Parms
The More Parameters option provides additional parameter settings to be used for SP or STP emulation. When the Emulated Node section is highlighted and the M key is pressed, this options menu is displayed (see **Figure 7.15**).

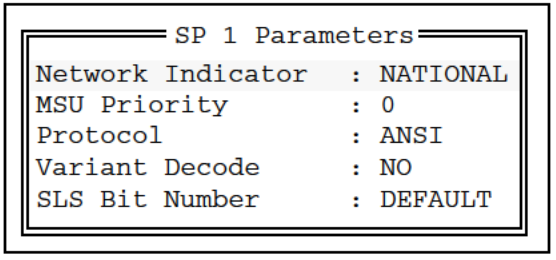


Figure 7.15 - Emulated Node More Parameters Options Menu

Network Indicator
This option allows the network indicator field to be set for your configuration. The Network Indicator options menu lists the following options:

- International
- Spare 01
- National
- Spare 11

MSU Priority
This option allows a priority to be assigned to MSUs for the signalling point. Valid entries are 0, 1, 2, or 3 with 3 being the highest priority setting. A high priority setting ensures that MSUs take transmission precedence in congested transmission situations. (This field is only valid when working with the ANSI protocol.)

Protocol
This option offers another way to change the Level 2 and Level 3 protocol options. This option overrides any other Level 2 selection. The Protocol options menu lists the following options:

- ANSI
- ITU-T RED
- ITU-T BLUE
- ITU-T WHITE
- CHINA
- BTNR
- JAPAN

✍ *Only those protocol options that have been purchased display.*

The protocol designation for each node appears next to that node in the Emulated Node section of the Network Configuration screen in the following format (see **Figure 7.14**):

- A for ANSI
- R for ITU-T RED
- B for ITU-T BLUE
- W for ITU-T WHITE
- C for CHINA
- BT for BTNR
- J for JAPAN

Variant Decode
This option allows the Spectra system to operate normally using some network specific variation of a standard protocol. The Variant Decode must be purchased from Inet.

✍ *Variant Decode is used for display only. If Variant Decode is set to YES, the Emulated Node protocol is the standard protocol for all Spectra functions other than message display. For example, if a variant of the ANSI protocol is being used, use the More Parameters option to set the Protocol to ANSI and the Variant Decode to YES; messages decode using the variant. However, filters, triggers, statistics, and call trace are still based on standard ANSI, and the Emulated Node section of the Network Configuration screen shows "A" for ANSI.*

SLS Bit Number
This option allows the Spectra system to toggle between DEFAULT (5-b SLS) or an 8-b SLS.

For JAPAN protocol, the SLS Bit Number allows selection of JAPAN 4-BIT, JAPAN 5-BIT, or JAPAN 9-BIT protocols.

Virtual SPs
The Virtual SPs option allows the Spectra system to emulate internal signalling points while the Spectra system is configured as an STP (or STPs). Up to 16 virtual signalling points can be created and linked to any STP node emulated by the Spectra system.

Sp/Stp
When a node is highlighted in either the Emulated Node section or the Adjacent signalling point/signalling transfer point section, press the S key to toggle the assignment of the node between signalling point and signalling transfer point.

SP/STP Routing Table
Every signalling point/signalling transfer point that has an adjacent STP in the configuration has a corresponding routing table. The SP/STP Routing Table feature allows different routing tables to be assigned to the various signalling points in a network configuration, but only one table displays at a time. Separate signalling points have their own routing table and, therefore, their own sets of destination point codes and routes. Each routing table displays the DPCs for that signalling point and the routes used for the corresponding messages. If a signalling point does not have an adjacent STP, no routing table appears for that signalling point.

The Point Code column in the SP/STP Routing Table displays the entries for the possible DPCs to be reached through the associated STP. The entries in the routing table are sorted and listed by numerical order of the point codes listed in the Point Code column.

The numbers entered in the Routes column correspond to the linkset numbering displayed between the Spectra system and the adjacent nodes. For example, LS1 = 1, LS2 = 2, etc. The terms Primary routes and Secondary routes are used for the routing table. The Primary route is the first route selection, and the Secondary routes are the second, third, or fourth route selections. Commas (,) are used to separate different route entries. The route entry listed before a comma is the primary route used; the route entry listed after the comma is the secondary route. The routing table uses dashes (-) between route entries to define loadsharing linksets with the same route priority.

The STP Routing Table gives several examples with brief explanations of the routing options (see **Figure 7.16**).

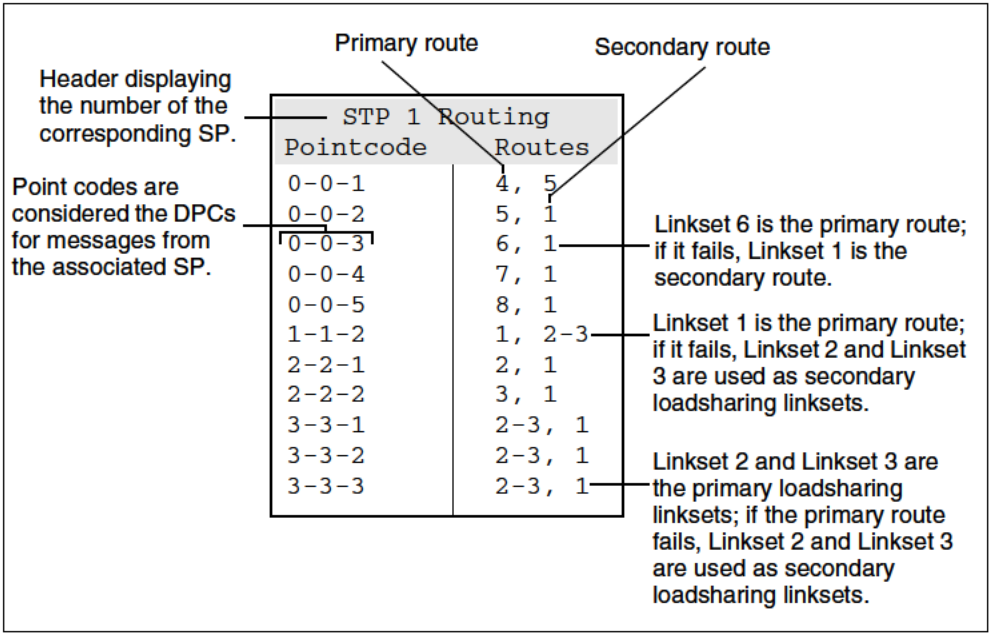


Figure 7.16 - Sample Settings for an STP Routing Table

The following direction line options appear when you access the SP/STP Routing Table.

↵Edit
Press the Enter (↵) key to open the Routing Creation dialog box.

Goto
Press the G key to move the cursor to a specified line in the routing table.

Find
Press the F key to find a specific point code in the routing table.

Delete
Press the Delete key to delete an entry in the routing table.

Multi
Press the M key to access the Multi-Insert Creation dialog box.

Insert
Place the cursor on any line in the routing table and press the Insert key to open the Routing Creation dialog box.

DumpData
This option dumps the current values of the Level 3 configurations as they are currently being defined to an ASCII disk file in the `C:\SPECTRA\PRINTLOG` directory under the test name with a `.PRT` extension. Press the D key to dump the values. The files can be viewed using the DOS Commands option under the F8 Tools menu.

Setting Up Your Network Configuration

It is important to set up the network configuration in a particular sequence because each step affects the next. By setting the Network Configuration screen field entries to correspond to your actual network setup, the Spectra system can accurately simulate network communication scenarios.

In the Network Configuration screen, the cursor is automatically placed on the first point code field under the Emulated Node section (see **Figure 7.17**).

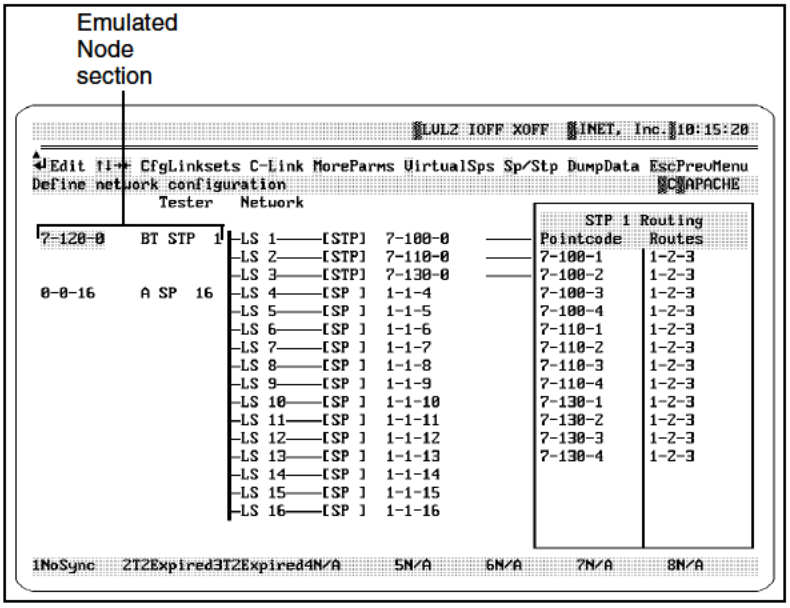


Figure 7.17 - Network Configuration Screen - Emulated Node Section

Before entering point code information, establish linkset and signalling point assignments.

It is important to set up the network configuration in a particular sequence because each step affects the next.

- **Step 1** through **Step 5** of the following procedure explains assigning linksets to signalling points.
- **Step 6** describes assigning SP/STP designations to emulated signalling points.
- **Step 7** and **Step 8** describe assigning point codes to emulated signalling points.
- **Step 9** through **Step 15** describe assigning additional parameters to emulated signalling points.
- **Step 16** and **Step 17** describe assigning point codes to adjacent signalling points.

- **Step 18** describes assigning SP/STP designation to adjacent signalling points.
- **Step 19** through **Step 22** describe assigning DPCs and routes in the SP/STP Routing Table.

Assigning virtual signalling points (optional) is described in "Assigning Virtual Signalling Points" on page 173 of this guide.

To setup the network configuration screen, complete each of these steps that apply to the network the SP/STP is emulating.

Step	Action

1. From the Network Configuration screen, press the **C** key to access the Assign Linksets option. The Assign Linksets screen is displayed (see **Figure 7.18**).

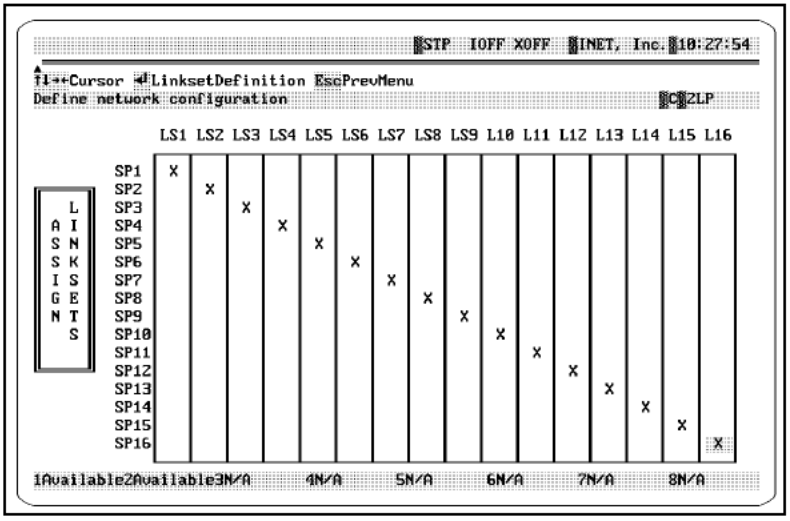


Figure 7.18 - Assign Linksets Screen

When the Assign Linksets option screen is displayed, the cursor is automatically placed on the X under the LS1 column.

2. Press the ↑↓ keys to move the selected X to the desired signalling point row. This assigns the individual linkset to a particular signalling point.

The assignment of linksets determines the number of signalling points that are emulated by the Spectra system in your configuration. For example, if one linkset is assigned to each of the signalling points (see **Figure 7.18**), the Spectra system can emulate 16 signalling points at a time.

3. Press the →← keys to move the cursor to the other linkset columns and repeat the assignment procedure for all linksets that need to be assigned to signalling points. You can assign any desired combination of linkset(s) per signalling point as needed to set up a particular configuration.

4. If individual links need to be allocated to specific linksets, press the **Enter** (↵) key while in the Assign Linksets screen to access the Linkset Definitions screen.

✍ *This provides a shortcut to the Linkset Definitions screen. This screen can also be reached by accessing the Link To Linkset Definitions options menu in the Level 3 Parameters options menu. Using the Linkset Definitions screen is described in "Link To Linkset Definitions" on page 177 of this guide.*

5. After the linkset assignments are made, press the **Esc** key to return to the Point Code field under the Emulated Node section of the Network Configuration screen.

Step 6 describes assigning SP/STP designations to emulated signalling points.

6. Set the parameters for the signalling point to be emulated by the Spectra system. With the point code for the SP/STP highlighted in the Emulated Node section, press the S key to designate whether this node is an STP or an SP. Pressing the S key toggles between the two options. The default is for the node to appear as a signalling point.

Step 7 and **Step 8** describe assigning point codes to emulated signalling points.

7. With the point code for the SP/STP highlighted in the Emulated Node section, press the **Enter** (↵) key to access the point code numeric entry field.

8. Enter the point code and press the **Enter** (↵) key to assign the point code to the field. For the valid point code ranges refer to "Setting Valid Point Code Ranges" on page 115 of this guide.

Step 9 through **Step 15** describe assigning additional parameters to emulated signalling points.

9. Assign the additional parameters for the selected signalling point. Press the **M** key to access the More Parameters options menu for SP1.

10. When the SP1 Parameters dialog box is displayed, the cursor is placed on the Network Indicator field. Press the **Enter (↵)** key to access the Network Indicators options menu. Press the ↑↓ keys to highlight an option, and press the **Enter (↵)** key to assign that option to the field.

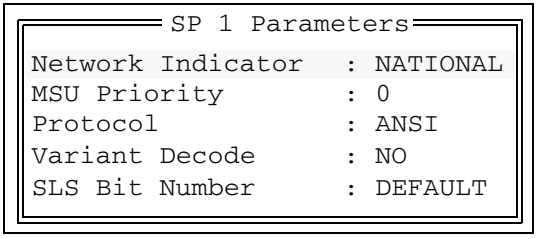


Figure 7.19 - More Parameters Options Menu

11. Press the ↓ key to move the cursor to the MSU Priority field. Press the **Enter (↵)** key to access the numeric entry field, enter a priority number (0 through 3, with 3 being the highest priority), and press the **Enter (↵)** key to assign that number to the field.

12. Press the ↓ key to move the cursor to the Protocol field. Press the **Enter (↵)** key to access the Protocol options menu (see **Figure 7.20**), press the ↑↓ keys to highlight an option, and press the **Enter (↵)** key to assign that option to the field.

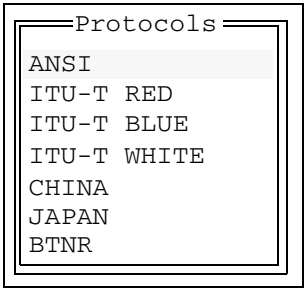


Figure 7.20 - Protocol Options Menu

13. Press the ↓ key to move the cursor to the Variant Decode field. Press the **Enter (↵)** key to toggle between YES or NO in order to turn this option ON or OFF.

14. Press the ↓ key to move the cursor to the SLS Bits field. Press the **Enter** (↵) key to toggle between DEFAULT (5 b SLS) or an 8 b SLS.

15. After the additional SP1 parameters are assigned, press the **Esc** key to return to the Point Code field under the Emulated Node section of the Network Configuration screen.

Step 16 and **Step 17** describe assigning point codes to adjacent signalling points.

16. Assign the parameters for the adjacent signalling point. Press the → key one time to move the cursor to the Adjacent SP/STP section and the Point Code field.

17. Press the **Enter** (↵) key to access the numeric entry field, enter the point code, and press the **Enter** (↵) key again to assign the point code.

Step 18 describes assigning SP/STP designation to adjacent signalling points.

18. To change the SP/STP status of the highlighted node in the Adjacent SP/STP section, press the **S** key to toggle between SP and STP.

    If the adjacent node is set to an STP, the SP/STP Routing Table is displayed. When any of the adjacent signalling points are assigned as STPs, a red line connecting the STP with the SP/STP Routing Table is displayed. This serves as an indicator that signalling points defined in the SP/STP Routing Table are accessible by the corresponding Emulated Node through that adjacent STP.

✍ *If the signalling point does not contain an adjacent STP in the configuration, no routing table entries are needed, and the Spectra system does not display a routing table. You may skip **Step 19** through **Step 22** for any adjacent node that is not an STP.*

Step 19 through **Step 22** describe assigning DPCs and routes in the SP/STP Routing Table.

19. Next, set up the available DPCs and routes for the adjacent signalling point(s). Press the → key one time to move the cursor to the SP/STP Routing Table on the first entry in the routing table. Press the **Insert** key to access the SP/STP Routing Creation dialog box (see **Figure 7.21**).

Or, if you plan to insert multiple entries in the routing table, press the **M** key to access the Multi-Insert Creation dialog box.

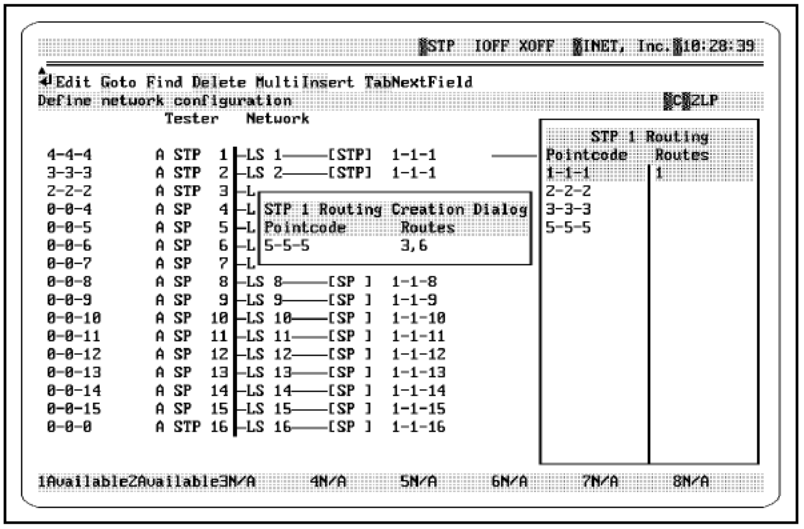


Figure 7.21 - SP/STP Routing Creation Dialog Box

20. Enter the point code and press the **Enter** (↵) key to assign the point code to the field. For the valid point code ranges refer to "Setting Valid Point Code Ranges" on page 115 of this guide.

21. In the Routes column, enter the numbers of the primary linksets connecting the originating signalling point and the destination signalling point. Then, enter a comma (,) and enter the numbers of the secondary connecting linksets (if available). This is done to assign linkset routing priority to networks. Be sure to include a dash (-) for any loadsharing linksets at the same routing priority level. Up to 64 destination routes (four routes per destination) can be assigned. After the destination routes have been assigned, press the **Enter** (↵) key to assign the routing table entry.

✍ *If the linkset route numbers entered are invalid because the route does not exist in the network, the entry does not display in the routing table afterwards.*

22. Press the **Insert** key to create a new entry anywhere in the routing table, and press the **Delete** key to delete a selected entry.

✍ *Routing table entries are automatically sorted and displayed in numerical order.*

23. Repeat **Step 6** through **Step 22** for each Emulated SP/STP and Adjacent SP/STP in your network configuration.

Assigning Virtual Signalling Points

Assigning virtual signalling points that allow the Spectra system to emulate additional signalling points is optional. It is not necessary to complete this sequence in order to run an emulation scenario. Complete the following sequence to assign the parameters for any virtual signalling points in your network.

Step	Action

1. From the Network Configuration screen, press the **V** key to access the Virtual SP screen (see **Figure 7.22**).

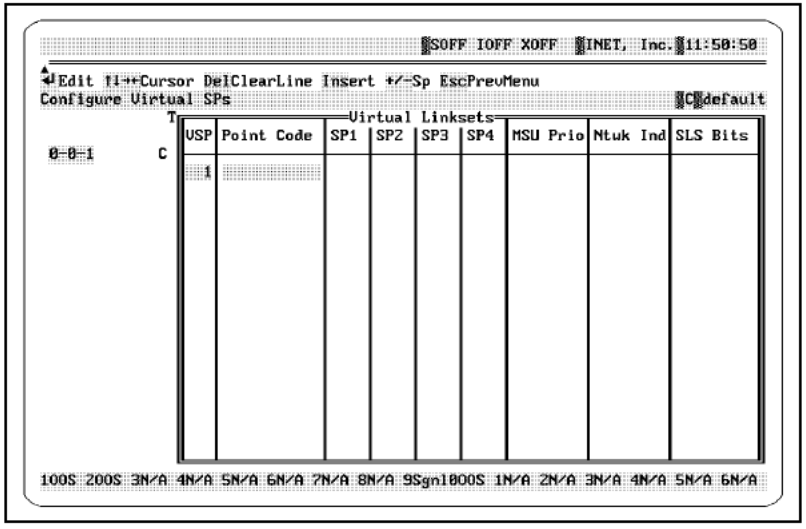


Figure 7.22 - Virtual SP Screen

2. When the screen is displayed, the cursor is automatically placed on the first row under the Point Code column. Press the **Enter** (↵) key to access the entry field. Enter a point code assignment for a virtual signalling point and press the **Enter** (↵) key to assign the point code. (For the valid point code ranges refer to "Setting Valid Point Code Ranges" on page 115 of this guide.)

3. Press the → key to move the cursor to the SP1 column. Press the **Enter** (↵) key to access the entry field, enter a unique name for the

virtual signalling point link (V1-V64), and press the **Enter (↵)** key to assign the associated virtual signalling points to the STP.

✍ *A signalling point in the Emulated Node section of the Network Configuration screen must be set to an STP before you can assign virtual SPs.*

4. Repeat **Step 3** to assign virtual signalling points to signalling points 2 through 16 (if necessary). Press the **+** or **-** keys to move between signalling points.

5. Press the → key to move the cursor to the MSU Priority column for the virtual SP. Press the **Enter (↵)** key to access the numeric entry field, Enter a priority number (0 through 3, with 3 having the highest priority), and press the **Enter (↵)** key to assign that number to the field.

6. Press the → key to move the cursor to the Network Indicator column. Press the **Enter (↵)** key to access the Network Indicator options menu, select a Network Indicator (International, Spare 1, National, or Spare 2), and press the **Enter (↵)** key to assign it.

7. Press the → key to move the cursor to the SLS Bits column. Press the **Enter (↵)** key to toggle between the DEFAULT (5 b SLS) or an 8 b SLS. For JAPAN protocol, the SLS Bits column allows you to select JAPAN 4-BIT, JAPAN 5-BIT, or JAPAN 9-BIT.

8. Repeat **Step 2** through **Step 7** for up to 16 virtual signalling points. Press the **Insert** key to insert a new entry above the highlighted row, or press the ↓ key until a new entry is displayed at the bottom of the list.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

Examples of Network Configurations

The following figures depict two sample network configurations and the subsequent settings that are required in the Network Configuration screen to emulate the network setup.

Figure 7.23 and Figure 7.24emulate six signalling points, and Figure 7.25 and Figure 7.26 emulate two STPs.

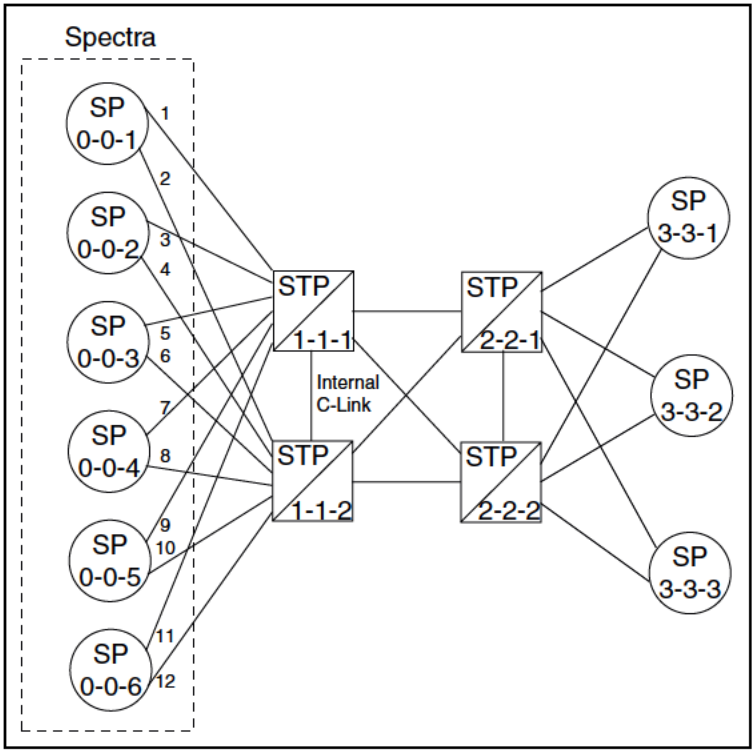


Figure 7.23 - Example 1 - Spectra System Network Configuration

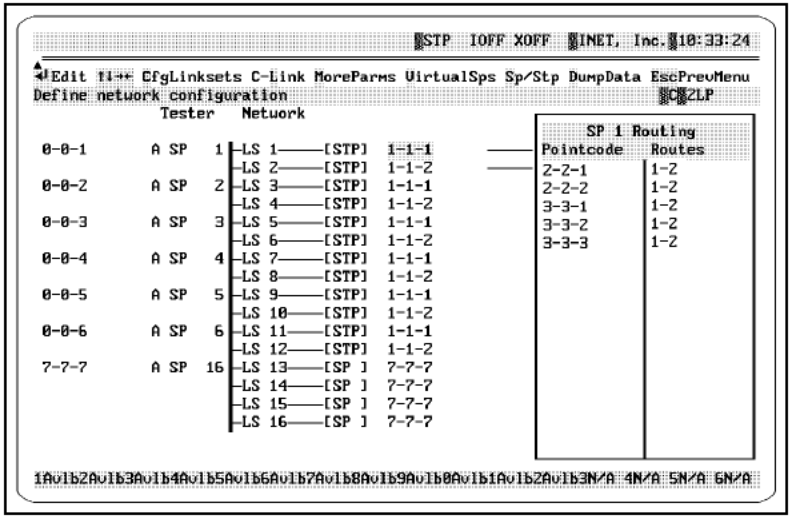


Figure 7.24 - Example 1 - Network Configuration Settings

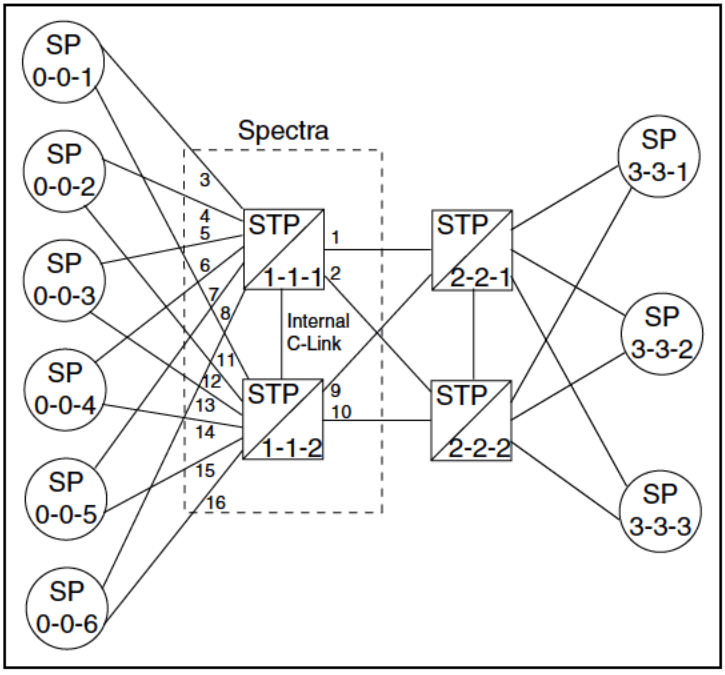


Figure 7.25 - Example 2 - Spectra System Network Configuration

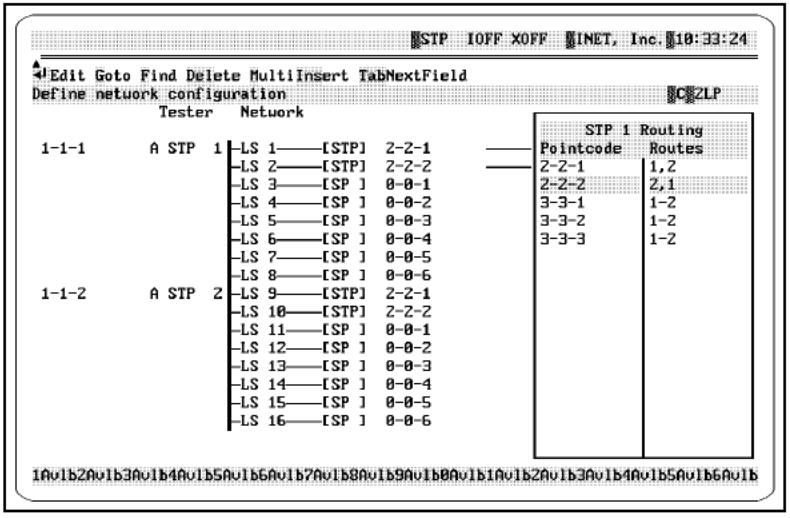


Figure 7.26 - Example 2 - Network Configuration Settings

LINK TO LINKSET DEFINITIONS

The Link To Linkset Definitions screen offers a way to allocate specific links to linksets. You can also give names to the individual linksets and specify the SLC for each link.

Follow these steps to access the Level 3 Linkset Definitions screen.

Step	Action

1. From the Level 3 Parameters options menu, highlight the **Link to Linkset Definitions** option, and press the **Enter** (↵) key. The Link to Linkset Definitions screen is displayed (see **Figure 7.27**).

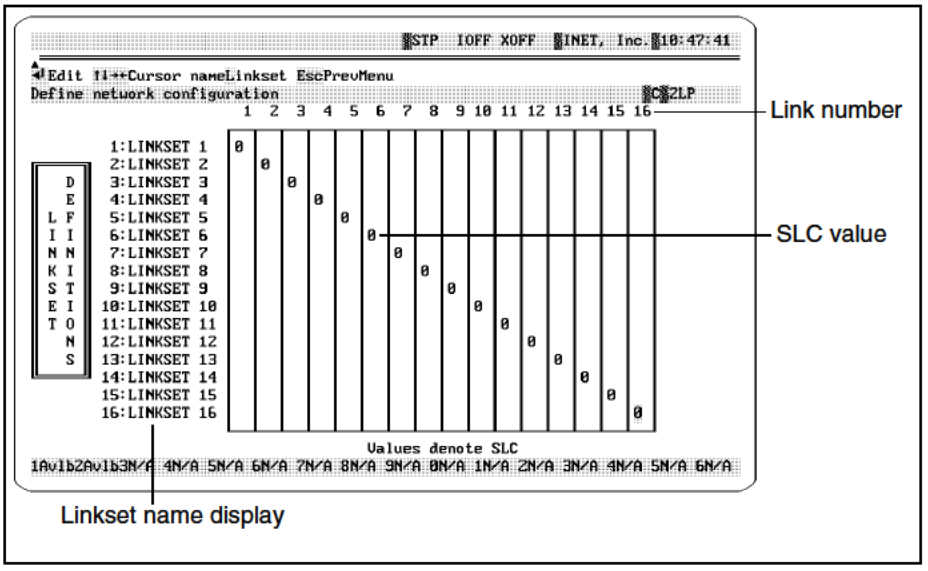


Figure 7.27 - Link To Linkset Definitions Screen

This screen can also be accessed through the Network Configuration screen for user-friendly configuration setup. This provides a short cut when you are setting up network configurations. From the Network Configuration screen, press the C key to access the Assign Linksets screen; from the Assign Linksets screen, press the Enter (↵) *key to access the Linkset Definitions screen. This allows you to access all screens needed for the network configuration setup from one screen.*

Link To Linkset Definitions Screen Definitions

↵Edit
Press the Enter (↵) key to access a field for editing an entry.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

nameLinkset
Press the L key to access the Name Linkset dialog box for the selected row. This allows you to enter the name to be associated with the linkset. Names can be a maximum of nine characters.

Linkset Name Display
This option displays the name assigned to the given linkset. The default name is Linkset #, where # is the link number.

Link Number Display
This row displays the link number.

SLC Values
This object denotes the SLC value set for that linkset.

Assigning Links to Linksets

Follow these steps to assign links to linksets.

Step	Action
1.	When the Link To Linkset Definitions screen is displayed, the cursor is automatically placed on the Linkset 1 field and under the Link 1 column. Press the **L** key to access the Name Linkset dialog box (see **Figure 7.28**).

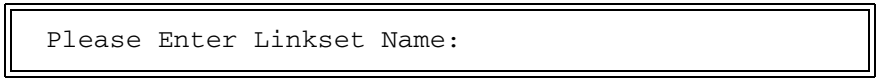


Figure 7.28 - Name Linkset Dialog Box

2.	Enter the name to be associated with the linkset (maximum of nine characters), and press the **Enter (↵)** key to assign the name.
3.	Press the ↑↓ keys to move the highlighted number display under the Link 1 column to the desired linkset row. This assigns the individual link to that linkset.

4. Press the **Enter** (↵) key to access the SLC entry field. Enter the SLC number, and press the **Enter** (↵) key again to assign the entry. This assigns the SLC for that link within the linkset.

✍ *You do not need to set the SLC if you plan to use only the Monitor mode for SS7.*

5. Repeat this procedure for all links that need to be assigned to linksets. Press the →← keys to move between links and linksets. To name a linkset, you must highlight the row for that particular linkset before the L key is pressed.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

LINK, LINKSET, AND NODE NAMES

The Spectra system allows logical names to be assigned to links, linksets, and emulated nodes to simplify their identification.

From the Level 3 Parameters options menu, highlight the Link, Linkset & Node Names option, and press the Enter (↵) key. The Link, Linkset & Node Names options menu is displayed (see **Figure 7.29**).

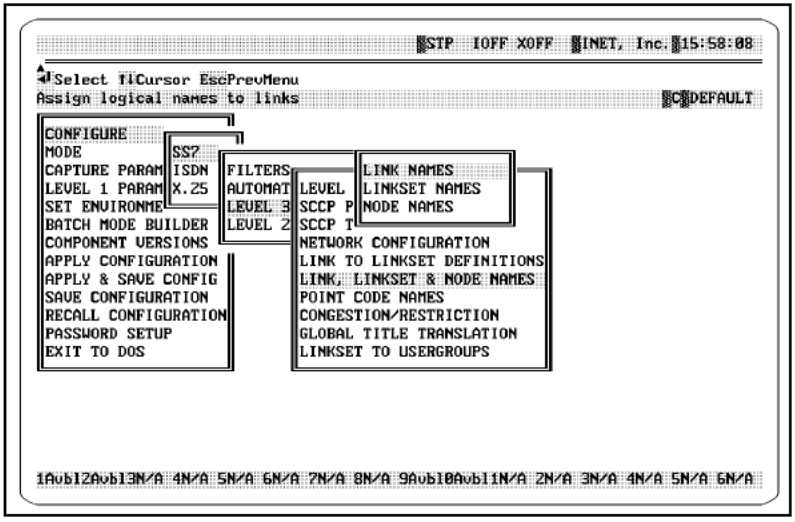


Figure 7.29 - Link, Linkset & Node Names Options Menu

Assigning Names to Links

Follow these steps to assign names to links.

Step	Action

1. From the Link, Linkset & Node Names options menu, highlight the **Link Names** option, and press the **Enter** (↵) key. The Link Names screen is displayed (see **Figure 7.30**).

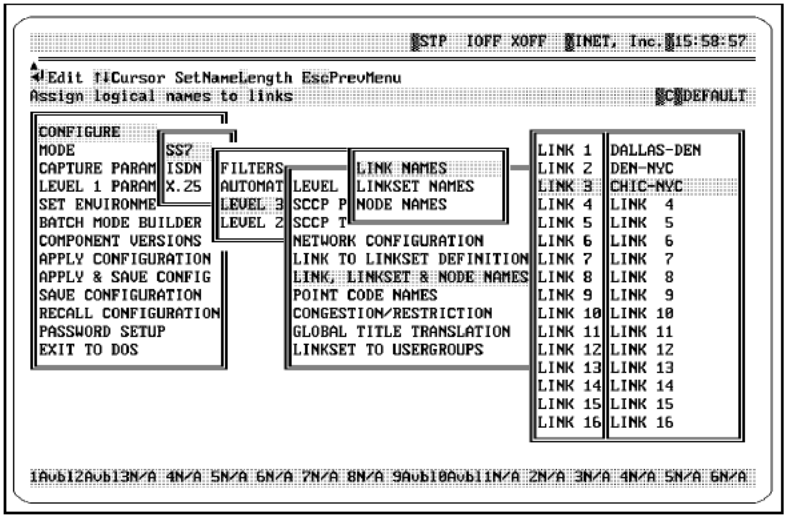


Figure 7.30 - Link Names Screen

2. Use the ↑↓ keys to highlight a link, and press the **Enter** (↵) key to access the link name entry field.

3. Enter a name (maximum of 14 characters) for the link, and press the **Enter** (↵) key to assign it.

✍ *You can designate the maximum number of characters to be used in naming links by using the Set Name Length option. Press the L key to access the Set Name Length dialog box, and enter the maximum number of characters to be used for link names. The default length is 14 characters.*

4. Repeat **Step 2** and **Step 3** for each link to be named.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

Assigning Names to Linksets

Follow these steps to assign names to linksets.

Step	Action

1. From the Link, Linkset & Node Names options menu, highlight the **Linkset Names** option, and press the **Enter** (↵) key. The Linkset Names screen is displayed (see **Figure 7.31**).

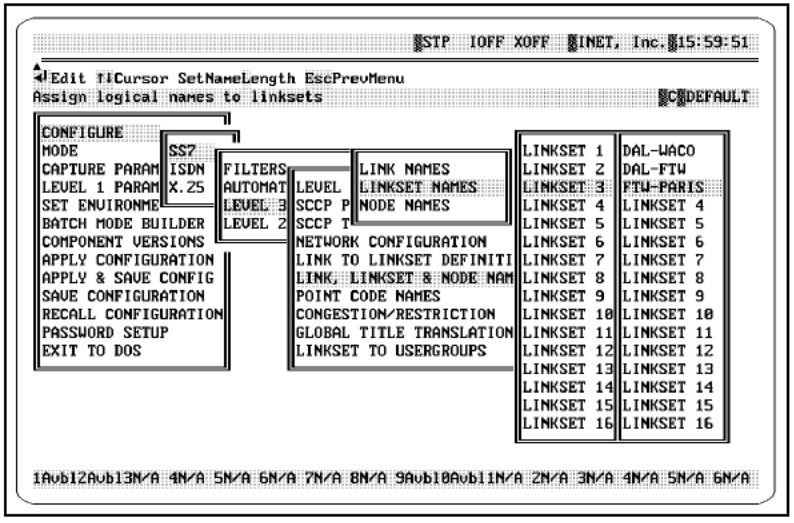


Figure 7.31 - Linkset Names Screen

2. Use the ↑↓ keys to highlight a linkset, and press the **Enter** (↵) key to access the linkset name entry field.

3. Enter a name for the linkset, and press the **Enter** (↵) key to assign it.

✍ *You can designate the maximum number of characters to be used in naming linksets by using the Set Name Length option. Press the L key to access the Set*

Name Length dialog box, and enter the maximum number of characters to be used for linkset names. The default length is 11 characters.

4. Repeat **Step 2** and **Step 3** for each linkset to be named.

You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.

Assigning Names to Nodes

Follow these steps to assign names to nodes.

Step	Action

1. From the Link, Linkset & Node Names options menu, highlight the **Node Names** option, and press the **Enter** (↵) key. The Node Names screen is displayed (see **Figure 7.32**).

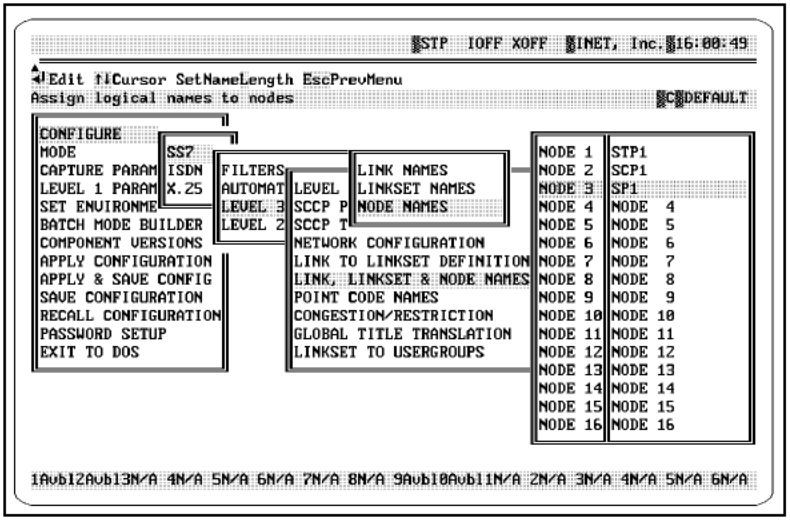


Figure 7.32 - Node Names Screen

2. Use the ↑↓ keys to select a Spectra system emulated node, and press the **Enter** (↵) key to access the node name entry field.

3. Enter a name for the node, and press the **Enter** (↵) key to assign it.

✍ *You can designate the maximum number of characters to be used in naming nodes by using the Set Name Length option. Press the L key to access the Set Name Length dialog box, and enter the maximum number of characters to be used for node names. The default length is 15 characters.*

4. Repeat **Step 2** through **Step 3** for each node to be named.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

POINT CODE NAMES

The Point Code Names screen allows names to be assigned to point codes. Point codes are assigned to the system database for reference by other functions of the Spectra system. A maximum of 240 point code names can be defined in the Point Code Names screen.

When a message signal unit is displayed in the Run screen or the Xamine screen, the Spectra system displays the point codes by either name or number, according to your preference (toggled by pressing the P key in either screen). If a message's point codes are not assigned a name in the Point Code Names screen, the point codes only display by number. For more information about the Run screen or the Xamine screen, see **Chapter 7** of the ***Spectra Features and Functions Guide***.

From the Level 3 Parameters options menu, highlight the Point Code Names option, and press the Enter (↵) key. The Point Code Names screen is displayed (see Figure 7.33).

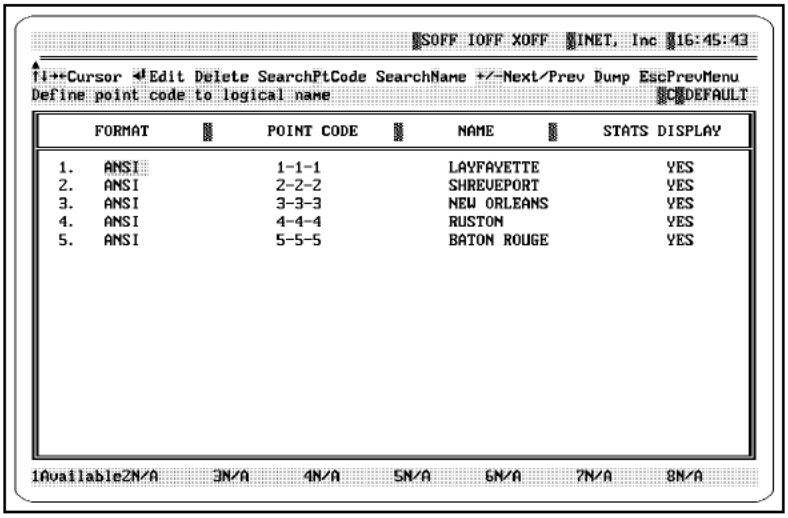


Figure 7.33 - Point Code Names Screen

Point Code Names Screen Definitions

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

↵Edit
Press the Enter (↵) key to access a field for editing an entry.

Delete
Press the Delete key to delete the selected row of point codes/names.

SearchPtCode
Press the P key to search for a specific point code. The following message is displayed: "Enter Point Code to Search For:". Enter a point code number, and press the Enter (↵) key. The cursor selects that point code.

SearchName
Press the N key to search for a specific point code name, press the N key. The following message is displayed: "Enter Point Code to Search For:". Enter a point code name, and press the Enter (↵) key. The cursor selects that point code name.

+/-Next/Previous
Press the + key to move the cursor toward the first of the list one entry at a time; press the - key to move the cursor toward the last of the list one entry at a time. This option moves from point code listing to point code listing in the Point Code Names screen.

Dump
Press the D key to dump the point code names that are currently being defined to an ASCII disk file in the `C:\SPECTRA\PRINTLOG` directory under the test name with a `.PRT` extension. The files can be viewed and printed using the F5 Print function. For more information about printing and viewing screens, see **Chapter 11** of the ***Spectra Features and Functions Guide***.

FORMAT
This field provides an option for entering the correct point code format (ANSI, ITU, CHINA, or JAPAN) to be used with the entry.

POINT CODE
This field provides an option for entering a valid point code. For the valid point code ranges refer to "Setting Valid Point Code Ranges" on page 115 of this guide.

NAME
This field allows you to assign a name to the point code. A maximum entry of 11 characters is allowed.

STATS DISPLAY
This field allows the point code entry to display in the Point Code Statistics screen (see **Chapter 9** of the ***Spectra Features and Functions Guide***). A YES display allows the Destination Point Code (DPC)/ Origination Point Code (OPC) to display in the statistics screen; a NO display allows the DPC/OPC to display with no counts.

Assigning Names/Stats Display to Point Codes

Follow these steps to assign names to point codes and to display statistics for point codes.

Step	Action
1.	When the Point Code Names screen is displayed, the cursor is automatically placed on the Format field for the first entry. Press the **Enter (↵)** key to toggle between ANSI, ITU, CHINA, or JAPAN.

2. Press the → key to move the cursor to the Point Code field for the first entry, and press the **Enter** (↵) key to access the data entry field.

3. Enter the point code to be named for the corresponding format, and press the **Enter** (↵) key.

4. Press the → key to move the cursor to the Name field for the first entry. Press the **Enter** (↵) key to access the data entry field. Enter the name (maximum of 11 characters) for the corresponding point code, and press the **Enter** (↵) key.

5. Press the → key to move the cursor to the Stats Display field for the first entry. Press the **Enter** (↵) key to toggle between YES and NO.

6. Repeat the above procedure for all point codes that require naming/stats display. Press the ↑↓↔ keys to move the cursor. Press the ↓ key to add a new field.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

CONGESTION/RESTRICTION

The Spectra system allows you to assign percentage thresholds for the buffer of the link(s) connected to a particular signalling points (signalling points are assigned in the Network Configuration screen, which is explained in "Network Configurations" on page 160 of this guide). The purpose of this operation is to allow message traffic congestion and restriction simulation to be performed when the Spectra system is in SCP Emulation, STP Emulation, ISUP/TUP Generation, or TCAP Generation modes (Automatic Level 3 modes).

✍ *This congestion manipulation option differs from the Congestion Control option under the Level 3 Tester. This screen deals with the traffic congestion on the link (or all links) going to/from a signalling point. The Level 3 Tester option deals with the congestion of the signalling point itself. For more information, see **Chapter 3** of the **Spectra Testers Guide**.*

Follow these steps to access the Congestion/Restriction screen.

Step	Action

1. From the Level 3 Parameters options menu, highlight the **Congestion/ Restriction** option, and press the **Enter** (↵) key. The Congestion/ Restriction screen is displayed (see **Figure 7.34**).

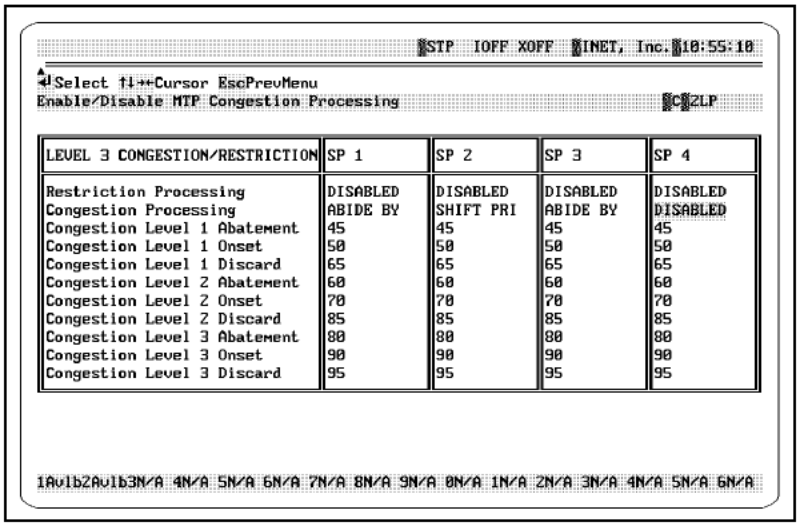
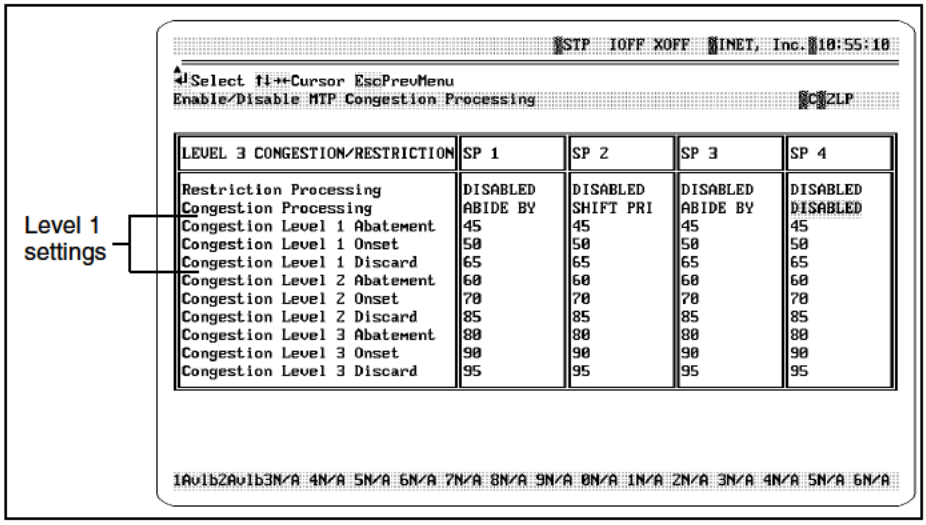


Figure 7.34 - Congestion/Restriction Screen

The Congestion/Restriction screen provides three threshold levels: Level 1, Level 2, and Level 3. Each of these categories has three individual sub-levels: Abatement, Onset, and Discard. The assignment of these thresholds is discussed later in this section.

To provide an overview of the congestion assignment process, the following figures show the results of Level 1 Abatement, Onset, and Discard level assignments made to SP 1 in the Congestion/Restriction screen.



LEVEL 3 CONGESTION/RESTRICTION	SP 1	SP 2	SP 3	SP 4
Restriction Processing	DISABLED	DISABLED	DISABLED	DISABLED
Congestion Processing	ABIDE BY	SHIFT PRI	ABIDE BY	DISABLED
Congestion Level 1 Abatement	45	45	45	45
Congestion Level 1 Onset	50	50	50	50
Congestion Level 1 Discard	65	65	65	65
Congestion Level 2 Abatement	60	60	60	60
Congestion Level 2 Onset	70	70	70	70
Congestion Level 2 Discard	85	85	85	85
Congestion Level 3 Abatement	80	80	80	80
Congestion Level 3 Onset	90	90	90	90
Congestion Level 3 Discard	95	95	95	95

Figure 7.35 - Congestion/Restriction Screen Settings for Level 1 Thresholds on SP1

In Figure 7.36, the link leading to SP 1 is considered congested at 30 percent. Messages with a message priority level lower than the congestion level of the link begin to be discarded from the link when the buffer reaches 35 percent of capacity. The link is only considered uncongested after the traffic level falls below the 25 percent abatement level.

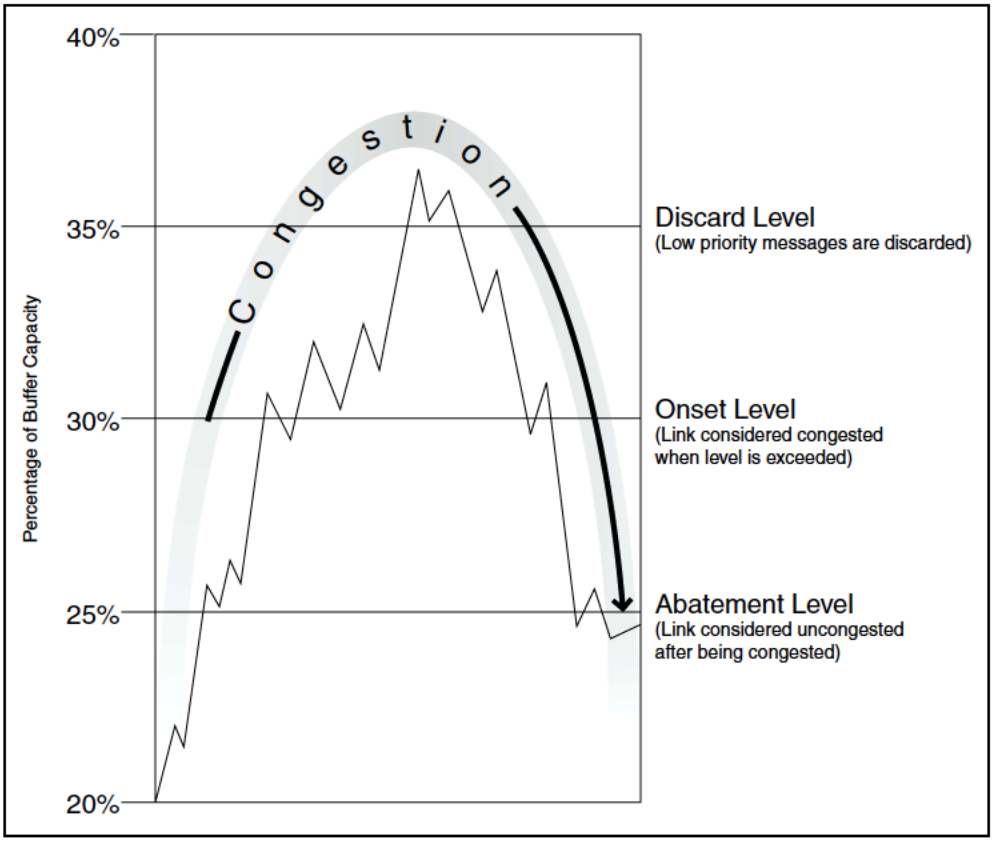


Figure 7.36 - Buffer Capacity Results in Response to Congestion/Restriction Screen Settings

Congestion/Restriction Screen Definitions

↵Select
Press the Enter (↵) key to access a field for editing an entry.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

+/- SP
This option cycles through the 16 signalling points when you press the **+** or **-** keys.

Restriction Processing
This option will be available in a future release.

Congestion Processing
This option provides three choices for congestion processing. These options can be selected by highlighting the field, and pressing the Enter (↵) key to toggle through the selections:

Disabled
This option turns congestion processing OFF for the signalling point.

Abide By
This option turns congestion processing ON for the signalling point and lets the Spectra system handle message traffic normally while taking congestion assignments into account.

Shift Priority

This option turns congestion processing ON for the SP and causes the Spectra system to shift the priority of messages on a link to the congestion level of the link. Message priority levels can be 0, 1, 2, or 3, with 3 being the highest. For example, if the Spectra system receives an Initial Address Message (IAM) message (see **Figure 7.37**) with a priority level of 0, and the congestion level of the link is 2, it automatically boosts the IAM's priority to 2 to allow the message to pass when it encounters congestion at the lower level. The Spectra system does not boost message priority levels to 3 because that level is reserved for maintenance messages.

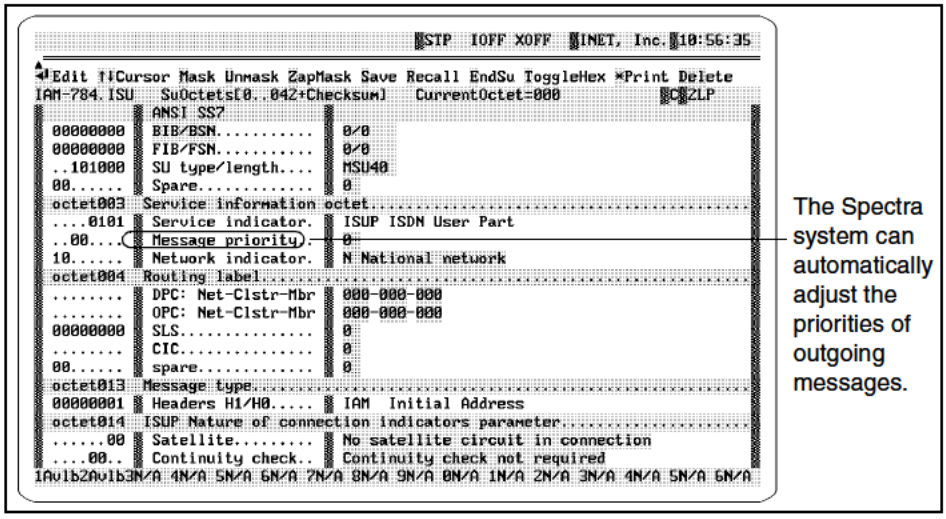


Figure 7.37 - Sample IAM Message

Congestion Levels 1, 2, 3

Congestion levels are divided into three groups, each with an Abatement, Onset, and Discard level. Levels 1, 2, and 3 refer to the congestion level of messages on the link. Message priority levels can be 0, 1, 2, or 3, with 3 being the highest. Each set of parameters (Abatement, Onset, and Discard) directly affects messages with the corresponding priority number. For more information, see "Assigning Congestion/Restriction Options" on page 195 of this guide.

When assigning congestion parameters to multiple congestion levels, do not set the Discard parameter of a lower level higher than the Onset parameter of

the next level. It may interfere with the proper execution of the congestion process.

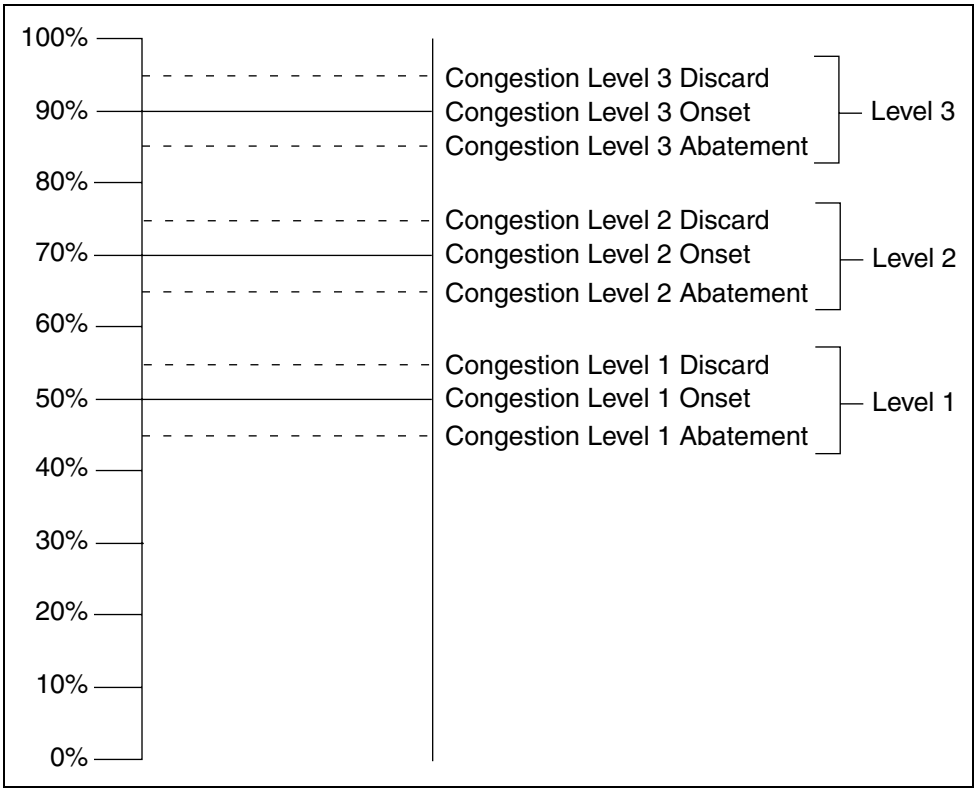


Figure 7.38 - Sample Settings For Levels 1, 2, and 3 in the Link Buffer

Abatement
The Abatement level is the point where traffic on a previously congested link drops to an uncongested level. Each Abatement threshold should be assigned a lower percentage than the corresponding Onset threshold in order to provide hysteresis (the process of "undoing" the first threshold by crossing the second threshold) during congestion recovery. For more information, see "Assigning Congestion/Restriction Options" on page 195 of this guide.

Onset
The Onset level is the point where traffic on a link reaches a percentage of buffer capacity that congests the link. For more information, see "Assigning Congestion/Restriction Options" on page 195 of this guide.

Discard

The Discard level is the point where messages are discarded from the link when they have a lower message priority level than the congestion level established on the link. For more information, see "Assigning Congestion/ Restriction Options" on page 195 of this guide.

The congestion level of the link is determined by the highest congestion onset threshold exceeded by the buffer occupancy. For example, if congestion onset threshold 2 is the highest congestion onset threshold exceeded by the current buffer occupancy, the current signalling link congestion status is assigned the value of 2.

SPs 1-16

SPs 1 through 16 of the Congestion/Restriction screen are established in the Network Configuration screen found under the Level 3 Parameters options menu. This screen is pictured in **Figure 7.39**. The assignments made in the Emulated Node section of the Network Configuration screen represent signalling points 1 through 16 of the Congestion/Restriction screen. The Network Configuration screen is discussed in detail in "Network Configurations" on page 160 of this guide.

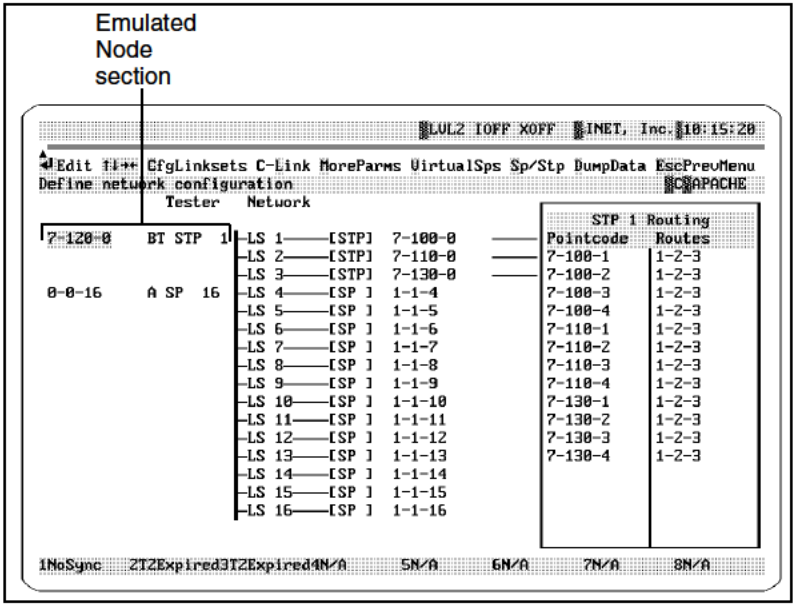


Figure 7.39 - Level 3 Network Configuration Screen (Example)

Assigning Congestion/Restriction Options

Follow these steps to assign congestion/restriction options.

Step	Action
1.	Verify that the correct signalling point settings are assigned in the Network Configuration screen.
2.	To access the Level 3 Parameters options menu, highlight the **Congestion/Restriction** option, and press the **Enter (↵)** key.
3.	When the Congestion/Restriction screen is displayed, the cursor is automatically placed on the Restriction Processing field under the SP 1 column. This option is not currently operational, so press the ↓ key to move to the Congestion Processing field.
4.	Press the **Enter (↵)** key to toggle between the congestion processing options. DISABLED turns congestion processing OFF, ABIDE BY turns regular control processing ON, and SHIFT PRIORITY turns congestion processing ON and causes the Spectra system to shift the priority of messages up above the level of congestion for the link. The Spectra system does not boost the message priority to 3 because priority Level 3 is reserved for maintenance messages.
5.	Press the ↓ key to move to the Congestion Level 1 Abatement field. Press the **Enter (↵)** key to access the field, and enter the percentage of buffer capacity that allows the link to return to an uncongested state from a congested state. Press the **Enter (↵)** key again to assign the value.

✍ *If you enter a percentage in the Abatement field that is greater than the associated Onset percentage, the Onset field turns red and flashes. This serves as a reminder that the Abatement level cannot exceed the Onset level. This same type of signal is displayed any time an invalid entry is made in any Congestion Level field.*

6.	Press the ↓ key to move to the Congestion Level 1 Onset field. Press the **Enter (↵)** key, and enter the percentage of buffer capacity that, when exceeded, causes the link to be considered congested. Press the **Enter (↵)** key again to assign the value.
7.	Press the ↓ key to move to the Congestion Level 1 Discard field. Press the **Enter (↵)** key, and enter the percentage of buffer capacity that,

when exceeded, causes the link to discard messages with a priority level lower than the congestion level established for the link. Press the **Enter (↵)** key again to assign the value.

8. Repeat **Step 5** through **Step 7** for the Level 2 and Level 3 fields.

9. Repeat **Step 1** through **Step 8** for the other signalling points. Press the →← keys to move between signalling points.

10. Choose the **Apply Configuration** option under the F1 Setup menu to apply these changes to your configuration. You can also use the Apply & Save Config option, but these changes are then saved as a part of your configuration file.

11. After all values are entered, press the **F2** key to start the run process and implement the congestion assignments.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

GLOBAL TITLE TRANSLATION

The Global Title Translation (GTT) screen assigns message translation parameters to simulate GTT in a lab environment. These message translation parameters are used by the Spectra system to group query messages for translation. When messages with a corresponding translation type number are received by the Spectra system, the relevant data in those messages is overwritten with the information provided in the parameter fields of the Global Title Translation screen.

The Spectra system GTT allows up to two active translation type files to be created per signalling point. Assignments can be made for up to 16 sets of GTT digits, point codes, and SSNs for each translation type.

From the Level 3 Parameters options menu, highlight the Global Title Translation option, and press the Enter (↵) key. The Global Title Translation screen is displayed (see Figure 7.40).

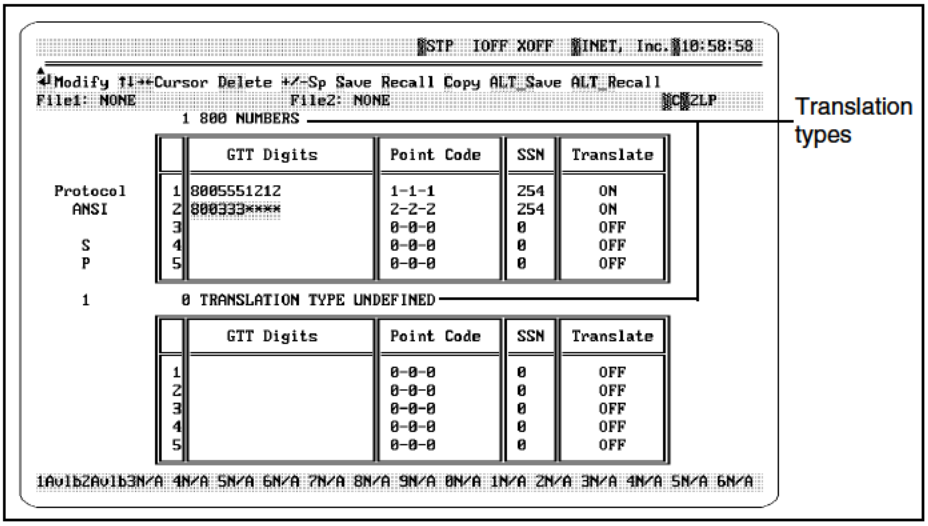


Figure 7.40 - Global Title Translation Screen

Refer to Figure 7.41 for an example of how a message (in this case, a 1-800 phone call) is transmitted from the 5-5-2 signalling point to the 5-5-0 STP (emulated by the Spectra system). The STP routes the message according to the parameters entered in the Global Title

Translation screen (in this case, SCP 7-7-3). Refer to **Figure 7.42** for an example of the Global Title Translation screen settings.

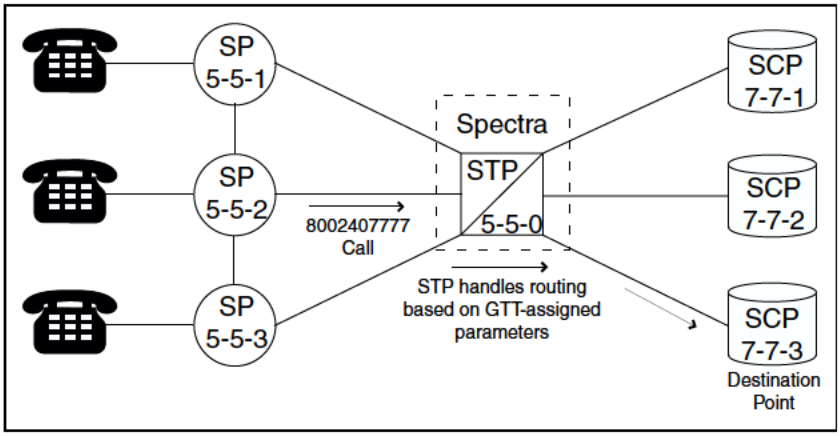


Figure 7.41 - Network with Spectra System Emulating an STP

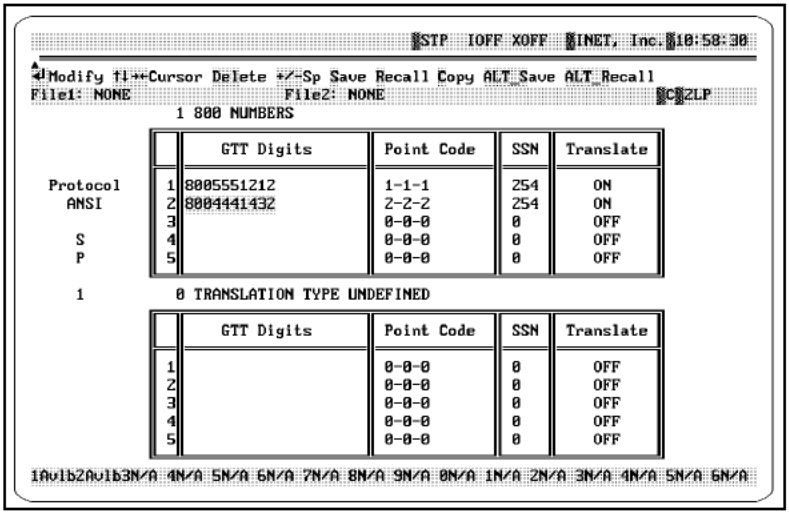


Figure 7.42 - Parameter Assignments for 800 Number Global Title Translation

Translation types can be grouped into two user-defined categories. For example, you may want to assign GTT parameters for a group of 800 phone numbers. Up to 16 different phone numbers can be assigned in a translation type category for a maximum of 32 per signalling point (16 numbers in each of the two categories).

Global Title Translation Screen Definitions

↵ Modify
Press the Enter (↵) key to access the numeric/description entry field.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

Delete
Press the Delete key to delete the selected entry.

+/- SP
Press the + key or the - key to move forward or backward through the signalling points.

Save
Press the S key to allow all the translation parameters that have been assigned to a selected signalling point to be saved. This allows certain GTT Digits, Point Codes, SSNs, and Translate switch settings to be quickly recalled without having to rebuild them. Enter a name for the file of up to eight characters in the Enter File name dialog box, and press the Enter (↵) key. The Enter Description dialog box is displayed. Enter a description of up to 55 characters for the file, and press the Enter (↵) key to assign it. Saved translation parameters are given a `.GTT` file name extension and are placed in a catalog where they can later be recalled.

Recall
Press the R key to access the catalog of saved parameters files. Highlight the desired file, and press the Enter (↵) key to display it.

✍ *The translation type number is not automatically assigned when a translation file is recalled; it must be re-assigned by the user each time a file is recalled.*

Copy
Press the C key to copy all screen assignments for the currently displayed link to each of the remaining links.

Alt_Save
While pressing the Alt key press the S key to access the Enter Model Name dialog box. Enter a name for the model of up to eight characters, and press the Enter (↵) key. The Enter Description dialog box is displayed. Enter a description of up to 55 characters for the model, and press the Enter (↵) key to assign it. Saved GTT models are given an `.MDL` file name extension and are placed in a catalog where they can later be recalled. The following parameters are saved:

- Translation Type settings
- GTT digits associated with each signalling point
- Point codes
- SSN values
- Translation switch settings

Alt_Recall
While pressing the Alt key, press the R key to access the catalog of saved GTT models. Highlight the desired model, and press the Enter (↵) key to display it.

Translation Type Fields
These fields allow a number and a name to be assigned to translation type categories for display purposes. The number represents the standard translation types for the network being tested. These numbers range from 1 to 255 and may vary in meaning from network to network. For example, one company's translation type 253 may represent 800 numbers, while another company's translation type 253 may represent some other application. Be aware of the translation type representations of the network being tested. If the translation type number is set to 0, the GTT for that translation type is turned OFF.

GTT Digits
This column can be used to enter up to 16 sets of GTT digits for each translation type. If any messages containing these numbers are processed by the Spectra system, the messages are routed according to the associated point codes and SSNs assigned.

✍ *An asterisk (*) can be used as a wildcard character. This wildcard character can be used to save time when entering numbers. For example, an entry of 80074399** can be used to represent all 800 numbers between 7439900 and 7439999. Any or all of the numbers may be wildcard characters.*

Point Code
This column assigns the DPC routing parameters for messages that contain the associated phone number.

SSN
This column assigns the subsystem number routing parameters for messages that contain the associated phone number. The subsystem number identifies a type of application performed by the network (for examples., 800 service, LIDB, etc.) and further qualifies the route of the message. The Spectra system ignores this field if it reads 0.

Translate
This column allows the GTT feature to be turned ON or OFF for individual phone numbers.

Assigning GTT Parameters

Follow these steps to assign GTT parameters.

Step	Action
1.	When the Global Title Translation screen is displayed, press the **+** or **-** keys to verify that the signalling point to be modified (SP1 through SP16) is displayed to the left side on the screen.

✍ *The identities of signalling points 1 through 16 are determined in the Network Configuration screen under the Level 3 Parameters options menu. This procedure is described in "Network Configurations" on page 160 of this guide.*

2.	When the Global Title Translation screen is displayed, the cursor is automatically placed on the Translation Type Number field. Press the **Enter** (↵) key to access the entry field, Enter the translation type number (0 through 255), and press the **Enter** (↵) key to assign the number. An entry of 0 automatically turns GTT OFF for that translation type.

✍ *When messages with a corresponding translation type number are received by the Spectra system, the relevant data in those messages is overwritten with the information displayed in the translation type parameter fields of the translation file.*

3. Press the → key to highlight the Translation Type name. Then press the **Enter** (↵) key to access the entry field, enter the name to be associated with the translation type (maximum of 50 characters), and press the **Enter** (↵) key again to assign the entry.

4. Press the ↓ key to move the cursor to the GTT Digits field for entry 1. Press the **Enter** (↵) key to access the data entry field, enter the appropriate GTT digits (maximum of 20 digits), and press the **Enter** (↵) key to assign the entry.

✍ *When these GTT digits are encountered in a message, the system causes the message to be routed according to the GTT parameters.*

5. Press the → key to move the cursor to the Point Code field for entry 1. Press the **Enter** (↵) key to access the data entry field. Enter in the point code of the signalling node where the associated message is to be routed and press the **Enter** (↵) key to assign the point code. For the valid point code ranges, refer to "Setting Valid Point Code Ranges" on page 115 of this guide.

6. Press the → key to move the cursor to the SSN field for entry 1. Press the **Enter** (↵) key to access the data entry field, enter the subsystem number (1 through 255) where the associated message is to be routed, and press the **Enter** (↵) key to assign the SSN.

7. Press the → key to move the cursor to the Translate field. Press the **Enter** (↵) key to toggle the field to ON so that GTT can take place in the messages containing the associated phone number.

8. Repeat **Step 1** through **Step 7** for a maximum of 16 entries in this Translation window.

9. Press the **S** key to save the file. Enter a file name (maximum of eight characters) in the dialog box, and press the **Enter** (↵) key to assign the file name. The translation parameters, along with the description name, are saved to a file. The translation type number is not saved to file and must be re-assigned each time you recall the file.

✍ *Although two translation files may display at a time, only one translation file can be saved at a time. Verify that the correct translation window is highlighted when saving it. Once saved, translation files can be recalled and assigned to any signalling point.*

10. If you want to assign another translation file to the current signalling point, press the ↑↓ keys to move to the other translation window, and

repeat the entire procedure. This allows up to 32 phone numbers to be assigned to the current signalling point (16 in each Translation window).

11. After all assignments have been made to the current signalling point, press the **+** or **-** keys to advance to other signalling points. Repeat the entire procedure to assign GTT parameters for up to 16 different signalling points.

12. If you want to save the GTT configuration model, while pressing the **Alt** key, press the **S** key. Enter a configuration model name (maximum of eight characters) in the dialog box, and press the **Enter (↵)** key to assign the model name.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

When tests are run under the F2 mode and messages are processed, the Spectra system checks the Global Title Translation screen for assignments. The current translation type numbers assigned in the Global Title Translation screen are referenced and the associated translation file information is applied to all relevant messages.

LINKSET TO USERGROUP

The Linkset To Usergroups screen offers a way to allocate linksets to specific user groups using the ↑↓↔ keys to maneuver the checkmark cursor to the desired positions. It also provides a way to assign names to user groups.

User groups represent a way to divide the Spectra system linksets into various groups to monitor only the traffic on specific links and linksets. For example, if Test Engineer A is only interested in viewing traffic test results for Linksets 1 and 2, then Usergroup 1 can consist of Linksets 1 and 2. If Engineer B is concerned about traffic on the rest of the linksets, Usergroup 2 can be assigned all remaining linksets. Statistics for these individual user groups can be viewed on the Pseudo Mode Statistics screen under the F3 Stats menu. For more information, see **Chapter 3** of the ***Spectra Testers Guide***

From the Level 3 Parameters options menu, highlight the Linkset To Usergroups option, and press the Enter (↵) key. The Linkset To Usergroups screen is displayed (see **Figure 7.43**).

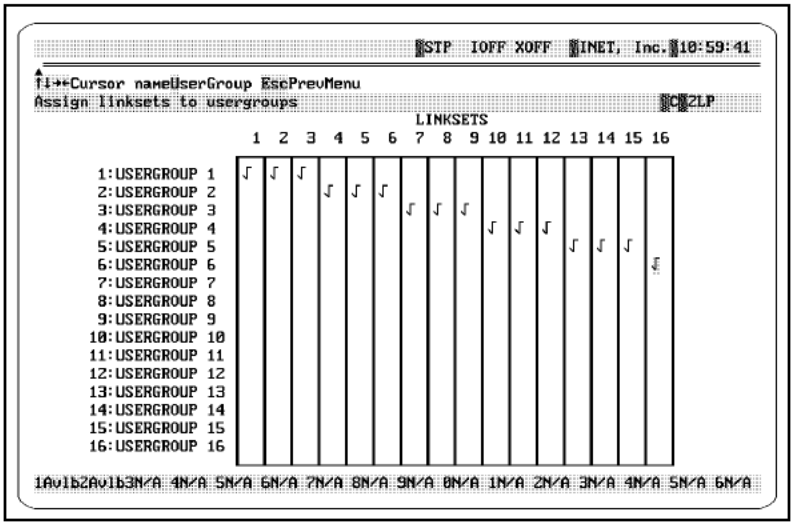


Figure 7.43 - Linkset To Usergroup Screen

Assigning Linksets To Usergroups

Follow these steps to assign linksets to usergroups.

Step	Action
1.	When the Linksets To Usergroups screen appears, the cursor is automatically placed on the Usergroup 1 field under the Linkset 1 column. Press the **U** key to access the Name User Group dialog box (see **Figure 7.44**).

```
Please Enter UserGroup Name:
```

Figure 7.44 - Name User Group Dialog Box

2.	Enter the name to be associated with the user group (maximum 12 characters), and then press the **Enter** (↵) key to assign the name.

3. Repeat **Step 1** and **Step 2** to assign names to up to 16 user groups.

4. Use the ↑↓ keys to move the highlighted √ displayed under the Linkset 1 column to the desired user group row. This assigns the individual linkset to that user group.

5. Repeat **Step 4** for all linksets that need to be assigned to user groups. Use the ↑↓↔ keys to move between linksets and user groups.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. Refer to "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

8 ISDN Specific Configuration

OVERVIEW

Using the Spectra system with the Integrated Services Digital Network (ISDN) protocol requires some protocol specific configuration. This chapter explains the setup of these parameters.

Follow these steps to access the ISDN Configure options menu.

Step	Action

1. Press the **F1** key to access the F1 Setup menu as pictured in **Figure 8.1**.

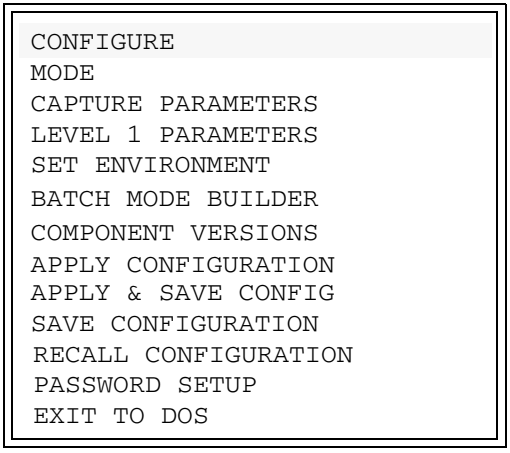


Figure 8.1 - F1 Setup Menu

2. Use the ↑↓ keys to select the Configure option, and press the **Enter (↵)** key. The Protocol options menu appears (see **Figure 8.2**).



Figure 8.2 - Protocol Options Menu

✍ *The Spectra system provides three protocol options: SS7, ISDN, and X.25. Since these protocols are available as separate options on the Spectra system, your system may have any combination of the three. If you requested only one protocol, no protocol choices are available. If you requested two protocols, only these choices are listed. If you purchased Spectra High Speed Links (HSL), two additional protocols, ATM and TALI are available. For more information on these protocols, refer to the* ***Spectra High Speed Links Guide****.*

3. Press the ↑↓ keys to highlight the ISDN option, and press the **Enter** (↵) key. The ISDN Configure options menu appears (see **Figure 8.3**).



Figure 8.3 - ISDN Configure Options Menu

✍ *If you purchased the Trunk Tester Network or Trunk Tester Switch, an additional option, TGT DB SETTINGS, is available. For more information about this option, refer to the* ***Spectra Trunk Tester Guide****.*

LEVEL 2 PARAMETERS

The Level 2 Parameters options menu offers three screens for assigning link access procedures on the D-channel (LAPD) parameters for Level 2 ISDN features. These three screens are the Level 2 Link Layer Parameters screen, the Service Access Point Identifier (SAPI) Assignments screen, and the Terminal Endpoint Identifier (TEI) Assignments screen. The fourth menu option, the Timeslot Assignments screen, is used for both the Digital Access Signalling System (DASS) protocol and the Digital Private Network Signalling System (DPNSS) protocol to toggle timeslots (channels) ON and OFF.

From the ISDN Configure options menu, select the Level 2 Parameters option, and press the Enter (↵) key. The Level 2 Parameters options menu is displayed (see **Figure 8.4**).

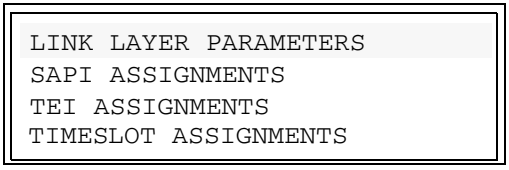


Figure 8.4 - ISDN Level 2 Parameters Options Menu

LINK LAYER PARAMETERS SCREEN

The Link Layer Parameters screen offers options for specifying parameters used for Level 2 monitoring or emulation. Options vary based on the selected data link layer protocol and available decodes. These parameters include the following options:

- Link
- Variant

✍ *The Spectra system offers a variant ISDN derived protocol option. Variant protocol decode is provided in the* `TEMPLATE.SS7` *file and is used for display only.*

- Functional Interface (USER or NETWORK)
- Timers T200 through T203
- Maximum Retransmissions
- Maximum Byte Length (used for declaring long SU detection)

From the Level 2 Parameters options menu, use the ↑↓ keys to select the Link Layer Parameters option, and press the Enter (↵) key. The Link Layer Parameters screen appears (see **Figure 8.5**).

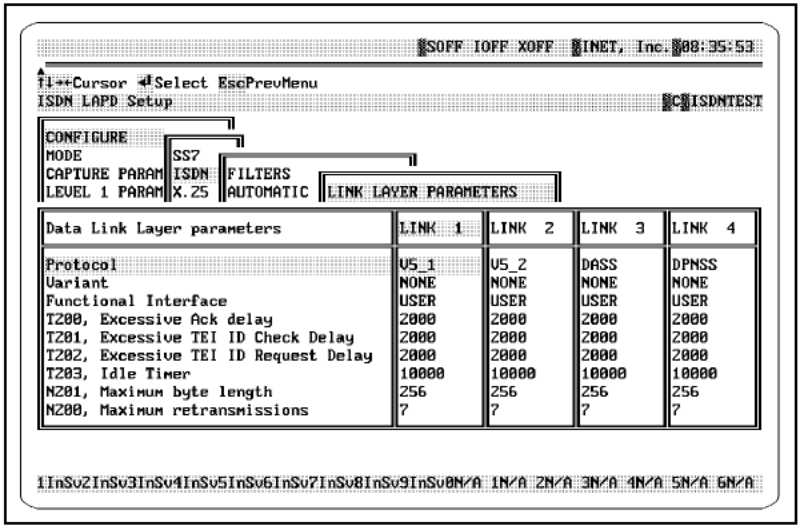


Figure 8.5 - Link Layer Parameters Screen

Link Layer Parameters Screen Definitions

↑↓Cursor
Press the ↑↓ keys to move the cursor to a particular field.

↵Select
Press the enter key to edit the selected field.

Protocol
This option defines the method of communication used by the link for Level 2 messages. Available protocol options include CCITT (ITU-T), European Telecommunications Standards Institute (ETSI), Application Binary Interface Standard (ABIS), V5.1, V5.2, DASS, and DPNSS.

Variant
This option allows the Spectra system to run a variant protocol to decode messages. If the current `TEMPLATE.SS7` file contains variant protocol(s), you have variant options from which to choose. Press the Enter (↵) key to toggle between the variants contained in the current `TEMPLATE.SS7` file.

✍ *Variant protocol decode is provided in the* `TEMPLATE.SS7` *file and is used for display only.*

If the current `TEMPLATE.SS7` file contains no variant protocols, NONE is the only option displayed. See "Decode Template" on page 18 of this guide for more information about the `TEMPLATE.SS7` file.

Functional Interface
This option defines the configuration of the interface as USER or NETWORK. This field is also used in conjunction with the TEI Assignments screen in regards to Service Profile Identifier (SPID)/ User Service Profile (USID) control for ISDN interfaces.

If the link is configured as USER in the Link Layers Parameters screen, the parameter that is displayed in the TEI Assignments screen is SPID. If it is configured as NETWORK, the parameter that is displayed is USID. The SPID/ USID feature is enabled or disabled from the TEI Assignments screen. The default value is disabled.

SPIDs are transmitted to the network as part of an INFO message when the Spectra system is used as terminal equipment. When the Spectra system is used as network equipment, it is possible to trigger off of incoming INFO messages when the SPID in the INFO message does and does not match a SPID in the index for that link.

T200, Excessive Delay
This option assigns the T200 timer for each link. The T200 timer indicates the duration, in milliseconds, that the Spectra system waits for an acknowledgment of transmitted messages. On expiration of T200, the Spectra system retransmits the message and restarts the T200 timer. The default value is 2000 milliseconds.

In the DASS and DPNSS protocols, the T200 timer corresponds to the retransmission limit parameter NT1—the minimum retransmission period. This period is the minimum amount of time during which a command frame must be retransmitted if not acknowledged. The recommended value is 500 milliseconds.

✍ *If any of the variables used in options T201 through N200 are exceeded, the Spectra system brings down the link.*

T201, Excessive TEI ID Check Delay
This option assigns the T201 timer for each link. The T201 timer indicates the duration, in milliseconds, that the Spectra system waits for ID Check response messages from connected TEI equipment. The default value is 2000 milliseconds. This timer is not used in conjunction with the DASS or DPNSS protocols.

T202, Excessive TEI ID Request Delay
This option assigns the T202 timer for each link. The T202 timer indicates the duration, in milliseconds, that the Spectra system waits for a response after sending an ID Request message. The default value is 2000 milliseconds. This timer is not used in conjunction with DASS or DPNSS protocols.

T203, Idle Timer
This option assigns the T203 timer for each link. When the link is inactive for the assigned idle time, a polled command is sent to ensure the availability of the link. For all other protocols except DPNSS, the T203 timer range is 0-99999 milliseconds. The default value for this timer is 10000 milliseconds. When this timer is used for DPNSS test frame generation, the timer value can be for up to10 minutes (0-600000 milliseconds).

In DPNSS test frame generation, the Spectra system will respond to every test frame received with a corresponding UI (R) response frame. If the value of 0 is entered, the word Disable appears in the field for this timer. If test generation is disabled, the Spectra system will not send any response to the test frame received. This timer is not used in conjunction with the DASS protocol.

N201, Maximum Byte Length
This option assigns the maximum byte length for complete LAPD messages. Acceptable lengths range from 0 to 263. The default value is 256. This option is not used in conjunction with DASS or DPNSS protocols.

N200, Maximum Retransmissions
This option assigns the maximum number of times the T200 timer is restarted. If the N200 threshold is reached, the system tries to re-establish a link. The default value is 7 milliseconds.

In the DASS and DPNSS protocols, the N200 timer corresponds to the retransmission limit parameter NL—the minimum retransmission count limit. This number is the minimum number of times a command frame must be retransmitted if not acknowledged. The recommended value is 64.

Assigning Link Layer Parameters to Links

Follow these steps to assign the link layer parameters.

Step	Action

1. When the Link Layer Parameters screen appears, the cursor is automatically placed on the Protocol field under the Link 1 column. Press the **Enter** (↵) key to cycle through the available protocol options—CCITT, ETSI, ABIS, V5.1, V5.2, DASS, or DPNSS—until the desired protocol is displayed (see **Figure 8.6**).

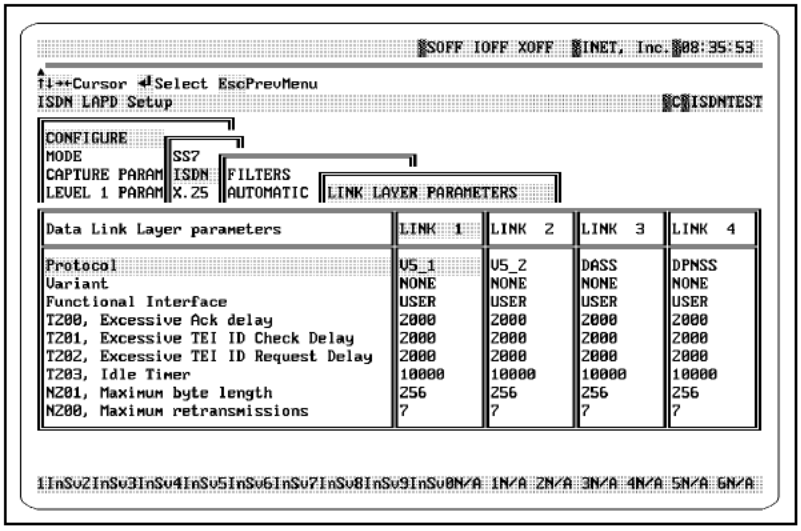


Figure 8.6 - Link Layer Parameters Screen

2. Press the ↓ key one time to move the cursor to the Variant field, and press the **Enter** (↵) key to toggle between the different variant decodes.

✍ *The Spectra system provides several variant decode options for the ISDN protocol. Since these variant decodes are available as separate options on the Spectra system, your system may have any combination listed or none. If no variant decode options are purchased, NONE is the only option displayed.*

3. Press the ↓ key one time to move the cursor to the Functional Interface field, and press the **Enter** (↵) key to toggle the Functional Interface between USER and NETWORK.

4. Press the ↓ key one time to move the cursor to the T200 Timer field. Press the **Enter (↵)** key to access the field. Enter a value, and press the **Enter (↵)** key to assign that value to the T200 Timer field. The default value is 2000 milliseconds. When using this timer in conjunction with DASS and DPNSS protocols, the recommended value is 500 milliseconds.

5. Press the ↓ key one time to move the cursor to the T201 Timer field, and press the **Enter (↵)** key to access the field. Enter a value, and press the **Enter (↵)** key to assign that value to the T201 Timer field. The default value is 2000 milliseconds. This timer is not used in conjunction with DASS or DPNSS protocols.

6. Press the ↓ key one time to move the cursor to the T202 Timer field, and press the **Enter (↵)** key to access the field. Enter a value, and press the **Enter (↵)** key to assign that value to the T202 Timer field. This timer is not used in conjunction with DASS or DPNSS protocols.

7. Press the ↓ key one time to move the cursor to the T203 Timer field, and press the **Enter (↵)** key to access the field. Enter a value, and press the **Enter (↵)** key to assign that value to the T203 Timer field. The default value is 10000 milliseconds. When using this timer in conjunction with DPNSS protocol, the field for this timer represents test generation. If a value of 0 is entered, the word Disable appears in this field. If test generation is disabled, the Spectra system will not send any response to the test frame received. This timer is not used in conjunction with the DASS protocol.

8. Press the ↓ key one time to move the cursor to the Maximum Byte Length field, and press the **Enter (↵)** key. Enter a value (between 0 through 263), and press the **Enter (↵)** key to assign that value to the Maximum Byte Length field. The default value is 256. This timer is not used in conjunction with DASS and DPNSS protocols.

9. Press the ↓ key one time to move the cursor to the Maximum Retransmissions field, and press the **Enter (↵)** key to access the field. Enter the desired number of times to retransmit an errored, rejected, or unacknowledged frame, and press the **Enter (↵)** key. The default value is 7 milliseconds. When using this timer in conjunction with DASS and DPNSS protocols, the recommended value is 64.

10. Repeat **Step 1** through **Step 9** for all links that require Level 2 parameters. Use the →← keys to move between link columns.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. See "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

SAPI ASSIGNMENTS SCREEN

The value of the SAPI sub-field identifies a type of D-Channel signalling termination point on the user premises. SAPIs are unique within a terminal, that is, the same SAPI cannot be used twice with the same TEI on different connections. The SAPI values presently defined are:

- 0—Signalling and call control procedures
- 1—Packet-mode switching using Q.931 procedures
- 16—X.25 packet-mode services
- 32-62—Frame Relay services
- 63—Layer 2 Management procedures
- All others—Future Standardization

The SAPI Assignments screen is used to assign which SAPI/Envelope_H values are available on each ISDN link. CCITT, ETSI, ABIS, V5.1, and V5.2 protocols use a SAPI index. Valid SAPI ranges for the V5.1 and V5.2 protocols are 0 through 62. SAPI assignments are not applicable to the DASS or DPNSS protocols.

From the Level 2 Parameters options menu, use the ↑↓ keys to select the SAPI Assignments option, and press the Enter (↵) key. The SAPI Assignments screen is displayed (see **Figure 8.7**).

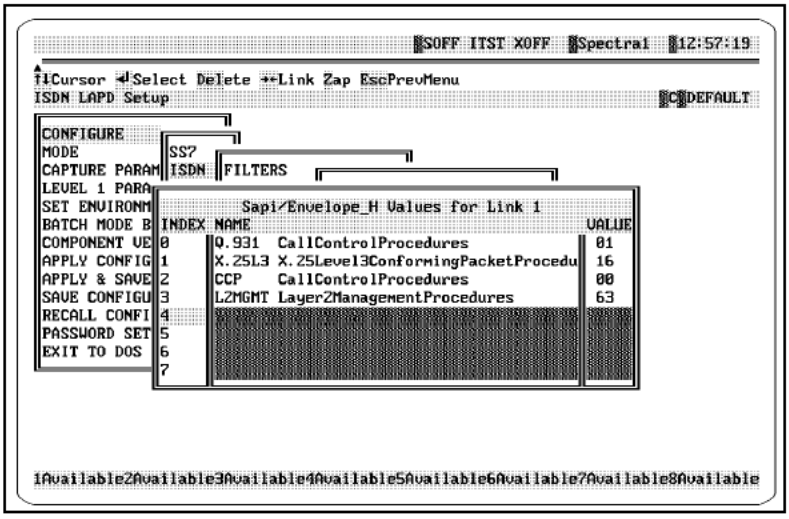


Figure 8.7 - SAPI Assignments Screen

SAPI Assignments Screen Definitions

↑↓Cursor
Press the ↑↓ keys to move the cursor to a particular field.

↵Select
Press the enter key to open the SAPI values options menu to edit SAPI/ Envelope_H value assignments.

The following direction line options are displayed when the SAPI values options menu is accessed. Press the Enter (↵) key to access the SAPI values options menu (see **Figure 8.8**).

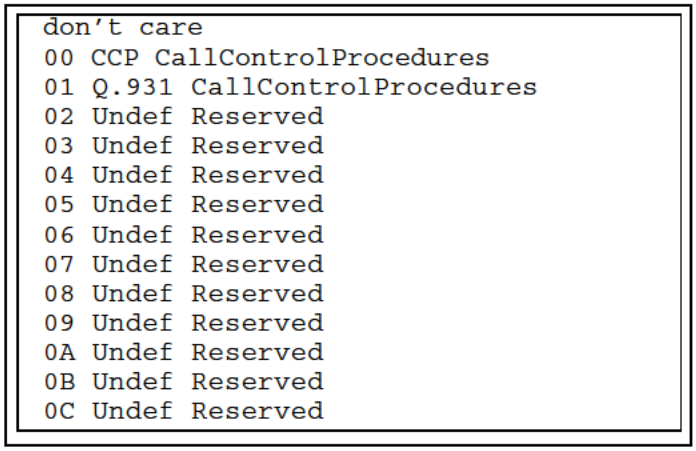


Figure 8.8 - SAPI Values Options Menu

A . . ZStringSearch
This search option allows you to locate a SAPI alphabetically. Press the corresponding letter key (A…Z) to move the cursor to the desired position in the catalog of SAPI options.

+SearchToggle
This option enables you to toggle between using the alphabetical string search (A…Z) option and using the hexadecimal search option. Press the + key to change the search option.

0 . . FHexSearch
This search option allows you to locate a SAPI by hexadecimal value. Press the corresponding hexadecimal number key (0…9 or A…F) to move the cursor to the desired position in the catalog of SAPI options.

Delete
Press the Delete key to delete the selected entry.

→← Link
Press the →← keys to display next or previous links.

Zap
Press the Z key to copy the current SAPI assignments to all links.

EscPrevMenu
This option allows you to return to the previous menu. Press the Esc key to return to the previous menu.

INDEX
This field assigns an index (or row) number for each SAPI/Envelope_H value assignment.

✍ *The value displayed in the Index field is not the SAPI value.*

NAME
The Name field displays the name of each available SAPI/Envelope_H value assigned to the link.

VALUE
The Value fields display the available SAPI/Envelope_H values assigned to the link. Press the Enter (↵) key to open the SAPI values options menu to select a different value.

Assigning SAPI/Envelope_H Values

Follow these steps to assign SAPI/Envelope_H values for each link.

Step	Action
1.	When the SAPI Assignments screen first appears, the cursor is automatically placed on the Index 0 row. Press the **Enter (↵)** key to access the catalog of SAPI options.
2.	Use the ↑↓ keys to select the desired SAPI, or use the String or Hex search functions to select the desired SAPI.
3.	When the desired SAPI/Envelope_H value is highlighted, press the **Enter (↵)** key to assign the entry to the link.
4.	Repeat **Step 1** through **Step 3** for each desired SAPI /Envelope_H value, using the ↑↓ keys to move the cursor between the entry fields.

✍ *SAPI/Envelope_H value entries can be deleted from the SAPI Assignments screen by highlighting the desired entry and pressing the Delete key.*

5. Press the →← keys to display the next or previous links, and repeat **Step 1** through **Step 4** until all SAPI assignments have been made.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. See "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

TEI ASSIGNMENTS SCREEN

The TEI identifies a connection endpoint at the user facility within a given SAPI. The TEI Assignments screen is used to assign the available TEIs for each link. Up to seven TEI values can be assigned to each link. The following TEIs are currently defined in Q.921:

- 0-63—Non-automatic TEI assignment
- 62-126—Automatic TEI assignment
- 1-27—Group TEI

SPIDs/USIDs are assigned using the TEI Assignments screen found under the Level 2 Parameters options menu. SPID/USID functionality is only applicable with Q.931, Q.932, and National ISDN-3. SPIDs/USIDs are valid for automatic TEIs only. SPID/USID control is only applicable to Basic Rate Interfaces (BRIs). The Spectra system supports SPIDs of up to 20 digits, encoded in the IA5 format. The range for USIDs is 0 through 127. For more information about SPID/USID control, see "ISDN SPID\USID Control" on page 223 of this guide.

From the Level 2 Parameters options menu, use the ↑↓ keys to highlight the TEI Assignments option, and press the Enter (↵) key. The TEI Assignments screen is displayed (see **Figure 8.9**).

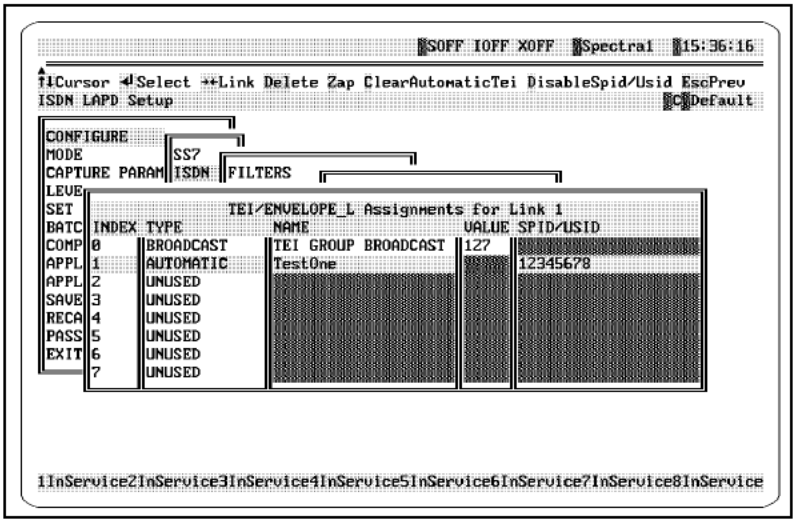


Figure 8.9 - TEI Assignments Screen

TEI Assignments Screen Definitions

The following options are displayed in the direction line across the top of the screen.

↑↓Cursor
Press the ↑↓ keys to move the cursor to a particular field.

↵Select
Press the Enter key to open the TEI/Envelope_L Assignments window to create and edit TEI assignments.

→← Link
Press the →← keys to view assignments for each link.

Delete
Press the Delete key to delete a row.

Zap
Press the Z key to copy TEI assignments to each remaining link. This option copies all TEI assignments for the currently displayed link to each of the remaining links.

ClearAutomaticTei
Press the C key to clear the current TEI assignment. A new value can then be established.

Enable/DisableSPID/USID
Press the D key or the E key to enable or disable the SPID/USID feature. The default setting is disabled.

✍ *This field must be enabled to for the TEI Assignments screen to display SPIDs/ USIDs entered through the TEI/Envelope_L Assignments window.*

The following fields are displayed in the TEI Assignments screen and the TEI/ Envelope_L Assignments window.

INDEX
This field assigns an index (or row) number for each TEI assignment.

✍ *The value displayed in the INDEX field is not the TEI value.*

TYPE
This field displays the type of a specific TEI assignment. This field can be toggled between BROADCAST, AUTOMATIC, NON-AUTOMATIC, or UNUSED. The BROADCAST setting is automatically entered in the first row, Index 0, and cannot be edited. The TYPE field is accessed through the TEI/ Envelope_L Assignments window. Press the Enter (↵) key to open the window.

NAME
This field displays the logical name assigned to each TEI value. This field allows a name of up to 20 characters to be assigned. The NAME field is accessed through the TEI/Envelope_L Assignments window. Press the Enter (↵) key to open the window.

VALUE
This field displays assigned TEI values. If the TEI type is set to AUTOMATIC, the TEI value is assigned by the network. TEI values can only be specified by the user for Non-Automatic TEIs. The VALUE field is accessed through the TEI/Envelope_L Assignments window and is for Non-Automatic TEI assignments only. Press the Enter (↵) key to open the window.

SPID or USID
This field displays assigned SPIDs/USIDs. If the link is configured as USER in the Link Layers Parameters screen, the parameter will be SPID. If it is configured as NETWORK, the parameter will be USID. The SPID/USID feature can be enabled or disabled from the TEI assignment screen. The default setting is disabled.

SPID/USID values can only be specified by the user for Automatic TEIs. The SPID/USID field is accessed through the TEI/Envelope_L Assignments window and is for automatic TEI assignments only. Press the Enter (↵) key to open the window.

When utilizing the SPID/USID Control feature, the number of SAPIs and TEIs are inversely proportionate. There must be at least two SAPIs, 0 and 63, assigned to a link in order to use the SPID/USID Control feature. After these two SAPIs have been assigned, the SPIDs/USIDs for each link can be assigned, each with a unique index number. Refer to **Table 8.1** for a complete listing of the available number of SAPIs and TEIs.

Table 8.1 - Possible SAPI/TEI Combinations for SPID/USID

If the number of assigned SAPIs is:	Then the available number of TEIs is:
2	7
3	6
4	4
5	4
6	3

ISDN SPID\USID Control

SPIDs, USIDs, and Terminal Identifications (TIDs) allow an ISDN to support identification and selection of specific terminals on a multi-point user-network interface to support multiple user service profiles in cases in which standard information elements are not sufficient for such purposes.

A service profile refers to the information that the network maintains for a given user to characterize the service offered by the network to that user. For example, it may contain the association of feature identifiers to specific supplementary services. A service profile may be allocated to an access interface or to a particular user equipment or a group of user equipment.

The SPID is parameter carried in a SPID information element that is sent from the user to network to allow network assignment of a USID and TID. A user's SPID uniquely identifies a specific profile of service characteristics stored within the network. The SPID allows the network to distinguish between different terminals that would otherwise be indistinguishable, for example, the same ISDN number. The SPID value is a three to 20 digit number, encoded in International Alphabet Number 5 (IA5) format, provided to the user at the time of subscription. The SPID is of significance at the local access interface only. It is not conveyed to transit or remote switches in association with call setup or supplementary service invocation.

A USID uniquely identifies a service profile on a user interface. A TID value is unique within a given USID. If two terminals on an interface subscribe to the same service profile, the two terminals will be assigned the same service USID. However, two different TIDs are required to uniquely identify each of the two terminals.

If the link is configured as USER in the Link Layer Parameters screen, the parameter will be SPID. If it is configured as NETWORK, the parameter will be USID. The SPID/USID feature can be enabled or disabled from the TEI Assignments screen. The default setting is disabled.

The network that receives the SPID in an INFO message uses the last two digits of the SPID to derive the TID value, a value coded within a range of 0 through 62. If the SPID value received is invalid, or the value of the last two digits of the SPID is outside the range allowed for a TID value, the network sends out an INFO message containing the following information:

- A NULL call reference
- A Call Information element that indicates invalid information element contents

Trigger messages allow the SPID to be selected and assigned to INFO messages. If a SPID index is selected that contains no SPID information, the Spectra system assumes that the SPID is not to be transmitted.

Assigning Names and Types to TEI/Envelope_L Values

Follow these steps to assign names and types to TEI/Envelope_L values.

Step	Action
1.	When the TEI Assignments screen first appears, the cursor is automatically placed on the Index 0 row. This row is used for the

Broadcast TEI and cannot be edited. Press the ↓ key once to move the cursor to Index Row 1.

2. Press the **Enter** (↵) key to access to TEI/Envelope_L Assignments for Link 1 window for Index Row 1 (see **Figure 8.10**).

TEI/Envelope_L Assignments for Link 1

INDEX	TYPE	NAME	TEI	SPID	DONE
1	UNUSED				Done

Figure 8.10 - TEI Assignments for Link 1 Window

3. Use the →← keys to select the TYPE column. Press the **Enter** (↵) key to cycle through the available options—UNUSED, AUTOMATIC, and NON-AUTOMATIC. When the desired entry is displayed, press the → key once or press the **Tab** key once to move the cursor to the NAME field.

✍ *If you selected UNUSED as the assignment type, and then pressed the → key or the Tab key, your cursor moves to the DONE field. Press the Enter (↵) key to return to the TEI Assignments screen. If additional assignments are desired, move the cursor to a new index row and restart the procedure from **Step 2**.*

4. If desired, enter a logical name of up to 27 characters for the desired TEI, and press the **Enter** (↵) key once or press the **Tab** key once to move the cursor to the TEI field.

✍ *If you selected AUTOMATIC as the assignment type in **Step 3** and then pressed the Enter (↵) key or the Tab key, your cursor moves to the SPID/USID field. You do not need to enter a TEI value. A SPID or USID can be assigned as described in **Step 6** or you can press the → key to advance the cursor to the DONE field. Press the Enter (↵) key to return to the TEI Assignments screen.*

5. If the specified TYPE is NON-AUTOMATIC, the cursor moves to the TEI field. Press the **Enter** (↵) key to access the entry field, and enter in the TEI value (0 through 63) to be associated with the name specified in **Step 4**. Press the **Enter** (↵) key again to accept the TEI value assignment.

6. If the specified TYPE is AUTOMATIC, after assigning a name the cursor moves to the SPID or USID field. Either a SPID from three to 20 characters can be added to the assignment or a USID value (0 through 127) can be added to the assignment. Press the

Enter (↵) key or the **Tab** key to accept the assignment. The cursor automatically moves to the DONE field. Press the **Enter** (↵) key to return to the TEI Assignments screen.

✍ *When utilizing the SPID/USID Control feature, the number of SAPIs and TEIs are inversely proportionate. There must be at least two SAPIs, 0 and 63, assigned to a link in order to use SPID/USID control. After these two SAPIs have been assigned, the SPIDs/USIDs for each link can be assigned, each with a unique index number. Refer to* ***Table 8.1*** *on page 223 of this guide for a complete listing of the available number of SAPIs and TEIs*

7. Repeat **Step 1** through **Step 6** for each TEI available on the link, using the ↑↓ keys to move the cursor between the entry fields.

✍ *Any TEI assignment can be deleted by highlighting the TEI and pressing the Delete key.*

8. Press the →← keys to make assignments to other links, and repeat **Step 1** through **Step 7** until all TEI assignments for all links are made.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running.*

If you selected Automatic as the assign type, return to the TEI Assignments screen, to view the Automatic values assigned. If values are not assigned, it may be necessary to use the F8 Tools function to reset the I/O interface for the DLP board(s) in use and restart the mode that you are running. For more information about resetting I/O interfaces, see "Reset I/O Interface" on page 488 of the ***Spectra Features and Functions Guide***

TIMESLOT ASSIGNMENTS SCREEN

The Timeslot Assignments screen is used for both the DASS and the DPNSS protocols to toggle timeslots (channels) ON and OFF. A timeslot that has been toggled OFF cannot receive a message. Therefore, it cannot be brought into service.

The Timeslot Assignments screen is used for the data link level for the DASS protocol to provide a 32-timeslot Digital Line Transmission System (DLTS). For the DASS protocol, a Set Asynchronous Balanced Mode Restricted (SABMR) message is a command frame that constitutes a reset signal. It indicates that the sending Private Branch Exchange (PBX)/Exchange Termination (ET) will reset its state variables upon receipt of the Unnumbered Acknowledgment (UA) or a SABMR frame from the remote ET/PBX. The remote ET/PBX, after receiving the SABMR frame, resets its state variables and responds with a UA frame.

For the DPNSS protocol, a SABMR message is used to initiate reset of a Data Link Connection (DLC). This message brings up all links and all timeslots not toggled OFF. The DPNSS protocol uses 64 available timeslots (channels), both real and virtual. Real and virtual channels can be used simultaneously. Timeslots are designated as real or virtual in the ISDN test script options. For more information, refer to "Creating ISDN Test Scripts" on page 323 of the ***Spectra Testers Guide***. This screen does not apply to CCITT, ETSI, ABIS, V5.1, and V5.2 protocols.

From the Level 2 Parameters options menu, use the ↑↓ keys to highlight the Timeslot Assignments option, and press the Enter (↵) key. The Timeslot Assignments screen appears (see **Figure 8.11**).

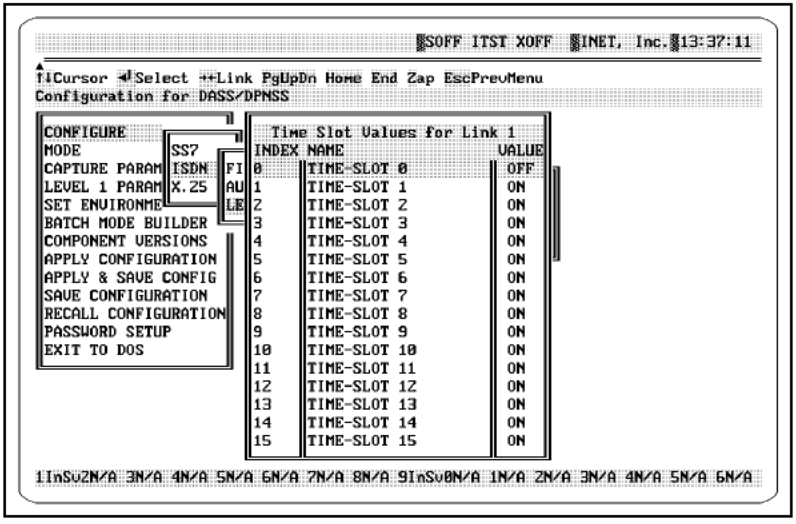


Figure 8.11 - Timeslot Assignments Screen

✍ *Timeslots 0 and 16 are reserved for common channel signalling for the DASS and DPNSS protocols.*

Timeslot Assignments Screen Definitions

↑↓Cursor
Press the ↑↓ keys to move the cursor to a particular field.

↵Select
Press the Enter (↵) key to toggle the selected Timeslot value ON or OFF.

→← Link
Press the →← keys to display next or previous links.

Zap
Press the Z key to copy timeslot assignments to all links.

INDEX
The Index field displays an index (or row) number for each timeslot assignment.

NAME
This option displays the name of the timeslot.

VALUE
This option toggles the timeslot value to ON or OFF. Press the Enter (↵) key to change the Timeslot value.

✍ *Timeslot 0 value and Timeslot 16 value are used for alignment and cannot be changed.*

Assigning Timeslot Values

Follow these steps to assign the timeslot values.

Step	Action

1. From the ISDN Level 2 Parameters options menu, use the ↑↓ keys to highlight the Timeslot Assignments option, and press the **Enter** (↵) key. The Timeslot Assignments screen is displayed (see **Figure 8.12**).

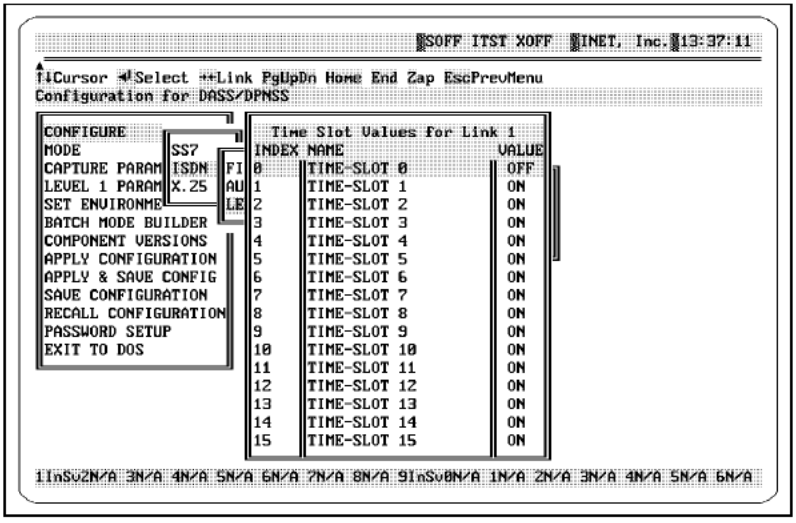


Figure 8.12 - Timeslot Assignments Screen

2. Press the ↓ key to move the cursor to the desired timeslot, and press the **Enter** (↵) key to toggle the value from OFF to ON.

3. Repeat **Step 2** until all timeslot values are selected.

4. Press the **Z** key to Zap copy all timeslot assignments to all links.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. See "Apply Configuration" on page 258 of this guide for more information about the Apply Configuration option.*

9 X.25 Specific Configuration

OVERVIEW

Using the Spectra system with the X.25 protocol requires some protocol specific configuration of both Level 2 and Level 3 parameters. This chapter explains the setup of these parameters.

Follow these steps to access the X.25 Configure options menu.

Step	Action

1. Press the **F1** key to access the F1 Setup menu as pictured in **Figure 9.1**.

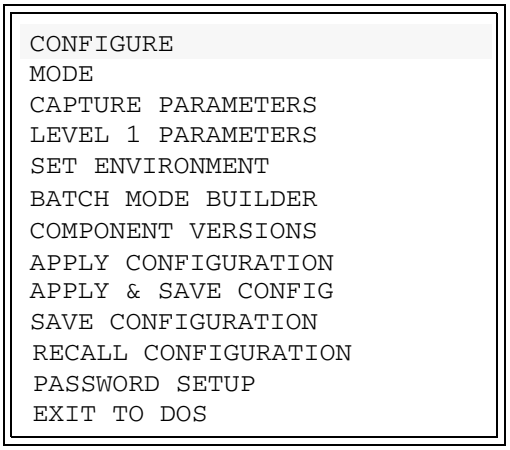


Figure 9.1 - F1 Setup Menu

2. Use the ↑↓ keys to highlight the Configure option, and press the **Enter (↵)** key. The Protocol options menu is displayed (see **Figure 9.2**).



Figure 9.2 - Protocol Menu

✍ *The Spectra system provides three protocol options: SS7, ISDN, and X.25. Since these protocols are available as separate options on the Spectra system, your system may have any combination of the three. If you requested only one protocol, no protocol choices are available. If you requested two protocols, only these choices are listed. If you purchased Spectra High Speed Links (HSL), two additional protocols, ATM and TALI are available. For more information on these protocols, refer to the* ***Spectra High Speed Links Guide****.*

3. Press the ↑↓ keys to highlight the X.25 option, and press the **Enter** (↵) key. The X.25 Configure options menu is displayed (see Figure 9.3).

```
FILTERS
AUTOMATIC RESPONSES
LEVEL 3 PARAMETERS
LEVEL 2 PARAMETERS
```

Figure 9.3 - X.25 Configure Options Menu

LEVEL 2 PARAMETERS

Assign the Level 2 parameters in the Link Layer Parameters screen. This screen allows X.25 LAPB/LAPD parameters to be assigned to up to 16 different system links. The assignments for the X.25 link layer can ensure an orderly and reliable interchange between interfaces.

From the X.25 Configure options menu, highlight the Level 2 Parameters option, and press the Enter (↵) key. The Link Layer Parameters screen is displayed (see Figure 9.4).

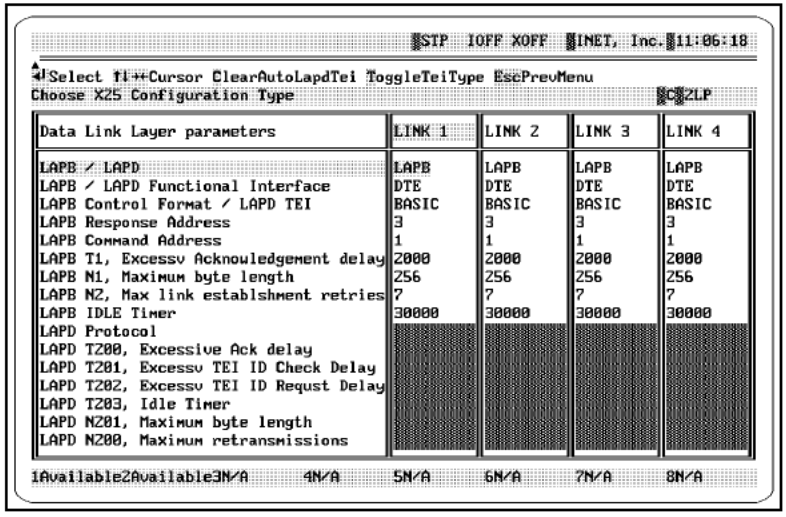


Figure 9.4 - Link Layer Parameters Screen

LINK LAYER PARAMETERS SCREEN DEFINITIONS

↵Select
Press the enter key to edit the selected field.

↑↓↔↓Cursor
Press the ↑↓↔↓ keys to move the cursor to a particular field.

LAPB/LAPD
This option allows selection of Link Access Procedure Balanced (LAPB) or Link Access Procedures on the D-Channel (LAPD) for the link layer protocol.

LAPB/LAPD Functional Interface
This field varies depending on the LAPB/LAPD designation described in LAPB/LAPD designation. For LAPB, this field allows selection of DCE (Data Communications Equipment) or DTE (Data Terminal Equipment) configuration for interfaces. For LAPD, this field allows selection of NETWORK (Network Equipment) or USER (Terminal Equipment) configuration for interfaces.

LAPB Control Field Format/LAPD TEI
This field varies depending on the LAPB/LAPD designation described in LAPB/LAPD designation. When the LAPB/LAPD field is set to LAPB, it represents the LAPB Control field format. When the LAPB/LAPD field is set to LAPD, it represents the LAPD TEI. These fields are described in the following paragraphs.

For LAPB, the Spectra system assigns either a Basic or an Extended parameter to all frames on various links. This determines the number of frames that can be sent before an acknowledgment has to be sent back. The Basic format allows zero to seven outstanding messages, and the Extended format allows zero to 127 outstanding messages.

Basic
The message sequencing is based on Modulo-8 (no more than eight acknowledged messages).

Extended
The message sequencing is based on Modulo-128 (no more than 128 acknowledged messages).

For LAPD, this field allows you to designate the TEI value for the link. The assignments you make here are for Non-automatic TEI values. The default for this field is Non-automatic. You can set the link for Automatic TEI assignments by using the ToggleTeiType feature described in the following paragraphs.

TEI values range from 0 to 127. Any TEI entry in this field that is greater than 127 is translated by the Spectra system into a corresponding Link Identification Code (LIC) format. The LIC identifies a specific link connection on the B-channel of the X.25 interface. The LIC parameter is displayed in a decimal format, (xxx-xxx-xxx) with the maximum value of each sub-field being 127 (for example, 120-115-110).

The Spectra system notifies you of the translation from a TEI value to a LIC value with a message in the upper-left corner of the Link Layer Parameters screen. The Spectra system then inserts the corresponding LIC value into the field.

✍ *The SAPI value is automatically set to 16.*

ToggleTeiType (LAPD only)
This option toggles between Automatic and Non-automatic TEI assignments. Automatic TEI values are assigned by the network. Non-automatic TEI values are assigned by the user. Press the T key to toggle.

ClearAutoLapdTei (LAPD only)
Automatic TEI values are assigned by the network. Press the C key to clear the current automatic TEI assignment. A new value can then be established.

Response Address (LAPB only)
Assigns the destination address used for all responses transmitted.

Command Address (LAPB only)
This option assigns the origination address used for all commands transmitted (in this case, the X.25 Tester).

T1, Excessive Acknowledgment delay (LAPB only)
This option assigns the T1 timer for various links. The T1 timer indicates the time (in milliseconds) that the application converter waits for an acknowledgment. On expiration of T1, the program retransmits the message and restarts T1.

N1, Maximum byte length (LAPB only)
This option assigns the maximum byte length allowed for all LAPB frames (not including the LAPB header).

N2, Max link establishment retries (LAPB only)
This option assigns the maximum number of times the T1 timer is restarted. If the N2 threshold is reached, the system tries to re-establish a link.

Idle Timer (LAPB only)
When the link is inactive for the assigned idle time, a polled command is sent to ensure the availability of the link.

LAPD Protocol (LAPD only)
This option assigns the protocol to be used as CCITT or ETSI.

LAPD T200 Excessive Ack delay (LAPD only)
This option assigns the T200 timer for each link. The T200 timer indicates the duration (in milliseconds) that the Spectra system waits for an acknowledgment of transmitted messages. On expiration of T200, the Spectra system retransmits the message and restarts the T200 timer.

LAPD T201 Excessive TEI ID Check Delay (LAPD only)
This option assigns the T201 timer for each link. The T201 timer indicates the duration (in milliseconds) that the Spectra system waits for ID Check response messages from connected TEI.

LAPD T202 Excessive TEI ID Request Delay (LAPD only)
This option assigns the T202 timer for each link. The T202 timer indicates the duration (in milliseconds) that the Spectra system waits for a response after sending an ID Request message.

LAPD T203 Idle Timer (LAPD only)
This option assigns the T203 timer for each link. When the link is inactive for the assigned idle time, a polled command is sent to ensure the availability of the link.

LAPD N201 Maximum Byte Length (LAPD only)
This option assigns the maximum byte length for complete LAPD messages. Acceptable lengths range from 0 to 263.

LAPD N200 Maximum Retransmissions (LAPD only)
This option assigns the maximum number of times the T200 timer is restarted. If the N200 threshold is reached, the system tries to re-establish a link.

ASSIGNING LINK LAYER PARAMETERS FOR LAPB

Follow these steps to assign link layer parameters for LAPB.

Step	Action
1.	When the Link Layer Parameters screen is displayed, the LAPB/LAPD field is highlighted. Press the **Enter** (↵) key to toggle between the LAPB and LAPD options until LAPB is displayed.
2.	Press the ↓ key one time to highlight the LAPB/LAPD Functional Interface field. Press the **Enter** (↵) key to toggle between the DCE and DTE options.

✍ *This re-assigns the Response and Command addresses to recommended values.*

3.	Press the ↓ key one time to highlight the LAPB Control Field Format field, and press the **Enter** (↵) key to toggle between the BASIC and EXTENDED options.
4.	Press the ↓ key one time to highlight the LAPB Response Address field, and press the **Enter** (↵) key. The Enter Response Address dialog box is displayed (see **Figure 9.5**).

```
Enter the Response Address (0-255):
```

Figure 9.5 - LAPB Response Address Dialog Box

Enter a value between 0 and 255, and press the **Enter** (↵) key to assign that value.

5.	Press the ↓ key one time to highlight the LAPB Command Address field, and press the **Enter** (↵) key. The Enter Command Address dialog box is displayed (see **Figure 9.6**).

```
Enter the Command Address (0-255):
```

Figure 9.6 - LAPB Command Address Dialog Box

Enter a value between 0 and 255, and press the **Enter** (↵) key to assign that value.

6. Press the ↓ key one time to highlight the LAPB T1, Excessive Acknowledgment Delay field, and press the **Enter** (↵) key. The Enter Time dialog box is displayed (see **Figure 9.7**).

```
Enter time in milliseconds(0-9999):
```

Figure 9.7 - Enter Time Dialog Box

Enter a value between 0 and 9999, and press the **Enter** (↵) key to assign that value.

7. Press the ↓ key one time to highlight the LAPB N1, Maximum byte length field, and press **Enter** (↵) key. The Enter Maximum Byte Length dialog box is displayed (see **Figure 9.8**).

```
Enter maximum byte length (25-263):
```

Figure 9.8 - Enter Maximum Byte Length Dialog Box

Enter a value between 25 and 263, and press the **Enter** (↵) key to assign that value.

8. Press the ↓ key one time to highlight the LAPB N2, Maximum link establishment retries field, and press **Enter** (↵) key. The Enter Maximum Establishment Retries dialog box is displayed (see **Figure 9.9**).

```
Enter maximum link establishment retries (0-99):
```

Figure 9.9 - Enter Maximum Establishment Retries Dialog Box

Enter a value between 0 and 99, and press the **Enter** (↵) key to assign that value.

9. Press the ↓ key one time to highlight the LAPB Idle Timer field, and press **Enter (↵)** key. The Enter Time dialog box is displayed (see **Figure 9.10**).

```
Enter time in milliseconds(0-99999):
```

Figure 9.10 - Enter Time Dialog Box

Enter a value between 0 and 99999, and press the **Enter (↵)** key to assign that value.

10. Repeat **Step 1** through **Step 9** for all links (up to 16) that require X.25 link layer parameters. Use the ↑↓↔ keys to move between fields, columns, and links. Links that are not present are filled with blanks in the associated column.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

ASSIGNING LINK LAYER PARAMETERS FOR LAPD

Follow these steps to assign link layer parameters for LAPD.

Step	Action
1.	When the Link Layer Parameters screen is displayed, the LAPB/LAPD field is highlighted. Press the **Enter (↵)** key to toggle between the LAPB and LAPD options until LAPD is displayed.
2.	Press the ↓ key one time to highlight the LAPB/LAPD Functional Interface field. Press the **Enter (↵)** key to toggle between the NETWORK and USER options.

3. Press the ↓ key one time to highlight the LAPD TEI field, and press the **Enter** (↵) key. The Enter LIC/TEI Value dialog box is displayed (see **Figure 9.11**).

```
Enter LIC/TEI (Current:1) Value:
```

Figure 9.11 - Enter LIC/TEI Value Dialog Box

Enter a value between 0 and 127 for TEIs. Entries greater than 127 are converted by the Spectra system into LIC format. For more information on TEI/LIC conversion, refer to "LAPB Control Field Format/LAPD TEI" on page 234 of this guide. When you have entered the desired value, press the **Enter** (↵) key to assign the value.

4. Press the ↓ key one time to highlight the LAPD Protocol field. Press the **Enter** (↵) key to toggle between the CCITT and ETSI options.

5. Press the ↓ key one time to highlight the LAPD T200, Excessive Ack delay field, and press the **Enter** (↵) key. The Enter Time dialog box is displayed (see **Figure 9.12**).

```
Enter time in milliseconds(0-9999):
```

Figure 9.12 - Enter Time Dialog Box

Enter a value between 0 and 9999, and press the **Enter** (↵) key to assign that value.

6. Press the ↓ key one time to highlight the LAPD T201, Excessive TEI Check Delay field, and press the **Enter** (↵) key. The Enter Time dialog box is displayed (see **Figure 9.13**).

```
Enter time in milliseconds(0-9999):
```

Figure 9.13 - Enter Time Dialog Box

Enter a value between 0 and 9999, and press the **Enter** (↵) key to assign that value.

7. Press the ↓ key one time to highlight the LAPD T202, Excessive TEI Request Delay field, and press the **Enter** (↵) key. The Enter Time dialog box is displayed (see **Figure 9.14**).

```
Enter time in milliseconds(0-9999):
```

Figure 9.14 - Enter Time Dialog Box

Enter a value between 0 and 9999, and press the **Enter** (↵) key to assign that value.

8. Press the ↓ key one time to highlight the LAPD T203, Idle Timer field, and press the **Enter** (↵) key. The Enter Time dialog box is displayed (see **Figure 9.15**).

```
Enter time in milliseconds(0-99999):
```

Figure 9.15 - Enter Time Dialog Box

Enter a value between 0 and 99999, and press the **Enter** (↵) key to assign that value.

9. Press the ↓ key one time to highlight the LAPD N201, Maximum byte length field, and press **Enter** (↵) key. The Enter Maximum Byte Length dialog box is displayed (see **Figure 9.16**).

```
Enter maximum byte length (0-263):
```

Figure 9.16 - Enter Maximum Byte Length

Enter a value between 0 and 263, and press the **Enter** (↵) key to assign that value.

10. Press the ↓ key one time to highlight the LAPB N200, Maximum retransmissions field, and press **Enter (↵)** key. The Enter Maximum Link Establishment Retries dialog box is displayed (**Figure 9.17**).

```
Enter maximum link establishment retries (0-99):
```

Figure 9.17 - Enter Maximum Link Establishment Retries

Enter a value between 0 and 99, and press the **Enter (↵)** key to assign that value.

11. Repeat **Step 1** through **Step 10** for all links (up to 16) that require X.25 link layer parameters. Use the ↑↓↔ keys to move between fields, columns, and links. Links that are not present are filled with blanks in the associated column.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

LEVEL 3 PARAMETERS

Assign the Layer 3 Parameters in three screens—the Packet Layer Parameters screen, the Virtual Circuit Configuration screen, and the Switch Virtual Circuit Mapping screen.

From the X.25 Configure options menu, highlight the Level 3 Parameters option, and press the Enter (↵) key. The Level 3 Parameters options menu is displayed (see **Figure 9.18**).

```
PACKET LAYER PARAMETERS
VIRTUAL CIRCUIT CONFIGURATION
SWITCH VIRTUAL CIRCUIT MAPPING
```

Figure 9.18 - X.25 Level 3 Parameters Options Menu

PACKET LAYER PARAMETERS SCREEN

Use the Packet Layer Parameters screen to help ensure proper interface communications at the data packet level between the Spectra system and the X.25 network under test. This screen allows X.25 parameters to be assigned to up to 16 different Spectra system links. Parameters include packet layer format, application type, and several timers.

From the Level 3 Parameters options menu, use the ↑↓ keys to highlight the Packet Layer Parameters option, and press the Enter (↵) key. The Packet Layer Parameters screen is displayed (see **Figure 9.19**).

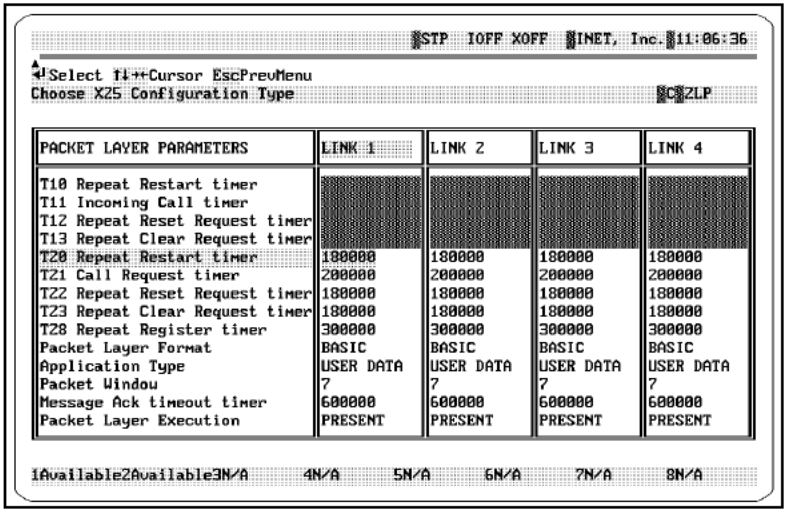


Figure 9.19 - Packet Layer Parameters Screen

Packet Layer Parameters Screen Definitions

↵Select
Press the enter key to edit the selected field.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

Timers
These timers define when links are taken in and out of service.

- T10 Repeat Restart Timer
  DCE issues a restart indication (Default 60000 milliseconds).
- T11 Incoming Call Timer
  DCE issues an incoming call (Default 180000 milliseconds).
- T12 Repeat Reset Request Timer
  DCE issues a reset indication (Default 60000 milliseconds).
- T13 Repeat Clear Request Timer
  DCE issues a clear indication (Default 60000 milliseconds).
- T20 Repeat Restart Timer
  DTE issues a restart request (Default 180000 milliseconds).
- T21 Call Request Timer
  DTE issues a call request (Default 200000 milliseconds).
- T22 Repeat Reset Request Timer
  DTE issues a reset request (Default 180000 milliseconds).
- T23 Repeat Clear Request Timer
  DTE issues a clear request (Default 180000 milliseconds).
- T28 Repeat Register Timer
  DTE issues a registration request (Default 300000 milliseconds).

✍ *Some timers are blocked out on your screen. Only those timers that are applicable to the functional interface defined in the Level 2 parameters are available. These parameters are defined in the Functional Interface field of the Link Layer Parameters screen. For more information about the Link Layer Parameters screen, see "Level 2 Parameters" on page 233 of this guide.*

Packet Layer Format
This option assigns either Basic or Extended format to various links. The Basic format allows zero to seven outstanding messages and the Extended format allows zero to 127 outstanding messages. Basic and Extended are defined as follows:

Basic
The message sequencing is based on Modulo-8 (no more than eight acknowledged messages).

Extended
The message sequencing is based on Modulo-128 (no more than 128 acknowledged messages).

Application Type
This option defines the application type used in Monitoring mode and Testing mode. The application types are:

IS41
This is industry standard, pre-defined IS41 application type.

ASCII
User-defined parameters can be edited in ASCII format for specific communication purposes.

USER DATA
User-defined parameters can be edited in hexadecimal format for specific communication purposes.

Any Proprietary Application Type
User-specific proprietary application types may be available in addition to those mentioned in previous paragraphs.

Packet Window
This option assigns the maximum number of unacknowledged outstanding packets allowed. If the assigned maximum number is reached, appropriate X.25 procedures prompt for an acknowledgment. Unacknowledged packets can be due to software problems, hardware problems, log time delays caused by heavy traffic, etc.

Message Ack Timeout Timer
This timer is not standard. It is the amount of time that a circuit waits for an acknowledgment to a Transmitted message. When exceeded, a PVC Reset Request is sent.

Packet Layer Execution
This option turns the packet layer ON or OFF. If the option is NOT PRESENT, the packet layer is turned OFF and bypassed. If it is PRESENT, the packet layer information is considered normal, and all SVCs, PVCs, etc. are recognized.

Assigning Packet Layer Parameters

Follow these steps to assign the packet layer parameters for each link.

Step	Action
1.	When the Packet Layer Parameters screen is displayed, the cursor is automatically placed on the T10 Repeat Restart Timer field or the T20 Repeat Restart Timer field under the Link 1 column. Press the **Enter (↵)** key to edit this field.

✍ *The available timers depend on the assignment made in the Functional Interface field of the Link Layer Parameters screen. For more information about the Link Layer Parameters screen, see "Level 2 Parameters" on page 233 of this guide.*

2. The Enter Time dialog box is displayed (see **Figure 9.20**). Enter the desired value, and press the **Enter (↵)** key to assign that value.

```
Enter time in milliseconds(1-1000000):
```

Figure 9.20 - Enter Time Dialog Box

3. Repeat **Step 1** through **Step 2** for all available timers.

4. Use the ↑↓ keys to highlight the Packet Layer Format field, and press the **Enter (↵)** key to toggle between the BASIC and EXTENDED options.

5. Press the ↓ key one time to move the cursor to the Application Type field, and press the **Enter (↵)** key to cycle through the available options—IS41, ASCII, DMX, and USER DATA.

6. Press the ↓ key one time to move the cursor to the Packet Window field, and press the **Enter (↵)** key. The Enter Packet Window dialog box is

displayed (see **Figure 9.21**). Enter the desired value, and press the **Enter (↵)** key to assign that value.

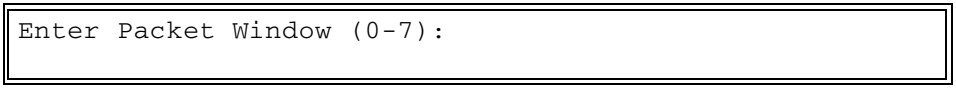


Figure 9.21 - Enter Packet Window Dialog Box

7. Press the ↓ key one time to move the cursor to the Message Ack Timeout Timer field, and press the **Enter (↵)** key. The Enter Message Ack Time dialog box is displayed (see **Figure 9.22**). Enter the desired value, and press the **Enter (↵)** key to assign that value.

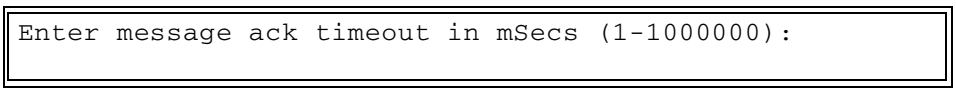


Figure 9.22 - Enter Message Ack Time Dialog Box

8. Use the ↓ key to highlight the Packet Layer Execution field, and press the **Enter (↵)** key to toggle between the NOT PRESENT and PRESENT options.

9. Repeat **Step 1** through **Step 8** for all links that require parameter settings. Use the ↑↓↔ keys to move between fields, columns, and links.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

VIRTUAL CIRCUIT CONFIGURATION SCREEN

The Virtual Circuit Configuration screen makes assignments for individual logical channels. Specific control over individual channels allows flexibility in testing procedures since channels can be tailored for specific systems.

For example, if a DTE is only going to receive calls, the lowest incoming channel can be set to 0 and the highest incoming channel can be set to 4095, thus allowing all 4096 channels to be freed for incoming calls.

From the Level 3 Parameters options menu, use the ↑↓ keys to highlight the Virtual Circuit Configuration option, and press the Enter (↵) key. The Virtual Circuit Configuration screen is displayed (see **Figure 9.23**).

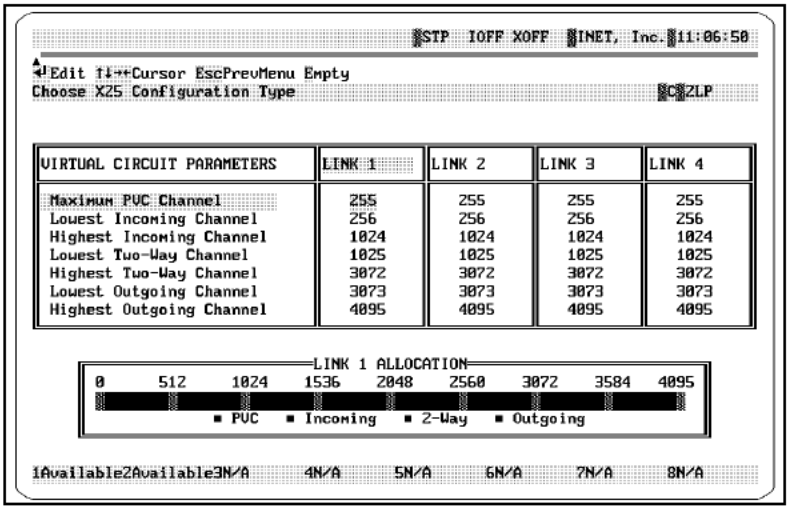


Figure 9.23 - Virtual Circuit Configuration Screen

Virtual Circuit Configuration Screen Definitions

↵Edit
Press the enter key to edit the selected field.

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

Empty
Press the E key to mark the highlighted field EMPTY. An EMPTY field does not use any channels for that function.

Maximum PVC Channel
The highest channel that is to be established for use as a Permanent Virtual Circuit (PVC). For example, if channels 0 to 255 need to be set aside as PVCs, set this field to 255.

Lowest Incoming Channel
The lowest channel that can handle messages coming into the terminal end.

Highest Incoming Channel
The highest channel that can handle messages coming into the terminal end.

Lowest Two-Way Channel
The lowest channel that can handle both incoming and outgoing messages to/from the terminal end.

Highest Two-Way Channel
The highest channel that can handle both incoming and outgoing messages to/from the terminal end.

Lowest Outgoing Channel
The lowest channel that can handle outgoing messages from the terminal end.

Highest Outgoing Channel
The highest channel that can handle outgoing messages from the terminal end.

Assigning Channels

Follow these steps to assign channels for each link.

Step	Action

1. When the Virtual Circuit Configuration screen is displayed, the cursor is automatically placed on the Maximum PVC Channel field under the Link 1 column. Press the **Enter (↵)** key to edit this field. The Enter Maximum PVC Channel # dialog box is displayed (see **Figure 9.24**).

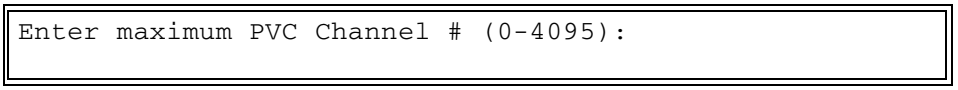


Figure 9.24 - Enter Maximum PVC Channel # Dialog Box

Enter the desired value, and press the **Enter (↵)** key to assign that value. The range of possible entries for this field depends on settings in the other fields.

✍ *Notice that when a channel number entry is made, the graph at the bottom of the screen adjusts to reflect the entry. Also, because the fields on this screen are interdependent, the ranges displayed in the entry dialog boxes change according to the settings in other fields.*

2. Use the ↓ key to highlight the Lowest Incoming Channel field, and press the **Enter (↵)** key. The Enter Lowest Incoming Channel # dialog box is displayed (see **Figure 9.25**).

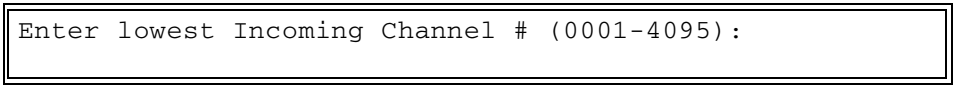


Figure 9.25 - Enter Lowest Incoming Channel # Dialog Box

The default range is 0256 to 1023. This field must be at least one number higher than the Maximum PVC Channel field setting. Enter the desired value, and press the **Enter (↵)** key to assign that value.

3. Use the ↓ key to highlight the Highest Incoming Channel field, and press the **Enter** (↵) key. The Enter Highest Incoming Channel # dialog box is displayed (see **Figure 9.26**).

```
Enter highest Incoming Channel # (0257-4095):
```

Figure 9.26 - Enter Highest Incoming Channel # Dialog Box

The default range is 0257 to 1024. Enter the desired value, and press the **Enter** (↵) key to assign that value.

4. Use the ↓ key to highlight the Lowest Two-Way Channel field, and press the **Enter** (↵) key. The Enter Lowest Two-Way Channel # dialog box is displayed (see **Figure 9.27**).

```
Enter lowest Two-way Channel # (1025-3071):
```

Figure 9.27 - Enter Lowest Two-Way Channel # Dialog Box

The default range is 1025 to 3071. This field must be at least one number higher than the Highest Incoming Channel field setting. Enter the desired value, and press the **Enter** (↵) key to assign that value.

5. Use the ↓ key to highlight the Highest Two-Way Channel field, and press the **Enter** (↵) key. The Enter Highest Two-Way Channel # dialog box is displayed (see **Figure 9.28**).

```
Enter highest Two-way Channel # (1026-3072):
```

Figure 9.28 - Enter Highest Two-Way Channel # Dialog Box

The default range is 1026 to 3072. Enter the desired value, and press the **Enter** (↵) key to assign that value.

6. Use the ↓ key to highlight the Lowest Outgoing Channel field, and press the **Enter** (↵) key. The Enter Lowest Outgoing Channel # dialog box is displayed (see **Figure 9.29**).

```
Enter lowest Outgoing Channel # (3073-4094):
```

Figure 9.29 - Enter Lowest Outgoing Channel # Dialog Box

The default range is 3073 to 4094. This field must be at least one number higher than the Highest Two-Way Channel field setting. Enter the desired value, and press the **Enter** (↵) key to assign that value.

7. Use the ↓ key to highlight the Highest Outgoing Channel field, and press the **Enter** (↵) key. The Enter Highest Outgoing Channel # dialog box is displayed (see **Figure 9.30**).

```
Enter highest Outgoing Channel # (3074-4095):
```

Figure 9.30 - Enter Highest Outgoing Channel # Dialog Box

The default range is 3074 to 4095. Enter the desired value, and press the **Enter** (↵) key to assign that value.

8. Use the →← keys to highlight other links, and repeat **Step 1** through **Step 7** for each link requiring channel assignments.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

SWITCH VIRTUAL CIRCUIT MAPPING SCREEN

The Switch Virtual Circuit Mapping screen assigns names and user-specific destination/origination codes to Switch Virtual Circuit (SVC) call numbers. It also displays the Establish status and logical channel number for SVC calls after they are established. This mapping process allows SVC calls to be established.

From the Level 3 Parameters options menu, use the ↑↓ keys to highlight the Switch Virtual Circuit Mapping option, and press the Enter (↵) key. The Switch Virtual Circuit Mapping screen is displayed (see **Figure 9.31**).

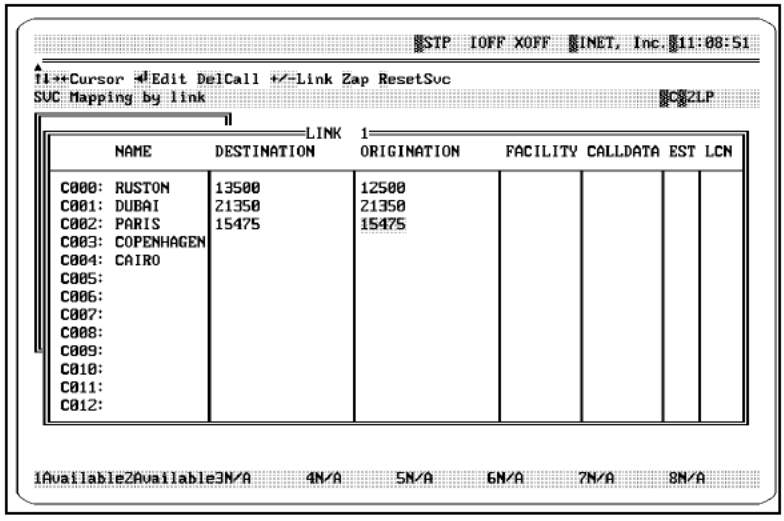


Figure 9.31 - Switch Virtual Circuit Mapping Screen

Switch Virtual Circuit Mapping Screen Definitions

↑↓↔Cursor
Press the ↑↓↔ keys to move the cursor to a particular field.

↵Edit
Press the enter key to edit the selected field.

DelCall
Press the Delete key to delete the name, destination code, and origination code associated with the currently highlighted SVC call number.

+/-Link
Press the + or - key to move links.

Zap
Press the Z key to set all links to the same settings as the current link.

Reset SVC
Press the R key to reset the highlighted SVC.

NAME
This option allows any name (up to 10 characters) to be assigned to a particular SVC call number for association purposes.

DESTINATION
This option allows any user-specific number (up to 15 characters) to be assigned to the screen. The destination number represents the code for the signalling device that receives messages from the Originating signalling device.

ORIGINATION
This option allows any user-specific number (up to 15 characters) to be assigned to the screen. The origination number represents the code for the signalling device that transmits messages to the Destination signalling device.

FACILITY (optional)
This option allows a user-specific entry to be assigned for this optional field in Call Request messages. Press the Enter (↵) key to access the X.25 User message catalog and select a previously created message to insert in this field in all Call Request messages for that SVC. X.25 User messages are created using the F6 Edit function. The Facility field allows a maximum of 109 bytes. For more information about creating messages, see **Chapter 5** of the ***Spectra Features and Functions Guide***. If this optional field is left blank, the field is omitted in all Call Request messages for that SVC.

CALL DATA (optional)
This option allows any user-specific entry to be assigned for this optional field in Call Request messages. Press the Enter (↵) key to access the X.25 User message catalog and select a previously created message to insert in this field in all Call Request messages for that SVC. X.25 User messages are created using the F6 Edit function. The Call Data field allows a maximum of 16 bytes. For more information about creating messages, see **Chapter 5** of the ***Spectra Features and Functions Guide***. If this optional field is left blank, the field is omitted in all messages for that SVC.

EST
This column displays a checkmark (√) when the call for the associated SVC call number has been established. SVC calls are considered established under one of the following conditions:

- The Spectra system originates a request message through the Establish Call feature (accessed through the F8 Tools menu), and the request is accepted by the Destination signalling device.

- The Spectra system, acting as the Destination signalling device, receives a request message from the Originating signalling device and accepts it.

This column is updated in real time as soon as a call is established.

LCN
After a call is established, this column automatically displays the Logical Channel Number (LCN) on which the call was established.

Making Switch Virtual Circuit Mapping Screen Assignments

Follow these steps to make switch virtual circuit mapping assignments.

Step	Action
1.	When the Switch Virtual Circuit Mapping screen is displayed, the cursor is automatically placed on the C000: field under the Name column. Press the **Enter (↵)** key to assign a name for the SVC. An Enter Call Name dialog box is displayed (see **Figure 9.32**).

```
Enter Call Name:
```

Figure 9.32 - Enter Call Name Dialog Box

Enter a name that helps associate the SVC call number to its assignment (for example, “NEWYORK” or “DALLAS”), and press the **Enter (↵)** key to assign that name.

2. Press the → key to highlight the Destination column, and press the **Enter (↵)** key. An Enter X.121 Destination Number dialog box is displayed (see **Figure 9.33**).

```
Enter X.121 Destination number:
```

Figure 9.33 - Enter X.121 Destination Number Dialog Box

Enter the desired user-specific code of up to 15 characters, and press the **Enter (↵)** key to assign the code.

3. Press the → key to highlight the Origination column, and press the **Enter** (↵) key. An Enter X.121 Calling Number dialog box is displayed (see **Figure 9.34**).

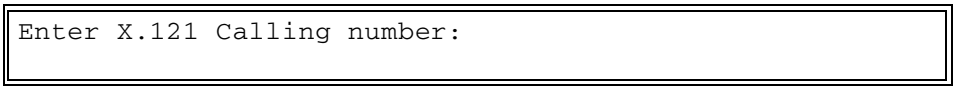


Figure 9.34 - Enter X.121 Calling Number Dialog Box

Enter the desired user-specific code of up to 15 characters, and press the **Enter** (↵) key to assign the code.

4. Press the → key to highlight the Facility column, and press the **Enter** (↵) key to access the X.25 User message catalog. Highlight a message from the catalog, and press the **Enter** (↵) key to assign the message to the field.

✍ *The Facility field is optional. If this field is left blank, the field is omitted in all Call Request messages for that SVC.*

5. Press the → key to highlight the Call Data column, and press the **Enter** (↵) key to access the X.25 User message catalog. Highlight a message from the catalog, and press the **Enter** (↵) key to insert the message into the field.

✍ *The Call Data field is optional. If this field is left blank, the field is omitted in all Call Request messages for that SVC.*

6. Repeat **Step 1** through **Step 5** for as many SVC call numbers as desired on this link.

7. Repeat **Step 1** through **Step 6** for all desired links. Use the + or - keys to move between links.

8. When calls are established, the EST and LCN fields automatically display the establish status and the LCN of the transmission.

✍ *You must use the Apply Configuration option before any changes to the settings take effect. After applying the configuration, press the F2 key to (re)start the mode that you are running. For more information about the Apply Configuration option, refer to "Apply Configuration" on page 258 of this guide.*

10 Applying, Saving, and Recalling Configurations

OVERVIEW

The F1 Setup menu contains several options for applying, saving, and recalling configurations for your Spectra system. These options provide maximum flexibility for your testing, emulating, and generating tasks.

Press the F1 key to access the F1 Setup menu (see **Figure 10.1**).

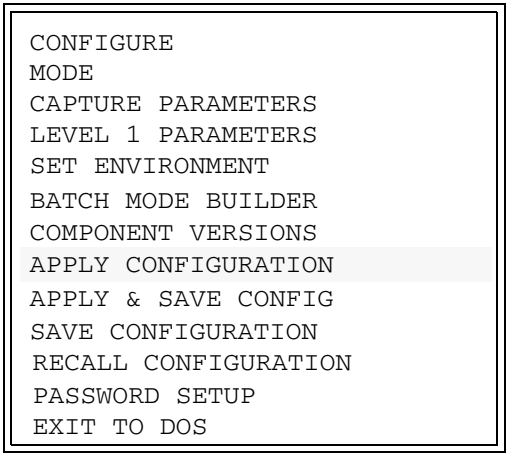


Figure 10.1 - F1 Setup Menu

These options are explained in the following material.

APPLY CONFIGURATION

This option applies the current settings in all screens to the current configuration file (displayed in the upper right-hand corner of the screen in the information line). This option allows uninterrupted assignment of new filters, triggers, and other settings. For example, if an ISUP test is running in the background, and you want to apply different filters without pressing the F2 key to restart a test, select this option. All current settings in the Spectra system screens are applied immediately, affecting tests that are already running.

Follow these steps to use the Apply Configuration option.

Step	Action
1.	Change all filters, triggers, etc. in their respective screens to the desired settings.
2.	Press the **Esc** key to return to the F1 Setup menu, and use the ↑↓ keys to highlight the Apply Configuration option.

3. Press the **Enter (↵)** key to apply all current settings to the current configuration.

APPLY & SAVE CONFIGURATION

This option applies and saves the current settings in all screens to the current configuration file (displayed in the upper right-hand corner of the screen in the information line). In addition to applying any modified settings to the current configuration, this option also saves those modifications in the stored configuration file. The Apply & Save Config option provides a shortcut for saving configuration files as opposed to the standard Save Configuration option.

Like the Apply Configuration option, this option allows uninterrupted assignment of new filters, triggers, and other settings. For example, if an ISUP test is running in the background, and you want to apply different filters without pressing the F2 key and restarting the test, select this option. All current settings in the Spectra system screens are applied immediately, affecting tests that are already running.

Follow these steps to use the Apply & Save Config option.

Step	Action
1.	Change all filters, triggers, etc. in their respective screens to the desired settings.
2.	Press the **Esc** key to return to the F1 Setup menu**,** and use the ↑↓ keys to highlight the Apply & Save Config option.
3.	Press the **Enter (↵)** key to apply all current settings, and save those settings under the current configuration file name (displayed in the upper right-hand corner of the screen in the information line).

✍ *When modified settings are applied and saved to the current configuration file, the original settings in the file are overwritten.*

SAVE CONFIGURATION

This option lets you save all settings in all screens of the Spectra system to a configuration file. By saving different configurations, individual settings do not have to be adjusted for different testing scenarios. These configurations can easily be recalled at any time with the Recall Configuration option.

The following parameters are saved using this command:

- Level 1 parameters
- Level 2 parameters
- All Level 3 settings
- Automatic Response settings
- Printer configurations
- Filter assignments

Follow these steps to save a configuration.

Step	Action
1.	From the F1 Setup menu, use the ↑↓ keys to highlight the **Save Configuration** option, and press the **Enter (↵)** key. The Enter Configuration Filename dialog box is displayed (see **Figure 10.2**).

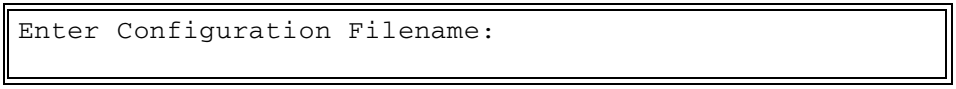


Figure 10.2 - Enter Configuration Filename Dialog Box

2.	Enter a configuration directory name (maximum of eight characters), and press the **Enter (↵)** key to save the current settings. The directory is placed in the `C:\SPECTRA\CONFIG` directory.

RECALL CONFIGURATION

This option recalls a specific configuration file that was previously saved.

Follow these steps to recall configuration files.

Step	Action
1.	From the F1 Setup menu, use the ↑↓ keys to select the **Recall Configuration** option, and press the **Enter (↵)** key to access the configuration catalog. The A…Z Search function can be used to alphabetically or numerically locate the desired file. Press the corresponding letter or number key to move the cursor to the desired file.

✍ *The Delete key can be used to delete the selected file.*

2.	After selecting the file, press the **Enter (↵)** key. A message flashes in the top border line, indicating the new configuration has not been applied. The configuration file name is displayed in the top-right corner of the description line.
3.	From the F1 Setup menu, use the ↑↓ keys to select the Apply Configuration option, and press the **Enter (↵)** key to apply the recalled configuration.

A SS7 Overview

OVERVIEW

As telecommunications systems increased in complexity and added more sophisticated functions, new message-based signalling systems developed to deliver the new services. The new services required more complex functions, including bidirectional signalling capabilities, flexible call setup, and remote database access. This increased complexity was made possible by the development of a signalling system capable of handling these new functions. This new system is known as Signalling System 7 (SS7). SS7 relies on Common Channel Signalling (CCS), a signalling method in which a channel conveys data relating to call setup, control, network management, and network maintenance by means of labeled messages.

SS7 NETWORK

A telecommunications network consists of switches and application processors interconnected by transmission circuits. The SS7 network exists within and controls the telecommunications network by creating and transferring call processing, network management, and maintenance messages to the network's various components. There are three basic types of SS7 network components: Signalling Service Points (SSPs), Signalling Transfer Points (STPs), and Signalling Control Points (SCPs). These components, generically referred to as signalling points or nodes, together with the links connecting them, comprise the SS7 network.

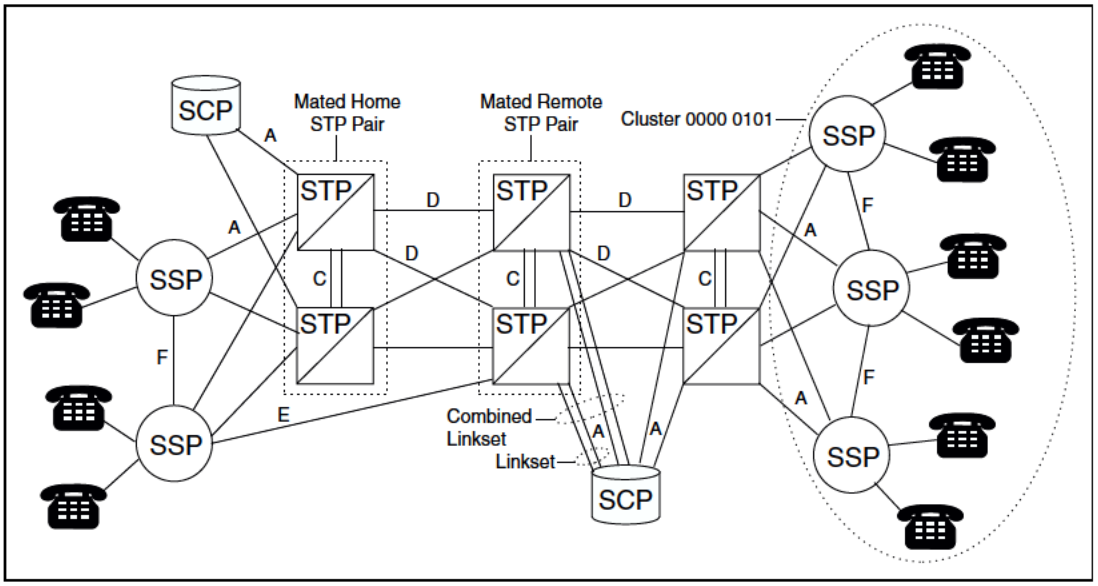


Figure A.1 - SS7 Network Components

SS7 NETWORK DEFINITIONS

SSPs and SPs

SSPs are switches interconnected by SS7 links. They serve as the connecting points for input instruments (for example, telephones) and perform call processing on calls that originate, tandem, or terminate at the site. The SSP may generate SS7 messages to transfer call-related information to other SSPs or to send a query to a Service Control Point for call routing instructions.

STPs
STPs relay messages between network switches and databases by transferring messages from one signalling link to another. Routing of messages is based on information contained in the SS7 message address fields.

SCPs
SCPs contain centralized network databases for providing enhanced services. These databases are used to confirm authorization codes. The SCP accepts queries from an SSP and returns the requested information to the originator of the query.

Mated Home STP Pair
A Mated Home STP Pair refers to a pair of STPs that provide a back-up to one another. Home refers to the mated STPs adjacent to the current SSP over the A links. Each STP is at a different geographical location to ensure system functionality in the event of fire, natural disaster, etc.

Mated Remote STP Pair
Remote refers to the mated STPs that are not adjacent to the current SSP.

A Links
A or access links carry information between SSPs and STPs and between STPs and SCPs.

C Links
C links carry information between mated STPs.

D Links
D or quad links carry information between STPs. D links within the same network may be referred to as B links.

E Links
E links carry information between SSPs and nonadjacent STPs.

F Links
F links carry information between SSPs.

Cluster
Groups of SSPs can be addressed in clusters.

Linkset
A Linkset is two or more links connecting adjacent nodes. A linkset may contain a maximum of 16 links.

Combined Linkset
A Combined Linkset is two or more linksets connected to mated STPs that share the same routing information.

SS7 PROTOCOL

Figure A.2 shows the functional levels of ITU SS7. The Message Transfer Part (MTP) comprises Level 1 to Level 3 and the user parts comprise Level 4.

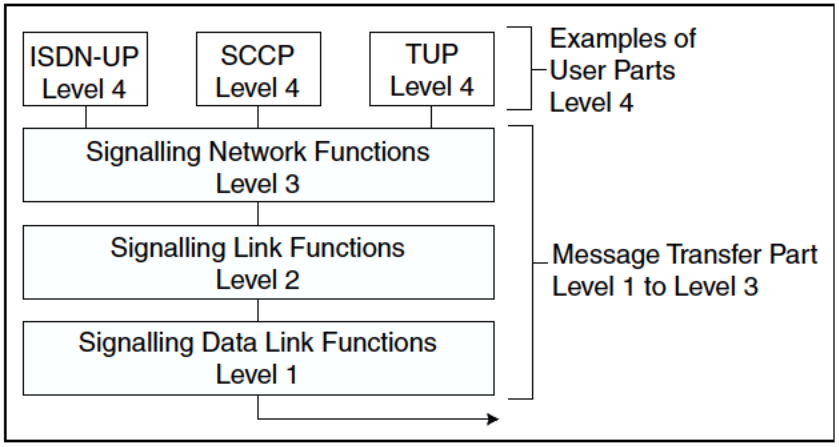


Figure A.2 - Functional Levels of the SS7 Protocol

Message Transfer Part Level 1 to Level 3
The MTP is used for routing messages within the SS7 network.

MTP Level 1 defines the SS7 signalling link characteristics.

MTP Level 2 defines procedures for transferring variable length messages over one signalling data link.

MTP Level 3 provides functions and procedures necessary for message routing and network management.

Level 4
The Level 4 user parts define the different applications that may be used in the SS7 network for call processing, transactions, and maintenance.

MTP LEVEL 1

MTP Level 1, the signalling data link, defines the physical, electrical, and functional characteristics of the signalling links that connect SS7 components. SS7 signalling data links are capable of operating over terrestrial and satellite transmission links. The signalling data link may be digital or analog.

MTP LEVEL 2

Level 2 (Q.703) is the data link layer found in SS7 networks. The signalling terminal at each end of the signalling data link contains the MTP Level 2 functions for reliable transfer of signalling messages between two directly connected signalling points. This layer overcomes the limitations found in physical circuits and allows errors in transmission to be detected and recovered, thereby masking deficiencies in transmission quality. **Figure A.3** shows the information flow for Level 2 signalling link control.

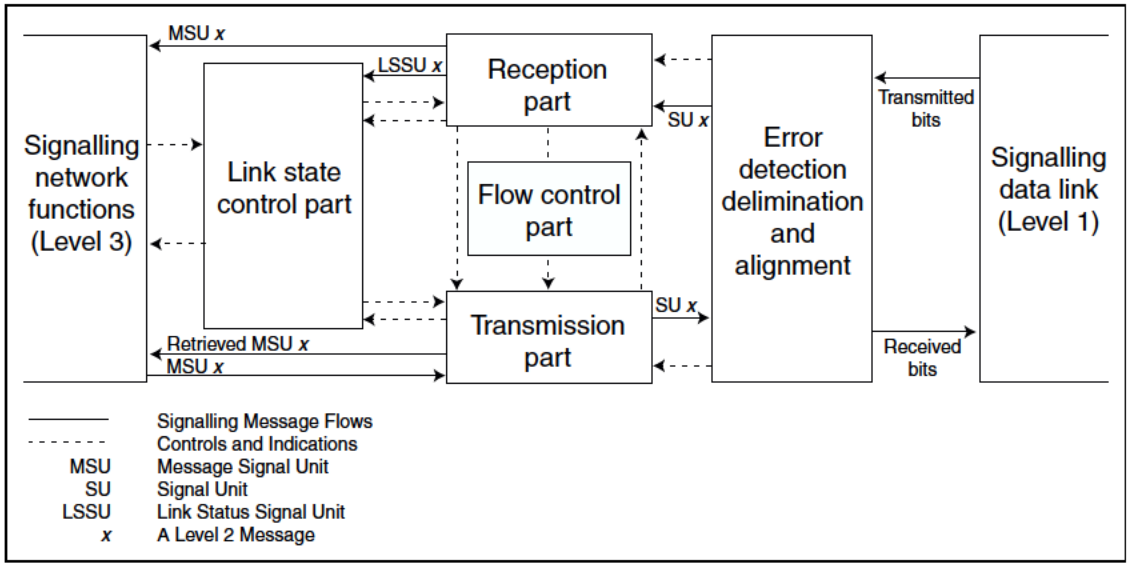


Figure A.3 - Signalling Link Control (Level 2)

SIGNAL UNITS

Signalling and other information originating from a user part is transferred over the signalling link by means of signal units. There are three types of signal units, and the following parameters are common to all three types. These parameters define the MTP Layer 2 signalling information.

Flag
The beginning and end of a signal unit are indicated by a unique 8-bit pattern called the flag. The flag is used for Signal Unit Delimitation and Alignment. Measures are taken to ensure that the pattern cannot be imitated elsewhere in the signal unit. Loss of alignment occurs when a bit pattern disallowed by the delimitation procedure (more than six consecutive 1s) is received or when a certain signal unit maximum length is exceeded.

Backward Sequence Number
The Backward Sequence Number (BSN) field is used to acknowledge received SUs.

Backward Indicator Bit
The Backward Indicator Bit (BIB) is used in the error recovery process.

Forward Sequence Number
The Forward Sequence Number (FSN) is the sequence number of the transmitted SU.

Forward Indicator Bit
The Forward Indicator Bit (FIB) is used in the error recovery process.

Cyclic Redundancy Check
The Cyclic Redundancy Check (CK) is a 16-bit checksum transmitted with each SU. If the checksum does not match at the receiving signalling point, it is assumed the SU contains errors and the SU is discarded.

Length Indicator Field
The Length Indicator (LI) field indicates the number of octets that follow the LI field and precede the CK field. These octets differentiate the three types of signal units: Message Signal Units (MSUs), Link Status Signal Units (LSSUs), and Fill-In Signal Units (FISUs).

The value of the LI field determines the type of signal unit as follows:

LI = 0 FISU

LI = 1-2 LSSU

LI = 3-63 MSU

Signal Unit Types

The following sections describe the signal unit types.

Fill-In Signal Units

FISUs are normally transmitted when no MSUs or LSSUs are being transmitted. This allows the SS7 network to receive immediate notification of signalling link failure. The LI defines this type of signal unit as a FISU. A FISU contains MTP Level 2 information only. There are no additional parameters in this type of signal unit.

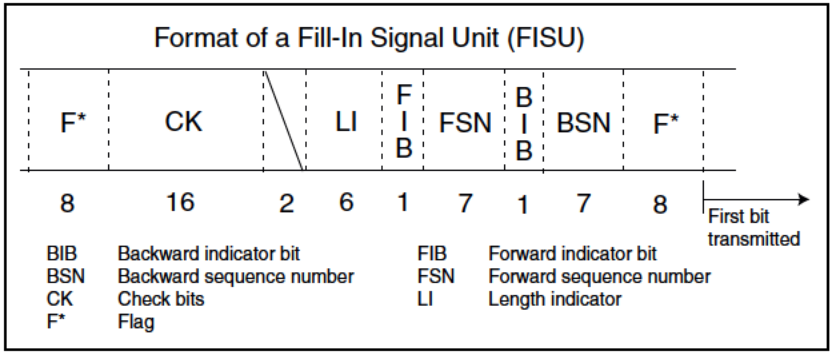


Figure A.4 - Fill-In Signal Unit

Ch# T1	ANSI SS7	Flags:1	Count	Time:17:10:43.34
00000000	BIB/BSN.....	0/0		
00000000	FIB/FSN.....	0/0		
..000000	SU type/length	FISU		
00.....	Spare	0		
Checksum	CRC 16.....	1100110		

Figure A.5 - Sample FISU Message

Link Status Signal Units

LSSUs are messages that provide MTP Level 2 link status indications to the remote end of the signalling link. The LSSU contains an additional parameter, the Status Field (SF).

Status Field
This field is used to indicate the link status. Examples of status indicators include Normal Alignment, Out of Service, and Processor Outage.

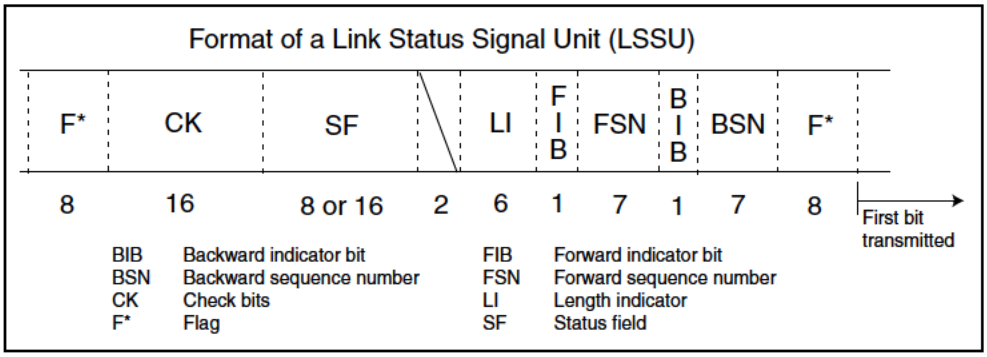


Figure A.6 - Link Status Signal Unit (LSSU)

Ch# T1	ANSI SS7	Flags:1	Count	Time:17:10:43.34
00000000	BIB/BSN.....	0/0		
00000000	FIB/FSN.....	0/0		
..000001	SU type/length	LSSU1		
00.....	Spare	0		
.....011	Link status	SIOS Out of service		
00000...	Spare	0		
Checksum	CRC 16.....	1001110111010111 hex=9dd7		

Figure A.7 - Sample LSSU Message

Message Signal Units

MSUs carry signalling information for routing, network management, and maintenance. The MSU includes MTP Level 3 parameters in addition to the MTP Level 2 portion of the message. An MSU may also contain Level 4 information, depending on the user part defined in the Service Information Octet (SIO). Routing information is contained in the Signalling Information Field (SIF).

Service Information Octet
This octet is made up of the service indicator and the sub-service field. The service indicator is used to associate the signalling message with a particular MTP user at a signalling point. The sub-service field contains the network indicator.

Signalling Information Field
This field contains the routing and signalling information of the message in the Routing Label. This is a variable length field that carries the information generated by the user part in the SIO, and a number of fixed length fields that carry information required for message transfer control.

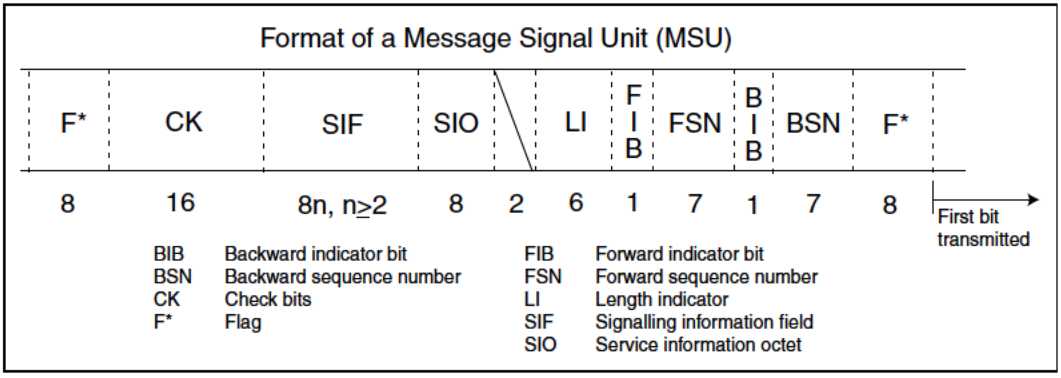


Figure A.8 - Message Signal Unit (MSU)

Ch# T1	ANSI SS7	Flags:1	Count	Time:17:10:43.34
00000000	BIB/BSN.....	0/0		
00000000	FIB/FSN.....	0/0		
..001010	SU type/length	MSU10		
00.....	Spare	0		
octet003	Service information octet			
....0000	Service indicator	SNM Signalling Network Management		
..11....	Message priority	3		
10.....	Network indicator	N National network		
octet004	Routing label			
.....	DPC: Net-Clstr-Mbr	000-000-000		
.....	OPC: Net-Clstr-Mbr	000-000-000		
...00000	SLS.....	0		
000.....	spare	0		
octet011	Message type			
00010110	Headers H1/H0	LIN Link inhibit		
....0000	Unavailable SLC	0		
0000...	spare	0		
Checksum	CRC 16.....	1011001111000101 hex=B3c5		

Figure A.9 - Sample MSU Message

MTP LEVEL 2 PROCEDURES

LSSUs are used for Alignment Procedures, Processor Outages, and Flow Control. The following table shows the six different types of LSSUs and the timers associated with the Level 2 procedures.

Table A.1 - LSSU Messages

Mnemonic	SF Field (3 Bits)	Function
SIOS	011	Message to take signalling link out of service
SIO	000	Message to begin alignment procedure
SIN	001	Message to begin normal proving
SIE	010	Message to begin emergency proving
SIB	101	Message representing a congested state at Level 2
SIPO	100	Message stating a processor outage has occurred

Level 2 Timers

Table A.2 lists the Level 2 timers.

Table A.2 - Level 2 Timers

Timers	Description	ANSI Recommendations	ITU Recommendations
1	Aligned/Ready (SIO to FISU)	13 seconds	40 seconds
2	Not Aligned (SIO State)	11.8 seconds to 23.5 seconds	5 seconds
3	Aligned (Proving State to FISUs)	11.8 seconds	1.5 seconds

Table A.2 - Level 2 Timers (Continued)

Timers	Description	ANSI Recommendations	ITU Recommendations
4N	Normal Proving Period	2.3 seconds	8.2 seconds
4E	Emergency Proving Period	0.6 seconds	0.5 seconds
5	Busy (SIB Frequency)	80 millisecond to 120 milliseconds	100 milliseconds
6	Remote Congestion (SIB Expected)	3 seconds to 6 seconds	3 seconds
7	Delay of Acknowledgment	0.5 seconds to 2.0 seconds	1 seconds

Initial Alignment Procedures

Initial Alignment Procedures (IAPs) occur when a signalling link is activated for the first time or restored after a link failure. A Normal Alignment procedure and an Emergency Alignment procedure are provided. A proving state is included in both procedures to measure error rates, thus ensuring that a reliable link is established.

Alignment Procedure

These steps describe the alignment procedure shown in **Figure A.10**.

Step	Action
1.	The Status Indicator-Out of Service (SIOS) message is sent both directions taking the link out of service. A Status Indicator-Out of Alignment (SIO) is sent both directions to indicate the beginning of the alignment procedure.
2.	Status Indicator-Normal (SIN) or Status Indicator-Emergency (SIE) messages are sent both directions to indicate a normal or emergency proving period. A normal proving period is performed if there is another link available in the linkset, and an emergency proving period is performed if there is only one link available in a linkset.

3. Following the proving period, a FISU must be sent both directions to indicate the link is in service and is available for message traffic.

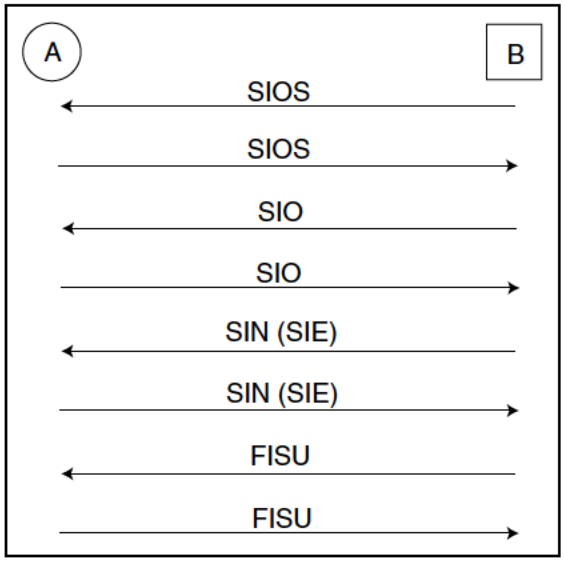


Figure A.10 - Alignment Procedure

Processor Outage

A processor outage occurs when, due to factors at a functional level higher than Level 2, use of the link is precluded. When Level 2 identifies a local processor outage, either by receiving an explicit indication from Level 3 or by recognizing a failure of Level 3, it transmits a Status Indicator-Processor Outage (SIPO) message. This indicates that a processor outage has occurred. It discards received MSUs. Provided that the Level 2 function at the far end of the signalling link is in its normal operating stage when it receives the SIPO, it notifies Level 3 and begins to continuously transmit FISUs.

Flow Control

Flow control procedures are initiated on a signalling link when congestion is detected at either end of the signalling link. Congestion may be due to processor outage or link failure anywhere on the network. When congestion is recognized by Level 2, it goes into a busy state, sending an Status Indicator-Busy (SIB) message.

Signalling Link Error Monitoring

Two different types of signalling link error rate monitors are provided to estimate signalling link error rates: the Signalling Unit Error Rate Monitor (SUERM) and the Alignment Error Rate Monitor (AERM).

The SUERM provides a fault indication to MTP Level 3 when error thresholds are exceeded while signalling links are in service. The AERM is used during the initial alignment procedure during the proving state. Error rate thresholds are based on the percent message error rate combined with the length of time over which errors are occurring.

Error Correction

In SS7, Level 2 uses positive and negative acknowledgments to indicate when a signal unit has been correctly received or to request retransmission of corrupted signal units. There are two forms of error correction. The Basic method is used when the distance between two SS7 nodes allows for timely acknowledgments. Preventative Cyclic Retransmission (PCR) is used when the nodes are a great distance apart (that is, satellite hops).

Basic Error Correction Example
In basic error correction, MSUs that were not received properly or in the proper order are retransmitted by the originating signalling point. In normal transmission the destination signalling point confirms successful transmission of an MSU with a positive acknowledgment of that MSU. If a negative acknowledgment is sent instead, the originating signalling point retransmits the MSU for which it received a negative acknowledgment and all subsequent MSUs.

The FSN is the sequence number of the SU being transmitted. Only MSUs can increment the FSN. Sequence numbers range from 0 to 127 and must be in order.

The FIB changes states for retransmitted MSUs.

The BSN is used to acknowledge received MSUs by reflecting the FSN. MSUs or FISUs can acknowledge receipt of an MSU.

The BIB is used to request retransmission from the remote end by changing states from a 1 to a 0 or from a 0 to a 1.

- Exchange A transmits an MSU with FSN = 1.
- Exchange B acknowledges successful receipt of the MSU by setting the BSN = 1 in the FISU it sends to Exchange A.
- Exchange A transmits two new MSUs, FSN = 2 and FSN = 3.
- In this example, Exchange B never receives the MSU with FSN = 2, but it does correctly receive the MSU with FSN=3. Exchange B sends an MSU to Exchange A with the BSN set to a 1. This indicates that FSN = 1 was the last MSU successfully received in order. The value of the BIB has changed states, which indicates a negative acknowledgment.
- Exchange A retransmits the MSUs with FSN = 2 and FSN = 3. The FIB is set to a 0, which indicates the MSUs are being retransmitted.

- Exchange B acknowledges these MSUs by replying with a FISU with BSN = 3. The FISU that serves as the acknowledgment for MSU with FSN = 3 also serves as an acknowledgment for all previous unacknowledged MSUs as well (in this case, MSU with FSN = 2). An exchange can send up to 127 MSUs before requiring an acknowledgment from the remote end. The time before an acknowledgment must be sent is controlled by a timer.

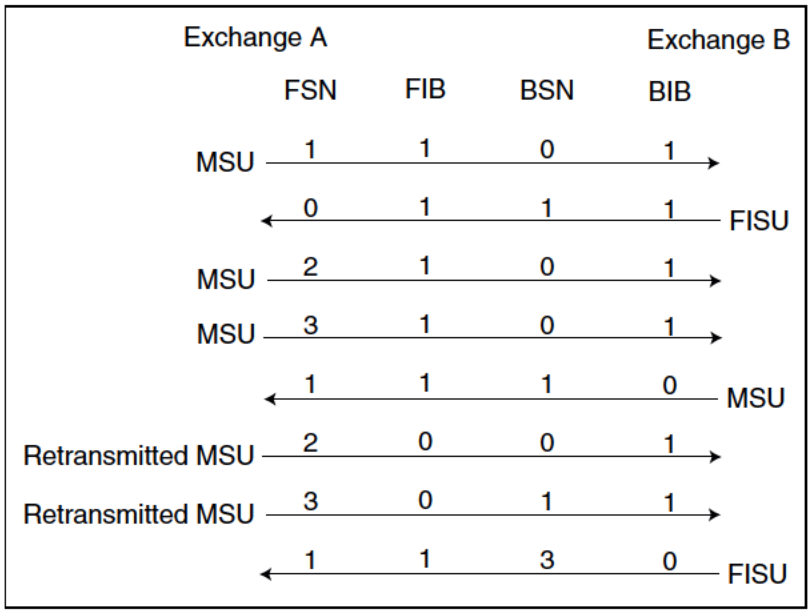


Figure A.11 - Basic Error Correction Example

MTP LEVEL 3

Level 3 provides signalling network functions related to message routing, maintenance, and network management. These functions include routing the message to the correct link or higher-level function and controlling routing and traffic in response to changes in network status. These functions are shown in **Figure A.12**.

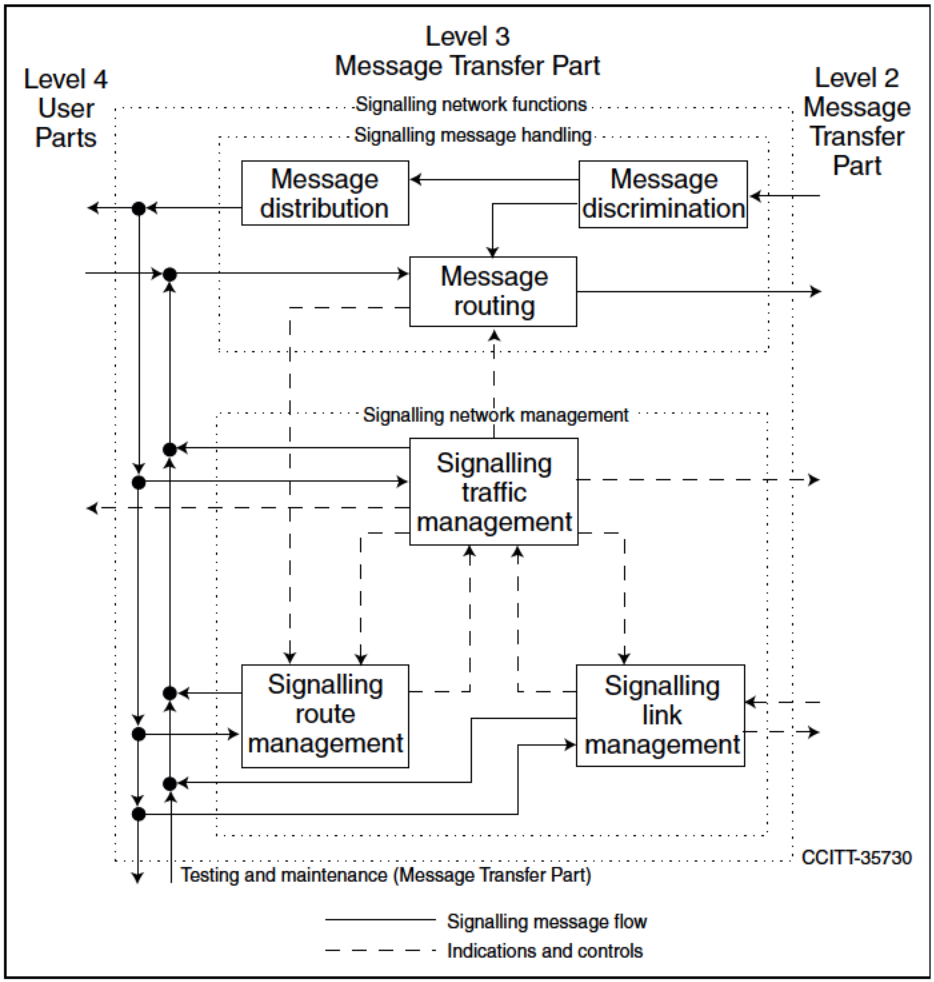


Figure A.12 - MTP Level 3 Functions

SIGNALLING MESSAGE HANDLING

Signalling message handling consists of message discrimination, message distribution, and message routing. Message discrimination and distribution are MTP functions designed to deliver the message to the correct process in the signalling point. Message routing determines the link over which the message is transmitted.

Message Discrimination

The message discrimination function examines the Destination Point Code (DPC) field of the received message. If the DPC of the message is that of the signalling point that has received the message, the message is delivered to the message distribution function for delivery within the signalling point. If the DPC is that of another signalling point, the message is sent to the message routing function for transmission to the remote signalling point.

Message Distribution

If the message distribution function receives a message from the message discrimination function, the service indicator is examined and the message is delivered to the appropriate user part.

Routing

A message route refers to a succession of signalling links on which a message is transported from the originating signalling point to the destination signalling point. The route for a given message is predetermined by the Routing Label of the SIF.

The Routing Label contains the Origination Point Code (OPC), the DPC, and the Signalling Link Selection (SLS) code. To route messages, each signalling point determines the signalling link over which a message has to be sent based on information contained in DPC and SLS fields.

Point codes are used to identify each signalling point in the SS7 network. ANSI uses a 24-bit point code. ITU uses a 14-bit point code. The OPC defines the origination point of a message, and the DPC defines the destination point for the message.

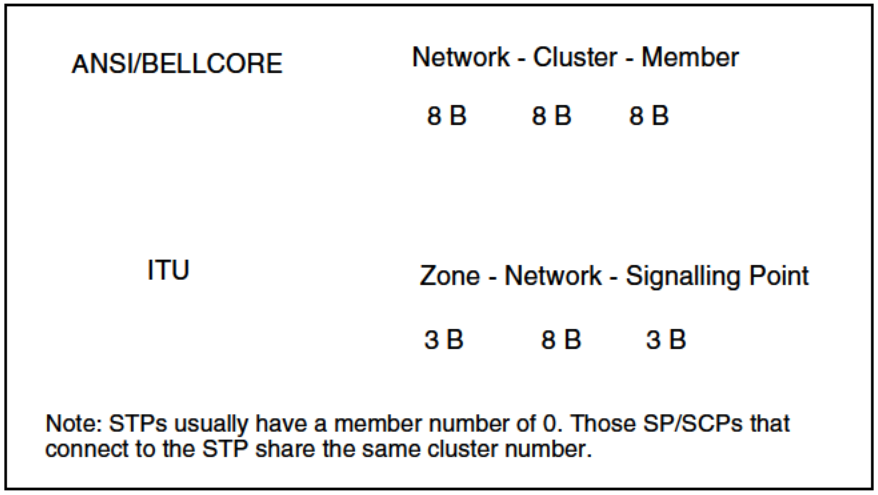


Figure A.13 - Point Code Breakdown

SLS codes are used for routing and for load sharing.Typically, more than one signalling link may be used to carry messages to a given DPC. The selection of the particular signalling link is made by means of the SLS field, thus effecting load sharing. In one common application, the least significant bit of the SLS code is used to select the linkset, and the remaining bits define which link in that linkset is used.

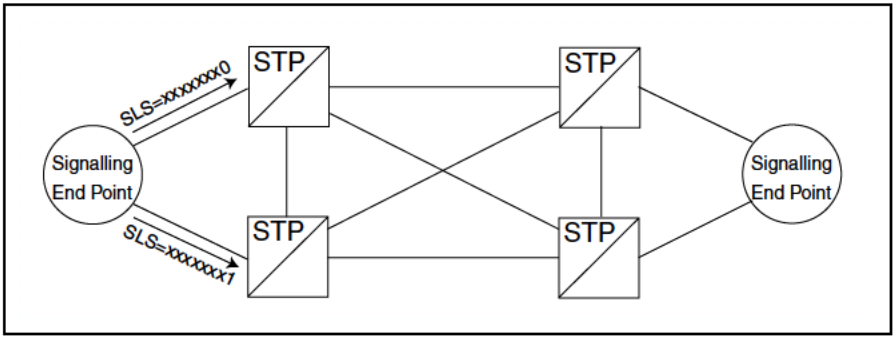


Figure A.14 - Network Routing Through STPs

SIGNALLING NETWORK MAINTENANCE

Signalling Network Test/Maintenance Regular (MTNR) or Special (MTNS) are Level 3 messages for testing links. There are two types of messages:

Signalling Link Test Message and Signalling Link Test Acknowledgment Message

A Signalling Link Test Message (SLTM) message is sent after the Level 2 link alignment procedure to verify the proper OPC, DPC, and Signalling Link Code (SLC) for each link in a linkset between adjacent nodes. SLTMs may also be sent periodically during normal link functioning. Each SLTM must be acknowledged by an Signalling Link Test Acknowledgment Message (SLTA) on the same link from the adjacent node. If the OPC, DPC, or SLC code are incorrect, the link is taken out of service.

Ch# T1	ANSI SS7	Flags:1	Count	Time:17:10:45.374
00000000	BIB/BSN.....	0/0		
00000000	FIB/FSN.....	0/0		
..001011	SU type/length	MSU11		
00.....	Spare	0		
octet003	Service information octet			
....0010	Service indicator	MTNS Signalling Network Test/Maint. Special		
..01....	Message priority	1		
10.....	Network indicator	N National network		
octet004	Routing label			
.....	DPC: Net-Clstr-Mbr	000-000-000		
.....	OPC: Net-Clstr-Mbr	000-000-000		
...00000	SLS.....	0		
000.....	spare	0		
octet011	Message type			
01010001	Headers H1/H0	SLTM Signalling Link Test Message		
....0000	Signalling link	0		
octet012	Test data information			
0001....	Test data length	1		
.....	Test data.....	00		
Checksum	CRC 16.....	1100110000100110 hex=cc26		

Figure A.15 - Sample SLTM

Signalling Link Code
Each link in a linkset is assigned an SLC to identify it within a linkset. The SLC for the link must be the same as the SLC defined for it at the adjacent node. SLCs range from 0 to 15. The first link in a linkset is usually SLC 0. The same SLC may not be duplicated within the same linkset.

Signalling Network Management

Signalling Network Management (SNM) messages control routing in response to congestion and failure information on the local links and on network routes.

In the case of failures, traffic is rerouted around the failed component if possible, and new signalling links may be activated. The reconfigurations are carried out so that messages are not lost, duplicated, or put out of sequence and that message delays do not become excessive.

The signalling network management functions are divided into three categories:

- Signalling Link Management
- Signalling Route Management
- Signalling Traffic Management

Signalling Link Management

The signalling link management function manages locally attached signalling links. The function is responsible for maintaining predetermined link set capabilities. Activation, Deactivation, and Restoration of links are used to manage links by placing them in or out of service. Linkset Activation is used to initially put a linkset in service.

Signalling Route Management

The signalling route management functions are used to exchange signalling route availability information between signalling points.

Transfer Restricted

The Transfer Restricted (TFR) procedure is performed at an STP when it has to notify one or more adjacent signalling points that they should not, if possible, route traffic toward a given destination through that signalling point. TFRs are sent under certain link failure and congestion situations.

The following example describes this procedure (see **Figure A.16**).

Step	Action
1.	On a failure of link A-B, a changeover procedure is initiated between A and B. Signalling traffic between A and F may take the following path: A-C-B-D-F (highlighted in **Figure A.16**). Signalling traffic management may decide that alternate routing over path A-C-D-F is more efficient.
2.	If so, B sends a TFP to C indicating that C should not route traffic destined for F through B. In this case, C initiates the controlled rerouting procedure and routes traffic destined for F through D.
3.	Similarly, B sends TFRs to D and E indicating that D and E should, if possible, reroute traffic destined for A. In this case, D and E initiate the controlled rerouting procedures and route traffic destined for A through C.
4.	The new route for messages going between A and F is highlighted in diagram 4 of **Figure A.16**.

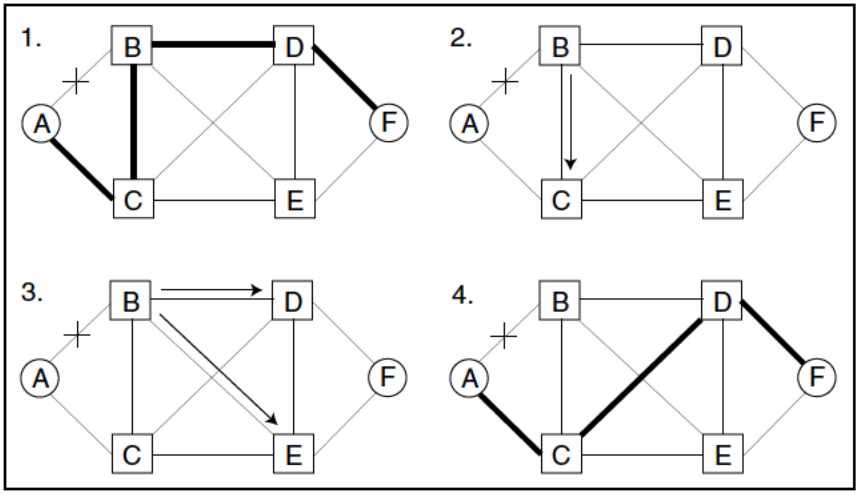


Figure A.16 - Transfer Restricted Procedure

Transfer Prohibited
The Transfer Prohibited (TFP) procedure is performed at an STP when an adjacent node is no longer accessible through that STP.

Signalling Route Set Test
The Signalling Route Set Test (RST) is performed at STPs to query whether signalling traffic towards a certain destination may be routed through an adjacent STP. This procedure is activated following receipt of a TFP or TFR from an adjacent SP.

Transfer Allowed
The Transfer Allowed (TFA) procedure is performed at an STP when it has to notify one or more adjacent signalling points that they may route traffic toward a given destination through that signalling point.

Ch# T1	ANSI SS7	Flags:1	Count	Time:17:10:41.543
00000000	BIB/BSN.....	0/0		
00000000	FIB/FSN.....	0/0		
..001010	SU type/length	MSU12		
00.....	Spare	0		
octet003	Service information octet			
....0000	Service indicator	SNM Signalling Network Management		
..11....	Message priority	3		
10.....	Network indicator	N National network		
octet004	Routing label			
.....	DPC: Net-Clstr-Mbr	000-000-000		
.....	OPC: Net-Clstr-Mbr	000-000-000		
...00000	SLS.....	0		
000.....	spare	0		
octet011	Message type			
01010100	Headers H1/H0	TFA Transfer-allowed		
.....	PC : Net-CLstr-Mbr	000-000-000		
Checksum	CRC 16.....	0000001100110000 hex=0330		

Figure A.17 - Sample TFA Message

Figure A.18 shows the following examples of TFP, RST, and TFA messages.

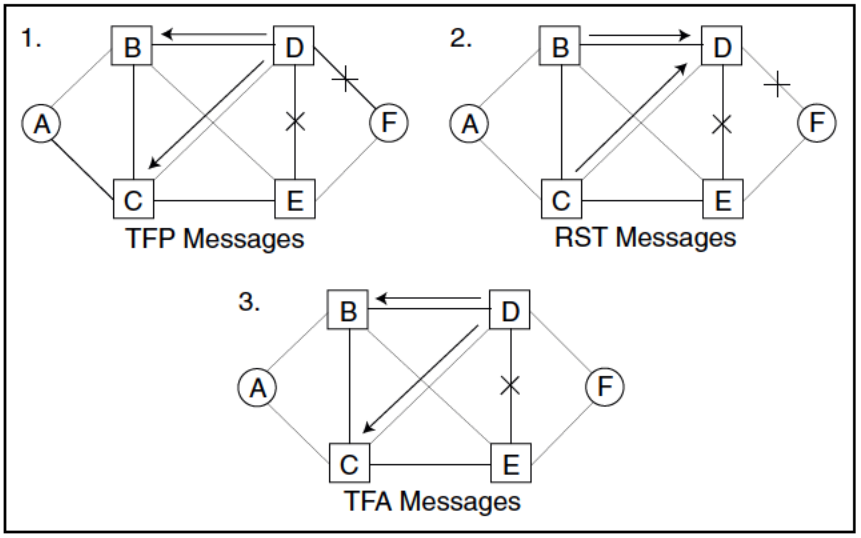


Figure A.18 - Signalling Route Management Messages

Transfer Prohibited:
On the failure of links D-F and D-E, D no longer has access to F. D indicates this condition to B and C by sending them TFPs identifying that F can no longer be reached through D. B and C initiate the forced rerouting procedures to reroute signalling traffic destined for F through E.

Signalling Route Set Test:
Signalling points B and C send RSTs to D requesting the status of the route to F. This occurs every 30 to 60 seconds until a Transfer Allowed (TFA) message is received from D. (A TFA indicates that the destination has become available.) Point D responds to the RST with a TFP, TFR, or TFA as dictated by the current status.

On recovery of link D-F, D sends a TFA to B and C identifying that F can now be reached through D. B and C may then initiate rerouting procedures to reroute the signalling traffic destined for F through D.

Transfer Controlled
The Transfer Controlled (TFC) procedure is used to notify adjacent signalling points of congestion at a signalling point or the congestion status of a signalling route. The action taken on receipt of a TFC is network dependent. The procedures vary depending on the implementation.

Signalling Route Set Congestion Test
The Route Set Congestion (RCT) test is performed at a signalling point to determine the congestion status of a specific destination. Congestion information is requested by the RCT and transmitted by the TFC.

Signalling Traffic Management

Signalling traffic management functions are used to divert traffic from a link or route to a different link or route as a result of failures or congestion.

Management Inhibiting Messages
Management Inhibiting of a link is requested whenever a management function considers it necessary to take a link out of service for purposes such as testing and maintenance. A link cannot be inhibited if the following conditions exist:

- A previously accessible destination becomes inaccessible as the result of the request.
- Congestion conditions exist on the route to that destination.

Link Inhibit message
A Link Inhibit (LIN) message is used whenever a management function wants to inhibit a link.

Link Inhibit Acknowledgment message
A Link Inhibit Acknowledgment (LIA) message is used to grant permission to inhibit a link.

Link Uninhibit message
A Link Uninhibit (LUN) message is used whenever a management function wants to return an inhibited link to in-service status.

Link Uninhibit Acknowledgment message
A Link Uninhibit Acknowledgment (LUA) message is used to change a link to in-service status.

Link Forced Uninhibit message
A Link Forced Uninhibit (LFU) message is used when a destination has become inaccessible and the linkset associated with that destination contains inhibited links.

Link Inhibit Denial message
A Link Inhibit Denial (LID) is used to deny permission to inhibit a link.

Changeover and Changeback Messages
The changeover procedure is used to ensure that signalling traffic carried by an unavailable signalling link or linkset is diverted to the alternate signalling link or linkset as quickly as possible. The changeback procedure is used to divert signalling traffic from alternate links back to primary links.

Changeover Order and Changeover Acknowledgment Messages
The Changeover Order (COO) message and the Changeover Acknowledgment (COA) message is used when a signalling link is recognized as unavailable due to link failure or blockage. The remote signalling point is notified to divert traffic to alternate link(s). The COO message is acknowledged by a COA. The failed signalling link is identified in the SLC field of the COO and COA messages. The COO/COA procedure includes buffer updating, where FSNs of received messages are compared so that messages are not lost.

Ch# T1	ANSI SS7	Flags:1	Count	Time:17:10:42.256
00000000	BIB/BSN.....	0/0		
00000000	FIB/FSN.....	0/0		
..001010	SU type/length	MSU12		
00.....	Spare	0		
octet003	Service information octet			
....0000	Service indicator	SNM Signalling Network Management Message		
..11....	Message priority	3		
10.....	Network indicator	N National network		
octet004	Routing label			
.....	DPC: Net-Clstr-Mbr	000-000-000		
.....	OPC: Net-Clstr-Mbr	000-000-000		
...00000	SLS.....	0		
000.....	spare	0		
octet011	Message type			
00010001	Headers H1/H0	COO Changeover-order		
....0000	Unavailable SLC	0		
.0000000	Last accepted FSN	0		
00000...	spare.....	0		
Checksum	CRC 16.....	1111010111111010 hex=f5fa		

Figure A.19 - Sample COO Message

Emergency Changeover Order and Emergency Changeover Acknowledgment Messages

The Emergency Changeover Order (ECO) and Emergency Changeover Acknowledgment (ECA) message procedure is similar to the COO/COA, but FSN information is not exchanged for buffer updating.

Changeback Declaration and Changeback Acknowledgment Messages
When a signalling link has been restored, a Changeback Declaration (CBD) message is sent to the remote signalling point to restart traffic on a the previously inaccessible link. A Changeback Acknowledgment (CBA) message is sent as an acknowledgment. Incoming traffic destined for that link is buffered until the Changeback procedure is complete. The buffered traffic is then started on the newly accessible link. The following example describes the procedure for changeover (see **Figure A.20**).

Step	Action
1.	Suppose that a backhoe has damaged link A-B. COOs are exchanged between A and B on an alternate route. These messages include information to allow A and B to update their buffers in order to retransmit those messages that were lost during the link failure.
2.	Both signalling points respond to the COOs with COAs.
3.	Following receipt of the COAs, A and B now send traffic on the alternate route, beginning with the messages stored in the retransmission buffer.
4.	When the A-B signalling link becomes active again, a CBD is issued by the signalling points at both ends of the link.
5.	Both signalling points respond to CBDs with CBAs.

6. Signalling points A and B start sending traffic on the link made available.

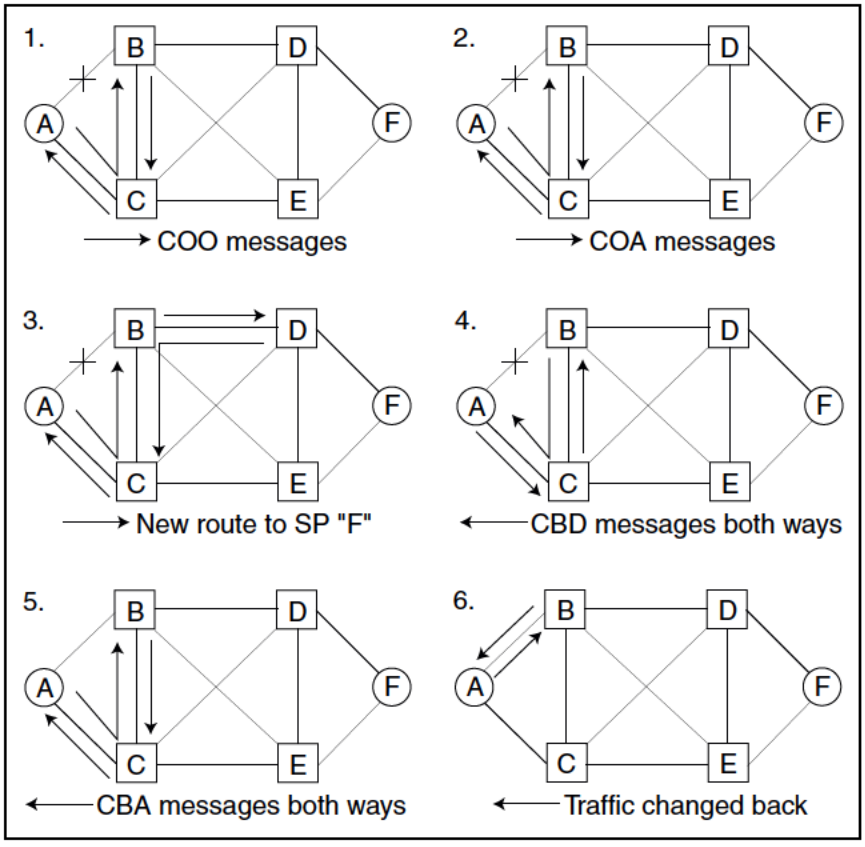


Figure A.20 - Changeover and Changeback Procedures

USER PARTS (LEVEL 4)

User parts define specific applications within a signalling point. The MTP Level 3 determines the user part based on the service indicator defined in the SIO. The following sections discuss three of these applications: the ISDN User Part (ISUP), the Signalling Connection Control Part (SCCP), and the Transaction Capabilities Application Part (TCAP).

INTEGRATED SERVICES DIGITAL NETWORK USER PART

ISUP provides the signalling functions needed to support basic bearer service, as well as supplementary services, for switched voice and non-voice (for example, data) applications in an ISDN environment. Two other user parts, the Telephone User Part (TUP) and the Data User Part (DUP), were specified prior to ISUP. ISUP provides all the functions provided by TUP. In addition, it provides functions that support non-voice calls and advanced ISDN and Intelligent Network (IN) services.

ISUP Messages

The basic service offered by ISUP is the control of circuit-switched network connections for subscriber-line exchange termination. It is divided into three phases: call setup, connection, and call release. ISUP information is carried in the Signalling Information Field (SIF) of the MSU. This information can include the messages described in the following paragraphs.

Initial Address Message
The Initial Address Message (IAM) is sent in the forward direction to initiate seizure of an outgoing circuit and to transmit address and other information relating to the routing and handling of a call.

Continuity Check
The Continuity Check (COT) is sent in the forward direction to indicate either the success or failure of the continuity check performed on a circuit in the connection. The COT is sent immediately following the completion of the continuity check.

Address Complete Message
The Address Complete Message (ACM) is sent in the backward direction when the called party number information is complete and any continuity checks required throughout the connection have been successfully completed (that is, a COT with indication “continuity check successful” has been received).

Answer Message
The Answer Message (ANM) is sent in the backward direction to indicate that a call has been answered. Once the ANM has been received, the set of possible subsequent messages in the backwards direction includes the Release message and the Suspend message.

Release Message
The Release (REL) message is sent in either direction to indicate that the specified circuit is being released from the connection. The specified circuit is released when the REL is sent, but the circuit is not idled until a Release Complete (RLC) message is received.

Release Complete Message
The Release Complete (RLC) message is sent in either direction in response to an REL. Once the RLC is received for a circuit, the circuit is idled.

Suspend Message
The Suspend (SUS) message is sent in the backward direction to indicate that the called party has disconnected before receipt of a Release message.

Resume Message (RES)
The Resume (RES) message is sent in the backward direction after an SUS has been sent to indicate that the called party has reconnected. The RES informs the network that the call was suspended is being resumed.

Continuity Check Procedure

A continuity check can be initiated when an IAM is initially transmitted. The IAM contains a parameter that specifies whether or not a continuity check is required on the circuit that will be used once a call is connected. The IAM contains a Circuit Identification Code (CIC) to identify which circuit is used once the call is established. All messages associated with that call will contain that same CIC code.

```
Ch# T1     ANSI SS7              Flags:1       Count:1      Time:17:10:41.681
00000010 | BIB/BSN.......... | 0/2
00000011 | FIB/FSN.......... | 0/3
..001001 | SU type/length.... | MSU09
00...... | Spare............ | 0
           Service information octet
....0101 | Service indicator. | ISUP ISDN User Part
..00.... | Message priority.. | 0
11...... | Network indicator. | ? Reserved (for national use)
           Routing label
........ | DPC: Net-Clstr-Mbr | 7-255-7
........ | OPC: Net-Clstr-Mbr | 255-1-1
...00000 | SLS.............. | 0
000..... | spare............ | 0
........ | CIC.............. | 0
00...... | spare............ | 0
           Message type
00000001 | Headers H1/H0..... | IAM Initial Address
           ISUP Nature of connection indicators parameter
......11 | Satellite......... | Spare
....11.. | Continuity check.. | Spare
...0.... | Echo suppressor... | Outgoing half echo suppressor not included
101..... | spare............ | 0
           ISUP Forward call indicators parameter
.......0 | Nat'l/Int'l       | Incoming national call
.....00. | End-to-end method. | No end-to-end method available
....0... | Interworking..... | No interworking encountered, No7 all the way
...0.... | End-to-end info... | No end-to-end information available
..0..... | ISUP indicator.... | ISDN user part not used all the way
10...... | ISUP preference... | ISDN user part required all the way
.......0 | ISDN access...... | Originating access non-ISDN
....000. | spare............ | 0
0000.... | reserved for nat'l | 0
           ISUP Calling party's category parameter
00000000 | Clg party category | Calling party's category unknown
00000011 | Pointer - User info | 3
00000101 | Pointer - Called # | 5
00001100 | Pointer - Optional | 12
           ISUP User service information parameter
00000010 | Parameter length.. | 2
...00000 | Info capability... | Speech
.00..... | Coding standard... | CCITT standard
1.......  | Extension bit..... | 1
...00000 | Information rate.. | Channel size
.00..... | Transfer mode..... | Circuit mode
1.......  | Extension bit..... | 1
           ISUP Called party number parameter
00000111 | Parameter length.. | 7
.0000000 | Nature of address. | Spare
0.......  | Odd/even.......... | Even number of address signals
....0011 | reserved.......... | 3
.100.... | Numbering plan.... | Reserved, unknown
0.......  | spare............ | 0
........ | Address signal.... | 01144103277
           ISUP Optional parameter
00001010 | Parameter name.... | Calling party number
00000111 | Parameter length.. | 7
.0000001 | Nature of address. | Unique Subscriber
0.......  | Odd/even.......... | Even number of address signals
......10 | spare............ | 2
....00.. | Addr. presentation | Presentation Allowed
.001.... | Numbering plan.... | ISDN numbering plan (CCITT Rec. E.164)
1.......  | spare............ | 0
........ | Address signals... | 2146809401
```

Figure A.21 - Sample ISUP Message (IAM Message)

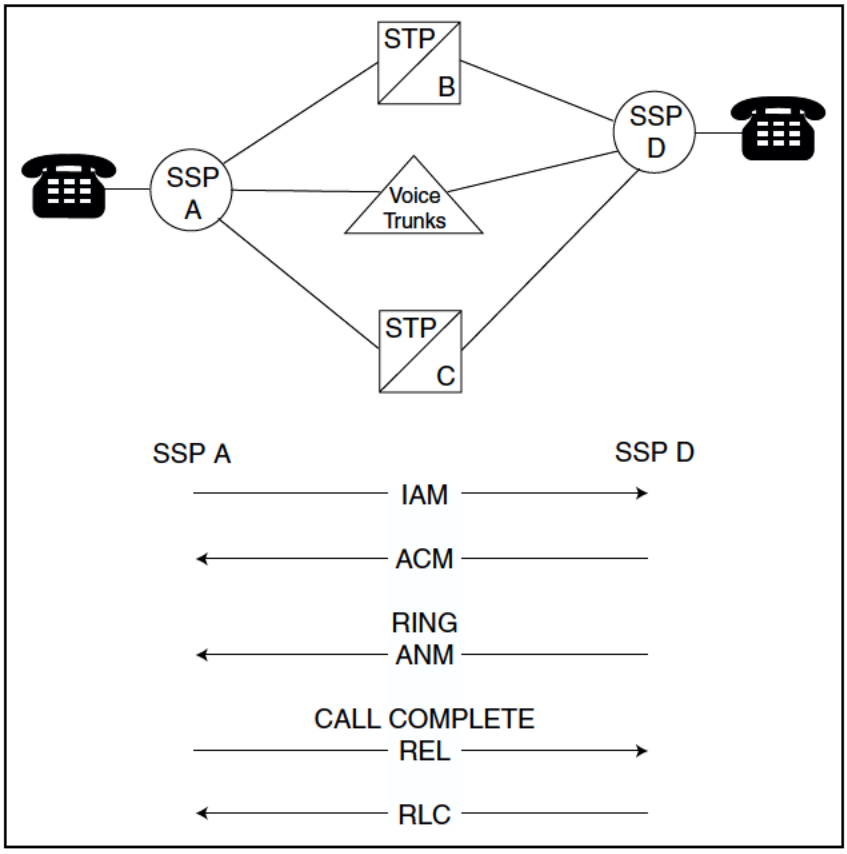


Figure A.22 - ISUP Call

SIGNALLING CONNECTION CONTROL PART

The addressing capability of MTP is limited to delivering a message to a node and using the 4-b service indicator of the SIO to distribute messages within a node. Signalling Connection Control Part (SCCP) supplements this capability by providing an addressing capability that uses DPCs plus Subsystem Numbers (SSNs). The SSN is local addressing information used by SCCP to identify each of the SCCP users at a node.

Specialized Routing

The STP uses the SCCP to perform Global Title Translations (GTT) on certain types of messages. Global titles are addresses that do not explicitly contain information allowing the MTP to route the message.

TRANSACTION CAPABILITIES APPLICATION PART

Transaction capabilities in the SS7 protocol are functions that control non-circuit-related information transferred between two or more signalling nodes through a signalling network. TCAP provides the capability for distributed applications to invoke procedures remotely within a database. TCAP transactions include one-way and two-way transactions between two application processes, that is, the transaction involves communication in one direction only or interactive communication. The application process initiating the TCAP transaction indicates which case applies, from its point of view, at the start of the transaction. TCAP features Credit Card, Third Party Billing, Collect Calls, 800/900, CLASS, Mobile Applications, and Private Virtual Network (PVN).

TCAP Messages and Procedures

TCAP parameters are contained within the SCCP user data of MSUs.

Initiation of Transactions
A transaction is initiated with the assignment of a Transaction ID. A TCAP transaction is initiated by sending or receiving a TCAP message.

Termination of Transactions
A transaction is terminated with the release of the Transaction ID.

Association of Application Process Transactions

Application process transactions are identified through Transaction IDs. Both application processes involved in the TCAP transaction may assign Transaction IDs in any manner convenient to them.

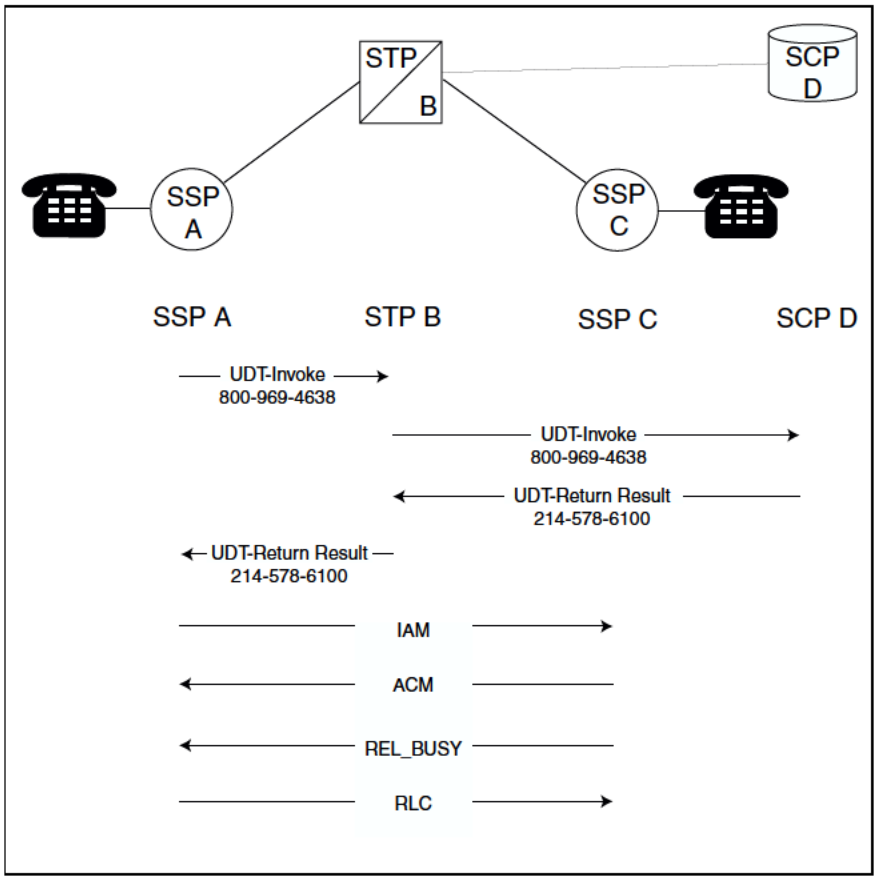


Figure A.23 - Sample SCCP 800 Query

800Quer1.SCC	SuOctets[0..063+Checksum]	Current Octet=000
	ANSI SS7	
10010111	BIB/BSN	1/23
10011001	FIB/FSN	1/25
. . 111110	SU type/length	MSU62
00.	Spare	0
octet003	Service information octet	
. . . . 0011	Service indicator	SCCP Signalling Connection Control Part
. . 00	Message priority	0
10	Network indicator	N National network
octet004	Routing label	
. . . . .	DPC: Net-Clstr-Mbr	002-002-002 STP1
. . . . .	OPC: Net-Clstr-Mbr	001-001-001 Orig SSP
. . . 11001	SLS	25
000	spare	0
octet011	Message type	
00001001	Headers H1/H0	UDT Unitdata
. . . . 0000	Protocol class	0
1000	Message handling	Return message on error
00000011	Pointer-> Called #	3
00001011	Pointer-> Call'g #	11
00010000	Pointer-> Data	16
octet016	Called Party Address	
00001000	Parameter length	8
. 1	SSN indicator	Address contains a Subsystem Number
. . . . . 0 .	SPC indicator	No Signalling Point Code in Address
. . 0010 . .	Global Title	GT includes Translation type only
. 0	Routing basis	Routing based on Global Title in the address
1	Address indicator	Nat'l address, coded to nat'l specification
11111110	Subsystem name	800 number translation
11111110	Translation type	Translation type
. . . . .	Address digits	8009694638
octet025	Calling Party Address	
00000101	Parameter length	5
. 1	SSN indicator	Address contains a Subsystem Number
. . . . . 1 .	SPC indicator	Address contains Signalling Point Code
. . 0000 . .	Global Title	No Global Title included
. 1	Routing basis	Routing based on Label DPC & SSN in Called #
1	Address indicator	Nat'l address, coded to nat'l specification
11111110	Subsystem name	800 number translation
. . . . .	SPC: Net-Clstr-Mbr	001-001-001 Orig SSP
octet031	SCCP user data	

00100000	SCCP data length	32
octet032	TCAP message, transaction portion	
11100010	Package type	Query w/ permission, National, constructor
00011110	Total TCAP length	30
11000111	Transaction ID	Transaction ID Identifier, Nat'l, primitive
00000100	Xaction ID length	4
. . . . .	Originating ID	11223344
11101000	Component sq ident	Component seq identifier, Nat'l, constructor
00010110	Compon't sq length	22
11101001	Component type	INVK InvokeLast, National, constructor
octet043	TCAP Message, Component portion	
00010100	Component length	20
11001111	Component ID ident	Component ID identifier, National, primitive
00000001	Compon't ID length	1
01100100	Invoke ID	100
11010000	Op Code identifier	National TCAP, National, primitive
00000010	Op Code length	
. 0000011	Operation family	Provide instructions
1.	Reply required?	Yes, reply required
00000001	Op specifier	Start
11110010	Parameter set ident	Parameter Set Identifier
00001011	Param set length	11
10000100	Parameter ident	Digits
octet054	Digits	
00001001	Parameter length	9
00000001	Digit type	Dialed (Called Party Number)
00000000	Nature of number	No Presentation Restriction, National
. . . . 0001	Encoding	BCD
0010. . . .	Numbering plan	Telephony Numbering Plan
00001010	Number of digits	10
. . . . .	Address digits	8009694638
Checksum	CRC 16	

Figure A.24 - Message 1: SCCP 800 Query Requiring GTT (SSP to STP)

800QUER2	SuOctets[0..060+Checksum]	CurrentOctet=000
	ANSI SS7	
10101101	BIB/BSN	1/45
10100100	FIB/FSN	1/36
. .111011	SU type/length	MSU59
00.	Spare	0
octet003	Service information octet	
. . . .0011	Service indicator	SCCP Signalling Connection Control Part
. .00	Message priority	0
10.	Network indicator	N National network
octet004	Routing label	
. . . . .	DPC: Net-Clstr-Mbr	004-004-004 SCP
. . . . .	OPC: Net-Clstr-Mbr	002-002-002 STP
. . .01110	SLS	14
000.	spare	0
octet011	Message type	
00001001	Headers H1/H0	UDT Unitdata
. . . .0000	Protocol class	0
1000. . . .	Message handling	Return message on error
00000011	Pointer-> Called #	3
00001000	Pointer-> Call'g #	8
00001101	Pointer-> Data	13
octet016	Called Party Address	
00000101	Parameter length	5
. 1	SSN indicator	Address contains a Subsystem Number
. . . . . .1 .	SPC indicator	Address contains Signalling Point Code
. .0000. .	Global Title	No Global Title included
.1.	Routing basis	Routing based on Label DPC & SSN in Called #
1.	Address indicator	Nat'l address, coded to nat'l specification
11111110	Subsystem name	800 number translation
. . . . .	SPC: Net-Clstr-Mbr	004-004-004 SCP
octet022	Calling Party Address	
00000101	Parameter length	5
. 1	SSN indicator	Address contains a Subsystem Number
. . . . . .1.	SPC indicator	Address contains Signalling Point Code
. .0000. .	Global Title	No Global Title included
.1.	Routing basis	Routing based on Label DPC & SSN in Called #
1.	Address indicator	Nat'l address, coded to nat'l specification
11111110	Subsystem name	800 number translation
. . . . .	SPC: Net-Clstr-Mbr	001-001-001 Orig SSP

octet028	SCCP user data	
00100000	SCCP data length	32
octet029	TCAP message, transaction portion	
11100010	Package type	Query w/ permission, National, constructor
00011110	Total TCAP length	30
11000111	Transaction ID	Transaction ID Identifier, Nat'l, primitive
00000100	Xaction ID length	4
. . . . .	Originating ID	11223344
11101000	Component sq ident	Component seq identifier, Nat'l, constructor
00000001	Compon't sq length	1
11101001	Component type	INVK InvokeLast, National, constructor
octet040	TCAP Message, Component portion	
00010100	Component length	20
11001111	Component ID ident	Component ID identifier, National, primitive
00000001	Compon't ID length	1
01100100	Invoke ID	100
11010000	Op Code identifier	National TCAP, National, primitive
00000010	Op Code length	2
.0000011	Operation family	Provide instructions
1.	Reply required?	Yes, reply required
00000001	Op specifier	Start
11110010	Parameter set ident	Parameter Set Identifier
00001011	Param set length	11
10000100	Parameter ident	Digits
octet051	Digits	
00001001	Parameter length	9
00000001	Digit type	Dialed (Called Party Number)
00000000	Nature of number	No Presentation Restriction, National
. . . .0001	Encoding	BCD
0010. . . .	Numbering plan	Telephony Numbering Plan
00001010	Number of digits	10
. . . . .	Address digits	8009694638
Checksum	CRC 16	1000010111101010 hex=85ea

Figure A.25 - Message 2: SCCP 800 Query After GTT (STP to SCP)

800RESP		
	ANSI SS7	
10001100	BIB/BSN	1/12
11111011	FIB/FSN	1/123
. .110111	SU type/length	MSU55
00.	Spare	0
octet003	Service information octet	
. . . .0011	Service indicator	SCCP Signalling Connection Control Part
. .00. . . .	Message priority	0
10.	Network indicator	N National network
octet004	Routing label	
. . . . .	DPC: Net-Clstr-Mbr	001-001-001 Orig SSP
. . . . .	OPC: Net-Clstr-Mbr	004-004-004 SCP
. . .10100	SLS	20
000.	spare	0
octet011	Message type	
00001001	Headers H1/H0	UDT Unitdata
. . . .0000	Protocol class	0
0000. . . .	Message handling	No special options
00000011	Pointer-> Called #	3
00001000	Pointer-> Call'g #	8
00001101	Pointer-> Data	13
octet016	Called Party Address	
00000101	Parameter length	5
. 1	SSN indicator	Address contains a Subsystem Number
. . . . . 1.	SPC indicator	Address contains Signalling Point Code
. . 0000. .	Global Title	No Global Title included
.1	Routing basis	Routing based on Label DPC & SSN in Called #
1.	Address indicator	Nat'l address, coded to nat'l specification
11111110	Subsystem name	800 number translation
. . . . .	SPC: Net-Clstr-Mbr	001-001-001 Orig SSP
octet022	Calling Party Address	
00000101	Parameter length	5
. 1	SSN indicator	Address contains a Subsystem Number
. . . . . 1.	SPC indicator	Address contains Signalling Point Code
. .0000 . .	Global Title	No Global Title included
. 1.	Routing basis	Routing based on Label DPC & SSN in Called #
1.	Address indicator	Nat'l address, coded to nat'l specification
11111110	Subsystem name	800 number translation
. . . . .	SPC: Net-Clstr-Mbr	004-004-004 SCP

octet028	SCCP user data	
00011100	SCCP data length	28
octet029	TCAP message, transaction portion	
11100100	Package type	Response, National, constructor
00011010	Total TCAP length	26
11000111	Transaction ID	Transaction ID Identifier, Nat'l, primitive
00000100	Xaction ID length	4
. . . . .	Responding ID	11223344
11101000	Component sq ident	Component seq identifier, Nat'l, constructor
00010010	Compon't sq length	18
octet039	TCAP message, component portion	
11101010	Component type	RSLT ReturnResultLast, National, constructor
octet040	TCAP Message, Component portion	
00010000	Component length	16
11001111	Component ID ident	Component ID identifier, National, primitive
00000001	Compon't ID length	1
01100100	Correlation ID	100
11110010	Parameter set ident	Parameter Set Identifier
00001011	Param set length	11
10000100	Parameter ident	Digits
octet047	Digits	
00001001	Parameter length	9
00000100	Digit type	Routing Number
00000000	Nature of number	No Presentation Restriction, National
. . . . 0001	Encoding	BCD
0010. . . .	Numbering plan	Telephony Numbering Plan
00001010	Number of digits	10
. . . . .	Address digits	2145786100
Checksum	CRC 16	0101000010010000 hex=5090

Figure A.26 - Message 3: SCCP 800 Response Message (SCP to SSP)

B ISDN Overview

OVERVIEW

This appendix looks at the protocols specific to Integrated Services Digital Network (ISDN) that are required for user access to ISDN while utilizing the Spectra system. The protocol architecture for user access to ISDN makes clear what functions and services are provided and how the ISDN-related protocols fit into the overall communications requirements. The physical layer specifies both the Basic Access Interface (BRI) and Primary Access Interface (PRI). Link Access Protocol-D (LAPD) channel is the data link control protocol developed for the D channel. The I.451 call control protocol allows the user to exercise call control on B channels by means of a D-channel protocol.

ISDN provides three types of service for end-to-end communication:

- Circuit-switched calls over the B channel
- Packet-switched calls over the B channel
- Circuit-switched calls over the D channel

CIRCUIT SWITCHING

The network configuration and protocols for circuit switching involve both the B and D channels. The B channel is used for the transparent exchange of user data. The communicating users may use any protocols they wish for end-to-end communication. The D channel is used to exchange control information between the user and the network for call establishment and termination and access to network facilities.

PACKET SWITCHING

ISDN must also permit user access to packet-switched services for data traffic (that is, interactive) that is best serviced by packet switching. There are two methods of establishing packet switching communications.

A connection between the user (through a B channel) and the packet-switching node with which it communicates may be either semi-permanent or circuit-switched. In the former case, the connection is always there and a user may freely invoke X.25 to set up a virtual circuit to another user. In the latter case, the D channel is involved.

Packet-switching service can also be obtained on the D channel. For D-channel access, the ISDN provides a packet-switching capability as part of the network. Since the D channel is also used for control signalling, some means are needed to distinguish between X.25 packet traffic and ISDN control traffic. This is accomplished by means of the link layer address scheme explained later in this appendix.

The ISDN protocol consists of three layers: Physical (Layer 1), Data Link (Layer 2), and Network (Layer 3).

LAYER 1, PHYSICAL LAYER

There are two types of physical interfaces, the BRI and the PRI.

INTERFACES

The BRI consists of two 64k B (Bearer) channels and one 16k D (Data) channel and is often referred to as 2B+D. Digital information can be transmitted at up to 128 kb/s. The BRI is used for connection between small PBXs, key systems, or individual terminals and larger PBXs or directly to the central office.

The PRI consists of 23 64k B channels and one 64k D channel, DS-1 or T1 in US, and is often referred to as 23B+D. In Europe, the PRI is 30 64 k B channels and one 64 k D channel, E1, and is often referred to as 30B+D. PRIs are used to connect larger PBXs to each other and to muxes, mainframes, and Central Offices. Muxes can connect several pieces of equipment (LAN, PBX, Video Conference Units, etc.) to one PRI.

Signalling, control, call setup, caller information, and user packet data are carried on the D channel, and user voice and data are on the B channels.

LAYER 2, DATA LINK LAYER

The purpose of Layer 2 is to reliably transfer a block of data, or frame, from one node to another using the physical layer.

LINK ACCESS PROTOCOL-D CHANNEL

ISDN uses LAPD, which is the link-layer procedure that handles all traffic over the D channel. Procedures are based on High Level Data Link Control (HDLC) procedures. LAPD is similar to Link Access Protocol-Balanced (LAPB) used in X.25 in that user information and protocol control information and parameters are transmitted in frames.

Frame Structure

All user information and protocol messages are transmitted in the form of frames. **Figure B.1** depicts the structure of the LAPD frame.

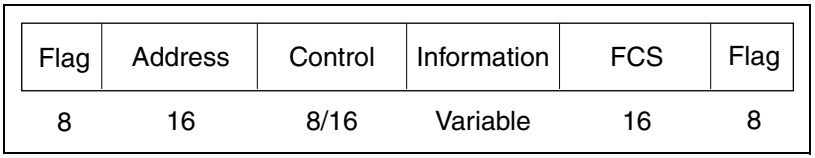


Figure B.1 - Frame Format

Flags
The 01111110 byte indicates the beginning and end of a frame. Zero insert/delete are used if a string of more than five consecutive 1s are detected in the data portion of a frame.

FCS
A16-b Frame Check Sequence (FCS) is used to detect transmission errors.

Information
This field is present only in I-frames and some unnumbered frames. The length of this field is variable up to some system-defined maximum (I.441 specifies a maximum length of 260 octets).

Control
LAPD defines three types of frames, each with a different control field format.

Information transfer frames (I-frames)
These frames carry data to be transmitted by the user. Additionally, flow and error control data are piggybacked on an information frame.

Supervisory frames (S-frames)
These frames provide error correction when piggyback is not employed.

Unnumbered frames (U-frames)
These frames provide supplemental link control functions and are also used to support unacknowledged operations.

Address

LAPD has to deal with two levels of multiplexing. First, at a subscriber site, there may be multiple user devices sharing the same physical interface. Second, within each user device, there may be multiple types of traffic, specifically packet-switched data and control signalling. To accommodate these levels of multiplexing, LAPD employs a two-part address consisting of:

Terminal Endpoint Identifier

TEIs identify a specific user device. TEI values are:

0-63 = Nonautomatic TEI Assignment-type User Equipment
64-126 = Automatic TEI Assignment-type User Equipment
127 = Group TEI-Broadcast Data Link Connection

Service Access Point Identifier

SAPIs identify a Layer 3 user of LAPD and corresponds to a Layer 3 protocol entity. Q.921 SAPI values are:

0 = Call Control Procedures
1 = Q.931 Call Control Procedures
16 = Packet Communications Conforming to X.25 Level 3 Procedures
63 = Layer 2 Management Procedures
All Others = Reserved For future Standardization

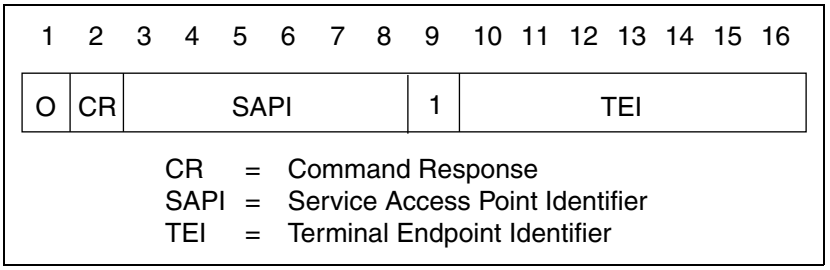


Figure B.2 - Address Field Format

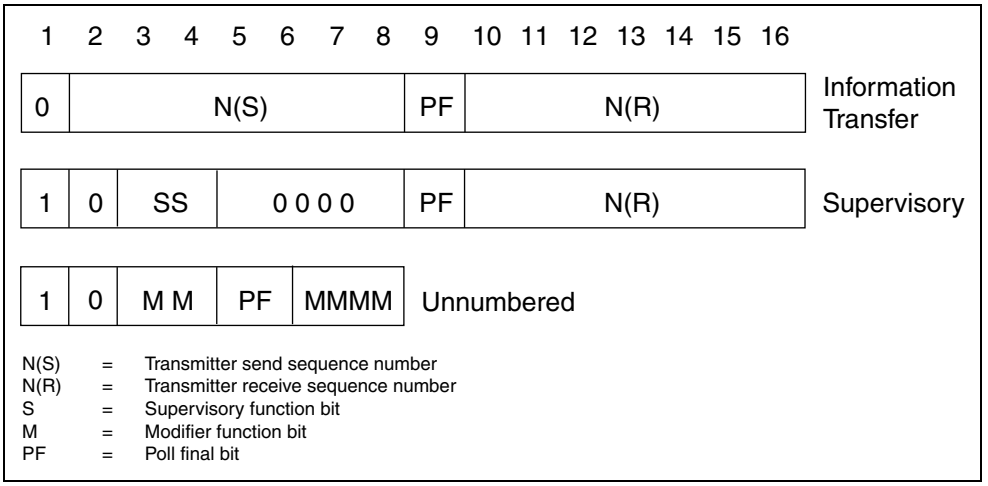


Figure B.3 - Control Field Formats

LAPD Procedures

After physical layer connection is established, N(S) and N(R) and other control parameters are initialized to zero on both sides of a data link. This is activated by either side sending a Set Asynchronous Balanced Mode Extended (SABME) (for modulo 128) frame. The receiving side initializes its control parameter values and acknowledges the receipt of the SABME by sending an Unnumbered Acknowledgment (UA) response frame. Upon receipt of the UA, the side that originated the SABME initializes its control parameter values to zero and completes the initialization procedure.

After initialization, either side can start sending Information frames (I-Frames) with appropriate N(S) and N(R) values.

The sending side sequentially numbers frames sent to the receiver in the Send Sequence Number-N(S). The receiver first checks the FCS for transmission errors and discards the frame if any are detected. If the FCS is good, the receiver checks whether the N(S) is in sequence. If it is, it acknowledges it by sending back the next expected frame number in the Receive Sequence Number-N(R). If the number is not in sequence, it asks the sending side for retransmission of all unacknowledged frames.

Frame numbering, flow control, and other control parameters are applied on a per data link connection basis.

LAPD COMMANDS AND RESPONSES

LAPD commands and responses occur in two forms: supervisory format and unnumbered format.

Supervisory Format

Receive Ready
The Receive Ready (RR) command is sent to acknowledge the last I-frame received by indicating the next I-frame expected.

Receive Not Ready
The Receive Not Ready (RNR) response acknowledges an I-frame, as with RR, but also asks the peer entity to suspend transmission of I-frames. When the entity that issued the RNR is again ready, it sends an RR.

Reject
The Reject (REJ) response initiates error correction. It indicates that the last I-frame received has been rejected and that retransmission of all I-frames beginning with number N(R) is required.

Unnumbered Format

Set Asynchronous Balanced Mode
The SABME is requested by either the network or user for a logical connection.

Disconnected Mode
The Disconnect Mode (DM) indicates the inability to establish or maintain logical connection.

Unnumbered Information
The Unnumbered Information (UI) format indicates unacknowledged information transfer service. Unacknowledged operation provides for the exchange of user data with no form of error control or flow control.

Disconnect
The Disconnect (DISC) command is sent by either side when a data link connection is no longer needed. It should be acknowledged by the UA command.

Unnumbered Acknowledgment
The Unnumbered Acknowledgment (UA) response is used to acknowledge a SABME or DISC.

Frame Reject
The Frame Reject (FRMR) response is used to indicate that an improper frame has arrived—one that somehow violates the protocol.

Exchange Identification
The Exchange Identification (XID) command is used for two stations to exchange information relating to connection management.

LAYER 3, NETWORK LAYER

The network layer of ISDN is specified by ITU Q.931 specifications. They define the protocols for establishing, maintaining, and clearing network connections, such as displayed in the following list:

- Circuit-switched connections using the B channel
- Packet-switched connections using the B or D channel
- User-to-user signalling connections using the D channel

The following list includes some features:

- Out-of-band signalling
- Circuit switched

- Packet switched
- User-to-User Signalling supported through the same interface
- Application for both BRI and PRI and Point-to-Point or Point-to-Multipoint configurations
- Interworking with SS7 ISDN User Part (ISUP) Messages

The process of establishing, controlling, and terminating a call occurs as a result of control signalling messages exchanged between the user and network over a D channel. A common format is used for all messages defined in I.1451 (see **Figure B.4**).

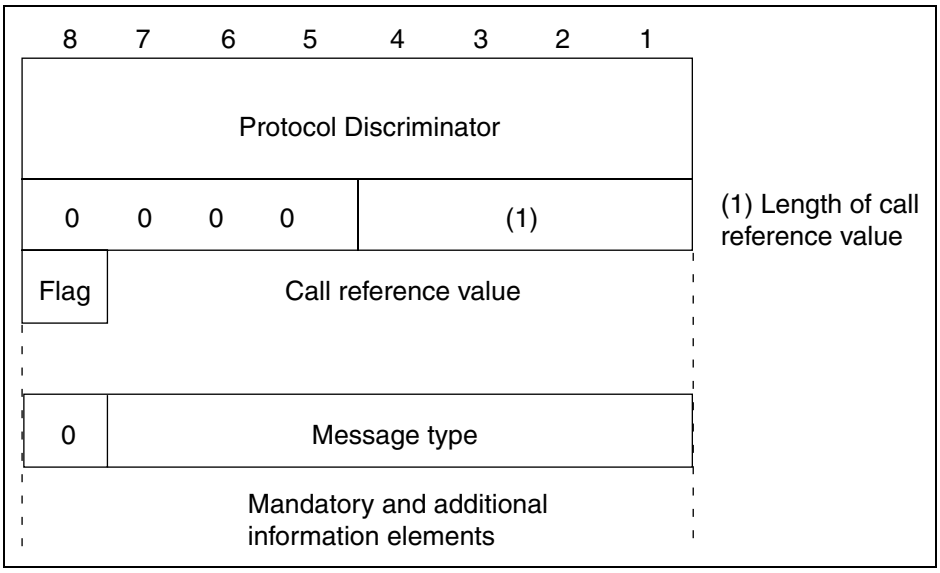


Figure B.4 - Common Message Format

The protocol discriminator identifies the protocol with which the message is associated.

Protocol discriminator values:

0 = User-specific protocol

1 = OSI high-layer protocols

8 = Q.931 user-network call control messages

16-63, 80-254 = Reserved for other network layer or Layer 3 protocols

64-71 = Reserved for national use

All Q.931 messages have a value of 8. The purpose is to allow use of the D channel for the transfer of other protocol messages, such as X.25 packet-level control messages.

The Call Reference Value identifies the call with which the message is associated. This is what gives the D channel the capability of handling call control messages for multiple calls. The Call Reference Value is only significant at the local user-network interface, not end-to-end. It may be a variable length, but it is usually one octet for BRI and two octets for PRI.

Message types identify the type of message being sent, such as Setup, Call Proceeding, Alerting, Connect, Disconnect, Release, and Release Complete.

Message-specific information is dependent on which message type is defined. Following the message type, the information element is defined. Information elements can be variable length or single octet. A message can have several information elements, such as Progress Indicator, User-user, Bearer Capability, Calling Party Number, and Called Party Number. Each element has an identifier and is then followed by parameters defining that specific element. Variable length elements appear in ascending order based on the code values of each Information Element Identifier sub-field. Single octet information elements may appear at any point in a message.

Call Control Procedures

In any PRI connection, one end functions as the user and the other end functions as the network. The differences between the functionality of a user and network is as follows:

- When a SETUP message is sent, user interface expects a CALL PROC message in response. Network interface receives CALL PROC, ALERT, or CONN in response.

- The user interface has one extra call state, CONN_SENT, which is entered when a CONN message is sent to the network. Timer T313 is started on the user side and is canceled on receipt of a CONN ACK message. The active state is then entered. When a network interface transfers a CONN message, the network state is set directly to active (no timer is started).

- Sending a CONN ACK message is not mandatory for the user in response to a CONN message, but it is mandatory for the network in response to a CONN message.

- If the link fails, the network interface sets timer T309 for all calls in the active state. If the timer expires, the call is torn down. For the user side, the call is left up.

For call control procedures, there are only a few differences between the network side and the user side. Figure B.5 shows a call between points A and F proceeding through the various nodes through PRI. The node at point C (call incoming on a PRI) is referred to as an originating exchange. The node at point D (call outgoing on a PRI) is referred to as a terminating exchange.

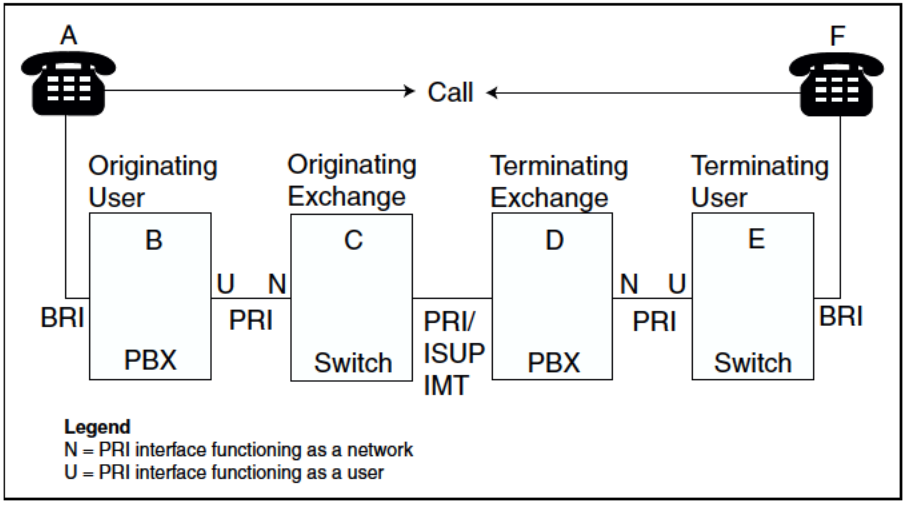


Figure B.5 - ISDN Call Set-up and Release

The following figure is a scenario of connecting and disconnecting a call showing the Q.931 messages at the subscriber phones and ISUP messages between the switches.

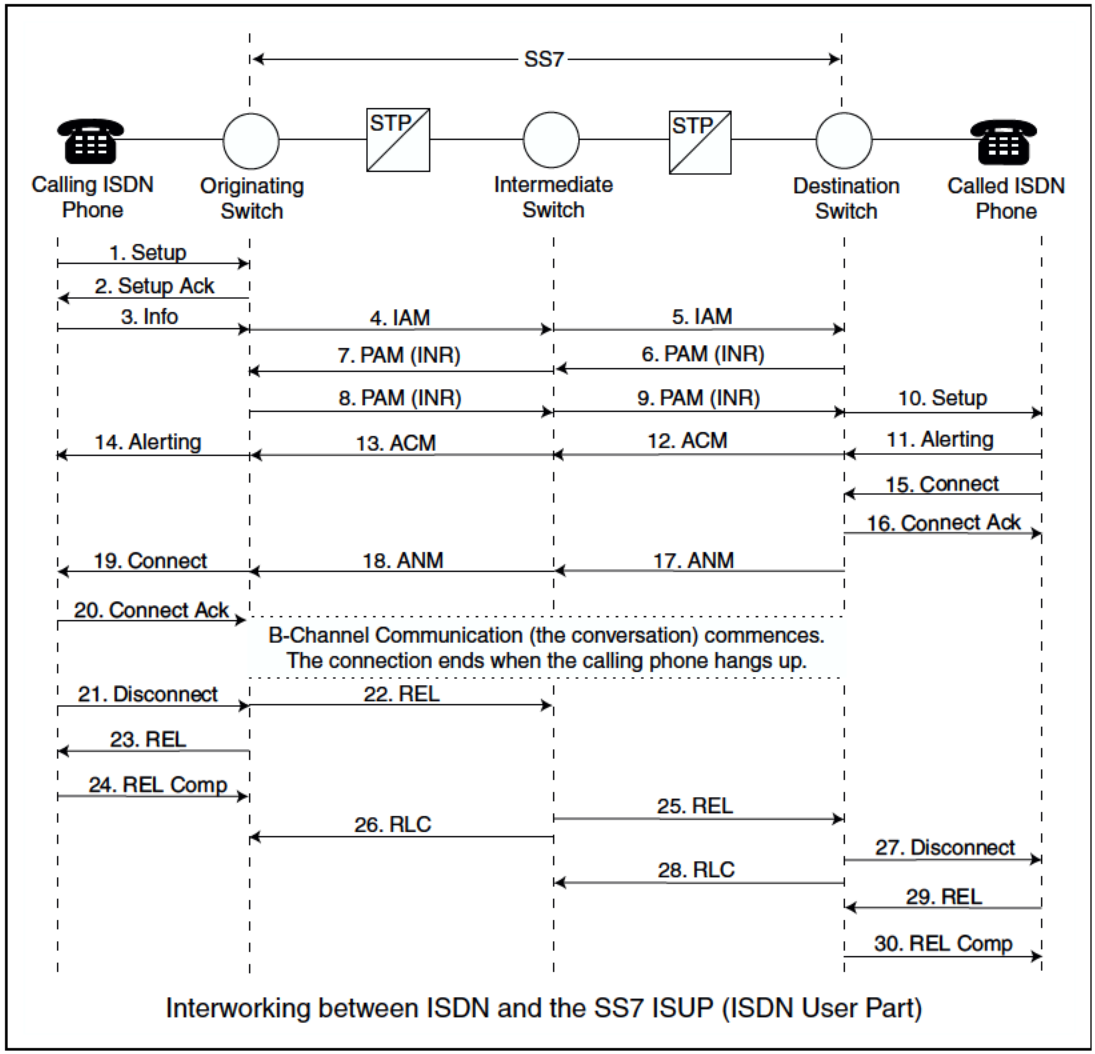


Figure B.6 - ISDN/SS7 Call Scenario

The following list explains **Figure B.6**.

- The setup message (1) is translated into the SS7 Initial Address Message (IAM) (2) at the originating exchange and is translated back into a setup message (10) at the terminating exchange.
- The Called terminal sends an alert (11) to its exchange, which is translated to an SS7 Address Complete Message (ACM) (12). The originating exchange translates the ACM message (13) back to an alert (14) when it is received.
- When the call is answered, the Terminating Users connect message (15) is translated into an SS7 Answer message (17) at its local exchange.
- The originating exchange translates it back to a connect message (19) to send to its user. At this point, the call is established.
- To clear the call, the disconnect message (21) is originated at one end and is translated to an SS7 Release (REL) (22) message at its local exchange.
- The REL is sent to the other side and is translated back to a disconnect (27). The SS7 REL is acknowledged by the SS7 Release Complete message. ISDN release and release complete messages are exchanged at the ISDN terminals.

C X.25 Overview

OVERVIEW

Many protocols have been introduced to connect a Data Terminal Equipment (DTE) with a packet switched network. CCITT standardized this interface in 1974 and called it X.25. X.25 uses packets, which utilize a call connect phase to establish a link with a distant DTE. During the call connect phase, a path is selected through the nodes and links, and all the data during the data transfer phase travels on this given route. The fixed route is called a virtual circuit.

With X.25, the telephone network and packet network both use mesh topology, which provides a terminal with access to any other terminal, whether it be a phone or a DTE (a DTE is a terminal or computer where data originates or terminates).

The telephone network is inherently a circuit switched network. This means that once a connection is made between the end points, there is one circuit dedicated to carry their conversation, and no other conversation can be transmitted on that same circuit. In a packet network, the link between two end points is shared by other connections. Data is typically transferred in packets of 128 bytes, and these packets are statistically multiplexed on each link that a connection is made across while over the Public Switched Telephone Network (PSTN), digitized voice is time division multiplexed on the inter-

machine trunks. The units of information that are conveyed over the X.25 network are octets (8 bits) or bytes, while the PSTN primarily supports 4 kHz voice. Another main difference between PSTN and packet networks is that it may take around 10 seconds to make a long distance connection, and in a packet network it usually takes less than one second.

X.25 INTERFACE AND ACCESS METHODS

X.25 is a specification for a network interface that uses individual protocols at each of its three levels—the physical layer, the data-link layer, and the network layer.

PHYSICAL LAYER

The physical layer is responsible for the transmission of raw bits of data across some physical medium. The X.25 physical layer does not specify which medium to use, but only establishes a set of rules governing the interface between the DTE and Data Communications Equipment (DCE).



Figure C.1 - X.25 Physical Interface

The physical interface familiar to most users is prescribed in the Electronic Industries Association's standard RS-232 or V.35 for computer-modem connections. The physical specification of RS-232/V.35 assigns signals or circuits to connector pins, recommends cable lengths, and prescribes which equipment uses the female connector (the DCE).

Flow control of data between the receiver and the sender is a somewhat contentious issue. There are two types of flow control; in-band or software flow control and out-of-band or hardware flow control. In-band flow control uses special control characters or bit patterns sent by the receiver and imbedded in the normal data stream to notify the transmitter to slow down. Out-of-band flow control uses hardware-control leads to the same purpose. X.25 places the primary responsibility for flow control in the software of Layer 2 and Layer 3.

The physical layer is continuously monitoring the physical circuit for failures. Should a failure occur, as in a loss of carrier, the appropriate DCE and/or DTE is notified by the control signals.

DATA LINK LAYER

For the data link control layer, CCITT recommends Link Access Procedure Balanced (LAPB), which utilizes three types of frames; Information or I-frames, Supervisory or S-frames, and Unnumbered or U-frames. Only I-frames transport data across the link and they are the only frames that require sequence numbers. The user data is contained in an information field that immediately follows the control field in an I-frame. The header and other data contained within this information field combine to form a data packet, which is built under the direction of the Network Layer protocol.

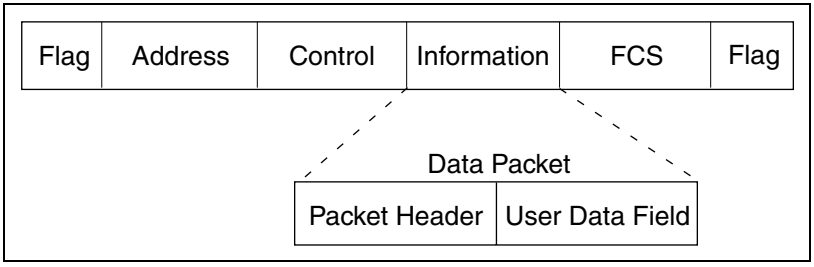


Figure C.2 - I-Frame

I-frames are assigned pairs of sequence numbers that operate in both send and receive directions and ensue that no frames are lost or interpreted out of order. Each transmitted frame is given a frame sequence number ranging from zero to seven. This is commonly referred to as a Modulo-8 frame window. A 3-bit N(S) field is used to identify these sequence numbers and is advanced by 1 for each frame sent.

The receiver maintains as N(R) its own count of error-free frames received. Each time an error-free frame is received, the N(R) count is incremented to the sequence number of the next expected frame. Acknowledgments of correctly received frames flow back to the sender imbedded in frames sent by the receiver and indicated in the receiver's own N(R) count. As long as both sender and receiver pass I-frames, no separate explicit acknowledgment frames are required.

Control Field					
Format	Commands	Responses	Encoding (bits) 876	5	4321
Supervisory	RR	RR	N(R)	P/F	0001
	RNR	RNR	N(R)	P/F	0101
	REJ	REJ	N(R)	P/F	1001
Unnumbered	SABM		001	P	1111
	DISC		010	P	0011
		DM	000	F	1111
		UA	011	F	0011
		FRMR	100	F	0111
Information Transfer			N(R)	P	N(S)0

Figure C.3 - Control Field Formats

In LAPB, the sender uses the P (Poll) bit to insist on an immediate response. In the response (non-information) frame, this same bit becomes the receiver's F (Final) bit. The P/F bit may be used when either end becomes unsure about proper frame sequencing, perhaps through a missing acknowledgment, and wants to re-establish a point of reference.

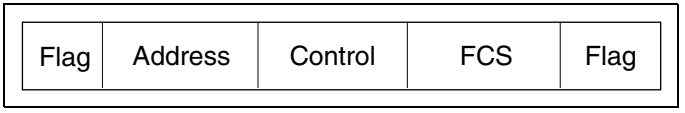


Figure C.4 - S-Frame

Supervisory frames are used to control information flow, request retransmission, and acknowledgment of I-frames. The Receive Ready (RR) command is used by either DTE or DCE to indicate readiness to received I-frames as well as to acknowledge previously received I-frames. A temporary busy condition and the inability to accept further I-frames (as with buffer depletion), is communicated by sending Receive Not Ready (RNR) commands. The Reject (REJ) command requests retransmission of I-frames commencing with N(R) and simultaneously acknowledges all preceding I-frames.

Unnumbered frames derive their name from the fact that they carry neither send nor receive sequence numbers. U-frames are intended to provide additional data-link-control functions, such as link initialization and disconnection, link reset after unrecoverable errors, and rejection of invalid frames.

LAPB treats DTE and DCE as equals. Since this is a balanced link access procedure, either end can begin link initialization by sending out the Set Asynchronous Balanced Mode (SABM) command. The acceptance of the SABM is confirmed by the receiving side when it issues a Unnumbered Acknowledgment (UA) response. At this point, I-frames may begin flowing. The N(S) and N(R) counters in these first I-frames are always re-initialized to zero.

Either DTE or DCE can suspend link operations by issuing a Disconnect (DISC) command. To acknowledge the receipt of this command, the receiver sends a UA response. A disconnected phase is begun once the originator of the DISC gets this response. These disconnect procedures ensure a graceful link shutdown, as in the case when either DTE or DCE is taken out of service for maintenance.

Unrecoverable errors, such as those not corrected by the retransmission of identical frames, are indicated with Frame Reject (FRMR) response. Contained within this response are bit fields that indicate the specific reason for the rejection of a particular frame. Among the possible reasons are receipt of an undefined frame or invalid N(R) sequence numbers or information fields that exceed maximum established sizes.

X.25 uses a 16-b Frame Check Sequence (FCS) to eliminate all single errors. At framing time the address, control, and information fields of each frame are subjected to some additional processing in the transmitter's shift register, which is reflected by the FCS bit combination. The leading and trailing flag fields complete the frame. Since flags are used for synchronization to identify the beginning and ending of a frame, a problem arises when the data stream coincidentally contains the same 01111110 bit pattern as a flag. To avoid this problem, bit stuffing or zero insertion is employed.

Due to their long transit delays (about 250 milliseconds in one direction), satellite transmission links are not efficient for use in X.25 networks operating with frame windows of 7 (Modulo 8). As a solution to this problem, an extended mode of operation was created within LAPB that supports a frame window up to 127 (Modulo 128). Up to 127 frames may be outstanding before an acknowledgment is required. This method of operation is specified at link setup time through the use of a Set Asynchronous Balanced Mode Extended (SABME), rather than the SABM command.

NETWORK LAYER

The network layer gives users access to the network. Since the X.25 network layer is connection-oriented, the establishment of network connections is a primary function of this layer. These connections are in the forms of virtual circuits or calls.

Many aspects of Layer 3 are neither apparent nor under the control of end users. One such transparent function is the ability to multiplex many simultaneous calls over a single physical connection.

The multiplexing technique used by X.25 is a form of Statistical Time-Division Multiplexing (STDM) in which bandwidth is dynamically allocated to active devices according to demand. This is in contrast to conventional Time-Division Multiplexing (TDM), which pre-allocates fixed amounts of bandwidth by assigning a time slot within a frame to a device's transmission whether the device is active or not.

PERMANENT AND SWITCHED VIRTUAL CIRCUITS

When a DTE establishes a call, it has to provide the address of the remote DTE. The switches find a path through the network using the various links that are available. This bi-directional association between two DTEs across a Packet Switch Network (PSN) is called a virtual circuit.

The physical links between the switches are statistically multiplexed, so that the links are shared by many connections. Each link has about 4,096 logical channels available, and these logical channels can be assigned to that many data conversations. A logical channel is designated by the Logical Channel Identifier (LCI) and is provided in the packet header. When a switch receives a packet, it routes that packet to the appropriate link depending on its LCI over the next link. Each node maintains a table specifying which LCIs on which links are routed to which new LCIs and links. New entries are made to these tables during the call establishment phase of calls.

There are two types of virtual circuits: Permanent Virtual Circuit (PVC) and Switched Virtual Circuit (SVC). Out of the possible 4,096 channels that are possible, channel 0 is used for network diagnostics purposes. The rest of the channels are assigned in groups to PVCs, incoming SVCs, two-way SVCs, and outgoing SVCs. The LCIs are assigned as calls are being made and are freed as calls become disconnected.

PVCs provide a dedicated channel between two users, and no call set-up phase is required. PVCs oppose X.25's philosophy of bandwidth on demand, so they are not that popular. SVCs provide a temporary logical connection between two DTEs and are established when making the call.

PACKET TYPES

Data, flow control, and supervisory are three types of packets. Flow control packets are used to positively or negatively acknowledge transmissions. Supervisory type of packets are used to establish and disconnect connections and also to bring up circuits in case of problems. **Figure C.5** shows how a connection is made and broken in Layer 3 and also summarizes the same for the first two layers.

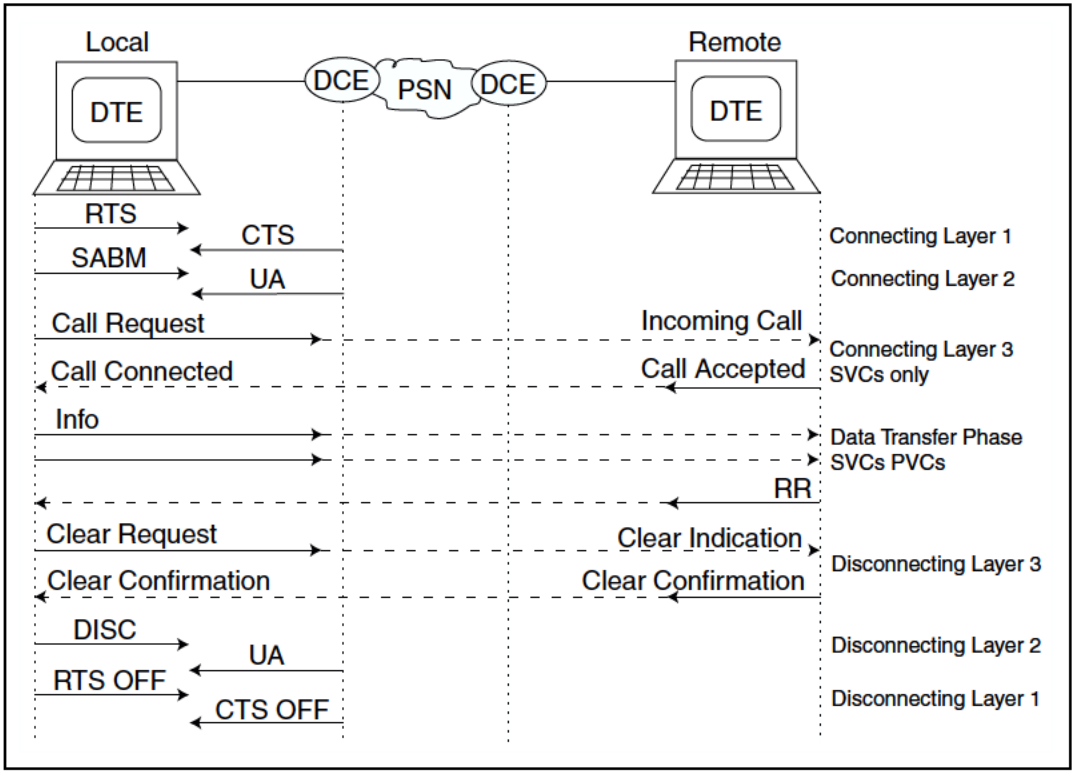


Figure C.5 - Establishing a Connection Using Layers of X.25

D GSM Overview

OVERVIEW

Global Standard for Mobile Communication (GSM) is the Pan-European digital cellular telecommunications standard that is establishing itself as the standard for digital cellular communications in the world market. Most mobile systems are national, which makes it impossible to use the mobile telephones abroad. Therefore, a common system is required for the widespread use of mobile telephones throughout Europe.

GSM solves present capacity limitations. Capacity increases two to three times due to better frequency usage and small cell technique, thus increasing the number of subscribers that can be served. Digital mobile telephones are smaller and use less power than their analog predecessors. Under poor conditions of weak signal or bad interference, GSM performs significantly better than other analog systems.

GSM provides a number of features, including the following items:

- International roaming
- High-speed data communication
- Facsimile and short-message services
- Service Center message delivery of short text messages to subscribers

- Data confidentiality (encryption)
- Subscriber authentication
- Fraud detection and privacy
- Inter-MSC handover
- Continuous speech connection between different Mobile Switching Centers (MSC) (when mobile)

To accommodate the growing testing needs of this market, the Spectra system provides simultaneous monitoring, emulation, and traffic generation features for any GSM network element, including MSCs, Visitor Location Registers (VLRs), Home Location Registers (HLRs), and Base Station Controllers (BSCs). In addition, GSM Abis and MAP A through MAP G interfaces are fully supported, thus allowing the Spectra system to be connected to any type of GSM hardware.

The Spectra system can monitor ABIS, Public Switched Telephone Network (PSTN), and MAP A through MAP G interfaces simultaneously to verify call completion, handover procedures, or trace transaction. Any GSM or PSTN network element can be emulated by the Spectra system and allow individual network nodes to be isolated for specific testing.

As an example, the Spectra system ISDN can be used to emulate a Base Transceiver Station (BTS) to simulate incoming traffic from mobile users so BSC transaction processing and capacities can be tested. The BSC can then be emulated to test the registration and handover procedures of the MSC. The health and efficiency of the entire GSM network can be determined by the Spectra system emulating the PSTN, thus allowing traffic to be simulated between the PSTN and the MSC.

GSM NETWORK

The GSM network is divided into three major systems: the Switching System (SS), the Base Station System (BSS), and the Operations and Maintenance Center (OMC). The SS is responsible for performing call processing and subscriber-related functions. The BSS performs all radio-related functions. The OMC is connected to all equipment in the SS and the BSS and provides operational and maintenance services required by the GSM network. The basic architecture of the GSM network is pictured in Figure D.1.

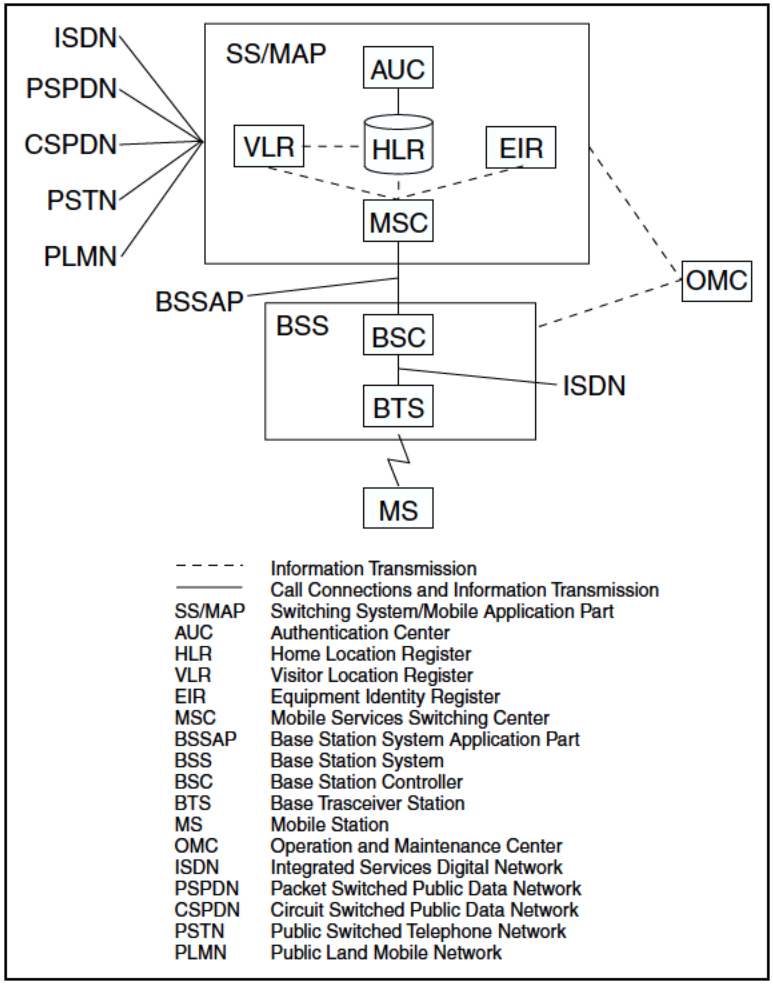


Figure D.1 - GSM System Model

The SS includes the following functional units:

- MSC
- VLR
- HLR
- AUC
- EIR
- GMSC

The BSS includes the following units:

- BSC
- BTS

The service area is completely covered by all of these neighboring radio cells. Each cell has a BTS operating on a set of radio channels. A group of BTSs is controlled by a BSC. BSC controls handover and power control functions. A number of BSCs are served by a MSC, which controls calls to and from the PSTN, ISDN, and public data networks.

The previous units are all involved in carrying speech connections between a Mobile Station (MS) and, for example, a subscriber in the PSTN, the fixed network. If it were not for the possibility of making calls to an MS, we would not need any further equipment. The problem arises when we want to make an MS terminated call. The originator hardly ever knows where the called MS is located. Due to this, we need a number of databases in the network that keep track of the MS. The HLR is the most important of these databases. When someone buys a subscription from one of the GSM operators, he/she is registered in the HLR of that operator. The HLR contains subscriber information, such as supplementary services, authentication parameters, and the location of the MS, that is in which MSC area the MS resides presently. This information changes as the MS moves around. The MS sends location information (through the MSC/VLR) to its HLR, thus providing a means to receive a call.

MSC/VLR

MSC/VLR performs switching of calls and constitutes the controlling point for location updating and handover. MSC is basically responsible for call set-up (which also involves the authentication procedure), call control, and charging.

The VLR functions are responsible for storing and updating the subscriber data. Note that all mobile subscribers are regarded by MSC/VLR as visitors.

GMSC connects the Public Land Mobile Network (PLMN) with other networks. It is at this point in the PLMN where calls to mobile subscribers enter. GMSC has the interrogation facility, that is, GMSC has functions for obtaining information from HLR about the subscriber's current location. It also has functions to reroute the call to the mobile according to the information received from the aforementioned interrogation.

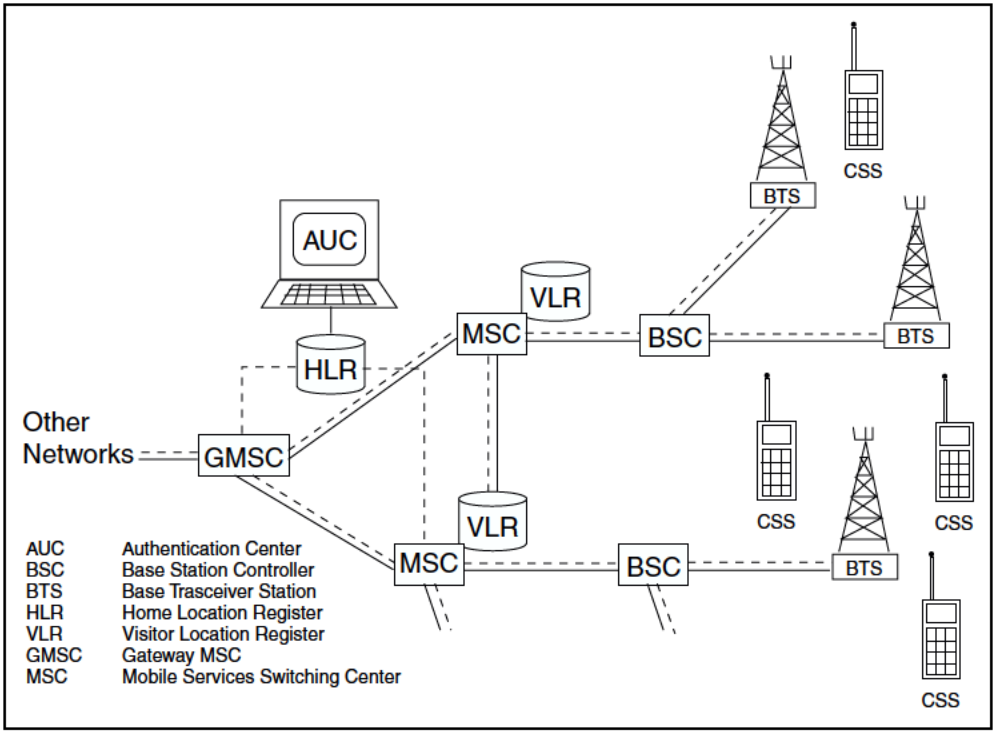


Figure D.2 - MSC/VLR and GMSC in the Network

HLR/AUC

Each GSM operator possesses a central database called an HLR that stores subscriptions, that is, information about subscriber numbers.

HLR carries information about all home subscribers. These are the subscribers who have committed themselves to this particular GSM operator. A subscriber, in most cases, has access to the whole Pan-European system (that is, GSM networks in all countries), but he pays the bills for subscription and for the use of the Pan-European system to his GSM operator.

✍ *Charging is not performed by HLR itself.*

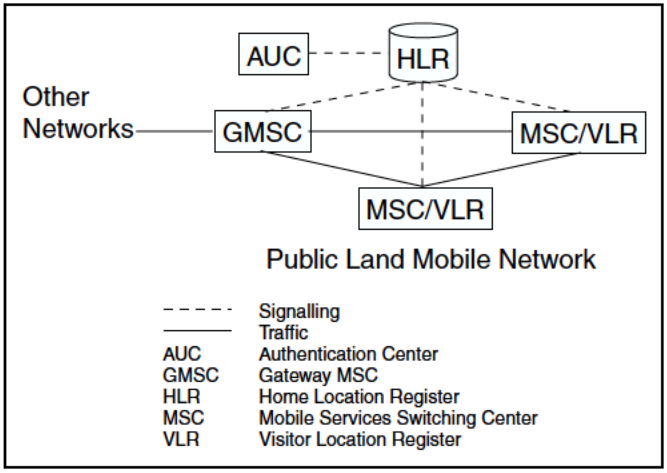


Figure D.3 - GSM Network Served by a Single Operator

HLR carries information entered by operators about subscribers, such as subscriber-associated number (IMSI and MSISDN) and subscriber category. HLR also carries information called dynamic data (data that continually changes) about each home subscriber, such as subscriber current location and supplementary services that are assigned to a subscriber. This type of information must be continuously updated, because the subscriber roams and activates/deactivates supplementary services, such as call forwarding or no reply, for example. Therefore, we need to know where to forward a call to such a subscriber. HLR contains this information.

The AUC continuously provides triplets for each subscriber. A triplet is used to authenticate a call to guard against possible fraud or a stolen subscriber card. At least one new triplet (per subscriber) must always be available in HLR, so that at any time this triplet can be provided at the request of MSC/VLR.

AUC

A unit called Authentication Center (AUC) is connected to the HLR. The function of the AUC is to provide the HLR with authentication parameters and ciphering key, which are both used for security reasons. These prevent false charges on your bill and ensures that incoming calls are correctly delivered.

EIR

In GSM there is a difference between the physical equipment and the subscription. The mobile station is a piece of equipment that can be vehicle installed or hand-portable. In GSM, there is a small unit called the Subscriber Identity Model (SIM), which is a separate physical entity, for example, an IC-card, also called a smart card. SIM and the mobile equipment together make up the mobile station. Without SIM, the MS cannot get access to the GSM network, except for emergency traffic. While the SIM-card is connected to the subscription and not the MS, the subscriber can use another MS as well as his own. This gives us a problem with stolen MSs, since it is no use barring the subscription if the equipment is stolen. We need a database that contains the unique hardware identity of the equipment, the Equipment Identity Register (EIR). The EIR is connected to the MSC over a signalling link. This enables the MSC to check the validity of the equipment. A non-type-approved MS can also be barred in this way. Remember that authentication of the subscription is done by parameters from AUC.

VLR

The VLR is a database containing information about all the MSs currently located in the MSC area. As soon as an MS roams into a new MSC area, the VLR connected to that MSC requests data about the MS from the HLR. At the same time, the HLR is informed of which MSC area the MS resides. If, later on, the MS wants to make a call, the VLR has all the information needed for the call set-up without having to interrogate the HLR each time. The VLR can be seen as a distributed HLR. The VLR also contains more exact information about the location of the MS in the MSC area.

GMSC

If someone in the fixed network (PSTN) wants to make a call to a GSM subscriber, the exchange in the PSTN connects the call to an MSC equipped with a function called a gateway function. This MSC is known as the Gateway MSC (GMSC), and it can be any of the MSCs in the GSM network (probably most of them). The GMSC has to find the location of the searched MS. This can be done by interrogating the HLR where the MS is registered. The HLR replies with the address to the current MSC area. The GMSC can now re-route the call of the correct MSC. When the call reaches that MSC, the VLR knows in more detail where the MS is located, and the call can be switched through.

OMC

The Operations and Maintenance Center (OMC) is connected to all equipment in the switching system and the BSS. The implementation of OMC is referred to as the Operation and Support System (OSS). The OSS is the functional entity from which the network operator monitors and controls the system.

GSM PROTOCOL

Protocol: ITU Blue

Subsystems:

- 5=MAP (Mobile Applications Part)
- 253=BSS (Operations and Maintenance)
- 254=BSSAP (BSS Radio Subsystem Application Part)

The GSM protocol includes both Connectionless and Connection-oriented messages. GSM is defined in the ITU Blue specification and includes Subsystem 5 (MAP Subsystem), Subsystem 253 (BSS Operations and Maintenance), and Subsystem 254 (BSS Radio Subsystem Application Part).

MAP is used for all messages sent between the SS7 network entities, and all MAP messages are connectionless. It is used for querying databases for roamer location, profile information, and authenticity. MAP runs on top of TCAP. The called and calling party addresses reflect the destination and origin of MAP messages. All MAP messages are Unit Data Type (UDTs). Sample MAP messages include update location and authentication.

BSSAP messages are sent on the A Interface, which is between the BSC and the MSC. BSSAP runs on top of the SCCP. Messages may be connectionless or connection-oriented. Connection-oriented messages are used for establishing, maintaining, and releasing connections. During connection establishment, resources of the send and receive entities are dedicated to a transaction. While maintaining a connection, each entity exchanges information to disallow other entities from sending messages to the resources assigned to a transaction. When a transaction is completed, each entity dedicated to that particular transaction exchanges release information to free the dedicated resources. Messages are matched by the connection ID. The reference number can be compared to a Connection ID between two points. In connection-oriented services, each node involved in the connection establishes a connection between itself and the next intermediate node. BSSAP supports Call Control (CC), Mobility Management (MM), and BSS Management Application Part (BSSMAP).

BSSAP connection messages are used for establishing a connection. Sample message types include the following types:

- CR Connection Request - A request for SCCP connection
- CC Connection Confirm - Confirms connection is up and data can be sent
- RLSD Released Connection - Release confirm is sent automatically

BSSAP data messages are sent after a connection is established. There are two types of data messages: Direct Transfer Application Sub-Part (DTAP) and BSSMAP. They are defined by the transparency parameter in message types of DT1. For example:

- User Part = SCCP
- Message type = DT1
- Transparency = BSSMAP or DTAP

Some sample BSSMAP messages include the Handover Request and Acknowledge and the Clear Command and Complete.

There are two types of DTAP messages: CC (Call Control) and MM (Mobility Management). DTAP CC is responsible for call routing, establishment, maintenance, and release. Some sample DTAP CC messages include the following messages:

- Connect and Connect Acknowledge
- Release and Release Complete

DTAP MM messages are responsible for location management and security. Sample DTAP MM messages include the following messages:

- Location Update Request and Response
- Authentication Request and Response

There is one connectionless BSSAP UDT type of message, the Paging Request. It is sent from an MSC to a BSC to tell the mobile user it has a call waiting and is trying to find it. The response is a Paging response.

E IS41 Overview

OVERVIEW

IS41 messages are Signalling Connection Control Part (SCCP) messages. The subsystem name in the SCCP message is IS41 Mobile Application Part (MAP) and is Subsystem 5 in ANSI. IS41 parameters are defined in the TCAP portion of the SCCP message. IS41 messages are used to provide intersystem services. The following list displays two major categories of intersystem services:

- Intersystem Handoff (call handoff)
- Automatic Roaming (call delivery)

IS41 MESSAGES

Home Location Register
The Home Location Register (HLR) is where a cellular subscriber's identity is assigned. The subscriber is identified by the serial number and Mobile Identification Number (MIN) of the cellular unit. The HLR contains subscriber information such as profile information, current location, and validation period. An HLR may serve several Mobile Switching Centers (MSCs) in its area.

Visitor Location Register
The Visitor Location Register (VLR) is used by an MSC to retrieve information for handling calls to or from a visiting subscriber. A VLR may serve several MSCs within its area.

Mobile Switching Center
The Mobile Switching Center (MSC) provides an interface between the cellular network and other public switched networks (phone companies) or other cellular networks.

Cellular Subscriber Station
The Cellular Subscriber Station (CSS) is cellular equipment used to terminate the radio path at the user side (cellular phones, car phones, etc.).

Cell Site
The cell site is the physical location of a cell's radio equipment and supporting systems.

Mobile Identification Number
The Mobile Identification Number (MIN) is usually the CSS phone number. The MIN and serial number of the CSS are used to register it. They are permanent in the CSS's HLR.

Temporary Local Directory Number
When a CSS registers with a VLR, the VLR assigns a temporary number in order to route calls to the CSS. In some VLRs, the Temporary Local Directory Numbers (TLDNs) are maintained until it receives a registration cancellation. In other systems, the TLDN may only be assigned for one call.

SS7 IS41 MESSAGE TYPES

Invoke
The Invoke is a message sent from an MSC, VLR, or HLR initiating an action or a query.

Return Result
The Return Result is sent in response to an invoke.

Return Error
If sent instead of a result, it indicates the Invoke received did not have an expected parameter or it had an unexpected parameter.

Return Reject
The Invoke was rejected because it was not understood. The TCAP portion of the Invoke could have been corrupted.

IS41 PROCEDURES

The IS41 procedures include intersystem handoffs and call handoffs.

Intersystem Handoff

Intersystem handoff is the procedure for transferring a call that is in progress to a different radio channel controlled by another MSC without interrupting the call. This procedure relies upon dedicated intersystem trunks and on direct dedicated circuits for the voice facilities. Only off-hook CSSs involved in a call may be handed off. A CSS in the alerting state should not be handed off.

The serving MSC (A) determines if a handoff to an adjacent MSC is necessary. It sends a Handoff Measurement Request Invoke message to adjacent MSCs. The adjacent MSCs, or Candidate MSCs, send back a Return Result, thus, providing the Cell IDs and Signal Quality Values. The serving MSC selects the best candidate MSC for handoff and then sends a Facilities Directive Invoke to the Target MSC (B), instructing it to connect a Voice Channel (VCH), and a data link. The target MSC sends a Return Result to indicate the VCH and data link have been connected. The target MSC then sends a Mobile on Channel Invoke message to the serving MSC, and the CSS switches radio frequencies to the target MSC's cell site.

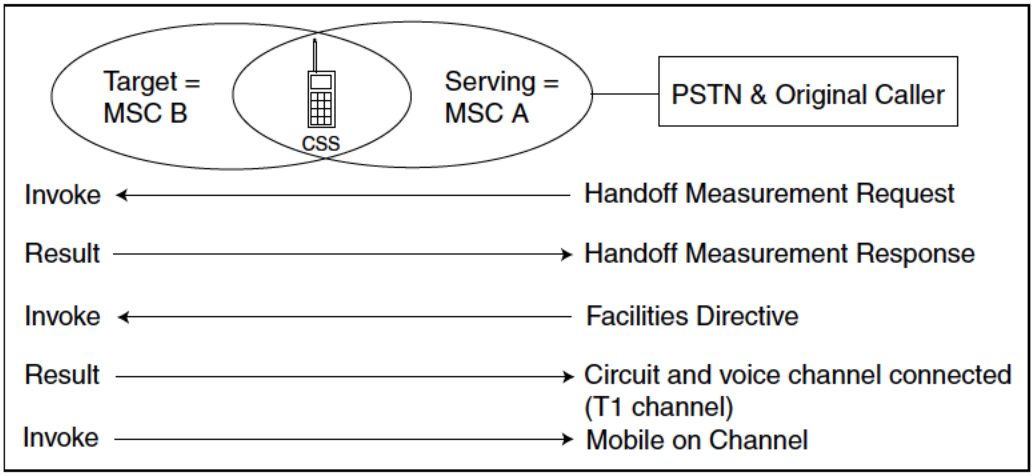


Figure E.1 - Intersystem Handoff

Handoff Back

If the CSS travels back to the original serving MSC (A), MSC B does a Handoff Back to MSC A so no "shoelace" results between MSC B and MSC A. In the previous example, a call was handed off from MSC A to MSC B. If MSC B hands it back to MSC A, the message would be sequenced as shown in **Figure E.2**.

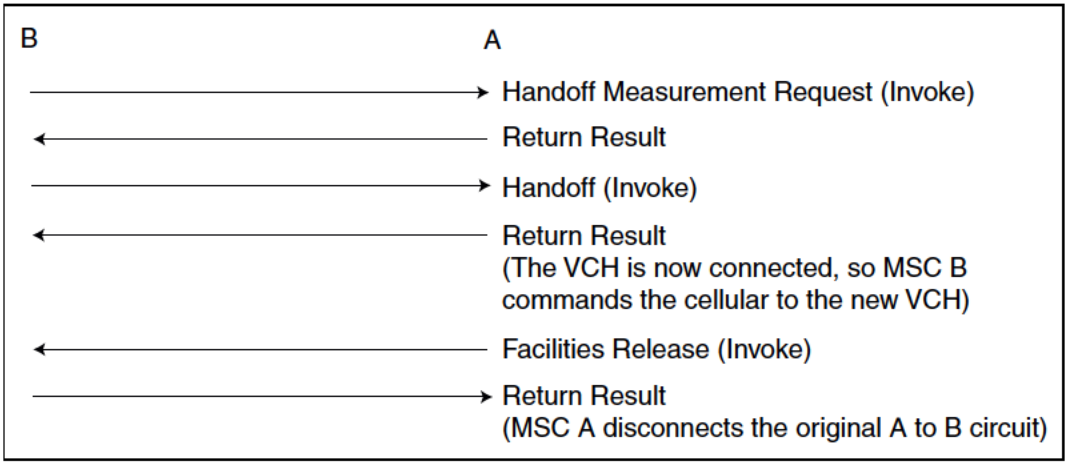


Figure E.2 - Handoff Back

Handoff to Third

In the next figure, a call is handed off from MSC A to MSC B. MSC B can hand off the call to another MSC (C), which would then result in a connection between A and B and B and C. This is an acceptable handoff procedure, provided there are dedicated voice and data circuits between A and B and B and C. However, if there are also dedicated circuits between A and C, hand off using path minimization could be used, thus connecting A directly to C.

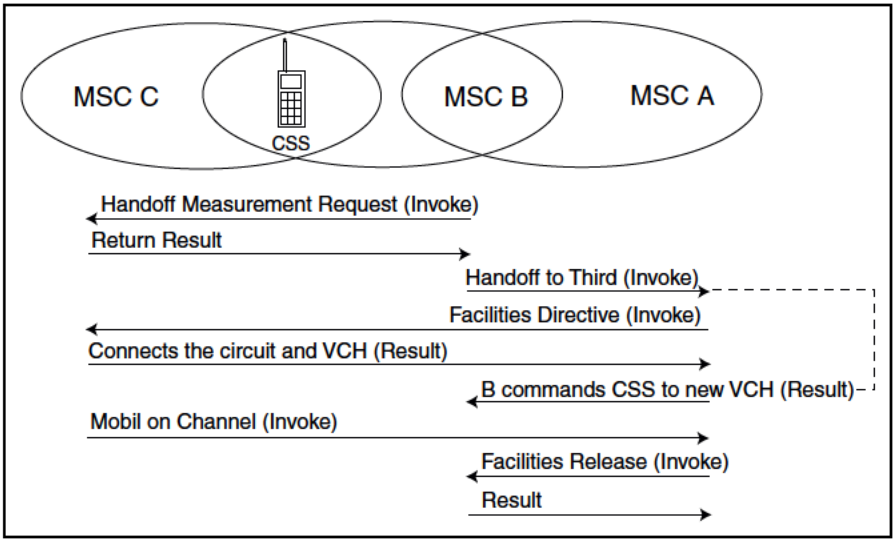


Figure E.3 - Handoff to Third

AUTOMATIC ROAMING AND CALL DELIVERY

The main aspect of automatic roaming and call delivery is registration notification and cancellation.

REGISTRATION NOTIFICATION AND CANCELLATION

The purpose of a registration notification is to obtain information on a roaming CSS and to notify its HLR of its location. The registration cancellation is used to notify a VLR that a CSS is no longer in the VLR's area. When a roaming CSS powers up or decides to make a call, the MSC in the visiting area originates a registration notification to the VLR. If the VLR does not have a record of the CSS, it sends a registration notification to the subscriber's HLR. The VLR identifies the CSS's HLR by its Mobile Identification Number (MIN). The HLR sends a registration notification return result to the VLR, which may include profile information of the CSS. If the registration notification received by the HLR is from a new VLR, and the subscriber had been previously registered in a different VLR, the HLR updates the location information to the new VLR and sends a registration cancellation to the old VLR. The old VLR removes the CSS's record from its register and also sends a registration cancellation return result to the HLR.

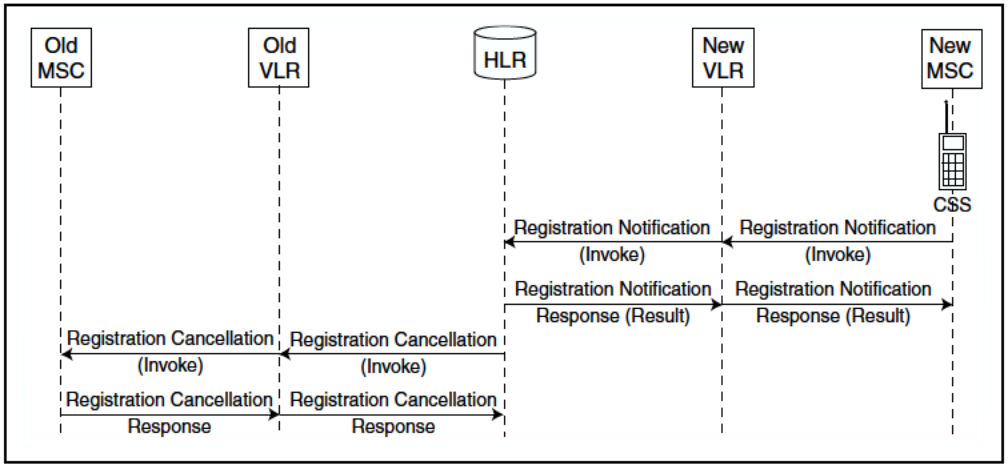


Figure E.4 - Registration Notification and Cancellation

LOCATION AND ROUTING REQUESTS

Location requests are sent to an HLR from an MSC to find out how to route a call to a CSS. If the CSS has roamed to another area, the HLR must then send a routing request to the VLR where the CSS last registered. Part of a request sequence is detailed in the following list and is pictured in **Figure E.5**.

MSC to HLR = Location Request

HLR to VLR = Routing Request

VLR to MSC = Routing Request

If an MSC receives a call from a Public Switched Telephone Network (PSTN) for a CSS, it sends a location request invoke to the HLR serving the CSS. If the CSS is in a visiting location, the HLR sends a routing request invoke to the VLR where the CSS last registered. The VLR sends a Routing request return result to the HLR, providing it with the Temporary Local Directory Number (TLDN) of the CSS so the call can be routed (see **Figure E.5**).

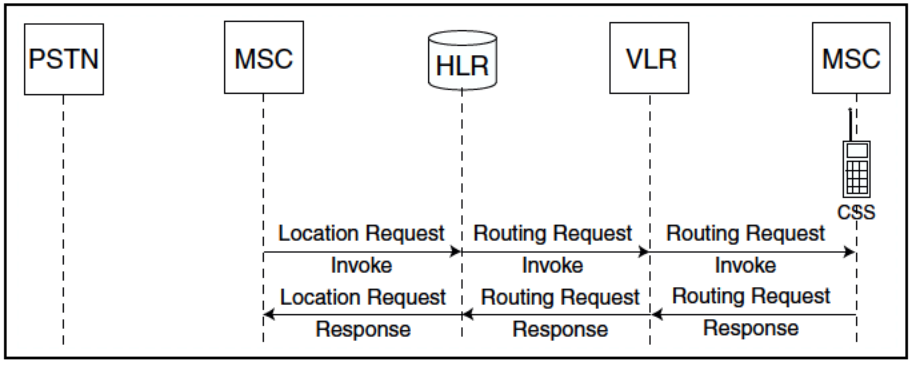


Figure E.5 - Location and Routing Request

OTHER IS41 MESSAGES

Profile Request (Service Profile Request)
The service profile of a CSS contains information regarding features the user is authorized to use and information about whether those features are active. An MSC or VLR may send a profile request invoke to the HLR to get a user's profile. The HLR sends back a profile request return result containing the requested profile. The profile can be a separate transaction or it may be contained as a parameter in the original registration notification invoke, and the HLR can send service profile information back to the VLR in the registration notification return result.

Service Profile Directive
If the service profile of a CSS changes, the HLR can send a profile directive to the VLR in which the CSS last registered. This indicates the changed service profile.

Qualification Request
Qualification information is used for verification of a user's credit worthiness. A qualification request is sent from a VLR to an HLR and is used to authenticate a CSS. Qualification information can also be requested in the original registration notification as a parameter.

Qualification Directive
If authentication of a CSS has changed (that is, the mobile was stolen so it does not allow any calls) the HLR can send a qualification directive to the VLR.

Remote Feature Control Access
If a CSS is trying to use features such as call forward, this message is sent from a visited MSC through the VLR to the HLR of the CSS. Based on the dialed digits of the CSS, the visited MSC or VLR identifies it as remote feature control access. If the digits are a local feature control access, the VLR updates the stored information related to the requested feature. If the digits are a remote feature control access, the VLR sends the remote feature control access invoke to the CSS's HLR. the HLR updates the stored information related to the requested feature. The HLR sends a remote feature control access return result to the requesting network entity (MSC or VLR).

Call Data Request
The call data request is sent from the VLR to the HLR for special services such as third-party billing.

Call Redirect
If an MSC sends a call for a CSS to the VLR where it is registered, and the CSS does not answer or is busy, the originating MSC sends a redirection request to the CSS's HLR. The HLR provides the MSC with the redirection information (for example, voice mail, call forward number, etc.). The MSC breaks down the call and reroutes it to the redirect number provided by the HLR.

Transfer to Number Request
This is similar to the call redirect, except the MSC does not break down the call to the VLR where the CSS registered. Instead, the VLR transfers it to the forwarding number.

CSSInactive
If a CSS is inactive (OFF) for a period of time, the MSC and VLR may send a CSSInact message to the HLR. The VLR and MSC may remove the CSS record from memory. The CSS then needs to re-register the next time it is powered back ON.

MISCELLANEOUS MESSAGES

SysMyTypeCode
SysMyTypeCode is a parameter contained within a registration notification that defines the system type that originated the message (for example, AT&T, Ericsson).

Authorization Period
Authorization Period indicates the length of time the authorization is valid.

Routing Number or Destination Number
Routing Number or Destination Number is the digits used for Automatic Number Identification (ANI).

F Technical Specifications

Physical Interface

DSO-A

Data/Composite Clock Connectors	WECO Bantam
Bit/Byte Clock Connector	9-pin D type female
Line Code	Bipolar NRZ, AMI
Bit/Byte Clock	135 Ω TTL clock inputs
Composite Clock	135 Ω composite clock input
Impedances	Terminated: 135 Ω Bridged: > 2K Ω

V.35

Connector	25-pin D type female
Interface type	DCE and DTE

Pin Outs - 25-Pin Female D-Sub		Industry-Standard V.35 Block Connector
7	Ground	B
1	Shields	A
2	Send Data - A	P
13	Send Data - B	S
3	Receive Data - A	R
16	Receive Data - B	T
15	Send Timing - A	Y

14	Send Timing - B	AA
17	Receive Timing - A	V
12	Receive Timing - B	X
4	Request To Send	C
5	Ready For Sending	D
6	Data Set Ready	E
8	Receive Line Signal Detect	F
20	Data Terminal Ready	H

RS-449

Connector .....37-Pin D type female
Interface types .....DCE and DTE

Pin Outs - 37 Pin Female D-sub

19	Ground
37	Ground
1	Shield
4	Send Data - A
22	Send Data - B
6	Receive Data - A
24	Receive Data - B
5	Send Timing - A
23	Send Timing - B
8	Receive Timing - A
26	Receive Timing - B
7	Request To Send - A
25	Request To Send - B
9	Clear To Send - A
27	Clear To Send - B
11	Data Mode - A
29	Data Mode - B
12	Terminal Ready - A
30	Terminal Ready - B
13	Receiver Ready - A
31	Receiver Ready - B

DS1

Connector .....WECO bantam
Line Codes .....AMI, B8ZS
Framing .....F4, SF, ESF, SLC-96
Impedances.....Terminated:110 Ω
Bridged: >2 K Ω

E1

Connector	WECO bantam or BNC unbalanced
Line Codes	HDB3
Framing	Double Frame & CRC-Multiframe
Impedances	Terminated:110 Ω, 75 Ω unbalanced Bridged:>2 K Ω

RS-232

Connector ..... 37 Pin D type male

Pin Outs - 25 Pin Female D-sub

7	Ground
1	Shield
2	Transmit Data Ch 1
3	Receive Data Ch 1
15	Transmit Clock (DCE source) Ch 1
17	Receive Clock (DCE source) Ch 1
24	Transmit Clock (DTE source) Ch 1
4	Request To Send Ch 1
5	Clear To Send Ch 1
6	Data Set Ready Ch 1
8	Carrier Detect Ch 1
20	Data Terminal Ready Ch 1
14	Transmit Data Ch 2
16	Receive Data Ch 2
9	Transmit Clock (DCE source) Ch 2
10	Receive Clock (DCE source) Ch 2
23	Transmit Clock (DTE source) Ch 2
19	Request To Send Ch 2
13	Clear To Send Ch 2
11	Data Set Ready Ch 2
12	Carrier Detect Ch 2
18	Data Terminal Ready Ch 2

ISDN S/T V2 Pod (BRI S/T)
Connector .....37 Pin D type male

RJ-45 Jack

TE Emulation Pin Definitions

1	Not used
2	Not used
3	Transmit +
4	Receive +
5	Receive -
6	Transmit -
7	Not Used
8	Not Used

NT Emulation Pin Definitions

1	Not used
2	Not used
3	Receive + (and + Power Source)
4	Transmit + (and - Power Source)
5	Transmit - (and - Power Source)
6	Receive - (and - Power Source)
7	Power Source +
8	Power Source -

Monitor Pin Definitions

1	Not used
2	Not used
3	Receive + from TE
4	Receive + from NT
5	Receive - from NT
6	Receive - from TE
7	Not Used

Handset Jack

Pin Definitions

1	Microphone (-)
2	Speaker
3	Speaker
4	Microphone (+)

J1

Connector	37 Pin D type male
Impedances	Terminated:110 Ω Bridged:> 2 K Ω

Physical Characteristics

Portable Spectra Unit

Display	VGA, Built-in DC Plasma 80 x 25 (Optional TFT Color Screen)
Bus Type	ISA
Microprocessor	i486 or Pentium
Microprocessor Speeds (MHz)	66 (i486 only), Up to 200 (Pentium only)
Base Memory	640 KB of first 1-MB installed
System Memory	4 MB minimum, 128 MB maximum of DRAM SIMMs
Cache Memory	256 KB
Math coprocessor	Internal
Diskette drives (standard)	one 3.5-inch 1.44-MB (internal) diskette drive
Hard-disk drives (optional)	capacities from 540 MB to 3.1 GB (formatted)
Ports (built-in)	one 6-pin PS/2-compatible keyboard connector one 6-pin PS/2-compatible mouse connector two 9-pin serial port connectors one 25-pin parallel port connector one 15-pin high-density VGA connector
Expansion slots	five full-length 16-bit slots
AC voltage (auto selectable)	115 V at 60 Hz or 230 V at 50 Hz
DC power supply	300 W
Chassis dimensions	24.8 centimeter high, 40.6 centimeter wide, 25.9 centimeter deep
Weight	22.0 pounds
Temperature (operating)	10° to 38° C (50° to 100° F)
Relative humidity (operating)	8% to 80% (noncondensing)

MegaPAC Portable

Display	VGA, 10.4-inch A/M Color TFT 640 X 480 SVGA, 1.04-inch A/M Color TFT 800 X 600
Bus Type	ISA
Microprocessor	Pentium
Microprocessor Speeds (MHz)	Up to 200
System Memory	8 MB minimum, 128 MB maximum of DRAM SIMMs
Diskette drives (standard)	one 3.5-inch 1.44-MB (internal) diskette drive
Hard-disk drives	3.5-inch 1.2 GB Standard, 9.0 GB optional
Expansion slots	Up to 10 ISA/PCI: 6 ISA, 3 PCI, 1 ISA/PCI 9 ISA, 1 ISA/PCI
AC voltage (auto selectable)	90-265 vac, 200 W Peak 47 to 440 Hz
Chassis dimensions	7.5-inches high, 14.4-inches wide, 19-inches deep (with feet)
Weight	25.0 pounds
Temperature (operating)	0° to 50° C (32° to 122° F)
Relative humidity (operating)	5% to 95% (noncondensing)

Rackmount Spectra Unit

Bus Type	ISA
Microprocessor	Pentium
Microprocessor Speeds (MHz)	Up to 200
Base Memory	640 KB of first 1-MB installed
System Memory	4 MB minimum, 128 MB maximum of DRAM SIMMs
Cache Memory	256 KB
Math coprocessor	Internal
Diskette drives (standard)	one 3.5-inch 1.44-MB (internal) diskette drive
Hard-disk drives (optional)	capacities from 540 MB to 3.1 GB (formatted)
Expansion slots	20 full length 16-bit slots
AC voltage (auto selectable)	115 V at 60 Hz or 230 V at 50 Hz
DC power supply	350 W
Chassis dimensions	19-inches wide, 17.5-inches deep, 10.5-inches high
Weight	48 pounds. (fully loaded with boards)
Temperature (operating)	0° C to 55° C
Relative humidity (operating)	95% at 40° C (noncondensing)

G Troubleshooting

The Troubleshooting section is intended to provide quick answers to commonly asked questions about the Spectra system. If you have further questions or need further assistance, please contact the Inet Technical Support Center.

What if the message "Module on board * is unplugged" appears?
After the Spectra system initializes the hardware, it checks to see if you have interface pods. If you do not have an interface pod on your last board, the Spectra system alerts you that the interface pod is not plugged in by displaying the above message.

What if my printer doesn't print?
If your printer is not printing, you may be using the wrong printer port. If you have a Rackmount system, make sure that you are using the 25-pin female connection located next to the DLP boards.

How do I re-establish links?

Monitor Mode

1. Check Level 1 Parameters, Baud Rate, Data/Clock relationship, Bridged or Terminated.

2. Check Level 2 Parameters, ANSI, ITU-T Red, ITU-T Blue, and ITU-T White.

3. Check hardware cabling. Make sure the Spectra system is in parallel with the link you are trying to monitor.

4. Check LED on the back of the pod. Make sure it is set to Bridged. If the LED pod is not on, you may have a defective pod or DLP.

5. Swap the cables of the problem link with a link you are monitoring. Try to determine if the problem is cabling, pod, or DLP related.

6. Make sure the mode you are running is Monitor mode.

7. Check link status indicator at the bottom. If it shows in service, but no messages are being displayed, check the filters to make sure you are passing all message types.

Terminated Mode

1. Check the Level 1 Parameters. If you are set to DTE and the link status indicator shows “NO Carrier”, you are not receiving a clock signal.

2. Check the Level 2 Parameters.

3. Check the Level 3 Parameters, Link to Linkset Definitions, and the point code values for the signalling points.

4. Check the hardware cabling. Make sure the link is terminated at the Spectra system.

5. Make sure the mode you are currently running is something other than Monitor mode.

6. If the Link Status Indicator shows “SLTA Error”, check the SLC and point code value for that link.

What does a blinking message mean?

1. A blinking message means that a message is built into a script, and the actual file for that message is gone.

2. Press the R key to Recall the test.

3. If you press the F6 key and your file is missing, delete the blinking file name from the script and re-save the script.

What if my system crashes?

1. Note the memory location of where the system crashed.
2. Turn the system OFF, and then ON again.
3. Type `chkdsk (space)/F` and press the Enter (↵) key key.
4. In DOS versions 6.0 and later, the system asks if you really want to run chkdsk; answer Y (Yes).
5. The check-disk command checks the hard drive for corrupted files. If corrupted files are found, the system asks "Do you wish to convert lost chains to files? Y/N"
6. Press the Y key to convert the lost chains to files.
7. Restart the system.

How do I print a screen?
Press the Shift key and the 6 key simultaneously (not Print-Screen) to print the screen.

What if the Spectra system is recalling scripts very slowly?
Run a disk utility to optimize your hard drive.

What if my board shows a yellow square under the Level 1 Parameters?

1. The Spectra system initializes the hardware and determines which boards are present in the system. If a yellow square appears under a board in the Level 1 Parameters screen, this means that the Spectra system does not detect that board, and the display "N/A" appears in the Status of Links field.
2. Remove the board from the system and re-position it into place.
3. Make sure that only one switch on the board is turned ON.

What if I am having trouble logging in?
Make sure you are using capital letters when typing in your password.

H Warranty

INET TECHNOLOGIES, INC. LIMITED WARRANTY

Inet Technologies, Inc. warrants the hardware that it manufactures to be free from defects in materials and workmanship for a period of 12 months from the date of shipment from Inet. This warranty is limited to the original purchaser of the product and is not transferable.

During the 12 month warranty period, Inet will repair or replace, at its option, any defective products or parts at no additional charge provided that the product is returned, shipping prepaid, to Inet. The purchaser is responsible for insuring any product so returned and assumes the risk of loss during shipping. All replaced parts become the property of Inet.

Hardware add-ons purchased or provided at no charge for existing equipment are warranted for 12 months or, if an extended warranty is purchased, for the length of the extended warranty period.

Inet warrants its software media to be free from defects in materials and workmanship for a period of 12 months from the date of shipment from Inet. This warranty is limited to the original purchaser of the product and is not transferable.

Inet warrants that its software shall operate on the designated equipment without significant errors for a period of 12 months from the date the programs are shipped from Inet. If the programs fail to meet this warranty and written notification of the failure is supplied to Inet during the warranty period, Inet will correct the failure by repair or replacement of the failed module in the programs. If, as determined by Inet, repair or replacement is not feasible, Inet will refund the amount paid for the failed module in the programs.

During the warranty period, Inet will provide any software updates/upgrades, at its option, at no additional charge.

Software modules or software upgrades purchased or provided at no charge for existing equipment are warranted for the remaining length of the existing equipment warranty or extended warranty, or for 12 months (whichever is greater). Any additional hardware that may be required to support the upgrade will be the customer's responsibility.

THIS LIMITED WARRANTY DOES NOT EXTEND TO ANY PRODUCTS WHICH HAVE BEEN DAMAGED AS A RESULT OF ACCIDENT, MISUSE, ABUSE, OR AS A RESULT OF SERVICE OR MODIFICATION BY ANYONE OTHER THAN INET.

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I Configurations

The following table lists the configurations included with the Spectra system.

Table I.1 - Configurations

Configuration Name	Description
CONFIG-A	ITU Configuration A
CONFIG-B	ITU Configuration B
CONFIG-C	ITU Configuration C
CONFIG-D	ITU Configuration D
ITGTDS1	ISDN Trunk Tester DS1 Configuration
ITGTE1	ISDN Trunk Tester E1 Configuration
TGTDS1	SS7 Trunk Tester DS1 Configuration
TGTE1	SS7 Trunk Tester E1 Configuration
V5_1	Sample ISDN v5.1 Configuration
V5_2	Sample ISDN v5.2 Configuration

Glossary

µ-Law

The PCM voice coding and companding standard used in Japan and North America.

A-Law

The PCM coding and companding standard used in Europe.

A-Links

Access links typically used to carry information between SSPs and STPs and between STPs and SCPs.

AAL

ATM Adaptation Layer

ABIS

Application Binary Interface Standard
The standard specified for the connection between a BSC and a BTS.

AC

Authentication Center
A functional piece of the HLR used to authenticate the user of mobile station equipment and to protect each subscriber or subscription number from unauthorized access.

ACM

Address Complete Message
An ISUP message, received by a call's destination SSP, acknowledging an IAM.

ADCCP

Advanced Data Communications Control Procedure

AERM

Alignment Error Rate Monitor
An error correction and monitoring procedure that takes place when a link is initially brought into service.

AIN

Advanced Intelligent Network
A dynamic database used in SS7. AIN supports advanced features by dynamically processing a call based upon trigger points throughout the call handling process and feature components defined for the originating or terminating number.

AIS

Alarm Indicator Signal
Also known as a Blue Alarm; indicates that an upstream failure has occurred.

AK

Data Acknowledgement

ALLO

Allow Service Message

AMI

Alternate Mark Inversion
A line-coding format in T1 transmission systems whereby successive ones (marks) are alternately inverted (sent with polarity opposite that of the preceding mark).

AN

Access Network

ANI

Automatic Number Identification
The automatic line identification of outward dialed calls that permits call completion and billing without the need for operator intervention.

ANM

Answer Message
An ISUP message from the destination SSP indicating that a call has been answered.

ANSI

American National Standards Institute
A non-government organization that develops standards and defines interfaces for telecommunications and other U.S. industries.

API

Application Programming Interface
A set of standard software interrupts, calls and data formats that application formats use to initiate contact with network services, mainframe communications programs, telephone equipment or program-to-program communications.

ASCII

American Standard Code for Information Interchange

ATM

Asynchronous Transfer Mode
A high bandwidth, low-delay, packet-like switching and multiplexing technique.

AUC

Authentication Center
A database that provides the HLR with authentication parameters and a ciphering key, both of which are used for security reasons.

B-Channel

In ISDN, a full duplex, 64-kilobits per second channel employed to send user data.

B-ISDN

Broadband Integrated Services Digital Network

B-Links

Bridged links typically used to carry information between STPs within the same network.

BCC

Bearer Channel Connection

BCD

Binary Coded Decimal
A form of coding of each octet within a cell so that each bit has one of two allowable states, 1 or 0.

BIB

Backward Indicator Bit
A signal unit field used in error recovery.

Binary

A notation in which one of two possible values or states (for example, on/off or 1/0) is used to indicate a particular condition.

Bit

Individual data elements, eight of which constitute a single byte.

BGAK

Begin Acknowledge (PDU)

BGN

Begin (PDU)

BGREJ

Begin Reject (PDU)

BLA

Blocking Acknowledgment
A message sent out in response to a BLO.

BLO

Blocking
A message sent out for maintenance purposes to the exchange at the other end of a circuit. Its purpose is to cause an engaged condition of the circuit for a subsequent call outgoing from that exchange.

Block

A group of bits transmitted and treated as a unit of information.

BNC

British Naval Connector
A bayonet-locking connector for thin coaxial cables such as Ethernet cables.

BP

Bit Pattern
A group of bits arranged in specified ways to represent numbers, letters, or symbols, forming a unique binary number for each character.

BRI

Basic Rate Interface
An ISDN subscriber interface that consists of two 64k B (Bearer) channels and one 16k D (Data) channel. It is often referred to as 2B+D. Digital information can be transmitted at up to 128 kbps on the BRI.

BSC

Base Station Controller
A new cellular network element introduced by GSM. It is responsible for the hand over operations of the calls as well as for controlling the power signals between the BTSs and the mobile station, thus relieving the switching center of several tasks.

BSN

Backward Sequence Number
The sequence number of the signal unit being acknowledged.

BSS

Base Station System
A GSM device charged with managing radio frequency resources and radio frequency transmission for a group of BTSs.

BSSAP

Base Station System Application Part

BT

British Telecom

BTNR

British Telecom National Requirement

BTS

Base Transceiver Station
A GSM device used to transmit radio frequencies over the air interface.

Buffer

A temporary storage location for information being sent or received.

C-Links

Cross links typically used to carry information between mated STPs; also called connected links.

CBA

Changeback Acknowledgment
A message sent out to acknowledge that SS7 traffic has resumed on the original route after a changeover has taken place.

CBD

Changeback Declaration
A message sent out to change the SS7 traffic back to the original route after a changeover has taken place.

CC

Call Control

CCITT

Consultative Committee for International Telephone and Telegraph (now ITU-T)
An international organization that develops standards and defines interfaces for telecommunications.

CCP

Call Control Procedures
A group of interactive signals required to establish, maintain and release a communication.

CCR

Continuity Check Request
A message sent from an exchange for a circuit on which a continuity check is to be performed to the exchange at the other end of the circuit. This message requests the attachment of the appropriate continuity checking equipment.

CCRA

Continuity Check Request Acknowledgment
A message sent in response to a CCR.

CCS

Common Channel Signalling
A signalling method in which a channel conveys signalling information using labeled messages.

CCSSO

Common Channel Signalling Service Office

CCT

Carrier Connect Time

CGB

Circuit Group Blocking
A message sent for maintenance purposes to the exchange at the other end of an identified group of circuits. Its purpose is to cause an engaged condition of this group of circuits for subsequent calls outgoing from that exchange.

CGBA

Circuit Group Blocking Acknowledgment
A message sent in response to a CGB.

CGU

Circuit Group Unblocking
A message sent to the exchange at the other end of an identified group of circuits. Its purpose is to cause the cancellation, in that group of circuits, of an engaged condition invoked earlier by a CGBA.

CGUA

Circuit Group Unblocking Acknowledgment
A message sent in response to a CGU.

CIC

Circuit Identification Code
A code used by ISUP to identify the message trunk associated with a call.

CK

Cyclic Redundancy Check
A 16-bit checksum transmitted with each signal unit. If the checksum does not match at the receiving signalling point, it is assumed the signal unit contains errors, and the signal unit is discarded.

CLASS

Custom Local Area Signalling Services
Services based on the availability of channel interoffice signalling.

CLI

Calling Line Identity

CLP

Cell Loss Priority bit

Cluster

A group of SSPs connected to the same mated pair of STPs.

CM

Connection Management

CNP

Connection Not Possible

CNS

Complementary Network Service
Basic services associated with an end user's lines that make it easier for ESPs to offer enhanced services.

COA

Changeover Acknowledgment
A message sent to acknowledge that a COO has been received.

COM

Continuation of Message
An indicator used by the ATM adaptation layer to indicate that a particular ATM cell is a continuation of a higher layer information packet that has been segmented.

Combined Linkset

Two or more linksets connected to mated STPs that share the same routing information.

Companding

A combination of the words "compressing" and "expanding." Companding is the process of compressing a signal for transmission and expanding it once it is received.

Configuration

The hardware and software arrangements that define a computer or telecommunications system. This arrangement determines what the system will do and how well it will do it.

COO

Changeover Order
A message sent out to change SS7 traffic over to a different route when the existing route becomes unavailable.

Copy

This option allows other linksets to be assigned the same trigger settings as the current displayed linksets.

COT

Continuity Test
A test to determine whether electrical current flows continuously throughout the length of a single wire on individual wires in a cable.

Continuity check message
The second of the ISUP call setup messages; indicates the success or failure of a continuity check if one is needed.

CP-AAL

Common Part-ATM Adaptation Layer

CPC

Cellular Phone Company

CPCS

Common Part Convergence Sublayer

CPU

Central Processor Unit
The part of the computer that manipulates data and processes instructions from software or from a human operator.

CQM

Circuit Query Message
A message sent on a routine or demand basis to request that the exchange at the other end of a group of circuits provide the state of the circuits in a particular range.

CQR

Circuit Query Response
A message sent in response to a CQM; indicates the state of all circuits in a particular range.

CRC

Cyclic Redundancy Check
A process used to check the integrity of a block of data.

CREF

Connection Refusal

CRM

Circuit Reservation Message
A message sent in the forward direction to reserve a circuit and initiate a required continuity check.

CSPDN

Circuit Switched Public Data Network
A circuit-oriented public network, usually based on X.25.

CSS

Cellular Subscriber Station

CSV

Comma Separated Value

CTPC

Call Termination Point Code

CVR

Conformance, Validation, and Regression
CVR is part of the SS7 Test Package.

CVT

Circuit Validation Test
A test during which a message is sent to request circuit translation information from the exchange at the other end of a circuit.

D-Channel

In ISDN, a data channel used to carry control signals and customer call data in a packet-switched mode.

D-Links

Diagonal links that typically connect STP mated pairs to each other.

DASS

Digital Access Signalling System
A message-based signalling system following the ISO model developed by British Telecom to provide multi-line IDA network interconnection. DASS is a precursor to DPNSS.

DCE

Data Communications Equipment
Equipment, such as a modem, that provides interfacing between DTE and the network.

Decoding

The act of changing a digital signal into analog form or into another type of digital signal.

DIP switch

Dual In-Line Package switch
A small switch or series of switches usually attached to a printed circuit board used to configure a board in a semipermanent way.

DISC

An abbreviation for disconnect.

DLC

Digital Loop Carrier
A digital transmission system designed for a subscriber loop plant; multiplexes a plurality of circuits onto very few wires or onto a single fiber pair.

Data Link Control
The characters that manage transmission by performing error checking functions such as connecting, initiating and terminating a call.

DLM

Data Link Management

DLP

Data Link Processor

DLTS

Digital Line Transmission System

DM

Disconnect Mode

DOS

Disk Operating System
Software that organizes how a computer reads, writes, and interacts with its disk and how it communicates with its peripheral devices. The most common version of DOS is MS-DOS (Microsoft Disk Operating System).

DPC

Destination Point Code
A signalling point code that contains the network and member ID of the network to which a message is addressed.

DPNSS

Digital Private Network Signalling System
A standard in Britain that enables PBXs from different manufacturers to be tied together with E1 lines and to pass calls transparently between them.

DRAM

Dynamic Random Access Memory
RAM that requires data to be refreshed periodically to prevent memory loss.

DS1

Digital Service, Level 1
DS1 is a connection with a capacity of 1.544 megabits per second in North America and a capacity of 2.048 megabits per second elsewhere. Such digital signal speeds are used to classify capacities of lines and trunks.

DSP

Digital Signal Processor
A specialized computer chip designed to perform complex operations on digital waveforms; required by the Spectra Trunk Tester for operation.

DSX

Digital System Cross-Connect Frame
A bay or panel to which T1 lines and DS1 circuit packs are wired. A DSX permits cross-connections by patch cords and plugs.

DTAP

Direct Transfer Application Part

DTE

Data Terminal Equipment
Equipment, such as a computer, that provides digital data as its output.

DTMF

Dual Tone Multi-Frequency
A term describing pushbutton dialing. When a user touches a button on a pushbutton pad, DTMF creates a combination of two tones, one high frequency and one low frequency.

DUP

Data User Part

DUPC

Data User Part Circuit

DUPF

Data User Part Facility

E1

A digital transmission link with a capacity of 2.048 megabits per second. This standard is widely used in Europe and in submarine cables as the rough equivalent of a T1. (E1 provides 30 64-kilobits per second channels, which is six more than a T1.)

E-Links

Extended links typically used to link an SSP to a remote STP, bypassing the home STP pair.

ECA

Emergency Changeover Acknowledgment
A message sent out to acknowledge that an ECO has been received.

ECO

Emergency Changeover
A message sent out to change SS7 traffic over to a different route when the existing route becomes unavailable during a link failure or other extreme condition.

EIM

Error Interval Monitor

EIR

Equipment Identity Register
A database repository used to verify the validity of mobile telephone service equipment.

EMI

Electromagnetic Interference
Interference in signal transmission or reception caused by radiation leakage in electrical or magnetic fields.

END

End (PDU)

ENDAK

End Acknowledge (PDU)

ER

Error Recovery (PDU)

ERAK

Error Recovery Acknowledge (PDU)

ERR

An abbreviation for error.

ESF

Extended Super Frame
A T1 format that provides frame synchronization, cyclic redundancy checking, and data link bits. ESF allows error information to be stored and retrieved easily, facilitating network performance monitoring and maintenance.

ET

Exchange Termination

Ethernet

A local area network that connects computers, printers, workstations, terminals, servers, etc. within the same building or area.

ETSI

European Telecommunications Standards Institute
The European counterpart to ANSI.

F-Links

Fully-associated links typically used to link two SSPs without going through an STP.

FCC

Federal Communications Commission
Regulates interstate communications such as licenses, rates, tariffs, standards, limitations, etc.

FCS

Frame Check Sequence
Bits added to the end of a frame for error detection.

FIB

Forward Indicator Bit
A signal unit field used in error recovery.

FIFO

First In, First Out
A buffering scheme in which the first byte of data that enters the buffer is also the first byte retrieved by the CPU. This scheme is used in most serial-buffering designs because it closely mimics the way serial data is actually transmitted—one bit at a time.

Firmware

Software kept in semipermanent memory because it is used so often that it is “burned” into a chip.

FISU

Fill-In Signal Unit
A signal unit transmitted when no MSUs or LSSUs are being transmitted. The constant transmittal of signal units allows the SS7 network to receive immediate notification of a signalling link failure.

FPGA

Field Programmable Gate Array
A gate array that can be programmed after its manufacture. An FPGA consists of an array of logic elements, including either gates or lookup table RAMs, flip-flops and programmable interconnect wiring.

Flag

A unique eight-bit pattern that signals the beginning and end of a signal unit.

Frame

A group of data bits in a specific format; enables network equipment to recognize the meaning and purpose of specific bits.

FRMR

Frame Reject
A data link layer ISDN message used to report a frame containing an unidentified control field.

FSN

Forward Sequence Number
The sequence number of the signal unit being transmitted.

FTP

File Transfer Protocol
A TCP/IP protocol used to transfer files between machines.

GAP

Generic Address Parameter

GMSC

Gateway Mobile Services Switching Center
A means of routing a mobile station call to the MSC containing the called party's HLR.

GMT

Greenwich Mean Time
The international standard for time measurement; based on the local time in Greenwich, England.

GRA

Circuit Group Acknowledgment
A message sent in response to a GRS; indicates that a circuit group reset has been performed.

GRS

Circuit Group Reset
A message sent by an exchange when it does not know the particular state of a group of circuits and wants to release any calls in progress, remove any blocked conditions, and align the state of the calls with the state of those circuits as perceived by the far-end exchange.

GSM

Global System for Mobile Communications
The standard digital cellular phone service found in Europe and Japan.

GTT

Global Title Translation
The SCCP function that translates an address, such as customer-dialed digits, to a routing address SS7 can recognize.

HDB3

High Density Bipolar 3
A bipolar coding method that does not allow more than three consecutive zeros.

HDLC

High Level Data Link Control
A communications standard protocol that is bit-oriented in which control codes differ according to their bit positions and patterns for point-to-point and multi-point communications.

HEC

Header Error Check field

Hex (Hexadecimal)

A base 16 numbering system that uses 16 characters — ten digits and six letters. It is used to condense the long strings of zeros and ones in large binary numbers.

HLR

Home Location Register
A permanent database used in GSM to identify a subscriber and to store subscriber data related to features and services.

HSL

High Speed Links
High Speed Links transmit data at speeds of 1.544 Megabit per second on B and C signalling links over a T1 interface and at 2.048 Megabit per second over an E1 interface.

IA5

International Alphabet No. 5

IAA

IAM Acknowledgment
A message sent out in response to an IAM.

IAI

Initial Address with Additional Information

IAM

Initial Address Message
An ISUP message used to indicate trunk signalling between two SSPs.

IAP

Initial Alignment Procedure
A procedure initiating the ability of a signalling link to carry traffic either for the first time or after a failure has occurred.

ICN

Interconnecting Network

IDA

Integrated Digital Access
The means of providing digital access for subscribers to the BT ISDN service. Two versions, single-line IDA and multi-line IDA, are available.

IDE

Integrated Drive Electronics
A hard-drive standard for computers.

IMEI

International Mobile Station Equipment Identity
An equipment identification number, similar to a serial number, used to identify a mobile station.

IMSI

International Mobile Subscriber Identity
An ITU specification used to identify a subscriber to mobile telephone service.

IN

Intelligent Network
A sophisticated network capable of recognizing the profile (authorization, chosen services) of its users or subscribers.

INA

Information Network Architecture

INAP

Intelligent Network Application Protocol
The ETSI standard for IN services.

INF

Information
A message sent to convey additional call-related information.

INR

Information Request
A message sent by an exchange to request additional call-related information.

IP

Internet Protocol

IS41

A signalling protocol used in the North American standard cellular system.

ISDN

Integrated Services Digital Network
A set of standards for the out-of-band signalling transmission of simultaneous voice, data and video information over fewer channels than would otherwise be needed.

ISO

International Standards Organization
An organization that defines global communications and computing standards.

ISOT

ISUP over TCP/IP

ISUP

Integrated Services Digital Network User Part
The upper level protocol in SS7 that provides ISDN services.

ISRM

Initial Service Request Message

ITU-T

International Telecommunications Union-Telecommunications (previously CCITT)
An international organization that develops standards and defines interfaces for telecommunications.

IWMSC

Interworking Mobile Switching Center
A location at which telephone traffic, either local or toll, is switched or connected from one circuit or line to another.

LAP

Link Access Protocol
The data link (OSI) Layer 2 protocol specified by ITU for the X.25 interface standard.

LAPB

Link Access Procedure Balanced
The most common data link control protocol used to interface X.25 DTEs with X.25.

LAPD

Link Access Procedure on the D-Channel
A link level protocol devised for ISDN connections; differs from LAPB in its framing sequence.

LCI

Logical Channel Identifier

LCN

Logical Channel Number
A virtual circuit identified at the packet level of X.25.

LE

Local Exchange
The telephone company exchange where a subscriber's line is terminated.

LED

Light Emitting Diode
An electronic device that emits light with little heat generation.

LFU

Link Forced Uninhibit

LI

Length Indicator
A field in a signal unit indicating the number of octets following the LI field and preceding the CK field. The value in this field differentiates MSUs, LSSUs, and FISUs.

LIA

Link Inhibit Acknowledge

LIC

Link Identification Code

LID

Link Inhibit Denial

LIDB

Line Information Database
A local exchange carrier's database that is used to provide calling card validation.

LIDN

Link Inhibit Denial message

LIN

Link Inhibit

Link

A physical and logical connection between two signalling points (STP, SSP, or SCP). A transmission path between two stations, channels, or parts of a communications system.

Linkset

Two or more signalling links connected to adjacent signalling points (STP, SSP, or SCP).

LLI

Logical Link Identifier

Link Local Inhibit

LM

Layer Management

Logical Channel

An X.25 concept referring to a virtual connection operated over a physical connection that can support one or more virtual connections simultaneously.

LOS

Loss of Signal (or Loss of Sync)
A condition at the receiver or a maintenance signal transmitted in the physical overhead indicating that the receiving equipment has lost the received signal.

LPA

Loopback Acknowledgment

LPO

Link Processor Outage

LRI

Link Remote Inhibit Test

LRN

Location Routing Number

LSB

Least Significant Bit
That portion of a number, address, or field that occurs in the rightmost position when its value is written as a single number in conventional hexadecimal or binary notation.

LSSU

Link Status Signal Unit
A type of signal unit providing link status indications to the remote end of a signalling link.

LUA

Link Uninhibit Acknowledge

LUN

Link Uninhibit

MAAL

Management ATM Adaptation Layer

MAC address

Media Access Control address
An address represented by a 48-bit number for a device as it is identified at the Media Access Control layer in the network architecture.

MAP

Mobile Application Part
A protocol used in SS7 for the specific needs of mobile and wireless networks. It allows roaming by mobile stations.

Mated Home STP Pair

A pair of STPs used for redundancy and load sharing. Home refers to the pair closest to the current SSP.

Mated Remote STP Pair

Mated STPs that are not adjacent to the current STP.

MaxCC

Maximum Connection Control (count)

MaxPD

Maximum Poll Data (count)

MaxSTAT

Maximum STAT (count)

MCOD

Mass Calling Onset Detection

Menu

A list of options displayed on a computer terminal screen.

MGC

Media Gateway Controller

MIB

Management Information Base
The database that relays information available from an SNMP manageable device or service to network management systems.

MIN

Mobile Identification Number
The actual seven-digit cellular telephone number assigned by a cellular carrier to a cellular phone. The MIN is used for billing and receiving calls.

MM

Mobility Management

MOC

Mobile Originated Call

MON

An abbreviation for monitor.

MS

Mobile Station
In GSM, a wireless telephone allowing mobility so that calls may be placed locally or in another geographic region.

MSB

Most Significant Bit
That portion of a number, address or field in the leftmost position when its value is written as a single number in conventional hexadecimal or binary notation.

MSC

Mobile Switching Center
A switch providing services and coordination between mobile users in a network and external networks.

MSU

Message Signal Unit
A type of signal unit carrying signalling information for call control, network management, and network maintenance in the signalling information field.

MTNR

Signalling Network Test/Maintenance Messages (Regular)

MTNS

Signalling Network Test/Maintenance Messages (Special)

MTP

Message Transfer Part
Layer 1 through Layer 3 of the SS7 protocols; equivalent to the physical, data link, and network layers in the OSI model.

MTP3

MTP3 over TCP/IP (TALI service message)

MU-Law

See μ-Law.

NETW-EN2

The part number for the Smart Ethernet Adapter card installed in the Spectra system. See SEA.

NL

In the DASS and DPNSS protocols, a frame transmission limit parameter used by the Spectra system N200 timer . NL refers to the minimum number of times a command frame must be retransmitted if it is not acknowledged.

NNI

Network Node Interface

Node

A generic term used to refer to an entity (such as an SSP, STP, or SCP) that accesses a network.

NOF

Network Operations Forum

NPAX

The telephony symbols N, P, A, and X can be used as wildcards to limit a digit to certain values.

NT

Network Termination

NUP

Network User Part

Octet

Eight bits of information; one byte

OMC

Operation and Maintenance Center
Computer hardware and software specifically assigned to monitor and manage part of a telecommunications network; usually employed in GSM.

OOS

Out Of Service

OPC

Origination Point Code
A signalling point code identifying the signalling point where the message originated.

OPDU

Operations Protocol Data Unit

OSI

Open System Interconnection
A standard for layered data communications to allow systems and terminals made by different suppliers to communicate.

PCI

Peripheral Component Interconnect
A 32/64-bit local bus inside a PC or Mac. It can transfer data between the main microprocessor (CPU) and the peripherals (hard disks, video adapters, etc.) at up to 132 megabytes per second.

PCM

Pulse Code Modulation
A modulation technique in which the signal being transmitted is sampled at regular intervals to determine its magnitude. The magnitude is converted to a digital pulse for transmission.

PCR

Preventative Cyclic Retransmission
An error correction method normally used when there is a substantial distance between signalling points, such as with satellite transmission of a signal.

PD

POLL Data

PDU

Protocol Data Unit
The PDU is utilized to facilitate interactions between peer entities and entities in adjacent layers in the SAAL. A signalling message delivered by the higher levels is transferred over the signalling link in variable length PDUs.

PDDM

Protocol Decode Definition Module
An optional Spectra system feature that enables users to add proprietary messages and parameters to existing protocol sets.

PIN

Personal Identification Number

PL

Payload Type

PLMN

Public Land Mobile Network
A mobile telephone communications network established by a provider to facilitate mobile telecommunications services. This includes equipment, operations and staff.

PMU

Protocol Monitoring Unit

PNNI

Private Network-Network Interface
A routing information protocol that enables extremely scalable, fully functional, dynamic multi-vendor ATM switches to be integrated into the same network.

Point Code

A unique number associated with a signalling point.

POLL

Poll (PDU)

Port

A physical entry or exit point for a network.

PRI

Primary Rate Interface
An ISDN subscriber interface that consists of 23 64k B (bearer) channels and one 16k D (data) channel. Information is transmitted at T1 (DS1) speed (equivalent to 24-voice grade channels).

Protocol

A formal set of conventions governing the format and control of inputs and outputs between two communicating entities.

PSN

Packet-Switched Network

PSTN

Public Switched Telephone Network
A network path, established using normal telephone signalling and circuits, over which data or other non-telephone services are carried.

PVC

Permanent Virtual Circuit
In data networking services, a circuit that is defined in a static manner with static parameters but is not tied to a given physical path through the network.

PVN

Private Virtual Network

QOS

Quality of Service
A measure of the quality of telephone service provided to a subscriber.

RAM

Random Access Memory
The primary working memory in a computer; used for temporary data storage. Any area of RAM can be accessed directly and immediately, and RAM data can be overwritten with new information.

RCT

Route Set Congestion Test
A test is performed at a signalling point to determine the congestion status of a specific destination.

RD

Receive Data

Real Channel

A communication channel that can be used to convey voice or data.

Real Time

The rapid transmission and processing of event-oriented data and transactions as they occur, in contrast to being stored and retransmitted or processed as batches.

REJ

An abbreviation for reject.

REL

Release
A message, sent in either direction, indicating that the circuit identified in the message is being released and is ready to be put into the idle state on receipt of an RLC.

RES

An abbreviation for resume.

RLC

Release Complete
A message, sent in either direction, in response to an REL.

RNR

Not Ready to Receive

Routing Label

The component of a signal unit that contains the OPC, DPC, and SLS code.

RR

Ready to Receive

RS

Resynchronization (PDU)

RSAK

Resynchronization Acknowledge (PDU)

RSC

Reset Circuit
A message sent by an exchange when it does not know the particular state of a circuit and wants to release any calls in progress, remove any blocked conditions, and align the state of the calls with the state of the circuit as perceived by the far-end exchange.

RSM

Route Set Message

RSR

Reset Request

RST

Route Set Test
This test is performed at STPs to query whether signalling traffic toward a certain destination may be routed via an adjacent STP.

RSTP

Regional Signal Transfer Point

RX

Receive

SAAL

Signalling ATM Adaptation Layer

SABM

Set Asynchronous Balanced Mode

SABME

Set Asynchronous Balanced Mode Extended

SABMR

Set Asynchronous Balanced Mode Restricted

SAP

Service Access Point

SAPI

Service Access Point Identifier
An ISDN frame value that identifies a logical point at which data link layer services are provided by a data link layer entity to a Layer 3 entity.

SAR

Segmentation and Reassembly

SCCP

Signalling Connection Control Part
An SS7 application that supports addressing and routing functions.

SCCP/TCAP over TCP/IP (TALI service message)

SCLC

SCCP Connectionless Control

SCN

Switched Circuit Network

SCOC

SCCP Connection-Oriented Control

SCP

Signalling Control Point
An SS7 signalling point that provides a line information database for enhanced services and user information.

SD

Send Data

Sequenced Data (PDU)

SDLC

Signalling Data Link Connection

Synchronous Data Link Control

SDLCA

Signalling Data Link Connection Acknowledgment

SDU

Service Data Unit

SEA

Smart Ethernet Adapter
A board installed in the Spectra system that allows for remote access to Spectra units. NETW-EN2, the part number for the SEA board, is another way of referring to this hardware.

Service Profile

A set of service or feature parameters available for access by a terminal.

SF

Status Field

Single Frequency
A method of inband signalling.

SI

Service Indicator
Information within a signalling message that identifies the user for which the message is intended.

SIB

Status Indicator - Busy

SIE

Status Indicator - Emergency

SIF

Signalling Information Field
A signal unit field that contains routing and signalling information in the routing label. See Routing Label.

Signal

A detectable impulse by which information is communicated through electronic or optical means or over wire, cable, microwaves, laser beams, etc.

Signal Unit

Signal Unit
A message type that carries signalling and other information over a link.

Signalling Point

An SSP, STP, or SCP.

SIM

Subscriber Identity Module
A card inserted into GSM mobile equipment that contains IMSI information; used for authentication and ciphering on the radio channel.

SIMM

Single Inline Memory Module
A form of chip packaging in which leads (pins) are arranged in a single row protruding from the chip. Connectors are attached to a stiff contact strip that permits a SIMM to be inserted into a slot such as an expansion adapter.

SIN

Status Indicator - Normal

SIO

Service Information Octet
A signal unit field that contains information about the type of signal unit being transmitted and the protocol necessary for Level 4 processing.

Status Indicator-Out of Alignment

SIOS

Status Indicator - Out Of Service

SIPO

Status Indicator - Processor Outage

SLC

Signalling Link Code
A signal unit field that contains a preassigned code for the physical link associated with a message.

SLS

Signalling Link Selection Field
A signal unit field typically used by the routing function to perform load sharing among different signalling links or linksets.

SLTA

Signalling Link Test Acknowledgment
A message sent in response to an SLTM.

SLTM

Signalling Link Test Message

Smart Wrap

A feature available through Spectra system testers and generators that consists of GET and PUT statements. This feature allows you to copy bits and bytes of information from an incoming trigger message and then place the information in the transmitted message of your choice.

SN

Sequence Number

SNM

Signalling Network Management

SP

Signalling Point
An SSP, STP, or SCP.

SPID

Service Profile Identifier
An eight- to 12-digit number that uniquely identifies a customer's chosen set of ISDN features. The SPID is of significance at the local access interface only. It is not conveyed to transit or remote switches in association with call setup or supplementary service invocation.

SRA

Signalling Route Acknowledgment

SRSCT

Signalling Route Set Congestion Test
A procedure used at an originating signalling point to update the congestion status associated with a route set toward a certain destination.

SRST

Signalling Route Set Test
A signalling route management procedure used to test the availability of a given signalling route that was previously declared unavailable.

SRT

Signalling Route Test

SS7

Signalling System 7
A common channel signalling system developed to provide enhanced telecommunication services by creating and transferring call processing, network management, and maintenance messages to the network's various components.

SS

Switching System
A set of one or more systems that act together and appear as a single switch for the purposes of PNNI routing.

SSA

Subsystem Allowed

SSCF

Service Specific Coordination Function

SSCOP

Service Specific Connection Oriented Protocol

SSCS

Service Specific Convergence Sublayer

SSN

Subsystem Number
A number that identifies a particular application (such as 800 service) performed by the network and further qualifies the route of the message.

SSP

Subsystem Prohibited

Signalling Service Point
Telephone switches, interconnected by SS7 links, that perform call processing on calls that originate, tandem, or terminate at that site.

SSRM

Subsequent Service Request Message

SST

Subsystem Test

STAT

Solicited Status (PDU)

STDM

Statistical Time Division Multiplexing
A multiplexing technique that differs from simple multiplexing in that the share of the available transmission bandwidth allocated to a given user varies dynamically. In other words, a channel is only assigned to communicating devices (voice, modem, etc.) when these devices actually have data to send or receive.

STP

Signalling Transfer Point
Telephone switches that relay messages between network switches and databases. STPs route messages to the correct outgoing signalling link based on information in the message address fields.

SU

Signal Unit
A message type that carries signalling and other information over a link.

SUERM

Signal Unit Error Rate Monitor
An error-checking mechanism that measures the error rate of an active signalling link by counting the number of correct and erroneous signal units.

SUS

Suspend

SUT

System Under Test
Refers to a network being tested by the Spectra system.

SVC

Switched Virtual Circuit
A connection across a network. It is established on an as-needed basis and can provide a connection to any other user in the network. The connection lasts only for the duration of the transfer.

SVN

Silicon Valley Networks
An automated testing company whose software is used in conjunction with the Spectra system to provide automated test management capabilities.

TALI

Transport Adapter Layer Interface
A signalling gateway interface that supports reliable communication between the SCN, which is the larger network that contains SS7, and applications residing within a TCP/IP network.

T1

A digital transmission link with a capacity of 1.544 megabits per second. This is a standard link for digital transmission in the United States, Canada, Hong Kong, and Japan.

TCAP

Transaction Capabilities Application Part
An upper layer SS7 protocol that provides advanced services.

TCH

Traffic Channel

TCP

Transmission Control Protocol

TCP/IP

Transmission Control Protocol/Internet Protocol
A set of working standards and conventions governing communication among interconnected networks, such as the Internet.

TDM

Time-Division Multiplexing
A technique for transmitting a number of separate data, voice and/or video signals simultaneously over one communication medium by quickly interleaving a piece of each signal one after the other.

TE

ISDN Terminal Equipment
Any device that can attach to and work with ISDN.

TEI

Terminal Endpoint Identifier
An ISDN frame value that defines for a given message which device is communicating with the central office switch. Up to eight devices can be connected to one ISDN BRI line.

Telecommunications

The transmission, emission, or reception of signs, signals, images, sound, or intelligence of any nature by wire, radio optical system, or other technical system.

Telnet

The remote terminal protocol for TCP/IP. Telnet enables a user at one site to control an application running on another host at another site.

Terminal

The piece of user equipment that terminates a Layer 2 data link signalling connection on the D-channel.

TFA/TCA

Transfer Allowed/Transfer Cluster Allowed

TFC

Transfer Controlled
This procedure is used to notify adjacent signalling points of congestion at a signalling point or the congestion status of a signalling route.

TFP/TCP

Transfer Prohibited/Transfer Cluster Prohibited

TFR/TCR

Transfer Restricted/Transfer Cluster Restricted

TI

Transaction ID

TID

Transaction Identifier

TLDN

Temporary Local Directory Number
A temporary number assigned to a roaming mobile subscriber for incoming calls.

TMSI

Temporary Mobile Subscriber Identity

Toggle

A toggle is any simple two-position switch, or the act of switching between two such positions.

TRA

Traffic Restart Allowed

Traffic Model

A model that consists of bundles of traffic parameters that can be used within test scripts to specify several pieces of information.

Transmit

An option that allows the transmission of pre-built messages.

Trigger

An option allows the assignment of response messages in scripts.

TRW

Traffic Restart Waiting

TS

Timeslot
In time division multiplexing or switching, the slot belonging to a voice, data, or video conversation. It can be occupied by conversation or left blank.

TTL

Transistor Transistor Logic

TUP

Telephone User Part
A predecessor to ISUP.

TX

Transmit

UA

Unnumbered Acknowledgment

UBA

Unblocking Acknowledgment
A message sent in response to a UBL.

UBL

Unblocking
A message sent to the exchange at the other end of a circuit to cancel, in that exchange, the engaged condition of the circuit.

UCIC

Unequipped Circuit ID Code

UD

Unnumbered Data (PDU)

UDT

Unit Data Type

UDTS

Unit Data Service

UI

Unnumbered Information
Refers to a type of ISDN frame that provides supplemental link control functions and supports unacknowledged operations.

UNI

User Network Interface

UNIX

A computer operating system used for data processing and/or running telephone systems.

USTAT

Unsolicited Status (PDU)

V5-interface

A general term for the family of V-interfaces that connect access networks to a local exchange (for example, a V5.1 interface or a V5.2 interface).

VAT

Validation Testing
A series of tests administered to determine whether an implemented system fulfills its requirements.

VCI

Virtual Channel Identifier

VCH

Voice Channel

VGA

Variable Graphics Array
A graphics standard developed by IBM that allows a computer screen to generate any of four levels of resolution. One of the sharpest of these provides 16 colors at a resolution of 640 horizontal picture elements (known as pels or pixels) by 480 vertical pels.

Virtual Channel

An information channel that has no physical realization outside the D-channel.

VLR

Visitors Location Register
A local database to an MSC; registers visiting mobile station users. This information is retained as long as the user resides in the geographic area of the visited MSC. The VLR obtains information from the HLR of the user.

VOIP

Voice Over Internet Protocol
Refers to the two-way transmission of audio over an Internet Protocol network.

VPI

Virtual Path Identifier

VSP

Virtual Signalling Point

Wildcard

A special character used to represent one or more characters. An asterisk (*) represents several characters, and a question mark (?) represents a single character.

X.25

An international narrowband packet-switching standard; a forerunner to frame relay and ATM.

XID

Exchange Identification

XUDTS

Extended Unit Data Service

ZCS

Zero Code Suppression
The insertion of a 1 bit in a message to prevent the transmission of eight or more 0 bits.

Index

Symbols

+/-Sp 145, 152

Numerics

56K/64K (LEDs) 50

A

Abatement 193
access-controlled Spectra system
    logging out of 99
Alignment Procedure 273
Application Software
    Component Versions screen 18
Application Type 245
Apply & Save Configuration 259
Apply Configuration 258
Assigning 195
ATMLevel1Parms
    Level 1 Parameters screen 122
AUTOEXEC.BAT 67

B

backplane 33
Basic 234, 244
Baud Rate (All Interfaces) 124
BIN files 76
BIOS 82
BRDG
    DS1/E1 V5 47
    DS1/E1 V6 49
BRI S/T Pods
    Bank 1, Bank 2 134
Bridged/Term 125
Buffer Position cursor
    Main Function Selection screen 8

C

Cable Suppression Ferrite 62
Capture Buffer
    Main Function Selection screen 8
CCLK (Composite Clock) (Jack) 51
Cfg Linksets 161
CH1 & CH2 (LEDs) 59
channels. *See* timeslots
C-Link 162
Cluster 265
Command Address 235
command line switches
    Spectra program 2
Common Channel Signalling 263
Component Versions screen 17
CONFIG.SEA 45, 68
CONFIG.SYS 67
CONFIG.T7 77
Configuration files 76
Configure Products screen 79
Congestion
    Congestion Levels 192
    Congestion Processing 191
    Congestion/Restriction Screen
        Assigning Congestion Options 195

connecting to access-controlled Spectra system 98
CPU BIOS
    setting 44
Current Configuration, Main Function Selection screen 8
customer support services agreement 86

D

Data/Clock (All Interfaces) 125
Database Drive, Main Function Selection screen 8
DCE 124
Decode Screen
    Component Versions screen 18
Decode Template
    Component Versions screen 18
decode template 68, 77
Delete 152
DeleteCall 253
Destination 254
Digital Line Transmission System 227
Direction Line, Main Function Selection screen 8
Discard 194
DLP Board Switches 37
DLTS. *See* Digital Line Transmission System
DOS Information screen
    Component Versions screen 19
DPNSS test frame generation
    disable 213
DS1/E1 V5 46
    Jacks
        IN1 47
        IN2 47
        OUT1 47
    LED
        BRDG 47
        DSXM 47
        LOS1 and LOS2 46
        TERM 47
DS1/E1 V6 48
    Jacks
        IN1 49
        IN2 49
        OUT1 49
DS1/E1 V6 (Continued)
    LED
        BRDG 49
        DSXM 48
        IN1 and IN2 48
        TERM 49
DSP Board 33
DSP boards 33
DSXM
    DS1/E1 V5 47
    DS1/E1 V6 48
DSXM (LED) 51, 60, 64
DTE 124
Dual/Single 122
Dump 119, 152, 186
DumpScript 152, 186

E

Error Correction 276–278
Error Correction Method 139, 214
    Basic 139
    PCR 139
EST 254
Exit to DOS 21
Extended 234, 245
external VGA board 36

F

F1 Setup
    main program functions 15
F10 Help
    main program functions 16
F2 Run
    main program functions 15
F3 Stats
    main program functions 15
F4 Reports
    main program functions 15
F5 Print
    main program functions 15
F6 Editor
    main program functions 15
F7 Remote
    main program functions 15

F8 Tools
main program functions 16
F9 Xamine
main program functions 16
FanoutToggle 119
Fill-in Signal Unit. See FISU
FISU 269
Flow Control 273, 275
Functional Interface 234
Link Layer Parameters screen 211

G

Global Title Translation Screen 197
Procedure for Assigning GTT Parameters 201
GSM Generator
GSM Network 329
GTT Digits 200

H

Hardware
MegaPAC Systems 29
Portable Systems 30
Rackmount Systems 25
Spectra System Overview 23
Help files 76
HSL Processor boards 33
HSL/DLPRevisionInfo, Component Versions screen 18
HSLLevel1Parms
Level 1 Parameters screen 123

I

Idle Timer 236
IN1
DS1/E1 V5 47
DS1/E1 V6 49
IN1 & IN2 (LEDs) 60, 63
IN1 and IN2
DS1/E1 V6 48
IN1, OUT1 & IN2 (Jacks) 52, 64
IN2
DS1/E1 V5 47, 49
Information Line
Main Function Selection screen 8
Initial Alignment Procedure 274
Integrated Services Digital Network User Part. *See* ISUP
Interface 123
Interface Pods. *See* Pods
ISDN
SPID\USID control 223
ISDN. *See* ISUP
ISUP 292

J

J1 Pod 63
Jacks
IN1, DS1/E1 V5 47
IN1, DS1/E1 V6 49
IN2, DS1/E1 V5 47
IN2, DS1/E1 V6 49
OUT1, DS1/E1 V5 47
OUT1, DS1/E1 V6 49
JAPAN J7 Pod 63
JAPAN Protocol 5-Bit 9-Bit Selection 139

L

LAPB Control Field Format 234
LCN 255
Level 1 Parameters Screen 118
Assigning Links to Level 1 Parameters 128
Level 2 messages 211
Level 2 Parameters menu 209
Level 2 Parameters Screen 138
Assigning Level 2 Parameters to Linksets 142, 214
Screen Definitions 211
Level 2 Procedures 273
Level 2 Timers 273
Level 3 Emulation Timers
Assigning Timers to Linksets 150
Level 3 Emulation Timers Screen 145
Level 3 Origination Parameters 145
Link 123, 253
Link Identification Code 235

Link Layer Parameters Screen 233
    Screen Definitions 234
Link Layer Parameters screen 210
Link Level Components
    Component Versions screen 18
Link Names Screen 181
Link Status Display line
    Main Function Selection screen 9
Link Status Signal Unit. See LSSU
Link To Linkset Definitions Screen 178
    Assigning Links to Linksets 179, 204
Link Type 123
Link types 265
Link, Linkset & Node Names
    Procedure for Assigning Names to Links 180
Link, Linkset & Node Names Menu 180
Linkset 265
Linkset Names Screen 182
LOS1 and LOS2
    DS1/E1 V5 46
LSSU 270, 273

M

MAC Address
    setting 45
Main Function Selection screen 6
main program functions 15
Max Octet Size 139
Message Ack Timeout Timer 245
Message Signal Unit. See MSU
Message Transfer Part. See MTP
Mode 124
    Main Function Selection screen 7
Monochrome Format 105, 108, 109, 111
More Parameters Option Menu 162, 170
More Parms 162
MSU 271
MSU Priority 162
MTP 266
    Level 1 267
    Level 2 267
MTP Level 3 279

N

Name 254
NETW-EN2. *See* Smart Ethernet Adapter card
Network Configuration Screen 161, 167
    Assigning Additional Parameters to Signalling Points 167, 169
    Assigning DPCs and Routes 168, 171
    Assigning Point Codes to Spectra Signalling Points 167, 169
    Assigning Settings 166
    Assigning SP/STP Designation to Adjacent Signalling Points 167, 168, 171
    Assigning SP/STP Designation to the Spectra Signalling Point 167, 169
    SP Routing Table 164
Network Indicator 162
NETWORK interface 211
NL, retransmission limit parameter. *See* timers, N200
Node Names Screen 183

O

Onset 193
Origination 254
OUT1
    DS1/E1 V5 47
    DS1/E1 V6 49

P

Packet Layer Execution 245
Packet Layer Format 244
Packet Layer Parameters Screen 243
Packet Window 245
Password
    as part of the normal log in procedure 4
Password Setup Screen 79, 93
PCI slots 23, 33, 34
PCR N1 139
PCR N2 139
Pods
    DS0 50
        Clock Options 51
    DS1/E1 V5 46

Pods (Continued)
DS1/E1 V6 48
Installation of
RS-232 58
RS-449 56
V.35 53
Point Code 186, 201
Point Code Name 186
Point Code Names Screen 185
Assigning Names/Display to Point Codes 186
Pointcode 281
PRI daughter board 34
Procedure for Assigning Names to Linksets 180
Procedure for Assigning Names to Nodes 180
Procedure for Assigning Virtual Point Codes 173
Processor Outage 273, 275
Product Configuration
Configure Products screen 79
editing options 80
setting 78
Protocol 138, 163
Protocol option
Link Layer Parameters screen 211
protocols
available for link layer parameters 211

R

Recall 199
Recall Configuration 261
Response Address 235
Restriction Processing 191
Run Time Support files 76

S

Save 199
Save Configuration 260
SCCP 295
SCCP Parameters Screen 151
SCCP Timers 157
SCP 265
SCRIPT.SEA 68, 77
SEA board. *See* Smart Ethernet Adapter card
Serial Number
Component Versions screen 19
Service Level Agreement 87
Service Profile Identifier. *See* SPID
Set Asynchronous Balanced Mode Restricted
as a reset signal for DASS 227
to initiate reset of a DLC in DPNSS 227
Set Colors
Assigning Colors to Channels 109
Assigning Colors to Link Status 110
Assigning Colors to Menus 105
Assigning Colors to Messages 106
Set Database Drive 103
Set Date 112
Set Point Code Format 114
Set Station ID 112
Set Time 111
Signal unit 268–271
Signal unit fields 268–271
Signal units 76
Signalling Connection Control Part. *See* SCCP
Signalling Link Error Monitoring 276
Signalling Link Management 283
Signalling Message Handling 280
Signalling Network Maintenance 282
Signalling Network Management 283
Signalling Route Management 283
Signalling System 7 263
Smart Ethernet Adapter card 28, 34, 36
Software installation
specifications 66
Spectra Installation Program Main screen 69
Software upgrades
BIOS 82
Y2000 RTC patch 82
Y2K Test and Fix program 82
Y2K Compliance testing 83
Y2K correction installation 85
SP Routing Table 165
Sp/Stp 164
Spectra
getting around in 5
Hardware Overview 23
main program functions 15
MegaPAC Systems 29
Portable Systems 30
Rackmount Systems 25

Spectra Custom Installation file structure 76
TEMPLATE.TXT 77
Spectra executable 76
Spectra Installation Program 66
accessing 69
AUTOEXEC.BAT 67
CONFIG.SEA 68
CONFIG.SYS 67
Disk Prompt dialog box 72, 75
Installation Options screen 70
installation path 66
Installing complete Spectra system software 71
Installing custom Spectra system software 73
minimum upgrade requirements 74
SCRIPT.SEA 68
Spectra Custom Installation file structure 76
BIN files 76
CONFIG.T7 77
Configuration files 76
Help files 76
Run Time Support files 76
SCRIPT.SEA 77
Signal units 76
Spectra executable 76
Support files for generators 76
Support files for ISDN Testers 77
Support files for SS7 Testers 77
Support files for X.25 Testers 77
TEMPLATE.SS7 77
Spectra Installation Options screen 71, 73
Spectra Installation Program Main screen 69
TEMPLATE.SS7 68
upgrading software and overwriting files 67
Spectra system, access-controlled
connecting to 98
logging out of 99
SPECTRA.EXE 76
SPID 223
SPR 89
SS7 263
SS7 Protocol 266
SSN 201
SSP 264
Station ID
Main Function Selection screen 8
Statistics
Stats Display 186
Stats Display 186
STP 265
Support files for generators 76
Support files for ISDN Testers 77
Support files for SS7 Testers 77
Support files for X.25 Testers 77
Switch Virtual Circuit Mapping Screen 253
Screen Definitions 253
System Information screen. *See* DOS Information screen

T

T1 235
T200 through T203. *See* timers
TALILevel1Parms
Level 1 Parameters screen 122
TCAP 296
TCP/IP, in conjunction with SEA board 36
Technical Support services 86
customer support services agreement 86
email addresses 88
receving and prioritizing requests 88
Service Level Agreement 87
System Problem Resolution numbers 89
Time and Materials 87
warranty period 86
TEMPLATE.SS7 68
as part of the Decode Template 18
TERM
DS1/E1 V5 47
DS1/E1 V6 49
TERM & BRDG (LED) 51, 54, 57, 64
Terminal Identifications. *See* TID
test frame generation. *See* DPNSS test frame generation
TGTSystemScreen, Component Versions screen 18
TID 224
Time
Main Function Selection screen 8

Time display
    Main Function Selection screen 8
Time SRC (LNK) 126
timers
    for use with DASS and DPNSS 212, 213
    N200, Maximum Retransmissions option 213
    N201, Maximum Byte Length option 213
    T200, Excessive Acknowledgment Delay timer 212
    T201, Excessive TEI ID Check Delay timer 212
    T202, Excessive TEI ID Request Delay timer 212
    T203, Idle timer 213
Timeslot Assignments screen
    using with DASS and DPNSS 227
timeslots
    real and virtual 227
    reserved 227
Timing 134
    Bank 1, Bank 2 122
Timing System, Normal 122
TIP-RING 125
Toggle DS1/E1 122
ToggleScreen
    Component Versions screen 18
tone card. *See* DSP Board
Top Border Line
    Main Function Selection screen 7
Transaction Capabilities Application Part. *See* TCAP
Translate 201
Translation Type Fields 200
Trunk Tester
    backplane 33
    DSP Board 33

U

Unnumbered Acknowledgment
    in reply to a SABMR in DASS 227
Upgrades
    Y2K 81
Upgrading software 67
User
    Monitor Only 95
    Network Access 96
    Read Only 94
    Set Filters 95
    System Admin 96
User Id
    as part of the normal log in procedure 4
USER interface 211
User Part 266, 292
User Service Profiles. *See* USID
USID 224

V

Valid Point Code Ranges 115
Variant option
    Link Layer Parameters screen 211
Virtual Circuit Configuration Screen 248
    Screen Definitions 248
Virtual Point Codes 173
Virtual SP Screen 173
Virtual SPs 164

W

warranty period 86

X

Xmt Flags 139

Y

Y2000 RTC patch 82
Y2K Compliance Testing and Upgrades 81
Y2K Fix program procedure 85
Y2K Test and Fix program 82
Y2K testing procedure 83

Z

Zap 253

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