FLUKE®

660 Series

Frame Relay Installation Assistant

Reference Manual

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Introduction and Universal Setup Parameters

Introduction

This Reference Manual is a guide to the 660 Series Frame Relay Installation Assistant (hereafter, referred to as the "tester") setup parameters, tests, and results.

The best way to learn how to use the tester is to start with the *660 Series Frame Relay Installation Assistant Users Guide.* This Reference Manual will help you with specific test configurations and interpretations of test results.

A glossary of terms used in both manuals and on the tester is included Chapter 10.

How to Use This Manual

The tester's internal software senses which interface module is attached to the tester and causes the tester to operate in a mode dedicated to that type of WAN (Wide Area Network) link (T1, E1, DDS, or Serial). For that reason, the Reference Manual is organized into chapters devoted to a specific service type.

An overview of topics covered in this manual is as follows:

- **Chapter 1:** Setup parameters that are universal for all interface modules.
- **Chapter 2:** Results for tests that are universal for all interface modules.
- **Chapter 3:** T1 Line Test setup parameters and results.
- **Chapter 4:** E1 Line Test setup parameters and results.
- **Chapter 5:** DDS Line Test setup parameters and results.
- **Chapter 6:** Serial Line Test setup parameters and results.

- **Chapter 7:** Top PVC and CIR Advisor setup parameters and results.
- **Chapter 8**: How to use the 660 Link PC software to copy reports, operate the tester remotely via a modem, and upgrade the tester's software.
- **Chapter 9:** List of accessories and user-replaceable parts.
- **Chapter 10:** Glossary of terms and acronyms.

Universal Setup Parameters

The setup information in this chapter applies to the tester no matter what interface module you use.

The Line setup sub-menu changes depending on which interface module is installed, and is described in the following service-specific chapters.

Results you see from various tests depend on the settings of setup parameters. Good results are usually obtained by using the factory default settings, which maximize the auto-configuring capability of the tester.

When you need to customize the tester's configuration, you will find a variety of parameters that you can change.

Table 1-1 correlates setup menus to the Single Tests. Selections that you make in setup mode are nonvolatile (saved when the power is turned off).

To restore all parameter settings to factory defaults, in the System setup sub-menu scroll down to "Restore Factory Defaults, select "Overwrite Settings," then press ENTER.

Table 1-1. Test Interaction with Setup Menus

Single Test	Sub-Test	Setup Menu that Controls the Single Test	Parameters that Most Directly Affect the Sub-Test
Line Test	See Chapter 3, 4, 5, or 6, depending on the line type.		
Line BERT	LINE Test	See Chapter 3, 4, 5, or 6 depending on the line type.	
	Pattern Sync	Setup Line BERT	BERT Pattern
	Basic BERT		Basic BERT Pass/Fail Criteria
	G.821 BERT		G.821 BERT Pass/Fail Criteria
Frame Relay Test	LINE Test	See Chapter 3, 4, 5, or 6, depending on the line type.	
	Frame Relay Service	Setup Frame Relay	Emulation Mode, LMI (Local Management Interface) Type
	LMI Test		LMI Type
	DLCI Test		DLCI (Data Link Connection Identifier) List Pass/Fail Criteria
	Circuit Traffic		Congestion Pass/Fail Criteria
	Frame Errors		Frame Errs Pass/Fail Criteria
Frame Loss Test	LINE Test	See Chapter 3, 4, 5, or 6, depending on the line type.	
	Frame Relay Test	See Frame Relay Test (above).	
	Frame Loss	Setup Frame Loss	Frame Loss Pass/Fail Criteria

Table1-1. Test Interaction with Setup Menus (cont.)

Single Test	Sub-Test	Setup Menu that Controls the Single Test	Parameters that Most Directly Affect the Sub-Test
Frame Loss Test (cont.)	Data Loss	Setup Frame Loss	See Frame Relay Test (previous page).
	Transfer Delay		
PING Test	LINE Test	See Chapter 3, 4, 5, or 6, depending on the line type.	
	Frame Relay Test	See Frame Relay Test (previous page).	
	PING Responses	Setup PING	Various
	Round Trip Delay		PING Pass/Fail Criteria

System Setup Sub-Menu

The System setup sub-menu controls general operating parameters of the tester. Table 1-2 explains the meaning of each parameter setting in the System setup menu.

Table 1-2. Explanation of System Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Power Down Time-out	Enables or disables automatic shut-off of operating power after a specified interval.	**Enable**	Shuts the power off after a programmed interval of 10, 20, 30 minutes, but only if a test is not in progress.
		Disable	Allows the power to stay on continuously.
Backlight Time-out	Enables or disables automatic shut-off of the backlight after a specified interval.	**Disable**	Allows the backlight to stay on continuously.
		Enable	Shuts the backlight off after a programmed interval of 1, 5, or 10 minutes.
Audible Tone	Allows you to suppress the beeper.	**Enable**	Beeper sounds.
		Disable	Beeper never sounds.
Restore Factory Defaults	**Caution: restores the settings of all parameters in all menus to factory default values.**	**Overwrite Settings**	Press ENTER to restore all setup parameters to their factory defaults. The tester prompts you to change the setting or abort the command.

Table1-2. Explanation of System Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Serial Port Baud Rate	Controls the baud rate of the printer/PC RS-232 port.	**Autobaud**	Allows the tester to automatically adopt the baud rate of a serial device connected to the RS-232 port.
		1200, 2400, 4800, **9600**, 19200, 38400, 57600, 115200	Available baud rates (bps) for the RS-232 port. If you select one of these, Autobaud is disabled.
Flow Control	Controls the flow control method used by the printer/PC RS-232 port.	**Xon/Xoff**	Printer/PC serial port flow control uses Xon/Xoff nonprinting characters.
		Hardware	Printer/PC serial port flow control uses the DTR/RTS RS-232 signal pins.
		None	No flow control is used with the Printer/PC serial port.
Language	Selects a language for screen displays.	**English**	Selects the language for the display of messages.
Numeric Format	Chooses a comma or period for decimal.	**00.0** or 00,0	Numeric results that have a decimal point can substitute a comma for country localization.
Date	Interactive menu to set the real-time clock date.	Date in the format defined by the Date Format parameter	Press ENTER and follow the instructions on the display to enter today's date.
Date Format	Selects the date format for the real-time clock.	**mm/dd/yy**, dd/mm/yy, dd mm yy, dd-mm-yy, yy/dd/mm, yy-dd-mm	Format for the display of the date is defined by this setting.

Table1-2. Explanation of System Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Time	An interactive menu to set the real-time clock time.	Time in the format defined by the Time Format parameter	Press ENTER and follow the instructions on the display to enter the time.
Time Format	Selects 12- or 24-hour time format for the real-time clock.	**12:00:00 am**, 24:00:00	Format for the display of the time is defined by this setting.
Fault Log Memory Config	Controls what happens when the fault log memory gets full.	**Overwrite When Full**	The tester overwrites the fault log memory space starting with the oldest entries (FIFO).
		Stop When Full	The tester stops and prompts you with choices before clearing the fault log memory.
Enable Software Options	An interactive menu that accepts a password to activate a software option.	**Select Option**	Press ENTER and follow the instructions on the display to enable a software option.
Setup External Modem	An interactive menu to enter a modem initialization string.	**Initialize Modem**	This string is sent to a modem attached to the PC/printer RS-232 port.

Auto Test Setup Sub-Menu

Parameters in the Auto Test setup sub-control whether the

AutoPING test is included in Auto Test, and selects the Auto Test duration.

Table 1-3 explains the meaning of each parameter setting in the Auto Test setup menu.

Table 1-3. Explanation of Auto Test Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Emulation Mode	Sets the tester to emulate CPE-to-Network, Network-to-CPE, or Network-to-Network; or to automatically detect the appropriate emulation mode based on LMI.	**AutoDetect**	Automatically sets the tester to the LMI (Local Management Interface) emulation mode discovered by the tester.
		UNI CPE	Emulates CPE (Customer Premise Equipment) on a UNI (User-to-Network interface). The tester transmits local management interface (LMI) Status Enquiries to the edge switch.
		UNI Network	Emulates a NET (network connection) on a UNI (User-to-Network interface). The tester transmits LMI Status Messages in response to CPE Status Enquiries.
		Net to Net (NNI)	Emulates a NNI (Network-to-Network interface). The tester transmits both LMI Status Enquiries and Status Messages.

Table 1-3. Explanation of Auto Test Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
AutoPING Test	Includes or excludes the AutoPING test in Auto Test.	**Enable**	Includes AutoPING in Auto Test.
		Disable	Excludes AutoPING from Auto Test.
Auto Test Duration	Controls the duration of an Auto Test.	**Run Once to Completion**	Sets the tester to perform Auto Test once after you press TEST, then stop. The run time is one minute.
		Run Continuous	Sets the tester to continuously perform Auto Test after you press TEST. To terminate a continuous Auto Test, press EXIT.

Line Test Setup Sub-Menu

Parameters in the Line Test setup sub-menu are dependent on which interface module you are using. See the appropriate chapter for Line setup information, for example, Chapter 2 for T1.

Line BERT Test Setup Sub-Menu

Table 1-4 explains the meaning of each parameter setting in the Line BERT Test setup menu. The Line BERT Test sends and receives data patterns over the transmission circuit to test the physical layer.

Table 1-4. Explanation of Line BERT Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Line Cabling	Configures the tester's transmit and receive signal connections to act as DTE, DCE or Auto Detect cabling.	**Auto Detect**	Sets the tester to the appropriate line cabling configuration (DTE or DCE) based on which pins the received signal is detected.
		Data Terminal Equipment (DTE)	Configures cabling to act as DTE (Data Terminal Equipment).
		Data Circuit Terminating Equipment (DCE)	Configures cabling to act as DCE (Data Circuit Terminating Equipment).

Table1-4. Explanation of Line BERT Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
BERT Pattern	Selects the Line BERT test pattern.	**As Received**	Sets the tester to adopt the received BERT pattern
		QRSS	Quasi-Random Signal Source ($2^{20} - 1$). Limited to 14 consecutive zeros. Simulates live data. (Typical T1 test.)
		1 in 8	(1 : 7) Mask testing. B8ZS not required.
		3 in 24	15 consecutive zeros, only 3 ones in 24. For testing clock recovery.
		1111 (all ones)	Maximum heating in E1 and T1 repeaters. Use this when making dBm measurements.
		0000 (all zeros)	Forces B8ZS operation in T1, HDB3 in E1.
		1010 (alternating)	Alternating ones and zeros.
		1100 (doubles)	Double alternating ones and zeros.
		2**6-1	($2^6 - 1$) 63 type; simulates traditional low-speed 6-bit data (EBDC, IPARS, etc.).
		2**9-1	($2^9 - 1$) 511type; CCITT Recommendation O.152 and O.153. Simulates 9-bit data with 9 consecutive zeros max.

Table1-4. Explanation of Line BERT Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Line BERT pattern (cont.)	Selects the Line BERT test pattern.	2**11-1	(2^{11} – 1) 2047 type; CCITT Recommendation O.152 and O.153. Eleven consecutive zeros maximum.
		2**15-1	(2^{15} – 1) CCITT Recommendation O.151. Fourteen consecutive zeros maximum. (Typical E1 test)
		2**20-1	(2^{20} – 1) CCITT Recommendation O.151. Twenty consecutive zeros maximum. (Typical E1 test)
		20**23-1	(2^{23} – 1) CCITT Recommendation O.151. Twenty-three consecutive zeros maximum. (Typical E3 test)
		User	Interactive menu to enter a byte-oriented, 32-bit maximum, user-defined pattern
Line BERT Test Duration	Selects the duration of the Line BERT Test.	**Continuous**, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours, 24 hours, 48 hours, 7 days	If set to **Continuous**, press EXIT to terminate a Line BERT Test.

Table1-4. Explanation of Line BERT Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
BERT Block Size	Selects a block size for determining and displaying BERT block errors.	0 to 5000 bits, (**1000 bits**)	Number of bits that comprise one BERT block.
Basic BERT Pass/Fail Criteria	Selects results criteria for the Basic BERT sub-tests. There are two settings for each sub-test: 1. The failure threshold 2. The message to be displayed after a test element fails (Warning, Fail, or exclude the sub-test result display).	Pattern Sync Losses 0 to (2^{23}-1) (**0, Fail**)	Number of times that the BERT pattern synchronization was lost.
		Errored Seconds 0 to (2^{23}-1) (**0, Warning**)	Number of seconds with one or more errors.
		Bit Errors 0 to (2^{63}-1) (**0, Warning**)	Total number of bits in error over the test interval.

Table 1-4. Explanation of Line BERT Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Basic BERT Pass/Fail Criteria (cont.)	Selects results criteria for the Basic BERT sub-tests. There are two settings for each sub-test: 1. The failure threshold 2. The message to be displayed after the sub-test fails (Warning, Fail, or exclude the sub-test result).	Bit Error Rate 0.0 to 1.0 (**0, Warning**)	Number of bits in error divided by the total number of bits received during the test interval.
		BERT Block Errors 0 to (2^{63}-1) (**0, Warning**)	Number of BERT blocks that contain at least one error. BERT block size is determined by the setting of the BERT Block Size parameter (see previous entry in this table).

Table 1-4. Explanation of Line BERT Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
G.821 BERT Pass/Fail Criteria	Selects results criteria for the G.821 BERT sub-tests. There are two settings for each sub-test: 1. The failure threshold 2. The message to be displayed after the sub-test fails (Warning, Fail, or exclude the sub-test result).	Available Time Ratio 0.0 to 1.0 (**100%, Warning**)	Number of available seconds divided by the total number of seconds in the test interval.
		Unavailable Seconds 0.0 to 1.0 (**0, Warning**)	Number of seconds that the BERT pattern in undetectable by the receiver for 10 or more seconds.
		Errored Seconds 0.0 to 1.0 (**0%, Warning**)	Number of seconds that contain at least one error, up to a BER of 1.0E-003.
		Errored Seconds Ratio (**0 Warning**)	Number of errored seconds divided by the total number of seconds in the test interval.
		Severely Errored Seconds (**0, Warning**)	Seconds with a BER greater than 1.0E-003.
		Severely Errored Secs Ratio (**100%, Warning**)	Seconds with a BER greater than 1.0E-003 divided by the total number of seconds in the test interval.

Frame Relay Test Setup Sub-Menu

Table 1-5 explains the meaning of each parameter setting on the Frame Relay Test setup menu. The Frame Relay Test performs a Line Test, then tests various frame relay circuit parameters.

Table 1-5. Explanation of Frame Relay Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Emulation Mode	Sets the tester to emulate CPE-to-Network, Network-to-CPE, or Network-to-Network; or to automatically detect the appropriate emulation mode based on LMI.	**AutoDetect**	Automatically sets the tester to the LMI (Local Management Interface) emulation mode discovered by the tester.
		UNI CPE	Emulates CPE (customer premise equipment) on a UNI (User-to-Network interface). The tester transmits LMI Status Inquiries to the edge switch.
		UNI Network	Emulates a NET (network connection) on a User-to-Network interface. The tester transmits LMI Status Messages in response to CPE Status Inquiries.
		Net to Net (NNI)	Emulates a NNI (Network-to-Network interface). The tester transmits both LMI Status Inquiries and Status Messages.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
LMI Type	Selects one of four LMI standards or allows the tester to automatically detect this parameter.	**AutoDetect**	Sets the tester to adopt the LMI standard detected.
		T1.617 Annex D	Uses the LMI protocol specified in ANSI T1.617 Annex D.
		Q.933 Annex A	Uses the LMI protocol specified in ITU Q.933 Annex A.
		Original LMI	Uses the LMI protocol specified in the original gang-of-four LMI specification.
		ITU X.36	Uses the LMI protocol specified in ITU X.36.
Inject Errored Frame Type	Selects the type of error to introduce into a frame when you press the **Inject Error** softkey during a test.	Bad Frame Checksum (FCS)	The tester transmits a frame on DLCI (data link connection identifier) 0 with an incorrect Frame Check Sequence value in the frame trailer.
		Long Frame	The tester transmits a frame on DLCI 0 that is equal to the user configured long frame size (in bytes) plus one byte.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Inject Errored Frame Type (cont.)	Selects the type of error to introduce into a frame when you press the **Inject Error** softkey during a test	Short Frame	Tester transmits a frame on DLCI 0 that is two bytes long.
		Abort Frame	Tester transmits a frame on DLCI 0 that contains an abort sequence of zeros.
		Invalid DLCI	Tester transmits a frame on DLCI 1008. This is a reserved DLCI value.
Frame Relay Test Duration	Selects the duration of the Frame Relay Test.	**Continuous**, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours, 24 hours, 48 hours, 7 days	If set to Continuous, press EXIT to terminate a Frame Relay Test.
T391LIV Timer	Sets the LMI Link Integrity Verification Timer interval.	5 to 30 seconds, (**10 seconds**)	If set to Continuous, press EXIT to terminate a Frame Relay Test.
T392 Polling Verify Timer	Sets the LMI Link Integrity Polling Verification Timer interval.	5 to 30 seconds, (**11 seconds**)	The Link Integrity Verification interval specifies how often the CPE should transmit an LMI Status Enquiry request. The industry standard setting is once every 10 seconds.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
N391 Full Status Polling Timer	Sets the LMI Full Status Message Enquiry timer interval	1 to 225 seconds (**6 seconds**)	Full Status Message Enquiry interval specifies how often the CPE should transmit a Full Status Enquiry request. This value is multiplied by the T391 timer interval to arrive at the actual number of seconds. The industry standard setting is once every 60 seconds (N391 =6 x T391=10).
N392 Error Threshold	Sets the LMI link error threshold	1 to 10 errors (**3 errors**)	Error Threshold specifies the limit of LMI errors within the N393 events before the CPE or Network equipment declares the Link unavailable.
N393 Monitored Events Count	Sets the LMI Monitored Events Count	1 to 10 events (**4 events**)	Monitored Events count is the number of LIV Enquiries or Status messages received to determine a service affecting condition. The industry standard is three errors in four events to constitute an unavailable link.
Long Frame Size	Sets the maximum valid frame relay frame size	252 to 8193 bytes (**1600 bytes**)	Long Frame Size is used to determine if a received frame relay frame is valid or invalid. If the length exceeds this limit, the frame is considered invalid and is counted as a long frame.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Committed Time Interval (Tc)	Sets the Committed Time Interval.	1 to 60 seconds (**1 second**)	Committed Time Interval is period of time over which PVC traffic is measured in order to calculate the Committed Information Rate (CIR).
Ignore Full Status Invalid DLCI	Selects whether to record or ignore invalid DLCI values contained in the LMI Full Status Message.	**No**, Yes	If set to "Yes", all invalid DLCI values contained in the LMI Full Status Message are filtered out and do not update the DLCI list results. If set to "No", then any DLCI value contained in the LMI Full Status Message will be added to the DLCI list results.
NET Emulation DLCI List	Configures the contents of the LMI Full Status Message used in NET and NNI emulation modes.	PVC #1-8: **Enable**, Disable DLCI: **16-23** PVC Status: **Active** IP Address: **198.178.246.1**	When the tester is in NET or NNI emulation mode, it must respond to a LMI Full Status Enquiry request from CPE by returning a Full Status Message. This message contains a list of all active DLCIs and their status. These parameters allow you to specify up to eight different “phantom” PVCs to use in verifying CPE operation. IP addresses can also be assigned so that PING utilities in CPE can be used to verify proper configuration.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
LMI Pass/Fail Criteria	Selects results criteria for the LMI sub-tests. There are two settings for each sub-test: 1. The failure threshold 2. The message to be displayed after the sub-test fails (Warning, Fail, or exclude the sub-test result).	LMI Time-outs 0 to (2^{32}-1) (**0, Warning**)	Number of times that the N391 Full Status Polling Timer expired before receiving an LIV Status Enquiry or Status Message over the test interval.
		Status Message Errors 0 to (2^{32}-1) (**0, Warning**)	Number of status message errors encountered over the test interval.
		Status Enquiry Message Errors 0 to (2^{32}-1) (**0, Warning**)	Number of status enquiry message errors encountered over the test interval.
		LMI Link Down Seconds 0 to (2^{32}-1) (**0, Warning**)	Number of seconds the link is not established over the test interval.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
DLCI List Pass/Fail Criteria	Selects the message displayed after a DLCI List sub-test fails (Warning, Fail, or exclude the sub-test result).	No Active DLCIs Found: (**Warning**)	The LMI Full Status Message does not include any DLCIs that have their status set to “active”. This also will be set if there are no DLCIs reported in the Full Status Message at all.
		Non-active DLCIs Found: (**Warning**)	Within the LMI Full Status Message, there are one or more DLCIs reported with their status set to Inactive or Deleted.
		No Far End IP Address Found: (**Ignore**)	This is set when any DLCI within the LMI Full Status Message that has a status of “active” does not return a valid reply to a frame relay Inverse Arp request to obtain the nearest IP address on that DLCI.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Frame Errs Pass/Fail Criteria	Selects results criteria for the Frame Errors sub-tests. There are two settings: for each sub-test: 1. The failure threshold 2. The message to be displayed after the sub-test fails (Warning, Fail, or exclude the sub-test result).	Percent Invalid Frames 0% to 100% (0%, **Warning**)	Percentage of invalid frames divided by the total number of frames received over the test interval.

Table 1-5. Explanation of Frame Relay Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Congestion Pass/Fail Criteria	Selects results criteria for the Circuit Traffic sub-tests. There are two settings: for each sub-test: 1. The failure threshold 2. The message to be displayed after the sub-test fails (Warning, Fail, or exclude the sub-test result).	Percent FECN Frames 0% to 100% (**0% Warning**)	Percentage of the total number of frames received that have the FECN (Forward Explicit Congestion Notification) bit set to 1.
		Percent BECN Frames 0% to 100% (**0% Warning**)	Percentage of the total number of frames received that have the BECN (Backward Explicit Congestion Notification) bit set to 1.
		Percent DE Frames 0% to 100% (**0% Warning**)	Percentage of the total number of frames received that have the DE (Discard Enable) bit set to 1.

Frame Loss Test Setup Sub-Menu

Table 1-6 explains the meaning of each parameter setting on the Frame Loss Test setup menu. The Frame Loss Test verifies the performance of operational frame relay permanent virtual circuits (PVCs) using metrics defined in the Frame Relay Forum FRF.13 Service Level Definition implementation agreement standard.

Table 1-6. Explanation of Frame Loss Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Emulation Mode	Sets the tester to emulate CPE-to-Network, Network-to-CPE, or Network-to-Network; or to automatically detect the appropriate emulation mode based on LMI.	**Auto Detect**	Automatically sets the tester to the LMI (local management interface) emulation mode discovered by the tester.
		UNI CPE	Emulates CPE (customer premise equipment) on a UNI (User-to-Network interface). The tester transmits LMI Status Enquiries to the edge switch.
		UNI Network	Emulates a NET (Network connection) on a UNI. The tester transmits LMI Status Messages in response to CPE Status Enquiries.
		Net to Net (NNI)	Emulates a NNI (Network-to-Network Interface. The tester transmits both LMI Status Enquiries and Status Messages.

Table 1-6. Explanation of Frame Loss Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Transmit DLCI	Selects the active DLCI on which you want to transmit.	Press ENTER for menu.	Pressing the **Auto Detect** softkey instructs the tester always to set the transmit DLCI (Data Link Connection Identifier) to the first (lowest numbered) active DLCI discovered. In addition, you can select an active DLCI from the list by using the arrow keys and ENTER or press the **User Entered** softkey to manually enter the DLCI.
Receive DLCI	Selects the active DLCI on which you want to receive.	Press ENTER for menu.	Pressing the **Auto Detect** softkey instructs the tester to always set the receive DLCI to the first (lowest numbered) active DLCI discovered. In addition, you can select an active DLCI from the list by using the arrow keys and ENTER or press the **User Entered** softkey to manually enter the DLCI.
Utilization %	Sets the amount of generated traffic	1% to 100% (**10%**)	The Utilization % value sets the rate at which traffic is generated by the tester to a percentage of the entire circuit's bandwidth. For example, 10% of a full T1 line is 0.10 x 1536 kbps = 153.6 kbps.

Table 1-6. Explanation of Frame Loss Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Utilization kbps	An alternative way to set the amount of generated traffic	1 to 2048 kbps (default setting based on Utilization %)	Utilization kbps value is an alternative way to set the rate at which traffic is generated for those who want to enter an exact rate instead of a percentage of the available bandwidth. Changing this setting changes the Utilization % setting.
Maximum Frame Size	Sets the length of the test frames generated by the tester.	(**128 bytes**)	Maximum Frame Size specifies the fixed size of all generated frames if the Varying Frame Size setting is "No." If the Varying Frame Size setting is "Yes," Maximum Frame Size specifies the length limit of all generated frames. This number must be 32 bytes or longer for T1, Serial, and DDS interface modules. For E1 interface modules, this number must be 64 bytes or longer.
Target CIR	Sets a target CIR (Committed Information Rate) in kbps.	0 to 2048 kbps (**8 kbps**)	Target CIR (Committed Information Rate) is the throughput in kbps over the time constant period (Tc usually equals one second) for a particular PVC that is guaranteed by the service provider.
Frame Loss Test Duration	Selects the duration of the Frame Loss Test.	**Continuous**, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours, 24 hours, 48 hours, 7 days	If set to **Continuous**, press EXIT to terminate a Frame Loss Test.

Table 1-6. Explanation of Frame Loss Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Varying Frame Size	Specifies whether the generated frame lengths are fixed or varied.	**No**, Yes	When Varying Frame Size is set to "No," all generated frames will equal the Maximum Frame Size setting in length. When Varying Frame Size is set to "Yes," the frame length will vary during the tests between the Maximum Frame Size setting and the minimum allowable size for the interface module attached.
Transmit DE Test Frames	Allows or disallows transmission of frames with the DE (Discard Eligible) bit set to 1.	Yes, **No**	All generated frames will have the DE bit set to 1 in the frame relay header.
Transmit FECN Test Frames	Allows or disallows transmission of frames with the FECN (Forward Explicit Congestion Notification) bit set to 1.	Yes, **No**	All generated frames will have the FECN bit set to 1 in the frame relay header.

Table 1-6. Explanation of Frame Loss Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Transmit BECN Test Frames	Allows or disallows transmission of frames with the BECN (Backward Explicit Congestion Notification) bit set to 1.	Yes, **No**	All generated frames will have the BECN bit set to 1 in the frame relay header.
Payload Data	Defines the contents of the Frame Loss Test payload.	**PRBS**	Pseudo-random bit sequence
		Quick Brown Fox	THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789
		All Ones	11111111
		All Zeros	00000000
		Alternating 1s & 0s	10101010

Table 1-6. Explanation of Frame Loss Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Frame Loss Pass/Fail Criteria	Selects the results criteria for the Frame Loss sub-tests. There are two settings for each sub-test: 1. The pass/fail threshold 2. The message to be displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result).	Lost Frames 0 to (2^{32}-1) (**0, Warning**)	Number of frames offered minus the number of frames delivered.
		Frame Delivery Ratio 0% to 100% (**100.0%, Warning**)	Number of delivered frames divided by the total number of frames transmitted
		FDR Committed 0% to 100% (**99.9%, Fail**)	Number of delivered frames divided by the total number of frames transmitted that are within the user-specified CIR (Committed Information Rate). Varying Frame Size setting must be set to "No" to see this result.
		FDR Excess 0% to 100% (**100.0%, Warning**)	Number of delivered frames divided by the total number of frames transmitted that exceed the user specified Committed Information Rate (CIR). Varying Frame Size setting must be set to "No" to see this result.
		Data Delivery Ratio 0% to 100% (**100.0%, Warning**)	Number of delivered payload bytes of data divided by the total number of payload data bytes transmitted.

Table 1-6. Explanation of Frame Loss Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Frame Loss Pass/Fail Criteria (cont.)	Selects the results criteria for the Frame Loss sub-tests. There are two settings for each sub-test: 1. The pass/fail threshold 2. The message to be displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result).	DDR Committed 0% to 100% (**0.0%, Warning**)	Number of delivered payload bytes of data divided by the total number of payload data bytes transmitted that are within the user specified Committed Information Rate. Varying Frame Size setting must be set to "No" to see this result.
		DDR Excess 0% to 100% (**0.0%, Warning**)	Number of delivered payload bytes of data divided by the total number of payload data bytes transmitted that exceed the user specified Committed Information Rate. Varying Frame Size setting must be set to "No" to see this result.
		Average Transfer Delay (0 to 99999 milliseconds) (**150.0, Fail**)	Average elapsed time in milliseconds starting from the time a test frame is generated to the time it is received on the far end. If a single tester is transmitting to a loopback on the far end, Transfer Delay becomes the round trip delay time divided by two. If two testers are used, one at each end, the Transfer Delay becomes the one-way delay time from the transmitting tester to the received tester.

PING Test Setup Sub-Menu

Table 1-7 explains the meaning of each parameter setting in the PING Test setup menu. The PING Test verifies end-to-end IP connectivity.

Table 1-7. Explanation of PING Setup Parameters

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Emulation Mode	Sets the tester to emulate CPE-to-Network, Network-to-CPE, or Network-to-Network; or to automatically detect the appropriate emulation mode based on LMI.	**Auto Detect**	Automatically sets the tester to the LMI (Local Management Interface) emulation mode discovered by the tester.
		UNI CPE	Emulates CPE (customer premise equipment) on a UNI (User-to-Network interface). The tester transmits LMI Status Enquiries to the edge switch.
		UNI Network	Emulates a NET (Network connection) on a UNI. The tester transmits LMI Status Messages in response to CPE Status Enquiries.
		Net to Net (NNI)	Emulates a NNI (Network-to-Network Interface). The tester transmits both LMI Status Enquiries and Status Messages.

Table 1-7. Explanation of PING Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Target DLCI	Selects the active DLCI through which you want to test.	Press ENTER for menu	Pressing the **Auto Detect** softkey instructs the tester to always set the target DLCI (Data Link Connection Identifier) to the first (lowest numbered) active DLCI discovered. In addition, you can select an active DLCI from the list by using the arrow keys and ENTER or by pressing the **User Entered** softkey to manually enter the DLCI.
Source IP Address	Selects the IP address for the near end (your tester).	Press ENTER for menu	Press the arrow keys to select an IP address from the list shown, or press the **Add Item** softkey and follow the instructions on the display to enter the desired source IP address.
Target IP Address	Selects the IP address for the far end device.	Press ENTER for menu	Press the arrow keys to select an IP address from the list shown, or press the **Add Item** softkey and follow the instructions on the display to enter the desired target IP address.
PING Test Duration	Selects the duration of the PING Test.	**Continuous**, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours, 24 hours, 48 hours, 7 days	If set to **Continuous**, press EXIT to terminate a PING Test.

Table 1-7. Explanation of PING Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
PING Response Timeout	Sets the maximum wait time for a reply to a PING.	1 to 30 seconds, (**1 second**)	PING Response Timeout is the number of seconds that the tester waits to receive an ICMP echo reply to the transmitted ICMP echo request before the PING attempt is considered failed.
Length of Data	Sets the length of the transmitted PING frame payload in bytes.	34 to 1600 bytes (**512 bytes**)	The Length of Data specifies the payload length of the transmitted ICMP echo request frame. The selected Payload Data is repeated inside the user payload area in the frame until the Length of Data value is met.
Payload Data	Defines the contents of the PING Test payload.	PRBS	Pseudo-random bit sequence.
		Quick Brown Fox	THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789
		All Ones	11111111
		All Zeros	00000000
		Alternating 1s & 0s	10101010
Respond to PINGs	Enables or disables the tester to automatically reply to PINGs	**Yes**, No	If Respond to PINGs is set to “Yes,” the tester monitors all active DLCIs for ICMP echo request packets. If it receives one, it transmits an ICMP echo reply to the sender. If Respond to PINGs is set to “No," the tester ignores all ICMP echo request packets.

Table 1-7. Explanation of PING Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Respond to Inverse ARPs	Enables or disables the tester to reply automatically to frame relay Inverse ARP requests.	**Yes**, No	If Respond to Inverse ARPs is set to “Yes,” the tester monitors all active DLCIs for frame relay Inverse ARP request packets. If it receives one, it transmits an Inverse ARP reply packet to the sender. If Respond to Inverse ARPs is set to “No,” the tester ignores all frame relay Inverse ARP request packets.
Multiprotocol Encapsulation	Selects the type of encapsulation used by the CPE to transmit packets within frame relay frames.	**Auto Detect**	Instructs the tester to monitor received non-management frames and automatically determine the type of multiprotocol encapsulation configured at the CPE.
		RFC 1490 (2427)	Sets the tester to use the standard RFC 1490 (now RFC 2427) as the multiprotocol encapsulation type.
		Cisco (Ethertype)	Sets the tester to use Ethertype (default in many Cisco products) as the multiprotocol encapsulation type.
		No Encapsulation	Sets the tester to use no multiprotocol encapsulation at all.

Table 1-7. Explanation of PING Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
PING Pass/Fail Criteria	Selects the results criteria for the PING sub-tests. There are two settings for each sub-test: 1. The pass/fail threshold 2. The message to be displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result).	Packet Loss (0% to 100%) (**0%, Warning**)	Ratio of failed PING attempts (Packet Loss) to all PING attempts for the duration of the test
		Maximum Round Trip Delay 0 to 10000 ms (**300 ms, Warning**)	Maximum threshold for the time between when an ICMP echo request is transmitted and the corresponding ICMP echo reply is received.
		Maximum Round Trip Delay 0 to 10000 ms (**300 ms, Warning**)	Maximum threshold for the time between when an ICMP echo request is transmitted and the corresponding ICMP echo reply is received.

IP Performance Setup Parameters

Table 1-8 explains the meaning of each parameter setting in the IP Performance setup menu.

Table 1-8. Explanation of IP Performance Setup Parameters

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Payload Data	Selects the payload data for transmitted frames.	**PRBS**	Pseudo-random bit sequence
		Quick Brown Fox	THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG. 0123456789
		All Ones	11111111
		All Zeros	00000000
		Alternating 1s & 0s	10101010
Single Speed or Ramp Up	Selects constant speed or ramped speeds for IP performance testing.	**Single Speed**	Forces single speed for testing
		Ramp Up	Activates ramped speeds for testing
Ramp-up Speed 1 CIR Utilization	Sets the first of four ramp-up speeds to a percentage of the user-configured CIR.	0% to 10,000% (**50%**)	The Committed Information Rate (CIR) for the target DLCI is configured by the user in kbps. The Ramp-up Speed 1 setting specifies the generated traffic rate as a percentage of the CIR that will be used for the first of four sequential IP performance tests that comprise a complete IP performance Ramp-up test.

Table 1-8. Explanation of IP Performance Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Ramp-up Speed 2 CIR Utilization	Sets the second of four ramp-up speeds to a percentage of the user configured CIR.	0% to 10,000% (**75%**)	The CIR for the target DLCI is configured by the user in kbps. The Ramp-up Speed 2 setting specifies the generated traffic rate as a percentage of the CIR that will be used for the second of four sequential IP performance tests that comprise a complete IP performance Ramp-up test.
Ramp-up Speed 3 CIR Utilization	Sets the third of four ramp-up speeds to a percentage of the user configured CIR.	0% to 10,000% (**100%**)	The CIR for the target DLCI is configured by the user in kbps. The Ramp-up Speed 3 setting specifies the generated traffic rate as a percentage of the CIR that will be used for the third of four sequential IP performance tests that comprise a complete IP performance Ramp-up test.
Ramp-up Speed 4 CIR Utilization	Sets the fourth of four ramp-up speeds to a percentage of the user configured CIR.	0% to 10,000% (**125%**)	The CIR for the target DLCI is configured by the user in kbps. The Ramp-up Speed 4 setting specifies the generated traffic rate as a percentage of the CIR that will be used for the last of four sequential IP performance tests that comprise a complete IP performance Ramp-up test.

Table 1-8. Explanation of IP Performance Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Transmit DE Test Frames	Allows or disallows transmission of frames with the DE (Discard Eligible) bit set to 1.	Yes, **No**	All generated frames will have the DE bit set to 1 in the frame relay header.
Transmit FECN Test Frames	Allows or disallows transmission of frames with the FECN (Forward Explicit Congestion Notification) bit set to 1.	Yes, **No**	All generated frames will have the FECN bit set to 1 in the frame relay header.
Transmit BECN Test Frames	Allows or disallows transmission of frames with the BECN (Backward Explicit Congestion Notification) bit set to 1.	Yes, **No**	All generated frames will have the BECN bit set to 1 in the frame relay header.

Table 1-8. Explanation of IP Performance Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
IP Performance P/F Criteria	Selects the results criteria for the IP Performance sub-tests. There are two settings for each sub-test: 1. The pass/fail threshold 2. The message to be displayed after a test element fails (Warning, Fail, or exclude the sub-test result).	CIR Utilization 0.0 to 100.0%, (**100.0%, Warning**)	Sets the threshold for percentage of CIR utilized. If the throughput falls below the set threshold, the test can be set to Fail or Warn.
		Packet Delivery Ratio 0% to 100% (**100.0%, Warning**)	Number of delivered packets divided by the total number of frames transmitted.
		Data Delivery Ratio 0% to 100% (**100.0%, Warning**)	Number of delivered user data bytes divided by the total number of user data bytes transmitted.
		PVC Invalid Frames 0.0 to 100.0%, (**100.0%, Warning**)	Sets the failure threshold for percentage of invalid frames received on the Target DLCI.
		FECN Test Frames 0.0 to 100.0%, (**0.0%, Warning**)	Sets the failure threshold percentage of frames received on the Target DLCI with the FECN bit set to 1.
		BECN Test Frames 0.0 to 100.0%, (**0.0%, Warning**)	Sets the failure threshold for percentage of frames received on the Target DLCI with the BECN bit set to 1
		DE Test Frames 0.0 to 100.0%, (**0.0%, Warning**)	Sets the failure threshold for percentage of frames received on the Target DLCI with the DE bit set to 1.

Table 1-8. Explanation of IP Performance Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
IP Performance P/F Criteria (cont.)	Selects the results criteria for the IP Performance sub-tests. There are two settings for each sub-test: 1. The pass/fail threshold 2. The message to be displayed after a test element fails (Warning, Fail, or exclude the sub-test result).	Maximum Transfer Delay 0.0 to 10000.0 ms (**150.0 ms, Warning**)	Sets the failure threshold for transfer delay in milliseconds from when a test frame is generated to when it is received on the far end. If a single tester is transmitting to a loopback on the far end, the Transfer Delay becomes the round trip delay time divided by two. If two testers are used, one at each end, the Transfer Delay becomes the one-way delay time from the transmitting tester to the received tester.
		Maximum Delay Variation 0.0 to 10000.0 ms (**25.0 ms, Warning**)	Sets the failure threshold for variation in transfer delays. This is the difference in milliseconds between the minimum transfer delay time and the maximum transfer delay time.

Chapter 2
Universal Test Results

Introduction

This chapter describes results for the following tests, which are identical (universal) for all interface modules:

- Line BERT test
- Frame Relay test
- Frame Loss test
- PING test

Test results that are specific to the T1, E1, DDS, and Serial interface modules are provided in Chapters 3 through 6, respectively.

Line BERT Test Results

The Line BERT Test sends and receives data patterns over the transmission circuit to test the physical layer.

Table 2-1 explains the meaning of each Line BERT test result.

Table 2-1. Line BERT Test Results

Sub-Test	Function of Test	Result	Explanation of Result
LINE Test	See Table 3-2.		
Pattern Sync	Provides specific information about the BERT pattern and pattern losses during the test.	BERT Pattern Sync	Indicates whether the tester is synchronized with a BERT pattern.
		BERT Pattern Rx	BERT pattern detected.
		Pattern Losses	Number of BERT pattern loss events.
		Pattern Loss Secs	Number of seconds with a lost BERT pattern.
Basic BERT	Provides basic BERT test results.	Bit Count	Total number of bits received while the BERT pattern is in sync.
		Bit Errors	Total number of bit errors detected while the BERT pattern is in sync.
		Bit Error Rate	Number of errored bits divided by the total number of bits received.
		Error Free Secs	Number of seconds in which no bit errors occurred.

Table 2-1. Line BERT Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Basic BERT (cont.)	Provides basic BERT test results.	Errored Secs	Number of seconds in which one or more bit errors were detected.
		BERT Block Count	Number of BERT blocks (a user-specified number of contiguous bits) received.
		BERT Block Errs	Number of BERT blocks containing one or more bit errors.
G.821 BERT	Provides BERT test results that conform to the ITU-T Recommendation G.821.	Available Secs	Number of seconds in which the BER was less than 10^{-3} for 10 consecutive seconds or more.
		Unavailable Secs	Number of seconds in which the BER was greater than 10^{-3} for a period of 10 consecutive seconds or more.
		Errored Secs	Number of Available Secs containing one or more bit errors.
		Severe Errd Secs	Number of Available Secs containing a BER greater than 10^{-3}.

Frame Relay Test Results

The Frame Relay Test performs a Line Test, then tests various frame relay circuit parameters.

Table 2-2 explains the meaning of each Frame Relay test result.

Table 2-2. Frame Relay Test Results

Sub-Test	Function of Test	Result	Explanation of Result
LINE Test	See Chapters 3 through 6.		
Frame Relay Service	Provides results of Emulation Mode and LMI type Auto Detection. Also indicates whether basic connectivity exists to a Frame Relay device on the far end of the link.	Emulation Mode	Displays the auto-discovered or configured LMI emulation mode. The tester can maintain an LMI polling session on either a UNI or NNI and can act as either CPE or network equipment depending on how this configuration is set.
		LMI Type	Displays the auto discovered LMI type (for example, T1.617 Annex D) or the configured LMI type. This result indicates which Link Management Interface protocol type the tester used for emulation.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Frame Relay Service (cont.)	Provides results of Emulation Mode and LMI type Auto Detection. Also indicates whether basic connectivity exists to a Frame Relay device on the far end of the link.	Service Active	Displays one of the following results: • Yes Indicates that there is an active frame relay CPE or Network device on the far end of the physical circuit. • No Indicates that there is no active frame relay device on the far end of the physical circuit based on: ♦ Continuous absence of idle HDLC flags (7E hex) ♦ Presence of invalid frame relay frames only ♦ No valid frames received within a "T392" LMI timeout period.
		Inactive Secs	Number of seconds over the duration of the Frame Relay Test in which the tester deemed the Frame Service inactive.
		Idle Flags Ratio	Percent of a link's available bandwidth that is filled up with idle HDLC flags (7E hex).

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI.	Link Up Secs	Number of seconds in which N393 (Monitored Events Count) consecutive events occurred without LMI errors. This is an indication of an operational LMI link that is capable of bearing user traffic.
		Link Down Secs	Number of seconds in which N392 (Error Threshold) of the last N393 (Monitored Events Count) events are in error. This is a service-affecting condition that indicates that the LMI protocol has failed and that the link is not capable of bearing user traffic.
		CPE Enquiries Tx	Number of LMI Status Enquiry messages transmitted by the tester during terminated LMI emulation operation acting as CPE or NNI.
		NET Responses Rx	Number of LMI Status Response messages received by the tester during terminated LMI emulation operation acting as CPE or NNI.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test (cont.)	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI.	CPE Enquiries Rx	Number of LMI Status Enquiry messages received by the tester during terminated LMI emulation operation acting as Network or NNI.
		NET Responses Tx	Number of LMI Status Response messages received by the tester during terminated emulation operation acting as Network or NNI.
		CPE Enquiries	Number of LMI Status Enquiry messages detected by the tester during passive monitor operation.
		Net Responses	Number of LMI Status Response messages detected by the tester during passive monitor operation.
		Enquires Seq # Tx	Sequence number imbedded in the last LMI Status Enquiry message that was transmitted by the tester during the terminated LMI emulation operation acting as CPE or NNI.
		Response Seq # Tx	Sequence number imbedded in the last LMI Status Response message transmitted by the tester during terminated LMI emulation operation acting as Network or NNI.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test (cont.)	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI.	Enquiry Send Seq #	Send Sequence number imbedded in the last LMI Status Enquiry message that was detected by the tester during passive monitor operation.
		Response Send Seq #	Send Sequence number imbedded in the last LMI Status Response message detected by the tester during passive monitor operation.
		Last Received Seq #	Last Received Sequence number imbedded in either the last LMI Status Enquiry or the last Status Response message detected by the tester during passive monitor operation.
		Skipped Enq Send Seq	Total amount of Send Sequence numbers missing from the sequence of all LMI Status Enquiry messages detected by the tester either during passive monitor operation or during terminated LMI emulation operation acting as Network or NNI.
		Skipped Res Send Seq	Total amount of Send Sequence numbers missing from the sequence of all LMI Status Response messages detected by the tester either during passive monitor operation or during terminated LMI emulation operation acting as CPE or NNI.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test (cont.)	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI.	Skipped Last Recvd Seq	Total amount of Last Received Sequence numbers missing from the sequence of all LMI Status Enquiry or Status Response messages detected by the tester during passive monitor operation.
		Seconds Between Enq	Number of seconds that elapsed between receipt of Status Enquiry Messages.
		Seconds Between Res	Number of seconds that elapsed between the receipt of Status Response Messages.
		LMI Timeouts	For CPE emulation, total number of missing Status Response messages (non-receipt of a Status Response Message in T391 seconds). For NET emulation, total number of missing Status Enquiry messages (non-receipt of a Status Enquiry message in T392 seconds).

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test (cont.)	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI.	Enquiry Errors	Total number of Status Enquiry message errors. May indicate one or more of the following problems: • An information element is incorrectly formatted, is illegal, or missing. • The report type LIV IE does not appear after the locking shift IE. • The received sequence number is other than the expected sequence number.
		Response Errors	Total number of Status Response message errors. May Indicate one or more of the following problems: • An information element is incorrectly formatted, illegal, or missing. • The report type or LIV IE does not appear after the locking shift IE. • The received sequence number is other than the expected sequence number. • An unsolicited response message or illegal DLCI is listed in the full status response message.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test (cont.)	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI	Bad LMI Frame Format	A possible cause of an Enquiry Error or Response Error result. May indicate one or more of the following problems: • A valid LMI frame is missing an information element or contains an incorrectly formatted or illegal information element. • The report type LIV IE does not appear after the locking shift IE.
		Unsolicited Responses	An LMI Status Response message was received unexpectedly when no Status Enquiry message was sent (applicable for terminated CPE or NNI emulation operation).

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
LMI Test (cont.)	Provides status and detailed results regarding the Link Management Interface on a UNI or NNI.	Bad Async PVC Message	An Asynchronous LMI Status Response message was received, which had one or more of the following problems: • Contained an incorrectly formatted or illegal information element • Was missing an information element • Was missing the report type or LIV IE after the locking shift IE (applicable for terminated CPE or NNI emulation operation).
		Bad DLCI Full Stat Res	An LMI Full Status Response message was received that contained one or more DLCI values in a reserved range.
		Net Device Resets	Number of LMI frames that were transmitted from the network equipment to the CPE with a sequence number equal to 0.
		CPE Device Resets	Number of LMI frames that were transmitted from the CPE to the network equipment with a sequence number equal to 0.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
DLCI List	Provides the following: • DLCI address obtained from a received LMI Full Status Response message or detected in the header of all received frames • Current status of each DLCI • IP Address returned (if any) of the nearest neighboring device for each DLCI that has a status of “Active”. *Note* *IP Addresses can be obtained only when in terminated operation.*		
Circuit Traffic	Shows utilization and throughput percentages and congestion status for each detected DLCI.	Displays a table of traffic data listed by DLCI	The following information is provided: • DLCI column contains the DLCI number. • Util% column shows the current real-time percentage of utilization with respect to total available link bandwidth. • Thru column shows the current real-time data rate throughput in kbps. • Congested column shows whether any PVC traffic contained DE, BECN, or FECN frames.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Circuit Traffic Details	Shows traffic statistics filtered by the user-selected DLCI.	Utilization % (Current, Average, Maximum)	Link bandwidth utilization for the user-selected DLCI, calculated as: $\frac{\text{Total number of bits received in one second (non-flag octets * 8)}}{\text{Link access rate in bits per seconds}} \times 100\%$
		Throughput kbps (Current, Average, Maximum)	Link bandwidth throughput for the user-selected DLCI, calculated as: Total number of bits received in one second (non-flag octets * 8)
		Frame Rate f/sec (Current, Average, Maximum)	Number of Frame Relay frames (valid or invalid) received in one second for the user-selected DLCI.
		Frame Length bytes (Current, Average, Maximum)	Length of frames for the user-selected DLCI, calculated as: Total number of octets between HDLC idle flags, including the header and FCS octets

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Circuit Traffic Details (cont.)	Shows traffic statistics filtered by the user-selected DLCI	Total PVC Frames	Number of valid Frame Relay frames received that contain the user-selected DLCI address within the frame header.
		FECN Frames	Number of valid Frame Relay frames received that contain the user-selected DLCI address within the frame header and have the FECN bit set to 1.
		BECN Frames	Number of valid Frame Relay frames received that contain the user-selected DLCI address within the frame header and have the BECN bit set to 1.
		DE Frames	Number of valid Frame Relay frames received that contain the user-selected DLCI address within the frame header and have the DE bit set to 1.

Table 2-2. Frame Relay Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Frame Errors	Differentiates invalid frames by defect.	Count of each of six types of defective frames, plus the total number of valid and invalid frames	Per CCITT Q.921, frame error types are: • Bad FCS Frames (have a Frame Check Sequence error) • Short Frames (have fewer than 6 octets between flags of frames that contain sequence numbers and fewer than 5 octets between flags of frames that do not contain sequence numbers) • Long Frames (have an octet count exceeding the value specified by the user under Frame Relay Setup – Long Frame Size) • Misaligned Frames (do not have an integral number of octets) • Aborted Frames (contain an aborted sequence of 7 or more contiguous 1 bits) • Invalid DLCI Frames (contain a single octet address field or a DLCI that is not supported by the receiver).
		Total Invalid Frames	Number of frames deemed invalid (meet one of the Frame Error criteria) for the entire link (inclusive of all DLCIs).
		Total Valid Frames	Number of valid frames for the entire link (inclusive of all DLCIs).

Frame Loss Test Results

The Frame Loss test verifies the performance of operational frame relay permanent virtual circuits (PVCs) using metrics defined in the Frame Relay Forum FRF.13 Service Level Definition implementation agreement standard. Table 2-3 explains the meaning of each Frame Loss test result.

Table 2-3. Frame Loss Test Results

Sub-Test	Function of Test	Result	Explanation of Result
LINE Test	See Chapters 3 through 6.		
Frame Relay Test	Provides all of the status and detailed results described in the Frame Relay Single test. This information is provided so that a correlation can be made between Frame Loss Test failures and Frame Relay Test failures.	Frame Relay Service	Overall Pass, Warning or Fail summary result for the Frame Relay Service subtest. The overall result is based on user-configured Pass/Fail criteria, which are set under the Setup Frame Relay – Frame Service Pass/Fail Criteria.
		LMI Test	Overall Pass, Warning or Fail summary result for the Frame Relay LMI subtest. The overall result is based on user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – LMI Pass/Fail Criteria.
		DLCI List	Overall Pass, Warning or Fail summary result for the Frame Relay DLCI List subtest. The overall result is based on user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – DLCI List Pass/Fail Criteria.

Table 2-3. Frame Loss Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Frame Relay Test (cont.)	Provides all of the status and detailed results described in the Frame Relay Single test. This information is provided so that a correlation can be made between Frame Loss Test failures and Frame Relay Test failures.	Circuit Traffic	Overall Pass, Warning or Fail summary result for the Frame Relay Circuit Traffic subtest. The overall result is based on user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – Congestion Pass/Fail Criteria.
		Frame Errors	Overall Pass, Warning or Fail summary result for the Frame Relay Circuit Frame Errors subtest. The overall result is based on the user-configurable Pass/ Fail criteria, which are set under the Setup Frame Relay – Frame Errors Pass/Fail Criteria.
Frame Loss	Reports the network's effectiveness in transporting an offered frame relay load in one direction of a single virtual connection.	Frms Offered Tx	Total number of attempted frame transmissions, including those within the CIR and those in excess of the CIR.
		Frms Offered c Tx	Total number of attempted frame transmissions within the CIR.
		Frms Offered e Tx	Total number of attempted frame transmissions in excess of the CIR.
		Frms Delivered Rx	Total number of successfully delivered frames, including those within the CIR and those in excess of the CIR.

Table 2-3. Frame Loss Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Frame Loss (cont.)	Reports the network's effectiveness in transporting an offered frame relay load in one direction of a single virtual connection.	Frms Delivered c Rx	Total number of successfully delivered frames within the CIR.
		Frms Delivered e Rx	Total number of successfully delivered frames in excess of the CIR.
		Frames Lost	Number of lost frames. Calculated as the difference between the number of attempted frame transmissions and the number of successfully delivered frames.
		Frm Delivery Ratio	Number of successfully received frames. Calculated by dividing the number of attempted frame transmissions (regardless of the CIR setting).
		Frm Delivery Ratio c	Number of successfully received frames divided by the number of attempted frame transmissions within the CIR.
		Frm Delivery Ratio e	Frame Delivery Ratio for load in excess of the CIR. Calculated by dividing the number of successfully received frames by the number of attempted frame transmissions in excess of the CIR.

Table 2-3. Frame Loss Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Data Loss	Reports the network's effectiveness in transporting offered data (payload without address field or FCS) in one direction of a single virtual connection.	Data Offered Tx	Number of attempted data payload octet transmissions, including those within the CIR and those in excess of the CIR.
		Data Offered Tx c	Number of attempted data payload octet transmissions within the CIR.
		Data Offered Tx e	Number of attempted data payload octet transmissions in excess of the CIR.
		Data Delivered Rx	Number of successfully delivered data payload octets, including those within the CIR and those in excess of the CIR.
		Data Delivered c Rx	Total number of successfully delivered data payload octets within the CIR.
		Data Delivered e Rx	Total number of successfully delivered data payload octets in excess of the CIR.
		Data Lost	Difference between the number of attempted payload octets transmitted and the number of successfully delivered payload octets.

Table 2-3. Frame Loss Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Data Loss (cont.)	Reports the network's effectiveness in transporting offered data (payload without address field or FCS) in one direction of a single virtual connection.	Data Delivery Ratio	Number of successfully received payload octets divided by the number of attempted payload octet transmissions.
		Data Delivery Ratio c	Number of successfully received payload octets divided by the number of attempted payload octet transmissions within the CIR.
		Data Delivery Ratio e	Data Delivery Ratio for load in excess of the CIR. Calculated by dividing the number of successfully received payload octets by the number of attempted payload octet transmissions in excess of the CIR.
Transfer Delay	Reports the time required to transport frame relay data through the network in one direction.	Transfer Delay (Average, Maximum, Minimum)	Difference in milliseconds between the time a frame is transmitted and the time the same frame enters the destination. *Note* *If you are using a PVC loopback on the far end of the link to loop back the Frame Loss test frames, the Transfer Delay result becomes the round-trip delay divided by 2. If you are using two testers, the result is the one-way delay between a tester's transmitter and the far-end tester's receiver.*

PING Test Results

The PING test verifies end-to-end IP connectivity. Table 2-4 explains the meaning of each PING test result.

Table 2-4. PING Test Results

Sub-Test	Function of Test	Result	Explanation of Result
LINE Test	See Chapters 3 through 6.		
Frame Relay Test	Provides the same types of status and detailed results as those given for the Frame Relay Single test so that correlations can be made between PING test failures and Frame Relay test failures.	Frame Relay Service	Overall Pass, Warning or Fail summary result for the Frame Relay Service subtest. The overall result is based on user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – Frame Service Pass/Fail Criteria.
		LMI Test	Overall Pass, Warning or Fail summary result for the Frame Relay LMI subtest. The overall result is based on the user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – LMI Pass/Fail Criteria.
		DLCI List	Overall Pass, Warning or Fail summary result for the Frame Relay DLCI List subtest. The overall result is based on the user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – DLCI List Pass/Fail Criteria.

Table 2-4. PING Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Frame Relay Test (cont.)	Provides the same types of status and detailed results as those given for the Frame Relay Single test so that correlations can be made between PING test failures and Frame Relay test failures.	Circuit Traffic	Overall Pass, Warning or Fail summary result for the Frame Relay Circuit Traffic subtest. The overall result is based on the user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – Congestion Pass/Fail Criteria.
		Frame Errors	Overall Pass, Warning or Fail summary result for the Frame Relay Circuit Frame Errors subtest. The overall result is based on the user-configurable Pass/Fail criteria, which are set under the Setup Frame Relay – Frame Errors Pass/Fail Criteria.
PING Responses	Reports the received ICMP frame results subsequent to attempted ICMP PING transmissions.	PINGs Tx	Number of attempted frame transmissions that contained an ICMP PING echo request.
		PINGs Rx	Number of successful ICMP PING echo replies that were returned by the target host device.
		Packet Loss %	Percent difference between the number of attempted ICMP PING echo requests transmitted and the number of ICMP echo replies received.

Table 2-4. PING Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
PING Responses (cont.)	Reports the received ICMP frame results subsequent to attempted ICMP PING transmissions.	PINGs Rx	Number of successful ICMP PING echo replies that were returned by the target host device.
		Packet Loss %	Percent difference between the number of attempted ICMP PING echo requests transmitted and the number of ICMP echo replies received.
		Encapsulation	Multi-protocol encapsulation type detected by the tester in non-LMI type Frame Relay frames received.
		ICMP Err Message	Last ICMP error message returned to the tester as a result of a failed ICMP PING echo request.
		ICMP Err Cause	Cause of the failed ICMP PING echo request stated within the last ICMP error message that was returned to the tester.
Round Trip Delay	Reports the difference in time between a PING frame's transmission and receipt of a sub-sequent reply.	Round Trip Delay (Current, Average, Maximum)	Difference (in milliseconds) between the time an ICMP PING echo request frame was transmitted and the time the resulting ICMP PING echo reply was received.

Chapter 3
T1 Line Test Setup and Results

Introduction

The tester has three modes for testing T1 circuits:

- **Out of service, emulate CPE:**

  To verify performance of a new T1 frame relay link before you connect it to CPE (Customer Premise Equipment).

- **Out of service, emulate the frame relay network:**

  To verify that CPE, such as a FRAD (Frame Relay Access Device) or router, is operational and configured correctly before you connect it to a frame relay circuit.

- **In service, monitor non-intrusively:**

  To analyze the performance of a frame relay link while it is in service.

This chapter covers the Line Test portion of T1 testing. The information in this chapter assumes that the 660M-T1 Frame Relay Interface Module for T1 circuits is installed on the tester.

Setups and results for tests other than the Line Test are universal for all interface modules.

Refer to Chapter 2 for information about the universal tests.

Auto Test

Auto Test consists of three Single Tests that can be used to verify correct provisioning of a new frame relay circuit. Auto Test is an out-of-service test (intrusive) because it requires that you terminate the tester either to the frame relay network or to CPE.

The first two Single Tests are Line and Frame Relay, and the last is Auto PING, which can be optionally omitted. Auto Test verifies the physical layer (Line Test), connects to the frame relay network and verifies that the correct DLCIs have been provisioned (Frame Relay Test), and proves IP layer connectivity to the far-end devices (Auto PING Test).

Setting up for a T1 Auto Test

Before you run an Auto Test, you must configure the tester's universal setup parameters, as described in Chapter 1, and the T1 Line Test setup parameters as described here.

T1 Line Setup Sub-Menu

The T1 Line setup sub-menu lists the operating parameters of the tester that are specific to the T1 interface module. Table 3-1 explains the meaning of each line setup parameter and its settings. Bold type in the Parameter column indicates the factory default setting.

Note

We recommend that you set all parameters to "AutoDetect." In this mode, the tester automatically configures itself.

Table 3-1 explains the meaning of each parameter's setting. Bold type in the Setting column indicates the factory default setting.

Table 3-1. T1 Line Setup Parameters

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Line Cabling	Configures the tester to transmit and receive signals on certain pairs of wires to match standard RJ48C cabling conventions for DTE or DCE connections.	**AutoDetect**	Tester automatically selects DTE (Data Terminal Equipment) line cabling if a valid T1 signal is detected on pins 1 and 2. Tester automatically selects DCE (Data Circuit Terminating Equipment) line cabling if a valid T1 signal is detected on pins 4 and 5.
		DTE	Tester configures cabling as DTE (customer premise). The tester receives on pins 1 and 2 and transmits on pins 4 and 5.
		DCE	Tester configures cabling as DCE (central office). The tester receives on pins 4 and 5 and transmits on pins 1 and 2.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Framing Type	Configures the basic ANSI T1.403 carrier framing type.	**AutoDetect**	Automatically configures the tester to adopt the framing type detected on the T1 circuit under test.
		ESF	Extended Super Frame. Twenty-four frames, each containing 192 bits and a framing bit (the 193rd bit). Twenty-four fractional channels are available.
		SF	Super Frame (also known as D4 framing). Twelve frames, each containing 192 bits and a framing bit (the 193rd bit). Twenty-four fractional channels are available.
		Unframed	No framing bits are generated, and no fractional channels are defined. The full bandwidth of the T1 is available for user data.
LINE Coding	Configures the T1 line code type to maintain ones density.	**AutoDetect**	Automatically configures the tester to adopt the line coding method detected on the T1 line under test.
		B8ZS	Binary 8 Zero Substitution. A special code is substituted for 8 consecutive zeros.
		AMI	Alternate Mark Inversion. Zeros are represented by 01, and ones are alternately 11 or 00.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
T1 Fractional Channels	Displays an interactive menu that is used to select fractional T1 channels. Select all 24 channels for full T1.	Channels 1 – 24 (**On**, Off)	Press ENTER, then press one of the following: • **Auto Detect** to adopt the timeslots in use by the T1 line under test. • **Select All** for full T1. • Arrow keys, followed by ENTER to select channels for fractional T1. Press SAVE after you make your selection.
T1 Fractional Channel Bandwidth	Selects the bandwidth of the circuit, where N is the number of fractional timeslots (for full T1, N = 24).	**AutoDetect**	Automatically configures the tester to the channel bandwidth detected on the T1 circuit under test.
		N x 64 kbps	Selects a 64 Kbps fractional channel bandwidth.
		N x 56 kbps	Selects a 56 Kbps fractional channel bandwidth.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Transmit Clock Source (out of service only)	Controls whether the timing of tester's transmitted signal is controlled by a received T1 clock signal or by an internal oscillator.	**Recovered Line**	The received clock times the tester's transmitter. If no received clock is available, Internal Clock is automatically substituted. Recovered Line is automatically set if the Line Cabling parameter is configured as "DTE" (customer premise).
		Internal Clock	The tester's internal clock times the tester's transmitter. Internal Clock is automatically set if the Line Cabling parameter is configured as "DCE" (central office). This can then be changed (overridden) by the user to recovered clock, if desired.
Line Build Out (out of service only)	Attenuates the tester's transmitted signal level by the selected level to simulate a length of transmission line.	**0 dB**, -7.5 dB, -15 dB, -22.5 dB	0 dB is no attenuation; the other available settings are as shown in the **Setting** column.
T1 Line Test Duration	Selects the duration of the LINE Test.	**Continuous**, 1 Minute, 5 Minutes, 15 Minutes, 30 Minutes, 1 Hour, 12 Hours, 24 Hours, 48 Hours, 7 Days	If set to **Continuous**, press EXIT to terminate a T1 LINE Test.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Data Sense	Configures the tester for normal or inverted data sense.	**Normal**	A mark represents a binary 1.
		Inverted	A mark represents a binary 0.
Loop Code to Monitor	Selects the type of loop code to monitor. The tester responds to the selected loop code depending on the setting of the **Respond to Loopback Codes** parameter (next in table). [ESF] means the setting is for Extended Super Frame only. [SF] means the setting is for Super Frame only.	V.54 Fractional T1	127-bit pseudo random Loop Up 127-bit pseudo random Loop Down
		CSU Line [ESF]	11111111 01110000 Loop Up 11111111 00011100 Loop Down
		CSU Payload [ESF]	11111111 00101000 Loop Up 11111111 01001100 Loop Down
		Network Interface [ESF]	11111111 01001000 Loop Up 11111111 00100100 Loop Down
		CSU Loopback [SF]	100000 Loop Up 100 Loop Down
		Facility 1 [SF] (sometimes referred to as a 4-bit NIU loop code)	1100 Loop Up 1110 Loop Down

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Loop Code to Monitor (cont.)	Selects the type of loop code to monitor. The tester responds to the selected loop code depending on the setting of the **Respond to Loopback Codes** parameter (next in table). [ESF] means the setting is for Extended Super Frame only. [SF] means the setting is for Super Frame only.	Facility 2 [SF] (sometimes referred to as a 5-bit NIU loop code)	11000 Loop Up 11100 Loop Down
		Facility 3 [SF]	100000 Loop Up 100 Loop Down
Respond to Loopback Codes	Sets the tester to respond to or ignore received loopback codes.	**Yes**	Responds to loopback codes.
		No	Ignores loopback codes.
Generate Yellow (RAI) on LOF	Controls generation of a Yellow Alarm (Remote Alarm Indication) on LOF (Loss of Frame).	**Yes**	Generates a Yellow alarm when an LOF (Loss of Frame) condition exists.
		No	Does not generate a Yellow alarm when an LOF condition exists.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Inject Line Error Type	Selects the type of line error injected into transmitted data when the **Inject Error** softkey is pressed.	**BPV Error**	Into the bit stream, injects a single BPV that is not corrected by the B8ZS line coding.
		Framing Bit Error	Corrupts the frame bit pattern (SF only).
		CRC-6 Error	Corrupts the CRC-6 code word (ESF only).
		Red Alarm (LOF)	Loss Of Frame alarm. Sets the tester's T1 framing type to "unframed".
		Blue Alarm (AIS)	Alarm indication Signal. Transmits an unframed all ones signal.
		Yellow Alarm (RAI)	Remote Alarm Indication. Continuously transmits SF or ESF RAI pattern.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Use Japanese Alarm Format	Uses fault management codes consistent with Japanese standards.	**No**	Uses ANSI/AT&T/ITU CRC6 calculation. A Yellow Alarm is declared in D4 framing when bit 2 of 256 consecutive channels is set to 0 for at least 254 occurrences.
		Yes	Uses Japanese standard JT-G704 CRC6 calculation. Japanese D4 framing Yellow Alarm is declared when the 12th framing bit is set to 1 for two consecutive occurrences.
T1 Idle Channel Code	Specifies the byte pattern that is transmitted by the tester within idle fractional channels.	00 to FF Hexadecimal *Note* *The default is 17 Hex (0001 0111 binary).*	A user-configurable pattern of eight bits that is used to fill fractional channel time slots unused for data transmission. This helps far-end T1 equipment discern which time slots are not used.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Perform Pass/Fail Criteria	Selects results criteria for the T1 Line sub-tests. Each sub-test has two settings: • The failure threshold • The message to be displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result display).	Code Violation Line 0 to (2^{63}-1) (**0, Warning**)	Occurrences of BPVs or EXZ errors (excessive zeros).
		Code Violation Path 0 to (2^{23}-1) (**0, Warning**)	Count of frame synchronization bit errors (FE) for SF framing format or a count of CRC-6 errors in the ESF framing format.
		Errored Seconds Line 0 to (2^{33}-1) (**0, Warning**)	Count of one-second intervals with one or more BPVs, one or more EXZs, or one or more LOS defects.
		Errored Seconds Path 0 to (2^{33}-1) (**0, Warning**)	A Path Errored Second for ESF framing is a one-second interval containing any of the following: CRC-6 (Cyclic-Redundancy Check), CS (Convergence Sublayer), SEF (Severely Errored Frame), and AIS (Alarm Indication Signal). A Path Errored Second for SF framing is a one-second interval that contains any of the following: FE, CS, SEF, and AIS.
		Severely Errored Secs Line, 0 to (2^{63}-1) (**0, Warning**)	Count of one-second intervals with 1544 or more BPVs plus EXZs, or one or more LOS defects.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Perform Pass/Fail Criteria (cont.)	Selects results criteria for the T1 Line sub-tests Each sub-test has two settings: • The failure threshold • The message to be displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result display).	Severely Errored Secs Path, 0 to (2^{63}-1) (**0, Warning**)	For ESF framing, a one-second interval with 320 or more CRC-6 errors or with one or more SEF or AIS defects. For SF framing, a one-second interval with eight or more FE errors (both Ft and Fs bits are measured).
		Unavailable Seconds Path, 0 to (2^{23}-1) (**0, Warning**)	A count of one-second intervals for which the DS1 path is unavailable. The DS1 path becomes unavailable at the onset of 10 contiguous SESs. The 10 SESs are included in unavailable time. Once unavailable, the DS1 path becomes available at the onset of 10 contiguous seconds with no SESs.
		SEF/AIS Seconds Path, 0 to (2^{33-}1) (**0, Warning**)	A count of one-second intervals containing one or more SEF defects or one or more AIS defects.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
T1 Alarms Pass/Fail Criteria	Specifies what the tester does after it detects the presence of an alarm during a T1 Line test. The specified failed test message appears after an alarm is detected. If "Ignored" is selected, the tester ignores the alarm.	Loss of Signal (LOS) Failure (Warning, **Fail**, Ignore)	Criteria used to declare an LOS failure: when no pulses are received for 3.0 seconds. Criteria used to clear an LOS failure condition: no loss of signal defects are detected for 20 or fewer contiguous seconds.
		Loss of Frame (LOF) Failure (Warning, **Fail**, Ignore)	Criteria used to declare an LOF failure: when a loss of frame condition persists for 3.0 seconds (except when an AIS defect is present). Criteria used to clear an LOF failure: when no loss of frame defects are detected for 20 or fewer contiguous seconds or when an AIS failure is declared.

Table 3-1. T1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
T1 Alarms Pass/Fail Criteria (cont.)	Specifies what the tester does after it detects the presence of an alarm during a T1 Line test. The specified failed test message appears after an alarm is detected. If "Ignored" is selected, the tester ignores the alarm.	RAI (Yellow) Alarm (Warning, **Fail**, Ignore)	Criteria used to declare an RAI failure: immediately upon detection of an RAI signal from the far end. Criteria used to clear an RAI failure: immediately upon detection of no RAI signal from the far end.
		AIS (Blue) Alarm (Warning, **Fail**, Ignore)	Criteria used to declare an AIS failure: when AIS defects (all ones signal) are detected for 3.0 seconds. Criteria used to clear an AIS failure: when no AIS defects are detected for 20 or fewer contiguous seconds.
Loop Code Pass/Fail Criteria	Selects the message displayed after the Loop Codes sub-test fails	Receive Loop Code (**Warning**, Fail, Ignore)	The specified failed test message appears after a loop code is received that matches the loop code type that is specified under Loop Code to Monitor.

T1 Line Test Results

Table 3-2 provides information about the results displayed for the T1 Line Test. For descriptions of results for all other tests, see Chapter 2.

Table 3-2. T1 Line Test Results

Sub-Test	Function of Test	Result	Explanation of Result
T1 Signal	Provides information about various T1 signal parameters.	Receive Pair	Shows that the received signal is wired as DTE (customer premise) or DCE (central office) equipment.
		LINE Coding	T1 line code type to maintain ones density: • B8ZS Binary 8 Zero Substitution. A special code is substituted for 8 consecutive zeros. • AMI Alternate Mark Inversion. Zeros are represented by 01, and ones are alternately 11 or 00.

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Signal (cont.)	Provides information about various T1 signal parameters.	T1 Framing	The ANSI T1.403 carrier framing type: • ESF (Extended Super Frame) Twenty-four frames, each containing 192 bits and a framing bit (the 193rd bit). Twenty-four fractional channels are available. • SF (Super Frame) (Also known as D4 framing). Twelve frames, each containing 192 bits and a framing bit (the 193rd bit). Twenty-four fractional channels are available. • Unframed No framing bits are generated, and no fractional channels are defined. The full bandwidth of the T1 is available for user data.

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Signal (cont.)	Provides information about various T1 signal parameters.	Signal Level	Signal level in dB. Refers to the optimal signal level of 0 dB at the transmit pins of the T1 framing chip.
		Far End Loopbk	Tester is receiving its own transmitted signal. This means that there is a physical connection between the transmit wire pair and the receive wire pair somewhere along the T1 circuit.
		Fractional Channels (Press the F4 function key to view.)	The T1 fractional channels either configured by the user or discovered by the tester for carrying data traffic: • Total Channels Selected/Discovered Number of fractional channels configured by the user or discovered by the tester. • Channel Bandwidth Configured/Discovered Fractional channel bandwidth (56 kbps or 64 kbps) configured by the user or discovered by the tester. • Combined Data Rate The number of fractional channels times the channel bandwidth.

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Errors	Provides a count of various defects detected.	Bipolar Violations	Count of BPVs. A BPV is the occurrence of a pulse with the same polarity as the previous pulse.
		Excess Zeros	Count of EXZs. For AMI line coding, the detection of more than 15 continuous 0 bits. For B8ZS line coding, the detection of more than seven continuous 0 bits.
		CRC-6	Count of Corrupted CRC-6 code words. The calculated CRC-6 code word does not equal the received CRC-6 code word. *Note* *Applies to ESF Framing only.*
		Frame Bit Errors	Count of framing bit errors. A frame bit in the received frame-bit pattern does not match the expected polarity. *Note* *Applies to ESF Framing only.*

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Errors (cont.)	Provides a count of various defects detected.	Loss of Signal Sec	Count of one-second intervals in which one or more LOS (Loss of Signal) defects were detected. Criteria used to declare an LOS defect: when 175 +/- 75 contiguous pulse positions with no pulses of either positive or negative polarity at a DS1 Line interface are detected. Criteria used to clear an LOS defect: when an average pulse density of 12.5 % is detected over a period of 175 +/- 75 contiguous pulse positions following the receipt of a pulse.
		Loss of Frame Sec	Count of one-second intervals in which one or more OOF (Out of Frame) defects were detected. This is a loss of frame synchronization to the incoming T1/FT1 signal. An LOF defect is the occurrence of a particular density of framing errors.
		AIS Sec	Count of one-second intervals in which one or more Alarm Indication Signal defects were detected. Criteria used to declare an AIS defect: upon detection of an unframed signal with a 1's density of at least 99.9 % (all ones).

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Alarms	Provides a count of seconds with one or more occurrences of various alarms.	LOS Failure	Criteria used to declare Loss of Signal: 2.5 s +/– 0.5 s of persistent LOS defects. Criteria used to clear Loss of Signal: 20 or fewer contiguous seconds with no LOS defects. • LOS Failure Seconds Count of one-second intervals in which an LOS failure is declared. • LOS Failure Count Number of instances in which an LOS failure was declared. • LOS Failure State Current state of the LOS failure alarm (active or inactive).

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Alarms (cont.)	Provides a count of seconds with one or more occurrences of various alarms.	LOF Failure	Criteria used to declare Loss of Frame: 2.5 s +/– 0.5 s of persistent LOF (Loss of Frame) defects (except when an AIS defect is present). Criteria used to clear Loss of Frame: when no LOF defects are detected for 20 or fewer contiguous seconds or when an AIS failure is declared. • LOF Failure Seconds Count of one-second intervals in which an LOF failure was declared. • LOF Failure Count Number of instances that an LOF failure was declared. • LOF Failure State Current state of the LOF failure alarm (active or inactive).

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Alarms (cont.)	Provides a count of seconds with one or more occurrences of various alarms.	RAI Yellow Alarm	Criteria used to declare an RAI failure: immediately upon detection of an RAI signal from the far end. A far-end T1 termination device will transmit an RAI if it no longer detects an incoming T1 carrier signal or if it cannot synchronize to the framing format. Criteria used to clear an RAI failure: no detection of RAI signal from the far end. • RAI Yellow Alarm Seconds Count of one-second intervals in which an RAI signal is detected. • RAI Yellow Alarm Count Number of instances that an RAI signal has been detected. • RAI Yellow Alarm State Current state of the RAI alarm (active or inactive).

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Alarms (cont.)	Provides a count of seconds with one or more occurrences of various alarms.	AIS Blue Alarm	Criteria used to declare an AIS failure: 2.5 s +/– 0.5 s of persistent AIS defects (unframed all ones signal). Criteria used to clear an AIS failure: 20 or fewer contiguous seconds with no AIS defects. • AIS Blue Alarm Seconds Count of one-second intervals in which an AIS failure was detected. • AIS Blue Alarm Count Number of instances that an AIS failure was declared. • AIS Blue Alarm State The current state of the AIS alarm (active or inactive).

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Performance Details	Provides a count of occurrences of various path or line errors in accordance with ANSI T1.231.	Code Violation Line	Count of BPV or EXZ errors.
		Code Violation Path	Count of seconds with frame synchronization bit errors (FE) for SF framing format or a count of seconds with CRC-6 errors in the ESF framing format.
		Errored Sec Line	Count of seconds with one or more BPVs, one or more EXZs, or one or more LOS defects.
		Errored Sec Path	Count of path errored seconds. Path errored Seconds for ESF framing are one-second intervals containing any of the following: CRC-6 (Cyclic-Redundancy Check), CS (Convergence Sublayer), SEF (Severely Errored Frame), and AIS. Path errored seconds for SF framing are seconds containing any of the following: FE, CS, SEF, and AIS.

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
T1 Performance Details (cont.)	Provides a count of occurrences of various path or line errors in accordance with ANSI T1.231	Severe Err Sec Line	Count of seconds with 1544 or more BPVs plus EXZs, or one or more LOS defects.
		Severe Err Sec Path	Count of severely errored path seconds. For ESF framing, the number of seconds with 320 or more CRC-6 errors or with one or more SEF and AIS defects. For SF framing, the number of seconds with eight or more FE errors (both Ft and Fs bits are measured).
		Unavail Sec Path	Count of seconds for which the DS1 path is unavailable. The DS1 path becomes unavailable at the onset of 10 contiguous SESs. The 10 SESs are included in unavailable time. Once unavailable, the DS1 path becomes available at the onset of 10 contiguous seconds with no SESs.
		SEF/AIS Sec Path	A count of seconds containing one or more Severely Errored Frame defects or one or more Alarm Indication Signal defects.

Table 3-2. T1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Loop Codes	Provides details for loop code detection	Loop Code	Count of loop codes detected that match the loop code selected in the setup menu under “Loop Code to Monitor” including: • Fractional T1 • CSU Line [ESF] • CSU Payload [ESF] • Smart Jack [ESF] • CSU Loopback [SF] • Facility1 [SF] • Facility 2 [SF] • Facility 3 [SF]

Chapter 4
E1 Line Test Setup and Results

Introduction

The tester has three modes for testing E1 circuits:

- **Out of service, emulate CPE:**

  To verify performance of a new E1 frame relay link before you connect it to CPE (Customer Premise Equipment).

- **Out of service, emulate the frame relay network:**

  To verify that CPE, such as a FRAD (Frame Relay Access Device) or router, is configured correctly before you connect it to a frame relay circuit.

- **In service, monitor non-intrusively:**

  To analyze the performance of a frame relay link while it is in service.

This chapter covers the Line Test portion of E1 testing.

The information in this chapter assumes that the 660M-E1 Frame Relay Interface Module for E1 circuits is installed on the tester.

Setups and results for tests other than the Line Test are universal for all interface modules.

Refer to Chapter 2 for information about the universal tests.

Auto Test

Auto Test consists of three Single Tests that can be used to verify correct provisioning of a new frame relay circuit.

Auto Test is an out-of-service test (intrusive) because it requires that you terminate the tester to either the frame relay network or to CPE. The first two Single Tests are Line and Frame Relay, and the last is Auto PING, which can be optionally omitted.

Auto Test verifies the physical layer (Line Test), connects to the frame relay network and verifies that the correct DLCIs have been provisioned (Frame Relay Test), and proves IP layer connectivity to the far-end devices (Auto PING Test).

Setting up for E1 Auto Test

Before you run an Auto Test, you must configure the tester's universal setup parameters as described in Chapter 1 and the E1 Line Test setup parameters as described here.

E1 Line Setup Sub-Menu

The E1 Line setup sub-menu controls operating parameters of the tester specific to the E1 interface module.

Note

We recommend that you set all parameters to "AutoDetect." In this mode, the tester automatically configures itself.

Table 4-1 explains the meaning of each E1 Line setup parameter setting.

Bold type in the Setting column indicates the factory default setting.

Table 4-1. E1 Line Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Line Cabling	Configures the tester to transmit and receive signals on certain pairs of wires to match standard RJ48C cabling conventions for DTE or DCE connections.	**AutoDetect**	Tester automatically selects DTE (Data Terminal Equipment) line cabling if a valid E1 signal is detected on pins 1 and 2. Tester automatically selects DCE (Data Circuit Terminating Equipment) line cabling if a valid E1 signal is detected on pins 4 and 5.
		DTE	Tester configures line cabling as DTE (customer premise). The tester receives on pins 1 and 2 and transmits on pins 4 and 5.
		DCE	Tester configures line cabling as DCE (central office). The tester receives on pins 4 and 5 and transmits on pins 1 and 2.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
E1 Framing Type	Configures the basic E1 G.704 carrier framing type.	**AutoDetect**	Automatically configures the tester to adopt the framing type detected on the E1 circuit under test.
		PCM31-FAS Only	Timeslot 0 is dedicated to the FAS (Frame Alignment Signal) and the NFAS (Non-frame Framing Alignment Signal). Timeslots 1 through 31 are available for user data.
		PCM30-CAS	Timeslot 0 is dedicated to the FAS and the NFAS. Timeslot 16 is dedicated to the MFAS (Multiframe Alignment Signal) and CAS (Channel Associated Signaling). Timeslots 1through 15 and 17 through 31 are available for user data.
		PCM31c-CRC4	Timeslot 0 is dedicated to the FAS, the NFAS, and a CRC4 checksum. Timeslots 1 through 31 are available for user data.
		PCM30c-CRC4 & CAS	Timeslot 0 is dedicated to the FAS and the NFAS and a CRC4 (Cyclic Redundancy Check) checksum. Timeslot 16 is dedicated to the MFAS and CAS. Timeslots 1 through 15 and 17 through 31 are available for user data.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
E1 Framing Type (cont.)	Configures the basic E1 G.704 carrier framing type.	Unframed	No framing bits are generated, and no fractional timeslots are defined. The full bandwidth of the E1 is available for user data.
E1 Fractional Timeslots	Displays interactive menu that is used to select fractional E1 timeslots. Select all timeslots for full E1.	Timeslots 1 to 31 (**On**, Off) *Note* *When E1 framing types PCM30c-CRC4 & CAS PCM31-FAS Only are selected, timeslot 16 is not available for user data.*	Press ENTER, then one of the following: • **Auto Detect** softkey to adopt the timeslots in use by the E1 line under test. • **Select All** softkey for full E1. • Arrow keys followed by ENTER to select timeslots for fractional E1. Press SAVE after you make your selection.
E1 Line Test Duration	Specifies the duration of the Line Test.	**Continuous**, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours, 24 hours, 48 hours, 7 days	If set to **Continuous**, press EXIT to terminate an E1 Line Test.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
E1 Transmit Clock Source (out of service only)	Controls whether the timing of the tester's transmitted signal is controlled by a received E1 clock signal or by an internal oscillator.	**Recovered Line**	Received clock times the tester's transmitter. If no received clock is available, Internal Clock is automatically substituted. Recovered Line is automatically set if the Line Cabling parameter is configured as "DTE."
		Internal Clock	Tester's internal clock times the tester's transmitter. The Internal Clock is automatically set if the Line Cabling parameter is configured as "DCE."
E1 Line Build Out (out of service only)	Adds series resistance to the transmitted signal output to simulate a length of transmission line.	+5.0 dB, +2.0 dB, **0.0 dB**, -2.0 dB, -3.5 dB, -7.0 dB	0.0 dB provides the normal signal amplitude (no attenuation or gain). *Note* *This parameter must be set to 0.0 dB for the tester to meet G.703 specifications.*

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
E1 inject line error type	Specifies the type of line error injected into transmitted data when the **Inject Error** softkey is pressed.	**LCV Error**	Injects a single Line Code Violation (LCV) into the bit stream that is not corrected by the HDB3 line coding.
		Framing Bit Error	Corrupts the FAS bit pattern.
		CRC-4 Error	Corrupts the CRC-4 codeword (PCM31c-CRC4 or PCM30c-CRC4 and CAS framing types only).
		FEBE (E-bit)	Sets the Error Indication bit in Timeslot 0 of an E1 frame.
E1 Line Coding	Configures the E1 line code type to maintain ones density. HDB3 line coding is required by G.703.	**Auto Detect**	Automatically configures the tester to adopt B8ZS or AMI line coding as detected on the E1 line under test.
		HDB3	High Density Bipolar 3. A special code is substituted for four consecutive zeros containing an intentional bipolar violation. This is the typical E1 line coding used to ensure ones density.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
E1 Line Coding (cont.)	Configures the E1 line code type to maintain ones density. HDB3 line coding is required by G.703.	AMI	Alternate Mark Inversion. Zeros are represented with no pulse, and ones (marks) are represented with alternating positive and negative pulses. This type of coding is not allowed according to the ITU-T G.703 specification. *Note* *Only HDB3 should be used for E1 transmission.*
Data Sense	Configures the tester for normal or inverted data sense.	**Normal**	A mark represents a binary 1.
		Inverted	A mark represents a binary 0.
E1 Generate Yellow (RAI) on LOF	Sets the tester to generate a Yellow Alarm (Remote Alarm Indication) on LOF (Loss of Frame).	**Yes**	Generates a Yellow alarm when an LOF condition exists.
		No	Does not generate a Yellow alarm when an LOF condition exists.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
E1 send alarm type	Specifies the type of UNI fault management alarm to generate when the **Send Alarm** softkey is pressed.	**Loss of Signal (LOS)**	Loss Of Signal alarm. Turns off the transmitter.
		Loss of Frame (LOF)	Loss Of Frame alarm. Sets the tester's E1 framing type to "unframed."
		Remote Alarm Indication (RAI)	Sets the Alarm Remote Alarm Bit in the NFAS of timeslot 0 of an E1 frame.
		Multiframe RAI (MRAI)	Sets the Multiframe Remote Alarm Bit in the MFAS of timeslot 16 of an E1 frame.
		Alarm Indication Signal (AIS)	Transmits unframed all ones signal.
		Timeslot 16 AIS (T16AIS)	Transmits all ones within timeslot 16 of an E1 frame.
		Timeslot 16 All 0s (T16AZS)	Transmits all zeros within timeslot 16 of an E1 frame.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
E1 Performance Pass/Fail Criteria	Selects results criteria for the E1 Line sub-tests Each sub-test has two settings: 1. The failure threshold 2. The message to be displayed after a sub-test test fails (Warning, Fail, or exclude the sub-test result display).	Errored Seconds 0 to (2^{63}-1) (**0, Warning**)	Criteria used to declare an Errored Second is the occurrence of one or more of the following error events within one second: LOF (Loss of Frame), LOS (Loss of Signal), AIS, LCV, FEBE (Far End Block Error), FAS (non-CRC4 framing), or CRC4 (CRC4 framing).
		Severely Errored Seconds 0 to (2^{63}-1) (**0, Warning**)	Criteria used to declare a Severely Errored Second is the occurrence of one or more of the following error events within one second: LOF, LOS, AIS, 28 or more FAS (non-CRC4 framing), or 805 or more CRC4 (CRC4 framing).
		Unavailable Seconds Path 0 to (2^{32}-1) (**0, Warning**)	Number of one-second intervals for which the E1 path is unavailable. The E1 path becomes unavailable at the onset of 10 contiguous SESs. The 10 SESs are included in unavailable time. Once unavailable, the E1 path becomes available at the onset of 10 contiguous seconds with no SESs.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
E1 Alarms Pass/Fail Criteria	Specifies what the tester does after it detects the presence of an alarm during an E1Line test. The specified failed test message appears after an alarm is detected, or if "Ignored" is selected. The tester ignores the alarm.	Loss of Signal (LOS) (Warning, **Fail**, Ignore)	Criteria used to declare an LOS alarm: 255 consecutive zeros are received. Criteria used to clear an LOS alarm: in 255 bit times, at least 32 1's are received.
		Loss of Frame (LOF) (Warning, **Fail**, Ignore)	Criteria used to declare an LOF alarm criteria: upon loss of framing synchronization to the received E1/FE1 signal. Criteria used to clear an LOF alarm: upon restoration of framing synchronization to the received E1/FE1 signal.
		Remote Alarm Indication (RAI): (Warning, **Fail**, Ignore)	Criteria used to declare an RAI alarm: Bit 3 of NFAS is set to 1 for three consecutive occasions. Criteria used to clear RAI alarm: Bit 3 of NFAS is set to 0 for three consecutive occasions.
		Multiframe RAI (MRAI) : (Warning, **Fail**, Ignore)	Criteria used to declare MRAI alarm: Bit 6 in timeslot 16 of frame 0 is set to 1 for two consecutive multiframes (PCM30 & PCM30c framing only). Criteria used to declare MRAI alarm: Bit 6 in timeslot 16 of frame 0 is set to 0 for two consecutive multiframes.

Table 4-1. E1 Line Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
E1 Alarms Pass/Fail Criteria (cont.)	Specifies what the tester does after it detects the presence of an alarm during an E1Line test. The specified failed test message appears after an alarm is detected, or if "Ignored" is selected. The tester ignores the alarm.	Alarm Indication Signal (AIS): (Warning, **Fail**, Ignore)	Criteria used to declare AIS alarm: less than three 0's in two consecutive frames (512 bits). AIS alarm criteria to clear an AIS alarm: more than two 0's in two consecutive frames (512 bits).
		Timeslot 16 AIS (T16AIS): (**Warning**, Fail, Ignore)	Criteria used to declare a T16AIS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains less than three 0's (PCM30 and PCM30c framing only). Criteria used to declare a T16AIS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains three or more 0's.
		T16 Signalling All 0s (T16AZS): (**Warning**, Fail, Ignore)	Criteria used to declare a T16AZS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains all 0's (PCM30 and PCM30c framing only). Criteria used to declare a T16AZS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains at least a single 1.

E1 Line Test Results

Table 4-2 provides information about the results displayed for E1 Line Test.

For information about the results for all other tests, see Chapter 2.

Table 4-2. E1 Line Test Results

Sub-Test	Function of Test	Result	Explanation of Result
E1 Signal	Provides information about various E1 signal parameters.	Receive Pair	Shows whether the received signal is wired as DTE (customer premise equipment) or DCE (central office equipment).
		E1 Framing	One of the following ITU-T G.704 synchronous framing types: • PCM31-FAS Timeslot 0 is dedicated to the FAS and NFAS Timeslots 1 through 31 are available for user data. • PCM30-CAS Timeslot 0 is dedicated to the FAS and the NFAS. Timeslot 16 is dedicated to the MFAS (Multiframe Alignment Signal) and CAS (Channel Associated Signaling). Timeslots 1 through 15 and 17 through 31 are available for user data.

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Signal (cont.)	Provides information about various E1 signal parameters.	E1 Framing (cont.)	• PCM31c-CRC4 Timeslot 0 is dedicated to the FAS, the NFAS, and a CRC4 checksum. Timeslots 1 through 31 are available for user data. • PCM30c-CRC4 & CAS Timeslot 0 is dedicated to the FAS and the NFAS and a CRC4 (Cyclic Redundancy Check) checksum. Timeslot 16 is dedicated to the MFAS and CAS. Timeslots 1 through 15 and 17 through 31 are available for user data. • Unframed No framing bits are generated and no fractional channels are defined. The full bandwidth of the T1 is available for user data.

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Signal (cont.)	Provides information about various E1 signal parameters.	LINE Coding	E1 Line Coding used to ensure ones density and maintain synchronization to the received signal: • HDB3 High Density Bipolar 3. A special code is substituted for four consecutive zeros containing an intentional bipolar violation. • AMI Alternate Mark Inversion. Zeros are represented with no pulse, and ones (marks) are represented with alternating positive and negative pulses. This type of coding is not allowed according to the ITU-T G.703 specification. *Note* *Only HDB3 should be used for E1 transmission.*

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Signal (cont.)	Provides information about various E1 signal parameters.	Signal Level	Signal level in dB. Refers to the optimal signal level of 0 dB at the transmit pins of the E1 transceiver.
		Far End Loopbk	Tester is receiving its own transmitted signal. This means that there is a physical connection between the transmit wire pair and the receive wire pair somewhere along the E1 circuit.
		Fractional Timeslots (Press the F4 function key to view.)	E1 fractional timeslots either configured by the user or discovered by the tester for carrying data traffic: • Total Timeslots Selected\Discovered Number of fractional timeslots configured by the user or discovered by the tester. • Combined Data Rate Number of fractional timeslots times the channel bandwidth of 64kbps.

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Errors	Provides a count of various defects.	Line Code Violation	Count of LCVs. An LCV is the occurrence of a pulse of the same polarity as the previous pulse.
		FAS Error	Count of FAS errors. An FAS error is a bit error (wrong polarity) in the received frame bit pattern. This pattern should always remain constant.
		Far End Block Err	Count of FEBEs. Indicates that an E1 frame was received in which the E-Bit is set to one. This indicates that the far-end device has calculated a CRC-4 error and is informing the transmitting device by setting the E-Bit in its transmitted E1 frame. This information helps you isolate the direction in which the transmission of path errors is occurring. *Note* *Valid for CRC4 framing only.*

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Errors (cont.)	Provides a count of various defects.	CRC-4 Error	Count of Corrupted CRC-4 code words. The calculated CRC-4 code word does not equal the received CRC-4 code word. *Note* *Applies to CRC-4 Framing only.*
		Loss of Signal	Criteria used to declare an LOS alarm: 255 consecutive zeros received. Criteria used to declare an LOS alarm: in 255 bit times, at least 32 1's are received. • LOS Seconds Count of one-second intervals in which an LOS alarm was declared. • LOS Count Number of instances that an LOS alarm was declared. • LOS State The current state of the LOS alarm (active or inactive).

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Errors (cont.)	Provides a count of various defects.	RAI	Criteria used to declare an RAI alarm: Bit 3 of NFAS is set to 1 for three consecutive occasions. Criteria used to declare an RAI alarm: Bit 3 of NFAS is set to 0 for three consecutive occasions. • RAI Seconds Count of one-second intervals in which an RAI alarm was detected. • RAI Count Number of instances that an RAI alarm was detected. • RAI State Current state of the RAI alarm (active or inactive).

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Errors (cont.)	Provides a count of various defects.	Multiframe RAI AIS	Criteria used to declare an MRAI alarm: Bit 6 in timeslot 16 of frame 0 is set to 1for two consecutive multiframes (PCM30 & PCM30c framing only). Criteria used to clear an MRAI alarm: Bit 6 in timeslot 16 of frame 0 is set to 0 for two consecutive multiframes. • MRAI Seconds Count of one-second intervals in which an MRAI alarm was detected. • MRAI Count Number of instances that an MRAI alarm was detected. • MRAI State Current state of the MRAI alarm (active or inactive).

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Errors (cont.)	Provides a count of various defects.	Time Slot 16 AIS	Criteria used to declare a T16AIS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains less than three 0's (PCM30 and PCM30c framing only). Criteria used to clear a T16AIS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains three or more 0's. • T16AIS Seconds Count of one-second intervals in which a T16AIS alarm was detected. • T16AIS Count Number of instances that a T16AIS alarm was detected. • T16AIS State Current state of the T16AIS alarm (active or inactive).

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Errors (cont.)	Provides a count of various defects.	Time Slot 16 All 0s	Criteria used to declare a T16AZS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains all 0's (PCM30 and PCM30c framing only). Criteria used to clear a T16AZS alarm: 16 consecutive frames (one full multiframe). Timeslot 16 contains at least a single 1. • T16AZS Seconds Count of one- second intervals in which a T16AZS alarm was detected. • T16AZS Count Number of instances that a T16AZS alarm was detected. • T16AZS State Current state of the T16AZS alarm (active or inactive).

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Performance	Provides a count of occurrences of various path or line errors per ITU-T Recommendation M.2100.	Errored Sec	Criteria used to declare an Errored Second is the occurrence of one or more of the following error events within one second: LOF (Loss of Frame), LOS (Loss of Signal), AIS, LCV, FEBE (Far End Block Error), FAS (non-CRC4 framing), or CRC4 (CRC4 framing). • Seconds Count of one-second intervals in which one or more of the errors previously listed occurred. • Ratio % Number of Errored Seconds divided by the total test time in seconds.

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Performance (cont.)	Provides a count of occurrences of various path or line errors per ITU-T Recommendation M.2100.	Severe Errd Sec	Criteria used to declare a Severely Errored Second is the occurrence of one or more of the following error events within one second: LOF, LOS, AIS, 28 or more FAS (non-CRC4 framing), or 805 or more CRC4 (CRC4 framing). • Seconds Count of one-second intervals in which one or more of the errors previously listed occurred. • Ratio % Number of Severely Errored Seconds divided by the total test time in seconds.

Table 4-2. E1 Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
E1 Performance (cont.)	Provides a count of occurrences of various path or line errors per ITU-T Recommendation M.2100.	Unavailable Sec	Number of one-second intervals for which the E1 path is unavailable. The E1 path becomes unavailable at the onset of 10 contiguous SESs. The 10 SESs are included in unavailable time. Once unavailable, the E1 path becomes available at the onset of 10 contiguous seconds with no SESs. • Seconds Count of one-second intervals in which the E1 path is unavailable. • Ratio % Number of seconds that the E1 path is unavailable divided by the total test time in seconds.

Chapter 5
DDS Line Test Setup and Results

Introduction

The tester has three modes for testing DDS (Dataphone Digital Service) circuits:

- **Out of service, emulate CPE:**

  To verify performance of a new DDS frame relay link before you connect it to CPE (Customer Premise Equipment).

- **Out of service, emulate the frame relay network:**

  To verify that CPE, such as a FRAD (Frame Relay Access Device) or router, is configured correctly before you connect it to a frame relay circuit.

- **In service, monitor non-intrusively:**

  To analyze the performance of a frame relay link while it is in service.

This chapter covers the Line Test portion of DDS testing.

The information in this chapter assumes that the 660M-DDS Frame Relay Interface Module for DDS circuits is installed on the tester.

Setups and results for tests other than the Line Test are universal for all interface modules.

Refer to Chapter 2 for information about the universal tests.

Auto Test

Auto Test consists of three Single Tests that can be used to verify correct provisioning of a new frame relay circuit.

Auto Test is an out-of-service test (intrusive) because it requires that you terminate the tester to either the frame relay network or to CPE.

The first two Single Tests are Line and Frame Relay, and the last is Auto PING, which can be optionally omitted.

Auto Test verifies the physical layer (Line Test), connects to the frame relay network and verifies that the correct DLCIs have been provisioned (Frame Relay Test), and proves IP layer connectivity to the far-end devices (Auto PING Test).

Setting up for DDS Auto Test

Before you run an Auto Test, you must configure the tester's universal setup parameters as described in Chapter 1 and the DDS Line Test setup parameters as described here.

DDS Line Setup Sub-Menu

The DDS Line setup sub-menu controls operating parameters of the tester that are specific to the DDS interface module.

Note

We recommend that you set all parameters to "AutoDetect." If you use this setting, the tester automatically configures itself.

Table 5-1 explains the meaning of each parameter's settings. Bold type in the Setting column indicates the factory default setting.

Table 5-1. DDS Line Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Line Cabling	Configures the tester to transmit and receive signals on certain pairs of wires to match standard RJ48S cabling conventions for DTE or DCE connections.	**AutoDetect**	Tester automatically selects DTE (Data Terminal Equipment) line cabling if a valid DDS signal is detected on pins 7 and 8. Tester automatically selects DCE (Data Circuit Terminating Equipment) line cabling if a valid DDS signal is detected on pins 1 and 2.
		DTE	Tester configures cabling as DTE (customer premise). The tester receives on pins 7 and 8 and transmits on pins 1 and 2.
		DCE	Tester configures cabling as DCE (central office). The tester receives on pins 1 and 2 and transmits on pins 7 and 8.

Table 5-1. DDS Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
DDS Data Rate	Configures the tester for a DDS data rate of 64 kbps or 56 kbps.	**Autobaud**	Tester conforms to the DDS data rate of the circuit under test (56 kbps or 64 kbps).
		64 kbps	Selects 64 kbps (64,000 bps).
		56 kbps	Selects 56 kbps (56,000 bps).
Transmit Clock Source (out of service only)	Controls whether the timing of tester's transmitted signal is controlled by a received DDS clock signal or by an internal oscillator.	**Recovered Line**	The received clock times the tester's transmitter. If no received clock is available, Internal Clock is automatically substituted. *Note* *Recovered line must be used for 64 kbps rate.*
		Internal Clock	Tester's internal clock times its transmitter. *Note* *Internal clock is for 56 kbps rate only.*

Table 5-1. DDS Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
DDS Line Test Duration	Selects the duration of the Line Test.	**Continuous**, 1 Minute, 5 Minutes, 15 Minutes, 30 Minutes, 1 Hour, 12 Hours, 24 Hours, 48 Hours, 7 Days	If set to **Continuous**, press EXIT to terminate a DDS Line Test.
Data Sense	Configures the tester for normal or inverted data sense.	**Normal**	A mark represents a binary 1.
		Inverted	A mark represents a binary 0.
Loop Code to Monitor	Selects the type of loop code to monitor. The tester's response to the selected loop code depends on the setting of the **Respond to Loopback Codes**. parameter (see next entry in this table).	**CSU Loopback**	Detection of a reversal in the sealing current polarity from the OCU-DP engages the CSU (Channel Service Unit) loopback in the tester.
		DSU Loopback	A DSU alternating loopback operates when a minimum of four consecutive bytes of a specific 7-bit loopback code are received at the proper data rate. The loopback is terminated upon receipt of five successive byte intervals without the loopback code present.

Table 5-1. DDS Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Respond to Loopback Codes	Sets the tester to respond to or ignore received loopback codes.	**Yes**	Responds to CSU loopback code.
		No	Ignores CSU loopback code. *Note* *The DSU loopback code cannot be ignored. The tester will always respond to a DSU loopback code.*
DDS Errors Pass/Fail Criteria	Selects results criteria for the DDS Errors sub-test There are two settings: 1. The failure threshold 2. The message to be displayed after the sub-test fails (Warning, Fail, or exclude the sub-test result display).	Bipolar Violations (BPV) 0 to (2^{63} – 1) (**0, Warning**)	Occurrences of invalid bipolar violations are counted when a data bit mark is received of the same polarity as the last mark, thus violating the AMI (Alternate Mark Inversion) rule. A BPV is valid and not counted only if it belongs to a 7-bit Control Code.

Table 5-1. DDS Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
DDS Alarms Pass/Fail Criteria	Specifies what the tester does after it detects the presence of an alarm during a DDS Line test. The specified failed test message appears after an alarm is received. If "Ignore" is selected, the tester ignores the alarm.	Loss of Signal (LOS) (**Fail**, Ignore, Warning)	An LOS alarm is declared after 32 consecutive zeros or when the signal strength is too weak to detect.
		Loss of Loop Current (LLC) (Warning, **Fail**, Ignore)	An LLC alarm is declared when the received sealing current is below 4 mA.
Control Code P/F Criteria	Specifies what the tester does after it detects a DDS control code. The specified message appears after a control code is detected. If "Ignore" is selected, the tester ignores the control code.	Control Mode Idle (CMI) (**Warning**, Fail, Ignore)	A special 7-bit control word was received from the far-end device that matches the control code for CMI. This indicates that there is live equipment connected on the on the far end, but the channel is not in use.

Table 5-1. DDS Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Control Code P/F Criteria (cont.)	Specifies what the tester does after it detects a DDS control code. The specified message appears after a control code is detected. If "Ignore" is selected, the tester ignores the control code.	Control Mode Idle (CMI) (**Warning**, Fail, Ignore)	A special 7-bit control word was received from the far-end device that matches the control code for CMI. This indicates that there is live equipment connected on the on the far end, but the channel is not in use.
		Out of Service (OOS) (**Warning**, Fail, Ignore)	A special 7-bit control word was received from the far-end device that matches the control code for OOS. This indicates that there is trouble in the synchronous DDS operation.
		Remote is Out of Frame (OOF) (**Warning**, Fail, Ignore)	A special 7-bit control word was received from the far-end device matching the control code for OOF. This indicates that there is trouble in the synchronous DDS operation.
		Data Mode Idle (DMI) (**Warning**, Fail, Ignore)	A special 7-bit control word was received from the far-end device matching the control code for DMI. This indicates that there is live equipment connected on the on the far end, but no data is currently being transmitted by the far-end device.
		Unmatched Code (**Warning**, Fail, Ignore)	A special 7-bit control word was received from the far-end device that does not match a control code recognized by the tester.

Table 5-1. DDS Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Loop Code Pass/Fail Criteria	Specifies what the tester does after it detects a DDS loop code. The specified message appears after a loop code is detected. If "Ignore" is selected, the tester ignores the loop code.	Receive Loop Code (**Warning**, Fail, Ignore)	The specified warning or fail test message appears after a loop code is received that matches the loop code type that is specified under Loop Code to Monitor.

DDS Line Test Results

Table 5-2 provides information about the results displayed for the DDS Line Test. For information about the results for all other tests, see Chapter 2.

Table 5-2. DDS Test Results

Sub-Test	Function of Test	Result	Explanation of Result
DDS Signal	Provides information about various DDS signal parameters.	Receive Pair	Shows the detected and configured line interface cabling as DTE (customer premise equipment) or DCE (central office equipment).
		Data Rate	Displays the detected and configured baud rate of the DDS signal: • 56kbps Indicates that an unframed bit stream of 56kbps has been detected/configured. • 64kbps Indicates that a framed (one frame bit per 8 data bits) synchronous bit stream of 64kbps has been detected/configured.
		Signal Level	Signal level in dB. Refers to the optimal signal level of 0 dB at the transmit pins of the DDS transceiver.

Table 5-2. DDS Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
DDS Signal (cont.)	Provides information about various DDS signal parameters.	Far End Loopbk	The tester is receiving its own transmitted signal. This means that there is a physical connection between the transmit wire pair and the receive wire pair somewhere along the DDS 4-wire local loop circuit.
DDS Errors	Provides a count of various defects.	Bipolar Violations	Count of invalid bipolar violations (BPVs). Invalid BPVs are counted when a data bit mark is received that has the same polarity as the last mark, thus violating the AMI (Alternate Mark Inversion) rule. A BPV is valid and not counted only if it belongs to a 7-bit Control Code.
DDS Alarms	Provides a count of seconds with one or more occurrences of various alarms.	Loss of Signal	An LOS alarm is declared after 32 consecutive zeros or when the signal strength is too weak to detect. • LOS Seconds Count of one-second intervals in which LOS alarm is declared. • LOS Count Number of instances that LOS alarm has been declared. • LOS State Current state of the LOS alarm (active or inactive).

Table 5-2. DDS Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
DDS Alarms (cont.)	Provides a count of seconds with one or more occurrences of various alarms.	Loss Loop Current	An LLC alarm is declared when the received sealing current is below 4 mA. If sealing current is never present, this alarm is not set. This alarm is only set when sealing current is present at the start of the test and is subsequently lost. • LLC Seconds Count of one- second intervals in which an LLC alarm was declared. • LLC Count Number of instances that an LLC alarm was declared. • LLC State Current state of the LLC alarm (active or inactive).

Table 5-2. DDS Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Control Codes	Provides a count of control code occurrences.	Control Mode Idle	Count of Received CMI control codes. A special 7-bit control word was received from the far-end device that matches the control code for CMI. This indicates that there is live equipment connected on the on the far end, but the channel is not in use.
		Out of Service	Count of Received OOS control codes. A special 7-bit control word was received from the far-end device that matches the control code for OOS. This indicates that there is trouble in the synchronous DDS operation.
		Remote OOF	Count of Received OOF control codes. A special 7-bit control word was received from the far-end device that matches the control code for OOF. This indicates that there is trouble in the synchronous DDS operation.

Table 5-2. DDS Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Control Codes (cont.)	Provides a count of control code occurrences.	Data Mode Idle	Count of Received DMI control codes. A special 7-bit control word was received from the far-end device that matches the control code for DMI. This indicates that there is live equipment connected on the on the far end, but no data is currently being transmitted by the far-end device.
		Unmatched Code	Count of Received UMC control codes. A special 7-bit control word was received from the far-end device that does not match a control code recognized by the tester.
Loop Codes	Provides details for loop code detection.	Loop Code	Count of loop codes detected that match the loop code selected in the setup menu under “Loop Code to Monitor”, including: • CSU Loopback Detection of a reversal in the sealing current polarity from the OCU-DP engages the CSU (Channel Service Unit) loopback in the tester. • DSU Loopback A DSU alternating loopback operates when a minimum of four consecutive bytes of a specific 7-bit loopback code are received at the proper data rate. The loopback is terminated upon receipt of five successive byte intervals without the loopback code present.

Chapter 6
Serial Line Test Setup and Results

Introduction

The tester provides three modes of testing Serial frame relay circuits:

- **Out of service, emulate CPE:**

  To verify performance of a new Serial frame relay link before you connect it to CPE (Customer Premise Equipment).

- **Out of service, emulate the frame relay network:**

  To verify that CPE, such as a FRAD (Frame Relay Access Device) or router, is configured correctly before you connect it to a frame relay circuit.

- **In service, monitor non-intrusively:**

  To analyze the performance of a frame relay link while it is in service.

This chapter covers the Line Test portion of Serial testing.

The information in this chapter assumes that the 660M-S Frame Relay Interface Module for serial circuits is installed on the tester.

Setups and results for tests other than the Line Test are universal for all interface modules.

Refer to Chapter 2 for information about the universal tests.

Auto Test

Auto Test consists of three Single Tests that can be used to verify correct provisioning of a new frame relay circuit.

Auto Test is an out-of-service test (intrusive) because it requires that you terminate the tester to either the frame relay network or to CPE.

The first two Single Tests are Line and Frame Relay, and the last is Auto PING, which can be optionally omitted.

Auto Test verifies the physical layer (Line Test), connects to the frame relay network and verifies that the correct DLCIs have been provisioned (Frame Relay Test), and proves IP layer connectivity to the far-end devices (Auto PING Test).

Setting up for Serial Auto Test

Before you run an Auto Test, you must configure the tester's universal setup parameters as described in Chapter 1 and the Serial Line Test setup parameters described next.

Serial Line Setup Sub-Menu

The Serial Line setup sub-menu controls operating parameters of the tester specific to the Serial interface module.

Note

We recommend that you set all parameters to "AutoDetect." In this mode, the tester automatically configures itself.

Table 6-1 explains the meaning of each parameter setting.

Bold type in the Setting column indicates the factory default setting.

Table 6-1. Serial Line Setup Parameters

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Line Cabling	Configures the tester to transmit and receive signals on certain pairs of wires to match standard cabling conventions for DTE or DCE connections.	**AutoDetect**	Tester automatically selects DTE (Data Terminal Equipment) line cabling if a valid Serial Clock signal is detected on the DTE receive pins for the type of Serial Y cable being used. Tester automatically selects DCE (Data Circuit Terminating Equipment) line cabling if a valid Serial Clock signal is detected on the DCE receive pins for the type of Serial Y cable being used.
		DTE	Tester configures cabling as DTE (customer premise). The tester receives on DTE receive pins and transmits on DTE transmit pins.
		DCE	Tester configures cabling as DCE (central office). The tester receives on DCE receive pins and transmits on DCE transmit pins.

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Clock Source	Controls whether the timing of tester's transmitted signal is controlled by a received clock signal or by an internal oscillator.	**Internal Clock**	Tester's internal clock times the tester's transmitter.
		Recovered Line	Received clock times the tester's transmitter. If no received clock is available, Internal Clock is automatically substituted.
Data Rate (Clock for DCE Emulation)	Selects the channel bandwidth (N x 56 or 64 kbps) and the number of channels (N).	Channel Bandwidth (N x 56 or **64 kbps**)	Selects either 56 kbps or 64 kbps for channel bandwidth.
		Number of Channels (N), 1 to **24**	Selects the number of channels, which with the bandwidth per channel, determines the circuit bandwidth. Example: To act as a DCE at a full T1 line rate, you would set the channel bandwidth to 64kbps and the number of channels to 24 (64 kbps x 24 = 1536 kbps).

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Serial Line Test Duration	Selects the duration of the Line Test.	**Continuous**, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 12 hours, 24 hours, 48 hours, 7 days	If set to **Continuous**, press EXIT to terminate a Serial Line Test.
530/449/232 Leads PF Criteria (D*oes not apply if the tester is connected to X.21 or V.35 interfaces.)*	Selects results criteria for the Serial Line sub-tests There are two settings for each sub-test: 1. The condition to detect (Changing, On, or Off) 2. The message displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result display).	Received Clock (**Changing, Warning**)	Receive Clock signal lead has one or more transitions.
		Received Data (**Changing, Warning**)	Receive Data signal lead has one or more transitions.
		Clear To Send (**On, Warning**)	Clear To Send signal lead is in an always-on state.
		Data Set Ready (**On, Warning**)	Data Set Ready signal lead is in an always-on state.
		Received Line Signal Detect (**On, Warning**)	Received Line Signal Detect signal lead is in an always-on state.

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
530/449/ 232 Leads PF Criteria (cont.) (*Does not apply if the tester is connected to X.21 or V.35 interfaces.)*	Selects results criteria for the Serial Line sub-tests There are two settings for each sub-test: 1. The condition to detect (Changing, On, or Off) 2. The message displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result display)	External Timing (**Off, Warning**)	External Timing signal lead is in an always-off state.
		Ready To Send (**On, Warning**)	Ready to Send signal lead is in an always-on state.
		Data Terminal Ready (**On, Warning**)	The Data Terminal Ready signal lead is in an always-on state.
		Signal Element Timing (**Changing, Ignore**)	The Signal Element Timing lead has one or more transitions.
		Receive (**Changing, Warning**)	The Receive Data signal lead has one or more transitions.
		Indication (**On, Warning**)	The Indication signal lead has an always on state.
		Control (On, **Warning**)	The Control signal lead has an always on state.

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
V.35 Leads Pass/Fail Criteria *(Does not apply if the tester is connected to anything other than a V.35 interface)*	Selects results criteria for the Serial Line sub-tests There are two settings for each sub-test: 1. The condition to detect (Changing, On, or Off) 2. The message displayed after a sub-test fails (Warning, Fail, or exclude the sub-test result display).	Received Clock (**Changing, Warning**)	The Receive Clock signal lead has one or more transitions.
		Received Data (**Changing, Warning**)	The Receive Data signal lead has one or more transitions
		Clear To Send (**On, Warning**)	The Clear To Send signal lead has an always on state.
		Data Set Ready (**On, Warning**)	The Data Set Ready signal lead has an always on state.
		Received Line Signal Detect (**On, Warning**)	The Received Line Signal Detect signal lead has an always on state.
		External Timing (**Off, Warning**)	The External Timing signal lead has an always off state.
		Ready To Send (**On, Warning**)	The Ready to Send signal lead has an always on state.
		Data Terminal Ready (**On, Warning**)	The Data Terminal Ready signal lead has an always on state.

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
LOC Alarm Pass/Fail Criteria	Selects the message displayed if there is an LOC Alarm (Warning, Fail, or exclude the result).	Loss of Clock (**Fail**)	Criteria used to declare an LOC alarm: no clock for > 1 second. Criteria used to clear an LOC alarm: clock signal present and stable for at least one second. *Note* *An LOC alarm will also be active if there was never a signal.*
Use RS530 or RS530A Scheme	Configures the tester for one of two variants of the RS-530 standard.	Use RS530 Scheme	Data Terminal Ready (DTR) is driven using differential paired wires. Data Set Ready (DSR) is received using differential paired wires.
		Use RS530A Scheme	DTR is driven using a single wire. DSR is received using a single wire.

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	Setting (default **bold**)	Explanation of Setting
Set V.35 Control Leads	Forces the state of the desired control lead being transmitted by the 660 to on or off.	Set Request to Send (**On**, Off)	Toggles the transmission state of the RTS lead between on and off
		Set Clear to Send (**On** , Off)	Toggles the transmission state of the CTS lead between on and off
		Set Data Set Ready (**On**, Off)	Toggle the transmission state of the DSR lead between on and off
		Set Data Terminal Ready (**On**, Off)	Toggle the transmission state of the DTR lead between on and off
		Set Rx Line Sig Detect (**On**, Off)	Toggle the transmission state of the RLSD lead between on and off

Table 6-1. Serial Line Setup Parameters (cont.)

Parameter	Function of Parameter	**Setting** (default **bold**)	Explanation of Setting
Set 530/449/232 Control Leads	Forces the state of the desired control lead being transmitted by the 660 to on or off.	Set Request to Send (**On**, Off)	Toggles the transmission state of the RTS lead between on and off.
		Set Clear to Send (**On** , Off)	Toggles the transmission state of the CTS lead between on and off.
		Set Data Set Ready (**On**, Off)	Toggles the transmission state of the DSR lead between on and off.
		Set Data Terminal Ready (**On**, Off)	Toggles the transmission state of the DTR lead between on and off.
		Set Rx Line Sig Detect (**On**, Off)	Toggles the transmission state of the RSLD lead between on and off.
Set X.21 Control Leads	Forces the state of the desired control lead being transmitted by the 660 to on or off.	Control (**On** , Off)	Toggles the transmission state of the Control lead between on and off.
		Indication (**On** , Off)	Toggles the transmission state of the Indication lead between on and off.

Serial Line Test Results

Table 6-2 explains the results displayed for the Serial Line Test.

An asterisk (*) indicates that the result is not appropriate for Monitor mode. For information about the results for all other tests, see Chapter 2.

Table 6-2. Serial Line Test Results

Sub-Test	Function of Test	Result	Explanation of Result
Serial Signal	Provides information about the various serial signal parameters.	Connected As	Shows the detected and configured line interface cabling as DTE (connected as customer premise equipment) or DCE (connected as central office equipment).
		Clock Source	Shows the detected and configured Clock Source for the 660 transmitter as: • Recovered The transmitter will set its clock rate to match the clock rate of the received signal. • Internal The transmitter will set its clock rate to match the value specified by the user under the serial setup parameter “Data Rate (Internal Source Clk Only)”. This uses a clock generated within the 660 tester to set the transmit data rate.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial Signal (cont.)	Provides information about the various serial signal parameters.	Data Rate	Shows the detected and configured Data Rate of the received serial signal. The configured Data Rate only applies if you are acting as DCE and are using the internal clock source.
		Serial Cable	Shows the detected type of serial Y test cable attached to the serial interface module: • V.35 • X.21 • RS232 • RS530 • RS449

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial Signal (cont.)	Provides information about the various serial signal parameters.	Clock Signal	Shows whether or not there is a clock signal detected at the serial interface • Clock Present A valid serial clock has been detected. Normal synchronous data transfer may take place over the serial interface. • No Clock No serial clock has been detected. No synchronous data transfer can take place over the serial interface.
		Far End Loopbk*	Tester is receiving its own transmitted signal. This means that there is a physical connection between the transmit wire pair and the receive wire pair somewhere along the serial or digital (T1/E1/DDS) path.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial V.35 Leads Received from DCE	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Receive Clock	Displays status as: • Changing (Normal condition for Receive Clock) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Received Data	Displays status as: • Changing (Normal condition for Receive Data) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial V.35 Leads Received from DCE (cont.)	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Clear To Send	Displays status as • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for CTS) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Data Set Ready	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for DSR) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial V.35 Leads Received from DCE (cont.)	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Rx Line Sig Detect	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for RLSD) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		External Timing	Displays status as: • Changing (Normal condition for External Timing) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial V.35 Leads Received from DTE	Displays the current status of the physical serial leads received from a DTE device when acting as a DCE device.	Receive Clock	Displays status as: • Changing (Normal condition for Receive Clock) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Received Data	Displays status as: • Changing (Normal condition for Receive Data) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial V.35 Leads received from DTE (cont.)	Displays the current status of the physical serial leads received from a DTE device when acting as a DCE device.	Request To Send	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for RTS) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Data Terminal Ready	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for DTR) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial 530/449/232 Leads received from DCE	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Receive Clock	Displays status as: • Changing (Normal condition for Receive Clock) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Received Data	Displays status as: • Changing (Normal condition for Receive Data) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial 530/449/232 Leads received from DCE (cont.)	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Clear To Send	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for CTS) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Data Set Ready	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for DSR) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial 530/449/232 Leads received from DCE (cont.)	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Rx Line Sig Detect	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for RLSD) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		External Timing	Displays status as: • Changing (Normal condition for External Timing) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial 530/449/232 Leads received from DTE	Displays the current status of the physical serial leads received from a DTE device when acting as a DCE device.	Receive Clock	Displays status as: • Changing (Normal condition for Receive Clock) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Received Data	Displays status as: • Changing (Normal condition for Receive Data) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial 530/449/232 Leads received from DTE (cont.)	Displays the current status of the physical serial leads received from a DTE device when acting as a DCE device.	Request To Send	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for RTS) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Data Terminal Ready	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for DTR) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial X.21 Leads received from DCE	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Signal Element Timing	Displays status as: • Changing (if used, should be normal condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (not a failing condition) Has remained in the On state for the duration of the test. • Off (not a failing condition) Has remained in the Off state for the duration of the test.
		Receive	Displays status as: • Changing (Normal condition for Receive Data) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial X.21 Leads received from DCE (cont.)	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Indication	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for Indication) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Signal Element Timing	Displays status as: • Changing (if used, should be normal condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (not a failing condition) Has remained in the On state for the duration of the test. • Off (not a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial X.21 Leads received from DCE (cont.)	Displays the current status of the physical serial leads received from a DCE device when acting as a DTE device.	Receive	Displays status as: • Changing (Normal condition for Receive Data) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Usually a failing condition) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.
		Control	Displays status as: • Changing (Usually a failing condition) Has transitioned from on to off or off to on at least once during the duration of the test. • On (Normal condition for Control) Has remained in the On state for the duration of the test. • Off (Usually a failing condition) Has remained in the Off state for the duration of the test.

Table 6-2. Serial Line Test Results (cont.)

Sub-Test	Function of Test	Result	Explanation of Result
Serial Alarms	Provides a count of seconds with one or more occurrences of a Loss of Clock alarm.	Loss of Clock	Criteria used to declare an LOC alarm: no clock for more than one second. Criteria used to clear an LOC alarm: clock signal present and stable for at least one second. *Note* *An LOC alarm will also be active if there never was a signal.* • LOC Seconds Count of one-second intervals in which an LOC alarm was declared. • LOC Count Number of instances that an LOC alarm was declared. • LOC State Current state of an LOC alarm (active or inactive).

Chapter 7
Monitor

Introduction

In monitor mode, the tester can analyze the performance of a frame relay link while it is in service.

This chapter describes the setup parameters for the CIR Advisor test and results for the following monitor mode tests:

- Top PVC
- CIR Advisor

For all interface modules, the results of the LINE monitor and Frame Relay monitor are the same as those provided for the Single LINE Test and Single Frame Relay Test, respectively.

See Chapters 3 through 6 for details.

CIR Advisor Setup Sub-Menu

Table 7-1 describes CIR Advisor test setup parameters.

Table 7-1. CIR Advisor Setup Parameters

Parameter	Function of Parameter	Setting (default bold)	Explanation of Setting
Target DLCI	Selects the active DLCI through which you want to test.	Press ENTER for menu.	Pressing the **Auto Detect** softkey instructs the tester to always set the target DLCI (Data Link Connection Identifier) to the first (lowest numbered) active DLCI discovered. In addition, you can use the arrow keys to select an active DLCI from the list then press ENTER or press the **User Entered** softkey to manually enter the DLCI.
Target CIR	Sets a target CIR (Committed Information Rate) in kbps.	0 to 2048 kbps (**8 kbps**)	The Target CIR (Committed Information Rate) is the throughput in kbps over the time constant period (Tc usually equals one second) for a particular PVC that is guaranteed by the service provider.

Top PVC Results

Table 7-2 describes results from the Top PVC test.

Table 7-2.Top PVC Results

Sub-Test	Function of Test	Result	Explanation of Result
Top PVCs	Displays a list of all active DLCIs. This test allows you to see which PVCs on an inservice link are the most active. (Press the Mode softkey to view the results in different formats.)	Utilization %	Average Link bandwidth utilization for all discovered DLCIs. Utilization percent is calculated as: $\frac{\text{Number of bits received in 1 sec (i.e., non-flag octets * 8)}}{\text{Link access rate in bits per second}} \times 100\ \%$
		Throughput (in kbps)	Average Link bandwidth throughput for all discovered DLCIs. Utilization throughput is calculated as: Number of bits received in 1 sec (i.e., non-flag octets * 8)
		Congestion %	Percentage of frames that are marked FECN, BECN or DE for all discovered DLCIs. Congestion percent is calculated as: $\frac{\text{Number of FECN + BECN + DE frames}}{\text{Total frame count}} \times 100\ \%$

CIR Advisor Results

Table 7-3 describes results from the CIR Advisor test.

Table 7-3. CIR Advisor Results

Sub-Test	Function of Test	Result	Explanation of Result
CIR Advisor	Monitors live traffic on a single DLCI and compares the utilization measured against a user-supplied CIR value. (Press the Mode softkey to view the results in different formats.)	CIR Util % (Current, Average, Maximum)	Percent of Committed Information Rate (CIR) bandwidth being utilized on the target DLCI. CIR utilization for each direction includes only frames matching the target DLCI. Utilization is calculated as: $\frac{\text{Number of bits received in 1 sec (i.e., non-flag octets * 8)}}{\text{CIR in bits per second}} \times 100\%$
		Suggested CIR	Suggested CIR value in kilobits per second for the target DLCI. The average amount of measured traffic would conform to this value.
		Total PVC Frames	Count of valid Frame Relay frames received on the target DLCI.

Table 7-3. CIR Advisor Results

Sub-Test	Function of Test	Result	Explanation of Result
CIR Advisor (cont.)	Monitors live traffic on a single DLCI and compares the utilization measured against a user-supplied CIR value. (Press the Mode softkey to view the results in different formats.)	Excess PVC Frames	Count of valid Frame Relay frames received on the target DLCI that were sent in excess of the user-specified CIR rate.
		Total PVC Data (in bytes)	Count of data payload octets received on the target DLCI.
		Excess PVC Data	Count of data payload octets received on the target DLCI that were sent in excess of the user-specified CIR rate.
		Percent FECN Time	Percentage of the total test time that FECN frames were received on the target DLCI. A summation of each time period is maintained in which the received frame relay frames had the FECN bit set. This is a better indicator of the severity of congestion than a count of FECN frames.
		Percent BECN Time	The percentage of the total test time that BECN frames were received on the target DLCI. A summation of each time period is maintained in which the received frame relay frames had the FECN bit set. This is a better indicator of the severity of congestion rather than a count of BECN frames.

Chapter 8
Using 660-Link

Introduction

The 660-Link software performs the following operations on the tester:

- Updates the tester's software
- Transfers reports saved in the tester's non-volatile memory to a PC
- Remotely operates the tester
- Activates tester software options.

This chapter describes how to use 660-Link to perform these operations.

System Requirements

The 660-Link software operates on PCs meeting the following minimum requirements:

- 486 processor or faster (recommended)
- 32 MB RAM or more
- 32-bit operating system, such as Microsoft Windows 95 or Windows NT 4.0 or later
- 5 MB free disk space.

Copying 660-Link to the PC

The tester comes with a diskette that contains the file **f660link.exe**. To copy the file to your PC:

1. Insert the 660-Liink diskette into the floppy disk drive.
2. Copy the file **f660link.exe** to your hard disk drive.

Note

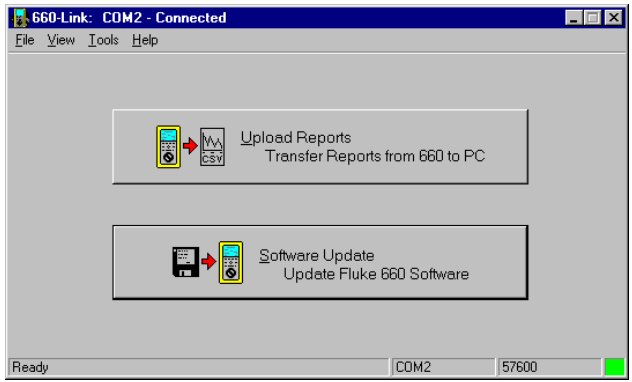
By creating a shortcut to the 660-Link software, you can start the application from your desktop.

Starting 660-Link

Before you start 660-Link, connect the tester to the PC as described in the section *"Connecting the Tester*" in the *660 Series Frame Relay Installation Assistant Users Guide.*

- In Windows Explorer, double-click **f660link.exe**.

  The opening screen appears as shown in Figure 8-1.



aac011s.bmp

Figure 8-1. Opening Screen

If 660-Link cannot establish a connection with the tester, a message box appears. Check the following:

- Is the tester turned on?
- Is the cable securely connected to both the PC and the tester through the selected COM port?
- Does the baud rate of the tester match the baud rate of the PC?

Note

To set the baud rate of the tester or re-establish a connection with the tester, see the section, "Setting Communications Options."

Setting Communications Options

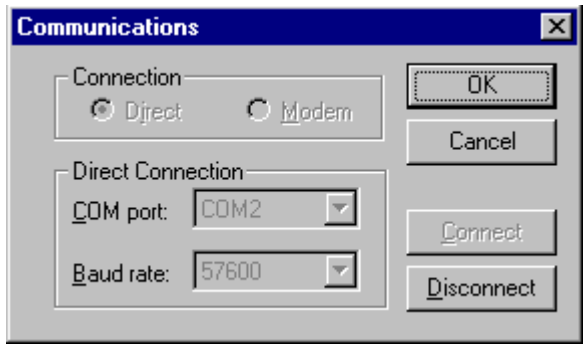
You also need to indicate whether you are communicating directly (via a cable) or remotely (via a modem).

- If you are communicating with the tester over a serial cable, you need to set the communications port and baud rate settings.
- If you are using a modem to communicate with the tester, you need to specify the phone number and the modem type.

Displaying the Communications Dialog Box

From the **Tools** menu, click **Options**, then click **Communications**.

The **Communications** dialog box appears. See Figure 8-2.



aac016s.bmp

Figure 8-2. Communications Options Dialog Box

Note

The communication settings are saved in the **f660link.ini** *file.*

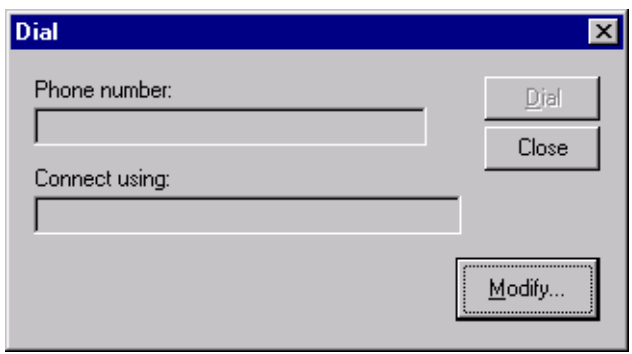
Changing the Direct Connections Options

1. Display the **Communications** dialog box.
2. If the tester is currently connected, click **Disconnect**.
3. Under **Connection**, click **Direct** to change the direct options.
4. In the **COM** port box, click the COM port used to connect to the tester.
5. In the **Baud rate** box, click your tester's baud rate.

Changing the Modem Settings

1. Display the **Communications** dialog box.
2. If the tester is currently connected, click **Disconnect**.
3. Under **Connection**, click **Modem**, then click **Connect** to change the modem settings.

   The **Dial** dialog box appears. See Figure 8-3.



aac020s.bmp

Figure 8-3. Dial Dialog Box

4. Click **Modify** to change the modem settings.

   The **Dial Modify** dialog box appears. See Figure 8-4.

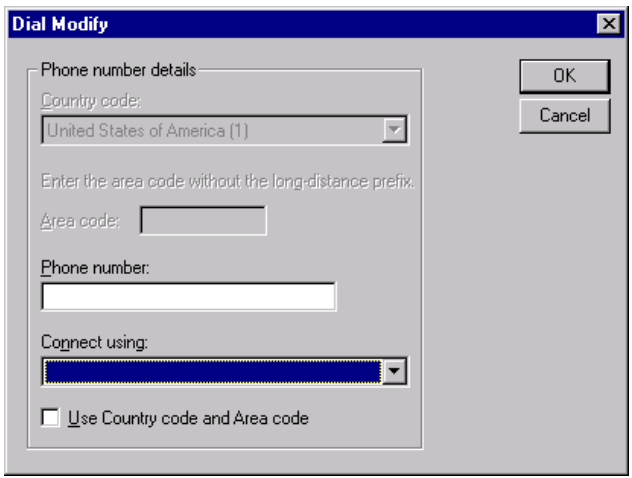


Figure 8-4. Dial Modify Dialog Box

5. Complete the **Dial Modify** dialog box.

Note

*The information displayed in the **Dial Modify** dialog box is set in the Modems option in Windows Control Panel.*

Connecting or Disconnecting the Tester

To connect the tester to the PC, click **Connect.**

To break the connection between the PC and the tester, click **Disconnect**.

Updating the Tester's Software

When a software update becomes available for the tester, you can download the latest version from the Fluke Web site (http://www.fluke.com/nettools/software/660) to your PC. Using the Web site requires Internet access and a Web browser.

Follow the instructions for downloading the software update. If you need help, call Fluke Technical Support.

After you transfer the software update to your PC, you can use 660-Link to download the files to the tester.

To download the files:

1. From the **Tools** menu, click **Software Update**.

   The **Open download file** dialog box appears. See Figure 8-5.

Figure 8-5. Open Download File Dialog Box

2. Locate the folder that contains the file **GENERIC.H86.**
3. Highlight **GENERIC.H86**, then click **Open** to download the software update to the tester.

Note

*You can also click the **Software Update** button.*

A series of status messages appear while the files are being downloaded to the tester. The final message indicates if the software download is successful. If the download fails, two types of errors may have occurred:

- A file error. Verify that the file to be downloaded to the tester is valid. You might have to repeat the software download from the Fluke Web site.
- Communication errors. See the section *"Starting 660-Link"* for a description of how to establish a connection to the tester.

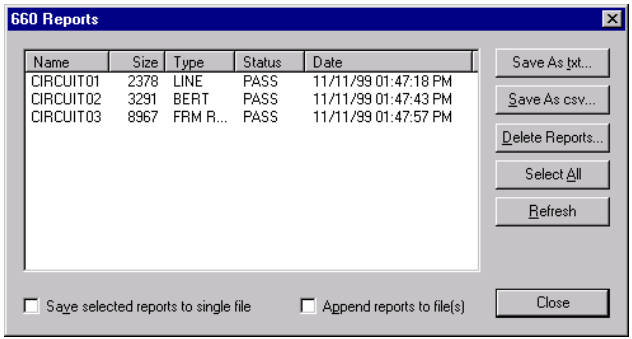
Transferring Reports to a PC

Use 660-Link to transfer reports you saved in the tester's memory to a PC. You can save the reports as a text file (.txt) or a comma-delimited file (.cvs). Reports saved as .cvs files can then be processed by *Microsoft Excel*.

Viewing Saved Reports

From the **File** menu, click **Upload and Save 660 Reports**.

The **660 Reports** dialog box appears. The dialog box displays the name and size of saved reports, the test types, the status of each test and the dates and times that the reports were saved. See Figure 8-6.



aac013s.bmp

Figure 8-6. 660 Reports Dialog Box

Note

*You can also click the **Upload Reports** button.*

Guidelines for Selecting Reports

- To select a single report, use your mouse pointer to highlight the report name.
- To save more than one report, hold down the CTRL key while you click each report name.
- To select all reports, click **Select All**.
- To update the list of saved reports, click **Refresh.**

Saving One or More Reports

1. Select the reports you want to save as described in the section "Guidelines for Selecting Reports."

2. Click **Save As txt** to save the reports you selected as text files. Or, click **Save As csv** to save the reports as comma-delimited (.cvs) files.

   The **660 Report Files** dialog box appears. See Figure 8-7. The displayed name is used as the default file name for each report.

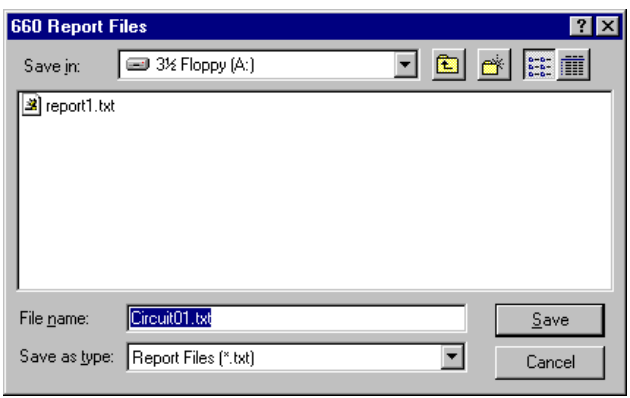


Figure 8-7. 660 Report Files Dialog Box

3. Identify the location where you want the report saved, type the report file name in the **File name** box, then click **Save**.

   A message box appears indicating that the report was transferred.

Notes

*To save several highlighted reports to a single file, select **Save selected reports to single file** before performing step 3.*

*To append a report to an existing file of the same name, select **Append reports to file(s)** before performing step 3.*

Deleting One or More Reports

1. Select the reports that you want to delete as described in the section "Guidelines for Selecting Reports."

2. Click **Delete Reports.**

   660-Link deletes the reports you selected from the tester.

Operating the Tester Remotely

Use 660-Link to view and operate the tester from a PC. You can either directly connect the tester to a PC using a cable or remotely connect the tester to a PC using a modem.

Displaying the Tester Window

1. Connect the tester to the PC and start 660-Link.
2. From the **Tools** menu, click **Remotely Control 660**.

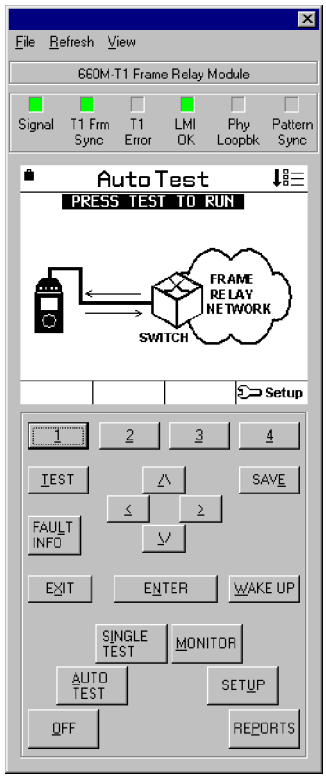
   A graphical representation of the tester appears as shown in Figure 8-8.
3. Operate the tester by using your mouse pointer to click the buttons.

   The tester responds to each mouse click.

The time it takes for the tester to respond to a mouse click might cause the display to become out of sync with the tester. If this is a problem, see Table 8-1 for a description of how to periodically update the tester's window.

Note

The PC needs to be connected to the tester.



aac015s.bmp

Figure 8-8. Tester Window

Remote Operation Tasks

The tasks that you can perform remotely are listed in Table 8-1.

Table 8-1. Remote Operation Tasks

Task	Menu Item
Save the tester window as a bitmap file (.bmp).	From the **File** menu, click **Save As**.
Print the display portion of the tester window.	From the **File** menu, click **Print**.
Update the tester window with new data.	Click **Refresh**.
Increase or reduce the size of the tester window.	From the **View** menu, click **Zoom**.
Periodically update the tester window with new data.	From the **View** menu, click **Periodic Update**. See Figure 8-9.
Toggle the mouse cursor on and off. (This is useful when printing the display window.)	From the **View** menu, click **Display Cursor**.
Display the tester window with the window to the left and the keypad to the right.	From the **View** menu, click **Keypad on the Side**.

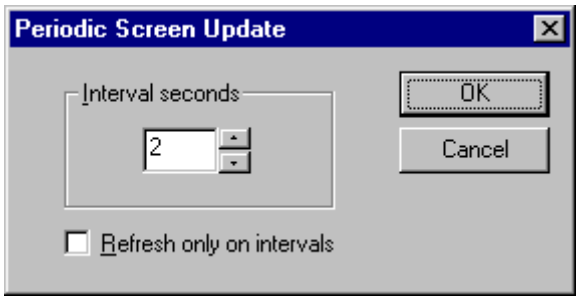


Figure 8-9. Periodic Screen Update Dialog Box

Notes

*Interval seconds indicates how often a refresh occurs. If you select **Refresh only on intervals**, a refresh only occurs on intervals, not when a key is pressed.*

Enabling New Tester Options

As new tests become available, the tests are added to new software downloads available from the Fluke Web site.

You can purchase a license for the new option by calling Fluke or visiting the Fluke Web site. You will be given a key code you can use to turn on the new test option.

To enable a new option, do the following:

1. From the **Tools** menu, click **Options**.
2. Click **Enable 660 Options**.

   The **Enable 660 Options** dialog box appears. See Figure 8-10.

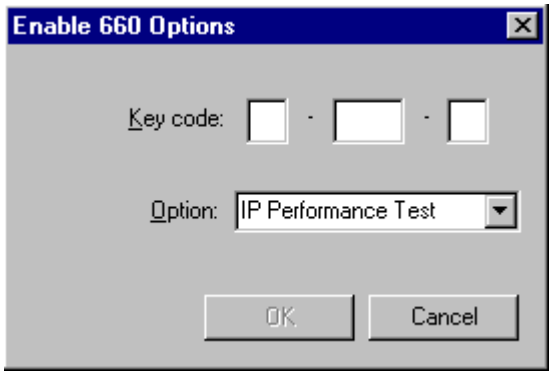


Figure 8-10. Enable 660 Options Dialog Box

3. In the **Option** box, click the name of the test.
4. In the **Key code** boxes, type the key code for the test.

   A message box appears indicating that the option has been enabled.

Troubleshooting

A Fluke support representative may ask you to open the Console window or download the Monitor file during a troubleshooting session. Instructions for these two tasks follow.

Opening a Console Window

You use the Console window to troubleshoot tasks that require a network emulator when one is not available. To display the Console window:

- From the **View** menu, click **Console Window**.

  A blank window appears.

  Note

  Press the Esc key to close the Console window.

Downloading the Monitor File to the PC

You can download the latest version of the monitor file (**MONITOR.H86**) from the Fluke Web site (http://www.fluke.com/nettools/software/660) to your PC. Using the Web site requires Internet access and a Web browser.

Follow the instructions for downloading the monitor file.

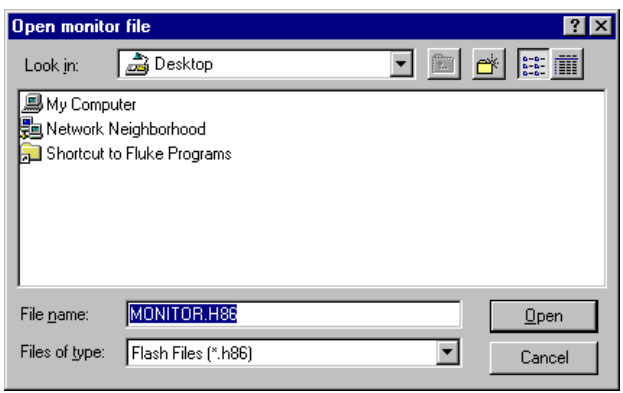
If you need help, call Fluke Technical Support.

Downloading the Monitor File to the Tester

After you download the monitor file to your PC, you can use 660-Link to download the monitor file to the tester.

1. From the **Tools** menu, click **Download Monitor File**.

   The **Open monitor file** dialog box appears. See Figure 8-11.



aac019s.bmp

Figure 8-11. Open Monitor Mode Dialog Box

2. Locate the folder that contains **MONITOR.H86**.

3. Highlight **MONITOR.H86**, then click **Open** to download the monitor file to the tester.

   A message box notifies you if the download is successful.

   ⚠Warning

   If you do not receive a message indicating that the download is successful, do not perform Step 6. Repeat the steps to download the monitor file to the PC and tester. If the Step 5 fails a second time, call Fluke Technical Support for assistance.

4. If the download is successful, from the **Tools** menu, click **Program Monitor Sectors**.

   A message box appears asking if you want to continue.

5. Click **Yes** to continue and program the monitor file into RAM.

   A message box notifies you if the monitor sectors have been programmed correctly

Chapter 9
Replacement Parts and Accessories

Introduction

This appendix lists the replacement parts and accessories that you can obtain from your local Fluke dealer for the 660 Frame Relay Installation Assistant.

Replacement Parts

Table 9-1 lists replacement parts that you can purchase for the tester.

When you place an order, you will need to supply the part number for the item.

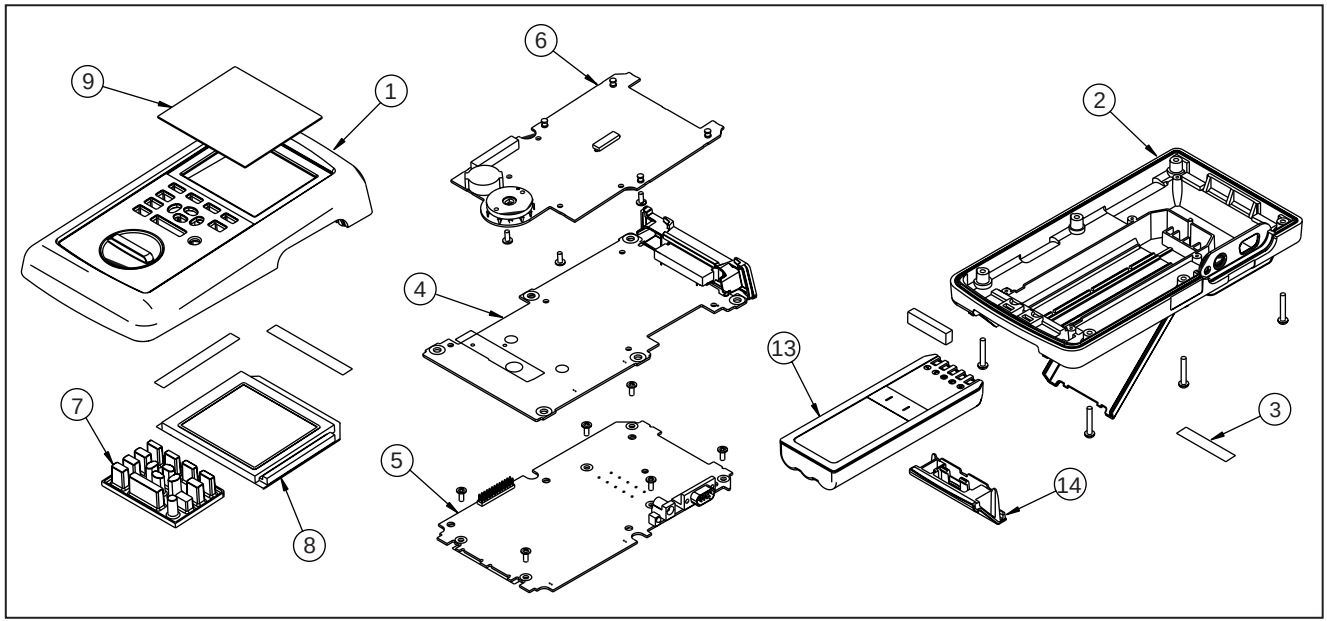
Refer to Figure 9-1 for an illustration of the replacement parts listed in this table.

Table 9-1. Replacement Parts for the 660 Series Frame Relay Installation Assistant

Item Number	Description	Order Number
①	Top case	PN 673480
②	Bottom case	PN 673491
③	Bottom case decal	PN 1277064
④	Framer assembly	PN 668316
⑤	Processor assembly	PN 668357
⑥	Keyboard assembly	PN 621018
⑦	Keypad	PN 621323
⑧	Display	PN 602430
⑨	Lens	PN 673571 (660T) PN 675477 (660TE)
⑩	Soft case	PN 675501
⑪	*660 Series Frame Relay Installation Assistant Users Guide* (English)	PN 804424

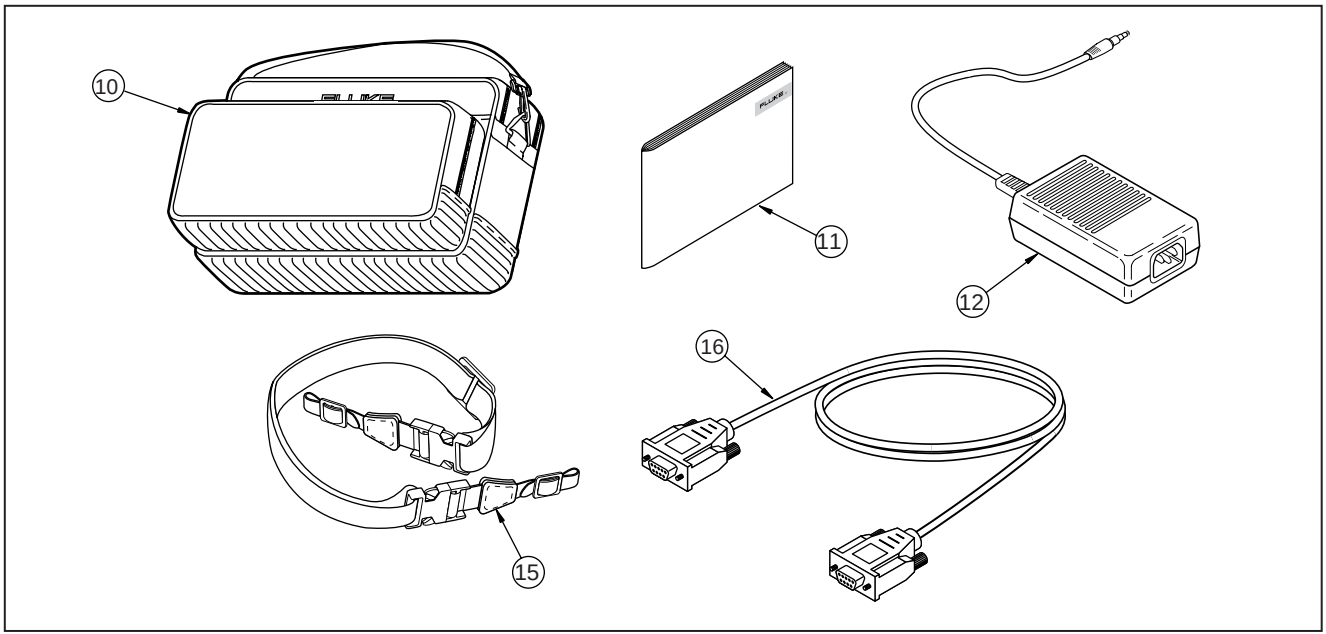
Table 9-1. Replacement Parts for the 660 Series Frame Relay Installation Assistant (cont.)

Item Number	Description	Order Number
Not shown	*660 Series Frame Relay Installation Assistant Reference Manual* Available on Fluke's website at http://www.fluke.com/manuals/660	None
⑫	Power supply INTL	PN 944223
⑬	Battery pack	PN 665083
⑭	Battery door	PN 938357
Not shown	Power cord	Contact Fluke Customer Service for appropriate power cord.
⑮	Strap	PN 946769
⑯	RS-232 cable	PN 944806



acc008f.eps

Figure 9-1. Replacement Parts



acc009f.eps

Figure 9-1. Replacement Parts (cont.)

Accessories

Table 9-2 lists the accessories that are available for purchase for the tester. These accessories are shown in Figure 9-2.

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant

Item Number	Description	Order Number
1	T1/FT1 Interface Module	660M-T1
2	E1/FE1 Interface Module	660M-E1
3	DDS 4-wire Interface Module	660M-DDS
4	Serial Interface Module	660M-S
5	Deluxe soft case (flight carry-on style)	C791
6	NiMH extra battery pack	BP7235
7	External battery charger NiMH INTL with power supply	BC7217 INTL
8	External battery charger NiMH 120 V with power supply	BC7217 120
9	Male RSV to female RSV extension cable	NS101

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant (cont.)

Item Number	Description	Order Number
⑩	Male RSV to X.21 Y cable	NS102
⑪	Male RSV to V.35 Y cable	NS103
⑫	Male RSV to French V.35 Y cable	NS104
⑬	Male RSV to RS-449/V.36 Y cable	NS105
⑭	Male RSV to RS-530 Y cable	NS106
⑮	Male RSV to RS-232/V.24 Y cable	NS107
⑯	Male RJ-48C to twin male Bantam cable adapter for T1	PN 1546664
⑰	Male RJ-48S to twin male Bantam cable adapter for DDS	PN 1546673
⑱	Male RJ-48C to male Siemens 3-prong cable adapter	PN 1275978
⑲	Female RJ-45 to male 15 pin D-sub adapter	PN 1541170
⑳	D-sub 15-pin socket to D-sub 15-pin socket	PN 1544228
㉑	4 Tap Boxes – Three female RJ-45 connectors	NT907

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant (cont.)

Item Number	Description	Order Number
(22)	Female RJ-45 to female RJ-45 coupler	PN 927884
(23)	Male RJ-45 to male RJ-45 Cat 5 patch cable	PN 107109
(24)	Male RJ-45 to alligator clips cable	PN 938394
(25)	Male BNC to male BNC cable-single, 2m, 75 Ω	PN 686623
(26)	Female BNC to Female BNC couplers-single, 75 Ω	PN 1278707
(27)	110 punchdown block to female RJ-45 adapter	PN 928379
(28)	66 punchdown block to female RJ-45 adapter	PN 928374
Not shown	Software Option IP Performance	660-TP
(29)	12V Vehicle Battery Charger/Adapter	PN 800695
(30)	Female RJ-48 to twin female BNC adapter	PN 1272912

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant (cont.)

Item Number	Description	Order Number
Not shown	T1/DDS Cable Kit • Male RJ-45 to male RJ-45 Cat 5 patch cable (PN107109) • Female RJ-48 to female RJ-48 coupler (PN 927884) • Male RJ-45 to alligator clips cable (PN 938394) • 110 punchdown block to female RJ-45 adapter (PN 928379) • 66 punchdown block to female RJ-45 adapter (PN 928374) • Male RJ-48C to twin male Bantam cable adapter for T1 (PN 1546664) • Female RJ-45 to male 15 pin D-sub adapter (PN 1541170) • Male RJ-48S to twin male Bantam cable adapter for DDS (PN 1546673) • D-sub 15-pin socket to D-sub 15-pin socket (PN 1544228)	NT801

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant (cont.)

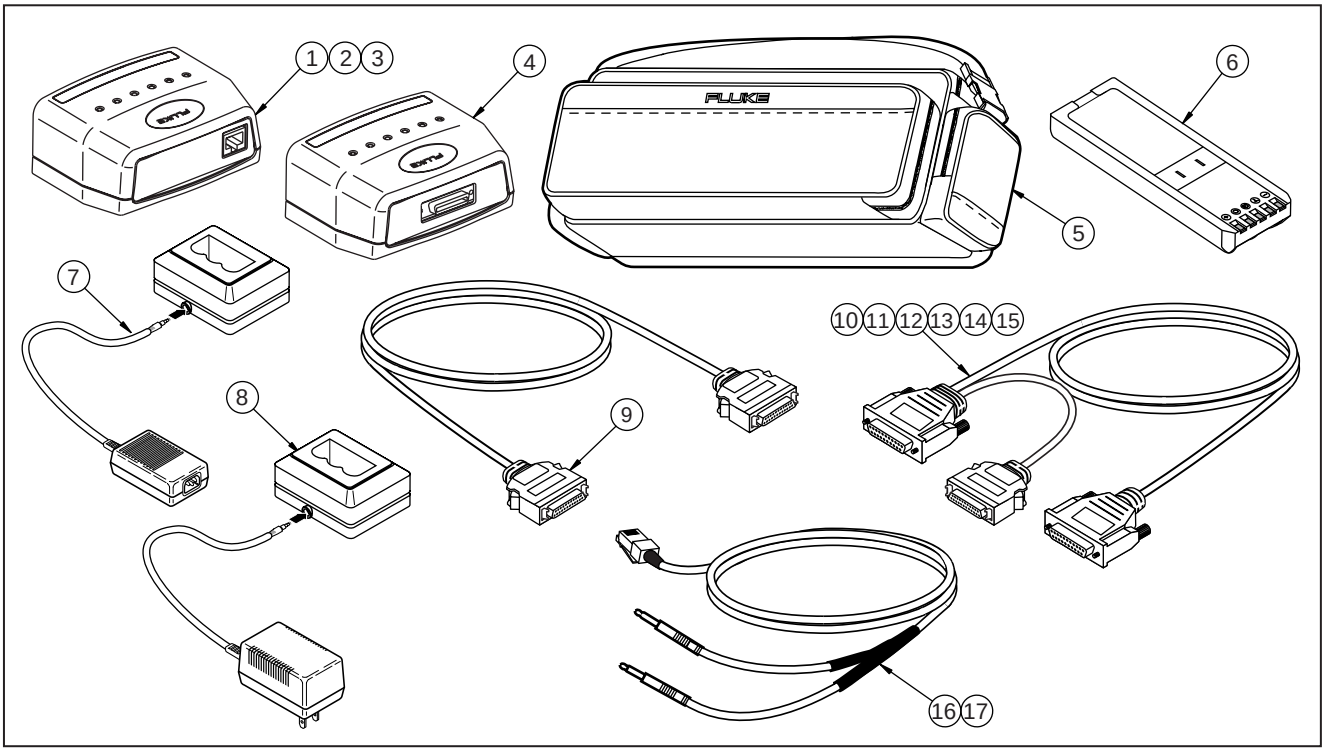
Item Number	Description	Order Number
Not shown	E1 Cable Kit • Male RJ-45 to male RJ-45 Cat 5 patch cable (PN 107109) • Female RJ-45 to female RJ-45 coupler (PN 927884) • Male RJ-45 to alligator clips cable (PN 938394) • Male RJ-48C to male Siemens 3-prong cable adapter (PN 1275978) • 2 Male BNC to male BNC cables-single, 2m, 75 Ω (PN 686623) • 2 Female BNC to Female BNC couplers-single, 75 Ω (PN 1278707)	NT802
Not shown	660T-Pack • 660T main tester • 660M-T1, 660M-DDS, 660M-S interface modules • Male RSV to V.35 Y cable (NS103) • External battery charger NiMH 120 V with power supply (BC7217 120) • Soft case (PN 675501) • 12V Vehicle Battery Charger/Adapter (PN 800695) • NiMH extra battery pack (BP7235)	660T-Pack

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant (cont.)

Item Number	Description	Order Number
Not shown	660E-Pack • 660TE main tester • 660M-E1, 660M-S interface modules • Male RSV to X.21 Y cable (NS102) • Male RSV to V.35 Y cable (NS103) • 2 Male BNC to male BNC cables-single, 2m, 75 Ω (NC101) • 2 Female BNC to Female BNC couplers-single, 75 Ω (NC901) • External battery charger NiMH INTL with power supply (BC7217 INTL) • Soft case (PN 675501) • 12V Vehicle Battery Charger/Adapter (PN 800695) • NiMH extra battery pack (BP7235)	660E-Pack

Table 9-2. Available Accessories for the 660 Series Frame Relay Installation Assistant (cont.)

Item Number	Description	Order Number
Not shown	660TE-Pack • 660TE main tester • 660M-T1, 660M-E1, 660M-S interface modules • Male RSV to X.21 Y cable (NS102) • Male RSV to V.35 Y cable (NS103) • 2 Male BNC to male BNC cables-single, 2m, 75 Ω (NC101) • 2 Female BNC to Female BNC couplers-single, 75 Ω (NC901) • External battery charger NiMH INTL with power supply (BC7217 INTL) • Soft case (PN 675501) • 12V Vehicle Battery Charger/Adapter (PN 800695) • NiMH extra battery pack (BP7235)	660TE-Pack



acc006f.eps

Figure 9-2. Accessories

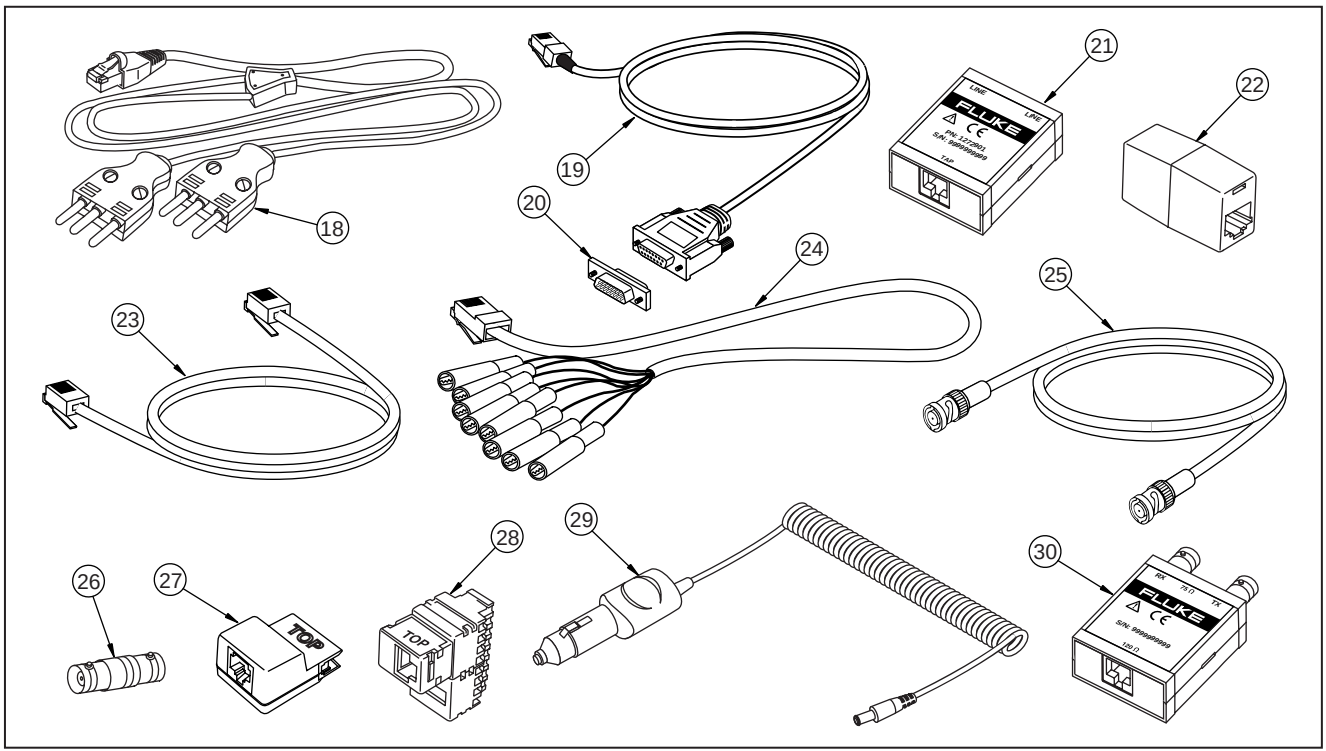


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Figure 9-2. Accessories (cont.)

Chapter 10
Glossary

A B C D E F H I L N O P Q S T U

A

AIS

Alarm Indication Signal. In a T1 or E1 transmission, an unframed all-ones signal transmitted instead of the normal signal to maintain transmission continuity and to indicate to the receiving equipment that there is a transmission interruption. The interruption is located either at the equipment originating the AIS signal or upstream from that equipment.

Alarm Indication Signal

See AIS.

Alternate Mark Inversion

See AMI.

American National Standards Institute

See ANSI.

AMI

Alternate Mark Inversion. A line code used for T1 and E1 circuits that transmit ones by alternate positive and negative pulses.

ANSI

American National Standards Institute. A voluntary organization that coordinates development and adoption of U.S. standards, such as those used in computer networking and telecommunications.

Asynchronous Transfer Mode

See ATM.

ATM

Asynchronous Transfer Mode. An international standard in which information is organized into cells. The recurrence of cells containing user data is not necessarily periodic.

Attenuation

The loss in strength of power between what is transmitted and what is received. Loss occurs through equipment, lines, or other transmission devices. Attenuation is usually expressed as a ratio in dB (decibel).

B

B8ZS

Binary 8-Zero Substitution. A line code used on T1 circuits that substitutes a special code whenever eight consecutive zeros are transmitted. The code is designed to maintain a certain density of ones required to keep the T1 carrier mean voltage at 0 V.

Backward Explicit Congestion Notification

See BECN.

Bandwidth

The difference in Hertz (Hz) between the highest and the lowest frequencies of a transmission channel. The bandwidth determines the capacity or amount of data that can be sent through a given circuit.

BECN

Backward Explicit Congestion Notification. A bit set in a frame relay frame header by a frame relay network. The bit notifies an interface device (DTE) that congestion avoidance procedures should be initiated by the sending device.

BER

Bit Error Rate. The ratio of received bits that contain errors to the total number of bits transmitted. BER is used to measure transmission quality. The value is usually so small that it is expressed in scientific notation. See SES.

BERT

Bit Error Rate Test. A test used to determine transmission quality of communications circuits. BERT is used for acceptance testing of new circuits, maintaining existing circuits, or troubleshooting failing circuits.

Binary 8-Zero Substitution

See B8ZS.

Bipolar Violation

See BPV.

Bit Error Rate

See BER.

Bit Error Rate Test

See BERT.

BPV

Bipolar Violation. A transmission error that occurs when there is a pulse of the same polarity as the previous pulse.

C

CAS

Channel Associated Signaling. A form of signaling that identifies a circuit's state by repeatedly sending one or more bits of signaling status.

CCITT

Comite Consultatif International Telegraphique et Telephonique. International Consultative Committee for Telegraphy and Telephony. An international standards organization that proposes recommendations for international communications. The organization is now called the ITU-T. See ITU-T.

Cell

A unit of transmission in ATM. Each cell consists of a 5-octet header and a 48-octet payload.

Channel

A communication path within a given T1 or E1 line with a defined bandwidth. In some cases, several channels can be multiplexed over a single cable.

Channel Associated Signaling

See CAS.

Channel Service Unit

See CSU.

Checksum

A technique used to check the integrity of transmitted data. A value is computed at the sending and receiving devices, then compared for verification.

CIR

Committed Information Rate. The rate in bps at which a frame relay network transfers data under normal conditions. The rate is averaged over a minimum time interval (Tc), usually set to one second.

Comite Consultatif International Telegraphique et Telephonique

See CCITT.

Committed Information Rate

See CIR.

Convergence Sublayer

See CS.

CPE

Customer Premises Equipment. Circuit terminating devices, such as routers or FRADs, that reside on the customer's premise. The devices may or may not be owned by the local telephone company.

CRC

Cyclic Redundancy Check. An error-checking technique that ensures the accuracy of the contents of T1 and E1 frames transmitted between circuit terminating devices. A value is computed by the sending device then compared to a recomputed value at the receiving device. T1 circuits use a method called CRC4, and E1 circuits use a method called CRC6.

CS

Convergence Sublayer. The conversion functions between frame relay and ATM protocols.

CSU

Channel Service Unit. A component of CPE used to terminate a digital circuit at the customer site. CSU usually performs signal regeneration and responds to loopback codes.

Customer Premises Equipment

See CPE.

Cyclic Redundancy Check

See CRC.

D

Data Circuit Terminating Equipment

See DCE.

Data-On-Demand Routing

See DDR.

Data Link Connection Identifier

See DLCI.

Data Service Unit

See DSU.

Data Terminal Equipment

See DTE.

Data Terminal Ready

See DTR.

Dataphone Digital Service

See DDS.

DCE

Data Circuit Terminating Equipment. Digital data communications equipment (typically modems) which provides the function of interfacing between data terminal equipment and a separate data communications channel.

DDR

Dial-On-Demand Routing. A technique that routers use to start and stop circuit-switched sessions that are requested by transmitting devices.

DDS

Dataphone Digital Service. A private line digital service. DDS lines typically transmit data at rates of 2,400; 4,800; 9,600; 56,000, and 64,000 bps.

DE

Discard Eligible. A bit position in the frame relay frame header designed to maintain network quality of service. When this bit is set by CPE or an Ingress edge switch, it marks a frame as low priority traffic. This frame may be discarded if network congestion occurs.

Discard Eligible

See DE.

DLCI

Data Link Connection Identifier. A unique value assigned to a PVC or SVC in a frame relay network. The identifier is assigned to a particular end device within a customer's access channel and has local significance only to that channel. In the LMI extended specification, DLCIs are globally significant.

DSU

Data Service Unit. A device that translates a serial data stream transmitted by DTE into a digital transmission stream, such as DDS or T1.

DTE

Data Terminal Equipment. Customer devices (for example, routers and FRADs) that connect to a network through data circuit terminating equipment.

DTR

Data Terminal Ready. A control signal that notifies the data communications equipment that the data terminal equipment is ready to send and receive data.

E

E1

A WAN digital transmission scheme used predominantly in Europe. E1 lines transmit data at the rate of 2.048 Mbps.

E3

A WAN digital transmission scheme used predominantly in Europe. E3 lines transmit data at the rate of 34.368 Mbps.

ESF

Extended Super Frame. A framing scheme used on T1 circuits that consists of 24 frames of 192 bits each. The 193d bit provides various functions, such as timing. See SF.

Extended Super Frame

See ESF.

F

FAS

Frame Alignment Signal. A signal that is inserted in every frame or once in every n frames that always occupies the same position within the frame and is used to establish and maintain frame alignment.

Far End Block Error

See FEBE.

FCS

Frame Check Sequence. The standard 16-bit cyclic redundancy check used in frame relay, HDLC, and other data link layer protocols. The FCS detects bit errors that occur between the opening flag and the FCS.

FDDI

Fiber Distributed Data Interface. A 100 Mbps LAN standard that was developed by ANSI X3T9.5. FDDI works on fiber-optic cables using techniques similar to token-ring.

FEBE

Far End Block Error. An E1 maintenance signal used to monitor bit error performance on the network communications channel. The E-bit is set in a frame transmitted by the far end equipment after it detects a CRC-4 error in its received signal.

FECN

Forward Explicit Congestion Notification. A bit set in the frame relay frame header by frame relay network equipment to notify an interface device (DTE) that congestion avoidance procedures should be initiated by the receiving device.

Fiber Distributed Data Interface

See FDDI.

Flow Control

A technique used to ensure that a transmitting device, such as a modem, does not overwhelm a receiving device with data. When the receiving device's buffers become full, it notifies the sending device to suspend transmission until the data have been processed.

Forward Explicit Congestion Notification

See FECN.

Fractional Channels

Groupings of consecutively or non-consecutively assigned time slots within a digital T1 or E1 transmission stream. In frame relay, the data within a group of dedicated time slots is concatenated to create a single data channel of n × 56 kbps or n × 64 kbps bandwidth. For T1, there are 24 time slots available for a maximum aggregate bandwidth of 1.536 Mbps. For E1, there are up to 31 time slots available for a maximum aggregate bandwidth of 1.984 Mbps.

FRAD

Frame Relay Access Device. Customer premise data terminal equipment that frames data with header and trailer information prior to transmission to a frame relay switch. On the receiving end, the FRAD strips away the frame relay control information so that the target DTE is presented with the data in its original form.

Frame

A logical grouping of data bits with delineating flags indicating the beginning and end of the frame. The bits are transmitted serially over the transmission medium.

Frame Alignment Signal

See FAS.

Frame Check Sequence

See FCS.

Frame Relay Access Device

See FRAD.

Frame Relay Frame

A variable-length unit of data in frame relay format that is transmitted through a frame relay network as pure data.

Framing Error

An error that occurs when a receiving device improperly interprets the bits in a frame.

H

Host

A computer system on a network.

I

Integrated Services Digital Network

See ISDN.

International Telecommunications Union

See ITU-T.

Internet Protocol

See IP.

IP

Internet Protocol. A network layer protocol that works with TCP and is usually identified as TCP/IP. IP provides a connectionless internetwork service.

IP address

Internet Protocol address. A 32-bit address assigned to hosts using TCP/IP. An IP address consists of a network number, an optional subnetwork number, and a host number. The network and subnetwork numbers are used for routing, and the host number is used to identify individual hosts.

ISDN

Integrated Services Digital Network. A telephone company communications protocol that permits telephone networks to carry traffic, such as data and voice.

ITU-T

International Telecommunications Union Telecommunications. ITU-T is an international body of member countries that defines international telecommunications industry standards. The ITU-T carries out the functions of the former CCITT.

L

LCV

Line Code Violation. An occurrence of a BPV or EXZ physical transmission error.

Line Build Out

A selectable output attenuation generally required of data terminal equipment to satisfy the requirement that the last span of T1 lines lose 15 to 22.5 dB.

Line Code Violation

See LCV.

LMI

Local Management Interface. A set of frame relay specification enhancements. LMI provides keep-alive signals (verify that data are flowing), multicasts (local and multicast DLCIs), global addressing, and DLCI status.

Local Management Interface

See LMI.

LOF

Loss of Frame. A condition that indicates that the receiving device has lost frame delineation.

Loopback

A diagnostic test in which the transmitted signal is returned to the sending device after it passes through a data communications link or network. A technician (or built-in diagnostic circuit) can compare the signals to identify any problems.

Loopback Test

A test that typically runs on a four-wire circuit. The two transmit leads are joined to the two receive leads, then a signal is sent around the loop. Any differences between the sent and received signals are measured.

LOS

Loss of Signal. A condition that indicates that a receiving device has lost the received signal.

Loss of Frame

See LOF.

Loss of Signal

See LOS.

N

Network Node Interface

See NNI.

NNI (Network-to-Network Interface)

Network-to-Network Interface. The standard interface between two frame relay switches that are both in a private network or both in a public network. NNI enables networks to query and respond to one another using link management frames.

O

OOF

Out of Frame. An error condition that occurs when the network or the DTE data terminal equipment senses that 2 of 4 or 2 of 5 framing bits are missing.

OOS

Out of Service. A condition in which equipment is removed from end-user service. The wide area network connection will be unavailable to DCE, such as computers, until the DTE or DCE equipment can be brought back into service.

Out of Frame

See OOF.

Out of Service

See OOS.

P

P/F criteria

Pass/Fail criteria. A method that uses a user-settable threshold to determine if a measured result is exceeding acceptable limits.

Packet

A logical grouping of data bits that includes a header containing control information and typically user data. The bits are sent as a data link layer unit over a transmission medium to a packet switching network.

Packet Internet Groper

See PING.

Payload

The portion of a cell, frame, or packet that contains upper layer data.

Permanent Virtual Circuit

See PVC.

PHY

Physical Sublayer. One of two sublayers of the FDDI physical layer. The physical sublayer provides for the transmission of cells over a physical medium that connects two ATM devices.

Physical Medium Dependent

See PMD.

Physical Sublayer

See PHY.

PING

Packet Internet Groper. A protocol and program for sending ICMP echo request packets to a particular IP destination device to determine whether or not another network device is online and responding.

PMD

Physical Medium Dependent. One of two sublayers of the FDDI physical layer. The PMD performs the most basic bit transmission functions of the network.

PRBS

Pseudo Random Bit Sequence. A test pattern resembling random data that enables another independent circuit to synchronize on the pattern and detect transmission bit errors.

Pseudo Random Bit Sequence

See PRBS.

PVC

Permanent Virtual Circuit. A virtual circuit that is established permanently. Data terminating devices with a need for continuous communication use PVCs to save the bandwidth required for circuit establishment and tear down.

Q

Q.933 Annex A

The signaling standard for frame relay to support a local LMI, PVCs, and SVCs. It is based on the signaling standard for ISDN.

QRSS

Quasi-Random Signal Sequence. A test pattern commonly used to simulate live data signals.

Quasi-Random Signal Sequence

See QRSS.

S

SEF (Severely Errored Frame)

For a T1 digital signal, a SEF defect is determined by examining contiguous time windows for frame bit errors. For SF, the window size is 0.75 ms, and only the Ft bits are examined. For ESF, the window size is 3 ms, and only the frame pattern sequence bits are examined.

Serial Transmission

A data transmission technique in which the bits are transmitted sequentially over a single channel.

SES

Severely Errored Seconds. A technique used to specify the error performance of physical transmission circuits. SES provides a more accurate indication of the distribution of bit errors than BER. See BER.

Severely Errored Frame

See SEF.

Severely Errored Seconds

See SES,

SF

Super Frame. A common framing type used on T1 lines. SF consists of 12 frames of 192 bits each. The 193rd bit provides functions, such as error checking.

Super Frame

See SF.

SVC

Switched Virtual Circuit. A connection that is dynamically established using signaling. The customer defines the endpoints when the call is initiated.

Switched Virtual Circuit

See SVC.

T

T1

A WAN digital transmission scheme. T1 lines transmit at the rate of 1.544 Mbps. Also referred to as digital signal level 1 (DS-1).

TC

Transmission Convergence. A sublayer of the ATM physical layer that transforms the flow of cells into a steady flow of bits and bytes for transmission over the physical medium.

Transmission Convergence

See TC.

U

UNI

User-Network Interface. ATM Forum and Frame Relay Forum standards that define connections between customers or end stations (DTE) and a local switch (DCE) on an ATM or frame relay network. These standards also describe local signaling between the CPE and the ingress switch.

User Network Interface

See UNI.

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