

User Manual

Tektronix

CTS 750
SDH/PDH and Jitter Test Set
070-8921-03

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse

To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Wear Eye Protection

To avoid eye injury, wear eye protection if there is a possibility of exposure to high-intensity rays.

Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:



DANGER
High Voltage



Protective Ground
(Earth) Terminal



ATTENTION
Refer to
Manual



Double
Insulated

Certifications and Compliances

CSA Certified Power Cords

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

Preface

This manual describes how to use the Tektronix CTS 750 SDH Test Set. This manual is your primary source of information about how the CTS 750 functions.

How This Manual is Organized

This manual is divided into four sections: *Getting Started*, *Operating Basics*, *Reference*, and *Appendices*.

- *Getting Started* provides an overview of the CTS 750 and describes first time operation.
- *Operating Basics* explains the basic principles of operating the CTS 750. The *Operating Basics* section also includes a tutorial which introduces you to most of the capabilities of the CTS 750 by having you run a BER test.
- *Reference* provides explanations of how to perform detailed tasks.
- The *Appendices* provide a listing of specifications, default factory settings, an incoming inspection test, and other useful information.

Conventions

This manual uses the following conventions:

- The names of front-panel controls and menus appear in all upper case letters, for example, TRANSMIT and HELP.
- Names appear in the same case in this manual as they appear on the display of the CTS 750, for example, Test Duration and USER DEFINED.
- Within a procedure, a specific button to be pressed or a parameter to be selected appears in boldface print. For example, press the **AUTOSCAN** button or select **Continuous**.

The *Tutorial* and the *Reference* sections frequently present procedures in tables. Perform the procedure by reading from left to right in the table (see example below). The word *none* in a cell indicates that no action is required.

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
Begin here with Step 1	Step 2	Step 3	Step 4
		Step 5	Step 6
		Step 7	Step 8, CTS 750 instruction is complete

Some procedures require several iterations of highlighting parameters and selecting choices. Some procedures may require more than one menu button or menu page selection as well.

Related Manuals

The following documents are also available for the CTS 750 SDH Test Set:

- The *CTS 750 SDH Test Set Reference* (Tektronix part number 070-9337-XX) provides a quick overview of the menu structure, front-panel buttons, example alarm responses, and a glossary.
- The *CTS 750 SDH Test Set Référence*, French translation (Tektronix part number 070-9338-XX).
- The *CTS 750 SDH Test Set Referenz*, German translation (Tektronix part number 070-9339-XX).
- The *CTS 750 SDH Test Set Riferimenti*, Italian translation (Tektronix part number 070-9713-XX).
- The *CTS 750 SDH Test Set Referencia*, Spanish translation (Tektronix part number 070-9770-XX).

- The *CTS 750 SDH Test Set Programmer Manual* (Tektronix part number 070-8925-XX) describes how to control the CTS 750 using an instrument controller.
- The *CTS 710 SONET Test Set & CTS 750 SDH Test Set Reference* (Tektronix part number 070-8854-XX) provides a quick overview of the instrument programming commands.
- The *CTS 710 SONET Test Set & CTS 750 SDH Test Set Service Manual* (Tektronix part number 070-8853-XX) provides information on maintaining and servicing your instrument to the module level.

Using the CTS 750 Reference

The Reference presents an overview of the CTS 750 menu structure, front-panel buttons, examples of alarm responses, and a glossary. To store the Reference for easy viewing, fold the card to display the desired page and slide the card behind the window located on the inside of the top flap of the pouch (see Figure i).

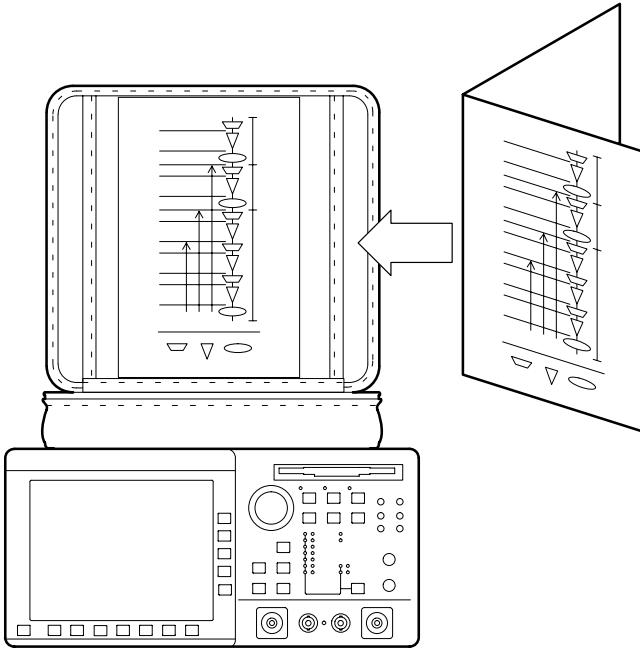


Figure i: Placing the Reference for Easy Viewing

Contacting Tektronix

Product Support	<p>For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time</p> <p>Or contact us by e-mail: tm_app_supp@tek.com</p> <p>For product support outside of North America, contact your local Tektronix distributor or sales office.</p>
Service Support	<p>Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations.</p> <p>http://www.tek.com</p>
For other information	<p>In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.</p>
To write us	<p>Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000</p>



Getting Started

Getting Started

This section provides a description of the CTS 750, a list of standard and optional accessories, and explains how to operate the CTS 750 for the first time.

Product Description

The Tektronix CTS 750 SDH Test Set is a rugged, portable test set designed for installing and maintaining telecommunications networks. The CTS 750 is an SDH analyzer that combines bit error rate test capabilities with overhead testing, payload mapping, and demapping in one unit. The CTS 750 features the following capabilities:

- STM-0, STM-0E, STM-1E, STM-1, STM-4, 2 Mb/s, 34 Mb/s, and 140 Mb/s transmit and receive
- Optical interface available at 1310 nm and 1550 nm
- Bit Error Rate testing
- BIP error monitoring and analysis
- PDH Add/Drop/Test
- Payload mapping and demapping
- Jitter generation and analysis
- Wander generation and measurement
- Unique timing quality measurement
- Pointer generation, including sequences, and analysis
- Alarm generation and analysis
- TU error monitoring and analysis
- Performance monitoring
- APS testing

- DCC and user channel access
- Programmable via IEEE 488.2 and RS-232

The CTS 750 meets the needs of the craftsperson and the network engineer. The CTS 750 meets the requirements of those working in network installation and maintenance by providing the capability to perform:

- Network integrity testing
- In-service performance monitoring
- Stimulus and response testing
- Stress testing
- Overhead testing
- Automated jitter conformance testing

Accessories

Some accessories are included with the CTS 750 SDH Test Set. If you wish to purchase optional accessories or additional standard accessories, see a Tektronix products catalog or contact your local Tektronix field representative.

Standard Accessories

- *CTS 750 SDH Test Set User Manual*, Tektronix part number 070-8921-XX
- *CTS 750 SDH Test Set Reference*, Tektronix part number 070-9337-XX
- Instrument Front Cover, Tektronix part number 200-3232-XX
- 75 Ω loopback cable, Tektronix part number 012-1338-XX
- Pouch, Tektronix part number 016-1266-XX

Optional Accessories

- *CTS 750 SDH Test Set Référence*, French translation (Tektronix part number 070-9338-XX)
- *CTS 750 SDH Test Set Referenz*, German translation (Tektronix part number 070-9339-XX)
- *CTS 750 SDH Test Set Riferimenti*, Italian translation (Tektronix part number 070-9713-XX)
- *CTS 750 SDH Test Set Referencia*, Spanish translation (Tektronix part number 070-9770-XX)
- *CTS 750 SDH Test Set Programmer Manual*, (Tektronix part number 070-8925-XX)
- *CTS 710 SONET Test Set & CTS 750 SDH Test Set Reference*, Programming commands (Tektronix part number 070-8854-XX)
- *CTS 710 SONET Test Set & CTS 750 SDH Test Set Service Manual* (Tektronix part number 070-8853-XX)
- Hard Transit Case, Tektronix part number 016-1157-XX
- Soft Carrying Bag, Tektronix part number 016-1158-XX
- K212 Portable Instrument Cart
- Optical Connector Kit, Tektronix part number 020-1885-XX

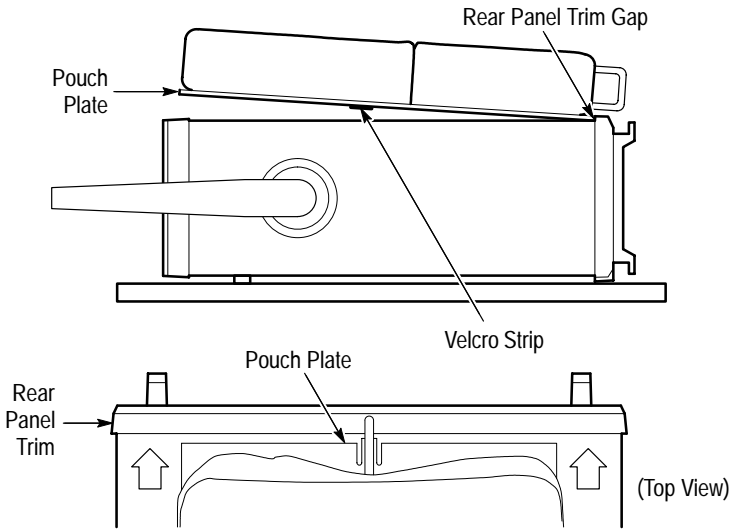
First Time Operation

This section describes how to set up the CTS 750 for the first time.

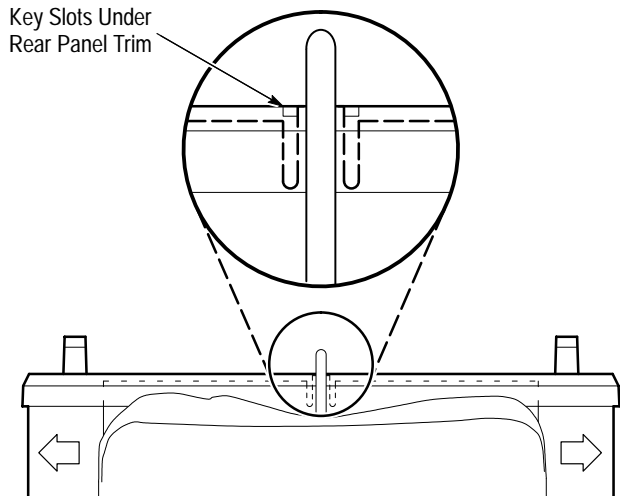
Installing the Accessory Pouch

The CTS 750 ships with an accessory pouch that mounts on top of the instrument. The pouch is not installed at the factory. To install the accessory pouch:

1. Place the CTS 750 on a table or work bench with the front facing toward you.
2. Center the pouch plate and insert the rear edge of the plate in the space between the cabinet top and the rear panel trim (see part A of Figure 1–1).
3. Move the pouch sideways as necessary to line up the key slots in the pouch plate with the keys on the rear panel (the plate is centered when it is aligned) and push the plate all the way in (see part B of Figure 1–1).
4. While keeping the pouch plate pushed under the rear panel trim, reach under the pouch plate and carefully remove the backing from the Velcro strip to expose the adhesive on the Velcro strip. The Velcro should remain attached to the pouch plate.
5. Grasp the pouch plate assembly with both hands near the front of the assembly.



A. Push the pouch plate into the rear panel trim gap.



B. Center the pouch plate to align with key slot under the rear panel trim.

Figure 1-1: Installing the Accessory Pouch



CAUTION. *In the next step, use only enough force to clear the front panel trim with the plate front edge. Excessive force will cause a permanent bow in the plate.*

6. Push back on the pouch plate and press down with the heels of your hands to bow the plate enough to slide the front of the plate into the space between the cabinet top and the front panel trim (see Figure 1–2).
7. Move the front of the pouch as needed to line up the slots in the plate with the keys on the front panel.
8. Release the pressure on the plate to allow it to return to its normal flat shape.
9. Press down firmly to secure the Velcro strip to the top of the cabinet top.

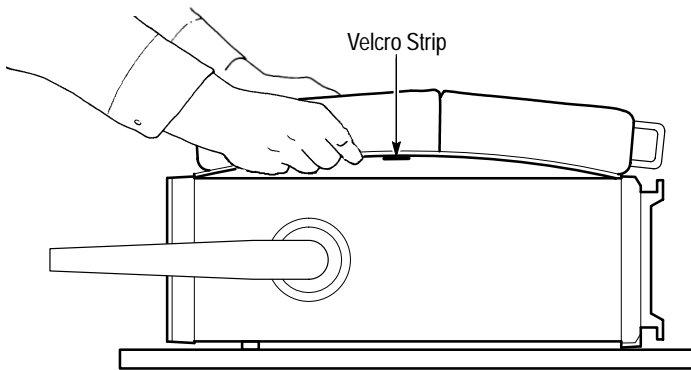


Figure 1–2: Inserting the Pouch Under the Front Panel Trim



CAUTION. Do not use the D-ring (see Figure 1–3) on the pouch plate to lift the CTS 750. Using the D-ring to lift the CTS 750 can pull the accessory pouch off the CTS 750, resulting in damage to the CTS 750.

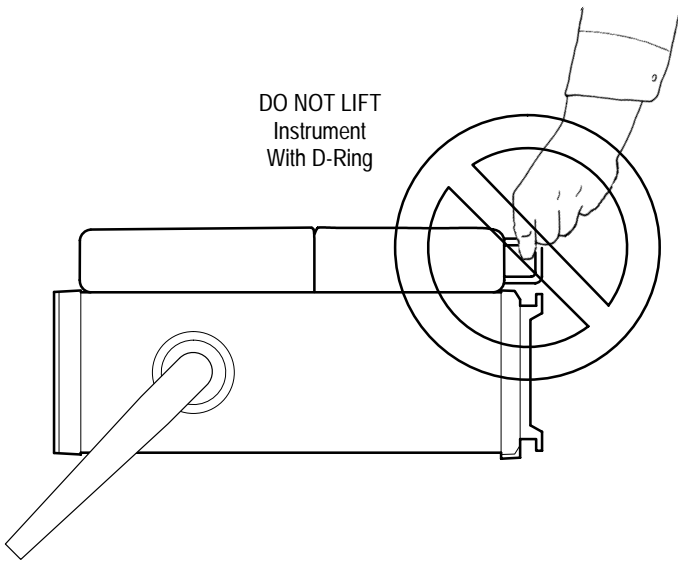


Figure 1–3: Location of the D-Ring on the Accessory Pouch

Setting Up the CTS 750

Before you use the CTS 750, ensure that it is properly set up and powered on.

To properly set up the CTS 750, do the following:

1. Be sure that the environment in which you will operate the CTS 750 is within instrument specifications. Specifications for temperature, relative humidity, altitude, vibrations, and emissions are included in *Appendix D*.
2. Leave space around the CTS 750 for cooling. Verify that the air intake and exhaust holes on the sides of the cabinet (where the fan operates) are free of any airflow obstructions. Leave at least 5 cm (2 in) free on each side.



WARNING. *To avoid electrical shock, be sure that the power cord is disconnected before checking the fuse.*

3. Check the fuse to be sure it is the proper type and rating (see Figure 1–4). The CTS 750 works with one of two fuses, depending on the AC supply. Each fuse requires its own cap (see Table 1–1). The CTS 750 is shipped with the UL-approved fuse installed.

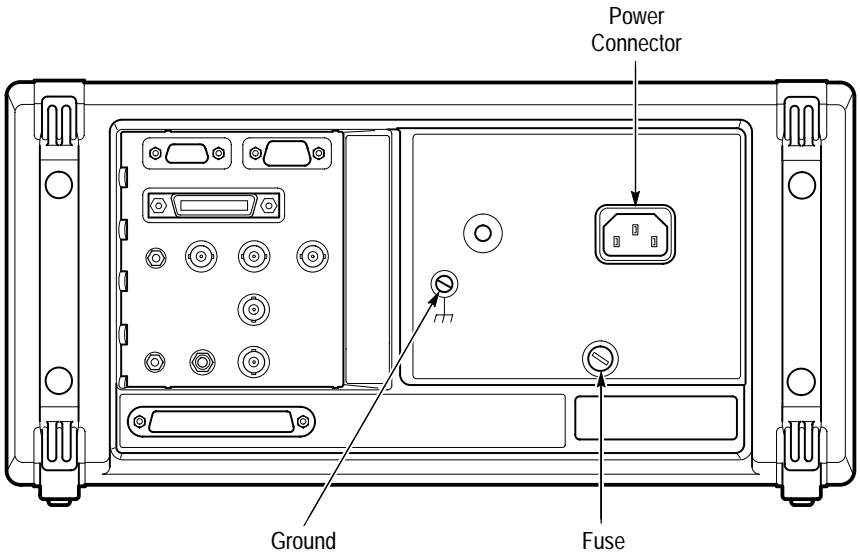


Figure 1-4: Rear-Panel Controls and Connectors Used in Setup

Table 1-1: Fuse and Fuse Cap Part Numbers

Fuse	Fuse Tektronix Part Number	Fuse Cap Tektronix Part Number
0.25 in × 1.25 in (UL 198.6, 3AG): 8 A FAST, 250 V	159-0046-XX	200-2264-XX
5 mm × 20 mm (IEC 127): 6.3 A, 250 V	159-0381-XX	200-2265-XX

4. Check that you have the proper electrical connections. The CTS 750 power requirements are listed in Table 1–2.

Table 1–2: Power Requirements

Voltage Range	Frequency
90–132 V	50/60 Hz
180–250 V	50/60 Hz
100–132 V	400 Hz

5. Connect the proper power cord from the rear-panel power connector (see Figure 1–4) to the power system.

Turning On the CTS 750

To turn on the CTS 750:

1. Press the front-panel **ON/STBY** (On/Standby) button (see Figure 1–5).

The ON/STBY button controls power to most instrument circuits. Power continues to go to certain parts even when this switch is set to STBY.

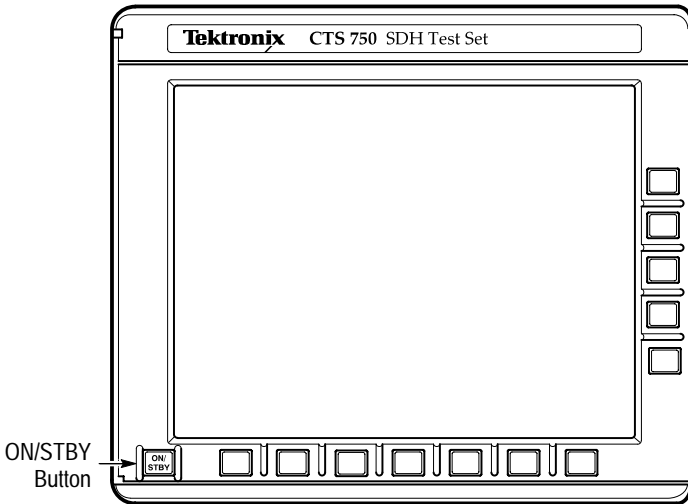


Figure 1-5: ON/STBY Button

The CTS 750 performs an internal self test each time it is turned on. When turned on, it displays a screen that states whether or not it passed the self test. (If the self test passes, the status display screen is removed after a few seconds.)

2. Check the self-test results.

If the self test fails, contact your local Tektronix Service Center for assistance.

Turning Off the CTS 750

Press the **ON/STBY** button to turn off the CTS 750.



Operating Basics



Functional Overview

This section describes how to use and navigate through the basic functions of the CTS 750, including:

- Controls, indicators, and connectors
- Elements of the display
- Menu structure
- On-line help
- Connecting signals
- Parameter selection and editing
- Disk drive operation

Front-Panel Controls, Indicators, and Connectors

Figures 2–1 and 2–2 identify the controls, indicators, and connectors located on the front panel of the CTS 750 SDH Test Set.

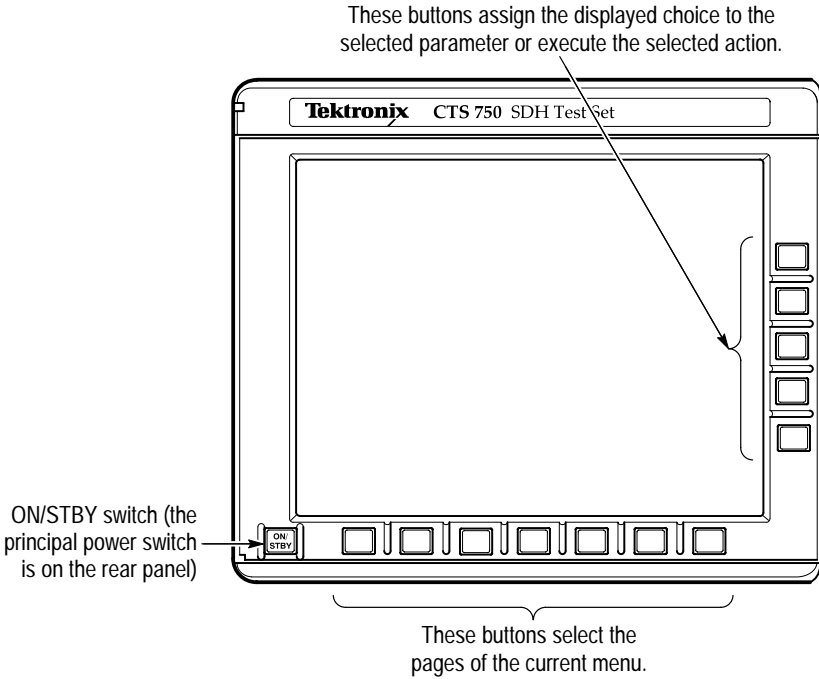


Figure 2–1: Controls Located Around the Display

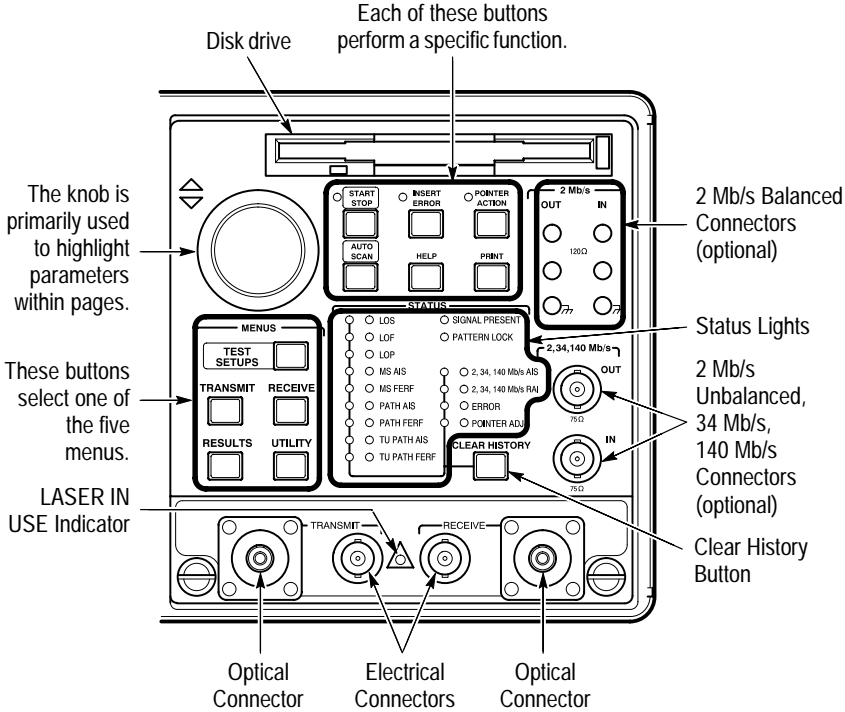


Figure 2-2: Front-Panel Controls, Indicators, and Connectors

Rear-Panel Controls and Connectors

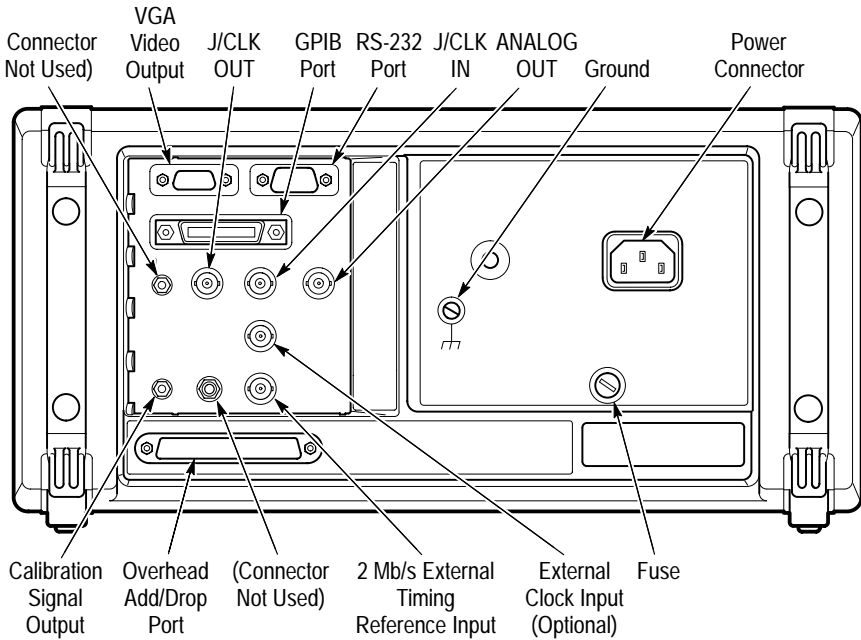


Figure 2-3: Rear-Panel Controls and Connectors

Front-Panel Status Lights

The status lights make it easy to quickly determine the condition of the received signal. There are three types of front-panel status lights.

- Green status lights. Green lights indicate whether a signal is present and whether the CTS 750 has locked onto the signal.
- Red status lights. When a red status light is on, it means that the indicated event is occurring. When the red light is off, no event is occurring.
- Yellow history lights. Once an event has been detected, a yellow history light is turned on. The yellow history light shows that the

associated event occurred at some time in the past. Yellow history lights remain on until you reset the event history by pressing the CLEAR HISTORY button, starting a new test, or changing the Receive Rate.

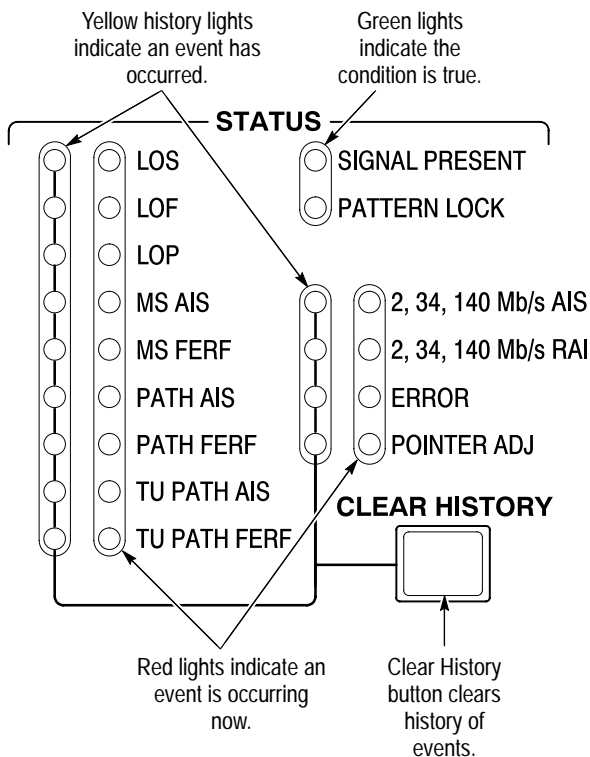


Figure 2-4: Status Lights (With Option 36 Installed)

Reading the Display

There are several major areas that make up the CTS 750 display (see Figure 2-5).

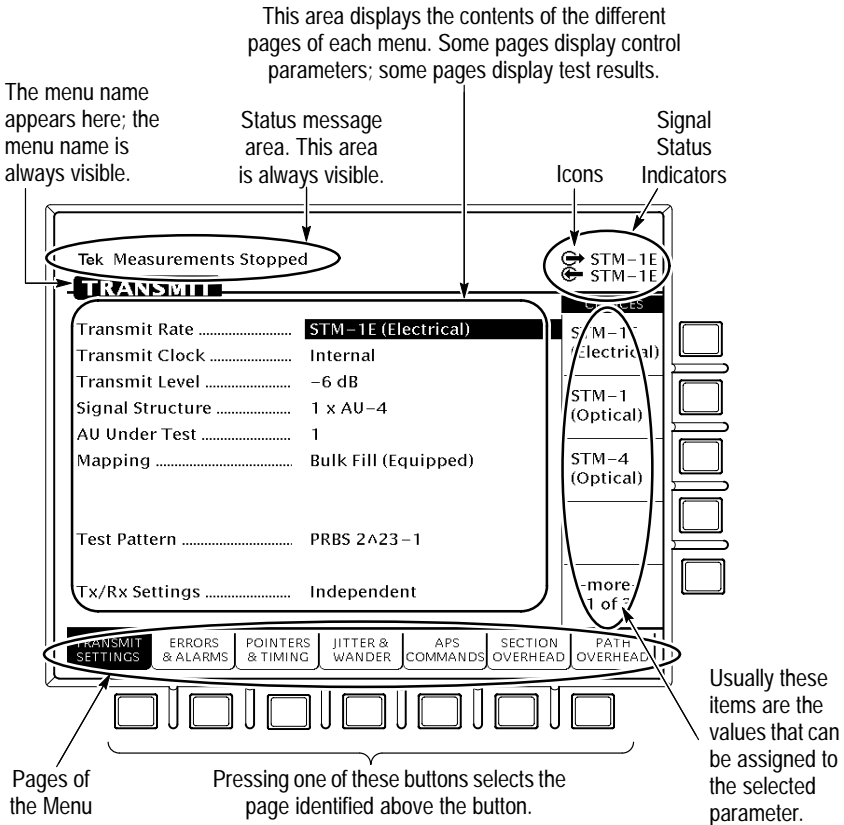


Figure 2-5: Major Areas of the Display

Figure 2–6 provides a guide to specific areas of the display.

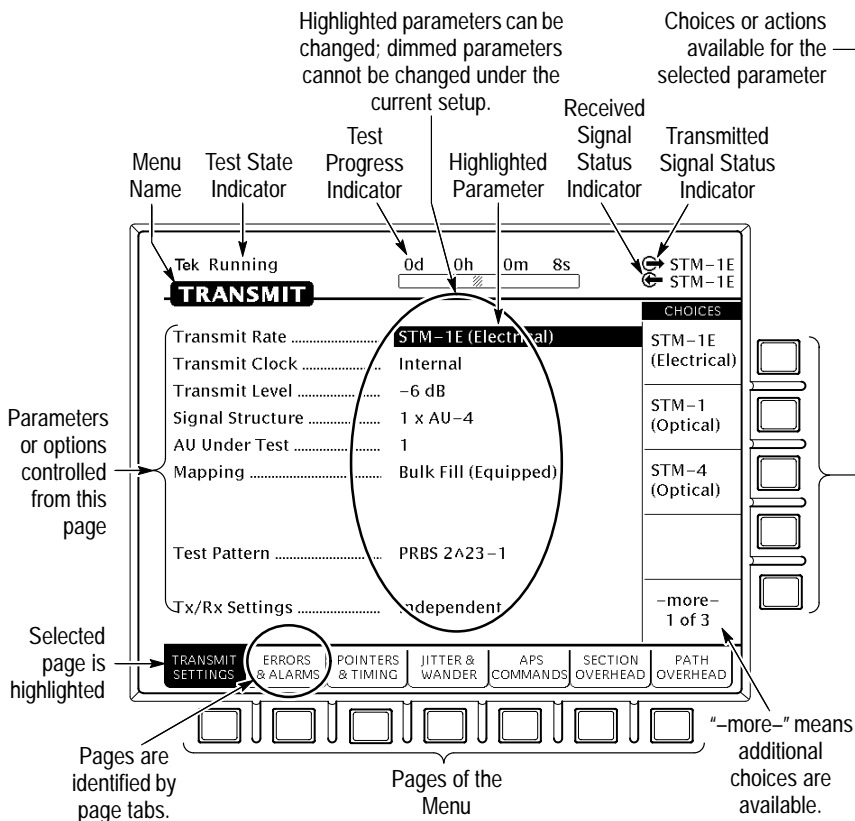













Figure 2–6: Specific Elements of the Display

Table 2–1 provides a list of icons that appear on the display. Icons are used to identify information, indicate instrument status, and clarify available actions.

Table 2-1: Icons that Appear in the Display

Icon	Meaning
	Transmitted signal
	Received signal
	CTS 750 is in through mode
	CTS 750 is in coupled mode
	Use the knob
	Not allowed
	File stored on disk
	File stored in memory
	Message or warning identifier
	Press the button to perform the indicated action
	The CTS 750 is busy

The Basic Menu Structure

The CTS 750 is controlled primarily through its menu system. Though several controls are located on the front panel, such as INSERT ERROR, most functions are controlled from one of the five menus. Figure 2-7 shows the five menus.

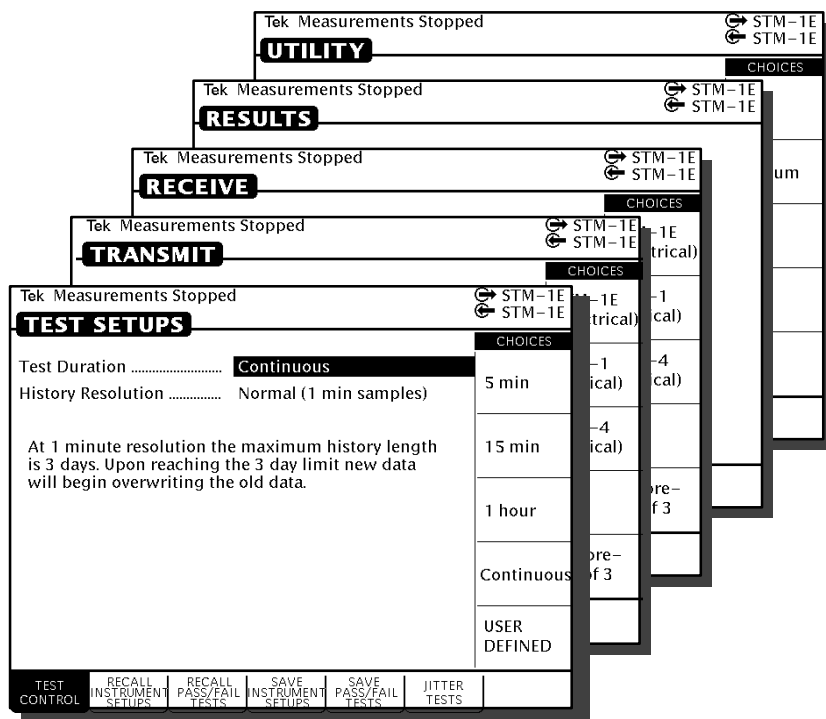


Figure 2-7: The Five Menus

What is a Menu?

A menu groups related functions together. For example, all settings that affect the signal transmitted by the CTS 750 are located in the TRANSMIT menu. Each menu is made up of pages. A page is

identified by a page tab located at the bottom of the display (see Figure 2–8).

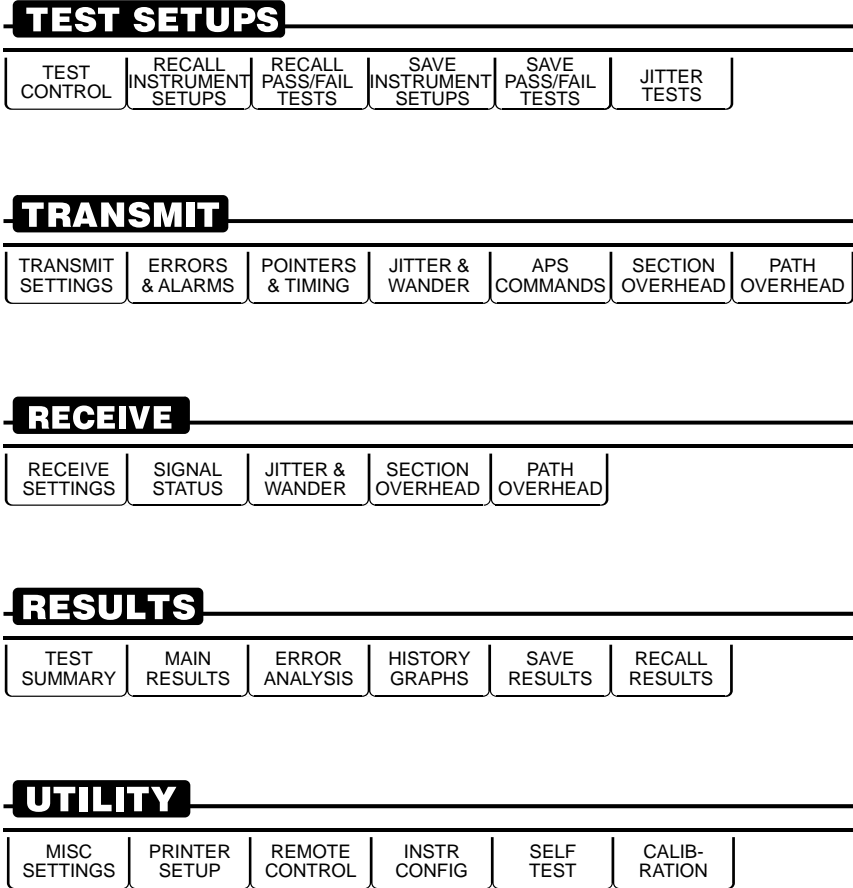


Figure 2–8: Menus and Pages

The CTS 750 always displays a menu. The name of the current menu is shown near the top of the display. To change to another menu, press a menu button on the front panel.

NOTE. *The only times pressing a menu button does not change menus are when a dialog box is displayed or when you are entering a value for a parameter. You must first exit the dialog box or finish entering the value before you can change menus.*

A page usually provides control over a related group of instrument functions or parameters. For example, the TRANSMIT SETTINGS page in the TRANSMIT menu controls the rate, format, and active channels of the signal transmitted by the CTS 750. However, some pages display information rather than provide control over settings; for example, the pages of the RESULTS menu display various test results.

Selecting Menus

To display a menu, press the button on the front panel with the same name (see Figure 2–9).

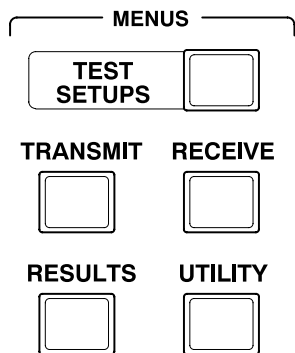


Figure 2–9: Menu Select Buttons

Selecting Pages

To select a page within a menu, press the button beneath the page tab located at the bottom of the display (see Figure 2–10).

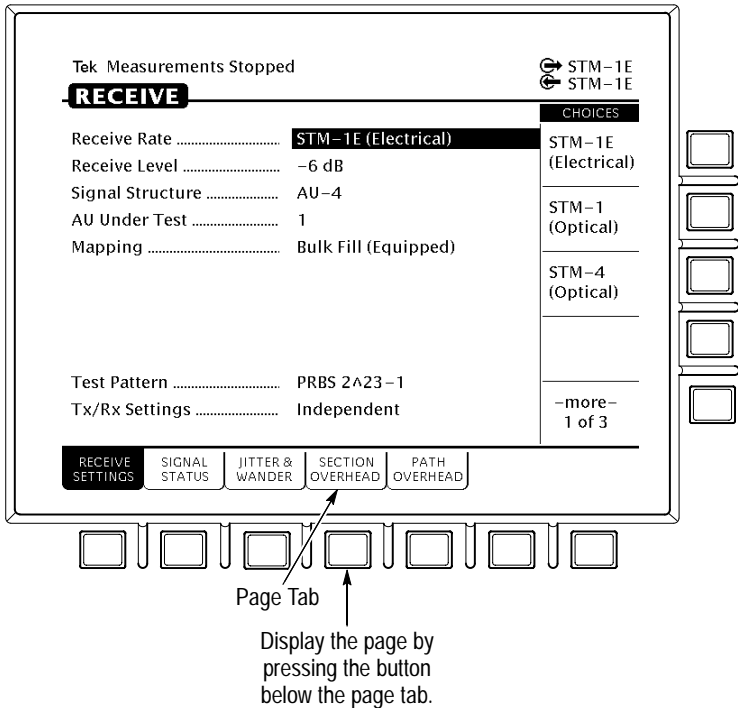


Figure 2–10: How to Display a Page

Displaying Help

To display help, press the **HELP** front-panel button.

When the HELP dialog box appears, use the knob to select the topic you wish to view (see Figure 2–11). After you select the topic to view, select **View Help** to see the help screen.

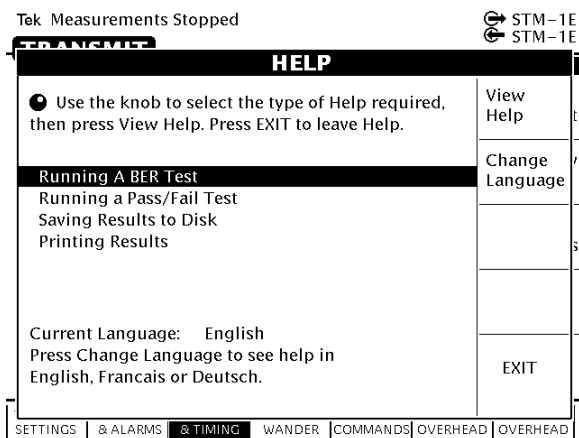


Figure 2–11: Help Dialog Box

Once you press View Help, the help screen for that topic is displayed. If a help topic covers more than one page, you can display the next page by selecting **Page Down**. To display the previous page, select **Page Up**.

To display help in a different language, select **Change Language**. Then, to display help in French, select **Francais**. To display help in German, select **Deutsch**.

When you finish reading the help text, you can exit the help dialog box by selecting **EXIT**. If you wish to read additional help topics, select **Help Menu** to return to the main help screen.

Connecting Signals

To connect signals to the CTS 750, use the electrical and optical connectors located at the bottom and right side of the front panel.

For optical connections, the CTS 750 accepts both single mode and multimode fiber. For electrical connections, the CTS 750 accepts 75 Ω coaxial cable with BNC connectors for SDH rates and 2 Mb/s Balanced, 34 Mb/s, and 140 Mb/s rates. The CTS 750 accepts Siemens connectors for 2 Mb/s Unbalanced signals.

Connecting Optical Signals

NOTE. *The optical TRANSMIT output is produced by a Class 1 laser device. The output from a Class 1 laser is safe to view without special eye protection. However, because other optical signals in your environment may exceed the Class 1 limits, we recommend eye protection as a precaution.*

To connect optical signals to the CTS 750:

1. Unscrew the dustcap that covers the optical port on the CTS 750.
2. Remove the dustcap (if present) covering the connector on the optical fiber.
3. Carefully insert the transmit end of the optical fiber into the **RECEIVE** port on the CTS 750. Line up the key on the optical fiber connector with the cutout on the optical port connector. Make sure that the optical fiber connector is fully inserted into the optical port.
4. Tighten the optical fiber connector so it does not accidentally come loose during use.
5. Carefully insert the receive end of the optical fiber into the **TRANSMIT** port on the CTS 750. Make sure that the optical fiber connector is fully inserted into the optical port.
6. Tighten the optical fiber connector so it does not accidentally come loose during use. Tighten the connectors only finger tight; do not use a tool to tighten the connectors.



CAUTION. *To prevent damage to the optical port connectors and to keep them clean, always replace the dustcaps on the optical port connectors when not using the optical ports.*

Connecting SDH Electrical Signals

To connect SDH electrical signals to the CTS 750:

1. Connect the transmit end of the signal cable to the **RECEIVE** connector on the CTS 750.
2. Connect the receive end of the signal cable to the **TRANSMIT** connector on the CTS 750.

Connecting PDH Electrical Signals

To connect electrical signals to the CTS 750:

1. Connect the transmit end of the signal cable to the **IN** connector for the appropriate rate on the CTS 750.
2. Connect the receive end of the signal cable to the **OUT** connector for the appropriate rate on the CTS 750.

Initiating Autoscan

Autoscan is a feature that automatically scans the received signal and changes the CTS 750 receive settings to match the received signal. Autoscan is the quickest way to set up the CTS 750 to view a signal.

To initiate autoscan, press the **AUTOSCAN** front-panel button. For detailed information on the AUTOSCAN function, see *Checking Signal Status* on page 3–75.

Changing Parameters

Most of the menu pages in the CTS 750 contain parameters (or settings) that you can change. The choices available for a parameter appear in four ways (examples in parentheses):

- As a list (Test Pattern: PRBS 2²³–1, PRBS 2²⁰–1, ...)
- As a decimal number (Frequency Offset: 74.3 ppm)
- As a binary number (Z1 Byte: 10101111)
- As a text string (File Name: TEST_34)

Selecting Parameters

To change a parameter, use the knob to highlight it. As you turn the knob, the display highlight moves from parameter to parameter (see Figure 2–12).

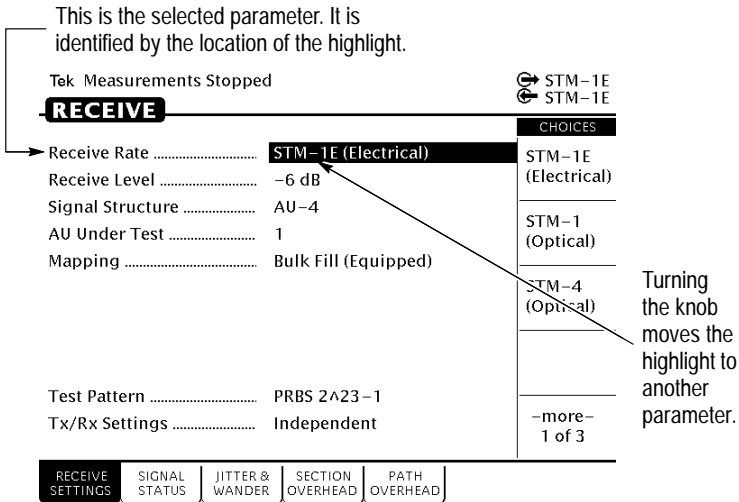


Figure 2–12: Selecting a Parameter

The parameter values displayed in high-intensity text indicate parameters that you can change. If a parameter is displayed in dimmed text, it cannot be selected under the current setup.

Selecting from Lists

Most parameters have a set group of choices available. The choices are presented as a list, located along the right side of the display. Press the button next to the choice to assign that choice to the highlighted parameter.

Sometimes parameters have more than five choices available. When more than five choices are available, the bottom choice changes to **-more-**. Selecting **-more-** displays additional choices. Each time you press **-more-** the next list of choices is displayed. Below **-more-** is a line that shows which list of choices is displayed. When the last list of choices is displayed, pressing **-more-** displays the first list of choices again (see Figure 2-13).

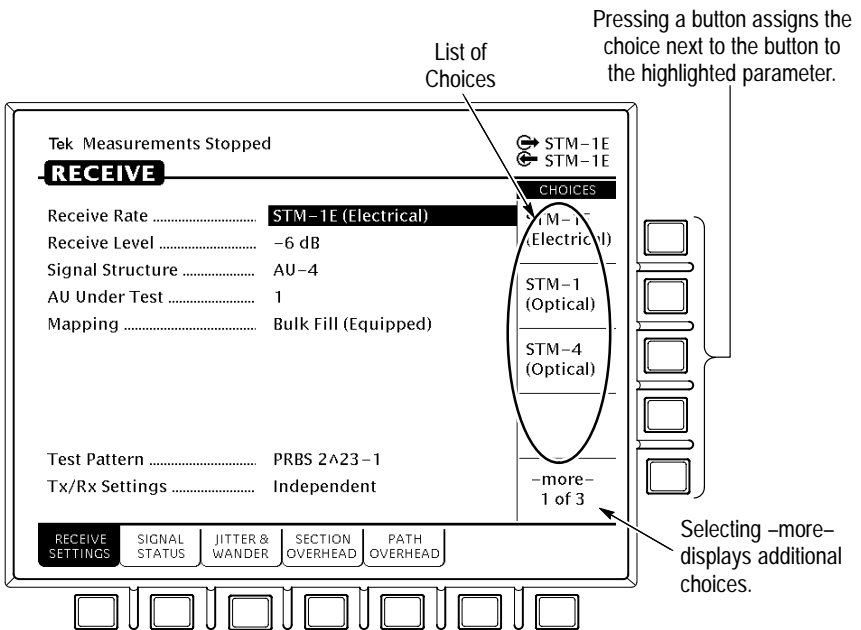


Figure 2-13: Selecting Choices From a List

Changing Decimal Numbers

Some parameters allow you to set a numeric value for them. For these parameters, preset choices are always provided to save you time. However, if the preset choices are not appropriate for your needs, you can set specific values by selecting the **USER DEFINED** choice (see Figure 2–14).

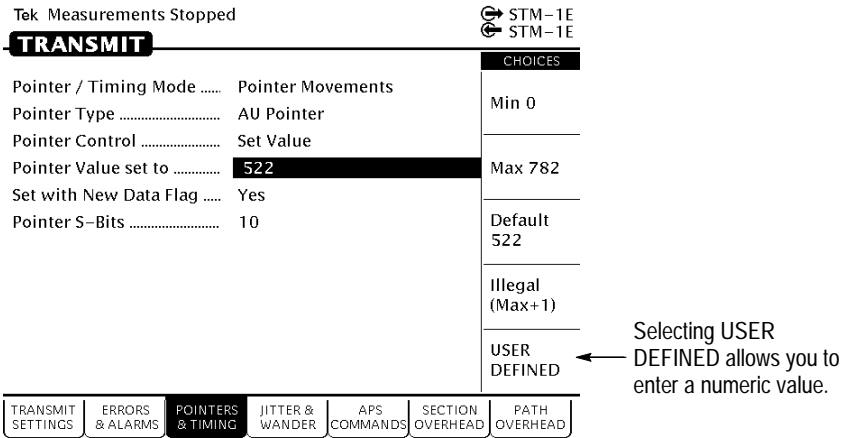


Figure 2–14: Selecting USER DEFINED

After you select USER DEFINED, the buttons at the right side of the display are reassigned, as shown in Figure 2–15.

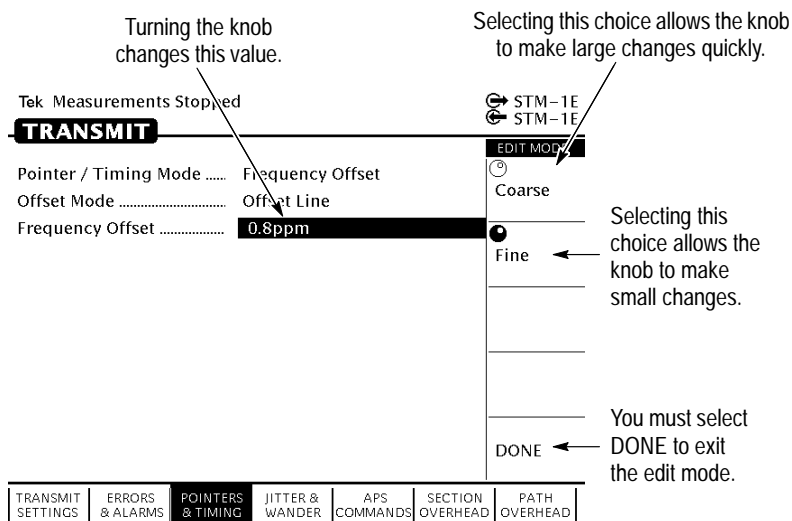


Figure 2–15: Entering a Numeric Value

After you press **USER DEFINED**, the CTS 750 enters edit mode. In edit mode, you change the value of the highlighted parameter by turning the knob. When you have set the parameter to the desired value, select **DONE** to enter the value and exit edit mode.

NOTE. *The new value does not take effect until **DONE** is selected.*

When in edit mode, the knob can work in several ways. As shown in Figure 2–15, the knob can be assigned to make either coarse or fine adjustments to the highlighted parameter. For other parameters, the knob is assigned to change different elements of the selected parameter. For example, when setting a test time, rather than making coarse or fine adjustments, the knob is assigned to change days, hours, minutes, or seconds.

The knob icon is displayed in solid form to indicate which function it is currently assigned to. The knob icon is displayed in outline form next to other possible choices.

Changing Binary Numbers

There are two kinds of binary numbers that can be changed in the CTS 750: payload patterns and overhead bytes. As with other numerical values, you can select preset values or enter specific values by selecting Edit Byte.

To change a byte:

1. Select the byte with the knob (see Figure 2–16).
2. Change the byte by selecting one of the preset choices at the right side of the display or to enter a different bit pattern, select **EDIT BYTE**. This places the CTS 750 into edit mode.

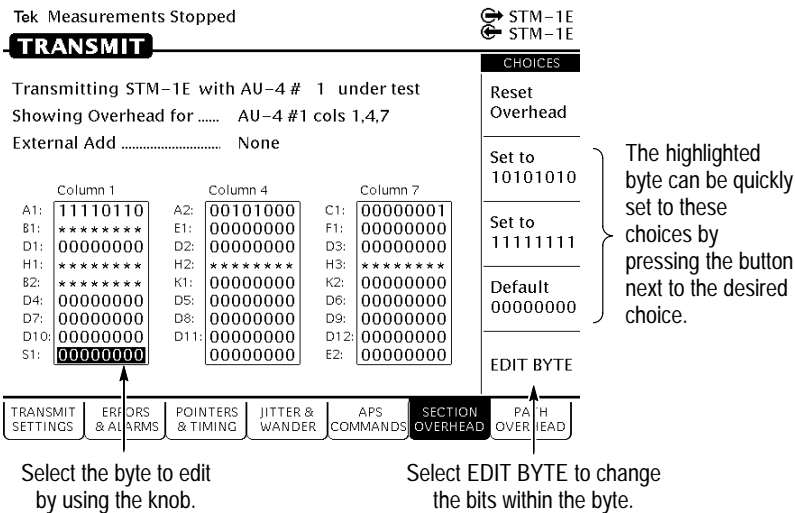


Figure 2–16: Selecting a Byte for Editing

When in edit mode, the choices along the right side of the display change (see Figure 2–17). The highlight now applies to a single bit.

3. To change the value of the highlighted bit, select either **1** or **0**. Each time you select 1 or 0, the highlighted bit is changed and the highlight moves to the next bit.
4. To select a different bit for editing, select either the right or left arrow to move the highlight. When the desired bit is highlighted, select either **1** or **0**.
5. When you are finished editing the byte, select **DONE**. This enters the changes to the byte and exits edit mode.

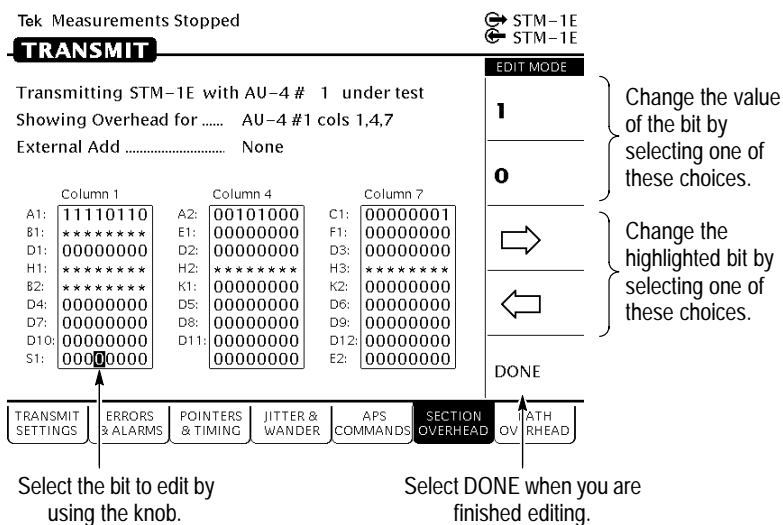


Figure 2-17: Editing a Byte

Entering Text

Several parameters, such as file names, operator prompts, and path trace messages, consist of text strings. You can set text strings to preset choices or enter your own text string. When you highlight a text parameter using the knob, the choices at the right side of the display change to present predefined text strings (if appropriate) and the option to edit the text string (see Figure 2-18).

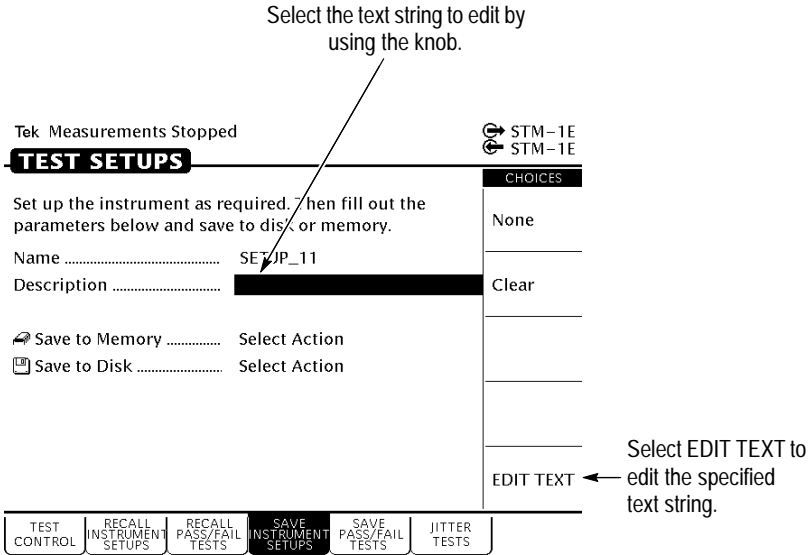


Figure 2–18: Selecting a Text String for Editing

To edit a text string:

1. Select the text string by turning the knob until the desired text string is highlighted (see Figure 2–18).
2. Select **EDIT TEXT**. This places the CTS 750 into edit mode.

When in edit mode, the choices along the right side of the display change (see Figure 2–19). In edit mode, the status line at the top of the display is replaced with a line that displays the characters available for placing into the text string. (Some characters available for message text are not available for file names.)

3. To change the highlighted character or enter a new one, select the character to enter by turning the knob.
4. To enter the selected character, select **Enter <character>**.

To delete a character already entered, use the arrows to highlight the character. Select **Delete** to delete the character.

5. When you are finished editing the text string, select **DONE**.

The characters available depend on the text string being edited. The characters used for file names are a subset of the characters available for message text.

Turning the knob selects the character to be entered.

Characters: ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890 !@#.%&*~+-

TRANSMIT

Transmitting STM-1E with AU-4 # 1 under test

Overhead View VC4 Overhead

External Add None

Path Overhead

J1:	USER
B3:	*****
C2:	00000001
G1:	*****
F2:	00000000
H4:	*****
F3:	00000000
K3:	00000000
N1:	00000000

Path Trace Message

TEKTRONIX CTS 750 SDH
BONJOUR GUTEN TAG
HELLO

EDIT MODE

Enter !

Delete

→

←

DONE

The highlighted character is the character that will be changed when Enter ! is selected.

Select DONE when you are finished editing text.

Select this choice to enter the selected character.

Select this choice to delete the selected character.

Select either of these choices to move the highlight within the text string.

Figure 2-19: Editing a Text String

Working with the Disk Drive

Use the disk drive in the CTS 750 to save instrument setups, pass/fail tests, measurement results and measurement histories. The CTS 750 reads disks formatted in MS-DOS format. It reads only 1.44 MB disks. The CTS 750 does not format disks. Files written to disk consist of four types, as shown in Table 2-2.

Table 2-2: CTS 750 Disk File Types

File Type	Description	File Extension
Instrument Setups	Complete description of instrument settings	.SET
Pass/Fail Tests	Complete description of instrument settings, operator prompts, and Fail If conditions	.TST
Measurement Results ¹	An ASCII file listing the results of a test	.RES
Measurement History ¹	Binary file containing the history of test results	.HIS
Jitter Tolerance Conformance Tests	An ASCII file listing the results of a conformance test	.JTL
	Microsoft Excel-compatible file containing test and mask data	.XTL
Jitter Transfer Conformance Tests	An ASCII file listing the results of a conformance test	.JTR
	Microsoft Excel-compatible file containing test and mask data	.XTR
Pointer Jitter Conformance Tests	An ASCII file listing the results of a conformance test	.PTR
Output Jitter Conformance Tests	An ASCII file listing the results of a conformance test	.OUT

¹ **The CTS 750 creates two files (with extensions .RES and .HIS) when you save measurement test results.**

The CTS 750 displays only file names with the extensions shown in Table 2-2. Disk files with any other extensions do not appear in file name displays.

Reading Files on Disk

You can display disk file names in three places: the RECALL INSTRUMENT SETUPS page and the RECALL PASS/FAIL TESTS

page of the **TEST SETUPS** menu, and the **RECALL RESULTS** page of the **RESULTS** menu.

To view instrument setups files on a disk:

1. Insert the disk into the disk drive.
2. Press the **TEST SETUPS** front-panel button to display the **TEST SETUPS** menu.
3. Select the **RECALL INSTRUMENT SETUPS** page.
4. Select **Disk** to display the instrument setups on disk.

To view pass/fail files on a disk:

1. Insert the disk into the disk drive.
2. Press the **TEST SETUPS** front-panel button to display the **TEST SETUPS** menu.
3. Select the **RECALL PASS/FAIL TESTS** page.
4. Select **Disk** to display the pass/fail tests on disk.

To view test results files on a disk:

1. Insert the disk into the disk drive.
2. Press the **RESULTS** front-panel button to display the **RESULTS** menu.
3. Select the **RECALL RESULTS** page.
4. Select **Disk** to display the test results files on disk.

NOTE. Disk operations may take several seconds if there are many files on the disk. The light on the front of the disk drive turns off when the disk operation is complete.

Tutorial

The tutorial acquaints you with the features of the CTS 750 by having you run a test while you explore specific features of the CTS 750. For full details on how to use the CTS 750, refer to *Reference*.

The tutorial presents procedures in tables. Perform the procedure by reading from left to right in the table (see example below). The word *none* in a cell indicates that no action is required.

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
Begin here with Step 1	Step 2	Step 3	Step 4
		Step 5	Step 6
		Step 7	Step 8, CTS 750 instruction is complete

Some procedures require several iterations of highlighting parameters and selecting choices. Some procedures may require more than one menu button or menu page selection as well.

Before Turning On the CTS 750

This tutorial describes how to perform a bit-error rate (BER) test on an STM-1E signal. To perform the tutorial, you need a 75 Ω coaxial cable with BNC connectors on each end. This tutorial assumes you have set up the CTS 750 as described in *First Time Operation*, on page 1–4.

To set up your CTS 750 for the tutorial, perform these steps:

- Check that the CTS 750 is turned off. If it is on, you can put it in standby mode by pressing the **ON/STBY** button.

Connect the coaxial cable between the **TRANSMIT** and **RECEIVE** BNC connectors on the front panel (see Figure 2–20).

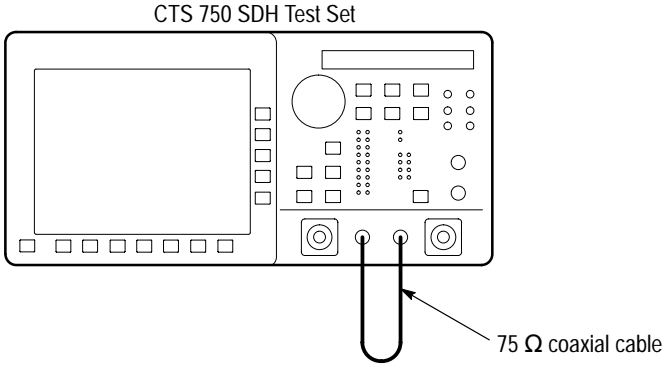


Figure 2–20: Setup for the Tutorial

Press the **ON/STBY** button to turn on the CTS 750.

The CTS 750 performs its power-on self test and then displays the TRANSMIT menu.

Before proceeding with the tutorial, initialize the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup

Setting Transmit Parameters

Before beginning the BER test, set the transmit and receive parameters.

To set the transmit and receive parameters:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate (see Figure 2-21)	STM-1E

Tek Measurements Stopped

TRANSMIT

Transmit Rate **STM-1E (Electrical)**

Transmit Clock Internal

Transmit Level -6 dB

Signal Structure 1 x AU-4

AU Under Test 1

Mapping Bulk Fill (Equipped)

Test Pattern PRBS 2^23-1

Tx/Rx Settings Independent

CHOICES

STM-1E (Electrical)

STM-1 (Optical)

STM-4 (Optical)

-more-
1 of 3

TRANSMIT SETTINGS ERRORS & ALARMS POINTERS & TIMING JITTER & WANDER APS COMMANDS SECTION OVERHEAD PATH OVERHEAD

Figure 2-21: The TRANSMIT SETTINGS Page of the TRANSMIT Menu

To set the mapping and the test pattern:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Mapping	No Mapping (Equipped)
		Test Pattern	PRBS 2^20-1

Setting Receive Parameters

You can set receive parameters two ways. The first way is to set the parameters individually: display the RECEIVE menu and set each parameter manually on the RECEIVE SETTINGS page. The second way is to couple the receive settings to the transmit settings. To do this, use the Tx/Rx Settings line on the TRANSMIT SETTINGS page. (The Tx/Rx Settings line appears on both the TRANSMIT SETTINGS page and the RECEIVE SETTINGS page. To couple transmit settings to the receive settings, you would use the Tx/Rx Settings line on the RECEIVE SETTINGS page.)

To couple the receive settings to the transmit settings:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Coupled

As soon as you select Coupled, the icon in the status area changes to indicate the Tx/Rx Settings are coupled.

When the Tx/Rx Settings parameter is set to Coupled, all parameter settings on the RECEIVE SETTINGS page transfer to the TRANSMIT SETTINGS page. Thereafter, any change to either page affects both pages as long as Tx/Rx Settings is set to Coupled.

Setting the Test Time

Before beginning the BER test, you must specify the duration of the test.

To set the duration of the test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS (see Figure 2-22)	TEST CONTROL	Test Duration	15 min

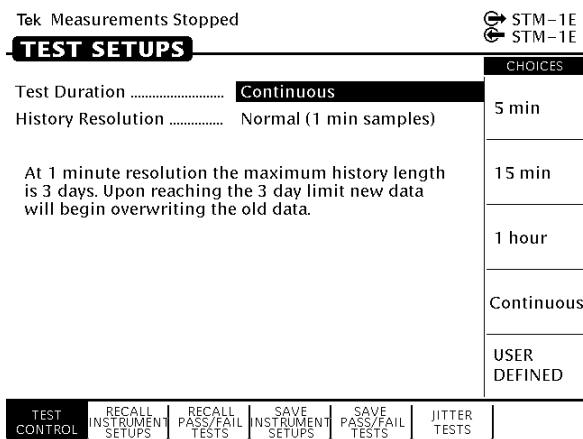


Figure 2-22: The TEST CONTROL Page of the UTILITY Menu

Where Test Results Are Displayed

Once you have set the transmit and receive parameters and the test time, you can begin the test. However, before starting the test, look at the RESULTS menu where the results of the test appear.

To display the RESULTS menu:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	<i>none</i>	<i>none</i>	<i>none</i>

The TEST SUMMARY page contains a summary of the current or most recent test (see Figure 2-23). Just below the menu name is information about the current or most recent test. If the test detected no alarms or errors, the CTS 750 displays the message No Alarms No Errors.

Tek Measurements Stopped

↻ STM-1E
↻ STM-1E

RESULTS

Results Source: ↻ Current Results
Results Rate: STM-1
Results Mapping: No Mapping (Unequipped)
Test Started: 20:04:00 16-Jul-95
Elapsed Time: 0d 0h 0m

TROUBLE SCAN

No Alarms No Errors

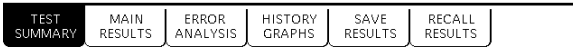


Figure 2–23: The TEST SUMMARY Page of the RESULTS Menu

The RESULTS menu contains four pages on which results are displayed: TEST SUMMARY, MAIN RESULTS, ERROR ANALYSIS, and HISTORY GRAPHS. Select **MAIN RESULTS** to see one way test results are displayed (see Figure 2–24).

Tek Measurements Stopped

↻ STM-1E
↻ STM-1E

RESULTS				CHOICES
Errors	ERROR COUNTS	ERROR RATIOS	ERRORED SECONDS	
RS B1 BIP	0	0.00	0	Errors
MS B2 BIP	0	0.00	0	Failures
Path B3 BIP	0	0.00	0	
Pattern Bit	0	0.00	0	Alarms
MS FEBE	0	0.00	0	Pointers
Path FEBE	0	0.00	0	
				Jitter / Wander

TEST SUMMARY	MAIN RESULTS	ERROR ANALYSIS	HISTORY GRAPHS	SAVE RESULTS	RECALL RESULTS
--------------	---------------------	----------------	----------------	--------------	----------------

Figure 2–24: The MAIN RESULTS Page of the RESULTS Menu

The MAIN RESULTS page contains a listing of the different errors that can occur. Since you have not started your test yet, the values are those of the last test run. To continue with the test setup, select TEST SUMMARY.

Begin the Test

Note at the top of the display the message Measurements Stopped. When you start the test, this message will change. To start the test, press the front-panel **START/STOP** button.

Once a test starts, the display changes in two ways. First, the message Running appears at the top of the display (see Figure 2–25). This message line is always visible so you know that a test is running, even if a page is displayed that doesn't contain any information about tests. Second, the test status indicator appears.

There are two elements to the test status indicator. The text above the bar graph indicates how long the test has been running. The text lists the days, hours, minutes, and seconds the test has been running. The bar graph indicates what percentage of the test is complete (except when the test duration is set to continuous).

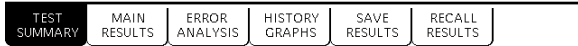
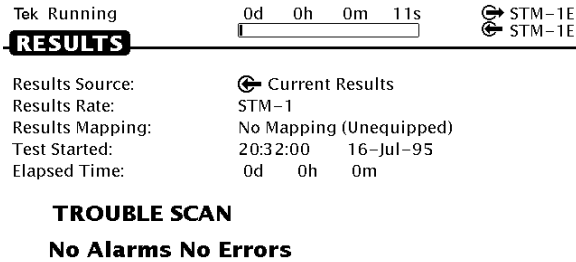


Figure 2–25: The Message Line and Test Status Indicator

Inserting Errors

Now that the test is running, you will insert some errors and see how the CTS 750 responds. To set the error insertion parameters, first display the ERRORS & ALARMS page as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS (see Figure 2–26)	<i>none</i>	<i>none</i>

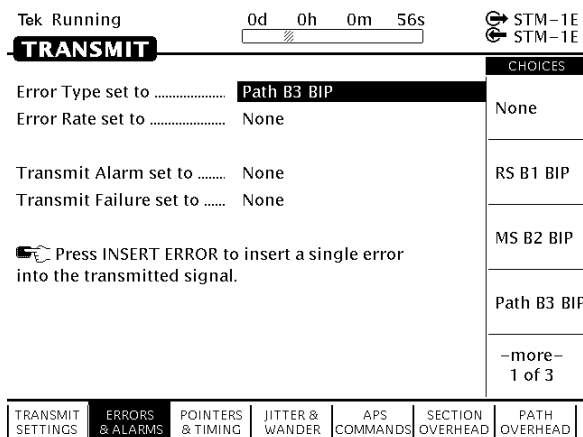


Figure 2–26: The ERRORS & ALARMS Page of the TRANSMIT Menu

There are two ways to insert errors into the transmitted signal. You can insert errors one at a time or you can set a rate at which the CTS 750 inserts errors automatically. Before inserting errors, you must specify the type of error to be inserted. You specify the type of error to be inserted with the Error type set to parameter.

To set the type of error to insert:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Error type set to	Path B3 BIP

The rate at which errors are inserted is specified on the Error rate set to line. An error rate of None specifies that no errors are inserted unless the INSERT ERROR button is pressed. Any error rate other than None results in a continuous stream of errors being inserted into the transmitted signal.

To insert a single error, press **INSERT ERROR**.

When you press the INSERT ERROR button the red ERROR light flashes.

To insert a continuous stream of errors:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Error rate set to	1.0E-5

Note that the red ERROR light now stays on all the time; errors are being detected continually.

To turn off the automatic error insertion:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Error Rate set to	None

Now that errors are no longer being transmitted, the red ERROR light has gone out, although the yellow history light is still on. To clear the error history, press **CLEAR HISTORY**.

Adjusting Pointers

The CTS 750 enables you to adjust or move pointers. Note that pointer movements are not necessarily errors. Pointer parameters are set on the POINTERS & TIMING page of the TRANSMIT menu.

To display the POINTERS & TIMING page:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING (see Figure 2-27)	<i>none</i>	<i>none</i>

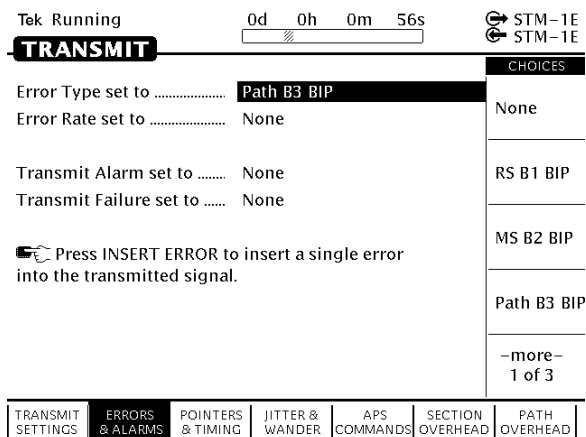


Figure 2-27: The POINTERS & TIMING Page of the TRANSMIT Menu

Before adjusting a pointer, you must decide what mode of pointer movement to use. You can change a pointer by adjusting the pointer directly or by using frequency offset. The default mode is Pointer Movements, which allows you to adjust pointers directly.

To specify how the pointer will be adjusted:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Control	Single

After selecting Single for pointer control, a message displays that tells you how to adjust the pointer. Pointer movement alternates between increment and decrement.

To adjust a pointer, press the front-panel **POINTER ACTION** button.

Each time you press **POINTER ACTION**, a pointer adjusts and the **POINTER ACTION** light turns on. Also, a message appears at the top of the display that describes the type of pointer movement that

occurs. On this page you can also adjust frequency offset which may cause a network element to generate pointer movements.

To see the pointer value changing:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	MAIN RESULTS	<i>none</i>	Pointers

Now press **POINTER ACTION** again.

To adjust a pointer using frequency offset:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING	Pointer / Timing Mode	Frequency Offset

After selecting Frequency Offset, note that the available parameters change. When in Frequency Offset mode, the only parameters that can be set are Offset Mode and Frequency Offset.

To change the frequency offset of the signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Frequency Offset	Stress +4.6ppm

If the preset choices do not match what you need, use **USER DEFINED** to define an alternative.

To define a specific frequency offset:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
			USER DEFINED

When you select USER DEFINED, the knob is assigned to adjust the frequency offset. Two choices are available in this mode: Coarse and Fine (see Figure 2–28). Coarse adjusts the frequency offset by 10 ppm. Fine adjusts the frequency offset by 0.1 ppm. The larger the value for frequency offset, the more often the pointer is adjusted.

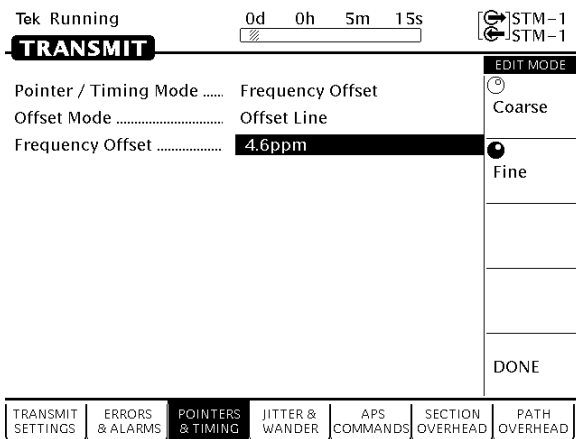


Figure 2–28: Adjusting Frequency Offset Using the Knob

Use the knob to change the value of Frequency Offset; select any value you wish. When you are finished selecting a frequency offset:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
			DONE

To turn off frequency offset:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING	Frequency Offset	Default 0ppm

Selecting Default 0ppm sets the Frequency Offset back to 0 ppm.

Viewing Section Overhead

The CTS 750 allows you to view the section overhead for the transmitted or received signal. To view the section overhead for the transmitted signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	SECTION OVERHEAD	<i>none</i>	<i>none</i>

The first line of text under the menu name describes the signal being received and the AU under test (see Figure 2–29).

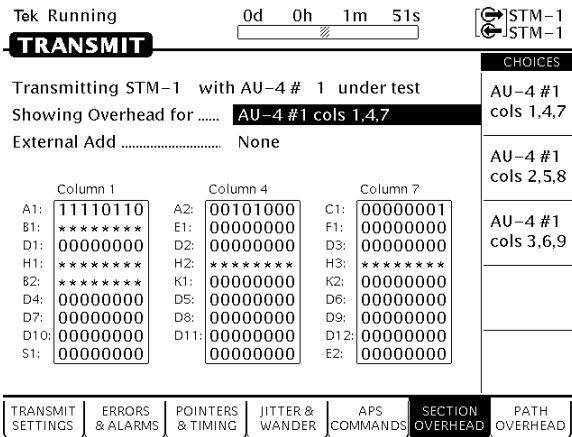


Figure 2-29: The SECTION OVERHEAD Page of the TRANSMIT Menu

The Showing Overhead for parameter identifies which columns of the section overhead are displayed. To display the overhead for other overhead columns within the signal, select the appropriate choice.

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Showing Overhead for	Cols 1, 4, 7

Editing the Section Overhead

Except for certain reserved bytes, you can edit the bytes of the section overhead of the transmitted signal. Reserved bytes are identified by asterisks (*) in the byte content area of the displayed column.

To edit a byte of the section overhead:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		S1 byte	EDIT BYTE

Once you have selected EDIT BYTE, the CTS 750 enters the edit mode (see Figure 2–30).

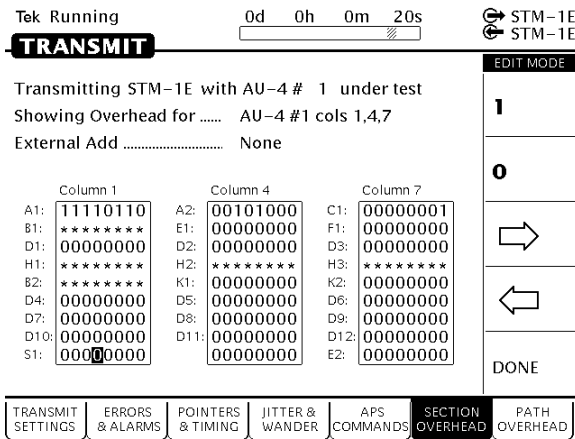


Figure 2–30: The Display in Edit Mode

To change the value of any bit within the byte, highlight the bit you wish to change. To change the value of the highlighted bit, select either 1 or 0. After you assign a value to the highlighted bit, the highlight moves to the next bit to be edited.

Edit the S1 byte to read **10101010**.

Select **DONE** when you have finished editing the byte.

You can assign preset values to the highlighted byte. For example, rather than editing each bit of the byte as you just did, you could also

have selected Set to 10101010. To see that the CTS 750 is now receiving the new value of the S1 byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	SECTION OVERHEAD	<i>none</i>	<i>none</i>

Verify that the section overhead for columns 1, 4, and 7 is displayed. If it is not:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Showing Overhead for	Cols 1, 4, 7

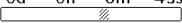


Look at the value of the S1 byte. You will see that it is 10101010, as previously set.

Viewing Test Results


The test has been running for several minutes and errors have been transmitted. To see the test results, you must display the RESULTS menu. To display the RESULTS menu:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	TEST SUMMARY	<i>none</i>	<i>none</i>

The TEST SUMMARY page identifies the most common errors that the CTS 750 has detected. You will see a line that identifies the worst error rate detected and may find listings for other types of errors (see Figure 2–31).

Tek Running 0d 0h 6m 45s   STM-1E
 STM-1E

RESULTS

Results Source:  Current Results
 Results Rate: STM-1
 Results Mapping: No Mapping (Unequipped)
 Test Started: 20:41:00 16-Jul-95
 Elapsed Time: 0d 0h 5m

TROUBLE SCAN

Worst Error Rate 5.59e-7
Path B3 Errors 28560

TEST SUMMARY	MAIN RESULTS	ERROR ANALYSIS	HISTORY GRAPHS	SAVE RESULTS	RECALL RESULTS
--------------	--------------	----------------	----------------	--------------	----------------

Figure 2-31: The TEST SUMMARY Page of the RESULTS Menu

The MAIN RESULTS page displays all the errors that have been detected. It also displays the error ratio and the number of errored seconds that have been logged (see Figure 2-32).

To display the MAIN RESULTS page:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
	MAIN RESULTS	<i>none</i>	<i>none</i>

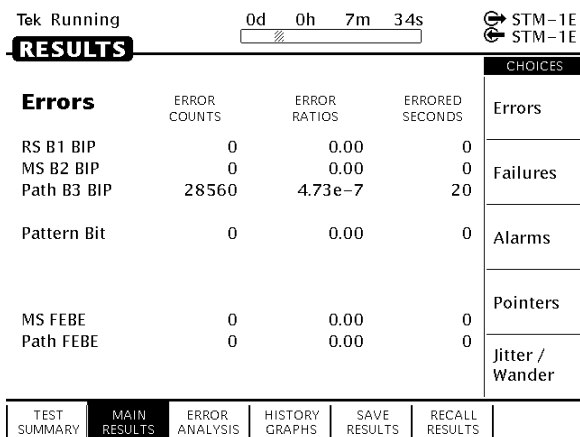


Figure 2-32: The MAIN RESULTS Page of the RESULTS Menu

This completes the tutorial. For detailed information on CTS 750 capabilities, refer to *Reference*, starting on page 3-1.



Reference

Basic Test Procedures

This section gives examples of how to set up and use the CTS 750 SDH Test Set for several common telecommunication network applications:

- Network continuity checking
- Transmission signal quality testing
- Fault tolerance testing
- Performance monitoring
- Jitter and wander testing
- Video timing quality testing

Setting Up the CTS 750

This section presents setup instructions for the CTS 750 in tables. Perform the steps reading from left to right in the table (see example below). The word *none* in a cell indicates that no action is required.

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
Begin here with Step 1	Step 2	Step 3	Step 4
		Step 5	Step 6
		Step 7	Step 8, CTS 750 Setup is complete

Menu buttons are located on the instrument front panel. Select menu pages with the buttons below the display. Use the knob to highlight a parameter; then use the buttons at the right to select a choice. Many setups require several iterations of highlighting parameters and selecting choices. Some setups may require more than one menu button or menu page selection as well.

The first step in each application setup initializes the CTS 750 to a known state.

Network Continuity Checking

With the AUTOSCAN feature of the CTS 750, it is easy to make a quick continuity check. The continuity check verifies that a SDH network element (NE), or portion of the network, is correctly set up and provisioned and that the signal passes through intact. In this example, the CTS 750 transmits an STM-1E signal into an NE. Then the CTS 750 receives the output from the NE and verifies that the AU-4, including its payload patterns, is intact.

1. Connect the CTS 750 to the NE as shown in Figure 3–1.

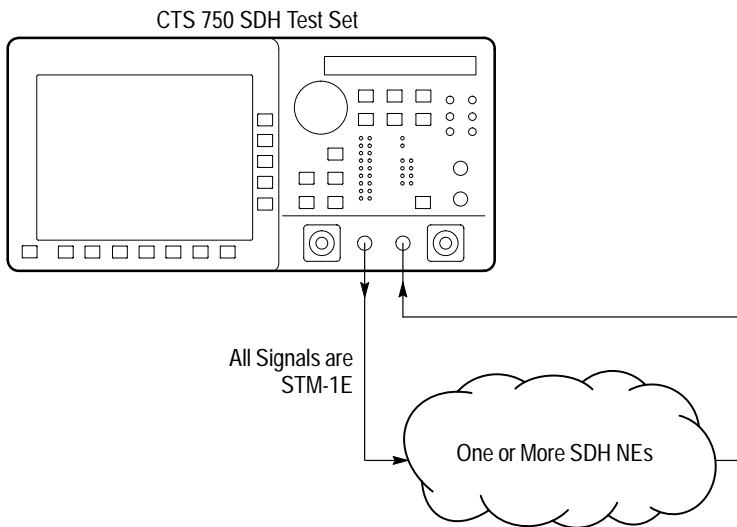


Figure 3–1: Setup to Check Network Continuity

- Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1E

- Press the **AUTOSCAN** button. The receiver locks onto the output from the NE, displays the signal structure, and shows information about the content of AU #1.
- To analyze the payload pattern, select **Show Payload**. The CTS 750 detects a PRBS of length $2^{23}-1$.
- Check the J1 Path Trace for any message.
- Check the front-panel status lights to verify that there are no errors, alarms, or failures.
- Select **EXIT** to leave the AUTOSCAN dialog box.

Transmission Signal Quality Testing

Measuring Bit Error Rate

The bit error rate (BER) test is one of the best ways to measure the quality of an SDH transmission link. You can use the CTS 750 to make a BER test on a two-way link that is connected in a loop-back configuration. If this is a test you perform often, save it as a pass/fail test for easy recall.

- Connect the CTS 750 to a network as shown in Figure 3-2.

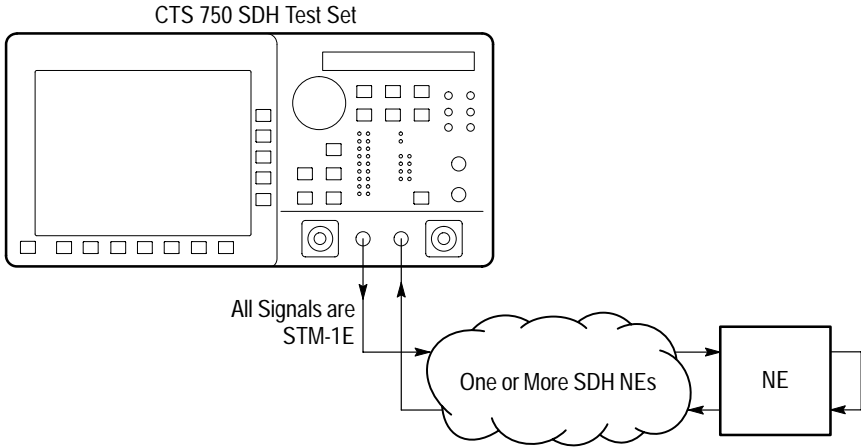


Figure 3-2: Setup to Check a Transmission Link

- Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1E
		Mapping	Bulk Fill No Mapping (Equipped)
		Tx/Rx Settings	Coupled
TEST SETUPS	TEST CONTROL	Test Duration	15 Minutes
RESULTS	MAIN RESULTS	<i>none</i>	Errors

- Press the **START/STOP** button.
- While the test is running, the CTS 750 counts errors and errored seconds and then calculates the error ratio for each error type.
- After 15 minutes have elapsed, the test stops automatically and the measured results are held on the MAIN RESULTS page until another test is started.
- When the test is complete, you can store the test results to disk or print out a hardcopy. To save the test results to disk, you must enter a name for the disk file as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	SAVE RESULTS	Name	EDIT NAME

- Enter an eight-character name for the file.

8. If you wish, you can also enter a description of the test results by highlighting **Description** and selecting **EDIT TEXT**.
9. Save the test results to disk as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Save to Disk	Save Current

Testing Mapping and Demapping

To test that a 2 Mb/s signal is correctly mapped into an SDH signal, you would use a Bit Error Rate test. However, testing mapping/demapping requires a different test setup than that described on page 3-3.

1. Connect the CTS 750 to an Add/Drop Multiplexer (ADM) as shown in Figure 3-3.

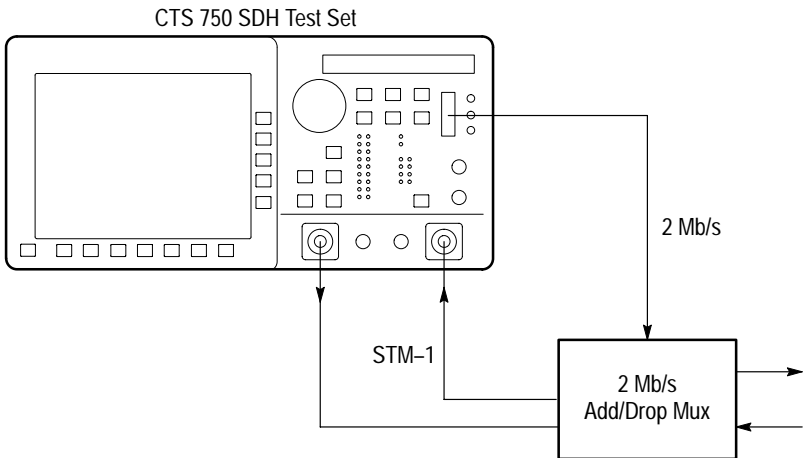


Figure 3-3: Setup to Test Mapping and Demapping

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	2 Mb/s
RECEIVE	RECEIVE SETTINGS	Receive Rate	STM-1
		Mapping	TU12 Async
		TU Under Test	<i>Set to match how the NE is provisioned</i>
		Payload	2 Mb/s Unframed
TEST SETUPS	TEST CONTROL	Test Duration	15 Minutes
RESULTS	MAIN RESULTS	<i>none</i>	Errors

3. Press the **START/STOP** button.

While the test is running, the CTS 750 counts errors and errored seconds and then calculates the error ratio for each error type.

After 15 minutes have elapsed, the test stops automatically and the measured results are held on the MAIN RESULTS page until another test is started.

4. When the test is complete, you can store the test results to disk or print out a hardcopy. To save the test results to disk, you must enter a name for the disk file as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	SAVE RESULTS	Name	EDIT NAME

5. Enter an eight-character name for the file.
6. If you wish, you can also enter a description of the test results by highlighting **Description** and selecting **EDIT TEXT**.
7. Save the test results to disk as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Save to Disk	Save Current

Fault Tolerance Checking

Fault tolerance testing (sometimes called stimulus/response testing or stress testing) is used to ensure that a network responds correctly to various fault conditions. Though there are many additional fault conditions you can test with the CTS 750, this section covers three common examples:

- Response to errors and alarms
- Response to pointer movements
- Response to line frequency offset

Response to Errors and Alarms

This example uses two CTS 750s to simultaneously check the upstream and downstream responses to an error or alarm condition. You can use a single CTS 750 to do the same thing by alternately

connecting the upstream and downstream signals to the RECEIVE input.

Table 3–1 shows the responses expected from Line Terminating Equipment (LTE), such as an STM-4/STM-1 multiplex section terminating element, when presented with three possible error and alarm conditions.

Table 3–1: LTE Responses to Errors and Alarms

Transmitted Error or Alarm	Expected Upstream Response	Expected Downstream Response
RS B1 Error	MS FEBE	<i>none</i>
MS AIS	MS FERF	PATH AIS
PATH FERF	<i>none</i>	PATH FERF

1. Connect two CTS 750s to an LTE as shown in Figure 3–4.

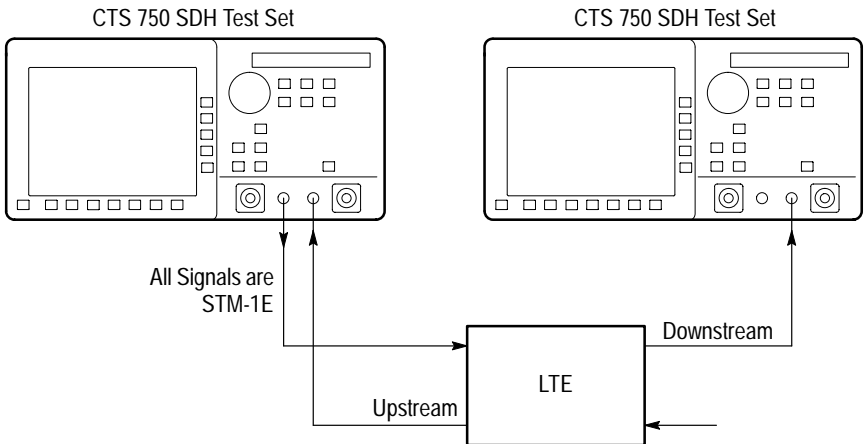


Figure 3–4: Setup to Check Error and Alarm Response

2. To check the LTE response to an RS B1 error, set up the upstream CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1E
		Tx/Rx Settings	Coupled
TRANSMIT	ERRORS & ALARMS	Error Type	RS B1
		Error Rate set to	1.0E-5
RESULTS	MAIN RESULTS	<i>none</i>	Errors

3. Set up the downstream CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
RECEIVE	RECEIVE SETTINGS	Receive Rate	STM-1E
RESULTS	MAIN RESULTS	<i>none</i>	Errors

4. Press the **START/STOP** buttons on both the upstream and downstream CTS 750s so that the START/STOP lights are on.
5. Verify that MS FEBE errors are counted in the MAIN RESULTS display of the upstream CTS 750.
6. Verify there are no errors counted in the MAIN RESULTS display of the downstream CTS 750.
7. Press the **START/STOP** buttons on both the upstream and downstream CTS 750s so that the START/STOP lights are off.
8. To check the LTE response to an MS AIS alarm, change the upstream CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Error Rate set to	None
		Transmit Alarm set to	MS AIS
RESULTS	MAIN RESULTS	<i>none</i>	Errors

9. Change the downstream CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	TRANSPORT OVERHEAD	<i>none</i>	<i>none</i>

10. Press the **START/STOP** buttons on both the upstream and downstream CTS 750s so that the START/STOP lights are on.

11. Verify that PATH FERF alarm seconds are counted in the MAIN RESULTS display of the upstream CTS 750.

12. With the downstream CTS 750, verify that the displayed K1 or K2 bytes are not all zeros.

13. Press the **START/STOP** buttons on both the upstream and downstream CTS 750s so that the START/STOP lights are off.

14. To check the LTE response to a PATH FERF alarm, change the upstream CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Error Rate set to	None
		Transmit Alarm set to	PATH FERF
RESULTS	MAIN RESULTS	<i>none</i>	Alarms

15. Change the downstream CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	MAIN RESULTS	<i>none</i>	Alarms

16. Press the **START/STOP** buttons on both the upstream and downstream CTS 750s so that the START/STOP lights are on.

17. Verify that the PATH FERF light is on, on the downstream CTS 750.

Response to Pointer Movements

Pointers allow the SDH network to multiplex signals from independent sources, even if the signal clock rates differ slightly from each other. Within the allowed range, pointer movements should have no adverse affect on the performance of the network.

This example transmits a signal with frequent pointer movements to an NE and checks that the downstream signal is error free.

1. Connect the CTS 750 to an NE as shown in Figure 3–5.

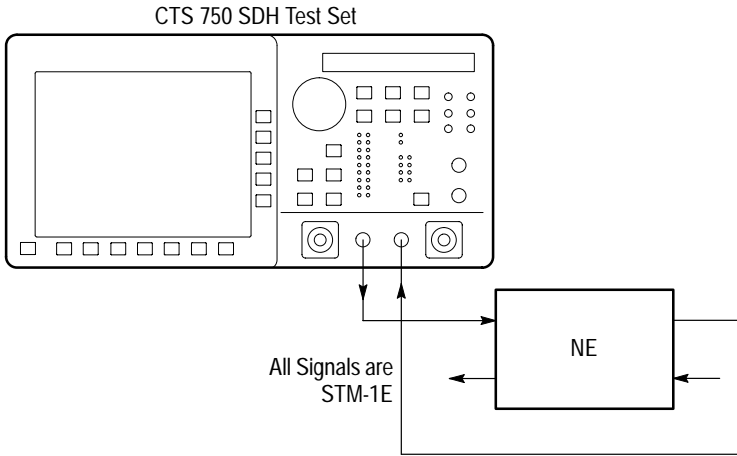


Figure 3-5: Setup to Check Pointer Movements

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1E
		Tx/Rx Settings	Coupled
TRANSMIT	POINTERS & TIMING	Pointer Control	Continuous
RESULTS	MAIN RESULTS	<i>none</i>	Errors

3. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.
4. Verify that there are no errors in the MAIN RESULTS display. When the front-panel ERROR light is not on, it also indicates there are no errors in the received signal.
5. To check for received pointer movements, change the CTS 750 setup as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	MAIN RESULTS	<i>none</i>	Pointers

6. Verify that the CTS 750 is counting positive pointer justifications. Depending on the clock rate of the NE, some negative pointer justifications are also possible.

Response to Line Frequency Offset

Pointers also accommodate differences in line frequency from one NE to another. In this example, the CTS 750 transmits a signal at an offset line frequency to an NE and measures the response.

1. Connect the CTS 750 to an NE as shown in Figure 3–6.

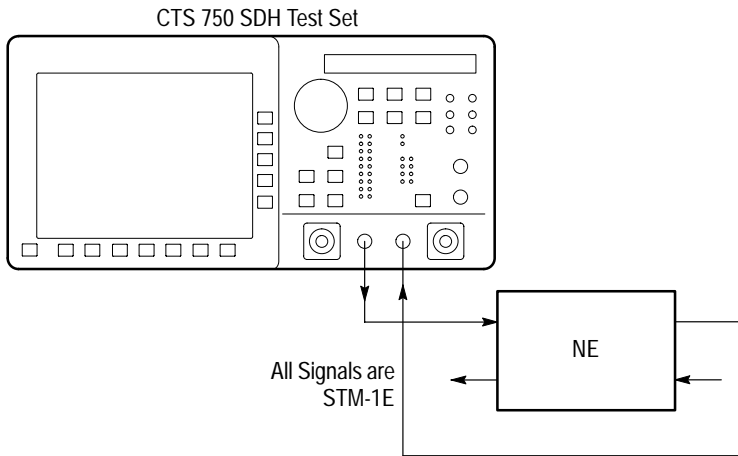


Figure 3–6: Setup to Check Line Frequency Offset Response

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1E
		Tx/Rx Settings	Coupled
TRANSMIT	POINTERS & TIMING	Pointer/Timing Mode	Frequency Offset
		Offset Mode	Line
		Frequency Offset	Stress +4.6 ppm
RESULTS	MAIN RESULTS	<i>none</i>	Errors

3. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.
4. Verify that there are no errors in the MAIN RESULTS display. When the front-panel ERROR light is not on, it also indicates there are no errors in the received signal.
5. To check that the NE is generating pointer movements, change the CTS 750 setup as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	MAIN RESULTS	<i>none</i>	Pointers

6. Verify that negative pointer justifications are being counted.

Performance Monitoring

When a new line is installed you may want to monitor performance for a day or so to be sure it is operating correctly. Or, if problems are suspected on a line, you may want to run a long test to determine the cause of the problem. In either case, the CTS 750 makes it easy to monitor an electrical or optical line without the need for splitters.

During a test, the CTS 750 simultaneously takes all performance measurements, analyzes the results according to the G.821 standard, and displays the measurements and analysis in your choice of three formats:

- In a brief summary
- In detail by type (error, alarm, failure)
- In detail by layer (regenerator section, multiplexer section, path)

In this example, the CTS 750 is placed directly in line with a live optical signal to monitor performance in an unintrusive mode (Through Mode).

1. Connect the CTS 750 in line with an optical signal as shown in Figure 3-7.

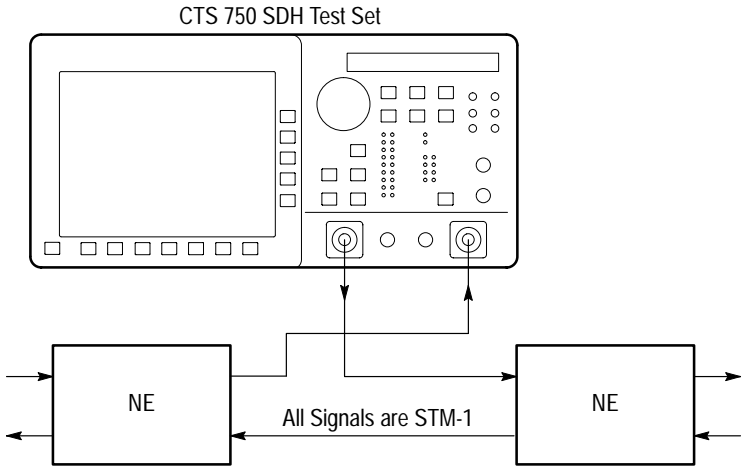


Figure 3-7: Setup to Monitor Performance

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
RECEIVE	RECEIVE SETTINGS	Receive Rate	STM-1
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Through Mode
RESULTS	ERROR ANALYSIS	<i>none</i>	RS Analysis

3. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.
4. As the test is running, the analysis of Regenerator Section errors continually updates. You can also look at the analysis of

Multiplexer Section, Path, or Payload errors by pressing the buttons corresponding to those choices.

5. To see network performance data since the start of the test presented in graphical form, change the CTS 750 setup as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	HISTORY GRAPHS	<i>none</i>	<i>none</i>

6. The CTS 750 history graphs can cover a time span up to 72 hours. You can choose history graphs of the measured performance indicators in the following categories:
 - Error count (any error you choose)
 - Errored seconds (any error you choose)
 - Pointer justifications
 - Pointer value
 - All failures
 - All alarms

7. For example, to change the bottom graph to display the history of Path B3 Errored Seconds, change the CTS 750 setup as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	HISTORY GRAPHS	<i>none</i>	Change Bottom
		<i>turn the knob to select the desired graph</i>	Path B3 Errored Secs
			Select Graph

8. Turning the knob moves the cursor from one bar to the next. The specific measurement values at the cursor location are shown in the display.
9. Once the graph fills the width of the display, you can pan through the entire test using the knob.
10. You can compress or expand the time scale with the Zoom Out or Zoom In action buttons. Press the button next to Zoom Out to change the time scale to 5 minutes per bar.

Jitter Testing

With the CTS 750 jitter generation and analysis capability, it is easy to run the following automated ITU jitter-conformance tests:

- Jitter Tolerance
- Jitter Transfer
- Output Jitter
- Pointer Jitter

This section shows examples of the jitter tolerance and jitter transfer tests. Refer to *Jitter Tests* on page 3–64 for more information about the compliance tests.

Testing Jitter Tolerance

The CTS 750 generates a signal that contains jitter at various frequencies and feeds it to the network element. Then the CTS 750 receives the output from the network element and analyzes its performance.

You can specify several parameters for the test:

- Mask type for jitter analysis
- Start frequency
- End frequency
- Number of frequency samples
- Tolerance criteria

The results are displayed in numerical and graphical form.

The CTS 750 provides two methods to measure the tolerance of a network element to jitter applied at its input:

- Onset-of-errors method
- 1 dB power penalty (BER) method

These methods are fully specified and described in ITU-T Recommendation O.171.

Onset-of-Errors Method. The onset-of-errors method measures the error output of a network element when jitter is applied to its input. If there are two or more Errored Seconds in a 30-second time interval, then the CTS 750 plots the jitter frequency and amplitude on a graph and compares it to a mask you can choose.

1. Connect the CTS 750 to the network element as shown in Figure 3–8.

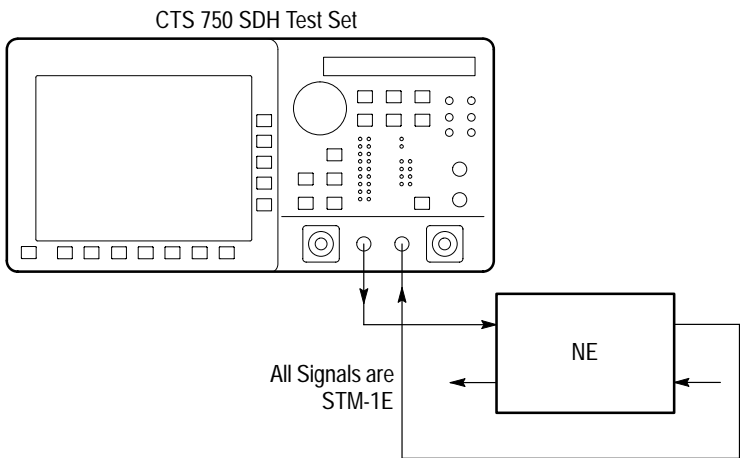


Figure 3–8: Setup to Check Onset-of-Errors Jitter Tolerance

2. Set the transmit and receive signals to STM-1E.

3. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Output	Line
TEST SETUPS	JITTER TESTS	Test Type	Jitter Tolerance
		Test Control	Edit Setup
		Mask Type	<i>as appropriate</i>
		Start Frequency	<i>as appropriate</i>
		End Frequency	<i>as appropriate</i>
		Number Freq Samples	<i>as appropriate</i>
		Tolerance Criteria	Onset of Errors

4. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.

As the test is running, the jitter tolerance graph is displayed on the screen. The test stops automatically after it has completed.

1 dB Power Penalty Method. The 1 dB power penalty method uses the BER to measure the amount of jitter that is equivalent to a 1 dB loss of signal power at the optical input of a network element.

1. Connect the CTS 750 to the network element as shown in Figure 3-9.

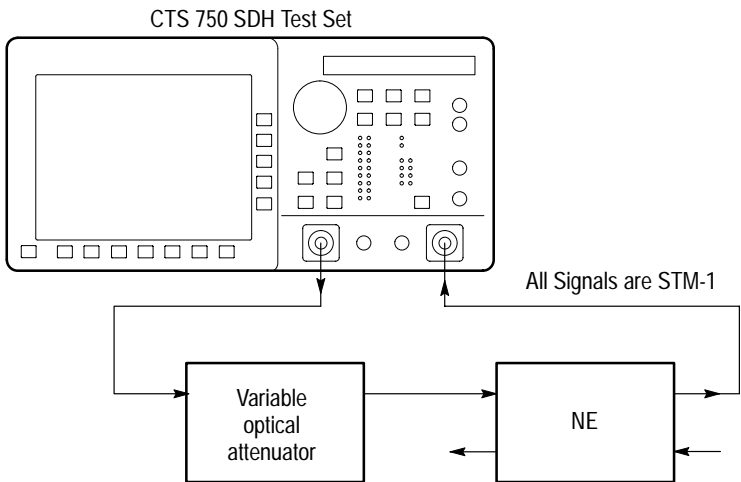


Figure 3-9: Setup to Check 1 dB Power Penalty Jitter Tolerance

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Output	Line
TEST SETUPS	JITTER TESTS	Test Type	Jitter Tolerance
		Test Control	Edit Setup
		Mask Type	<i>as appropriate</i>
		Start Frequency	<i>as appropriate</i>
		End Frequency	<i>as appropriate</i>
		Number Freq Samples	<i>as appropriate</i>
		Tolerance Criteria	BER
		Record Error Threshold	Measure BER

3. Observe the Current BER and Recommended BER values in the display. Increase the optical attenuation until the Current BER reaches or exceeds the Recommended BER.
4. When the Current BER exceeds the Recommended BER:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Record Error Threshold	Record BER

5. Reduce the optical attenuation by 1 dB.
6. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.

The CTS 750 applies progressively increasing jitter to the input until the Current BER reaches the threshold you set. At that time, the test stops automatically and the results are displayed.

Testing Clock-to-Line Jitter Transfer

This test measures the transfer function for jitter in the output of a network element relative to jitter in its clock. The CTS 750 generates a 2 MHz G.703 clock signal containing jitter that is connected to the network element. The CTS 750 also generates a jitter-free test pattern connected to the input of the network element. Then, the CTS 750 receives the output from the network element and analyzes its performance.

You can specify several parameters for the test:

- Mask type for jitter analysis
- Start frequency
- End frequency
- Number of frequency samples

The results are displayed in numerical and graphical form.

1. Connect the CTS 750 to the network element as shown in Figure 3–10.

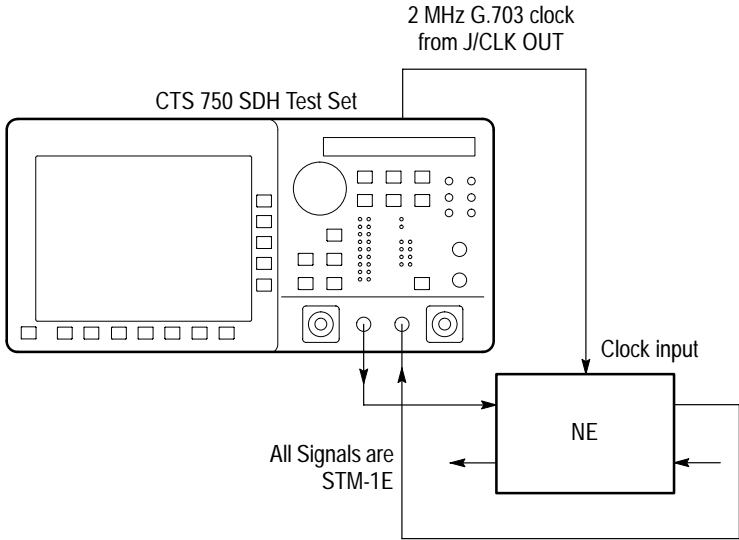


Figure 3-10: Setup to Check Clock-to-Line Jitter Transfer

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Output	2 MHz G.703
RECEIVE	JITTER & WANDER	Jitter Input Source	Line
TEST SETUPS	JITTER TESTS	Test Type	Jitter Transfer
		Test Control	Edit Setup
		Mask Type	<i>as appropriate</i>
		Start Frequency	<i>as appropriate</i>
		End Frequency	<i>as appropriate</i>
		Number Freq Samples	<i>as appropriate</i>

3. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.

As the test is running, the jitter transfer graph is displayed on the screen. The test stops automatically after it has completed.

Video Timing Quality Testing

Compressed digital video signals transmitted over a network can be impaired by low-frequency jitter or frequency drift that may be acceptable in other applications. One source of this jitter is pointer movement used to synchronize SDH payloads across a network. You can use the CTS 750 to analyze jitter in a PDH signal due to pointer movement in the SDH signal. Two new measurements, Frequency Drift and Pointer Hit Seconds, help show this effect.

The CTS 750 generates a SDH signal containing a sequence of pointer movements. The CTS 750 analyzes the timing of the dropped 34 Mb/s signal.

1. Connect the CTS 750 to the network element as shown in Figure 3–11.

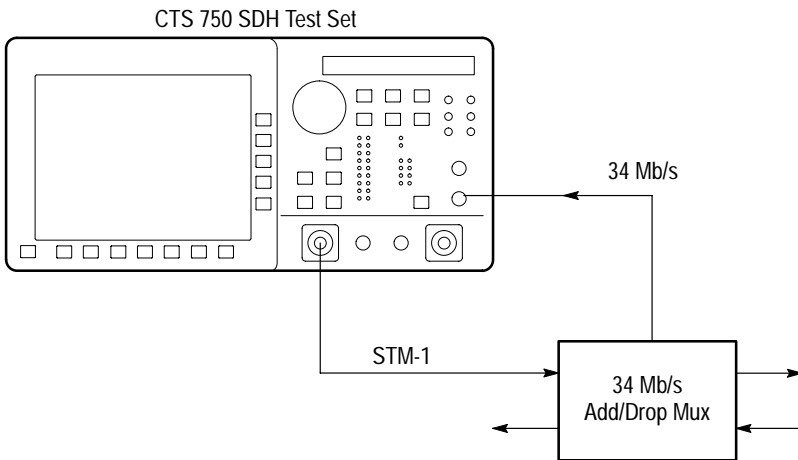


Figure 3–11: Setup to Check Video Timing Quality

2. Set up the CTS 750 as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1E
		Mapping	TU3 Async
TRANSMIT	JITTER & WANDER	Jitter Output	Line
TRANSMIT	POINTERS & TIMING	Pointer/Timing Mode	Pointer Sequences
		Pointer Type	AU Pointer
		Sequence Type	Periodic 87-3
RECEIVE	RECEIVE SETTINGS	Receive Rate	34 Mb/s
RESULTS	MAIN RESULTS	<i>none</i>	Jitter/Wander

3. Press the **POINTER ACTION** button to start the pointer sequence.
4. Press the **START/STOP** button on the CTS 750 so that the START/STOP light is on.

As the test is running, results are displayed on the screen. The test stops automatically after it has completed.

Setting Test Control Parameters

This section describes how to set the duration for a test, the resolution of the test history, and how to start and stop a test. It also lists parameters that cannot be adjusted during a test and other actions that cannot be performed while a test is running.

Setting the Test Time Duration

Before running a test, you must specify how long the test will run. The default test duration is continuous, which means a test runs until you stop it with the START/STOP button.

***NOTE.** Most jitter tests run for a fixed duration. You do not need to set test duration, as shown below, for jitter tests.*

To set the duration of a test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	TEST CONTROL (see Figure 3-12)	Test Duration	5 min
			15 min
			1 hour
			Continuous
			USER DEFINED

- Select **Continuous** to set the test to run until the START/STOP button is pressed. If you select Continuous, the CTS 750 accumulates measurements from the time you start the test until the time you stop the test.

Once the test duration is set, any time a test is started it will run for the time specified on the Test Duration line.

NOTE. If an instrument setup or pass/fail test is recalled from memory or disk, it overwrites the test duration specified on the **TEST TIME** page.

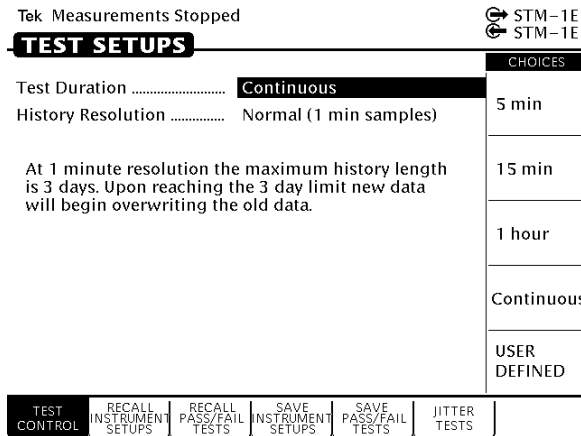


Figure 3-12: The Test Control Page

Setting a Unique Test Time Duration

To set a test duration time other than the three choices presented, use the **USER DEFINED** choice.

To set a unique test duration:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	TEST CONTROL	<i>none</i>	USER DEFINED (see Figure 3-13)
			Day
			Hour
			Minute
			Second

- Select **Day**, **Hour**, **Minute**, or **Second** as appropriate, then use the knob to set the duration of the selected period. Set each choice as necessary.
- Select **DONE** when finished setting the duration to enter the specified test duration.

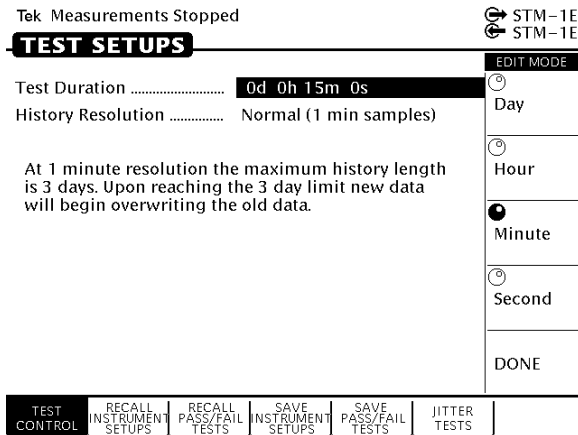


Figure 3-13: Setting a USER DEFINED Test Duration

Table 3–2 lists the range limits for the test duration.

Table 3–2: Test Duration Limits

Choice	Range	Increment
Day	0 to 99	1
Hour	0 to 23	1
Minute	0 to 59	1
Second	0 to 59	1

NOTE. *Although a test can be set to run up to 99 days, 23 hours, 59 minutes, and 59 seconds, only results from a limited period are saved in memory. The period of test results saved is determined by the History Resolution setting.*

Setting the History Resolution

The history of test results can be recorded at three resolutions, either 1 second, 1 minute, or 15 minutes. At 1-second resolution, one hour of test results can be recorded. At 1-minute resolution, 3 days of test results can be recorded. At 15-minutes resolution, 45 days of test results can be recorded.

To set the history resolution of a test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	TEST CONTROL (see Figure 3–12 on page 3–34)	History Resolution	High (1 sec)
			Normal (1 min)
			Low (15 min)

Starting and Stopping a Test

To start or stop a test:

- Press **START/STOP**.

When a test starts, the light next to the START/STOP button turns on and the status line displays the message, Running.

NOTE. *Pressing START/STOP while a test is running stops the test immediately, even if the test time has not expired.*

While a test is running, the status line shows the elapsed time since the test began. If a limited test duration has been set (any setting other than Continuous), a bar graph indicates the current percentage of test completion. Figure 3–14 shows the locations of the elapsed time indicator and bar graph.

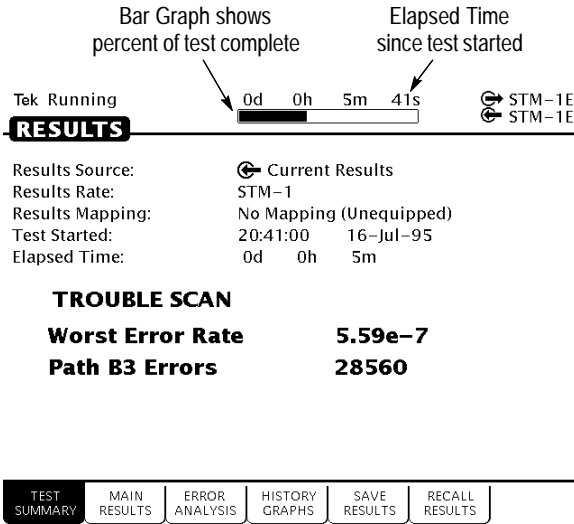


Figure 3-14: Elapsed Time and Bar Graph Indicators

Making Changes While Running a Test

If you change instrument receive settings while a test is running, the test is restarted. Error counts are cleared and the test begins again using the new settings. You can change transmitter settings while a test is running without restarting the test.

Actions You Cannot Perform While Running a Test

There are actions you cannot perform while a test is running (see Table 3-3). You cannot recall instrument settings, pass/fail tests, or results and you cannot save results while a test is running. If you try to perform a recall while a test is running, you are warned that a recall is not allowed while a test is running.

Table 3–3: Actions You Cannot Perform While a Test is Running

Menu	Page	Action
TEST SETUPS	RECALL INSTRUMENT SETUPS	Recall an instrument setup
	RECALL PASS/FAIL TESTS	Recall a pass/fail test
RESULTS	RECALL RESULTS	Recall previous results
	SAVE RESULTS	Save current results to disk
UTILITY	SELF TEST	Execute self test or diagnostics
AUTOSCAN		Autoscan the received signal

Working with Test Setups

This section describes how to do the following tasks:

- Save and recall instrument setups
- Create and run pass/fail tests
- Run jitter compliance tests

Instrument setups are files, stored in memory or on disk, that completely describe how the CTS 750 is set up. You can use this feature to ensure that every time a test is run, using an instrument setup, that the CTS 750 is configured the same way, thus ensuring consistent results. The disk file is an ASCII format file that consists of SCPI commands. The disk file can be edited with any ASCII file editor.

Pass/fail tests are tests that display a message indicating whether the completed test encountered any of the specified failure conditions. Up to four failure conditions can be specified in a pass/fail test. Pass/fail tests can be configured to save test results to disk or to print out the test results when the test completes.

Jitter tests are a set of standard compliance tests that measure the jitter in a signal or the response of a network to applied jitter. These tests are defined by ITU Standards 9.823, 9.825, and 9.783. For some tests, the CTS 750 generates jitter to stimulate a network element and simultaneously measures its response. Results are displayed in numerical and graphical form. You can set parameters to customize most jitter tests.

Saving and Recalling Instrument Setups

Instrument setups are files stored in memory or on disk that define how the CTS 750 is configured. If you regularly set up the CTS 750 in the same way, you can save the instrument settings in an instrument setup. Then you can recall the instrument setup whenever you want the CTS 750 configured a certain way. This capability saves you time and minimizes the chances of error when setting up the CTS 750 for standard tasks.

NOTE. *Instrument setups saved to memory are retained when the instrument is turned off. Instrument setups are retained in memory even if power is removed from the CTS 750.*

Saving Instrument Setups

To save an instrument setup:

1. Set up the CTS 750 as desired. Set all instrument parameters as required.
2. To save an instrument setup to disk, it must have a name. Enter a file name as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	SAVE INSTRUMENT SETUPS (see Figure 3-15)	Name	SETUP_XX
			EDIT NAME

- If you wish to label the setup file as SETUP<Number>, you can save time by selecting **SETUP_XX**. Once you select **SETUP_XX**, select **EDIT NAME** and edit **XX** to the desired number (or letter). Select **DONE** when you are finished editing the setup name. The instrument setup name can be up to eight characters long.
- Select **EDIT NAME** to enter a name other than **SETUP_XX**. Select **DONE** when you are finished editing the setup name. The instrument setup name can be up to eight characters long.

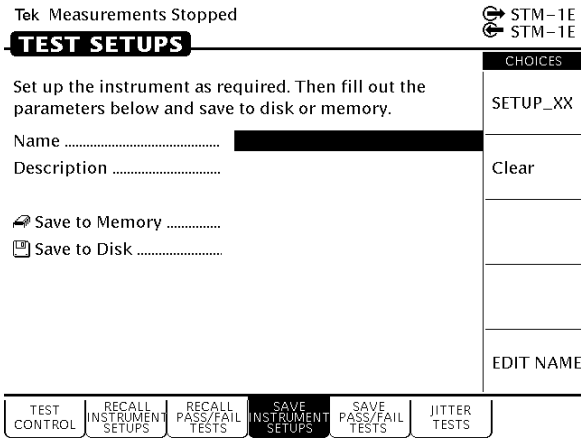


Figure 3–15: The SAVE INSTRUMENT SETUPS Page

3. Enter a description of the instrument setup as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Description	EDIT TEXT

- Select **EDIT TEXT** to edit the description of the instrument setup. The description can be up to 24 characters long. To remove an existing description, select **Clear** or **None**.

4. Save the instrument setup to memory as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Save to Memory	Memory n

5. Save the instrument setup to disk as follows:

- Insert a disk to store the file on, if one has not already been inserted.

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Save to Disk	Save File

The instrument setup is saved to disk with the name specified on the Name line. Status messages indicate the progress of the file save. Once the file is written to disk, the CTS 750 reads the disk directory and updates the file listing shown on the RECALL INSTRUMENT SETUPS page.

Recalling Instrument Setups

To recall an instrument setup from memory:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS (see Figure 3-16)	<i>none</i>	Memory
		<i>none</i>	Disk
		select setup	Recall Setup

- Use the knob to select the desired instrument setup.
- To recall setups from memory rather than disk, select **Memory** to highlight the Memory listing (see Figure 3-16).
- To recall setups from disk rather than memory, select **Disk** to highlight the Disk listing.

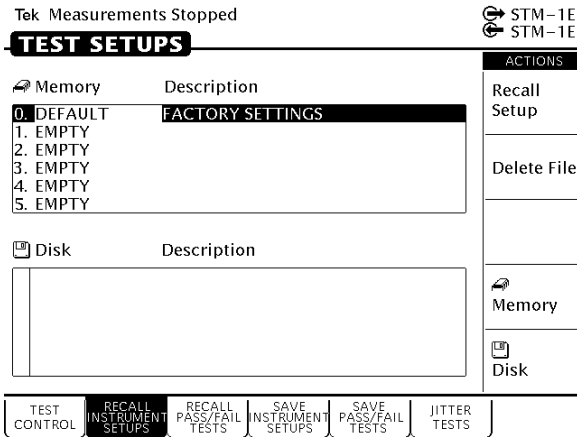


Figure 3–16: The RECALL INSTRUMENT SETUPS Page

The disk file listing displays up to six file names at a time. If more than six files are on disk, the file listing automatically scrolls when you turn the knob.

Recalling the Default Factory Setup

To recall the default factory setup (initialize the CTS 750):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS (see Figure 3–16)	<i>none</i>	Memory
		0. Default	Recall Setup

Recall the default settings whenever you want to restore the CTS 750 to a known state. For a listing of the factory default settings, see page C–1.

Deleting Instrument Setups from Disk

You can delete instrument setups from disk using the Delete File action.

To delete an instrument setup from disk:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS (see Figure 3–16)	<i>none</i>	Disk
		select setup	Delete File

- Use the knob to select the file to delete (see Figure 3–17).

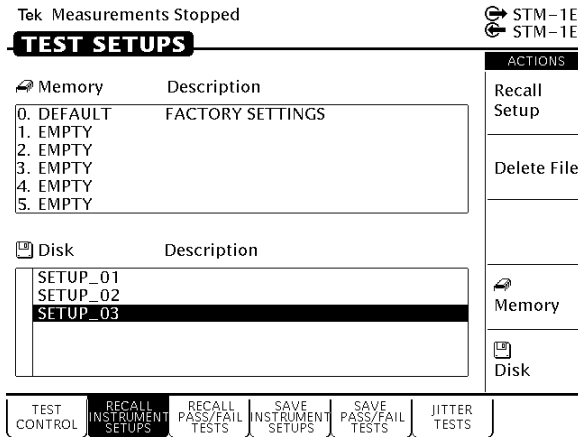


Figure 3–17: Selecting a Disk File for Deleting

After you select Delete File, status messages appear indicating the progress of the file deletion. When the file has been deleted, the file listing updates.

Pass/Fail Tests

A pass/fail test is an easy way to run a test and get a simple response stating whether or not the CTS 750 encountered the specified errors during the test. When a pass/fail test completes, the CTS 750 displays a message stating that either the test passed or failed. Pass/fail tests are set up in the TEST SETUPS menu on the SAVE PASS/FAIL TESTS page (see Figure 3–18). A pass/fail test consists of instrument setup information and the parameters described in *Parameters of a Pass/Fail Test*.

Tek Measurements Stopped STM-1E
STM-1E

TEST SETUPS

CHOICES

Set up the instrument as required. Then fill out the parameters below and save your test to disk.

Name

Description

Operator Start Prompt

Test Duration 0d 0h 15m 0s

Fail If	None	None	None	None
	None	None	None	None
	None	None	None	None

Operator End Prompt

On Test Completion Do Nothing

Save to Disk

TEST CONTROL

RECALL INSTRUMENT SETUPS

RECALL PASS/FAIL TESTS

SAVE INSTRUMENT SETUPS

SAVE PASS/FAIL TESTS

JITTER TESTS

TEST_XX

Clear

EDIT NAME

Figure 3–18: The SAVE PASS/FAIL TESTS Page

Parameters of a Pass/Fail Test

A pass/fail test has the following parameters (some parameters are optional):

- **Name.** The name of the test, a mandatory parameter. It can be up to eight-characters long. The name of the test also serves as the file name for the test when you save it to disk.

NOTE. *A pass/fail test can only be saved on disk. It cannot be saved in memory.*

- **Description.** An optional, 24-character field that describes the test.
- **Operator Start Prompt.** An optional, 72-character field that is displayed at the beginning of the test. You can use the operator start prompt to provide instruction to the operator prior to the beginning of the test.
- **Test Duration.** A required parameter that sets the length of the test.
- **Fail If conditions.** The specific conditions that define whether a test has failed.
- **Operator End Prompt.** An optional, 72-character field that is displayed at the end of the test. You can use the operator end prompt to provide instruction to the operator after the test is completed.
- **On Test Completion.** A required parameter that defines the action to be taken when a test completes.

Fail If Conditions

A Fail If condition is what determines if a test passes or fails. There are three elements to a Fail If condition: condition type, specific condition, and threshold (see Table 3–4).

The condition type describes the general condition that indicates a test has failed. For each condition type (except None), there is list of specific conditions and thresholds used to determine when a test fails. None indicates that no condition type has been assigned.

The specific condition describes the type of failure used to determine when a test fails. The specific conditions that define a failure depend on the condition type (see Table 3–4).

The threshold is the level at which a test fails (see Table 3–4). For example, for the condition types Alarm and Failure, the threshold for any specific condition is Detected or Not Detected.

- Detected. If the specified condition is detected, the test fails.
- Not Detected. If the specified condition is not detected, the test fails.

Table 3–4: Fail If Conditions of a Pass/Fail Test

Condition Type	Specific Condition	Threshold
Alarm	Any	Detected/Not Detected
	MS AIS	Detected/Not Detected
	MS FERF	Detected/Not Detected
	Path AIS	Detected/Not Detected
	PATH FERF	Detected/Not Detected
	TU AIS	Detected/Not Detected
	TU FERF	Detected/Not Detected
	PDH AIS	Detected/Not Detected
	PDH RAI	Detected/Not Detected
Failure	Any	Detected/Not Detected
	LOS	Detected/Not Detected
	LOF	Detected/Not Detected
	AU LOP	Detected/Not Detected
	TU LOP	Detected/Not Detected
	TU LOM	Detected/Not Detected
	Pattern Sync	Detected/Not Detected
Error Ratio	Any	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER

Table 3-4: Fail If Conditions of a Pass/Fail Test (Cont.)

Condition Type	Specific Condition	Threshold
	RS B1	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER
	MS B2	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER
	Path B3	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER
	TU BIP	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER
	TU FEBE	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER
	Payload BIT	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER
	2 Mb/s CRC	>1.0e-9 >1.0e-8 >1.0e-7 >1.0e-6 USER

Table 3-4: Fail If Conditions of a Pass/Fail Test (Cont.)

Condition Type	Specific Condition	Threshold
Error Count	Any	>0 >10 >100 >1000 USER (0 - 10000)
	RS B1	>0 >10 >100 >1000 USER (0 - 10000)
	MS B2	>0 >10 >100 >1000 USER (0 - 10000)
	Path B3	>0 >10 >100 >1000 USER (0 - 10000)
	TU BIP	>0 >10 >100 >1000 USER (0 - 10000)
	TU FEBE	>0 >10 >100 >1000 USER (0 - 10000)
	Payload BIT	>0 >10 >100 >1000 USER (0 - 10000)

Table 3-4: Fail If Conditions of a Pass/Fail Test (Cont.)

Condition Type	Specific Condition	Threshold
	2 Mb/s CRC	>0 >10 >100 >1000 USER (0 - 10000)
Errored Seconds	Any	>0 >1 >10 >60 USER (0-10000)
	RS B1	>0 >1 >10 >60 USER (0-10000)
	MS B2	>0 >1 >10 >60 USER (0-10000)
	Path B3	>0 >1 >10 >60 USER (0-10000)
	TU BIP	>0 >1 >10 >60 USER (0-10000)
	TU FEBE	>0 >1 >10 >60 USER (0-10000)

Table 3-4: Fail If Conditions of a Pass/Fail Test (Cont.)

Condition Type	Specific Condition	Threshold
	Payload BIT	>0 >1 >10 >60 USER (0-10000)
	2 Mb/s CRC	>0 >1 >10 >60 USER (0-10000)
Pointer	AU NDFs	>0 >1 >10 >60 USER (0-10000)
	AU Ptr. Justifys	>0 >1 >10 >60 USER (0-10000)
	TU NDF's	>0 >1 >10 >60 USER (0-10000)
	TU Ptr. Justifys	>0 >1 >10 >60 USER (0-10000)

Creating a Pass/Fail Test

To create a pass/fail test:

1. Set up the CTS 750 as required to perform the desired test.

Set all transmit and receive parameters as necessary. When the pass/fail test is recalled, the CTS 750 is set up exactly as it was when the pass/fail test was saved.

2. Set the name of the pass/fail test as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	SAVE PASS/FAIL TESTS (see Figure 3-18)	Name	TEST_XX
			EDIT NAME
			Clear

- If you wish to name the test file as TEST<Number>, you can save time by selecting **TEST_XX**. Once you select TEST_XX, select **EDIT NAME** and edit XX to the desired number (or letter). Select **DONE** when you are finished editing the setup name.
- Select **EDIT NAME** to enter a name other than TEST_XX for the pass/fail test. Select **DONE** when you are finished editing the test name.
- Select **Clear** to remove an existing name.

3. Enter a description of the pass/fail test as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	SAVE PASS/FAIL TESTS	Description	EDIT TEXT
			None
			Clear

- Select **EDIT TEXT** to enter a description of the test, up to 24 characters long. Select **DONE** when you are finished editing the description.
 - Select **None** if you do not want to use a description.
 - Select **Clear** to remove an existing description.
4. Enter an operator start prompt as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	SAVE PASS/FAIL TESTS	Operator Start Prompt	Default
			Clear
			Preview
			EDIT TEXT

- Select **Default** to enter the default prompt TEST IS ABOUT TO START!.
- Select **Clear** to remove any previously entered prompt text.
- Select **Preview** to see how the prompt text you have entered appears in the pass/fail test dialog box. Select **EXIT** to remove the preview.

- Select **EDIT TEXT** to enter an operator start prompt, up to 72 characters long. The prompt appears on the display as three lines of 24 characters. Select **DONE** when you are finished editing the prompt.

5. Set the test duration as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	SAVE PASS/FAIL TESTS	Test Duration	5 min
			15 min
			1 hour
			Continuous
			USER DEFINED

- Select **USER DEFINED** to enter a time other than one of the preset choices. The maximum duration is 99 days, 23 hours, 59 minutes, 59 seconds.
6. Highlight the first entry in the first column of the Fail If table (see Figure 3–19). Select one of the preset choices to specify a condition type.

Tek Measurements Stopped ↻ STM-1E
↻ STM-1E

TEST SETUP

Set up the instrument as required. Then fill out the parameters below and save your test to disk.

Name

Description

Operator Start Prompt

Test Duration 0d 0h 15m 0s

Fail If	None	None	None	CHOICES	
	None	None	None		Alarm
	None	None	None		Failure
	None	None	None		Error Ratio
	None	None	None	Error Count	

Operator End Prompt

On Test Completion Do Nothing

Save to Disk

-more-
1 of 2

TEST CONTROL RECALL INSTRUMENT SETUPS RECALL PASS/FAIL TESTS SAVE INSTRUMENT SETUPS **SAVE PASS/FAIL TESTS** JITTER TESTS

Figure 3-19: Entering Fail If Conditions

7. Highlight the first entry in the second column (see Figure 3-19). If you wish to specify a specific condition, select one of the preset choices.
8. Highlight the first entry in the third column (see Figure 3-19). Select one of the preset choices to set the threshold. Select **USER** to specify a threshold other than one of the preset choices. (USER is not available for Alarm or Failure condition types.)
9. Repeat steps 6 through 8 as necessary to specify additional Fail If conditions. A maximum of four Fail If conditions can be specified.

10. Enter an operator end prompt as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	SAVE PASS/FAIL TESTS	Operator End Prompt	Default
			Clear
			Preview
			EDIT TEXT

- Select **Default** to enter the default prompt TEST HAS ENDED!.
- Select **Clear** to remove any previously entered prompt text.
- Select **Preview** to see how the prompt text you have entered appears in the pass/fail test dialog box. Select **Exit** to remove the preview.
- Select **EDIT TEXT** to enter an operator end prompt, up to 72 characters long. The prompt appears on the display as three lines of 24 characters. Select **DONE** when you are finished editing the prompt.

11. Specify the action to be taken when the test completes as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	SAVE PASS/FAIL TESTS	On Test Completion	Do Nothing
			Print Summary
			Save to Disk

- Select **Do Nothing** if you do not want any action taken at test completion.

- Select **Print Summary** to print the test results when the test completes.
- Select **Save to Disk** to create a disk file of the test results when the test completes.

12. Save the pass/fail test to disk as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	SAVE PASS/FAIL TESTS	Save to Disk	Save File

Running a Pass/Fail Test

To run a pass/fail test:

1. Insert the disk containing the pass/fail test into the disk drive.
2. Select the pass/fail test to run as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL PASS/FAIL TESTS	<i>none</i>	Disk
		select disk file name	Recall

NOTE. The Disk action displays only files with the extension .TST.

Selecting Recall begins the recall of the pass/fail test.

As the file recall begins, the TEST BEGIN dialog box appears (see Figure 3–20). The first line of text in the dialog box is the file name. The second line of text is the test description. The third line informs the user that the file was recalled successfully. The

fourth line states how to begin the test. The fifth line is the operator start prompt.

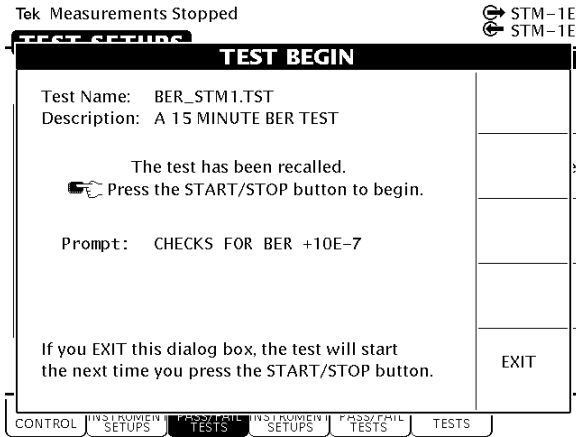


Figure 3–20: The TEST BEGIN Dialog Box

3. To run the pass/fail test immediately, press **START/STOP**.

The pass/fail test will begin. When the test is completed, the CTS 750 displays either **TEST PASSED!** or **TEST FAILED!**.

If you decide not to run the test, select **EXIT** from the dialog box.

4. Select **EXIT** to remove the dialog box after the test completes.
5. Press **RESULTS** to see the detailed results of the test.

A test does not have to be run when it is recalled from disk. After the **TEST BEGIN** dialog box appears, you can exit the dialog box by selecting **EXIT**. You can then select the **SAVE PASS/FAIL TESTS** page and edit the parameters of the pass/fail test.

Changing an Existing Pass/Fail Test

You do not have to create a pass/fail test from the beginning every time. You can recall an existing test, edit the parameters of the test, and then save it under a new name.

To change an existing pass/fail test:

1. Insert the disk containing the pass/fail test into the disk drive.
2. Select the pass/fail test to edit as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL PASS/FAIL TESTS	<i>none</i>	Disk
		select disk file name	Recall

NOTE. *The Disk action displays only files with the extension .TST.*

As the file recall begins, the TEST BEGIN dialog box appears (see Figure 3–20).

3. Select **EXIT** to remove the dialog box.
4. Select **SAVE PASS/FAIL TESTS**.
5. Edit the parameters of the pass/fail test as necessary.
6. If you want to save the edited pass/fail test under a different name, change the Name of the test. You do not have to change the name of the test file to save it to disk.

7. Save the pass/fail test to disk as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	SAVE PASS/FAIL TESTS	Save to Disk	Save File

- If you select Save File without changing the name of the file, a Disk dialog box appears asking if you want to overwrite the existing file. To overwrite the file, select **Overwrite**. If you do not want to overwrite the file, select **Cancel**.

Deleting a Pass/Fail Test from Disk

Delete a pass/fail test from disk as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL PASS/FAIL TESTS	select file name	Delete File

- If necessary, select **Disk** from the list of actions to display the names of the files on disk (see Figure 3–21).

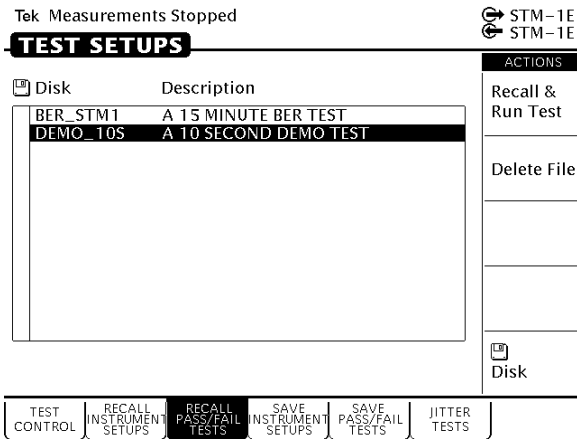


Figure 3-21: Selecting a Pass/Fail Test for Deleting

After you select Delete, status messages appear indicating the progress of the file deletion. The file list updates after the file is deleted.

Jitter Tests

You can use the CTS 750 to run the following types of jitter conformance tests:

- Jitter Tolerance
- Transfer Jitter
- Output Jitter
- Pointer Jitter

In each of these tests, the CTS 750 measures the jitter in a signal or at the output of a network element. For some tests, the CTS 750 generates jitter to stimulate the network or a network element while it simultaneously measures the network response.

For the most part, the jitter tests are self contained. When you define a jitter test, you set the specific jitter generation and measurement parameters required by the test. However, you may also need to use the TRANSMIT and RECEIVE menus to select signal sources and set parameters.

When the test is complete, you can save the results, print the results, or export the results data to incorporate in a spreadsheet.

Setting Up a Jitter Test

To set up a jitter test:

1. Use the RECEIVE menu to set the receive parameters that are appropriate for the signal you will be measuring. Refer to *Setting SDH Receive Parameters* on page 3–125 for information about this topic.
2. If the jitter test requires the CTS 750 to generate jitter, use the TRANSMIT menu to set the transmit parameters that are appropriate for the signal you will be generating. Refer to *Setting SDH Transmit Parameters* on page 3–83 for information about this topic.

3. To set the type of jitter test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Test Type	Output Jitter
			Jitter Tolerance
			Jitter Transfer
			Pointer Jitter

- Select **Output Jitter** to measure the jitter at the output of a network element. (The output jitter test does not use the CTS 750 jitter-generation capability.)
- Select **Jitter Tolerance** to measure the tolerance of the input of a network element to applied jitter.
- Select **Jitter Transfer** to measure the transfer of jitter from the input to the output of a network element.
- Select **Pointer Jitter** to measure jitter in PDH signals due to pointer movement in the SDH signal.

The remaining parameters are dependent on the type of jitter test you select.

4. To edit the jitter test parameters:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Test Control	Edit Setup

Jitter Tolerance Test. Follow these additional steps to set up a jitter tolerance test.

1. Set the mask type as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Mask Type	G.825
			G.958 (Type A)
			G.958 (Type A)

The available mask types are dependent on the current transmit rate and are defined by ITU standards.

The CTS 750 modulates the transmitted line or clock frequency with sinusoidal jitter. The jitter generator begins at the start frequency and stops at the end frequency.

2. To set the start frequency for the jitter generator:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Start Frequency	<i>as appropriate</i>

3. The available end frequencies are dependent on the current transmit rate. To set the end frequency for the jitter generator:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	End Frequency	<i>as appropriate</i>

4. The CTS 750 can generate jitter at intermediate frequencies between the start frequency and end frequency. To set the total number of frequencies generated (including the start and end frequencies):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	JITTER TESTS	Number Freq Samples	<i>as appropriate</i>

5. To set the tolerance criteria:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	JITTER TESTS	Tolerance Criteria	Onset of Errors
			BER

- Select **Onset of Errors** to define the tolerance as two Errored Seconds in a 30-second time interval.
 - Select **BER** to measure the amount of jitter that is equivalent to a 1 dB loss of signal power at the input of the network element (optical only).
6. If you selected Onset of Errors in step 5, skip to step 12. If you selected BER –1 dB, continue with step 7.
 7. The CTS 750 must be connected to a network element through an optical attenuator. Refer to Figure 3–9 on page 3–25 for more information about the required setup.

8. To set a baseline bit-error rate for the measurement:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	JITTER TESTS	Record Error Threshold	Measure BER

9. Observe the Current BER and Recommended BER values in the display. Increase the optical attenuation until the Current BER reaches or exceeds the Recommended BER.

10. When the Current BER exceeds the Recommended BER:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUP	JITTER TESTS	Record Error Threshold	Record BER

11. Reduce the optical attenuation by 1 dB.

12. Press the **START/STOP** button to run the jitter test. The results are displayed on screen in numerical and graphical form.

Transfer Jitter Test. Follow these additional steps to set up a transfer jitter test.

1. Set the mask type as follows; the available mask types are dependent on the current transmit rate:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Mask Type	G.958 (Type A)
			G.958 (Type B)

The CTS 750 modulates the transmitted line or clock frequency with sinusoidal jitter. The jitter generator begins at the start frequency and stops at the end frequency.

2. To set the start frequency for the jitter generator:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Start Frequency	<i>as appropriate</i>

3. The available end frequencies are dependent on the current transmit rate. To set the end frequency for the jitter generator:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	End Frequency	<i>as appropriate</i>

4. The CTS 750 can generate jitter at intermediate frequencies between the start frequency and end frequency. To set the total number of frequencies generated (including the start and end frequencies):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Number Freq Samples	<i>as appropriate</i>

NOTE. You can calibrate a 0 dB baseline, as described in ITU-T O.171, prior to measuring transfer jitter if the following two conditions are met: the jitter generation output and measurement input are both set to line, and if the transmit and receive rates are set to the same rate. If either of the conditions cannot be met, skip to step 10.

5. Verify that the jitter generation output and measurement input are both set to Line.
6. Verify that the transmit and receive rates are set to the same rate.
7. To calibrate a 0 dB baseline:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Action	Calibrate

8. Press the **START/STOP** button to run the 0 dB baseline calibration routine.

9. To run the transfer jitter test after the calibration is complete:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	<i>none</i>	Edit Setup
		Action	Jitter Transfer

10. Press the **START/STOP** button to run the jitter test. The results are displayed on screen in numerical and graphical form.

Output Jitter Test. Follow these additional steps to set up an output jitter test.

1. The recommended time duration for an output jitter test is one minute. To set the test duration to one minute (or any other duration of your choice):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Test Duration	15 sec
			30 sec
			1 min
			15 min
			USER DEFINED

- Select **USER DEFINED** to enter a time other than one of the preset choices. The maximum duration is 99 days, 23 hours, 59 minutes, 59 seconds.
2. Press the **START/STOP** button to run the jitter test. The results are displayed on screen in numerical and graphical form.

Pointer Jitter Test. Follow these additional steps to set up a pointer jitter test.

1. To set the pointer sequence type:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Sequence Type	<i>as appropriate</i>

Refer to *Generating Pointer Sequences* on page 3–177 for a description of the available pointer sequences.

2. Press the **START/STOP** button to run the jitter test. The results are displayed on screen in numerical and graphical form.

Saving and Recalling Results

You can save jitter test results to disk and recall the test results for later display and analysis. The CTS 750 automatically saves the results of the last two tests in memory. If you want to save test results permanently, you must save the test results to a disk.

The CTS 750 saves each type of jitter test result with a unique file-name extension. Because of the unique extensions, you can perform different types of jitter tests on a network element and give them a common results file name.

To save jitter test results:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	JITTER TESTS	Test Control	Save Results

Refer to *Saving and Recalling Results* on page 3–221 for detailed information about using the disk drive to save and recall results.

Printing Results

You can print jitter test results using the “Print Last Screen” choice in the Print Control dialog box. Refer to *Printing Results* on page 3–225 for detailed information about printing.

Exporting Results into a Document

You can export the jitter tolerance and jitter transfer test results in a Microsoft Excel-compatible format to produce a graph for your documentation. Use the saved files with .XTL or .XTR for this purpose.

The file format consists of a header that identifies the type of test, the date and time, the transmit source, the transmit and receive rates, and the number of sample points in the graph. Data following the header is comma separated and consists of four values for each sample point in the graph: modulation frequency, mask amplitude, measured amplitude, and a status indicator that indicates an overrange condition.

Checking Signal Status

This section describes how to use the CTS 750 to check signal status. The CTS 750 continuously monitors the input signal for alarms, errors, and failures and provides indicators for the current signal status as well as indicating the history of the signal status.

Viewing Signal Structure

The quickest way to view the structure of a signal is to use AUTOSCAN. AUTOSCAN analyzes the input signal and once a signal is found, the CTS 750 synchronizes with the signal and displays the structure of the signal.

To view signal structure using AUTOSCAN:

1. Connect a signal to the receiver input.
2. If a test is running, stop the test by pressing **START/STOP**.
3. Press the **AUTOSCAN** front-panel button.

While AUTOSCAN is running, several messages appear in the display. While the CTS 750 searches for a signal it displays the message: Please wait, autosetting to received signal. The CTS 750 scans all line rates and all receiver input connectors until it finds a framed signal. When the CTS 750 finds a framed signal, the instrument displays the message: Autosetting to received signal. If a signal is not found, a message to that effect is displayed.

When the AUTOSCAN finishes, the CTS 750 displays the signal structure in graphical form (see Figure 3–22). Use the knob to scroll through the different active channels.

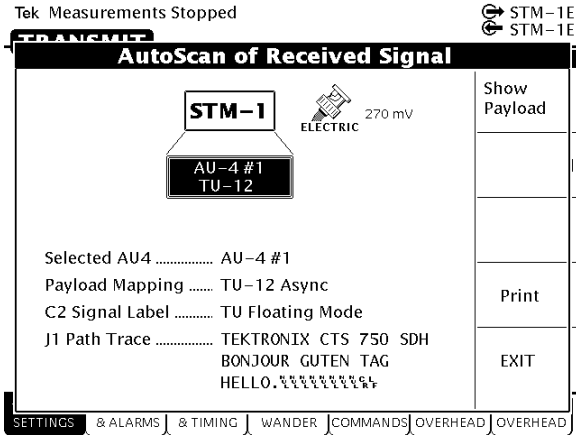


Figure 3–22: The AUTOSCAN Dialog Box Showing Signal Structure

Viewing the Payload (Add/Drop/Test Option Only)

If the received signal uses tributary mapping, then Autoscan can display the different tributaries within the AU.

To display the tributary payload, highlight an AU-4 where TU12 or TU3 is shown as the mapping and select the **Show Payload** choice (see Figure 3–23).

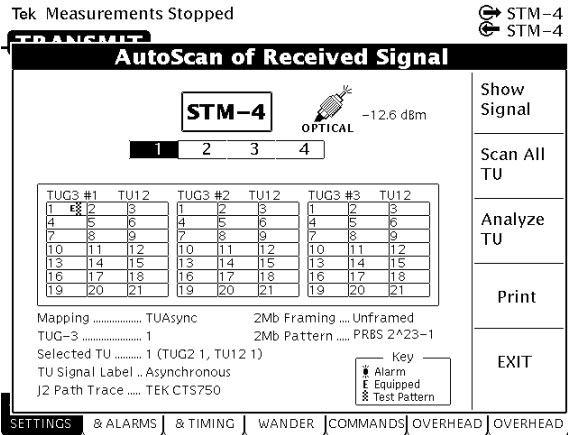


Figure 3-23: Viewing Tributary Signal Structure

Determining the Payload Pattern and Framing (Add/Drop/Test Option Only)

To search for a pattern in the data of the received signal or determine the framing, select **Analyze TU**. After you select Analyze TU, the CTS 750 scans the selected TU in the received signal to see if there is a pattern within the data and if the signal is framed. If a pattern is found, it is displayed below the payload map on the Pattern line (for example, PRBS 2²³-1). If the CTS 750 is unable to find a pattern within the signal, it displays Unknown on the Pattern line. The CTS 750 will display Unframed or Framed on the Framing line.

To scan every TU in the received signal, select **Scan All TUs**. As the CTS 750 scans the signal, it will indicate for each TU whether it has detected an alarm, whether the TU is equipped, and whether a test pattern was found in the TU. The key which describes each of the indicators is located in the lower, right corner of the AutoScan dialog box (see Figures 3-23 and 3-24).

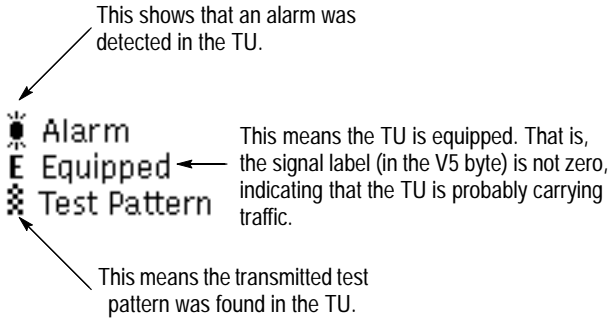


Figure 3–24: The Meaning of the Icons in the Autoscan Dialog Box

You exit the AUTOSCAN dialog box by selecting **EXIT**. When you exit the AUTOSCAN dialog box, the receiver settings are set to match the active channel most recently selected.

Printing the AutoScan Dialog Box

You can print the AutoScan dialog box by selecting **Print**. This prints the displayed dialog box using the settings on the **PRINTER SETUP** page of the **UTILITY** menu. The printout takes about two minutes.

Viewing the Signal State

Three colors are used to indicate signal state: green, red, and yellow (see Figure 3–25).

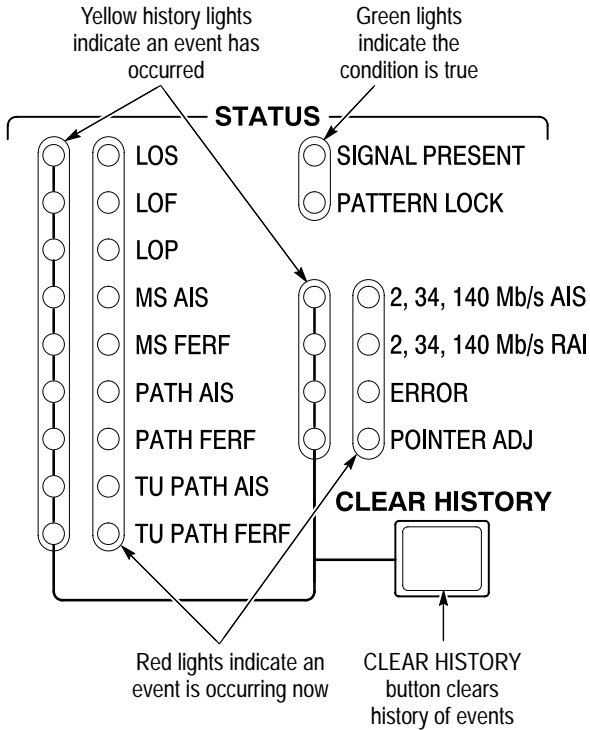


Figure 3-25: Front-Panel Status Lights (with Add/Drop/Test Option Installed)

- Green lights indicate the condition is true. See Table 3-5.

Table 3-5: Green Status Lights

Label on Light	Meaning if Light is On
SIGNAL PRESENT	A signal at the line rate specified by the Receive Rate parameter is present.
PATTERN LOCK	Lock to a PRBS or fixed pattern has been achieved.

- Red lights indicate the associated condition is valid. For example, if the red light next to LOS is on, no signal is being received. See Table 3–6.
- A yellow light is associated with each red light. The yellow lights are turned on when an error, alarm, or failure condition first occurs and then stay on to indicate the history even if the condition goes away (see Table 3–6). Press the **CLEAR HISTORY** button to clear the status history.

Table 3–6: Red and Yellow Status Lights

Label on Light	Meaning if Light is On
LOS	Loss of received signal.
LOF	Loss of frame of received signal.
LOP	Loss of AU or TU pointer for selected channel in received signal.
MS AIS	A multiplex section alarm indication signal is being received.
MS FERF	A multiplex section far end receive failure code is being received.
PATH AIS	A path alarm indication signal is being received.
PATH FERF	A path far end receive failure signal is being received.
TU PATH AIS	A tributary alarm indication signal is being received. (Add/Drop/Test Option Only)
TU PATH FERF	A tributary far end receive failure is being received. (Add/Drop/Test Option Only)
2, 34, 140 Mb/s AIS	A tributary alarm indication signal is being received. (Add/Drop/Test Option Only)
2, 34, 140 Mb/s RAI	A tributary remote alarm indication is being received. (Add/Drop/Test Option Only)
ERROR	A bit, regenerator section, multiplex section, path, or TU parity error is detected; or a MS, path, or TU FEBE is being received.
POINTER ADJ	A pointer adjustment is being received.

Extended Status

The red-yellow pair of ERROR lights on the front panel turn on when a variety of error conditions exist on the line. For more detail about the specific error types and frequency of occurrence, see the TEST SUMMARY, MAIN RESULTS, and ERROR ANALYSIS pages of the RESULTS menu. For more information on this topic, see page 3–202.

Setting the Beeper

You can set a beeper to sound every time a red status light turns on.

To enable or disable the beeper:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	MISC SETTINGS	Beeper	On
			Off

Setting SDH Transmit Parameters

This section describes how to set the transmit rate, specify the AU under test, set the payload mapping and content, and set the overhead bytes for SDH signals.

The CTS 750 SDH Test Set contains independent transmitter and receiver modules. One set of parameters controls the transmitter module and another set controls the receiver module. You can set the parameters that control the transmitter independently or you can choose to link the parameters to the receiver settings.

Steps for Setting Parameters

The sequence of steps for setting transmit parameters varies with the type of signal to be transmitted. The figures that follow show the sequence of steps required to set the transmit parameters of an SDH signal without a mapped PDH signal and an SDH signal with a mapped PDH signal. See page 3–115 for details on setting tributary signal parameters (for example 2 Mb/s).

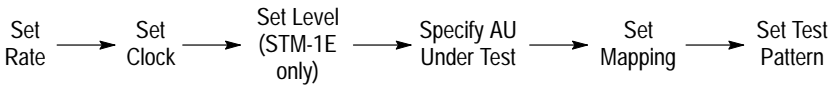


Figure 3–26: Sequence for Setting SDH Signal Parameters

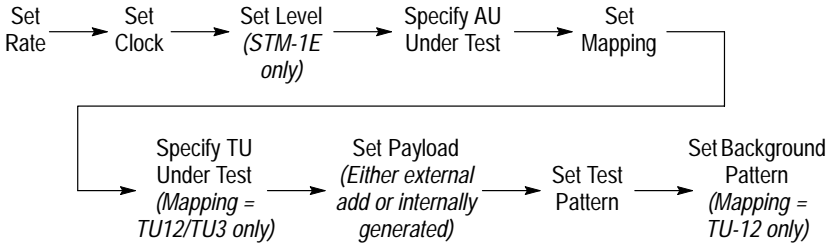


Figure 3–27: Sequence for Setting SDH Signal Parameters When Mapping a PDH Signal

Setting the Transmit Rate

To set the transmit rate:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate (see Figure 3–28 on page 3–86)	as appropriate

- Select **STM-1E**, **STM-1**, **STM-4**, **STM-0E**, or **STM-0** to transmit an SDH signal.
- Select **2 Mb/s Balanced**, **2 Mb/s Unbalance**, **34 Mb/s**, or **140 Mb/s** to transmit a PDH signal. See page 3–115 for details on setting PDH signal parameters.

NOTE. Even though there are output connectors for both SDH and PDH signals on the CTS 750 front panel, the CTS 750 can transmit only one type of signal at a time.

Independent Transmit and Receive Settings

Generally, you can set the transmit and receive settings independently. For example, you can receive an electrical signal at the STM-1E rate while simultaneously transmitting an optical signal at the STM-4 rate.

However, when working with PDH signals, the transmit and receive parameters are not completely independent. You cannot transmit a 2 Mb/s signal and receive a 34 Mb/s signal. When working with PDH signals, you must set the mapping for transmit and receive to the same value or to **Bulk Fill No Mapping**. For example, you can transmit a 34 Mb/s signal and receive an STM-4 signal, but you must set the mapping of the received signal to either **Bulk Fill No Mapping** or **34 Mb/s**; it cannot be set to 2 Mb/s.

Coupling Transmit and Receive Settings

If your application requires that the transmit settings and receive settings be identical, you can save time by coupling them together. After they are coupled, any change you make to a parameter on the TRANSMIT SETTINGS page will also be made to the corresponding setting in the RECEIVE SETTINGS page of the RECEIVE menu. The inverse is also true.

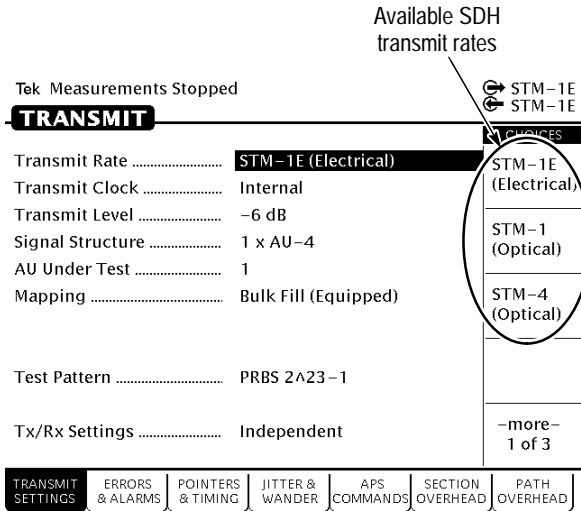


Figure 3-28: SDH Transmit Rates

To couple the transmit and receive settings together from the TRANSMIT SETTINGS page:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Coupled

NOTE. When settings are coupled from the TRANSMIT SETTINGS page, the receive parameters are changed to match the transmit parameters. Conversely, when settings are coupled from the RECEIVE SETTINGS page, the transmit parameters are changed to match the receive parameters.

Notice that the signal status icons, in the upper-right corner of the display, changed to reflect the coupling of the settings.

To change transmit and receive settings so that they are no longer coupled:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Independent

Notice that the signal status icons, in the upper-right corner of the display, changed to indicate that the settings are no longer coupled.

Through Mode

Use Through Mode to monitor a signal without changing it. In Through Mode, the rate and content of the transmitted signal is that of the received signal. You cannot make changes to pointers or timing, overhead bytes, or insert alarms or errors when the CTS 750 is in Through Mode. Through Mode does not perform clock recovery before retransmitting the recovered signal. Through Mode is used for nonintrusive performance monitoring of the active signal.

To put the CTS 750 into Through Mode:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Through Mode

To indicate when the CTS 750 is in Through Mode, the transmit and receive icons at the upper-right corner of the display have an arrow linking them together and the parameters on the TRANSMIT SETTINGS page are replaced by a message stating that the CTS 750 is in Through Mode (see Figure 3–29).

To take the CTS 750 out of Through Mode:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Independent
			Coupled

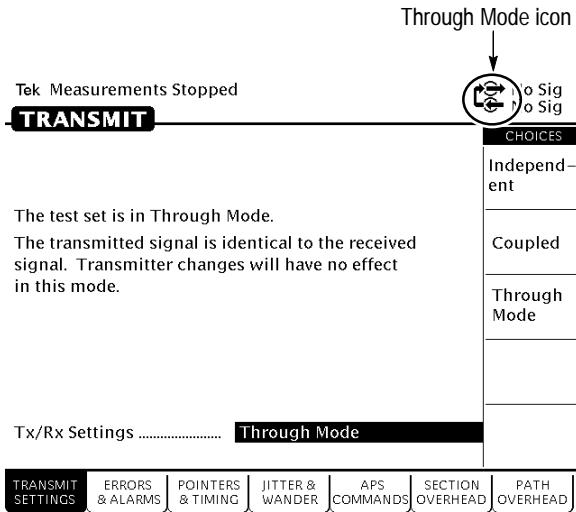


Figure 3-29: CTS 750 in Through Mode

Setting the Transmit Clock

To specify the transmit clock:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Clock	Internal
			Recovered
			External 2 Mb/s

- Select **Internal** to set the transmit clock to the internal clock.
- Select **Recovered** to use the clock recovered from an incoming signal.
- Select **External 2 Mb/s** to use the clock signal from an external 2 Mb/s reference. Attach the external 2 Mb/s reference to the 2 Mb/s connector on the rear panel.

Setting the Transmit Level

To specify the transmit level for electrical signals:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Level	0 dB
			-6 dB

- Select **0 dB** to set the line level to high.
- Select **-6 dB** to set the line level to the cross-connect level.

Reading the Signal Structure Line

You can see the structure of the transmitted signal by looking at the Signal Structure line on the TRANSMIT SETTINGS page. You cannot set the signal structure. For STM-1E or STM-1 signals, the structure is $1 \times \text{AU-4}$. For STM-4 signals, the structure is $4 \times \text{AU-4}$. For STM-0E signals, the structure is $1 \times \text{AU3}$.

Specifying the AU to Test

If you are using the STM-4 line rate, you must designate which AU to test.

To designate which AU to test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	AU Under Test	as appropriate

Setting the Payload Mapping

To set the payload mapping:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Mapping	Bulk Fill No Mapping (Equipped)
			Bulk Fill No Mapping (Unequipped)
			TU12 Async
			TU3 Async
			140 Mb/s

NOTE. Some payload mappings require options that might not be installed in your CTS 750. Depending on the mapping you choose, you might need to set additional parameters.

- Select **Bulk Fill No Mapping (Equipped)** to fill the whole payload with the test pattern specified and set the C2 byte to 1.
- Select **Bulk Fill No Mapping (Unequipped)** to fill the whole payload with the test pattern specified and set the C2 byte to 0. An all-zeros pattern is the recommended test pattern for unequipped payloads.
- Select **TU12 Async** to map an externally supplied or an internally generated 2 Mb/s signal to the transmitted signal. (Not available for STM-0/STM-0E rate.) See *Mapping a PDH Signal* on page 3–92 for details.
- Select **TU3 Async** to map an externally supplied or internally generated 34 Mb/s signal to the transmitted signal. (Not available for STM-0/STM-0E rate.) See *Mapping a PDH Signal* on page 3–92 for details.

- Select **140 Mb/s** to map an externally supplied or internally generated 140 Mb/s signal to the transmitted signal. (Not available for STM-0/STM-0E rate.) See *Mapping a PDH Signal* on page 3–92 for details.

Unequipped Payload Mapping

If you choose Bulk Fill No Mapping (Unequipped) payload mapping, the CTS 750 places the unequipped code in byte C2. You can transmit any of the pattern choices available with the Bulk Fill No Mapping (Equipped) payload mapping. However, the default pattern (all zeros prior to scrambling) is recommended.

When an SDH network element receives a signal with an unequipped channel, the network element should pass the signal through without making changes to it. This treatment should be consistent from one end of the network to the other. A loopback at the far end of the network would then allow a sole CTS 750 to transmit a PRBS across the payload channel and verify the error performance of the entire link from end to end.

Mapping a PDH Signal (Add/Drop/Test Option Only)

To map a tributary signal, you first set the Mapping to the appropriate PDH mapping (as described in the previous section). When mapping a signal, you must also specify the payload. The payload can be either an external signal connected to the appropriate IN connector on the front panel or an internally generated signal.

When you use the TU12 Floating Async or TU3 Floating Async mapping, you must also specify the tributary unit under test and payload (see Figure 3–30).

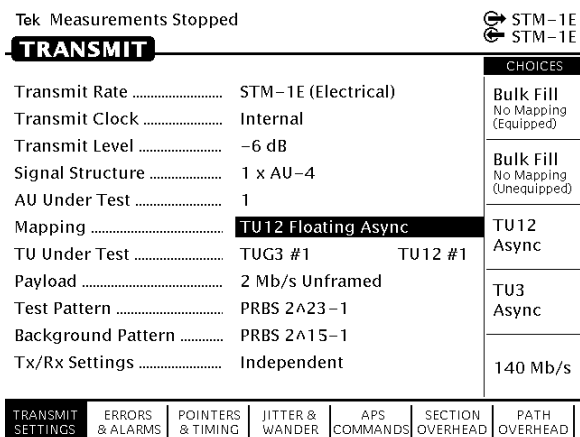


Figure 3-30: Mapping a Tributary Signal

To configure the CTS 750 for mapping a signal:

1. Set the mapping as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Mapping	TU12 Async
			TU3 Async
			140 Mb/s

- Select **TU12 Async** to map an externally supplied or internally generated 2 Mb/s signal to the transmitted signal.
- Select **TU3 Async** to map an externally supplied or internally generated 34 Mb/s signal to the transmitted signal.
- Select **140 Mb/s** to map an externally supplied or internally generated 140 Mb/s signal to the transmitted signal.

2. If the Mapping is set to TU-12, specify the TU Under Test by first specifying the Tributary Unit Group (TUG) as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		TU Under Test (TUG3 #n)	TUG3 #1
			TUG3 #2
			TUG3 #3

3. If TU12 Async is the selected mapping, specify the Tributary Unit (TU) as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		TU Under Test (TU12 #n)	<i>as appropriate</i>

4. If TU3 Async is the selected mapping, specify the Tributary Unit (TU) as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
			TU3 #1
			TU3 #2
			TU3 #3

- Select **TU3 #1**, **TU3 #2**, or **TU3 #3** to specify the TU Under Test.

5. Specify the payload as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Payload	<i>as appropriate</i>

NOTE. The choices available for Payload depend on the selected Mapping.

- Select **2 Mb/s Ext Add (Balanced)** to map a 2 Mb/s signal, connected to the 2, 34, 140 Mb/s IN connectors on the CTS 750 front panel, into the payload of the selected tributary unit.
- Select **2 Mb/s Ext Add (Unbalanced)** to map a 2 Mb/s signal, connected to the 2 Mb/s IN connectors on the CTS 750 front panel, into the payload of the selected tributary unit.
- Select **2 Mb/s Unframed** to map an internally generated, unframed 2 Mb/s signal into the payload of the selected tributary unit.
- Select **2 Mb/s PCM30 (CAS)** to map a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16 into the payload of the selected tributary unit.
- Select **2 Mb/s PCM31** to map a framed, 31 channel 2 Mb/s signal into the payload of the selected tributary unit.
- Select **2 Mb/s PCM30CRC (CAS)** to map a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16 with CRC4 multiframe into the payload of the selected tributary unit.
- Select **2 Mb/s PCM31CRC** to map a framed, 31 channel 2 Mb/s signal with CRC4 multiframe into the payload of the selected tributary unit.
- Select **34 Mb/s Ext Add** to map a 34 Mb/s signal, connected to the 34 Mb/s IN connectors on the CTS 750 front panel, into the payload of the selected tributary unit.

- Select **34 Mb/s Unframed** to map an internally generated, unframed 34 Mb/s signal into the payload of the selected tributary unit.
- Select **34 Mb/s Framed** to map an internally generated, framed 34 Mb/s signal into the payload of the selected tributary unit.
- Select **140Mb/s Ext Add** to map a 140 Mb/s signal, connected to the 2, 34, 140 Mb/s IN connector on the CTS 750 front panel, into the payload of the selected tributary unit.
- Select **140Mb/s Unframed** to map an internally generated, unframed 140 Mb/s signal into the payload of the selected tributary unit.
- Select **140 Mb/s Framed** to map an internally generated, framed 140 Mb/s signal into the payload of the selected tributary unit.

Setting the Test Pattern

You can select a test pattern to transmit in the TU.

To specify the test pattern to transmit:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Test Pattern	<i>as appropriate</i>

NOTE. The choices available for Test Pattern depend on the selected Mapping.

- Select **1 in 8** to set the test pattern to 10000000.
- Select **User Word 8 bit**, **User Word 16 bit**, or **User Word 24 bit** to set a test pattern different from the preset choices. If

you choose User Word, the test pattern description changes to display the byte selected.

If you select User Word 8 bit/16 bit/24 bit for the test pattern, set the value of the User Word as follows:

1. Set the contents of the User Word Byte(s) as follows (see Figure 3–31):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Test Pattern	Set to 00000000
			Set to 11111111
			Default 10101010
			EDIT BYTE/ Edit XX bits

2. Select **EDIT BYTE/Edit XX bits** to specify a value different from the preset choices.
3. Select **Predefined Patterns** if you decide to use the standard patterns.
4. Select **DONE** when you are finished editing the byte.

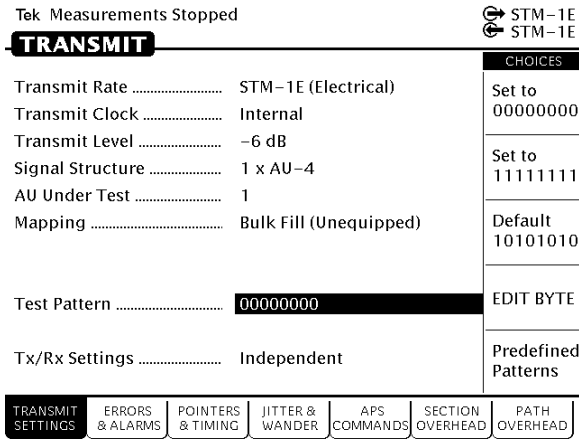


Figure 3-31: Editing the User Word Byte

Setting the Background Pattern (TU12 Mapping Only)

If you use TU12 Floating Async mapping, you can also set the background pattern.

To specify the test pattern to transmit:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Background Pattern	PRBS 2 ¹⁵ -1
			Idle

- Select **2¹⁵-1** to set the test pattern to the specified pseudo-random binary sequence.
- Select **Idle** to set the test pattern to Idle.

Setting Overhead Bytes

To stress test a network, you sometimes need to simulate errors or alarms. Use the controls on the ERRORS & ALARMS page of the TRANSMIT menu to simulate errors or alarms. As an alternative, you can edit the transport overhead and path overhead bytes directly to simulate errors, alarms, and create other stress conditions. This section describes how to use the SECTION OVERHEAD and PATH OVERHEAD pages to edit overhead bytes.

How to Edit an Overhead Byte

The following procedure applies to editing either section overhead or path overhead bytes. However, when editing path overhead bytes, you must specify which overhead you want to edit (VC4, VC3, or VC12) before you can edit the overhead bytes.

To edit overhead bytes:

1. Display the section overhead as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	SECTION OVERHEAD		

2. Select the columns you wish to edit as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Showing Overhead for	as appropriate

3. Turn the knob to highlight the byte you want to edit. See Figure 3–32.

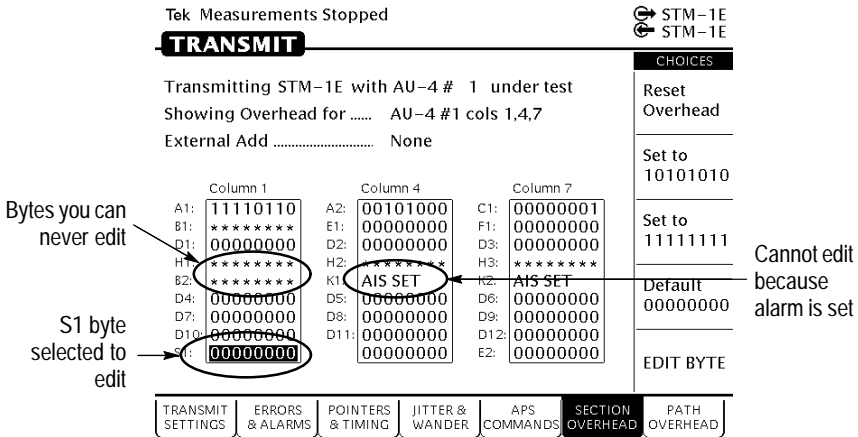


Figure 3-32: Editing the S1 Section Overhead Byte

There are several ways to edit the byte:

- Select **Reset Overhead** to set all bytes in the overhead to their individual default values. However, Reset Overhead does not remove simulated error conditions that have been set using controls in the ERRORS & ALARMS page. A simulated error condition overrides the default value of the overhead byte that signals that particular error condition.
- Select **Default (XXXXXXXX)** to set the selected byte to its default value. The specific default value depends on the selected byte and on the rate and structure of the signal.
- Select **EDIT BYTE** to define the byte as a value different from the preset choices.

4. To edit the selected byte to a value of your choice:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
			EDIT BYTE

- Define your own byte with the buttons next to **1** and **0**. Use the left and right arrow buttons to move the cursor from one bit to the next. See Figure 3–33.
- When you finish editing the byte, select **DONE**.

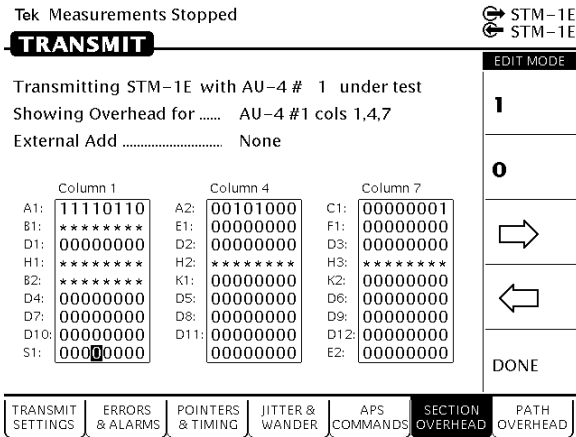


Figure 3–33: Editing an Overhead Byte

Editing the VC4, VC3, and VC12 Overhead Bytes

To edit the VC4, VC3 or VC12 overhead bytes:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	PATH OVERHEAD	Overhead View	VC4 Overhead
			VC3 Overhead
			VC12 Overhead

NOTE. *The choices available depend on the signal Mapping.*

If the signal Mapping is set to TU-12, you can edit the V5, N2, and K4 bytes after displaying the VC12 Overhead. The J2 trace byte is fixed and cannot be edited. Note that only bits 5, 6, and 7 (the signal label bits) of the V5 byte are editable. See Table 3–7.

Table 3–7: Choices for Bits 5, 6, and 7 of the V5 Byte

Choice
Unequip (000)
Equipped (001)
Async (010)
Bit-Sync (011)
Byte-Sync (100)
Reserved (101)
TSS4 (110)
VC-AIS

Bytes You Cannot Edit

Certain bytes in the section overhead and path overhead cannot be edited in the SECTION OVERHEAD or PATH OVERHEAD pages. These uneditable bytes have calculated values that are based on the payload and signal structure (see Table 3–8).

Table 3–8: Overhead Bytes That Cannot Be Edited

Overhead Byte	Function
B1	Section level parity byte
B2	MS level parity byte
B3	Path level parity byte
G1	Path status

Table 3–8: Overhead Bytes That Cannot Be Edited (Cont.)

Overhead Byte	Function
H1, H2, H3	Identify location of payload
H4	Multiframe indicator

The bytes that cannot be edited are marked with a line of asterisks on the SECTION OVERHEAD or PATH OVERHEAD pages (see Figure 3–32 on page 3–100).

In addition, there are bytes you may not be able to edit depending on parameter settings in the CTS 750. As shown in Figure 3–32, a short text string replaces the binary values in the byte field of the SECTION OVERHEAD and PATH OVERHEAD pages when a byte cannot be edited. Table 3–9 shows the affected bytes, the text string, and a description of the parameter setting that prevents the byte from being edited.

Table 3–9: Bytes You Cannot Edit Due to Parameter Settings

Section and Path Overhead Byte(s)	Text String that Replaces the Binary Values	Parameter Setting Affecting Byte-Edit Capability
A1, A2	LOF SET	Loss of Frame Failure is being simulated
D1, D2, D3	EXT ADD	RS Data Communication Channel External Add is enabled
K1, K2	MS AIS SET	MS AIS is being simulated
	FERF SET	MS FERF is being simulated
D4, D5, D6, D7, D8, D9, D10, D11, D12	EXT ADD	MS Data Communication Channel External Add is enabled
S1	FEBE SET	MS FEBE is being simulated

Table 3-9: Bytes You Cannot Edit Due to Parameter Settings (Cont.)

Section and Path Overhead Byte(s)	Text String that Replaces the Binary Values	Parameter Setting Affecting Byte-Edit Capability
G1	FERF SET	Path FERF is being simulated
	FEBE SET	Path FEBE is being simulated
All path overhead bytes set to ones	PAIS SET	Path AIS is being simulated

Editing the J1 Path Trace Byte

The J1 Path Trace Byte carries a fixed-length, 64-byte string intended for sending user messages. The Path Trace Byte is a string consisting of ASCII characters (rather than the ones and zeros used to edit the other overhead bytes).

To edit the J1 Path Trace Byte:

1. Display the Path Trace Byte as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	PATH OVERHEAD	<i>J1 byte</i>	Reset Overhead
			Null Trace
			Default 64 byte
			Default 16 byte
			EDIT TRACE

The text string USER is shown in place of the actual byte value. There are five ways you can change the Path Trace message.

- Select **Reset Overhead** to set all bytes in the path overhead to their default values.

***NOTE.** Reset Overhead does not remove simulated error conditions that have been set using controls in the **ERRORS & ALARMS** page.*

- Select **Null Trace** to set all the J1 bytes in the string to the null character.
 - Select **Default Trace** to set the J1 byte string to the default string “Tektronix CTS 750 SDH Test Set, hello, bonjour, guten tag.”
 - Select **Default 64 Byte** to set the J1 byte string to the default string “Tektronix CTS 750 SDH Test Set, hello, bonjour, guten tag.”
 - Select **User Trace** to set the J1 byte string to a string you can enter using the EDIT TRACE function.
 - Select **Default 16 Byte** to set the J1 byte string to the string “Tek CTS 750” padded with spaces and ending with a carriage return/line feed.
 - Select **EDIT TRACE** to define your own text string.
2. Select **EDIT TRACE** to edit the path trace message (see Figure 3–34).

The string can contain a maximum of 64 characters, including spaces.
 3. Select **DONE** when you have completed the entering string.

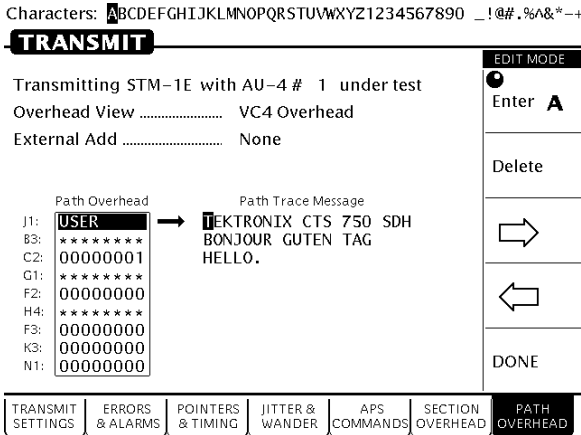


Figure 3-34: Editing the J1 Path Trace Byte

Adding DCC and User Channel Overhead Bytes

You can add data generated by an external protocol analyzer into the Data Communication Channel (DCC) and User Channel. The data from the protocol analyzer is added through the Overhead Add/Drop Port located on the rear panel. See *Appendix G* for detailed information on the port pin assignments.

To add external data into the DCC:

1. Connect an external protocol analyzer to the CTS 750 using the Overhead Add/Drop Port on the rear panel of the CTS 750.

2. To configure the CTS 750 to add the external data bytes:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	SECTION OVERHEAD	External Add	None
			D1-D3
			D4-D12
			F1

- Select **None** if you do not want to add external data.
- Select **D1-D3** to add data, generated by an external protocol analyzer, to the D1-D3 bytes of the DCC.
- Select **D4-D12** to add data, generated by an external protocol analyzer, to the D4-D12 bytes of the DCC.
- Select **F1** to add data, generated by an external protocol analyzer, to the F1 byte of the DCC.

As soon as you select which bytes to add data to, the CTS 750 displays the words EXT ADD as the value for the selected bytes (see Figure 3-35).

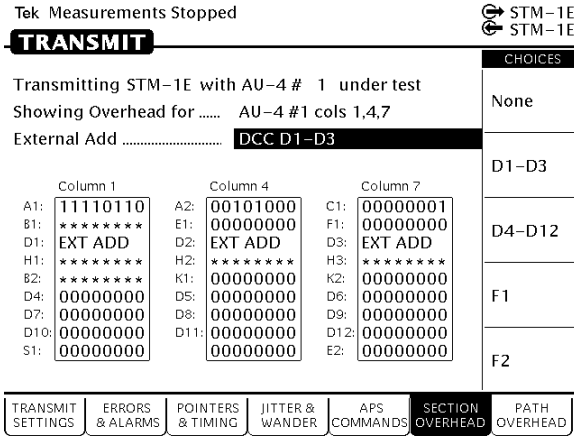


Figure 3-35: Adding Data into the DCC

To add external data into the User Channel:

1. Connect an external protocol analyzer to the CTS 750 using the Overhead Add/Drop Port on the rear panel of the CTS 750.
2. To configure the CTS 750 to add the external data byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	PATH OVERHEAD	External Add	None
			F2

NOTE. The F2 byte cannot be externally generated for VC3 Overhead. However, the F2 byte can be edited from the **PATH OVERHEAD** page.

- Select **None** if you do not want to add external data.
- Select **F2** to add data, generated by an external protocol analyzer, to the User Channel.

As soon as you select F2, the CTS 750 displays the words **EXT ADD** as the value for F2 (see Figure 3–36).

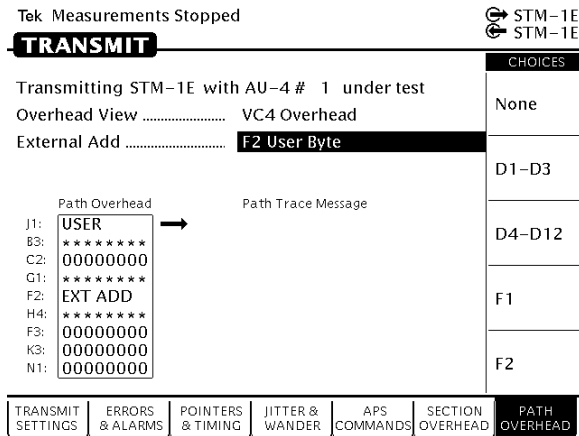


Figure 3–36: Adding Data into the User Channel

Setting Jitter or Wander Generation

To test the response of a network to jitter, you may need to generate SDH signals, PDH signals, or clock signals that contain jitter. You can use the CTS 750 to generate any of these signals with a controlled amount of jitter. This jitter is a sinusoidal modulation of the line rate or clock rate; you can specify the frequency and amplitude of the jitter.

Wander generation is identical to jitter generation except that it applies for modulation frequencies of 10 Hz or less.

NOTE. *The jitter compliance tests, available through the JITTER TESTS page of the TEST SETUPS menu, automatically set the jitter generation parameters needed for the test. When you use the jitter compliance tests, you do not need to set the controls described below.*

Periodic calibration of the jitter generation system is recommended to maintain best accuracy. You can execute a built-in calibration routine before making critical measurements. Refer to Jitter Calibration on page 3–241 for more information.

Turning on Jitter or Wander Generation

To turn on jitter or wander generation:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter/Wander Generation	Off
			On

- Select **Off** to disable jitter/wander generation.
- Select **On** to enable jitter/wander generation.

Selecting the Jitter Output

To select the signal that you want to apply generated jitter to:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Output	Line
			Clock 0.8 V
			2 MHz G.703

- Select **Line** to enable generated jitter on the transmitted line (SDH signal or PDH signal) that comes out of the front panel. This will also generate jitter on the rear-panel Jitter Clock Output, even though it may not be in use.
- Select **Clock 0.8 V** to enable generated jitter on the rear-panel jitter clock output (J/CLK OUT) only (AC-coupled ECL). The transmitted line remains jitter free.
- Select **2 MHz G.703** to enable generated jitter on the rear-panel jitter clock output (J/CLK OUT) that meets the interface requirements for synchronization signals as specified in G.703. The transmitted SDH or PDH line signal remains jitter free.

If you set the jitter source to Clock, the signal on the transmitted line remains jitter free. Also, you can independently set the Jitter Clock Output rate and frequency offset, regardless of the line rate and frequency offset of the transmitted signal. To set an independent rate for the Jitter Clock Output:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Output	Clock 0.8V
		Jitter Clock Rate	<i>as appropriate</i>

To set an independent frequency offset for the Jitter Clock Output:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Output	Clock 0.8V
		Jitter Clock Offset	<i>as appropriate</i>

Setting the Jitter Frequency and Amplitude

The generated jitter is a sinusoidal modulation of the nominal line or clock rate. Refer to *Modulation Range* specifications page D-4 for details about jitter/wander generation capability. To set the modulation frequency:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Frequency	<i>as appropriate</i>

- Select **USER DEFINED** to specify a jitter frequency different from the predefined choices.

NOTE. To generate jitter, set the Jitter Frequency to 10 Hz or greater. To generate wander, set the Jitter Frequency to less than 10 Hz.

To set the modulation amplitude (in unit intervals):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	JITTER & WANDER	Jitter Amplitude	<i>as appropriate</i>

- Select **USER DEFINED** to specify a jitter amplitude different from the predefined choices.

Setting PDH Transmit Parameters

This section describes how to set the transmit rate, transmit clock, line code, framing, and test pattern for a PDH signal.

Steps for Setting Parameters

The sequence of steps for setting transmit parameters varies depending on the type of signal to be transmitted. Figure 3–37 shows the sequence of steps required to set the transmit parameters for a PDH signal (for example, 2 Mb/s).



Figure 3–37: Sequence for Setting PDH Signal Parameters

Setting the Transmit Rate

To set the transmit rate:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate (see Figure 3–38)	2 Mb/s
			34 Mb/s
			140 Mb/s

- Select **2 Mb/s**, **34 Mb/s**, or **140 Mb/s** to transmit a PDH signal.

NOTE. The CTS 750 can transmit only one signal rate at a time. The CTS 750 can transmit either an SDH signal or a PDH signal, but not both at the same time.

Independent Transmit and Receive Settings

Generally, you can set the transmit and receive settings independently. For example, you can receive an electrical signal at the STM-1E rate while simultaneously transmitting an optical signal at the 140 Mb/s rate.

However, when working with PDH signals, the transmit and receive parameters are not completely independent. You cannot transmit a 2 Mb/s signal and receive a 34 Mb/s signal. When working with PDH signals, you must set the mapping for transmit and receive to the same value or to **Bulk Fill No Mapping**. For example, you can transmit a 34 Mb/s signal and receive an STM-4 signal, but you must set the mapping of the received signal to either **Bulk Fill No Mapping** or **34 Mb/s**; it cannot be set to 2 Mb/s.

Coupling Transmit and Receive Settings

If your application requires that the transmit settings and receive settings be identical, you can save time by coupling them together. After they are coupled, any change you make to a parameter on the TRANSMIT SETTINGS page will also be made to the corresponding setting in the RECEIVE SETTINGS page of the RECEIVE menu. The inverse is also true.

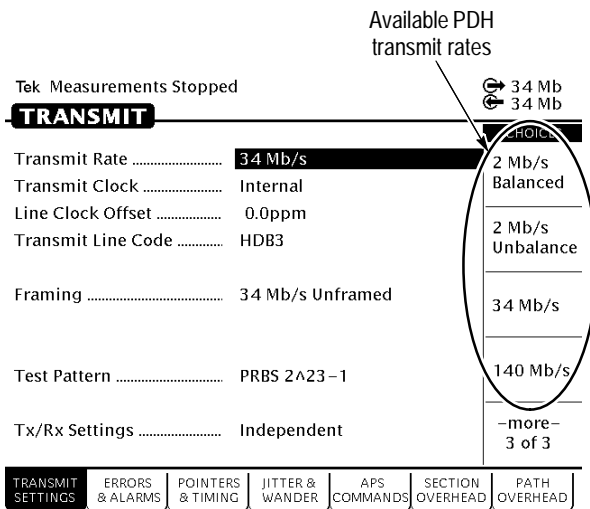


Figure 3-38: PDH Transmit Rates

To couple the transmit and receive settings together from the TRANSMIT SETTINGS page:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Coupled

NOTE. When settings are coupled from the *TRANSMIT SETTINGS* page, the receive parameters are changed to match the transmit parameters. Conversely, when settings are coupled from the *RECEIVE SETTINGS* page, the transmit parameters are changed to match the receive parameters.

Notice that the signal status icons, in the upper-right corner of the display, changed to reflect the coupling of the settings.

To change transmit and receive settings so that they are no longer coupled:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Independent

Notice that the signal status icons, in the upper-right corner of the display, changed to indicate that the settings are no longer coupled.

Setting the Transmit Clock

To specify the transmit clock:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Clock	Internal
			Recovered
			External 2 Mb/s
			External PDH

- Select **Internal** to set the transmit clock to the internal clock.

- Select **Recovered** to use the clock recovered from an incoming signal.
- Select **External 2 Mb/s** to use the clock signal from an external 2 Mb/s reference. Attach the external 2 Mb/s reference to the 2 Mb/s connector on the rear panel.
- Select **External PDH** to use an external PDH clock. Attach the clock to the external clock connector located on the rear panel.

Setting the Line Clock Offset

To specify the line clock offset:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Line Clock Offset	Max +100ppm
			Stress +1.0ppm
			Default 0ppm
			USER DEFINED

Viewing the Transmit Line Code

To view the transmit line code for the PDH signal:

The line code for the different PDH rates is fixed and cannot be changed. The line code for each PDH rate is listed in Table 3–10.

Table 3–10: PDH Rate Line Codes

Transmit Rate	Line Codes Available
2 Mb/s, 34 Mb/s	HDB3
140 Mb/s	CMI

- HDB3 (High Density Bipolar 3) is the only line code available for 2 Mb/s/34 Mb/s rates.
- CMI (Coded Mark Inversion) is the only line code available for the 140 Mb/s rate.

Specifying the Framing

The framing choices available depend on the selected transmit rate.

To set the framing for a 2 Mb/s signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Framing	2 Mb/s Unframed
			2 Mb/s PCM30 (CAS)
			2 Mb/s PCM31
			2 Mb/s PCM30CRC (CAS)
			2 Mb/s PCM31CRC

- Select **2 Mb/s Unframed** to transmit an unframed 2 Mb/s signal.
- Select **2 Mb/s PCM30 (CAS)** to transmit a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16.
- Select **2 Mb/s PCM31** to transmit a framed, 31 channel 2 Mb/s signal.
- Select **2 Mb/s PCM30CRC (CAS)** to transmit a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16 with CRC4 multiframe.
- Select **2 Mb/s PCM31CRC** to transmit a framed, 31 channel 2 Mb/s signal with CRC4 multiframe.

To set the framing for a 34 Mb/s signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Framing	34 Mb/s Unframed
			34 Mb/s Framed

To set the framing for a 140 Mb/s signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Framing	140 Mb/s Unframed
			140 Mb/s Framed

Specifying the Test Pattern

You can select a test pattern to transmit in the PDH signal.

To specify the test pattern to transmit:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Test Pattern	PRBS 2 ²³ -1
			PRBS 2 ²⁰ -1
			PRBS 2 ¹⁵ -1
			1 in 8
			All Ones

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
			All Zeros
			User Word 8 bit
			User Word 16 bit
			User Word 24 bit

- Select **1 in 8** to set the test pattern to 10000000.
- Select **User Word 8 bit**, **User Word 16 bit**, or **User Word 24 bit** to set a test pattern different from the preset choices. If you choose one of the User Word choices, the test pattern description changes to User Defined Byte.

If you select User Word 8 bit/16 bit/24 bit for the test pattern, set the value of the User Word as follows:

1. Set the contents of the User Word as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Test Pattern	Set to 00000000
			Set to 11111111
			Default 10101010
			EDIT BYTE/ Edit XX bits

2. Select **EDIT BYTE/Edit XX bits** to specify a value different from the preset choices (see Figure 3–39).
3. Select **Predefined Patterns** if you decide to use the standard patterns.
4. Select **DONE** when you are finished editing the byte.

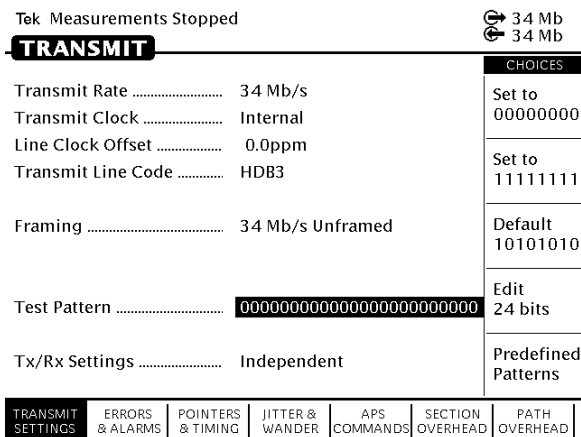


Figure 3–39: Editing the User Word

Setting Jitter or Wander Generation

To test the response of a network to jitter, you may need to generate PDH signals that contain jitter. You can use the CTS 750 to generate these signals with a controlled amount of jitter. Refer to *Setting Jitter and Wander Generation* on page 3–110 for information about this topic.

Setting SDH Receive Parameters

This section describes how to manually set the receive line rate, define the AU under test, set the payload mapping and content, check the received optical signal power, and view the overhead bytes.

The CTS 750 SDH Test Set contains independent transmit and receive modules. One set of parameters controls the transmit module and a separate set controls the receive module. You can set the receive parameters independent of the transmit parameters or you can choose to link them to the transmit settings.

Pressing AUTOSCAN sets the receive parameters automatically based on the received signal.

Steps for Setting Parameters

The sequence of steps for setting receive parameters varies with the type of signal to be received. Figure 3–40 shows the sequence of steps required to set the receive parameters for an SDH signal without demapping a PDH signal. Figure 3–41 shows the steps required to set the receive parameters for an SDH signal when demapping a PDH signal. See page 3–115 for details on setting PDH signal parameters (for example 2 Mb/s).



Figure 3–40: Sequence for Setting SDH Signal Parameters

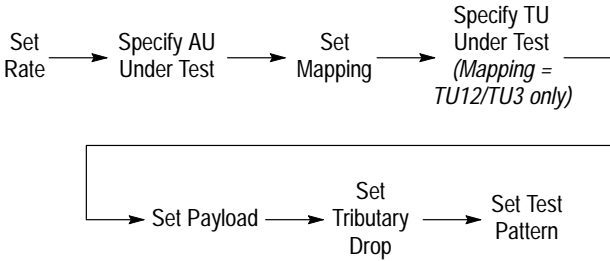


Figure 3-41: Sequence for Setting SDH Signal Parameters When Demapping a PDH Signal

Setting the Receive Rate

To set the receive rate:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS (see Figure 3-42)	Receive Rate	<i>as appropriate</i>

- Select **STM-1E**, **STM-1**, **STM-4**, **STM-0E**, or **STM-0** to receive an SDH signal.
- Select **2 Mb/s Balanced**, **2 Mb/s Unbalance**, **34 Mb/s**, or **140 Mb/s** to receive a PDH signal. See page 3-151 for details on setting PDH signal parameters.

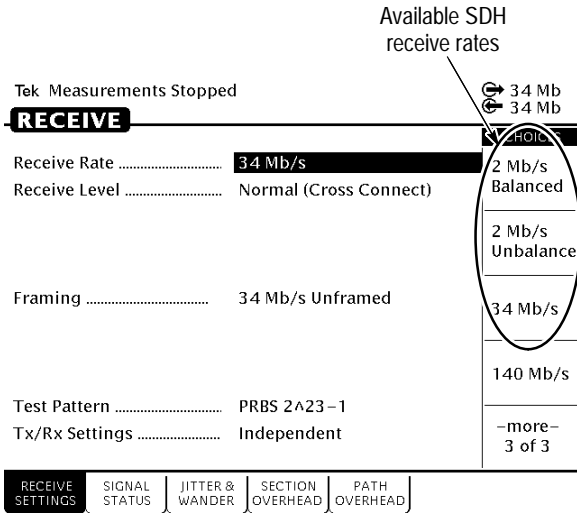


Figure 3-42: SDH Receive Rates

Independent Receive and Transmit Settings

Generally, you can set the receive and transmit settings independently. For example, you can receive an electrical signal at the STM-1E rate while simultaneously transmitting an optical signal at the STM-1 rate.

However, when working with PDH signals, the receive and transmit parameters are not completely independent. You cannot receive a 2 Mb/s signal and transmit a 34 Mb/s signal. When working with PDH signals, you must set the mapping for receive and transmit to the same value or to **Bulk Fill No Mapping**. For example, you can receive a 34 Mb/s signal and transmit an STM-4 signal, but you must set the mapping of the transmitted signal to either **Bulk Fill No Mapping** or **34 Mb/s**; it cannot be set to 2 Mb/s.

Coupling Receive and Transmit Settings

If your application requires that the receive settings and transmit settings be identical, you can save time by coupling them together. After they are coupled, any change you make to a parameter on the

RECEIVE SETTINGS page will also be made to the corresponding setting in the TRANSMIT SETTINGS page of the RECEIVE menu. The inverse is also true.

To couple the receive and transmit settings together from the RECEIVE SETTINGS page:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Tx/Rx Settings	Coupled

NOTE. When settings are coupled from the RECEIVE SETTINGS page, the transmit parameters are changed to match the receive parameters. Conversely, when settings are coupled from the TRANSMIT SETTINGS page, the receive parameters are changed to match the transmit parameters.

To change receive and transmit settings so that they are no longer coupled:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Tx/Rx Settings	Independent

Notice that the signal status icons, in the upper-right corner of the display, changed to indicate that the settings are no longer coupled.

NOTE. When the incoming line rate changes, a valid LOS must occur between the old and new line rates; otherwise, the CTS 750 might lose pattern lock and display an LOS or LOF status. If this occurs, reselect the correct Receive line rate after the change or initiate a valid LOS (for example, disconnect and reconnect the received signal or assert LOS at the source).

Setting the Receive Level

To specify the receive level for electrical signals:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Receive Level	0 dB
			-6 dB
			-12 dB
			Monitor

- Select **0 dB** to set the line level to 0 dB.
- Select **-6 dB** to set the line level to -6 dB.
- Select **-12 dB** to set the line level to -12 dB.
- Select **Monitor** to set the line level to the monitor level.

Reading the Signal Structure Line

You can see the structure of the received signal by looking at the Signal Structure line on the RECEIVE SETTINGS page. You cannot set the signal structure.

Specifying Which AU to Test

If you are using a line rate other than the SDH basic-level rates STM-1E or STM-1, you must select one AU to test.

To designate which AU to test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	AU Under Test	<i>as appropriate</i>

Setting the Mapping

You can specify whether the payload contains live data or not. If you know the mapping of the received signal, you can specify what the mapping is on the RECEIVE SETTINGS page.

NOTE. *The CTS 750 cannot demap a PDH signal and transmit a PDH signal at the same time.*

To specify the mapping of the received signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Mapping	Bulk Fill No Mapping (Equipped)
			Bulk Fill No Mapping (Unequipped)
			TU12 Async
			TU3 Async
			140 Mb/s

NOTE. Some mappings require options that might not be installed in your CTS 750. Depending on the mapping you choose, you might need to set additional parameters.

- Select **Bulk Fill No Mapping (Equipped)** to receive a payload that is filled with the test pattern specified (on the Test Pattern line) and where the C2 byte is set to 1.
- Select **Bulk Fill No Mapping (Unequipped)** to receive a payload that is filled with the test pattern specified (on the Test Pattern line) and where the C2 byte is set to 0.
- Select **TU12 Async** to demap a 2 Mb/s signal from the received signal. See *Demapping a PDH Signal* for details.
- Select **TU3 Async** to demap a 34 Mb/s signal from the received signal. See *Demapping a PDH Signal* for details.
- Select **140 Mb/s** to demap a 140 Mb/s signal from the received signal. See *Demapping a PDH Signal* for details.

Demapping a PDH Signal (Add/Drop/Test Option Only)

To demap and test a PDH signal, you set Mapping to the appropriate PDH mapping.

NOTE. The CTS 750 cannot demap a PDH signal and transmit a PDH signal at the same time.

When you use tributary signal mapping, you must also specify the tributary under test and payload (see Figure 3–43).

When you use TU-12 or TU-3 signal mapping, you must also specify the tributary unit under test and payload (see Figure 3–43).

Tek Measurements Stopped

STM-1E
STM-1E

RECEIVE

Receive Rate	STM-1E (Electrical)	
Receive Level	-6 dB	
Signal Structure	AU-4	
AU Under Test	1	
Mapping	TU12 Floating Async	
TU Under Test	TUG3 #1	TU12 #1
Payload	2 Mb/s Unframed	
Tributary Drop	Off	
Test Pattern	PRBS 2^23-1	
Tx/Rx Settings	Independent	

CHOICES
Bulk Fill No Mapping (Equipped)
Bulk Fill No Mapping (Unequipped)
TU12 Async
TU3 Async
140 Mb/s

RECEIVE SETTINGS | SIGNAL STATUS | JITTER & WANDER | SECTION OVERHEAD | PATH OVERHEAD

Figure 3-43: Setting PDH Mapping

To specify the TU Under Test and set the payload:

- Specify the TU Under Test as follows:

NOTE. The choices available for TU Under Test depend on the selected Mapping.

- If the Mapping is set to TU-12, specify the TU Under Test by first specifying the Tributary Unit Group (TUG) as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		TU Under Test (TUG3 #n)	TUG3 #1
			TUG3 #2
			TUG3 #3

7. If TU12 Async is the selected mapping, specify the Tributary Unit (TU) as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		TU Under Test (TU12 #n)	<i>as appropriate</i>

8. If TU3 Async is the selected mapping, specify the Tributary Unit (TU) as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
			TU3 #1
			TU3 #2
			TU3 #3

- Select **TU3 #1**, **TU3 #2**, or **TU3 #3** to specify the TU Under Test.

9. Specify the payload as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Payload	<i>as appropriate</i>

NOTE. The choices available for Payload depend on the selected Mapping.

- Select **2 Mb/s Unframed** to demap an unframed 2 Mb/s signal.

- Select **2 Mb/s PCM30 (CAS)** to demap a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16.
- Select **2 Mb/s PCM31** to demap a framed, 31 channel 2 Mb/s signal.
- Select **2 Mb/s PCM30CRC (CAS)** to demap a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16 with CRC4 multiframe.
- Select **2 Mb/s PCM31CRC** to demap a framed, 31 channel 2 Mb/s signal with CRC4 multiframe.
- Select **34 Mb/s Framed** to demap a framed 34 Mb/s signal.
- Select **34 Mb/s Unframed** to demap an unframed 34 Mb/s signal.
- Select **140 Mb/s Unframed** to demap an unframed 140 Mb/s signal.
- Select **140 Mb/s Framed** to demap an unframed 140 Mb/s signal.

Dropping a PDH Signal

To drop a signal it must be demapped, as described previously, and you must turn on Tributary Drop.

To turn on Tributary Drop:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Tributary Drop	Off
			On Balanced
			On Unbalance

NOTE. The choices available for Tributary Drop depend on the selected Mapping.

- Select **On** to drop the signal specified on the Payload line. The signal will be dropped to the appropriate OUT connector on the front panel.
- Select **On Unbalance** to drop a 2 Mb/s signal to the 2, 34, 140 Mb/s 75 Ω BNC connectors.
- Select **On Balanced** to drop a 2 Mb/s signal to the 2 Mb/s 120 Ω connectors.

Setting the Test Pattern

To specify the test pattern that will be received:

1. Specify the received test pattern using the following procedure:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Test Pattern	PRBS 2 ²³ -1
			PRBS 2 ²⁰ -1
			PRBS 2 ¹⁵ -1
			PRBS 2 ⁰⁹ -1
			All Ones
			All Zeros
			User Word
			Unknown

- Select **User Word** to receive a test pattern different from the preset choices. If you choose User Word, the test pattern description changes to User Defined Byte.
 - Select **Unknown** when you do not know what test pattern is being transmitted or when the test pattern is not stable.
2. Select the line containing the byte to set the value of the User Defined Byte.
 3. Select a preset choice or select **EDIT BYTE** to enter a byte string different from the preset choices.

When you are finished editing the byte, select **DONE**.

Unequipped Payload Mapping

If you choose Bulk Fill No Mapping (Unequipped) payload mapping, the CTS 750 receiver expects to find the unequipped code in byte C2. The received payload is ignored except for parity checks.

Checking Received Optical Power or Received Peak Voltage

To check the optical power or the peak voltage of the received SDH signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	SIGNAL STATUS	<i>none</i>	<i>none</i>

NOTE. The CTS 750 may take several seconds to respond when a signal is connected to the input.

If Receive Rate, on the RECEIVE SETTINGS page, is set to an optical rate, the SIGNAL STATUS page displays the received optical power. If Receive Rate is set to an electrical rate, the SIGNAL STATUS page displays the received peak voltage.

The optical power of the received signal is displayed in dBm (see Figure 3–44). The peak voltage of the received signal is displayed in volts. The SIGNAL STATUS page does not display results for PDH signals.

If the Jitter/Wander Test option is installed, three additional items are displayed and updated on the SIGNAL STATUS page:

- The actual received frequency in Hz
- The delta frequency from the expected frequency to the actual frequency in ppm
- The frequency source, line or clock

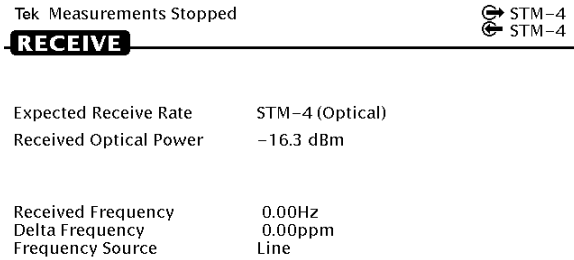


Figure 3-44: Displaying Received Optical Power

Viewing Overhead Bytes

This section describes how to use the SECTION OVERHEAD and PATH OVERHEAD pages to view overhead bytes. The display updates about once per second to track changes in the overhead. At any time, you can pause the updating process to analyze the bytes.

Viewing Section Overhead Bytes

To view section overhead bytes:

1. Display the section overhead as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	SECTION OVERHEAD	<i>none</i>	<i>none</i>

If you are receiving a line rate higher than the SDH basic-level rates STM-1E or STM-1, you must indicate which overhead, at the STM-1 level, you want to display.

2. Select the columns you wish to display as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Showing Overhead for	<i>as appropriate</i>

Viewing Path Overhead Bytes

To view path overhead bytes:

1. Display the path overhead as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	SECTION OVERHEAD	Overhead View	VC4 Overhead
			VC3 Overhead
			VC12 Overhead

NOTE. *The choices available depend on the mapping of the received signal.*

- Select **VC4 Overhead** to display the VC4 overhead bytes.
- Select **VC3 Overhead** to display the VC3 overhead bytes.
- Select **VC12 Overhead** to display the VC12 overhead bytes.

Displaying the J1 Path Trace Message

To view the Path Trace Message:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	PATH OVERHEAD (see Figure 3-45)	<i>none</i>	<i>none</i>

Displaying the J2 Path Trace Message

To view the J2 path trace message (TU12 Mapping Only):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	PATH OVERHEAD (see Figure 3-45)	Overhead View	VC12 Overhead

Displaying the V5 Byte

To view the V5 byte (TU12 Mapping Only):

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	PATH OVERHEAD (see Figure 3-45)	Overhead View	VC12 Overhead

NOTE. When the VC12 Overhead is displayed, the J2, N2, and K4 bytes will also be displayed.

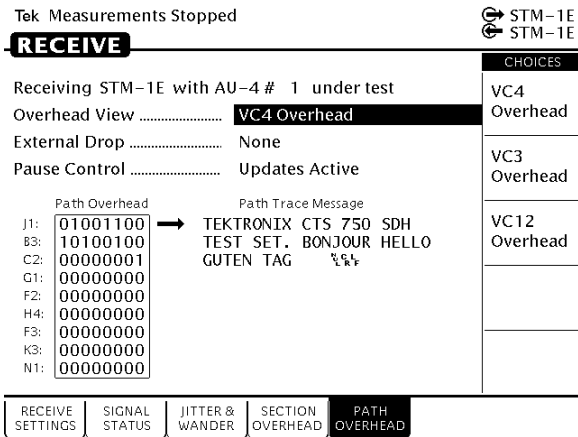


Figure 3-45: J1 Path Trace Message Received by the CTS 750

Dropping DCC and User Channel Overhead Bytes

You drop the contents of the Data Communications Channel (DCC) and User Channel to an external protocol analyzer. The data from the DCC and User Channel is dropped through the Overhead Add/Drop Port located on the rear panel. See *Appendix G* for detailed information on the port pin assignments.

To drop data from the DCC:

1. Connect an external protocol analyzer to the CTS 750 using the Overhead Add/Drop Port on the rear panel of the CTS 750.

2. Configure the CTS 750 to drop the DCC data bytes:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	SECTION OVERHEAD	External Drop (see Figure 3–46)	None
			D1–D3
			D4–D12
			F1

- Select **None** if you do not want to drop the DCC bytes.
- Select **D1–D3** to drop the D1–D3 bytes of the DCC.
- Select **D4–D12** to drop the D4–D12 bytes of the DCC.
- Select **F1** to drop the F1 byte of the DCC.

Tek Measurements Stopped

RECEIVE

Receiving STM-4 with AU-4 # 1 under test
Showing Overhead for AU-4 #1 cols 1,4,7
External Drop **DCC D1-D3**
Pause Control Updates Active

Column 1	Column 4	Column 7
A1: 11110110	A2: 00101000	C1: 00000001
B1: 00110110	E1: 00000000	F1: 00000000
D1: 00000000	D2: 00000000	D3: 00000000
H1: 01101010	H2: 00001010	H3: 00000000
B2: 01000111	K1: 00000000	K2: 00000000
D4: 00000000	D5: 00000000	D6: 00000000
D7: 00000000	D8: 00000000	D9: 00000000
D10: 00000000	D11: 00000000	D12: 00000000
S1: 00000000	00000000	E2: 00000000

CHOICES

None

D1–D3

D4–D12

F1

F2

RECEIVE SETTINGS | SIGNAL STATUS | JITTER & WANDER | **SECTION OVERHEAD** | PATH OVERHEAD

Figure 3–46: Dropping Data from the DCC

To drop data from the User Channel:

1. Connect an external protocol analyzer to the CTS 750 using the Overhead Add/Drop Port on the rear panel of the CTS 750.
2. Configure the CTS 750 to drop the User Channel data byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	PATH OVERHEAD	External Drop (see Figure 3-47)	None
			F2

- Select **None** if you do not want to drop the User Channel data.
- Select **F2** to drop the User Channel byte.

Tek Measurements Stopped

RECEIVE

Receiving STM-1E with AU-4 # 1 under test

Overhead View VC4 Overhead

External Drop **F2 User Byte**

Pause Control Updates Active

Path Overhead	Path Trace Message
J1: 00110101	TEKTRONIX CTS 750 SDH
B3: 11001010	TEST SET. BONJOUR HELLO
C2: 00000001	GUTEN TAG
G1: 00000000	
F2: 00000000	
H4: 00000000	
F3: 00000000	
K3: 00000000	
N1: 00000000	

CHOICES

- None
- D1-D3
- D4-D12
- F1
- F2**

RECEIVE SETTINGS SIGNAL STATUS JITTER & WANDER SECTION OVERHEAD **PATH OVERHEAD**

Figure 3-47: Dropping the User Channel Data Byte

Controlling the Display Update

To pause or continue overhead byte updating:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	PATH OVERHEAD	Pause Control	Pause
			Continue

Setting Jitter Receive Parameters

You can set the CTS 750 to measure jitter or wander in incoming SDH signals, PDH signals, or clock signals. First, set the jitter receive parameters below. Then, you can view jitter or wander measurement results in the MAIN RESULTS page of the RESULTS menu as described on page 3–202.

NOTE. *The jitter compliance tests, available through the JITTER TESTS page of the TEST SETUPS menu, automatically set the jitter receive parameters needed for the test. When you use the jitter compliance tests, you do not need to set the controls described below.*

Periodic calibration of the jitter measurement system is recommended to maintain best accuracy. You can execute a built-in calibration routine before making critical measurements. Refer to Jitter Calibration on page 3–241 for more information.

Selecting the Jitter Mode

To select the jitter measurement mode:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Jitter Mode	Peak-Peak
			RMS

- Select **Peak-Peak** to make peak-to-peak jitter measurements.
- Select **RMS** to make RMS jitter measurements. If you select RMS, the only available input filter is a 12 kHz high-pass filter.

Selecting the Input Source

To select the input source on which you want to measure jitter:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Jitter Input Source	Line
			Clock

- Select **Line** to measure jitter in the received line (front-panel SDH or PDH signal) selected in the RECEIVE SETTINGS page.
- Select **Clock** to measure jitter on the rear-panel external jitter clock input (J/CLK IN). If you select Clock, you must set the external jitter clock input rate; that rate does not have to be the same as the Receive Rate selected in the RECEIVE SETTINGS page.

Selecting the Jitter Range

The jitter range determines the maximum measureable jitter and the resolution of the measurement. To select the range:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Jitter Range	Normal
			Extended

- Select **Normal** to measure jitter up to $6 U_{I_{p-p}}$ with a resolution of 0.002 UI.
- Select **Extended** to extend the jitter measurement range up to $200 U_{I_{p-p}}$ (frequency dependent) with a resolution of 0.01 UI.

Selecting the Jitter Input Filter

You can choose from three types of jitter input filters defined by ITU-T standards: wideband, highband, and fullband. The passbands for the filters, shown in Figure 3–48, are dependent on the signal or clock rate settings; the –3 dB frequencies are described in the *Specifications* on pages D–11.

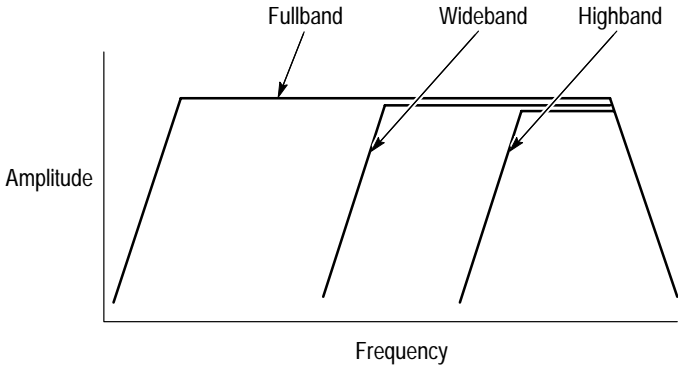


Figure 3-48: Jitter Filter Passbands

To select the jitter input filter:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Jitter Input Filter	Wideband
			Highband
			Fullband

- Select **Wideband** to measure jitter using the wideband measurement filter.
- Select **Highband** to measure jitter using the highband measurement filter.
- Select **Fullband** to measure jitter over the wideband range plus very low frequency jitter that may affect video timing quality.

NOTE. Separate Highband High Q and Highband Low Q settings are available for the 2 Mb/s rate.

If you select the Fullband jitter input filter, perform the following steps to set the filter high-pass frequency:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Fullband High-pass	0.1 Hz
			1 Hz
			10 Hz

Setting the Jitter Hit Threshold

The jitter hit threshold determines the sensitivity of the Jitter Hit Seconds measurement, which is based on peak-to-peak jitter. To set the jitter hit threshold:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Jitter Hit Threshold	<i>as appropriate</i>

- Select **USER DEFINED** to specify a jitter hit threshold different from the predefined choices.

Setting the Pointer Hit Threshold

The pointer event threshold determines the sensitivity of the Jitter Pointer Hits measurement, which is based on frequency drift. To set the pointer event threshold:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	JITTER & WANDER	Pointer Hit Threshold	<i>as appropriate</i>

- Select **USER DEFINED** to specify a pointer hit threshold different from the predefined choices.

Setting PDH Receive Parameters

This section describes how to manually set the receive rate, receive level, framing, and test pattern for PDH signals.

Pressing AUTOSCAN sets the receive parameters automatically based on the received signal.

Steps for Setting Parameters

The sequence of steps for setting receive parameters varies with signal to be received. Figure 3–49 shows the sequence of steps required to set the receive parameters for PDH signals (for example, 2 Mb/s).

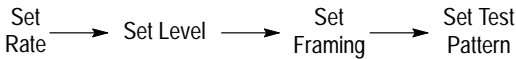


Figure 3–49: Sequence for Setting PDH Signal Parameters

Setting the Receive Rate

To set the receive rate:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS (see Figure 3–50)	Receive Rate	<i>as appropriate</i>

- Select **2 Mb/s Balanced**, **2 Mb/s Unbalance**, **34 Mb/s**, or **140 Mb/s** to receive a PDH signal.

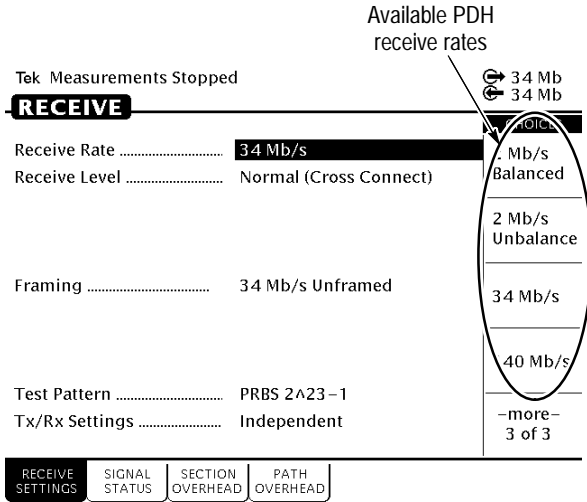


Figure 3-50: PDH Signal Receive Rates

Independent Receive and Transmit Settings

Generally, you can set the receive and transmit settings independently. For example, you can receive an electrical signal at the 34 Mb/s rate while simultaneously transmitting an optical signal at the STM-1 rate.

However, when working with PDH signals, the transmit and receive parameters are not completely independent. You cannot transmit a 2 Mb/s signal and receive a 34 Mb/s signal. When working with PDH signals, you must set the mapping for transmit and receive to the same value or to **No Mapping**. For example, you can transmit a 34 Mb/s signal and receive an STM-4 signal, but you must set the mapping of the received signal to either **No Mapping** or **34 Mb/s**; it cannot be set to 2 Mb/s.

Coupling Receive and Transmit Settings

If your application requires that the receive settings and transmit settings be identical, you can save time by coupling them together. After they are coupled, any change you make to a parameter on the

RECEIVE SETTINGS page will also be made to the corresponding setting in the TRANSMIT SETTINGS page of the RECEIVE menu. The inverse is also true.

To couple the receive and transmit settings together from the RECEIVE SETTINGS page:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Tx/Rx Settings	Coupled

NOTE. When settings are coupled from the *RECEIVE SETTINGS* page, the transmit parameters are changed to match the receive parameters. Conversely, when settings are coupled from the *TRANSMIT SETTINGS* page, the receive parameters are changed to match the transmit parameters.

To change receive and transmit settings so that they are no longer coupled:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Tx/Rx Settings	Independent

Notice that the signal status icons, in the upper-right corner of the display, changed to indicate that the settings are no longer coupled.

Setting the Receive Level

To specify the receive level for electrical signals:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Receive Level	Normal
			Monitor
			Bridge

- Select **Normal** to set the line level to normal.
- Select **Monitor** to set the line level to the monitor level.
- Select **Bridge** to set the line level to the bridged level.

Setting the Framing

When receiving a PDH signal you can specify the framing of the signal.

To specify the framing of a received PDH signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Framing	<i>as appropriate</i>

NOTE. The choices available for Framing depend on the selected Receive Rate.

- Select **2 Mb/s Unframed** to receive an unframed 2 Mb/s signal.

- Select **2 Mb/s PCM30 (CAS)** to receive a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16.
- Select **2 Mb/s PCM31** to receive a framed, 31 channel 2 Mb/s signal.
- Select **2 Mb/s PCM30CRC (CAS)** to receive a framed, 30 channel 2 Mb/s signal with Channel Associated Signalling in Timeslot 16 with CRC4 multiframe.
- Select **2 Mb/s PCM31CRC** to receive a framed, 31 channel 2 Mb/s signal with CRC4 multiframe.
- Select **34 Mb/s Unframed** to receive an unframed 34 Mb/s signal.
- Select **34 Mb/s Framed** to receive a framed 34 Mb/s signal.
- Select **140 Mb/s Unframed** to receive an unframed 140 Mb/s signal.
- Select **140 Mb/s Framed** to receive a framed 140 Mb/s signal.

Specifying the Test Pattern

To specify the test pattern of the received signal:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RECEIVE	RECEIVE SETTINGS	Test Pattern	<i>as appropriate</i>

NOTE. The choices available for Test Pattern depend on the selected Receive Rate.

- Select **1 in 8** to set the test pattern to 1000 0000.
- Select **User Word 8 bit**, **User Word 16 bit**, or **User Word 24 bit** to set a test pattern different from the preset choices. If

you choose User Word, the test pattern description changes to User Defined Byte.

- Select **Unknown** when you do not know what test pattern is being transmitted or when the test pattern is not stable.

If you select User Word for the test pattern, set the value of the User Word as follows:

1. Select the line containing the byte to set the value of the User Defined Byte.
2. Define the contents of the User Defined Byte as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		<i>select displayed byte</i>	Set to 00000000
			Set to 11111111
			Default 10101010
			EDIT BYTE

- Select **Set to 00000000** to set the test pattern to all zeros.
 - Select **Set to 11111111** to set the test pattern to all ones.
 - Select **Default 10101010** to set the test pattern to alternating ones and zeros
3. Select **EDIT BYTE** to specify a value different from the preset choices.
 4. Select **DONE** when you are finished editing the byte.

Setting Jitter Receive Parameters

You can set the CTS 750 to measure jitter or wander in PDH signals. Refer to *Setting Jitter Receive Parameters* on page 3–144 for information about this topic.



Setting Alarms and Inserting Errors

This section describes how to simulate error conditions, set alarms, and simulate network failures. To test the response of a network, you might need to simulate parity errors, send alarm signals, and simulate network failures. This type of testing is simple and convenient using the CTS 750 SDH Test Set.

Simulating Error Conditions

The specific errors the CTS 750 simulates depend on the transmit rate and payload mapping.

Specifying the Error to Insert

Specify the type of error transmitted as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Error type set to	RS B1 BIP
			MS B2 BIP
			Path B3 BIP
			Path FEBE
			Frame Bit
			TU BIP (Add/Drop/Test Option Only)
			TU FEBE (Add/Drop/Test Option Only)
			Pattern Bit (Add/Drop/Test Option Only)
			CRC (2 Mb/s) (Add/Drop/Test Option Only)

NOTE. The errors available to insert depend on the Mapping and Payload settings. Not all errors are available all the time.

Inserting Errors

You can choose to insert errors manually (one at a time) or you can have errors inserted automatically at a rate you specify.

To insert a single error, press the **INSERT ERROR** button.

To have the CTS 750 insert errors automatically:

1. Turn on automatic error insertion as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Error rate set to	None
			1e-3
			1e-4
			1e-5
			1e-6
			1e-7
			1e-8
			USER DEFINED

- Select **None** to turn off automatic error insertion. However, you can still insert errors manually using the front-panel INSERT ERROR button.
- The maximum allowable error rate depends on the transmit rate, signal structure, and error type (see Tables 3-11 and 3-12).

Table 3-11: Maximum Error Rates for SDH Signals

Error Type	Rate	
	STM-1	STM-4
RS B1 BIP	1E-4	1E-5
MS B2 BIP	1E-4	1E-4
Path B3 BIP	1E-4	1E-4
Path FEBE	1E-4	1E-4
Pattern Bit	1E-3	1E-3

Table 3–12: Maximum Error Rates for TU Mappings and PDH Signals

Error Type	2 Mb/s		34 Mb/s		140 Mb/s	
	Minimum Rate	Maximum Rate	Minimum Rate	Maximum Rate	Minimum Rate	Maximum Rate
TU BIP	1E-10	1E-4	1E-10	1E-4	N/A	N/A
TU FEBE	1E-10	1E-4	1E-10	1E-4	N/A	N/A
CRC	1E-5	1E-2	N/A	N/A	N/A	N/A
Frame	1E-7	1E-2	1E-7	1E-2	1E-8	1E-2
Pattern Bit	1E-8	1E-2	1E-9	1E-2	1E-9	1E-2

2. Select **USER DEFINED** to specify an error rate different from the preset choices. The CTS 750 enters edit mode (Figure 3–51).
 - If the knob is assigned to Coarse, it changes the exponent.
 - If the knob is assigned to Fine, it changes the decimal number.
3. Select **DONE** to enter the error rate you have specified.

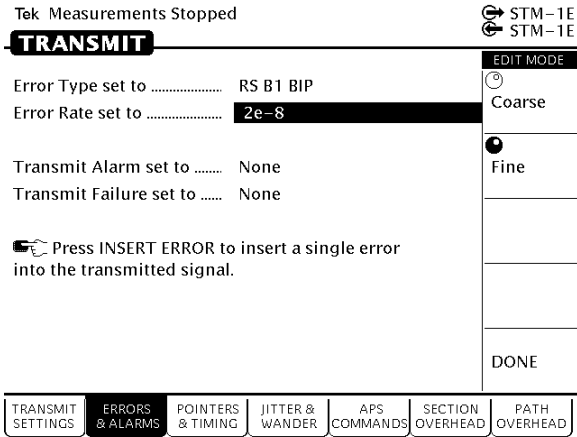


Figure 3-51: Setting An Error Rate

Setting Alarms

The CTS 750 can simulate alarm conditions to test the response of the network.

To transmit an alarm:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Transmit alarm set to	None
			MS AIS
			MS FERF
			Path AIS
			Path FERF
			TU AIS (Add/Drop/Test Option Only)
			TU FERF (Add/Drop/Test Option Only)
			PDH RAI (Add/Drop/Test Option Only)
			PDH AIS (Add/Drop/Test Option Only)

- Select **None** to stop transmitting an alarm.
- Select **MS AIS** to transmit an MS AIS alarm.
- Select **MS FERF** to transmit an MS FERF alarm.
- Select **Path AIS** to transmit a Path AIS alarm.
- Select **Path FERF** to transmit a Path FERF alarm.
- Select **TU AIS** to transmit a TU PATH AIS alarm.

- Select **TU FERF** to transmit a TU FERF alarm.
- Select **PDH RAI** to transmit a PDH RAI alarm.
- Select **PDH AIS** to transmit a PDH AIS alarm.

***NOTE.** The TU PATH AIS and TU PATH FERF choices will be displayed only if Mapping, on the TRANSMIT SETTINGS page, is set to TU-12 Async.*

All transmit alarm choices remain in effect until they are deliberately turned off.

Simulating Transmit Failures

The CTS 750 can simulate transmit failure conditions to test the response of the network.

To simulate a transmit failure:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	ERRORS & ALARMS	Failure set to	None
			LOS
			LOF
			AU LOP (Add/Drop/Test Option Only)
			TU LOP (Add/Drop/Test Option Only)
			TU LOM (Add/Drop/Test Option Only)

NOTE. *TU LOP and TU LOM can be selected only if Mapping, on the TRANSMIT SETTINGS page, is set to TU-12 Async.*

- Select **None** to stop simulating failures.
- Select **LOS** to simulate a loss of signal failure.
- Select **LOF** to simulate a loss of frame failure.
- Select **AU LOP** to simulate a loss of pointer failure in the administrative unit.

- Select **TU LOP** to simulate a loss of pointer failure in the tributary unit.
- Select **TU LOM** to simulate a loss of multiframe failure in the TU12 mapping.

All transmit failures remain in effect until they are deliberately turned off.

Setting Pointers and Changing Timing

This section describes how to generate pointer movements within the transmitted signal. When stress testing a network, you may want to move pointers or introduce a frequency offset. The CTS 750 SDH Test Set allows you to control this type of testing five ways. You can:

- Make discrete pointer movements under manual control
- Make repetitive pointer movements at a rate you determine
- Introduce a frequency offset in the internally generated AU
- Introduce a frequency offset in the transmit rate
- Generate sequences of pointer movements

Setting Pointers

To set up the CTS 750 to make discrete or repetitive pointer movements:

1. Specify the pointer mode as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING	Pointer / Timing Mode	Pointer Movement

The choices allow you to choose to move pointers using time parameters or with a frequency offset. Selecting Pointer Movements moves pointers utilizing time parameters.

2. Specify the pointer type as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING	Pointer Type	AU Pointer
			TU Pointer

Manual Pointer Control

You can move pointers under manual control using the POINTER ACTION button on the front panel. To set up for this type of control, use the knob to highlight the **Pointer Control** line.

There are three types of manual pointer movements: Single, Burst, and Continuous (see Figure 3–52). The choices are described in detail below; some require additional setup.

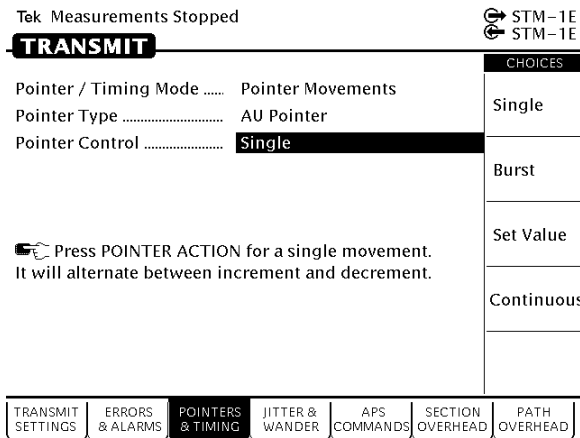


Figure 3–52: Manual Pointer Control Choices

Single Pointer Movements. With Single selected, each press of the front-panel POINTER ACTION button moves the pointer up or down by one location. The first press increments the pointer, the second press decrements it, the third press increments it, and so forth.

Burst Pointer Movements. With Burst selected, pressing the front-panel POINTER ACTION button starts a burst of pointer movement. Each burst consists of a series of one-location pointer movements that are spaced four frames apart. Pressing POINTER ACTION repeatedly alternates between an incrementing burst and a decrementing burst (see Figure 3–53).

To set the number of pointer movements in the burst:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Control	Burst
		Burst Size	2
			3
			4
			5
			6
			7
			8

To start a burst of pointer movements, press **POINTER ACTION**.

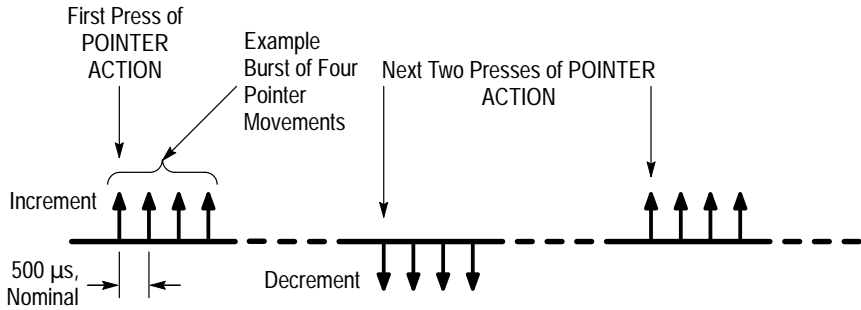


Figure 3-53: Alternating Burst Pointer Movement

Setting Pointer to a Specific Value. With Set to Value selected, you can move the pointer immediately to a new location, with or without a new data flag being set. Payload data can be lost when you use jump pointer movements of this type.

To set the new pointer value for an AU pointer:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Control	Set Value
		Pointer Value Set to	Min 0
			Max 782
			Default 522
			Illegal (Max + 1)
			USER DEFINED

- Select **Min 0** to set the pointer to location zero (points to the byte immediately following the H3 transport overhead byte). If you choose this setting, the pointer is moved immediately; you do not need to press POINTER ACTION.

- Select **Max 782** to set the pointer to location 782 (points to the byte immediately preceding the H1 transport overhead byte of the next frame). If you choose this setting, the pointer is moved immediately; you do not need to press **POINTER ACTION**.
- Select **Default 522** to set the pointer to location 522 (points to the first payload byte in the next frame). If you choose this setting, the pointer is moved immediately; you do not need to press **POINTER ACTION**.
- Select **Illegal (Max+1)** to move the pointer to illegal location 783 (the maximum allowed location + 1). Choosing the illegal pointer location may cause a loss-of-pointer failure. If you choose this setting, the pointer is moved immediately; you do not need to press **POINTER ACTION**.
- Select **USER DEFINED** to set the pointer to a value different from the preset choices.

Selecting **USER DEFINED** places the CTS 750 into Edit Mode.

- Select **DONE** when you are finished setting the pointer value.
As soon as you press **DONE**, the pointer is moved; you do not need to press **POINTER ACTION**.

To set the new pointer value for a TU pointer:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Control	Set Value
		Pointer Value Set to	Min 0
			Max 139
			Default 0
			Illegal (Max + 1)
			USER DEFINED

- Select **Min 0** to set the pointer to location zero. If you choose this setting, the pointer is moved immediately; you do not need to press POINTER ACTION.
 - Select **Max 139** to set the pointer to location 139. If you choose this setting, the pointer is moved immediately; you do not need to press POINTER ACTION.
 - Select **Default 0** to set the pointer to location 0. If you choose this setting, the pointer is moved immediately; you do not need to press POINTER ACTION.
 - Select **Illegal (Max+1)** to move the pointer to illegal location 140 (the maximum allowed location + 1). Choosing the illegal pointer location may cause a loss-of-pointer failure. If you choose this setting, the pointer is moved immediately; you do not need to press POINTER ACTION.
3. Specify whether a New Data Flag is set with the pointer movement as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Set with New Data Flag	Yes
			No

4. Set the Pointer S-Bits as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer S-Bits	00
			01
			10
			11

Continuous Pointer Movement

To make repetitive pointer movements:

1. Specify the type of pointer control and movement rate as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Control	Continuous
		Pointer Rate	Max 2ms
			Min 10000ms
			Default 50ms
			USER DEFINED

- Select **Max 2ms** to move the pointer one location every sixteen frames.
 - Select **Min 10000ms** to move the pointer location one location every 10 seconds.
 - Select **Default 50ms** to move the pointer one location every 50 ms.
 - Select **USER DEFINED** to set continuous pointer movement at a rate different from the preset choices.
2. Select **USER DEFINED** to set the pointer movement to a value different from the preset choices.

Selecting **USER DEFINED** places the CTS 750 into Edit Mode. Now you can set the rate to the exact value you want, with 1 ms resolution. The minimum rate is 1 ms. The maximum rate is 10000 ms.

3. Specify the pointer movement direction as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Direction	Increment
			Decrement
			Alternate

- Selecting **Increment** causes the pointer to increment at the set rate.
- Selecting **Decrement** causes the pointer to decrement at the set rate.
- Selecting **Alternate** causes pointer movements at the set rate, but they alternate in incrementing and decrementing directions.

When using continuous pointer movement, a message line in the display tells you the equivalent payload frequency offset in parts per million if the pointer direction is set to either increment or decrement (see Figure 3–54).

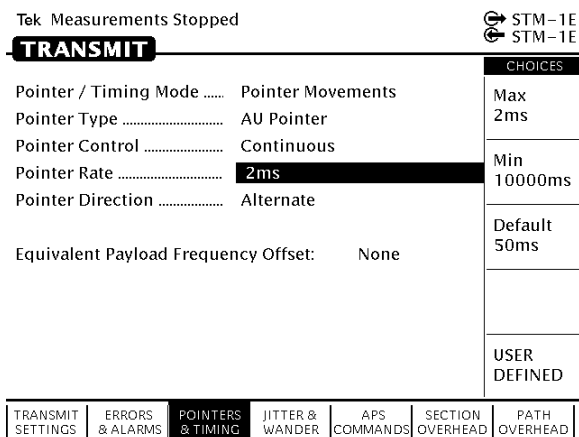


Figure 3-54: Incrementing Pointer Location Once Every Two Milliseconds

Changing Timing

As an alternative to setting pointer movements directly, you can introduce a frequency offset in the internally-generated AU, the transmit line rate, or both together.

To generate pointer movements using frequency offset:

1. Specify the pointer/timing mode as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING	Pointer / Timing Mode	Frequency Offset

2. Specify the Offset Mode as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Offset Mode	Line
			Payload

- Select **Line** to change the transmit line rate. With this setting, the AU location (pointer) does not move relative to the transmitted frame.
- Select **Payload** to change the offset of the payload.

3. Specify the frequency offset as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Frequency Offset	Max +100ppm
			Stress +4.6ppm
			Stress -4.6ppm
			Default 0ppm
			USER DEFINED

- Select **Max +100ppm** to set the frequency offset to the maximum available amount.
- Select **Stress +4.6ppm** to set the frequency offset at the upper stratum three limit.
- Select **Stress -4.6ppm** to set the frequency offset at the lower stratum three limit.
- Select **Default 0ppm** to turn off frequency offset.
- Select **USER DEFINED** to set a frequency offset different from the preset choices.

Selecting **USER DEFINED** places the CTS 750 in Edit Mode. The knob is assigned to change the value of the frequency offset.

- Coarse changes the frequency offset by 10.0 ppm.
- Fine changes the frequency offset by 0.1 ppm.

The frequency offset can be changed by ± 100.0 ppm.

- Select **DONE** to enter the frequency offset when you are finished setting it.

When using a frequency offset, a message line in the display tells you the equivalent pointer movement rate. Figure 3–55 shows an example frequency offset and the resulting message.

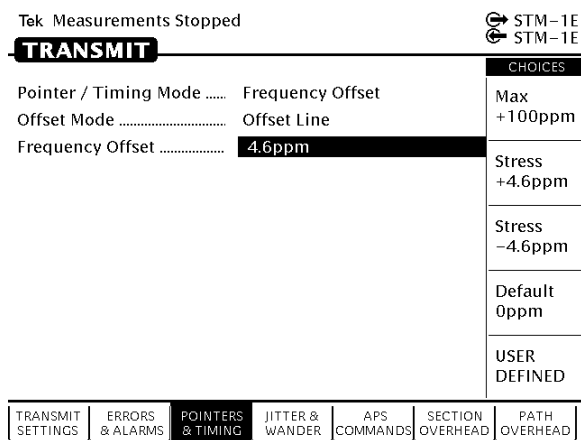


Figure 3–55: Offsetting the Transmit Rate by +4.6 ppm

Generating Pointer Sequences

In addition to the simpler pointer movements previously described, the CTS 750 can generate pointer sequences (sequences of pointer movements). Pointer sequences are made up of three periods: the Initialization Period, the Cool Down Period, and the Sequence Period (see Figure 3–56).

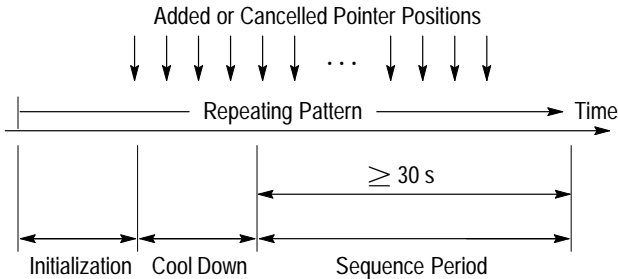


Figure 3–56: The Three Periods of a Pointer Sequence

- Initialization Period – a thirty second period where the CTS 750 produces a 30 second burst of 1 pointer movement per second in the same direction as the specified pointer sequence. The Initialization Period can be turned on or off.
- Cool Down Period – a period at least 60 seconds long, following the Initialization Period, where the specified pointer sequence is running.
- Sequence Period – the period following the Cool Down period where the specified pointer sequence runs continuously.

The CTS 750 generates the pointer sequences described in the revised ITU-T G.783 standard. The CTS 750 also supports the pointer sequences described in the ANSI T1.105.03–1994 standard. An example of a pointer sequence is shown in Figure 3–57. The details of these sequences are shown in Table 3–13. Note that not all pointer sequences are available all the time. Some sequences are available only with one pointer type or with a specific mapping, as shown in Table 3–14 on page 3–183.

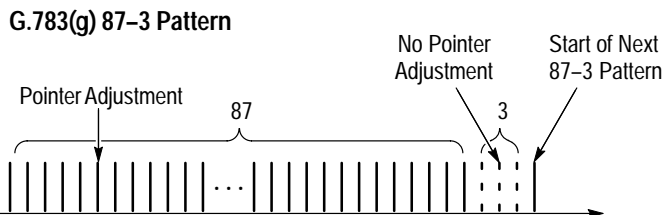


Figure 3-57: An Example of a Pointer Sequence

Table 3-13: Pointer Sequences Generated

Pointer Sequence	Description
G.783(a) Single Alternating	Alternating single pointer movement. The time between pointer movements is 30 s.
G.783(b) Regular + Double	<p>Time between added pointer movement and previous normal pointer movement for AU-4 and TU-3 pointers is 0.5 ms and for TU-12 pointers is 2 ms. Time between normal pointer movements is as follows:</p> <ul style="list-style-type: none"> • AU-4 and TU-3 pointers have a range of 0.34 s to 10 s with a resolution of 1 ms. • TU-12 pointer movements has a range of 0.760 s to 10 s with a resolution of 1 ms. <p>Time between added pointers is equal to: (the time between pointer movements \times N) where N is selected to be the smallest integer that makes the product \geq 30 s.</p>
G.783(c) Regular + Missing	<p>Time between AU pointers has a range of 0.034 s to 10 s with a resolution of 1 ms.</p> <p>Time between cancelled pointers is equal to: (time between pointer movements \times N), where N is selected to be the smallest integer that makes the product \geq 30 s.</p>
G.783(d) Double Alternating	Alternating double pointer movement. The time between the double pointer movements is 2 ms, and the time between each pair of pointer movements is 30 s.
G.783(e) Single	Time between pointer adjustments is 30 s.

Table 3-13: Pointer Sequences Generated (Cont.)

Pointer Sequence	Description
G.783(f) Burst	<p>Time between bursts of 3 pointers for AU pointers is 0.5 ms and for TU pointers is 2 ms.</p> <p>Time between pointer bursts is 30 s.</p>
G.783(g) Periodic 87-3	<p>Sequence pattern is 87 pointer movements followed by 3 missing pointer movements.</p> <p>Time between AU pointer movements has a range of 0.34 s to 10 s with a resolution of 1 ms.</p>
G.783(g) Periodic 87-3 With Cancel	<p>Sequence pattern is 87 pointer movements followed by 3 missing pointer movements with a cancelled pointer movement at the 87th pointer.</p> <p>Time between AU pointer movements has a range of 0.34 s to 10 s with a resolution of 1 ms.</p> <p>Time between cancelled pointers is equal to: $(\text{time between pointers} \times 90 \times N)$ where N is selected to be the smallest integer that makes this product ≥ 30 s.</p>
G.783(g) Periodic 87-3 With Add	<p>Sequence pattern is 87 pointer movements followed by 3 missing pointer movements with an added pointer movement after the 43rd pointer.</p> <p>Time between AU pointer movements has a range of 0.34 s to 10 s with a resolution of 1 ms; time between added pointer movement and previous normal pointer movement for AU pointers is 0.5 ms.</p> <p>Time between added pointers is equal to: $(\text{time between pointers} \times 90 \times N)$ where N is selected to be the smallest integer that makes this product ≥ 30 s.</p>
G.783(h) Periodic	<p>Time between AU pointers has a range of 0.034 s to 10 s with a resolution of 1 ms.</p>
G.783(h) Periodic with Cancel	<p>Time between AU pointers has a range of 0.034 s to 10 s with a resolution of 1 ms.</p> <p>Time between cancelled pointers is equal to: $(\text{time between pointer movements} \times N)$, where N is selected to be the smallest integer that makes the product ≥ 30 s.</p>

Table 3–13: Pointer Sequences Generated (Cont.)

Pointer Sequence	Description
G.783(h) Periodic with Add	<p>Time between added pointer movement and previous normal pointer movement for AU-4 and TU-3 pointers is 0.5 ms and for TU-12 pointers is 2 ms. Time between normal pointer movements is as follows:</p> <ul style="list-style-type: none"> • AU-4 and TU-3 pointers have a range of 0.34 s to 10 s with a resolution of 1 ms. • TU-12 pointer movements has a range of 0.760 s to 10 s with a resolution of 1 ms. <p>Time between added pointers is equal to: (the time between pointer movements \times N) where N is selected to be the smallest integer that makes the product \geq 30 s.</p>
Phase Transient Pointer Adjustment Burst	<p>Time between pointer movement burst of seven pointers is 0.25 s, 0.25 s, 0.5 s, 0.5 s, 0.5 s, 0.5 s.</p> <p>Time between pointer bursts is 30 s.</p>
TU-3 Periodic 85–5	<p>Sequence pattern is 85 pointer movements followed by 5 missing pointer movements.</p> <p>Time between pointer movements has a range of 0.34 s to 10 s with a resolution of 1 ms.</p>
TU-3 Periodic 85–5 With Cancel	<p>Sequence pattern is 85 pointer movements followed by 5 missing pointer movements with a cancelled pointer movement at the 85th pointer, yielding a gap of 6.</p> <p>Time between pointer movements has a range of 0.34 s to 10 s with a resolution of 1 ms.</p> <p>Time between cancelled pointers is equal to: (time between pointers \times 90 \times N) where N is selected to be the smallest integer that makes this product \geq 30 s.</p>

Table 3–13: Pointer Sequences Generated (Cont.)

Pointer Sequence	Description
TU-3 Periodic 85–5 With Add	<p>Sequence pattern is 85 pointer movements followed by 5 missing pointer movements with an added pointer movement after the 43rd pointer.</p> <p>Time between AU pointer movements has a range of 0.34 s to 10 s with a resolution of 1 ms; time between added pointer movement and previous normal pointer movement for AU pointers is 0.5 ms</p> <p>Time between added pointers is equal to: $(\text{time between pointers} \times 90 \times N)$ where N is selected to be the smallest integer that makes this product ≥ 30 s.</p>
TU-12 Periodic 35–1	<p>Sequence pattern is 35 pointer movements followed by 1 missing pointer movement.</p> <p>Time between pointer movements has a range of 0.760 s to 10 s with a resolution of 1 ms.</p>
TU-12 Periodic 35–1 With Cancel	<p>Sequence pattern is 35 pointer movements followed by 1 missing pointer movement with a cancelled pointer movement at the 35th pointer, yielding a gap of 2.</p> <p>Time between pointer movements has a range of 0.760 s to 10 s with a resolution of 1 ms.</p> <p>Time between cancelled pointers is equal to: $(\text{time between pointers} \times 36 \times N)$ where N is selected to be the smallest integer that makes this product ≥ 30 s.</p>
TU-12 Periodic 35–1 With Add	<p>Sequence pattern is 35 pointer movements followed by 1 missing pointer movement with an added pointer movement after the 17th pointer.</p> <p>Time between normal pointer movements has a range of 0.760 s to 10 s with a resolution of 1 ms; time between added pointer movement and previous normal pointer movement is 2 ms.</p> <p>Time between added pointers is equal to: $(\text{time between pointers} \times 36 \times N)$ where N is selected to be the smallest integer that makes this product ≥ 30 s.</p>

Table 3-14: Availability of Pointer Sequences

Pointer Sequence	Mapping		
	AU	TU-3	TU-12
G.783(a) Single Alternating	✓	✓	✓
G.783(d) Double Alternating	✓	✓	✓
G.783(e) Single	✓	✓	✓
G.783(f) Burst	✓	✓	✓
G.783(g) Periodic 87-3	✓	✓	✓
G.783(g) Periodic 87-3 With Cancel	✓	✓	✓
G.783(g) Periodic 87-3 With Add	✓	✓	✓
G.783(h) Periodic	✓	✓	✓
G.783(h) Periodic with Cancel	✓	✓	✓
G.783(h) Periodic with Add	✓	✓	✓
Phase Transient Pointer Adjustment Burst	✓	✓	✓
TU-3 Periodic 85-5		✓	
TU-3 Periodic 85-5 With Cancel		✓	
TU-3 Periodic 85-5 With Add		✓	
TU-12 Periodic 35-1			✓
TU-12 Periodic 35-1 With Cancel			✓
TU-12 Periodic 35-1 With Add			✓

Starting Pointer Sequences

To set up the CTS 750 to make generate pointer sequences:

1. Specify the pointer mode as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	POINTERS & TIMING	Pointer / Timing Mode	Pointer Sequences

The choices allow you to move pointers using time parameters, with a frequency offset, or in sequences. Selecting Pointer Sequences moves pointers in sequential patterns.

2. Specify the pointer type as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Type	AU Pointer
			TU Pointer

3. Specify the Sequence Type as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Sequence Type	<i>as appropriate</i>

NOTE. *The pointer sequences available depend on the selected Pointer Type.*

4. If Sequence Type is set to anything other than Single or Double Alternating, set the pointer direction as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Direction	Increment
			Decrement

5. If Sequence Type is set to one of the continuous patterns, set the pointer rate as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Pointer Rate	1000ms
			2000ms
			5000ms
			10000ms
			USER DEFINED

- Select **USER DEFINED** to set a pointer rate different from the preset choices.

6. Specify whether Initialization Time is included as part of the pointer sequence as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Initialization Time	On
			Off

***NOTE.** The Initialization Time is a set value (either 0 seconds or 30 seconds); it cannot be changed directly.*

7. Specify whether Cool Down Time is included as part of the pointer sequence as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Cool Down Time	On
			Off

***NOTE.** The Cool Down Time is a calculated value based on the sequence type; it cannot be changed directly.*

8. To initiate a pointer sequence, press **POINTER ACTION**.

Pointer sequences will continue to run until they are stopped.

9. To stop a pointer sequence, press **POINTER ACTION**.

After you press **POINTER ACTION**, the pointer sequence begins. The status area at the bottom of the display will change to indicate where the CTS 750 is within the pointer sequence; see Figure 3–58. Table 3–15 describes the meaning of the lines in the status display.

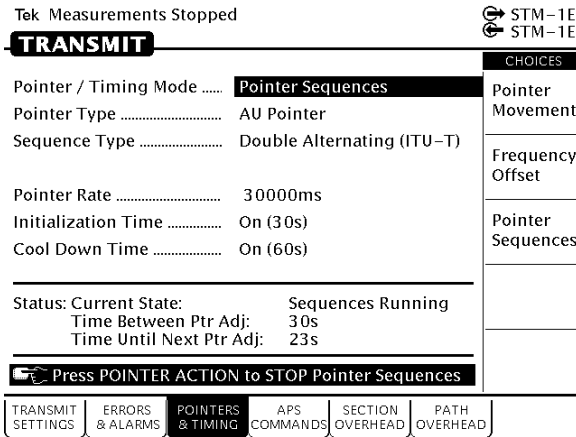


Figure 3–58: Status Display While Pointer Sequences are Running

Table 3–15: Status Lines for Pointer Sequences

Status Line	Description
Current State	Indicates the state of Pointer Sequences: Not Running, Initialization State, Cool Down, or Sequences Running
Time Between Anomalies ¹	Indicates the time between pointer anomalies
Time Until Next Anomaly ¹	Indicates the time remaining until the next anomaly occurs
Time Between Ptr Adj ¹	Indicates the time between pointer adjustments
Time Until Next Ptr Adj ¹	Indicates the time remaining until the next pointer adjustment occurs

¹ This information is displayed depending on sequence type. Not all information is displayed. When this information is displayed, Time Between Anomalies is displayed with Time Until Next Anomaly, and Time Between Prt Adj is displayed with Time Until Next Ptr Adj.

Testing Automatic Protection Switching

This section describes how to generate Automatic Protection Switching (APS) commands and view the network response.

APS commands are located in the K1 and K2 bytes of the section overhead. The K1 byte indicates a request for switch action. The K2 byte provides additional information about network architecture and alarm conditions.

Setting the APS Mode

The APS mode specifies whether the network is a ring network or a span network. The APS mode determines how the K1 and K2 bytes are interpreted and displayed by the CTS 750.

To specify the APS mode:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS (see Figure 3-59)	APS Mode	Span
			Ring

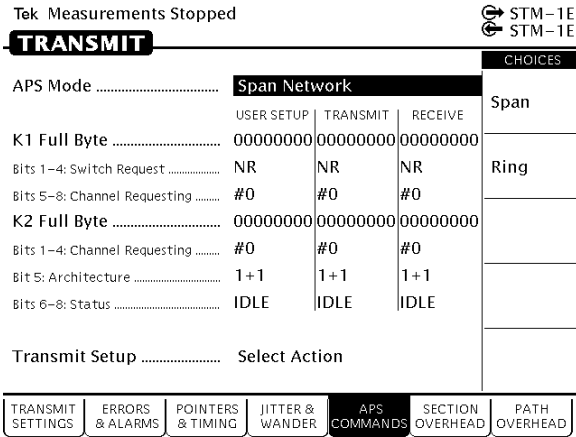


Figure 3-59: The APS COMMANDS Page

Setting the K1 Byte

There are two ways to edit the bits of the K1 byte. The first way is to set the value of each bit of the byte, one bit at a time. The second way is to assign values to the bits using preset choices, which use mnemonics to identify bit patterns.

To set the bit pattern of the K1 byte one bit at a time:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	K1 FULL BYTE	Set to 00000000
			Set to 11111111
			Default 10101010
			EDIT BYTE

- Select **EDIT BYTE** to set the byte to a pattern different than the preset choices.

To set the bit pattern for the first four bits of the K1 byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	Bits 1–4: Switch Request (under K1 FULL BYTE)	<i>as appropriate</i>

The selections available for the first four bits of the K1 byte depend on whether the mode is set to Ring or Span. See Tables 3–16 and 3–17 for descriptions of the preset choices.

Table 3–16: Choices for Bits 1–4 of the K1 Byte When Mode is Set to Ring

Main Screen Mnemonic	Choice Text	Bit Pattern
NR	NR No Request	0000
RR–R	RR–R Reverse Request Ring	0001
RR–S	RR–S Reverse Request Span	0010
EXER–R	EXER–R Exerciser Ring	0011
EXER–S	EXER–S Exerciser Span	0100
WTR	WTR Wait To Restore	0101
MS–R	MS–S Manual Switch Ring	0110
MS–S	MS–S Manual Switch Span	0111
SD–R	SD–R Signal Degrade Ring	1000
SD–S	SD–S Signal Degrade Span	1001
SD–P	SD–P Signal Degrade Protection	1010
SF–R	SF–R Signal Fail Ring	1011

Table 3–16: Choices for Bits 1–4 of the K1 Byte When Mode is Set to Ring (Cont.)

Main Screen Mnemonic	Choice Text	Bit Pattern
SF–S	SF–S Signal Fail Span	1100
FS–R	FS–R Forced Switch Ring	1101
FS–S	FS–S Forced Switch Span	1110
LP–S	LP–S Lockout of Protection Span	1111

Table 3–17: Choices for Bits 1–4 of the K1 Byte When Mode is Set to Span

Main Screen Mnemonic	Choice Text	Bit Pattern
NR	NR No Request	0000
DNR	DNR Do Not Revert	0001
RR	RR Reverse Request	0010
Not Used	Not Used	0011
EXER	EXER Exerciser	0100
Not Used	Not Used	0101
WTR	WTR Wait to Restore	0110
Not Used	Not Used	0111
MS	MS Manual Switch	1000
Not Used	Not Used	1001
SD–LP	SD Signal Degrade Low	1010
SD–HP	SD Signal Degrade High	1011
SF–LP	SF Signal Fail Low	1100

Table 3–17: Choices for Bits 1–4 of the K1 Byte When Mode is Set to Span (Cont.)

Main Screen Mnemonic	Choice Text	Bit Pattern
SF-HP	SF Signal Fail High	1101
FS	FS Forced Switch	1110
LP	LP Lockout of Protection	1111

The label for Bits 5–8, of the K1 byte, is Destination Node ID when the mode is set to Span. The label for Bits 5–8 is Channel Requesting when the mode is set to Ring.

To set the bit pattern for the last four bits of the K1 byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	Bits 5–8: (under K1 FULL BYTE)	<i>as appropriate</i>

See Table 3–18 for descriptions of the preset choices.

Table 3–18: Choices for Bits 5–8 of the K1 Byte

Main Screen Mnemonic	Choice Text	Bit Pattern
#0	#0 (0000)	0000
#1	#1 (0001)	0001
#2	#2 (0010)	0010
#3	#3 (0011)	0011
#4	#4 (0100)	0100
#5	#5 (0101)	0101
#6	#6 (0110)	0110
#7	#7 (0111)	0111
#8	#8 (1000)	1000
#9	#9 (1001)	1001
#10	#10 (1010)	1010
#11	#11 (1011)	1011
#12	#12 (1100)	1100
#13	#13 (1101)	1101
#14	#14 (1110)	1110
#15	#15 (1111)	1111

Setting the K2 Byte

There are two ways to edit the bits of the K2 byte. The first way is to set the value of each bit of the byte, one bit at a time. The second way is to assign values to the bits using preset choices, which use mnemonics to identify bit patterns.

To set the bit pattern of the K2 byte one bit at a time:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	K2 FULL BYTE	Set to 00000000
			Set to 11111111
			Default 10101010
			EDIT BYTE

- Select **EDIT BYTE** to set the byte to a pattern different than the preset choices.

The label for Bits 1–4, of the K2 byte, is Channel Requesting when the mode is set to Span. The label for Bits 5–8 is Source Node ID when the mode is set to Ring.

To set the bit pattern for the first four bits of the K2 byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	Bits 1–4: (under K2 FULL BYTE)	<i>as appropriate</i>

See Table 3–19 for descriptions of the preset choices.

Table 3–19: Choices for Bits 1–4 of the K2 Byte

Main Screen Mnemonic	Choice Text	Bit Pattern
#0	#0 (0000)	0000
#1	#1 (0001)	0001
#2	#2 (0010)	0010
#3	#3 (0011)	0011
#4	#4 (0100)	0100
#5	#5 (0101)	0101
#6	#6 (0110)	0110
#7	#7 (0111)	0111
#8	#8 (1000)	1000
#9	#9 (1001)	1001
#10	#10 (1010)	1010
#11	#11 (1011)	1011
#12	#12 (1100)	1100
#13	#13 (1101)	1101
#14	#14 (1110)	1110
#15	#15 (1111)	1111

The label for Bit 5, of the K2 byte, is Architecture when the mode is set to Span. The label for Bit 5 is Path when the mode is set to Ring.

To set the value of the fifth bit of the K2 byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	Bit 5: (under K2 FULL BYTE)	<i>as appropriate</i>

See Tables 3–20 and 3–21 for descriptions of the preset choices for Bit 5.

Table 3–20: Choices for Bit 5 of the K2 Byte When Mode is Set to Span

Main Screen Mnemonic	Choice Text	Bit Value
1+1	1+1	0
1:N	1:N	1

Table 3–21: Choices for Bit 5 of the K2 Byte When Mode is Set to Ring

Main Screen Mnemonic	Choice Text	Bit Value
SHORT	SHORT	0
LONG	LONG	1

The label for Bits 6–8, of the K2 byte, is Status whether the mode is set to Ring or Span.

To set the bit pattern for the last three bits of the K2 byte:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	Bits 6–8: (under K2 FULL BYTE)	<i>as appropriate</i>

See Table 3–22 for descriptions of the preset choices.

Table 3–22: Choices for Bits 6–8 of the K2 Byte

Main Screen Mnemonic	Choice Text	Bit Pattern
IDLE	IDLE	000
BR	BR Bridged	001
BR&SW	BR & SW Bridged & Switched	010
Not Used	Not Used	011
Not Used	Not Used	100
Not Used	Not Used	101
FERF	FERF	110
AIS	AIS	111

Transmitting the K1 and K2 Bytes

Changing the values of the K1 and K2 bytes, shown in the USER SETUP column, does not automatically change the values of the transmitted K1 and K2 bytes. The TRANSMIT column shows the K1 and K2 bytes that are being transmitted.

NOTE. You can edit the transmitted K1 and K2 bytes directly from the *SECTION OVERHEAD* page.

To transmit new K1 and K2 bytes:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	Transmit Setup	Transmit User Setup
			Transmit Default
			Transmit Illegal

NOTE. You cannot transmit new values for the K1 or K2 bytes when the CTS 750 is transmitting an MS AIS or MS FERF.

- Select **Transmit User Setup** to change the value of the K1 and K2 bytes to that shown under USER SETUP.
- Select **Transmit Default** to change all the bits in the K1 and K2 bytes to zeros.
- Select **Transmit Illegal** to change all the bits in the K1 and K2 bytes to ones.

When you select an action from the Transmit Setup line, the TRANSMIT column is updated.

Viewing the Network Response to APS Commands

To view the network response to APS commands:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	APS COMMANDS	none	none

The network response to APS commands appears under the column labeled RECEIVE on the APS COMMANDS page (see Figure 3–60).

The RECEIVE Column

Tek Measurements Stopped

TRANSMIT STM-1E
STM-1E

APPS Mode	Span Network	TRANSMIT	RECEIVE	ACTIONS
USER SETUP				Transmit User Setup
K1 Full Byte	00000000	00000000	00000000	Transmit Default
Bits 1-4: Switch Request	NR	NR	NR	
Bits 5-8: Channel Requesting	#0	#0	#0	
K2 Full Byte	00000000	00000000	00000000	Transmit Illegal
Bits 1-4: Channel Requesting	#0	#0	#0	
Bit 5: Architecture	1+1	1+1	1+1	
Bits 6-8: Status	IDLE	IDLE	IDLE	
Transmit Setup	Select Action			

TRANSMIT SETTINGS ERRORS & ALARMS POINTERS & TIMING JITTER & WANDER **APS COMMANDS** SECTION OVERHEAD PATH OVERHEAD

Figure 3–60: The RECEIVE Column on the APS COMMANDS Page

Viewing Results

This section describes how to view, save, recall, and print test results.

You can look at test results while a test is running or after it has completed. The CTS 750 SDH Test Set can display test results as a summary or in a more detailed tabular form. The CTS 750 also displays measurement history in a graphical format.

Viewing a Summary of Results

To display a summary of test results:


Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	TEST SUMMARY	<i>none</i>	<i>none</i>

Figure 3–61 shows the TEST SUMMARY page. The top half of the display shows the source of the displayed results, the line rate of the displayed results, the mapping of the displayed results, when the displayed test results started and the duration of the test (elapsed time). The bottom half of the display is where the TroubleScan feature displays information. TroubleScan provides a quick overview of test results by displaying the four most significant alarm, failure, or error conditions that have occurred during the test. The specific conditions that TroubleScan displays depends on the problems that occur in the signal during the test.

Tek Measurements Stopped

↻ STM-1E
↻ STM-1E

RESULTS

Results Source:  Current Results
Results Rate: STM-1
Results Mapping: No Mapping (Unequipped)
Test Started: 20:04:00 16-Jul-95
Elapsed Time: 0d 0h 0m

TROUBLE SCAN

No Alarms No Errors



Figure 3-61: The Test Summary Page

Viewing Detailed Results

You can view results either as a summary or as a history. The summary format displays test results in a table. The history format displays test results in a graphical format.

The summary format is displayed on two pages in the RESULTS menu, the MAIN RESULTS page, and the ERROR ANALYSIS page. The MAIN RESULTS page provides an overview of test results, divided into seven categories: Errors, Failures, Alarms, Pointers, Jitter, and Wander. The ERROR ANALYSIS page displays an analysis of errors according to G.826, G.821, and M2100. Errors on the ERROR ANALYSIS page are displayed by Regenerator Section, Multiplexer Section, Path, TU, M2100 Out of Service, M2100 In Service or Pattern.

Displaying an Overview of Test Results

To display an overview of test results:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	MAIN RESULTS	<i>none</i>	Errors
			Failures
			Alarms
			Pointers
			Jitter
			Wander

Table 3–23 lists all of the test results that are displayed on the MAIN RESULTS page.

Table 3–23: Results Displayed on MAIN RESULTS Page

Category	Error Displayed
Errors	Parity
	RS B1 BIP
	MS B2 BIP
	Path B3 BIP
	TU Path BIP
	Pattern Bit
	MS FEBE
	Path FEBE
	TU Path FEBE
Frame Bit	
Failures	Loss of Signal Seconds

Table 3-23: Results Displayed on MAIN RESULTS Page (Cont.)

Category	Error Displayed
	Loss of Frame Seconds
	Out of Frame Seconds (SEFS)
	Loss of AU Pointer Seconds
	Loss of Power Seconds
	Loss of TU Pointer Seconds
	TU LOM Seconds
	Loss of Pattern Sync Seconds
	PDH Loss of Frame Seconds
Alarms	MS AIS Seconds
	MS FERF Seconds
	Path AIS Seconds
	Path FERF Seconds
	TU PATH AIS Seconds
	TU PATH FERF Seconds
	AIS Seconds
	RAI Seconds
Pointers	Loss of Pointer Seconds
	New Data Flag Seconds
	Illegal Pointer Seconds
	Positive Justifications
	Negative Justifications
	Illegal Pointer Count
	Pointer Value

Table 3–23: Results Displayed on MAIN RESULTS Page (Cont.)

Category	Error Displayed
Jitter	Peak–Peak Jitter
	Positive Peak Jitter
	Negative Peak Jitter
	Jitter Hit Seconds
	Jitter Unlocked Seconds
Timing Quality	Current Frequency Drift Rate
	Maximum Frequency Drift Rate
	Jitter Pointer Event Seconds
Wander	Peak–Peak Wander
	TIE
	Estimated Bit Slips (2 Mb/s rate only)
	Estimated Frame Slips (2 Mb/s rate only)
Frequency	Current Frequency
	Maximum Frequency
	Minimum Frequency

Displaying an Analysis of Test Results

To display an analysis of test results:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	ERROR ANALYSIS	<i>none</i>	RS Analysis
			MS Analysis
			Path Analysis
			TU Analysis
			PDH M2100 Out of Service
			PDH M2100 In Service
			Pattern Bit

Tables 3–24 through 3–30 detail the error analysis that appears on the ERROR ANALYSIS page. With the exception of the error count, the analysis of the error conditions that appear on the ERROR ANALYSIS page is made up of two numbers. The first number is the number of seconds the condition existed. The second number is the percentage of the test duration that the condition existed.

Table 3–24: G.826 RS Analysis Results Displayed on the ERROR ANALYSIS Page

Category	Type	Analysis Result
RS	RS Analysis (B1 BIP)	Error Blocks
		Errored Seconds
		Background Block Errors
		Severely Errored Seconds
		Unavailable Seconds

Table 3–25: G.826 MS Analysis Results Displayed on the ERROR ANALYSIS Page

Category	Type	Analysis Result
MS	MS Analysis (B2 BIP)	Error Blocks
		Errored Seconds
		Background Block Errors
		Severely Errored Seconds
		Unavailable Seconds
	MS Analysis (FEBE)	Error Blocks
		Errored Seconds
		Background Block Errors
		Severely Errored Seconds
		Unavailable Seconds

Table 3–26: G.826 Path Analysis Results Displayed on the ERROR ANALYSIS Page

Category	Type	Analysis Result
Path	Path Analysis (B3 BIP)	Error Blocks
		Errored Seconds
		Background Block Errors
		Severely Errored Seconds
		Unavailable Seconds
	MS Analysis (FEBE)	Error Blocks
		Errored Seconds
		Background Block Errors

Table 3–26: G.826 Path Analysis Results Displayed on the ERROR ANALYSIS Page (Cont.)

Category	Type	Analysis Result
		Severely Errored Seconds
		Unavailable Seconds

Table 3–27: G.826 Analysis Results Displayed on the ERROR ANALYSIS Page

Category	Type	Analysis Result
TU Analysis	TU Analysis (BIP)	Error Blocks
		Errored Seconds
		Background Block Errors
		Severely Errored Seconds
		Unavailable Seconds
	TU Analysis (FEBE)	Error Blocks
		Errored Seconds
		Background Block Errors
		Severely Errored Seconds
		Unavailable Seconds

Table 3–28: PDH M2100 Out of Service Analysis Results Displayed on the ERROR ANALYSIS Page

Category	Type	Analysis Result
PDH	M2100 Out of Service	Errored Seconds
		Severely Errored Seconds

Table 3–28: PDH M2100 Out of Service Analysis Results Displayed on the ERROR ANALYSIS Page (Cont.)

Category	Type	Analysis Result
		Unavailable Seconds
		Error Free Seconds

Table 3–29: PDH M2100 In Service Analysis Results Displayed on the ERROR ANALYSIS Page

Category	Type	Analysis Result
PDH	M2100 In Service	Errored Seconds
		Severely Errored Seconds
		Unavailable Seconds
		Error Free Seconds

Table 3–30: G.826 Pattern Bit Analysis Results Displayed on ERROR ANALYSIS Page

Category	Type	Analysis Result
Payload	Pattern Bit Analysis (Bit Error)	Error Counts
		Errored Seconds
		Degraded Minutes
		Severely Errored Seconds
		Unavailable Seconds
		Error Free Seconds

G.826, G.821, and M.2100 Analysis

G.826 analysis is based on pattern bit errors occurring within the payload of an SDH or PDH rate signal. G.821 is an out-of-service measurement since the normal traffic payload is occupied by a pattern.

M.2100 out-of-service analysis is identical to G.821 pattern bit analysis. M.2100 in-service Frame analysis is based on frame bit error in “live traffic” PDH and mapped PDH signals. It is intended to replace G.821 as an overall quality of service measurement for PDH.

G.826 analysis pertains to primary rate SDH signals and replaces G.821 analysis. G.826 makes use of block-based measurements to get media-independent results and thus is more convenient for in-service measurement.

Viewing Measurement Histories

The CTS 750 records measurement histories whenever you run a test. Measurement histories are displayed as graphs. The graph displays how an individual measurement changed over time. The vertical axis of a graph depends on what is displayed, but the horizontal axis always displays time.

To display a history graph:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	HISTORY GRAPHS	<i>none</i>	<i>none</i>

Types of Graphs

There are three types of history graphs: bar graphs, line graphs, and on/off graphs.

Bar Graphs. Bar graphs are used for most measurements (see Figure 3–62). There are two kinds of bar graphs: a count graph that displays code violations and pointer justifications and an errored

seconds graph that displays errored seconds. Table 3–31 lists the different bar graphs that can be displayed.

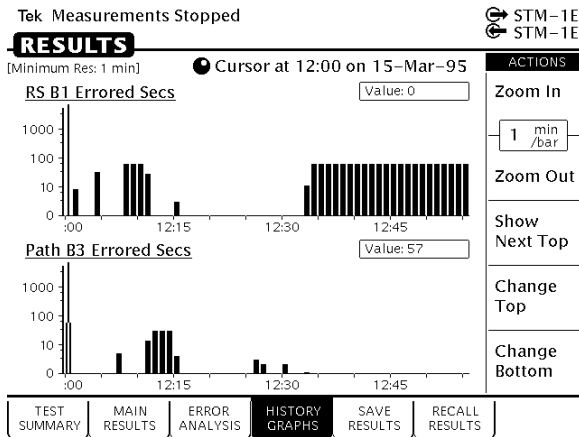


Figure 3–62: Bar Graphs Showing Code Violations and Errored Seconds

Table 3–31: Measurements Displayed as Bar Graphs

Measurement
RS B1 Error Counts
RS B1 Errored Secs
MS B2 Error Counts
MS B2 Errored Secs
MS FEBE Error Counts
Path B3 Error Counts
Path B3 Errored Secs
Path FEBE Error Counts
Pattern Error Counts

Table 3-31: Measurements Displayed as Bar Graphs (Cont.)

Measurement
Pattern Errored Secs
AU Pointer Justifications
TU Pointer Justifications
TU BIP2 Errors
TU BIP2 Errored Secs
TU FEBE Error Count
TU FEBE Errored Secs
CRC Errored Seconds
Frame Errored Seconds
Maximum Jitter (peak-to-peak or RMS)

Line Graphs. A line graph is used to display pointer movement history (see Figure 3-63). The vertical axis of the line graph ranges from 0 to the maximum, which is different for AUs and TUs. There is only one measurement displayed as a line graph, as shown in Table 3-32.

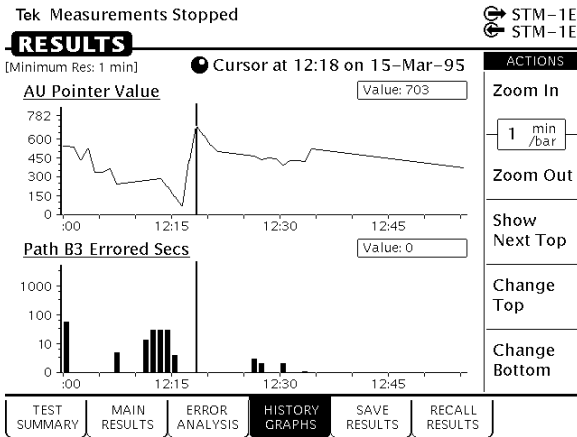


Figure 3-63: Line Graph Showing Pointer Value

Table 3-32: Measurements Displayed as a Line Graph

Displayed Value
AU-4 Pointer Value
TU Pointer Value
Delta Frequency
TIE
Frequency Drift

On/Off Graphs. On/off graphs indicate whether alarms and failures were on or off (see Figure 3-64). There are only two types of on/off graphs, as shown in Table 3-33. One type displays alarms and the other type displays failures.

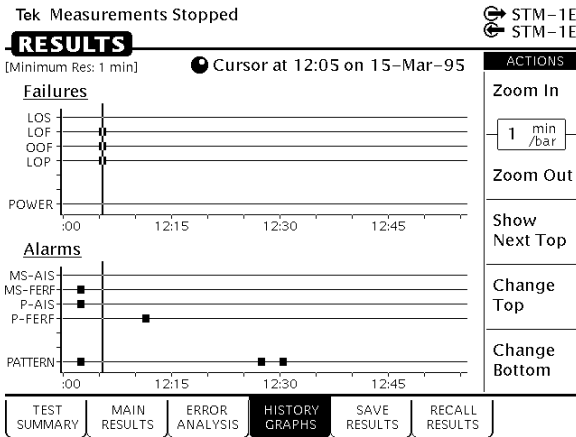


Figure 3-64: On/Off Graphs Showing Failures and Alarms

Table 3-33: Measurements Displayed as On/Off Graphs for SDH Rates

Graph Type	Displayed Value
Failures	LOS
	LOF
	OOF
	AU LOP
	TU LOP
	TU LOM
	Power
SDH Alarms	MS-AIS
	MS-FERF
	P-AIS
	P-FERF

Table 3–33: Measurements Displayed as On/Off Graphs for SDH Rates (Cont.)

Graph Type	Displayed Value
	TU Path AIS
	TU Path FERF
	Pattern

Table 3–34: Measurements Displayed as On/Off Graphs for PDH Rates

Graph Type	Displayed Value
PDH Alarms and Failures	Power
	LOS
	LOF
	Idle
	AIS
	RAI
	Pattern

Elements of the History Graph Display

Figure 3–65 shows the elements of a typical history graph display. The HISTORY GRAPHS page always displays two graphs. The two graphs can be changed to display any measurement taken during a test.

Graph Name

Above each graph is a name that identifies the measurement the graph illustrates.

History Resolution

Above the graph name is a line that states the minimum resolution at which the graph can be displayed. The minimum resolution is set at the time the test is run.

Power Out Indicator

If the power to the CTS 750 fails while a test is running, the CTS 750 displays the words "POWEROUT" on the history graph. POWEROUT is displayed vertically on the graph and spans the period of time the CTS 750 was without power.

Cursor

The cursor is a line that is scrolled across the graph using the knob.

Cursor Position

Just below the menu name is a line that identifies the position of the cursor. Cursor position is identified by time and date.

Measurement Results at Cursor Position

To the right of the graph name is a box that displays the value of the measurement at the cursor location (the box is not displayed for history graphs of alarms or failures). If the displayed graph represents errored seconds, the measurement results box displays the number of errored seconds that occurred during the interval indicated. If the displayed graph represents an error count, the measurement results box displays the number of errors counted during the indicated interval and the resulting bit error rate (BER).

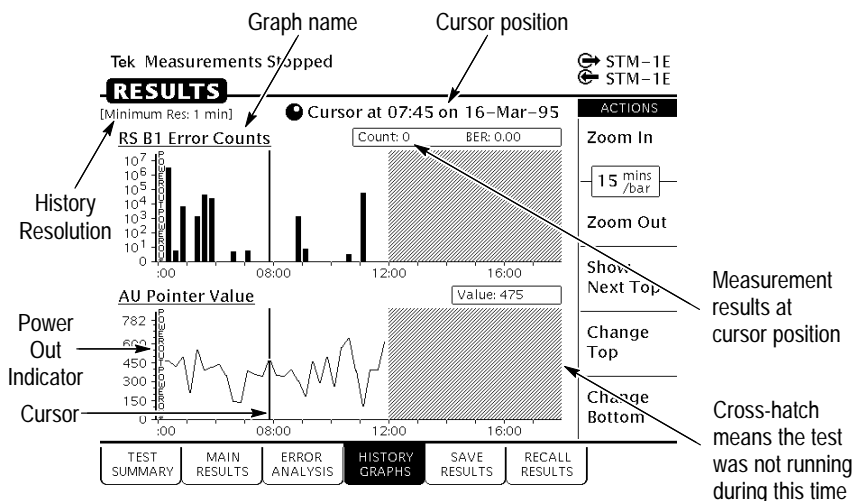


Figure 3-65: Elements of a History Graph

Zooming History Graphs

History graphs display measurement history in intervals. Each interval is represented by a bar on the history graph. The interval of time represented by a bar can be changed. Changing the interval a bar represents is called zooming. History graphs can be zoomed out or in. When a history graph is zoomed out, a bar represents an increasingly longer period of time. When a history graph is zoomed in, a bar represents a decreasingly shorter period of time. Table 3-35 lists the intervals a bar can represent, depending on the history resolution setting when the test was run.

Table 3-35: Time Represented by Bars on History Graph

History Resolution = Normal (1 min samples)	History Resolution = Low (15 min samples)
1 minute	15 minutes
5 minutes	60 minutes

Table 3–35: Time Represented by Bars on History Graph (Cont.)

History Resolution = Normal (1 min samples)	History Resolution = Low (15 min samples)
15 minutes	4 hours
60 minutes	12 hours

There are 56 intervals of a history graph displayed on the screen at a time. At a resolution of one minute per bar, a history graph displays test results for a period of 56 minutes. At a resolution of 15 minutes per bar, a history graph displays test results for a period of 840 minutes, or 14 hours.

The minimum test duration required to display results on a history graph is one minute. Tests shorter than one minute will not display any results on the HISTORY GRAPHS page. However, test results do appear on the MAIN RESULTS and ERROR ANALYSIS pages for tests shorter than one minute.

The longest period for which test results are displayed is 72 hours (3 days) at a History Resolution of 1 minute or 1080 hours (45 days) at a History Resolution of 15 minutes. If you run a test continuously, only results for the last 72 hours (1 minute resolution) or 1080 hours (15 minutes resolution) are maintained in memory.

To zoom in a history graph, select **Zoom In**.

To zoom out a history graph, select **Zoom Out**.

NOTE. When viewing long test durations (for example, three days) at a resolution of one minute, you might see a timestamp error. For example, you might see two one-minute intervals stamped with the same time. The timestamp error is simply revealing the clock accuracy. The correct number of intervals for the test duration are present.

Panning History Graphs

You can display different portions of a history graph by panning the graph. Panning a history graph shifts the displayed section of the graph to the left or right.

At the maximum resolution of one minute per bar, a history graph can display only about one hour of test results. To maintain maximum resolution, you can display the graph at maximum resolution (one minute per bar) and pan to other portions of the history graph as necessary.

To pan a history graph, turn the knob.

When the knob is turned, the cursor moves across the history graph. If the history graph contains more data than will fit on the display, the history graph shifts to display additional information. The direction the display shifts depends on which direction the knob is turning.

Changing the Displayed History Graph

To change the displayed history graph:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	HISTORY GRAPHS		Show Next Top
			Change Top
			Change Bottom
		<i>select graph with knob</i> (see Figure 3-66)	Select Graph

- Select **Show Next Top** to automatically display the next graph on the top half of the screen.
- Select **Change Top** to select a different graph for display on the top half of the screen.

- Select **Change Bottom** to select a different graph for display on the bottom half of the screen.
- Select **Cancel** if you decide not to change the displayed graph.

Displaying Mini-Graphs

When you select either Change Top or Change Bottom from the HISTORY GRAPHS page, the selected graph is replaced by three mini-graphs (see Figure 3–66). Each mini-graph is a reduced-size version of a normal graph. Turn the knob to display a different graph. The middle graph, which is highlighted, is the graph that will be displayed full-size when you choose Select Graph. When you turn the knob, the mini-graphs scroll either up or down depending on which direction you turn the knob. Whether the next mini-graph appears at the top or the bottom depends on the direction the knob turns.

Use the mini-graph capability to view several results at once. With mini-graphs displayed, the CTS 750 displays four graphs at the same time. This will enable you to see relationships between different results that might otherwise be difficult to spot.

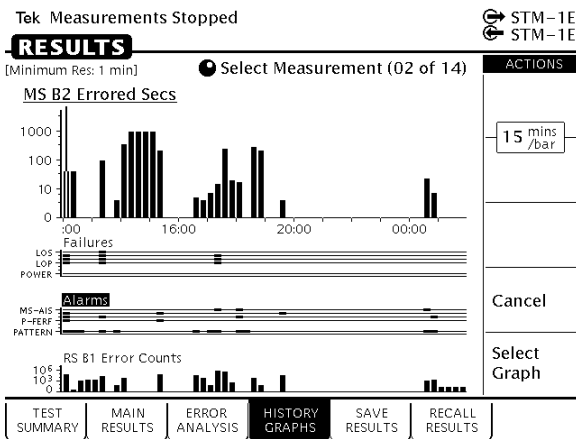


Figure 3–66: Changing the Displayed History Graph

Saving and Recalling Results

You can save test results to disk and recall the test results for later display and analysis. The CTS 750 automatically saves the results of the last two tests in memory. If you want to save test results permanently, you must save the test results to disk.

Saving Test Results to Disk

NOTE. The CTS 750 saves only the last 3 days (at a History Resolution of Normal) or 45 days (at a History Resolution of Low) of test results. If a test runs longer than these limits, the results older than 3 days/45 days are discarded.

To save test results to disk:

1. Name the test results file as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	SAVE RESULTS (see Figure 3-67)	Name	RESLT_XX
			Clear
			EDIT NAME

- If you wish to name the results file as **RESLT<Number>**, you can save time by selecting **RESLT_XX**. Once you select **RESLT_XX**, select **EDIT NAME** and edit **XX** to the desired number (or letter). Select **DONE** when you are finished editing the setup name.
- Select **Clear** to remove an existing name. A message appears to remind you that you cannot save results to disk without a name.

- Select **EDIT NAME** to enter a name other than **RESULT_XX** for the pass/fail test. Select **DONE** when you are finished editing the test name.

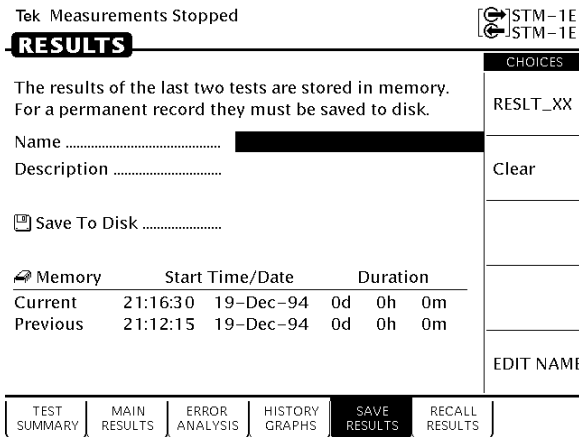


Figure 3-67: The SAVE RESULTS Page

2. Enter a description of the test results file as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	SAVE RESULTS	Description	EDIT TEXT
			None
			Clear

- Select **EDIT TEXT** to enter a description of the test results, up to 24 characters long. Select **DONE** when you are finished editing the description.
- Select **None** if you do not want to use a description.
- Select **Clear** to remove an existing description.

3. Save the test results to disk as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	SAVE RESULTS	Save to Disk	Save Current
			Save Previous

At the bottom of the SAVE RESULTS page are two lines that identify the current and previous tests by start time/date and by duration.

- Select **Save Current** to save the current (most recent) test results.
- Select **Save Previous** to save the previous test results.

Recalling Test Results from Disk

To recall test results from disk:

1. Insert the disk containing the test results into the disk drive.
2. Select and recall the test results file as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	RECALL RESULTS (see Figure 3–68)		Disk
		<i>select disk file name</i>	Recall Result

NOTE. The Disk action displays only files with the extensions .HST and .MST. It does not display any other files on the disk.

To verify that the file has been recalled, select the TEST SUMMARY page and look at the Results Source line at the top of

the page. The Results Source line will display the name of the file recalled.

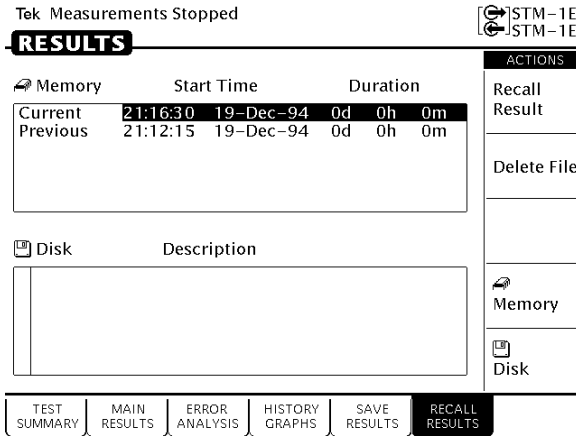


Figure 3-68: The RECALL RESULTS Page

Deleting Test Results from Disk

To delete test results from disk:

1. Insert the disk containing the test results into the disk drive.
2. Select the test results file to be deleted, as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	RECALL RESULTS (see Figure 3-68)		Disk
		<i>select disk file name</i>	Delete File

Recalling Test Results from Memory

To recall test results from memory:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
RESULTS	RECALL RESULTS		Memory (see Figure 3-68)
		<i>select Current or Previous</i>	Recall Result

Printing Results

There are two ways to print out the results of the current test. One way is to tell the CTS 750 which results to print from the print dialog box. The second way is to display the results you wish to print out and then print the displayed screen (this is the only way to print out history graphs).

Results are printed according to the Printer Type, which is set on the PRINTER SETUP page (see page 3-233). Results can be printed to a printer or to a disk file. Results are printed to disk in three formats: Windows BMP format, Interleaf image format, and Encapsulated PostScript format.

Printing Main Results or Error Analysis

When the CTS 750 prints test results, it prints out the contents of the MAIN RESULTS page or the ERROR ANALYSIS page. The printed results are reformatted so that all results fit on a single page.

Before printing results, check that the printer setup is correct. The printer setup is displayed on the PRINTER SETUP page of the UTILITY menu.

To print the results of the current test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
PRINT (see Figure 3-69)		Print Main Results	
		Print Error Analysis	Print
			Abort
			EXIT

- Highlight **Print Main Results** and then select **Print** to print the contents of the MAIN RESULTS page.
- Highlight **Print Error Analysis** and then select **Print** to print the contents of the ERROR ANALYSIS page.
- Select **Abort** to cancel a printout in process.
- Select **EXIT** if you decide not to print out any test results.

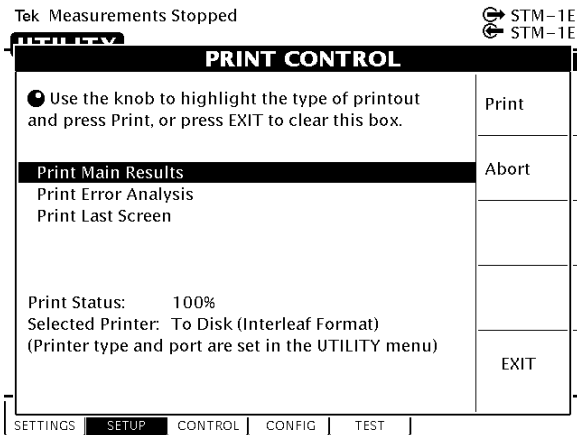


Figure 3-69: The PRINT CONTROL Dialog Box

To print the results of a test saved on disk, recall the results (see page 3–223) and then print as previously described.

To print the results of the previous test, recall the previous test (see page 3–225) and then print as previously described.

Printing History Graphs

To print a history graph from the CTS 750:

1. Display the history graph you want to print.

The history graph can be for the current test or the previous test or it can be recalled from disk.

2. Print the history graph as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
PRINT (see Figure 3–69)		Print Last Screen	Print
			Abort
			EXIT

- Select **Print** to print the displayed history graph using the settings on the PRINTER SETUP page of the UTILITY menu.
- Select **EXIT** if you decide not to print any test results.
- Select **Abort** to cancel a printout in process.

Changing Instrument Settings

This section describes how to change the date and time settings, printer settings, and the GPIB and RS-232 parameters. This section describes how to display a screen that details the CTS 750 configuration. You will also find a description of how to run the instrument self-test in this section.

Viewing the Instrument Configuration

You can display a page that describes how the CTS 750 is configured as well as the installed options and the hardware and firmware revision level.

To display the instrument configuration:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	INSTR CONFIG	<i>none</i>	<i>none</i>

Table 3–36 describes the lines of the INSTR CONFIG page.

Table 3–36: Lines of the Instrument Configuration Page

Line	Description
Model	The model number of the instrument.
Serial Number	The serial number of the instrument.
Hardware Revision	The version of hardware.
Firmware Revision	The version of firmware.
Options	Separates information that applies to every instrument from information about optional configurations.

Table 3-36: Lines of the Instrument Configuration Page (Cont.)

Line	Description
Interface Module	Displays which interface module is installed (supported transmit and receive rates) and wavelength of module, if optical.
PDH Option	Indicates whether the 2, 34, 140 Mb/s Add/Drop/Test option is installed.

Setting the Display Brightness

You can set the display brightness to three levels: Low, Medium, and High.

To set the display brightness:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	MISC SETTINGS (see Figure 3-70)	Display Brightness	Low
			Medium
			High

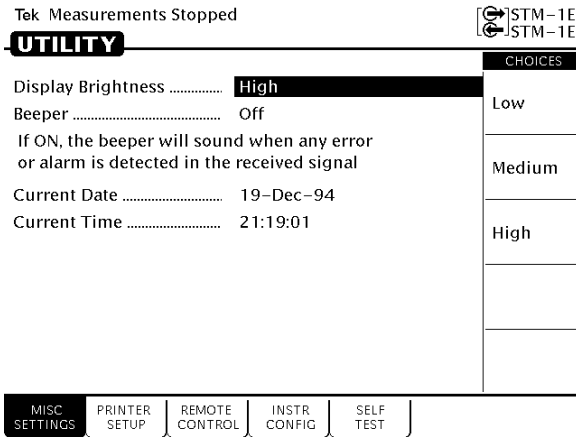


Figure 3-70: The MISC SETTINGS Page

Turning the Beeper On and Off

The CTS 750 has a beeper. The beeper is used alert you when a pass/fail test has completed, or when certain conditions occur. You can turn off the beeper if you wish.

To turn the beeper on or off:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	MISC SETTINGS (see Figure 3-70)	Beeper	On
			Off

Setting the Date

The date is used when writing files to disk, it is used to track measurement history, and it is used when displaying history graphs.

To set the date:

1. Display the current date setting as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	MISC SETTINGS	Current Date	SET DATE

After you select SET DATE, the CTS 750 enters Edit Mode.

2. Assign the knob by selecting **Year**, **Month**, or **Day** as necessary.
3. Turn the knob to change the setting.
4. Select **CANCEL** to abort any changes and exit Edit Mode.
5. Select **DONE** to enter your changes and exit Edit Mode.

Setting the Time

The time is used when writing files to disk, it is used to track measurement history, and it is used when displaying history graphs.

To set the time:

1. Display the current time as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	MISC SETTINGS (see Figure 3-70)	Current Time	SET TIME

After you select SET TIME, the CTS 750 enters Edit Mode.

***NOTE.** While you set the time in Edit Mode, the clock stops running.*

2. Assign the knob by selecting **Hour**, **Minute**, or **Second** as necessary.
3. Turn the knob to change the setting.
4. Select **CANCEL** to abort any changes and exit Edit Mode.
5. Select **DONE** to enter your changes and exit Edit Mode.

Changing the Printer Setup

The CTS 750 prints to Tek DPU-411 printers, Epson-compatible printers, and Hewlett-Packard Thinkjet printers. It can also print to a file on disk. The print parameters are located on the **PRINTER SETUP** page of the **UTILITY** menu (see Figure 3-71). Printers are supported only by an RS-232 connection.

Tek Measurements Stopped		STM-1E
UTILITY		STM-1E
		CHOICES
Printer Type	To Disk (Interleaf Format)	Tek DPU-411
RS-232:		Epson
Baud Rate	9600	Thinkjet
Stop Bits	1	To Disk BMP Format
Parity	None	-more- 1 of 2
Flow Control	None	
Print User & Company	Off	
User Name		
Company Name		
MISC SETTINGS	PRINTER SETUP	REMOTE CONTROL
		INSTR CONFIG
		SELF TEST

Figure 3-71: The PRINTER SETUP Page

Setting up the CTS 750 for a printer consists of two steps, specifying the printer or file type and setting RS-232 parameters. Additionally,

you can specify two lines of text to be included on any printout. The two lines of text identify the user name and the company name.

Specifying the Printer or File Type

To set the printer or file type:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	PRINTER SETUP	Printer Type	Tek DPU-411
			Epson
			Thinkjet
			To Disk BMP Format
			To Disk Ileaf Format
			To Disk EPS Format

- Select **To Disk BMP Format** to print a file to disk in Windows bitmap format.
- Select **To Disk Ileaf Format** to print a file to disk in Interleaf image format.
- Select **To Disk EPS Format** to print a file to disk in Encapsulated PostScript format.

Setting RS-232 Parameters

To determine the correct RS-232 settings for your printer, refer to the manual that came with your printer.

To set the RS-232 parameters for the printer:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	PRINTER SETUP	Baud Rate	1200
			2400
			4800
			9600
		Stop Bits	1
			2
		Parity	None
			Odd
			Even
		Flow Control	None
			Software
			Hardware
			H/W & S/W

Setting the Print User & Company Text

You can have the CTS 750 include text on a printout that identifies the user name and company name. Including this text is optional.

To set the user name and company name:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	PRINTER SETUP	Print User & Company	On
			Off
		User Name	EDIT TEXT
		Company Name	EDIT TEXT

- The User Name and Company Name fields are 20 characters long. Select **DONE** when you are finished editing the name.

Setting Remote Control Parameters

You can control the CTS 750 using a General Purpose Interface Bus (GPIB) or an RS-232 connection. For information on remote control commands, refer to the *CTS 750 Programmer Manual*.

Setting the GPIB Address

To set the CTS 750 GPIB address:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	REMOTE CONTROL	GPIB Primary Address (see Figure 3-72)	Default 4
			Inc
			Dec
			Offline

- Select **Default 4** to set the GPIB address to its default value.
- Select **Inc** to increment the GPIB address.
- Select **Dec** to decrement the GPIB address.
- Select **Offline** to place the CTS 750 in the offline state.
- The maximum GPIB address value is 30. The minimum GPIB address value is 0.

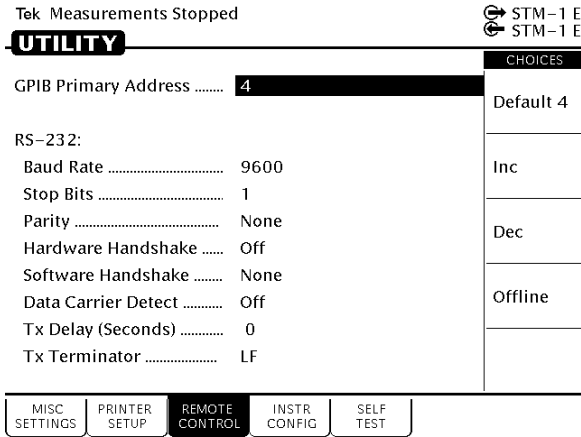


Figure 3-72: The REMOTE CONTROL Page

Setting RS-232 Parameters

The appropriate settings for RS-232 parameters depend on how the controller is set up. Refer to the user manual that came with your controller to determine the correct settings.

To set the remote control RS-232 parameters:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	REMOTE CONTROL (see Figure 3-72)	Baud Rate	1200
			2400
			4800
			9600
		Stop Bits	1
			2
		Parity	None
			Odd
			Even
		Hardware Handshake	Off
			On
		Software Handshake	None
			Xon/Xoff
		Data Carrier Detect	Off
			On
		Tx Delay (Seconds)	0
			1
			5
			Inc
			Dec

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
		Tx Terminator	LF
			CR
			CR/LF
			LF/CR

- For Tx Delay, select one of the preset choices or use **Inc** and **Dec** to specify a value different from the preset choices.
- The maximum value for Tx Delay is 60. The minimum value is 0.

Running Instrument Self Tests

The CTS 750 provides self-contained tests that can be run any time you suspect the CTS 750 may not be performing properly.

The only test you might need to perform is the Power up Self Test. The other self tests available for selection are for servicing the instrument. Complete details on the self tests are located in the *CTS 710 SONET Test Set & CTS 750 SDH Test Set Service* manual.

Running the Power Up Self Test

To run the power up self test:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	SELF TEST	Self Test Group	Power up Self Test
		Self Test Loop	Once
		Self Test Control	Run

- Select **Abort** to stop a self test in progress.

If your CTS 750 fails the self test, contact the nearest Tektronix Service Center.

Jitter Calibration

Periodic calibration of the jitter generation and measurement systems is recommended to maintain best accuracy. You can execute built-in calibration routines before making critical measurements.

Executing Jitter Calibration

To calibrate the jitter generation system:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	CALIBRATION	Calibration System	Jitter Generation
		Calibration Routine	All
		Calibration Control	Run

To calibrate the jitter measurement system:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	CALIBRATION	Calibration System	Jitter Measurement
		Calibration Routine	All
		Calibration Control	Run

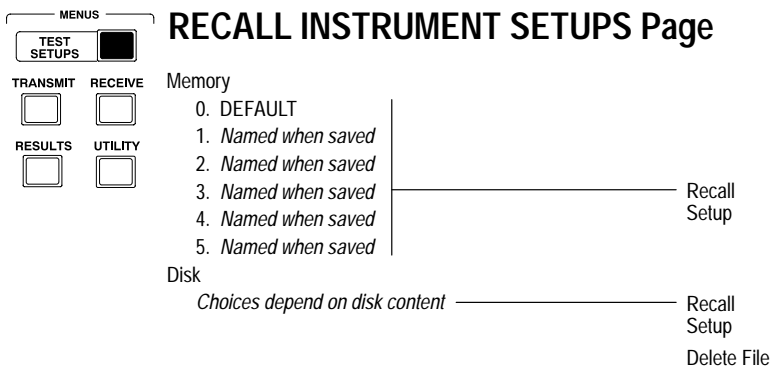
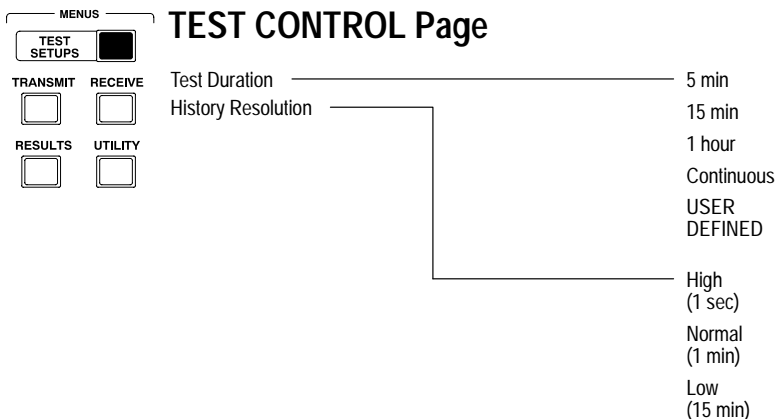
A status message indicates that the calibration is running, has completed and has passed, or has failed.

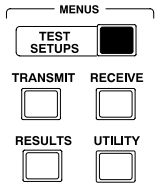
- Select **Abort** to stop a calibration in progress.



Appendices

Appendix A: Menu Maps



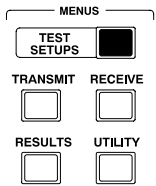


RECALL PASS/FAIL TESTS Page

Disk

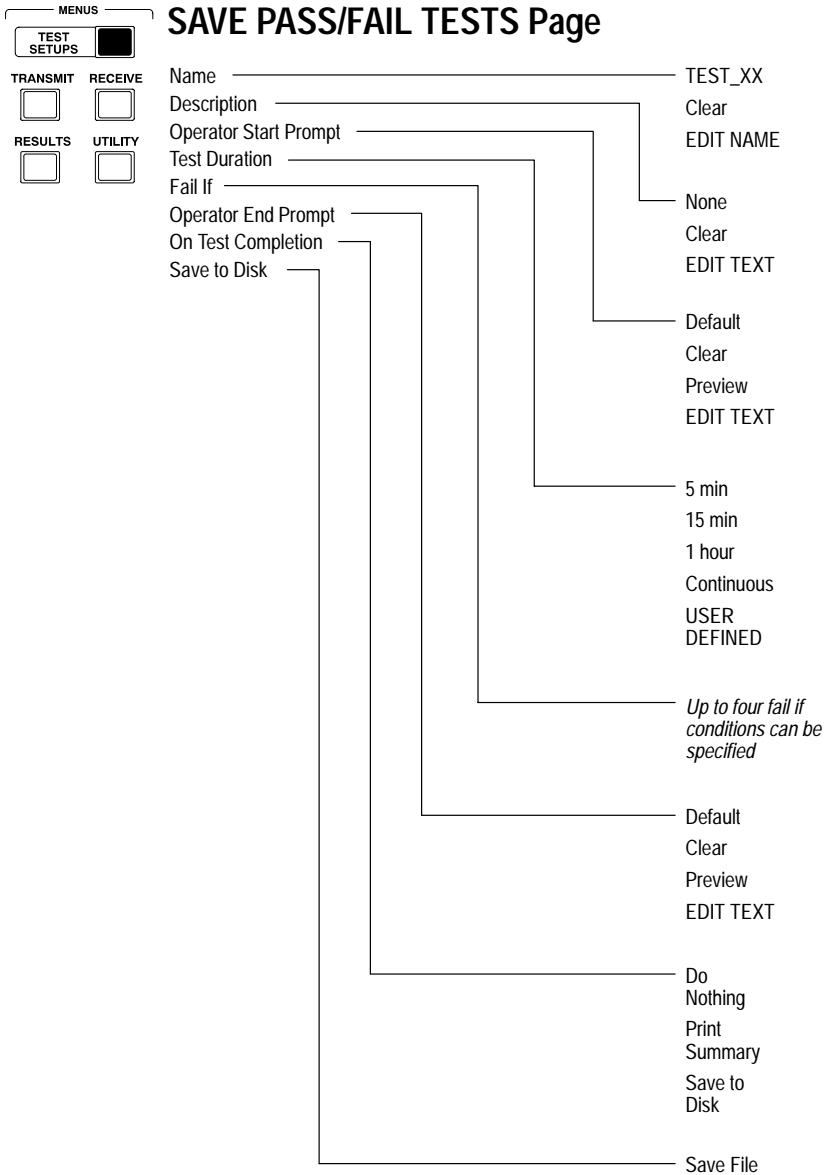
Choices depend on disk content

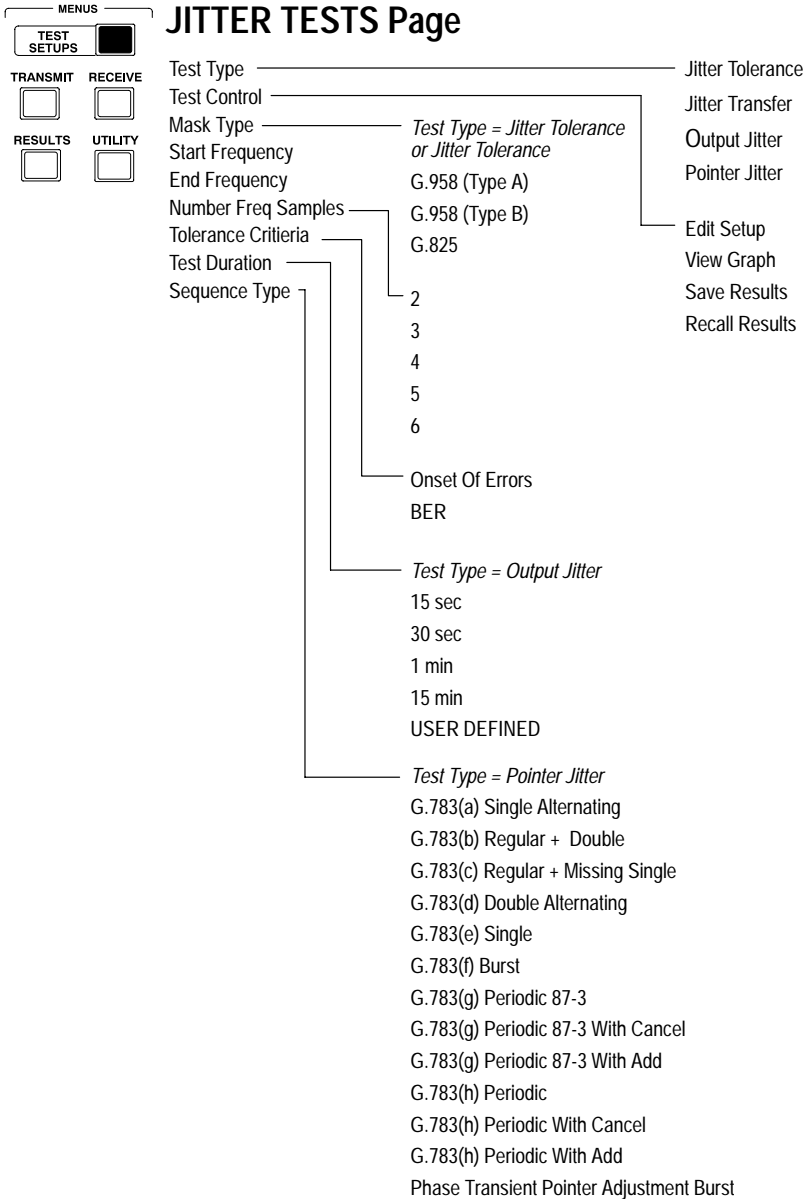
- Recall & Run Test
- Delete File

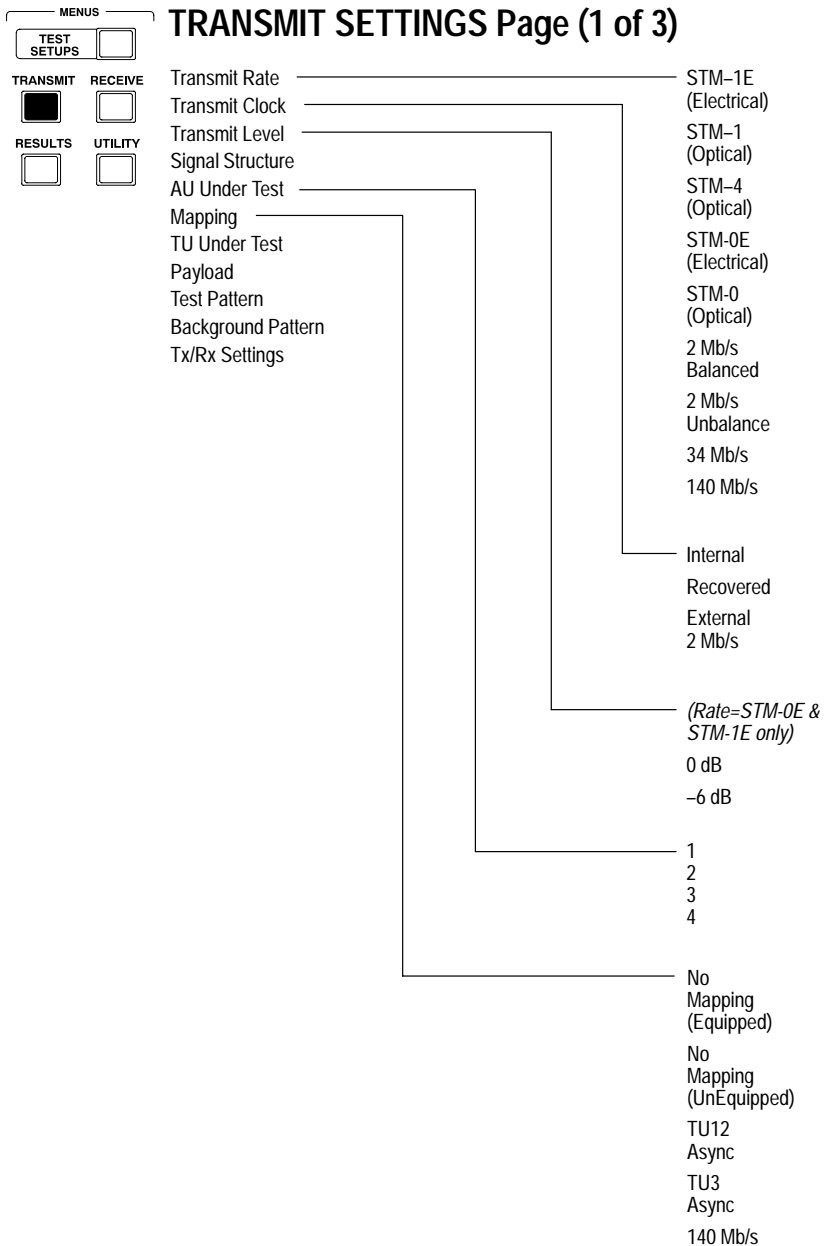


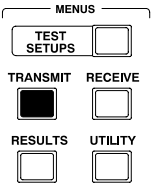
SAVE INSTRUMENT SETUPS Page

- Name SETUP_XX
- Description Clear
- Save to Memory EDIT NAME
- Save To Disk
 - None
 - Clear
 - EDIT TEXT
 - Memory 1
 - Memory 2
 - Memory 3
 - Memory 4
 - Memory 5
 - Save File







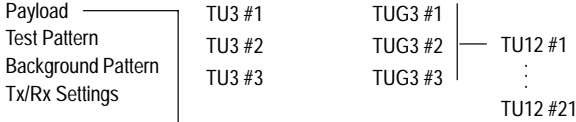


TRANSMIT SETTINGS Page (2 of 3)

- Transmit Rate
- Transmit Clock
- Transmit Level
- Signal Structure
- AU Under Test

Mapping

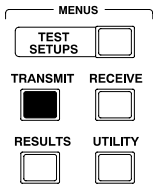
TU Under Test ——— (Mapping= TU3) ——— (Mapping= TU12)



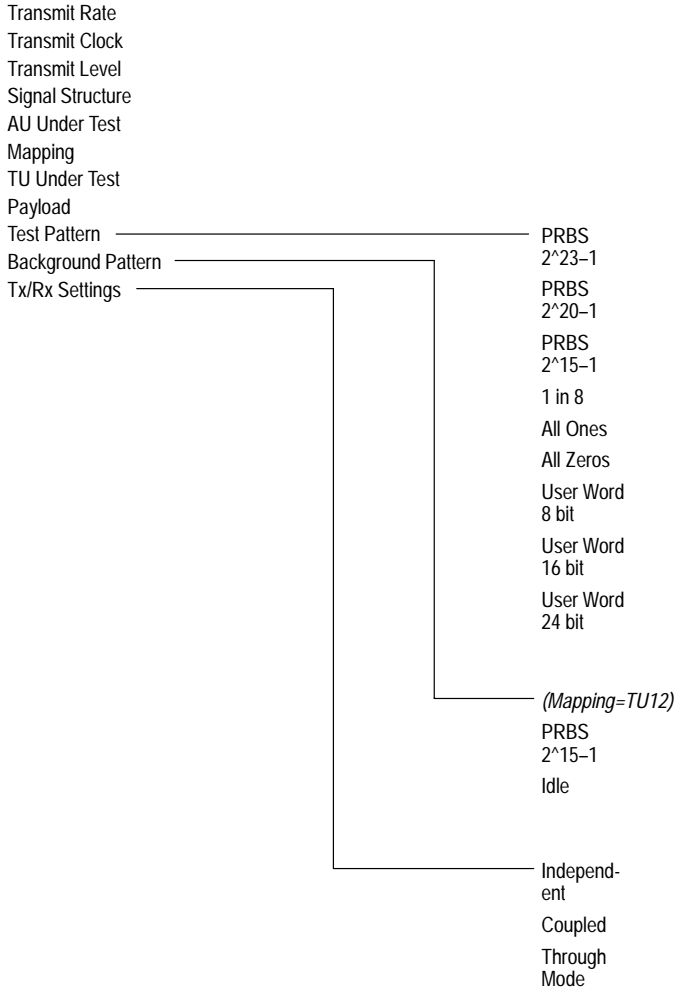
Tx/Rx Settings

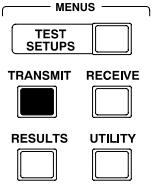
(Mapping= TU12) ——— (Mapping= TU3) ——— (Mapping= 140 Mb/s)

- | | | |
|--------------|----------|----------|
| 2 Mb/s | 34 Mb/s | 140Mb/s |
| Ext Add | Ext Add | Ext Add |
| (Balanced) | 34 Mb/s | 140Mb/s |
| 2 Mb/s | Unframed | Unframed |
| Ext Add | 34 Mb/s | 140Mb/s |
| (Unbalanced) | Framed | Framed |
| 2 Mb/s | | |
| Unframed | | |
| 2 Mb/s | | |
| PCM30 | | |
| (CAS) | | |
| 2 Mb/s | | |
| PCM31 | | |
| 2 Mb/s | | |
| PCM30CRC | | |
| (CAS) | | |
| 2 Mb/s | | |
| PCM31CRC | | |



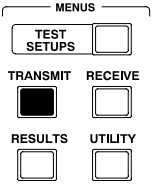
TRANSMIT SETTINGS Page (3 of 3)





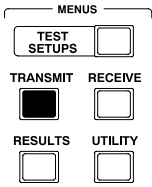
ERRORS & ALARMS Page

Error Type set to	(Mapping= No Mapping)	(Mapping= TU12 or TU3)	(Mapping= 140 Mb/s)
Error Rate set to	None	None	None
Transmit Alarm set to	RS B1 BIP	RS B1 BIP	RS B1 BIP
Transmit Failure set to	MS B2 BIP	MS B2 BIP	MS B2 BIP
	Path B3 BIP	Path B3 BIP	Path B3 BIP
	Path FEBE	Path FEBE	Path FEBE
	Pattern Bit	TU BIP	Pattern Bit
		TU FEBE	
		Pattern Bit	
		(Mapping= TU12 & Payload= 2 Mb/s framed)	(Mapping= TU12 & Payload= 2Mb/sPCM30CRC or 2Mb/sPCM31CRC)
	None	None	None
	1e-3	RS B1 BIP	RS B1 BIP
	1e-4	MS B2 BIP	MS B2 BIP
	1e-5	Path B3 BIP	Path B3 BIP
	1e-6	Path FEBE	Path FEBE
	1e-7	TU BIP	TU BIP
	1e-8	TU FEBE	TU FEBE
	USER DEFINED	Pattern Bit	Pattern Bit
		Frame Bit	Frame Bit
			CRC (2 Mb)
	(Mapping= No Mapping)	(Mapping= TU12 or TU3)	(Mapping= 140 Mb/s)
	None	None	None
	MS AIS	MS AIS	MS AIS
	MS FERF	MS FERF	MS FERF
	Path AIS	Path AIS	Path AIS
	Path FERF	Path FERF	Path FERF
	None	TU AIS	PDH AIS
	LOS	TU FERF	
	LOF	PDH AIS	
	AU LOP		
	TU LOP		
	TU LOM		

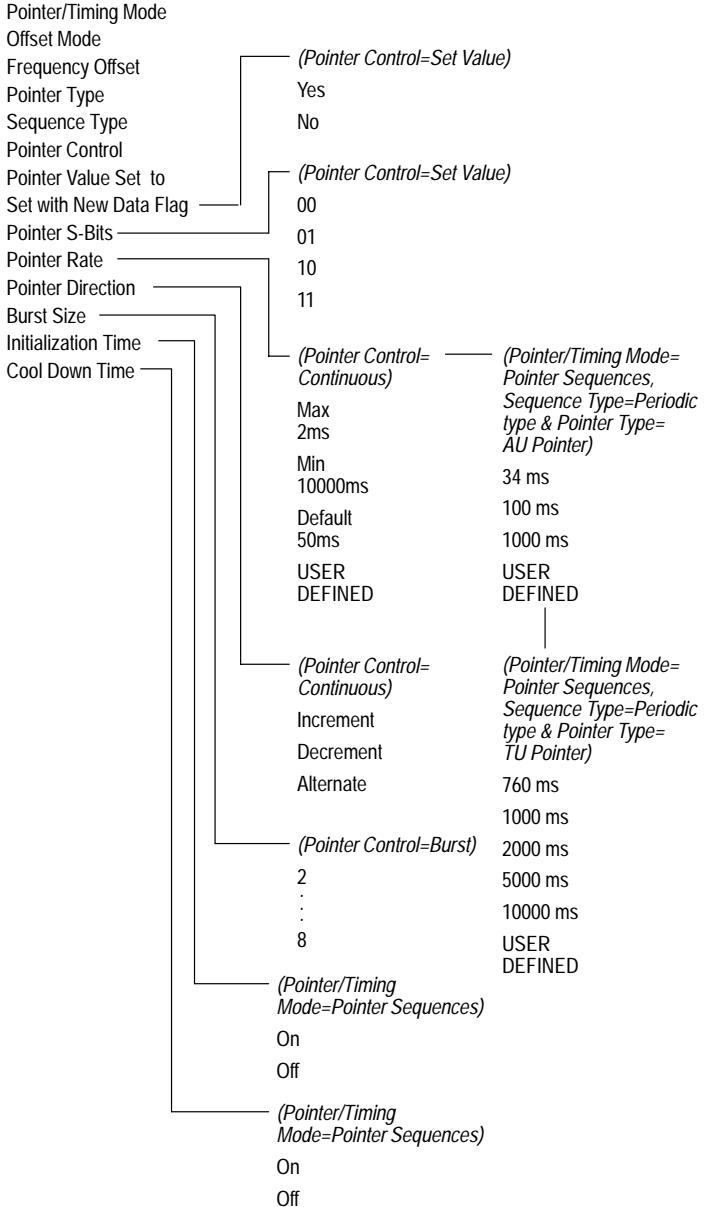


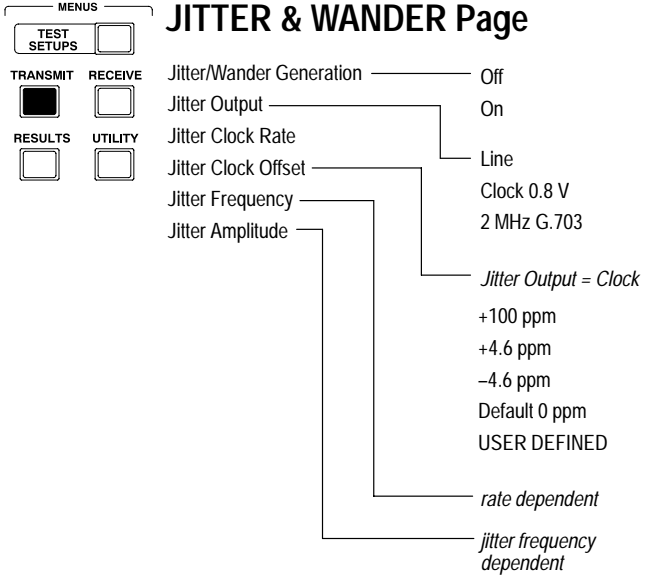
POINTERS & TIMING Page (2 of 3)

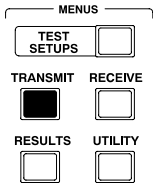
Pointer/Timing Mode	(Pointer/Timing Mode=Pointer Sequences & Pointer Type=AU Pointer)	(Pointer/Timing Mode=Pointer Sequences & Pointer Type=TU Pointer & Mapping=TU12)	(Pointer/Timing Mode=Pointer Sequences & Pointer Type=TU3)
Offset Mode			
Frequency Offset			
Pointer Type			
Sequence Type	G.783(a) Single Alternating	G.783(a) Single Alternating	G.783(a) Single Alternating
Pointer Control			
Pointer Value Set to	G.783(b) Regular + Double	G.783(b) Regular + Double	G.783(b) Regular + Double
Set with New Data Flag			
Pointer S-Bits	G.783(c) Regular + Missing	G.783(c) Regular + Missing	G.783(c) Regular + Missing
Pointer Rate			
Pointer Direction	G.783(d) Double Alternating	G.783(d) Double Alternating	G.783(d) Double Alternating
Burst Size	G.783(e) Single	G.783(e) Single	G.783(e) Single
Initialization Time	G.783(f) Burst	G.783(f) Burst	G.783(f) Burst
Cool Down Time	G.783(g) Periodic 87-3	G.783(g) Periodic 87-3	G.783(g) Periodic 87-3
	G.783(g) Periodic 87-3 With Cancel	G.783(g) Periodic 87-3 With Cancel	G.783(g) Periodic 87-3 With Cancel
	G.783(g) Periodic 87-3 With Add	G.783(g) Periodic 87-3 With Add	G.783(g) Periodic 87-3 With Add
	G.783(h) Periodic	G.783(h) Periodic	G.783(h) Periodic
	G.783(h) Periodic with Cancel	G.783(h) Periodic with Cancel	G.783(h) Periodic with Cancel
	G.783(h) Periodic with Add	G.783(h) Periodic with Add	G.783(h) Periodic with Add
	Phase Transient Pointer Adjustment Burst	TU-12 Periodic 35-1	G.783(h) Periodic with Cancel
		TU-12 Periodic 35-1 With Cancel	G.783(h) Periodic with Add
	Single	TU-12 Periodic 35-1 With Add	TU-3 Periodic 85-5
	Burst	Phase Transient Pointer Adjustment Burst	TU-3 Periodic 85-5 With Cancel
	Set Value		TU-3 Periodic 85-5 With Add
	Continuous		Phase Transient Pointer Adjustment Burst
	(Pointer Control=Set Value)		
	Min 0		
	Max 782		
	Default 522		
	Illegal (Max +1)		
	USER DEFINED		



POINTERS & TIMING Page (3 of 3)

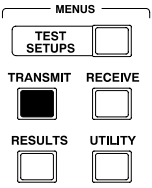






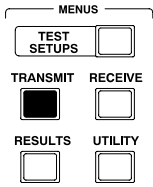
APS COMMANDS Page (1 of 3)

APS Mode	Span	
K1 Full Byte	Ring	
Bits 1-4:		
Bits 5-8:		
K2 Full Byte	Set to	
Bits 1-4:	00000000	
Bit 5:	Set to	
Bits 6-8:	11111111	
Transmit Setup	Default	
	10101010	
	EDIT BYTE	
	(APS Mode=Ring)	(APS Mode=Span)
	NR No Request	NR No Request
	RR-R Reverse Request Ring	DNR Do Not Revert
	RR-S Reverse Request Span	RR Reverse Request
	EXER-R Exerciser Ring	Not Used
	EXER-S Exerciser Span	EXER Exerciser
	WTR Wait To Restore	Not Used
	MS-S Manual Switch Ring	WTR Wait to Restore
	MS-S Manual Switch Span	Not Used
	SD-R Signal Degrade Ring	MS Manual Switch
	SD-S Signal Degrade Span	Not Used
	SD-P Signal Degrade Protection	SD Signal Degrade Low
	SF-R Signal Fail Ring	SD Signal Degrade High
	SF-S Signal Fail Span	SF Signal Fail Low
	FS-R Forced Switch Ring	SF Signal Fail High
	FS-S Forced Switch Span	FS Forced Switch
	LP-S Lockout of Protection Span	LP Lockout of Protection

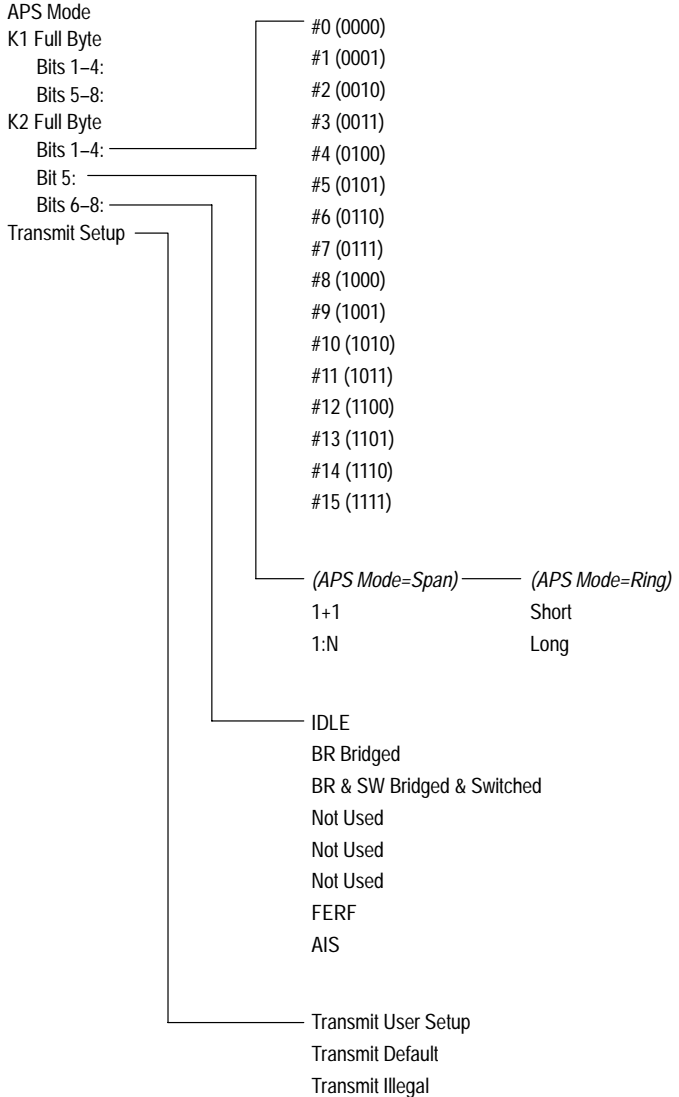


APS COMMANDS Page (2 of 3)

APS Mode	
K1 Full Byte	
Bits 1-4:	
Bits 5-8:	_____ #0 (0000)
K2 Full Byte	_____ #1 (0001)
Bits 1-4:	_____ #2 (0010)
Bit 5:	_____ #3 (0011)
Bits 6-8:	_____ #4 (0100)
Transmit Setup	_____ #5 (0101)
	_____ #6 (0110)
	_____ #7 (0111)
	_____ #8 (1000)
	_____ #9 (1001)
	_____ #10 (1010)
	_____ #11 (1011)
	_____ #12 (1100)
	_____ #13 (1101)
	_____ #14 (1110)
	_____ #15 (1111)
	Set to 00000000
	Set to 11111111
	Default 10101010
	EDIT BYTE



APS COMMANDS Page (3 of 3)



MENUS

TEST SETUPS

TRANSMIT RECEIVE

RESULTS UTILITY

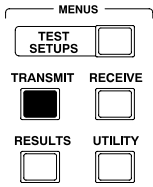
SECTION OVERHEAD Page

Showing Overhead for _____ Choices depend on transmit rate

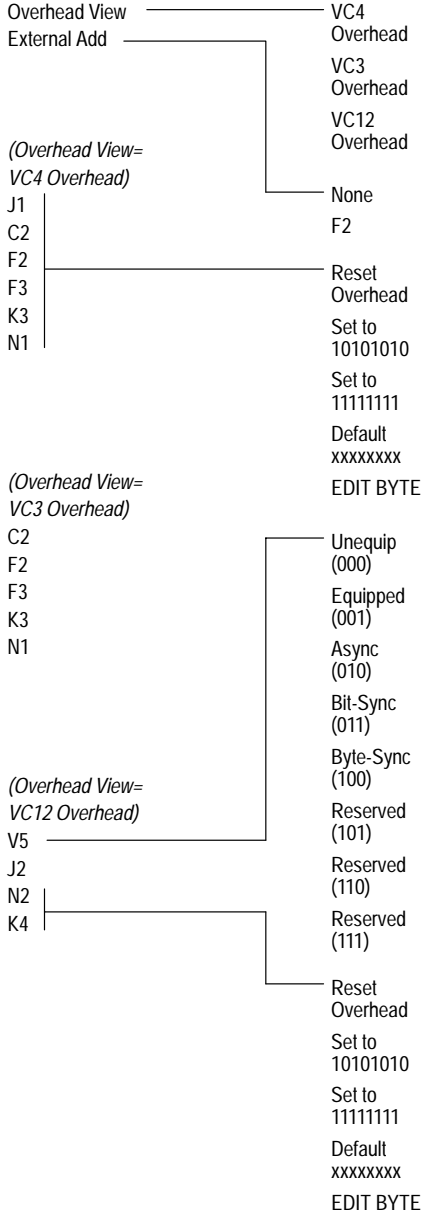
External Add _____

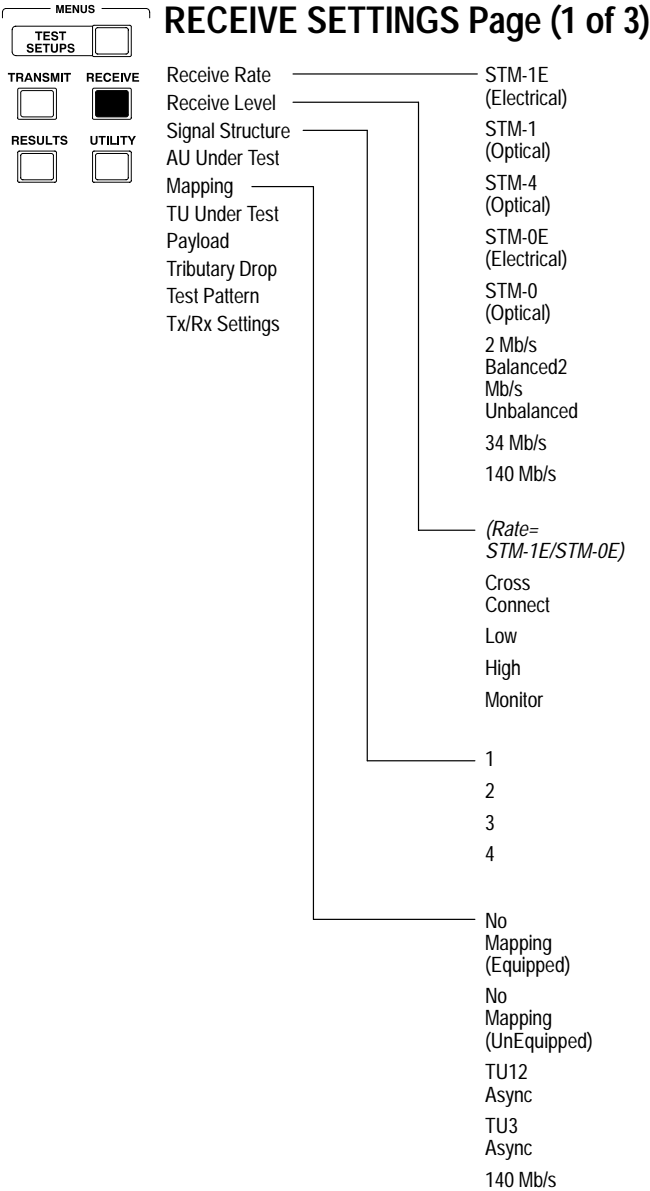
A1	A2	C1
	E1	F1
D1	D2	D3
	K1	K2
D4	D5	D6
D7	D8	D9
D10	D11	D12
S1		E2

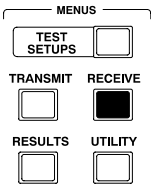
- None
- D1-D3
- D4-D12
- F1
- Reset Overhead
- Set to 10101010
- Set to 11111111
- Default xxxxxxxx
- EDIT BYTE



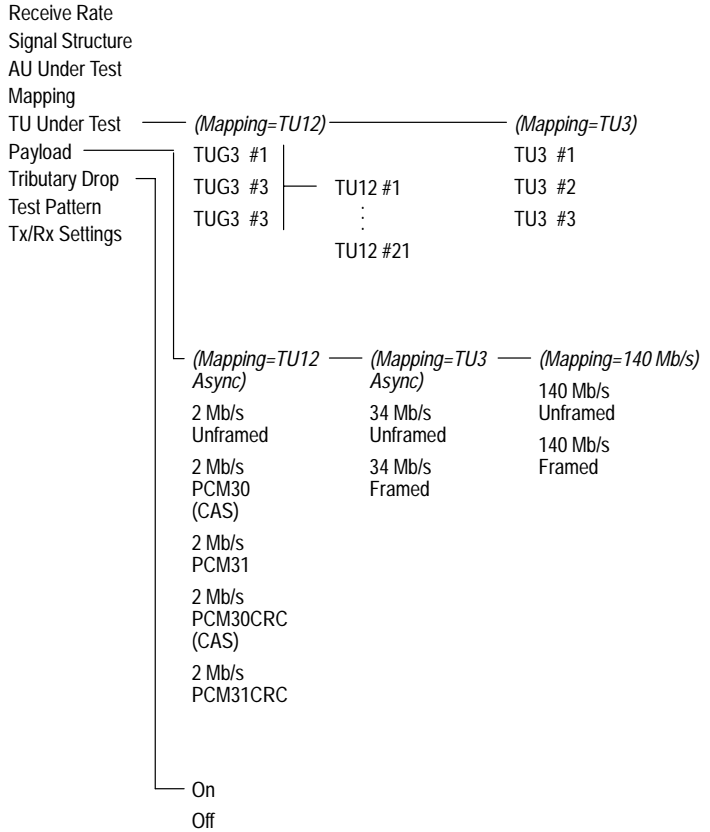
PATH OVERHEAD Page

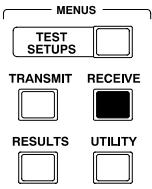






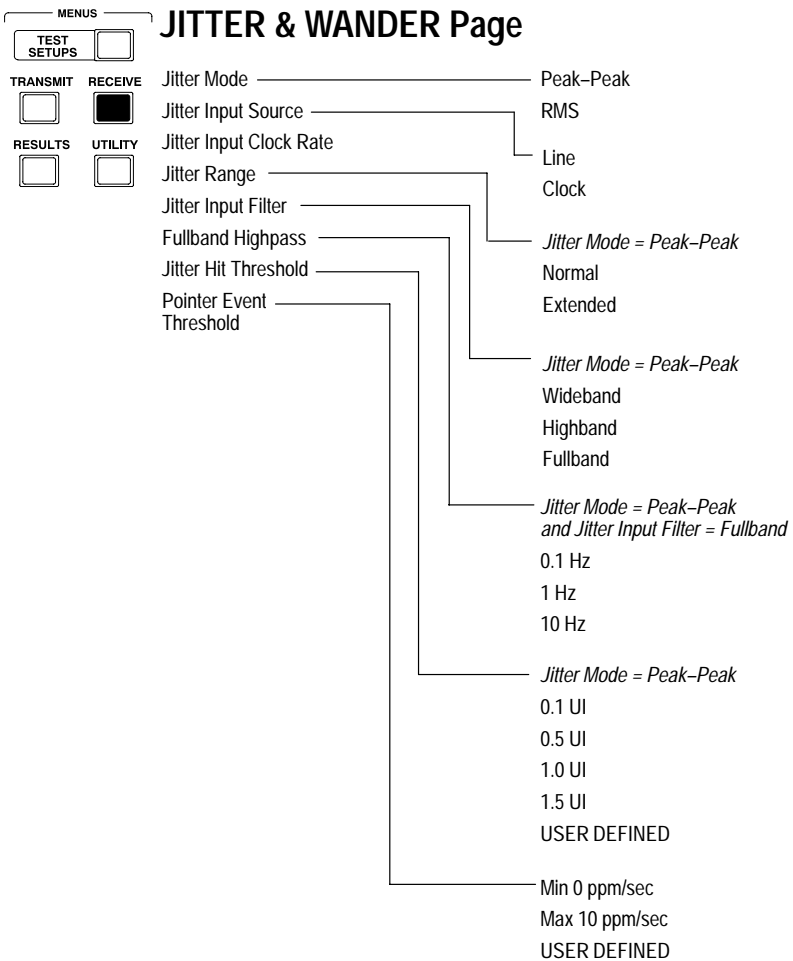
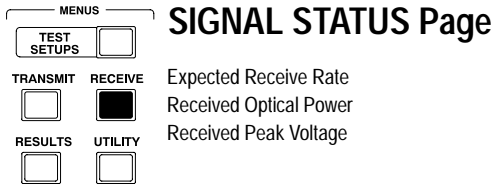
RECEIVE SETTINGS Page (2 of 3)

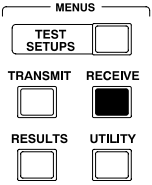




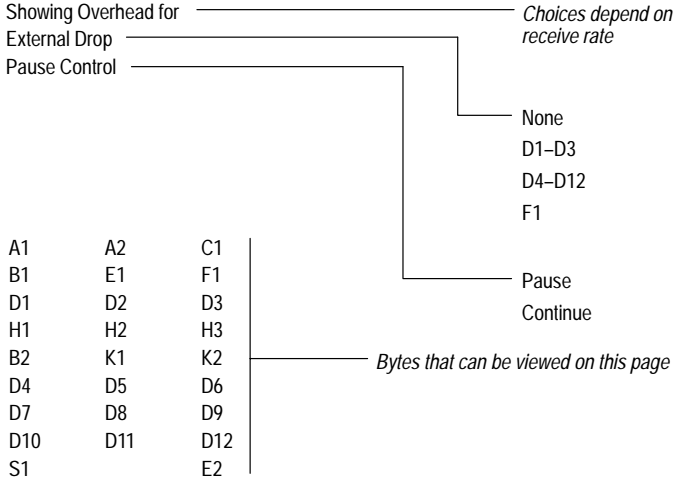
RECEIVE SETTINGS Page (3 of 3)

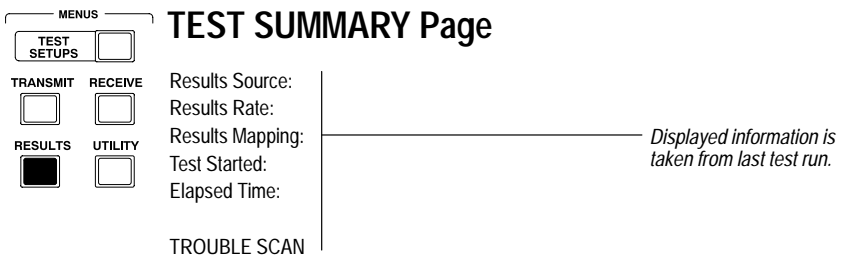
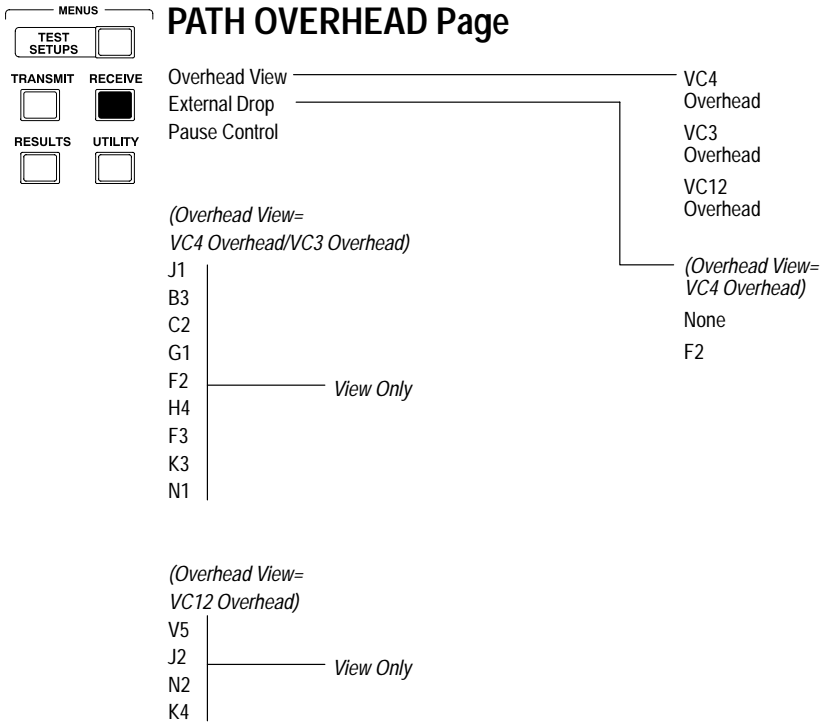
Receive Rate		
Signal Structure		
AU Under Test		
Mapping		
TU Under Test		
Payload		
Tributary Drop		
Test Pattern	(Mapping=STM-1E, STM-1, STM-4)	(Mapping=TU12, TU3, 140Mb/s)
Tx/Rx Settings	<ul style="list-style-type: none"> PRBS 2²³-1 PRBS 2²⁰-1 PRBS 2¹⁵-1 PRBS 2⁰⁹-1 All Ones All Zeros User Word Unknown 	<ul style="list-style-type: none"> PRBS 2²³-1 PRBS 2²⁰-1 PRBS 2¹⁵-1 1 in 8 All Ones All Zeros User Word 8 bit User Word 16 bit User Word 24 bit Unknown
	<ul style="list-style-type: none"> Independent Coupled Through Mode 	





SECTION OVERHEAD Page





MAIN RESULTS Page

MENUS

TEST SETUPS

TRANSMIT RECEIVE

RESULTS UTILITY

- Errors
- Failures
- Alarms
- Pointers
- Jitter
- Wander (Frequency)

ERROR ANALYSIS Page

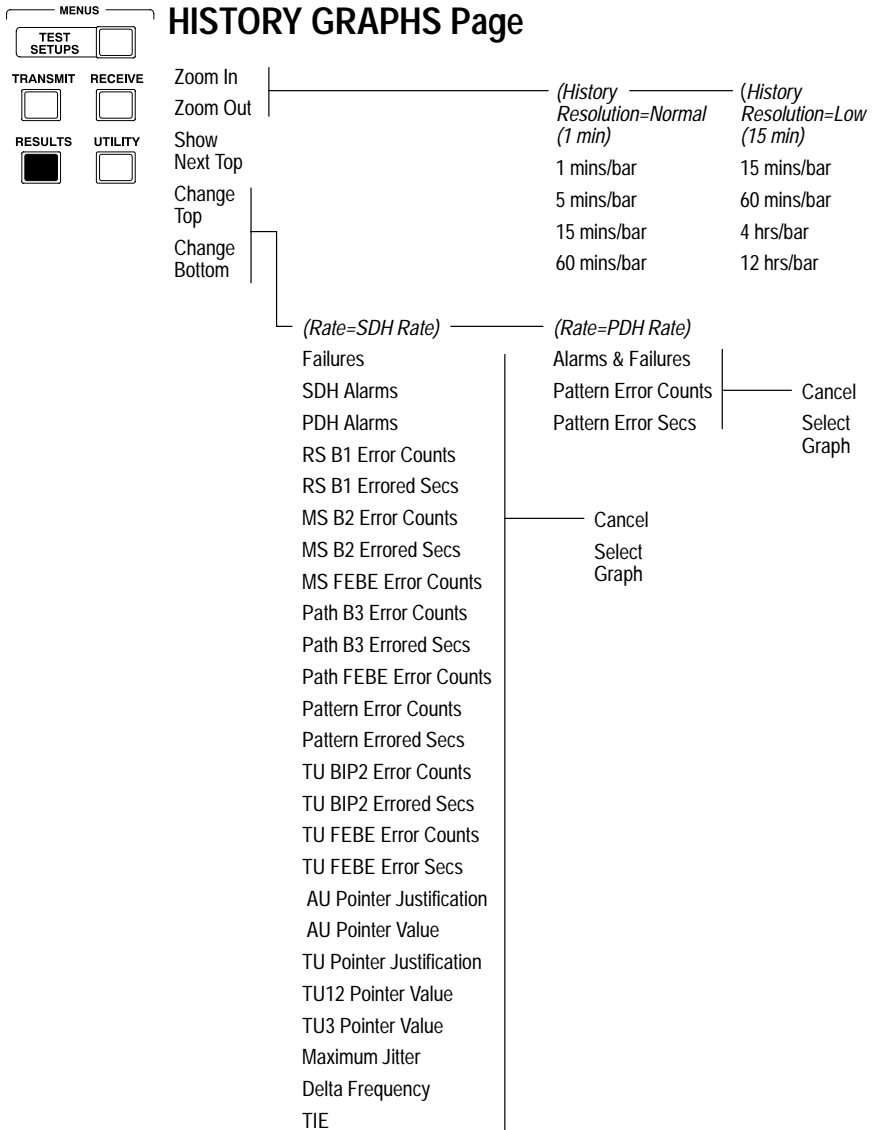
MENUS

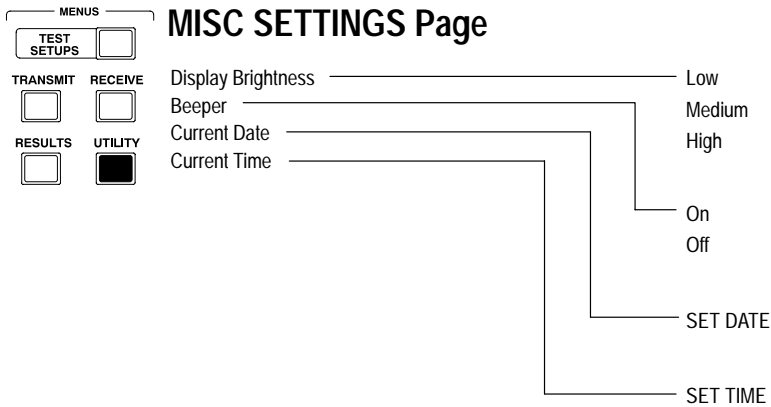
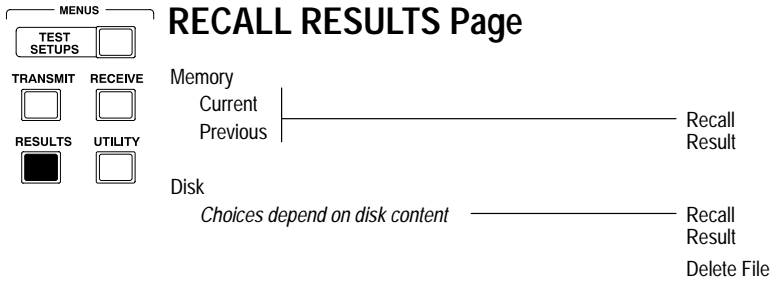
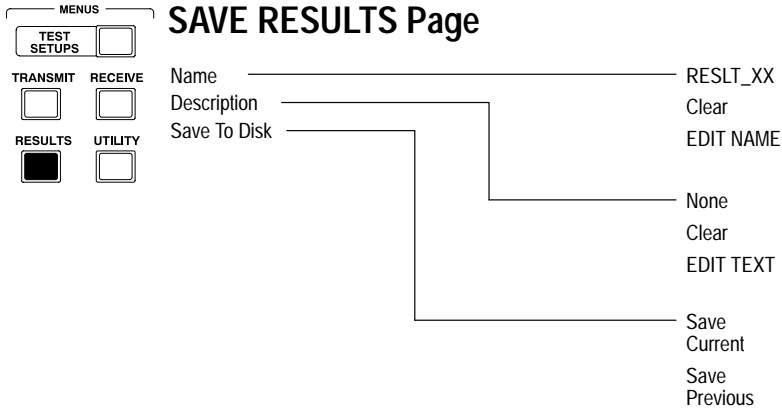
TEST SETUPS

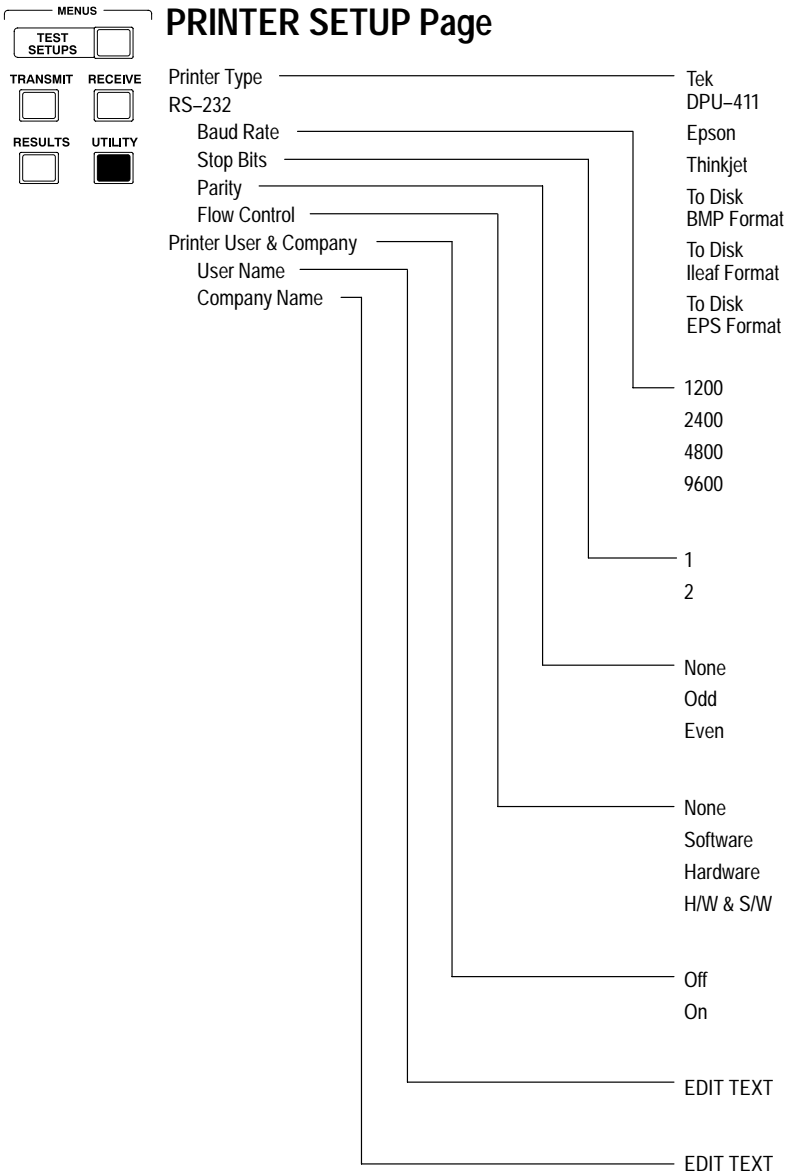
TRANSMIT RECEIVE

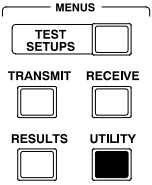
RESULTS UTILITY

- RS Analysis
- MS Analysis
- Path Analysis
- TU Analysis
- PDH M2100 Out of Service
- PDH M2100 In Service
- Pattern Bit

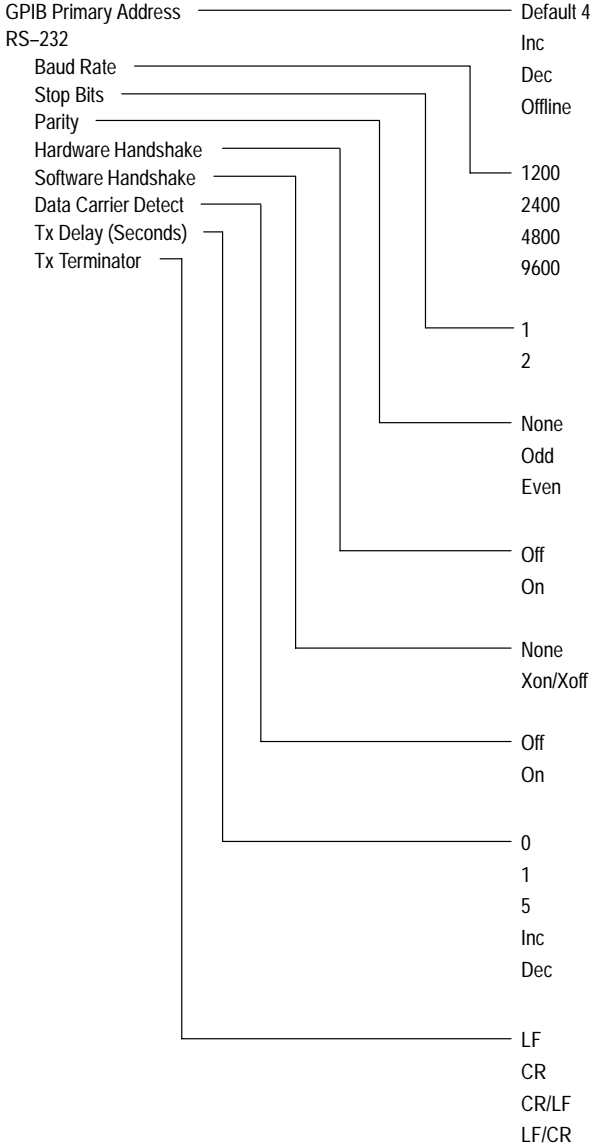


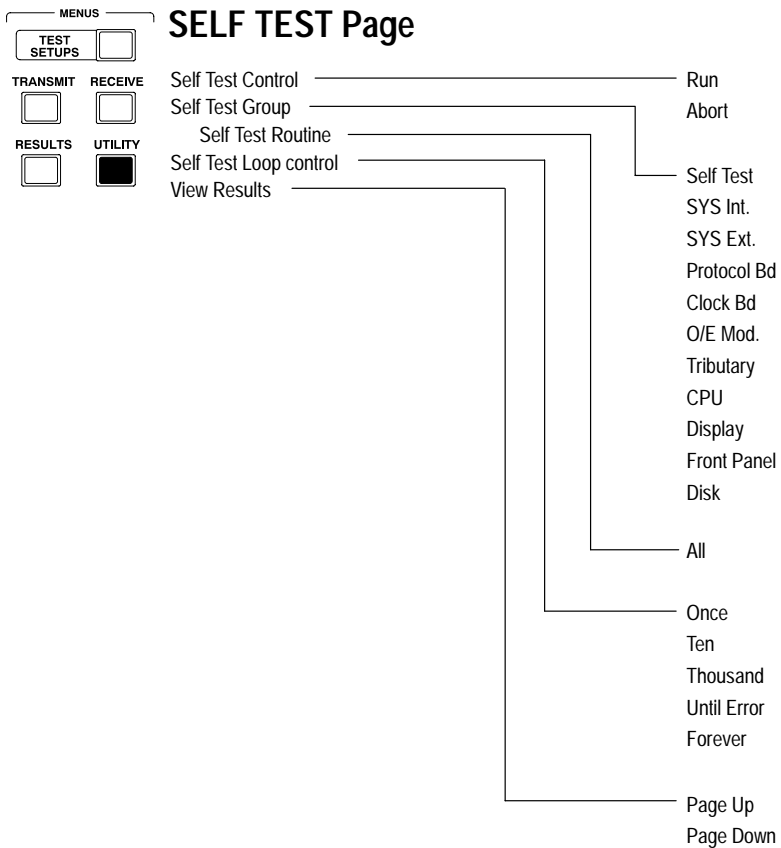
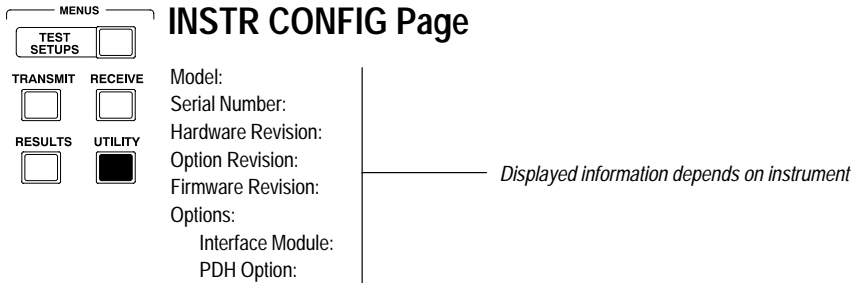


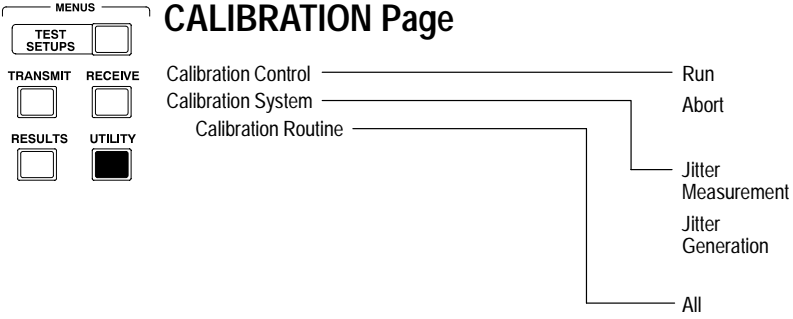




REMOTE CONTROL Page







Appendix B: Status and Error Messages

This appendix describes the status and error messages that appear on the CTS 750 display. Status messages are statements about actions the CTS 750 has completed. Status messages appear during normal operation. Error messages are statements about actions the CTS 750 was unable to complete. Error messages appear when the CTS 750 is unable to perform a requested action.

Status Messages

Autoscan complete. The CTS 750 has successfully completed the Autoscan sequence.

Burst pointer movement transmitted. The POINTER ACTION button was pressed with the Pointer Control set to Burst.

Disk root directory read. The CTS 750 has successfully read the disk directory.

Factory settings restored, non-volatile settings cleared. This message appears when the instrument is turned on after it was turned off during a state change. The instrument settings were corrupted during the shutdown and so the factory default settings were loaded at turn-on and all information stored in RAM was cleared.

File has been deleted. The CTS 750 has successfully deleted the selected file.

Hardcopy complete. The CTS 750 has successfully completed a printout.

Instrument factory reset complete. The recall of default factory settings, from the RECALL INSTRUMENT SETUPS page, was completed successfully.

Instrument returned to previous setup. This message appears if you select Cancel while an Autoscan is in progress.

Instrument setup for received signal. The CTS 750 has completed an Autoscan and has changed its settings to match those of the received signal.

Internal diagnostics completed. An instrument self test has been initiated and completed successfully.

No Setup file with '.SET' extension found. You selected the Disk action on the RECALL INSTRUMENT SETUPS page and no instrument setup files were found on the disk.

Previous power down instrument state restored. This message appears when the CTS 750 turns on. It means that the settings in effect when the CTS 750 was last turned off have been successfully restored.

Reading disk.... The CTS 750 is reading the disk directory.

Recall of instrument setup complete. This message confirms that the recall of an instrument setup was successfully completed.

Recall of measurement results/histories complete. The CTS 750 has successfully recalled the selected results from disk.

Recall of pass/fail test complete. The CTS 750 has successfully recalled the selected pass/fail test from disk.

Save of instrument setup complete. This message confirms that an instrument setup was successfully written to disk.

Save of measurement results/histories complete. The CTS 750 has successfully saved test results to disk.

Save of pass/fail test complete. The CTS 750 has successfully saved the pass/fail test to disk.

Single pointer movement transmitted. You pressed the POINTER ACTION button with the Pointer Control set to Single.

Test restarted due to change in receiver settings. You changed the receive settings while a test was running. When any settings are changed, a running test is restarted.

Transmit rate change complete. The CTS 750 has successfully changed transmit rate. This message can occur when an instrument setup file is recalled from disk.

Error Messages

Alarm generation invalid while in through mode. You attempted to transmit an alarm while the CTS 750 was in Through Mode. Transmit settings cannot be changed while the transmit rate is set to Through Mode.

Autoscan already in progress. You pressed the Autoscan front-panel button while an Autoscan was in progress.

Button disabled in edit mode. You pressed a front-panel button while the CTS 750 was in edit mode. You must exit edit mode before you can use the front-panel buttons.

Button disabled when dialog box is displayed. You pressed a front-panel button while a dialog box (for example, PRINT CONTROL) was displayed. Some front-panel buttons are disabled while a dialog box is displayed. Exit the dialog box to enable all the front-panel buttons.

Can not insert tributary error/alarm while adding external signal. An attempt was made to insert a PDH error or alarm while adding an external signal.

Could not create disk file. The CTS 750 was unable to create a file on the disk. Try saving the file on a different disk.

Could not delete file. You attempted to delete a file and a disk error occurred that prevented the CTS 750 from deleting the file. The file is probably corrupted, though you might be able to fix the problem with an MS-DOS disk recovery program.

Could not open disk file. The CTS 750 has attempted to read a file from disk and was unable to do so. The file is probably corrupted, though you might be able to recover the file using an MS-DOS file recovery program.

Could not read disk's root directory. The CTS 750 was unable to read the disk directory. The disk directory is probably corrupted, though you might be able to recover files from the disk with an MS-DOS disk recovery utility.

Diagnostics invalid while disk or autoscan busy. You tried to run Self Test diagnostics while accessing the disk or completing an Autoscan. Wait until disk access is complete or the Autoscan is complete before running a self test routine.

Disk file too large for memory buffer, truncated. You recalled a file and it was too large to load into memory. This can occur if an instrument settings file is recalled that has been edited on a PC and the edited file is larger than the original file.

Disk has changed, operation aborted. You attempted to recall a disk file and the disk has been changed since the directory was read. Reinsert the original disk and recall the file again.

Disk is busy. You tried to save a file to disk while the disk was active. Wait until the disk activity light turns off and save to disk again.

Disk is full. You tried to save a file to disk and there is not enough room on the disk for the file. Insert a disk with space available and save the file again.

Disk not present in drive. You tried to save a file to disk, but no disk is in the drive. Insert a formatted disk and save the file again.

Disk is write-protected, cannot write to file. You tried to save a file to a disk that is write-protected.

Disk operation failed. A disk error occurred while reading or writing to the disk. If you were trying to save a file to disk, save the file to a different disk. If you were trying to read a file from disk, you might be able to recover the file using an MS-DOS disk recovery program.

Error insertion disabled while in Through Mode. You pressed the INSERT ERROR button while the CTS 750 was in Through Mode. You cannot insert errors while the CTS 750 is in Through Mode because the transmit signal must match the received signal.

Errors in test recall, test not loaded. The CTS 750 encountered disk errors while recalling a pass/fail test and the operation was aborted. You might be able to recover the file with an MS-DOS disk recovery program.

Extra data in history file ignored. You recalled a history file that contains extra data. This can occur if the history file has been edited with a file editor and the edited file contains inappropriate information.

Failure generation invalid while in through mode. You attempted to transmit a failure while the CTS 750 was in Through Mode. Transmit settings cannot be changed while the transmit rate is set to Through Mode.

File name required. You entered a name for an instrument setup, a pass/fail test, or a results file and then you removed the name by selecting Clear. This message is just a reminder that a name must be

entered for the file to be saved to disk; that is, there is no default file name.

Filename not found. This message appears if the disk was swapped after the directory was read and you attempted to recall a file. Insert the original disk and recall the file again.

File not read. A disk error occurred while reading a file. The file is probably corrupted, though you might be able to recover the file with an MS-DOS disk recovery program.

Frequency offset disabled with current transmit clock. You attempted to change from Pointer/Timing Mode to Frequency Offset while the transmit clock was set to External. Frequency Offset can be selected only when the transmit clock is set to Internal or Recovered.

Hardcopy already in progress. You tried to start a printout while a printout was already in progress. Wait until the current printout completes and then select Print again.

Instrument unable to drop signal while transmitting current rate. You attempted to turn on tributary drop while the transmit rate was set to a PDH rate. Because the PDH transmit connector and tributary drop connector are the same connector, you cannot transmit a PDH signal and drop a PDH signal at the same time.

Internal diagnostics failed. A malfunction has occurred that requires servicing. Contact a Tektronix representative for assistance.

Internal Error N: Contact Tektronix Service. A hardware malfunction has occurred that requires servicing. Contact a Tektronix representative for assistance.

Internal format of file incorrect; file not read. You recalled a file that does not contain data in the correct format. This occurs when a file is recalled that happens to have the same extension as the type of CTS 750 file being recalled, but it is not a CTS 750 file.

Invalid history data format in file. You recalled a file that does not contain data in the correct format. This occurs when a file is recalled that happens to have the correct extension for a history file (and thus shows up on the RECALL RESULTS page) even though it is not a CTS 750 history file.

Loss of added signal. You have selected an externally generated tributary signal, but no valid signal is present.

Loss of external clock. You have selected an external clock source that does not have a valid clock source attached.

Measurements are running, recall not allowed. You tried to recall instrument setups from memory or disk while a test is running. Wait until the test is completed and then recall the file.

Measurements are running, results cannot be saved. You attempted to save results to disk while a test was running. Wait until the test is completed and then save the results to disk.

No Result file with '.RES' extension found. This message appears when you select Disk (on the RECALL RESULTS page) but the disk does not contain any results files.

Not available without tributary option. The requested action requires that the Add/Drop/Test tributary option be installed.

No Test file with '.TST' extension found. This message appears when you select Disk (on the RECALL PASS/FAIL TESTS page) but the disk does not contain any pass/fail test files.

Numeric value greater than maximum limit. You attempted to enter a numeric value larger than the maximum value.

Numeric value less than minimum limit. You attempted to enter a numeric value smaller than the minimum value.

Operation invalid while a test is running. You tried to perform an action that cannot be completed while a test is running. For example, this message would appear if you attempted to recall instrument settings while a test is running.

Optical power has been overloaded. You have connected an optical signal that has saturated the CTS 750 optical receiver.

Pointer burst active, request ignored. You pressed the POINTER ACTION button while a pointer burst movement was occurring.

Pointer movements disabled while in Through Mode. You pressed the POINTER ACTION button while the CTS 750 was in Through Mode. Pointer movements are not allowed while the CTS 750 is in Through Mode because the transmit signal must match the received signal.

Root directory is full. You tried to save a file to disk but the directory shows that the disk is full. Insert a disk with space available and save the file again.

Through Mode invalid while receiving a tributary signal. You attempted to change the transmit rate to Through Mode while a test was running at a tributary rate. Any change in settings would invalidate the test, so no change was made.

Unexpected End Of File, file not read. You tried to recall an instrument setup file, a pass/fail file, or a history file and a disk error occurred. The file is corrupted and cannot be recovered.

Warning: No received signal currently identified. You started a test while there was no received signal.

Write Failure on Disk. The CTS 750 was unable to write to the disk. Try saving the file on a different disk.

Appendix C: Default Factory Settings

Table C-1 lists the instrument settings after Default Factory Settings have been recalled.

Table C-1: Default Factory Settings

Parameter	Default Value
Transmit Rate	STM-1E
Transmit Clock	Internal
Transmit Level	0 dB
AU Under Test	1
Mapping	Bulk Fill No Mapping (Equipped)
Transmit Test Pattern	PRBS 2 ²³ -1
Transmit Overhead Path Trace	" " (64 null characters)
Transmit Overhead External Add	None
Transmit Error Rate	None
Transmit Error Type	RS B1 BIP Error
Transmit Alarm	None
Transmit Failure	None
Transmit Pointer/Timing Mode	Pointer Movements
Transmit Pointer Type	AU
Transmit Pointer Control	Single
Transmit Pointer Value	522
Transmit Pointer Set with New Data Flag	Yes
APS Mode	RING
Receive Rate	STM-1E
Receive Level	Cross Connect

Table C-1: Default Factory Settings (Cont.)

Parameter	Default Value
Receive AU Under Test	1
Receive Mapping	No Mapping (Equipped)
Receive Tributary Drop	Off
Receive Test Pattern	PRBS 2 ²³ -1
Test Duration	Continuous
Receive Path Overhead External Drop	None
Beeper	Off
Display Brightness	Medium
Printer Type	TEK DPU-411
Print User & Company	Off

Appendix D: Specifications

This appendix contains the CTS 750 specifications. All specifications are guaranteed unless labeled “typical.” Typical specifications are provided for your convenience but are not guaranteed.

Table D-1: Standard CTS 750 Specifications

Characteristic	Description
Generator Output	
Electrical Output	
Data Rates	STM-0: 51.84 Mb/s STM-1: 155.52 Mb/s
Data Formats	STM-0E: AMI, B3ZS STM-1E: CMI
Signal Level at Transmit Output	STM-0E Hi: ± 1.0 Vpk $\pm 10\%$ into 75 Ω STM-0E: equivalent of -6 dB of cable loss (-12.7 dB \sqrt{f} characteristic cable) STM-1E Hi: ± 0.5 Vpk $\pm 10\%$ into 75 Ω STM-1E: equivalent of -6 dB of cable loss (-12.7 dB \sqrt{f} characteristic cable)
Pulse Shape at Transmit Output	Meets ITU-T G.703 Eye Pattern Masks
Return Loss	>15 dB
Connector	Unbalanced BNC, 75 Ω to ground
Optical Output	
Data Rates	STM-0: 51.84 Mb/s STM-1: 155.52 Mb/s STM-4: 622.08 Mb/s

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Optical Module Options	Opt. 03, 1310 nm, IR, STM-0/1 Opt. 04, 1310 nm, IR, STM-0/1/4 Opt. 05, 1550 nm, LR, STM-0/1/4 Opt. 06, 1310/1550 nm, STM-0/1/4
Signal Level & Wavelength	-10 dBm, typical 1310 nm (Opt. 03, 04, 06) 0 dBm, typical, 1550 nm (Opt. 05, 06)
Pulse Shape	Meets ITU-T G.957 Eye Pattern Masks
Wavelength	1308 nm, typical (Opt. 03, 04, 06) 1550 nm, typical (Opt. 05, 06)
Spectral Width	≤ 4 nm, 1310 nm (Opt. 03, 04, 06) ≤ 1 nm, 1550 nm (Opt. 05, 06)
Laser Classification	Class 1 laser, complies with 21 CFR 1040.10 and 1040.11, complies with IEC 825, Section 9.4
Connectors	FC-PC Standard: Optical Connector kit with ST, SC, and DIN 47256 included
Signal Structure	
Standards Compliance	Meets the requirements of ITU-T707, 708, 709
Payload Channel (AU)	One active STM-1 in STM-4 (The other 3 channels are unequipped) One active STM-0 in STM-1 Selection (The other 2 channels are unequipped) One active STM-0 in STM-4 (The other 11 channels are unequipped)
Unequipped Payload	C2 byte is set to 00
Internal Pattern Generator	
Patterns Bulk Fill in a selected AU channel (AU3 or AU4)	PRBS: 2 ⁹ -1, 2 ¹⁵ -1, 2 ²⁰ -1, 2 ²³ -1; All 1s, All 0s, 8-bit programmable word
Errors Single or Continuous	RS BIP (B1) MS BIP (B2) Path BIP (B3), Path FEBE Payload pattern bit

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Error Rate Range	1×10^{-3} to 1×10^{-10} with 0.1 resolution ¹
Alarms	MS AIS, MS FERF Path AIS, Path FERF
Failures	LOS, LOF, LOP
Transmitter Clock	
Internal Clock	
Accuracy	± 4.6 ppm, for instrument calibrated within 24 months
External Clock Reference	
Rates	2.048 Mb/s ± 40 ppm 2.048 MHz ± 50 ppm
Input	Unbalanced, 75 Ω $\pm 5\%$, BNC connector
Recovered Clock	
Loop timing	Clock is recovered from received signal
Transmit Line Frequency Offset	
Frequency offset rate	± 100 ppm of nominal line rate

¹ Depends on error type.

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description																																																											
Jitter Generator (requires Option 14)																																																												
Jittered Line Output	Sinusoidal modulation of transmit clock frequency, applicable to any SDH or PDH data rate. Changes to jitter amplitude or frequency are phase continuous.																																																											
Modulation Range	<p>Modulation is selectable up to the following limits, which depend on the rate:</p> <p>Jitter/Wander Amplitude</p> <table border="1"> <thead> <tr> <th>Amplitude Scale in UI_{p-p}</th> <th>A_0</th> <th>A_1</th> <th>A_2</th> <th>A_3</th> </tr> </thead> <tbody> <tr> <td>All rates</td> <td>100,000</td> <td>10</td> <td>3</td> <td>1</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Frequency Scale in Hz</th> <th>f_0</th> <th>f_1</th> <th>f_2</th> <th>f_3</th> <th>f_4</th> <th>f_5</th> </tr> </thead> <tbody> <tr> <td>2 Mb/s rate</td> <td>12 μ</td> <td>30 m</td> <td>300</td> <td>9 k</td> <td>33 k</td> <td>100 k</td> </tr> <tr> <td>34 Mb/s rate</td> <td>12 μ</td> <td>30 m</td> <td>300</td> <td>10 k</td> <td>270 k</td> <td>800 k</td> </tr> <tr> <td>140 Mb/s rate</td> <td>12 μ</td> <td>30 m</td> <td>300</td> <td>20 k</td> <td>1.2 M</td> <td>3.5 M</td> </tr> <tr> <td>52 Mb/s rate</td> <td>12 μ</td> <td>30 m</td> <td>300</td> <td>10 k</td> <td>130 k</td> <td>400 k</td> </tr> <tr> <td>155 Mb/s rate</td> <td>12 μ</td> <td>30 m</td> <td>300</td> <td>35 k</td> <td>430 k</td> <td>1.3 M</td> </tr> <tr> <td>622 Mb/s rate</td> <td>12 μ</td> <td>30 m</td> <td>300</td> <td>125 k</td> <td>1.7 M</td> <td>5 M</td> </tr> </tbody> </table>	Amplitude Scale in UI_{p-p}	A_0	A_1	A_2	A_3	All rates	100,000	10	3	1	Frequency Scale in Hz	f_0	f_1	f_2	f_3	f_4	f_5	2 Mb/s rate	12 μ	30 m	300	9 k	33 k	100 k	34 Mb/s rate	12 μ	30 m	300	10 k	270 k	800 k	140 Mb/s rate	12 μ	30 m	300	20 k	1.2 M	3.5 M	52 Mb/s rate	12 μ	30 m	300	10 k	130 k	400 k	155 Mb/s rate	12 μ	30 m	300	35 k	430 k	1.3 M	622 Mb/s rate	12 μ	30 m	300	125 k	1.7 M	5 M
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Amplitude Accuracy, typical	$\pm 5\% \pm 0.06 UI$, at 622 Mb/s rate $\pm 5\% \pm 0.03 UI$, for all other rates																																																											
Frequency Accuracy	$\pm 1\%$, from 12 μ Hz to 20 Hz ± 5 ppm, from 20 Hz to f_{max}																																																											

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Jittered Clock Output	Operates in addition to the jittered line output. Compliant with G.703 2048 kHz synchronization interface specifications.
Output Level, typical	0.8 V _{p-p} output (for all rates) is ECL compatible when terminated with 75 Ω 2 MHz G.703 output is compliant with G.703 2048 kHz synchronization interface specifications
Nominal Data Rates	2 MHz, 34 MHz, 140 MHz, 52 MHz, 155 MHz, or 622 MHz. Same as transmit line or can be set independently.
Connector	Rear-panel, unbalanced 75 Ω BNC
Jitter Clock Input	Input to measure jitter on a clock signal.
Nominal Data Rates	Any supported SDH or PDH rate. Rate is independent of the receive line rate.
Frequency Tolerance	Nominal rate ±100 ppm
Data Format	RZ
Sensitivity, typical	0.4 V _{p-p}
Maximum Input Amplitude	1.5 V _{p-p}
Connector	Rear-panel, unbalanced 75 Ω BNC
Analog Jitter Output	Demodulated jitter from the receiver. The output is filtered by any measurement filters selected.
Connector	Rear-panel 50 Ω BNC
Sensitivity, typical	Normal measurement range: 125 mV/UI Extended measurement range: 3.5 mV/UI
Output Level, typical	± 1V, centered at 0 V ± 100 mV

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Receive Input	
Electrical Input	
Data Rates	STM-0: 51.84 Mb/s \pm 100 ppm STM-1: 155.52 Mb/s \pm 100 ppm
Data Formats	STM-0E: AMI, B3ZS coded STM-1E: CMI
Signal Sensitivity/Equalization	STM-0E Hi: 0.5 Vpk min to 1.2 Vpk max STM-0E -6 dB ² : 0.25 Vpk min to 0.6 Vpk max STM-0E Lo ³ : 0.125 Vpk min to 0.35 Vpk max STM-0E Monitor: 20 dB of flat loss below -6 dB STM-1E Hi: 0.35 Vpk min to 0.6 Vpk max STM-1E -6 dB ⁴ : 0.35 Vpk min to 0.6 Vpk max STM-1E Lo ⁵ : 0.07 Vpk min to 0.3 Vpk max STM-1E Monitor: 26 dB of flat loss below Hi
Signal Level Display	Readout for: Electrical signal level in mV
Return Loss	>15 dB
Connector	Unbalanced BNC, 75 Ω to ground

² -6 dB cable loss @ 25 MHz (-12.7 dB \sqrt{f} characteristic cable)

³ -12 dB cable loss @ 25 MHz (-12.7 dB \sqrt{f} characteristic cable)

⁴ -6 dB cable loss @ 78 MHz (-12.7 dB \sqrt{f} characteristic cable)

⁵ -12 dB cable loss @ 78 MHz (-12.7 dB \sqrt{f} characteristic cable)

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Optical Input	
Data Rates	STM-0: 51.84 Mb/s (± 100 ppm) STM-1: 155.52 Mb/s (± 100 ppm) STM-4: 622.08 Mb/s (± 100 ppm)
Maximum Input Power	-7 dBm: Opt. 05 and 06 include a 10 dB attenuator
Operating Wavelength	1310 nm and 1550 nm: 1100 nm to 1570 nm operating range
Signal Sensitivity	-28 dBm for BER $\leq 10^{-10}$
Optical Power Meter Accuracy	2 dBm, typical: For input power in a range of -30 dBm to -6 dBm
Connectors	FC-PC standard: Optical connector kit with ST, SC, and DIN 27256 included
Through Mode	Monitors a selected channel and passes the signal through unchanged
Transmit and Receive Functional Specifications	
Section Overhead	
Access	Set overhead bytes to any value from binary 00000000 to 11111111: A1, A2, C1, E1, F1, D1-D3, K1, K2, D4-D12, S1, Z2, M2, E2 View all Section Overhead bytes
Add/Drop	Insert data from the Overhead Add/Drop connector into the Section DCC, Line DCC or F1 user byte. Drops data from the Section DCC, Line DCC, or F1 user byte out to the Overhead Add/Drop connector.
K1 and K2 (APS)	Set the APS Bytes, K1 and K2, to any code defined in ANSI T1.105A Selectable by text description for all Span and Ring messages

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Path Overhead	
Access	Set Path Overhead bytes to any value from binary 00000000 to 11111111: C2, F2, Z3, Z4, and Z5 View all Path Overhead bytes
Add/Drop	Insert data from the Overhead Add/Drop connector into the F2 user byte Drop data from the F2 user byte out to the Overhead Add/Drop connector
Path Trace Byte J1	A user-defined string can be transmitted in 64-byte sequence, or set to 00000000
Pointer Movement	
Single	Single pointer justification (increment or decrement)
Burst	Bursts of two to eight pointer justifications spaced four frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions
Continuous	Pointer justifications occur continuously at a predetermined rate in an incrementing, decrementing, or alternating direction. Rate between movements: 2 ms to 10 s, with a resolution of 1 ms.
Set to Value	Set to a new location with or without the NDF being set. Range is 0 to 1023 (783 – 1023 are illegal locations).

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Pointer Test Sequences	
AU Pointer sequences available	G.783(a) Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing G.783(d) Double Alternating G.783(e) Single G.783(f) Burst G.783(g) Periodic 87-3 G.783(g) Periodic 87-3 With Add G.783(g) Periodic 87-3 With Cancel G.783(h) Periodic G.783(h) Periodic with Add G.783(h) Periodic with Cancel Phase Transient Pointer Adjustment Burst
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test
Cool Down Period	On or Off This will last at least 60 seconds
Measurements	
Error Count, Error Rate, and Errored Seconds for:	B1, B2, B3, Payload, MS-FEBE, Path-FEBE
Alarm and Failure Seconds for	LOS, OOF, LOF, AU LOP, MIS AIS & FERF, Path AIS & FERF, Loss of Power, Loss of Pattern Sync
AU Pointer Measurements	Seconds: Count: LOP Illegal pointers Illegal pointers Positive justifications NDF Negative justifications

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
G.826 Analysis	
RS B1 Seconds and ratio	Error Blocks, ES, SES, UAS Background Block Errors
MS B2 & FEBE Seconds and ratio	Error Blocks, ES, SES, UAS Background Block Errors
Path B3 & FEBE Seconds and ratio	Error Blocks, ES, SES, UAS Background Block Errors
G.821 Analysis	
Pattern Bit Seconds and % of total time	Error-Count, ES, SES, UAS, EFS, DM
Section B1 Seconds and ratio	Error Blocks, ES, SES, UAS Background Block Errors
RS B1 Seconds and ratio	Error Blocks, ES, SES, UAS Background Block Errors
MS B2 & FEBE Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS FEBE-Count, FEBE-ES, FEBE-UAS, FEBE-EFS
Path B3 & FEBE Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS FEBE-Count, FEBE-ES, FEBE-UAS, FEBE-EFS
Pattern Bit Seconds and % of total time	Error-Count, ES, ES-A, ES-B, SES, UAS, EFS

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description																
Jitter and Wander Analysis																	
Jitter Measurements	<p>Peak-to-peak Jitter, Positive Peak Jitter, Negative Peak Jitter, Jitter Hit Seconds, Jitter Out-of-range Seconds</p> <p>Peak-to-peak or RMS jitter measurement of the Clock or Line input. Exceeds the requirements of ITU-T G.783, G.823, G.825, G.958, and O.171.</p>																
Video Related Jitter Measurements	Jitter Pointer Event Seconds, Current Frequency Drift Rate, Maximum Frequency Drift Rate																
Measurement Filter Response	<p>Measurement filters meet the requirements of ITU-T G.783, G.823, G.825, G.958, and O.171.</p> <p>Lower cutoff (high pass) is first order (-20 dB/decade). Upper cutoff (low pass) is third order (-60 dB/decade) Butterworth.</p> <p>Cutoff frequencies are $-3 \text{ dB} \pm 1 \text{ dB}$.</p>																
Wideband Filter (-3 dB)	<table> <tbody> <tr> <td>2 Mb/s:</td> <td>20 Hz to 100 kHz</td> </tr> <tr> <td>34 Mb/s:</td> <td>100 Hz to 800 kHz</td> </tr> <tr> <td>140 Mb/s:</td> <td>200 Hz to 3.5 MHz</td> </tr> <tr> <td>STM-0E:</td> <td>100 Hz to 400 kHz</td> </tr> <tr> <td>STM-1E:</td> <td>500 Hz to 1.3 MHz</td> </tr> <tr> <td>STM-1:</td> <td>500 Hz to 1.3 MHz</td> </tr> <tr> <td>STM-4:</td> <td>1 kHz to 5 MHz</td> </tr> </tbody> </table>	2 Mb/s:	20 Hz to 100 kHz	34 Mb/s:	100 Hz to 800 kHz	140 Mb/s:	200 Hz to 3.5 MHz	STM-0E:	100 Hz to 400 kHz	STM-1E:	500 Hz to 1.3 MHz	STM-1:	500 Hz to 1.3 MHz	STM-4:	1 kHz to 5 MHz		
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Highband Filter (-3 dB)	<table> <tbody> <tr> <td>2 Mb/s (low Q):</td> <td>18 kHz to 100 kHz</td> </tr> <tr> <td>2 Mb/s (high Q):</td> <td>700 Hz to 100 kHz</td> </tr> <tr> <td>34 Mb/s:</td> <td>10 kHz to 800 kHz</td> </tr> <tr> <td>140 Mb/s:</td> <td>10 kHz to 3.5 MHz</td> </tr> <tr> <td>STM-0E:</td> <td>20 kHz to 400 kHz</td> </tr> <tr> <td>STM-1E:</td> <td>65 kHz to 1.3 MHz</td> </tr> <tr> <td>STM-1:</td> <td>65 kHz to 1.3 MHz</td> </tr> <tr> <td>STM-4:</td> <td>250 kHz to 5 MHz</td> </tr> </tbody> </table>	2 Mb/s (low Q):	18 kHz to 100 kHz	2 Mb/s (high Q):	700 Hz to 100 kHz	34 Mb/s:	10 kHz to 800 kHz	140 Mb/s:	10 kHz to 3.5 MHz	STM-0E:	20 kHz to 400 kHz	STM-1E:	65 kHz to 1.3 MHz	STM-1:	65 kHz to 1.3 MHz	STM-4:	250 kHz to 5 MHz
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STM-1:	65 kHz to 1.3 MHz																
STM-4:	250 kHz to 5 MHz																

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Fullband Filter (-3 dB)	2 Mb/s: 10 Hz* to 100 kHz 34 Mb/s: 10 Hz* to 800 kHz 140 Mb/s: 10 Hz* to 3.5 MHz STM-0E: 10 Hz* to 400 kHz STM-1E: 10 Hz* to 1.3 MHz STM-1: 10 Hz* to 1.3 MHz STM-4: 10 Hz* to 5 MHz * Lower -3dB frequency is user selectable to 0.1 Hz, 1 Hz, or 10 Hz.
RMS Filter (-3 dB)	2 Mb/s: 12 kHz to 100 kHz 34 Mb/s: 12 kHz to 800 kHz 140 Mb/s: 12 kHz to 3.5 MHz STM-0E: 12 kHz to 400 kHz STM-1E: 12 kHz to 1.3 MHz STM-1: 12 kHz to 1.3 MHz STM-4: 12 kHz to 5 MHz

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Normal Jitter Measurement Resolution and Range	Resolution: 0.005 UI Range: see graph
	Jitter/Wander Amplitude
	<p style="text-align: center;">Jitter/Wander Frequency</p>
Amplitude Scale in UI_{p-p} All rates	A_0 6 A_1 0.5 *
Frequency Scale in Hz	
2 Mb/s rate	f_0 0.1 f_1 5.3 k f_2 64 k f_3 100 k
34 Mb/s rate	0.1 13.3 k 160 k 800 k
140 Mb/s rate	0.1 26.7 k 320 k 3.5 M
52 Mb/s rate	0.1 26.7 k 320 k 400 k
155 Mb/s rate	0.1 26.7 k 320 k 1.3 M
622 Mb/s rate	0.1 68 k 800 k 5 M

* A_1 amplitude is $0.3 UI_{p-p}$ for 2 Mb/s rate with PRBS pattern.

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description																																										
Extended Jitter Measurement Resolution and Range	Resolution: 0.01 UI Range: see graph																																										
	<p>Jitter/Wander Amplitude</p> <p style="text-align: center;">Jitter/Wander Frequency</p>																																										
Amplitude Scale in UI_{p-p} All rates	<table> <tr> <td>A_0</td> <td>A_1</td> <td>A_2</td> </tr> <tr> <td>200</td> <td>16</td> <td>0.5 *</td> </tr> </table>	A_0	A_1	A_2	200	16	0.5 *																																				
A_0	A_1	A_2																																									
200	16	0.5 *																																									
Frequency Scale in Hz	<p>* A_1 amplitude is 0.3 UI_{p-p} for 2 Mb/s rate with PRBS pattern.</p> <table> <tr> <td>f_0</td> <td>f_1</td> <td>f_2</td> <td>f_3</td> <td>f_4</td> <td>f_5</td> </tr> <tr> <td>0.1</td> <td>30</td> <td>375</td> <td>2 k</td> <td>64 k</td> <td>100 k</td> </tr> <tr> <td>0.1</td> <td>30</td> <td>375</td> <td>5 k</td> <td>160 k</td> <td>800 M</td> </tr> <tr> <td>0.1</td> <td>30</td> <td>375</td> <td>10 k</td> <td>320 k</td> <td>3.5 M</td> </tr> <tr> <td>0.1</td> <td>30</td> <td>375</td> <td>10 k</td> <td>320 k</td> <td>400 k</td> </tr> <tr> <td>0.1</td> <td>30</td> <td>375</td> <td>10 k</td> <td>320 k</td> <td>1.3 M</td> </tr> <tr> <td>0.1</td> <td>30</td> <td>375</td> <td>25 k</td> <td>800 k</td> <td>5 M</td> </tr> </table>	f_0	f_1	f_2	f_3	f_4	f_5	0.1	30	375	2 k	64 k	100 k	0.1	30	375	5 k	160 k	800 M	0.1	30	375	10 k	320 k	3.5 M	0.1	30	375	10 k	320 k	400 k	0.1	30	375	10 k	320 k	1.3 M	0.1	30	375	25 k	800 k	5 M
f_0	f_1	f_2	f_3	f_4	f_5																																						
0.1	30	375	2 k	64 k	100 k																																						
0.1	30	375	5 k	160 k	800 M																																						
0.1	30	375	10 k	320 k	3.5 M																																						
0.1	30	375	10 k	320 k	400 k																																						
0.1	30	375	10 k	320 k	1.3 M																																						
0.1	30	375	25 k	800 k	5 M																																						
2 Mb/s rate	0.1 30 375 2 k 64 k 100 k																																										
34 Mb/s rate	0.1 30 375 5 k 160 k 800 M																																										
140 Mb/s rate	0.1 30 375 10 k 320 k 3.5 M																																										
52 Mb/s rate	0.1 30 375 10 k 320 k 400 k																																										
155 Mb/s rate	0.1 30 375 10 k 320 k 1.3 M																																										
622 Mb/s rate	0.1 30 375 25 k 800 k 5 M																																										

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description				
Intrinsic Noise with Jitterless Clock, typical	For peak-to-peak measurement, in UI_{p-p} :				
		<i>Highband</i>	<i>Wideband</i>	<i>Fullband (10 Hz)</i>	
	2 Mb/s rate	≤0.02	≤0.03	≤0.1	
	34 Mb/s rate	≤0.02	≤0.03	≤0.1	
	140 Mb/s rate	≤0.02	≤0.03	≤0.1	
	52 Mb/s rate	≤0.02	≤0.03	≤0.1	
	155 Mb/s rate	≤0.02	≤0.03	≤0.1	
622 Mb/s rate	≤0.05	≤0.06	≤0.1		
	For RMS measurement, ≤0.01 UI_{RMS} at all rates				
Intrinsic Noise with Jitterless PRBS Data Signal, typical	For peak-to-peak measurement, in UI_{p-p} :				
		<i>Highband</i>	<i>Wideband</i>	<i>Fullband (10 Hz)</i>	<i>Fullband (1 Hz)</i>
	2 Mb/s rate	≤0.035	≤0.035	≤0.1	≤0.2
	34 Mb/s rate	≤0.035	≤0.035	≤0.1	≤0.2
	140 Mb/s rate	≤0.035	≤0.035	≤0.1	≤0.2
	52 Mb/s rate	≤0.035	≤0.035	≤0.1	≤0.2
	155 Mb/s rate	≤0.035	≤0.035	≤0.1	≤0.2
622 Mb/s rate	≤0.06	≤0.07	≤0.25	≤0.75	
	For RMS measurement, ≤0.01 UI_{RMS} at all rates				

Table D-1: Standard CTS 750 Specifications

Characteristic	Description
Jitter Measurement Accuracy	<p>Jitter measurement accuracy is a function of the jitter frequency, intrinsic noise in the CTS 750, the filter chosen, and measurement resolution. Measured jitter uncertainty is expressed by the equation below, where f_{LC} is the lower cutoff frequency and f_{UC} is the upper cutoff frequency:</p> <p><i>Measured jitter (f) = Jitter input (f) ×</i></p> $\left[\sqrt{\frac{\left(\frac{f}{f_{LC}}\right)^2}{1 + \left(\frac{f}{f_{LC}}\right)^2}} \times \sqrt{\frac{1}{1 + \left(\frac{f}{f_{UC}}\right)^6}} \pm 5\% \right]$ <p><i>± Intrinsic noise ± Resolution</i></p>
Additional Corrections to Jitter Measurement Accuracy	2 Mb/s Extended Range, add ±5%
Wander Measurements	Estimated Bit Slips, Estimated Frame Slips, Peak-to-peak Wander, TIE (Time Interval Error), Current Frequency, Maximum Frequency, Minimum Frequency
Peak-to-peak Measurement	Range: 1,000,000 ns Noise: ± 5ns Accuracy: 1% ± noise Bandwidth: 0 Hz to 10 Hz
TIE Measurement	Range: 500,000 ns Noise: ± 5ns Accuracy: 1% ± noise Bandwidth: 0 Hz to 10 Hz
Frequency Measurement	Resolution: 1 Hz absolute (0.01 ppm change) Accuracy: ±0.1 ppm (with respect to source clock)
Frequency Drift Measurement	Range: 100 ppm/s Resolution: 0.001 ppm/s Accuracy: 1% ± 0.01 ppm/s Bandwidth: 0 Hz to 0.5 Hz

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
LEDs	
Status Indicators	LOS, LOF, LOP, MS AIS, MS FERF, Path AIS, Path FERF, Errors, Pointer Adjust, Signal Present, Pattern Lock
Histograms	
Error Count, Bit Error Rate and Errored Seconds	B1, B2, B3, MS-FEBE, Path-FEBE, Pattern Bit
Alarms & Failures On/Off	LOS, OOF, LOF, AU-LOP, MIS-AIS, AU-FERF, Path-AIS, Path-FERF, Pattern Loss, Loss of Power
Pointers	AU Pointer Value, Pointer Justification
Measurement Utilities	
Measurement Control	Manual Start/Stop Timed: 1 s to 99 days with 1 s resolution Continuous
Histogram Display Resolution	High: 1 sec (displays 1 hour with 1 sec resolution) Normal: 1 min, 5 min, 15 min, 1 hour (displays 72 hours with 1 min resolution) Low: 15 min, 60 min, 4 hrs, 12 hrs (displays 45 days with 15 min resolution)
Result Logging	All measurements are recorded with start, stop time and date. The current and previous results are stored in memory both totalized and graphical. Both graphical and totalized results can be stored on a disk.

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Utilities	
TroubleScan	Scans all measurement results for key violations
AutoScan	AutoScan to incoming signal (rate, mapping, framing and pattern). Identifies incoming signal and presents graphical display of AU and TU structure. Identifies TU signal status by showing TU number, equipped vs unequipped, alarms, and pattern.
Stored Setups	5 front panel setups in memory 200 front panel setups per disk
Pass/Fail Tests	Predefined Pass/Fail Tests can be created, stored and executed Pass/Fail tests are stored on disk 200 Pass/Fail test setups per disk
Add/Drop Interface for Data Communication Channels and User Channels	A DB-37 female connector provides the interface to an external protocol analyzer. Clock and data signals are differential TTL, conform to RS-422 specifications, and are also compatible with single-ended TTL signals. Add/Drop: D1–D3, D4–D12, F1, F2 Connector: 37 Pin DIN (DTE and DCE)
Triggering	Pulse at start of each frame, (Tx and Rx), Connector: 37 Pin DIN
Disk Drive	3.5 inch, 1.44 MB, DOS compatible Measurement Result stored in ASCII Stored Setups and Pass/Fail Tests in IEEE 488.2 format
Printer	Optional printer in pouch (thermal): HC 411 Printer support: Epson, HP Thinkjet Serial Printer Port: RS-232 Print to disk: BMP format, Interleaf format, and Encapsulated PostScript
Computer Interface	IEEE-488.2 interface RS-232-C interface (DB9)

Table D-1: Standard CTS 750 Specifications (Cont.)

Characteristic	Description
Help Mode	Online task-oriented help
Display	7 inch diagonal CRT, magnetic deflection Horizontal raster-scan green phosphor Resolution: 640 by 480 pixels VGA output: 15 pin connector

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities

Characteristic	Description
2 Mb/s, 34 Mb/s, 140 Mb/s Generator	
Electrical Output	
Data Rates	2 Mb/s (2.048 Mb/s) 34 Mb/s (34.368 Mb/s) 140 Mb/s (139.264 Mb/s)
Formats	2 Mb/s, 34 Mb/s: HDB3 coded 140 Mb/s: CMI coded
Signal Level	2 Mb/s: 3 Vpk ± 0.6 V into 120 Ω 2 Mb/s: 2.37 Vpk ± 0.6 V into 75 Ω 34 Mb/s: 1 Vpk ± 0.6 V into 75 Ω 140 Mb/s: 1 Vpk ± 0.6 V into 75 Ω
Pulse Shape	Meets ITU-T G.703 Pulse Masks
Connectors	2 Mb/s: 3 pin Siemens 120 Ω 2 Mb/s, 34 Mb/s, 140 Mb/s: BNC 75 Ω
Data Source	2 Mb/s: 2 Mb/s Internal Generator SDH TU12 Drop 34 Mb/s: 34 Mb/s Internal Generator SDH TU3 Drop 140 Mb/s: 140 Mb/s Internal Generator SDH VC4 Drop
2 Mb/s, 34 Mb/s, 140 Mb/s Internal Pattern Generator	
Framing	2 Mb/s: PCM30 (CAS) PCM31 PCM30 CRC (CAS) PCM31 CRD Unframed 34 Mb/s & 140 Mb/s: Framed Unframed
Patterns	PRBS: 2 ¹⁵ -1, 2 ²⁰ -1, 2 ²³ -1; All 1s, All 0s, 1 in 8 (2 Mb/s only); Fixed Pattern: 8 bit, 16 bit, 24 bit
Errors Single or Continuous	Frame Bit Error CRC-4 Error (2 Mb/s only) Pattern Bit Error

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description								
Error Rate Range	1×10^{-2} to 1×10^{-8} with 0.1 resolution ¹								
Alarms	RAI AIS								
TU12/TU3/VC4 Mapping									
Mapping Signal Source for TU12, TU3, and VC4	<table> <tr> <td>Internal Generator:</td> <td>Received Signal:</td> </tr> <tr> <td>2 Mb/s</td> <td>2 Mb/s</td> </tr> <tr> <td>34 Mb/s</td> <td>34 Mb/s</td> </tr> <tr> <td>140 Mb/s</td> <td>140 Mb/s</td> </tr> </table>	Internal Generator:	Received Signal:	2 Mb/s	2 Mb/s	34 Mb/s	34 Mb/s	140 Mb/s	140 Mb/s
Internal Generator:	Received Signal:								
2 Mb/s	2 Mb/s								
34 Mb/s	34 Mb/s								
140 Mb/s	140 Mb/s								
Mapping mode	Floating Asynch								
TU12 Active Map Channel Selection	Allows selection of any one of 63 TU channels Remaining 62 TU channels are background								
TU3 Active Map Channel Selection	Allows selection of any one of 3 TU channels Remaining 2 TU channels are background								
140 Mb/s Active Map Channel Selection	Into selected STM-1 VC4								
TU Background Channels									
TU Background Channel Content	When internal 2 Mb/s or 34 Mb/s generator is used: PRBS: $2^{15}-1$ or Idle pattern (11010101) when external source is used: PRBS: $2^{15}-1$								
Background Channel Framing	When internal 2 Mb/s or 34 Mb/s generator is used: Same as active channel When external source is used: Unframed								
TU Errors (Single or Continuous)	<table> <tr> <td>TU12 BIP-2</td> <td>TU3 BIP-8</td> </tr> <tr> <td>TU12 FEBE</td> <td>TU3 FEBE</td> </tr> </table>	TU12 BIP-2	TU3 BIP-8	TU12 FEBE	TU3 FEBE				
TU12 BIP-2	TU3 BIP-8								
TU12 FEBE	TU3 FEBE								
TU Alarms and Failures	TU AIS TU FERF TU Loss of Pointer TU Loss of Multiframe								

¹ Depends on error type.

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description
Transmitter Clock	
Internal Clock	
Accuracy	±4.6 ppm, for instrument calibrated within 24 months
External Clock Reference	
Rates	2.048 Mb/s ±40 ppm 2.048 MHz ±50 ppm
Input	Unbalanced, 75 Ω BNC connector
Recovered Clock	
Loop timing	Clock is recovered from received signal
Transmit Line Frequency Offset	
Frequency offset rate	2 Mb/s: ±50 ppm of nominal line rate 34 Mb/s: ±130 ppm of nominal line rate 140 Mb/s: ±100 ppm of nominal line rate with 0.1 ppm resolution
External Reference	±100 ppm of line rate referenced to external source
External PDH Clock Input (for Jitter Generation)	
Rates	2 Mb/s, 34 Mb/s, 140 Mb/s
Input	Unbalanced, 75 Ω BNC, AC coupled
Signal Level	0.5 V to 1.5 V peak to peak
Internal Jitter Generator	Refer to <i>Jitter Generator</i> on page D-4
2 Mb/s, 140 Mb/s Receiver	
Electrical Input	
Data Rates	2 Mb/s (2.048 Mb/s) ±150 ppm 34 Mb/s (34.368 Mb/s) ±150 ppm 140 Mb/s (139.264 Mb/s) ±150 ppm
Formats	2 Mb/s: HDB3 coded 34 Mb/s: HDB3 coded 140 Mb/s: CMI coded

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description
Impedance	2 Mb/s: 120 Ω balanced 2 Mb/s Bridged: 1 k Ω balanced 2 Mb/s, 34 Mb/s, 140 Mb/s: 75 Ω unbalanced
Signal Level	2 Mb/s: 3 Vpk \pm 0.6 V into 120 Ω 2.37 Vpk \pm 0.6 V into 75 Ω Monitor: 26 dB flat loss below Hi 34 Mb/s: 0.6 Vpk \pm 0.24 V into 75 Ω Monitor: 26 dB flat loss below Hi 140 Mb/s: 0.6 Vpk \pm 0.24 V into 75 Ω Monitor: 26 dB flat loss below Hi
Connectors	2 Mb/s: 3 pin Siemens 120 Ω 2 Mb/s, 34 Mb/s, 140 Mb/s: BNC 75 Ω
2 Mb/s, 34 Mb/s 140 Mb/s Internal Pattern Receiver	
Pattern Receiver Source	2 Mb/s: 2 Mb/s External Input SDH TU12 Drop 34 Mb/s: 34 Mb/s External Input SDH TU3 Drop 140 Mb/s: 140 Mb/s External Input SDH VC4 Drop
Framing	2 Mb/s: 34 Mb/s & 140 Mb/s: PCM30 (CAS) Framed PCM31 Unframed PCM30 CRC (CAS) PCM31 CRC Unframed
TU12/TU3/VC4 Demapping	
Demapping TU12, TU3 and VC4 Signal Drop to	Internal Receiver: External Signal Output 2 Mb/s 2 Mb/s 34 Mb/s 34 Mb/s 140 Mb/s 140 Mb/s
Demapping mode	Floating Asynch
TU12 Active Demap Channel Selection	Allows selection of any one of 63 TU channels
TU3 Active Demap Channel Selection	Allows selection of any one of 3 TU channels

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description
140 Mb/s Active Demap Channel from	Selected STM-1 VC4
TU Path Overhead	
TU12 Path Overhead Access	V5 control (---xxx-) Set Path Overhead bytes to any value from binary 00000000 to 11111111: Z3, Z4, and Z5 View all TU Path Overhead bytes
TU3 Path Overhead Access	Set Path Overhead bytes to any value from binary 00000000 to 11111111: C2, F2, Z3, Z4, and Z5 View all TU Path Overhead bytes
TU3 Path Trace Byte J1	Send user-defined 16 or 64-byte sequence, or set to 00000000 View Path Trace J1
TU12 Path Trace Byte J2	Send user-defined 16-byte sequence, or set to 00000000 View Path Trace J2
TU Pointer Measurement	
TU Pointer Interaction	TU12, TU3, or AU, but not at the same time
Single	Single pointer justification (increment or decrement)
Burst	Bursts of two to eight pointer justifications spaced four multi-frames apart. All adjustments within a given burst are in the same direction. Subsequent bursts are in alternating directions.
Continuous	Pointer justifications occur continuously at a predetermined rate in an incrementing, decrementing, or alternating direction. Rate between movements: 48 ms to 1 s, with a resolution of 1 ms.

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description
Set to Value	Set to a new location with or without the NDF being set. TU12 Range is from 0 to 1023 (140 – 1023 are illegal locations). TU3 Range is from 0 to 1023 (783 – 1023 are illegal locations).
TU Pointer sequences available	G.783(a) Single Alternating G.783(b) Regular + Double G.783(c) Regular + Missing G.783(d) Double Alternating G.783(e) Single G.783(f) Burst G.783(g) Periodic 87-3 G.783(g) Periodic 87-3 With Add G.783(g) Periodic 87-3 With Cancel G.783(h) Periodic G.783(h) Periodic with Add G.783(h) Periodic with Cancel Phase Transient Pointer Adjustment Burst TU-3 Periodic 85-5 TU-3 Periodic 85-5 With Add TU-3 Periodic 85-5 With Cancel TU-12 Periodic 35-1 TU-12 Periodic 35-1 With Add TU-12 Periodic 35-1 With Cancel
Pointer Direction	Positive or Negative
Initialization Period	On or Off Thirty second burst of 1 pointer per second in the same direction as the selected test
Cool Down Period	On or Off This will last at least 60 seconds
PDH & TU Measurements	
PDH Error Count, Error Rate and Error seconds for	Frame Bit CRC-4 (2 Mb/s only) Pattern Bit
TU Error Count, Error Rate and Error seconds for	TU12 BIP-2 TU3 BIP-2 TU12 FEBE TU3 FEBE

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description
PDH Alarm and Failure Seconds for	AIS RAI Loss of Pattern Sync Loss of Frame Loss of Signal
TU Alarm and Failure Seconds for	TU AIS TU FERF TU Loss of Pointer TU Loss of Multiframe
TU Pointer Measurements	Seconds: Count: LOP Illegal pointers Illegal pointers Positive justifications NDF Negative justifications
G.826 Analysis for TUs	
TU12 BIP-2 & FEBE Seconds and ratio	Error Blocks, ES, SES, UAS, Background Block Errors FEBE-Count, FEBE-ES, FEBE-UAS FEBE-EFS
TU3 BIP-8 & FEBE Seconds and ratio	Error Blocks, ES, SES, UAS, Background Block Errors FEBE-Count, FEBE-ES, FEBE-UAS FEBE-EFS
G.821 Analysis for PDH	
PDH Frame & CRC-4 Errors, Seconds, and % of total time	Error-Count, ES, SES, UAS, EFS, DM
Payload (Pattern Bit Errors), Seconds and % of total time	Error-Count, ES, SES, UAS, EFS, DM
M.2100 Analysis for PDH	
In Service Seconds and % of total time	Error-Count, ES, SES, UAS, EFS
Out of Service Seconds and % of total time	Error-Count, ES, SES, UAS, EFS
Jitter and Wander Analysis	Refer to <i>Jitter and Wander Analysis</i> on page D-11

Table D-2: Option 36 2 Mb/s, 34 Mb/s, 140 Mb/s, TU12, TU3 Capabilities (Cont.)

Characteristic	Description
LEDs	
Status Indicators	TU AIS TU FERF TU12 BIP-2 ERROR TU3 BIP-8 ERROR
	PDH AIS PDH RAI PDH ERROR
Histograms for PDH & TU	
Error Count, Bit Error Rate, and Errored Seconds	PDH-Frame, 2 Mb/s CRC-4, TU-BIP, TU-FEBE, Pattern Bit
Alarms & Failures On/Off	LOS, LOF, PDH-AIS, PDH-RAI, TU-LOP, TU-AIS, TU-FERF, TU-LOM, Pattern Loss, Loss of Power
TU Pointers	TU Pointer Value, Pointer Justification
Measurement Utilities	
Measurement Control	Manual Start/Stop Timed: 1 s to 99 days with 1 s resolution Continuous
Histogram Display Resolution	High: 1 sec (displays 1 hour with 1 sec resolution) Normal: 1 min, 5 min, 15 min, 1 hour (displays 72 hours with 1 min resolution) Low: 15 mins, 60 mins, 4 hrs, 12 hrs (displays 45 days with 15 min resolution)
Result Logging	All measurements are recorded with start, stop time and date. The current and previous results are stored in memory both totalized and graphical. Both graphical and totalized results can be stored on a disk.

Table D-3: Environmental Specifications

Characteristic	Description
Temperature	Operating: 0° C to +40° C Nonoperating: -40° C to +75° C
Altitude	Operating: 4,572 m (15,000 ft) Nonoperating: 12,192 m (40,000 ft)
Humidity	Operating: To 95%, relative humidity at or below +40° C for 2 hours or less To 90% relative humidity at or below 30° C, continuous
Transportation Handling	Qualifies under National Safe Transit Association 1s Pre-shipment Test; 1A-B-1.

Table D-4: Physical Characteristics

Characteristic	Description								
Dimensions	Height: 165 mm (6.5 in) 191 mm (7.5 in) with accessory pouch Width: 362 mm (14.25 in) Depth: 490 mm (19.25 in) with front cover 564 mm (22.2 in) with handle extended								
Weight	Net: Approximately 8.7 kg (19.3 lb) Shipping: Approximately 14.1 kg (31 lb)								
Power Requirements	<table border="0"> <tr> <td><i>Line Voltage</i></td> <td><i>Line Frequency</i></td> </tr> <tr> <td>90 V to 132 V</td> <td>50/60 Hz</td> </tr> <tr> <td>180 V to 250 V</td> <td>50/60 Hz</td> </tr> <tr> <td>100 V to 132 V</td> <td>400 Hz</td> </tr> </table> Maximum current is 6 A _{RMS} .	<i>Line Voltage</i>	<i>Line Frequency</i>	90 V to 132 V	50/60 Hz	180 V to 250 V	50/60 Hz	100 V to 132 V	400 Hz
<i>Line Voltage</i>	<i>Line Frequency</i>								
90 V to 132 V	50/60 Hz								
180 V to 250 V	50/60 Hz								
100 V to 132 V	400 Hz								

Table D-5: Certifications and compliances

Characteristic	Description
EC Declaration of Conformity – EMC	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EN 55011 Class A Radiated and Conducted Emissions</p> <p>EN 50082-1 Immunity:</p> <p>IEC 801-2 Electrostatic Discharge Immunity</p> <p>IEC 801-3 RF Electromagnetic Field Immunity</p> <p>IEC 801-4 Electrical Fast Transient/Burst Immunity</p> <p>IEC 801-5 Power Line Surge Immunity</p>
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits
EC Declaration of Conformity – Low Voltage	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC</p> <p>EN 61010-1/A1 Safety requirements for electrical equipment for measurement, control, and laboratory use</p>
Approvals	<p>UL3111-1 – Standard for Electrical Measuring and Test Equipment</p> <p>CAN/CSA C22.2 No. 1010-1 – CSA Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use</p>

Table D-5: Certifications and compliances (cont.)

Characteristic	Description
Conditions for Safety Certification	Operating temperature: +5 to +40 °C
	Relative Humidity (maximum operating) 80% up to 31 °C, decreasing linearly to 50% at 40 °C
	Max. Operating altitude: 2000 m
	Equipment Type: Test and measuring
	Safety Class: Class I, grounded product (IEC1010-1)
	Overvoltage Category: CAT II (IEC1010-1)
	Pollution Degree: Pollution Degree 2, rated for indoor use only (IEC1010-1)

Table D-5: Certifications and compliances (cont.)

Characteristic	Description
Installation Category Descriptions	<p>Terminals on this product may have different installation category designations. The installation categories are:</p> <p>CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location</p> <p>CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected</p> <p>CAT I Secondary (signal level) or battery operated circuits of electronic equipment</p>

Appendix E: Incoming Inspection Test

The purpose of the incoming inspection test is to verify that the CTS 750 SDH Test Set is functioning properly. The incoming inspection test relies on the front panel status lights to indicate the results of the test. Figure E-1 shows the location of the status lights used in these procedures.

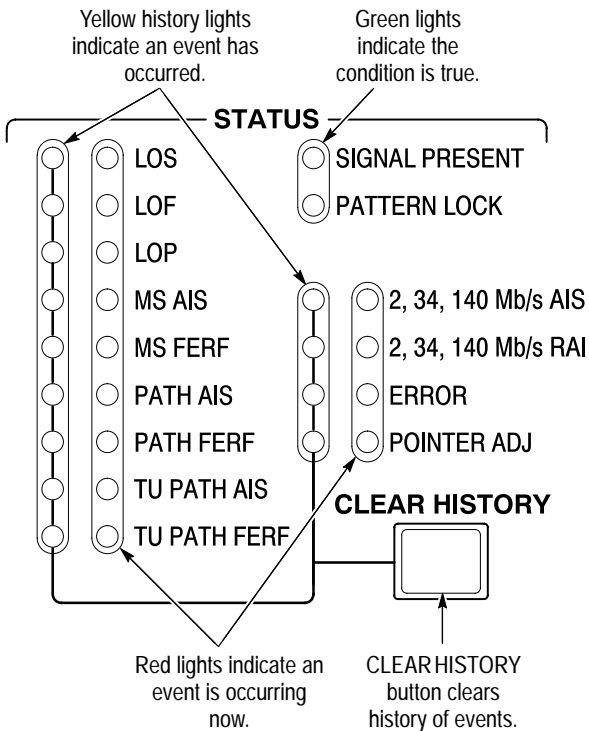


Figure E-1: Front-Panel Status Lights

Table E-1 details the equipment required to complete the incoming inspection test.

Table E-1: Required Equipment

Item Number and Description	Minimum Requirements	Example	Purpose	
1	Optical Fiber Cable ¹	62.5/125 μm multimode fiber; FC/PC connector on one end; compatible with CTS 750 connector option on other end	FC/PC to FC/PC, Tektronix part number 174-2322-00	Interconnect optical signals
2	10 dB Optical Attenuator ²	10 dB at $\lambda = 1550 \text{ nm}$, with connectors compatible with item 1 and CTS connector option	Tektronix part number 119-5118-00 (included with Option 05)	Provide optical attenuation at 1550 nm
3	75 Ω Coaxial Cable	75 Ω impedance; $\approx 1 \text{ m}$ length, BNC connectors	Tektronix part number 012-1338-00	Interconnect electrical signals
4	120 Ω Siemens Cable	120 Ω impedance; $\approx 2 \text{ m}$ length, banana plugs	Tektronix part number 012-1469-00	Interconnect electrical signals

¹ This equipment is required to test a CTS 750 with any one of the optional Optical/Electrical Plug-in Interface Modules installed; otherwise, it is not required.

² This equipment is only required if Option 05 is installed.

Loop-Back Connection

The incoming inspection test requires an external loop-back connection from the TRANSMIT/OUT output to the RECEIVE/IN input. For the SDH rate electrical loop-back, you can use the 75 Ω

BNC coaxial cable provided as a standard accessory to the CTS 750. If the Add/Drop/Test Option is installed, you can use the 75 Ω coaxial cable for checking 2 Mb/s Balanced, 34 Mb/s, and 140 Mb/s operation. You will need to use a 120 Ω Siemens cable (a standard accessory with the Add/Drop/Test Option) to check 2 Mb/s Unbalanced operation. If one of the Electrical/Optical Plug-in Interface Modules is installed in your CTS 750, you also need a short optical cable that is compatible with the optical connectors on your instrument. Optical cables are not included as standard accessories to the CTS 750.

How to Proceed

If the CTS 750 fails any of these tests, it has failed the incoming inspection test. Double check the electrical and optical connections and repeat any failed test. If the failure persists, contact your local Tektronix field office or representative for assistance.

You can perform the following tests in any order. Each test is independent and does not depend on the setup from the previous test.

- Turn on the CTS 750. Allow it to warm up for 20 minutes before proceeding with the tests.

System Self Test with External Loop-Back

This test executes the Self Test including coverage of the transmitter and receiver I/O circuitry.

Equipment Required	75 Ω BNC coaxial cable for electrical loop-back Optical loop-back cable if Electrical/Optical Plug-in Interface Module is installed 10 dB optical attenuator if Option 05 is installed
Prerequisites	CTS 750 warmed-up at least twenty minutes
Time Required	Approximately two minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT/OUT outputs to the RECEIVE/IN inputs.

NOTE. Connectors labeled *OUT* and *IN* are present only on instruments equipped with the *Add/Drop/Test Option*.

2. Set up and execute the system self test with the following sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
UTILITY	SELF TEST	Self Test Group	Sys: Ext
		Self Test Control	Run

SDH Signals

This test checks that the CTS 750 transmits and receives error-free signals at all SDH rates.

Equipment Required	75 Ω BNC coaxial cable for electrical loop-back Optical loop-back cable if Electrical/Optical Plug-in Interface Module is installed 10 dB optical attenuator if Option 05 is installed
Prerequisites	CTS 750 warmed up at least twenty minutes
Time Required	Approximately five minutes

1. Attach electrical and optical loop-back cables from the TRANSMIT outputs to the RECEIVE inputs.

2. Perform the initial setup of the CTS 750 with the following sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUPS	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Coupled
	POINTERS & TIMING	Pointer Control	Set Value
		Pointer Value set to	Default 522

3. To check the rate, press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.

NOTE. When changing the transmit rate, the LOP, LOS, and LOF history lights may turn on; this is normal. However, the red event lights should not stay on.

4. Steps 5 through 8 of this procedure apply only if one of the Electrical/Optical Plug-in Interface Modules (Option 03 or Option 04) is installed in your CTS 750.
5. To check the STM-1 rate, perform the setup sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-1

6. Press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.

- If your CTS 750 does not have STM-4 capability, you have completed the incoming inspection test. To check the STM-4 rate, perform the setup sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	STM-4

- Press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.

PDH Signals (Add/Drop/Test Option Only)

This test checks that the CTS 750 transmits and receives error-free signals at all PDH rates.

Equipment Required	75 Ω BNC coaxial cable for 2 Mb/s Unbalanced, 34 Mb/s and 140 Mb/s electrical loop-back 120 Ω Siemens Cable for 2 Mb/s Balanced electrical loop-back
Prerequisites	CTS 750 warmed up at least twenty minutes
Time Required	Approximately five minutes

- Attach electrical and optical loop-back cables from the OUT outputs to the IN inputs.

2. Perform the initial setup of the CTS 750 with the following sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TEST SETUPS	RECALL INSTRUMENT SETUP	DEFAULT FACTORY SETTINGS	Recall Setup
TRANSMIT	TRANSMIT SETTINGS	Tx/Rx Settings	Coupled
		Transmit Rate	2 Mb/s Balanced

3. To check the 2 Mb/s Balanced rate, press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.
4. To check the 2 Mb/s Unbalanced rate, set the transmit rate as follows:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	2 Mb/s Unbalanced

NOTE. When changing the transmit rate, the LOP, LOS, and LOF history lights may turn on; this is normal. However, the red error lights should not stay on.

5. Press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.

6. To check the 34 Mb/s rate, perform the setup sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	34 Mb/s

7. Press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.
8. To check the 140 Mb/s rate, perform the setup sequence:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate	140 Mb/s

9. Press the **CLEAR HISTORY** button, wait two seconds, and then verify that no yellow history lights are on.

This completes the incoming inspection test.

Appendix F: Example Disk Contents

This manual ships with a disk containing files that you can load into your CTS 750. The files are examples of instrument setups, test results and pass/fail tests. The files contained on the disk are described in the following paragraphs.

Instrument Setups

The STRESS file is an instrument setup file. The file sets up the CTS 750 to generate an STM-1E signal that contains alarms, errors and pointer movements. The STRESS file is an example of how the CTS 750 can save you time by storing instrument setups on disk for later recall.

Test Results

The ONEDAY file is a test results file. It contains one day (24 hours) of test results. Recall the file from the RECALL RESULTS page of the RESULTS menu. You can view the test results on the MAIN RESULTS and ERROR ANALYSIS pages of the RESULTS menu. You can view a graph of the test results on the HISTORY GRAPHS page of the RESULTS menu. The HISTORY GRAPHS page shows when alarms, errors and pointer movements occurred.

Pass/Fail Tests

The DEMO_10S file is a pass/fail test that runs for just 10 seconds. To make the test fail, press the INSERT ERROR button on the front panel. To run the test, connect an electrical cable between the TRANSMIT and RECEIVE connectors on the front panel and then recall the test from the RECALL PASS/FAIL TESTS page of the TEST SETUP menu. You can see how the test was set up by viewing the test parameters on the SAVE PASS/FAIL TESTS page of the TEST SETUP menu after you recall the test.

The BER_STM1 file is a 15-minute BER test. The test passes if the BER is better than $10E-7$. To run the test, connect an electrical cable between the TRANSMIT and RECEIVE connectors on the front panel and then recall the test from the RECALL PASS/FAIL TESTS page of the TEST SETUPS menu. You can see how the test was set up by viewing the test parameters on the SAVE PASS/FAIL TESTS page of the TEST SETUPS menu after you recall the test.

Appendix G: Rear-Panel Connectors

This appendix describes the connectors located on the rear panel of the CTS 750.

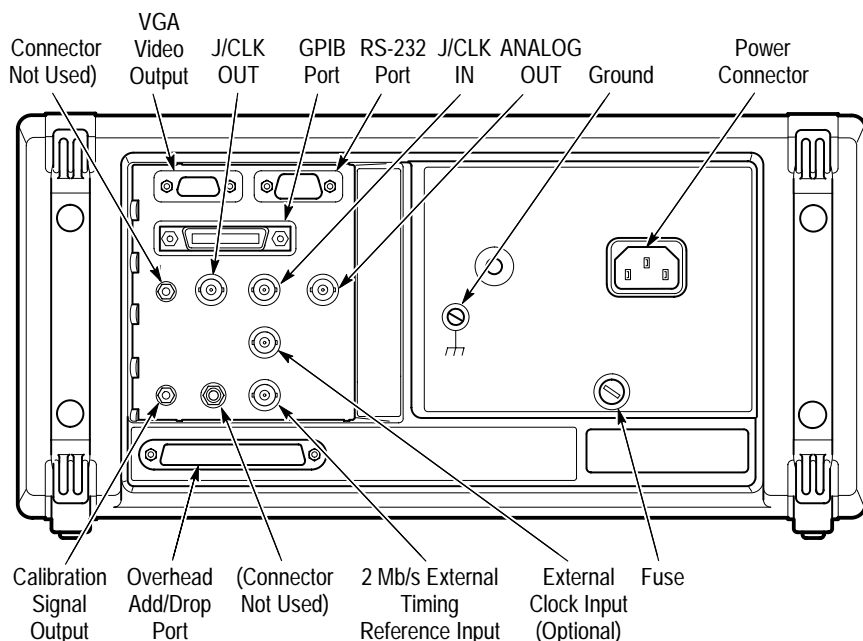


Figure G-1: CTS 750 Rear Panel Connectors

VGA Video Output

The CTS 750 can drive an external IBM-compatible VGA monitor. There are no parameters to set in order to drive an external monitor. The output is monochrome (green only); the resolution is 640 pixels × 480 pixels. Figure G-2 shows how the pins are numbered on the

VGA connector. Table G–1 lists the pin assignment for the rear-panel VGA connector.

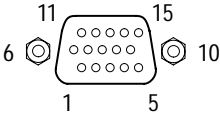


Figure G–2: The VGA Video Output Connector

Table G–1: VGA Video Output Connector Pin Assignment

Pin Number	Description
1	Ground
2	Video Signal (Green)
3	Ground
4	–
5	–
6	Ground
7	Ground
8	Ground
9	–
10	Ground
11	Ground
12	–
13	Horizontal Sync
14	Vertical Sync
15	–

GPIB Port

The GPIB (General Purpose Interface Bus) port is used for remote control of the CTS 750. For detailed information on remote control of the CTS 750, see the *CTS 750 SDH Test Set Programmer Manual* (Tektronix part number 070-8925-XX)

RS-232 Port

The rear panel RS-232 connector is used to connect to printers and instrument controllers. Set the RS-232 parameters for printers on the **PRINTER SETUP** page of the **UTILITY** menu. Set the RS-232 parameters for instrument controllers on the **REMOTE CONTROL** page of the **UTILITY** menu. You can find more detailed information on remote control of the CTS 750 in the *CTS 750 SDH Test Set Programmer Manual*. Figure G–3 shows how the pins are numbered on the RS-232 port. Table G–2 lists the pin assignment for the RS-232 port on the CTS 750 rear panel.

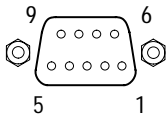


Figure G–3: The RS-232 Port

Table G–2: RS-232 Rear Panel Connector Pin Assignment

Pin Number	Name	Description
1	DCD	Data Carrier Detect
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground

Table G-2: RS-232 Rear Panel Connector Pin Assignment (Cont.)

Pin Number	Name	Description
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

Calibration Signal Output

You use the calibration signal output for servicing the CTS 750. Information on servicing the CTS 750 is located in the *CTS 710 SONET Test Set & CTS 750 SDH Test Set Service Manual*, Tektronix part number 070-8853-XX.

Overhead Add/Drop Port

You use the Overhead Add/Drop port to add/drop the section and line data communication channels (DCC), and the section and line user channels. The DCC and user channel add/drop functions are independent; for example, you can add a DCC while dropping a user channel. Only one DCC or user channel can be added or dropped at a time. The parameters for adding a DCC or a user channel are located on the SECTION OVERHEAD and PATH OVERHEAD pages of the TRANSMIT menu. The parameters for dropping a DCC or a user channel are located on the SECTION OVERHEAD and PATH OVERHEAD pages of the RECEIVE menu.

The Overhead Add/Drop port uses a gapped clock. Figure G-4 shows how the pins are numbered on the Overhead Add/Drop port. Tables G-3 and G-4 summarize the different communication channels.

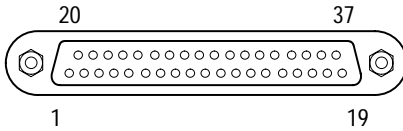


Figure G-4: The Overhead Add/Drop Port

Table G-3: Overhead Channels Added

Added Channel	Bytes Added	Data Rate	Clock Rate
DCC	D1, D2, D3	192 kbps	216 kHz
DCC	D4, D5, D6, D7, D8, D9, D10, D11, D12	576 kbps	2.16 MHz ¹
User Channel	F1	64 kbps	72 kHz
User Channel	F2	64 kbps	72 kHz

¹ The DCC signal has a 1/3–2/3 duty ratio.

Table G-4: Overhead Channels Dropped

Dropped Channel	Bytes Dropped	Data Rate	Clock Rate
Section DCC	D1, D2, D3	192 kbps	216 kHz
Line DCC	D4, D5, D6, D7, D8, D9, D10, D11, D12	576 kbps	2.16 MHz
Section User Channel	F1	64 kbps	72 kHz
Path User Channel	F2	64 kbps	72 kHz

Table G-5 summarizes the data signal pin assignments on the Overhead Add/Drop port. Table G-6 summarizes the additional pin assignments on the Overhead Add/Drop port. The signal lines listed

in Table G–5 can drive 100 Ω , differential TTL lines. The signal lines are terminated with a 100 Ω impedance and can drive 100 Ω lines.

Table G–5: Overhead Add/Drop Port Data Signal Pin Assignments

Signal	+Pin	–Pin
Added Tx Data (input)	4	22
Added Tx Clock (output)	5	23
Tx Common (ground)	37	–
Dropped Rx Data (output)	6	24
Dropped Rx Clock (output)	8	26
Rx Common (ground)	20	–

Table G–6: Overhead Add/Drop Port Additional Pin Assignments

Signal	Pin
Shield (ground)	1
Signal Ground (ground)	19
Reserved	33
Tx Frame Pulse (output) ¹	15
Rx Frame Pulse (output) ¹	36

¹ The Frame Pulse signals are nominal 8 kHz, TTL, single-ended signals.

2 Mb/s Timing Reference Input

Use the 2 Mb/s timing reference input connector to connect to a 2 Mb/s reference. To synchronize the CTS 750 transmit clock with a 2 Mb/s reference:

Press Menu Button	Select Menu Page	Highlight Parameter	Select Choice
TRANSMIT	TRANSMIT SETTINGS	Transmit Clock	External 2 Mb/s

Jitter Inputs and Outputs

If the CTS 750 SDH Test Set has the Jitter Test Option (Option 14) installed, four additional connectors are located on the rear panel in the JITTER/WANDER group.

BITS OUT

The BITS OUT connector is not used by the CTS 750 SDH Test Set.

ANALOG OUT

The ANALOG OUT connector provides the demodulated jitter from the receiver as an analog waveform. You can use an oscilloscope or spectrum analyzer to analyze this waveform if you consider the limitations of this output.

The ANALOG OUT signal is not calibrated; the amplitude has low accuracy, but the spectral content is valid. The spectral content is filtered by the measurement filter you select. Refer to *Setting Jitter Receive Parameters* on page 3–144 for information about controlling the measurement range and filter.

The ANALOG OUT connector is a 75 Ω BNC. The signal level is typically $\pm 1V$ or less and is centered at 0 V. Typical sensitivity is 125 mV/UI in normal mode and 3.5 mV/UI in extended mode.

J/CLK IN

J/CLK IN (jitter clock input) is an input you can use to measure the jitter on a clock signal. The signal must be NRZ coded and at SDH or PDH rate. Refer to *Setting Jitter Receive Parameters* on page 3–144 for information about setting the jitter measurement source and rate.

The J/CLK IN connector is a 75 Ω BNC. The input is AC coupled. Typical sensitivity is 0.4 V_{p-p}.

J/CLK OUT

J/CLK OUT (jittered clock output) provides a clock signal modulated by generated jitter. You can choose any SDH or PDH rate. In addition, the J/CLK OUT connector can provide a 2048 kHz G.703 synchronization signal. Refer to *Setting Jitter or Wander Generation* on page 3–110 for information about controlling the signal type, rate, jitter, and frequency offset.

The J/CLK OUT connector is a 75 Ω BNC. The output is ECL compatible when terminated by 75 Ω .

Appendix H: Changing Optical Port Connectors

The following procedures are discussed in this appendix:

- Cleaning the Optical Ports
- Changing the Optical Port Connectors

Cleaning the Optical Ports

If the CTS 750 performance appears degraded, the optical fiber and optical port may be dirty. Clean the fiber connector with a clean cloth.

To clean an optical port:

1. Verify that the CTS 750 has been turned off with the principal power switch on the rear panel.
2. Remove the four screws that attach the bulkhead connector to the front panel (see Figure H-1).
3. Gently pull the bulkhead out of the unit and unscrew the fiber connector. Be careful not to pull beyond the fiber slack.
4. Using a soft, lint-free cloth with a high-quality glass cleaner, clean the tip of the fiber cable.
5. If available, use low-pressure compressed air or canned air to blow any dirt out of the bulkhead connector. If compressed air is not available, then the bulkhead will have to be taken apart and cleaned. Refer to the *Changing the Optical Port Connectors* procedure, on page H-2, for information about bulkhead disassembly.
6. After cleaning the bulkhead, reconnect the fiber and install the bulkhead. Be sure to reinstall the dustcap chain.

NOTE. To keep cleaning to a minimum, install the dustcap when no fiber is connected to the optical port.

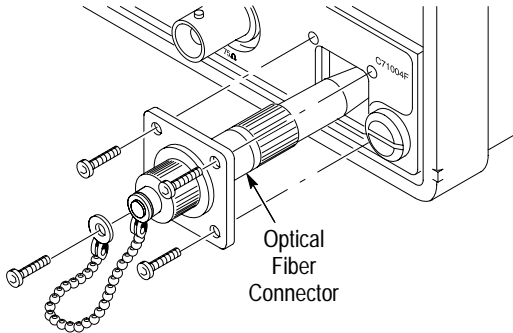


Figure H-1: Removing the Optical Bulkhead Connector

Changing the Optical Port Connectors

The CTS 750 is shipped with the FC connector bulkhead and dustcap installed. If you wish to change to the ST, DIN 47256, or SC connectors perform the following procedure:

1. Verify that the CTS 750 has been turned off with the principal power switch on the rear panel.
2. Remove the four screws that attach the bulkhead connector to the front panel (see Figure H-1).
3. Gently pull the bulkhead out of the unit and unscrew the fiber connector. Be careful not to pull beyond the fiber slack.
4. Disassemble the bulkhead as shown in Figures H-2 through H-5.

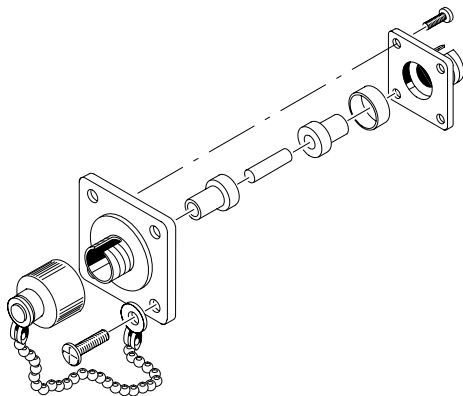


Figure H-2: FC Optical Bulkhead Assembly

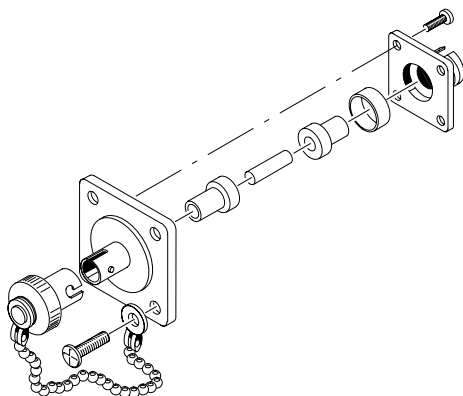


Figure H-3: ST Optical Bulkhead Assembly

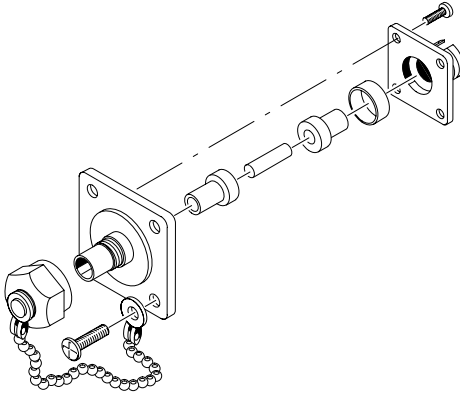


Figure H-4: DIN 47256 Optical Bulkhead Assembly

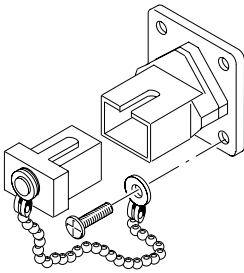


Figure H-5: SC Optical Bulkhead Assembly

5. Replace the current bulkhead with the one you wish to use and reassemble.
6. Installation is the reverse of steps 1 through 3.

Appendix I: Cleaning Instructions

Clean the CTS 750 often enough to prevent dust and dirt from accumulating. Dirt acts as a thermal insulator, preventing effective heat dissipation, and can also provide high-resistance leakage paths between conductors or components in a humid environment.



CAUTION. To avoid damage to the optical ports, refer to page H-1 for specific instructions to clean the optical ports.

Cleaning the Exterior

Clean the dust from the outside of the instrument with a soft, clean cloth or small brush. A brush is especially useful for removing dust from around the buttons and connectors. Remove hardened dirt with a soft cloth dampened with a mild detergent and water solution. Do not use abrasive cleaners.

Cleaning the CRT

Clean the light filter and CRT face with a soft, lint-free cloth dampened in denatured alcohol. Do not use abrasive cleaners.

Cleaning the Interior

Interior cleaning and maintenance should be performed by qualified service personnel only. Instructions for interior maintenance are provided in the service manual.

Appendix J: Packing for Shipment

If you ship the CTS 750, pack it in the original shipping carton and packing material. If the original packing material is not available, package the instrument as follows:

1. Obtain a corrugated cardboard shipping carton with inside dimensions at least 15 cm (6 in) taller, wider, and deeper than the CTS 750. The shipping carton must be constructed of cardboard with 170 kg (375 lb) test strength.
2. If you are shipping the CTS 750 to a Tektronix field office for repair, attach a tag to the CTS 750 showing the instrument owner and address, the name of the person to contact about the instrument, the instrument type, and the serial number.
3. Wrap the CTS 750 with polyethylene sheeting or equivalent material to protect the finish.
4. Cushion the CTS 750 in the shipping carton by tightly packing dunnage or urethane foam on all sides between the carton and the CTS 750. Allow 7.5 cm (3 in) on all sides, top, and bottom.
5. Seal the shipping carton with shipping tape or an industrial stapler.



Glossary and Index

Glossary

AIS

An acronym for Alarm Indication Signal. An AIS is used to alert downstream equipment that an upstream failure has been detected.

Analog Jitter Out

A signal that contains the demodulated jitter from a line or clock input.

APS

An acronym for Automatic Protection Switching.

ASCII

An acronym for American Standard Code for Information Interchange.

AU

An acronym for Administrative Unit.

AU-4

Virtual Container (VC) plus the Transport Overhead pointers.

BBE

An acronym for Background Block Error. A Background Block Error is an errored block that occurs outside of a Severely Errored Second.

BER

An acronym for Bit Error Ratio (or Rate). The principal measure of quality of a digital transmission system. BER is defined as:

$$BER = \frac{\textit{Number of Errors}}{\textit{Total Number of Bits}}$$

BER is usually expressed as a negative exponent. For example, a BER of 10^{-7} means that 1 bit out of 10^7 bits is in error.

BIP

An acronym for Bit Interleaved Parity. A method used to monitor errors in the transmitted signal.

Bit Error

An incorrect bit. Also known as a coding violation.

BITS

An acronym for Building Integrated Timing Supply.

COFA

An acronym for Change of Frame Alignment.

Conformance Tests

Conformance Tests (also known as Standards Conformance Tests) are predefined tests that measure the impact of jitter or wander on networks or network elements. They are defined in the ITU-T Recommendations.

CV

An acronym for Coding Violation.

dB

The symbol for decibels.

dBm

The symbol for power level in decibels relative to 1 mW.

DM

An acronym for Degraded Minute. A minute with a BER greater than 10^{-6} .

EB

An acronym for Errored Block. An Errored Block is a block with one or more bit errors, usually applied to a single SDH frame.

EFS

An acronym for Error Free Seconds.

ES

An acronym for Errored Second. A second with at least one error.

E1, E2, E3, E4

The preferred names for the ITU 2 Mb/s, 8 Mb/s, 32 Mb/s, and 140 Mb/s tributary signals.

FEBE

An acronym for Far End Block Error. An indication returned to the transmitting LTE that an errored block has been detected at the receiving LTE.

FERF

An acronym for Far End Receive Failure. A FERF indicates to the transmitting LTE that the receiving LTE has detected an incoming line failure or is receiving a Line AIS.

Frequency Drift Rate

The rate of change of a line or clock frequency, measured in ppm/sec. A new measure of timing quality.

Fullband

A jitter filter range that includes the wideband range but extends the low-frequency cutoff to 10 Hz or below. This filter is useful when analyzing video timing quality.

Highband

A jitter filter range that measures high-frequency jitter. The band pass filters are defined in ITU-T standards (where they are sometimes referred to as HP2 – LP1).

Highpass

The lower –3 dB corner frequency of a filter. The filter passes frequencies higher than this frequency.

ITU

An acronym for the International Telecommunication Union.

Jitter Hit

When peak-to-peak jitter crosses a predetermined threshold.

Jitter Tolerance

A conformance test that measures the susceptibility of a network element input to incoming jitter.

Jitter Transfer

A conformance test that measures the transfer of jitter from the input to the output of a network element.

Jitter Transfer Function

A graph that shows jitter gain as a function of jitter frequency.

Line Alarm Indication Signal (AIS)

A Line AIS is generated by Section Terminating Equipment upon Loss of Signal or Loss of Frame.

Line Coding Violation (CV)

The sum of the BIP errors detected at the Line layer. Line CVs are collected using the BIP codes in the B2 bytes of the Line Overhead.

Line Errored Second (ES)

A second during which at least one Line CV occurred, or a second during which the line was in the Line AIS state.

Line Far End Receive Failure (FERF)

An indication returned to a transmitting LTE from the receiving LTE that a Line AIS or incoming line failure has been detected.

Line Overhead (LOH)

Controls the payload information using the section layer and provides alarm indications, error monitoring, and message signalling between two LTEs.

Line Severely Errored Second (SES)

A second with N or more Line CVs, or a second during which the line was in the Line AIS state. The value of N varies with the transmit rate, but corresponds to a 2×10^{-7} BER.

LOF

An acronym for Loss of Frame.

LOP

An acronym for Loss of Pointer.

LOS

An acronym for Loss of Signal.

Low Frequency Jitter

Jitter that crosses the wander threshold (approximately 0.1 Hz to 500 Hz). Low frequency jitter is often the result of pointer movement.

Lowpass

The upper -3 dB corner frequency of a filter. The filter passes frequencies lower than this frequency.

LTE

An acronym for Line Terminating Equipment.

Mapping

The process of placing a tributary signal into an SDH AU.

Mb/s

Megabits per second.

MS

An acronym for Multiplexer Section.

NE

An acronym for Network Element.

OOF

An acronym for Out of Frame.

Output Jitter

A compliance test that measures the output jitter of a network or network element.

Path Overhead (POH)

A set of bytes allocated within the information payload to carry status and maintenance information between two network elements.

POH

An acronym for Path Overhead.

Pointer Hit

When the line or clock frequency drift crosses a predetermined threshold.

Pointer Jitter

A measure of the jitter output of a network when specified pointer test sequences are applied to its input.

PTE

An acronym for Path Terminating Equipment.

RS

An acronym for Regenerator Section.

Rx

An abbreviation for Receive.

SDH

An acronym for Synchronous Digital Hierarchy.

Section

The portion of a transmission line between a Network Element (NE) and a Line Terminating Equipment (LTE) or two LTEs.

Section Errored Second (ES)

A second during which at least one Section CV or OOF/COFA event occurred, or a second during which the NE was (at any point during the second) in the LOS state.

Section Overhead (SOH)

A set of bytes allocated within each frame to carry framing and error monitoring information between an NE and LTE or between two LTEs. Part of the transport overhead.

SES

An acronym for Severely Errored Seconds.

Severely Errored Seconds (SES)

A second with more than N CVs. N varies with the transmit rate but corresponds to a BER of 2×10^{-7} .

SOH

An acronym for Section Overhead.

STE

An acronym for Section Terminating Equipment.

STM

An acronym for Synchronous Transport Module.

STM-N

An acronym for Synchronous Transport Module-N (STM-1, -4, -16). The different STM-N rates for the SDH Signal Hierarchy are listed in the following table:

SDH Signal Hierarchy

Electrical Signal	Data Rate (Mb/s)
STM-1	155.52
STM-4	622.08
STM-8	1244.16
STM-16	2488.32

TE

An acronym for Terminal Equipment.

Through Mode

The ability to retransmit the incoming signal and manipulate its contents.

TIE

Time Interval Error is the time difference in nanoseconds between the nominal value of a line or clock period and the actual received period.

TOH

An acronym for Transport Overhead.

Transport Overhead (TOH)

A set of bytes allocated within each frame to carry operation, administration, and maintenance information from one end of the system to the other.

Tributary

The lower rate signal that is input to a multiplexer for combination (multiplexing) with other low rate signals to form a higher rate signal.

TU

An acronym for Tributary Unit. A structure (not a signal) designed for transport and switching of sub-AU-4 payloads. The TU sizes currently in use are TU-11, TU-12, and TU-3.

TUG

An acronym for Tributary Unit Group.

Tx

An abbreviation for Transmit.

VC

An acronym for Virtual Container.

Wideband

A jitter filter range that measures jitter over a wide range. The band pass filters are defined in ITU-T standards (where they are sometimes referred to as HP1 – LP1).

Yellow Signal

A code sent upstream to indicate that a failure condition has been declared downstream.

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