Tutorial

The tutorial acquaints you with the features of the CTS850 by having you run a test while you explore specific features of the CTS850 SDH/PDH Test Set. For full details on how to use the CTS850, refer to Chapter 3 *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 with Step 1	Step 2	Step 3	Step 4
		Step 5	Step 6
		Step 7	Step 8, CTS850 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.

Note: Use the buttons below the display to Select Menu Page. Use the rotary knob to Highlight Parameter. Use the buttons to the right of the display to Select Choice.

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Before Turning On the CTS850

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 coaxial cable with BNC connectors on each end. This tutorial assumes you have set up the CTS850 as described in *First Time Operation*, in Chapter 1 Getting Started.

To set up your CTS850 for the tutorial, perform these steps:

H Check to see that the CTS850 is turned off.

Connect the coaxial cable between the **TRANSMIT** and **RECEIVE** BNC connectors on the front panel (see Figure 2 22).



Figure 2 22: Setup for the Tutorial

Press the **ON/STBY** button to turn on the CTS850.

The CTS850 performs its power-on self test and then displays the TRANSMIT menu.

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

Before proceeding with the tutorial, initialize the CTS850 as follows:

Setting Transmit Parameters

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

To set the transmit and receive parameters:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
TRANSMIT	TRANSMIT SETTINGS	Transmit Rate (see Figure 2 23)	STM-1E

Tek Measurements Stopped	STM-1E
TRANSMIT	
Transmit Rate STM-1 Electrical Transmit Clock Internal	STM-4
Transmit Level 0 dB SDH Structure AU-4 Bulk	STM 1
Payload Structure	STM-0
	140 Mb/s
Tx/Rx Setup Independent	-more- 1 of 2
TRANSMIT S4K IX DEFECTE & POINTERS JITTERS ARS SETTINGS PETTINGS ANOMALES & TIMING WANDER COMMAND	I of 2

Figure 2 23: The TRANSMIT SETTINGS Page of the TRANSMIT Menu

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Press Menu
ButtonSelect Menu
PageHighlight
ParameterSelect ChoicePayloadBulk (Equipped)Test PatternPRBS 2^20 1

Setting Receive Parameters

To set the payload and the test pattern:

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 Setup line on the TRANSMIT SETTINGS page. (The Tx/Rx Setup 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 Setup line on the RECEIVE SETTINGS page.)

To couple the receive settings to the transmit settings:

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

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

If the operator couples from the TRANSMIT SETTINGS menu, the TX settings copy to the Receive side of the test unit. If the operator couples from the RECEIVE SETTINGS menu, the RX settings copy to the Transmit side of the test unit.

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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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
TEST SETUPS (see Figure 2 24)	TEST CONTROL	Test Duration	15 min

Tek Measurements Stopped	STM-1E
TEST SETUPS	JSTM-TE
Test Duration Continuous History Resolution Normal (1 min samples)	Normal (1 min)
At 1 minute resolution the maximum history length is at least 5 days. Upon reaching the 5 day limit	Low (15 min)
new data win begin overwriting the old data.	High (1 sec)
TEST CONTROL SELUIS PASS/FAIL INSTRUMENT PASS/FAIL JIITEN SELUIS IESIS	



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.

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To display the RESULTS menu:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
RESULTS	TEST Summary	none	none

The TEST SUMMARY page contains a summary of the current or most recent test (see Figure 2 25). Just below the menu name is information about the current or most recent test. If the test detected no alarms or errors, the CTS850 displays the message No Alarms No Errors.

Results Source:	🚱 Current Results	
Results Rate:	STM-1	
Results Structure:	Test Signal 0.181	
Results Payload:	2 Mb/s	
Fest Started:	20:02:12 28-Jan-01	
Elapsed Time:	0d 0h 0m	
TROUBLE SC	AN	
No Alarms N	o Frrors	

TEST	SDH	PDH	E STORY	SAVE	RECALL	(more
SUMMARY	SESULTS	RESULTS	GRAPHS	RESULTS	RESULTS	2 of 2

Figure 2 25: The TEST SUMMARY Page of the RESULTS Menu

The RESULTS menu contains ten pages on which results are displayed: TEST SUMMARY, SDH or PDH RESULTS, ERROR ANALYSIS, Performance Analysis, JITTER & WANDER, and HISTORY GRAPHS. Select **SDH RESULTS** to see one way test results are displayed (see Figure 2 26).

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Tek Measurements Stopped			0	→ STM-1E → STM-1E
				CHOICES
OOF (SEFS)	Seconds	0s		Network Defects
RS-TIM		0s		Section Defects
MS-AIS		0s	-	Path Defects
MS-RDI		0s	-	SDH Anomalies
			-	Pointers
TEST SDH PDH SUMMARY RESULTS RESULTS	E STORY GRAPHS	SAVE RESULTS	RECALL RESULTS	(more 2 at 2

Figure 2 26: SDH Results, SDH Section Defects, from RESULTS menu

The SDH or PDH 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 27). 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).

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Tek Running	Od Oh C	lm 23s	[€]STM-1E STM-1E
RESOLTS			
Results Source:	🗲 Current	Results	
Results Rate:	STM-1		
Results Structure:	Test Signal	0.181	
Results Payload:	34 Mb/s		
Fest Started:	20:25:28	28-Jan-01	
Elapsed Time:	0d Oh	0m	
TROUBLE SC	CAN		
No Alarms N	lo Errors		

TEST	SDH	PDH	E STORY	SAVE	RECALL	$\begin{pmatrix} more \\ 2 \text{ of } 2 \end{pmatrix}$
SUMMARY	SESULTS	RESULTS	GEAPHS	RESULTS	RESULTS	

Figure 2 27: The Message Line and Test Status Indicator

Inserting Errors

Now that the test is running, you will insert some errors and see how the CTS850 responds. To set the error insertion parameters, first display the Defects & Anomalies page as follows:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
TRANSMIT	Defects & Anomalies (see Figure 2 28)	none	none

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Tek Measurements Stopped	Gelstm−1
TRANSMIT	CHOICES
Error Type set to HP-REI Error Rate set to 1.0e-4	HP-REI
Transmit Alarm set to MS-RDI	TU BIP-2
	LP-REI
Transmit Failure set to Loss of Signal	Pattern Bit
➡ Press INSERT ERROR to insert a single error into the transmitted signal.	-more- 2 of 2
IRANSMIT 84K IX DEFECTS & POINTERS JITTER & STTT NSS SETTINGS ANOMALIES & TIMING WANDES	(more 1 of 2

Figure 2 28: The Defects & Anomalies 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 CTS850 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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
		Error type set to	Path B3 BIP

The rate at which errors are inserted is specified on the Error rate set to parameter. An error rate of None specifies that no errors are inserted unless the INSERT ERROR button is pressed. Any error rate

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other than None results in a continuous stream of errors being inserted into the transmitted signal.

To insert a single error, press the **INSERT ERROR** button located on the front panel.

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

To insert a continuous stream of errors:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
		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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
TRANSMIT	Defects & Anomalies	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 CTS850 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.

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To display the POINTERS & TIMING page:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
TRANSMIT	POINTERS & TIMING (see Figure 2 29)	none	none

Tek Measurements Stopped	🔿 STM-1E
TRANSMIT	
Pointer / Timing Mode Pointer Movements Pointer Type AU Pointer	Min 0
Pointer Control Set Value Pointer Value set to	Max 782
Pointer ss–Bits 10	Default 522
	Illegal (Max+1)
	USER DEFINED
TRANSMIT 54K TX DEFECT: # POINTERS TITTER.# SETTINGS FETTINGS ANOMALIES & TIMING WANDER	more 1 at 2

Figure 2 29: Example of Pointers & Timing Page of 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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
		Pointer Control	Single

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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 **POINTER ACTION** button on the front panel of the test set.

Each time you press the **POINTER ACTION** button, 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.

Be aware that it is necessary to press the Start/Stop button the front panel to see all the changes. To see the pointer value changing

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
RESULTS	SDH or PDH RESULTS	none	Pointers

Now press the **POINTER ACTION** button again.

To adjust a pointer using frequency offset:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
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.

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To change the frequency offset of the signal:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
		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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
			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 30). 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.

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Tek Running	0d ∟≋	0h	5m	15s	[⊖]STM-1 C=]STM-1
Pointer / Timing Mode Offset Mode	Freq Offse	uency et Line	Offset		EDIT MODE (3) Coarse
Frequency Offset	4.6p	pm			F ine
					DONE
TRANSMIT SETTINGS & TIMIN	RS G				

Figure 2 30: 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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
			DONE

To turn off frequency offset:

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

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

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Viewing Section Overhead

The CTS850 allows you to view the section overhead for the transmitted or received signal. To view the section overhead for the transmitted signal, press the MORE 1 of 2 Key softkey at the bottom of the test set screen, in order to see more choices:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
TRANSMIT	SECTION OVERHEAD	none	none

The first line of text under the menu name describes the signal being received and the AU under test (see Figure 2 31).

Tek Measuremen	ts Stopped	[€]STM-1 STM-1
		CHOICES
Transmitting ST [*] Showing Overhea	M 1 AU 4 # 1 under test ad for AU-4 #1 cols 1,4,7	Reset Overhead
J0 RS Trace S1 Sync. Status M	TEK CTS850 lessage G.812 Transit	Set to 10101010
Column 1 A1 1110110 81: *******	Column 4 Column 7 42: 00101000 Jo: USER E1: 00000000 F1: 000000 IV: 0000000 F1: 000000	Set to
H ⁻ : ************************************	H2: +***** H3: +*** K1: 00000000 K2 00000 D5: 00000000 C6: 00000	*** 000 000 000 000 000 000 000 000 000
D7: 00000000 D10 00000000 S1: 00000100	D8: 00000000 D9: 00000 D11: 00000000 E12: 00000 00000000 E2: 000000	000 000 000 EDIT BYTE
TRANSMIT 54k TX SETTINGS SETTING	S OVERHEAD OVERHEAD COMMANDS	DVERHEAD more

Figure 2 31: Example of Section Overhead Page of 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.

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

Once you have selected EDIT BYTE, the CTS850 enters the edit mode (see Figure 2 32).

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Tek Running	b0	0h 0m 20s	😝 STM-1E
TRANSMI			EDIT MODE
Transmitting S Showing Overh	TM-1E with AU-4 read for AU-4	# 1 under test #1 cols 1,4,7	1
Column 1	Column 4	Column 7	0
A1: 1111011 B1: ****** D1: 0000000	0 A2: 0010100 * E1: 0000000 0 D2: 0000000	0 C1: 00000001 0 F1: 00000000 0 D3: 00000000	\Rightarrow
H1: ****** 62: ****** D4: 0000000	* H2: ****** * K1: 0000000 0 D5: 0000000	* H3: * * * * * * * * * 0 K2 000000000 0 D6: 000000000 0 S2 000000000	$\langle \neg$
D10: 0000000 D10: 0000000 S1: 0000000	0 D3: 000000 0 D11: 0000000 0 0000000	0 D12: 00000000 0 E2: 00000000	DONE
TRANSMIT		SECT	

Figure 2 32: 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 CTS850 is now receiving the new value of the S1 byte:

Press Menu	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
RECEIVE	SECTION OVERHEAD	none	none

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

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

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	Select Menu	Highlight	Select Choice
Button	Page	Parameter	
RESULTS	TEST SUMMARY	none	none

The TEST SUMMARY page identifies the most common errors that the CTS850 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 33).

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Tek Measurements Sto	pped	STM-1E
Results Source: Results Rate: Results Structure: Results Payload: Lest Started: Elapsed Time:	← Current Results STM-1 Test Signal O.181 2 Mb/s 20:02:12 28-Jan-01 0d 0h 0m	
TROUBLE SC No Alarms N	AN o Errors	

TEST	SDH	PDH	E STORY	SAVE	RECALL	more
SUMMARY	SESULTS	RESULTS	GRAPHS	RESULTS	RESULTS	2 of 2
		L	<u>ل</u> ــــــــــــــــــــــــــــــــــــ	<u> </u>	L	,

Figure 2 33: The TEST SUMMARY Page of the RESULTS Menu

The SDH or PDH 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 the following figure).

To display the SDH or PDH RESULTS page:

Press Menu	Select Menu	Highlight	Select Choice	
Button	Page	Parameter		
	SDH or PDH RESULTS	none	none	

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Tek Meas	urements	Stopped				↔ STM-1E
RESUL	TS					CHOICES
SDH Se	ection	Defects	Seconds			Network
OOF (SEFS	5)			0s		Derects
RS-TIM			0s		Section Defects	
MS-AIS				Path Defects		
MS-RDI			0s		SDH Anomalies	
						Pointers
16S1 SUMMARY	SDH RESULTS	PDH RESULTS	E STORY GEAPHS	SAVE RESULTS	RECALL RESULTS	more 2 of 2

Figure 2 34: SDH Results, SDH Section Defects, from RESULTS menu

This completes the tutorial. For detailed information on CTS850 capabilities, refer to Chapter 3 *Reference*.

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