User Manual

Tektronix

DMA 120 & 121
Digital Modulation Analyzers

071-0126-00

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CE

Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

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Service Assurance Advantages

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- Eliminates unexpected service expenses

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Name	VISA or Master Card number and expiration date or purchase order number
Company	
Address	Repair Protection (1,2, or 3 years)
City, State, Postal code	Calibration Services (1,2,3,4, or 5 years)
Country	Instrument model and serial number
Phone	Instrument purchase date

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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.

To Avoid Fire or Personal Injury

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not connect the common terminal to elevated voltages.

Replace Batteries Properly. Replace batteries only with the proper type and rating specified.

Recharge Batteries Properly. Recharge batteries for the recommended charge cycle only.

Use Proper AC Adapter. Use only the AC adapter specified for this product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in an Explosive Atmosphere.

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. These symbols may appear on the product:


CAUTION
Refer to Manual


WARNING
High Voltage


Double
Insulated


Not suitable for
connection to
the public telecom-
munications network

Preface

This manual provides user information in the following sections:

- *Getting Started* provides first time operating information.
- *Operating Basics* provides information about using the controls and connectors, navigating the menus, editing screen fields, and setting up the analyzer.
- *Reference* describes each of the measurements and displays and gives information on what each means.
- *Appendices* describes specifications, memory cards, channel table editor software, and battery care.

For a quick information resource, refer to the *DMA 120 & 121 Digital Modulation Analyzer Reference* card. The reference card provides a full page menu hierarchy, describes each measurement briefly, and lists the screen on which each measurement appears.

Contacting Tektronix

Product Support	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 Or contact us by e-mail: tm_app_supp@tek.com For product support outside of North America, contact your local Tektronix distributor or sales office.

Service Support	Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations. http://www.tek.com
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000

Getting Started

Getting Started

This section gives a product description, lists standard and optional accessories, and lists procedures for first time operation.

Product Description

The DMA 120 and DMA 121 Digital Modulation Analyzers take precision field measurements of 64QAM transmission on cabled networks.

The analyzers measure digital transmission signals that comply with the following standards:

- DMA 120 measures signals compliant to ITU–T– J.83, Annex B.
- DMA 121 measures signals compliant to ITU–T– J.83, Annex A, commonly referred to as DVB–C.

Accessories

Refer to Tables 1–1 and 1–2 for standard and optional accessories.

Table 1–1: Standard accessories

Description	Option or part number	Comments
Wall mount power supplies		
US	119-4855-00	Standard for DMA 120
European	119-4856-00	Standard for DMA 121
Vehicle power adapter	119-4860-00	Draws power from the vehicle battery through the cigarette lighter
Certificate of Traceable Calibration	NA	Included in box

Table 1–1: Standard accessories (cont.)

Description	Option or part number	Comments
Soft carrying case	016-1673-00	
Software and English user documentation	020-2236-XX	Includes the Channel Table Editor disk, the English user manual, and the English reference card
NiMH battery	DMABAT	DR30 battery
Cable	174-4024-00	6 foot, RJ-45 to RJ-45
Adapter	103-0403-00	RJ-45 to 9-pin female

Table 1–2: Optional accessories

Description	Option or part number	Comments
Wall mount power supplies		
A0, US	119-4855-00	Option for DMA 121
A1, European	119-4856-00	Option for DMA 120
A2, UK	119-4857-00	Option for either product
A3, Australian	119-4858-00	Option for either product
NiMH battery	DMABAT	Extra DR30 battery

Table 1–2: Optional accessories (cont.)

Description	Option or part number	Comments
NiMH charger	DMACHG	Includes an external charger with a US and a European power cord. UK (A2) and Australian (A3) power cord options are also available.
Printer kit	DMAPRN	Includes DPU414 thermal printer, battery, RJ-45 to 9-pin null modem adapter, paper, and US AC adapter. European (A1), UK (A2), and Australian (A3) AC adapter options are also available.

First Time Operation

The analyzer can operate on internal battery power or on external power with an AC line adapter or with a vehicle power adapter.

1. Supply internal or external power to the analyzer:
    a. Internal power. Be sure the battery is installed and that it has charge. Refer to *Appendix B* for battery charging and installation instructions.
    b. External power. Connect either the AC power adapter or the vehicle power adapter to the external power jack (item 2 in Figure 2–1 on page 2–3).
2. Press ON/STBY to power the analyzer on. The main power-on screen appears as shown in Figure 1–1.
3. If necessary, adjust the display to make the screen easier to read:
    a. To adjust the screen contrast, use the front panel CONTRAST keys.
    b. To toggle the LCD backlight on (or off), press (F2). The battery charge will last longer if you operate the analyzer with the backlight off.

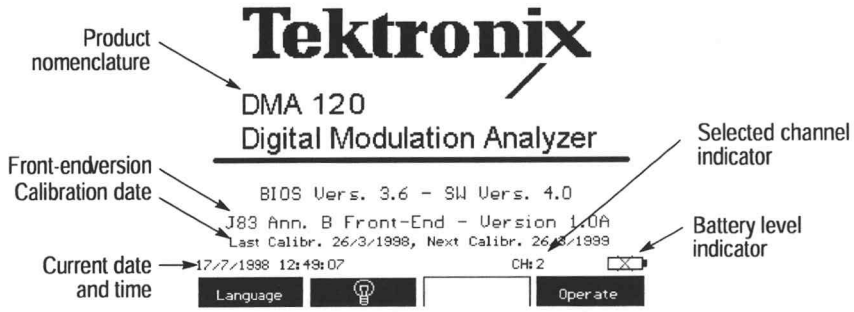


Figure 1–1: Power-on screen

4. Press Language (F1) to display a list of available languages for the user interface. Use the arrow keys to highlight a language, and then press ENTER to select the language and to return to the power-on screen.
5. Press Operate (F4) to display the status screen with menu choices for setting instrument parameters and making measurements. The status screen is shown in Figure 1–2.
6. Press MENU key anytime to go directly to the measurements screen.

NOTE. *Press ESC anytime to back up to a higher menu level. Successive presses will eventually return you to the power-on screen shown in Figure 1–1.*

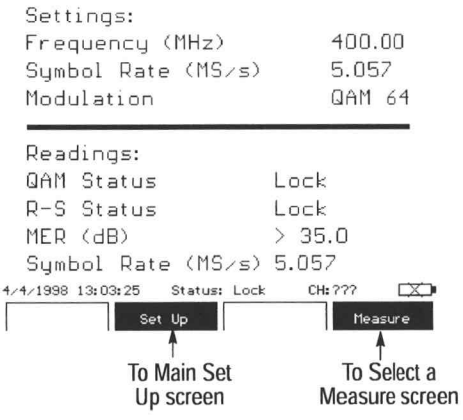


Figure 1–2: Status screen

Here is an overview of the steps you can use to take a measurement:

1. From the status screen, press Set Up (F2) to access the Main Set Up screen.

   Check the settings on each of the set up screens available from the Main Set Up screen. (Refer to *Set Up Menus* beginning on page 2–11.) These settings can modify the way measurement data is displayed.

2. Create a custom channel table on a PC using the Channel Table Editor software and then transfer the custom channel table to the analyzer. Refer to *Appendix D: Channel Table Editor.*

   Alternatively, you can create and edit a channel table on the analyzer from the Channel Table Management screen described on page 2–26.

   You can also take a measurement without a channel table by entering the channel center frequency in the Tuning screen (page 2–13) or in the Spectrum screen (page 3–21).

3. Activate the channel table in the analyzer and select a channel. Refer to page 2–26.
4. Connect the analyzer to a signal source. For connector information, refer to *Using Controls and Connectors* on page 2–2.

CAUTION. *The sum of the signal power of all signals (not just the signal on the tuned channel) must remain below +60 dBmV or +120 dBμV. Exceeding this limit could result in damage to the analyzer.*

5. From the status screen, press Measure (F4) to access the Select a Measure screen. Refer to the *Reference* section for information on each of the measurements available.

Operating Basics

Operating Basics

This chapter covers the following topics:

- Using Controls and Connectors
- Editing Screen Fields
- Navigating the Menu Hierarchy
- Checking the Status screen
- Using Set Up Menus
- Managing Channel Tables

Using Controls and Connectors

The following descriptions of analyzer controls and connectors are numbered to correspond to the numbers in Figure 2–1.

1. RS-232 connector allows communication to a PC or to a printer.
2. External power jack (12 VDC, 2 Amps maximum) connects to the AC line adapter or to the vehicle power adapter. Use only the adapters provided with this product.
3. Menu function keys (F1, F2, F3, and F4) select the displayed function menu.
4. Alpha-numeric keypad enters letters or numbers into a selected edit field.
5. ON/STBY key with indicator powers the analyzer on. Red LED indicates the analyzer is on.
6. ESC key backs up one display screen level.
7. CONTRAST keys adjust the display contrast.
8. PRINT key sends the current display to a printer connected via the RS-232 connector. For printing procedures, refer to *Appendix E.*
9. Arrow keys navigate through the display menus.
10. ENTER key confirms or executes selections.
11. MENU key displays the Select a Measure screen.
12. CHAN key displays the Channel Select screen.
13. Connector connects to a cable carrying digital signals for testing. Do not exceed the input limits.

CAUTION. *The sum of the signal power of all signals (not just the signal on the tuned channel) must remain below +60 dBmV or +120 dBμV. Exceeding this limit could result in damage to the analyzer.*

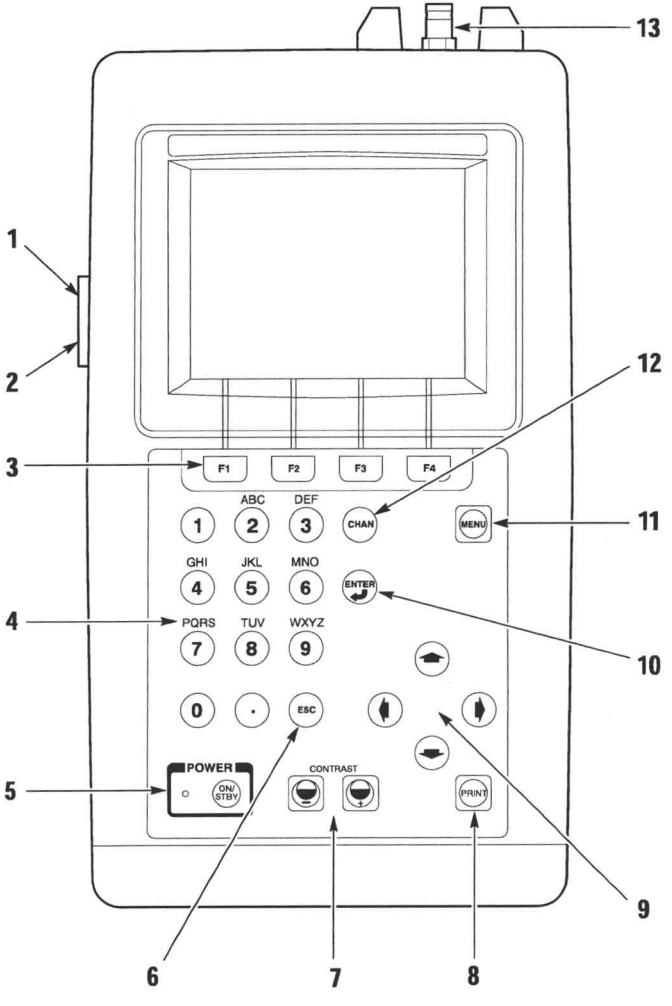


Figure 2–1: Controls and connectors

Editing Screen Fields

There are two types of edit fields. One type accepts input from the front-panel keys. The other type displays a pop-up menu, as shown in Figure 2–2.

Follow these steps to edit a field:

1. Select an edit field using the arrow keys.
2. Press ENTER. One of two things happens:
   - A pop-up menu appears. Use the arrow keys to highlight your selection. Press ENTER.
   - A cursor flashes in the edit field. Use the alpha-numeric keypad to enter characters.

     If the field accepts letters as well as numbers, press the key once to enter the number or continue pressing the key to cycle through the letters. For example, the 2 key cycles through 2, A, B, C.

     Use the right arrow key to move to the next place holder to enter another character or to enter a space. Press the backspace arrow (F2) key to delete the last character. When you have finished editing the field, press Enter.

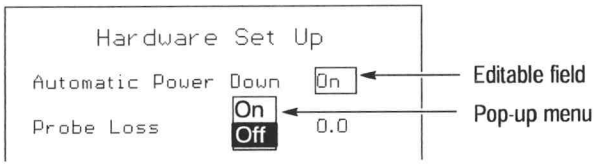


Figure 2–2: Editing fields

Navigating the Menu Hierarchy

Press the ESC key any time you want to leave a screen and back up one menu level. Press ESC repeatedly to return to the power-on screen.

Refer to the menu hierarchies in Figures 2–4 through 2–8 to see the layout of the user interface. Refer to the *DMA 120 & 121 Digital Modulation Analyzer Reference* card for a full-page illustration of the entire menu hierarchy.

The analyzer uses two types of menus:

- Screen menus. Highlight the desired menu using the arrow keys and then press ENTER.

  In the menu hierarchies, these menus are listed directly under the bold screen title.

- Function menus. Press the F-key (F1, F2, F3, or F4) located directly below the menu name on screen. Refer to Figure 2–3.

  In the menu hierarchies, these menus are represented in boxes. For example, the function menus available on the Status screen are represented as [Set Up | Measure] in Figure 2–4.

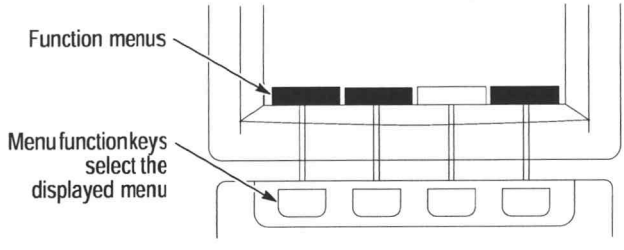


Figure 2–3: Function menus and F-keys

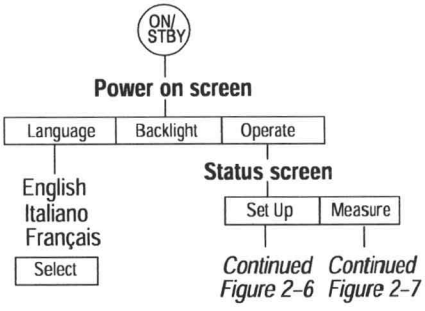


Figure 2–4: Power-on screen menu hierarchy

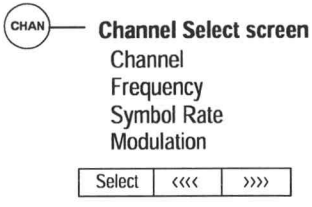


Figure 2–5: Channel Select screen menu hierarchy

Continued from Set Up, Figure 2–4

Main Set Up screen

Tuning screen
- Frequency
- Symbol Rate
- Modulation

Session screen
- Site
- Operator
- Temperature
- Clear Stored Measures
- Stored measures
- Free memory

Parameters screen
- Level unit
- I/Q Polarity
- Lock Loop
- Time span for level and MER measures

Threshold screen
- Level
- MER (dB)
- C/N (dB)
- Errored frame ratio for SES10^–5
- Adjacent channel Level difference (dB)

Peripherals screen
- RS-232 settings
- Printer Type
- Parameters
- Flow

Hardware Set Up screen
- Automatic Power Down
- Probe Loss (dB)
- Date / Time

Set Clock | Read Clock

Channel Tables

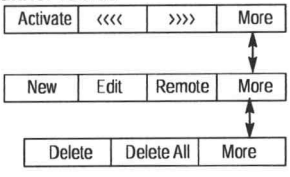


Figure 2–6: Main Set Up screen menu hierarchy

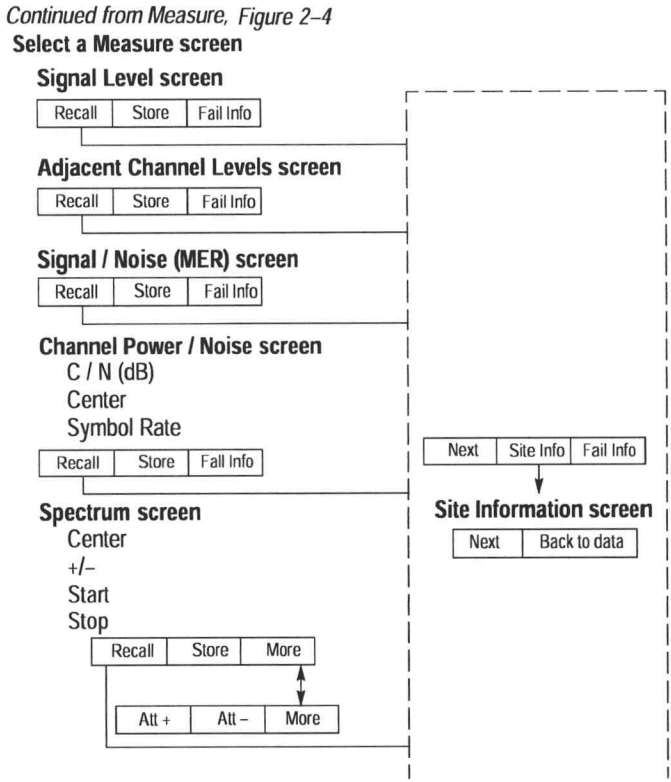


Figure 2–7: Measurement screen menu hierarchy, part 1

Continued from Measure, Figure 2–7

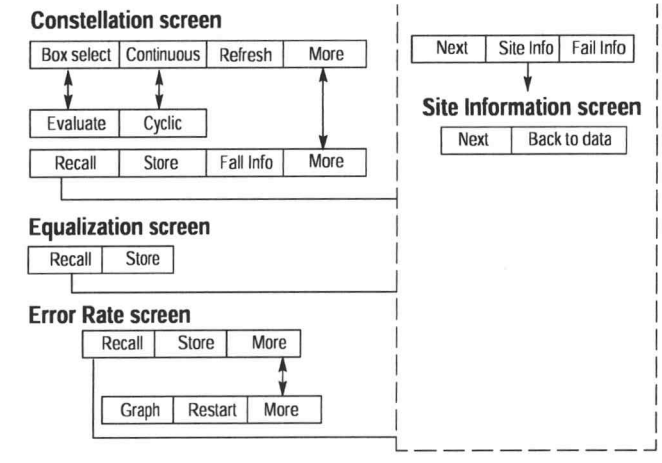


Figure 2–8: Measurement screen menu hierarchy, part 2

Checking the Status Screen

Follow the menu path to display the Status screen:

Power-on screen
Operate ——— Status screen

You can check the general settings of the analyzer by displaying the Status screen, shown in Figure 2–9. This screen also gives you access to the Main Set Up screen and the Select a Measure screen.

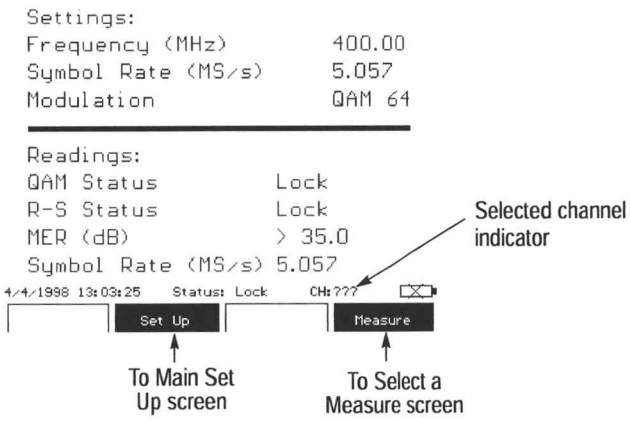


Figure 2–9: Status screen

Using Set Up Menus

Follow the menu path to display the Main Set Up screen:

From the Main Set Up screen, shown in Figure 2–10, you can access all of the analyzer set up parameters. This section describes each menu selection.

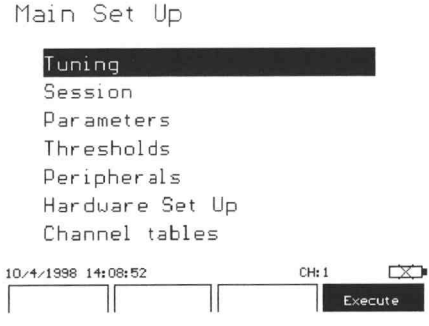


Figure 2–10: Main Set Up screen

- Tuning. Enter information for a channel not already in a channel table.
- Session. Enter information about the test site. Check the memory status.
- Parameters. Set measurement units, I/Q polarity, lock loop bandwidth, and test duration.
- Thresholds. Define measurement limits.

- Peripherals. Define settings for communicating with a PC or a printer.
- Hardware Set Up. Set the clock, the input probe loss offset, and the automatic power down function.
- Channel tables. Activate and edit a channel table and then select a channel. Enter Remote mode to transfer channel tables to and from the Channel Table Editor software on a PC.

Tuning

Follow the menu path to display the Tuning Set Up screen:

Main Set Up screen
Tuning ——————— Tuning Set Up screen

From the Tuning Set Up screen, shown in Figure 2–11, you can enter channel information without using a channel from a channel table.

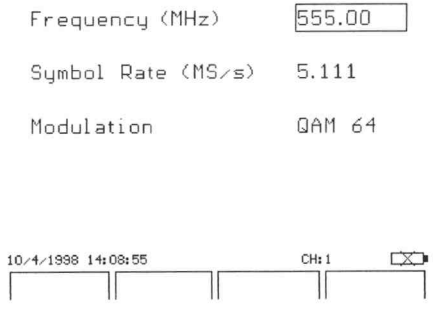


Figure 2–11: Tuning Set Up screen

The tuning settings found here initially match the settings of the selected channel from the active channel table. You can change the settings on the Tuning screen to test channels without entering them into a channel table.

If you enter new values in the Tuning screen, the selected channel indicator at the bottom of each screen will display ??? to indicate that no channel has been selected from a channel table.

Use the arrow keys to select an edit field. Enter the value with the keypad and press ENTER to confirm the change.

NOTE. *The data you enter in the Tuning screen will be overwritten when you next select a channel from a channel table.*

Press ESC to exit the Tuning screen.

Session Set Up

Follow the menu path to display the Session Set Up screen.

Main Set Up screen
Session ——————— Session Set Up screen

From the Session Set Up screen, shown in Figure 2–12, you can enter information about the site, the operator, and the ambient temperature. You can choose to clear the memory. You can also look at information on the number of measurements stored in memory and the amount of memory available.

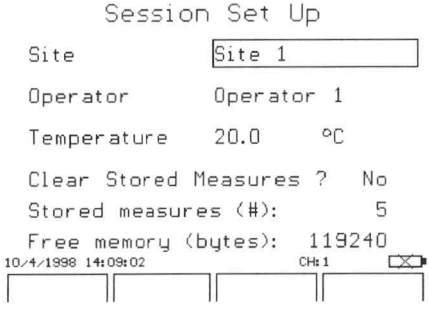


Figure 2–12: Session Set Up screen

Enter information about the test site:

- Site. Enter the location of the test.
- Operator. Enter the name of the person performing the tests.
- Temperature. Enter the ambient temperature.
- Clear Stored Measures. Choose to delete stored measurements by selecting Yes from the pop-up menu. All stored measurements will be deleted.

NOTE. *When you select Yes from the Clear Stored Measures pop-up menu, all stored measurements are deleted.*

This screen also gives you memory information.

- Stored Measures (#). Displays the number of measurements stored. The total number of measurement displays that can be stored is dependent on the measurement since some measurements use more memory than others.
- Free memory (bytes). Displays the amount of memory space available. The analyzer has approximately 130 kBytes of memory. You can increase the amount of memory by installing a PCMCIA memory card. See *Appendix C: Memory Cards* on page C–1.

Press ESC to exit the Session screen.

Parameter Set Up

Follow the menu path to display the Parameters Set Up screen.

Main Set Up screen
Parameters ——— Parameters Set Up screen

From the Parameters Set Up screen, shown in Figure 2–13, you can set the scale of the units, the I/Q polarity, the parameters of the carrier and timing recovery loops, and the duration of measurement graphs.

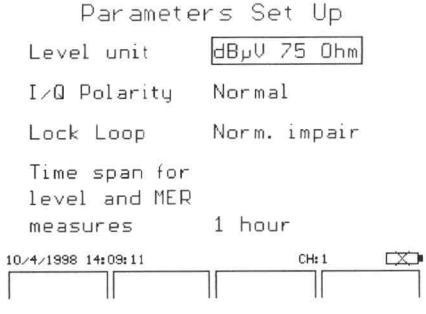


Figure 2–13: Parameters Set Up screen

Level unit. Selects the units and the scale the analyzer uses to display measurement results. Choose from dBµV 75 Ω, dBpW, dBmV 75 Ω, or dBm.

I/Q Polarity. Affects the demodulator's selection I and Q axes. Select one of the following options:

- Normal. The demodulator establishes QAM lock with a particular I/Q polarity.
- Inverted. The demodulator swaps the interpretation of the I and Q axes.
- Autodetect. The analyzer uses demodulated data to select the correct polarity. Use this setting under most conditions.

NOTE. *If the Status screen displays the following:*

```
QAM Status     Lock
R-S Status     No Lock
```

then try changing the I/Q polarity to Autodetect.

If the R–S status still does not say Lock, verify the type of R–S coding on the incoming signal.

Lock Loop. Sets parameters for the carrier and timing recovery loops. Refer to Table 2–1 for the bandwidth settings for the two menu choices.

- Norm. Impair. Gives the most accurate measurements. Use this setting under most conditions.
- High Impair. Gives less accurate measurements. Use this setting in a noisy environment if you cannot otherwise lock on a signal.

Table 2–1: Lock Loop bandwidth settings

Pop-up menu choices	Carrier phase recovery bandwidth	Carrier frequency recovery bandwidth	Timing recovery bandwidth
Norm. Impair	30 kHz	100 kHz	100 Hz
High Impair	50 kHz	450 kHz	2.5 kHz

Time span for level and MER measures. Sets the signal level and MER graph durations. You can select one of nine settings ranging from 4 minutes to 48 hours. If you select a long duration, you should plan to operate the analyzer on external power.

Press ESC to exit the Parameters screen.

Thresholds Set Up

Follow the menu path to display the Thresholds Set Up screen.

Main Set Up screen
Thresholds ——— Thresholds screen

From the Thresholds Set Up screen, shown in Figure 2–14, you can set the pass/fail thresholds for measurements.

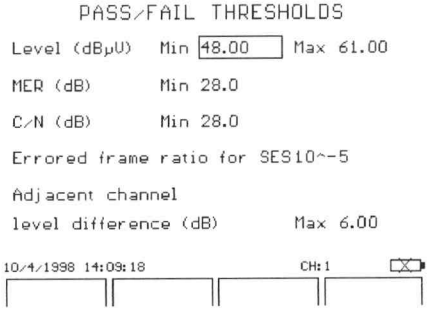


Figure 2–14: Thresholds Set Up screen

The Thresholds screen allows you to define the acceptance limits of measurements. If the measurements remain within the set limits, the relevant measurement screen displays PASS; otherwise FAIL is displayed.

Threshold detection is optimized for unattended monitoring. If a failure is detected, it will remain on screen until you re-initiate the measurement.

To set the thresholds, use the arrow keys to select an edit field. Enter the value with the keypad and press ENTER to confirm the change.

Set the following measurement thresholds:

- Level. Define the minimum and maximum limits for the radio frequency signal level. Set the units in the Parameters setup screen. See *Parameters* on page 2–17.
- MER (dB). Define the minimum Modulation Error Ratio allowed.
- C/N (dB). Define the minimum ratio between the signal level present in the selected channel and a selected noise frequency.
- Adjacent channel level difference (dB). Define the maximum difference allowed between the level for two adjacent digital channels.

Press ESC to exit the Thresholds Set Up screen.

Peripherals Set Up

Follow the menu path to display the Peripherals Set Up screen.

Main Set Up screen
Peripherals ——— Peripherals Set Up screen

From the Peripherals Set Up screen, shown in Figure 2–15, you can define the settings for communicating with a PC or a printer.

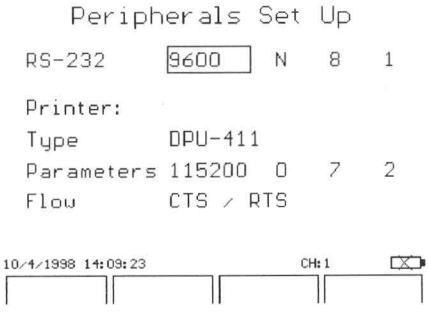


Figure 2–15: Peripherals set up screen

RS-232. Define the port for connecting to a PC. There are four settings:

- Set the baud rate to 9600, 19200, 38400, 57600, or 115200.
- Set the parity to None (N), Odd (O), or Even (E).
- Set the data bits to 7 or 8.
- Set the stop bits to 1 or 2.

For communication with the Channel Table Editor software, set the RS-232 settings to 9600, N, 8, 1.

Printer Type. Lists the printer type.

Parameters. Set the data transmission parameters. There are four settings:

- Set the baud rate to 9600, 19200, 38400, 57600, or 115200.
- Set the parity to None (N), Odd (O), or Even (E).
- Set the data bits to 7 or 8.
- Set the stop bits to 1 or 2.

For communication with the DPU414 printer, set the transmission parameters to 9600, N, 8, 1.

Flow. Lists the handshaking setup.

Press ESC to exit the Peripherals Set Up screen.

Hardware Set Up

Follow the menu path to display the Hardware set up screen.

Main Set Up screen
Hardware ——— Hardware Set Up screen

From the Hardware set up screen, shown in Figure 2–16, you can set the analyzer to power down automatically, the probe loss to account for an attenuator, and the date and time.

Figure 2–16: Hardware setting screen

From this screen you can set the following:

Automatic Power Down. Set to On to automatically power off the analyzer 10 minutes after the last key is pressed. To power the analyzer back on, use the ON/STBY key. When this setting is set to On, APD appears on each screen next to the battery indicator.

Probe Loss. If you attach an attenuator, a preselector, or a preamplifier to the front-end input, set the signal amplitude measurement offset here.

Date/Time. Set the date and time:

1. With the arrow keys, scroll to the parameter you want to change.
2. Use the keypad to edit the value. Press ENTER to accept the new value. Press ESC to return the parameter to its prior value.
3. Repeat for all other date and time parameters.
4. Press Set Clock to update the internal clock to the new values.

The Read Clock menu selection reads the analyzer time and date values into the edit fields.

Channel Tables Management screen

From the Channel Tables Management screen, you can create, edit, delete, or activate a channel table. Refer to *Managing Channel Tables* beginning on page 2–26.

Managing Channel Tables

Although you can create and edit channel tables with the analyzer alone, you will generally find it easier to do so using the Channel Table Editor software and a PC. Refer to *Appendix D: Channel Table Editor* for information on how to create channel tables and transfer them to the analyzer.

Once you have transferred channel tables to the analyzer, you can activate a channel table and select a channel.

Activating a Channel Table

1. Follow the menu path to the Channel Tables Management screen:

Main Set Up screen
Channel Tables ——— Channel Tables Management screen

The screen shown in Figure 2–17 appears.

2. Highlight a channel table with the arrow keys, press Activate (F1), and then press Yes (F3).

The channel table you chose is now the active channel table.

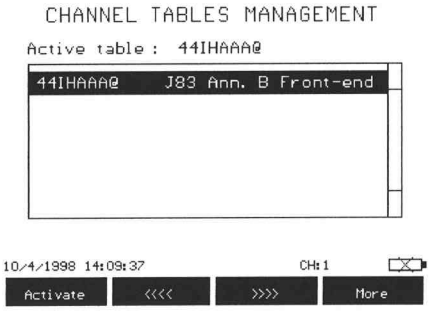


Figure 2–17: Channel Tables Management screen

Selecting a Channel

All measurements are performed on the selected channel.

You can select a channel in two ways: by editing the channel table from the Channel Tables Management screen or by going to the Channel Select screen. You can access the Channel Select screen any time by pressing the CHAN key and then automatically return to the screen where you had previously been working.

1. Press the CHAN key to display the Channel Select screen:

CHAN —— Channel Select screen

The screen shown in Figure 2–18 appears.

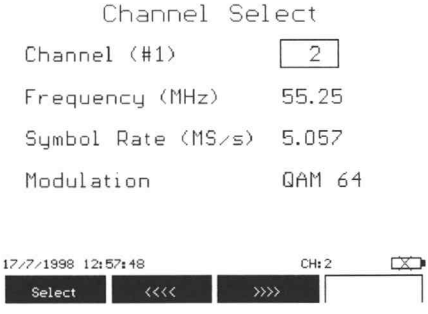


Figure 2-18: Channel select screen

2. Enter the channel number using the numeric keypad.
3. Press Confirm (F4) to confirm your selection and to return to the screen where you had previously been working.

Editing a Channel Table

Although you can create and edit channel tables with the analyzer alone, you will generally find it easier to do so using the Channel Table Editor software and a PC. Refer to *Appendix D: Channel Table Editor* for information on how to create and edit channel tables and transfer them to the analyzer.

To edit a channel table with the analyzer, follow the menu path:

Channel Tables Management screen
More — Edit — Edit Channel Table screen

From the Edit Channel Table screen, shown in Figure 2–19, you can edit 116 channels. Each channel has two variables that you can set: Frequency in MHz and Symbol Rate in MS/s.

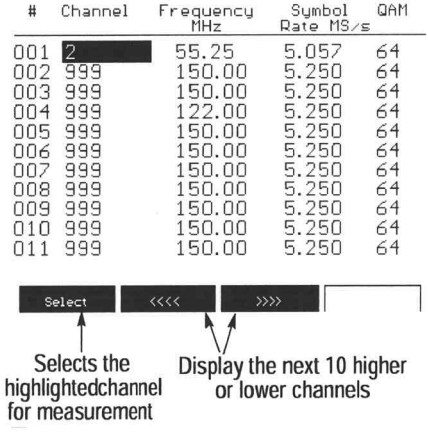


Figure 2–19: Edit Channel Table screen

To edit the channel table values, follow these steps:

1. Select the field you want to edit.

   Press <<<< (F2) or <<<< (F3) to move up or down by ten channels.

   Use the front-panel arrow keys to move up or down by one channel or to move horizontally from field to field.

2. Enter the values with the keypad.

3. Press ENTER to confirm your entry.

Reference

Overview of Measurements

The analyzer performs four main types of measurements: digital demodulation measurements, system availability measurements, RF measurements, and displays. Measurements are valid for 64 QAM digital signals on a 75 Ω network:

- DMA 120 measures signals compliant to ITU–T– J.83, Annex B.
- DMA 121 measures signals compliant to ITU–T– J.83, Annex A, commonly referred to as DVB–C.

Digital Demodulation Measurements

Digital measurements indicate the quality of the transmission channel by measuring digital transmission parameters.

Modulation Error Ratio (MER)

Ratio (in dB) of equalized signal power to total signal degradation. MER indicates the ability of a receiver to correctly demodulate the signal. MER indicates linear and nonlinear distortions, ingress, and reflections.

This measurement is found on the MER screen. See page 3–16 for more information about MER.

Error Vector Magnitude (EVM)

Ratio (in percentage) of signal error magnitude to equalized signal magnitude. EVM expresses, in a different format, the same information as MER.

This measurement is found on the Constellation screen. See page 3–25 for more information about EVM.

Bit Error Rate (BER)

Ratio of erroneous bits (prior to Reed-Solomon decoder) to total transmitted bits, expressed in exponential notation. BER describes the overall quality of the digital transmission link.

This measurement is found on the Error Rate screen. See page 3–36 for more information about BER.

Estimated Noise Margin

The amount of synthesized noise which can be added to the signal before critical BER is reached. Estimated Noise Margin indicates the susceptibility of the transmission channel to additional impairment.

This measurement is found on the MER screen. See page 3–16 for more information about Estimated Noise Margin.

Symbol Rate

The symbol rate (in MegaSymbols per second) of the input signal.

This measurement is found on the Status screen. See page 2–10 for more information on Symbol Rate.

System Availability Measurements

System Availability describes the long-term quality of the complete digital transmission over the transmission link.

Errored Seconds (ES)

The number of cumulative one-second periods, each having one or more Errored Blocks (EB). An EB is an MPEG Transport Stream packet with an uncorrectable error (post decoder).

This measurement is found on the Error Rate screen. See page 3–36 for more information about ES.

Severely Errored Seconds (SES)

The number of cumulative one-second periods, each containing greater than a specified number of errored blocks, or at least one severely disturbed period.

Define SES on the Thresholds Setup screen in the Errored Frame Ratio for SES field; specify the number of errored blocks per one second period.

This measurement is found on the Error Rate screen. See page 3–36 more information SES.

Severely Disturbed Period (SDP)

Cumulative duration of sync loss. Sync loss occurs when two or more consecutive sync bytes within the transport stream are corrupted. Sync is acquired again when five consecutive sync bytes are correctly decoded.

This measurement is found on the Error Rate screen. See page 3–36 for more information about SDP.

Unavailable Time (UT)

The cumulative duration of unavailable time periods.

An unavailable time period begins with (and includes) 10 consecutive Severely Errored Seconds (SES) and continues until there are 10 consecutive non-SES events. These 10 consecutive non-SES events are part of available time.

This measurement is found on the Error Rate screen. See page 3–36 for more information about UT.

RF Measurements

RF measurements do not require demodulation.

RF Signal Level

Average signal power within the channel bandwidth. Signal level can be expressed in dBμV, dBmV, dBm, or dBpW.

This measurement is found on the Signal Level screen. See page 3–10 for more information about RF Signal Level.

Channel Power to Noise Ratio

Power ratio between the test channel and a nearby noise frequency. You specify a channel number or frequency and a noise measurement frequency.

This measurement is found on the Channel Power/Noise screen. See page 3–19 for more information about Channel Power to Noise Ratio.

Adjacent Channel Level

Displays the average power in dB of the selected channel, the two channels above it, and the two channels below it.

This measurement is found on the Adjacent Channel Levels screen. See page 3–13 for more information about Adjacent Channel Level.

Displays

Display screens give a graphic representation of an aspect of a signal that cannot be easily described by a single number.

Spectrum

Spectral density of signal displayed as a function of frequency. Resolution bandwidth is fixed at 135 kHz. Spectrum displays are useful to ascertain the transmission's spectral shape and relative power with respect to adjacent channels.

This measurement is found on the Spectrum screen. See page 3–21 for more information about the Spectrum screen.

Constellation

Display of accumulated symbol time samples of inphase and quadrature signal components. This constellation is plotted on perpendicular coordinate axes. The display can indicate signal impairments such as amplitude imbalance, quadrature error, noise, phase jitter, and interference.

This measurement is found on the Constellation screen. See page 3–25 for more information about the Constellation screen.

Equalization

Display of the relative amplitudes (in dB) of the adaptive equalizer taps: for the DMA121 there are 8 precursor and 8 postcursor taps, and for the DMA120 there are 8 precursor and 24 postcursor taps. This display indicates how hard the equalizer is working to compensate for linear impairments such as reflections.

This measurement is found on the Equalization screen. See page 3–34 for more information about the Equalization screen.

Taking Measurements

Measurements are valid for 64 QAM digital signals on a 75 Ω network:

- DMA 120 measures signals compliant to ITU–T– J.83, Annex B.
- DMA 121 measures signals compliant to ITU–T– J.83, Annex A, commonly referred to as DVB–C.

Before you take a measurement, consider these issues:

1. What channel do you want to test? Check the currently selected channel information on the Status screen (refer to page 1–6). If necessary, select a new channel or adjust the tuning:
   a. You can select a channel using the CHAN key if there are channels defined in a channel table. Refer to page 2–26.
   b. You can adjust the tuning directly using the Tuning Set Up screen. Refer to page 2–13.
2. Is it important that you have a record of the test site and operator? If so, go to the Session Set Up screen (refer to page 2–15).
3. Go to the Parameters Set Up screen. Check all the items there for correctness (refer to page 2–17).
4. Go to the Thresholds Set Up screen. Check all threshold settings that apply to any measurements you are about to make (refer to page 2–20).
5. Is there an attenuator attached to the front-end input? Go to the Hardware Set Up screen to set the amplitude measurement offset adjustment (refer to page 2–24).

Connect to the Cable Under Test

CAUTION. *The sum of the signal power of all signals (not just the signal on the tuned channel) must remain below +60 dBmV or +120 dBμV. Exceeding this limit could result in damage to the analyzer.*

1. Be sure the channel under test will not exceed the analyzer's input limits.
2. Connect the cable under test to the analyzer front-end input. For the location of the front-end input, refer to item 13 in Figure 2–1 on page 2–2.

You are now ready to select a measurement. This chapter describes each measurement.

Select a Measure Screen

To access the Select a Measure screen, press the MENU key.

Select a Measure screen

From the Select a Measure screen, shown in Figure 3–1, you can access all the analyzer measurements.

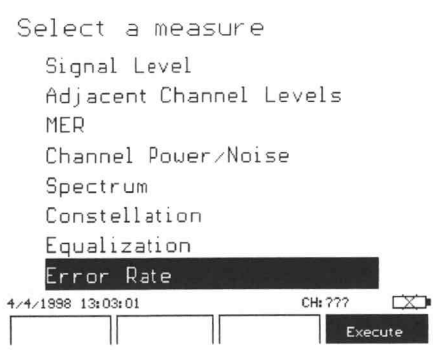


Figure 3–1: Select a Measure screen

From the list of possible measurements, highlight your selection with the arrow keys and press ENTER. The measurement starts immediately.

Signal Level

Follow the menu path to display the Signal Level screen:

Select a Measure screen
Signal Level ——— Signal Level screen

From the Signal Level screen, shown in Figure 3–2, you can measure the average signal power within the channel bandwidth. Use this measurement to check that the signal level is appropriate for your system.

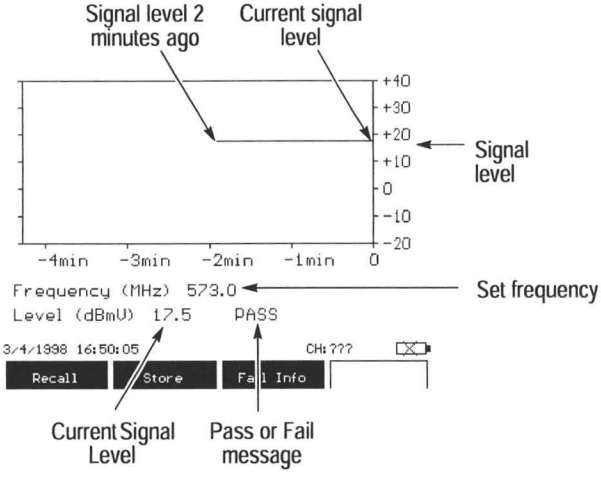


Figure 3–2: Signal Level measurement example

The vertical scale (signal level) changes depending on the measurement units chosen with the Parameters Set Up screen. See page 2–17.

Signal Level displays the received signal amplitude. If the signal level goes off the edge of the graph's scale, a > or < sign is displayed with the maximum or minimum value that the graph can display.

For example, if the units are set to dBμV, then the limits are 37 and 103. Exceeding these limits results in a Level reading of >103 dBμV or <37 dBμV.

The Pass/Fail indicator indicates whether the signal level has exceeded the minimum or maximum threshold settings. If the signal fails, the FAIL indicator remains on screen until you exit the measurement.

Table 3–1: Signal Level F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored Signal Level measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored Signal Level measurement. Repeated presses cycle through all stored Signal Level measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored Signal Level measurement. Repeated presses cycle through all stored Signal Level measurements.
Back to Data	Returns you to the stored measurements screen.
Fail Info	Same as described below.
Store	Saves the current display to memory.
Fail Info	Displays failure information if set limits are exceeded. Limits are set in the Thresholds screen (see page 2–20). The Fail Info menu is available only if there is a failure.
ESC	Returns to the Select a Measure screen.

Adjacent Channel Levels

Follow the menu path to display the Adjacent Channel Levels screen:

Select a Measure
Adjacent Channel Levels —— Adjacent Channel Levels screen

From the Adjacent Channel Levels screen, shown in Figure 3–3, you can compare the power level of a channel to the power level in adjacent channels.

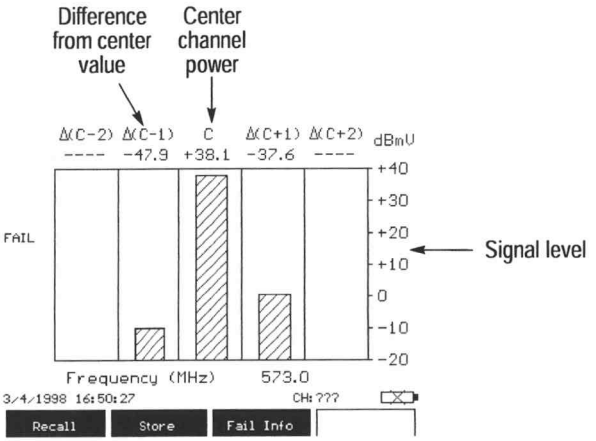


Figure 3–3: Adjacent channel levels measurement example

Use the Adjacent Channel Levels display to view a bar graph representation of the average power levels of five channels: the selected channel, the two channels in the frequency range just above the selected channel, and the two channels in the frequency range just below the selected channel.

If no channel is present in an adjacent frequency range, then no bar should appear in that range. If a bar appears in a channel that should be empty, then signal is leaking from an adjacent channel.

Though the center channel (the selected channel) must be in the analyzer channel table, the adjacent channels are not necessarily in the channel table.

The measurement is valid for measuring adjacent digital channels but not adjacent analog channels.

The average power of the selected channel, labeled C, appears in the center slot of the display.

The channel data of the adjacent channels are labeled Δ(C–1), Δ(C–2), Δ(C+1), and Δ(C+2). The average power of the adjacent channels is expressed in dB as a value relative to the selected channel. For example, if Δ(C–1) displays –47.9, then its average power is 47.9 dB less than the average power of the selected channel.

The vertical scale (signal level) changes depending on the measurement units chosen with the Parameters set up screen. See page 2–17.

Table 3–2: Adjacent Channel Levels F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored adjacent channels measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored Adjacent Channel Levels measurement. Repeated presses cycle through all stored Adjacent Channel Levels measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored Adjacent Channel Levels measurement. Repeated presses cycle through all stored Adjacent Channel Levels measurements.
Back to Data	Returns you to the stored measurements screen.
Fail Info	Same as described below.
Store	Saves the current display to memory.
Fail Info	Displays failure information if set limits are exceeded. Limits are set in the Thresholds screen (see page 2–20). The Fail Info screen is available only if there is a failure.
ESC	Returns to the Select a Measure screen.

Modulation Error Ratio (MER)

Follow the menu path to display the Modulation Error Ratio screen:

Select a Measure
MER —— Modulation Error Ratio screen

From the Modulation Error Ratio screen, shown in Figure 3–4, you can measure both Modulation Error Ratio and Estimated Noise Margin, two measurements which indicate signal quality and signal robustness.

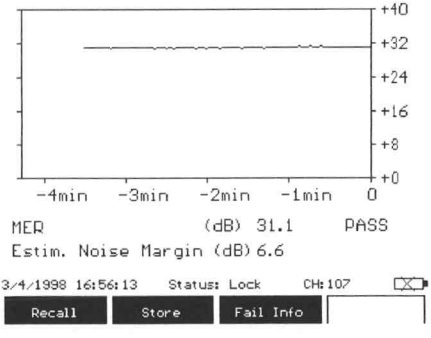


Figure 3–4: Modulation Error Ratio measurement example

Modulation Error Ratio

Modulation Error Ratio (MER) measures the ratio in dB of equalized signal power to total signal degradation. This ratio can indicate problems with a signal including linear or nonlinear distortions, ingress, and reflections. MER indicates the ability of a receiver to correctly demodulate the signal.

The analyzer can measure MER values ranging from 22 to 35 dB. The higher the MER number, the better the signal. If the MER number is less than the minimum threshold you set on the Threshold screen, the Modulation Error Ratio screen will display Fail. Refer to page 2–20 to set the MER threshold.

The Modulation Error Ratio graph displays the measurement results over time. In general, you want to see a high ratio that is steady over time.

In Figure 3–4, the graph shows that the MER was about 30 dB for the last 3 1/2 minutes.

Estimated Noise Margin

Estimated Noise Margin measures the amount of additional synthesized noise that can be added to the signal before minimum signal quality is lost. The analyzer calculates the Estimated Noise Margin by simulating the addition of white Gaussian noise, which gives a predicted critical BER of 10^{-8} after Reed-Solomon decoding. (This critical BER corresponds to a pre-Reed-Solomon decoding value of 2.1×10^{-4} for the DMA120 or 3.3×10^{-3} for the DMA121.) The measurement indicates the susceptibility of the transmission channel to additional impairment.

The analyzer can measure Estimated Noise Margin values ranging from 1 to 10 dB (DMA 121) or 1 to 12 dB (DMA 120). The higher the number, the better the signal.

Table 3–3: Modulation Error Ratio F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored MER measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored MER measurement. Repeated presses cycle through all stored MER measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored MER measurement. Repeated presses cycle through all stored MER measurements.
Back to Data	Returns you to the stored measurements screen.
Fail Info	Same as described below.
Store	Saves the current display to memory.
Fail Info	Displays failure information if set limits are exceeded. Limits are set in the Thresholds screen (see page 2–20). The Fail Info screen is available only if there is a failure.
ESC	Returns to the Select a Measure screen.

Channel Power/Noise

Follow the menu path to display the Channel Power/Noise screen:

Select a Measure
Channel Power/Noise —— Channel Power/Noise screen

From the Channel Power/Noise screen, shown in Figure 3–5, you can measure the power ratio between the test channel and a nearby noise frequency. You specify a channel number or frequency, and a noise measurement frequency.

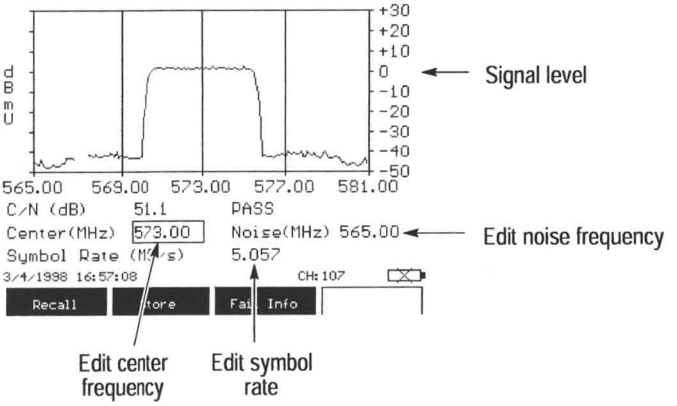


Figure 3–5: Channel power-to-noise measurement example

If you are not using a channel table, enter the center frequency of the test channel. Then enter a frequency where the noise floor will be measured.

The vertical scale (signal level) changes depending on the measurement units chosen with the Parameters set up screen. See page 2–17.

Table 3–4: Channel Power/Noise F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored Channel Power/Noise measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored Channel Power/Noise measurement. Repeated presses cycle through all stored Channel Power/Noise measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored Channel Power/Noise measurement. Repeated presses cycle through all stored Channel Power/Noise measurements.
Back to Data	Returns you to the stored measurements screen.
Fail Info	Same as described below.
Store	Saves the current display to memory.
Fail Info	Displays failure information if set limits are exceeded. Limits are set in the Thresholds screen (see page 2–20). The Fail Info screen is available only if there is a failure.
ESC	Returns to the Select a Measure screen.

Spectrum

Follow the menu path to display the Spectrum screen:

Select a Measure
Spectrum —— Spectrum screen

From the Spectrum screen, shown in Figures 3–6 and 3–7, you can view the frequency spectrum of a user-determined bandwidth.

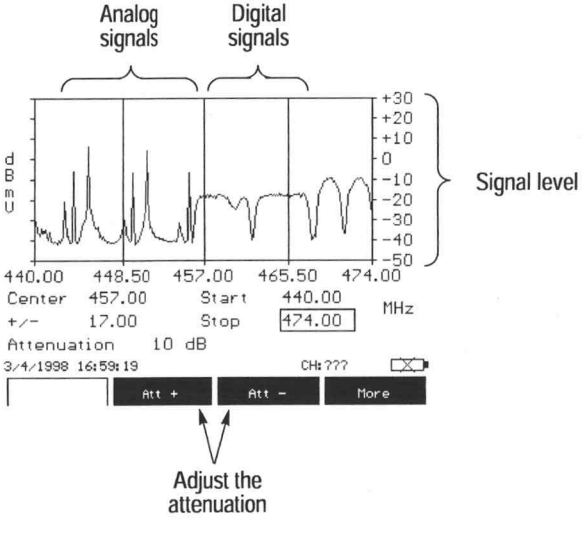


Figure 3–6: Spectrum measurement example 1

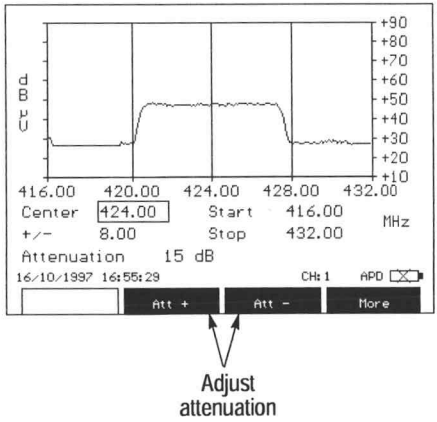


Figure 3–7: Spectrum measurement example 2

The spectral density of the signal is displayed as a function of frequency. The resolution bandwidth is fixed at 135 kHz. You can use the Spectrum display to view the transmission's spectral shape and relative power with respect to adjacent channels.

You can adjust the horizontal scale by modifying the values in the editable fields below the spectrum You can adjust the frequency span in one of two ways:

- Set Center and +/–. Center defines the center frequency of the spectrum. +/– defines half of the total frequency span in MHz (from the center value) displayed on the spectrum. When you set Center and +/–, the Start and Stop values adjust accordingly.
- Set Start and Stop. Start and Stop define the outside limits of the spectrum. When you set Start and Stop, the center frequency and +/– values adjust accordingly.

You can also adjust the attenuation level of the input signal. Press More (F4) and then Att+ (F2) or Att– (F3) to cycle through the choices: Automatic or 0 dB to 35 dB in five 5 dB increments. Select Automatic to allow the analyzer to adjust the attenuation automatically, and to maximize the dynamic range.

The vertical scale (signal level) changes depending on the measurement units chosen in the Parameters set up screen. See page 2–17.

Table 3–5: Spectrum F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored Spectrum measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored Spectrum measurement. Repeated presses cycle through all stored Spectrum measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored Spectrum measurement. Repeated presses cycle through all stored measurements.
Back to Data	Returns you to the stored measurements screen.
Store	Saves the current display to memory.
More	Displays menus to adjust the attenuation level of the measurement display. You can set the attenuation to Automatic to allow the analyzer to pick the best attenuation factor or you can vary the level from 0 dB to 35 dB in 5 dB increments.
Att+	Increases the attenuation.
Att–	Decreases the attenuation.
ESC	Returns to the Select a Measure screen.

Constellation

Follow the menu path to display the Constellation screen:

Select a Measure
Constellation ——— Constellation screen

From the Constellation screen, shown in Figure 3–8, you can assess the quality of the transmitted signal. The display can indicate signal impairments such as amplitude imbalance, quadrature error, noise, phase jitter, and interference.

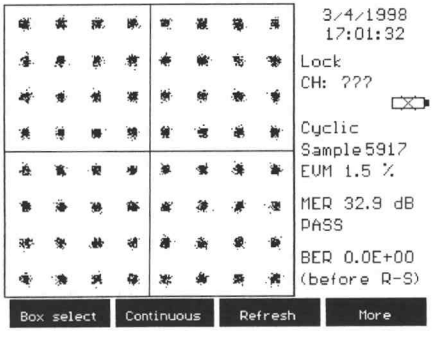


Figure 3–8: Constellation display

The constellation diagram displays, on a Cartesian plane, the accumulated inphase and quadrature signal components sampled at symbol times.

If the analyzer doesn't lock onto the signal, the display remains blank.

Table 3–6: Constellation F-key menu actions

Menu selection	Action
Box Select / Evaluate	Zooms in on the selected symbol location. See Zooming on page 3–27.
Continuous / Cyclic	Toggles the refresh mode. Cyclic allows a data refresh every 8192 points. Continuous allows perpetual data accumulation. When data is refreshed, the analyzer purges collected data and begins to collect new data.
Refresh	Purges collected data and begins to collect new data.
More	Displays menus for Recall, Store, and Fail Info.
Recall	Stops the current measurement and displays the most recently stored Constellation measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Store	Saves the current display to memory.
Next	Displays the next most recently stored Constellation measurement. Repeated presses cycle through all stored Constellation measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored Constellation measurement. Repeated presses cycle through all stored measurements.
Back to Data	Returns you to the stored measurements screen.
Fail Info	Displays failure information if set limits are exceeded. Limits are set in the Thresholds screen (see page 2–20). The Fail Info screen is available only if there is a failure.
ESC	Returns to the Select a Measure screen.

Zooming.

Enlarge a symbol cluster to examine it more closely.

1. Press Box Select (F1). A black box appears.

   You will see a display similar to that shown on the left of Figure 3–9.

2. Use the arrow keys to move the black box to the symbol location you wish to enlarge, and then press Evaluate (F1).

   The area in the black box becomes the area within the solid line in the enlarged screen. The solid line represents the symbol location decision boundaries. The dotted lines cross at the center of the box. See Figure 3–9.

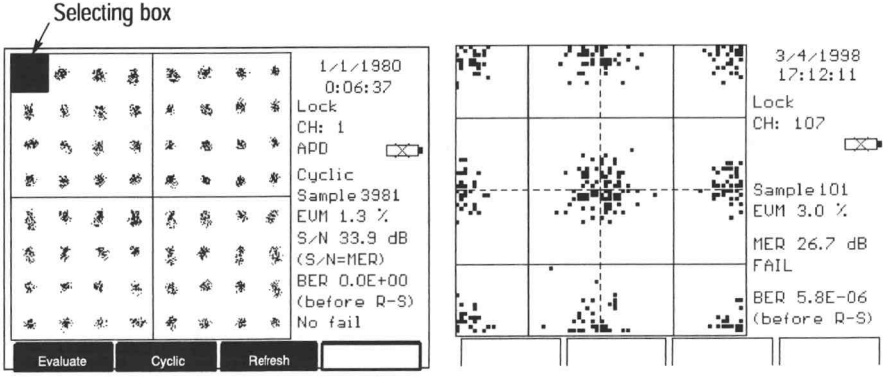


Figure 3–9: Zoomed view of symbol cluster in Constellation display

Constellation display examples

This section describes constellations resulting from some recognizable transmission impairments.

Ideal Signal. Figure 3–8 shows a signal with correct synchronization. Look for tightly clustered symbol points and an array of symbol clusters that are evenly spaced and arranged in a square. Contrast this example with each of the displays showing errors.

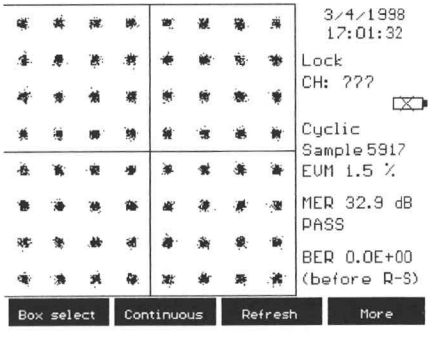


Figure 3–10: Constellation display with correct synchronization

Amplitude Imbalance. Amplitude imbalance describes the different gains of the I and Q components of a signal. In a constellation diagram, amplitude imbalance is indicated by one signal component being expanded and the other one being compressed.

See Figure 3–11. Look for a rectangular, rather than square, array of symbol clusters.

Phase Jitter. Phase jitter (or phase noise) is a statistical quantity that affects the I and the Q paths equally. In the constellation diagram, phase jitter is indicated by the signal states being rotated about their coordinate origin.

See Figure 3–11. Look for elongated symbol clusters that seem to circle the center of the display. The symbol clusters furthest from the origin are the most elongated.

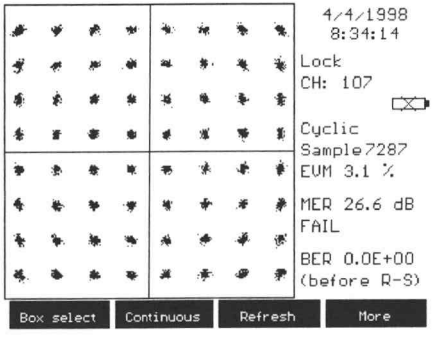


Figure 3–11: Constellation display with I/Q gain imbalance and phase jitter

Be sure to look carefully at the symbol clusters at the periphery of the display. Notice how the symbol clusters near the center of the display (shown zoomed in Figure 3–12) are nearly normal, while a symbol cluster from the corner of the display (shown zoomed in Figure 3–13) is off-center and is elliptical instead of being evenly distributed around the center of the box.

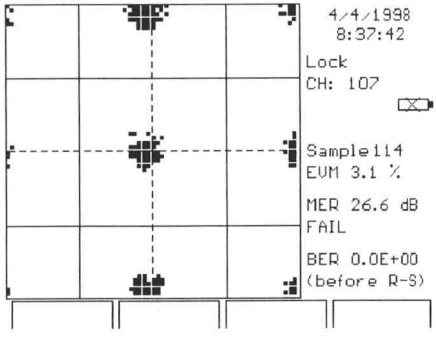


Figure 3–12: Zoomed center box of Constellation display with I/Q gain imbalance and phase jitter

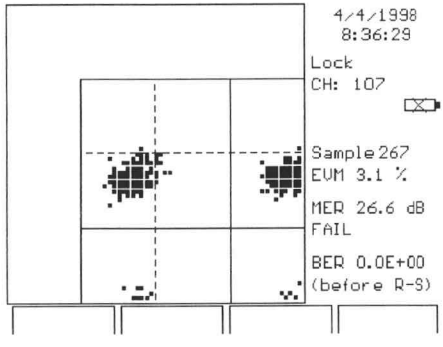


Figure 3–13: Zoomed upper left corner of Constellation display with I/Q gain imbalance and phase jitter

Interferer. Coherent interferers are sinusoidal spurious signals occurring in the transmission frequency range and superimposed on the QAM signal at some point in the transmission path. In the constellation diagram, an interferer shows up in the form of a rotating phasor superimposed on each constellation point.

See Figure 3–14. Look for symbol clusters with a hollow area at the center.

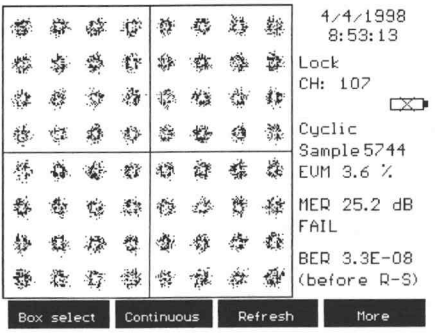


Figure 3–14: Constellation display with coherent interferer

Noise. Noise can disturb the digitally modulated signal during analog transmission. If no other error is present at the same time, the points representing the ideal signal status expand to form circular clouds.

See Figure 3–15. Look for loose clusters of symbol points.

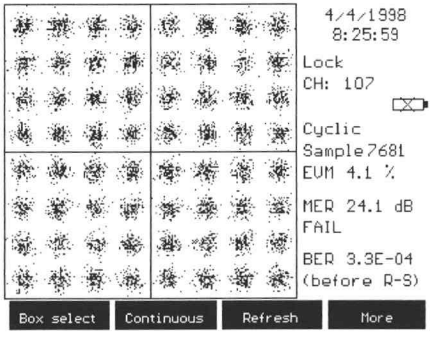


Figure 3–15: Constellation display with noise

The following types of interference can cause constellation diagrams similar to Figure 3–15:

- Impulsive noise
- Nonlinearities in amplifiers
- Intermodulation
- Errors from uncompensated echoes and non-flat frequency response

Phase Error. The phase error (also referred to as quadrature offset or quadrature error) is the difference between the phase angles of the I and Q components, referenced to 90°. The I and Q components are, in this case, not orthogonal to each other after demodulation.

See Figure 3–16. Look for an array of symbol clusters arranged in a rhomboid shape.

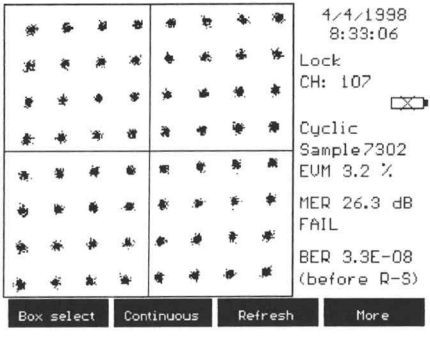


Figure 3–16: Constellation display with phase error

Equalization

Follow the menu path to display the Equalization screen:

Select a Measure
Equalization ——— Equalization screen

From the Equalization screen, shown in Figure 3–17, you can view the relative amplitudes (in dB) of the adaptive equalizer taps. For the DMA121 there are 8 precursor and 8 postcursor taps, and for the DMA120 there are 8 precursor and 24 postcursor taps. This display indicates how hard the equalizer is working to compensate for linear impairments such as reflections.

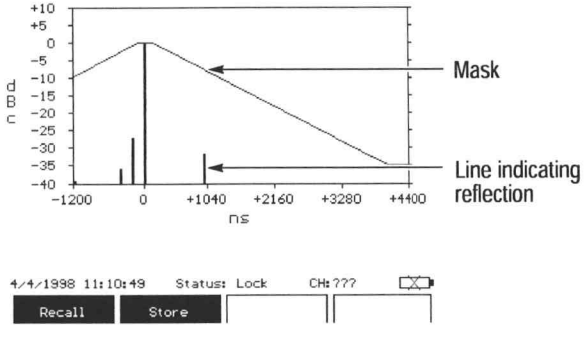


Figure 3–17: Equalization measurement example

If the lines on the Equalization screen come close to the mask (see the third line in Figure 3–17), the equalizer is approaching the limit of its ability to equalize linear impairments.

In Figure 3–17, the fourth line in the graph indicates a reflection.

Table 3–7: Equalization F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored Equalization measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored Equalization measurement. Repeated presses cycle through all stored Equalization measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored Equalization measurement. Repeated presses cycle through all stored Equalization measurements.
Back to Data	Returns you to the stored measurements screen.
Store	Saves the current display to memory.
ESC	Returns to the Select a Measure screen.

Error Rate

Follow the menu path to display the Error Rate screen:

Select a Measure
Error Rate ——— Error Rate screen

From the Error Rate screen, shown in Figure 3–18, you can measure many aspects of the error level of the received signal.

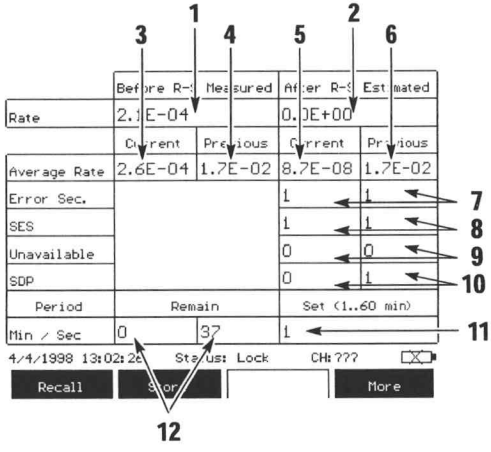


Figure 3–18: Error rate display example

The numbers on the following page correspond to the numbered labels in Figure 3–18:

1. Instantaneous current error ratio before Reed-Solomon correction.
2. Instantaneous current error ratio after Reed-Solomon correction.
3. Cumulative average error ratio during the current period, before Reed-Solomon correction.
4. Cumulative average error ratio of the previous period, before Reed-Solomon correction.
5. Estimated cumulative average error ratio during the current period, after Reed-Solomon correction.
6. Estimated cumulative average error ratio of the previous period, after Reed-Solomon correction.
7. Errored seconds. The number of cumulative one-second periods, each having one or more Errored Blocks (EB). An EB is an MPEG Transport Stream packet with an error that Reed-Solomon correction cannot fix.
8. Severely errored seconds. The number of cumulative one-second periods, each containing greater than a specified number of errored blocks, or at least one severely disturbed period. Define SES on the Thresholds Setup screen in the Errored Frame Ratio for SES field; specify the number of errored blocks per one second period.
9. Unavailable time. The cumulative duration of unavailable time periods. An unavailable time period begins with (and includes) 10 consecutive Severely Errored Seconds (SES) and continues until there are 10 consecutive non-SES events. These 10 consecutive non-SES events are part of available time.
10. Severely Disturbed Period. Cumulative duration of sync loss. Sync loss occurs when two or more consecutive sync bytes within the transport stream are corrupted. Sync is acquired again when five consecutive sync bytes are correctly decoded.

11. Time period of measurement. You can set it here by entering the number of minutes with the numeric keypad.

12. Minutes and seconds remaining in the current measurement period.

Table 3–8: Error Rate F-key menu actions

Menu selection	Action
Recall	Stops the current measurement and displays the most recently stored Error Rate measurement. The stored screen has another set of menus: Next, Site Info, and Fail Info.
Next	Displays the next most recently stored Error Rate measurement. Repeated presses cycle through all stored Error Rate measurements.
Site Info	Displays the session information saved with the measurement. This screen has two additional menus: Next and Back to Data.
Next	Displays session information for the next stored measurement. Repeated presses cycle through all stored Error Rate measurements.
Back to Data	Returns you to the stored measurements screen.
Store	Saves the current display to memory.
More	
Graph	Displays the Error Rate graph screen described on page 3–39.
Restart	Purges collected data and begins to collect new data.
ESC	Returns to the Select a Measure screen.

Error Rate Graph screen

Follow the menu path to display the Error Rate Graph screen:

Error Rate screen
More — Graph — Error Rate Graph screen

From the Error Rate Graph screen, shown in Figure 3–19, you can view the ratio of errors to the transmitted bits over time on a logarithmic scale. The analyzer displays the last 24 periods.

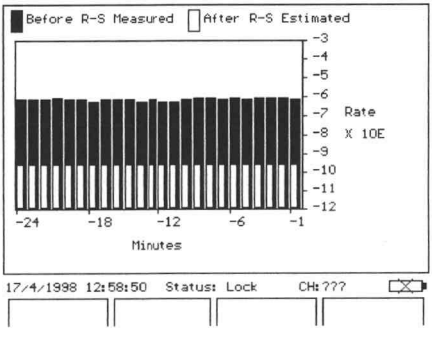


Figure 3–19: Error Rate Graph screen

Figure 3–19 shows a summary with the history of the last 24 periods executed.

The lower the bars in the bar graph, the better the signal quality. The level of the black bar represents the error ratio before Reed-Solomon correction. The level of the white bar represents the estimated error ratio after Reed-Solomon correction.

Appendices

Appendix A: Specifications

All specifications are guaranteed unless labeled "typical" or "nominal."

Performance requirements listed in this section are valid provided the analyzer is operating within environmental parameters and has been warmed up for at least 25 minutes.

CAUTION. *The sum of the signal power of all signals (not just the signal on the tuned channel) must remain below +60 dBmV (120 dBμV). Exceeding this limit could result in damage to the analyzer.*

Table A–1: Input specifications

Characteristic	Description
Maximum nondestructive RF power	+60 dBmV (120 dBμV)
Maximum nondestructive voltage	70 V_{rms} or 100 V peak
DC input (power)	12 V, 2 A
Input impedance	75 Ω, nominal
Frequency range	DMA120: 54 to 860 MHz DMA121: 50 to 866 MHz
Input connector	F female

Table A–2: Operational specifications

Characteristic	Description
Battery	Fully compliant DR30 type
Run time (18°C to 25°C)	2 hours (typical) without backlight
Charge time, instrument off	4 hours (typical)
Setup of RS-232 parameters	Baud rate from 9600 to 115200
I/Q Polarity	Normal, Inverted, Automatic detection

Table A–3: Performance specifications

Characteristic	Description
Spectrum display	
Displayed level (average power of 64 QAM signal at 6.875 MSymbols/s)	
Maximum	100 dBµV (+40 dBmV)
Minimum	40 dBµV (–20 dBmV)
Vertical scale	nominal: 10 to 90 dBµV, –50 to 30 dBmV, –100 to –20 dBm, –10 to 70 dBpW
Span settings	2 to 824 MHz
Flatness	±1 dB
Tuner frequency resolution	62.5 KHz, nominal
Tuner frequency accuracy	±50 Khz, nominal
Resolution bandwidth	135 KHz typical
Distortion free dynamic range	>40 dB
Constellation display	
Size	64QAM
Resolution	8 bits I, 8 bits Q
Single point evaluation	Yes

Table A–3: Performance specifications (Cont.)

Characteristic	Description
Equalizer display	
Number of taps	
DMA 120	8 pre-echo, 24 post-echo
DMA 121	8 pre-echo, 8 post-echo
Scale	–40 to +10 dB relative to center tap
Mask	DVB
RF Signal level	
Channel bandwidth	
DMA 120	6 MHz, typical
DMA 121	8 MHz, typical
Level (channel average power)	
Maximum	100 dBμV (40 dBmV)
Minimum	40 dBμV (–20 dBmV)
Accuracy	
18° C to 25° C	±1.5 dB
–5° C to 40° C	±3.0 dB
Reference units (75m input)	dBμV, dBmV, dBm, dBpW
User adjustable pass/fail threshold	40 dBμV to 100 dBμV (–20 to +40 dBmV)
Channel power-to-noise	
Minimum ratio	3 dB
Maximum Ratio	40 dB
Accuracy (18° C to 25° C)	±2.1 dB
User adjustable pass/fail threshold	0 dB to 40 dB
Adjacent channel level	
Difference amplitude range	
DMA 120	+10 to –25 dB

Table A–3: Performance specifications (Cont.)

Characteristic	Description
DMA 121	+15 to –25 dB
Accuracy (18° C to 25° C)	±2.1 dB
Display vertical scale	40 to 100 dBμV, –20 to 40 dBmV, –65 to –5 dBm, 25 to 85 dBpW, nominal
User adjustable pass/fail threshold	0 dB to 25 dB
Modulation error ratio (MER)	
Range	22 to 35 dB
Accuracy (18° C to 25° C)	±1.5 dB
User adjustable pass/fail threshold	22 to 35 dB
Error vector magnitude (EVM)	
Range	1.2 to 4.1%
Accuracy	±0.4% over 1.2 to 2.0% range; ±0.8% over 2.1 to 4.1% range
Average bit error rate (BER), before R-S decoding	
Range	10^{-4} to 10^{-9}
User-selectable time period	1 to 60 minutes
Graphics display	24 × time period, nominal (24 to 1440 minutes)
Average bit error rate (BER), after R-S decoding	
Range	10^{-4} to 10^{-9}
User-selectable time period	1 to 60 minutes
Estimated noise margin	
Range	
DMA120	1 to 12 dB
DMA121	1 to 10 dB
Accuracy	±1.5 dB
Symbol record length	1024 nominal

Table A–3: Performance specifications (Cont.)

Characteristic	Description
Symbol rate 64 QAM	
DMA 120	5.057 to 5.360 Mbaud
DMA 121	5.000 to 6.956 Mbaud

Table A–4: Environmental conditions[1]

Characteristic	Description
Temperature (operating)	–5°C to +40°C

1 **All performance specifications and accuracies apply across the operating temperature range unless otherwise stated.**

Table A–5: Safety standards and certification compliance

Characteristic	Description
Equipment Type	Test and Measuring
International Protection Type	IP 44
U.S. Nationally Recognized Testing Laboratory Listing	ANSI/ISA S82.01 – Safety Standard for Electrical and Electronic Test, Measuring, Controlling, and Related Equipment
Canadian Certification	CAN/CSA C22.2 No. 1010.1 – Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
European Union Compliance	Low Voltage Directive 73/23/EEC, Amended by 93/68/EEC EN61010–1 – Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use
Safety Class	Class II (as defined in IEC 1010–1, Annex H) – Double Insulated
Temperature (operating)	+5°C to +40°C

Table A–5: Safety standards and certification compliance

Characteristic	Description
Altitude (maximum operating)	2000 meters
Relative humidity (maximum operating)	80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C
Installation (Overvoltage) Category	RF Input terminal is Overvoltage Category II (as defined in IEC 1010–1, Annex J): CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated. Pollution Degree 2 Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

Table A–6: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC	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 Union: EN 55011 Class A Radiated and Conducted Emissions EN 50082-1 Immunity: IEC 1000–4–2 Electrostatic Discharge Immunity IEC 801–3 Radiated RF Electromagnetic Field Immunity[1, 2] IEC 1000–4–4 Electrical Fast Transient/Burst Immunity[1]
Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AS/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment:1992
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union: Low Voltage Directive 73/23/EEC, amended by 93/69/EEC EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control, and laboratory use.

1 **Tested with Tektronix supplied AC/DC adapter connected and battery installed.**

2 **In RF fields of 3V/m, an input signal of 80 dBµV/20 dBmV is required to measure a BER of 1E–08 or smaller. Fields 0f 3 V/m may be encountered close to a high-power television broadcast antenna.**

Table A–7: Physical specifications

Characteristic	Description
Dimensions	
Height	32 cm (12.5 in)
Width	17 cm (6.75 in)
Depth	6 cm (2.25 in)
Weight	2.1 kg (4.6 lbs)

Appendix B: Battery Care

The analyzer uses a DR30 (7.2 V) nickel metal hydride battery.

Removing and Installing the Battery

To remove or install the battery, follow these steps:

1. Power the analyzer off.
2. To access the battery compartment, grasp the cover locks and turn them a quarter turn; remove the bottom cover. Refer to Figure B–1.
3. If a battery is already in the compartment, remove it by pushing the battery eject button shown in Figure B–2.

CAUTION. *Replace battery with fully compliant DR30 type only.*

A fully compliant DR30 battery includes overcurrent and overtemperature protection against the hazards that can result from overcharge, overdischarge, or short circuit conditions.

This protection is relied upon to prevent damage to this product and to protect the user from potential hazards.

Be sure that any replacement DR30 battery (including DR30AA) includes these protections. If there is any doubt, replace the battery with the specified Tektronix replacement part DMABAT.

4. To install the new battery, hold the battery with the slots in the top left corner and slide the battery into the compartment. Refer to Figure B–2.
5. Reinstall the bottom cover before operating the analyzer.

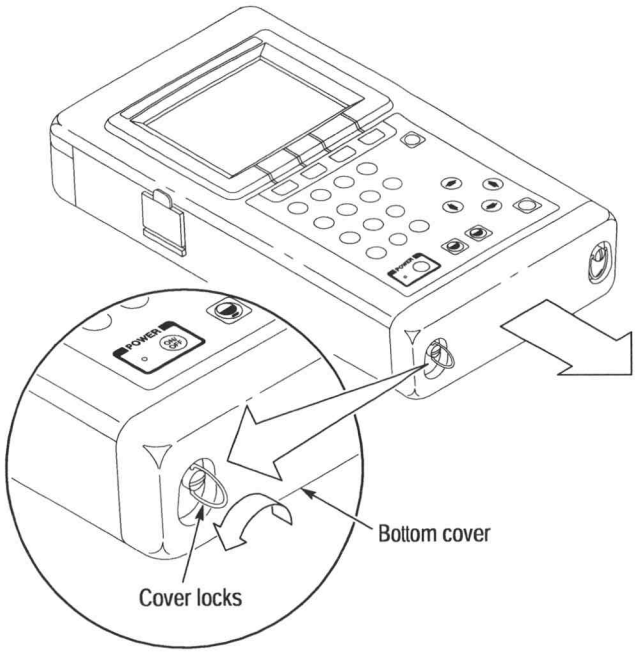


Figure B–1: Removing the bottom cover

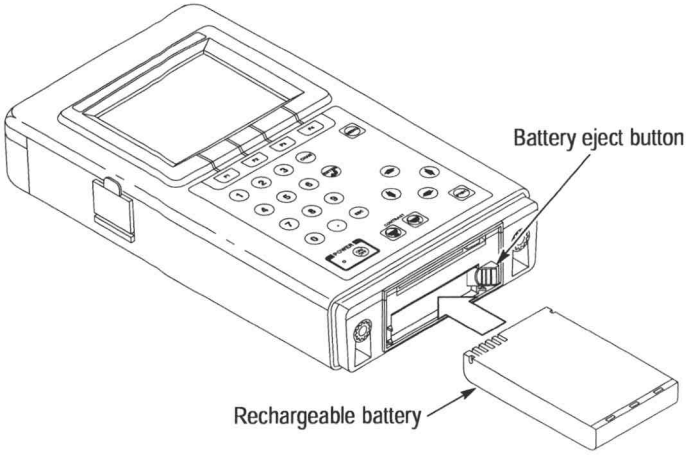


Figure B–2: Battery compartment

Battery Indicator

The battery indicator, which appears on the right side of the screen, indicates the approximate level of charge in the battery; it assumes a fully charged battery when the analyzer is powered on.

Battery Storage

If you will not be using the analyzer for a long period, store the battery separately in a cool, dry place.

Conserving Battery Charge

To conserve battery charge, set the analyzer to power itself off when not in use and do not use the analyzer backlight.

Use the Automatic Power Down (APD) feature to power off the analyzer automatically when the analyzer has not been used for ten minutes. See page 2–25 for information on how to set the APD feature.

With the backlight off, the battery charge lasts approximately two hours. When the low battery warning beeps and begins to flash, connect to external power or replace the discharged battery with a charged battery to continue operation.

Recharging

To maximize the recharging life of the battery, allow the battery to discharge completely and then fully recharge it.

You can recharge the battery internally or externally:

- Recharge in the analyzer by connecting the analyzer to external power while the analyzer is powered off. The battery recharges in about four hours.
- Recharge in the optional external NiMH battery charger in two hours.

Recycling or Disposal

Recycle or dispose of the battery in compliance with your local laws.

Appendix C: Using a Memory Card

You can use a memory card to provide extra analyzer memory.

NOTE. *Use only ATA Type II PCMCIA Flash storage devices.*

To insert or remove a memory card, you must cycle the power. This causes you to lose current measurement data. Stored data will be unaffected.

1. Save any current measurement data you do not want to lose.
2. Press the ON/STBY key to put the analyzer on standby.
3. To access the compartment, grasp the cover locks and turn them a quarter turn; remove the bottom cover. Refer to Figure B–1 on page B–2.
4. To remove a memory card, push the eject button. Refer to Figure C–1.
5. To insert a memory card, orient it so that the write-protect switch is to the right. Insert the memory card into the drive; press firmly to seat the card. Refer to Figures C–1 and C–2.
6. Press the ON/STBY key to power the analyzer on.

NOTE. *If you insert or eject a memory card while the analyzer is powered on, the analyzer will lock up. To unlock the analyzer, cycle the power by pressing the ON/STBY key twice.*

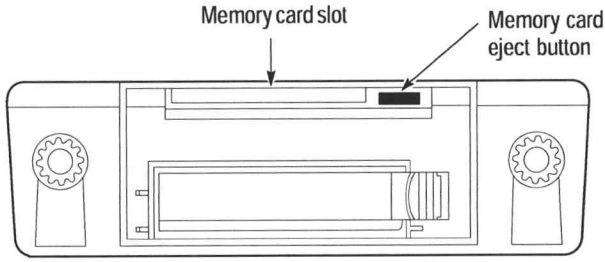


Figure C–1: Location of the memory card slot

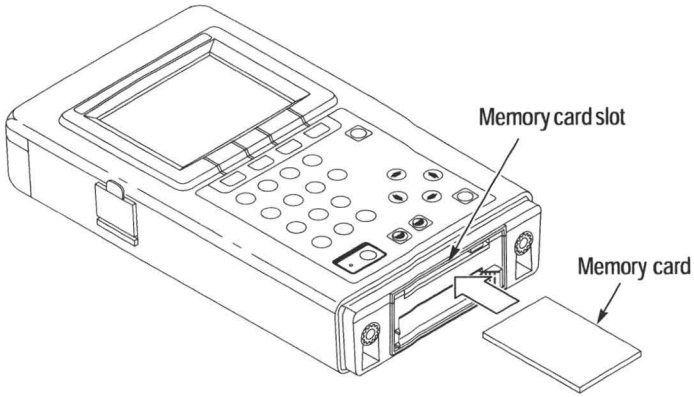


Figure C–2: Memory card installation

Appendix D: Channel Table Editor

The purpose of the Channel Table Editor is to create and edit channel tables for use with many instruments. This chapter describes only the features which relate to the DMA 120 and DMA 121 Digital Modulation Analyzers.

You can create channel tables in the Channel Table Editor and then load them into the analyzer.

This appendix covers the following topics:

- Installing and starting the Channel Table Editor
- Hiding fields not related to the analyzer
- Creating a new channel table
- Editing an existing channel table
- Checking limits
- Transferring a channel table to or from the analyzer
- Using the channel tables provided
- Setting connections
- Interpreting error and warning messages

Installing the Channel Table Editor

Before installing, be sure your system meets these minimum requirements:

- Microsoft Windows 3.1, Windows 95, or Windows NT 4.0
- 66 MHz 486 CPU
- 4 MB of RAM
- 4 MB of free hard drive space
- an available RS–232 port

Follow these steps to install the Channel Table Editor and the standard channel tables:

1. Create a directory on your harddrive where you want the Channel Table Editor software installed.

   For example, from the DOS prompt, you can create the directory "CTLOAD" on the C drive:

Type...	Result
C:<enter>	Puts you in the C drive.
CD\<enter>	Puts you at the root of the C drive.
MKDIR CTLOAD<enter>	Creates the CTLOAD directory.
CD CTLOAD<enter>	Changes to the CTLOAD directory.

2. Copy the files from the distribution disk to your hard drive where you want the CTLOAD software installed.

   For example, to copy the files from the A drive to C:\CTLOAD, insert the Channel Table Editor diskette into the A drive, and type the following:

Type...	Result
XCOPY A:*.*<enter>	Copies everything from the A drive into the current directory, C:\CTLOAD.

3. Install the Channel Table Editor software.

   From the directory you created in step 2, run the INSTALL.BAT batch file by typing the following:

Type...	Result
INSTALL.BAT<enter>	This batch file creates all the program files and directories required for the Channel Table Editor software.

4. Create a shortcut from the desktop or from the start menu. Refer to your system documentation.

Starting the Channel Table Editor

Click on the icon or select the start menu item that you created in step 4 when you installed the Channel Table Editor.

The program opens; Figure D–1 shows the results (with the standard Channel Table std.cht loaded).

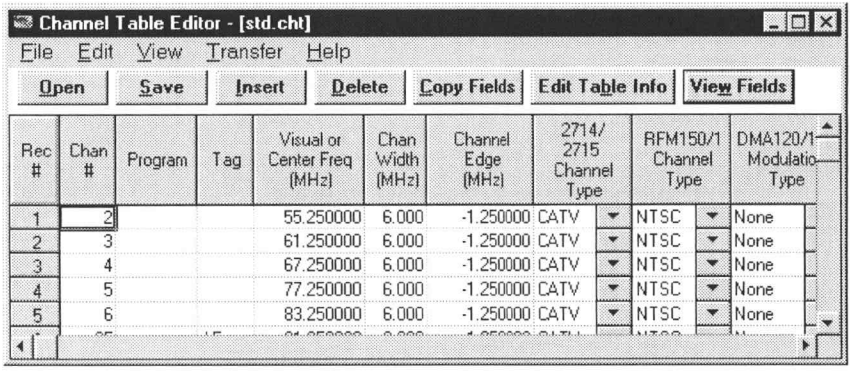
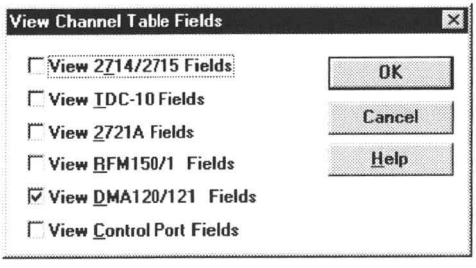


Figure D–1: The main window of the Channel Table Editor

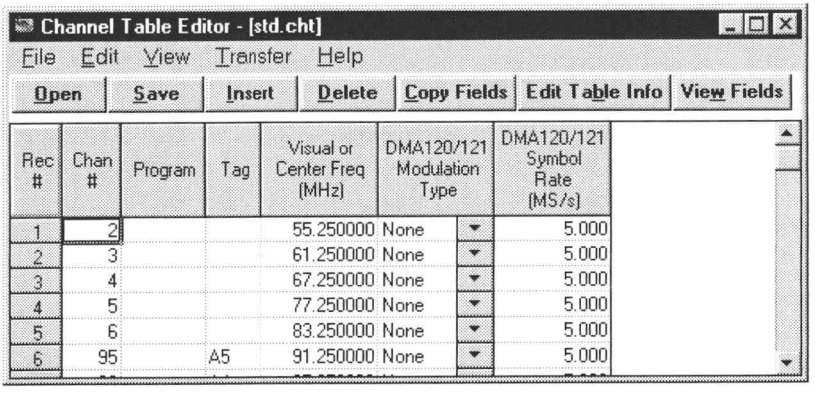
Viewing Only the DMA 120 and DMA 121 Fields

Hide the fields that are not relevant:

1. Click the View Fields button. The View Channel Table Fields dialog box appears.



2. Check mark the View DMA 120/121 Fields box. Uncheck any other boxes which may be check marked.
3. Click OK. Only the DMA 120/121 fields will appear in the channel table.

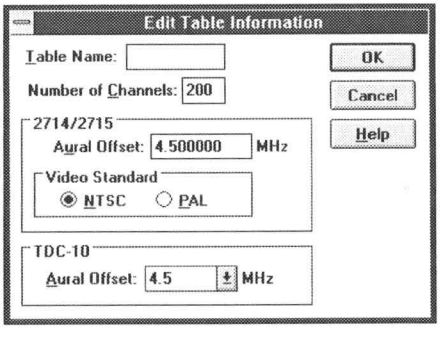


Creating a New Channel Table

To create a new table that is not based on an existing table, use the procedure described below. (To more quickly create a new table, refer to *Creating a Channel Table from an Existing Channel Table* on page D–9.)

1. From the File menu, choose New. This clears the Channel Information and loads the default values into the Table Information.
2. Choose the Edit Table Info command button from the Button Bar. This displays the Edit Table Information dialog box.

   Only the first two text boxes, Table Name and Number of Channels, apply to the DMA 120 and DMA 121 Digital Modulation Analyzers.



3. Enter a name for the new Channel Table in the Table Name text box. (For this example, use "test1.cht.") The standard DOS filename rule applies; use a maximum of eight characters.

4. Enter the number of channels. The maximum number of channels available in the Channel Table Editor is 500. The analyzer will accept up to 116 channels.

   If you increase the number of channels, blank channels are added to the end of the Channel Table. If you decrease the number of channels, the channels are deleted beginning with the last channel in the Channel Table and working backward.

5. Choose the OK command button to save the changes and exit the Edit Table Information dialog box. A new channel table appears.

6. Enter values into the column text boxes or select from the drop-down list box. Refer to Table D–1 for information on what type of data to enter into each column. For further information on editing, refer to *Editing a Channel Table* on page D–11.

7. Choose the OK command button to save the changes.

NOTE. *If you are using the keyboard, use* ALT+↓ *to open the field's drop-down list boxes.*

Table D–1: Channel Table Editor field descriptions

Column name	Range	Contents/Function
Chan #	1 to 999	Enter the commonly known number of this channel.
Program	Any 6 characters	Enter a 6-character identifier for the channel, used for the channel's call letters or abbreviated name. (This field is not used by the analyzer.)
Tag	Any 3 characters	Enter a 3-character designation for the channel. (This field is not used by the analyzer.)
Visual or Center Freq (MHz)	DMA 120: 54.000000 to 860.00000 DMA 121: 50.000000 to 866.00000	Enter the channel center carrier frequency in MHz.
DMA120/121 Modulation Type	None or 64 QAM	Choose None for analog channels; these channels will not be transferred to the analyzer. Choose 64 QAM for digital channels.
DMA120/121 Symbol Rate (MHz)	DMA 120: 5.057 to 5.360 DMA 121: 5.000 to 6.956	Enter the symbol rate in MS/s.

Creating a Channel Table from an Existing Channel Table

Creating a new table by basing it on an existing table is often quicker than creating a new table from scratch.

1. From the File menu, choose Open. The Open dialog box appears, as shown in Figure D–2.

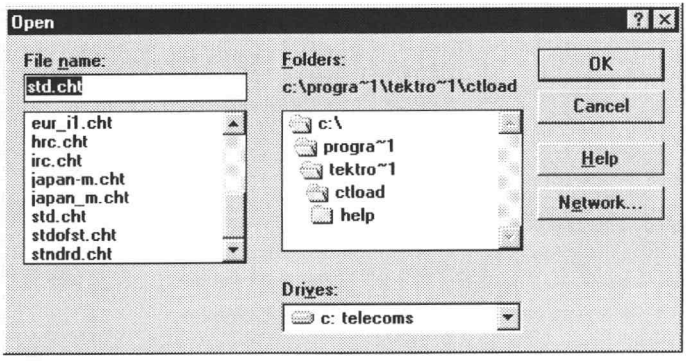


Figure D–2: The Open dialog box

2. Select a file from the File Name list box. Refer to Table D–2 for information about the channel tables which are provided with the Channel Table Editor application.
3. Choose the OK command button. The Channel Table will load and will appear similar to Figure D–3.

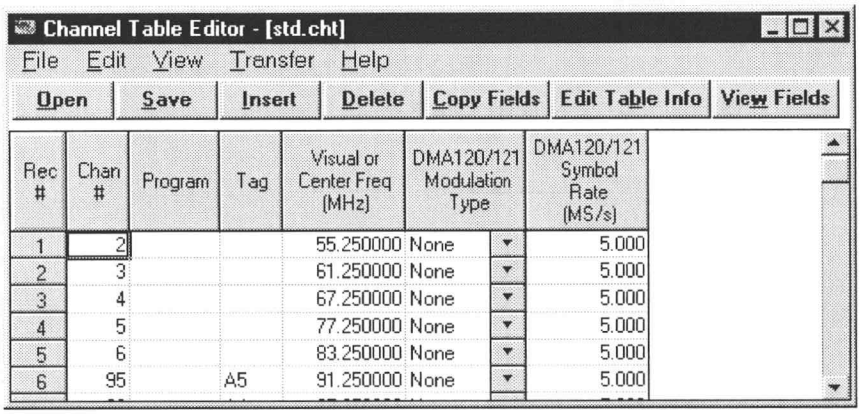


Figure D–3: The std.cht channel table

4. From the File menu, choose Save As.
5. Enter a new file name, such as "learners.cht," in the File Name text box.

NOTE. *The Channel Table Editor automatically adds the ".cht" filename extension.*

---

6. Choose the OK command button to save the changes and leave the Save As dialog box. Any changes you make now will be made in your new file (learners.cht) and not the original file.

Editing a Channel Table

Select a channel and make any changes that might be required for your system. To save your changes, choose Save from the File menu.

Copying Fields.

If any fields are the same for all channels, you can copy fields as follows:

1. Select the Rec # of the channel from which you will copy fields.
2. Choose the Copy Fields command button from the Button Bar. The dialog box looks similar to Figure D–4. (If a field is not in view, then it is not listed in the Available Fields list box.)

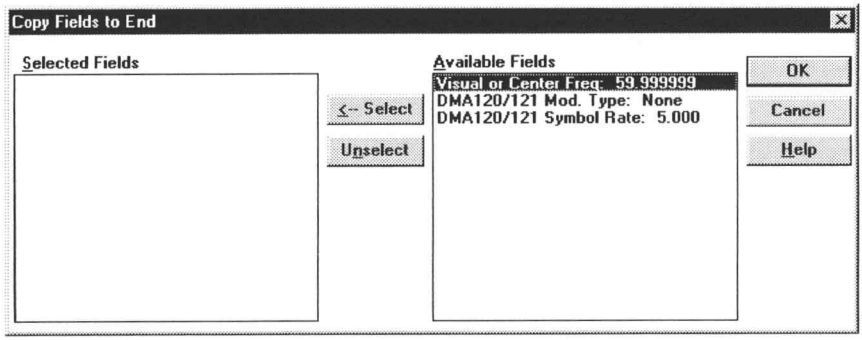


Figure D–4: The Copy Fields to End dialog box

3. In the Copy Fields to End dialog box, select all of the fields you want to be the same as the channel you selected in step 1.
4. Choose the OK command button to copy these fields to all channels below it in the Channel Table.

Inserting a Channel.

1. Select the Rec # of the channel below the spot where you want to add a channel.
2. Click the Insert button to add a blank row to the Channel Table (only the default values are filled in).

Deleting a Channel.

1. Select the Rec # of the channel or channels you will delete.
2. Click the Delete button. The selected channels disappear.

Appending a Channel

To add a new channel to the end of the Channel Table, choose Append from the Edit menu.

Sorting Channels

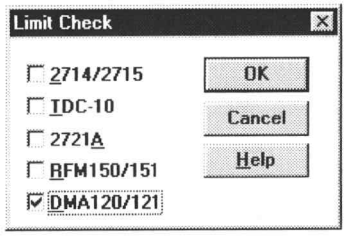
To sort the channels in a channel table, choose Sort from the Edit menu. Then choose one of the three sort methods:

- By Channel Number
- By Frequency
- By Program

Checking Limits

The Channel Table fields have limits. When you try to transfer a file containing values that exceed those limits, you are given a warning that there is a problem with the file. To locate the problem, follow these steps:

1. From the Transfer menu, choose Limit Check. The Limit Check dialog box appears.



2. Check mark the DMA 120/121 box. Uncheck any other boxes that are check marked. Click OK.

   A message will appear, either describing the location and nature of the first error found, or saying that the Limit Check passed.

3. If an error is indicated, correct it and rerun the Limit Check until the limit check passes.

   For more information on the acceptable values for each field, refer to Table D–1 on page D–8.

NOTE. *If the Limit Check indicates nothing out of limit and yet you get an out of limit message when you try to send the channel table to your analyzer, look to see if your channel table values are appropriate for the type of analyzer you are using. Refer to the acceptable ranges for each analyzer for Symbol Rate and for Visual or Center Frequency shown in Table D–1 on page D–8.*

The Limit Check does not differentiate between values acceptable to the DMA 120 but not to the DMA 121, or vice versa. The Limit check can only catch values which are inappropriate for either type of analyzer. You may have a value that is within the acceptable range for one instrument but is not within the acceptable range for the type of analyzer to which you are trying to send the channel table.

Transferring a Channel Table From the Analyzer to the PC

To transfer a channel table from the analyzer to the Channel Table Editor, follow these procedures.

NOTE. *If you transfer a channel table from the analyzer to the Channel Table Editor, any channel table of the same name on the PC will be overwritten.*

1. Make note of the name of the table so that you can type it in later.
2. Be sure the analyzer is in the Remote mode:
   a. From the Main Set Up screen, select Channel tables.
   b. From the CHANNEL TABLES MANAGEMENT screen, select More (F4) and then Remote (F2).

3. Be sure the serial port of the analyzer is connected with an RS-232 cable to the serial port of the PC.
4. From the Transfer menu on the Channel Table Editor, choose From. The dialog box shown in Figure D–5 appears.

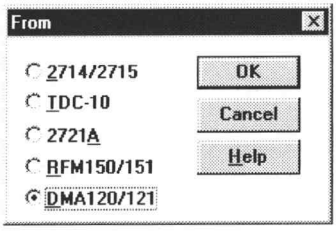


Figure D–5: The From dialog box

5. Select DMA120/121. Click OK. The Enter Table Name dialog box appears, as shown in Figure D–6.

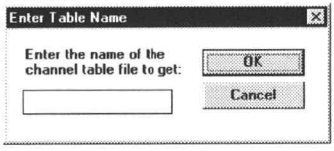


Figure D–6: The Enter Table Name dialog box

6. In the Enter Table Name dialog box, enter the name of the table to transfer. Click OK. The table name appears in the Channel Table Editor open menu.

   If you get the error message shown in Figure D–7, be sure that the analyzer is in Remote mode and that the RS-232 cable is securely attached to both the analyzer and the PC.

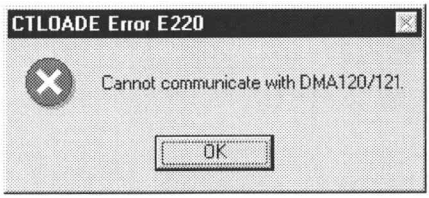


Figure D–7: Error message

Transferring a Channel Table From the PC To the Analyzer

To transfer a channel table from the Channel Table Editor to the analyzer, follow the steps below.

NOTE. *If you transfer a channel table from the Channel Table Editor to the analyzer, any channel table of the same name on the analyzer will be overwritten.*

The analyzer must be powered on before you attach the cable.

---

1. Be sure the analyzer is in the Remote mode:
   a. From the Main Set Up screen, select Channel tables.
   b. From the CHANNEL TABLES MANAGEMENT screen, select More (F4) and then Remote (F2).

2. Be sure the serial port of the analyzer is connected with an RS-232 cable to the serial port of the PC.
3. From the Transfer menu on the Channel Table Editor, choose To. The dialog box shown in Figure D–8 appears.

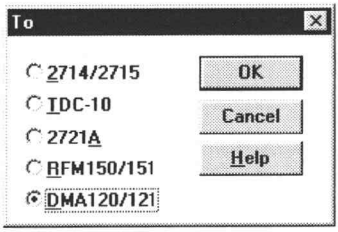


Figure D–8: The To dialog box

4. Select DMA120/121. Click OK.

If you get the error message shown in Figure D–7, be sure that the analyzer is in Remote mode and that the RS-232 cable is securely attached to both the analyzer and the PC.

NOTE. *To communicate with a PC, the analyzer must be in the Remote mode and must be connected by an RS-232 cable.*

Deleting or Activating a Channel Table On the Analyzer

You can not delete or activate a channel table on the analyzer from the Channel Table Editor. Instead, delete or activate the channel table from the analyzer Channel Tables Management screen.

Channel Tables Provided

Table D–2 is a list of the standard channel tables provided with the Channel Table Editor.

When you edit a channel table, you should rename it, being careful not to use a name from the list below.

Table D–2: Channel Tables provided with this application

Channel table name	System	Frequency range	Channel descriptions
B'CAST.CHT	M/N	55.25 to 885.25	North American broadcast
CATV-HRC.CHT	M/N	54.0027 to 642.0321	NCTA harmonically related
CATV-IRC.CHT	M/N	55.25 to 643.25	NCTA incrementally related
CATV-STD.CHT	M/N	55.25 to 1069.25	NCTA cable
CATV–500.CHT	M/N	55.25 to 511.25	NCTA cable to 500 MHz
CHIN_DK.CHT	D/K	49.75 to 621.25	System D/K standard
CHINA-DK.CHT	D/K	49.75 to 903.25	System D/K VHF/UHF standard
EUR-BG.CHT	B/G	48.25 to 855.25	System B/G VHF/UHF standard
EUR-I.CHT	I	471.25 to 855.25	System I UHF standard
EUR_BG.CHT	B/G	48.25 to 623.25	System B/G VHF/UHF standard
EUR_I.CHT	I	55.25 to 623.25	System I standard
EUR_I1.CHT	I	120.01 to 544.01	System I standard
FRANCE-L.CHT	L	120.00 to 855.25	System L standard
HRC.CHT	M/N	54.00 to 642.00	NCTA harmonically related
IRC.CHT	M/N	55.25 to 643.25	NCTA incrementally related
JAPAN-M.CHT	M/N	91.25 to 765.25	Japanese standard
JAPAN_M.CHT	M/N	91.25 to 621.25	Japanese standard

Table D–2: Channel Tables provided with this application (cont.)

Channel table name	System	Frequency range	Channel descriptions
SDTOFST.CHT	M/N	55.25 to 1069.25	North American broadcast with aeronautical band offsets
STD.CHT	M/N	55.25 to 643.25	NCTA cable
STNDRD.CHT	M/N	1.01 to 625.25	NCTA cable including T-channels

Setting Connections

Use the Connections dialog box (shown in Figure D–9) to set the GPIB and RS-232 port addresses for the instruments in the Channel Table Editor.

CAUTION. *Make sure that all ports and GPIB addresses are unique and match the addresses set in the instruments. The ports and addresses must be unique for both the Cable TV Software and the Channel Table Editor, because the connections menus interact. If the ports and addresses are not unique, the software will not work correctly.*

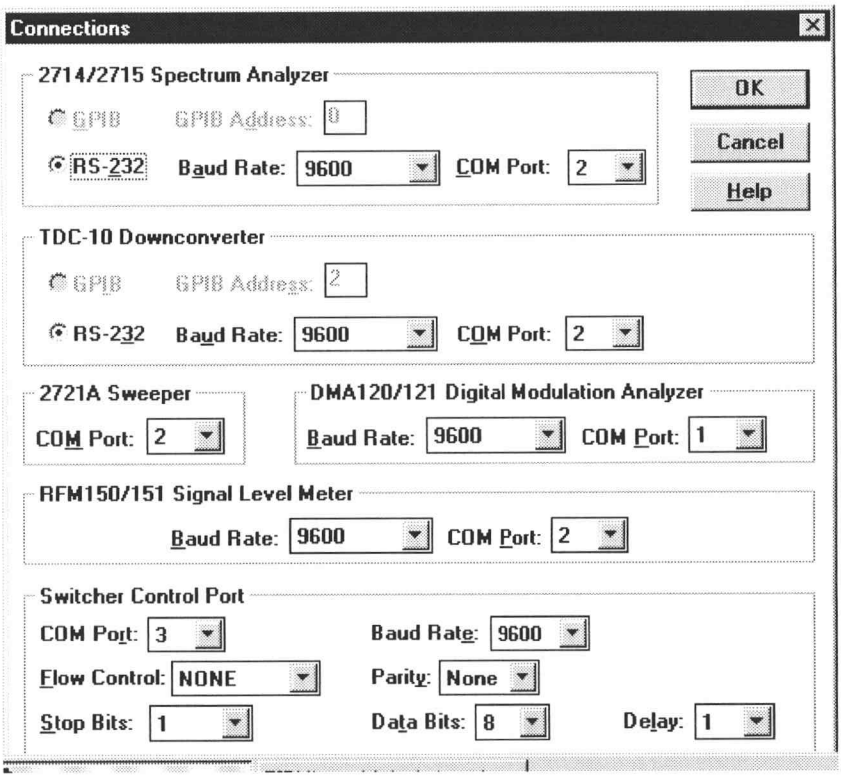


Figure D–9: The Connections dialog box

Interpreting Error and Warning Messages

Refer to Table D–3 for explanations of error messages. Refer to Table D–4 for explanation of warning messages.

NOTE. *Replace XX or YY in the following error messages with a filename, value, or instrument name.*

The following lists of error and warning messages are abbreviated. Refer to the Channel Table Editor online help for a complete list; Select Contents from the Help menu, and then view the Error messages topic.

Table D–3: Error Messages

Error number		Explanation
E100	Invalid RS-232 Port.	An invalid RS-232 port was entered. Verify the Connections information.
E1000	Error opening file: 'XX'	The file is corrupt or not in the proper format.
E1011	Number out of range. Enter a number between XX and YY	Enter a number between the stated limits.
E1013	File XX is not valid	The stated file is corrupt or of the wrong type.
E1015	Only 1 help window may be open at a time	Close the open Help window before trying to open another one. The Help window may be under another window.
E1020	CTLOADE already running	Only one copy of CTLOADE can be run at a time. Use the copy that is already open.
E1024	Invalid channel table name	The channel table filename specified is not valid.
E1026	Table Info was incomplete in the selected file	A Channel Table file must have table information for at least one channel. The file may be corrupt.
E1034	No filename has been defined -- Save file first	CTLOADE cannot send a Channel Table to an instrument until a filename has been defined (since this is where the table name is derived from). Save the Channel Table to a file first, then transfer to an instrument.

Table D–3: Error Messages (cont.)

Error number		Explanation
E1045	Channel Table name too long for XX (YY characters max)	The Channel Table name is too long for the specified instrument. Select a shorter file name and retry.
E1050	Incompatible visual frequency for XX. (record YY) Enter a number between XX and YY	The Visual Carrier Frequency for the stated channel is incompatible with the stated instrument.
E1069	Channel Table name is incompatible with XX	Some of the characters in the Channel Table name are inappropriate for the stated instrument. For a 2721A, only characters A–Z, 0–9, and underscore are allowed.
E1081	Incompatible modulation type for <DMA120/DMA121>. (record <number>)	The user has selected an invalid modulation type for the indicated instrument. This invalid modulation type first appeared in the indicated record number.
E1082	Incompatible symbol rate for <DMA120/DMA121>. (record <number>). Enter a number between <lowest> and <highest>.	The user has selected an invalid symbol rate for the instrument. This invalid symbol rate first appeared in the indicated record number. Enter a number between (or including) the given limits.
E1083	<DMA120/DMA121> reports an error. Message follows: '<message from DMA120 or DMA121>'"	The analyzer detected a problem while sending or receiving a channel table. The text shown is the message produced by the analyzer.
E1084	Too few channels for <DMA120/DMA121>. Must be 1 or more.	There are no channels to be sent to the analyzer. In order for a channel to be sent to the analyzer, the "DMA120/DMA121 Modulation Type" field for the channel must be something other than "NONE".

Table D–4: Warning Messages

Warning number		Explanation
W1100	Channel table changed. Do you wish to save it?	Answer YES if the current Channel Table is to be saved to a file.

Appendix E: Printing with a DPU 414 Printer (DMAPRN)

You can print screens from the analyzer to provide a record of measurement results. For a description of the printer kit option, DMAPRN, refer to page 1–3.

From the printer kit, you will need the following items:

- RJ45 cable
- 9 pin DB–9 male to RJ45 adapter

NOTE. *The analyzer must be powered on before you attach the cable.*

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1. Power on the analyzer.
2. Attach the adapter to the cable.
3. Connect the adapter end of the cable to the RS-232 connector on the printer.
4. Connect the RJ45-end of the cable to the analyzer.
5. On the analyzer Peripherals screen, set the Parameters to 9600, N, 8, 1.
6. Configure the printer and add paper according to the directions in the documentation provided with the printer.
7. Go to the screen you wish to print.
8. Press the PRINT key.

Appendix F: Cleaning

Before cleaning, disconnect the analyzer from the power source.

NOTE. *To prevent damaging the plastics used in the analyzer, do not use abrasive cleaning agents.*

To avoid potential electric shock hazard or damage to the circuits, do not allow any moisture inside the analyzer during external cleaning; use only enough liquid to dampen the cloth or applicator.

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1. Remove loose dust on the outside of the analyzer with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.

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