Instruction Manual

Tektronix

AM70
Digital Audio Analyzer/Generator

070-8971-06

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

www.tektronix.com

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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NOTE. *This Warranty covers the AM70, exclusive of options, ONLY. Please see Appendix C for the Warranty that pertains to options, assemblies, and supplies.*

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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.

The common terminal is at ground potential. 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 With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

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

Double
Insulated

Battery Recycling

This product contains a Nickel Cadmium (NiCd) battery, which must be recycled or disposed of properly. For the location of a local battery recycler in the U.S. or Canada, please contact:

RBRC
Rechargeable Battery Recycling Corp.
P.O. Box 141870
Gainesville, Florida 32614

(800) BATTERY
(800) 227-7379
www.rbrc.com

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 1-503-627-2400 6:00 a.m. – 5:00 p.m. Pacific time

*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Getting Started

This section contains all the information you'll need to put your AM70 into operation. For a detailed description of the instrument's capabilities and instructions on its use, see the "Operating Basics" section of this manual.

Supplying Power

The AM70 is DC powered. You may power it with the standard AC adapter, the optional NiCad battery pack, four standard AA batteries, or a "BP" type battery pack that supplies 9 VDC through a negative-center plug. The external DC power connector is on the left side of the instrument.

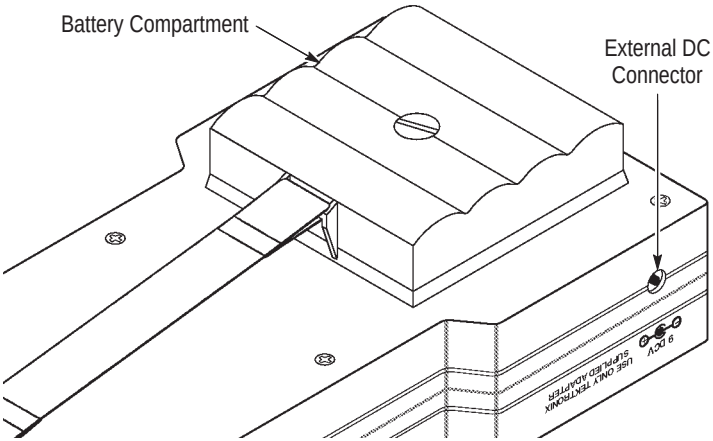


Figure 4: The Battery Compartment and DC Connector

Using Batteries

To install AA batteries or the battery pack, open the battery compartment of the AM70 by loosening the captive retaining screw and removing the compartment cover (see Figure 4). Install batteries in alternating directions as indicated by the legend molded into the "floor" of the battery compartment. Install the optional battery pack with the label facing away from the instrument and the contact on the opposite side of the pack touching the contact on the floor of the compartment.

- AA batteries are not included with the instrument; buy them locally. Order the optional NiCad battery pack through your Tektronix representative or the nearest field office.
- There is no need to remove the NiCad battery pack for recharging. The AM70 will "trickle charge" the pack whenever the standard AC adapter is attached. It can take up to 16 hours to fully charge the battery pack.
- Rechargeable AA batteries may be used, but, unlike the battery pack, they are NOT automatically recharged when AC adapter is used. To recharge AA batteries, remove them from the instrument and use an appropriate charger. For safety, read and follow the battery charger instructions. Do NOT attempt to recharge standard alkaline batteries.
- **"Auto power-down"** is enabled by default when the AM70 is battery-powered; it shuts the instrument down approximately 10 minutes after the last key press. This operating mode prevents complete battery discharge if you forget to switch the instrument off, or if you accidentally switch it on (during transport, for example).

  Automatic power-down is disabled when the instrument is powered with the AC adapter or an external battery pack. This lets you leave the instrument "in line" to Monitor, Generate, or Modify a signal for extended time periods without constant operator intervention. You may also disable auto power down when operating with internal battery power. To do so, hold the "1" key down when switching the instrument on. The message "Automatic Power-down disabled" will appear on the LCD. Once it does, press any key to proceed with normal operation.

***NOTE**. All menu settings will be lost on auto power-down unless the settings have been saved for later QK retrieval. Be sure to disable this feature—or power the instrument with the AC adapter—if the AM70 is used to Generate or Modify a signal for more than 10 minutes.*

- The red low-battery LED will light when the charge falls below the level needed for 10 more minutes of operation.[1] For best results, replace the batteries when you first notice that the low-battery LED is lit.
- In order to preserve the contents of non-volatile memory, the AM70 will shut itself down when the battery voltage becomes too low for reliable operation. This function is independent of automatic power down—it is *not* dependent on the time elapsed since the last key press. If the instrument turns itself off immediately after you switch it on, it is likely that the battery charge has fallen below this threshold. If this happens, try powering the instrument with new batteries or the AC adapter before contacting Tektronix for service advice.

***NOTE**. To preserve user settings and presets (stored in NVRAM), always connect the AC adapter when replacing the AM70 batteries.*

Using the AC Adapter

To power the AM70 without batteries, simply plug the standard AC adapter into the local AC supply and the instrument. Circuits within the instrument let you change power source “on the fly.” In other words, if batteries (with adequate charge) are installed, you can disconnect the AC adapter at any time—and reconnect it later—without interrupting operation or losing the current instrument settings.

1 **With the DAC switched off. If “DAin” or “DAout” appear in the upper right of the LCD, the batteries will discharge more quickly. See the Operating Basics section for more information.**

CAUTION. *Attempting to operate the AM70 with an improper AC adapter can damage the instrument. To avoid damage, USE ONLY AN APPROPRIATE DC POWER SOURCE: Voltage must be 9 to 15 VDC; the connector must have the NEGATIVE contact in the center; and open-circuit voltage of the power source must not exceed 18 VDC.*

For best results, use the AC adapter that is supplied with the instrument. If the supplied adapter is incorrect for the local AC power supply, please contact your nearest Tektronix representative.

Note that it is a good idea to install AA batteries even if you intend to power the AM70 exclusively with the AC adapter. Batteries will provide back-up power for the NVRAM in case of interruption in the local AC supply.

Connecting the AM70

A set of six cables is supplied with the AM70 for connection to digital and analog audio equipment. The set includes:

- One digital input cable, female XLR to 3.5 mm phone plug for balanced AES/EBU input; identified with white bands on either end.
- One digital output cable, 3.5 mm phone plug to male XLR for balanced output; identified with black bands.

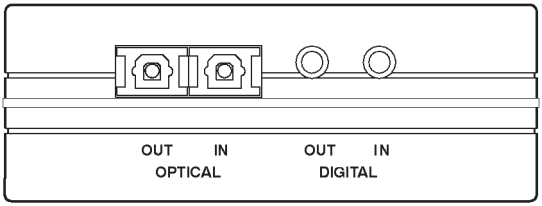


Figure 5: The DIGITAL and OPTICAL (Fiber-Optic Digital) Connectors

The digital connectors are on the “display end” of the instrument, as shown in Figure 5. The OPTICAL connectors are TOSLINK™ compatible; purchase optical (fiber optic) cables, typically used with consumer equipment, from a local vendor.

- Four analog output cables: two 3.5 mm phone plug to male XLR; and two 3.5 mm phone to RCA plugs. One cable of each pair is marked with red bands, the other is marked with blue.

  All phone plug-to-male XLR cables are constructed as shown in Figure 6.

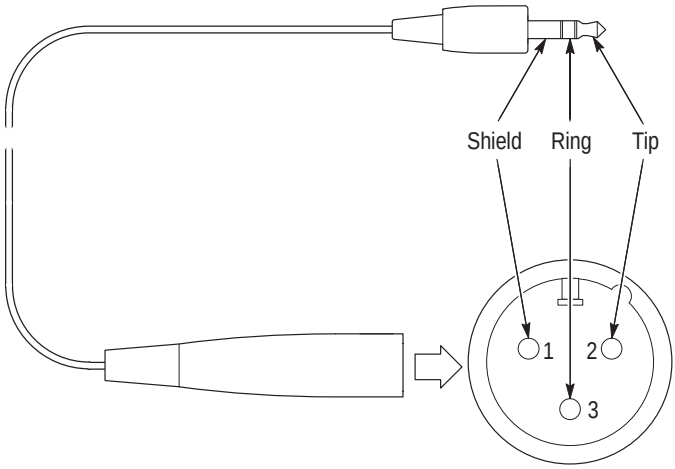


Figure 6: The Phone Plug-to-Male XLR Cables

The analog output connectors are on the lower-right side of the AM70, as shown in Figure 7. The headphone jack will accommodate common consumer (“Walkman®-style”) headphones; you can also use professional-quality headphones, but may have to acquire or build an adapter. Figure 8 is a schematic diagram of the headphone connector; the remaining electrical connectors—digital and analog—are diagrammed in Figure 9.

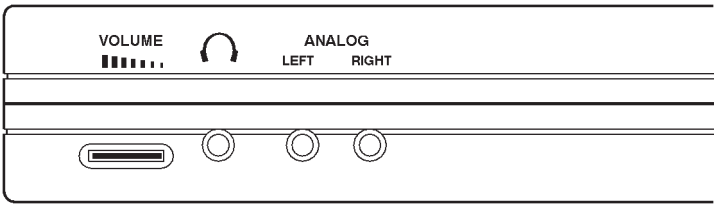


Figure 7: The Analog Output Connectors and Volume Control

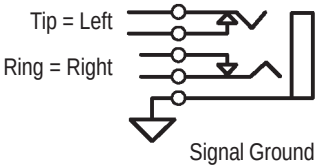


Figure 8: The Headphone Output Connector (Schematic)

Connecting headphones will silence the internal speaker.

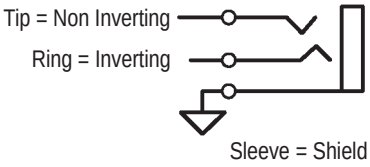


Figure 9: The Digital I/O and Analog Output Connectors (Schematic)

Instrument Controls

The AM70 volume control is visible in Figure 7; instrument switches are illustrated in Figure 10; the LCD contrast control is shown in Figure 11.

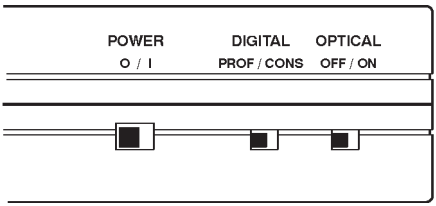


Figure 10: The Power, Digital, and Optical Switches

Volume Control

The VOLUME control affects all analog outputs: headphones, analog left and right, and the internal loudspeaker. Turn the knurled knob to the right to reduce the analog output amplitude, and to the left to increase it.

Switches

The POWER switch follows the convention of 0 = Off and 1 = On. To switch the instrument back On after an "Auto Power Down," first slide the switch to the 0 position, then back to 1.

The DIGITAL switch sets the impedance of the DIGITAL input, and the level of the DIGITAL output. In the PROF (professional, balanced) position, the input impedance is 110 Ω and the output signal is nominally 5.0 V_{p-p}. When the switch is set to CONS (unbalanced consumer), the input impedance is 75 Ω and the output signal is nominally 0.5 V_{p-p}. Be sure to set the switch to match the type of digital audio you are monitoring or modifying.

The OPTICAL switch controls power to the optical circuits of the AM70. To conserve battery charge, leave the OPTICAL switch in the OFF position unless you are using the OPTICAL input.

LCD Contrast

The LCD contrast control is accessed through an opening in the AM70 front panel, immediately below the display, as shown in Figure 11. Use a small screwdriver to adjust the contrast to suit the ambient light and your preferred viewing angle. Note that the display will appear blank when the contrast control is at the minimum (full clockwise) setting.

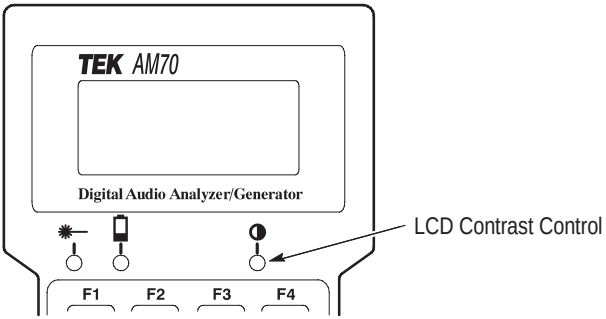


Figure 11: The LCD Contrast Control

Valid/Invalid Input

Correct operation of the AM70 often requires that a digital audio signal be present on either the optical or electrical digital input. A valid signal is a prerequisite for using the Monitor and Modify modes; it is also required in the Generator mode when the "Slave" clock is selected. When a valid signal is required but not detected, the message "Invalid Digital Input" will appear on the display, as shown in Figure 12.

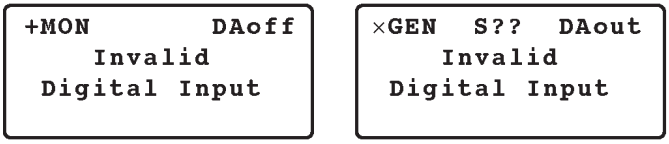


Figure 12: "Invalid Digital Input" Displays

Possible reasons for this message include:

- No digital input signal is present.
- An analog input signal has been incorrectly connected to the digital input.
- The amplitude of the digital input is outside the input signal range of the AM70 (200 mV > input Voltage > 20 V_{p-p}).
- The sample rate of the digital input signal is outside of the sample rate acquisition window of the AM70 (25 kHz > Sample Rate > 50 kHz).
- An optical input signal is present, but Optical power has not been turned on (with the Optical On/Off switch on the side of the instrument).

Functional Verification

The AM70 has a number of built-in diagnostic routines that you can use to verify proper operation of the instrument. Please see *Functional Verification*, beginning on page NO TAG of this manual.

Operating Basics

This section contains all the information needed to use your AM70. The subsections are: Overview, Keypad and Display Conventions, Overall Operating Diagram, Using Monitor Mode, Using Generator Mode, and Using Modify Mode.

Your new AM70 is a very capable instrument, and using it may seem complicated at first. However, every effort has been made to create a straightforward and consistent user interface. Please take a few minutes to look through this section and study the Overall Operating Diagram. Additional diagrams that show the operation of each mode are included in the “Using...” sections; you may find these diagrams useful in learning how to operate your new instrument.

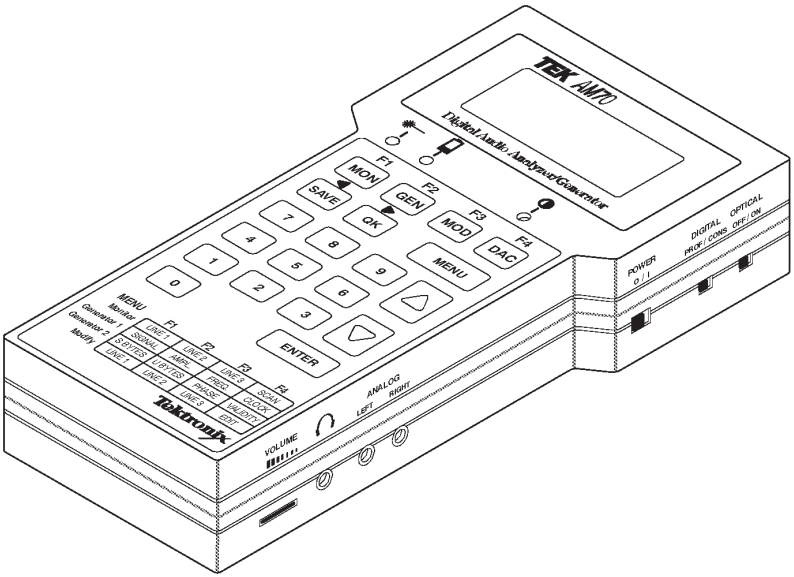


Figure 13: The Tektronix AM70

Overview

The AM70 is designed to perform three primary functions:

- To **Monitor** a digital audio signal, its characteristics, and embedded parameters.
- To **Generate** digital and analog audio test signals.
- To **Modify** selected characteristics and parameters of a digital audio signal.

The instrument has three modes of operation: Monitor mode, Generator mode, and Modify mode. Each operating mode has at least one "menu mode," entered by pressing the **MENU** key. You'll use the menu modes to make choices about instrument operation that are pertinent to the "parent" operating mode.

Monitor Mode

The instrument has, in fact, two Monitor operating modes that let you "observe" a digital audio signal and discover the status of many signal parameters and characteristics. Monitor/Scan mode—the default power-up operating mode of the AM70—cycles through a sequence of seven displays to show the status of 18 significant characteristics. In contrast, the "regular" Monitor mode lets you choose three (out of a list of 59) signal characteristics for continual monitoring.

A typical use of the AM70 Monitor mode is confidence monitoring of digital audio signals. You may insert the instrument in the digital audio signal path, or monitor a buffered version of the signal. Note that the AM70 will introduce a four-sample throughput delay (approximately 100 µs) when you use it "in line."

A complete discussion of the Monitor and Monitor Menu modes begins on page 23.

You may also use the AM70 to monitor the audio signal in the more traditional sense of the word by using the built-in Digital-to-Analog Converter (DAC) to produce an analog signal that you can listen to with headphones or a loudspeaker. See *Ancillary Features and Functions* on page 14.

Generator Mode

When you select Generator mode, the instrument becomes an extremely flexible digital audio[1] signal generator. With the AM70, you can:

- Produce single tones, amplitude and frequency sweeps, multitones, CCITT 0.33 and Tektronix autosequences, white and pink noise, a channel-ID click cycle, and a polarity tone.
- Specify the frequency, amplitude, and phase of the signals where applicable.
- Use the internal clock to generate signals with 32, 44.1, or 48 kHz sample rates, or use the clock derived from an input signal.
- Specify, if desired, the value of several parameters of the digital audio signal.

You can also use Generator mode to make tape test leaders, trace signal paths, identify wires, perform proofs of installations, and calibrate digital or analog audio equipment. A complete discussion of the Generator and Generator Menu modes begins on page 34.

Modify Mode

With the AM70 inserted in the digital audio signal path, you can use Modify mode to change various aspects of the signal "on the fly" while leaving the program material—whether it is a Mozart Concerto or an audio test tone—essentially unchanged. A few of the possible changes are: exchange left and right channel data; truncate audio samples (from 24 to 20 bits, for instance); and edit the channel status data blocks. Modify mode lets you define as many parameter changes as necessary while leaving the remaining parameters unchanged. It introduces a small throughput delay (one block of 192 samples, or approximately 4 ms) in the data stream.

Typically, you'll use Modify mode to locate, identify, and temporarily correct equipment compatibility problems caused by data format errors or other inconsistencies. You can also change source and/or destination IDs to tag signal paths, tapes, or other parts of your

1 **When the DAC is activated, the AM70 will also act as an analog signal generator. See *Ancillary Features and Functions* on page 14.**

digital audio system. Though not intended for permanent installation, the instrument can be left in position for as long as needed.

A complete discussion of the Modify and Modify Menu modes begins on page 50.

Ancillary Features and Functions

The AM70 also has some additional operating and self-test features that you may find useful:

- The internal **Digital-to-Analog Converter** (DAC) lets you listen to the audio encoded in the digital audio signal with the internal speaker, attached headphones, or—with the analog outputs driving a power amplifier—external monitor speakers. In this way, the AM70 can be used as an emergency D/A converter—bridging from the digital to analog audio domains.
- **Save** and **QK** ("Quick Key") modes, which you can use to store—and later recall—up to four instrument configurations in each of the three main operating modes. See page 56 for more information.
- Power-up **Diagnostics** (diagnostic routines), used to verify proper operation of the instrument. See the Performance Verification section of this manual (beginning on page NO TAG) for more information.

Keypad and Display Conventions

The AM70 Front Panel is shown in Figure 14; its features and use are introduced in the next few paragraphs.

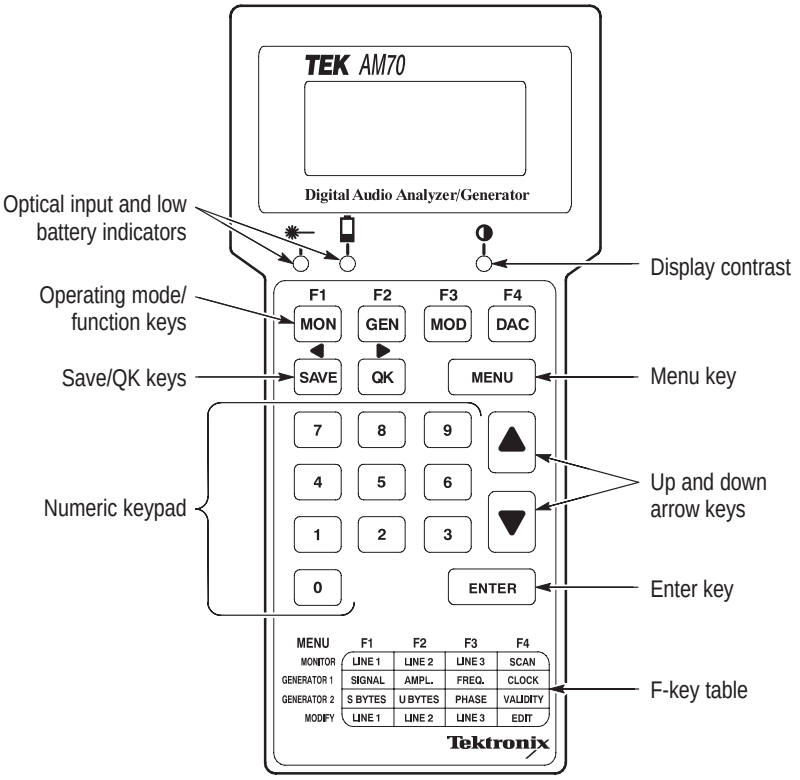


Figure 14: The AM70 Front Panel

Display

The high-contrast “Supertwist” liquid crystal display (LCD) panel has four lines of 16 characters per line. A character matrix is 5 x 7 pixels; the AM 70 display contrast is variable for good readability from all angles. A typical display is represented in Figure 15. The

alternating + / × indicator draws attention to the current operating mode.

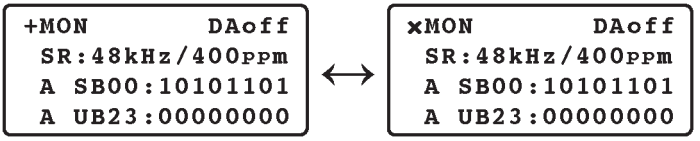


Figure 15: The Alternating +/x Display Indicator

Optical and Low Battery LEDs

There are two indicator lights (LEDs) immediately below the LCD panel: A green light that is illuminated when the Optical output circuit is active, and a red light that warns of low battery charge. The functions of these indicators are signified by pictorial icons.

Keypad Color Coding

Several features of the AM70 keypad are printed in yellow. This is to remind you that these items apply or are used, for the most part, when the instrument is in a menu mode. The “F numbers” above the operating mode keys—explained next—are a good example.

Operating Mode/Function Keys

During normal operation, these keys select the operating mode of the instrument. As you might expect, **MON** selects Monitor mode, **GEN** selects Generator mode, and **MOD** selects Modify mode. **DAC** controls the function of the digital-to-analog converter.

The operating mode keys become function keys (F-Keys) when you put the instrument into one of the menu modes, as indicated by the F# printed in yellow above each key. The F-key table, printed below the keypad, serves as a handy guide to the function of each F-key, depending on the current menu. Generally speaking, F1 selects the first parameter line (which is the *second* line on the display) for editing; F2 selects the second parameter line; and F3 selects the third.

The Menu and Enter Keys

Pressing **MENU** when in one of the three operating modes will place the AM70 in the corresponding menu mode. The Monitor and Modify modes each have one menu; the Generator mode has two. The second Generator menu ("GENERATOR 2") is entered by pressing **MENU** when in the first Generator menu mode. "MENU," "MEN1," or "MEN2" will appear in the upper-right corner of the display when the instrument is in one of the menu modes.

The **ENTER** key accepts current settings—such as the DAC status set with the DAC key—and also returns the instrument to the parent operating mode from any of the menus.

Save and QK (Quick Key) Keys

These keys are used to save and recall instrument presets when the AM70 is in one of the three operating modes. The keys can also move a highlight cursor horizontally in some menu/editing circumstances, as indicated by the left and right arrows (◀ and ▶) printed above them.

The Up and Down Arrow Keys

Use these keys to scroll up and down menu lists, such as the lists of parameters to be monitored or modified in those operating modes, or the list of available output signals in the Generator mode.

Numeric Keypad

Use these keys to enter numeric values, such as frequency, amplitude, or phase in the Generator menus.

Overall Operating Diagram

The overall operation of the AM70 is diagrammed in Figure 16. Various regions of the diagram are numbered and explained in corresponding paragraphs that follow.

❶ The **Operating Mode** of the instrument is selected with the MON (Monitor), GEN (Generator), and MOD (Modify) keys.

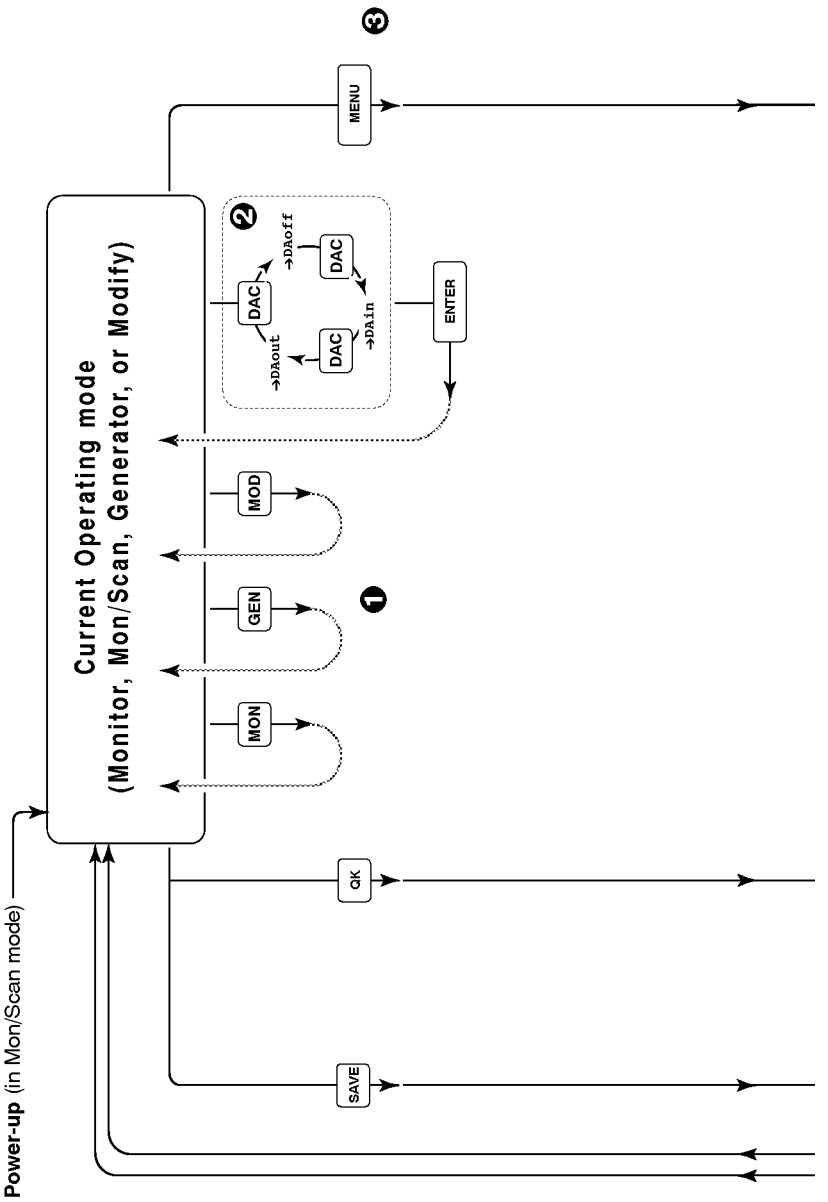


Figure 16: Operating the AM70

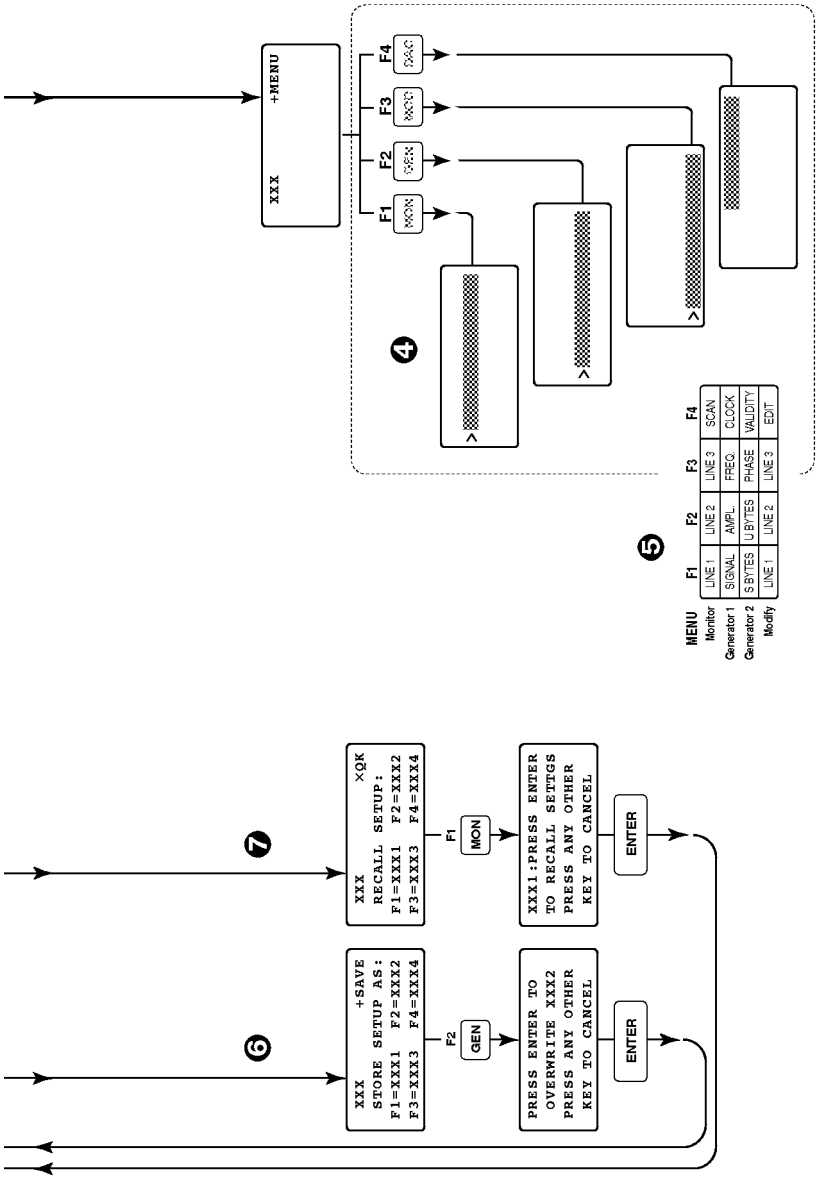


Figure 16: Operating the AM70 (Cont.)

The abbreviated name of the current operating mode will always appear in the upper-left corner of the AM70 display. When the instrument is in "normal operation"—that is, actually Monitoring, Generating, or Modifying a signal—the abbreviation is preceded by the alternating + / × indicator.

You may change modes whenever the instrument is in normal operation simply by pressing the appropriate button. Each mode is diagrammed and discussed in detail later in this manual: *Using the Monitor Modes* begins on page 23; *Using the Generator Mode* begins on page 34; and *Using the Modify Mode* begins on page 50.

❷ **Controlling the DAC** — The **DAC** key controls the operation of the Digital-to-Analog Convertor in the current operating mode. When "DAoff" is selected, no power is supplied to the analog circuits. This disables the built-in speaker, as well as the headphone and analog outputs. Battery life is maximized when the DAC is turned off.

"DAin" connects the DAC and all analog circuits to the digital input signal. When DAin is selected, any signal present at the digital input will be converted to the analog domain. DAin, then, lets you hear the audio that is encoded into the input signal.

"DAout," on the other hand, connects the DAC and all analog circuits to the digital output signal. When DAout is selected, any signal present at the digital output is converted to the analog domain. DAout lets you hear the audio that is encoded into the output signal.

To change the status of the DAC in the current operating mode:

b. With the instrument in a normal operating (not menu) mode, press the **DAC** key. The DAC status name on the upper right of the LCD will change (from DAoff to DAin, for example) and will be preceded by a flashing arrow.

c. Press the **DAC** key repeatedly until the desired DAC status name appears after the flashing arrow.

d. Press **ENTER**. The DAC and analog circuits will change as desired, the flashing arrow will disappear, and the AM70 will resume normal operation.

Note that the DAC status applies to the current operating mode (Monitor, Generator, or Modify) only. If you select a different mode, the DAC status will either revert to DAoff (the power-up default) or—if it had been changed since power-up—the status in effect the last time the mode was active.

❸ The **MENU** key invokes the configuration (menu) mode for the current operating mode. When you press **MENU** to enter a menu mode, the DAC status name will be replaced by the word "MENU," preceded by the alternating + / × indicator to remind you that the instrument is now in one of the menu modes. The operating mode name will remain in the upper-left of the display.

Use **Monitor menu** mode to select three characteristics of the incoming signal to be continually monitored and displayed when the AM70 is in simple Monitor mode. Leaving the Monitor menu with the **ENTER** key invokes simple Monitor mode, in which only the three visible signal characteristics will be monitored. Alternately, leaving the Monitor menu by pressing **F4** puts the instrument in the power-up Monitor/Scan mode.

***NOTE**: Monitoring will pause when **MENU** is pressed, and will resume when you press **ENTER** or **F4** to leave Monitor menu mode.*

There are two levels of the **Generator menu**. Select Generator Menu 1 to choose the *clock* used by the generator, the *type* of signal generated, and—as applicable—the signal *amplitude* and *frequency.* Press the **MENU** key a second time to enter Generator Menu 2; use it to designate additional signal parameters, including *Status Bytes*, *User Block*, *phase*, and *validity.*

***NOTE**: The AM70 will not generate an output signal when in either generator menu. Most signals will resume when you press **ENTER** to leave the menu; however, you must press **ENTER** a second time to begin a CCITT or TEK sequence (see "Using the Generator Mode" for more information).*

Select the **Modify menu** to specify changes to the input signal. See "Modify Menu Mode," beginning on page 54. Once you press **ENTER** to leave the modify menu, the changes will be in effect in the digital output signal.

❹ The functions of the four "F-keys" depend on the current menu mode. In general, **F1** gives access to the first parameter line (which is actually the *second* line on the display); **F2**, parameter line 2; and **F3**, line 3. **F4** applies to items that are shown on the top "status" line of the display in the Monitor and Generator menus; it serves an "EDIT" (parameter) function in the Modify menu.

❺ A table printed on the front of the AM70 describes the F-key actions for each of the Menu modes.

❻ Press the **SAVE** key to store the current AM70 configuration in non-volatile RAM as a "Quick Key" (QK). Otherwise, all selections made through the menu(s) will be lost when the instrument is switched off. Note that there a four storage locations for each of the three operating modes (MON, GEN, and MOD). The save function will only store the settings that apply to the current, active operating mode. Because MON/Scan mode has no settings, the **SAVE** key is inactive when the AM70 is in that mode.

❼ **QK** is the "Quick Key." Use it to retrieve previously stored (with SAVE; see above) instrument settings that pertain to the current operating mode. **QK** will retrieve MON mode settings when the AM70 is in MON/Scan mode.

***NOTE**: You can store and retrieve instrument presets only when the AM70 is in a normal operating mode. **SAVE** and **QK** become left and right arrow keys, ◀ and ▶, when the instrument is in a menu mode.*

Using the Monitor Modes

The AM70 has two modes for observing the input signal and reporting its characteristics: Monitor and Monitor/Scan. The Monitor modes are diagrammed in Figure 17.

Table 3: Monitor/Scan Mode Display Groupings

Parameter Group	Abbreviations
Sample rate A Amplitude B Amplitude	SR ASamp/dB BSamp/dB
Sample rate A/B match Link errors	SR A/B MATCH LINK
Channel A status byte 0 Channel A status byte 1 Channel A status byte 2	A SB00 A SB01 A SB02
Channel A status byte 3 Channel A status byte 4 Channel A status byte 5	A SB03 A SB04 A SB05
Sample rate Chan A source ID Chan A destination ID	SR SIDA DIDA
Sample rate Channel A sample address code Channel A time of day code	SR A SACd A TmCd
Sample rate Channel A status byte 22 Channel A status byte 23	SR A SB22 A SB23

Monitor/Scan (MON/Scan) Mode

Monitor/Scan mode is the default power-up operating mode of the instrument. It gives the user an overview of the input signal by cycling through the seven display groupings listed in Table 3, pausing 10 seconds for each group. In 70 seconds, then, MON/Scan mode will

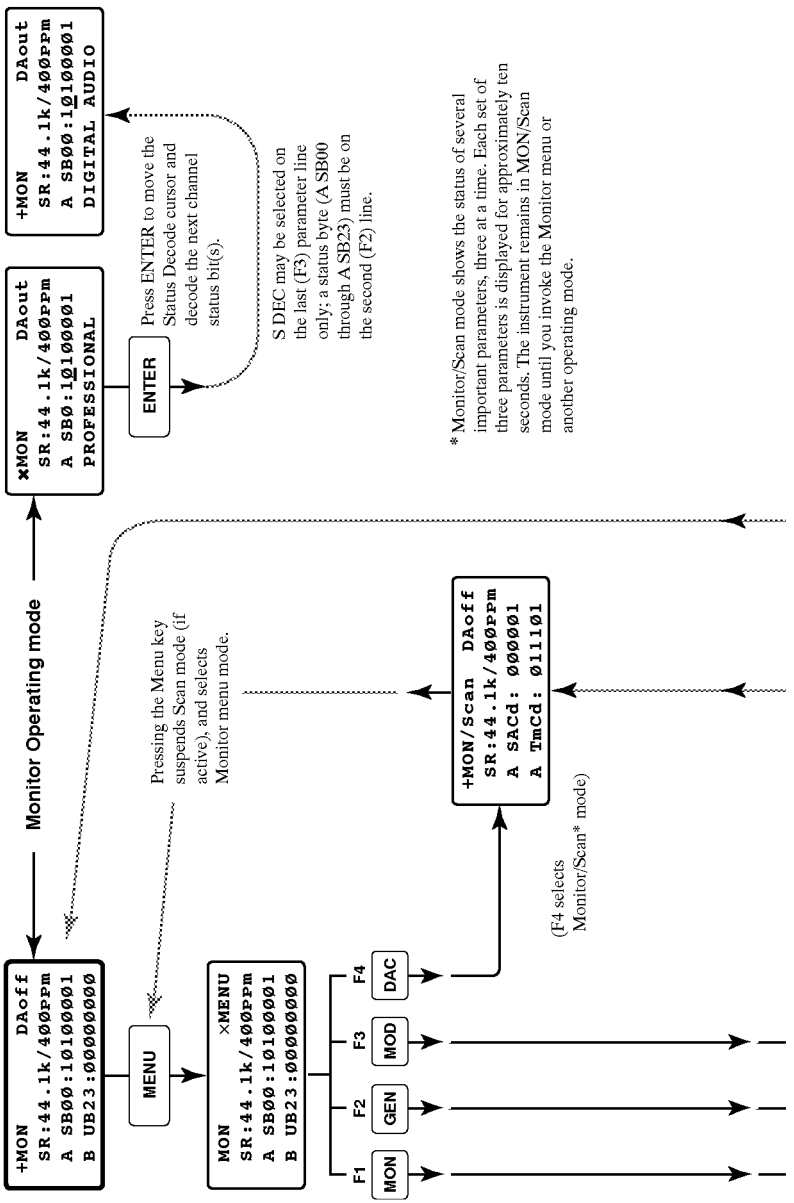


Figure 17: The Monitor and Monitor Menu Modes

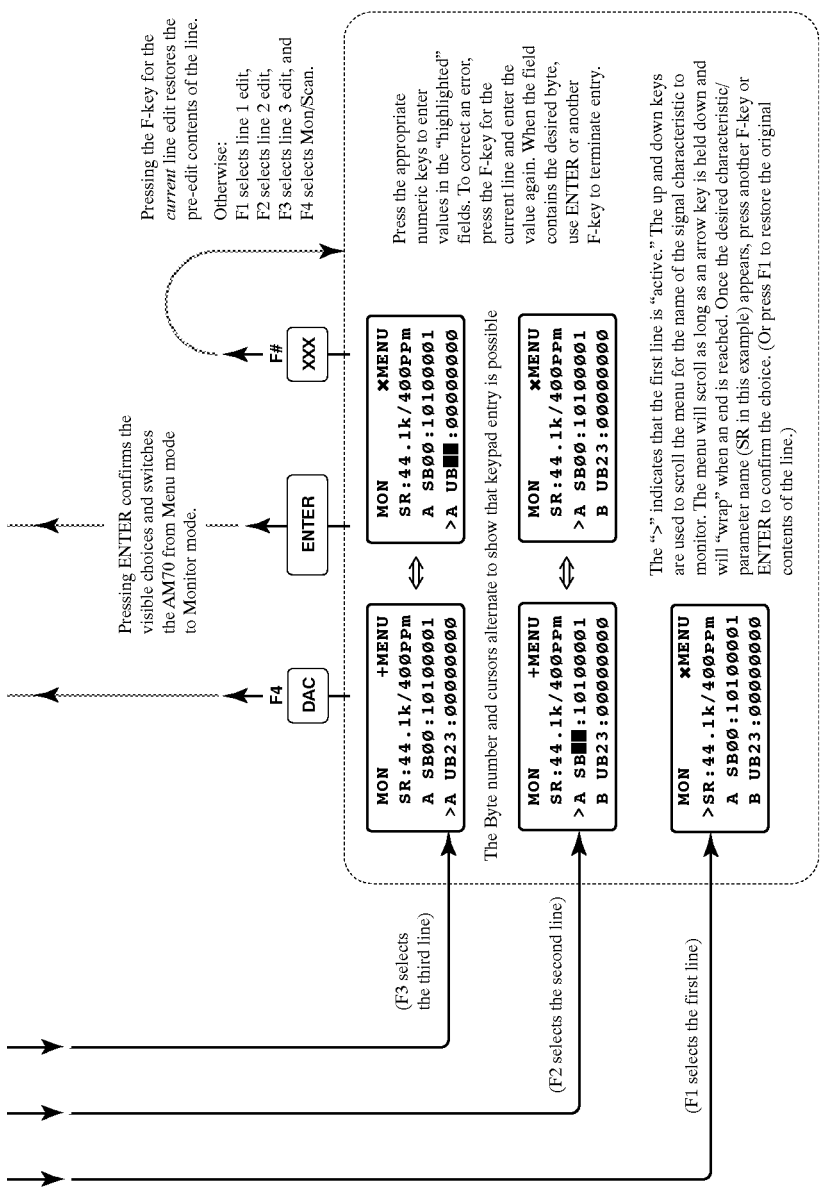


Figure 17: The Monitor and Monitor Menu Modes (Cont.)

give you an "overview" of the input signal. Monitor/Scan mode will continue to cycle through the seven displays as long as it is active.

Simple Monitor (MON) Mode

Simple Monitor mode continually displays three characteristics of the digital audio signal or the data embedded in the signal. Table 4 lists the signal attributes/parameters that you can monitor with the AM70. Parameters are selected through the Monitor menu mode.

Monitoring a Digital Audio Signal

To use a Monitor mode, you need only connect your AM70 to a signal of interest and switch the instrument On. Monitor/Scan will then begin its seven-display cycle.

Simple Monitor (MON) mode is all about watching the three signal characteristics *of your choice*. To get there from MON/Scan mode, you must first enter Monitor menu mode by pressing the **MENU** key. The AM70 will suspend monitoring and wait for further input. After you have selected the three signal characteristics of interest (see *Monitor Menu Mode*, beginning on page 26), press **ENTER** to begin monitoring.

Incidentally, if the three parameters that you wish to monitor make up one of the seven MON/Scan display groups, you can select them by "freezing" the instrument when that group is displayed. Simply wait for the display to appear in MON/Scan mode and press **MENU**, then **ENTER**. The AM70 will continually monitor the three "scan group" characteristics as long as you wish.

To restart the Monitor/Scan cycle from the Monitor mode, simply press **MENU**, then **F4**.

NOTE. *All MON mode selections will be lost when MON/Scan mode is restarted with* ***F4****. To save time later, consider saving the current setup as a "Quick Key" before resuming MON/Scan (see page 56).*

Monitor Menu Mode

You'll use the Monitor Menu mode as shown in Figure 17 to select the three signal parameters to be monitored and displayed.2

1. Enter Monitor Menu mode from the Monitor or Monitor/Scan operating mode by pressing the **MENU** key. The word "MENU," preceded by the alternating + / × indicator, will replace the DAC status in the upper-right corner of the display. Note that Monitoring is suspended when the instrument is in Monitor menu mode.
2. Press **F1**, **F2**, or **F3** to select a parameter display line (see the table printed on the face of the instrument, below the keypad). An angle bracket ("〉") will appear at the beginning of the line.
3. Use the up and down arrow keys (▲ and ▼) to scroll through the list of choices as they appear in Table 4.

Table 4: Monitor Menu Choices

Abbreviation	Parameter	Possible Values
SR	Sample Rate	Out of Range 48 ±400ppm 48 ±4% 44.1 ±400ppm 44.1 ±4% 32 ±400ppm 32 ±4% 44.056 ±400ppm
SIDA	Channel A Source ID (status bytes 6–9, decoded)	XXXX (Four alpha-numeric characters)
DIDA	Channel A Destination ID (status bytes 10–13, decoded)	YYYY (Four alpha-numeric characters)
A SB[00...23]	Any channel A status byte [0...23]	00000000–11111111
A UB[00...23]	Any channel A user byte [0... 23]	00000000–11111111
A SACd	A Sample Address Code (bytes 14–17)	000000–111111
A TmCd	Ch. A Time of Day Code (bytes 18–21)	000000–111111
ASamp/dB	A Amplitude	0 to –96 dB (FS)
BSamp/dB	B Amplitude	0 to –96 dB (FS)

Table 4: Monitor Menu Choices (Cont.)

Abbreviation	Parameter	Possible Values
SIDB	Channel B Source ID (status bytes 6–9, decoded)	XXXX (Four alpha-numeric characters)
DIDB	Channel B Destination ID (status bytes 10–13, decoded)	YYYY (Four alpha-numeric characters)
B SB[00...23]	Any channel B status byte [0...23]	00000000–11111111
B UB[00...23]	Any channel B user byte [0... 23]	00000000–11111111
B SACd	B Sample Address Code (bytes 14–17)	000000–111111
B TmCd	Ch. B Time of Day Code (bytes 18–21)	000000–111111
S DEC	Status byte decode (Available in the last parameter line only. Functional only if A SB[00...23] or B SB[00...23] is on the second parameter line, immediately above.)	"plain English"
LINK A/B MATCH VAL–BIT	Link Status (Available in the first parameter line only; shows A/B Match and Validity Bit status in the remaining parameter lines)	Error/No Error Yes/No Low/High

Two of the choices, status bytes and user bytes, require the entry of a number between 00 and 23 to designate the exact byte to be monitored. Therefore, when you scroll to a status byte or user byte selection, all display pixels in the byte number positions will flash, as shown in Figure 18, to prompt you for more information. Enter the number of the desired byte with the numeric keypad. To specify byte 5, for example, you would press **0**, and then **5**. When you have entered two numerals, the prompting rectangles will disappear and only the number will flash. If the number is not correct, press the F-key for the current line and try again.

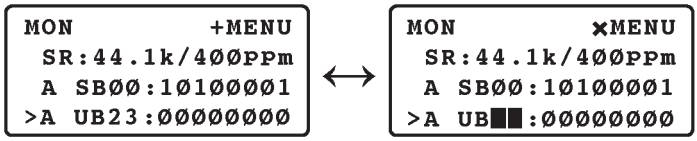


Figure 18: The Monitor Menu Byte Selection Prompt

***NOTE**. In keeping with industry practice, Channel Status and User bytes are displayed as bit Ø (LSB) left, to bit 7 (MSB) right.*

Note that the LINK and S DEC choices have special requirements and techniques. See *Monitoring Link Status* (on page 29) and *Status Byte Decoding* (on page 30) for more information.

4. To cancel an entry, press the active line's F-key again.
5. When the display line shows the desired parameter:
   - Press **ENTER** to accept the choice and begin or resume monitoring, OR
   - Press **F1**, **F2**, or **F3** to select another parameter line, OR
   - Press **F4** to abort MON mode and restart MON/Scan mode.

Monitoring Link Status

In the AM70, "Link" refers to the serial digital communications process, and the factors that affect the integrity of the link between the sending and receiving equipment. As indicated in Table 4, you can select Link Status in the **F1** parameter line only. When you do, the instrument will automatically monitor A/B Match and the Validity Bit on the two remaining parameter lines (the display will resemble the left side of Figure 19).

When there are no problems with the data link, LINK will report "No Error." If the instrument detects one or more errors, the LCD will alternate between the normal Link monitoring display and a display that reports the type (or types) of detected error, as shown in Figure 19. Each display will persist for approximately 10 seconds.

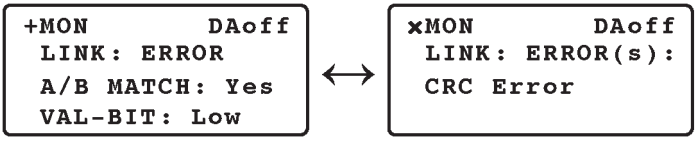


Figure 19: Alternating Link Error Displays

Possible LINK errors are:

- CRC Errors — Either the CRC character is missing from the input signal, or the character does not contain the same sum as calculated by the AM70.
- Parity Error — A parity error has been detected.
- Confidence — The "eye width" of the digital input signal is less than one-half the expected value (due to excess jitter).
- Out of Lock — The sampling frequency of the input signal is less than 25 kHz or greater than 55 kHz.
- Coding — Errors in biphase coding have been detected.

"A/B MATCH" — The instrument will report "Yes" if the channel status bits of input channel B are identical to those on channel A; it will report "No" if they are not.

VAL-BIT — In AES/EBU digital audio, the Validity bit is low (logic 0) if the audio sample word is suitable for conversion to an analog audio signal, and high (logic 1) when it is not. This line will report the bit to be either "Low" or "High."

Status Byte Decoding

To decode the channel status block of the input signal into "plain English," you *must* select a Status byte ("A SB*nn*" or "B SB*nn*," where *nn* can be any number from 00 through 23) on the **F2** parameter line and "S DEC" on the **F3** line. When you have done so, and are still in Monitor menu mode, the display will resemble Figure 20 (the status byte number will automatically revert to ØØ).

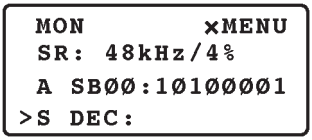


Figure 20: Status Decode Selected in the Monitor Menu

Now press enter to resume monitoring the signal. The display will resemble Figure 21, with bit 0 of Status byte 0 alternating with an underline cursor. The contents of the bottom display line will depend on the value of the bit; in AES and IEC standards, “0” indicates consumer use of the channel status block, while “1” verifies professional use.

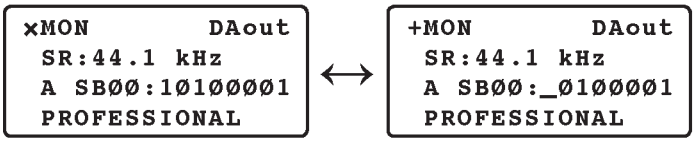


Figure 21: Status Byte 0, Bit 0 Decoded

To decode the remainder of the status block, press the ▼ key repeatedly. Each press will change the highlighted bit(s), and perhaps the byte number. The bottom display line will contain the meaning of the highlighted bits. Use the ▲ key to return to an earlier selection. If byte 00, bit 0 is high (1), decoding follows the AES3 “professional” standard, as shown in Table 5; if the bit is low, however, decoding follows the IEC958 consumer standard, as listed in Table 6.

Table 5: Information Embedded in the AES3 Status Block

S Byte(s)	Bit(s)	Significance
00	0	Professional/Consumer
00	1	Audio/non-audio
00	2–4	Emphasis
00	5	Sampling frequency locked/unlocked
00	6–7	Sampling frequency
01	0–3	Channel mode (stereo/mono)
01	4–7	User bits management
02	0–2	Maximum sample word length; use of auxiliary bits
02	3–5	Sample word length
02	6–7	Reserved/undefined
03	0–7	Reserved/undefined
04	0–1	DAR status
04	2–7	Reserved/undefined
05	0–7	Reserved/undefined
06–09	All	Alphanumeric source ID
10–13	All	Alphanumeric destination ID
14–17	All	Sample address code (SACd)
18–21	All	Time of day sample code (TmCd)
22	0–3	Reserved/undefined
22	4	Channel status data reliability, Bytes 0–5
22	5	Channel status data reliability, Bytes 6–13
22	6	Channel status data reliability, Bytes 14–17
22	7	Channel status data reliability, Bytes 18–21
23	0–7	CRCC (checksum)

Table 6: Information Embedded in the IEC958 Status Block

S Byte(s)	Bit(s)	Significance
00	0	Professional/Consumer
00	1	Audio/non-audio
00	2	Copyright protection (yes/no)
00	3–5	Emphasis
00	6–7	Reserved/undefined
01	0–3	Group category[1]
01	4–6	Group subcategory[1]
01	7	Generation status
02	0–3	Source number
02	4–7	Channel number
03	0–3	Sampling frequency
03	4–5	Clock accuracy
03	6–7	Reserved/Undefined (should be zero)
04–23	All	Reserved/Undefined (should be zero)

1 **Interpreted together; see IEC958 and IEC 958 Amendment 1.**

Using the Generator Mode

When Generator mode is selected, the AM70 acts as a digital (and analog, if the DAC is on) audio signal generator. The instrument can use its internal clock oscillator to generate digital output signals, or it may derive its sample rate by locking to an incoming digital audio signal.

Available Signals

The signals generated by the AM70 are listed and explained in the paragraphs below; many are described more fully in Appendix NO TAG. All signals are generated in both left and right channels by default. You may also select “L ...” (left channel only) and “R ...” (right channel only) versions of the tone, sweep, and multitone signals. Signal selection is through Generator menu 1 (see page 37).

Default characteristics of the output signals are listed in Table 7. The characteristics that may be changed through Generator menu 1 are listed in Table 8 (and explained in Table 9); those that can be edited through menu 2 are listed in Table 10.

- **TONE** (L TONE, R TONE) — Sine wave signals. Tone amplitude, frequency, and phase are user-programmable.
- **FSWEEP** (L FSWEEP, R FSWEEP) — Fixed amplitude, stepped frequency sine wave signals. Amplitude is user-programmable. Frequencies include 25 Hz to 20 kHz, and FSWEEP duration is 22 seconds. See page NO TAG for more information.
- **ASWEEP** (L ASWEEP, R ASWEEP) — Fixed frequency, stepped amplitude sine wave signals. Amplitude sweeps from –60 dBFS to 0 dBFS. Frequency is user-programmable. See page NO TAG for more information.
- **MTONE 1, 3** (L MTONE 1, 3; R MTONE 1, 3) — Tektronix-defined sine wave combinations (“Multitones”) with energy distributed throughout 15 kHz spectrum. Multitone test signals are compatible with Tektronix AM700 and VM700A Multitone Measurement applications. Amplitude is user-programmable. See page NO TAG for more information.
- **MTONE 2, 4** (L MTONE 2, 4; R MTONE 2, 4) — Tektronix-defined sine wave combinations with energy distributed

throughout the 20 kHz spectrum. Multitone test signals are compatible with Tektronix AM700 and VM700A Multitone Measurement applications. Amplitude is user-programmable. See page NO TAG for more information.

- **DIG LINEUP** — Sine wave signals on Left and Right channels. Amplitude and frequency are user-programmable.
- **CCITT 0.33:00 ... :05** — International audio test sequences used to establish quality of sound contribution and transmission links. CCITT 0.33:XX signals are sequences of individual tones. FSK signaling tones and identification characters initiate automatic tests at receiving end of circuit under test. Tektronix VM700A Measurement Set will recognize these signals and automatically execute the standard tests. Press **ENTER** to start any of the sequences. See page NO TAG for more information.
- **TEK90 ... TEK95** — Tektronix-defined audio tests sequences that employ individual tones and identification characters for testing applications similar to those described in above CCITT section. Press **ENTER** to start any of the sequences. See page NO TAG for more information.
- **TEK POLARITY** — 400 Hz and 800 Hz sine wave combination which, when viewed on an oscilloscope, permits users to detect if polarity reversals have occurred in balanced, analog audio connections. Amplitude setting is user-programmable. See page NO TAG for more information.
- **BURST** — Sine wave signal whose output level periodically switches between two amplitude settings. Amplitude, frequency and duty cycle settings of BURST signal are user-programmable.
- **CLICKS** — 1 kHz tone on left and right channels. A 50 ms interruption (click) in the left channel is followed by two successive 50 ms clicks in the right channel. By counting clicks, a listener can tell if left channel (1 click), right channel (2 clicks) or both channels (3 clicks) are present. The amplitude setting is user-programmable. See page NO TAG for more information.
- **WHITE NOISE** — Band-limited (20 kHz) noise signal with constant energy/Hz density. Noise signals are used to test audio, surround sound and sound reinforcement systems. Amplitude setting is user-programmable.

- **PINK NOISE** — Band-limited (20 kHz) noise signal with constant energy/octave density. Amplitude is user-programmable.
- **DIG AUDIO REF** — Silence (no signal) with required AES/EBU channel status bits identifying this signal as a digital audio reference. No user-programmable settings are available.
- **SILENCE** — This signal is essentially the residual noise floor of the AM70.

Table 7: Generator Power-Up Defaults

Parameter	Default Value
Status bytes:	(bit 0/LSB–bit 7/MSB)
0	10100001
1	00010000
2	00100000
3–5	00000000[1]
6–9 (Source ID)	'AM70'
10–13 (Destination ID)	' ' (NULL Symbols)
14–21	00000000
22–23	For proper Reliability & CRCC data
User bytes (all)	00000000
Sample Address (SB 14–17)	0
Time of Day (SB 18–21)	0
Validity bit	0
Parity bit	EVEN
Phase	0°

1 **Status byte 4 is 10000000 when DAR is selected.**

Generator Menu Modes

AM70 Generator output is configured with two menu "levels." Level 1, described in Figure 22, lets the user specify the test signal type and sample frequency as well as the tone amplitude, frequency, and phase where appropriate.

Generator menu level 2 allows definition of the channel status and user blocks in the output data stream (channel B = channel A) for all signals; it is described in Figure 25.

Generator Menu 1

Use the Generator menu mode 1 as shown in Figure 22 to select the signal to be generated, the sample clock, and other signal characteristics as listed in Table 8.6

1. Enter Generator menu 1 Generator operating mode by pressing the **MENU** key. The word "MENU," preceded by the alternating + / × indicator, will replace the DAC status in the upper-right corner of the display. Note that signal generation is suspended when the instrument is in either Generator menu mode.

2. To select a signal, press **F1**. Then:

   a. Use the ▲ and ▼ keys to scroll the signal list for the signal you wish to generate. The list will scroll as long as the arrow key is held down and will "wrap" when the beginning or end is reached. The signal names will appear in the order listed in Table 8.

   b. To select an "L" or "R" signal, first scroll to TONE, ASWEEP, FSWEEP, or MTONE *n*, then press the ◀ or ▶ key.

   c. When the name of the desired signal is visible, complete the selection by pressing:
   - another F-key to remain in menu 1 and edit a signal parameter;
   - **MENU** to change to Generator menu 2; or
   - **ENTER** to return to Generator operating mode.

3. Press **F2** or **F3** to edit the parameters (if any) on the two lower display lines. The signal characteristics adjusted through these F-keys are listed in Table 8 and further described in Table 9. An angle bracket ("〉") will appear at the beginning of the active line.

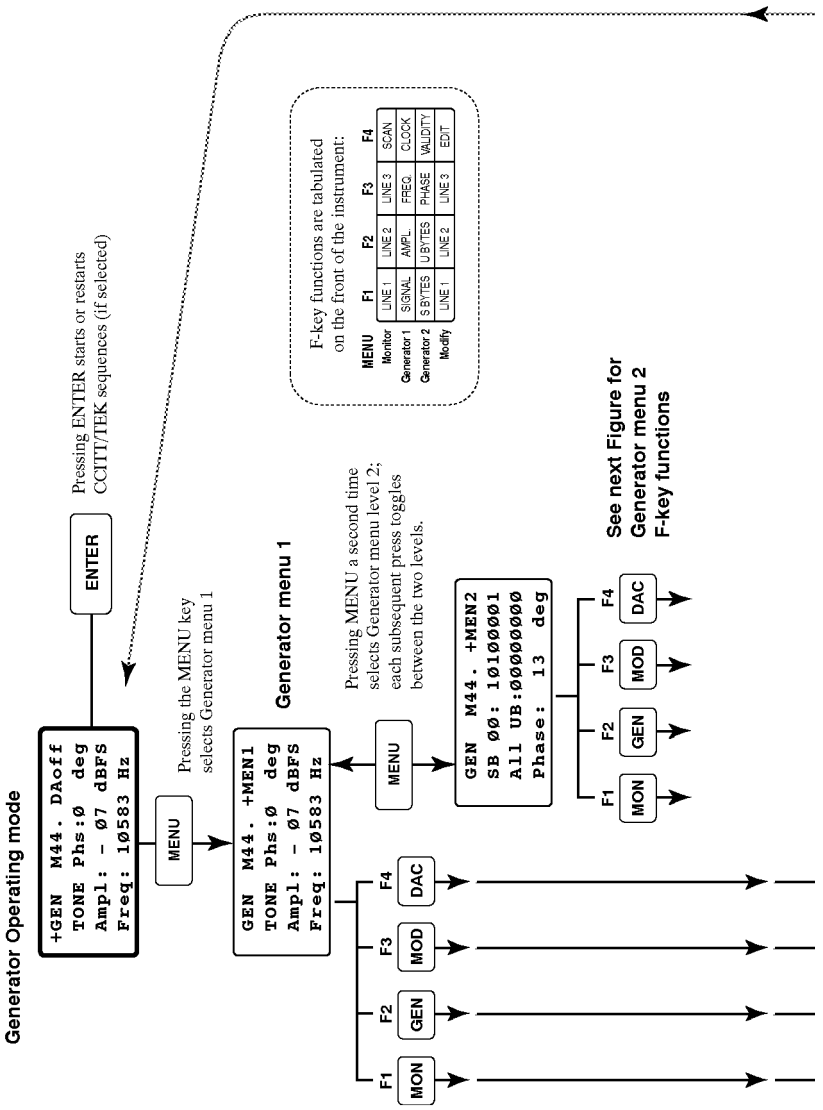


Figure 22: The Generator and Generator menu 1 modes

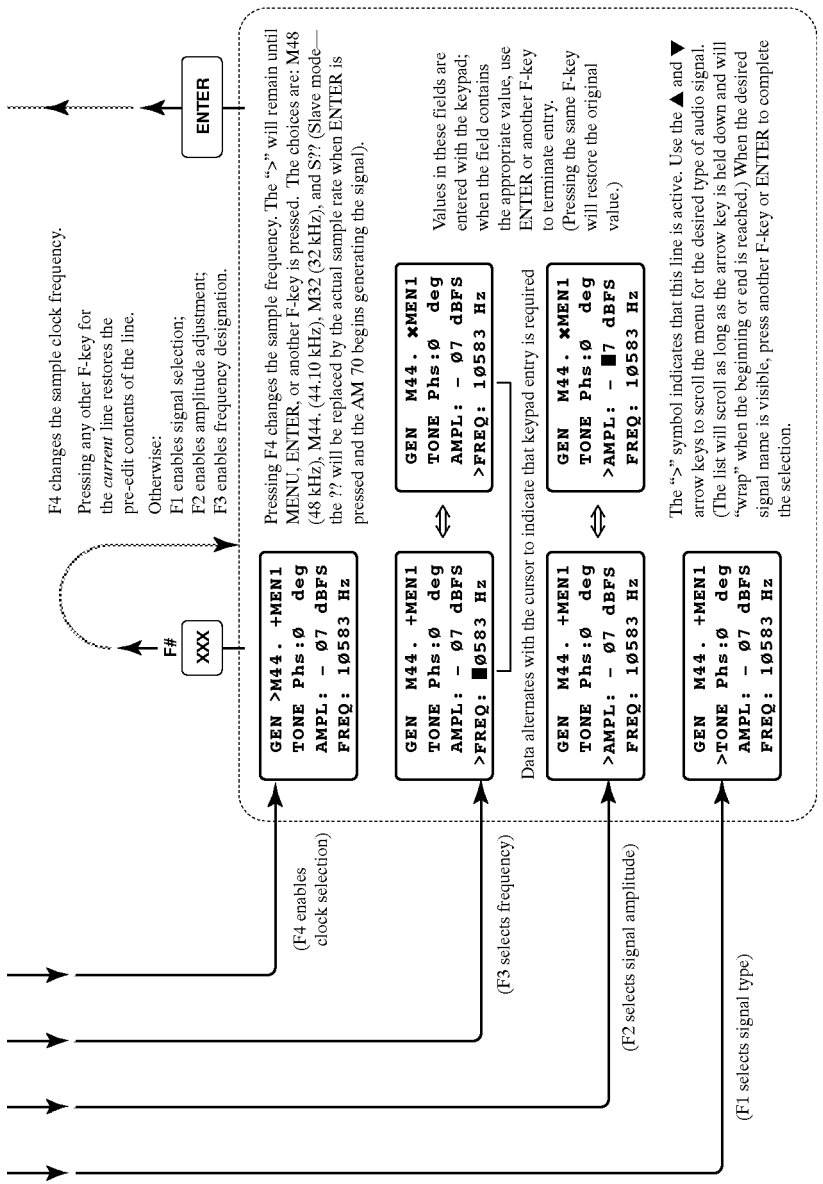


Figure 22: The Generator and Generator menu 1 modes (Cont.)

Use the keypad to enter values into numeric fields, such as amplitude and frequency. The cursor will move to the next position when you enter a numeral; you may also move side-to-side within the field with the ◀ and ▶ keys. As always, pressing the F-key for the current line will cancel the change and restore the pre-edit value, while pressing another F-key, **ENTER**, or **MENU** will confirm the field contents as the new value. New values only become effective when you press **ENTER** to resume generating (to begin a sequence, you must press **ENTER** twice—see step 5).

Table 8: Generator Menu 1 Signals and F-key Selections

Signal (F1)	F2 to Select	F3 to Select
TONE[1]	Ampl (Amplitude)	Frequency
FSWEEP[1]	Ampl (Amplitude)	—
ASWEEP[1]	—	Frequency
MTONE 1[1]	Ampl (Amplitude)	—
MTONE 2[1]	Ampl (Amplitude)	—
MTONE 3[1]	Ampl (Amplitude)	—
MTONE 4[1]	Ampl (Amplitude)	—
DIG LINEUP	Ampl (Amplitude)	Frequency
CCITT 0.33:00	Ref (reference ampl.)	SrcID (source ID)[2]
CCITT 0.33:01	Ref (reference ampl.)	SrcID (source ID)[2]
CCITT 0.33:02	Ref (reference ampl.)	SrcID (source ID)[2]
CCITT 0.33:03	Ref (reference ampl.)	SrcID (source ID)[2]
CCITT 0.33:04	Ref (reference ampl.)	SrcID (source ID)[2]
CCITT 0.33:05	Ref (reference ampl.)	SrcID (source ID)[2]
TEK90	Ref (reference ampl.)	SrcID (source ID)[2]
TEK91	Ref (reference ampl.)	SrcID (source ID)[2]
TEK92	Ref (reference ampl.)	SrcID (source ID)[2]
TEK93	Ref (reference ampl.)	SrcID (source ID)[2]
TEK94	Ref (reference ampl.)	SrcID (source ID)[2]
TEK95	Ref (reference ampl.)	SrcID (source ID)[2]
TEK POLARITY	Ampl (Amplitude)	—

Table 8: Generator Menu 1 Signals and F-key Selections (Cont.)

Signal (F1)	F2 to Select	F3 to Select
BURST (Select Frequency)	Period (of repetition) OR Amp1 (amplitude 1)	Width (of pulse) OR Amp2 (amplitude 2)
CLICKS	Ampl (Amplitude)	—
WHITE NOISE	Ampl (Amplitude)	—
PINK NOISE	Ampl (Amplitude)	—
DIG AUDIO REF	—	—
SILENCE	—	—

NO TAG **Signals have L and R versions, selected with the ◀ and ▶ keys.**

2 **Note that this Source ID is embedded in the sequence preamble to be decoded by receiving instruments such as the Tekronix VM700A; it is different than the "S ID" embedded in the channel status bytes. See *Appendix A*.**

4. Press **F4** repeatedly to choose the sample clock/frequency. The three internally generated master clocks are M48 (48 kHz), M44 (44.1 kHz), and M32 (32 kHz). You may also use the clock frequency derived from the input signal, if one is present. During clock selection, the "slave" option is indicated as "S??." Once you return the instrument to Generator operating mode, the actual sample rate of the input signal will replace the question marks on the display. If no valid input signal is present, the question marks will remain and the display will contain the message "Invalid Digital Input."

Table 9: Generator Menu 1 Signal Characteristics

Abbreviation	Parameter	Available Values
Freq/F	Tone frequency	10 Hz to 20 kHz, one Hz resolution
Ampl	Amplitude	–99 to 0 dBFS in one dB increments
Ref	Sequence ref. ampl.	Depends on the sequence selected
Period	Burst "cycle" duration	2 to 60000 ms (.002 to 60 seconds)

Table 9: Generator Menu 1 Signal Characteristics (Cont.)

Abbreviation	Parameter	Available Values
Width	Burst (amp1) duration	1 to (period–1) ms
SrcID	Preamble Source ID	XXXX (four alpha-numerics)
(none)	Sample Clock Rate	S??, M32, M44., M48 (kHz; M=master; S=slave)

5. Press **MENU** to invoke Generator menu 2, or press **ENTER** to accept all settings and resume Generator mode. Generation of all but the sequence signals will begin immediately; press **ENTER** again to initiate a CCITT or TEK sequence.

Once a sequence is begun, its progress will be indicated by a "bar graph" on the bottom line of the AM70 display (see Figure 23); all pixels will be "lit" at the end of the sequence. When the sequence is complete, the Source ID parameter will again appear on the display. When it does, you may repeat the sequence by once again pressing **ENTER**.

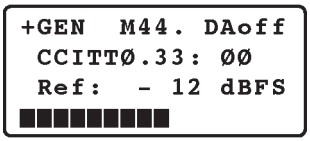


Figure 23: The Sequence-Progress "Bar Graph"

Special technique: SrcID entry — When a CCITT or TEK sequence is selected through **F1**, the **F3** parameter becomes "SrcID," or Preamble Source ID. This ID is embedded in the sequence preamble (see page NO TAG), and should not be confused with the Status byte Source ID that is set through Generator menu 2. When you select the line for editing by pressing **F3**, the first character of the existing ID (the default is "AM70") will alternate with the rectangular cursor, as shown in Figure 24.6

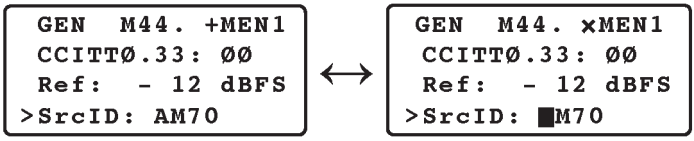
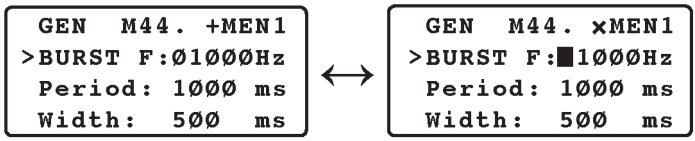


Figure 24: The Sequence Source ID Entry Display

1. Change the contents of the character position with ▲ and ▼, or enter a numeral from the keypad. See Appendix NO TAG for a list of available characters. The list of characters will scroll as long as you hold an arrow key down.
2. Move to a new position with the ◀ and ▶ keys.
3. Restore the pre-edit ID text by pressing **F3**.
4. Press **ENTER** or another F-key to accept the new SrcID.

Exception: Burst Parameters5 — The Burst signal has unique "menu 1" parameters. Select them with the following steps.

1. After you select the Burst signal and the first parameter (**F1**) line is still active, the AM70 display will look like this:

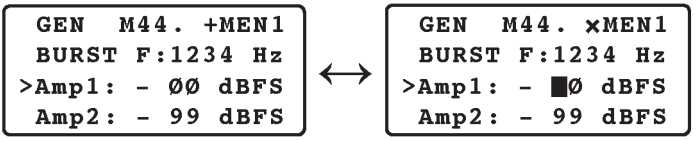


   The cursor in the frequency field is a reminder to enter the desired frequency with the keypad. As usual, you may move the cursor with the ◀ and ▶ keys, and you can cancel the changes (and restore the pre-edit value) by pressing **F1**.

2. When the Burst frequency is correct, press **F2** and enter the desired period the same way. The period is the time between the rising edges of successive burst packets. The period entry must be greater than the width. If you enter a smaller number, the AM70 will automatically replace the current width with half of the period.

3. Press **F3** and use the same technique to enter the burst width. The instrument will *not* accept a width entry greater than the period.

4. Press **F2**, then ▼. The display will change to reveal the amplitude settings, like this:



   "Amp1" is the amplitude of the burst packet; "Amp2" is the amplitude of the signal during the remainder of the period. The default values are 0 dBFS and –99 dBFS, as shown. You may enter any value between those two extremes; however, Amp2 cannot be greater than Amp1. For example, if you enter –20 dB for Amp1, Amp2 should be –21 dB or less.

   Enter the desired value for Amp1 with the numeric keys. If you enter and accept a value that is lower than the existing Amp2, |Amp2| will become twice |Amp1|.

5. Press **F3** and use the same technique to enter the Amp2. The instrument will *not* accept an Amp2 that is greater than Amp1.

6. Finally, press:

   - **ENTER** to begin generating the reconfigured Burst signal,
   - **MENU** to change to Generator menu 2,
   - or another F-key to edit another Burst signal parameter. Remember, to reveal and edit the amplitudes, select Period (**F2**) and then press the▼ key.

Generator Menu 2

Enter Generator menu 2 from Generator menu 1 by pressing **MENU**. "GenMen2" is diagrammed in Figure 25. With the exception of Tone phase, the characteristics selected/edited in menu 2 do not vary from signal to signal. The characteristics are listed in Table 10.

Use the same basic techniques to select menu 2 parameters as in menu 1. The major difference is that, in menu 2, more than one parameter may be edited on the **F1** parameter line.

Table 10: Generator Menu 2 Signal Characteristics

Parameter	Possible values	How edited
(**F1**:) Status Block (bytes 0–5 and 22)	00000000– 11111111	Use ◀ or ▶ key to enter byte number field or bit field: Only the 0 and 1 keys are active in the bit field.
Source ID (S ID, Status bytes 6–9)	XXXX (four chars)	Use ◀ or ▶ key to select position, then use ▲ or ▼ to select character
Destination ID (D ID; bytes 10–13)	YYYY (four chars)	Same as S ID
CRCC	Enabled or Disabled	Toggle with SAVE/QK (◀ / ▶) keys
(**F2**) User bytes	00000000– 11111111	1 and 0 keys, all bytes, both channels, identical
(**F3**) Phase (TONE only)	0–359°	Numeric keypad
(**F4**) Validity Bit	0 or 1	Toggle with the DAC/F4 key

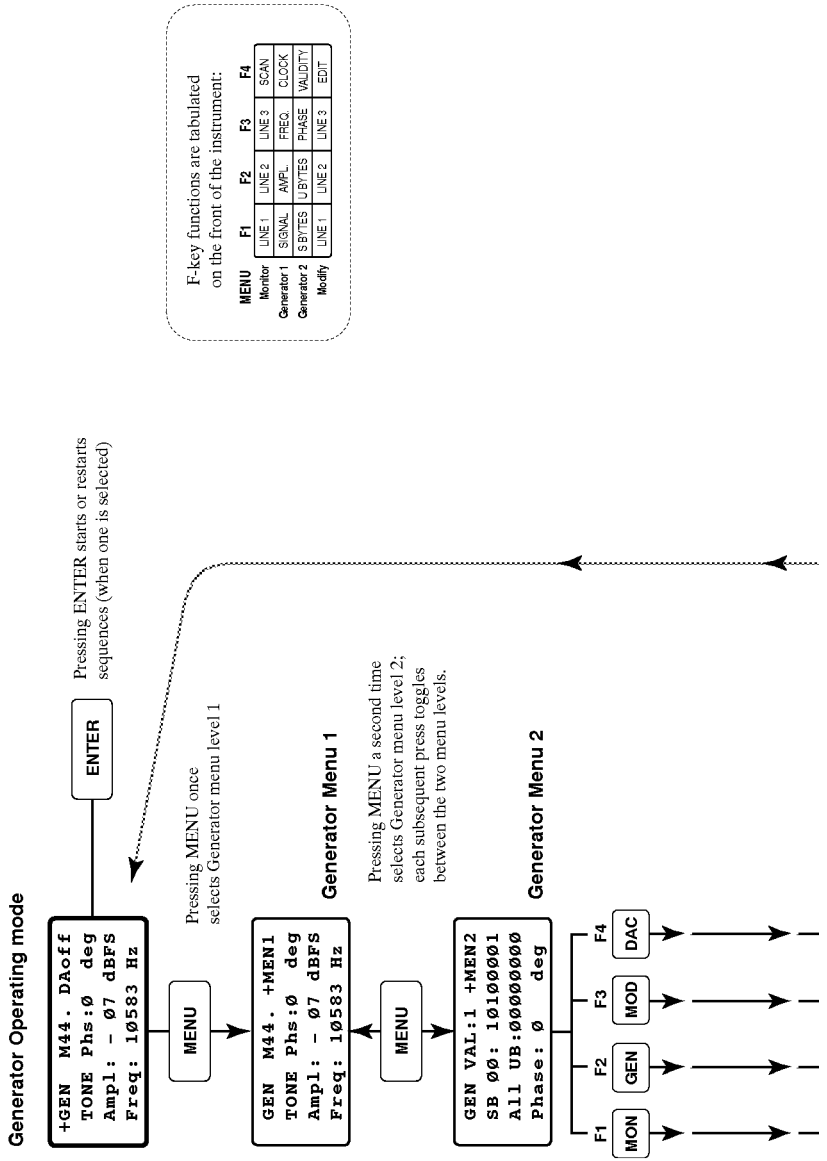


Figure 25: The Generator Menu 2

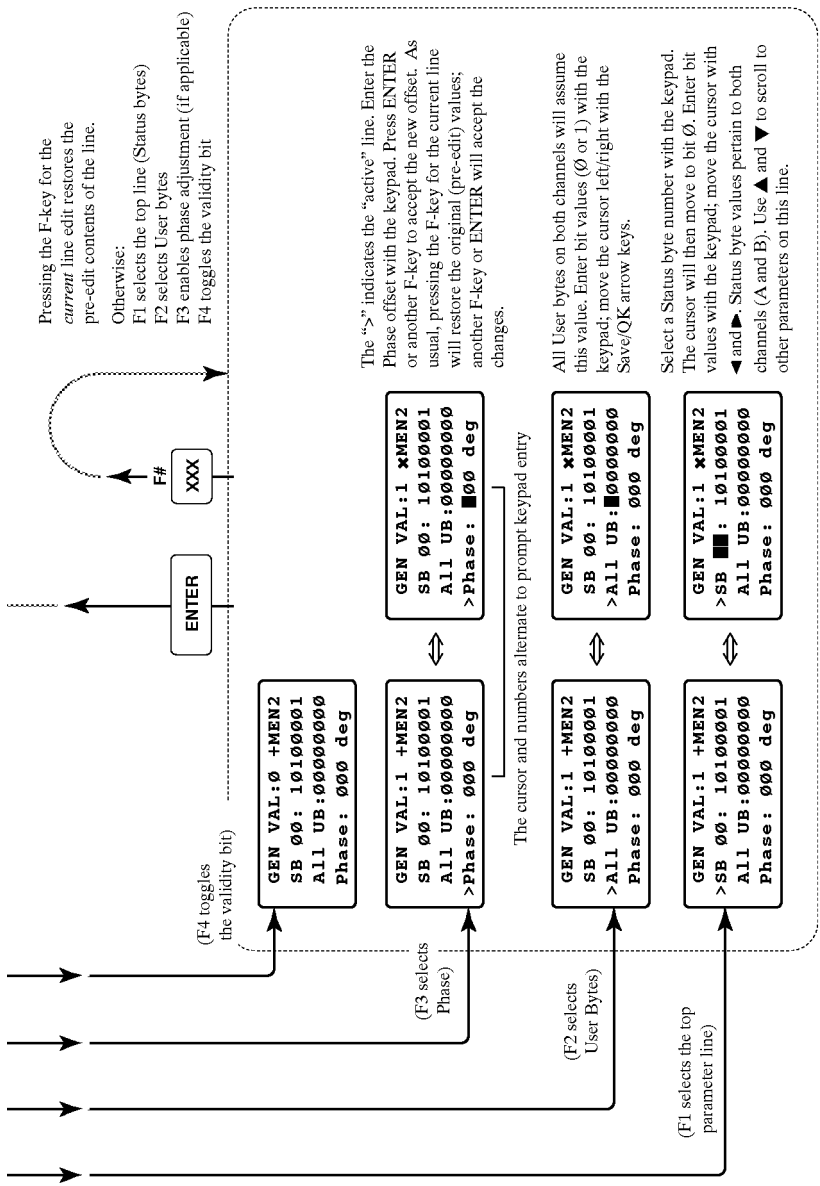


Figure 25: The Generator Menu 2 (Cont.)

Menu 2, F1 parameter selection and editing — **F1** parameters are: Status Bytes, Source ID, Destination ID, and CRCC (cyclic redundancy check character). Immediately after pressing **F1**, choose among them with the ▲ and ▼ keys.

Six **Status bytes**, 00–05 and 22, may be edited. When "SB *nn*" is first visible on the first parameter line, enter the number of the desired byte with the keypad. The cursor will automatically enter the bits field. As with menu 1 parameters, you may then enter each bit with the 0 and 1 keys. The cursor will move to the next position when you enter a numeral; you may also move side-to-side within the field with the◀ and ▶ keys. As always, press **F1** to restore the original contents. Once the selected byte is correct, you have a number of options. You can:

- use the ▲ and ▼ keys to select another Status byte;
- move back to the byte number by pressing ◀ repeatedly, then use the ▲ and ▼ keys to select Source ID, Destination ID, or CRCC; or
- as always, press another F-key, **MENU**, or **ENTER** to accept the new value and move on.

The default **Source ID** is "AM70." When S ID is first selected through **F1** and ▼, all characters of the current ID will alternate with the cursor character. To edit the ID:7

1. First press the ▶ key. The cursor will disappear from all but one character position.
2. Select new contents of the position by holding the ▲ or ▼ key down until the desired character appears.
3. Use ◀ and ▶ to move to another character position, and repeat step 2.
4. When all characters are correct:
   - press **F1** to return to the "all characters blinking" state, then use ▲ or ▼ to select Status bytes, Destination ID, or CRCC; OR
   - press another F-key or **ENTER** to accept the new value and move on (**MENU** does nothing in this particular case).

The default **Destination ID** is four blank characters. Change it the same way as the Source ID.

The **CRCC** is calculated from the channel status bytes and is used in some audio systems to check for correct transmission of the entire channel status data block (Status bytes 00 through 22). Use ◀ or ▶ to toggle it between enabled and disabled.

F2, User Bytes — All User bytes of the generated signal will assume the value that you enter in this field. Enter each bit as 0 or 1; use ◀ and ▶ to move within the bits field; restore the original value with **F2**; and exit by pressing another F-key, **ENTER**, or **MENU**, as usual.

F3, Phase — Is available for TONE signals only. Use it to change the phase relationship between channels A and B.

F4, Validity Bit — In AES/EBU digital audio, the Validity bit is logic 0 if the audio sample word is suitable for conversion to an analog audio signal, and logic 1 when it is not. When in Generator menu 2, simply press **F4** to toggle the bit between 0 and 1.

Saving Your Settings

Remember that all settings made through Generator menus 1 and 2 will revert to the defaults when the AM70 is switched off and back on. If you have made many changes through these menus, and are likely to use the same settings again, it is a good idea to save the instrument setup as a "Quick Key" preset. See *SAVE and QK Operation*, beginning on page 56, for instructions.

Using the Modify Mode

Modify mode is used when the AM70 is inserted in-line with a digital audio signal. Through the Modify menu, the user can specify various changes to the signal. For example, left and right channel audio data can be exchanged; data words can be truncated (shortened); and channel status data blocks can be edited. All modifications affect both channels; that is, if the status bytes, user bytes, validity bit, or sample length are changed, they will have the same (new) value in both channels (A and B) of the output signal.

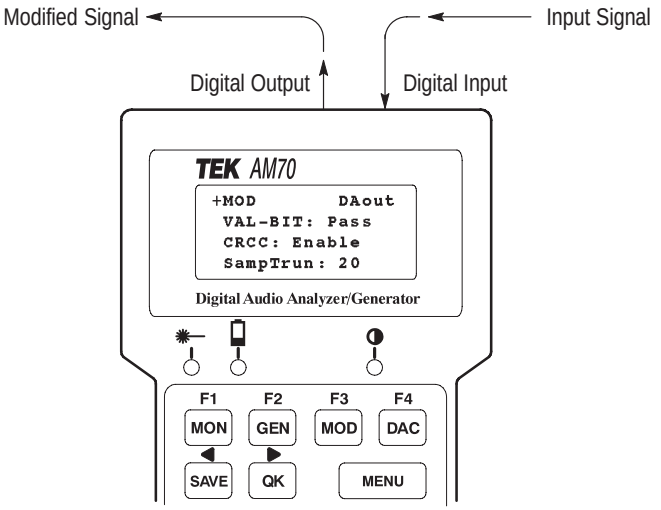


Figure 26: Modifying a Digital Audio Signal with an AM70

Modify mode is intended to help locate, identify, and temporarily correct compatibility problems caused by data format errors or equipment incompatibilities. Though not intended for permanent installation, the AM 70 can be left in position for as long as necessary. Note that Modify mode does introduce a small throughput delay (approximately 4 ms) in the data stream.

Figure 27 is a diagram of the Modify menu mode. The signal characteristics/parameters that can be changed with the AM70 are listed in Table 11.

Modifying a Digital Audio Signal

To modify a signal, first connect your AM70 in the digital audio signal path as shown in Figure 26. If necessary, use Monitor/Scan mode first to check the status of the various input signal characteristics. Press **MOD** to select Modify operating mode. Then, through the Modify menu, specify the desired changes to the appropriate parameters. The output signal will contain the specified changes when you exit the Modify menu.

Table 11 lists the parameters that can be manipulated through Modify mode. As in Monitor mode, the parameters—and their current settings—will "cycle through" the display in groups of three whenever the AM70 is in Modify mode. Each group will be displayed for approximately ten seconds.

Table 11: Modify Mode Parameters

Abbreviation	Parameter	Possible Values
SIDA	Source ID (Status bytes 6–9)	Pass or XXXX
DIDA	Destination ID (Status bytes 10–13)	Pass or YYYY
A SACd	Sample Code	Pass or Disable
A TmCd	Time Code	Pass or Disable
All UB	User block (if modified, all bytes, both chans, are identical)	Pass or 00000000–11111111
CRCC	Cyclic Redundancy Check character	Enable or Disable
VAL–BIT	Validity Bit	Pass, Low, or High
SampTrun	Sample Truncate	0–24 (bits)
APolarity	A Polarity	Norm or Flip
BPolarity	B Polarity	Norm or Flip
Chans A/B	Channels A and B	Norm or Swap
A SB*nn* *nn* = 00–05, 22	Channels status block (bytes 0–5 and 22)	Pass or 00000000–11111111

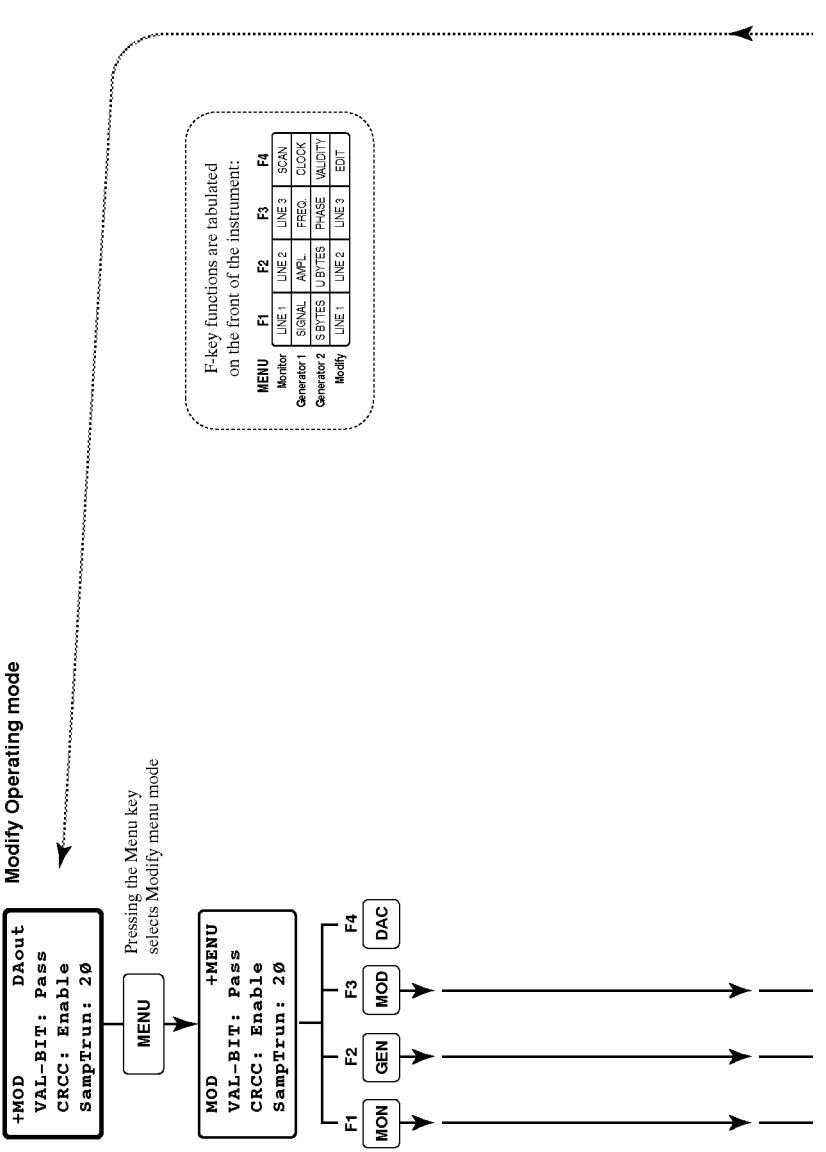


Figure 27: The Modify and Modify Menu Modes

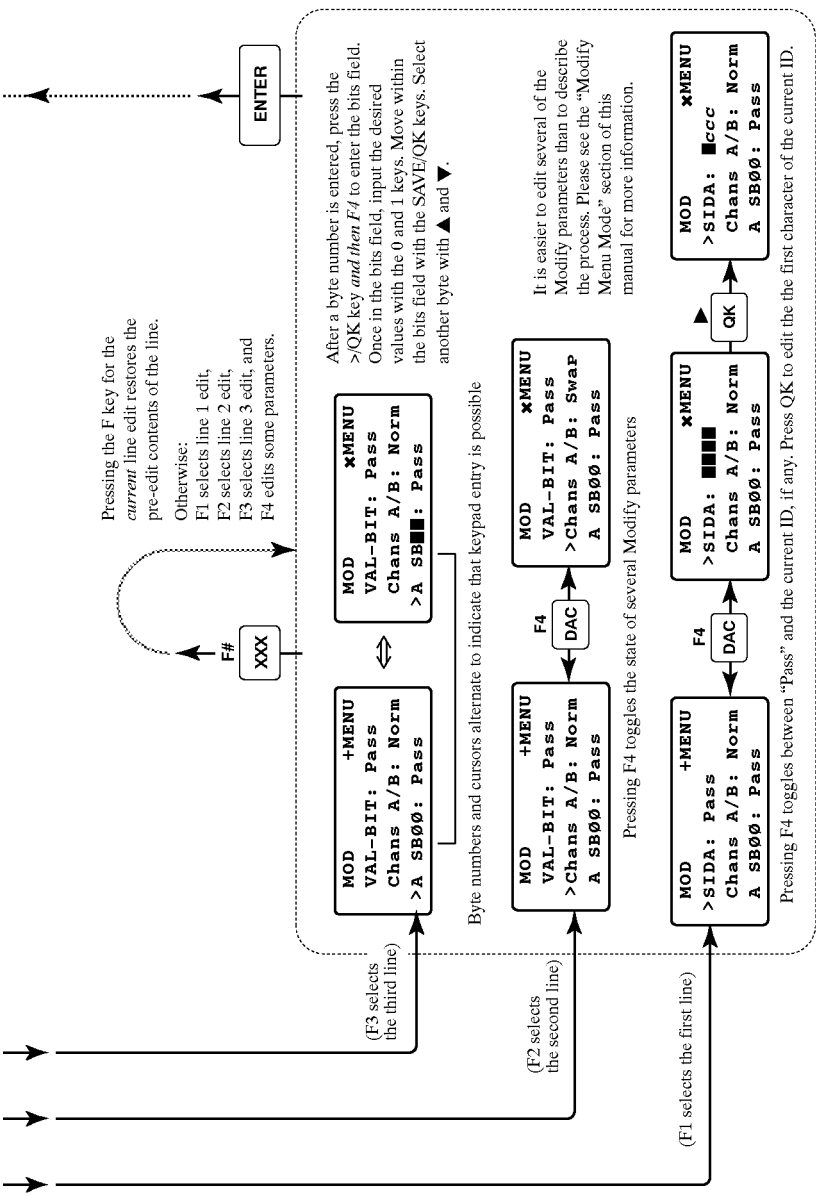


Figure 27: The Modify and Modify Menu Modes (Cont.)

Modify Menu Mode5

Use the Modify menu mode as shown in Figure 27 to select the signal parameters to be modified, and to specify the desired status or value for those parameters.6

1. Enter Modify menu mode from the Modify operating mode by pressing the **MENU** key. The display will "freeze" in the currently displayed parameter group, and the word "MENU," preceded by the alternating + / × indicator, will replace the DAC status in the upper-right corner of the display. All parameters are available on all three lines, and a parameter value will remain changed even when it is no longer visible on the display. It makes no difference, then, which line you select. An angle bracket (") will appear at the beginning of the active line.

2. Use the up and down arrow keys (▲ and ▼) to scroll through the list of choices in the order that they appear in Table 4.

3. When the parameter to be modified appears on the display, edit it with the appropriate technique outlined next.

   SACd, TmCd, CRCC, VAL-BIT, APolarity, BPolarity, and Chans A/B (swap) — Press **F4** to toggle the state of these parameters. The possible states are listed in Table 11. Note that there are three possible states for the validity bit; keep pressing **F4** until the desired state appears on the display. Once the state is changed, you may select another parameter on the same line with ▲ and ▼.

   SIDA and DIDA — Press **F4** to toggle between "Pass" and the current ID, if any. To modify:

   - Press **F4** to show the current ID.
   - Press ▶ to enter the ID character field, then use the ◀ / ▶ keys to move the cursor to the desired position.
   - Enter a numeral into the position from the numeric keypad, or select another ASCII character by pressing and holding ▲ or ▼. See Appendix NO TAG for a list of available characters.

- When the current position contains the desired character, move to another position with the ◀ / ▶ keys and enter a new character as necessary.
- When the ID is correct, press **ENTER** to leave the Modify menu, or—to select another parameter for editing—press ◀ repeatedly until all ID characters alternate with the cursor, then scroll to the desired parameter with ▲ or ▼.

SampTrun — Press **F4** to toggle between "Pass" and the current value. To modify:

- Press **F4** to show the current audio sample word length.
- Enter the desired length (between 0 and 24 bits). If you make an error, press the F-key for the current line and start again.
- When the sample word length is correct, press **ENTER** to leave the Modify menu, or—to select another parameter for editing—press the F-key that selects one of the other two parameter lines.

All UB — The cursor will be in bit position Ø when "All UB:" is first selected. Enter the bit as 1 or Ø, and the cursor will move to the next position. You may also use the ◀ / ▶ keys to move the cursor within the bits field. When all bits are correct, you may select another parameter on the same line with ▲ or ▼.

***NOTE**. In keeping with industry practice, Channel Status and User bytes are displayed bit Ø (LSB) to bit 7 (MSB), left to right.*

Status bytes — When Status bytes are first selected, the cursor will alternate with the byte number. Either the word "Pass" or the eight bits will be shown after the byte number. To modify:

- Enter the desired byte number OR press ▶. If the current status is "Pass," no cursors will flash.
- Press **F4** (EDIT) to toggle between "Pass" and the bits field. The cursor will occupy position Ø in the bits field.
- Enter 1 or Ø, or use the ◀ / ▶ keys to move the cursor
- When all bits are correct, press ▲ / ▼ to select another byte, or press **ENTER** to leave the Modify menu, or—to select another parameter for editing—press the F-key that selects one of the other two parameter lines.

4. When you have specified all desired modifications to the input signal, press **ENTER** to leave the menu and begin (or resume) modifying the signal.

Saving Your Settings

Remember that all settings made through the Modify menu will revert to the defaults when the AM70 is switched off and back on. If you have made many changes through the menu and are likely to use the same settings again, it is a good idea to save the instrument setup as a "Quick Key" preset. See "SAVE and QK Operation," next, for instructions.

SAVE and QK ("Quick Key") Operation

The AM70 has the ability to store—in non-volatile RAM—up to four instrument configurations ("setups") for each operating mode. This is especially convenient for saving often-used combinations of parameters, because settings made through the various menus will otherwise be "lost" when the instrument is switched off. Figure 28 contains a diagram of SAVE and QK operation starting from the Monitor operating mode. Note that the SAVE/QK names for setups in Generator mode are GEN1, ..., GEN4; names in Modify mode are (not surprisingly) MOD1, ..., MOD4.

Storing a Setup with SAVE

To save the current settings of the active mode for later recall, first press the **SAVE** key. The display will change to remind you to use the F-keys to designate a storage "address" for the current settings. Because saving the settings will overwrite any previous contents of that address, you will then be asked to confirm the command by pressing **ENTER**; pressing any other key will cancel the save and return the AM70 to the current operating mode.

Retrieving a Saved Setup with the QK Key

To recall a saved setup in the current operating mode, press QK. The display will remind you to use the F-keys to select the storage address of the settings you wish to retrieve. Because retrieving saved settings will overwrite the current settings, you will be prompted to confirm the command by pressing **ENTER**; pressing any other key will

cancel the QK and return the AM70 to the current operating mode and settings.

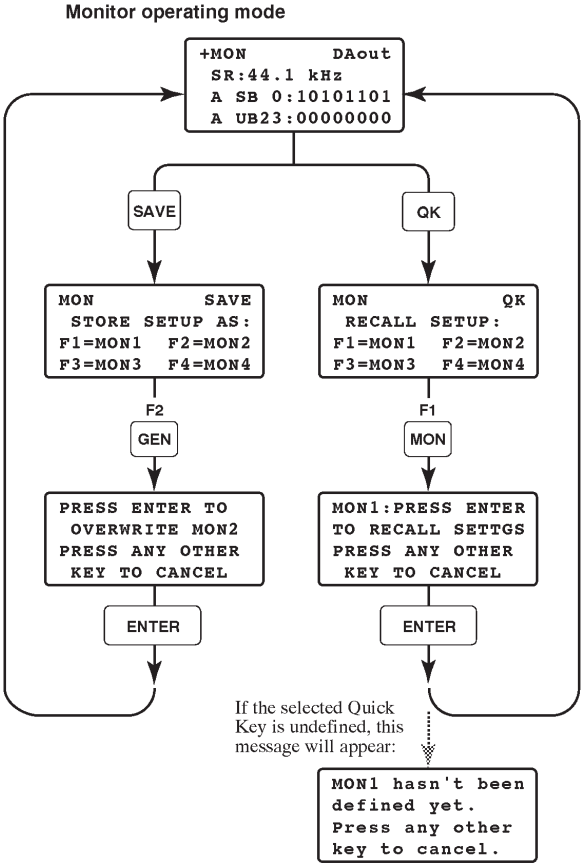


Figure 28: Save and Quick Key Operation

Preserving Presets During Battery Replacement

Note that QK presets will be lost if the AM70 batteries are removed unless the instrument is powered *On* with the AC adapter. The correct procedure for replacing batteries is as follows:5

1. Connect the AC adapter to both the local AC (“mains”) supply and the AM70.
2. Switch the AM70 On.
3. Remove and replace the batteries.

After the new or recharged batteries have been installed, you may switch the instrument Off and remove the AC adapter.

If you do not back up AM70 memory with the AC adapter when replacing the batteries, you will see the “[QK] hasn’t been defined yet” message the next time you try to recall a Quick Key preset.

Specifications

Electrical Characteristics

Necessary Conditions

The specifications listed in this section are valid under the following conditions:

The instrument must have been calibrated/adjusted at an ambient temperature of approximately 25° C, and with a minimum warm-up time of 20 minutes.

The instrument must be in an environment within the limits described in Table 18.

The Low Battery LED must not be illuminated.

Table 12: Digital Input Specifications

Characteristic	Performance requirement	Information/Typical
Input Voltage Range Professional mode Consumer mode		 200mV – 20V_{p-p} 200mV – 20V_{p-p}
Impedance (0.1 to 6.0 MHz) Professional mode Consumer mode		 110 Ω 75 Ω
Sample Rate Range	30–52 kHz	25–55 kHz, typical

Table 13: Digital Output Specifications

Characteristic	Performance Requirement	Information/Typical
Output Voltage Professional Mode Consumer Mode		 5.0 V_{p-p}, typical 0.5 V_{p-p}, typical
Output Impedance Balanced Unbalanced		(0.1 to 6.0 MHz) 110 Ω 75 Ω
Output Sample Rate Accuracy 48 kHz 32 kHz 44.1 kHz	 ≤ ±20 ppm ≤ ±20 ppm ≤ ±20 ppm	
Slave Mode Sample Rate Range	30–52 kHz	25–55 kHz, typical

Table 14: Analog Audio Output Specifications

***NOTE**: Test conditions are 1 kHz output, 0 dBFS, 10 kΩ load, 48 kHz sample rate unless otherwise specified.*

Characteristic	Performance requirement	Information/Typical
Full-scale Output Voltage (0 dBFS amplitude)		12 dBu, typical
Output Voltage Range	0 to –99 dB	Relative to full scale
Noise Floor, A-weight		–110 dB, typical Relative to full scale
Amplitude Response (20–20 kHz)	± 0.5 dB	Relative to 1 kHz; 0.15 dB typical
THD + N 1 kHz @ 0 dBFS 10 kHz @ 0 dBFS 1 kHz @ –20 dBFS 10 kHz @ –20 dBFS 1 kHz @ –60 dBFS 10 kHz @ –60 dBFS		Typical: ± 0.005 % ± 0.01 % ± 0.05 % ± 0.05 % ± 5.0 % ± 5.0 %

Table 14: Analog Audio Output Specifications (Cont.)

***NOTE**: Test conditions are 1 kHz output, 0 dBFS, 10 kΩ load, 48 kHz sample rate unless otherwise specified.*

Characteristic	Performance requirement	Information/Typical
Interchannel Gain Matching	± 0.5 dB	± 0.25 dB typical (16 bit or longer words)
Interchannel Phase Matching	± 2.0°	± 1° typical, (16 bit or longer words)
Channel Separation @ 10 kHz		100 dB typical

Table 15: Generator Output Signal Tolerances

Characteristic	Performance Requirement	Information/Typical
Amplitude Resolution Digital Output Analog Output		Typical: 1 dB 1 dB
Amplitude Accuracy Digital Output Analog Output		 24 bits ±1 dB typical
Frequency Resolution Digital Output Analog Output		Typical: 1 Hz 1 Hz
Frequency Accuracy Digital Output Analog Output		Typical: 1/2 Hz 1/2 Hz

Table 16: Monitor Measurement Accuracy

Characteristic	Performance Requirement	Information/Typical
Sample Rate Indication Accuracy “48 kHz/400 ppm” “48 kHz/4%” “44.1 kHz/400 ppm” “44.1 kHz/4%” “44.056 kHz/400 ppm” “32 kHz/400 ppm” “32 kHz/4%” “Out of Range”		Typical: ± 10 Hz ± 50 Hz ± 10 Hz ± 50 Hz ± 10 Hz ± 10 Hz ± 50 Hz ± 50 Hz
Eye Opening Indication Accuracy “Confidence Low”		Typical: ± 0.25 Unit Intervals
Amplitude Indication Accuracy “A Samp/dB” “B Samp/dB”		Typical: ± 1 dB ± 1 dB

Physical and Environmental

Table 17: Physical Characteristics

Characteristic	Information
Height	5.6 cm (2.2 in)
Width	10 cm (3.24 in)
Depth	21 cm (8.3 in), w/o optical connector covers
Net Weight AM70 AM70 with batteries	 0.47 kg (1.03 lb) 0.57 kg (1.25 lb)
Shipping Weight (w/AC adapter)	2.66 kg (5.9 lb)
Transportation	Meets the requirements of NTSB Test Procedure 1A, category II (24 inch drop)

Table 18: Certifications and compliances

Characteristic	Information
EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/ECC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 55103 Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use[1]. Environment E2 – commercial and light industrial Part 1 Emission EN 55022 Class B Radiated and Conducted Emissions EN 55103-1, Annex A Radiated magnetic field emissions EN 55103-1, Annex B Inrush Current Part 2 Immunity IEC 61000-4-2 Electrostatic Discharge Immunity IEC 61000-4-3 RF Electromagnetic Field Immunity IEC 61000-4-4 Electrical Fast Transient/Burst Immunity IEC 61000-4-5 Power Line Surge Immunity IEC 61000-4-6 Conducted RF Immunity IEC 61000-4-11 Voltage Dips and Interruptions Immunity EN 55103-2, Annex A Radiated Magnetic Field Immunity EN 55103-2, Annex B Balanced Ports Common Mode Immunity EN 61000-3-2 AC Power Line Harmonic Emissions

Table 18: Certifications and compliances (Cont.)

Characteristic	Information
EMC Compliance	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility when it is used with the product(s) stated in the specifications table. Refer to the EMC specification published for the stated products. May not meet the intent of the Directive if used with other products.
Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AN/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

1 **High quality shielded cables must be used to ensure compliance to the above listed standards.**

Functional Verification

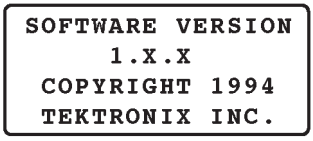
AM70 “Power-Up” Diagnostics

The AM70 has a built-in diagnostic routine that is used to verify correct operation of several instrument features. To invoke the diagnostics, hold the “0” (zero) key down while switching the instrument On. The diagnostic mode is confirmed by a display something like this:

Press the Down arrow key (▼) to show the AM70 software version.

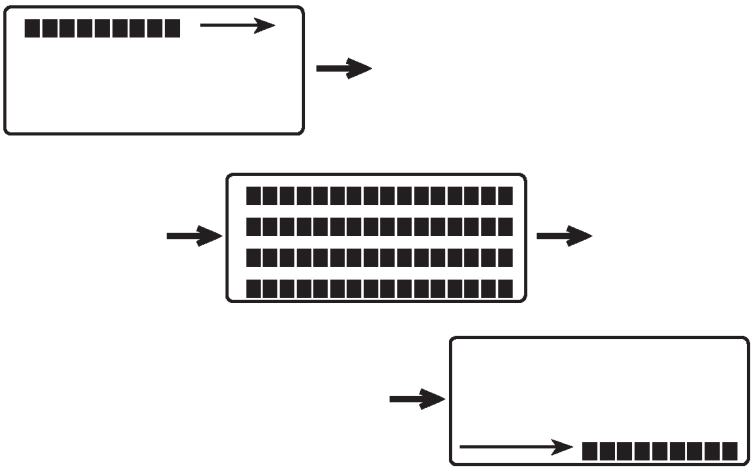
Software Version

The version of the installed software is shown as illustrated below. Press the ▼ key to begin the display test.



Display Test

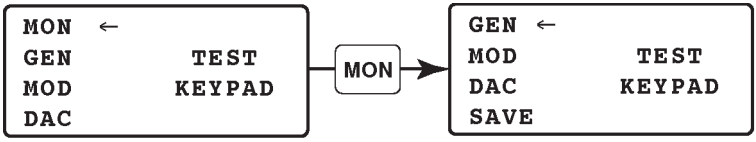
The display test alternately turns all LCD segments “on” and “off” as illustrated next.



The display test continues until the up or down arrow is pressed. To return to the software version, press the ▲ key; to begin the keypad test, press the ▼ key.

Keypad Test

In the keypad test, the key names appear in the display window in the order they appear on the instrument, as shown below. Pressing the key named at the top of the display removes that name from the display, and the list will scroll up, with the name of the next key to test moving to the top of the display. This process will continue until all keys have been pressed and the display is blank.



To return to the display test, press the ▲ key; to begin the speaker/headphone checks, press the ▼ key.

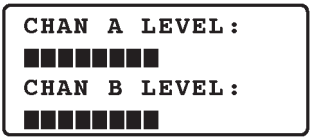
Speaker/Headphones Checks

The Speaker/Headphones checks consist of five separate amplitude ramps and frequency sweeps. The built-in Digital-to-Analog Converter (DAC) is used to create analog tones that may be heard through the built-in speaker or with attached headphones. The amplitude ramp are identical to the one produced by the instrument in Generator mode (see page 34 and Appendix A). The frequency sweeps are described in Table 1–2. Each sweep or ramp will take approximately 12 seconds. The first analog circuit checks are 1000 Hz amplitude ramps.

Table 19: The Diagnostic Frequency Sweeps

Frequency (Hz)	Duration (seconds)
25	1
40	1
63	1
100	1
160	1
250	1
400	1
630	0.5
1000	0.5
1600	0.5
2500	0.5
4000	0.5
6320	0.5
10000	0.5
16000	0.5
20000	0.5 (48 kHz clock only)

Two-channel 1 kHz tone, amplitude ramp to full scale



During the amplitude ramps, the 16 character segments of the display will become a bar graph "level meter" for the active channel(s), as shown above. All segments will be "lighted" when the sweep reaches the highest amplitude (–0 dBFS).

To return to the keypad display test, press the ▲ key; to begin the left channel amplitude ramp, press the ▼ key.

Left channel (CHAN A) 1 kHz amplitude ramp

To return to the two-channel amplitude ramp, press the ▲ key; to begin the right channel amplitude ramp, press the ▼ key.

Right channel (CHAN B) 1 kHz amplitude ramp

To return to the left channel amplitude ramp, press the ▲ key; to begin the left channel frequency sweep, press the ▼ key.

Left channel (CHAN A) 0 dBFS frequency sweep

During the frequency sweeps, the 16 character segments of the display will become a bar graph to indicate sweep progress, as shown below. All segments will be "lighted" when the sweep reaches the highest frequency (20 kHz).

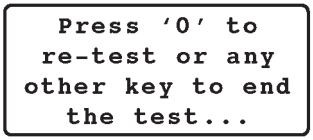
The sweeps will repeat until another diagnostic routine is selected. To return to the right channel amplitude ramp, press the ▲ key; to begin the right channel sweep, press the ▼ key.

Right channel (CHAN B) 0 dBFS frequency sweep

To return to the left channel sweep, press the ▲ key; to move to the retest/end test display, press the ▼ key.

Exiting the Diagnostic mode

When you have reached the bottom of the list of diagnostics, you'll be prompted with the following message.



Pressing any key other than "0" will put the instrument into MON/Scan mode. To exit the diagnostic mode without scrolling through the entire list until you see this message, switch the instrument off momentarily.

Verifying the Digital Circuits

Once you have used the built-in diagnostics to confirm proper operation of the AM70 mechanical platform and the generation of analog signals, follow this procedure to verify operation of the digital input and output.4

1. With the instrument switched On, press **GEN** to start Generator mode.
2. Plug the black-banded cable into the DIGITAL OUT connector on the top end of the AM70; plug the white-banded cable into the DIGITAL IN connector; and connect the XLR ends of the two cables together.
3. Press **DAC** to show "DAin," preceded by a flashing arrow, in the upper-right corner of the display. Then press **ENTER**.
4. Adjust the volume with the control on the lower right side of the instrument case, if necessary, to hear the generated signal through the internal speaker. Presence of the tone in the analog circuits of

the instrument verifies correct function of the digital input and output, and the digital input-to-analog circuits.

5. If you intend to use the Optical inputs and outputs, repeat the above test with optical cables (not supplied with the AM70). Be sure to switch the Optical circuits On with the switch on the upper right side of the instrument case. When you do, the green optical input indicator, just above the keypad, will be illuminated.

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all safety summaries before performing any service.

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Use the Proper Fuse

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

Maintenance

Preventive Maintenance

Under average conditions, the AM70 should receive preventive maintenance every 2000 hours. This is approximately one year of operation. Preventive maintenance includes cleaning, visual inspection, and a performance verification.

CAUTION. *The AM70 case is made of molded plastic. Do not allow water to get inside any enclosed assembly or component. Do not clean any plastic materials with organic cleaning solvents—benzene, toluene, xylene, acetone, or similar compounds—because they may damage the plastic.*

Circuit Board Replacement

The individual circuit board assemblies in the AM70 are available through your nearest Tektronix field office or representative. See the Replaceable Parts section of this manual (page NO TAG) for ordering information. The remainder of this section contains instructions for opening the instrument case and replacing the three circuit boards.

Opening the AM706

The AM70 is assembled in layers, as shown in Figure 29. The case has three major parts: the top, spacer, and bottom. The circuit board assemblies are attached to the top and bottom of the case. In addition to the six screws inserted through the case bottom, the instrument is held together by 50 pins connecting the I/O and Microprocessor boards. The location of the connector, relative to the outside of the instrument, is shown in Figure 30; it is also illustrated in Figure 31.

NOTE. *The battery back-up to AM70 NVRAM will be disconnected when the instrument case is opened, and all "Quick Key" presets will be lost.*

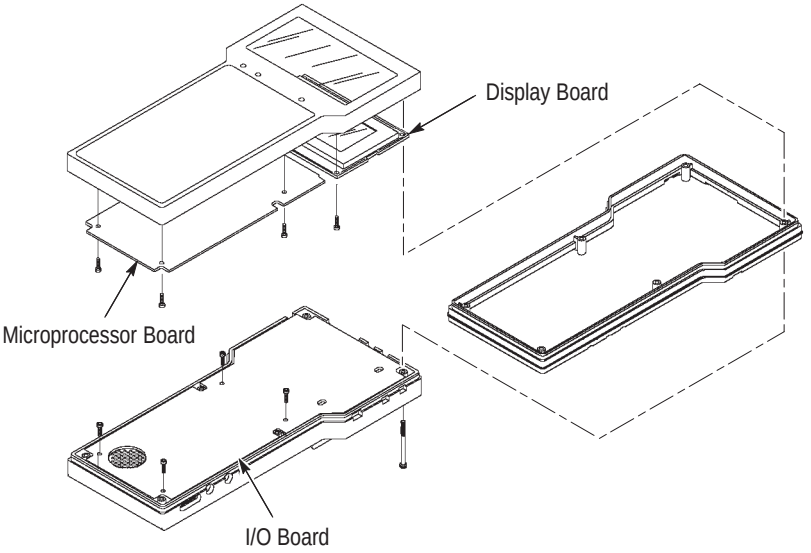


Figure 29: Disassembling the AM70

To open the AM70 case:

1. Turn the instrument off and disconnect the AC adapter as well as all input and output cables.
2. Remove the six screws that hold the case together. There is no need to remove the screw that anchors the elastic strap to the case.
3. Carefully separate the case top and bottom. When you do so, keep the two parts nearly parallel to avoid bending the I/O-to-μP connecting pins. You may find it helpful to first separate the case

a small amount at the display end of the instrument. (Using a flat-blade screw driver or coin to separate the case spacer and top near the connector will work, but it is also likely to mar the surface of both parts and is therefore *not* recommended.)

When reassembling the instrument, be sure to align the connector carefully, and do not over-tighten the self-tapping case screws.

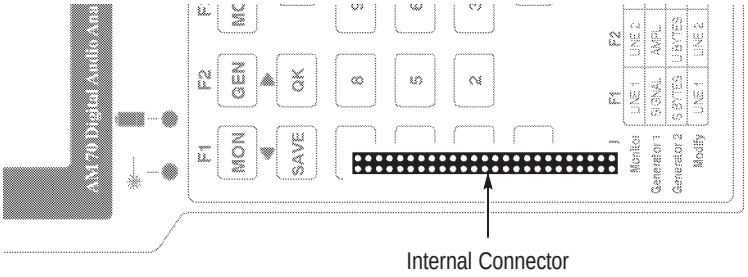


Figure 30: Location of the Internal 50-Pin Connector

Removing/Replacing the Microprocessor (µP) Board

See Figure 29 to identify the three AM70 circuit boards. Use the following steps to remove the µP board:

4. Lay the case top face-down on a soft or smooth surface that will not scratch the display lense.
5. Carefully remove the keypad ribbon cables from the horizontal pin connector, J3.
6. Remove the four screws that hold the µP board to the case top.
7. Lift the µP board slightly and carefully remove the ends of the two display board cable assemblies from horizontal pin connector J4.

Reverse the procedure to replace the board.

Removing/Replacing the Display Board

Follow these steps to remove the display board:

8. For best results, remove the μP board first.

9. Remove the two screws that hold the display board to the case top, and lift the board away from the case.

10. If replacing the display board, disconnect the two seven-conductor cable assemblies from the horizontal connector pins.

Reverse the procedure to replace the board. Note that the cable assembly that connects to pin 1 on the display board also connects to pin 1 of J4 on the μP board. Pin 1 of J4 is on the *lower* row of connector pins.

Removing/Replacing the I/O Board

Follow these steps to remove the I/O board (see Figure 31):

11. Remove the four screws that hold the board to the case bottom.

12. Desolder the battery terminal tabs from J13 and J14.

13. Lift the board by pin connector P1, tipping it up to disengage the volume control, analog output jacks, and the slide switches from the case.

14. Lift the board completely away from the case.

Reverse the procedure to replace the board.

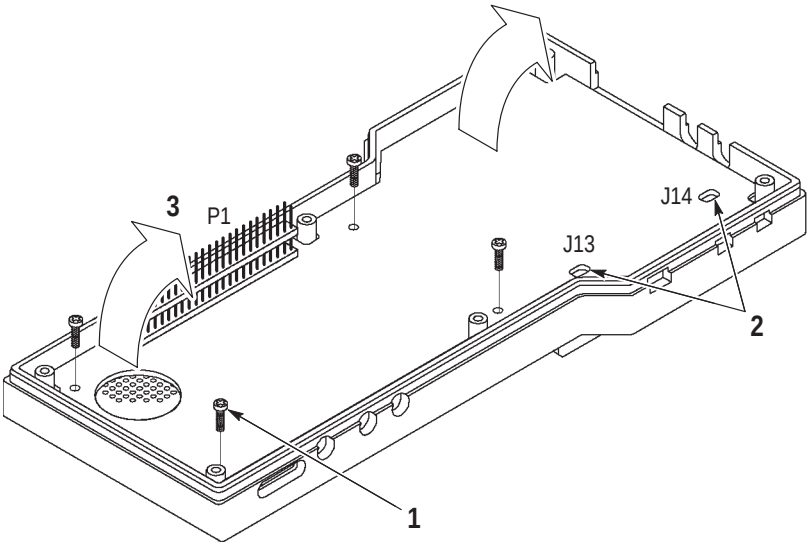


Figure 31: Removing the I/O Board

Replaceable Parts

This section contains a list of the components that are replaceable for the AM70. Use this list to identify and order replacement parts. There is a separate Replaceable Parts list for each instrument.

Parts Ordering Information

Replacement parts are available from or through your local Tektronix, Inc., Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc., Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

Using the Replaceable Parts List

The tabular information in the Replaceable Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

Cross Index–Mfr. Code Number to Manufacturer

The *Mfg. Code Number to Manufacturer Cross Index* for the mechanical parts list is located on page 84. The cross index provides codes, names, and addresses of manufacturers of components listed in the mechanical parts list.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

Chassis Parts

Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Parts list.

Column Descriptions

Figure & Index No. (Column 1)

Items in this section are referenced by figure and index numbers to the illustrations.

Tektronix Part No. (Column 2)

Indicates part number to be used when ordering replacement part from Tektronix.

Serial No. (Column 3 and 4)

Column three (3) indicates the product serial number at which the part was first used. Column four (4) indicates the product serial number at which the part was removed. No serial number entry indicates the part is good for all serial numbers.

Qty (Column 5)

This indicates the number of parts used.

Name and Description (Column 6)

An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

Mounting Parts always appear in the same indentation as the Item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. **Mounting parts must be purchased separately, unless otherwise specified.**

Mfr. Code (Column 7)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

Mfr. Part Number (Column 8)

Indicates actual manufacturer's part number.

Cross Index – Mfr. Code Number To Manufacturer

Mfr. Code	Manufacturer	Address	City, State, Zip Code
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609–3320
14310	AULT INC	7105 NORTHLAND TERRACE	MINNEAPOLIS, MN 55428–1534
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001

Replaceable Parts

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
32–	437–0449–00		B010158	1	CASE ASSY:CASE, BOTTOM,TOP,& CENTER,ASSEMBLED	80009	437044900
	437–0449–01	B010159	B030499	1	CASE ASSY:CASE, BOTTOM,TOP,& CENTER,ASSEMBLED	80009	437044901
	437–0449–02	B030500		1	CASE ASSY:CASE, BOTTOM,TOP,& CENTER,ASSEMBLED	80009	437044902
–1	————————			1	COVER,BATTERY:WITH STRAP *MOUNTING PARTS*		
–2	————————			1	.SCREW,TPG:2–32 X 0.25,FLH,POZ *END MOUNTING PARTS*		
–3	————————			1	.CASE,BOTTOM: *MOUNTING PARTS*		
–4	————————			1	.SCREW,TPG: *END MOUNTING PARTS*		
–5	————————			1	.CASE,CENTER:		
–6	————————			1	.CASE,TOP:		
–7	378–0500–00		B030499	1	.LENS:LENS,AM70	80009	378050000
	378–0500–01	B030500		1	.LENS:LENS,AM70	80009	378050001
–8	174–3293–00			2	CA ASSY,SP:DESCRETE;CPD,7,26 AWG, 2.875 L,1X7,0.1 CTR,RCPT BOTH ENDS	80009	174329300
–9	119–4964–00			1	LCD MODULE:LCD MODULE,DOT MATRIX, W/CONNECTORS,AM70 *MOUNTING PARTS*	80009	11949640
–10	213–0120–00			4	SCREW,TPG,TF:2–32 X 0.25,TYPE B,PNH,STL CDPL,POZ *END MOUNTING PARTS*	TK0435	1393–300
–11	671–3211–00		B010199	1	CIRCUIT BD ASSY:MICROPROCESSOR	80009	671321100
	671–3211–01	B020000		1	CIRCUIT BD ASSY:MICROPROCESSOR *MOUNTING PARTS*	80009	671321101
–12	213–0120–00			4	SCREW,TPG,TF:2–32 X 0.25,TYPE B,PNH,STL CDPL,POZ *END MOUNTING PARTS*	TK0435	1393–300
–13	119–4791–01		B030499	1	SWITCH:MEMBRANE SWITCH	80009	119479101
	119–4791–02	B030500		1	SWITCH:MEMBRANE SWITCH	80009	119479102
–14	671–3212–00		B019999	1	CIRCUIT BD ASSY:IO	80009	671321200
	671–3212–01	B020000	B029999	1	CIRCUIT BD ASSY:IO	80009	671321201
	671–3212–03	B030000		1	CIRCUIT BD ASSY:IO *MOUNTING PARTS*	80009	671321203
–15	213–0120–00			4	SCREW,TPG,TF:2–32 X 0.25,TYPE B,PNH,STL CDPL,POZ *END MOUNTING PARTS*	TK0435	1393–300
					STANDARD ACCESSORIES		
	016–1312–00			1	CASE,CARRYING:ADJ HANDLE/SHLDR STRAP,DUAL ZIPPER,BLACK CORDURA OR EQUIV	80009	016131200
	070–8971–06			1	MANUAL,TECH:INSTRUCTION,AM70	80009	070897106
	198–5822–00		B029999	1	WIRE SET,ELEC: SHLD TWPR;CRC,4 EA, 26 AWG TWPR,40.0 L,(4 EA) 3 POS,CIRC, FEMALE,XLR X 3.5MM,STEREO,PLUG	80009	198582200

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
	198–5822–01	B030000		1		WIRE SET,ELEC: SHLD TWPR;CRC,4 EA, 26 AWGTWPR,40.0 L,(4 EA) 3 POS,CIRC, FEMALE,XLR X 3.5MM,STEREO,PLUG	80009	198582201
	198–5823–01			1		WIRE SET.ELEC:COAX;RPD,2 EA,75 OHM, 40.0L,2 EA,RCA,PHONO PLUG X 3.5MM, STEREO,PLUG	80009	198582301
–16	119–4538–01			1		POWER SUPPLY:WALL MOUNT,12W,120VAC 60HZ IN,12VDC 1.0A OUT,UNREG,USA,183CM CABLE,RT ANG CONN,W/NOISE FILTER (STANDARD ONLY)	14310	P48121000A2 40CM
						OPTIONAL ACCESSORIES		
–16	119–4540–02			1		POWER SUPPLY:WALL MOUNT,12W,220 VAC 50HZ IN,12VDC 1.0A OUT,UNREG,EUROPEAN,183CM CABLE,RT ANG CONN,W/NOISE,FILTER (EUROPEAN OPTION A1 ONLY)	14310	D48121000A2 40CM
–16	119–4541–02			1		POWER SUPPLY:WALL MOUNT,12W,240VAC 50HZ IN,12VDC 1.0A OUT,UNREG,UK,183CM,CABLE,RT ANG CONN,W/NOISE,FILTER (UNITED KINGDOM OPTION A2 ONLY)	14310	F48121000A2 40CM
–16	119–4542–02			1		POWER SUPPLY:EXTERNAL,WALL MOUNT,12W 240VAC 50HZ IN,12VDC 1.0A OUT,UNREG,AUSTRALIAN,183CM CABLE,RT ANG CONN,W/NOISE,FILTER (AUSTRALIAN OPTION A3 ONLY)	14310	E48121000A2 40CM
–16	119–4539–01			1		POWER SUPPLY:WALL MOUNT,12W, 100VAC 50HZ IN,12VDC 1.0A OUT,UNREG,JAPAN TYPE,183CM CABLE,RT ANG CONN,W/NOISE,FILTER (OPTION A6 ONLY)	14310	G48121000A 240DM
	146–0113–00			1		BATTERY PACK:5.2V,750MAH,NICAD,4 AA IN A PACK,2 X 2 X 0.5, SHRINK WRAPPED	80009	146011300

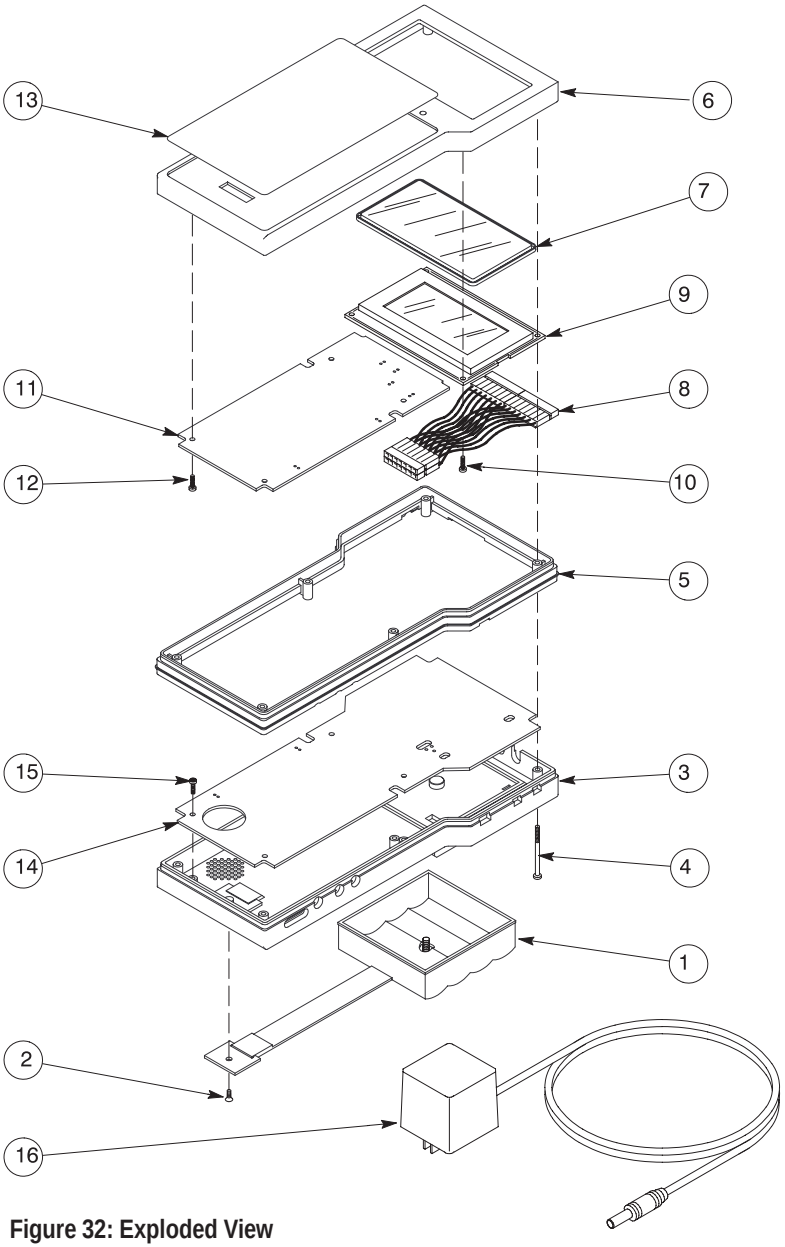


Figure 32: Exploded View

Appendices

Appendix A: Test Signals and Sequences

Amplitude Sweep

The frequency of the amplitude sweep is user-specified with ± 1 Hz resolution.

Amplitude (dBFS)	Duration (seconds)
–60	1
–50	1
–40	1
–35	1
–30	1
–25	1
–20	1
–15	1
–10	1
–6	1
–5	0.5
–4	0.5
–3	0.5
–2	0.5
–1	0.5
0	0.5

Frequency Sweep

The amplitude of the Frequency Sweep is user-specified with ± 1 dBFS resolution.

Frequency (Hz)	Duration (seconds)
25	1
31	1
40	1
50	1
63	1
80	1
100	1
125	1
160	1
200	1
250	1
315	1
400	1
500	1
630	0.5
800	0.5
1000	0.5
1250	0.5
1600	0.5
2000	0.5
2500	0.5
3150	0.5
4000	0.5
5000	0.5
6300	0.5
8000	0.5
10000	0.5
12500	0.5
16000	0.5
20000	0.5 (48 kHz clock only)

Multitone Signals

Tektronix Multitone (Mtone) Signals are combinations—or mixtures—of discrete single-frequency tones. When used (in analog form) with the Tektronix AM700 or the Tektronix VM700T Option 40 or 41 "view level" measurements, these test signals enable quick response-curve measurements and continuous, near-real-time updates for use in circuit adjustment. The frequencies in the four Mtone signals are listed below.

Mtone 1:	Mtone 2:	Mtone 3:	Mtone 4:
59 (Hz)	23 (Hz)	47 (Hz)	23 (Hz)
117	94	141	117
187	141	281	234
246	223	656	750
293	270	1031	867
375	352	2016	1758
422	562	4031	3492
949	879	8109	6984
1184	1113	15000	13992
1512	1395		
1887	1758		
2391	2227		
3000	2789		
3785	3516		
4758	4430		
6012	5590		
7570	7043		
9539	8871		
12012	11180		
15000	14074		
	17742[1]		
	19992[1]		

[1] **Not present when generating with the 32 kHz clock/sample rate.**

The phase relationships of the Mtone components are randomized to minimizes constructive effects and reduce the crest factor. The Mtones are corrected for SIN(x)/x and group delay effects. Frequency accuracy of each individual component is ± 1 Hz.

CCITT Signal Sequences

The CCITT 0.33 audio test sequences have been defined for automated testing of analog audio systems. The following information pertains to use of the AM70 CCITT 0.33 sequences with the Tektronix VM700A.

Preamble

The preamble occupies the first time interval in each sequence. It contains data that perform the following functions:

- Instruct the receiving unit to start the measurement sequence.
- Identify the source of the test signals.
- Indicate which measurement program will be output.

The preamble consists of 7 data bits, one even parity bit, and two stop bits. Frequency-shift keying with a mark frequency of 1650 Hz and a space frequency of 1850 Hz is employed. The transmission rate is 110 baud.

Char #	Character Significance	ISO-7 Character
1	Start of Heading	"SOH" (01 Hexadecimal)
2–5	Source ID	Any four alphanumeric characters
6	Special Signaling; not applicable to the AM70.	
7	Start of Transmission	"STX" (02 Hexadecimal)
8–9	Measurement Program ID	Characters for numbers 00 to 99
10	End of Transmission	"ETX" (03 Hexadecimal)

The end of the second stop bit of the "ETX" character defines the start of the measurement sequence.

The preamble signal is set to 12 dB below the test level. The CCITT 0.33 standard requires the test level to be 9 dB below the maximum level permitted at the point where the measurement is made.

Sequence Descriptions

The sequence descriptions list the period (duration), frequency, and level of the sequence components in the order that they are output. The scale factor between digital and analog outputs is 0 dBFS = 12 dBu.

Sequence: CCITT 0.33:00

	Period (sec)	Channel A (L) sending unit Frequency (Hz)	Channel B (R) sending unit Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	1020	1020	0
	1	1020	1020	–12
	1	40	40	–12
	1	80	80	–12
	1	200	200	–12
	1	500	500	–12
	1	820	820	–12
	1	1900	1900	–12
	1	3000	3000	–12
	1	5000	5000	–12
	1	6300	6300	–12
	1	9500	9500	–12
	1	11500	11500	–12
	1	13500	13500	–12
	1	15000	15000	–12
	1	1020	1020	+9
	1	Silence	Silence	–
	1	60	60	+9
	1	820	820	+6
	1	820	820	–6
	1	820	820	+6
	8	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS.**

	Sequence: CCITT 0.33:01			
		Channel A (L) sending unit	Channel B (R) sending unit	
	Period (sec)	Frequency (Hz)	Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	1020	1020	0
	1	1020	1020	–12
	1	40	40	–12
	1	80	80	–12
	1	200	200	–12
	1	500	500	–12
	1	820	820	–12
	1	1900	1900	–12
	1	3000	3000	–12
	1	5000	5000	–12
	1	6300	6300	–12
	1	9500	9500	–12
	1	11500	11500	–12
	1	13500	13500	–12
	1	15000	15000	–12
	1	1020	1020	+9
	1	Silence	Silence	–
	1	60	60	+9
	1	2040	Silence	-12
	1	Silence	2040	-12
	1	820	820	+6
	1	820	820	–6
	1	820	820	+6
	8	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

Sequence: CCITT 0.33:02			
	Channel A (L) sending unit	Channel B (R) sending unit	
Period (sec)	Frequency (Hz)	Frequency (Hz)	Level (dB)[1]
(Preamble) 1	1650/1850	1650/1850	–12
1	1020	1020	0
1	1020	1020	–12
1	40	40	–12
1	80	80	–12
1	200	200	–12
1	300	300	–12
1	500	500	–12
1	820	820	–12
1	1400	1400	–12
1	3000	3000	–12
1	5000	5000	–12
1	6300	6300	–12
1	7400	7400	–12
1	8020	8020	–12
1	10000	10000	–12
1	1020	1020	+9
1	Silence	Silence	–
1	60	60	+9
1	820	820	+6
1	820	820	–6
1	820	820	+6
8	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

Sequence: CCITT 0.33:03

	Period (sec)	Channel A (L) sending unit Frequency (Hz)	Channel B (R) sending unit Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	1020	1020	0
	1	1020	1020	–10
	1	200	200	–10
	1	300	300	–10
	1	400	400	–10
	1	600	600	–10
	1	820	820	–10
	1	1400	1400	–10
	1	1900	1900	–10
	1	2400	2400	–10
	1	2700	2700	–10
	1	2900	2900	–10
	1	3000	3000	–10
	1	3100	3100	–10
	1	3400	3400	–10
	1	1020	1020	+9
	8	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

Sequence: CCITT 0.33:04			
	Channel A (L) sending unit	Channel B (R) sending unit	
Period (sec)	Frequency (Hz)	Frequency (Hz)	Level (dB)[1]
(Preamble) 1	1650/1850	1650/1850	–12
1	1020	1020	0
1	1020	1020	–10
1	200	200	–10
1	300	300	–10
1	400	400	–10
1	600	600	–10
1	820	820	–10
1	1400	1400	–10
1	1900	1900	–10
1	2400	2400	–10
1	2700	2700	–10
1	2900	2900	–10
1	3000	3000	–10
1	3100	3100	–10
1	3400	3400	–10
1	1020	1020	+9
1	820	820	+6
1	820	820	–6
1	820	820	+6
8	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

	Sequence: CCITT 0.33:05			
		Channel A (L) sending unit	Channel B (R) sending unit	
	Period (sec)	Frequency (Hz)	Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	–	–12
	1	Silence	Silence	–
	2	1020	1020	–12
	8	1020	1020	0
	2	1020	Silence	0
	3	Silence	Silence	–
	2	Silence	1020	0

[1] **Relative to test level; default test level is –12 dBFS**

Tek Autosequence Signals

The Tektronix test sequences allow testing for audio line measurements not defined in the CCITT 0.33 recommendations. The following information pertains to the Tek sequences *in analog form.* Like the CCITT 0.33 sequences, the Tek autosequences may be used as a source for VM700A Option 40 and 41 automated audio measurements.

Preamble

The Tek autosequence preamble conforms to the CCITT 0.33 format; please see page A–4.

Sequence Descriptions

The following sequence descriptions list the period (duration), frequency, and level of the sequence components in the order that they are output by the AM70.

The scale factor between digital and analog outputs in the AM70 is 0 dBFS = 12 dBu.

Sequence: TEK 90				
	Period (sec)	Channel A (L) sending unit Frequency (Hz)	Channel B (R) sending unit Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	400	400	0
	1	Polarity	Polarity	–8
	0.25	15000	15000	–8
	0.25	13999	13999	–8
	0.25	12503	12503	–8
	0.25	11243	11243	–8
	0.25	9001	9001	–8
	0.25	7500	7500	–8
	0.25	6203	6203	–8
	0.25	3499	3499	–8
	0.25	953	953	–8
	0.25	400	400	–8
	0.5	101	101	–8
	1	50	50	–8
	1	400	400	+10
	2	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

Sequence: TEK 91

	Period (sec)	Channel A (L) sending unit Frequency (Hz)	Channel B (R) sending unit Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	400	400	0
	1	Polarity	—	–8
	1	–	Polarity	–8
	0.25	15000	15000	–8
	0.25	13999	13999	–8
	0.25	12503	12503	–8
	0.25	11243	11243	–8
	0.25	9001	9001	–8
	0.25	7500	7500	–8
	0.25	6203	6203	–8
	0.25	3499	3499	–8
	0.25	953	953	–8
	0.25	400	400	–8
	0.5	101	101	–8
	1	50	50	–8
	1	400	400	+10
	2	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

	Sequence: TEK 92			
		Channel A (L) sending unit	Channel B (R) sending unit	
	Period (sec)	Frequency (Hz)	Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	0
	1	1000	1000	0
	0.5	Polarity	Silence	0
	0.5	Silence	Polarity	0
	1	55	55	0
	0.5	100	100	0
	0.5	200	200	0
	0.5	1000	1000	0
	0.5	7500	7500	0
	0.5	10000	10000	0
	1	55	Silence	0
	0.5	100	Silence	0
	0.5	200	Silence	0
	0.5	1000	Silence	0
	0.5	7500	Silence	0
	0.5	10000	Silence	0
	1	Silence	55	0
	0.5	Silence	100	0
	0.5	Silence	200	0
	0.5	Silence	1000	0
	0.5	Silence	7500	0
	0.5	Silence	10000	0
	1	55	55	10
	1	1000	1000	10
	1	7500	7500	10
	1	55	55	15
	1	1000	1000	15
	1	7500	7500	15
	3	Silence	Silence	–

[1] **Relative to test level; default test level is –70 dBFS**

	Sequence: TEK 93			
		Channel A (L) sending unit	Channel B (R) sending unit	
	Period (sec)	Frequency (Hz)	Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	1000	1000	0
	0.5	Polarity	Silence	0
	0.5	Silence	Polarity	0
	1	55	55	0
	0.5	100	100	0
	0.5	200	200	0
	0.5	400	400	0
	0.5	1000	1000	0
	0.5	3000	3000	0
	0.5	5000	5000	0
	0.5	7500	7500	0
	0.5	10000	10000	0
	0.5	15000	15000	0
	1	55	Silence	0
	0.5	100	Silence	0
	0.5	200	Silence	0
	0.5	400	Silence	0
	0.5	1000	Silence	0
	0.5	3000	Silence	0
	0.5	5000	Silence	0
	0.5	7500	Silence	0
	0.5	10000	Silence	0
	0.5	15000	Silence	0
	1	Silence	55	0
	0.5	Silence	100	0
	0.5	Silence	200	0
	0.5	Silence	400	0
	0.5	Silence	1000	0
	0.5	Silence	3000	0

Sequence: TEK 93 (Cont.)

0.5	Silence	5000	0
0.5	Silence	7500	0
0.5	Silence	10000	0
0.5	Silence	15000	0
1	55	55	10
1	1000	1000	10
1	7500	7500	10
1	55	55	15
1	1000	1000	15
1	7500	7500	15
3	Silence	Silence	–

1 **Relative to test level; default test level is –12 dBFS**

Sequence: TEK 94

	Period (sec)	Channel A (L) sending unit Frequency (Hz)	Channel B (R) sending unit Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	1000	1000	0
	0.5	Polarity	Silence	0
	0.5	Silence	Polarity	0
	1	50	50	0
	0.5	100	100	0
	0.5	400	400	0
	0.5	1000	1000	0
	0.5	2000	2000	0
	0.5	3000	3000	0
	0.5	5000	5000	0
	0.5	7500	7500	0
	0.5	10000	10000	0
	0.5	12500	12500	0
	1	50	Silence	0

Sequence: TEK 94 (Cont.)

0.5	100	Silence	0
0.5	400	Silence	0
0.5	1000	Silence	0
0.5	2000	Silence	0
0.5	3000	Silence	0
0.5	5000	Silence	0
0.5	7500	Silence	0
0.5	10000	Silence	0
0.5	12500	Silence	0
1	Silence	50	0
0.5	Silence	100	0
0.5	Silence	400	0
0.5	Silence	1000	0
0.5	Silence	2000	0
0.5	Silence	3000	0
0.5	Silence	5000	0
0.5	Silence	7500	0
0.5	Silence	10000	0
0.5	Silence	12500	0
3	Silence	Silence	–

[1] **Relative to test level; default test level is –12 dBFS**

Sequence: TEK 95				
	Period (sec)	Channel A (L) sending unit Frequency (Hz)	Channel B (R) sending unit Frequency (Hz)	Level (dB)[1]
(Preamble)	1	1650/1850	1650/1850	–12
	1	400	400	0
	1	Polarity	Polarity	–8
	0.25	15000	15000	–8
	0.25	13999	13999	–8
	0.25	12503	12504	–8
	0.25	11243	11243	–8
	0.25	9001	9001	–8
	0.25	7500	7500	–8
	0.25	6203	6203	–8
	0.25	3499	3499	–8
	0.25	953	953	–8
	0.25	400	400	–8
	0.5	101	101	–8
	1	50	50	–8
	1	400	Silence	10
	1	Silence	400	10
	1	400	400	10
	2	Silence	Silence	–

1 Relative to test level; default test level is –12 dBFS

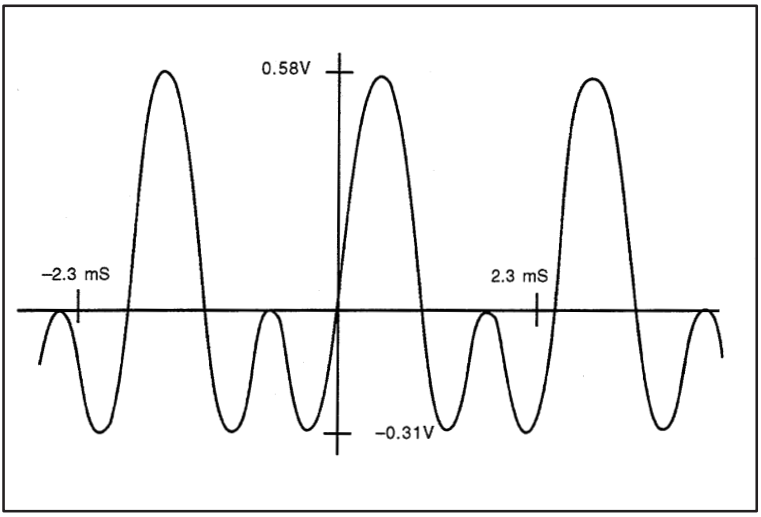
The Tektronix Polarity Tone

The polarity tone, *in analog form*, consists of a 400 Hz tone summed with an 800 Hz tone. Relative phase is selected to product the waveform shown below. The mathematical formula that describes this signal is:

$$A_t = A\left(\sin\left(2\Pi ft - \frac{5\Pi}{6}\right) + \cos\left(2\left(2\Pi ft - \frac{5\Pi}{6}\right)\right)\right)$$

where f = 400 Hz.

The polarity of this tone is easily seen with an oscilloscope.



Tek Clicks

The “click” frequency is 1000 Hz; the amplitude is user-specified. The cycle repeats until it is replaced by another tone or sequence, or another AM70 mode is selected.

Left Tone	Right Tone	Duration
on	on	1000 msec
off	on	50 msec
on	on	250 msec
on	off	50 msec
on	on	250 msec
on	off	50 msec

Appendix B: AM70 ID Characters

The 94 characters available for source and destination IDs are listed below. The list "begins" with the blank character, scrolls up and down the columns, and wraps to the opposite end when either end is reached.

(blank)			
!			
"	8		
#	9		
$	:	Q	
%	;	R	
&	<	S	i
'	>	T	j
(	?	U	k
)	(clock symbol)	V	l
*	A	W	m
+	B	X	n
,	C	Y	o
–	D	Z	p
.	E	[	q
/	F	¥	r
∅	G	]	s
1	H	^	t
2	I	_	u
3	J	‘	v
4	K	a	w
5	L	b	x
6	M	c	y
7	N	d	z
[continued in next column]	O	e	{
	P	f	|
	[continued in next column]	g	→
		h	←
		[continued in next column]	*[returns to (blank) in first column]*

Appendix C: Option Warranty

Option 01, the NiCad Battery Pack, is covered by the following Warranty:

Tektronix warrants that the parts, assemblies, and supplies (“product”) that it manufactures and sells, will be free from defects in materials and workmanship for a period of three (3) months from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

This warranty is given by Tektronix with respect to this product in lieu of any other warranties, express or implied. Tektronix and its vendors disclaim any implied warranties of merchantability or fitness for a particular purpose. Tektronix’ responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. Tektronix and its vendors will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether Tektronix or the vendor has advance notice of the possibility of such damages.