# User Manual

Tektronix

## TSG95 Pathfinder™
## PAL/NTSC Signal Generator

**070-8916-07**

www.tektronix.com

## Contacting Tektronix

Tektronix, Inc.
14200 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

## Warranty 2

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year 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. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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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# 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

**Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.

**Connect and Disconnect Properly.** Do not connect or disconnect probes or test leads while they are connected to a voltage source.

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

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

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

**Power Disconnect.** The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

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

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

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

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

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

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

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

**Do Not Operate in Wet/Damp Conditions.**

**Do Not Operate in an Explosive Atmosphere.**

**Keep Product Surfaces Clean and Dry.**

## 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.*

## Symbols and 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.

The following symbol(s) may appear on the product:

CAUTION
Refer to Manual

Double
Insulated

# Environmental Considerations

This section provides information about the environmental impact of the product.

## Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

**Equipment Recycling.** Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

**Battery Recycling.** This product may contain a Nickel Cadmium (NiCd) rechargeable battery, which must be recycled or disposed of properly. Please properly dispose of or recycle the battery according to local government regulations.

## Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, and hexavalent chromium.

# Getting Started

Please read the following statements before using your new TSG95 Pathfinder, then see the rest of the section for tips on supplying power, making preliminary settings, and connecting the instrument.

***WARNING.*** *Install or replace batteries only with the instrument switched OFF and the AC adapter disconnected. Electrical shock or equipment damage can result.*

***CAUTION.*** *Do not attempt to operate the TSG95 with an improper AC adapter. Damage to the instrument can result.*

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

The adapter voltage must be 9 to 15 VDC with an open-circuit voltage less than 18 VDC; the adapter connector must have the negative (-) polarity contact in the center.

***CAUTION.*** *The AC adapter connector has +12 V on the outer casing. Damage may result if it is allowed to come in contact with live circuitry or other equipment. To prevent this, unplug the adapter from the AC source before you unplug the adapter from the TSG95.*

***NOTE****. Internal batteries are recommended when using an external power adapter. A loose adapter connector can cause the loss of some user settings and unexpected results the next time the instrument is powered on.*

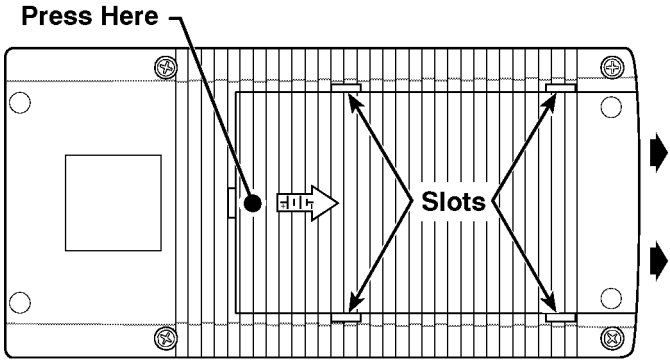
The battery type, disposable or rechargeable, must be selected using through the Utility menu (see page 6). Failure to select the proper battery type can result in damage to the batteries and product.

Replace the batteries only with standard AA batteries (1.2–1.5 V, nominal), or the Tektronix rechargeable battery pack listed on page 73.

For more information, please contact your nearest Tektronix representative or field office. In the United States and Canada, you can also call the Tektronix information number, 1-800-TEK-WIDE (1-800-835-9433), between 8:00 am and 5:00 pm Pacific time.

## Supplying Power

The TSG95 is DC powered. You may power it with the standard AC adapter, the optional 9.6 V NiCad battery pack, eight standard AA batteries, or a "BP" type battery pack with the correct voltage and polarity. The external DC power connector is on the left side of the instrument.




To install AA batteries or the battery pack, open the battery compartment of the TSG95 by pressing down on the cover and sliding it in the direction of the inscribed arrow, as shown above. When the cover tabs line up with the slots in the case, lift the cover away from the instrument. Install batteries in alternating directions as indicated by the graphic molded into the "floor" of the battery compartment. If using the optional battery pack, take the time to identify both contacts and install the pack properly.

When selecting a power source for your TSG95, please remember:

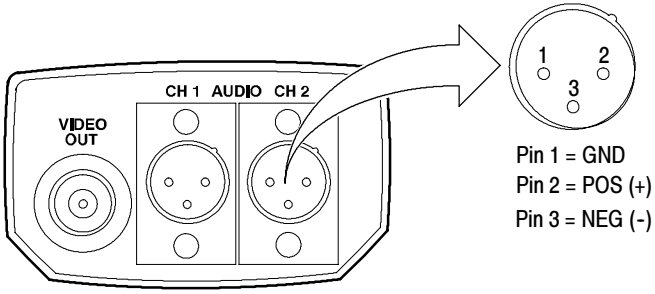
- Attempting to use an improper AC adapter can damage the instrument. See the Caution statement on the previous page.

- There is no need to remove the optional NiCad battery pack for recharging. The TSG95 will "trickle charge" the battery pack whenever the standard AC adapter is used. Recharging the battery pack fully can take up to 16 hours. *Note that charging will occur only if the adapter supplies at least 12V; make sure that the adapter you use is appropriate for the local AC supply.*
- AA batteries are not included with the instrument; obtain them locally. Rechargeable AA batteries may be used, but they will NOT be recharged automatically by the AC adapter. To recharge AA batteries, remove them from the instrument and use an appropriate battery charger. For safety, read and follow the battery charger instructions. Do NOT attempt to recharge standard alkaline batteries.
- After a minute with no key-press, the TSG95 will automatically switch to lock out mode (as if you had pressed the Lock Out key); the display back light will shut off to conserve battery charge. When you want to resume keypad input, press **Lock Out** to exit lock out mode.
- To guard against battery discharge if you forget to turn the TSG95 off after use, enable Auto Power Down through the Utility menu (see page 6).
- The TSG95 can sense low battery voltage. It will warn you when the charge is sufficient for approximately ten more minutes of operation. The instrument will shut itself down when the battery voltage becomes too low for reliable operation. For proper function of these features, the Battery Type must be set correctly in the Utility menu.. Please see "Setting the Battery Type," which follows.

The **ON** key toggles instrument power On and Off.

## Connecting the TSG95

Connect the Pathfinder to your equipment as you would any television test signal generator. Use 75Ω coaxial cable (for video) and be sure that the signal path is properly terminated.




You may wish to confirm proper operation of your TSG95—and gain familiarity with it—by first connecting it directly to a video or waveform monitor.

A performance verification procedure, which some users may require for acceptance testing, is included in the optional TSG95 service manual (Tek p/n 070-8917-0x). To order a service manual, please contact your nearest Tektronix representative or field office.

## Keypad and Display Conventions

Please see the Instruction card (p/n 070-8915-00) supplied with your TSG95 for a “tour” of the keypad and an explanation of the display symbols. For your convenience, the following panels are taken from the card.

**Display Symbols**

= Auto power-down enabled (symbol "rotates"). Disable through the Configuration menu: see the reverse side of this card for instructions.

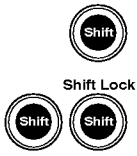
= Shift (Press **Shift** again to Shift Lock)

= Shift Lock (Press **Shift** again to unlock)

= Lockout enabled (Press **Lock Out** to unlock)

= Blank ID Position; will not obscure test signal

**Shift/Shift Lock**




Only the next key-press is shifted; shifted functions and characters are shown in yellow

All following keys are shifted (Until **Shift** is pressed again)

**Keypad Lock Out**


Toggles keypad Lock/Unlock (when keypad is locked, only **Lock Out** and **On** keys are "active")

## Definitions

There are two phrases used in this manual that deserve a little explanation. We at Tektronix sincerely hope that these explanations do not confuse you further.

**Signal Set—** The group of signals that can be selected through the TSG95 keypad at a given time. In the preprogrammed signal sets, all of the signals are the same video standard. You may create a "User" signal set, however, that contains both PAL and NTSC signals assigned to the letter keys of your choice, for easy selection.

**Tone Level—** One of four predefined audio output amplitudes that may be selected through the Tone menu. The levels (1 through 4) are "named" -10, 0, +4, and +8 dBu and calibrated to those amplitudes when the TSG95 is manufactured. Qualified personnel, with the appropriate equipment, can rename and readjust the levels between -10 and +10 dBu. See page 26 for more discussion; see the Service manual for instructions.

## Preliminary Settings

Once the Pathfinder is up and running, you should choose some settings depending on how you'll be using the instrument. These settings are made through the Utility menu. Invoke the Utility menu by holding **Lock Out** down while pressing the **ON** key, then follow these directions to set the Video Standard and Battery Type, and enable Auto Power Down (if desired).

### Choose the Video Standard/Signal Set

1. Use the ▲ and ▼ keys to scroll to the SELECT STNDRD menu item.
2. Select, with the ◀ and ▶ keys, the signal standard or "signal set" that is appropriate to your application. The choices are: PAL; NTSC; NTSC JAPAN, which includes NTSC signals with 0% setup; and USER SIG SET, the user-configurable signal set that can contain up to 26 signals of your choice—see page 22 for more information.
3. When the name of the desired signal set is displayed, continue to the Battery Type, or press any rectangular key to exit the Utility menu and return to normal operation.

### Set the Battery Type

1. While still in the Utility menu, use the ▲ and ▼ keys to scroll to the BATTERY TYPE item.
2. Toggle to the selection that matches the type of battery you have installed in your TSG95 by pressing either ◀ or ▶. The choices are "rechargeable" and "disposable." Select rechargeable when using NiCad AA cells or the optional battery pack; choose disposable when you are using common Alkaline AA batteries, which cannot be recharged.
3. When the correct battery type is displayed, continue to Auto Power Down, or press any rectangular key to exit the Utility menu and return to normal operation.

### Enable (Disable) Auto Power Down

"Auto Power Down" will switch the instrument off when ten minutes have passed without a key press. Enable this feature when you are

using battery power and operating in an environment in which unplanned shutdown of the TSG95 is permissible.

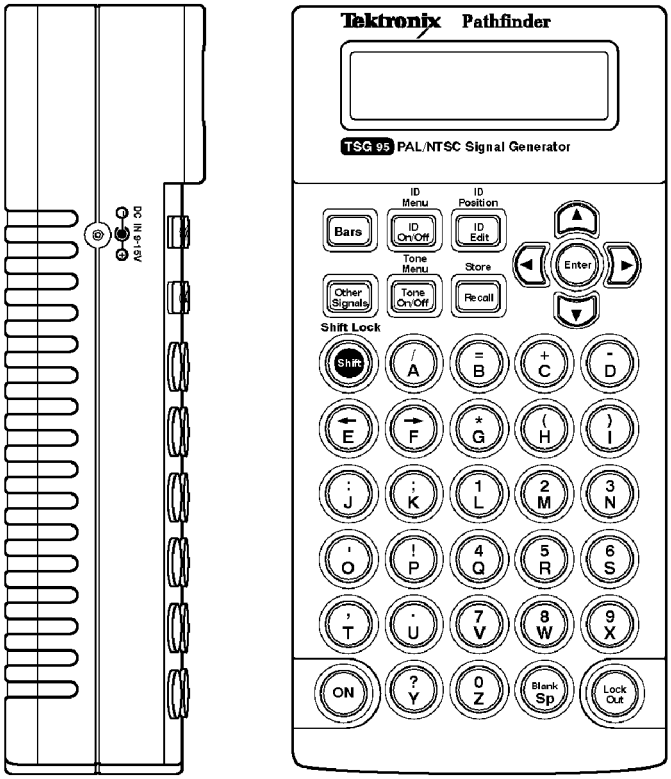
1. While still in the Utility menu, use the ▲ and ▼ keys to scroll to the AUTO PWR DOWN item.
2. Disable/enable Auto Power Down by pressing either ◀ or ▶. The new state will be in effect when you return to normal operation. Enabled Auto Power Down is indicated by a “rotating line” symbol in the upper-right corner of the Pathfinder display.
3. Use the ▲ and ▼ keys to access other Utility menu items, or press any rectangular key to exit the menu and resume normal operation.

## Other Settings

There are other, less important TSG95 settings that are configured through the Utility menu and its Calibration submenu. See “The Utility Menu,” beginning on page 19 for more information.

# Operating Basics

To begin using the instrument as quickly as possible, see “Using your TSG95,” below. For even more information on selected topics, turn to the Reference section of this manual, beginning on page 19.




## Using Your TSG95

Here’s what you can do with your TSG95. Instructions for each use begin on the indicated page.

- Output either PAL or NTSC video test signals (page 11). You can configure the instrument to generate:
  - PAL signals

- NTSC signals
- "NTSC JAPAN" signals that have 0 IRE (as opposed to 7.5 IRE, used in North America) setup
- A "User Signal Set" that can contain selections from all three lists, as well as VITS and non-VITS versions of the same signal (permitting you to choose VITS without entering the Utility menu). If you want, the User signal set can even include both PAL and NTSC signals.

See page 19 in the Getting Started section for information on choosing a video standard/signal set. Directions for creating (or editing) your own User signal set begin on page 22.

- Generate audio tones (page 12). You may:
  - Choose one of 13 discrete "factory" frequencies, or select a frequency sweep that sweeps repeatedly from 50 Hz to 20 kHz (page 12)
  - Designate three "User Frequencies" in the same range (page 25) and later output one of these frequencies
  - Select a factory-calibrated audio output level of -10, 0, +4, or +8 dBu (page 13)
  - Recalibrate the audio output to permit selection of any whole dB level between -10 and -3 dBu, or 0 through +10 dBu (*qualified service technicians only*—page 26)
  - Include channel-ID "clicks" in the audio output (page 13)
- Add an ID message to the video signal (pages 13), edit it (page 14), and place it in the vertical interval or position it where desired in the active video (page 14)
- Store up to eight ID messages for later use (page 15)
- Create a sequence of (up to four) stored ID messages that will cycle continuously in the output (page 16)
- Save all the current instrument settings as a "Preset" for later recall (page 17)

## Outputting Test Signals

1. Connect the TSG95 to your system and make the appropriate preliminary settings as described in the Getting Started section of this manual.
2. Switch the instrument on or return to normal operation by pressing either the Bars or Other Signals key. By default, the instrument "powers up" with the settings that were in effect when it was last switched off.
3. Select the desired test signal one of four ways:
   - Press the Bars key repeatedly to select among the available color bars signals. The signal will be output as soon as the name is displayed on the TSG95 LCD.
   - Press the Other Signals key repeatedly to select among the "non-bars" signals. Again, the signal will be output as soon as its name is displayed on the LCD.
   - Use the ▲ and ▼ keys to scroll through the full list of signals until you get to the desired signal.
   - Press the appropriate letter key (A through U) to "direct-select" the signal. The available signals and their corresponding keys are listed in Table 1, below.

**Table 1: TSG95 Video Test Signals**

| PAL Signal Set | NTSC Signal Set | NTSC JAPAN Signal Set | Key |
|---|---|---|---|
| 75% Bars | SMPTE Bars | SMPTE Bars* | A |
| 100% Bars | 75% Bars | 75% Bars* | B |
| 75% Bars/Red | Convergence | SNG Bars* | C |
| 100% Bars/Red | Safe Area | Convergence | D |
| Convergence | Red Field | Safe Area | E |
| Pluge | 50IRE Flat Field | Red Field* | F |
| Safe Area | 100IRE Flat Field | 50IRE Flat Field | G |
| Green Field | Black Burst | 100IRE Flat Field | H |
| Blue Field | 5-Step | Black Burst* | I |
| Red Field | Multiburst | 5-Step | J |
| 100% Flat Field | NTC7 Composite | Multiburst | K |

**Table 1: TSG95 Video Test Signals (Cont.)**

| PAL Signal Set | NTSC Signal Set | NTSC JAPAN Signal Set | Key |
|---|---|---|---|
| 50% Flat Field | NTC7 Combination | NTC7 Composite | L |
| 0% Flat Field | FCC Composite | NTC7 Combination | M |
| Multiburst | Cable Multiburst | FCC Composite | N |
| 60% Sweep | Cable Sweep | Cable Multiburst | O |
| 5-Step | SIN X/X | Cable Sweep | P |
| Mod. 5-Step | Matrix | SIN X/X | Q |
| Matrix | 0 IRE, no Burst | Matrix* | R |
| Field Square Wave | Field Square Wave | 0 IRE, no Burst | S |
| Bounce | Bounce | Field Square Wave | T |
| — | — | Bounce | U |

* These signals differ from those in the NTSC signal set.

## Outputting Audio Tones

- Toggle the audio output On/Off by pressing the **Tone On/Off** key.

## Selecting the Audio Frequency

1. Enter the Tone menu (press **Shift**, then **Tone On/Off**). The first menu item is TONE FREQ.
2. Use the ◀ and ▶ keys to select the desired frequency. The choices are:

   50, 63, 125, 250, and 400 Hz;
   1, 2, 4, 8, 10, 12.5, 16, and 20 kHz;
   USER1, USER2, USER3; and
   SWEEP 50-20K (a 50 Hz-20 kHz sweep)

   You may specify the USER# frequencies through the Utility/Calibration menu; see page 25. (Note that there is no default value for USER3; therefore, the USER3 choice will not appear in a new—or reset—instrument.)

   You can pause a sweep at any of its 27 frequency steps (listed in Table 10 in the Characteristics section) by pressing **Enter** when in the TONE FREQ menu item and SWEEP 50-20K is selected.

The message SWEEP PAUSED will appear on the display. You may find this capability useful for checking a problem noticed at a particular frequency while sweeping. Press **Enter** a second time to resume the frequency sweep.

3. Tone frequencies are in effect as soon as they are indicated on the display. Scroll down to other Audio menu items with the ▼ key, or exit the menu by pressing any rectangular key.

### Setting the Audio Tone Level (Amplitude)

1. In the Audio menu, use the ▼ or ▲ key to reach the TONE LEVEL item.
2. Use the ◀ and ▶ keys to select the desired level. When manufactured, the four TSG95 tone levels are designated as -10, 0, +4, and +8 dBu and calibrated to those amplitudes. Qualified technicians may rename and recalibrate the tone levels to any integer value in the ranges of -10 to -3 dBu and 0 to +10 dBu. See page 26 for more information; see the optional Service manual for instructions.
3. The new tone level will be in effect immediately. Scroll to other Audio menu items with the ▼ or ▲ key, or exit the menu by pressing any rectangular key.

### Inserting Channel-ID Clicks in the Audio

When click is enabled, the instrument will insert a single click into channel 1, and a double click into channel 2.

1. In the Audio menu, use the ▼ or ▲ key to reach the CLICK item.
2. Use the ◀ and ▶ keys to toggle the ID clicks On/Off.
3. Scroll to other Audio menu items with the ▼ or ▲ key, or exit the menu by pressing any rectangular key.

### Inserting ID Messages

- Toggle the ID message or cycle on and off by pressing the **ID On/Off** key. The status of the ID—on, off, or cyc (cycle)—is indicated on the second line of the TSG95 display, as shown in the next illustration.


### Editing ID Messages

In the TSG95, only the current ID message may be edited. The "current" message is the ID that will appear in the output if ID=on. (The current ID will not appear in the output when ID=off, and may not appear in the output if ID=cyc, but it can still be edited and saved in either case.)

1. Press **ID Edit**. The current ID message will appear on the LCD.
2. Use the arrow keys to position the blinking underline cursor and enter text with the alphanumeric keys.
3. Press **Enter** or one of the rectangular keys to terminate the ID edit; the new ID will become the current ID. If ID=on, the new ID will be inserted into the video output. Note that if a stored ID or preset is recalled before new current ID is saved (see "Saving ID Messages," page 15), the changes will be overwritten and lost.

### Positioning ID Messages

The current ID can be positioned within the safe area of active video, or the first line can be placed in the vertical interval.

1. Press **Shift**, then **ID Edit**. The LCD will look something like this:


2. Change the horizontal (H) position with the ◀ / ▶ keys and the vertical (V) position with the ▲ / ▼ keys.

   The H position can range from ØØ (left edge of safe area) to 69-3*n*, where *n* is the number (1-16) of the right-most character position occupied by the message. Note that, when editing a short message (*n*<16) that has been placed as far to the right as possible, the end character positions will be occupied by ■ symbols. You will not be able to put characters in those positions until the message is repositioned to the left.

The V setting can range from ØØ (top of safe area) to 41 (bottom). The vertical interval is indicated by V=vert; it is one ▲ key-press above V=ØØ. Only the first ID message line will fit into the vertical interval.

3. When the ID message is in the desired position, press any rectangular key to resume normal operation. Note that the position of an ID message is part of its definition. You must save the ID message (see below) to save its new location. If a stored ID or preset is recalled before the current ID (in its new location) is saved, the new location will be lost.

### Saving ID Messages

The contents and position of the current ID can be stored in one of eight ID# locations for later recall or inclusion in an ID cycle.

1. Press **Shift**, then **Recall**. The display will change to resemble this illustration:


   The first line of the current message will occupy the bottom half of the display. You may scroll between the first and second lines of the message with the ▼ and ▲ keys.

2. Use the ◀ and ▶ keys to select the ID# location (1 through 8) in which the current message is to be stored. Note that the previous contents of that location will be overwritten.

3. When the desired storage number is displayed, press **Enter** to save the message; press any rectangular key to abort the operation and return the instrument to normal operation.

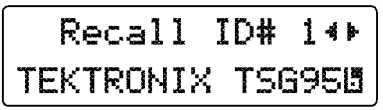
   Recall the message later with the **Recall** key, as described next.

### Recalling ID Messages

1. Press the **Recall** key.

2. Use the ◀ and ▶ keys to select one of the ID message numbers, ID# 1 through ID# 8. The first line of the message will appear on the second display line; press the ▼ key to see the second line of

the message. For example, if the saved ID# 1 is “TEKTRONIX TSG95 PAL/NTSC,” the display will first look like this:




Pressing the ▼ key will change it to this:

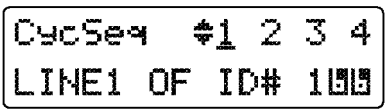

Note that an empty character position will show as a black space in the video, while the ■ symbol indicates a “Blank.” Underlying video will show through a Blank.

3. Press **Enter** to recall the ID message.
4. Press any rectangular key to exit the Recall menu and resume normal operation.

### Setting up an ID Cycle

An ID cycle is a sequence of up to four stored ID messages. Once you set up a cycle, it will be inserted in the video output if: ID is toggled On with the **ID On/Off** key, and the ID CYCLE item of the ID menu is set to “on.” When those two conditions are met, the TSG95 display will indicate ID=cyc during normal operation.

1. Edit and save the ID messages that you want to cycle (see “Editing ID messages,” page 14). Note the numbers of the IDs, and the order in which they should appear.
2. Enter the ID menu by pressing **Shift**, then **ID On/Off**.
3. Press ▼ twice to reach the CYCLE SETUP item, then press **Enter**. The display will resemble the following illustration.



4. Use the ◀ / ▶ keys to move the underline cursor to one of the four sequence "time intervals." The IDs will appear in the order that their numbers appear—from left to right—on the display.
5. Use the ▲ / ▼ keys to select the number of the ID to appear during each interval. Choose the hyphen (it's below #1) to eliminate the interval. If you want a blank interval (that is, a time gap between ID messages), you must create an all-blank ID to put in that interval.
6. When the correct ID numbers occupy all four time interval positions, press a rectangular key to exit the ID menu. The cycle sequence information will be written to the instrument's memory.

   Note that the TSG95 "remembers" the ID#, not the actual message. Therefore, if you save a new message as ID# 1, the new message will appear the next time an ID cycle comes to a time interval in which ID# 1 is displayed.
7. To set the duration of each cycle time interval, re-enter the ID menu (by pressing **Shift**, then **ID On/Off**), then press the ▼ key to reach the CYCLE TIME menu item. Use the horizontal arrow keys to select the duration between one and nine seconds.
8. To insert the ID cycle instead of the current ID, scroll up the ID menu to the ID CYCLE (on/off) selection. Press ◀ or ▶ to toggle the selection. The cycle will appear in the picture if toggled on with the **ID On/Off** key.

### Saving (Storing) Presets

1. Press **Shift** and then **Recall**.
2. Scroll through the "STORE ID" (#1 through #8) and "STO PRESET" (#1 through #4) locations with the ◀ / ▶ keys. The first line of the current ID will be displayed on the second line of the LCD.
3. When the desired storage number is displayed, press **Enter** to save the current instrument settings. Remember that storing the current settings will overwrite the contents of the selected PRESET# location.
4. Press any rectangular key to exit the Store function.

A preset includes *most* of the instrument settings in effect when the preset is saved.. The settings not stored in a preset are: Standard/signal set; auto power down status; user tone frequencies; and battery

type. While the current tone level (one of four possible; see page 5) becomes part of the preset, its name and actual amplitude—both set through the Calibration menu—are not.

Note also that while the *current* ID is saved, the particular messages used in a saved cycle are *not* stored. Thus, if the cycle stored with a preset "remembers" to display ID# 4 (for example), the *latest* message in ID# 4 will appear whenever that preset is recalled. Remember, editing an ID message can have an affect on what you get when you recall a preset.

### Recalling Presets

1. Press **Recall**.
2. Scroll through the "RECALL ID" (#1 through #8) and "RCL PRESET" (#1 through #4) locations with the ◀ / ▶ keys. The first line of the preset's "current" ID message will occupy the bottom line of the display; use the ▼ key to see the second line.
3. When the desired storage number is displayed, press **Enter** to recall the preset. The video and audio output of the TSG95 will return to the signal and tone that was selected when the preset was stored.
4. Press any rectangular key to exit the Recall menu.

# Reference

This section discusses several aspects of the TSG95 that are manipulated or configured through the Utility menu. Important topics that are not discussed elsewhere in this manual include:



## The Utility Menu

To enter the Utility menu, hold the Lock Out button down while pressing the ON button. To exit the Utility menu and resume normal operation, press any of the rectangular buttons at the top of the keypad, or scroll to the EXIT MENU item and press **Enter**.

The Utility menu items are listed below. Use the up (▲) and down (▼) arrow keys to scroll up and down the list. Note that there are two submenus: Calibration (CALIB) and Diagnostic (DIAGN). These submenus are discussed in separate sections, below.


1. Standard/Signal Set select; use the ◀ or ▶ key to select the desired set of signals. The choices are: PAL, NTSC, NTSC JAPAN (which includes NTSC signals with 0% Setup), and USER SIG SET.


2. This item permits construction or editing of a custom “User Signal Set” that can contain up to 26 signals chosen from a list of *all* the signals that the TSG95 can generate. Thus you can create a User signal set that has both PAL and NTSC signals. Or you can make a signal set that contains only the signals that you use regu-

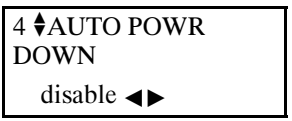
larly and “bind” them to letter keys that are easy for you to remember. For example, you can assign the Bounce signal to **B**, a Matrix without VITS to **M**, a Matrix with VITS to **N**, and the Red Field to **R**. (Note that control of VITS insertion through the next Utility menu item is disabled when the User signal set is active.)

Instructions for editing the Use signal set—with a list of all available signals—begin on page 22.


3. VITS (Vertical Interval Test Signals); use the ◀ or ▶ key to toggle between VITS SIGNALS and NO VITS SIGS. When VITS SIGNALS is selected, the listed signals will include VITS (see Tables 4 and 8 in the Characteristics section) whenever they are output.. This utility is disabled when the User signal set is selected.

**Signals that can include VITS**

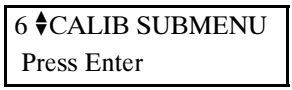
PAL 100% FLD
PAL 50% FLD
PAL 0% FIELD
PAL MATRIX
NTSC 100 IRE
NTSC 50 IRE
NTSC BLK BRST
NTSC MATRIX
JPN 100 IRE
JPN 50 IRE
JPN BLCK BRST
JPN MATRIX



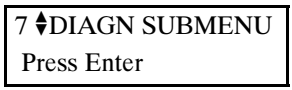

4. Auto power down; use the left (◀) or right (▶) arrow key to toggle between enabled and disabled.

The Auto Power Down function shuts the TSG95 off to conserve battery charge when there has been no key press for approximately 10 minutes. The Auto Power Down symbol (a rotating line) appears in the upper-right corner of the display when the function is enabled.


5. Battery type; use the ◀ or ▶ key to toggle between disposable (Alkaline AA cells) or rechargeable (NiCad cells or the optional battery pack). For best results when operating the TSG95 under battery power, this setting must match the installed type of battery.




6. Press **Enter** to "drop into" the Calibration submenu. This submenu includes items for specifying the User tone frequencies, choosing and calibrating audio tone amplitudes, and performing a "Factory Reset." Please see the Calibration Submenu section, which begins immediately after this discussion of top level items.

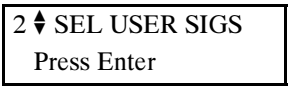



7. Press **Enter** to "drop into" the Diagnostic submenu. The Diagnostic submenu functions are intended for use when the instrument is manufactured or serviced. Please see the optional Service manual (Tektronix p/n 070-8917-0x) for more information.


8. To exit the Utility menu, scroll to this item and press **Enter**. The instrument will resume normal operation (notice that changes made through the Utility menu items and submenus will take effect immediately).

## Creating/Editing the User Signal Set

1. When in the top level of the Utility menu, use the ▲ / ▼ keys to scroll the the SEL USER SIGS item.




2. Press **Enter** to edit the User signal set. The display will become:


3. Select a letter key from A to Z with the ◀ and ▶ keys, or simply press the letter key itself.

4. Use the ▲ and ▼ keys to choose the signal (PAL, NTSC, or NTSC JAPAN) to be "associated" with the letter key. The available signals are listed in order below. Signals that include a VITS are indicated by an asterisk (*). The "No Signal" selections that separate the PAL, NTSC, and JPN portions of the list may be used to designate a letter key as "undefined."

   The specified signal will become part of the User signal set. You can select it (when the User signal set is active) with normal signal selection techniques: see the Operating Basics section of this manual or the TSG95 Instruction card for details.

5. Add more signals to the User set by selecting additional letter keys (step 3) and choosing new signals for them (step 4). When you're done, press **Enter** to exit the "SEL USER SIGS" item.

**Signals available for the User Signal Set**

PAL 75% BARS
PAL 100% BARS
PAL 75% / RED
PAL 100% / RED
PAL CONVERGENCE
PAL PLUGE
PAL SAFE AREA
PAL GREEN FIELD

**Signals available for the User Signal Set (Cont.)**

PAL BLUE FIELD
PAL RED FIELD
PAL 100% FIELD
PAL 100% FLD VT*
PAL 50% FIELD
PAL 50% FLD VT*
PAL 0% FIELD
PAL 0% FIELD VT*
PAL MULTIBURST
PAL 60% SWEEP
PAL 5-STEP
PAL MOD 5-STEP
PAL MATRIX
PAL MATRIX VTS*
PAL FLD SQ WAVE
PAL BOUNCE
NO SIGNAL
NTSC SMPTE BARS
NTSC 75% BARS
NTSC CONVERGENCE
NTSC SAFE AREA
NTSC RED FIELD
NTSC 100 IRE
NTSC 100 IRE VT*
NTSC 50 IRE
NTSC 50 IRE VT*
NTSC BLK BURST
NTSC BLK BRST V*
NTSC 5-STEP
NTSC MULTIBURST
NTSC NTC7 CMPST
NTSC NTC7 COMB.
NTSC FCC CMPST
NTSC CABLE MB

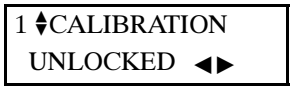
**Signals available for the User Signal Set (Cont.)**

NTSC CABLE SWP
NTSC SIN X/X
NTSC MATRIX
NTSC MATRIX VTS*
NTSC 0IREnoBRST
NTSC FLD SQ WAV
NTSC BOUNCE
NO SIGNAL
JPN SMPTE BARS
JPN 75% BARS
JPN SNG BARS
JPN CONVERGENCE
JPN SAFE AREA
JPN RED FIELD
JPN 100 IRE
JPN 100 IRE VTS*
JPN 50 IRE
JPN 50 IRE VTS*
JPN BLACK BRST
JPN BLCK BRST V*
JPN 5-STEP
JPN MULTIBURST
JPN NTC7 CMPST
JPN NTC7 COMB.
JPN FCC CMPST
JPN CABLE MB
JPN CABLE SWP
JPN SIN X/X
JPN MATRIX
JPN MATRIX VTS*
JPN 0IRE NoBRST
JPN FLD SQ WAVE
JPN BOUNCE

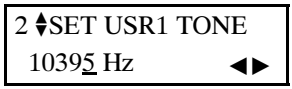
* Includes VITS (Vertical Interval Test Signal)

## The Calibration Submenu

Only the "SET USR# TONE" items of this menu are intended for use by the typical TSG95 user. Be sure you know what you are doing before using or changing any of the other submenu items.




1. Toggle calibration from UNLOCKED to LOCKED with the ◀ or ▶ key. When calibration is locked, only this and the EXIT SUB-MENU menu items will be visible; when unlocked, all items in the calibration submenu will be available.




2. Set the "USER1" tone frequency with either the ◀ and ▶ keys, or through direct input from the keypad. The keypad is automatically shifted when in this menu item, and only the number keys (0–9) are active. The selection range is 50 through 20000 Hz; the factory default is 10395 Hz.


3. Set the "USER2" tone frequency, again with either the ◀ and ▶ keys, or through direct input from the keypad. Factory default is 7867 Hz.


4. Set the "USER3" tone frequency, again with either the ◀ and ▶ keys, or through direct input from the keypad. Disable the User tone by pressing "-" (D). Factory default is no selection/disabled, as illustrated.

```
5 ▲▼TONE MIN LEVL
 ADJUST POT
```

5. Used during manufacture to set tone level DC offset. See the TSG95 Service manual for more information.

```
6 ▲▼NAME TONE LV1
  -10dBu ◄►
```

6. Name tone level 1: combined with the next menu item, this permits qualified users with the appropriate equipment to change tone level 1 from the factory default value of -10 dBu to a value of their choice. The possible selections are -10 to -3 dBu and 0 to +10 dBu. This item only changes the *name* of the level as it appears in the Tone menu.

***CAUTION.*** *Changing a tone level name (menu items 6, 8, A, and C) without recalibrating the amplitude through the following menu item is not recommended. Please see the Service manual (Tektronix p/n 070-8917-0x) for more information. A FACTORY RESET will NOT restore the tone level names to their original values.*

```
7 ▲▼CAL TONE LV1
-10dB: Low 17    ◄►
```

7. Calibrate tone level 1: this item is used during manufacture to calibrate the first tone level to -10 dBu. Qualified users may also use it to readjust the tone amplitude to accurately reflect the level name chosen in the previous menu item. The range of adjustment is Low 00 to Hgh (high) 99.

***CAUTION.*** *Changing the "CAL TONE LV#" settings (menu items 7, 9, B, and D) will affect the audio tone amplitude and can give unexpected or inaccurate results. A FACTORY RESET will NOT restore these settings to their original values. These settings should be changed by Qualified Service Personnel ONLY. Please see the TSG95 Service manual (p/n 070-8917-0x) for more information.*

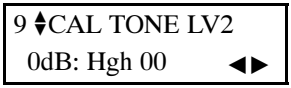
To ensure your ability to restore the original factory tone calibration settings in the case of inadvertent changes, please record the following information:

TSG95 serial number: _____

Original -10 dB setting: _____ (e.g., Low 17)

Also take the time to record the settings for the remaining tone levels in menu (list) items 9, B (11), and D (13).

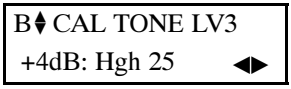

8. Name tone level 2: use this—and the next menu item—to change tone level 2 from the factory default value of 0 dBu to a value of your choice. See menu/list item 6, above.




9. Calibrate tone level 2: please see menu/list item 7, above.

   Original 0 dB setting: _____ (e.g., Low 99)

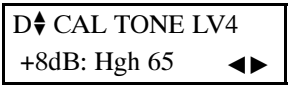

10. Name tone level 3: use this—with the next menu item—to change tone level 3 from the factory default value of +4 dBu to a value of your choice. See menu/list item 6, above.




11. Calibrate tone level 3: please see menu/list item 7, above.

    Original +4 dB setting: _____ (e.g., Hgh 25)


12. Name tone level 4: combined with the next menu item, this permits qualified users with the appropriate equipment to change tone level 4 from the factory default value of +8 dBu to a value of their choice. See menu/list item 6, above.




13. Calibrate tone level 4: please see menu/list item 7, above.

    Original +8 dB setting: _____ (e.g., Hgh 65)


14. This item selects special output signals used during manufacture.


15. Press **Enter** to restore most of the original "as manufactured" instrument settings. ***WARNING:*** *All user selections, ID Messages, and Presets will be lost.* A factory reset may be appropriate when you wish to "erase" the User signal set, all ID messages, or all Presets. Factory Reset will *not* restore the original audio tone level names or calibration.


16. To exit the Calibration submenu, scroll to this item and press **Enter**. The instrument will return to the "CALIB SUBMENU" item in the Utility menu. To exit the entire Utility menu from this point, and resume normal instrument operation, press any rectangular key.

# Characteristics

The information in this section is included for the convenience of the TSG95 operator. It is not intended as a complete list of guaranteed specifications. The waveform illustrations represent properly decoded output. For a full list of instrument specifications, as well as performance verification and adjustment procedures, please see the TSG95 Service Manual (Tektronix p/n 070-8917-0X).

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***NOTE**. Shielded cables were used in the EMI certification of this instrument; therefore, it is recommended that shielded cables be used when operating. (EC 92)*

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## Safety Standard Compliance

The following safety standards apply to the TSG95:

- ANSI S82 — Safety Standard for Electrical and Electronic Test, Measuring, Controlling, and Related Equipment, 1988.
- CAN/CSA C22.2 No. 231 M89 — CSA Safety Requirements for Electrical and Electronic Measuring and Test Equipment.
- IEC1010-1 — Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use (1990).
- UL1244 — Standard for Electrical and Electronic Measuring and Testing Equipment, Second Edition (1980).

## EC Declaration of Conformity - EMC

Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

**EN 55103.** Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.

- 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 61000-3-2.** AC power line harmonic emissions

### Australia / New Zealand Declaration of Conformity - EMC

Complies with EMC provision of Radiocommunications Act per these standard(s):

- AS/NZS 2064.1/2. Industrial, Scientific, and Medical Equipment: 1992

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***NOTE**. High quality shielded cables must be used to ensure compliance.*

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## Specification Tables

**Table 2: General PAL Test Signal Characteristics**

| Characteristic | Performance Requirements | Supplemental Information |
|---|---|---|
| Luminance Amplitude Accuracy | ± 1% of 700 mV | |
| Chrominance-to-Luminance Gain | ± 2% of 700 mV | 1% typical. |
| Blanking Level | 0 V ± 50 mV | |
| Rise Time Accuracy | ± 10% | Except where otherwise specified |
| Burst Amplitude | 300 mV ± 2% of 700 mV | |
| Sync Amplitude | 300 mV± 2% of 700 mV | |
| Sync Rise Time | 250 ns | |
| Output Impedance | | 75 Ω |
| Return Loss | | ≥ 36 dB at 4.2 MHz |
| Subcarrier Stability | 4.43361875 MHz ±10 Hz | Over a temperature range of 0 to +40° C. Annual adjustment required. |
| Signal-to-Noise Ratio | | ≥ 60 dB; Signal passed through a continuous random noise measurement low pass filter, $F_c$=5 MHz. |
| Chrominance-to-luminance Delay | ≤ 10 ns | ≤ 5 ns typical. |
| SCH Phase | 0° ± 5° | |
| Frequency Response<br>to 4.8 MHz<br>to 5.8 MHz | <br>Flat within ± 2%<br>Flat within ± 3% | Sin(X)/X ± 1 dB to 5 MHz |
| Field Tilt | ≤ 0.5% | |
| Line Tilt | ≤ 0.5% | |
| 5-Step Linerarity Error | ≤ 1% | Relative step matching. |
| Differential Gain | ≤ 1% | Averaged, ≤ 5% typical |
| Differential Phase | ≤ 1° | Averaged |
| 2T Pulse K-Factor | ≤ 0.5% | Ringing ≤ 1.5% peak. |

**Table 2: General PAL Test Signal Characteristics (Cont.)**

| Characteristic | Performance Requirements | Supplemental Information |
|---|---|---|
| Luminance Rise Time | Digitally derived | 250 ns ±50 ns<br>Except where otherwise specified |
| Chrominance Rise Time | Digitally derived | 350 ns ±50 ns<br>Except where otherwise specified |
| Burst Rise Time | Digitally derived | 350 ns ±50 ns; greater than BBC specifications to prevent ringing. |
| Line Timing | Digitally derived | All signals comply with PAL timing specifications; see Figures 1 through 26. |
| Front Porch Duration | Digitally derived | 1.55 μs minimum |
| Line Blanking Interval | Digitally derived | 12.0μs ±0.15 μs, measured at the 50% point of active video. |
| Breezeway Duration | Digitally derived | 900ns ±50 ns |
| Line Sync Duration | Digitally derived | 4.7μs ±50 ns at half-amplitude |
| Vertical Serration Duration | Digitally derived | 4.7μs ±50 ns at half-amplitude |
| Equalizing Pulse Duration | Digitally derived | 2.35μs ±50 ns at half-amplitude |
| Burst<br>Delay from Sync<br><br>Duration | Digitally derived | <br>5.6μs ±50 ns from half-amplitude point of Sync<br>2.25μs ±0.1 μs (10 cycles of subcarrier) |

**Table 3: Individual PAL Test Signal Characteristics**

| Characteristic | Information | | |
|---|---|---|---|
| *75% Bars* | See Figure 1 | | |
| Luminance Rise Times | 150 ns | | |
| Packet Characteristics: | Luminance Amplitude (mV) | Subcarrier Amplitude ($mV_{p-p}$) | Subcarrier Phase (degrees) |
| White | 700.0 | 0.0 | 0.0 |
| Yellow | 465.1 | 470.5 | 167.1 |
| Cyan | 368.0 | 663.8 | 283.5 |
| Green | 308.2 | 620.1 | 240.7 |
| Magenta | 216.8 | 620.1 | 60.7 |
| Red | 157.0 | 663.8 | 103.5 |
| Blue | 59.9 | 470.5 | 347.1 |
| *100% Bars* | See Figure 2 | | |
| Luminance Rise Times | 150 ns | | |
| Packet Characteristics: | Luminance Amplitude (mV) | Subcarrier Amplitude ($mV_{p-p}$) | Subcarrier Phase (degrees) |
| White | 700.0 | 0.0 | 0.0 |
| Yellow | 620.2 | 627.3 | 167.1 |
| Cyan | 490.7 | 885.1 | 283.5 |
| Green | 410.9 | 826.8 | 240.7 |
| Magenta | 289.1 | 826.8 | 60.7 |
| Red | 209.3 | 885.1 | 103.5 |
| Blue | 79.8 | 627.3 | 347.1 |
| *75% Bars over Red* | See Figures 1 and 3 | | |
| Luminance Rise Times | 150 ns | | |
| Field Timing | | | |
| Color Bars | Lines 24-166 & 336-478 | | |
| Red | Lines 167-310 & 479-622 | | |
| Packet Characteristics | See 75% Bars, above. | | |
| *100% Bars over Red* | See Figures 2 and 4 | | |
| Luminance Rise Times | 150 ns | | |
| Field Timing | | | |
| Color Bars | Lines 24-166 & 336-478 | | |
| Red | Lines 167-310 & 479-622 | | |
| Bars Packet Chars. | See 100% Bars, above. | | |
| Red Luminance Pedestal | 209.3 mV | | |
| Red Chrominance Ampl. | 885.1 $mV_{p-p}$ | | |
| Red Chrominance Phase | 103.5° | | |

**Table 3: Individual PAL Test Signal Characteristics (Cont.)**

| Characteristic | Information |
|---|---|
| *Convergence* | See Figures 5 and 6 |
| Amplitude | 525.0 mV |
| Pattern | 19 vertical lines and 14 horizontal lines per field |
| Pulse HAD | 225 ns |
| *Pluge* | See Figure 7 |
| Pluge Levels | -14 mV and +14 mV |
| Lum Ref Levels | 700 mV, 450 mV, 200 mV, and 110 mV |
| *Safe Area* | See Figure 9 |
| Amplitude | 525 mV |
| *Green Field* | See Figure 8 |
| Luminance Pedestal | 308.2 mV |
| Chrominance Amplitude | 620.1 $mV_{p-p}$ |
| Chrominance Phase | 240.7° |
| *Blue Field* | See Figure 10 |
| Luminance Pedestal | 59.9 mV |
| Chrominance Amplitude | 470.5 $mV_{p-p}$ |
| Chrominance Phase | 347.1° |
| *Red Field* | See Figure 4 |
| Luminance Pedestal | 157.0 mV |
| Chrominance Amplitude | 663.8 $mV_{p-p}$ |
| Chrominance Phase | 103.5° |
| *Flat Field* | |
| 100% | 700 mV (see Figure 11) |
| 50% | 350 mV (see Figure 12) |
| 0% | 0 mV (see Figure 13) |
| *Multiburst* | See Figure 14 |
| White Bar Amplitude | 420 $mV_{p-p}$ |
| Packet Amplitudes | 420 $mV_{p-p}$ (Equal width packets) |
| Pedestal | 350 mV |
| Burst Frequencies | 0.5, 1.0, 2.0, 4.0, 4.8, and 5.8 MHz |
| Packet Rise Time | 350 ns typical |
| *60% Reduced Line Sweep* | See Figure 15 |
| Frequency | 500 Hz to 6.5 MHz |
| Amplitude | 420 $mV_{p-p}$ |
| Markers | 1, 2, 3, 4, 5, and 6 MHz |
| *5-Step* (Grey Scale) | See Figure 16 |
| Amplitude | 700 mV |

**Table 3: Individual PAL Test Signal Characteristics (Cont.)**

| Characteristic | Information |
|---|---|
| *Modulated 5 Step* | See Figure 17 |
| Luminance Amplitude | 700, 560, 420, 280, and 140 mV |
| Chrominance Amplitude | 280.0 $mV_{p-p}$ |
| Chrominance Phase | 60.7° |
| *Matrix* (Signal) | (Lines) |
| CCIR 17 | 24-47 & 336-359 See Figure 18 |
| CCIR 330 | 48-71 & 360-383 See Figure 19 |
| CCIR 331 | 72-95 & 384-407 See Figure 20 |
| CCIR 18 | 96-119 & 408-431 See Figure 21 |
| 75% Color Bars | 120-143 & 432-455 See Figure 1 |
| Sin(X)/X | 144-166 & 456-478 See Figure 22 |
| 75% Red Field | 167-190 & 479-502 See Figure 3 |
| 15 kHz Square Wave | 191-214 & 503-526 See Figure 23 |
| 50% Flat Field | 215-238 & 527-550 See Figure 12 |
| Shallow Ramp | 239-262 & 551-574 See Figure 24 |
| UK ITS 1 | 263-286 & 575-598 See Figure 25 |
| UK ITS 2 | 287-310 & 599-622 See Figure 26 |
| *Field Square Wave* | See Figures 11 and 13 |
| Field Timing | |
| Lines (White) | Lines 89-244 (and 401-556) |
| Lines at Blanking | All remaining active lines |
| Amplitude | 700 mV |
| *Bounce* | See Figures 11 and 13 |
| Amplitude | 0 or 700 mV flat field |
| Rate | ≈ 1.0 second high, ≈ 1.0 second low |

**Table 4: PAL Vertical Interval Test Signals (VITS)**

| Waveform | Line(s) |
|---|---|
| CCIR 17 | 17 |
| CCIR 18 | 18 |
| ITS 1 | 19 and 332 |
| ITS 2 | 20 and 333 |
| CCIR 330 | 330 |
| CCIR 331 | 331 |

**Table 5: General NTSC Test Signal Characteristics**

| Characteristic | Performance Requirements | Supplemental Information |
|---|---|---|
| Luminance Amplitude Accuracy | ± 1% of 714.3 mV (100 ± 1 IRE) | |
| Chrominance-to-Luminance Gain | ± 2% of 714.3 mV (100 ± 2 IRE) | 1% typical. |
| Blanking Level | 0 V ± 50 mV | |
| Rise Time Accuracy | ± 10% | Except where otherwise specified |
| Burst Amplitude | 285.7 mV (40 IRE) ± 2% of 100 IRE | |
| Sync Amplitude | 285.7 mV (40 IRE) ± 2% of 100 IRE | |
| Sync Rise Time | 140 ns ± 20 ns | |
| Output Impedance | | 75 Ω |
| Return Loss | | ≥ 36 dB at 4.2 MHz |
| Subcarrier Stability | 3.579545 MHz ± 10 Hz | Over a temperature range of 0 to +40° C. Annual adjustment required. |
| Signal-to-Noise Ratio | | ≥ 60 dB; Signal passed through a continuous random noise measurement low pass filter, $F_c$=5 MHz. |
| Chrominance-to-Luminance Delay | ≤ 15 ns | 10 ns typical. Measured with the NTC7 Composite signal. |
| SCH Phase | 0° ± 5° | |
| Frequency Response | Flat within ± 2% to 4.2 MHz | Sin(X)/X ± 1 dB to 4.2 MHz |
| Field Tilt | ≤ 0.5% | |
| Line Tilt | ≤ 0.5% | |
| 5-Step Linearity Error | ≤ 1% | Relative step matching. |
| Differential Gain | ≤ 1% | Averaged |
| Differential Phase | ≤ 1° | Averaged |
| 2T Pulse K-Factor | ≤ 0.5% | Ringing ≤ 1.5% peak. |
| Luminance Rise Time | Digitally derived | 250 ns |

**Table 5: General NTSC Test Signal Characteristics (Cont.)**

| Characteristic | Performance Requirements | Supplemental Information |
|---|---|---|
| Chrominance Rise Time | Digitally derived | 400 ns |
| Burst Rise Time | Digitally derived | 400 ns |
| Line Timing | Digitally derived | See Figures 27 through 49 |
| Front Porch Duration | Digitally derived | 1.5 μs ± 0.1 μs |
| Line Blanking Interval | Digitally derived | 10.9 μs ± 0.2 μs, measured at the 20 IRE point of active video. |
| Breezeway Duration | Digitally derived | 600 ns ± 100 ns |
| Line Sync Duration | Digitally derived | 4.7 μs ± 100 ns<br>Half-amplitude duration (HAD) |
| Vertical Serration Duration | Digitally derived | 4.7 μs ± 100 ns (HAD) |
| Equalizing Pulse Duration | Digitally derived | 2.3 μs ± 100 ns (HAD) |
| Burst<br>Delay from Sync<br><br>Duration | Digitally derived | <br>5.308 μs ±35 ns (19 cycles of subcarrier)<br>2.51 μs ± 0.1 μs (9 cycles of subcarrier) |

**Table 6: Individual NTSC Test Signal Characteristics**

| Characteristic | Information | | |
|---|---|---|---|
| *SMPTE Bars* | See Figure 29 | | |
| Rise Times | | | |
| Luminance | 140 ns | | |
| Chrominance | | | |
| -I | 250 ns | | |
| Q | 833 ns | | |
| Field Timing | | | |
| Color Bars | Lines 21-182 | See Figure 29a | |
| Reverse Blue Bars | Lines 183-202 | See Figure 29b | |
| IYQB | Lines 203-262 | See Figure 29c | |
| Packet Characteristics: | Luminance Amplitude (Pedestal, mV) | Subcarrier Amplitude (p-p, mV) | Subcarrier Phase (degrees) |
| White | 549.1 | 00.0 | 00.0 |
| Yellow | 492.6 | 443.3 | 167.1 |
| Cyan | 400.9 | 626.6 | 283.5 |
| Green | 344.5 | 585.2 | 240.7 |
| Magenta | 258.2 | 585.2 | 60.7 |
| Red | 201.7 | 626.6 | 103.5 |
| Blue | 110.1 | 443.3 | 347.1 |
| -I | 53.6 | 285.7 | 303.0 |
| Q | 53.6 | 285.7 | 33.0 |
| *75% Color Bars* | See Figure 27<br>Full Field Color Bars, 75% Amplitude, 7.5% Setup, 100 IRE White Flag. | | |
| *Convergence* | See Figure 28 | | |
| Amplitude | 549.3 mV (76.9 IRE) | | |
| Pattern | Crosshatch: 14 horizontal/17 vertical lines per field | | |
| Pulse HAD | 225 ns | | |
| *Safe Area* | See Figure 30 | | |
| Amplitude | 549.1 mV (76.9 IRE) | | |
| Safe Title | | | |
| Horizontal Bar | Lines 45 and 238 | | |
| Vertical Timing | 14.925 and 56.525 μs | | |
| Safe Action | | | |
| Horizontal Bar | Lines 33 and 250 | | |
| Vertical Timing | 12.325 and 59.125 μs | | |

**Table 6: Individual NTSC Test Signal Characteristics (Cont.)**

| Characteristic | Information |
|---|---|
| *Red Field* | See Figure 31 |
| Luminance Pedestal | 201.74 mV (28.3 IRE) |
| Chrominance Amplitude | 626.66 $mV_{p-p}$ (87.8 IRE) |
| Chrominance Phase | 103.5° |
| *50 IRE Flat Field* | See Figure 32 |
| Amplitude | 357.2 mV |
| *100 IRE Flat Field* | See Figure 33 |
| Amplitude | 714.3 mV |
| *Black Burst* | See Figure 34 |
| Amplitude | 53.57 mV (7.5 IRE) |
| *(SIN X)/X* | See Figure 42 |
| Spectrum | -3 dB at 4.75 MHz |
| *5-Step Staircase* | See Figure 35 |
| Amplitude | 714.3 mV (100 IRE) |
| *Multiburst* | See Figure 36 |
| Amplitudes | |
| White Reference Bar | 500 mV (70 IRE) |
| Packets | 428.6 $mV_{p-p}$ (60 IRE), equal width packets |
| Pedestal | 285.7 mV (40 IRE) |
| Burst Frequencies | 0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz |
| Packet Rise Time | |
| 0.5 MHz | 140 ns typical (sine-squared packets) |
| All Other Packets | 400 ns typical (sine-squared packets) |
| *NTC7 Composite* | See Figure 37 |
| Bar | |
| Amplitude | 714.3 mV (100 IRE) |
| Rise Time | 125 ns |
| 2T Pulse | |
| Amplitude | 714.3 mV (100 IRE) |
| HAD | 250 ns |
| Modulated $Sin^2$ Pulse | |
| Phase | 60.8° ± 1° |
| Amplitude | 714.3 mV (100 IRE) at peak amplitude |
| HAD | 1.563 μs |
| Modulate 5-Step Staircase | |
| Luminance | 642.9 mV (90 IRE) |
| Chrominance | 285.7 mV (40 IRE) |

**Table 6: Individual NTSC Test Signal Characteristics (Cont.)**

| Characteristic | Information |
|---|---|
| *NTC7 Combination* | See Figure 38 |
| Multiburst | |
| Amplitudes | |
| White Bar | 714.3 mV (100 IRE) |
| Packets | 357.2 mV (50 IRE) |
| Pedestal | 357.2 mV (50 IRE) |
| Burst Frequencies | 0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz |
| Packet Rise Times | |
| 0.5 and 1.0 MHz | 140 ns typical (sine-squared packets) |
| All Other Packets | 400 ns typical (sine-squared packets) |
| Modulated Pedestal | |
| Pedestal Amplitude | 357.2 mV (50 IRE) |
| Chrominance Ampl. | 142.9 mV (20 IRE), 285.7 mV (40 IRE), and 571.4 mV (80 IRE) |
| Phase | 90° |
| Rise Time | 400 ns |
| *FCC Composite* | See Figure 39 |
| Bar | |
| Amplitude | 714.3 mV (100 IRE) |
| Rise Time | 250 ns |
| 2T Pulse | |
| Amplitude | 714.3 mV (100 IRE) |
| HAD | 250 ns |
| Modulated $Sin^2$ Pulse | |
| Phase | 60.8° ± 1° |
| Amplitude | 714.3 mV (100 IRE) |
| HAD | 1.563 μs |
| Modulate 5-Step Staircase | |
| Luminance | 571.4 mV (80 IRE) |
| Chrominance | 285.7 mV (40 IRE) |
| Rise Time | 375 ns |
| *Cable Multiburst* | See Figure 40 |
| Amplitudes | |
| White Ref. Bar | 428.6 mV (60 IRE) |
| Packets | 428.6 $mV_{p-p}$ (60 IRE), equal width packets |
| Pedestal | 214.3 mV (30 IRE) |
| Burst Frequencies | 0.5, 1.25, 2.0, 3.0, 3.75, and 4.0 MHz |
| Packet Rise Time | |
| 0.5 MHz | 140 ns typical (sine-squared packets) |
| All Other Packets | 400 ns typical (sine-squared packets) |

**Table 6: Individual NTSC Test Signal Characteristics (Cont.)**

| Characteristic | Information |
|---|---|
| *Cable Sweep* | See Figure 41 |
| Frequency | 100 Hz to 4.2 MHz, lines 21-202 |
| Amplitude | 714.28 $mV_{p-p}$ (100 IRE) |
| Markers | .5, 1, 2, 3, 3.75, and 4 MHz, lines 203-263 |
| *Matrix* | Field Lines (inclusive; see Figure 43) |
| NTC7 Composite | 21-69 |
| NTC7 Combination | 70-117 |
| Color Bars | 118-165 |
| Sin(X)/X | 166-213 |
| 50 IRE Flat Field | 214-262 |
| *0 IRE No Burst* | See Figure 44<br>0 mV |
| *Field Square Wave* | See Figure 33 |
| Field Timing | |
| Lines (White) | Lines 70-213 |
| Lines at Blanking | All remaining active lines |
| Amplitude | 714.3 mV (100 IRE) |
| *Bounce* | See Figures 45 and 33 |
| Amplitude | 0 or 100 IRE flat field |
| Rate | ≈ 1.0 second high, ≈ 1.0 second low |

**Table 7: NTSC JAPAN Test Signal Characteristics**

| Characteristic | Information |
|---|---|
| *SMPTE Bars, No Setup* | See Figure 46 |
| Rise Times | |
| Luminance | 140 ns |
| Chrominance | |
| -I | 250 ns |
| Q | 833 ns |
| Field Timing | |
| Color Bars | Lines 21-182 See Figure 46a |
| Reverse Blue Bars | Lines 183-202 See Figure 46b |
| IYQB | Lines 203-262 See Figure 46c |

| Packet Characteristics: | Luminance Amplitude (Pedestal, mV) | Subcarrier Amplitude (p-p, mV) | Subcarrier Phase (degrees) |
|---|---|---|---|
| White | 535.1 | 00.0 | 00.0 |
| Yellow | 476.8 | 479.3 | 167.1 |
| Cyan | 375.0 | 677.5 | 283.5 |
| Green | 316.1 | 632.6 | 240.7 |
| Magenta | 219.6 | 632.6 | 60.7 |
| Red | 160.7 | 677.5 | 103.5 |
| Blue | 58.9 | 479.3 | 347.1 |
| -I | 0.0 | 285.7 | 303.0 |
| Q | 0.0 | 285.7 | 33.0 |

| | |
|---|---|
| *75% Color Bars, No Setup* | See Figure 47<br>Full Field Color Bars; 75% Amplitude, No Setup with a 100 IRE White Flag. |
| *SNG Bars (Matrix)* | Field Lines (inclusive): |
| 30 IRE Flat Field | 21-162 and 209-262 See Figure 32 |
| SMPTE Bars, 0 Setup | 163-197 See Figure 46a |
| IYQB | 198-208 See Figure 46c |
| *Red Field, No Setup* | See Figure 48 |
| Luminance Pedestal | 160.14 mV (22.4 IRE) |
| Chrominance Ampl. | 677.08 $mV_{p-p}$ (94.8 IRE) |
| Chrominance Phase | 103.5 |
| *Black Burst, No Setup* | See Figure 49<br>0 mV (0 IRE) |

**Table 8: NTSC and NTSC JAPAN VITS**

| Waveform | Line(s) |
|---|---|
| NTC7 Composite<br>NTC7 Combination | 17<br>280 |

**Table 9: Character Identification**

| Characteristic | Information |
|---|---|
| Number of Characters Displayed | Two lines of up to 16 characters per line |
| Display Position | Movable within the Safe Action area of the picture. One line (the first) may be in the Vertical Blanking Interval. |
| Character Amplitude, PAL<br>Character Amplitude, NTSC | Black: 105 mV; White: 630 mV<br>Black: 85.7 mV (12 IRE); White: 585.7 mV (82 IRE) |

**Table 10: Audio Tone**

| Characteristic | Information |
|---|---|
| Amplitude | Factory calibrated: -10, 0, +4, or +8 dBu into 600 Ω; may be readjusted by user (*qualified personnel only*) |
| Amplitude Accuracy | ± 0.25 dBu, as adjusted during manufacture |
| Connector Polarity | Pin 1 = GND; Pin 2 = POS (+); Pin 3 = NEG (-) |
| Output Impedance | 50 Ω |
| Frequency | 50, 63, 125, 250, and 400 Hz; 1, 2, 4, 8, 10, 12.5, 16, and 20 kHz; Sweep, and three user selections |
| Frequency Accuracy | ± 0.5 Hz |
| Sweep | 1 kHz for 5 s followed by 0.5 s at each of the following frequencies:<br>50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, and 800 Hz; then 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 8, 10, 12.4, 16, and 20 kHz. |
| Distortion (THD) | ≤ 1% (20 kHz bandwidth) |
| Audio ID “click” (click ON) | Channel 1, 1 click<br>Channel 2, 2 clicks<br>Channel clicks are offset for positive channel identification. |

**Table 11: Power Supply**

| Characteristic | Information |
|---|---|
| Altitude<br>Operating<br>Storage | <br>to 15,000 feet (4572 m); IEC 1010-1 compliance to 2000 m<br>to 50,000 feet (15420 m) |
| DC Input Range | 9 to 15 VDC |
| Fuse | 2 A, 32 V min |
| Power Limit<br>without adapter<br>with adapter | <br>3.25 W<br>5.25 W |
| Power Consumption<br>Audio and Back light off<br>Audio and Back light on | Typical (not charging):<br>2.0 W<br>2.5 W |
| Peak Inrush Current | 1.95 A @230 VAC, Environment E2 |

**Table 12: Physical Characteristics**

| Characteristic | Performance Information |
|---|---|
| Height | 5.6 cm (2.2 in) |
| Width | 9.1 cm (3.6 in) |
| Depth | 19.1 cm (7.5 in) |
| Net Weight<br>TSG95<br>TSG with battery pack | <br>0.48 kg (1.06 lb)<br>0.68 kg (1.5 lb) |
| Shipping Weight | 1.50 kg (3.31 lb) with AC adapter |

**Table 13: Environmental Characteristics**

| Characteristic | Information |
|---|---|
| Temperature<br>Operating<br><br>Storage | <br>0° C to +50° C (32 to +122° F); IEC 1010-1 compliance to +40° C<br>-30° C to +65° C (-22 to +149° F) |
| Altitude<br>Operating<br>Storage | <br>to 15,000 feet (4572 m); IEC 1010-1 compliance to 2000 m<br>to 50,000 feet (15420 m) |
| Equipment Type | Test |
| Equipment Class | Class III (as defined in IEC 1010-1, Annex H) |
| Installation Category | Category II (as definded in IEC 1010-1, Annex J)<br>Note: Rated for indoor use only. |
| Pollution Degree | Pollution Degree 2 (as defined in IEC 1010-1) |
| Transportation | Meets the requirements of NTSB Test Procedure 1A, category II (24 inch drop) |

# PAL Waveform Diagrams

***NOTE**. Time references in the following waveform diagrams apply to the signal's half-amplitude points or pulse peaks, unless indicated otherwise.*

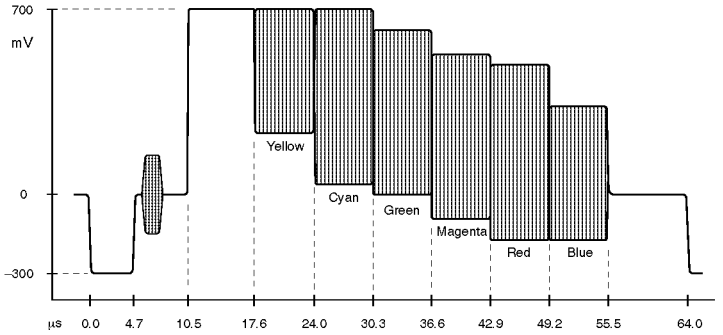



**Figure 1: PAL 75% Color Bars**

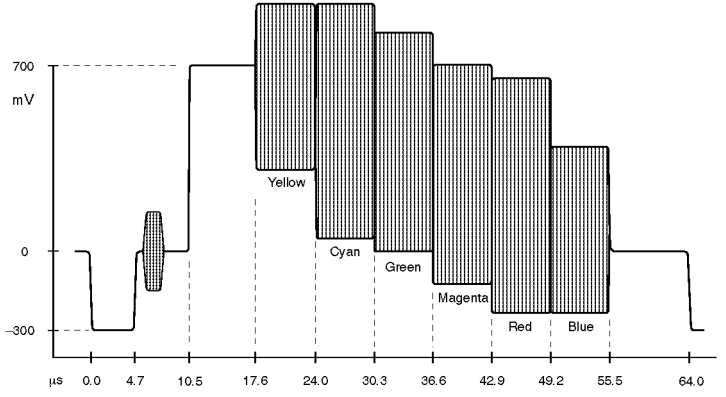



**Figure 2: PAL 100% Color Bars**

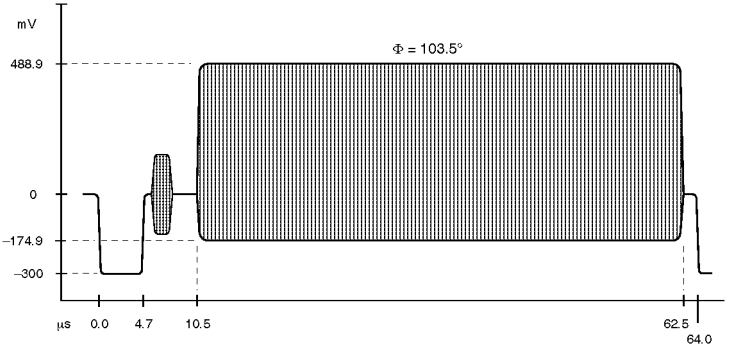



**Figure 3: PAL 75% Red and Red Field**

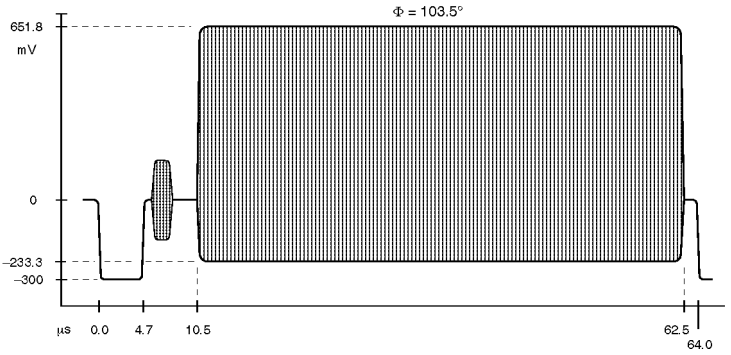



**Figure 4: PAL 100% Red**

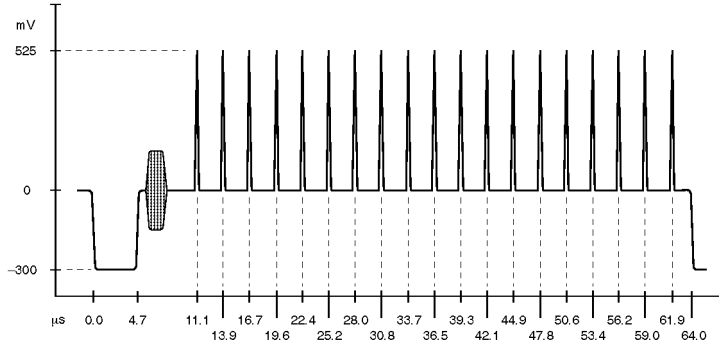



**Figure 5: PAL Convergence (vertical lines)**

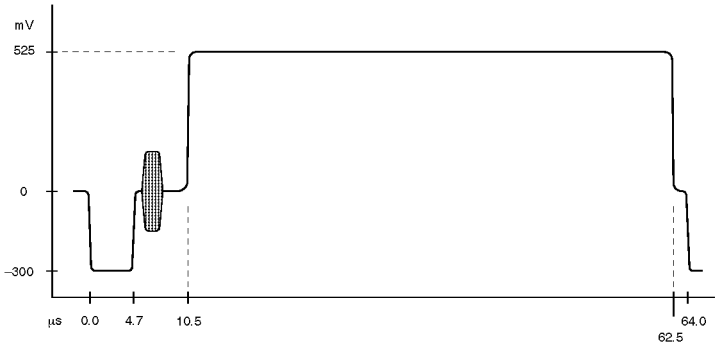



**Figure 6: PAL Convergence (horizontal lines)**

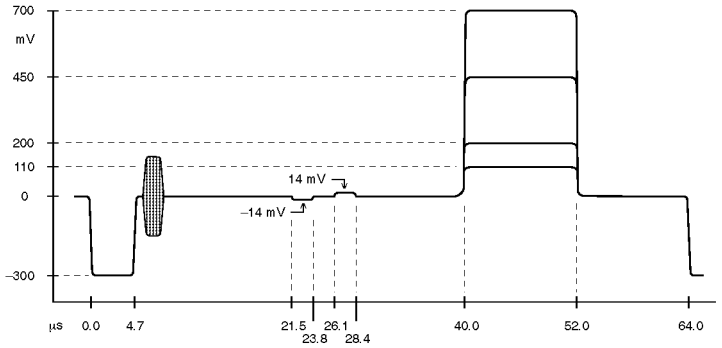



**Figure 7: PAL Pluge**

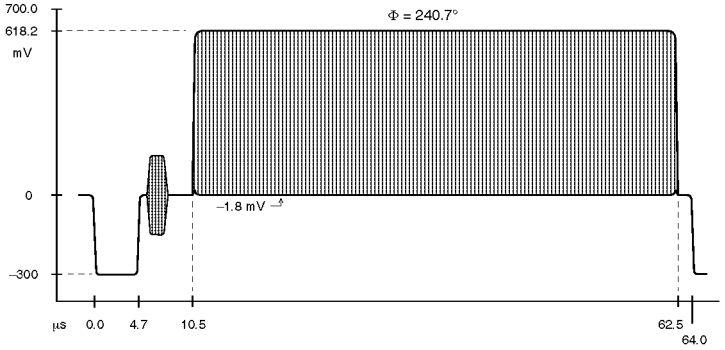
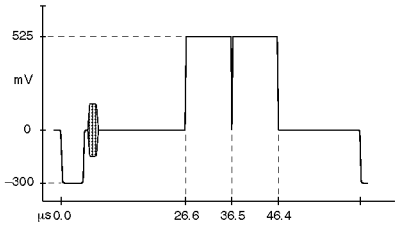
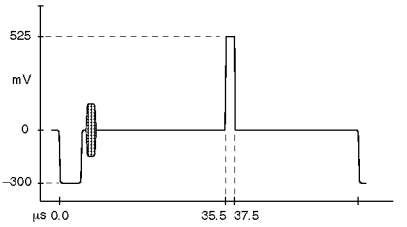


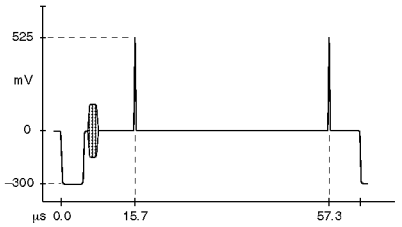

**Figure 8: PAL Green Field**



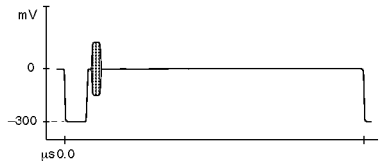

Lines 52 and 282



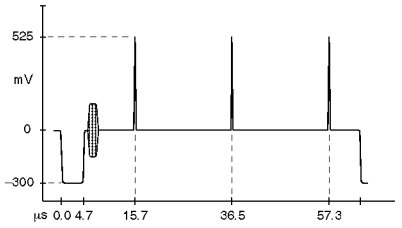

Line 167



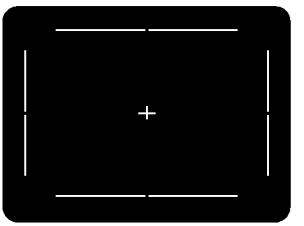

Lines 113–159 and 175–221




All remaining lines




Lines 160–166 and 168–174



Safe Area display

**Figure 9: PAL Safe Area**

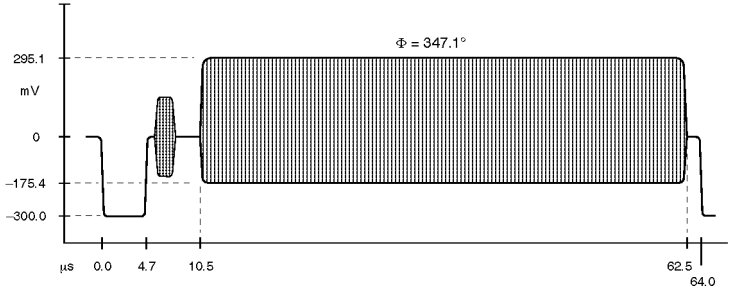



**Figure 10: PAL Blue Field**

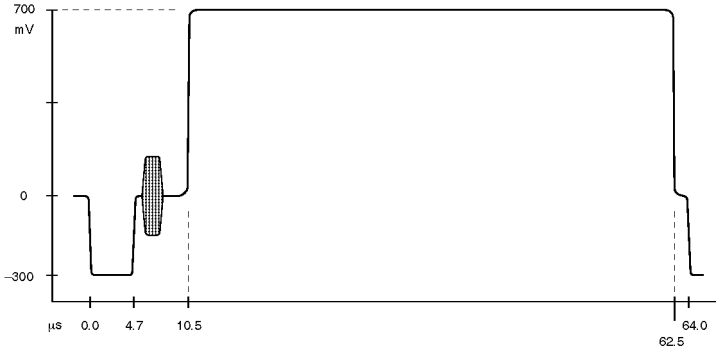



**Figure 11: PAL 100% Flat Field and Bounce (High)**

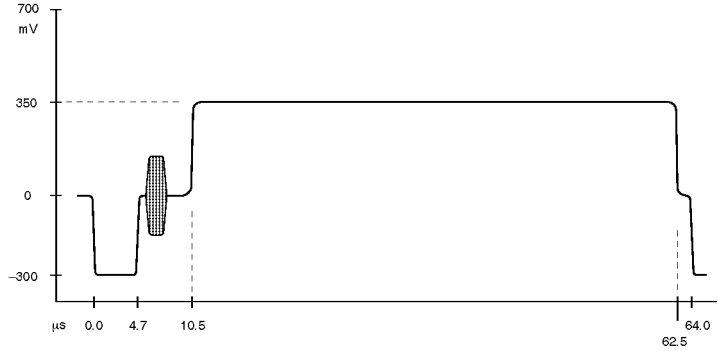



**Figure 12: PAL 50% Flat Field**

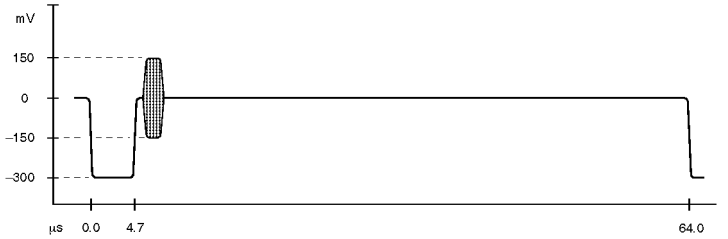



**Figure 13: PAL 0% Flat Field and Bounce (Low)**

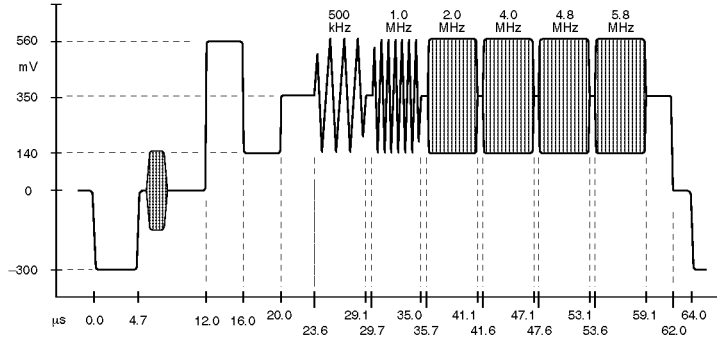



**Figure 14: PAL Multiburst**

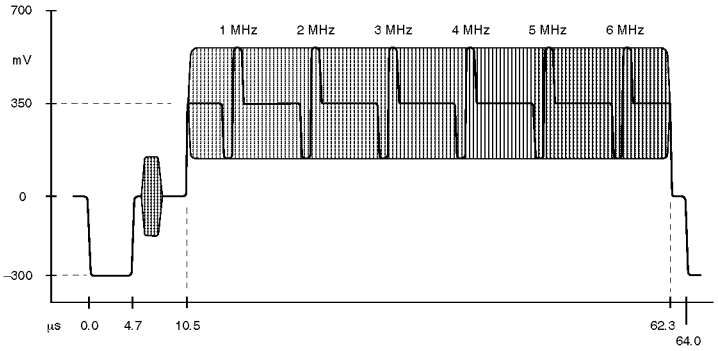



**Figure 15: PAL Reduced Sweep**

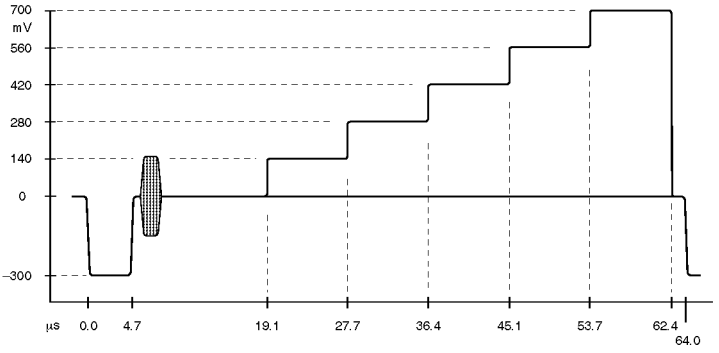



**Figure 16: PAL 5-Step (Gray Scale)**

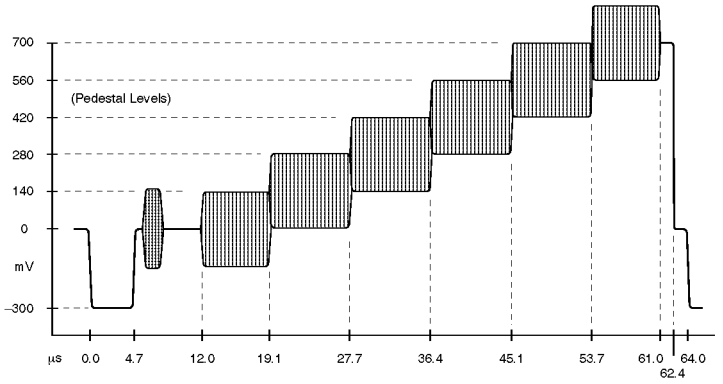



**Figure 17: PAL Modulated 5-Step**

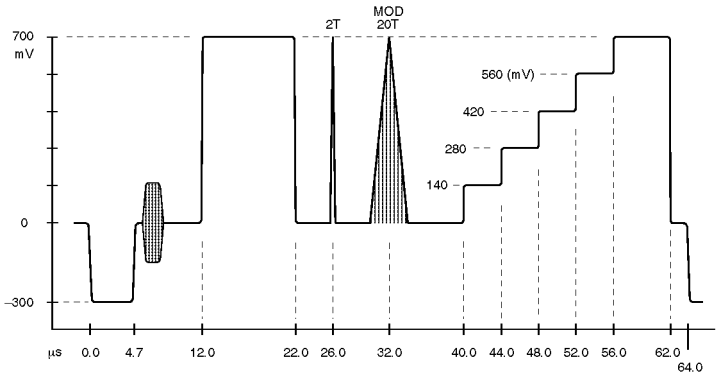



**Figure 18: PAL Matrix Signal — CCIR 17**

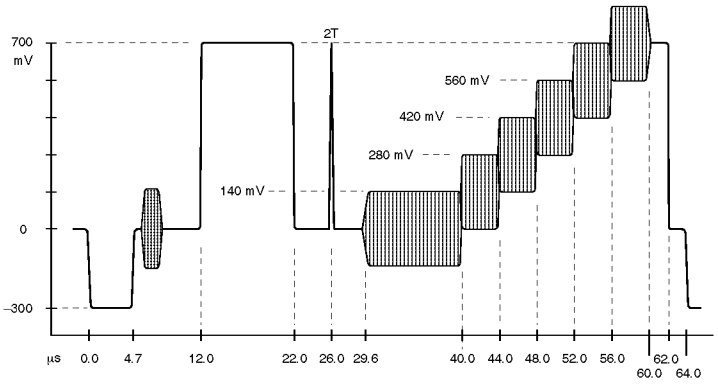



**Figure 19: PAL Matrix Signal — CCIR Line 330**

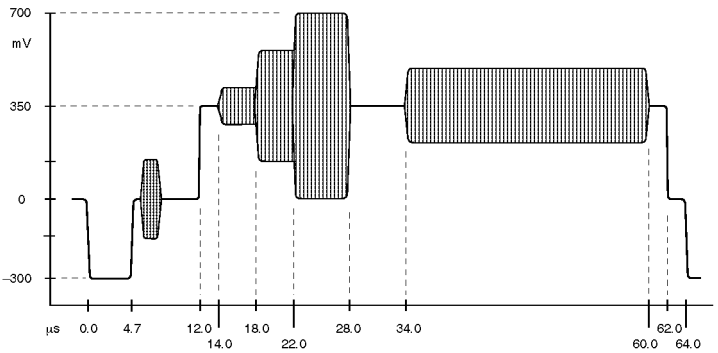



**Figure 20: PAL Matrix Signal — CCIR Line 331**

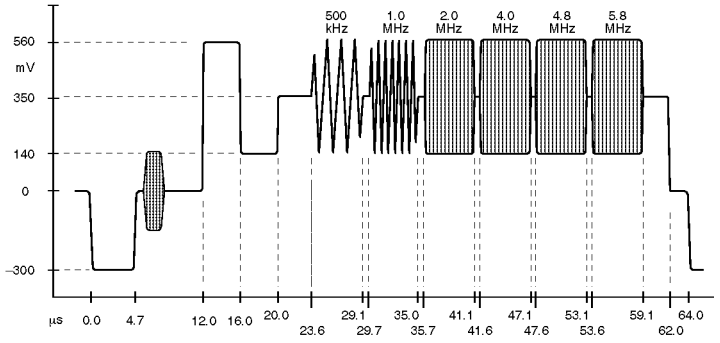



**Figure 21: PAL Matrix Signal — CCIR 18**

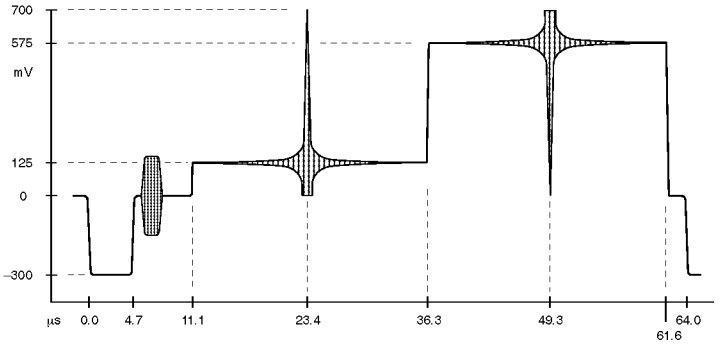



**Figure 22: PAL Matrix Signal — Sin(x)/x**

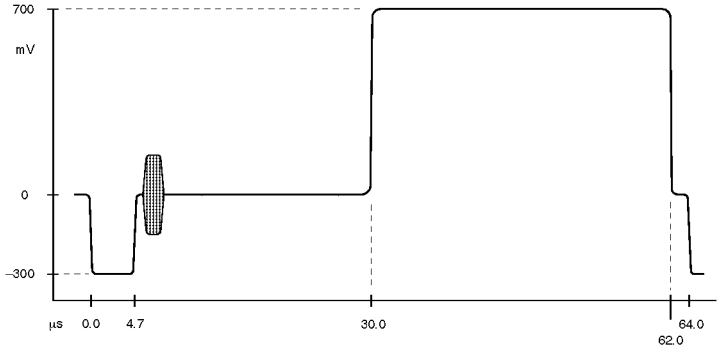



**Figure 23: PAL Matrix Signal — 15 kHz Square Wave**

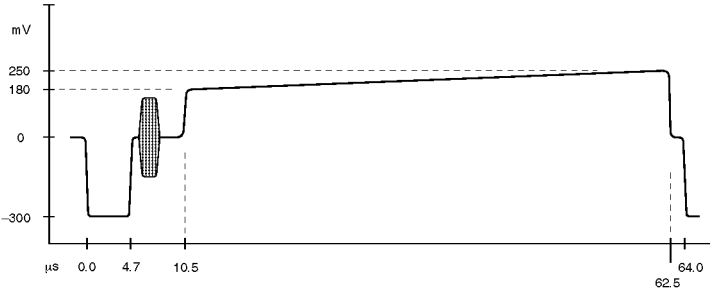



**Figure 24: PAL Matrix Signal — Shallow Ramp**

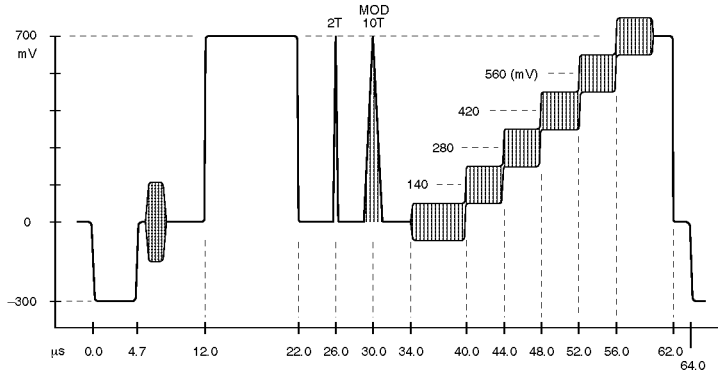



**Figure 25: PAL Matrix Signal — UK ITS 1**

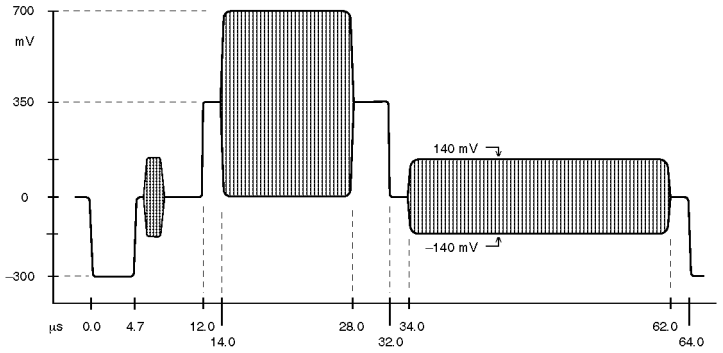



**Figure 26: PAL Matrix Signal — UK ITS 2**

# NTSC Waveform Diagrams

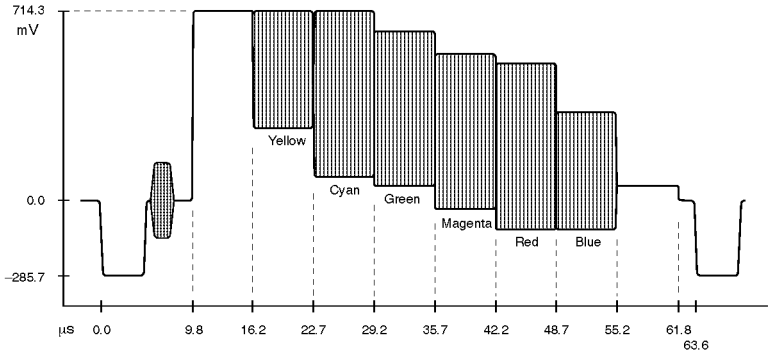



**Figure 27: NTSC 75% Color Bars**

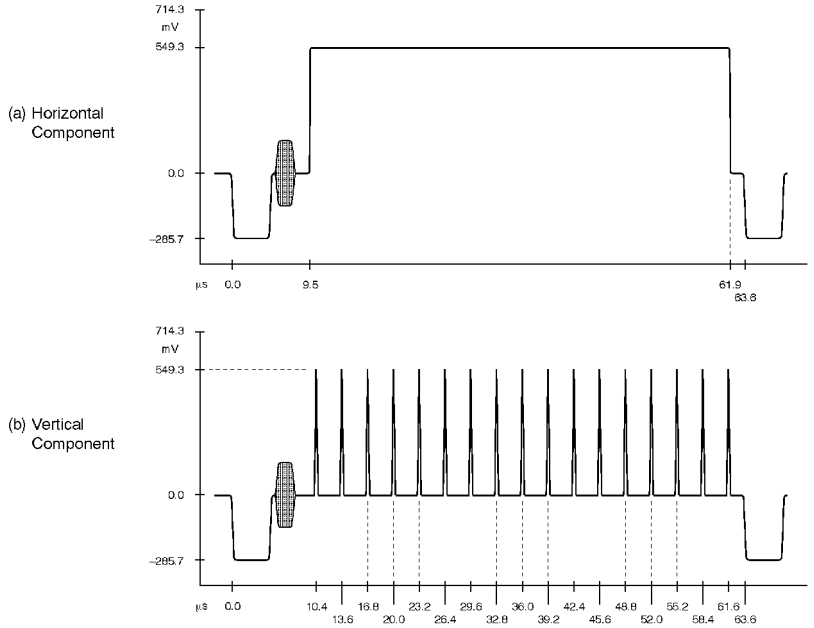
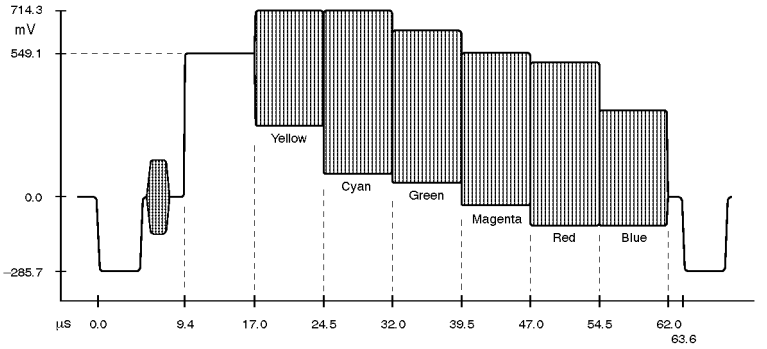
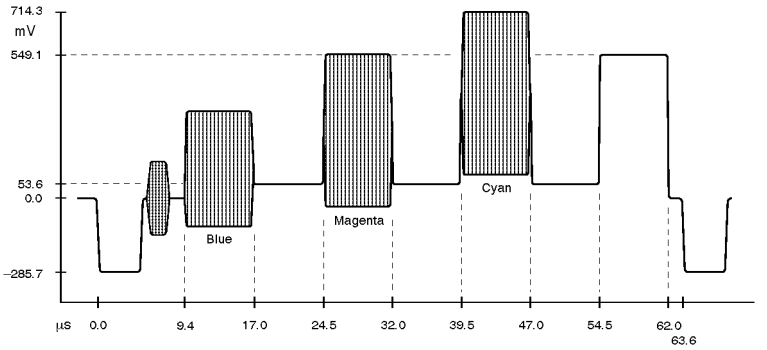


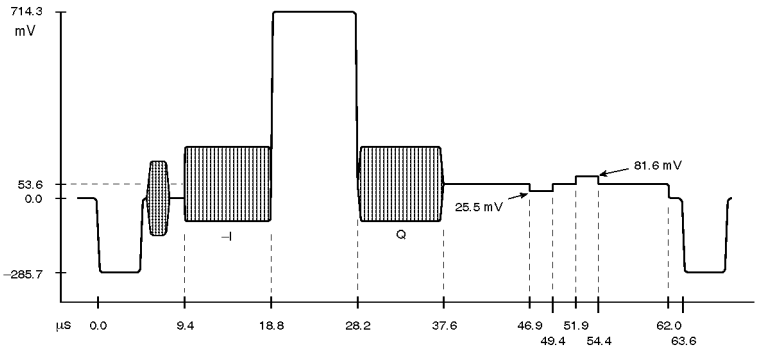

**Figure 28: NTSC Convergence Components**




(a) Color Bars (EIA Color Bars), lines 21–182

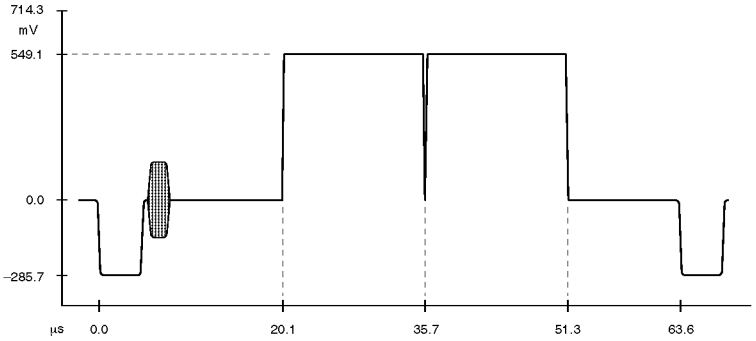



(b) Reverse Blue Bars, lines 183–202

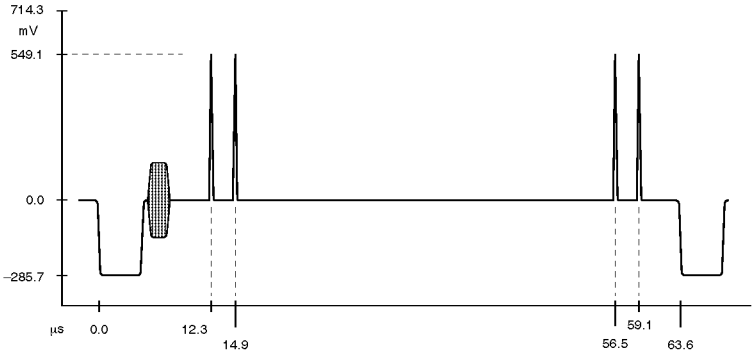



(c) IYQB for SMPTE Bars, lines 203–262

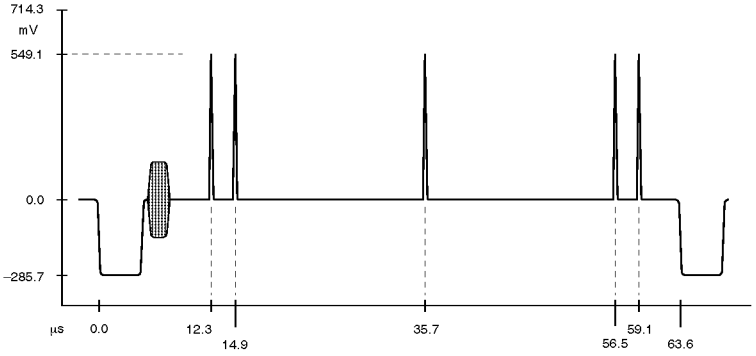
**Figure 29: SMPTE (NTSC) Color Bar Components**




Lines 33, 45, 238, and 250

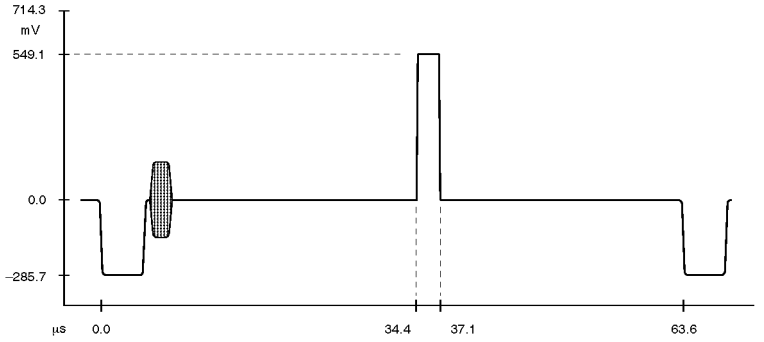



Lines 69–132 and 149–213

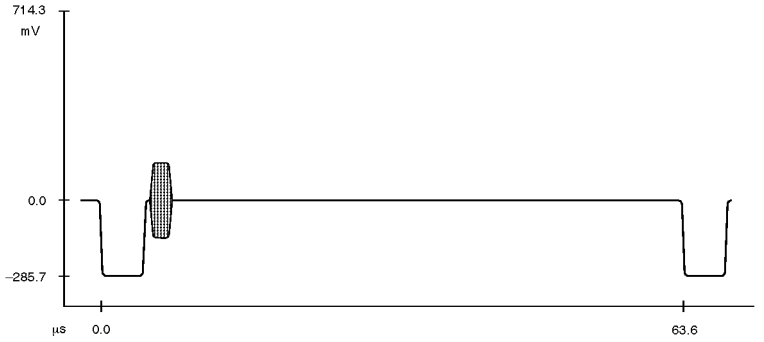



Lines 133–140 and 142–148

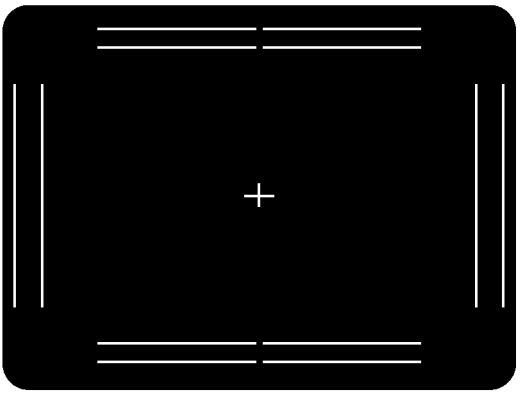
**Figure 30: NTSC Safe Area Signal Components**




Line 141




All remaining lines



Safe Area display

**Figure 30 (cont.): NTSC Safe Area Signal Components**

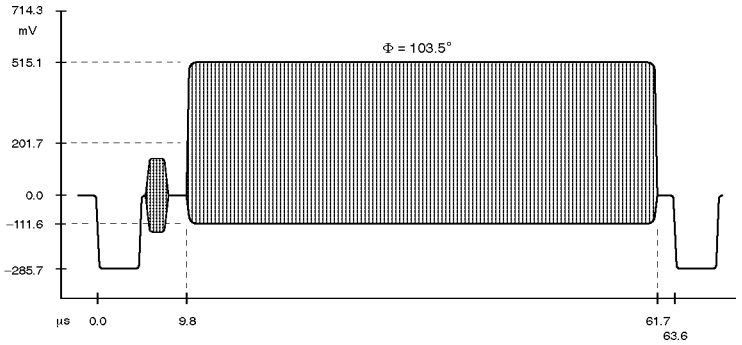



**Figure 31: NTSC Red Field**

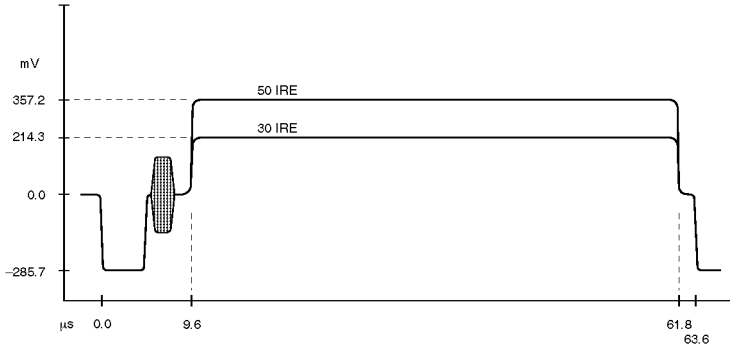



**Figure 32: NTSC 30 IRE and 50 IRE Flat Fields**

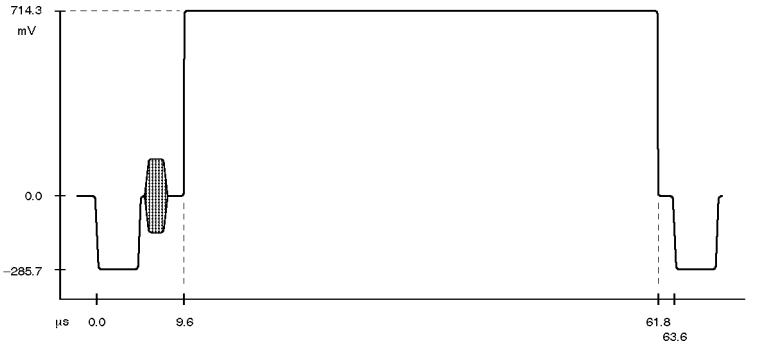



**Figure 33: NTSC 100 IRE Flat Field, Field Square Wave, and Bounce (High)**

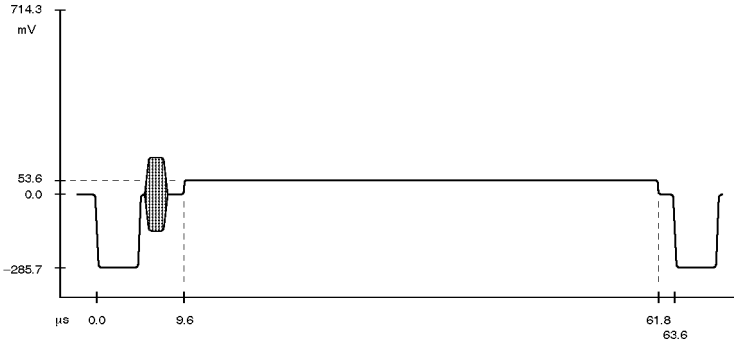



**Figure 34: NTSC Black Burst**

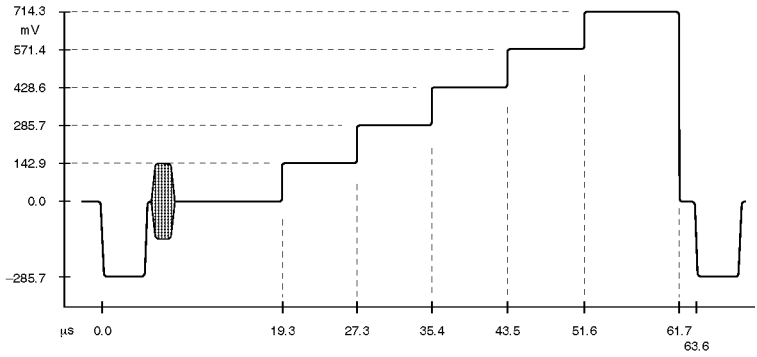



**Figure 35: NTSC 5-Step Staircase (Gray Scale)**

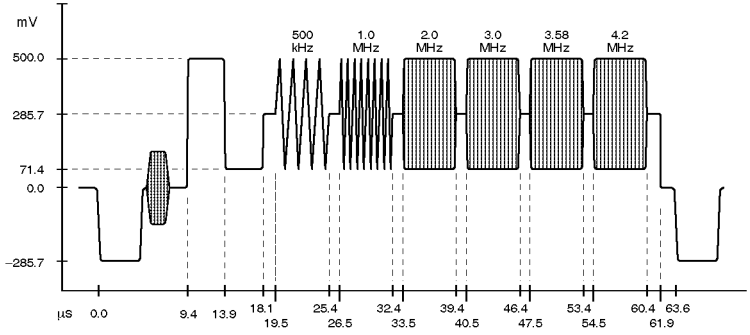



**Figure 36: NTSC Multiburst**

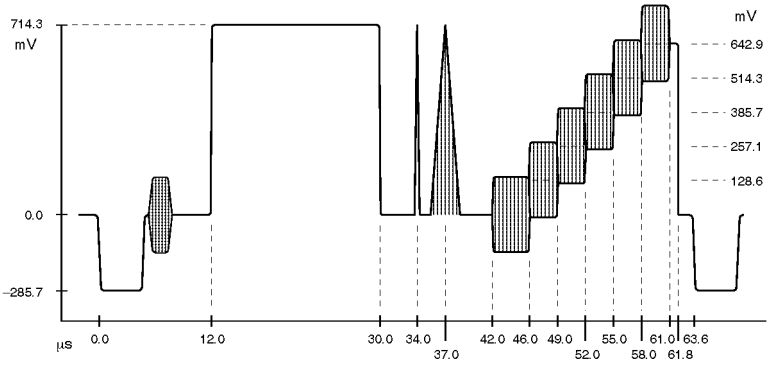



**Figure 37: NTC7 (NTSC) Composite**

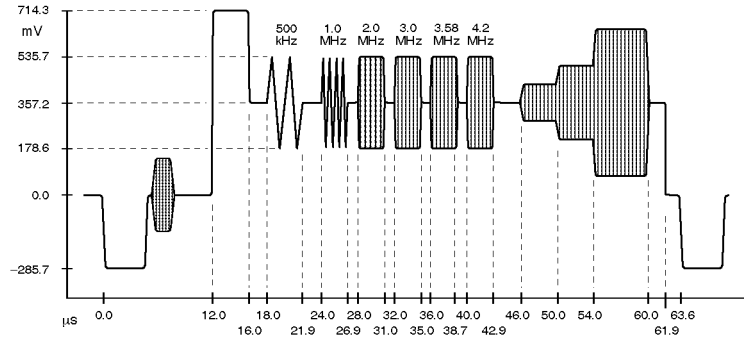



**Figure 38: NTC7 (NTSC) Combination**

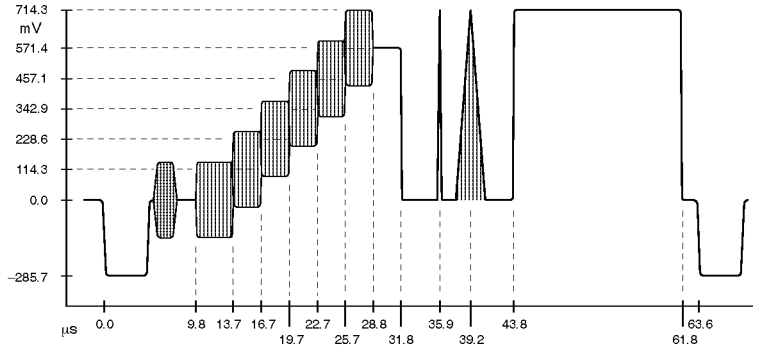



**Figure 39: FCC (NTSC) Composite**

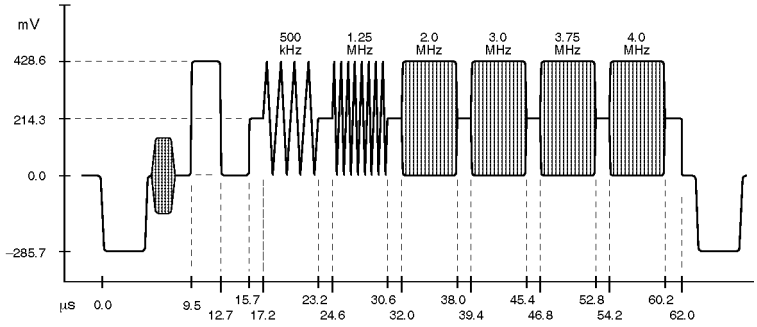



**Figure 40: NTSC Cable Multiburst**

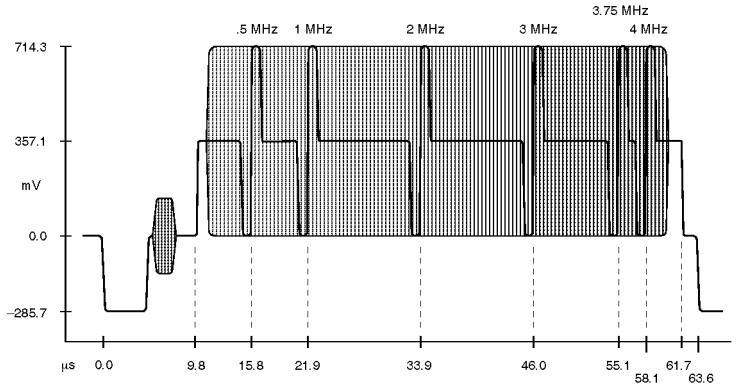



**Figure 41: NTSC Cable Sweep**

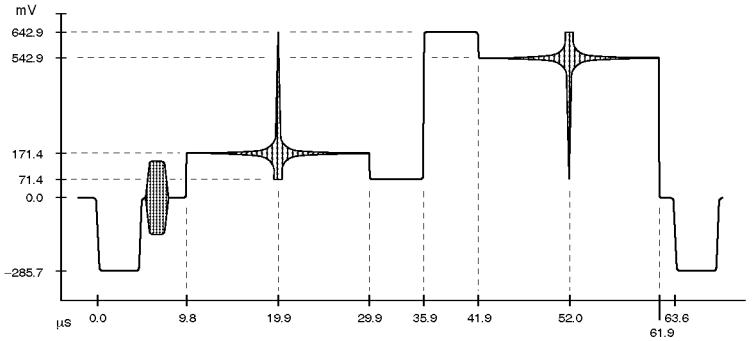



**Figure 42: NTSC SIN(X)/X**

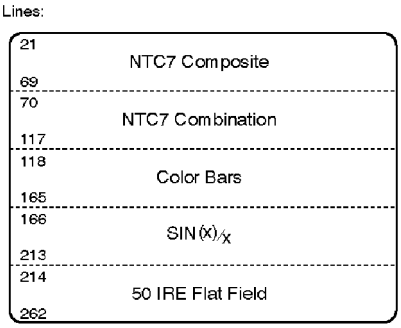



**Figure 43: NTSC Matrix**

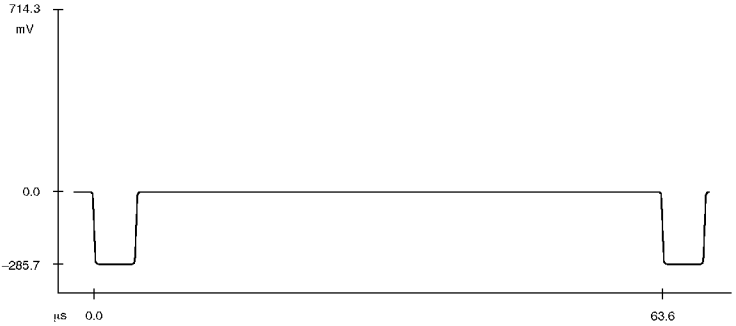



**Figure 44: NTSC 0 IRE No Burst**

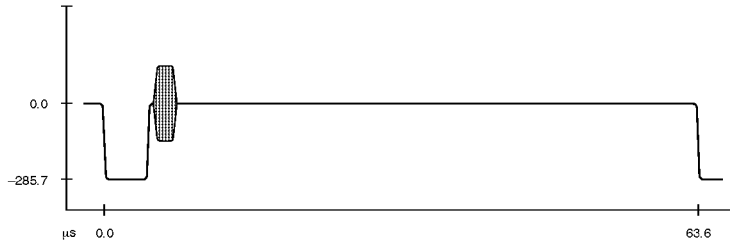



**Figure 45: NTSC Bounce (Low)**

# NTSC JAPAN (No Setup) Waveform Diagrams

(a) Color Bars, lines 21–182

(b) Reverse Blue Bars, lines 183–202

(c) IYQB for SMPTE Bars, lines 203–262

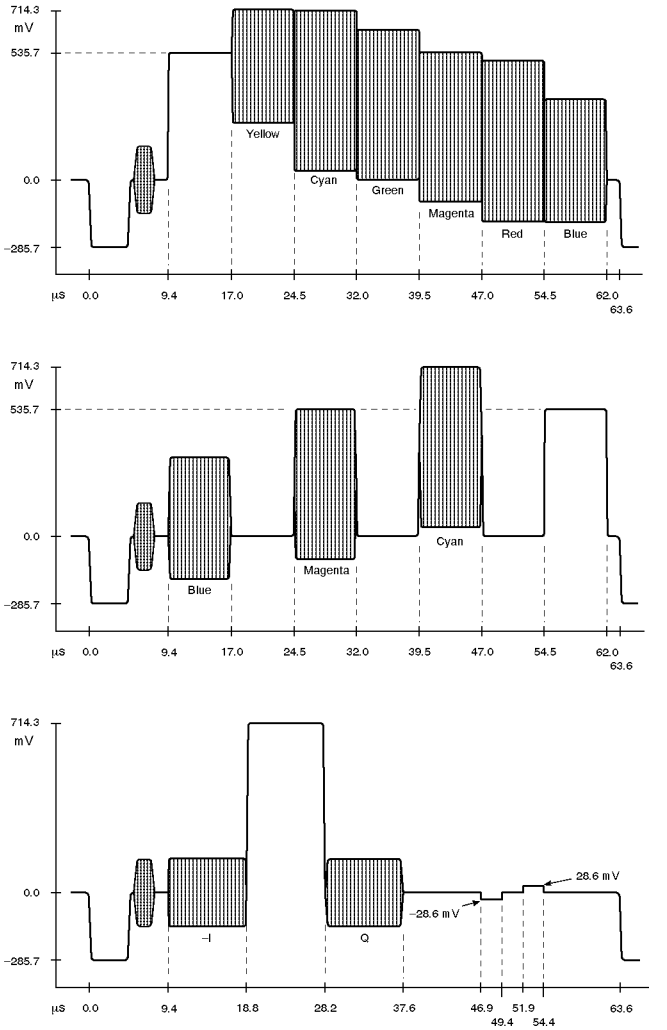



**Figure 46: SMPTE (NTSC) Color Bars, No Setup**

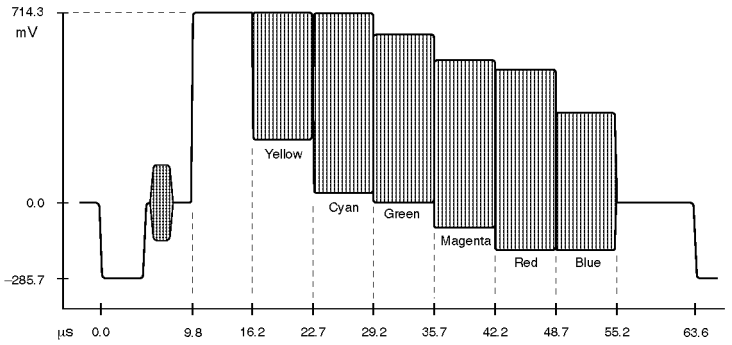



**Figure 47: NTSC 75% Color Bars, No Setup**

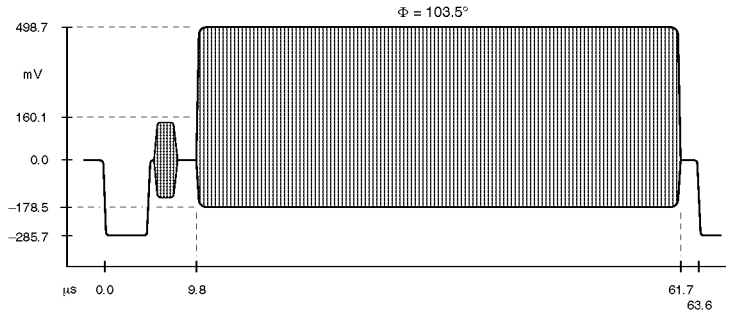



**Figure 48: NTSC Red Field, No Setup**

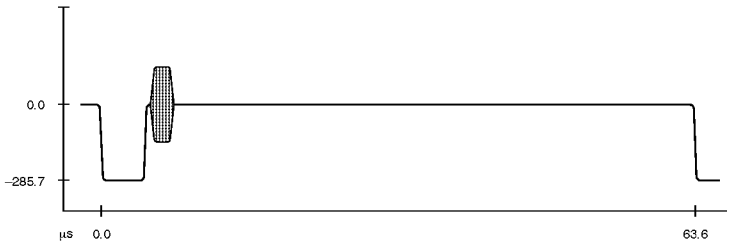



**Figure 49: NTSC Black Burst, No Setup**

# Replaceable Parts

The following replaceable parts for the TSG95 Pathfinder are available through your local Tektronix, Inc. field office or representative.

It is important when ordering parts to include the following information in your order: Part number; instrument type and number; instrument serial number; and modification number, if applicable.

| Description | Tektronix Part No. |
|---|---|
| Instructions (card) | 070-8915-xx |
| Service Manual (Optional accessory) | 070-8917-xx |
| Rechargeable Battery Pack (Optional accessory) | 119-4488-02 |
| Carrying Pouch | 016-1229-00 |
| AC Adapter | 119-7284-xx |
| Power Cord | See Table 14 |
| Case Assembly, Top | 614-0925-00 |
| Case Assembly, Bottom | 614-0913-00 |
| Stand, Black Vinyl Plastic | 386-6787-01 |
| Battery Door | 200-4075-00 |
| LCD Display | 119-5566-00 |
| Rear Panel Assembly | 333-4065-00 |
| Fuse 2.0A, 125V, Slow Blow | 159-0378-00 |

**Table 14: Power Cords**

| Option | Description | Part Number |
|---|---|---|
| A0 | North America power | 161-0066-00 |
| A1 | Universal EURO power | 161-0066-09 |
| A2 | United Kingdom power | 161-0066-10 |
| A3 | Australia power | 161-0066-13 |

**Table 14: Power Cords (Cont.)**

| Option | Description | Part Number |
|---|---|---|
| A6 | Japan power | 161-0298-00 |
| A10 | China power | 161-0304-00 |

# User Service

## Battery Hints

For optimal battery life and capacity, use the rechargeable NiCad battery pack (Tektronix p/n 119-4488-00) in full charge/discharge cycles. In other words, fully discharge the battery pack before recharging, and then charge the battery pack until fully charged, approximately 16 hours. A new battery pack will take a few charge/discharge cycles to reach full capacity.

***WARNING.*** *Install or replace batteries only with the instrument switched OFF and the AC adapter disconnected. Failure to do so could result in injury or death.*

*Replace the batteries only with standard AA batteries (1.2-1.5 V, nominal), or with the optional rechargeable battery pack.*

Setting the Auto Power Down (page 20) and Battery Type (page 21) functions in the diagnostic menu also have an impact on battery life. The battery types are disposable (Alkaline) or rechargeable (NiCad). Setting the battery type changes the voltage thresholds for both the BATTERY LOW display message and low-battery shutdown.

### The BATTERY LOW Message

The warning "BATTERY LOW" will appear on the second line of the TSG95 display when the battery voltage drops below a predetermined level. The level depends on the Battery Type set in the Diagnostic menu (see page 21). The TSG will operate for approximately ten minutes after the message first appears. For best results, replace or recharge the batteries when you first see this warning.

### Low Battery Shutdown

To prevent erratic operation at very low power levels, the TSG95 will shut itself down if the battery voltage drops below a second, lower threshold that also depends on the Battery Type setting.

Low-battery shutdown can happen with little or no warning if, for instance, the instrument has been left on by mistake with Auto Power

Down disabled. In such cases, the TSG95 is likely to shut itself down almost immediately the next time you switch it on. If this happens:

- Install fresh batteries or operate the instrument with the AC adapter, and
- Confirm that the Utility menu Battery Type setting is appropriate.

The shutdown threshold is higher for rechargeable batteries than for disposable. Therefore, you will receive a false BATTERY LOW message and may experience premature shutdown if using Alkaline batteries when the Battery Type is set to “rechargeable.” On the other hand, NiCad batteries may be damaged—they can lose their “rechargeability”—if they are discharged to the TSG95 threshold for disposable batteries. Be sure to select the correct Battery Type.

## Preventive Maintenance

Under average conditions, the TSG95 should receive preventive maintenance every 2000 hours. This is approximately one year of operation. Preventive maintenance includes cleaning, visual inspection, a performance check and, if necessary, calibration. See the Service manual for performance verification and adjustment procedures.

***CAUTION.*** *The TSG95 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.*