

# User Manual

**Tektronix**

## **TSG 90 PATHFINDER NTSC Signal Generator**

**070-8964-00**

**Please check for change information at the rear  
of this manual.**

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For further information, contact: Tektronix, Inc., Corporate Offices,  
**P.O. 500, Beaverton, Oregon, 97077**

# Warranty

Tektronix warrants that the TSG 90 PATHFINDER NTSC Signal Generator will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If this product proves defective during the 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 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.**



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# Getting Started

Please note the following statements before using your new TSG 90 PATHFINDER.



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**CAUTION.** *Attempting to operate the TSG 90 with an improper AC adapter can result in permanent damage to 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.*

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**WARNING.** *Install or replace batteries only with the instrument switched OFF and the AC adapter disconnected.*

*Replace the batteries only with standard AA batteries (1.2–1.5 V, nominal), or with a Tektronix rechargeable battery pack (p/n 119-4488-00).*

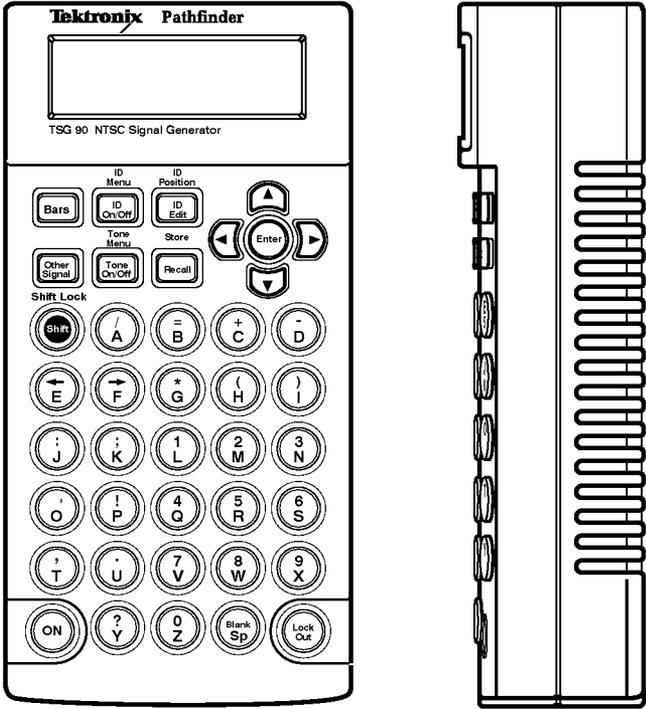
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If you have any questions regarding the operation of this instrument, please contact your nearest Tektronix representative or field office. In the United States and Canada, you may also call the Tektronix information number, 1-800-TEK-WIDE (1-800-835-9433), between 8:00 am and 5:00 pm Pacific time.



# Operating Basics

The TEKTRONIX TSG 90 PATHFINDER TV Signal Generator is designed for ease of operation and outstanding portability. It provides a complement of 16 NTSC test signals, including the Safe Area signal. It also provides 13 selectable audio frequencies from 50 Hz to 20 kHz, a 50 Hz to 20 kHz audio sweep, and an audio click channel ID. The two stereo AUDIO outputs may be set to one of three selectable amplitudes: 0 dBu, +4 dBu, or +8 dBu.



The PATHFINDER provides character ID capability, as well, storing up to eight messages consisting of two 16 character lines of text. Any one of these text messages may be inserted into the video test signal, or up to four of them may be cycled in a continuous loop (displaying for 1 to 9 seconds each) in any order. These messages may be displayed anywhere in the safe action area of the pic-

ture, or the first line of the message may be moved into the vertical interval.

In addition to the eight text messages, the PATHFINDER can also store as many as four complete front-panel configurations (user presets), which can include menu selections, text messages, and tone and cycle information.

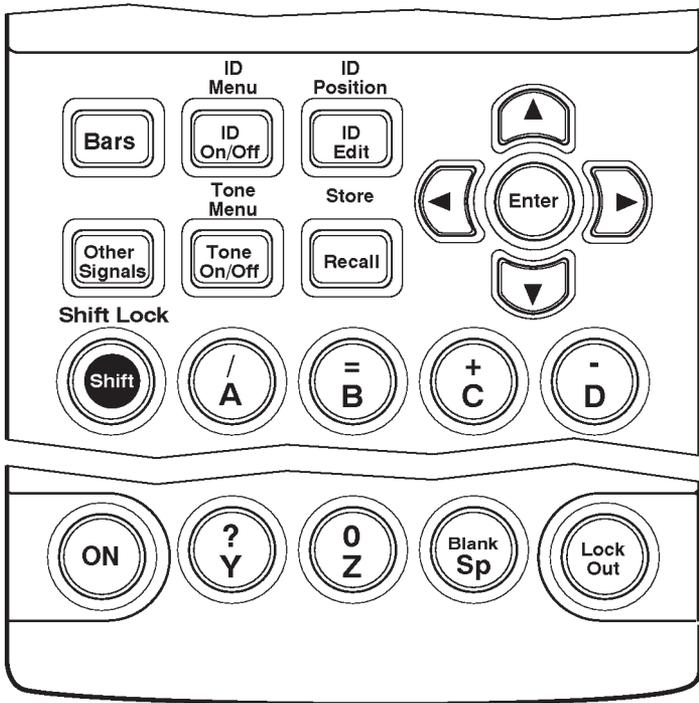
You may power the PATHFINDER with the standard AC adapter, the optional 9.6 V NiCad battery pack, or with eight standard AA batteries. AA batteries are not supplied with the instrument.

- Remember that attempting to operate the TSG 90 with an improper AC adapter can result in permanent damage to the instrument. **USE AN APPROPRIATE DC POWER SOURCE ONLY:** 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.
- The optional NiCad battery pack may be recharged without removing it from the instrument. The AC adaptor will provide a “trickle” charge to the pack whenever the adaptor is connected to the PATHFINDER and an AC power source.
- Rechargeable AA batteries may be used, but they will not be recharged when in the instrument. To recharge AA batteries, remove them from the PATHFINDER and use any appropriate charger.

## Controls

PATHFINDER controls consist of a keypad, which has buttons to make operational selections and entering menus; alphanumeric buttons for text entry and test signal selection; and arrow buttons for maneuvering through the menus and positioning text on screen. There is an enter button in the center of the arrow keys, used in menu selections. There is also a Shift/Shift Lock button, an ON button, and a Lock Out button.

**Shift/Shift Lock.** The Shift/Shift Lock button is used to access the upper (shifted) nomenclature associated with each of the buttons, including itself. When Shift is pressed, a reverse video S is dis-



played in the lower right corner of the LCD display, indicating that the next keystroke will use the shifted nomenclature. If the next keystroke is the Shift button again, then the keypad is locked into the shift mode and all keystrokes will use the shifted nomenclature. The LCD display shows a reverse video SL, indicating that shift lock is active. Shift Lock is cancelled by pressing the Shift button a third time.

**Lock Out.** The Lock Out button is used to disable the keypad. While locked out, pressing any key (except Lock Out or ON) produces the message “press Lock Out” on the LCD display and has no other effect. While in Lock Out mode, a lock symbol (padlock icon) appears in the lower right corner of the LCD display.

Holding the Lock Out button down while switching the instrument on will invoke the diagnostic menu. See Appendix C (page 27) for more information.

**Bars and Other Signals.** The Bars and Other Signals buttons are used, along with the alphanumeric keys, for selecting test signals. This occurs in the Signal Select mode; the default operating mode for the PATHFINDER. The PATHFINDER powers up in this mode, and returns to it after exiting any of the other modes. While in the Signal Select mode, the Bars button selects SMPTE Bars and 75% Bars, and the Other Signals button scrolls through the remaining test signals. The arrow keys will also scroll forward and backward through the signal list. In addition, the alphanumeric keys may be used to select signals directly, eliminating the need to scroll through all the signals to get to the one you want:

**Direct Signal Selection List**

A=SMPTE Bars	I=Field Square Wave
B=75% Bars	J=50 IRE Flat Field
C=Multiburst	K=0 IRE No Burst
D=NTC7 Composite	L=Black Burst
E=NTC7 Combination	M=SIN X/X
F=FCC Composite	N=Convergence
G=5 Step	O=Matrix
H=Red Field	P=Safe Area

**Option 1J Direct Signal Selection List  
SN B021565 and Above**

A=SMPTE Bars	I=Red Field
B=75% Bars	J=Field Square Wave
C=SNG Bars	K=50 IRE Flat Field
D=Multiburst	L=Black Burst
E=NTC7 Composite	M=SIN X/X
F=NTC7 Combination	N=Convergence
G=FCC Composite	O=Matrix
H=5 Step	P=Safe Area

**ID On/Off and ID Menu.** The ID On/Off button toggles the character ID messages (captions) on and off. The LCD display will read **ID=off**, **ID=on** for a single text ID message, or **ID=cyc** if cycle has been turned on in the ID Menu. The ID Menu is accessed by pressing the Shift button before pressing the ID On/Off button. The ID Menu allows the ID cycle to be turned on or off, sets the display time for the captions, and selects which of the stored ID messages to cycle in what order.

**ID Edit and ID Position.** Pressing the ID Edit button enters a mode where the current ID text can be edited. Editing occurs off-line, in an edit buffer, so any displayed messages are not affected. When finished editing, pressing the Enter button saves the ID from the edit buffer as the current ID, and the new text is inserted into the video signal, unless the ID cycle function is in use.

The ID Position mode (Shift-ID Edit) allows positioning of the message on screen. The H and V readouts on the LCD display allow the operator to determine where the message is being positioned, even if there is no video display available. The H value shows how many letter spaces from the left edge the message starts. The V value shows the character line that the first line of text occupies. If the first line of text is placed into the vertical interval, the LCD display will read V=vert.

**Tone On/Off and Tone Menu.** The Tone On/Off button toggles the audio tone on and off. When Tone is On, the LCD display will display the selected audio level (for example, **Tone=4dB**). The Tone Menu (Shift-Tone On/Off) is used to select the tone frequency, select the audio level (0, +4, or +8 dBu), and to turn the audio click on and off.

The tone frequency menu will select one of 13 fixed frequencies between 50 Hz and 20 kHz, or a 50 Hz–20 kHz audio sweep. This sweep signal is composed of 27 separate frequencies, more than double the number of specified fixed frequencies. While in the tone frequency menu, with sweep selected (displayed on the LCD readout), pressing the ENTER key will stop the sweep and the PATH-FINDER will continue to output the frequency it was producing when the ENTER key was pressed. The display will change from **SWEEP 50–20K** to **SWEEP PAUSED**. This is useful for checking

a problem noticed at a particular frequency while sweeping, and also allows the use of frequencies not specifically addressed in the Tone Menu. Pressing the ENTER key again will restart the sweep.

**Recall and Store.** The Recall button allows the user to recall one of eight user-defined IDs or four user presets. In this mode, the left/right arrows select the ID or preset number, and pressing ENTER will then recall it. The up and down arrow buttons may be used to view the second line of the text message before recalling.

Store is used to store the current ID text with an assigned ID number, or it will store the current text and instrument settings as a user preset.

# Appendix A: Characteristics

This appendix contains information about the TSG 90 and its output that the operator may find useful. Included are illustrations of the various test signal waveforms and, where helpful, accompanying tables. Signal timing information appears on each figure; the corresponding table—if any—contains nominal amplitude values that may not be apparent in the figure. See the TSG 90 Service Manual, Tektronix p/n 070-8706-00, for more complete descriptions of the test signals.

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**NOTE.** *The information in this section is included for the convenience of the TSG 90 operator. It is not intended as a list of guaranteed specifications or performance requirements. For a full listing of PATHFINDER specifications, and complete performance verification and adjustment procedures, please see the TSG 90 Service Manual.*

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**Table 1: Physical Data and Environmental Limits**

Characteristic	Nominal Value/Limits
Height	5.6 cm (2.2 in)
Width	9.1 cm (3.6 in)
Depth	19.1 cm (7.5 in)
Weight without batteries with battery pack	0.48 kg (1.06 lb) 0.68 kg (1.5 lb)
Temperature Limits Operating Storage (w/o batteries)	0° to +50° C (32 to +122° F) -30° to +65° C (-22 to +149° F)
Altitude Limits Operating Storage	to 4267 m (14,000 feet) to 15420 m (50,000 feet)

**Table 2: Power Requirements/Battery Life**

Characteristic	Information
DC Input Voltage Range Polarity	9 to 15 V NEGATIVE CENTER
Typical Battery Life Alkaline Cells Rechargeable Pack	10 to 16 hours 4 to 6 hours
Recharging Time	Approximately 16 hours (completely discharged to fully charged)

**Table 3: Test Signal Generator—General Characteristics**

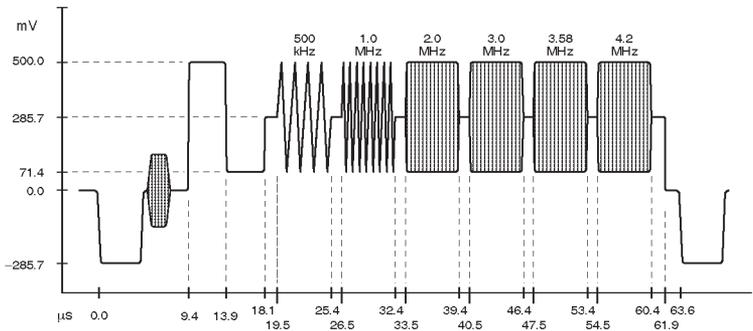
Characteristic	Specification
Luminance Accuracy	$\pm 1\%$ of 714.3 mV (100 IRE)
Rise Time Accuracy	$\pm 10\%$ (unless specified)
Subcarrier Stability	3.579545 MHz $\pm 10$ Hz (0° to 45° C)
Y/C Gain	$\pm 2\%$ of 714.3 mV (100 IRE)
Y/C Delay	$\leq 15$ ns
Frequency Response	Flat within $\pm 2\%$ to 4.2 MHz
SCH Phase Accuracy	$0 \pm 5^\circ$
Differential Phase	$\leq 1^\circ$
Differential Gain	$\leq 1\%$
Line and Field Tilt	$\leq 0.5\%$
2T Pulse K Factor	$\leq 0.5\%$
Blanking Level	0 mV $\pm 50$ mV
Burst Amplitude	285.7 mV (40 IRE) $\pm 2\%$
Sync Amplitude	285.7 mV (40 IRE) $\pm 2\%$

**Table 4: Audio Tone Output**

Characteristic	Information
Amplitude	0, +4, or +8 dBu $\pm$ .25 dBu into 600 $\Omega$
Frequencies	50, 63, 125, 250, and 400 Hz; 1, 2, 4, 8, 10, 12.5, 16, and 20 kHz $\pm$ 0.5 Hz; Sweep
Sweep	1 kHz for 5 s followed by 0.5 s at each of the following frequencies: 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.

**Table 5: Multiburst Test Signal**

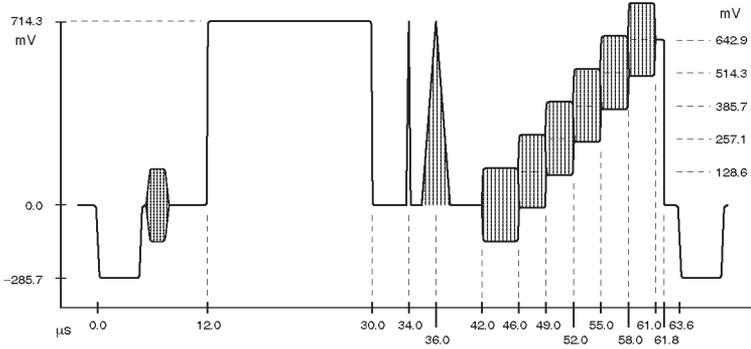
Characteristic	Nominal Value
Amplitudes White Bar Packets Pedestal	500 mV (70 IRE) 428.6 mV (60 IRE), peak-to-peak 285.7 mV (40 IRE)
Burst Frequencies	0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz
Packet Rise Times	0.5 MHz, 140 ns typical; All others; 400 ns typical



**Figure 1: Multiburst**

**Table 6: NTC7 Composite**

Characteristic	Nominal Value
Bar	
Amplitude	714.3 mV (100 IRE)
Rise time	125 ns $\pm$ 25 ns
2T Pulse	
Amplitude	714.3 mV (100 IRE)
HAD	250 ns
Modulated 12.5T Pulse	
Amplitude	714.3 mV (100 IRE)
HAD	1.563 $\mu$ s
Modulated Phase	60.8° $\pm$ 1°
Modulated 5-Step	
Luminance Amplitude	642.9 mV (90 IRE)
Chroma Amplitude	285.7 mV (40 IRE) peak-to-peak



**Figure 2: NTC7 Composite**

Table 7: NTC7 Combination

Characteristic	Nominal Value
Multiburst	
Bar Amplitude	714.3 mV (100 IRE)
Packet Amplitude	357.2 mV (50 IRE) peak-to-peak
Pedestal	357.2 mV (50 IRE)
Burst Frequencies	0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz
Modulated Pedestal	
Pedestal Amplitude	357.2 mV (50 IRE)
Chroma Amplitudes	142.8, 285.7, 571.4 mV (20, 40, 80 IRE)
Rise Time	400 ns

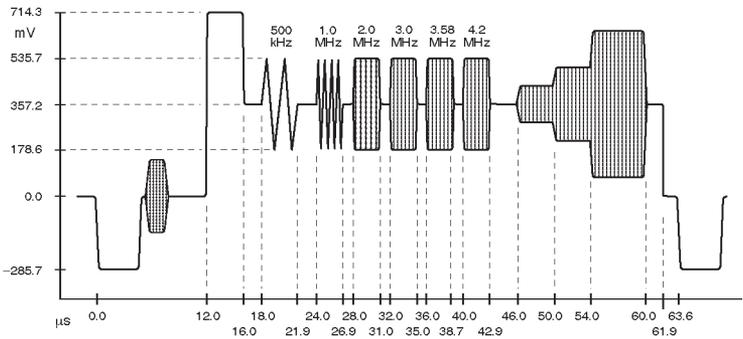
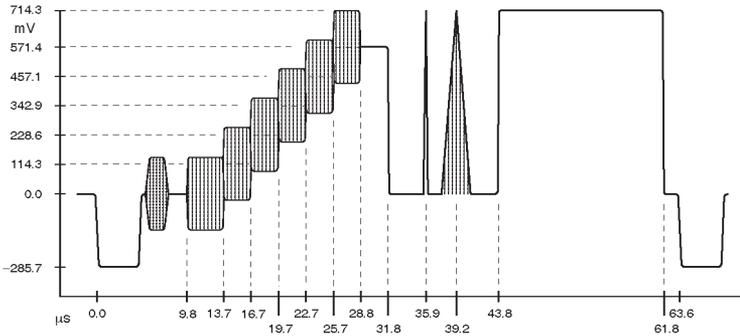


Figure 3: NTC7 Combination

**Table 8: FCC Composite**

Characteristic	Nominal Value
Bar	
Amplitude	714.3 mV (100 IRE)
Rise Time	250 ns
2T Pulse	
Amplitude	714.3 mV (100 IRE)
HAD	250 ns
Modulated Sin <sup>2</sup> Pulse	
Amplitude	714.3 mV (100 IRE)
HAD	1.563 μs
Modulated Phase	60.8° ± 1°
Modulated 5-Step	
Luminance Amplitude	571.4 mV (80 IRE)
Chroma Amplitude	285.7 mV (40 IRE) peak-to-peak

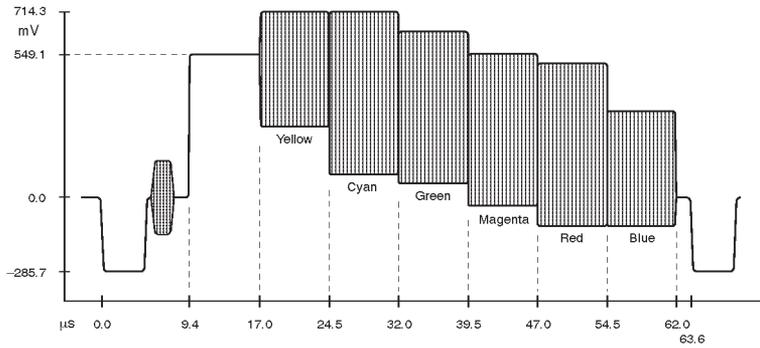


**Figure 4: FCC Composite**

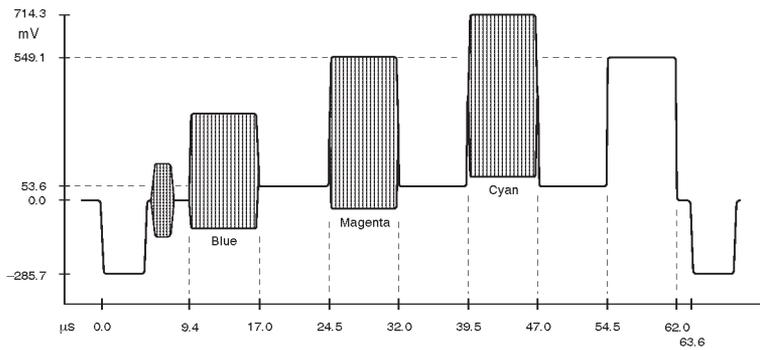
**Table 9: Remaining Test Signals**

Signal	Comments
SMPTE Bars	Figure 5, page 16
75% Color Bars	Figure 6, page 17
5-Step Staircase	Figure 7, page 17 Linearity error $\leq 1\%$
Red Field	Figure 8, page 17 Chroma Amplitude, 626.7 mV (87.7 IRE) p-p
Field Square Wave	Figure 9, page 18 Highlight the page num White on lines 70 through 213
50 IRE Flat Field	Figure 10, page 18
0 IRE, No Burst (STD only)	Figure 11, page 18
Black Burst	Figure 12, page 19 7.5 IRE active video
SIN(X)/X	Figure 13, page 19 Spectrum, -3 dB at 4.75 MHz
Convergence	Figure 14, page 20 14 Horizontal lines, 17 Vertical lines
Matrix	Figure 15, page 20 Line numbers in the figure are inclusive
Safe Area	Figure 16, page 21 Safe action area indicated by lines 33 and 250; Safe title area indicated by lines 45 and 238
SNG Bars* (Opt 1J only) Lines 21 – 163 Lines 164 – 198 Lines 199 – 209 Lines 210 – 262	Figure 17, page 23  30 IRE Flat Field Color Bars of 0 Setup SMPTE Color Bars IYQB of 0 Setup SMPTE Color Bars 30 IRE Flat Field

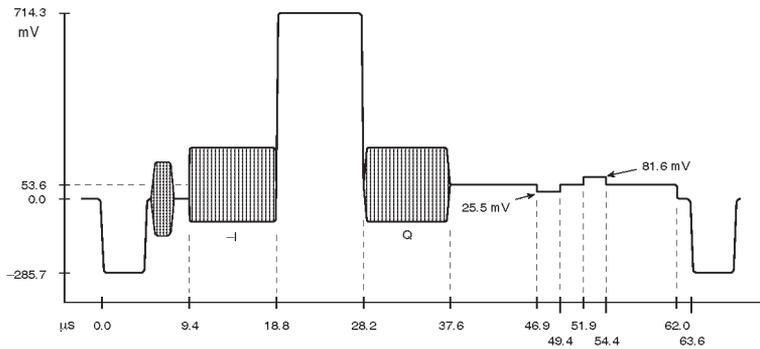
\*SN B021565 and above



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



(b) Reverse Blue Bars, lines 183–202



(c) IQB for SMPTE Bars, lines 203–262

Figure 5: SMPTE Color Bar Signal Components

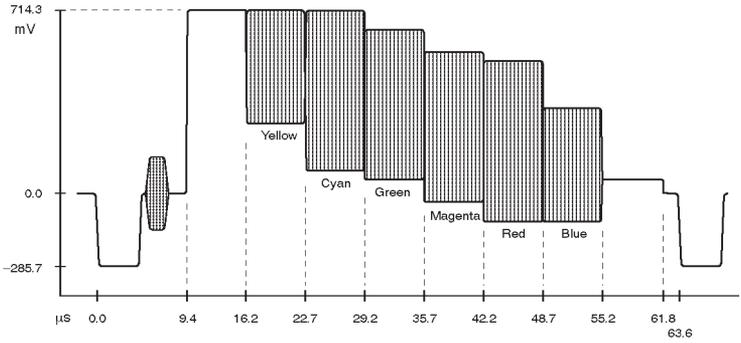


Figure 6: 75% Bars

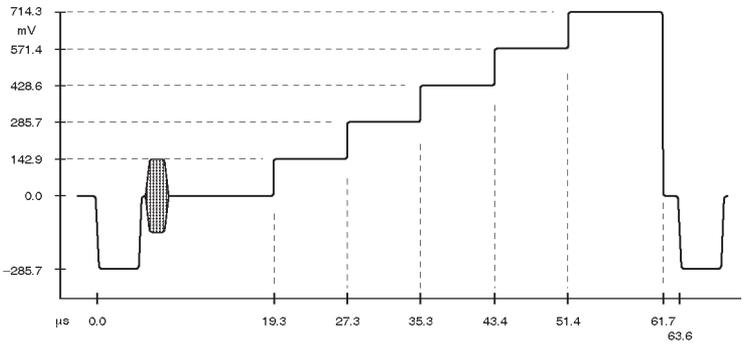


Figure 7: 5-Step Staircase (Gray Scale)

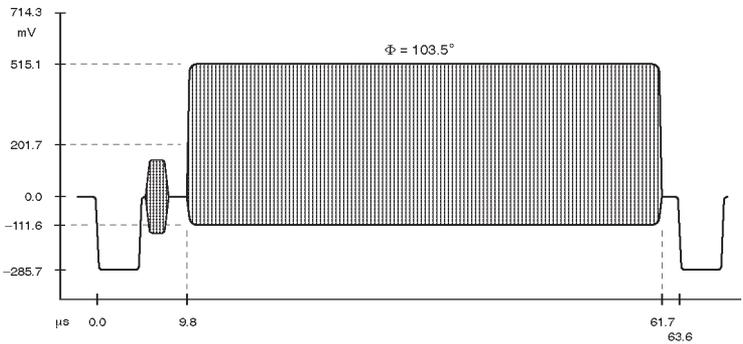


Figure 8: Red Field



Figure 9: Field Square Wave

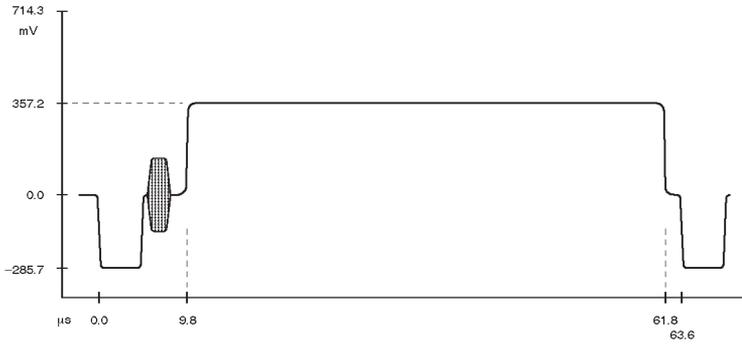


Figure 10: 50 IRE Flat Field

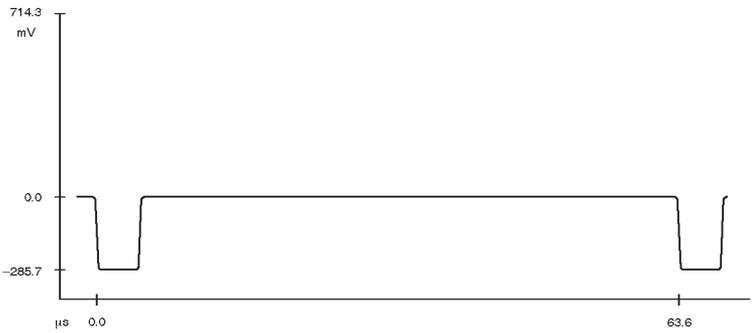


Figure 11: 0 IRE, No Burst

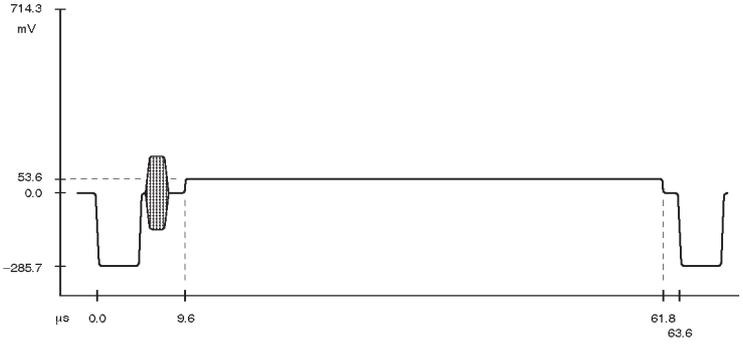


Figure 12: Black Burst

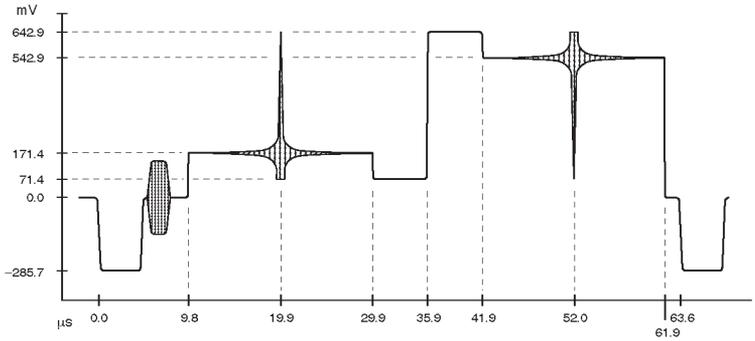
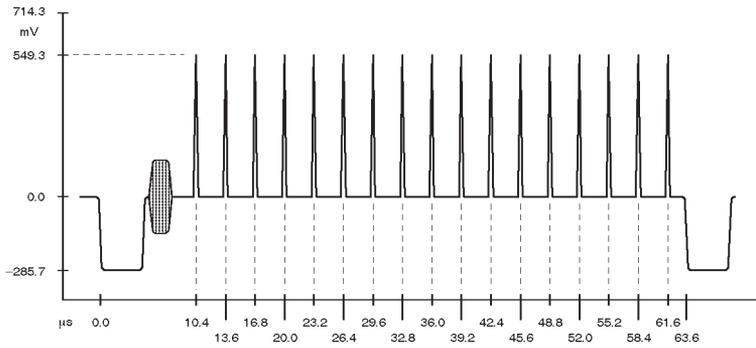


Figure 13: SINX/X



(a) Horizontal Component



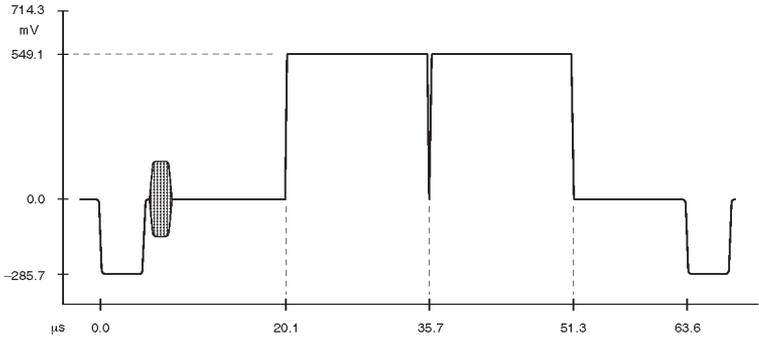
(a) Vertical Component

Figure 14: Convergence Signal Components

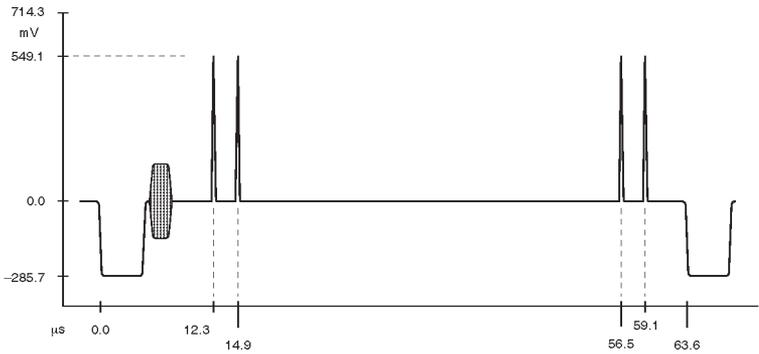
Lines:

21	NTC7 Composite
69	
70	NTC7 Combination
117	
118	Color Bars
165	
166	$SIN(x)/x$
213	
214	50 IRE Flat Field
262	

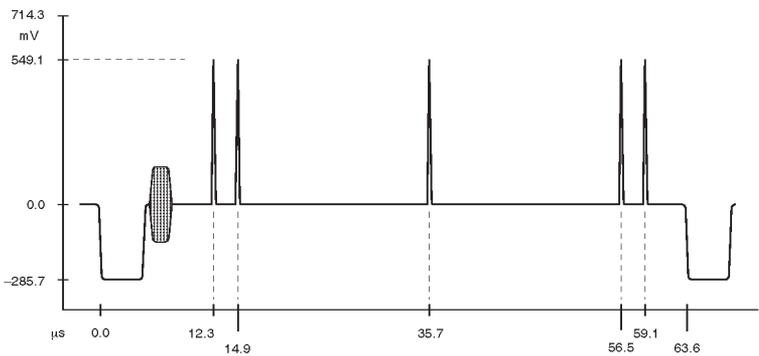
Figure 15: Matrix



Lines 33, 45, 238, and 250

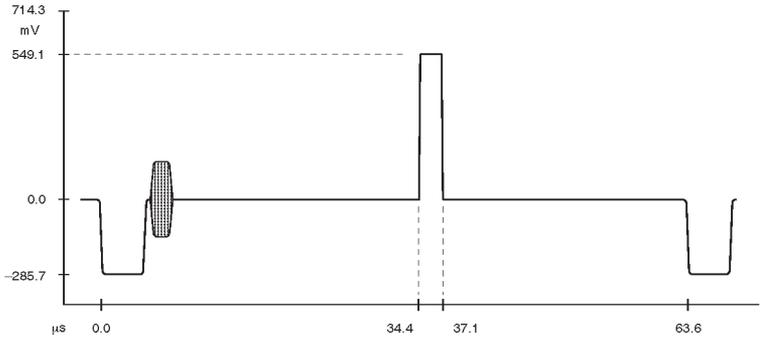


Lines 69-132 and 149-213

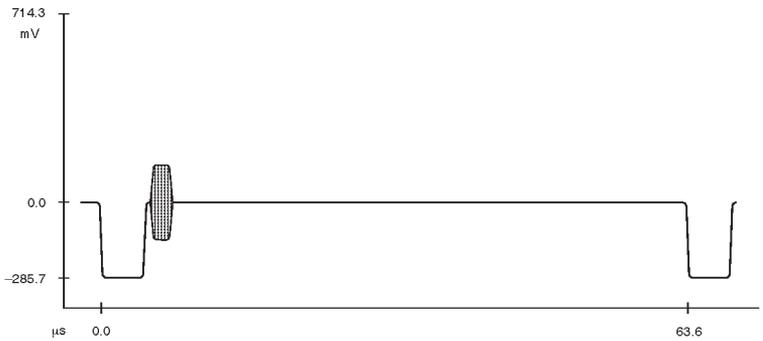


Lines 133-140 and 142-148

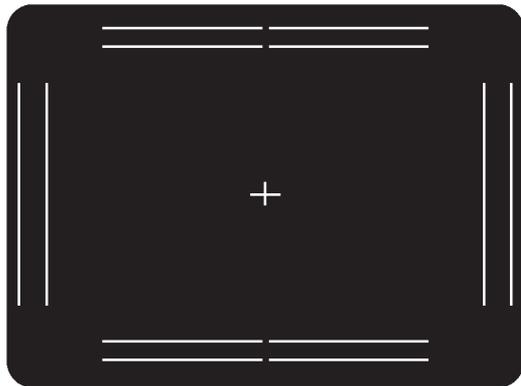
Figure 16: Safe Area Signal Components



Line 141



All remaining lines



Safe Area display

Figure 16 (cont.): Safe Area Signal Components

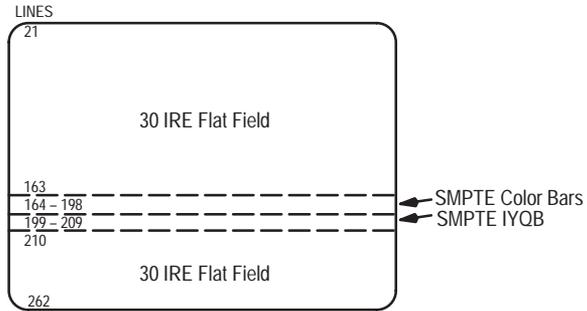


Figure 17: SNG Bars (Option 1J only)



# Appendix B: Replaceable Parts

The following Replaceable parts for the TSG 90 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.

<b>Description</b>	<b>Tektronix Part No.</b>
Reference Card	063-1449-00
Service Manual (Optional accessory)	070-8706-00
Rechargeable Battery Pack (Optional accessory)	119-4488-00
Carrying Pouch	016-1229-00
AC Adapter	119-4538-00
Case Assembly, Top	614-0915-00
Case Assembly, Bottom	614-0913-00
Battery Door	200-4075-00
LCD Display	119-4506-00
Rear Panel Assembly	333-4065-00
Fuse 1.5A, 125V	159-0153-00



# Appendix C: 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.



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**WARNING.** *Install or replace batteries only with the instrument switched OFF, and the AC adapter disconnected.*

*Replace the batteries only with standard AA batteries (1.2–1.5 V, nominal), or with a Tektronix rechargeable battery pack (p/n 119-4488-00).*

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Setting the Battery Type and the Auto Power Down functions in the diagnostic menu also has an impact on battery life. The battery types are disposable (Alkaline) or rechargeable (NiCad). Setting the battery type changes the voltage level that causes the battery low message to be displayed, and also changes the cut-off voltage for instrument operation.

The Auto Power Down function, when enabled, shuts the PATH-FINDER off when there is no keypress for approximately 10 minutes, to conserve battery life. Auto Power Down is indicated, when enabled, by a rotating line in the upper right corner of the display.

## The Diagnostic Menu

To enter the diagnostic menu, hold the Lock Out button down while turning the instrument on. To exit the diagnostic menu and resume normal instrument operation, press any of the rectangular buttons at the top of the keypad.

The diagnostic menu items are listed below. Use the up (▲) and down (▼) arrow keys to move up and down the list.

1. Auto power-down; use the left (◀) or right (▶) arrow key to toggle between enabled and disabled.
2. Battery type; use the left (◀) or right (▶) arrow key to toggle between disposable or rechargeable.
3. Factory Reset; press the Enter button to reset the instrument to the factory defaults. *WARNING: All user selections will be lost.*
4. LCD Diagnostic; press the ◀ key to turn all segments on, and press the ▶ key to turn all segments off.
5. Tone LVL0; used in setting the 0 dBu tone level. See the Service manual (Tektronix p/n 070-8706-00) for the audio amplitude adjustment procedure.
6. Tone LVL4; used in setting the 4 dBu tone level. See the Service manual for the audio amplitude adjustment procedure.
7. Tone LVL8; used in setting the 8 dBu tone level. See the Service manual for the audio amplitude adjustment procedure.

## Preventive Maintenance

Under average conditions, the PATHFINDER 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 PATHFINDER case is made of molded plastic. Do not allow water to get inside of 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.*

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