User Manual

Tektronix

WFM 90 & WFM 91
Handheld Waveform, Vector, Picture, & Audio Monitor

070-8968-05

This document supports firmware version 1.00 and above.

CE

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

WARRANTY

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

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

The common terminal is at ground potential. Do not connect the common terminal to elevated voltages.

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

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

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Safety Terms and Symbols

Terms in This Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. These symbols may appear on the product:

CAUTION
Refer to Manual

Double
Insulated

Battery Recycling

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

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

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

Preface

This manual is a guide for operators of the WFM 90 and WFM 91 Waveform, Vector, Picture, and Audio Monitor, and contains instructions for practical use.

Throughout this manual, instrument controls and display readouts appear in ALL CAPITALS.

Manual Overview

The following is a brief description of the content of the different sections of this manual:

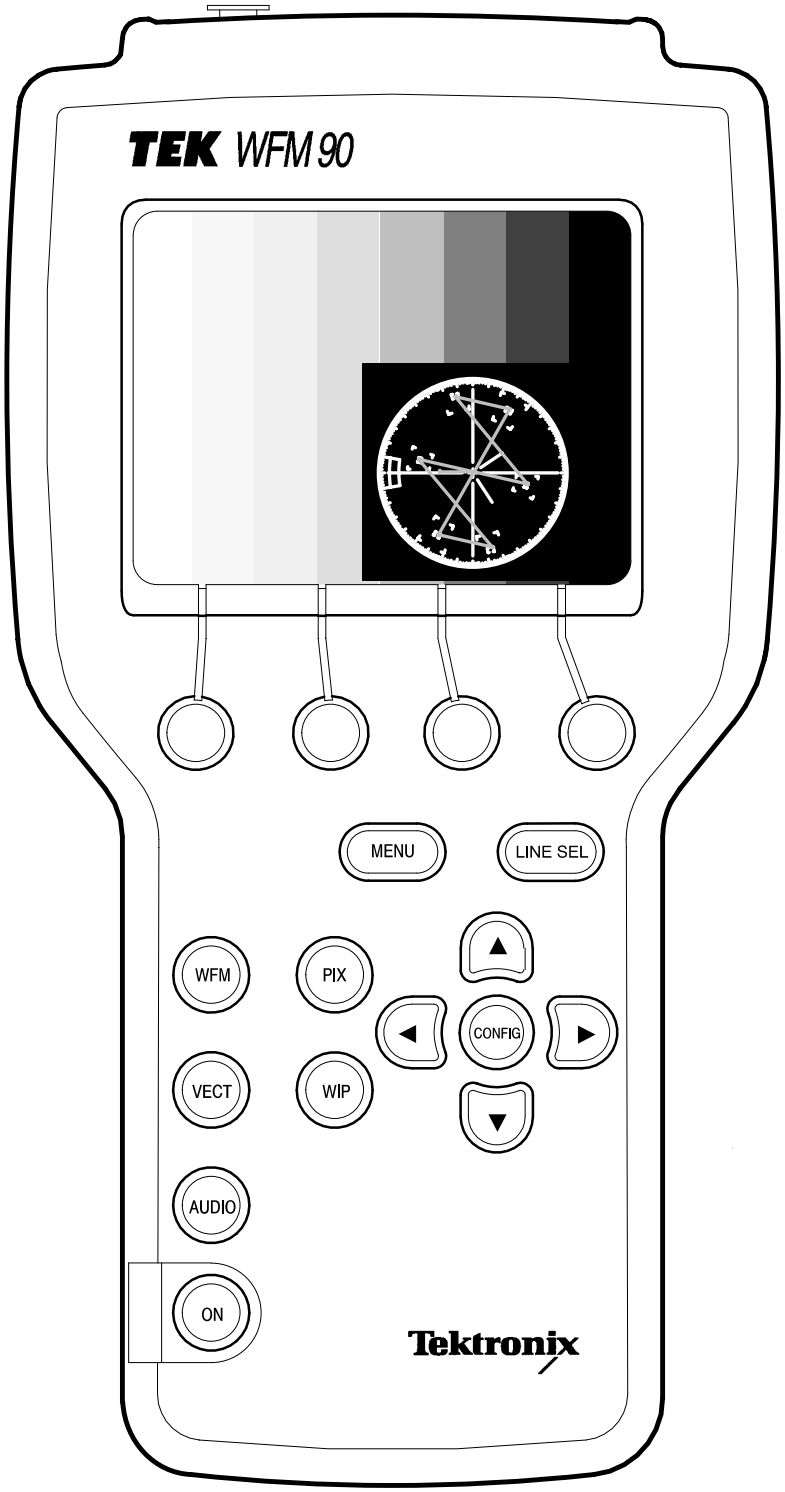
Getting Started provides a product description, a list of available options and accessories, and information concerning the electrical and mechanical installation of the instrument.

Operation Basics contains a functional description of instrument operation and is followed by an operator familiarization tutorial.

Reference provides descriptions of each menu selection and also describes the different graticules and how to use them to make basic signal measurements.

Appendix A lists complete instrument specifications, both electrical and mechanical.

Appendix B provides instructions for preventive maintenance of the instrument.



The WFM 90 Handheld Waveform, Vector, Picture, and Audio Monitor

Getting Started: Product Description

The Tektronix WFM 90 and WFM 91 is a handheld, self-contained, rasterizing television waveform/vector/picture/audio monitor. The instrument has a built-in LCD color display device and is powered by batteries or by an AC adapter producing 12 VDC.

Applications

The WFM 90 and WFM 91 can be used in traditional in-house applications of television production, post-production, and signal transmission. The portability of this instrument allows it to be used in non-traditional applications such as field production and system maintenance.

Key Features

- Rasterized waveforms and graticules shown on the built-in color, 4-inch diagonal TFT LCD display with viewing angle adjustment
- Instrument is powered by batteries or a DC adapter
- Menu-assisted monitoring operation
- Video and audio signal input/output capability
- Waveform, Vector, Picture, Audio, and Waveform-in-Picture display modes
- Line Select mode which allows the selection of any single line of video for viewing
- Time-out mode which shuts off power to the display backlight and/or the instrument when the instrument is not in use
- Signal level alarm mode for the waveform and audio displays
- Preset menu to store/recall the front panel and menu setup
- Instrument readjustment is performed entirely from the keypad (the adjustment procedures are located in the service manual)

Description of Features

Rasterized Color LCD Display

The WFM 90 and WFM 91 uses a proprietary rasterizer which displays analog waveforms or vectors on the color 4-inch diagonal, backlit thin-film transistor (TFT) LCD raster display, simultaneously with the appropriate measurement graticules. A viewing-angle control for the display permits optimal signal viewing from different positions.

The LCD display will retain an image if the instrument is left on in one display mode for an extended period of time. This is typical for the LCD display device. The retained image will fade over time, and the fading can be accelerated by leaving the instrument turned off.

CAUTION. *LCD Display Image Retention*

To prevent image retention in the LCD display, enable the backlight time-out mode or turn the instrument off if the monitor is going to be left alone for more than two hours.

Battery or AC Adapter Operation

The instrument can be powered by six C-cell batteries, (alkaline or NiCad) by an internally rechargable NiCad battery pack, or by an AC adapter wall unit with a negative center lead producing 12 VDC. The rechargeable NiCad battery pack is automatically recharged when the 12 VDC adapter is plugged into the instrument, while instrument power is on or off.

NOTE*. To avoid uninterupted operation when using the wall adapter, be sure that the batteries are installed in the instrument.*

***NOTE**. Only the NiCad battery pack recharges in the instrument.*

Alkaline batteries are not recharged. The message LOW BAT is displayed in the on-screen readout when the batteries get critically low on power.

Menu-Assisted Monitoring Operation

The menus use a combination of on-screen readout and multi-use buttons, in conjunction with the Arrow Buttons, to control most of the monitoring functions. Menus are entered by pressing one of the MENU, CONFIG, or LINE SEL buttons. Menus are exited by pressing the entry button for the open menu, or by entering another menu.

Video and Audio Input/Output

The WFM 90 and WFM 91 displays signals from the one channel of composite video input, or from the one channel of audio input. An external reference input allows the use of an external sync signal.

The video and external reference inputs are BNC connectors, each with a rear-panel switch providing the choice of an internal 75 Ω signal termination, or an unterminated high-impedance input. The audio input is a standard 3-pin XLR connector.

The video output is a BNC connector that will drive a remote monitor or video switcher. The audio output is a mini-headphone stereo jack which outputs the mono input signal to both stereo channels. The audio volume is fixed for each reference level. The larger the displayed signal, the louder the volume.

Waveform Display Mode

The Waveform display mode provides a voltage-versus-time display of the video signal with three standard sweep rates: 1H (5 μs/division), 2H (10 μs/division), and 2F (two field). Each line-rate sweep can be magnified X10 to sweep rates: 1H Mag (0.5 μs/division), and 2H Mag (1 μs/division). The 2F sweep is magnified by approximately X20.

Vertical gain is fixed at X1 or X5, or variable from 45% to 155%. The gain setting tracks between the Waveform and Vector display

modes. The signal filters are Flat (no filter) and Luminance (low-pass filtered). The Line Select mode enables the selection of a single line of video for display.

Vector Display Mode

The Vector display mode presents an XY plot of the demodulated chrominance phase and amplitude portion of the video signal. The vector angle represents chrominance phase, and the distance from the center represents chrominance amplitude. The vector display is useful when making differential gain and phase measurements.

A full 360° phase shifter, and 75% and 100% color bar settings are provided. Vector gain is fixed at X1 or X5, or variable from 45% to 155%. The gain setting tracks between the Waveform and Vector display modes. The +V mode (PAL only) overlays the –V axis on the +V axis to check the PAL system color encoders.

Picture Display Mode

The Picture display mode provides an unprocessed full color display of the composite video signal. The NTSC Safe Action and Safe Title areas, as well as the PAL Safe Area can be highlighted. The vertical interval portion of the signal can be viewed by vertically shifting the display. Controls for adjusting the hue and color of the picture display are provided.

Audio Display Mode

The Audio display mode provides a voltage-versus-time display of a single audio channel. The audio voltage is displayed on the vertical scale with time on the horizontal scale at a two-field sweep rate.

Audio reference levels can be set to –10, 0, 4, or 8 dBu, with an additional level available for microphone checks. The audio headroom reference level can be set to –3 dB or +10 dB, and is for audio signals below or above the reference level, respectively.

Waveform-in-Picture Display Mode

The Waveform-in-Picture (WIP) display mode provides a 1/4-screen-sized window over the Picture display for any one of the Waveform,

Vector, or Audio displays. The WIP window can be positioned to any one of the four corners of the display. The Arrow Buttons retain their default function for the display mode in the WIP window.

Line Select Mode

The Line Select mode enables the user to select any line of video for viewing in either the Waveform or Vector display modes. The desired line can be selected from either all video fields or from alternating fields. With two-field sweep selected in the Waveform display mode, the selected line is highlighted in the field display.

Time-Out Mode

When the Time-out mode is enabled, power is turned off to the display backlight and/or the instrument when the front panel has not been in use for a menu-selected length of time.

Amplitude Alarm Mode

The Amplitude Alarm mode provides automatic signal level checking in the Waveform and Audio display modes. In the Waveform display mode, the portion of the waveform exceeding the 100 IRE (1.0 V PAL) graticule line is highlighted. In the Audio display mode, the portion of the waveform exceeding the selected reference level is highlighted.

Preset Menu

The Preset menu allows the user to store the current instrument front panel and menu settings for future use. In addition, there is a menu selection which sets the front panel and menu settings back to a factory-set default. These default settings are listed on page 3–7.

Instrument Readjustment

The WFM 90 and WFM 91 can be adjusted entirely from the front panel after entering the Calibration menu. The instrument should only be adjusted by qualified personnel. The service manual contains the instructions for readjusting the instrument.

More Information

- Instrument options and accessories, as well as ordering information, are listed beginning on page 1–7.
- Battery operation is discussed beginning on page 1–12.
- A tutorial covering basic instrument operation starts on page 2–11.
- Detailed menu descriptions begin on page 3–1.
- A complete listing of instrument performance specifications is located in *Appendix A*.

Options and Accessories

This section lists the options which can be ordered as well as the standard and optional accessories for the WFM 90 and WFM 91. Ordering information is given at the end of the accessories list.

Options

The options listed below can be ordered with the WFM 90 and WFM 91. Listed with the power adapter options are the Tektronix part numbers to be used when ordering replacements.

Option A1 220 V Wall Unit Power Adapter, European TUV (119-4540-00)

Option A2 240 V Wall Unit Power Adapter, UK (119-4541-00)

Option A3 240 V Wall Unit Power Adapter, Australia (119-4542-00)

Option A6 100 V Wall Unit Power Adapter, Japan (119-4539-00)

Option M2 5 years Warranty/Remedial Service

Option M8 4 Calibration/Performance Tests

Option 33 Travel-line package including:
NiCad Battery Pack
Viewing Hood
Desk Stand
Carrying Case for a WFM 90 or WFM 91 and a TSG 90–Series signal generator

Accessories

Standard accessories are shipped with every instrument while optional accessories must be ordered. Listed below are the standard and optional accessories for the WFM 90 and WFM 91 along with the Tektronix part number to be used when ordering.

Standard Accessories

1 User Manual (070-8968-XX)

1 120 V Wall Unit Power Adapter, North American (119-4538-00)

1 Carrying Pouch (016-1330-00)

Optional Accessories

Service Manual (070-8969-XX)

NiCad Battery Pack (146-0107-00)

Instrument Desk Stand (386-6787-00)

Viewing Hood (011-0167-00)

Carrying Case for the WFM 90 and WFM 91 and a TSG 90–Series signal generator (016-1344-00)

Backlight Replacement Kit (150-0215-00)

Ordering

Options and accessories for the WFM 90 and WFM 91 can be ordered with the instrument, or purchased through a Tektronix field office or distributor. When ordering, include both the option or part number and the description of the option or accessory.

Installation

This section gives instructions for the mechanical and electrical installation of the WFM 90 and WFM 91. Included are directions for the packaging of the instrument for shipment.

Instrument Packaging

Unpacking

Save the shipping carton and packing materials in case it becomes necessary to ship the instrument to a Tektronix Service Center for service or repair.

Check that the following standard accessories are included:

- User Manual
- 120 V Wall Unit Power Adapter, North American
- Carrying Pouch

If the instrument was ordered with the travel case (Option 33), the instrument was packaged in the travel case for shipment. Follow the instructions below for repackaging the instrument for shipment.

Packaging for Shipment

If you ship an instrument to a Tektronix Service Center, follow these packaging instructions:

1. Attach a tag to the instrument showing: the owner, complete address and phone number of someone at your firm who can be contacted, the instrument serial number, and a description of the required service.

2. Package the instrument in the original packaging materials. If the original packaging materials are not available, follow these directions:
   a. Obtain a carton of corrugated cardboard having inside dimensions six or more inches greater than the dimensions of the instrument. Use a shipping carton that has a test strength of at least 250 pounds.
   b. Place the instrument in its carrying pouch or surround the instrument with a protective bag.
   c. Pack dunnage or urethane foam between the instrument and the carton. If using Styrofoam kernels, overfill the box and compress by closing the lid. There should be three inches of tightly packed cushioning on all sides of the instrument.
3. Seal the carton with shipping tape, industrial stapler, or both.

Travel Case

The optional travel case (Option 33) is used to safely hold the WFM 90 or WFM 91 and its accessories while traveling between different locations. The travel case was designed to also provide room for a companion TSG90–Series handheld generator. Figure 1–1 illustrates the use of the compartments within the travel case.

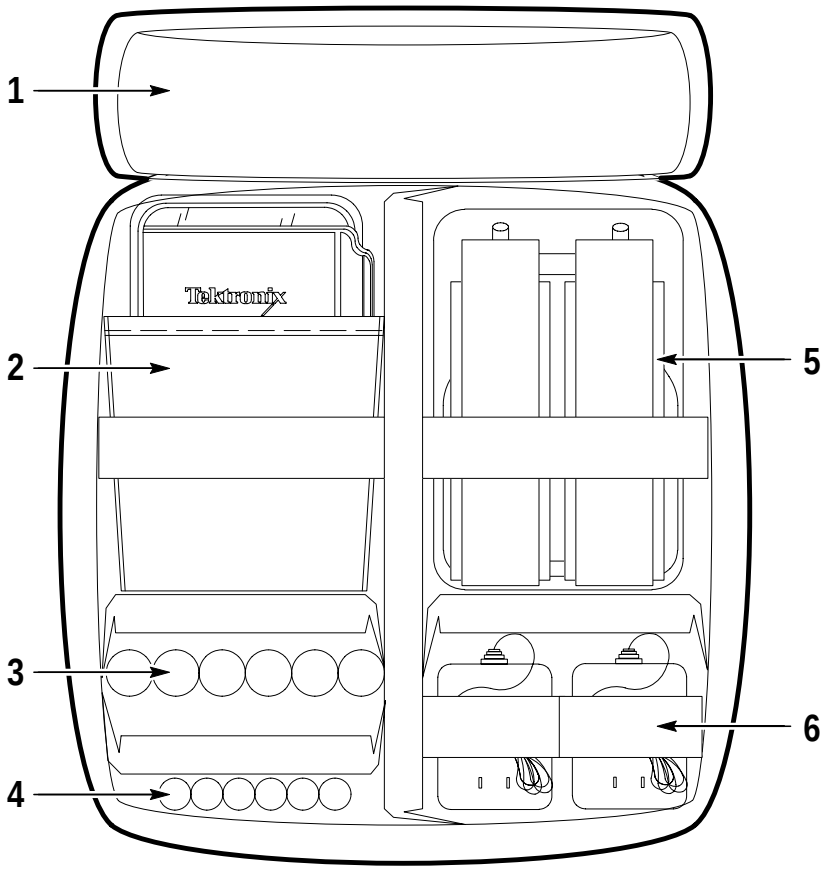


Figure 1–1: Packing the Option 33 travel case

1 The pouch in the cover of the travel case holds signal cables and the user manual(s) for the instrument(s).

2 This compartment holds the WFM 90 or WFM 91 instrument, with the viewing hood slipping around the instrument.

3 This compartment holds the spare batteries for the WFM 90 or WFM 91.

4 This compartment holds the spare batteries for the TSG 90–Series.

5 This compartment holds the TSG 90–Series instrument, the desk stand, and the carrying straps.

6 This compartment holds the AC adapter(s).

Electrical Installation

Power Source

The WFM 90 and WFM 91 are designed to operate from either six C-cell batteries, alkaline or rechargeable NiCad, or from an AC adapter wall unit producing 12 VDC.

CAUTION. *DC Power Source*

To avoid possible damage to the instrument circuitry when using a DC power source other than the supplied AC adapter, ensure that the DC source is a negative-ground 11 – 18 V system with a negative center lead. The DC source should be able to provide 12 W of power.

Battery Operation

The rechargeable NiCad batteries are automatically recharged when the 12 VDC adapter is plugged into the instrument. The batteries are recharged while instrument power is on or off. The battery charge time is 6.5 hours when the instrument is off, and 20 hours while the instrument is on. The WFM 90 and WFM 91 shifts into a safe trickle-charge mode, that can run indefinitely, when the NiCad batteries are fully charged.

The message LOW BAT is displayed on-screen when the remaining battery power cannot guarantee reliable instrument operation. The length of time the WFM 90 and WFM 91 will continue to operate after this message is displayed is dependent on the current operating mode of the instrument.

For optimal battery life and capacity, use the rechargeable NiCad battery pack in full charge/discharge cycles. In other words, fully discharge the battery pack before recharging, and then charge the battery pack until it is fully charged. A new battery pack will take a few charge/discharge cycles to reach full capacity.

Battery Installation and Removal

Replacing Alkaline Batteries. The WFM 90 and WFM 91 battery compartment is located under the back panel of the instrument. The battery compartment is opened by turning the screw head at the top of the panel 1/4 turn.

A label on the bottom of the battery compartment illustrates the correct battery polarity. The polarity of the alkaline batteries must be correct for the instrument to operate. Figure 1–2 shows the correct alkaline battery polarity.

***NOTE**. Replacement of Alkaline Batteries*

Always replace all of the alkaline batteries at the same time when replacing discharged batteries.

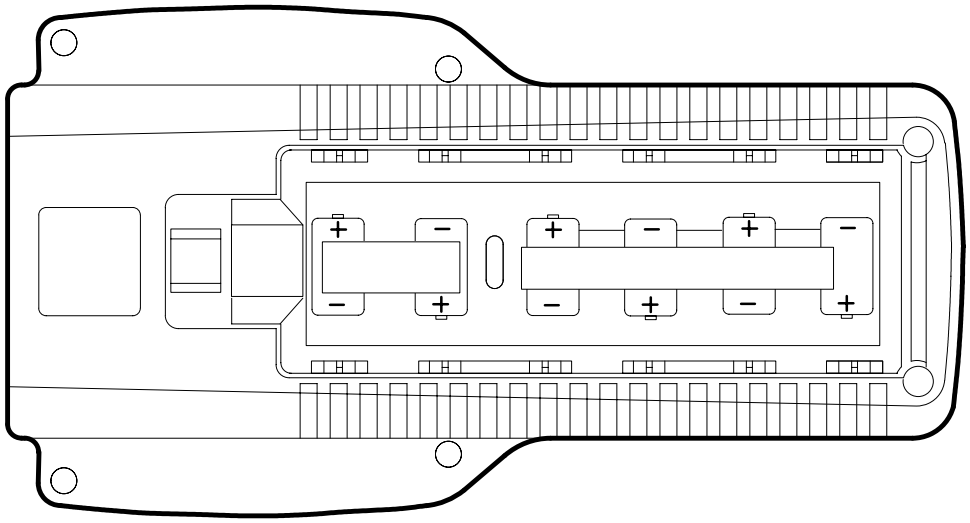


Figure 1–2: Installed polarity of alkaline batteries

Replacing NiCad Batteries. The optional NiCad battery pack has a connector which fits on the jumper in the battery compartment. Be sure the battery connector tab snaps onto the jumper housing to prevent a loss of battery power.

To remove the NiCad battery pack, grasp the batteries close to the wire leads. Use your thumb to press in on the top portion of the battery connector tab, and then pull gently upwards. Figure 1–3 shows how to remove the NiCad battery pack.

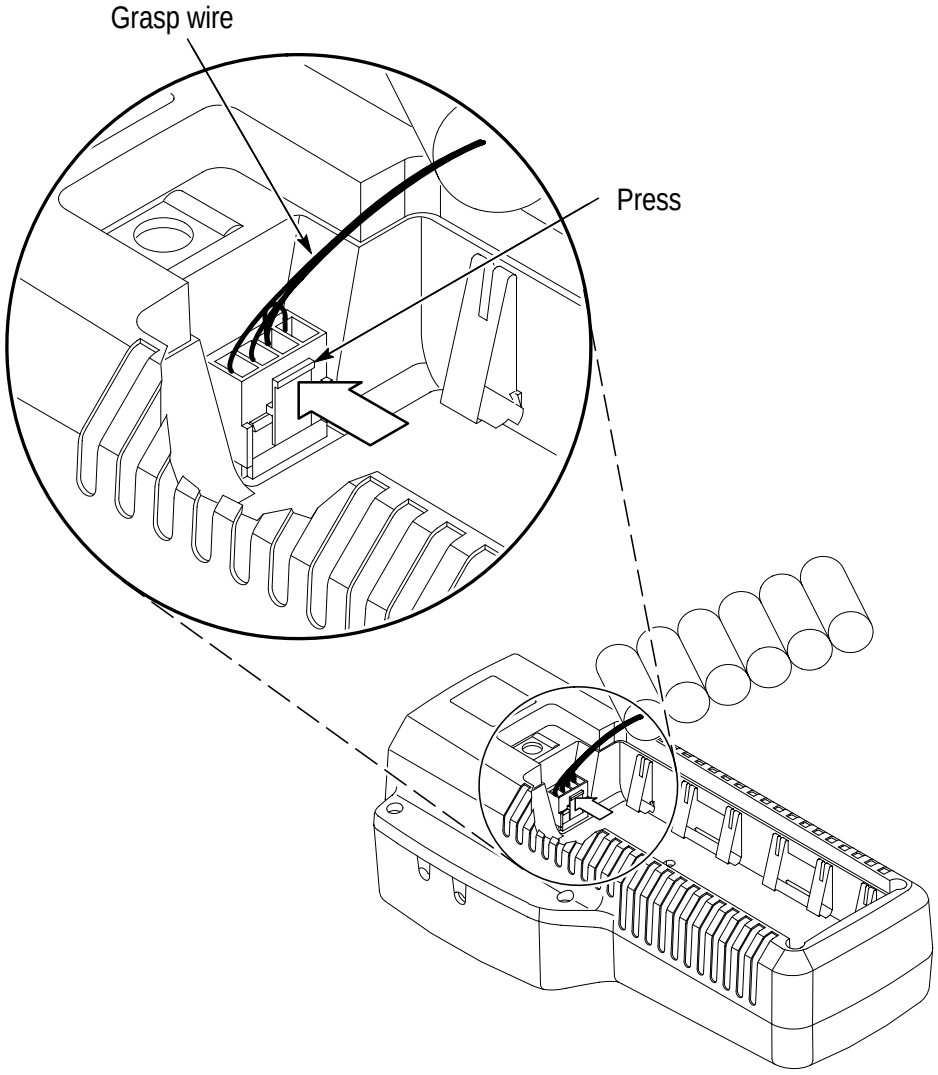


Figure 1–3: Removing the NiCad battery pack

Operational Jumpers

The only operational modifications made to this monitor are done through the menu system. There are no internal jumper settings for modifying the operational configuration of the instrument.

Mechanical Installation

The WFM 90 and WFM 91 are offered with a viewing hood and desk stand as optional accessories that enhance its on-site use. The installation of these accessories is described below.

Viewing Hood

The optional viewing hood allows the user to readily view the instrument display in well-lighted situations. The hood is attached to the instrument by first applying the supplied Velcro® strips to the sides of the instrument, and then pressing the flaps of the viewing hood onto the strips as shown in Figure 1–4.

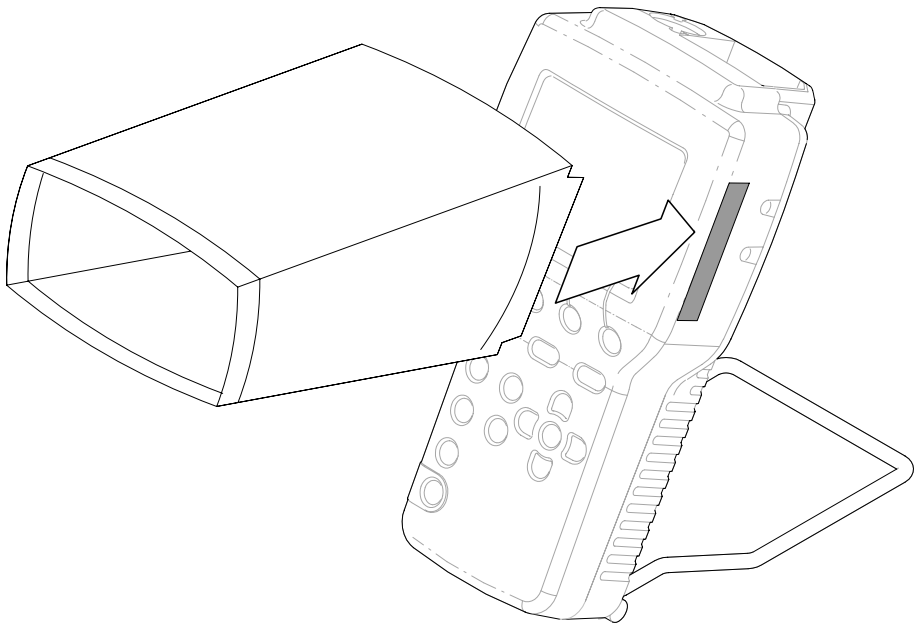


Figure 1–4: Installing the viewing hood

Desk Stand

The optional desk stand provides the user with a stable means to hold the instrument upright on a flat surface. The prongs of the stand are inserted into the holes in the back of the instrument as illustrated in Figure 1–5.

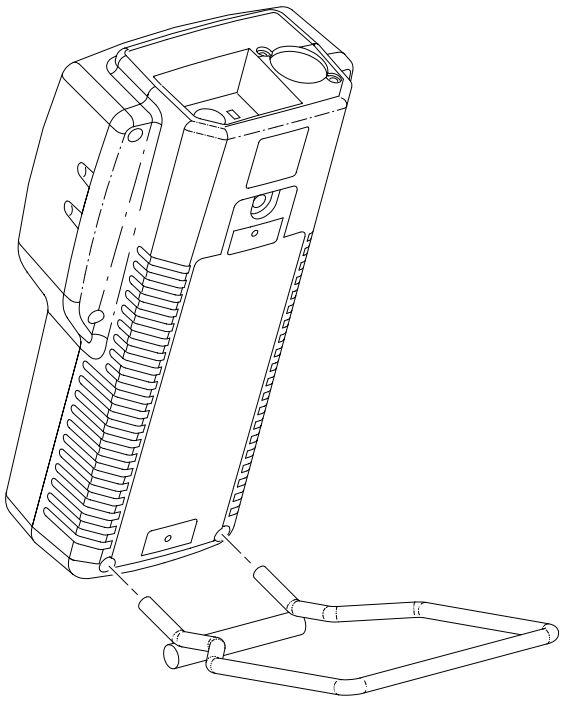


Figure 1–5: Installing the desk stand

Operation Basics: Functional Overview

This section describes the WFM 90 and WFM 91 controls and connectors. Descriptions of special operating modes begin on page 2–6. A tutorial which guides you through a procedure exercising the different functions of the instrument begins on page 2–11. Menu operation is detailed in *Using the Menus*, starting on page 3–1.

Keypad Controls

The keypad (front panel) is illustrated in Figure 2–1.

Power Switch

ON. The ON button toggles the instrument power on and off. The current instrument keypad and menu selections are saved when the instrument is turned off using this button. The instrument configuration is not saved if the power source is removed before the instrument is turned off with this button.

Display Mode Selection

WFM. Pressing the WFM button enters the Waveform display mode.

VECT. Pressing the VECT button enters the Vector display mode.

AUDIO. Pressing the AUDIO button enters the Audio display mode.

PIX. Pressing the PIX button enters the Picture display mode.

WIP. Pressing the WIP button enters the Waveform-in-Picture display mode. The previously selected display mode, other than Picture, is shown in a 1/4-screen-sized window that overlays the Picture display.

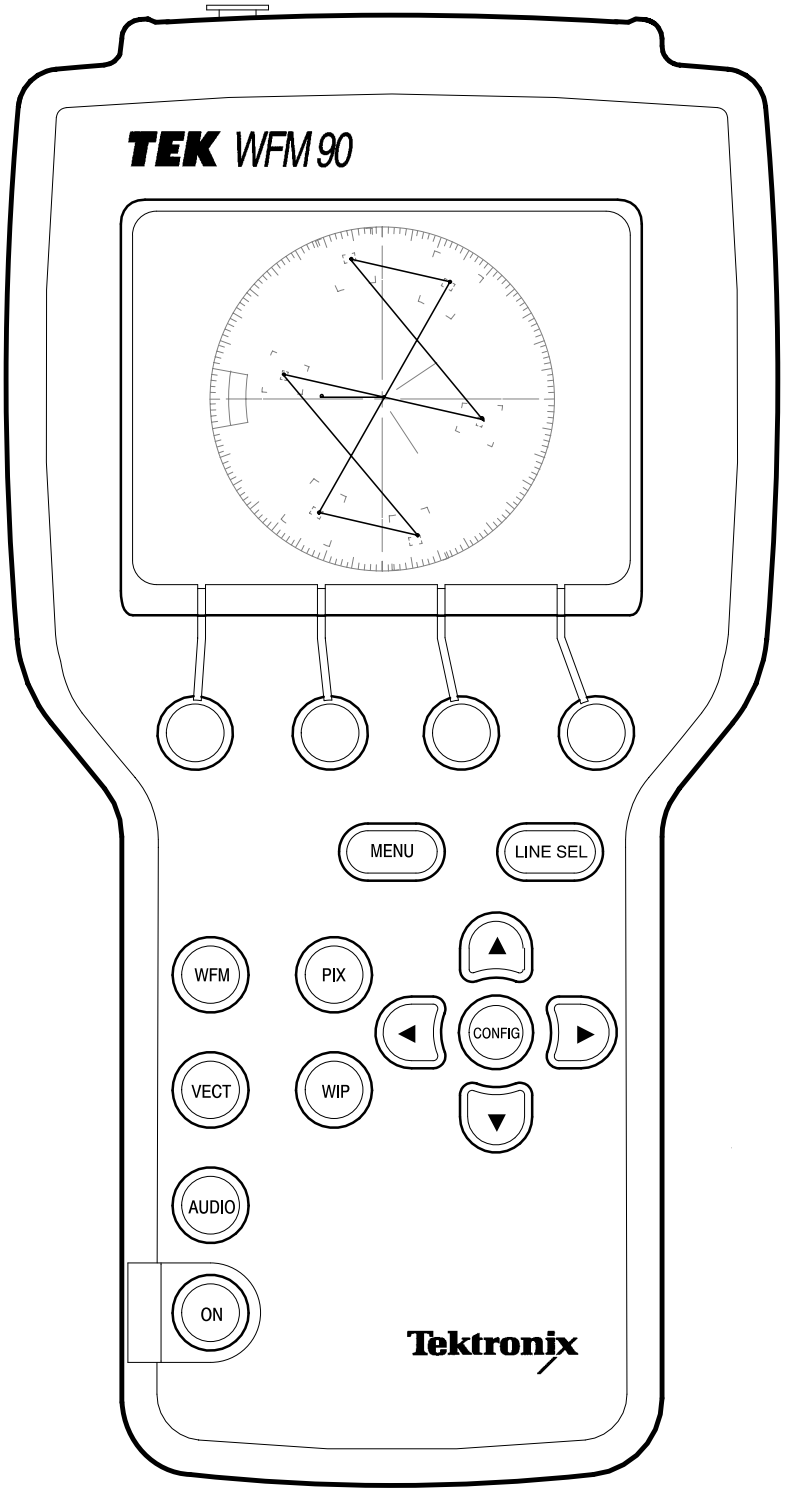


Figure 2–1: WFM 90 keypad

Menu Control

Menu operation and selections are detailed in *Using the Menus* starting on page 3–1.

MENU. Pressing the MENU button toggles the Operating menu on and off. The Operating menu contains monitoring selections which are specifically related to the currently selected display mode. Operating menu selections include signal gain and filtering, audio reference levels, and safe action and title outlines.

CONFIG. Pressing the CONFIG button toggles the Configuration menu on and off. The Configuration menu contains selections which control overall instrument monitoring operation. Configuration menu contents include signal and display controls such as brightness and variable gain. Special modes for monitoring signal amplitude and managing the battery power consumption are enabled in this menu.

LINE SEL. Pressing the LINE SEL button toggles the Line Select mode on and off and displays the Line Select menu.

Bezel Buttons. The four unlabeled buttons directly below the display are referred to as the Bezel Buttons. These buttons are used for making menu selections and are only enabled while menus are displayed on screen.

Arrow Buttons

The function of the Arrow Buttons is dependent on the current state of the instrument. For the Waveform and Audio display modes, they control signal positioning. For the Vector display mode, they control vector phase, with the ▲ and ▼ buttons providing fine adjustment, and the ◀ and ▶ buttons providing coarse adjustment.

The Arrow Buttons retain their default function for the reduced display when the Waveform-in-Picture display mode is selected. When the Configuration menu is displayed, the ▲ and ▼ buttons operate the menu category selection, while the ◀ and ▶ buttons retain their default function for the current display mode.

Instrument Reset

Extraordinary conditions may cause the WFM 90 and WFM 91 controls to become locked or to respond erratically. To reset the instrument, first press the ON button to turn off the power, then press the ON button again while holding down the WIP and LINE SEL buttons. The instrument should return to normal operation with the keypad controls and menu selections assigned to the factory-set defaults.

If this reset does not return the instrument to normal operation, contact your Tektronix field office or call Tektronix at the phone number listed in the front of this manual.

Side-Panel Connectors and Switches

The WFM 90 and WFM 91 side panels are illustrated in Figure 2–2.

Video Input and Output Connectors

VIDEO IN. Passive BNC input, unterminated, and 75 Ω compensated for a video signal. A rear-panel switch provides an internal 75 Ω signal termination.

NOTE. *A loop-through connector can be used by connecting a BNC "T" connector to the Video In BNC. Slide the rear panel switch in the HI-Z position.*

EXT REF. Passive BNC input, unterminated, and 75 Ω compensated for an external sync video signal. A rear-panel switch provides an internal 75 Ω signal termination.

VIDEO OUT. A BNC connector used to output the instrument display to a remote monitor or video switcher.

Audio Input and Output Connectors

AUDIO IN. A standard three-pin XLR connector for a single channel of audio input.

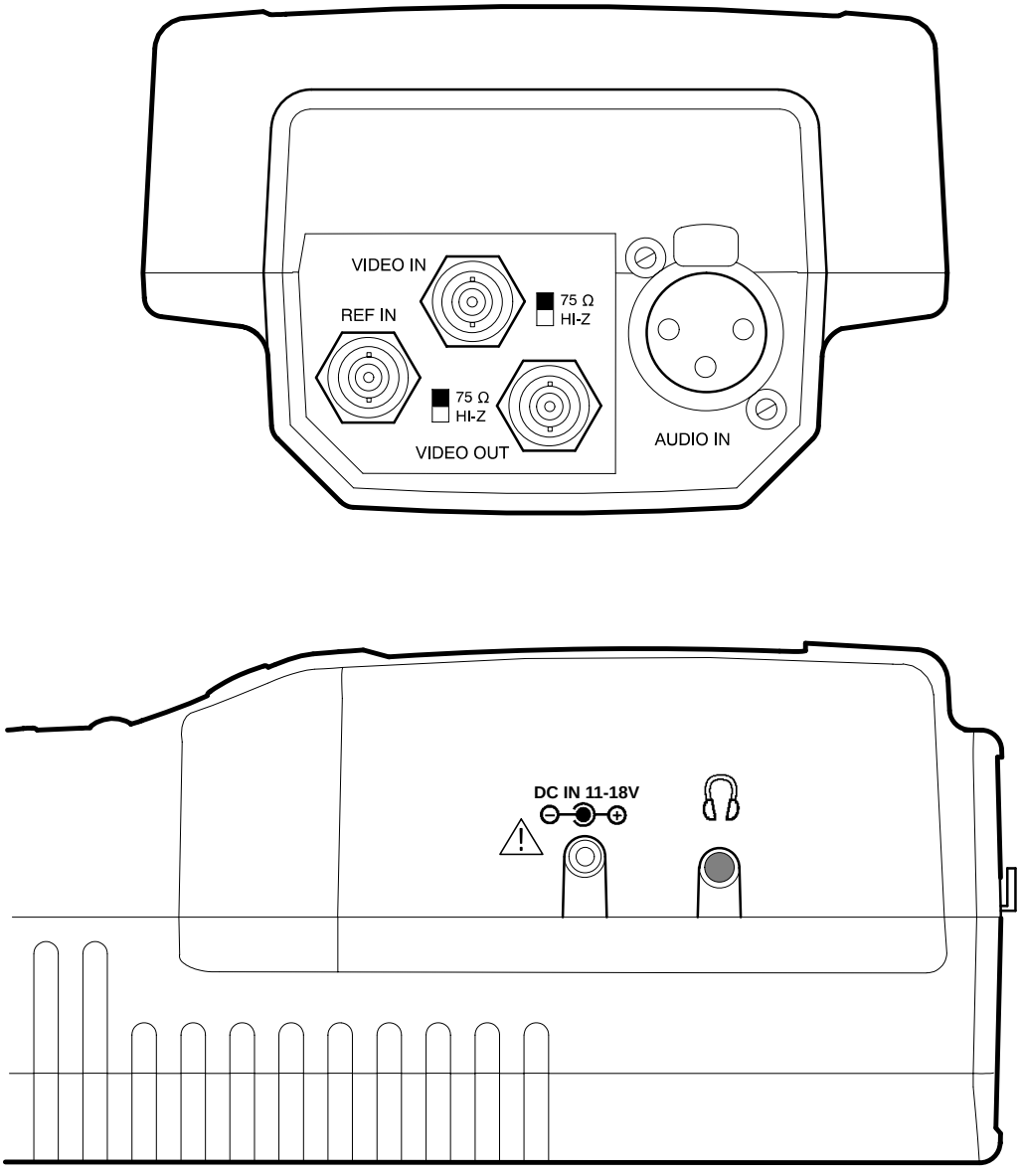


Figure 2–2: WFM 90 and WFM 91 side panels

Audio Out. A standard stereo mini-headphone jack for the output of the audio input signal. The mono input signal is heard on both stereo channels. The audio volume is fixed for each reference level. The larger the displayed signal, the louder the volume.

DC Power Input Connector

DC IN 11 – 18 V. A 2 mm plug which accepts a 12 VDC power input using a negative center lead.

CAUTION. *DC Power Source*

To avoid possible damage to the instrument circuitry when using a DC power source other than the supplied AC adapter, ensure that the DC source is a negative-ground 11 – 18 V system with a negative center lead. The DC source should be able to provide 12 W of power.

Special Operating Modes

Amplitude Alarm Mode

The Amplitude Alarm mode provides a means for automatic monitoring of the signal amplitude for the Waveform and Audio displays. The mode is enabled through a menu selection in the Configuration menu.

For the Waveform display mode, the portion of the signal exceeding the 100 IRE (1.0 V PAL) graticule line is highlighted. For the Audio display mode, the portion of the signal exceeding the menu-selected reference level is highlighted. The highlighted portion of the signal is also visible in the Waveform-in-Picture (WIP) display mode.

Variable Gain Mode

The Variable Gain mode allows the user to vary signal gain for the Waveform and Vector displays between 45% and 155%. The mode is enabled through a menu selection in the Configuration menu.

The variable gain adjustment tracks between the Waveform and Vector display modes, and can be adjusted from the Waveform-in-Picture display mode. When the Variable Gain mode is enabled, the message GAIN UNCAL is displayed in the on-screen readout.

Time-Out Mode

The Time-out mode allows the user to automatically shut down the backlight and/or the instrument after there has been no keypad activity for a menu-selected length of time. The Time-out mode enables the user to reduce battery power usage while the instrument is battery powered, and also to extend the life of the backlight bulb. The Time-out mode is enabled through a menu selection in the Configuration menu.

When the backlight has been timed out, the LCD display goes blank and the instrument appears to be off. The backlight is turned back on by pressing any keypad button other than the ON button. The backlight shutdown is functional when the instrument is either battery or DC powered.

When the instrument power has been timed out, the ON button must be pressed to turn the instrument back on. The instrument power shutdown is only functional when the instrument is battery powered.

Calibration Mode

The Calibration mode allows the user to adjust the instrument to factory specifications, if necessary. The Calibration mode is entered by pressing and holding the CONFIG button for a few seconds. The instrument adjustments are performed entirely from the keypad with the use of specified input signals. The instructions for readjusting the instrument to specifications are located in the service manual.

CAUTION. *Instrument Adjustment*

Do not attempt to adjust the instrument without using the instructions listed in the service manual, or your instrument may not meet the published specifications.

On-Screen Readout

The WFM 90 and WFM 91 use on-screen messages to alert the user to certain monitoring conditions. Figure 2–3 shows the readout messages and their locations.

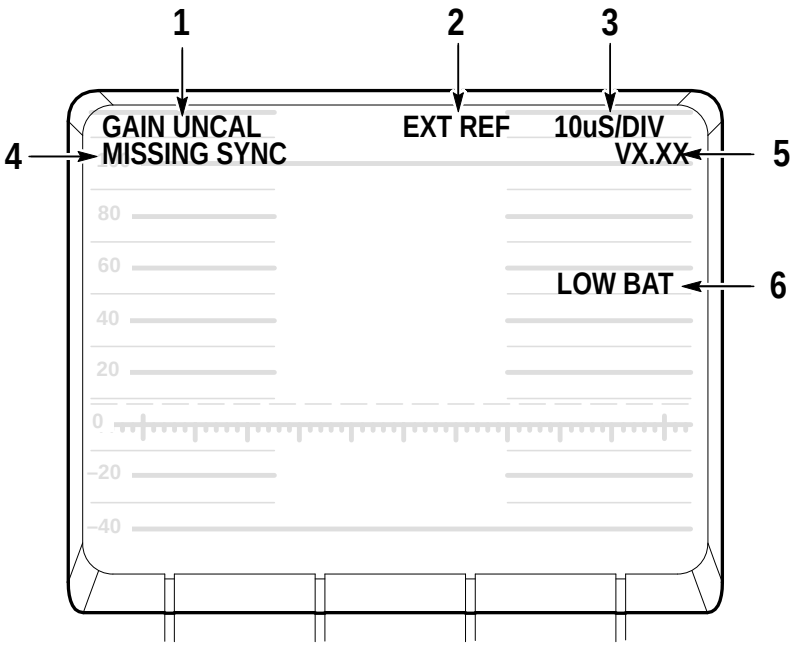


Figure 2–3: On-screen readout messages

Readout Description

1 The GAIN UNCAL message appears in the Waveform, Vector, and Waveform-in-Picture display modes when the Variable Gain mode has been turned on.

2 The EXT REF message appears in the Waveform and Vector display modes when the video signal is locking to an external video reference signal.

3 The sweep rate is only displayed in the Waveform display mode. There is no sweep rate readout when 2 Field sweep is selected.

4 The MISSING SYNC message appears in all video display modes when the signal reference has been lost.

5 The instrument software version number is displayed when the Configuration menu is open with the DISPLAY category selected.

6 The LOW BAT message is displayed when the instrument is battery operated and the remaining battery power has reached a critically low level. The remaining length of time that the instrument can be operated reliably is dependent on the current operating mode.

Tutorial

The following tutorial guides you through a procedure which exercises the different functions of the WFM 90 and WFM 91. The procedure is designed for operator familiarization and for checking basic instrument operation (not measurement quantities or specifications). The tutorial is written with the assumption that you have read the *Functional Overview* section which starts on page 2–1.

If performing this procedure reveals improper instrument operation, first check the operation of the associated equipment. If the associated equipment is operating normally, refer the WFM 90 or WFM 91 to qualified service personnel for repair or adjustment.

Required Equipment

The following equipment is required to perform this procedure:

1. Television/Audio Signal Generator with:

Composite Color Bars
Black Burst or comparable signal with burst and sync
Audio tone at adjustable levels

For example:

Tektronix TSG95 Pathfinder NTSC/PAL Signal Generator

2. Coaxial Cable, 75 Ω (2)

For example:

42-inch RG59U (Tektronix Part No. 012-0159-00)

3. Audio Cable, 3-pin Male-to-Female XLR

For example:

3-foot cable (Switchcraft Part No. SC3XXJ)

Initial Equipment Connections

- Connect power to the WFM 90 or WFM 91 by plugging in the AC power adapter or by installing batteries.
- Connect a 75% color bar signal (with setup for NTSC) of the correct standard for your instrument from the television signal generator to the VIDEO IN connector. Verify that the VIDEO IN input switch is set to the 75 Ω position.
- Connect a black burst or other signal with burst and sync from the television signal generator to the EXT REF connector on the WFM 90 or WFM 91. Verify that the EXT REF input switch is set to the 75 Ω position.

Procedure

1. Initialize the front-panel controls and menu selections

Press the CONFIG button to enter the Configuration menu. Press the Bezel Button below the Configuration menu categories a few times. Notice that the highlight bar toggles down through the menu categories. Press the ▲ and ▼ buttons and notice that they move the highlight bar up and down through the menu categories.

Select the PRESETS category, then select DEFAULT. The front-panel controls and menu selections are now set to the factory-set defaults. The display should be a two-line waveform monitor display centered on the graticule baseline.

2. Adjust the display

Enter the Configuration menu. Notice that the menu opened with the INTENS category selected and that the right two Bezel Buttons are ready to adjust the trace intensity. Adjust the display to the desired intensity, then select GRAT and adjust the graticule intensity to the desired level.

Select the DISPLAY menu category. Press the right two Bezel Buttons to adjust the viewing angle of the LCD display to the desired angle. Select BRIGHT and adjust the display brightness to the desired level. Press the CONFIG button to remove the menu display.

3. Using the waveform monitor

Press the MENU button to enter the Operating menu. The current selection for each monitoring function is highlighted. Pressing the Bezel Button below each function will toggle the highlight bar through the different menu selections.

X1/X5 Gain. Press the left Bezel Button and notice that X5 is highlighted and that the waveform is vertically amplified. Use the ▲ and ▼ buttons to view the entire signal. Select X1 and return the signal to the graticule baseline. The gain setting affects both the Waveform and Vector displays since they track together.

Filter. Press the Bezel Button below the FILTER selection and notice that LUM is highlighted and that the display changes to show only the luminance portion of the signal. Press the Bezel Button again to return the filter selection to FLAT.

Sweep. Press the Bezel Button below the SWEEP selection and notice that 2F is highlighted and that the waveform changes to a two-field display. Press the Bezel Button again and notice that 1H is highlighted and that the waveform changed to a one-line display and that 5 uS/DIV is displayed in the on-screen readout. Return the sweep rate to 2H (two line).

MAG. Press the right Bezel Button and notice that ON is highlighted and that the waveform is horizontally amplified. The sweep rate readout should read 1 uS/DIV. Use the ◀ and ▶ buttons to view the entire waveform. Select MAG OFF from the menu and center the waveform on the display.

DC Restorer. Enter the Configuration menu and select the INPUT category. Notice that there is a menu selection which allows you to change the DC restorer speed between FAST and SLOW.

Signal Reference. Press the Bezel Button below the menu selection labeled REF. Notice that EXT is highlighted and that EXT REF appears in the on-screen readout. Remove the cable from the EXT REF input and notice that the waveform free-runs and that the message MISSING SYNC appears in the on-screen readout. Return the reference selection to INT.

Line Selection. Press the LINE SEL button to enter the Line Select mode. Notice that the selected line number (Line 17) is displayed in the bar over the right two Bezel Buttons and that it is being displayed from ALL video fields. Line 17 is displayed on the left, with Line 18 displayed on the right in the two-line sweep. Use the Bezel Buttons to select Line 30 for display.

Press the MENU button to enter the Operating menu and select 2F SWEEP. Notice that the selected line is highlighted in both field displays. Press the LINE SEL button to return to the Line Select menu. Press the left Bezel Button to select 1 OF 2 FIELDS. Notice that an additional menu selection of ALT FIELD appears, that the line number display now includes the field number, and that the selected line is now highlighted in only the left field display. Press the ALT FIELD Bezel Button and notice that the field number readout changes and that the highlight bar in the waveform toggles between the two fields.

Turn off the Line Select mode by pressing the LINE SEL button. Enter the Operating menu and select 2H SWEEP.

Variable Gain. Enter the Configuration menu and select the VAR GAIN category. Select VAR GAIN ON and notice that a bar appears over the right two Bezel Buttons labeled VAR ADJUST and that the message GAIN UNCAL appears in the on-screen readout.

Press one of the right two Bezel Buttons just once. Notice that the Configuration menu category list over the left Bezel Button has been replaced with a single label of CONFIG to provide full viewing of the waveform, and that Up/Down arrows appear in the bar over the right two Bezel Buttons signifying that they are enabled to adjust the signal gain. The menu category list can be restored by pressing the left Bezel Button or by turning off the variable gain.

Use the right two Bezel Buttons to adjust the signal gain to any desired level. Select VAR GAIN OFF and notice that the waveform gain is restored to 100%. Select VAR GAIN ON again and notice that the waveform gain returns to your adjusted setting.

Leave the variable gain on and the Configuration menu open, and proceed to the next step.

4. Using the vectorscope

Press the VECT button to enter the Vector display mode. Notice that the Configuration menu is still open and that the vector waveform gain is the same as it was adjusted in the previous step in the Waveform display mode. Turn off the variable gain and press the CONFIG button to exit the Configuration menu.

Phase Adjustment. The Arrow Buttons adjust the vector phase. Press and hold the ▲ button. Notice how fast the phase of the waveform changes. Press and hold the ▶ button. Notice that the phase changes at a much faster rate. The same is true for the ▼ and ◀ buttons. Adjust the burst vector back to the 180° graticule line so that the vector dots land in the target boxes.

Bar Amplitude. Select 100% color bars output from the television signal generator. Notice that vector waveform is too large to land in the target boxes. Enter the Configuration menu and select the VECTOR category. Select 100% BARS and notice that the vector waveform now lands in the target boxes. Select 75% color bars output from the signal generator and return the menu setting to 75% BARS.

Setup. This menu selection appears in the WFM 90 only. Select SETUP NO from the menu and notice that the vector waveform does not land in the target boxes. Select an NTSC color bar signal without setup from the signal generator and notice that the vector dots again land in the target boxes. Select SETUP YES from the menu and set the signal generator for a 75% color bar output with setup.

Alternate Phase. This menu selection appears in the WFM 91 only. Select ALT PH ON from the menu and notice that the vector waveform now has a mirrored image. Adjust the vector phase with the Arrow Buttons and notice that the mirrored vectors can be overlaid. Select ALT PH OFF from the menu and return the burst vector back to the 180° graticule line.

5. Using the picture monitor

Press the PIX button to enter the Picture display mode. Select PICTURE from the Configuration menu category list.

Hue. This menu selection appears in the WFM 90 only. Select PICTURE HUE and notice that the right two Bezel Buttons are ready to adjust the picture hue. Press the WFM button to enter the Waveform display mode and notice that the bar over the right two Bezel Buttons now reads ENTER PIX TO ADJ. This message reminds you that the picture hue can only be adjusted while in the Picture display mode. The same is true for the picture color adjustment.

Return to the Picture display mode and press the right two Bezel Buttons to adjust the picture hue to a desired setting.

***NOTE**. Resetting the Picture Hue and Color*

Once the picture hue and/or color has been adjusted, resetting the instrument to the factory default settings, through the Configuration menu PRESETS category, is the only way to ensure that the hue and color have been correctly reset.

Color. Select PICTURE COLOR and notice that the right two Bezel Buttons are ready to adjust the picture color. Press the WFM button to enter the Waveform display mode and notice that the bar over the right two Bezel Buttons now reads ENTER PIX TO ADJ. This message reminds you that the picture color can only be adjusted while in the Picture display mode.

Return to the Picture display mode and press the right two Bezel Buttons to adjust the picture color to a desired setting.

Select PRESETS from the Configuration menu category list and select DEFAULT to reset the picture hue and color back to their proper settings. Select the Picture display mode.

Safe Action. This menu selection appears in the WFM 90 only. Press the MENU button to enter the Operating menu. Select ACTION ON and notice that the Safe Action area is outlined on the display.

Safe Title. This menu selection appears in the WFM 90 only. Select TITLE ON and notice that the Safe Title area is now also outlined.

Safe Area. This menu selection appears in the WFM 91 only. Press the MENU button to enter the Operating menu. Select SAFE AREA ON and notice that the Safe Area is outlined on the display.

Vertical Shift. Select V SHIFT ON and notice that the display has shifted vertically so that you can see the vertical interval portion of the video signal.

6. Using the waveform-in-picture (WIP) display

Press the WIP button to enter the Waveform-in-Picture (WIP) display mode. Notice that the Waveform display is shown in the 1/4-screen-sized window over the Picture display, and that the Picture display does not show the Safe Area(s) or the vertical shift which were left on in the Picture display mode. The Waveform display is shown in the WIP window because it was the last display mode selected in the previous steps.

Press the Arrow Buttons and notice that they still have control of signal positioning. You have access to all of the Waveform display controls except those located in the Operating menu. The Operating menu selections for any display mode can only be changed while that display mode is selected.

Location. Press the right Bezel Button a few times and notice that the location of the WIP window rotates around the four corners of the Picture display.

Display Mode. The left three Bezel Buttons allow you to change which display mode is shown in the WIP window.

7. Using the audio monitor

Connect the output of the audio generator to the AUDIO IN connector on the WFM 90 or WFM 91. Set the generator for a 0 dB tone output. Press the AUDIO button to select the Audio display mode. Notice that the audio waveform is free-running and that the audio graticule has solid lines labeled 0 dBu representing the reference level and dashed lines labeled –3dB representing the headroom setting.

Reference dBu. Select 4 dBu from the Operating menu. Notice that the amplitude of the waveform is reduced and that the graticule line label changed to 4 dBu. Set the audio generator for a +4 dB output and notice that the signal amplitude is returned to the reference level graticule line.

Headroom. Select 10dB HEADROOM from the Operating menu. Notice that the graticule scale expands so that the headroom graticule lines are now located outside the reference level graticule lines, and that they are now labeled +10dB. The +10 dB setting allows signals greater than 3 dB over the reference level to be viewed.

8. Using the amplitude alarm

Enter the Configuration menu and select the ALARMS category. Select ON to turn on the Amplitude Alarm mode. Return to the Operating menu and select 0 dBu reference level. Notice that the portion of the audio signal exceeding the reference level graticule lines has been highlighted. Enter the WIP display mode and notice that the alarm highlighting is visible there as well.

Select the Waveform display mode to be displayed in the WIP menu. Use the ▲ button to position the waveform above the 100 IRE graticule line. Notice that the portion of the signal exceeding the 100 IRE graticule line is highlighted.

9. Using the presets

Enter the Configuration menu, select the PRESETS category and then select STORE. Now select DEFAULT from the menu and notice that the instrument returned to the Waveform display mode which is the factory-set default mode. Return to the Presets menu and select RECALL. Notice that the instrument returns to the WIP display mode with the Waveform display mode displayed with the Amplitude Alarm on, which was the instrument setting when you stored your preset previously.

10. Using the time-out mode

Select the TIME-OUT category from the Configuration menu. Select 2 MIN from the BACK LT menu choices. Wait two minutes and notice that the display goes blank. Press any Bezel Button and notice that the display returns. Pressing any keypad button except the ON button will turn the backlight back on.

The SHUTDOWN menu selections turn off instrument power after the menu-selected length of time. Once the instrument has timed out, it is turned back on by pressing the ON button.

This concludes the operator familiarization tutorial.

Reference: Using the Menus

This section begins with general information on menu operation. Descriptions of each menu selection begin on the following pages:

General Menu Information

Entering and Exiting Menus

- Pressing the MENU button opens the Operational menu for the currently selected display mode.
- Pressing the CONFIG button opens the Configuration menu, which is the same for all display modes.
- Pressing the LINE SEL button turns on the Line Select mode, and opens the Line Select menu.
- Menus are exited by pressing the entry button for the open menu, entering another menu, or by turning on the Line Select mode.
- Menus remain open while switching between display modes.

Making Menu Selections

- Menu selections are made by pressing the Bezel Button corresponding to the desired menu selection.
- When there is more than one menu selection corresponding to a Bezel Button, a highlight bar toggles through the available menu selections.
- Menu selections can be only made while a menu is displayed. The Bezel Buttons are inoperative when there is no menu displayed.

- When menu selections are made, changes to the display occur immediately.
- When the Configuration menu is open, the ▲ and ▼ buttons are reassigned from their default function to selecting the menu category. The ◀ and ▶ buttons retain their default function for the currently selected display mode.

Operating Menus

The following pages describe the Operating menus for the different display modes. The Operating menu selections only affect the display mode in which they appear unless otherwise noted.

Waveform Display Mode Operating Menu

GAIN. Toggles the Waveform display mode vertical gain and the Vector display mode gain between X1 and X5.

FILTER. Toggles the Waveform display between FLAT (no filter), and LUM (low-pass filtered for luminance display).

SWEEP. Cycles the sweep rate through 1H (5 μs/division), 2H (10 μs/division), and 2F (two field).

MAG. Toggles the Waveform horizontal gain between ON and OFF. When MAG is ON, additional sweep rates are available: 1H + MAG (0.5 μs/division), 2H + MAG (1 μs/division), and 2F + MAG (magnified by approximately X20).

Vector Display Mode Operating Menu

GAIN. Toggles the Vector display mode gain and the Waveform display mode vertical gain between X1 and X5.

Audio Display Mode Operating Menu

REFERENCE dBu. Cycles the Audio reference level through MIC, –10, 0, 4, and 8. The reference levels are measured in dBu, while the MIC level is for testing microphones.

HEADROOM. Toggles the headroom reference level between –3 dB and +10 dB. The +10 dB setting is used for viewing signal levels greater than 3 dB over the reference level.

Picture Display Mode Operating Menu

ACTION. Toggles the Safe Action area markers ON and OFF. This menu selection appears on the WFM 90 only.

TITLE. Toggles the Safe Title area markers ON and OFF. This menu selection appears on the WFM 90 only.

SAFE AREA. Toggles the Safe Area markers ON and OFF. This menu selection appears on the WFM 91 only.

V SHIFT. Toggles the vertical shift ON and OFF. The vertical shift allows the viewing of the vertical interval on the Picture display. The vertical interval display does not appear on the VIDEO OUT signal.

WIP Display Mode Operating Menu

WFM. Selects the Waveform display mode to be shown in the WIP window.

VECT. Selects the Vector display mode to be shown in the WIP window.

AUDIO. Selects the Audio display mode to be shown in the WIP window.

LOCATION. Cycles the position of the WIP window around the four corners of the Picture display.

Configuration Menu

The Configuration menu is opened by pressing the CONFIG button. A list of menu categories is displayed above the left Bezel Button, while menu selections within the selected category appear over the right three Bezel Buttons.

The following pages describe the Configuration menu selections, which are the same for each display mode. The description is organized in the order that the menu categories appear on the display.

Configuration Menu DISPLAY Category

VIEW. When VIEW is selected, the right two Bezel Buttons adjust the viewing angle of the LCD display up or down. This adjustment allows for optimal viewing of the display from different positions.

BRIGHT. When BRIGHT is selected, the right two Bezel Buttons adjust the brightness of the LCD display.

Configuration Menu INTENS Category

TRACE. When TRACE is selected, the right two Bezel Buttons adjust the intensity of the signal trace.

GRAT. When GRAT is selected, the right two Bezel Buttons adjust the intensity of the measurement graticule.

Configuration Menu INPUT Category

DC REST. Toggles the DC restorer speed between SLOW and FAST.

REF. Toggles the video signal reference between INT (internal) and EXT (external reference input signal). When external reference is selected, EXT REF appears in the on-screen readout of the Waveform and Vector displays. When the WFM 90 or WFM 91 loses its signal reference, MISSING SYNC is displayed in the on-screen readout.

Configuration Menu VAR GAIN Category

VAR GAIN. Toggles the Variable Gain mode ON and OFF. When ON is selected, the right two Bezel Buttons are assigned to adjusting the signal gain. The Waveform or Vector display modes must be selected in order to adjust variable gain.

The first press of one of the right two Bezel Buttons removes the Configuration category list over the left Bezel Button to provide maximum signal viewing, and enables the right two Bezel Buttons to adjust signal gain. Pressing the left Bezel Button redisplays the Configuration category list. When the Variable Gain mode is turned on, GAIN UNCAL is displayed in the on-screen readout of the Waveform, Vector, and Waveform-in-Picture display modes.

Configuration Menu VECTOR Category

BARS. Pressing this Bezel Button toggles the calibration of the vector chrominance gain to correctly process 75% and 100% amplitude color bar signals.

SETUP. This menu selection appears on the WFM 90 only. Pressing this Bezel Button toggles the vector gain between correctly processing NTSC signals with or without setup.

ALT PH. This menu selection appears on the WFM 91 only. Pressing this Bezel Button toggles the PAL +V mode ON and OFF. When the mode is ON, the phase reference of the –V lines is inverted, and then shown as an overlay on the +V lines to provide a comparison display.

Configuration Menu PICTURE Category

HUE. This menu selection appears on the WFM 90 only. When HUE is selected, the right two Bezel Buttons adjust the hue of the Picture display. The Picture display mode must be selected before you can adjust the picture hue.

COLOR. When COLOR is selected, the right two Bezel Buttons adjust the color of the Picture display. The Picture display mode must be selected before you can adjust the picture color.

***NOTE**. Resetting the Picture Hue and Color*

Once the picture hue and/or color has been adjusted, resetting the instrument to the factory default settings, through the Configuration PRESETS category, is the only way to ensure that the hue and color have been correctly reset.

Configuration Menu TIME-OUT Category

The Time-out mode shuts down power to the Backlight and/or the instrument after there has been no front-panel activity for a menu-selected length of time.

BACK LT. Pressing this Bezel Button cycles the Backlight Time-out mode through DISABLED, 2 MIN, and 5 MIN.

SHUTDOWN. Pressing this Bezel Button cycles the instrument Time-out mode through DISABLED, 5 MIN, and 10 MIN.

Configuration Menu ALARMS Category

ALARM. Pressing this Bezel Button toggles the Alarm mode ON and OFF for the Waveform and Vector display modes.

Configuration Menu PRESETS Category

STORE. Stores the current keypad and menu settings in memory for future recall.

RECALL. Resets the keypad and menu settings to match the ones that were last stored in memory.

DEFAULT. Resets the front panel and menu settings to their factory-set defaults. Monitoring adjustments such as signal position, vector phase, and picture hue are also reset. The default settings of the keypad and menus are listed below.

Display mode	Waveform
Signal reference	Internal
Filter	Flat
DC restorer speed	Slow
Gain	X1
Variable gain	Off
Sweep	2H (2 Line)
Mag	Off
Bars	75%
Setup (WFM90 only)	Yes
Alt Phase (WFM91 only)	Off
Reference dBu	0 dBu
Headroom	3 dB
WIP location	Bottom right
Alarms	Off
Safe Action	Off
Safe Title	Off
Vertical shift	Off
Backlight time-out	Disabled
Instrument time-out	Disabled

Line Select Menu

The Line Select menu is displayed when the Line Select mode is turned on. The number of the selected line and/or field is displayed in the menu bar over the two right Bezel Buttons.

FIELDS. Toggles which video fields are displayed between ALL and 1 OF 2. When 1 OF 2 is selected, the menu selection ALT FIELD appears.

ALT FIELD. Toggles the display of the selected line between alternating video fields. This menu selection only appears when 1 OF 2 is selected.

Up/Down Arrows. The two right Bezel Buttons adjust which line number is selected for display. The menu bar over these two buttons include the displayed line and/or field number.

Making Measurements

This section contains descriptions of the different graticules provided with the WFM 90 and WFM 91 and methods for using them to perform basics signal measurements.

This monitor uses a proprietary rasterizer to display the graticules. The internal graticule scales are on the same plane as the CRT phosphor, eliminating parallax errors.

Waveform Graticule

There are two versions of the Waveform display mode graticule, illustrated in Figure 3–1 and Figure 3–2:

- NTSC composite video graticule (WFM 90 only)
- PAL (CCIR) composite video graticule (WFM 91 only)

Horizontal Scale

The 0 IRE (0.3 V PAL) graticule line is divided into 12 major divisions. Each division represents a unit of time determined by the SWEEP and MAG settings. Line-sweep rates appear in the on-screen readout, and are as follows:

SWEEP	TIME/DIV	MAG ON
1H (1 LINE)	5 µS/DIV	0.5 µS/DIV
2H (2 LINE)	10 µS/DIV	1 µS/DIV

In 2F (two field) sweep with MAG on, the signal is magnified by X20, and the entire vertical interval can be viewed.

Vertical Scales

The NTSC graticule is scaled in IRE units and extends from –40 to +120 IRE, in 10 IRE increments. Black level setup is denoted by a dashed line at 7.5 IRE.

The PAL (CCIR) graticule is scaled in volts and extends from 0 to 1.2 V, in 0.1 V increments.

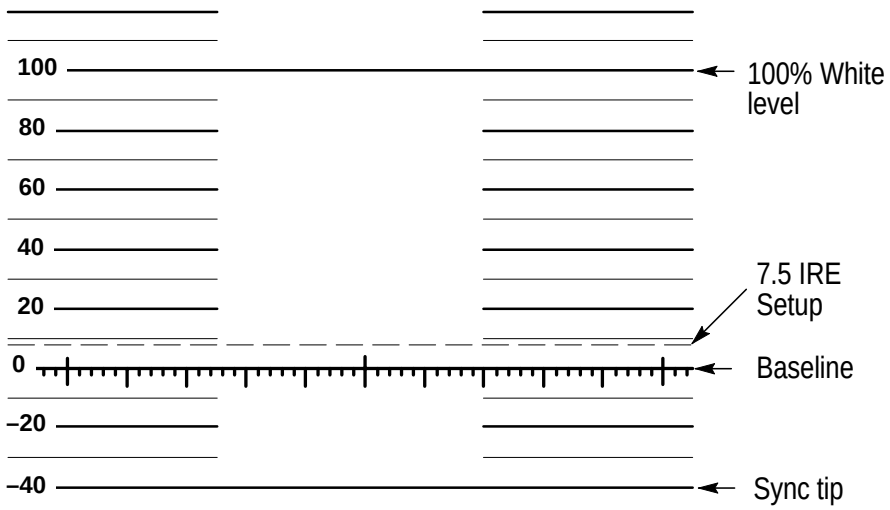


Figure 3–1: NTSC waveform graticule

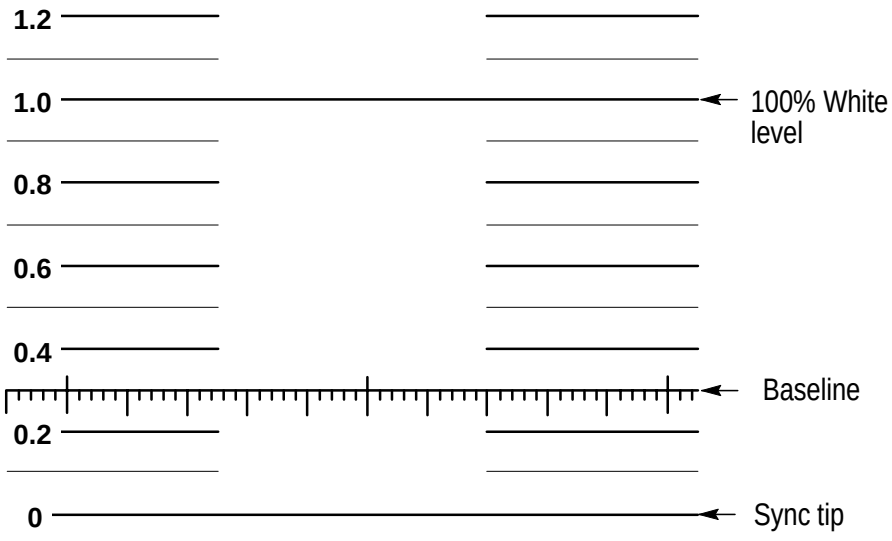


Figure 3–2: PAL waveform graticule

Making Waveform Measurements

Standard Measurements

Standard amplitude and timing measurements of the signal are made by positioning the waveform on the graticule. The magnification controls aid in measuring small portions of the waveform.

Peak White

With the signal blanking level on the graticule baseline, the amplitude of the 100% white reference of a color bar should be on the 100 IRE (1.0 V PAL) graticule line. The Amplitude Alarm mode highlights any portion of the signal which exceeds the 100 IRE (1.0 V PAL) graticule line.

DC Restorer

Use the SLOW setting for the DC restorer to measure hum or other low-frequency distortions. The FAST setting removes hum from the display so it will not interfere with other measurements. The back porch portion of the input signal is used as the clamping point.

***NOTE**. DC Restorer use with VCRs*

When using the shuttle mode on VCRs, set the instrument DC restorer speed to slow to prevent the loss of signal sychronization.

Vector Graticule

The Vector display mode permits measurements of hue in terms of the relative phase of the chrominance signal with respect to the color burst. Relative amplitude of chrominance to burst is expressed in terms of the displacement from center (radial dimension of amplitude). The two versions of the vector graticule are illustrated in Figure 3–3 and Figure 3–4:

- NTSC composite vector graticule (WFM 90 only)
- PAL (CCIR) composite vector graticule (WFM 91 only)

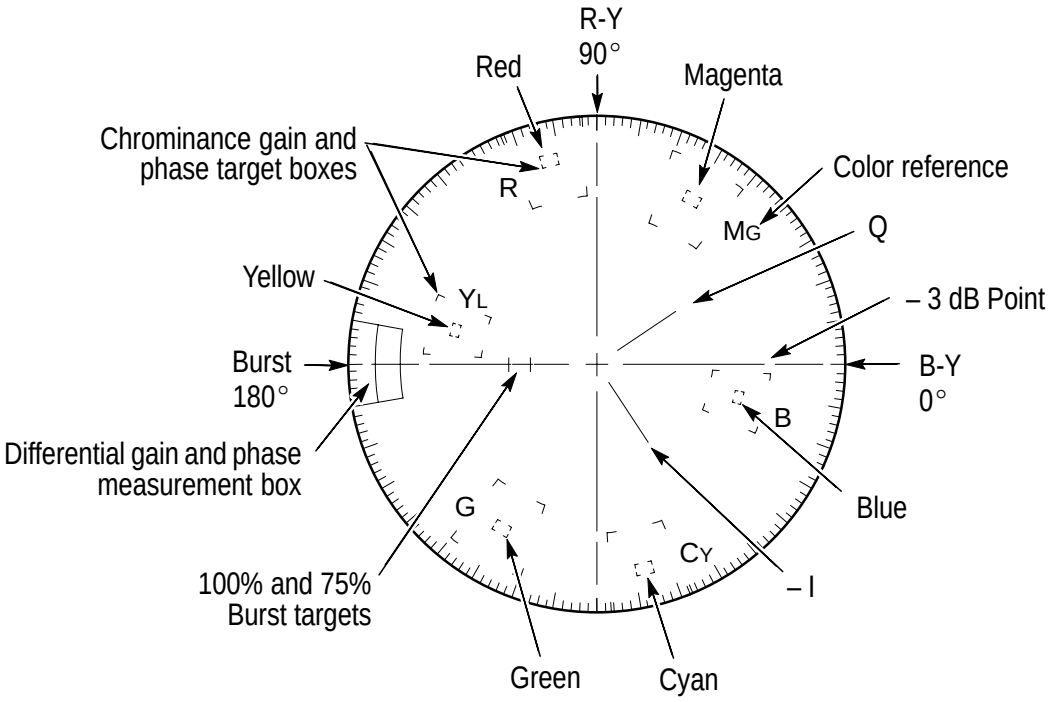


Figure 3–3: NTSC vector graticule

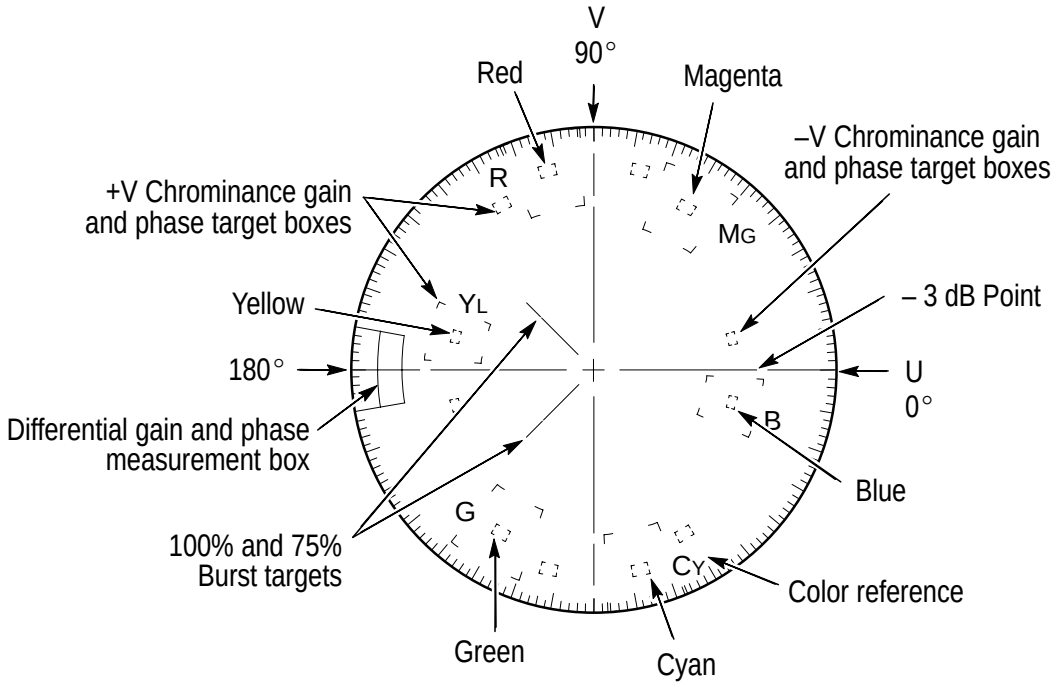


Figure 3–4: PAL vector graticule

Chrominance Vector Targets

The chrominance vectors terminate in a system of graticule targets consisting of two boxes (a small box inside a large box). A sample target is shown in Figure 3–5.

The dimensions of the large boxes represent ±10° centered on the exact chrominance phase, and ±20% of chrominance amplitude centered around standard amplitude. The dimensions of the smaller boxes represent ±2.5° and ±2.5 IRE (±3° and ±5% PAL) of chrominance amplitude.

For the PAL graticule, each chrominance vector related to the +V burst terminates in targets consisting of two boxes (a small box inside a large box). The vectors associated with the –V burst terminate in the targets consisting of smaller boxes only.

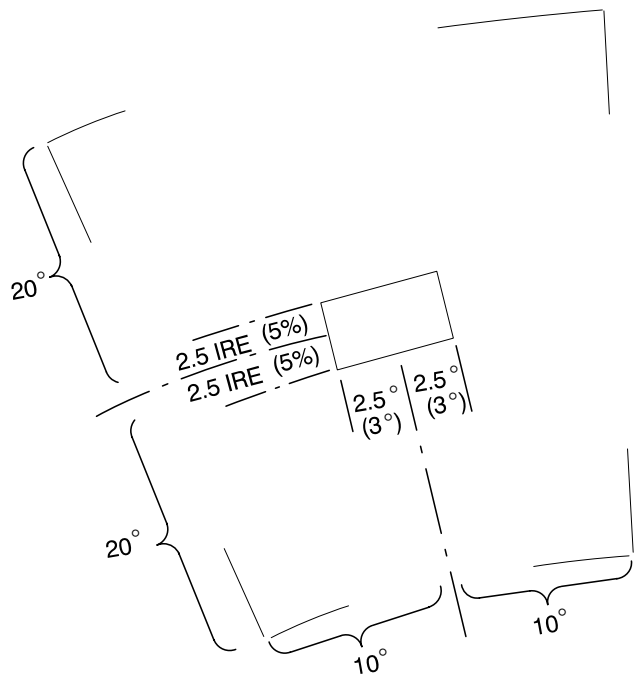


Figure 3–5: Vector targets – NTSC values (PAL values in parentheses)

Differential Phase and Gain Measurement Box

Differential gain (dG) and differential phase (dφ) measurements use the graticule markings located at the outer edge of the B-Y or U axis 180° line. See Figure 3–6.

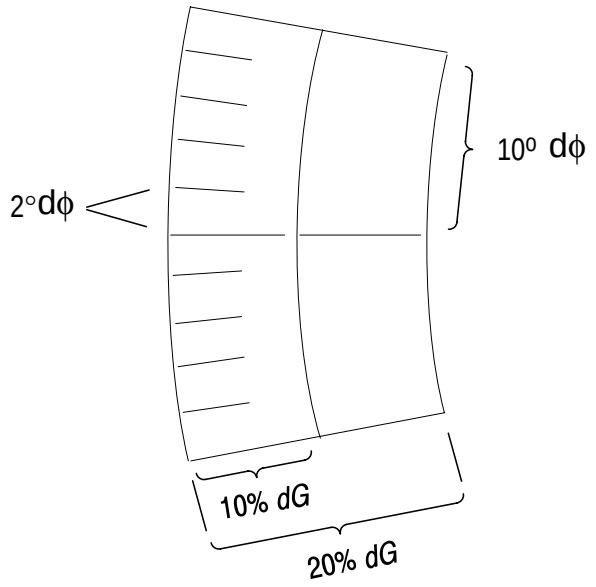


Figure 3–6: Differential gain and phase measurement box

Making Vector Measurements

Chroma Bandwidth

The horizontal and vertical axes of the vector graticule contain markings for checking chroma bandwidth. A subcarrier frequency sine wave (whose amplitude places it on the outer compass rose) is used as a reference. When the frequency is changed, the diameter of the circle should reduce in size. At a point equal to 70.7% of full amplitude (–3 dB), there are gaps in the horizontal and vertical axes. This calibration aid makes it possible to check the –3 dB points of the demodulator output amplifiers.

Audio Graticule

The audio graticule does not utilize a horizontal scale since the signal free-runs at a two-field sweep rate. The vertical scales are comprised of the audio reference level and the selected headroom setting mirrored around the baseline. The audio graticule is illustrated in Figure 3–7 with –3 dB headroom selected, and in Figure 3–8 with +10 dB headroom selected.

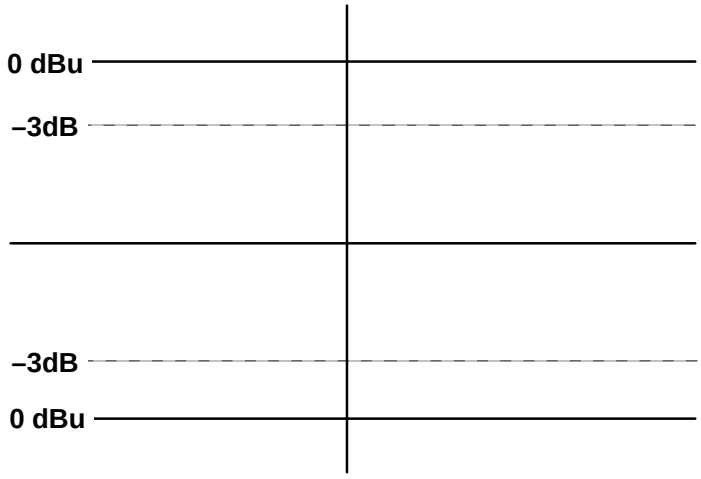


Figure 3–7: Audio graticule with –3 dB headroom selected

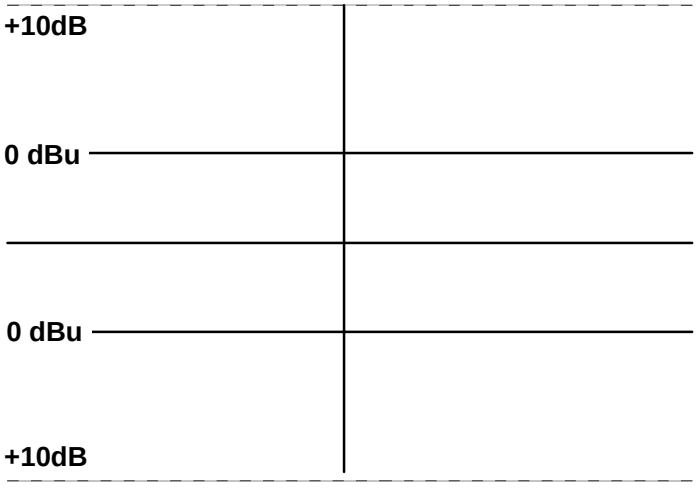


Figure 3–8: Audio graticule with +10 dB headroom selected

Making Audio Measurements

Basic audio system measurements such as signal amplitude and frequency response can be made using the audio graticule.

Signal Amplitude

Signal amplitude is checked by setting the WFM 90 and WFM 91 reference level through the Operating menu to match your system requirements. The amplitude of the signal display should reach the reference level graticule line during normal operation. The +10 dB headroom setting allows the system amplitude limits to be checked. The amplifier limits are reached when the signal becomes clipped, which is displayed as a squaring off of the signal peaks.

Frequency Response

Signal frequency response is checked by inputting a known signal frequency into the system and verifying that the signal amplitude does not drop below system requirements, usually accepted at –3 dB.

Headroom

The –3 dB headroom setting is used during system setup to verify frequency response of the audio system. The +10 dB headroom setting provides viewing of audio signals 3 dB above the system reference level so that any amplifier clipping can be viewed.

Appendix A: Performance Specification

The specification tables use the following abbreviations:

Performance Requirement (Req). All performance requirements in the specification tables are identified with ***Req***, and can be assured by completing the Performance Check Procedure located in the service manual. Allow a warm-up time of 20 minutes.

Performance requirements in the electrical specifications are valid over an ambient temperature range of +20° C to +30° C. The Performance Requirement tolerances listed in the Electrical Specification are doubled over the temperature range of 0° C to +40° C, unless otherwise specified. Test equipment used to verify Performance Requirements must be calibrated and working within the limits specified in the service manual Equipment Required List.

Reference Information. Information that amplifies a performance requirement or is of special importance is indicated by ***REF***. There is no need to check these items to a specific tolerance.

Safety Standards

ANSI/ISA S82 – Safety Standard for Electrical and Electronic Test, Measuring, Controlling, and Related Equipment.

CAN/CSA C22.2 No. 1010.1-92 – Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.

IEC1010-1 – Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use (1990).

UL3111 – Standard for Electrical Measuring and Test Equipment.

Electrical Specifications

A-1. Vertical deflection system

CATEGORY	DESCRIPTION
Frequency Response	***REF:*** Specifications apply for full screen height video input signal, with VARIABLE GAIN off. ***REQ:*** Flat Filter 1 V Full Scale: 50 kHz to 6 MHz within 2% of response at 50 kHz. ***REQ:*** Flat Filter X5 Gain: 50 kHz to 6 MHz within 5% of response at 50 kHz. ***REF:*** Low Pass Filter: ≥40 dB attenuation at 3.58 MHz NTSC, 4.43 MHz PAL. ***REF:*** Response at 15 kHz does not vary between FLAT and LUM (low pass) filters by more than 1%.
Deflection Factor	***REQ:*** 1 V Full Scale: 1 V input displayed within 1% of 140 IRE. ***REF:*** Flat filter selected. ***REQ:*** X5 Gain: Gain accuracy within 5% with 1 V input signal. ***REF:*** X5 Gain Registration: ≤1 major division of vertical shift from baseline between unmagnified and magnified signal. ***REQ:*** Variable Gain Range: Input signals between 0.8 V and 2 V can be adjusted to 140 IRE (1.0 V) display. 160 mV to 400 mV for X5 Gain. ***REQ:*** Position Range: 1 V signal can be positioned so that peak white and sync tip can be placed at blanking level, with the DC RESTORER on, regardless of gain setting.

A-1. Vertical deflection system (Continued)

CATEGORY	DESCRIPTION
Transi ent Response	***REF:*** Specifications apply for full screen height video input signal, with VARIABLE GAIN off, 1 V Full Scale or X5 Gain selected, and FLAT filter selected. ***REF:*** Pulse-to-Bar Ratio: X1: 0.99:1 to 1.01:1. X5: 0.98:1 to 1.02:1. ***REF:*** Preshoot: ≤1%. ***REF:*** Overshoot: X1: ≤2%. X5: ≤4%. ***REF:*** Ringing: X1: ≤2%. X5: ≤4%. ***REF:*** Field Rate Tilt: ≤1%. ***REF:*** Line Rate Tilt: ≤1%. ***REQ:*** Overscan: ≤2% variation in baseline of 100 IRE (700 mV) 12.5T (20T) modulated pulse as it is positioned over the middle 80% of the screen.
Maximum Absolute Input Level	***REF:*** ±5 VDC plus peak AC. ***REF:*** Displays in excess of 200 IRE (1.428 V) may cause frequency response aberrations.
DC Input Impedance (Unterminated)	***REQ:*** ≥15 kΩ. ***REF:*** With input switch in the HIZ position.
Video Input Return Loss	***REF:*** ≥40 dB from 50 kHz to 6 MHz with 75 Ω termination on.
Video Out Return Loss (75Ω)	***REF:*** ≥30 dB from 50 kHz to 6 MHz.
Video Out Differential Gain (50% APL)	***REF:*** Within 1% with a 140 IRE (1.0 V PAL) unit display.
Video Out Differential Phase (50% APL)	***REF:*** Within 1° with a 140 IRE (1.0 V PAL) unit display.

A-2. DC restoration

CATEGORY	DESCRIPTION
DC Restorer Clamp Time	***REF:*** Back Porch.
Frequency Response at 60 Hz (50 Hz PAL)	***REQ:*** Attenuation of 60 Hz (50 Hz PAL) on Input Signal: Slow Mode: ≤ 20%. Fast Mode: ≥ 90%. ***REF:*** Blanking Level Shift with 10% to 90% APL Change: APL changes from 50% to either 10% or 90% will cause blanking level shift of 1 IRE unit (7.14 mV PAL) or less. ***REF:*** Blanking Level Shift Due to Presence or Absence of Burst: 1 IRE unit (7.14 mV) or less shift from no color burst to presence of color burst.

A-3. Audio mode

CATEGORY	DESCRIPTION
Reference Levels	***REQ:*** –10 dBu, 0 dBu, +4 dBu, +8 dBu. ***REF:*** Nominal MIC reference: –50 dBu.
Measurement Accuracy	***REQ:*** 0.5 dB at 1 kHz.
Frequency Response	***REQ:*** 0.5 dB from 50 Hz to 20 kHz.
Maximum Input Level Amplitude	***REF:*** +18 dBu.
DC Input Impedance	***REF:*** ≥ 15 kΩ.
Audio Output Connector	***REF:*** Mini stereo headphone jack.
Maximum Power Output	***REF:*** 250 mW.

A-4. Horizontal deflection system

CATEGORY	DESCRIPTION
Sweep	***REQ:*** Sweep will occur in all Horizontal mode settings with or without synchronization. ***REF:*** Sweep Length: Two Line and Two Field sweep length is nominally 12 divisions.
1LINE Sweep Repetition Rate	***REQ:*** Equal to line-rate of applied video or external sync.
2LINE Sweep Repetition Rate	***REQ:*** Equal to half line-rate of applied video or external sync.
2FLD Sweep Repetition Rate	***REF:*** Displays 2 full fields, including the field-rate sync between them.
2FLD Sweep Magnification	***REF:*** Approximately X20.
Sweep Magnifier Registration	***REF:*** Magnification occurs about the center of the screen.
Timing Accuracy	***REF:*** All timing and linearity specifications exclude the first and last major divisions of the unmagnified display. ***REQ:*** 10 μs/division (2LINE): Within 2%. ***REQ:*** 5 μs/division (1LINE): Within 2%. ***REQ:*** 1 μs/division (2LINE + MAG): Within 2%. ***REQ:*** 0.5 μs/division (1LINE + MAG): Within 3%.
Integral Linearity	***REQ:*** Within 1%. ***REF:*** Measured between the 10 μs and 110 μs points on the 10 μs/division (2LINE) sweep.
Horizontal Position	***REF:*** Any portion of a synchronized video sweep can be positioned on-screen in all sweep modes.

A-5. Vector mode

CATEGORY	DESCRIPTION
Chrominance Processing Nominal Subcarrier Frequency (F_{SC})	***REF:*** NTSC: 3.579545 MHz. PAL: 4.43361875 MHz.
Chrominance Processing Chrominance Bandwidth	***REQ:*** Upper –3 dB Point: F_{SC} +500 kHz, ±100 kHz. Lower –3 dB Point: F_{SC} – 500 kHz, ±100 kHz.
Chrominance Processing +V Mode (Applicable to PAL operation only)	***REF:*** +V-type display as selected by front-panel button. When pushed, V axis is inverted at a 1/2 line rate to produce a single vector display.
Display Vector Phase Accuracy	***REF:*** ±1.25°. ***REF:*** Measured with color bar signal.
Display Vector Gain Stability	***REF:*** Typically ±2.5%.
Display Quadrature Phasing	***REF:*** Typically ±0.5°.
Display Differential Phase	***REF:*** ±1°. ***REF:*** Measured with 140 IRE (1 V) linearity signal (5 step, 10 step, or Ramp) with 40 IRE (300 mV) of subcarrier.
Display Differential Gain	***REF:*** ±1%. ***REF:*** Measured with 140 IRE (1 V) linearity signal (5 step, 10 step, or Ramp) with 40 IRE (300 mV) of subcarrier.
Subcarrier Regenerator Pull-In Range	***REQ:*** NTSC: ±50 Hz of F_{SC}. PAL: ±10 Hz of F_{SC}. ***REF:*** Subcarrier Regenerator free-runs in absence of appropriate signal. Reference can be burst of either displayed signal or external reference signal.
Subcarrier Regenerator Pull-In Time	***REF:*** Pull-In Time: Within 1 second, with subcarrier frequency within 50 Hz (10 Hz for PAL) of F_{SC}.

A-5. Vector mode (Continued)

CATEGORY	DESCRIPTION
Subcarrier Regenerator Phase Shift with Subcarrier Frequency Change	***REQ:*** NTSC: ±2° from F_{SC} to (F_{SC} + 50 Hz), or F_{SC} to (F_{SC} – 50 Hz). PAL: ±2° from F_{SC} to (F_{SC} + 10 Hz), or F_{SC} to (F_{SC} – 10 Hz).
Subcarrier Regenerator Phase Shift with Burst Amplitude Change	***REQ:*** ±2° from nominal burst amplitude to ±6 dB. ***REF:*** Internal or External burst reference.
Subcarrier Regenerator Phase Shift with Variable Gain Control	***REQ:*** ±1° as gain is varied from +3 dB to –6 dB.
Subcarrier Regenerator Phase Control Range	***REF:*** 360° continuous rotation.
Subcarrier Regenerator Burst Jitter	***REF:*** 0.5° RMS or less. ***REF:*** With 140 IRE (1 V) composite video input. INT or EXT referenced.

A-6. Synchronization

CATEGORY	DESCRIPTION
Input Requirements	***REQ:*** Internal Reference: Composite video or black burst with sync amplitudes 40 IRE (300 mV PAL) ±6 dB. ***REQ:*** External Reference: Sync amplitude between 143 mV and 4 V will synchronize sweeps.
External Reference Input	***REQ:*** DC Input Impedance (Unterminated): ≥15 kΩ. ***REF:*** Return Loss (75 Ω): ≥40 dB from 50 kHz to 6 MHz. (With 75 Ω termination on, instrument power on.) ***REF:*** Absolute Maximum Input Voltage: ±12 VDC plus peak AC.

A-7. Physical characteristics

CATEGORY	DESCRIPTION
Dimensions	***REF:*** Instrument: 5 inches (127 mm). 3.15 inches (80.0 mm). 9.6 inches (243.8 mm). Shipping Box: 13.25 x 13.75 x 6 inside 14 x 14.25 x 6.25 outside
Weight	***REF:*** With batteries and pouch: 3 lbs.-9 oz. Without batteries and pouch: 1 lb.-14 oz. Shipping weight with packaging: 5 lbs.-14 oz.

A-8. Environmental characteristics

CATEGORY	DESCRIPTION
Operating Altitude	***REQ:*** To 15,000 feet (4572 meters). ***REF:*** IEC 1010-1 compliance to 2000 meters.
Operating Temperature	***REQ:*** 0° to +50° C. ***REF:*** IEC 1010-1 compliance to +40° C.
Equipment Type	***REQ:*** Measurement.
Installation Category	***REQ:*** Installation Category I (as defined in IEC 1010-1, Annex J). ***REF:*** Rated for indoor use only.
Pollution Degree	***REQ:*** Pollution Degree 2 (as defined in IEC 1010-1).
Vibration – Operating	***REF:*** 15 minutes each axis at 0.015 inch, frequency varied from 10–55–10 Hz in 1-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 Hz if no resonant point is found.
Shock – Non-Operating	***REF:*** 100 g's, 1/2 sine, 11 ms duration, 3 shocks per surface (18 total).
Transportation	***REF:*** Qualified under NTSC Test Procedure 1A, Category II (24-inch drop).
Humidity	***REF:*** Will operate at 95% relative humidity for up to five days. Meets the five-day cycling humidity test as called out in Tektronix standard 062-2847-00.

A-9. Power source

CATEGORY	DESCRIPTION
Battery	***REF:*** 6 C-sized cell batteries, or Tektronix NiCad battery pack (Tektronix Part No. 146-0107-00).
Battery Charge Time	***REF:*** Fast Charge: 550 mA. ***REF:*** Slow Charge: 150 mA.
Power Consumption	***REF:*** Picture Mode: 5.5 Watts Waveform Mode 7.2 Watts Vector Mode 7.2 Watts
External Power	***REQ:*** DC Source of 11 – 18 Volts.

Table A–1: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union: EN 55011 Class A Radiated and Conducted Emissions EN 55011 Class B Radiated and Conducted Emissions EN 50081-1 Emissions: EN 55022 Class B Radiated and Conducted Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity
Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AN/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment:1992 AN/NZS 3548 Information Technology Equipment: 1995
EMC Compliance	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility when it is used with the product(s) stated in the specifications table. Refer to the EMC specification published for the stated products. May not meet the intent of the directive if used with other products.
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.

Appendix B: User Service

This section contains instructions for user and preventive maintenance. If the instrument is not functioning properly, it should be referred to qualified service personnel or returned to Tektronix for service. Packaging directions for shipment are on page 1–9.

Fuse Replacement

The WFM 90 and WFM 91 do not have any user replaceable fuses.

Battery Replacement

Instructions for installing or replacing the batteries along with battery operation tips are listed starting on page 1–12.

Cleaning

The instrument should be cleaned often enough to prevent dust and dirt from accumulating.

CAUTION. *Instrument Cleaning*

Do not allow water to get inside the instrument. Do not clean any plastic materials with benzene, toluene, xylene, acetone, or similar compounds, because they may damage the plastic.

Exterior

Clean the dust from the outside of the instrument with a soft, clean cloth or small brush. A brush is especially useful for removing dust from around the keypad buttons and the connectors. Hardened dirt can be removed using a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used.

Display Screen

The protective screen over the LCD display is susceptible to smudging from dirt and grease. It can be cleaned by spraying a glass-type cleaner onto a lint-free cloth and gently rubbing the display. Only dampen the cloth to prevent moisture from getting behind the protective screen of the display.

Interior

Interior cleaning and maintenance should be performed by qualified service personnel only. Instructions for interior maintenance are provided in the service manual.

LCD Display

The LCD display will retain an image if the instrument is left on in one display mode for an extended period of time. This is typical for the LCD display device. The retained image will fade over time, and that time can be accelerated by leaving the instrument turned off.

CAUTION. *LCD Display Image Retention*

To prevent image retention in the LCD display, enable the backlight time-out mode or turn the instrument off if the monitor is going to be left alone for more than two hours.

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