

WFM7200, WFM8200, and WFM8300
Waveform Monitors
System Integration
Technical Reference



077-0391-02

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Waveform Monitors
System Integration
Technical Reference**

Warning

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

www.tektronix.com

077-0391-02

Tektronix

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

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

To safely perform service on this product, additional information is provided at the end of this section. (See page iv, *Service safety summary*.)

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

Comply with local and national safety codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Do not use the provided power cord for other products.

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

Power disconnect. The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

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

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

Do not operate without covers. Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

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

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product.

Provide proper ventilation. Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product.

Use only the Tektronix rackmount hardware specified for this product.

Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

To avoid electric shock. Do not touch exposed connections.

Do not service alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect power. To avoid electric shock, switch off the product power and disconnect the power cord from the mains power before removing any covers or panels, or opening the case for servicing.

Use care when servicing with power on. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

Verify safety after repair. Always recheck ground continuity and mains dielectric strength after performing a repair.

Terms in this manual

These terms may appear in this manual:



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



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

Symbols and terms on the product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

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



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal



Standby

Preface

This document provides information for system integrators who are designing systems for high-definition (HD), standard-definition (SD), and 3 Gb/s, UHDTV1/4K SDI digital video content where the Tektronix WFM7200, WFM8200, and WFM8300 Waveform Monitors are to be deployed.

This manual is divided into the following sections:

- *Physical, environmental, and power specifications*
- *Rack and custom installation*
- *Instrument connectors*
- *System installation*
- *Network operation*

Where to find more information

The following tables list the documentation that is available for the product and shows where you can find it: in a printed manual, on the product documentation CD-ROM, or on the Tektronix Web site.

Table i: Product documentation

Item	Purpose	Location
Installation and Safety Instructions (this manual)	Provides safety and compliance information along with hardware installation instructions to present the associated safety warnings. This manual is available in English, Japanese, and Simplified Chinese.	Printed manual and also available in electronic format at www.tektronix.com/manuals
User Manual	Provides operation and application information. This manual is available in English, Japanese, and Simplified Chinese.	Product Documentation CD and available at www.tektronix.com/manuals
Online Help	In-depth instrument operation and UI help.	On the instrument
Specifications and Performance Verification Technical Reference	Specifications and procedures for checking instrument performance.	Product Documentation CD and available at www.tektronix.com/manuals
WFM and WVR Series Management Information Database (MIB) Programmer Manual	SNMP command reference for remotely controlling the instrument.	Product Documentation CD and available at www.tektronix.com/manuals
Service Manual	Provides information about adjustments, repair, and replaceable parts.	Available at www.tektronix.com/manuals

Table ii: Related reference documents

Item	Purpose	Location
Top 10 Application-Based Presets	Describes useful presets and how to set them up.	Product Documentation CD and available at www.tektronix.com
Preventing Illegal Colors (application note)	Describes how the Diamond, Arrowhead, and Lightning displays can be used to help prevent the undesired impact of color gamut violations and to simplify the assessment of proper gamut compliance.	Product Documentation CD and available at www.tektronix.com/manuals
Understanding Colors and Gamut (poster)	Provides a large visual display of how the Diamond, Arrowhead, and Lightning displays can be used to help prevent the undesired impact of color gamut violations.	Available at www.tektronix.com/manuals
A Guide to Standard and High Definition Digital Video Measurements (primer)	This book explains the basics of making standard and high-definition, digital-video measurements.	Product Documentation CD and available at www.tektronix.com/manuals
Analog and Digital Audio Monitoring (application note)	Describes how to monitor analog and digital audio signals. Also discussed are specific differences in the methods used to monitor analog audio versus digital audio, and how to plan the transition from monitoring analog audio to monitoring digital audio.	Available at www.tektronix.com/manuals
Audio Monitoring (application note)	Describes balanced and unbalanced audio signals, and explains the physical and electrical characteristics and the specific strength and weaknesses of the different digital audio signal formats.	Available at www.tektronix.com/manuals
Monitoring Surround Sound Audio (application note)	Describes the basics of 5.1-channel surround sound audio and tells how to use the Surround Sound display to visualize key audio-level and phase relationships in this audio format.	Available at www.tektronix.com/manuals
NTSC Video Measurements (primer)	This book explains the basics of making NTSC video measurements.	Product Documentation CD and available at www.tektronix.com/manuals
PAL Systems Television Measurements (primer)	This book explains the basics of making PAL video measurements.	Product Documentation CD and available at www.tektronix.com/manuals

Table iii: Graphics, photos, and CAD file images for system integrators

Item	Purpose	Location
Front and rear panel photos of the WFM7200, WFM8200, and WFM8300	These photos might be useful if you need to present information to your customer	Product Documentation CD
Front and rear panel line art	This line art might be useful if you need to present information to your customer	Product Documentation CD and this manual
Front and rear panel CAD file images of various Tektronix video products in .dwg format	These images can be used in Visio and AutoCAD system drawings	Attached to the PDF of this manual and Product Documentation CD

Physical, environmental, and power specifications

The physical, environmental, and power specifications apply to all instrument models. Use this information to ensure proper ventilation and clearance when installing an instrument into a rack.

Table 1: Physical specifications

Characteristic	Description	
Dimensions	Height	5.25 in (133.4 mm)
	Width	8.5 in (215.9 mm)
	Depth (front to back including handles and BNCs)	18.125 in (460.4 mm)
Weight	Net	12 lbs (5.5 kg), maximum
	Shipping	21 lbs (9.6 kg), approximately
Required clearances	Top	None
	Bottom	None
	Left side	2 in (51 mm)
	Right side	2 in (51 mm)
	Front	None
	Rear	2 in (51 mm)

Table 2: Power specifications

Characteristic	Description	
Power	Input Voltage	100 to 240 VAC \pm 10%
	Input Power Frequency	50 or 60 Hz
	Power Consumption, typical	50 to 110 VA at 110 or 240 VAC

NOTE. More information about the power connector is available in this document. (See page 9, Power connector.) You can also read about the power-on and power-off procedures. (See page 25.)

Table 3: Environmental specifications

Characteristic		Description
Temperature	Operating	0 °C to +40 °C
	Non-operating	-20 °C to +60 °C
Humidity	Operating	20% to 80% relative humidity (% RH) at up to +40 °C, non-condensing
	Non Operating	5% to 90% RH (relative humidity) at up to +60 °C, non-condensing
Altitude	Operating	9,842 ft (3,000 m)
	Non-operating	40,000 ft (12,192 m)
Cooling		The variable fans provide forced air circulation. Do not block ventilation openings.
	Bare instrument (no optional sleeves)	To ensure proper air flow, there must be 2 inches of clearance on both sides of the instrument, at least 2 inches of clearance from the rear of the instrument, and at least a 1/2 inch of clearance from the top of the instrument.
	Portable cabinet	Use only the Tektronix portable cabinet, WFMF02, to ensure proper airflow with this instrument. When using the portable cabinet, the same minimum clearances as the Bare Instrument apply.
	Rack cabinet	Use only the Tektronix rackmount insert, WFM7F00, with the Tektronix Dual Rack Adapter, WFM RACK-NN and WFM RACK-ON, for this instrument. To ensure proper airflow when installing the Dual Rack Adapter in a closed rack with solid walls, there must be at least 2 inches of clearance from both sides of the rack adapter frame to the rack side walls, at least 3 inches of clearance from the rear of the rack adapter frame to the rack's back wall, and at least a 1/2 inch of clearance from the top of the rack adapter to another rack adapter or installed instrument. The rack intake air to the side vents must not exceed 40 °C.
Pollution degree		2, Indoor use only

Rack and custom installation



CAUTION. *To prevent damage to the instrument and the cabinet, do not install the instrument in any cabinet except one that is approved by Tektronix, such as the WFM RACK-NN or WFM RACK-ON.*

The instrument is shipped in a wrap-around chassis that covers the instrument bottom and two sides. A cover is installed on the chassis, and the rear panel is made up of the module rear panels.

You can operate the instrument in the instrument chassis (be sure the top cover is on) or installed in a rack adapter or custom installation.

Information about custom installation

If you install the instrument in a custom application, such as a console, be sure to follow these guidelines to ensure adequate airflow:

- Do not block the ventilating holes.
- Adhere to the clearance requirements. (See Table 3 on page 2.)

Information about rack adapters

To accommodate different products, two types of rack adapter configurations are available for the WFM7200, WFM8200, and WFM8300 products. Each configuration is designed to properly fit only the combination of products listed below.



CAUTION. *Be sure to use the correct configuration for your product. If you use the wrong configuration, it could damage the instrument and cause overheating problems. Refer to the cooling specifications in this manual. (See page 2.)*

The ventilation holes and EMI shielding for each configuration are specially designed to meet the requirements of the instruments for which they were intended.

WFMRACK-NN

Tektronix part number 650-4445-XX. This rack adapter configuration contains two N sleeves and can house two of any of the following instruments in any combination:

- WFM700
- WFM6000, WFM6100, WFM6120
- WFM7000, WFM7020, WFM7100, WFM7120, WFM7200
- WFM8200, WFM8300
- AMM768
- MTX100A and MTX100B
- RTX A series and RTX B series

Information about installing short depth instruments. This configuration also includes two adapters for accommodation of Tektronix short depth waveform monitors.

NOTE. *If you want to house only short depth instruments, you may want to purchase the WFMRACK-S2 short depth rack adapter. Contact your Tektronix service representative for more information.*

Information about utility drawers. If you only have one instrument in the rack adapter, you can purchase a 1700F07 utility drawer to install in the other side of the rack adapter. This drawer can be used to house accessory items. With the tray secured to the rear of the rack adapter, the drawer can be opened and closed freely, unless latched.

WFM RACK-ON Tektronix part number 650-4394-XX. This rack adapter configuration contains one O sleeve and one N sleeve and can house one of the instruments in the first table with one of the instruments in the second table.

Table 4: O-sleeve instruments

Instrument
1700 series
WFM601
MTX100
Older half-rack instruments
760A
764

Table 5: N-sleeve instruments

Instrument
WFM700
WFM6000, WFM6100, WFM6120
WFM7000, WFM7020, WFM7100, WFM7120, WFM7200
WFM8200, WFM8300
AMM768
MTX100A and MTX100B
RTX A series and RTX B series

Information about installing short depth instruments. This configuration also includes two adapters for accommodation of Tektronix short depth waveform monitors.

NOTE. *If you want to house only short depth instruments, you may want to purchase the WFM RACK-S2 short depth rack adapter. Contact your Tektronix service representative for more information.*

Information about utility drawers. If you only have one instrument in the rack adapter, you can purchase a 1700F07 utility drawer to install in the other side of the rack adapter. This drawer can be used to house accessory items. With the tray secured to the rear of the rack adapter, the drawer can be opened and closed freely, unless latched.

Rack adapter dimensions

The following three figures show the dimensions of the WFM Rack-NN and -ON rack adapter hardware.

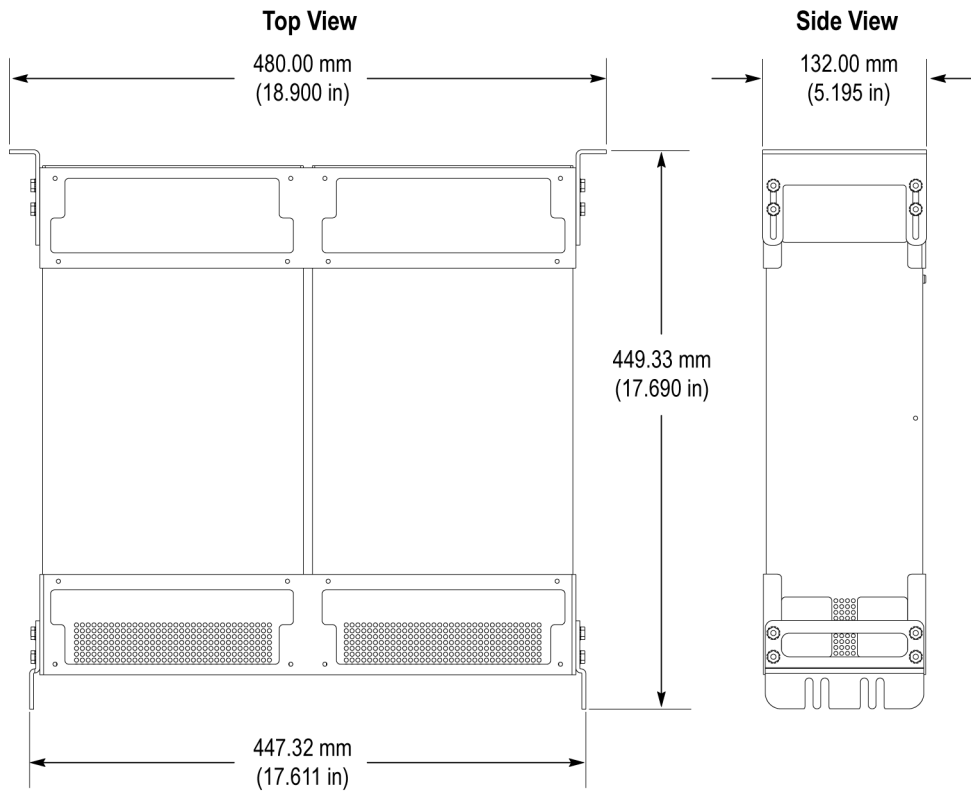


Figure 1: Rack adapter dimensions

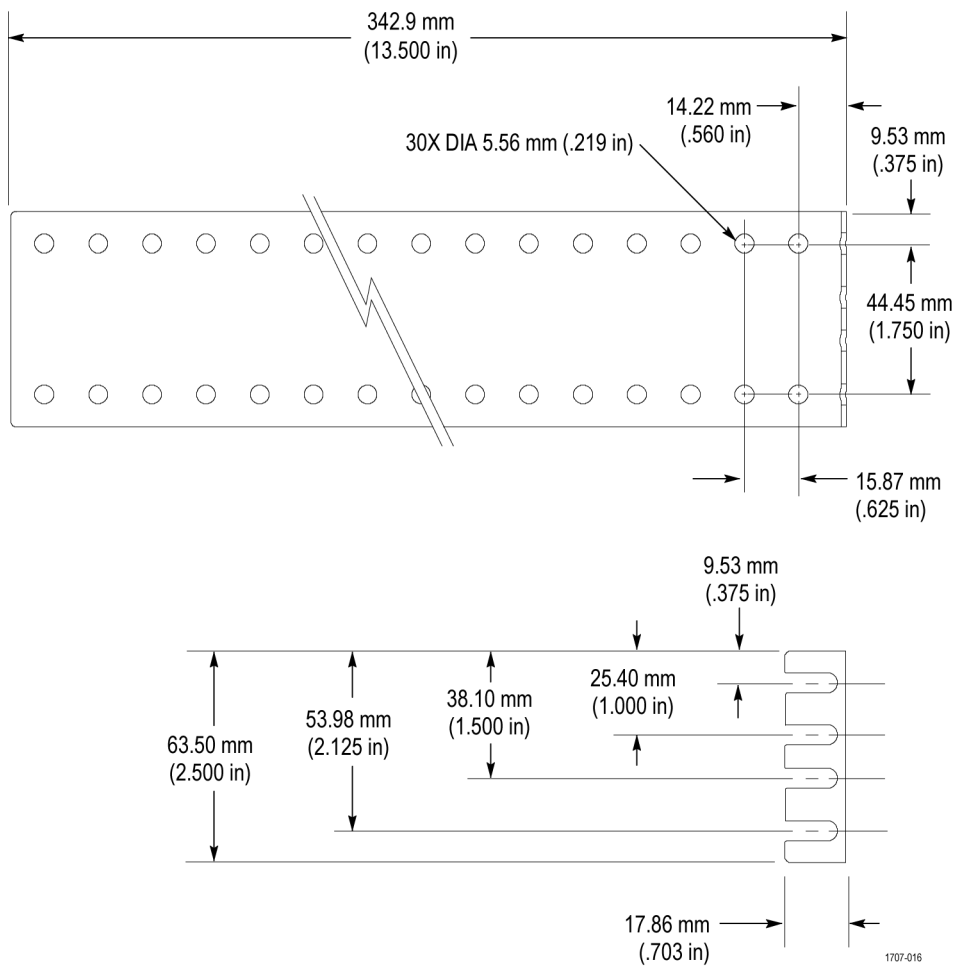


Figure 2: Rear-bracket guide dimensions

Rack adapter installation considerations

NOTE. See *WFM RACK-S2, WFM RACK-NN, and WFM RACK-ON Rack Adapter Instructions (Tektronix part number 071-1107-XX)* for detailed installation instructions.

Before and during installation, be aware of the following:

- The rack adapter is marked with the word "TOP" to indicate which side of the adapter should face up.
- You can adjust the position of the handle brackets to mount the adapter flush with other equipment in the rack.
- Install the rack adapter into the rack BEFORE installing the instrument(s) into the adapter.

Instrument connectors

The instrument has connectors on the front and rear panels. The following pages describe the connector types, pin numbering, and associated signal requirements.

The first illustration shows the rear panel of a fully optioned instrument. Your instrument may have a different configuration than that shown.

NOTE. More illustrations and photographs of these instruments are available in JPEG format on the Tektronix Web site (www.tektronix.com) and on the Product Documentation CD that was shipped with your instrument.

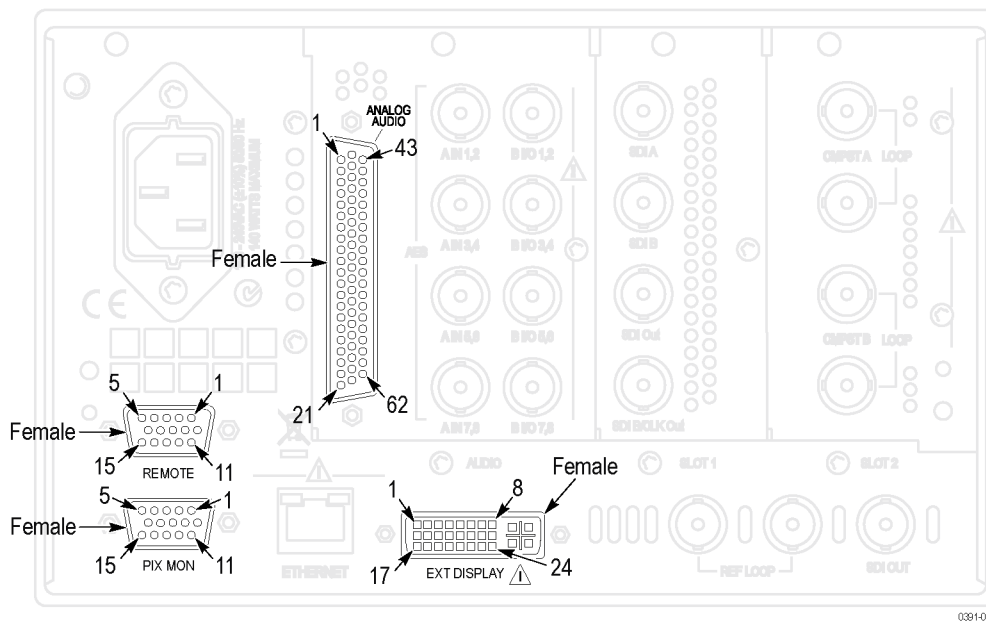
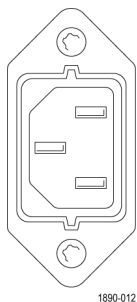


Figure 3: Rear panel with Option CPS, EYE or PHY or PHY3, and AD or DDE installed

Power connector



The instrument has the following power requirements:

- A single-phase power source with one current-carrying conductor at or near earth-ground (the neutral conductor).
- The power source frequency must be 50 or 60 Hz, and a operating voltage range must be from 100 to 240 VAC, continuous.



WARNING. *To reduce risk of fire and shock, ensure the mains supply voltage fluctuations do not exceed 10% of the operating voltage range.*

- Systems with both current-carrying conductors live with respect to ground (such as phase-to-phase in multiphase systems) are not recommended as power sources.

NOTE. *Only the line conductor is fused for over-current protection. The fuse is internal and not user replaceable. Do not attempt to replace the fuse. If you suspect the fuse has blown, return the unit to an authorized service center for repair.*

SDI video connectors

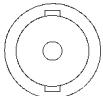
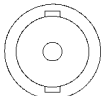


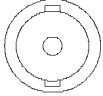
SDI inputs are self-terminating inputs. Use the SDI A and SDI B inputs to connect a serial digital video signal to the instrument.

The SDI A Out signal is the reclocked output of the SDI A input and has the same data rate as the input signal. The SDI B/CLK Out signal is the reclocked output from the SDI B input and has the same data rate as the input signal. If the instrument has Option EYE, PHY, or PHY3, the SDI B/CLK Out signal can also be the recovered clock output. You can connect the Clock Out signal to a spectrum analyzer to view jitter frequency components in the video signal.

The SDI OUT can be selected to output either the looped-through input signal, a test signal (Option 3G only), or the Pix Mon signal output, which contains configurable error brightups. This can be done from the Config > Outputs > SDI Output menu.

The following table lists the characteristics of the SDI video connectors.

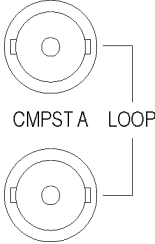
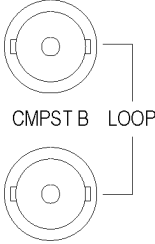
Table 6: SDI video connector specifications

Connector	Characteristic	Description
 SDI A	Input Type	BNC, 75 Ω internally terminated
	Input Level	800 mV \pm 10%
	Cable Loss Accommodation: 270 Mb/s	0 to 30 dB attenuation at $\frac{1}{2}$ of serial rate Equivalent to approximately 300 m of Belden 8281 at 270 Mb/s
 SDI B	Cable Loss Accommodation: 1.5 Gb/s, 3 Gb/s	0 to 20 dB attenuation at $\frac{1}{2}$ of serial rate Equivalent to approximately 80 m of Belden 8281 at 1.485 Gb/s. Typical performance to 110 m
	Output Type	BNC, 75 Ω internally terminated Reclocked output of the SDI A input.
 SDI A Out <small>0391-003</small>	Output Level	800 mV \pm 10% into 75 Ω load
	Output Type	BNC, 75 Ω internally terminated Reclocked output of the SDI B input.
 SDI B/CLK Out <small>0391-004</small>	Alternate Output Type (for instruments with Option EYE or PHY or PHY3)	Reference clock; BNC, 800 mV \pm 10% p-p into 75 Ω load
	Alternate Output Frequency	SD = 27 MHz HD = 74.25 or 74.17852 MHz
	Output Type	BNC, 75 Ω internally terminated
 SDI OUT	Output Level	800 mV \pm 10% into 75 Ω load

Composite video connectors

Use the CMPST A and CMPST B inputs to connect an NTSC or PAL composite video signal to the instrument. The following table lists the signal characteristics of the composite video connectors.

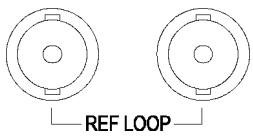
Table 7: Composite video connector specifications

Connector	Characteristic	Description
 <p>CMPST A LOOP</p>	Input Type; Quantity	BNC, passive loop-through, 75 Ω compensated; 2 inputs (Composite A and Composite B)
	Maximum Operating Amplitude with Clamping Off (DC Coupled)	-1.8 V to +2.2 V (all inputs), DC + peak AC
	Maximum Absolute Input Voltage	-6.0 V to +6.0 V, DC + peak AC
 <p>CMPST B LOOP</p> <p>0381-002</p>		

Video external reference connector

Use the REF LOOP connector to input a composite Black Burst signal or a tri-level sync signal for use as a sync timing reference for the selected video input signal. The following table lists the signal characteristics of the external reference connectors.

Table 8: External reference connector specifications

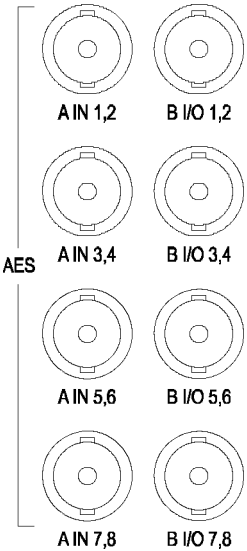
Connector	Characteristic	Description
 <p>REF LOOP</p>	Input Type	BNC, passive loop-through, 75 Ω compensated
	Input Level	-6 to +6 dB
	Maximum Input Voltage Level	± 5 V, DC
	Maximum Absolute Input Voltage	± 5 V, DC

AES digital audio connectors

Use the AES audio connectors to input or output digital audio signals. The "A" connectors are input only. You can configure the "B" connectors to function as additional inputs or as outputs of the selected audio inputs. Use the Audio Inputs/Outputs menu to configure the channel mapping in the audio displays.

The following table lists the signal characteristics of the AES Audio connectors.

Table 9: AES digital audio connector specifications

Connector	Characteristic	Description
	Input Type (A and B connectors)	BNC, 75 Ω terminated, unbalanced (meets requirements of AES 3-ID and SMPTE 276M-1995)
	Input Amplitude Range (A and B connectors)	0.1 V _{p-p} to 2 V _{p-p}
	Output Type (B connectors only)	BNC, 75 Ω terminated, unbalanced (meets requirements of AES 3-ID and SMPTE 276M-1995)
	Output Amplitude Range (B connectors only)	0.9 V to 1.1 V Pk-Pk into 75 Ω

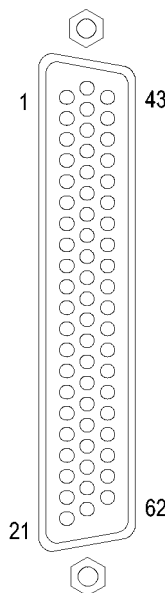
Analog audio connector

Use the ANALOG AUDIO connector to input or output analog audio signals. The connector is a 62-pin, female, D-subminiature connector. Pin assignments and pin names are listed in the following figure and table.

Use the Audio Settings menu to configure the channel mapping in the audio displays.

For all audio options, use the supplied 62-pin DSUB connector to attach analog-audio signals to the instrument. Solder wires to the connector as needed to accommodate the desired audio inputs and outputs. Audio signals can be connected as either balanced or unbalanced. Be sure to use a suitable cable when you are wiring balanced audio. An example of a suitable cable is Belden 8451, which is a shielded twisted pair cable. Alternatively, you can purchase an audio breakout cable (Tektronix part number 012-1688-00), which provides a two meter cable with XLR connectors for all twelve inputs and eight outputs.

Table 10: Analog audio connector specifications

Connector	Pin	Description	Pin	Description
	1	Ch. 1 input, line A, positive	22	Ch. 1 input, line A, negative
	2	Ch. 1 input, line B, positive	23	Ch. 1 input, line B, negative
	3	Ch. 2 input, line A, positive	24	Ch. 2 input, line A, negative
	4	Ch. 2 input, line B, positive	25	Ch. 2 input, line B, negative
	5	Ch. 3 input, line A, positive	26	Ch. 3 input, line A, negative
	6	Ch. 3 input, line B, positive	27	Ch. 3 input, line B, negative
	7	Ch. 4 input, line A, positive	28	Ch. 4 input, line A, negative
	8	Ch. 4 input, line B, positive	29	Ch. 4 input, line B, negative
	9	Ch. 5 input, line A, positive	30	Ch. 5 input, line A, negative
	10	Ch. 5 input, line B, positive	31	Ch. 5 input, line B, negative
	11	Ch. 6 input, line A, positive	32	Ch. 6 input, line A, negative
	12	Ch. 6 input, line B, positive	33	Ch. 6 input, line B, negative
	13	Ground	34	Ground
	14	Ch. 1 output, positive	35	Ch. 1 output, negative
	15	Ch. 2 output, positive	36	Ch. 2 output, negative
	16	Ch. 3 output, positive	37	Ch. 3 output, negative
	17	Ch. 4 output, positive	38	Ch. 4 output, negative
	18	Ch. 5 output, positive	39	Ch. 5 output, negative
	19	Ch. 6 output, positive	40	Ch. 6 output, negative
	20	Ch. 7 output, positive	41	Ch. 7 output, negative
	21	Ch. 8 output, positive	42	Ch. 8 output, negative
		43-62	No connection	
Characteristic	Description			
Input Type	62 pin, 3 row, DSUB, balanced, unterminated			
Maximum Input Level	+24 dBu \pm 0.3 dBu			
Output Type	62 pin, 3 row, DSUB, balanced, unterminated; ground negative output to support unbalanced mode			
Maximum Output Level	+24 dBu \pm 0.5 dBu (designed to drive a \geq 600 Ω load)			

Remote connector (WFM8200 and WFM8300)

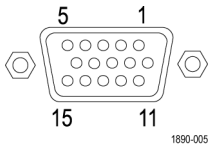
The REMOTE connector is a 15-pin, female, D-type connector with socket contacts. It uses ground closures for remote control and sending indications to external equipment when alarms have occurred. The input of LTC is through the REMOTE connector.

Use the Remote connector to input LTC time code signals, and to remotely select one of the first four instrument presets in group "A" using ground closure. The following table lists the signal characteristics of the Remote connector.

Table 11: WFM8200 and WFM8300 remote connector pin assignments and specifications

Characteristic	Pin out	Preset functions			
		Hex	Binary Pins 15, 14, 13, 12, 11, 10	Direct mode selection	Encoded mode selection
Connector pin assignments	1 GND (In) 2 Reserved (I/O) 3 Reserved (I/O) 4 Reserved (In) 5 Reserved (In) 6 GND (In) 7 Time Code Positive (LTC In) 8 Time Code Negative (LTC In) 9 Ground Closure (Alarm Out) 10 Preset 1 (In) 11 Preset 2 (In) 12 Preset 3 (In) 13 Preset 4 (In) 14 Preset 5 (In) 15 Preset 6 (In)	F E D C B A 9 8 7 6 5 4 3 2 1 0 N/A N/A	111111 XX1110 XX1101 XX1100 XX1011 XX1010 XX1001 XX1000 XX0111 XX0110 XX0101 XX0100 XX0011 XX0010 XX0001 XX0000 101111 011111	none Preset 1 Preset 2 Preset 3 Preset 4 Preset 4 Preset 3 Preset 2 Preset 1 Preset 5 Preset 6	No action No action No action SDI B SDI A No action No action Preset 8 Preset 7 Preset 6 Preset 5 Preset 4 Preset 3 Preset 2 Preset 1 Unused N/A N/A

Characteristic	Description
LTC input connector	15-pin DSUB, balanced, unterminated
LTC input signal	Longitudinal Time Code per IEC Publication 461
LTC signal amplitude range	0.2 V _{p-p} to 5.0 V _{p-p} balanced differential or single-ended
Ground closure input signal	TTL thresholds, 5 V max input, -0.5 min input; pull low to assert
Ground closure output signal	One open collector output



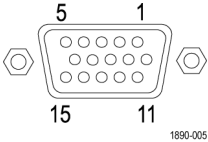
Remote connector (WFM7200)

The REMOTE connector is a 15-pin, female, D-type connector with socket contacts. It uses ground closures for remote control and sending indications to external equipment when alarms have occurred. The input of LTC is through the REMOTE connector.

Use the Remote connector to input LTC time code signals, and to remotely select one of the first four instrument presets in group "A" using ground closure. The following table lists the signal characteristics of the Remote connector.

Camera tally mode. This mode is used to define which input is on-air (RED) and which input is available to be adjusted (GREEN). This state is indicated in the status bar and above the Picture display of the selected input on the instrument display screen.

Table 12: WFM7200 remote connector pin assignments and specifications

Characteristic	Pin out	Preset functions			
	1 GND (In)	Hex	Binary	Direct	Encoded
	2 Reserved (I/O)		Pins 15,	mode	mode
	3 Reserved (I/O)		14, 13,	selection	selection
	4 Reserved (In)		12, 11,		
	5 Reserved (In)		10		
	6 GND (In)	F	111111	none	No action
	7 Time Code Positive (LTC In)	E	XX1110	Preset 1	CMPST B
	8 Time Code Negative (LTC In)	D	XX1101	Preset 2	CMPST A
	9 Ground Closure (Alarm Out)	C	XX1100		SDI B
	10 Preset 1 (In)	B	XX1011	Preset 3	SDI A
	11 Preset 2 (In)	A	XX1010		Channel B
	12 Preset 3 (In)	9	XX1001		Channel A
	13 Preset 4 (In)	8	XX1000		Preset 8
	14 Preset 5 (In)	7	XX0111	Preset 4	Preset 7
	15 Preset 6 (In)	6	XX0110		Preset 6
	5	XX0101		Preset 5	
	4	XX0100		Preset 4	
	3	XX0011		Preset 3	
	2	XX0010		Preset 2	
	1	XX0001		Preset 1	
	0	XX0000		Unused	

Characteristic	Description
LTC input connector	15-pin DSUB, balanced, unterminated
LTC input signal	Longitudinal Time Code per IEC Publication 461
LTC signal amplitude range	0.2 V _{p-p} to 5.0 V _{p-p} balanced differential or single-ended
Ground closure input signal	TTL thresholds, 5 V max input, -0.5 min input; pull low to assert
Ground closure output signal	One open collector output

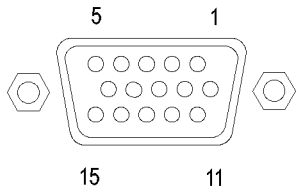
PIX MON connector

The PIX MON connector is a 15-pin, female, D-type connector with socket contacts. This is the video picture output. The output is compatible with standard analog PC monitors, either CRT or LCD-based.

Use the PIX MON connector to output the video picture, including configurable cursor, safe area graticules, and error brightups, to an external monitor. For HD and SD input signals, use the CONFIG > Outputs menu to configure the output signal to be RGB, YPbPr, or off.

The following table lists the signal characteristics of the PIX MON connector.

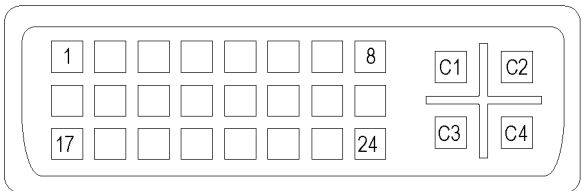
Table 13: Picture Monitor (PIX MON) connector pin assignments and specifications

Connector	Pin	Description	Pin	Description
	1	Red output	9	Not used
	2	Green output	10	Ground
	3	Blue output	11	Not used
	4	Not used	12	Not used
	5	Ground	13	Horizontal sync output
	6	Ground	14	Vertical sync output
	7	Ground	15	Not used
	8	Ground		
Characteristic	Description			
Output connector	VGA DSUB			
Output format	Y, Pb, Pr with sync on Y; RGB with sync on all			
Active video accuracy	700 mV _{p-p} ± 5% (Y-Pb-Pr mode)			

EXT DISPLAY connector

The EXT DISPLAY connector is a female DVI-I connector with socket contacts. This is the external display monitor output. The display resolution is 1024 x 768. The output supports DVI monitors directly and analog PC (RGB) monitors with the use of a DVI-I to VGA adapter.

Table 14: EXT DISPLAY connector specifications

Connector	Pin	Description	Pin	Description
 0081-006				
	1	TMDS Data 2– Red – (Link 1)	13	TMDS Data 3+ Blue + (Link 2)
	2	TMDS Data 2+ Red + (Link 1)	14	Ground
	3	TMDS Data 2/4 shield	15	+ 5 V Power for monitor when in standby
	4	TMDS Data 4– Green – (Link 2)	16	Hot plug detect
	5	TMDS Data 4+ Green + (Link 2)	17	TMDS Data 0– Blue – (Link 1) and digital sync
	6	DDC clock	18	TMDS Data 0+ Blue + (Link 1) and digital sync
	7	DDC data	19	TMDS data 0/5 shield
	8	Analog vertical sync	20	TMDS Data 5– Red – (Link 2)
	9	TMDS Data 1– Green – (Link 1)	21	TMDS Data 5+ Red + (Link 2)
	10	TMDS Data 1+ Green + (Link 1)	22	TDMS clock shield
	11	TMDS Data 1/3 shield	23	TDMS clock + Digital clock + (Links 1 and 2)
	12	TMDS Data 3– Blue – (Link 2)	24	TDMS clock – Digital clock – (Links 1 and 2)
	C1	Analog red	C4	Analog horizontal sync
	C2	Analog green	C5	Analog ground Return for R, G, B signals
	C3	Analog blue		
Characteristic	Description			
Output connector	DVI-I (integrated, digital and analog)			

Ethernet connector

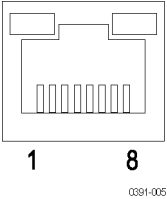
Use the Ethernet connector to connect the waveform monitor to your local network. A network connection is required for remote control, software upgrades, and enabling some instrument options.

The Ethernet connector includes built-in green and yellow LEDs to indicate signal status as indicated below:

- Lit green LED indicates connection is active
- Lit yellow LED indicates a 100 MB transmission rate
- Unlit yellow LED indicates a 10 MB transmission rate

The following table lists the signal characteristics of the Ethernet connector.

Table 15: Ethernet connector pin assignments

Connector	Pin/LED	Name	Description
	1	TX_D1+	Transceive Data+
	2	TX_D1-	Transceive Data-
	3	RX_D2+	Receive Data+
	4		Not used
	5		Not used
	6	RX_D2-	Receive Data-
	7		Not used
	8		Not used
Characteristic	Description		
Ethernet connector	RJ-45 LAN supporting 10/100/1000 BaseT; supports manual and DHCP address modes		

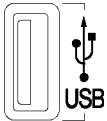
Headphone jack Use the headphone jack, located on the front panel, to listen to the audio associated with the selected video input signal. The following table describes the signal characteristics of the headphone jack.

Table 16: Headphone jack specifications

Connector	Characteristic	Description
	Output Type	Standard 1/4-inch stereo phone jack, capable of driving a 6.25 dBu sine wave into 32 Ω or 16 Ω

USB connector Use the USB connector, located on the front panel, to save and restore instrument presets and captured data using a USB memory drive. The following table describes the signal characteristics of the USB connector.

Table 17: USB connector specifications

Connector	Characteristic	Description
	Type	Host
	Speed	Complies with USB 1.1 and 2.0 Full Speed Specification (12 Mb/s)

Video system installation

The instrument can operate almost anywhere in the distribution system.

NOTE. See the *Specifications and Performance Verification manual on the Product Documentation CD* for maximum-allowed cable lengths.

To monitor the video bit stream of a serial receiver

You can route one or two incoming serial signals into the SDI inputs of the instrument. (See Figure 4.) (See Figure 5.)

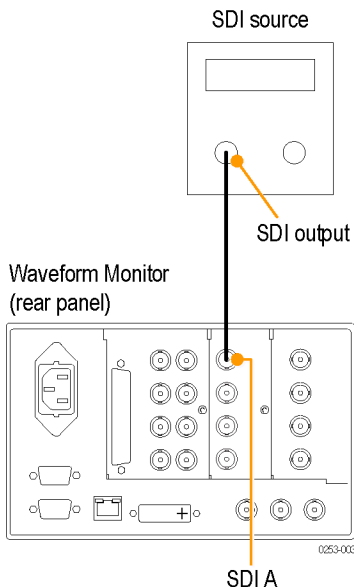


Figure 4: Connecting a single SD, HD, or 3 Gb/s SDI input

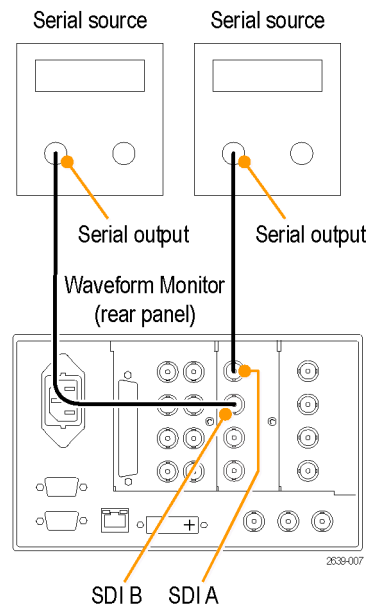


Figure 5: Connecting two SD, HD, or 3 Gb/s SDI inputs

NOTE. To monitor serial digital signals around a routing switcher, connect your serial sources through a patch panel to a serial router. Connect the output of the serial router to an SDI input for comparison.

To monitor composite signals

Connect your sources to the CMPST A or CMPST B loop-through inputs on the rear-panel. (See Figure 6.)

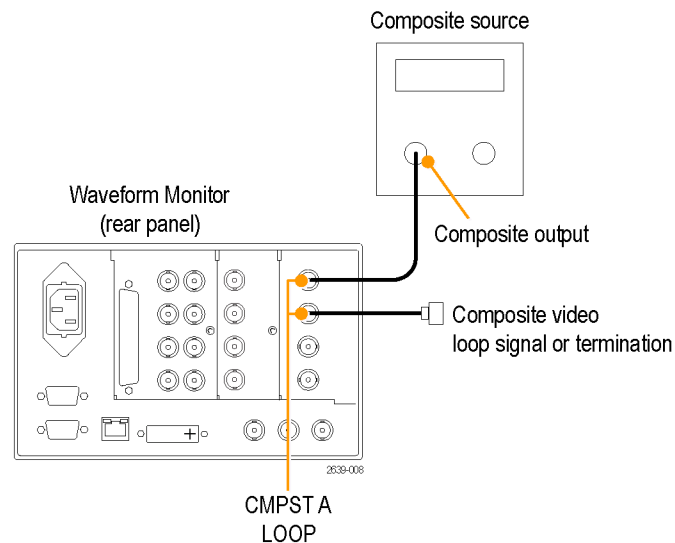


Figure 6: Composite signal connection

To monitor Dual Link signals

You can connect two SDI signals or one SDI signal and one composite signal when you are using a Dual Link signal or monitoring two signals in simultaneous input mode. (See Figure 7.)

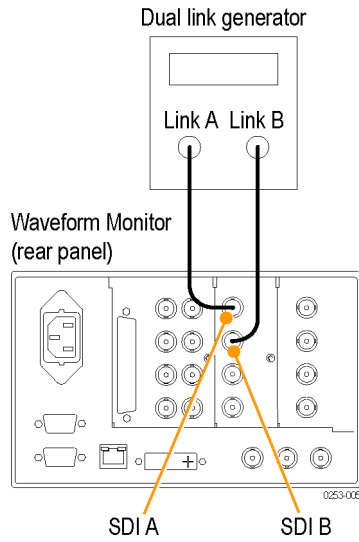
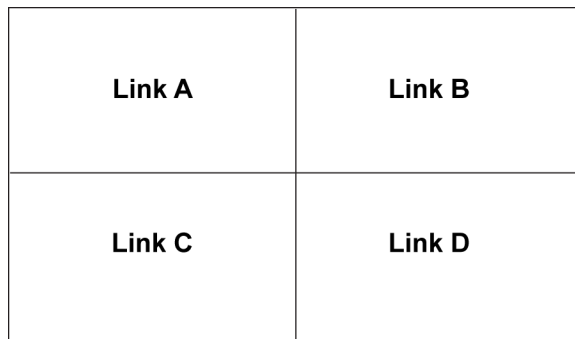


Figure 7: Dual Link signal connection

To monitor UHDTV1/4K signals

NOTE. The UHDTV1/4K signal must be in square division format and each quadrant must connect to the SDI inputs as shown below. The instrument must have Options 4K, 3G, and 2SDI installed.

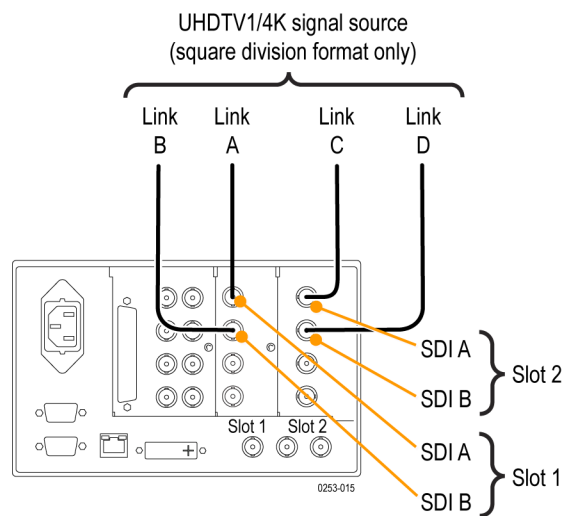
In square division signals, the four links of the signal combine to display the video picture as shown below.



0253-016

Figure 8: Mapping of the four links that make up a UHDTV1/4K format signal

Connect each link of the UHDTV1/4K signal to each of the SDI inputs as shown below. Use the Picture display to verify proper signal connections.



0253-015

Figure 9: Options 4K, 3G, 2SDI

Line termination

The instrument uses passive loop-through analog and reference inputs. Accordingly, the loop-through must be terminated externally. It is important that this external termination meet accuracy and return loss requirements.

If the instrument is installed to monitor an operating link, the destination receiver and the connecting cable serve as the termination. This monitoring connection is best because it checks the performance of the entire path. The return loss of the instrument is sufficiently high that, in most cases, the destination receiver sets the system return loss.

In cases where the instrument is placed at the end of a link, a BNC termination must be installed on one side of the loop-through analog or reference connector. The termination must be 75 Ω and DC coupled (good return loss extends to DC). Return loss should exceed 40 dB from DC to 6 MHz for composite.

Compatibility of BNC center pins

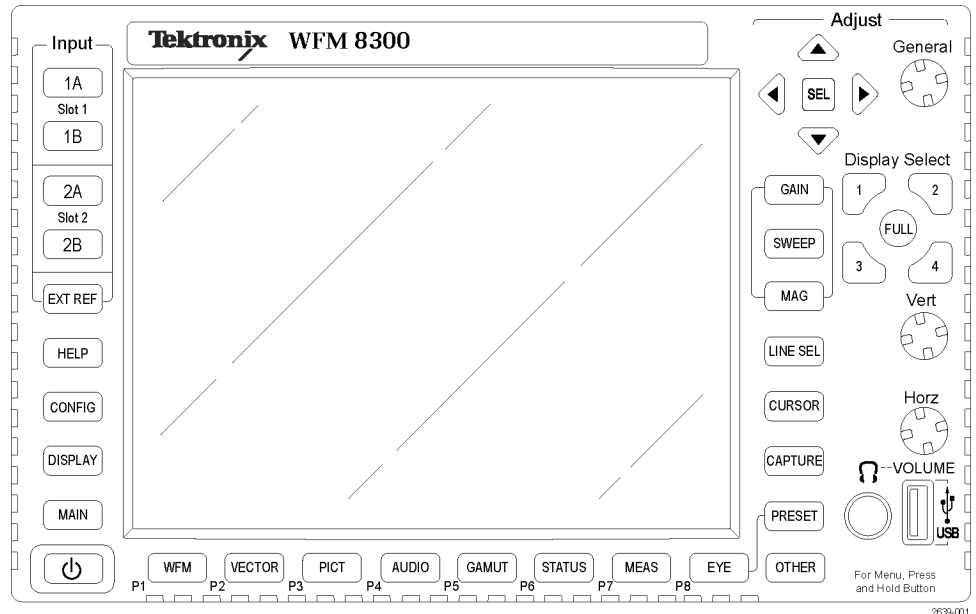
Most BNC connectors for video equipment, whether 50 Ω or 75 Ω , use a 50 Ω standard center pin. Some laboratory 75 Ω BNC connectors use a smaller diameter center pin. The BNC connectors this instrument are designed to work with the 50 Ω standard (large diameter) center pins.



CAUTION. *To prevent intermittent signal connections, do not use connectors or terminators with the smaller diameter center pins.*

Power-on and power-off procedures

- Power-on**
1. Connect the supplied power cord to the rear-panel power connector.
 2. Press the power button on the instrument front-panel and the instrument will turn on.



NOTE. *The Standby button on the front-panel does not disconnect mains power. Only the power cord at the rear of the product can disconnect mains power.*

Ensure that the power cord is accessible when the product is operating.

- Power-off**
1. Press the power button on the instrument front-panel to turn the instrument off.
 2. If you want to remove power completely, disconnect the power cord from the rear-panel of the instrument.

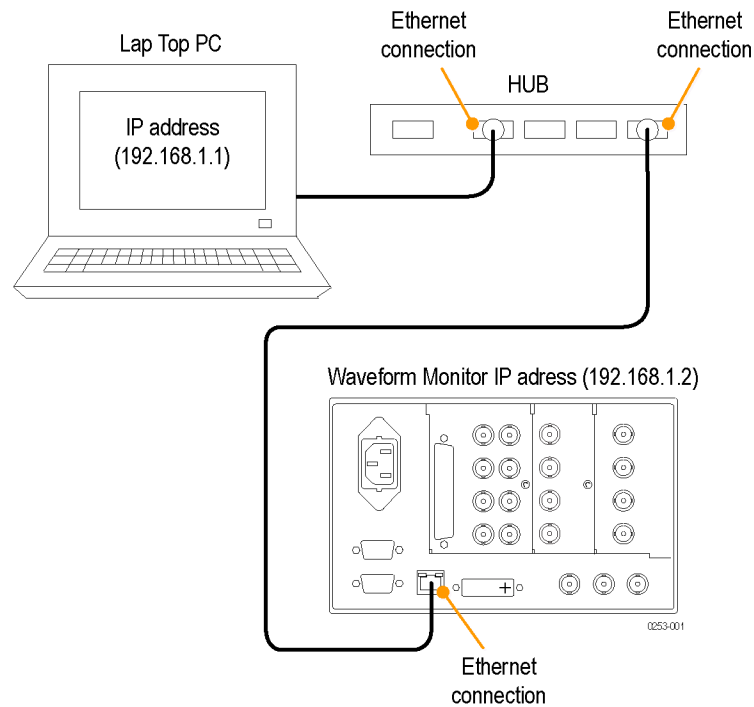
Network operation

This section provides the following information for operating the instrument on a local LAN network:

- How to configure the instrument for operation on an IP network
- How to configure the instrument to send and/or receive SNMP remote commands
- How to use a Web browser to start a remote application to enable control of the instrument, or to download the Event and Diagnostic log files, or to capture images of the instrument display

Ethernet connection

Connect the instrument to your network using an Ethernet cable. You can connect it directly to the instrument or through a HUB, as shown below.



IP settings configuration

To allow network access to the instrument, you need to set the IP address. Network addresses can be assigned either automatically (DHCP) or manually. If your network does not use DHCP, you will have to manually enter the address for the instrument. To obtain a valid IP address, contact your LAN administrator.

Perform the following steps to configure the IP settings on the instrument:

1. Press the **CONFIG** button to display the Configuration menu.
2. Use the General knob to navigate to **Network Settings**.
3. Press the right arrow key to select **IP Config Mode**.
4. Press the **SEL** button to select between **DHCP** and **Manual**.
5. If you selected DHCP, you are finished.
6. If you selected Manual mode, you need to set the Subnet Mask and Gateway Address parameters. Contact your LAN administrator for these values. (Be sure to use compatible addresses between the PC and the instrument.)
7. Press the down arrow key to select **IP Address**.
8. Press the right arrow key. A dialog box will appear that allows you to enter the IP address.
9. Repeat steps 7 and 8 for the Subnet Mask and the Gateway Address.
10. If desired, select **Instrument Name** and then press the right arrow button to assign the instrument a network name.
11. Press the **CONFIG** button to close the configuration menu.

SNMP remote control configuration

SNMP remote control is primarily intended for instrument access using automated systems. If you intend to use SNMP commands to control the instrument, you must first configure the SNMP settings on the waveform monitor.

NOTE. *The SNMP commands are contained in a MIB (Management Information Base). Refer to the WFM Series Waveform Monitors and WVR Series Waveform Rasterizers Management Information Base Technical Reference (Tektronix part number 077-0261-XX) for information about using the MIB to control the waveform monitor.*

The procedure to configure SNMP settings is similar to that previously described for configuring the IP settings. Touch SNMP Setup in the Communication submenu of the Main menu to configure the following SNMP parameters:

- Remote SNMP Mode. Use this setting to configure the remote access to the instrument via SNMP. You can select enabled, disabled, or read only.
- SNMP Traps. Use this setting to enable or disable the SNMP traps that are sent from the instrument when error conditions are detected.
- Trap Destination Address. Use these settings to enter up to four different IP addresses to which SNMP traps will be sent when error conditions are detected.

NOTE. *A value of all zeroes for the IP address will disable that trap output.*

- Private Community String. Use this menu setting to enter the Private Community string, which effectively is a password. Without this string, SNMP commands cannot change values in the waveform monitor.

NOTE. *Use the Private Community String to control the ability of SNMP commands to make changes to the waveform monitor. Use the Public Community String to control the ability of SNMP commands to read information from the waveform monitor.*

- Public Community String. This menu entry allows you to set the Public Community string. This string is effectively a password. Without this string, SNMP commands cannot read information from the instrument.

Web browser operation

You can connect to an instrument installed on an Ethernet IP network without installing any software and using only a Web browser. Using the Web browser, you can perform the following functions:

- Start a remote application to enable control of the instrument
- Download the Event and Diagnostic log files
- Capture images of the instrument display

Perform the following steps to connect to the instrument using a Web browser:

1. Verify that the instrument has been configured for IP network operation and note the IP address. (See page 27, *IP settings configuration*.)
2. Press the **CONFIG** button.
3. Use the General knob to navigate to **Network Settings**.
4. Press the right arrow key and then use the General knob to navigate to **Web Enable**.
5. Press the **SEL** button to select **On**.
6. On your PC, start your Web browser and enter the network address of the instrument into the URL entry box like this:

`http://123.123.123.123/`

NOTE. Many Web browsers do not correctly interpret IP addresses with leading zeros. If the IP address shown in the Configuration menu contains leading zeros, remove any leading zeros when you enter the address in the browser.

For example, the IP address 124.161.038.092 should be entered as follows:

124.161.38.92

7. The Web browser will display the remote interface for the instrument. To make a selection, click the desired link.