Tektronix®

PRISM
Media Analysis Platform

User Manual

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For product information, sales, service, and technical support:
- In North America, call 1-800-833-9200.
- Worldwide, visit www.tek.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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

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

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[W2 – 15AUG04]

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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 viii, *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.

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.

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.

Use proper AC adapter. Use only the AC adapter specified for this product.

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.

The measuring terminals on this product are not rated for connection to mains or Category II, III, or IV circuits.

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 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

Preface

This manual contains information to help you use the Tektronix PRISM Media Analysis Platform. This information includes the following:

- How to operate the instrument using the front panel or remote connection.
- How to use the various displays for monitoring SDI or IP video signals.
- How to capture display data.
- How to set up error logging and alarms.
- How to navigate instrument menus.

Where to find more information

The following table shows you where you can find information about your product. You can always find the most updated documentation and software for your product on the Tektronix Web site at www.tek.com/downloads.

Table i: Product documentation

Document	Tektronix part number	Description	Availability Print	Web
Installation and Safety Instructions	071-3500-xx	Describes how to install the instrument and provides basic safety and operating information	√	√
User Manual	077-1290-xx	Provides detailed operating information		√
Specifications and Performance Verification	077-1291-xx	Lists the product specifications and provides procedures for verifying product performance		√
Software Licenses Reference	077-1292-xx	Lists the software licenses that apply to the product		√
Release Notes	077-1293-xx	Describes the new features, improvements, and limitations of the instrument firmware		√
Declassification and Security Instructions	077-1294-xx	Describes how to clear or sanitize the data storage (memory) devices in the product for customers with data security concerns		√
Dual Rack Cabinet Installation Instructions	071-3501-xx	Describes how to install the instrument in a 19" equipment rack using the optional MPI-RACK-MM or MPI-RACK-MW dual rack cabinet	√	√
Field Upgrade Kit Instructions	075-1095-xx	Describes how to install post-purchase field upgrades in the instrument	√	√

Conventions used in this manual

The PRISM Media Analysis Platform is also referred to as the "PRISM monitor" throughout this manual.

Getting started

This section will help you set up and begin to use the PRISM Media Analysis Platform. It is divided into the following four sections:

- **Product description** describes your instrument and provides a list of key features.

- **Controls and connectors** shows you how to verify that you have received all of the parts of your instrument and provides a list of standard and optional accessories and a list of options that are available for your instrument.

- **Network installation** shows you how to set up your instrument on an Ethernet network.

- **Incoming inspection** provides a procedure for verifying the basic operation and functionality of your instrument.

Figure 1: PRISM Media Analysis Platform shown with the optional portable cabinet

Product description

The PRISM Media Analysis Platform provides flexible options and field-installable upgrades to monitor a diverse variety of IP statistics as well as video and audio content. The comprehensive feature set, along with an intuitive and simplified graphical presentation of IP statistics, including video quality and diagnostic information, enables engineers to ensure the delivery of superior Quality of Service (QoS) levels in an increasingly complex broadcast environment involving compressed / uncompressed video transmission through SDI/IP signal paths.

PRISM is an ideal solution for monitoring SDI/IP hybrid environments including master control rooms, production studios, OB vans, and signal contribution/distribution centers.

Features and benefits
- A comprehensive analysis and monitoring tool for a hybrid SDI/IP broadcast systems that provides system evaluation for long term system quality monitoring and reporting

- Real time SDI/IP analysis and monitoring to quickly identify the issue to determine the root cause

- Graphical displays that show the traffic present in the 10G Ethernet link, allowing engineers to understand what is on their network and to easily select the stream of interest

- Select and view the desired content in the stream with picture, waveform and audio bar displays allowing visual confirmation of your content

- Detect IP packet errors, monitor the Packet Interval Time (PIT) and time stamped delay factor (TS-DF) to allow engineers to observe issues that may cause intermittent loss of Video, Audio or Data

- Analysis tools coupled with historical data give engineers the ability to understand and resolve complex and intermittent problems quickly

- Ensure proper PTP message timing and metadata setup to let the instruments accurately synchronize in the system

- Multipoint or remote site monitoring allowing one engineer to quickly respond to issues from multiple points in the system

- Build an extensive monitoring solution with the SDI signal decoded from the SMPTE 2022-6 stream

- The picture display provides a full HD 9-inch screen that can be used for confidence monitoring

- All-in-one instrument within 3RU half rack platform that can be used for either portable application or rack mount application

Rackmount installation

There are two optional dual rack cabinets (19", 3RU) available for the PRISM monitor:

- **MPI-RACK-MM.** Allows you to install one PRISM monitor or two PRISM monitors side-by-side. Each side of the cabinet front panel has two USB ports and a headphone jack for each PRISM monitor.

- **MPI-RACK-MW.** Allows you to install one PRISM monitor or one PRISM monitor in a side-by-side installation with a Tektronix WFM52x0, WFM7200, WFM8x00 waveform monitor. The left side of the cabinet front panel has two USB ports and a headphone jack for one PRISM monitor.

Dual rack cabinet cooling and clearance requirement

⚠ *CAUTION. To prevent risk of fire, adequate airflow to instrument(s) and rack adapter must be maintained. Failure to provide adequate airflow to instrument(s) could cause an instrument to shut down.*

Inadequate airflow includes placing instrument(s) and rack adapter in any small, enclosed room that lacks a ventilation system, such as a closet. If the airflow is restricted or blocked and the instrument(s) do not shut down, the risk of fire is increased and the instrument(s) could be permanently damaged.

The instrument has specific cooling and clearance requirements. Ensure that the clearance requirements for proper airflow are met for both the dual rack cabinet and the instrument. See the *PRISM Installation and Safety Instructions* manual for information about the environmental operating requirements for the instrument.

Table 1: Clearance requirements for the dual rack cabinet

Instrument side	Clearance requirement
Top and bottom	None
Left and right sides	2 in (51 mm)
Front	None
Rear	3 in (76 mm)

Supplied hardware The following table lists the hardware supplied with the dual rack cabinet kit. The installation instructions includes references to these parts by the item numbers to aid in selecting the correct parts.

Table 2: Supplied hardware

Item number	Tektronix part number	Description	Quantity
1	210-1061-00	WASHER, FLAT; 0.203 ID X 0.625 OD X 0.062, ZINC PLATED STEEL	4
2	210-1298-01	WASHER; SHOULDER & RETAINER, 0.195 ID X 0.195 THK, PLASTIC, TV GRAY, 6.575 OD	4
3	211-0511-00	SCREW, MACHINE; 6-32 X 0.5, PNH, STEEL, ZINC PLATED, T15 TORX	8
4	211-0718-00	SCREW, MACHINE; 6-32 X 0.312, FLH100, STEEL, ZINC FINISH, T-10 TORX DR	4
5	212-0577-00	SCREW, MACHINE; 10-32 X 0.625, TRH, ZINC PLATED STEEL, PHIL	8
6	212-0591-00	SCREW, MACHINE; 10-32X.750 OVAL HEAD, POZI	4
7	381-0251-01	NUT BAR; 10-32 X 3.0 X 0.375 X 0.120	4
8	407-3752-00	BRACKET, EXT; 2.5 X 8.06 X 0.06, STEEL; SAFETY CONTROLLED	2
9	407-6011-00	RACK MOUNT, INSTRUMENT MTG BRACKET, 5000 SERIES	1

Install the dual rack cabinet in the equipment rack

Before you install an instrument into the rack adapter, install the adapter into the rack as follows:

1. Position the dual rack cabinet so that the headphone jack(s) on the front of the cabinet is on the bottom. (See Figure 2.)

NOTE. The MPI-RACK-MM cabinet has headphone jacks on both sides of the cabinet; the MPI-RACK-MW cabinet has one headphone jack on the left side of the cabinet.

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2. **MPI-RACK-MW only**: Perform the following steps if you are installing a WFM52x0 waveform monitor in a MPI-RACK-MW cabinet:

   a. Install the WFM52x0 bracket (item 9 in Table 2) in the right side of the cabinet as shown. (See Figure 2.)

   b. Secure the WFM52x0 bracket to the cabinet using four screws (item 4 in Table 2).

3. If desired, you can adjust the position of the handle brackets to mount the adapter flush with other equipment in the rack. To do this, loosen the nuts that attach the handle brackets to the rack adapter, adjust the position of the handle brackets as desired, and then tighten the nuts securely. (See Figure 3.)

4. Secure the rack adapter assembly to the front frame of the rack using four screws (item 6 in Table 2) and four shoulder washers (item 2 in Table 2).

5. Install one guide bracket (item 8 in Table 2) to one side of the rear frame of the rack using two screws (item 5 in Table 2) and one nut bar (item 7 in Table 2) as shown. (See Figure 2.)

6. Secure the guide bracket to the cabinet using two screws (item 5 in Table 2), two washers (item 1 in Table 2) and one nut bar (item 7 in Table 2). Use the holes in the bracket that will accommodate the depth of the instrument rack frame being used. Leave the screws loose.

7. Repeat steps 5 and 6 to install the second guide bracket to the other side of the cabinet.

8. Tighten all of the attaching screws that were left loose in the previous steps.

MPI unit

Secure each instrument in the
cabinet using two screws.

WFM52x0 bracket

Screws (4)

WFM52x0 unit
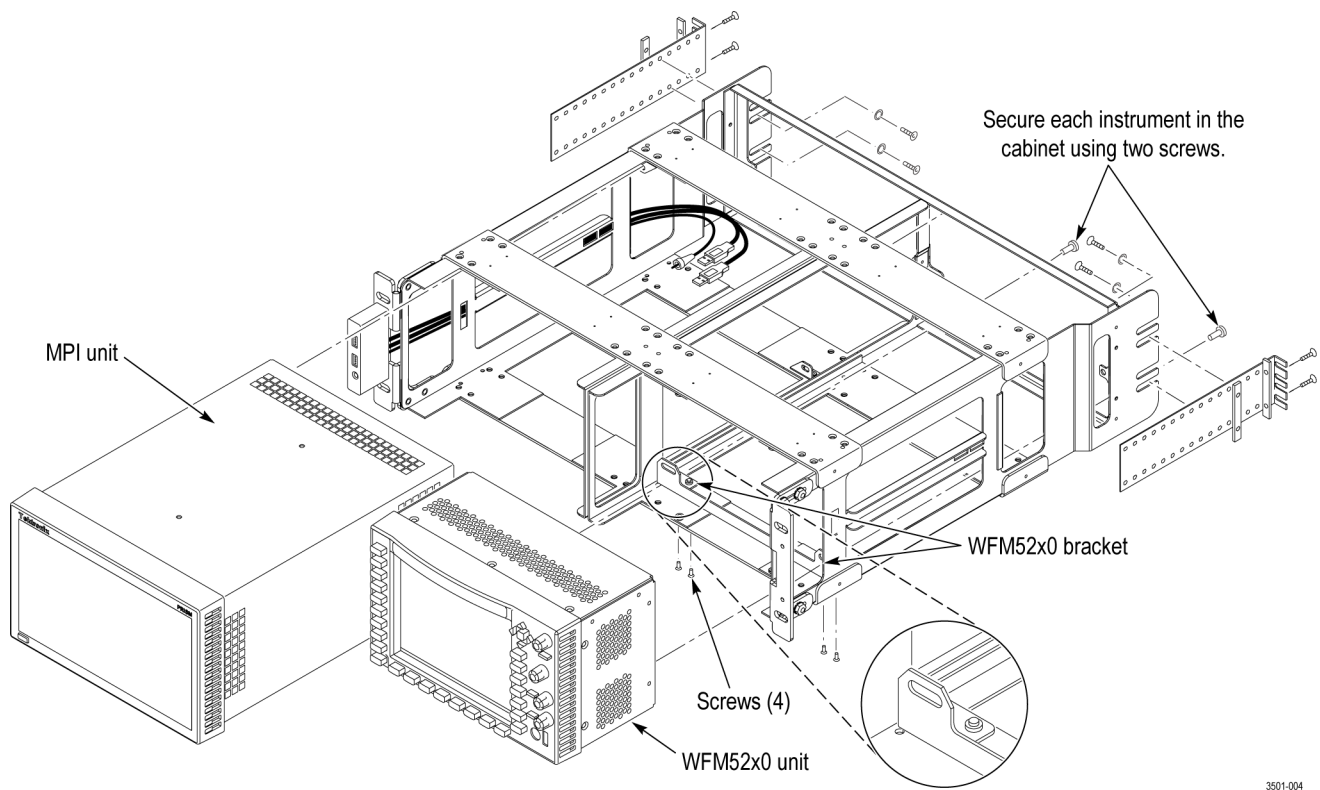
3501-004

Figure 2: Installing one MPI monitor and one WFM52x0 waveform monitor in the MPI-RACK-MW dual rack cabinet

WFM7200 or WFM8x00 unit

MPI unit

Secure each instrument in the cabinet using two screws.

To adjust the handle bracket to be flush with other equipment in the rack, attach the handle bracket using one of the three settings shown below.

3501-002
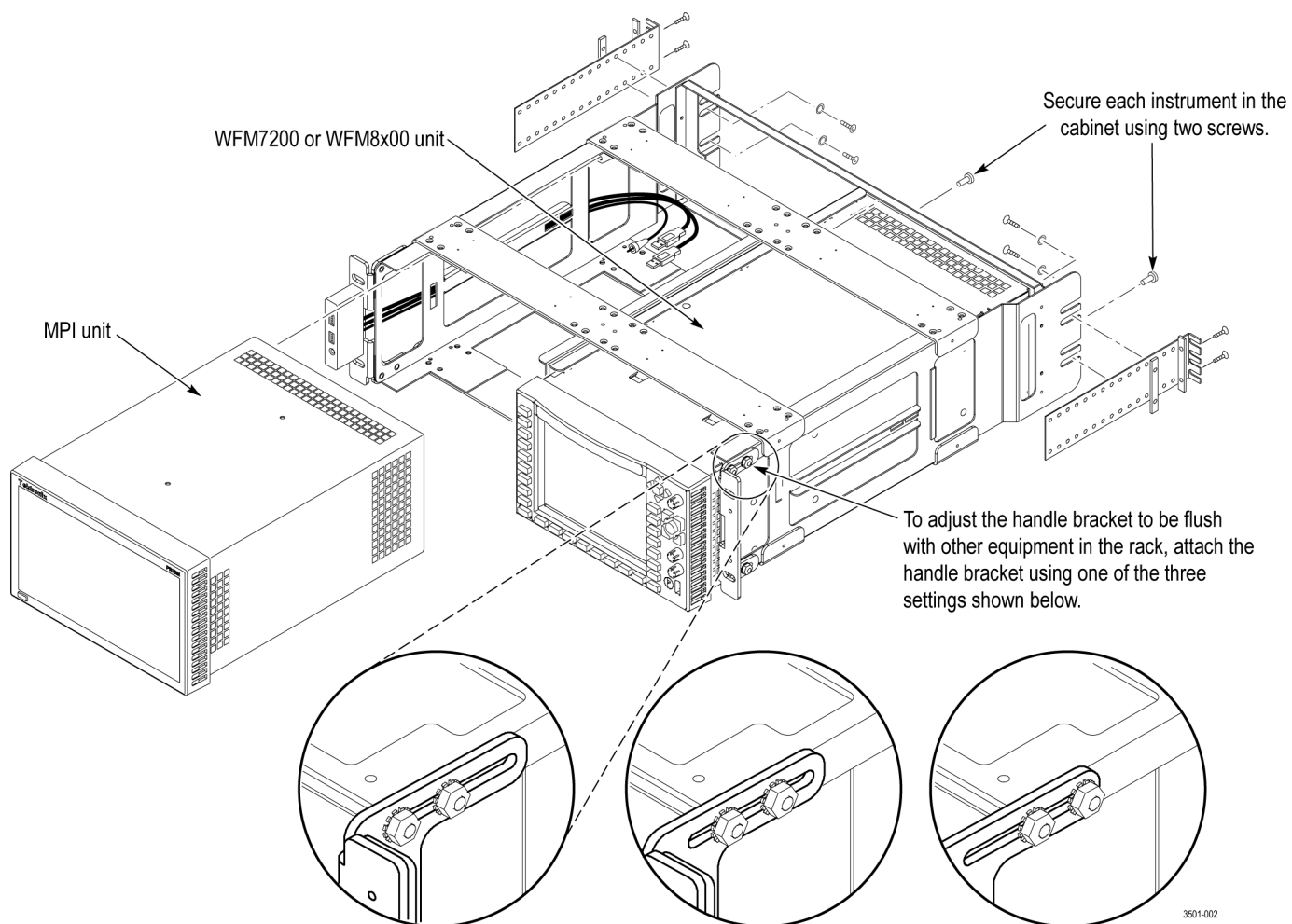
Figure 3: Installing one MPI monitor and one WFM7200 or WFM8x00 waveform monitor in the MPI-RACK-MW dual rack cabinet

Secure each instrument in the
cabinet using two screws.

To adjust the handle bracket to be flush
with other equipment in the rack, attach the
handle bracket using one of the three
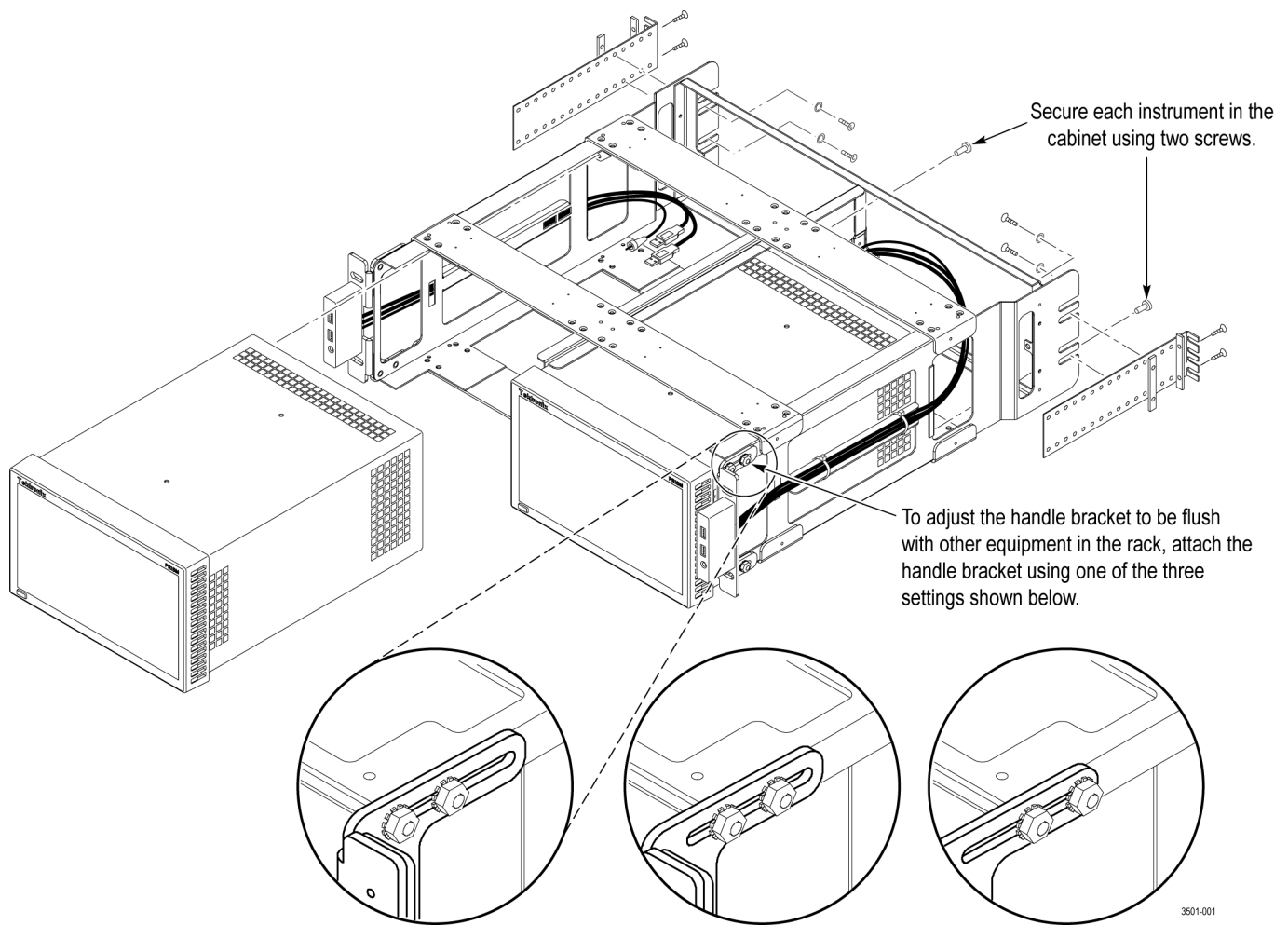settings shown below.

3501-001

Figure 4: Installing two MPI monitors in the MPI-RACK-MM dual rack cabinet

Install instrument(s) in the dual rack cabinet

After you install the dual rack cabinet in the equipment rack, perform the following steps to install instrument(s) in the cabinet:

1. Install an MPI unit in the dual rack cabinet: (See Figure 2.) (See Figure 3.) (See Figure 4.)

    a. Slide an MPI unit into the left slot in the dual rack cabinet.

    NOTE. For the MPI-RACK-MW cabinet, the MPI unit must be installed in the left slot of the cabinet. For the MPI-RACK-MM cabinet, you can install the MPI unit in the left or right slot of the cabinet.

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    b. Use two screws (item 3 in Table 2) to secure the instrument in the dual rack cabinet. The screws attach to the top right and bottom left holes in the instrument chassis as viewed from the rear.

    c. Connect the cables from the USB ports and headphone jack on the dual rack cabinet to the rear of the instrument. (See Figure 5.)

    NOTE. The headphone jack is not currently functional. You can connect the USB cables to either set of USB ports on the rear panel.

    ---

    d. Connect power, signal, and Ethernet cables to the instrument as needed. See the *PRISM Installation and Safety Instructions* manual for information about making signal connections to the instrument.

2. For the MPI-RACK-MM cabinet only, repeat step 1 to install a second MPI unit in the right slot of the dual rack cabinet.

3. For the MPI-RACK-MW cabinet only:

    a. Install a Tektronix WFM52x0, WFM7200, or WFM8x00 waveform monitor in the right slot of the dual rack cabinet. (See Figure 2.) (See Figure 3.)

    b. Use two screws (item 3 in Table 2) to secure the waveform monitor in the dual rack cabinet. The screws attach to the right and left holes in the middle of the instrument chassis as viewed from the rear.

    c. Connect power and signal cables to the waveform monitor as needed.

    NOTE. See the installation manual for your waveform monitor for information about making power and signal connections to the instrument.
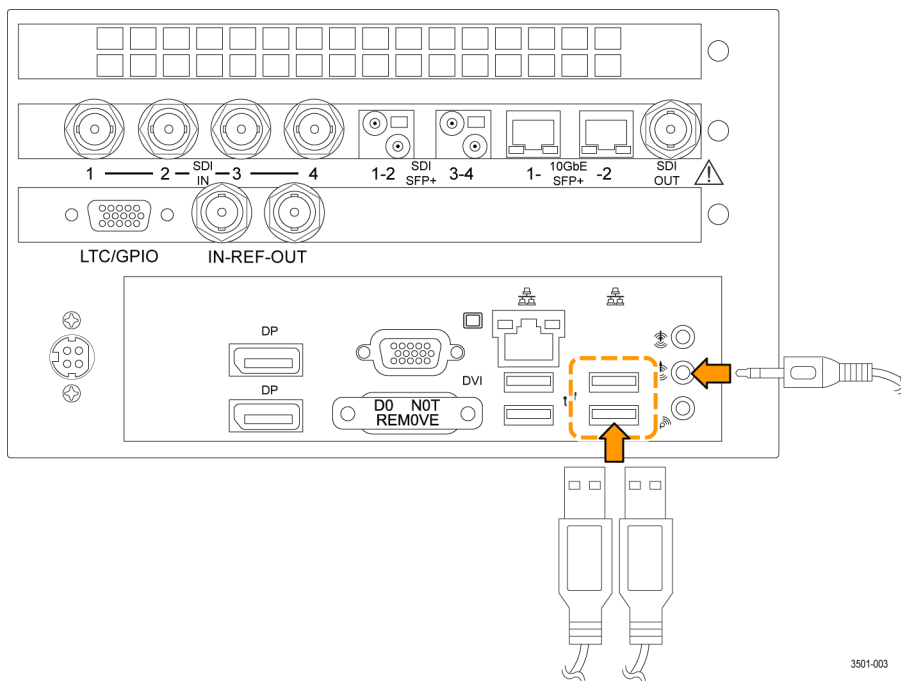
Figure 5: Connecting the cabinet USB and audio cables to the PRISM monitor

Power-on and power-off procedures

This section describes how to apply power to the instrument and how to power-on and power-off the instrument.

Power cord installation This instrument is powered by the DC output of an AC power adapter. Connect the AC adapter to the power connector on the rear panel of the instrument as shown below. The power connector is keyed to be directional, with the flat portion of the power cord housing facing the left of the instrument (as viewed from the rear). When fully inserted, the power cord housing latches onto the instrument power connector.

> ⚠ **CAUTION.** *To minimize the risk of damage to the instrument, it is strongly recommended that the AC adapter be connected to the instrument before the adapter is connected to the AC power source.*

3500-011

To AC power source
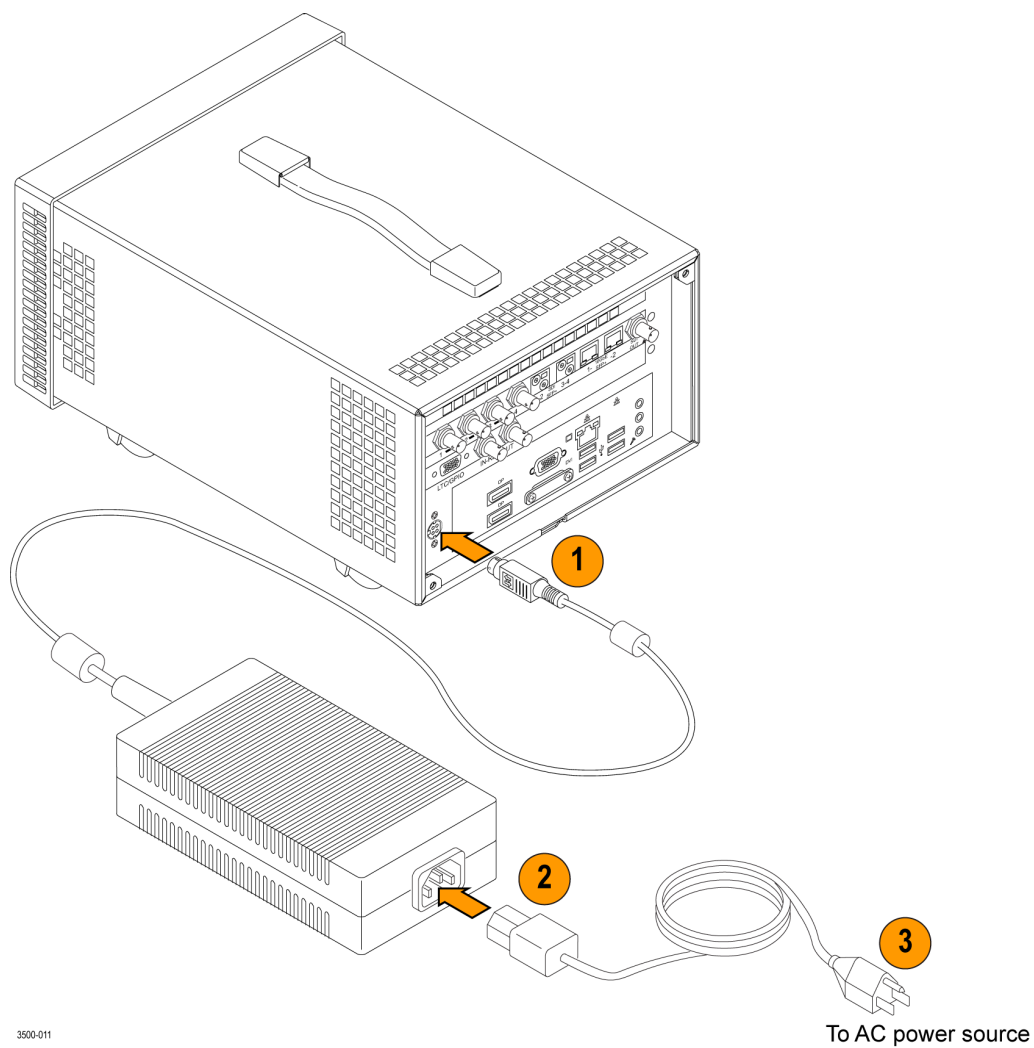
Figure 6: Connecting the power cord to the instrument

Power cord removal   The power cord housing latches onto the instrument power connector when fully inserted. To remove the power cord, grasp the connector housing as shown below and firmly pull the cord away from the instrument.

⚠ *CAUTION. To prevent damage to the power cord or to the instrument power connector, do not attempt to disconnect the power cord by pulling on the cable. You must pull on the connector housing to disengage the locking mechanism.*

To minimize the risk of damage to the instrument, it is strongly recommended that the AC adapter be disconnected from the AC power source before the adapter is disconnected from the instrument.

3500-007
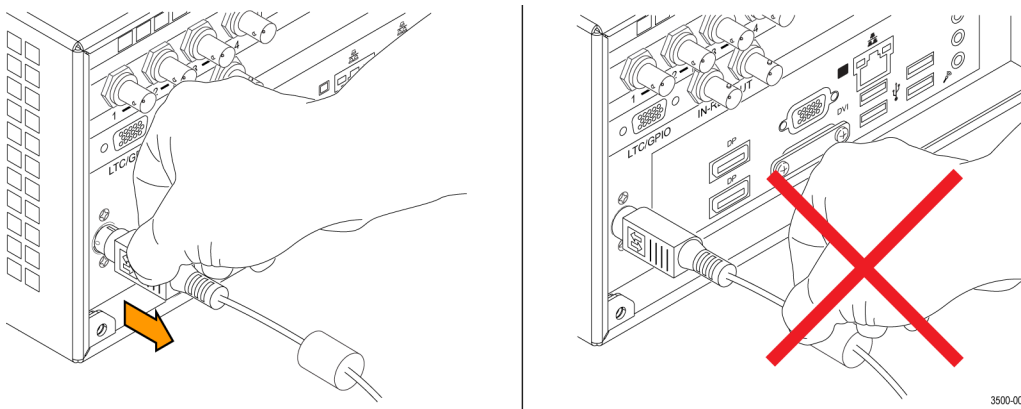
Figure 7: Disconnecting the power cord

Power-on procedure   **1.** Apply power to the instrument. (See page 10, *Power cord installation*.)

NOTE. If the PRISM monitor was previously powered off by a power interruption or by removing the power cord from the rear of the instrument, the instrument will power on when power is reapplied.

2. Press the **Power/Standby** button on the instrument front panel to turn the instrument on.

NOTE. The Power/Standby button illuminates during the power-on sequence and then turns off during normal instrument operation.

1290-002

Power-off procedure

1. Press the **Power/Standby** button on the instrument front panel to turn the instrument off.

⚠ **CAUTION.** *To prevent data loss, it is strongly recommended that you first shut down the instrument using the power button or the Settings > Utilities > Power submenu before disconnecting the power cord.*

To minimize the risk of damage to the instrument, it is strongly recommended that the AC adapter be disconnected from the AC power source before the adapter is disconnected from the instrument.

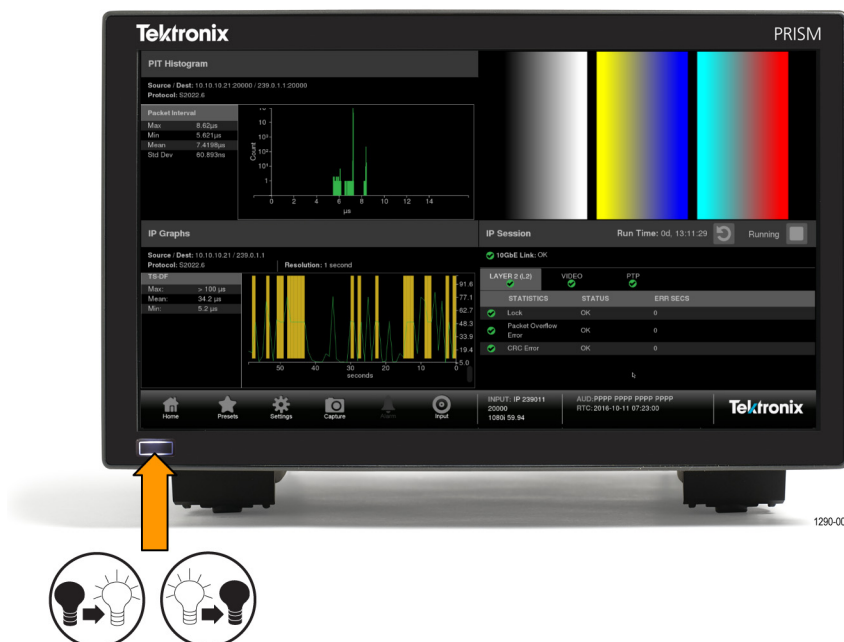2. To completely remove power from the instrument, disconnect the power cord from the instrument. (See page 12, *Power cord removal*.)

SFP+ module installation

There are several types of optional SFP+ modules available:

- SD/HD/3G-SDI optical transmitter

- SD/HD/3G-SDI DIN transmitter

- SD/HD/3G-SDI HD-BNC transmitter

- 10G Ethernet short range transceiver (850 nm)

- 10G Ethernet long range transceiver (1310 nm)

To install the SFP+ module, insert the module into the SFP+ connector as shown below (optical SFP+ module shown). The module will latch into place when fully inserted.
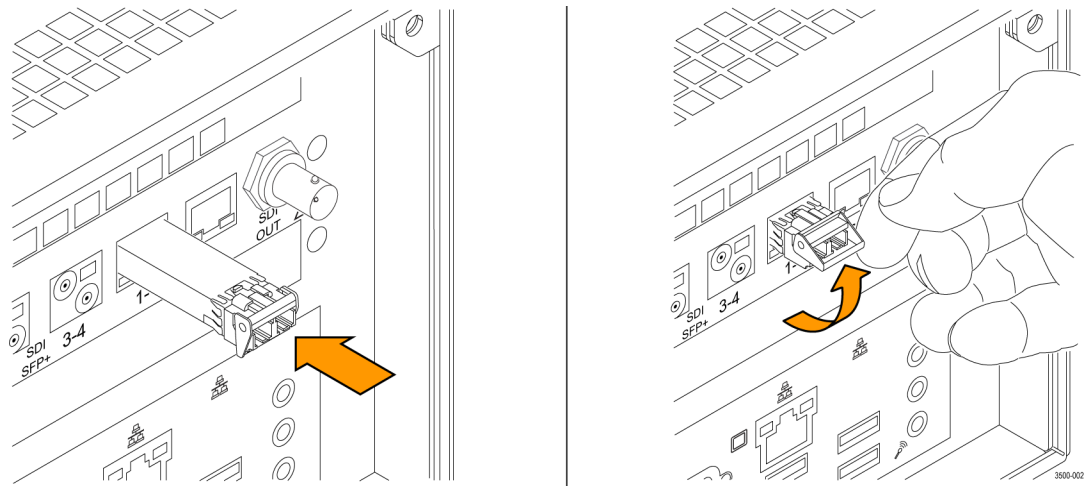
Figure 8: Installing and removing an optical SFP+ module

To remove the optical SFP+ module, lift up on the latch and then pull the module out of the SFP+ connector as shown above (optical SFP+ module shown).

NOTE. An optical SFP+ module is shown above. Other types of SFP+ modules may have different latching mechanisms.

SFP+ module transportation

⚠️ *CAUTION. To prevent static damage to the SFP+ module, if you remove the SFP+ module from the instrument, always transport the SFP+ module in a anti-static bag or container.*

Network installation

See the *PRISM Installation and Safety Instructions* manual that shipped with your instrument for basic installation instructions.

After your instrument is physically installed, you might want to connect it directly to a PC or to a network. The following information can help you do that.

Connecting directly to a PC

The following procedure will help you connect your instrument directly to a PC:

1. Connect the instrument directly to a PC with an Ethernet cable. The instrument has an auto-crossover feature. You can also use a HUB. (See Figure 9.)

2. Set up the instrument as described in the following procedures, choosing Manual IP mode to set the IP address manually. Be sure to set an address that is compatible with the setting of your PC. The default IP address of the PRISM monitor is 192.168.1.2.
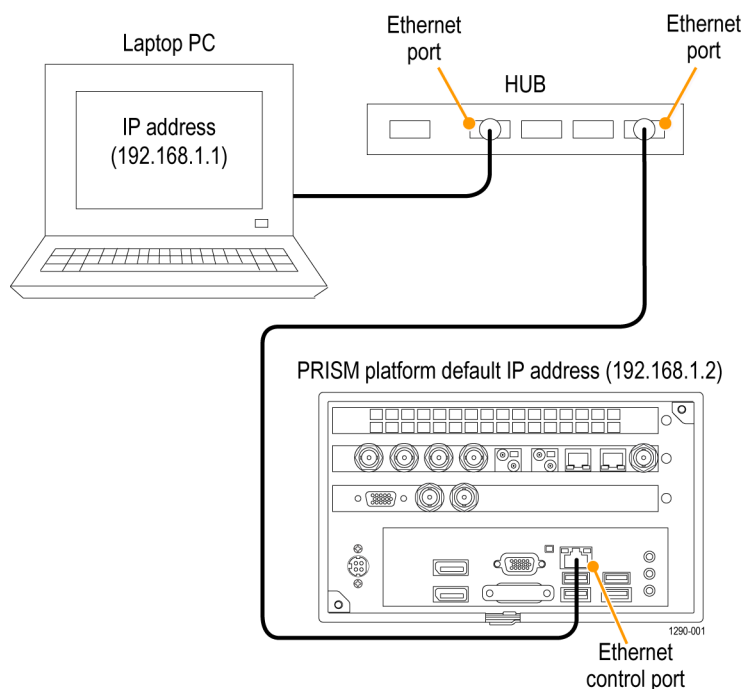

Figure 9: Connecting the instrument to a PC

Connecting to a network

To allow network access to the instrument, you must 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 get a fixed address, talk to your LAN administrator. The default IP address of the PRISM monitor is 192.168.1.2.

To connect your instrument to a network and access it with a remote PC, do the following:

1. On the PRISM monitor, touch the **Settings** icon to display the Settings menu.

2. Touch **Network** to open the Network submenu.

3. Touch **CONTROL IP PORT** to open the Control IP Port submenu.

4. Depending on your local network requirements, touch **DHCP** or **Manual** to select the method for selecting an IP address.

Figure 10: Setting network parameters

5. If you cannot use DHCP and you selected Manual, use the Manual submenu to set the IP address, subnet mask, gateway address and DNS address network parameters you obtained from your LAN administrator. (Be sure to use compatible addresses between the PC and the instrument.) Touch an address box to open the address editing tool. Use the editing box as described for editing an IP input address. (See Figure 20 on page 31.)

6. Touch the **Settings** icon or touch the X icon to close the Settings menu.

Connectors

The following figure shows the external connections to the instrument. A description of each connector is provided in the following table.
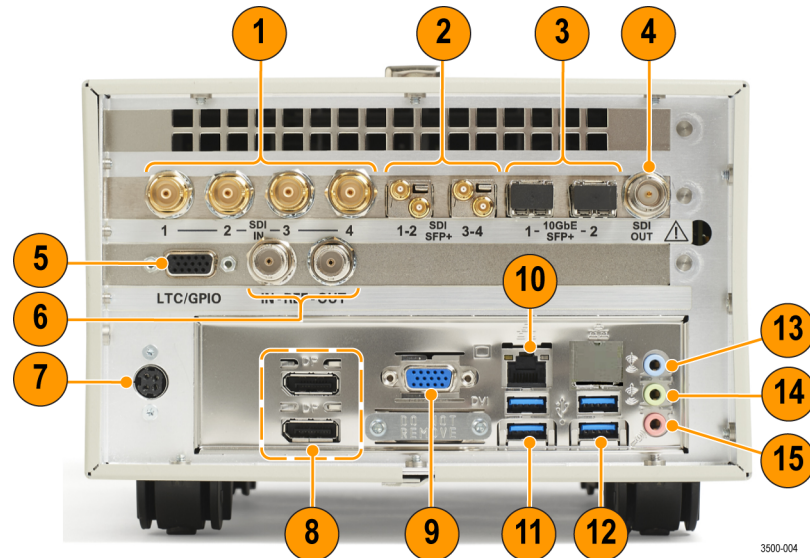
Figure 11: PRISM rear panel

Item number (See Figure 11.)	Description
1	**SDI INPUTS (1-4).** Four BNC inputs with only one active at a time.
2	**SDI SFP+ (1-2 and 3-4).** Two optional SFP+ outputs for SDI signals (HD-BNC transmitter SFP+ modules shown).
3	**10GbE SFP+ (1 and 2).** Optional 10 GbE Ethernet input on port 1. Port 2 is for future functionality.
4	**SDI OUT.** BNC output of the selected SDI input.
5	**LTC/GPIO.** 15-pin, D-type connector is for future functionality.
6	**IN – REF – OUT.** The REF IN connector is for future use. The REF OUT connector outputs a 1 PPS (Pulse Per Second) signal when the instrument is locked to a PTP reference.
7	**DC power input.** Power connector for 48 VDC input.
8	**Display port (DP).** Two display port outputs for external monitors.
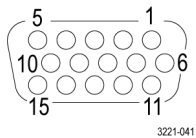
Item number (See Figure 11.)	Description
9	**PC MONITOR.** 15-pin, D-type connector is for future functionality.

```
  5 ——————— 1
   ○ ○ ○ ○ ○
10○ ○ ○ ○ ○ ○6
   ○ ○ ○ ○ ○
  15 ——————— 11
        3221-041
```
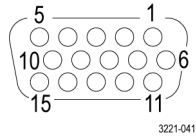
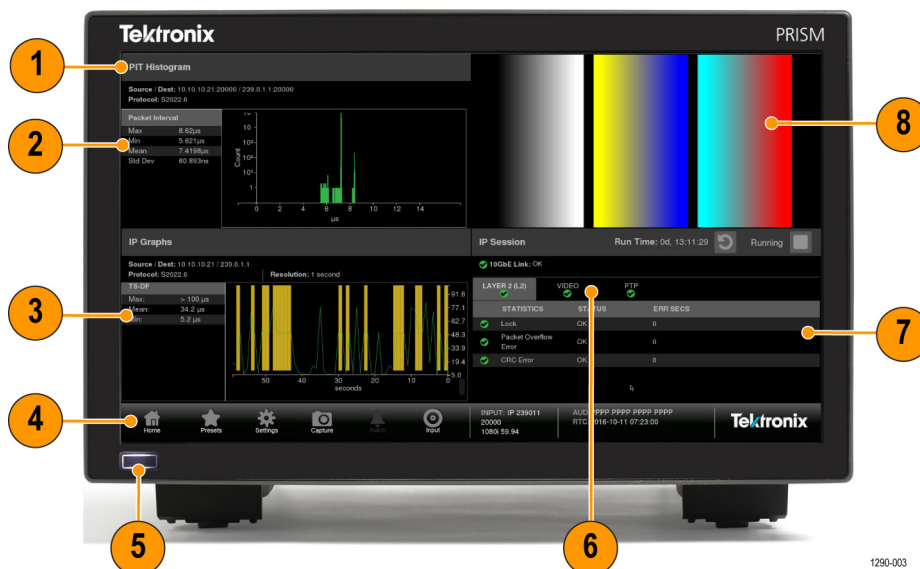| Item number (See Figure 11.)	Description
10	**Control IP port (Ethernet LAN).** Standard RJ-45 connector for a 10/100/1000Base-T Ethernet cable. This port is used to remotely connect to the instrument via your local network.
11	**USB ports.** Four USB ports for connecting a mouse and keyboard or for upgrading the instrument firmware. The ports comply with USB 1.1 and USB 2.0 Full and Low-Speed specifications.
12	**Audio input.** This connector is for future use.
13	**Audio output.** This connector is for future use.
14	**Mic input.** This connector is for future use.

Display elements

Figure 12: Elements of the front panel

Item number (See Figure 12.)	Description
1	Application name. Lists the name of the displayed application.
2	Application tile 1. [1]
3	Application tile 3. [1]
4	Status bar. The right side of the Status bar lists instrument status such as the selected input, type of input signal, selected signal reference (internal or external), audio channel status, and the real time clock setting. The left side of the Status bar has icons with links to various instrument setting menus, presets, and status readouts. Use the Home icon to exit any displayed menus.
5	Power / Standby button. Press the button to turn the instrument on or off. To completely remove power from the instrument, remove the power cord. ⚠ *CAUTION. To prevent data loss, it is strongly recommended that you first shut down the instrument using the power button or the Settings > Utilities menu before disconnecting the power cord.*
6	Application tabs. Some applications have selectable tabs (highlighted readouts) you can use to display additional information.
7	Application tile 4. [1]
8	Application tile 2. [1]

[1] The application panels can be shown in four-tile mode or in full screen mode.

Diagnostics report

You can download a .zip file containing a service report of instrument diagnostics using the Settings menu. Should your instrument need service, you may be asked to provide the Diagnostics file to Tektronix to aid in troubleshooting problems with the instrument.

1. Touch the **Settings** icon ( ) to open the Settings menu.

2. Select **Utilities** to open the Utilities submenu.

3. Select **Diagnostics** to open the Diagnostics submenu.

4. Insert a USB device into one of the USB ports on the PRISM monitor.

5. Select **Save Diagnostics** to save the diagnostics report to the USB device.

Methods of operation

This section describes the four primary methods of operating the instrument:

- Front panel touchscreen
- Keyboard and mouse
- External touchscreen display
- Remote control via VNC
- Remote control via API commands

Front panel touchscreen operation

The following figure shows the instrument display with an open menu for one of the applications.
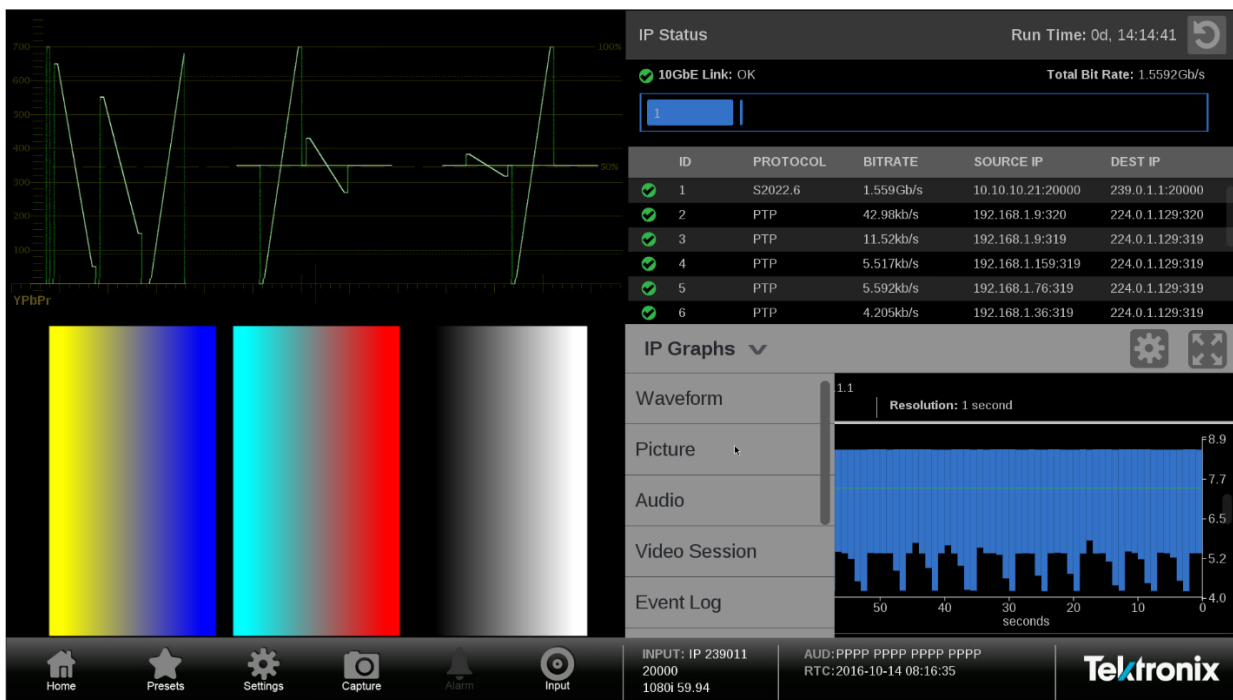

Figure 13: PRISM display in four-tile mode

Supported touchscreen gestures

You can use the following touchscreen gestures to control the instrument:

■ Touch or tap the screen to select display elements.

■ Press and hold on an application panel to open the application menu.

■ Double tap an application panel to toggle the display between four-tile and a full-screen display of the tapped application panel.

■ Swipe up/down or left/right as necessary to navigate menus and preset listings and to view additional application information.

How to select and control an application to display

1. Press and hold on an open application to open the application menu.

2. If necessary, touch the menu down arrow to open the list of available applications.

Waveform ⌄
Waveform
Picture
Audio
Video Session
Event Log
IP Status
IP Session
IP Graphs
PIT Histogram
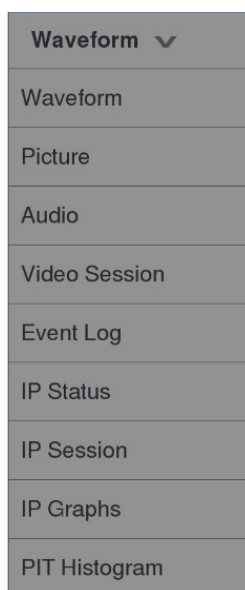
Figure 14: Selecting an application to display

NOTE. When the display in four-tile mode, you will need to scroll down through the list to access all of the applications. (See Figure 13 on page 21.)

3. Swipe the application list up or down to locate the desired application.

4. Touch the name of the desired application to display that application.

5. If available, touch or tap the ⚙ icon in the menu bar to open the settings menu for the application.

6. Touch or tap the ⬚ icon in the menu bar to change the selected application display to full screen.

7. If available, touch or tap the ↺ icon to clear or reset the selected display.

Keyboard and mouse operation

You can use a USB keyboard and mouse to operate the instrument. The mouse needs to have a scrolling wheel in order to access all of the menu selections. Click or click and hold on applications to perform actions like you would on the touch panel.

Connect the keyboard and mouse as follows:

- Use the USB ports on the rear panel of the instrument

- Use the USB port on the front of the optional dual rack cabinet (MPI-RACK-MM or MPI-RACK-MW)

External touchscreen display operation

You can use an external touchscreen display to control the instrument. Two connections are required:

- Connect the Display Port output from the PRISM monitor to the input on the external device.

- Connect the output of the external device to one of the USB ports on the PRISM monitor.

Remote control via VNC operation

When the PRISM monitor is connected to an Ethernet network, you can use a computer connected to the same network to remotely control the instrument via VNC. Use the following steps to connect to the PRISM monitor via VNC:

1. On the PRISM monitor, open the **Settings** > **Network** page to view the **Control IP Port** address of the instrument to which you are going to connect.

2. On your computer, enter the following in the URL box of your web browser, where xxx.xxx.xxx.xxx is the IP address of the Control IP Port of the instrument.

   `http://xxx.xxx.xxx.xxx:6080/vnc.html`

3. This opens a login Web page as shown below.

4. In the Control bar, click the **Settings** icon to open the Settings dialog.

5. In the Settings dialog, use the Scaling Mode drop-down list to select **Local Scaling**, and then click **Apply**.
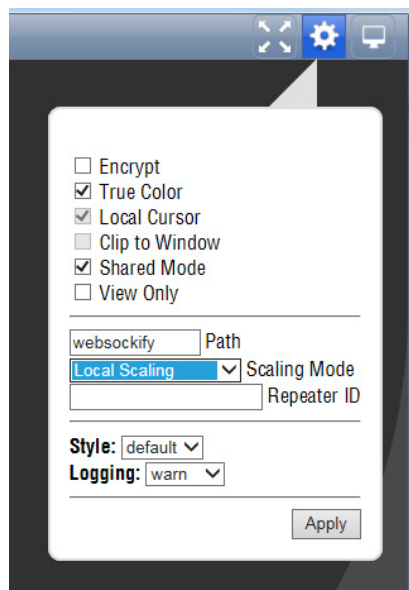
6. In the Control bar, click the **Connect** icon to open the Connect dialog.

7. In the Settings dialog, enter the default password **PRISM** (case sensitive), and then click **Connect**.

NOTE. You can use the WEB REMOTE tab of the PRISM Settings > Network menu to change the default password for the remote Web connection.
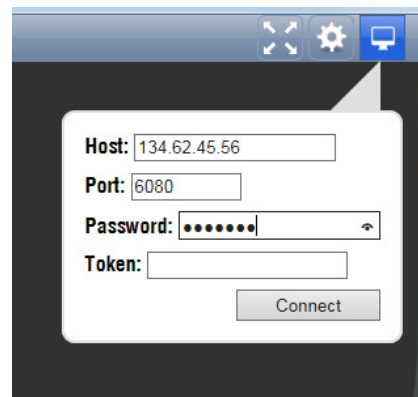
8. The web browser connects to the instrument with the browser display appearing exactly like the instrument display, but with a slower update rate.
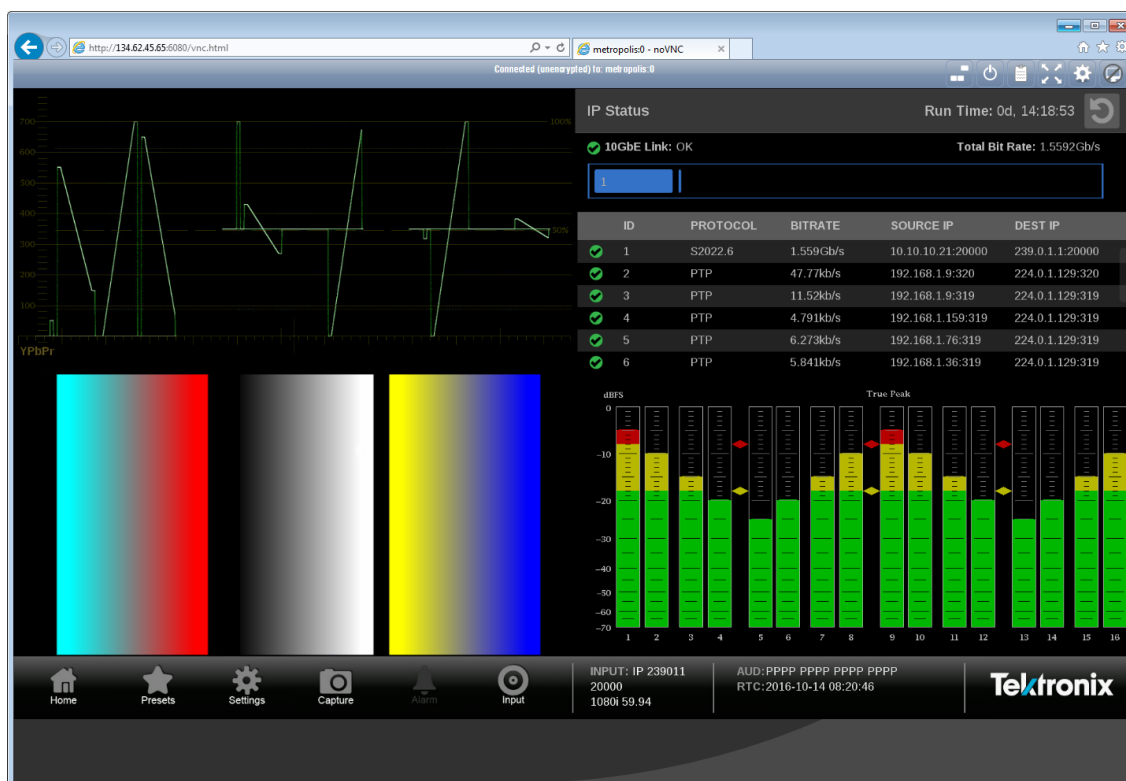
Remote control via API commands
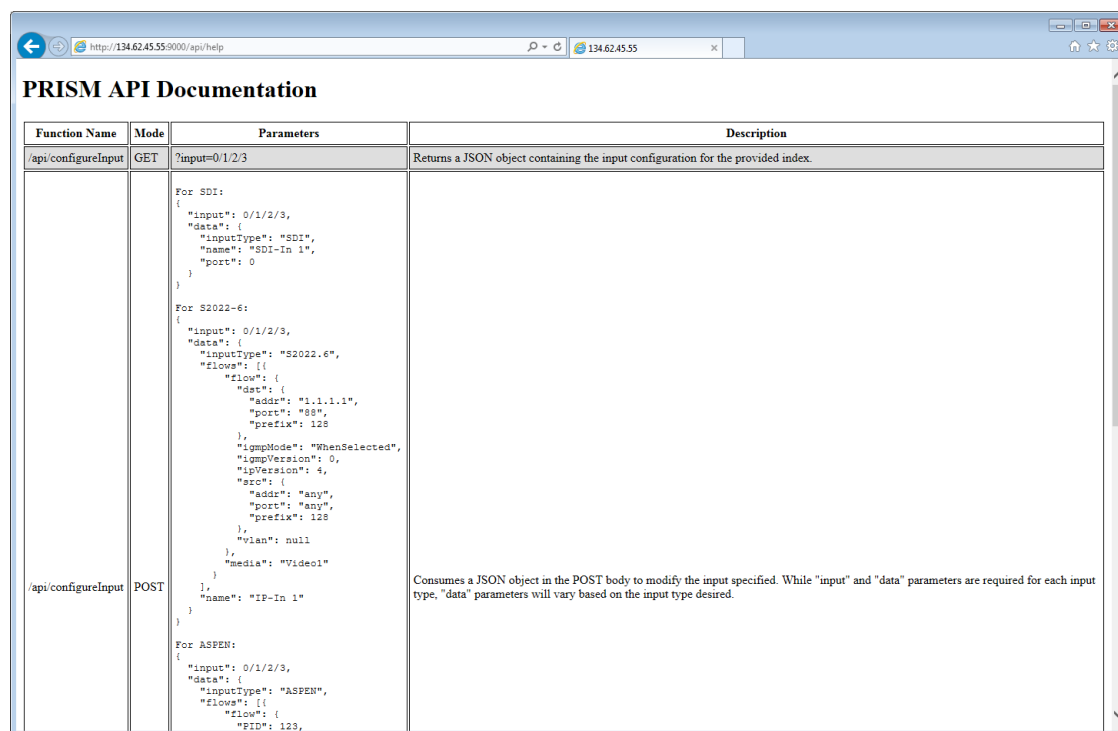
The PRISM monitor has a limited command set for controlling the instrument using REST-style API commands. You can use GET and POST commands to configure the signal inputs and to select the active input.

Use the following steps to access the API documentation:

1. On the PRISM monitor, open the **Settings** > **Network** page to view the **Control IP Port** address of the instrument to which you are going to connect.

2. On your computer, enter the following in the URL box of your web browser, where xxx.xxx.xxx.xxx is the IP address of the Control IP Port of the instrument.

   http://xxx.xxx.xxx.xxx:9000/api/help

3. This opens a PRISM API Documentation Web page as shown below.

Figure 15: API documentation Web page

How to configure the instrument

Most of the instrument settings are controlled using the Settings menu. You can access the Settings menu by touching the Settings icon. This section describes how to configure the following instrument settings:

- Signal inputs (See page 28, *How to configure signal inputs*.)

- PTP reference settings (See page 32, *How to configure PTP reference settings*.)

- Presets (See page 34, *How to set and recall instrument presets*.)

- Internal time and date (See page 41, *How to set the time and date*.)

- Firmware upgrade (See page 43, *How to upgrade the instrument firmware*.)

NOTE. Some of the configuration settings require you to enter values. A USB keyboard can be used to enter these values instead of using the touchscreen keypad on the instrument.

How to configure signal inputs

The PRISM monitor allows you to configure up to four signal inputs. Use the Input icon to select which of the four input signals to monitor.

Perform the following procedure to configure a signal input:

1. Touch the **Settings** icon (⚙) to open the Settings menu.

2. Select **Inputs** to open the Inputs submenu.

3. Select one of the four available inputs to open the configuration page for that input.

4. To configure the selected input for an SDI signal, perform these steps:

   a. Select **SDI** to view a list of the four SDI inputs.
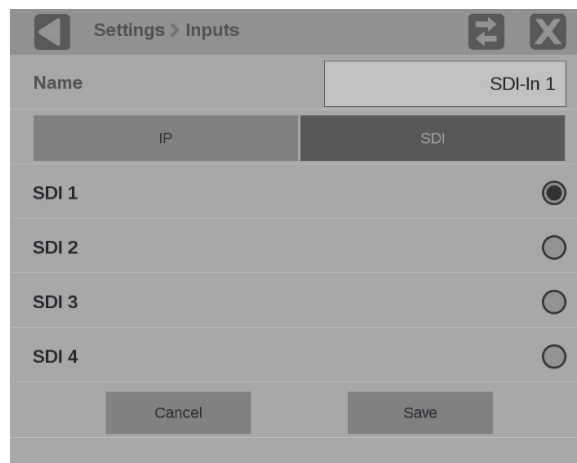
Figure 16: SDI signal configuration

   b. Select which of the four SDI inputs you want to monitor. The example above shows the SDI 1 input being selected.

c. If you want to rename the input to a meaningful name, touch the **Name** box to open the text editing display shown below.

NOTE. The default name is SDI-In <input number>. The name you enter will appear on the input selection icon.
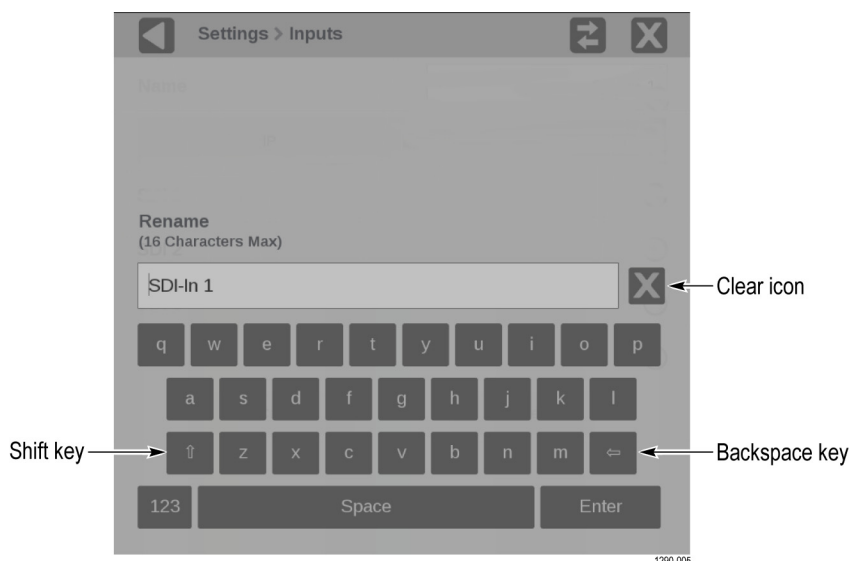
Figure 17: Renaming a signal input

d. Use the editing controls to enter a new name for the input. Here are some notes on using the text editor:

   – Enter a name with a maximum of 16 characters.

   – Use the ☒ icon to clear the existing name.

   – Use the **shift** key to access capital letters.

   – Use the **backspace** key to delete characters by backspacing over them.

   – Use the **123** and **abc** keys to toggle between accessing letters and numbers/symbols.

e. When you are done editing the input name, touch the **Enter** key.

f. When you are done editing the input, touch **Save** to save your changes.

5. To configure the selected input for an IP stream, perform these steps:

    a. Select **IP** to view a list IP input parameters for ST2022-6 streams (See Figure 18.).

    b. If you will be monitoring ASPEN (Adaptive Sample Picture Encapsulation) streams, select **ASPEN** (See Figure 19.).

Figure 18: IP input configuration – ST2022-6 streams

Figure 19: IP input configuration – ASPEN streams

c. To have the instrument ignore a parameter, touch the **Unmasked** control next to the parameter to toggle the state to **Masked**.

NOTE. It is common to mask the source address and port parameters and to enter only the destination address and port parameters.

---

d. To edit one of the parameter values, touch inside the parameter box to open the editing display shown below.
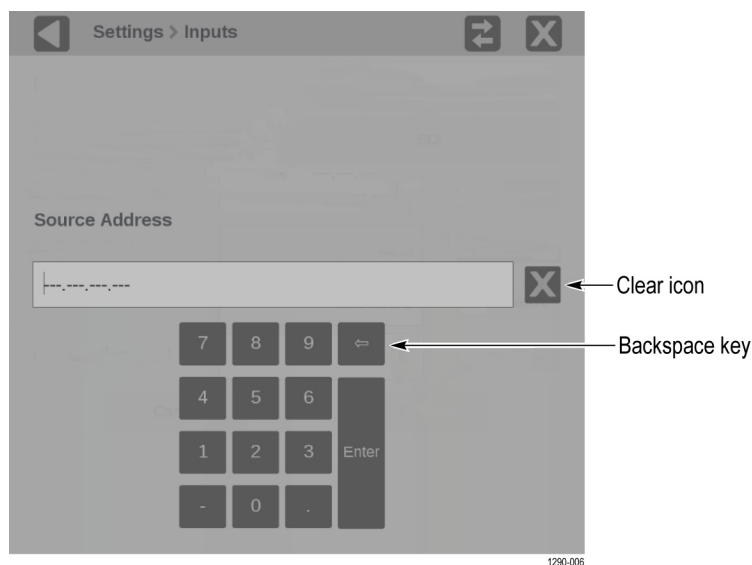
Figure 20: Editing an IP input address

e. Use the editing controls to enter a new address for the parameter. Here are some notes on using the editor:

- Use the icon to clear the existing address.

- Use the **backspace** key to delete characters by backspacing over them.

e. When you are done editing the IP parameter, touch the **Enter** key.

f. Edit each parameter as necessary.

g. When you are done editing the parameters, touch **Save** to save your changes.

How to configure PTP reference settings

Perform the following steps to configure the PTP reference settings:

1. Touch the **Settings** icon ( ) to open the Settings menu.

2. Select **Reference** to open the PTP settings submenu shown below.

Figure 21: Editing PTP reference settings

3. To enable or disable PTP logging to the Event Log, touch the control box to toggle the setting to the desired state.

4. Select the profile to configure: **ST2059**, **AES67** or **General**. The default communication mode for each profile is **Multicast**.

5. If you selected the ST2059 profile, select **Mixed SMPTE w/o negotiation** if the communication mode will be a mixture of Multicast and Unicast.

NOTE. On the SMPTE profile mixed mode, the PTP Announce and Sync messages are sent as Multicast. However, the Delay request and Delay Response messages are sent as Unicast.

6. Touch the **Domain (0-127)** box to open the editing display shown below.

Figure 22: Editing the PTP domain setting
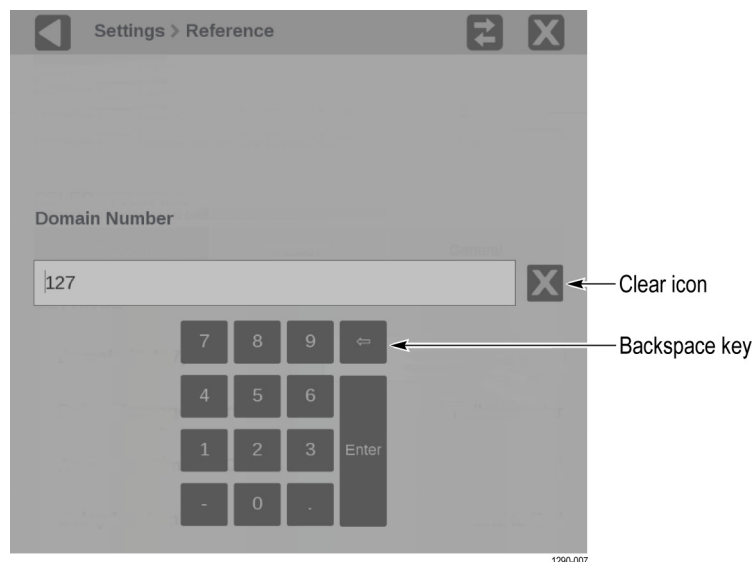
7. Use the editing controls to enter a new domain number. Here are some notes on using the editor:

  - Use the icon to clear the existing domain number.

  - Use the **backspace** key to delete characters by backspacing over them.

8. When you are done editing the domain number, touch the **Enter** key.

9. Repeat steps **4** to **6** for each PTP profile.

How to set and recall instrument presets

Instrument setups can become complex as you tailor them to monitor various parameters. To save set up time and ensure consistency, you can save and quickly access instrument setups in your instrument using the **Presets** icon on the instrument display.

The instrument can store up to 36 separate instrument presets. The presets are divided into six groups, A through F, with each group containing 6 preset storage locations. The default preset names are A1 – A6, B1 – B6, C1 – C6, D1 – D6, E1 – E6, and F1 – F6.

All instrument settings except those set in the Utilities and Network Settings submenus of the Configuration menu are saved in a Preset. Settings that are not saved are those such as the clock setting, IP configuration, and network address. The following is an overview of the settings saved in a Preset. Some settings are option dependant.

- Application assigned to each tile

- Application specific settings

- Input selection and configuration

- PTP reference settings

How to save and rename presets

Perform the following steps to save a preset and to assign a user-defined name to the preset:

1. Set up the instrument exactly as you want to have it configured. This includes selecting the application display for each tile, configuring inputs and the PTP reference settings.

2. Save the instrument settings as a preset:

    a. Touch the **Presets** (⭐) icon to open the Preset selection controls at the bottom of the PRISM display.

Figure 23: Preset selection controls (Group B shown)

b. Locate the Preset button icon you want to use for the current instrument configuration. You can use the ◀ and ▶ arrow buttons or swipe left/right to navigate to the desired preset group (A–F).

*NOTE. When a preset has no content, **<empty>** is displayed on the preset button icon.*

c. When you have located the desired preset group, touch and hold the preset button you want to assign the current instrument configuration. The selected preset button will highlight and a confirmation box will appear. In the example shown below, the Group B preset B6 is being saved.
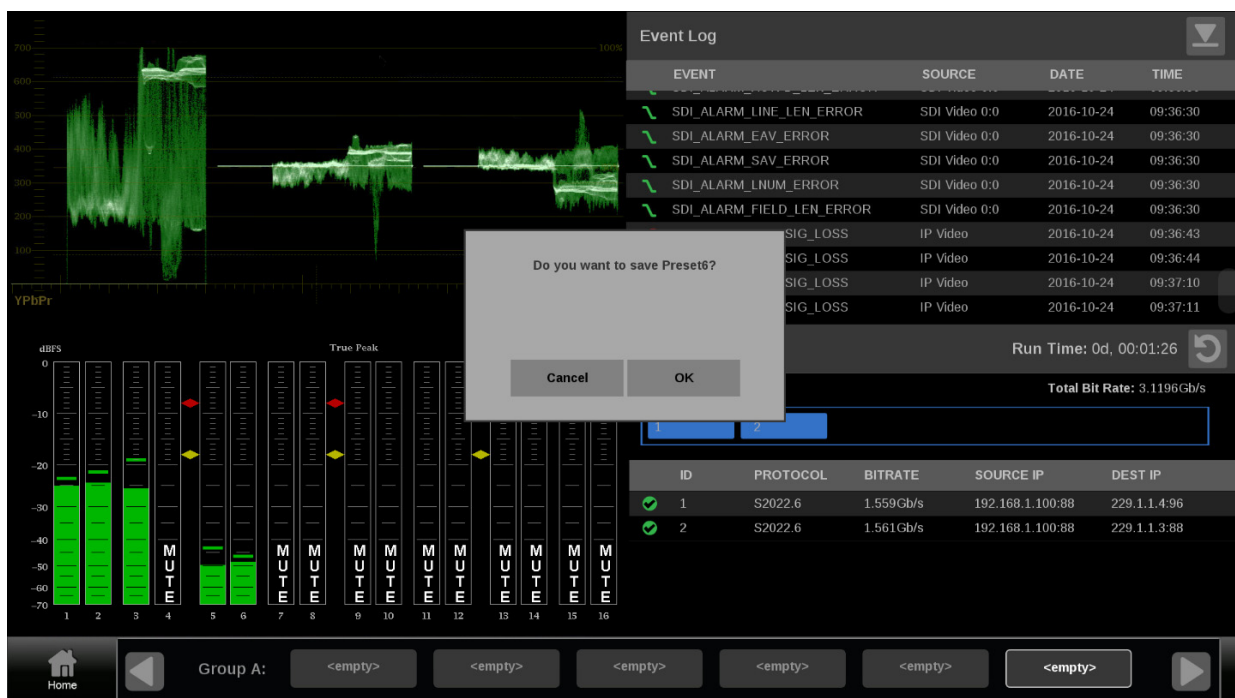
Figure 24: Assigning a preset

d. Touch **OK** to assign the preset or touch **Cancel** to cancel the operation.

e. When you select OK, the preset name changes from **<empty>** to **Preset<number>**, where the number is the preset position within the preset group. (See Figure 27.)

f. Touch the Home icon (🏠) or touch anywhere within an application tile to close the Preset selection controls.

3. Assign a user-defined name to a preset:

    a. Touch the Settings icon (![gear]) to open the Settings menu.

    b. Select **Presets** to open the Presets submenu.

    c. Select **Rename** to open the Presets Rename submenu shown below.
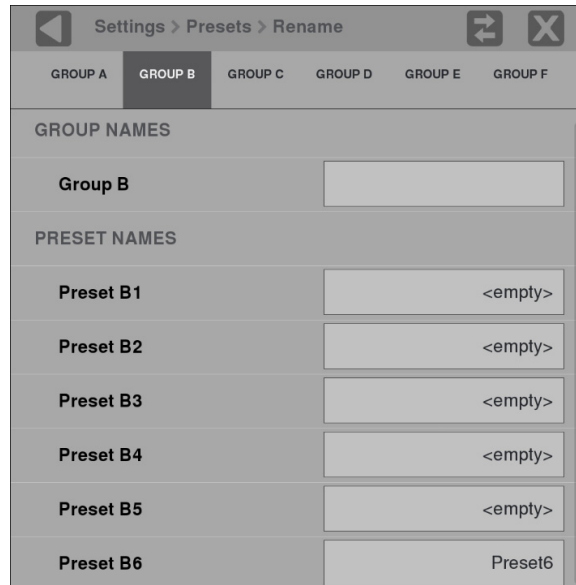
Figure 25: Presets Rename submenu

    d. Select the Preset group at the top of the submenu that corresponds to the preset you just saved. The example above shows Group B being selected.

e. Touch the preset name box you want to change to open the editing display shown below.
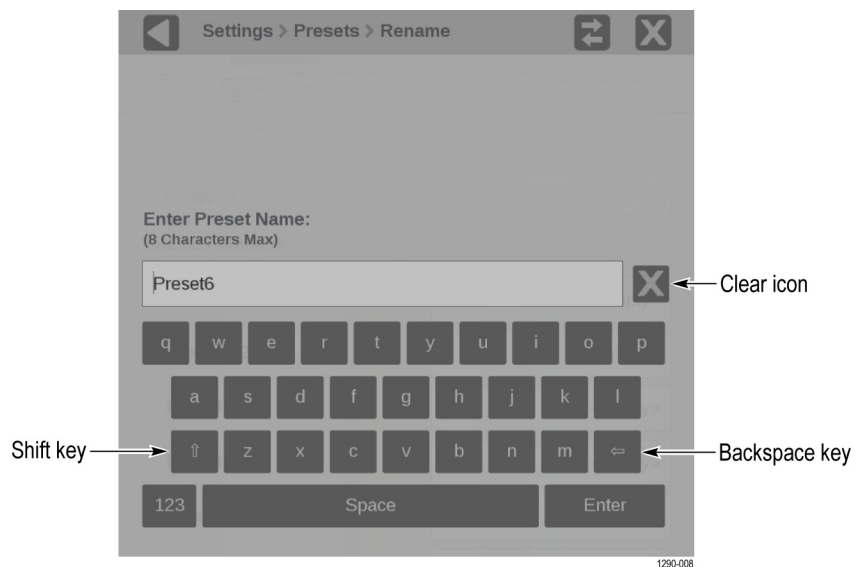
Figure 26: Editing a Preset name

f. Use the editing controls to enter a new name for the preset. Here are some notes on using the text editor:

- Enter a name with a maximum of 8 characters.
- Use the ✕ icon to clear the existing name.
- Use the **shift** key to access capital letters.
- Use the **backspace** key to delete characters by backspacing over them.
- Use the **123** and **abc** keys to toggle between accessing letters and numbers/symbols.

g. When you are done editing the preset name, touch the **Enter** key.

NOTE. You can also assign a user-defined name to the selected preset group by touching inside the Group Name box.

How to recall user-defined presets

Perform the following steps to recall a user-defined preset:

1. Touch the **Presets** (⭐) icon to open the Preset selection controls at the bottom of the PRISM display.

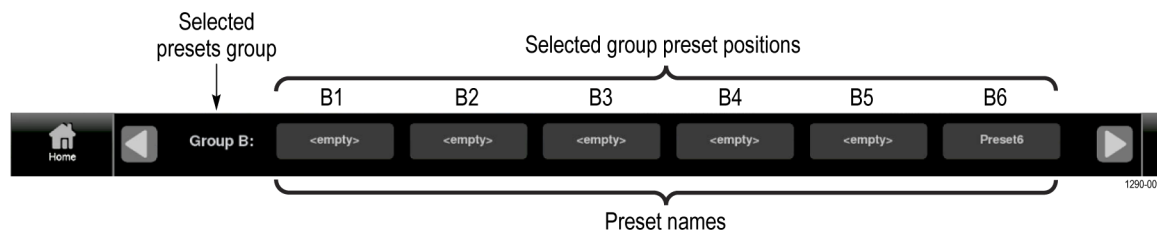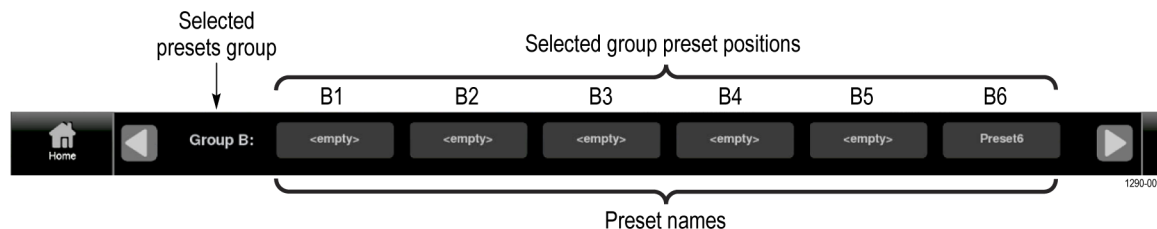Figure 27: **Preset selection controls (Group B shown)**

2. Locate the Preset you want to recall by using the ◀ and ▶ arrow buttons or by swiping left/right to navigate to the desired preset group (A–F).

NOTE. *When a preset has no content, **<empty>** is displayed on the preset button icon.*

---

3. When you have located the desired preset group, touch the preset button you want to recall. The selected preset button will highlight and the instrument settings will change to those assigned to the selected preset.

4. Touch the Home icon (🏠) or touch anywhere within an application tile to close the Preset selection controls.

How to recall the Factory preset

Perform the following steps to recall the Factory preset:

1. Touch the **Settings** icon ( ) to open the Settings menu.

2. Select **Presets** to open the Presets submenu.

3. Select **Recall Factory Preset**. A confirmation box opens as shown below.
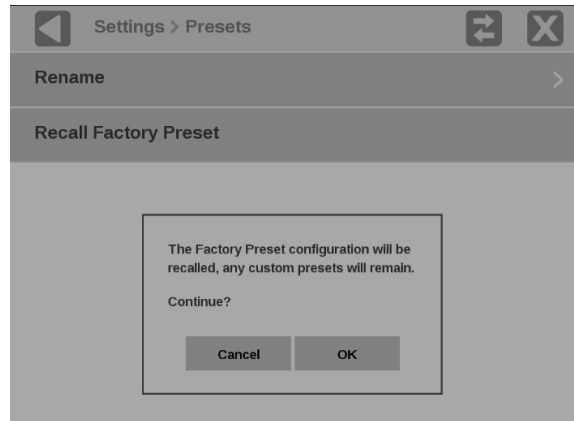
Figure 28: Presets Rename submenu

4. Select **OK** to confirm the selection and to reset the instrument settings to the factory defaults.

The following table lists the instrument settings that are reset by recalling the Factory preset.

Table 3: Instrument settings that are reset by recalling the Factory preset

Item	Setting
Tile 1 application	Waveform
Tile 2 application	Video Session
Tile 3 application	Picture
Tile 4 application	Audio
SDI-In 1 input configuration	
Input name	SDI-In 1
Input type	SDI
Input connector	SDI 1
SDI-In 2 input configuration	
Input name	SDI-In 2
Input type	SDI
Input connector	SDI 2

Table 3: Instrument settings that are reset by recalling the Factory preset (cont.)

Item	Setting
SDI-In 3 input configuration	
Input name	SDI-In 3
Input type	SDI
Input connector	SDI 3
SDI-In 4 input configuration	
Input name	SDI-In 4
Input type	SDI
Input connector	SDI 4
PTP reference configuration	
PTP Logging to the Event Log	Enabled
Selected Profile	ST2059
ST2059 domain	127
ST2059 communication mode	Multicast

How to set the time and date

Perform the following steps to set the internal time and date used by the instrument to record events.

NOTE. When the time and date settings are changed, the instrument must be rebooted to implement the changes.

---

1. Touch the **Settings** icon (⚙️) to open the Settings menu.

2. Select **Utilities** to open the Utilities submenu.

3. Select **Time and Date** to open the submenu shown below. The submenu has two tabs: **TIME AND DATE** and **TIME ZONE**.
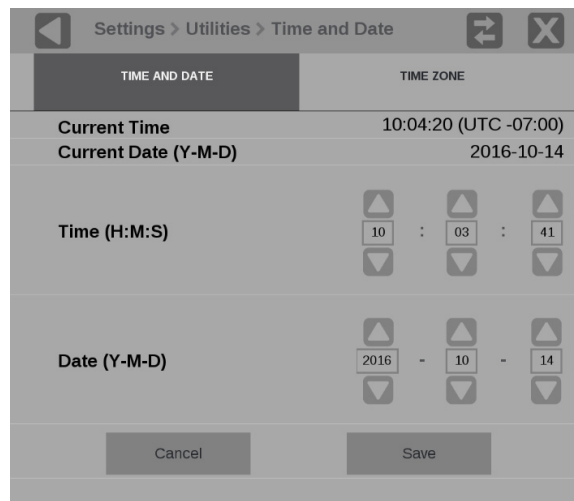
Figure 29: Time and Date submenu

4. In the TIME AND DATE tab, adjust the time and date using the up and down arrows to adjust each parameter as needed. The time setting uses a 24 hour clock, so no AM/PM setting is required.

5. Touch TIME ZONE to open the submenu shown below.
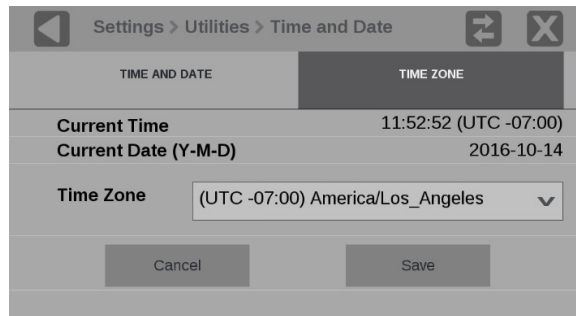
Figure 30: Time Zone submenu

6. Use the **Time Zone** drop-down list to select the correct time zone offset for your location. The selection names include the time offset from UTC and also major cities within those time zones.

7. When you are done setting the time and date parameters, touch **Save**.

8. The message box shown below opens asking whether you want to reboot the instrument now or later to implement the time and date changes. Perform one of the following actions:

- Touch **Reboot** to reboot the instrument immediately and implement the changes.

- Touch **Later** to delay implementing the time and date changes until the next time the instrument is rebooted.
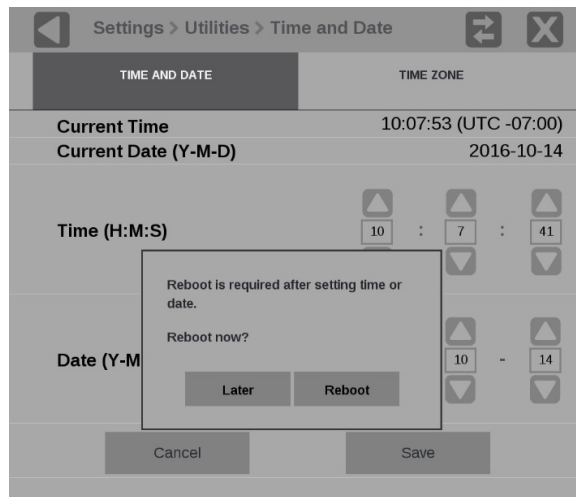
Figure 31: Time and date change reboot message

How to upgrade the instrument firmware

Before you begin Tektronix releases updates to product firmware to add new features or to fix reported problems. You should check the Tektronix Web site regularly for new firmware releases.

You do not need to perform a firmware upgrade if your instrument has the latest version of firmware already installed. Perform the following steps to determine if the firmware on your instrument needs to be upgraded:

1. Power on the instrument.

2. Verify the current software version installed on the instrument:

   a. Touch the **Settings** icon to open the Settings menu.

   b. Touch **Utilities** icon to open the Utilities submenu.

   c. Touch **Version** to open the Version display.

   d. In the Software section, make a note of the version number installed on the instrument.

Instrument Firmware version number	

3. Verify the latest version of firmware at the Tektronix Web site:

   a. Use the Web browser on a PC to navigate to the following Tektronix Web site:

      `http://www.tektronix.com/downloads`

   b. On the Downloads Finder Web page, search by model number (such as PRISM) and filter by software and software type to locate the software-upgrade package for the instrument.

   c. Note the latest version number of the software-upgrade package(s).

Web site Firmware version number	

4. If the latest firmware version at the Web site is newer than the version on your instrument, you should upgrade the firmware.

5. Download the latest version to your PC.

6. After the firmware package is downloaded, click on the self-extracting archive to extract the upgrade file(s) into the directory of your choice. The upgrade file will have a .bin file extension and there may also be a readme.txt file.

The time required to complete the upgrade is about 15 minutes.

> ⚠ **CAUTION.** *Once the instrument has started the upgrade process, DO NOT remove power from the instrument. If you do so, the instrument flash will be corrupted. The instrument will have to be sent to a Tektronix factory service center to have the system firmware restored.*

> **NOTE.** *If power to the instrument is lost before it begins erasing the internal flash, you can restart the firmware upgrade after the instrument reboots.*

Firmware upgrade procedure

Perform the following steps to upgrade the instrument firmware:

1. Copy the upgrade file with a .bin file extension from the upgrade package onto a USB memory device. You will need approximately 320 MB of available space on the USB device.

> **NOTE.** *If the upgrade package included a readme.txt file, read the file before performing the upgrade. The file will contain important information about the firmware release.*

2. Insert the USB memory device into a USB port on the PRISM monitor.

3. On the PRISM monitor, touch the **Settings** icon to open the Settings menu.

4. Touch **Utilities** icon to open the Utilities submenu.

5. Touch **Firmware Upgrade**. The display will list all of the files on the USB device with a .bin file extension.

6. Touch the desired file in the list to select it, and then touch **Install** to start the upgrade.
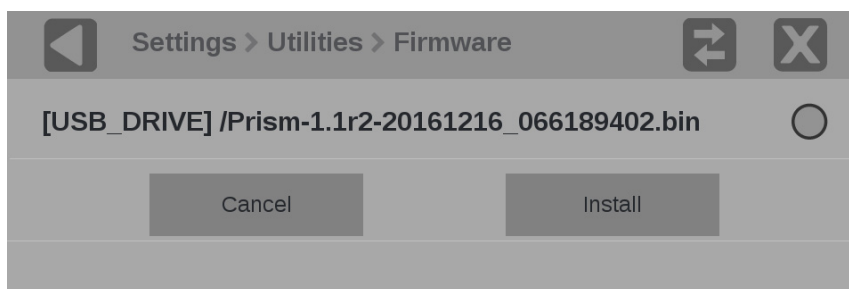
Figure 32: Selecting the firmware upgrade file

7. While the upgrade is in process, the message box shown below appears stating that the firmware installation is in progress.

⚠ **WARNING.** *To prevent upgrade failure, do not remove the USB device or power off the instrument until the upgrade is complete. The upgrade may take up to 5 minutes.*

INSTALLATION IN PROGRESS

[A40B-5A03] /bin/Prism-1.0r1-20161014Bld1132.bin

Please do not shutdown the unit.

Time Elapsed: 12 Sec

Reboot Now   Reboot Later
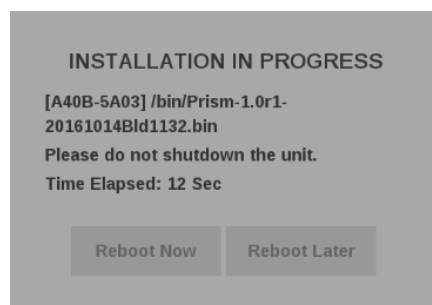
Figure 33: Upgrade Installation In Process message box

8. When the upgrade is complete, the following message box appears. Perform one of the following actions:

    -   Touch **Reboot Now** to reboot the PRISM monitor and complete the installation of the upgrade.

    NOTE. *It is strongly recommended that you select Reboot Now after the upgrade files are installed. If the instrument does not reboot, remove and then reapply power to the instrument to cause it to reboot.*

    -   Touch **Reboot Later** to maintain instrument operation with the older version of firmware. The upgraded firmware will be automatically installed the next time the instrument is rebooted.

INSTALLATION COMPLETE

Upgrade successful. New version of prism-sw is prism-sw-1.0b3-0.1475623096git4f69ba.el7.centos.x86_64

Time Elapsed: 01 Min : 10 Sec

Reboot Now   Reboot Later

Figure 34: Upgrade Installation Complete message box

9. Remove the USB device from the PRISM monitor.

Verify the firmware upgrade

Perform the following procedure to verify the firmware upgrade:

1. Touch the **Settings** icon to open the Settings menu.

2. Touch **Utilities** icon to open the Utilities submenu.

3. Touch **Version** to open the Version display.

4. Verify that the displayed firmware version number matches the version of the firmware upgrade package you installed.

How to upgrade the software license

A software license upgrade allows you to add optional software features to your instrument. The following license upgrades are available:
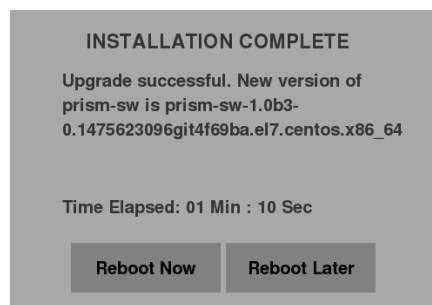
- **MPI-IP-STD-UP**. Adds SMPTE 2022-6 and PTP (IEEE1588, SMPTE 2059-2) support, includes IP Status application – NODE LOCKED LICENSE.

- **MPI-IP-MEAS-UP**. Requires Option MPI-IP-STD. Adds IP Measurement feature sets: IP Graph, IP/PTP Session, and IP PIT Histogram applications (SMPTE 2022-6 and PTP) – NODE LOCKED LICENSE.

Obtain the software license upgrade file

Perform the following procedure to obtain a software license upgrade file from Tektronix:

1. On the PRISM monitor you want to upgrade, make a note of the instrument serial number. The serial number is located on the instrument rear panel.

NOTE. If the instrument serial number is not easily located (for example, if the instrument is installed in an equipment rack), you can obtain the serial number by performing steps 1 to 4 in the Install the software license upgrade procedure. (See page 47.)

2. Provide the serial number of the PRISM monitor you are upgrading when you contact Tektronix to place your software license upgrade order. After your upgrade order is processed, you will be sent a notification e-mail with details on how to download the software license upgrade file.

3. Follow the e-mail instructions to download the upgrade file. As noted in the e-mail, you will need to access your MyTek account to download the upgrade file.

Install the software license upgrade

Perform the following procedure to install the software license upgrade:

1. On the PRISM monitor, open the **Settings** > **Network** menu page to view the **Control IP Port** address of the instrument which you are going to upgrade.

2. Copy the software license upgrade file you downloaded to a location on the hard drive of your computer.

3. On your computer, enter the following in the URL box of your web browser, where xxx.xxx.xxx.xxx is the IP address of the Control IP Port of the instrument you are upgrading. The IP address is case sensitive.

   `http://xxx.xxx.xxx.xxx:9000/licensePortal.html`

4. This opens the Tektronix PRISM License Installation Web page as shown below. The Web page shows the current software license string and the instrument serial number.
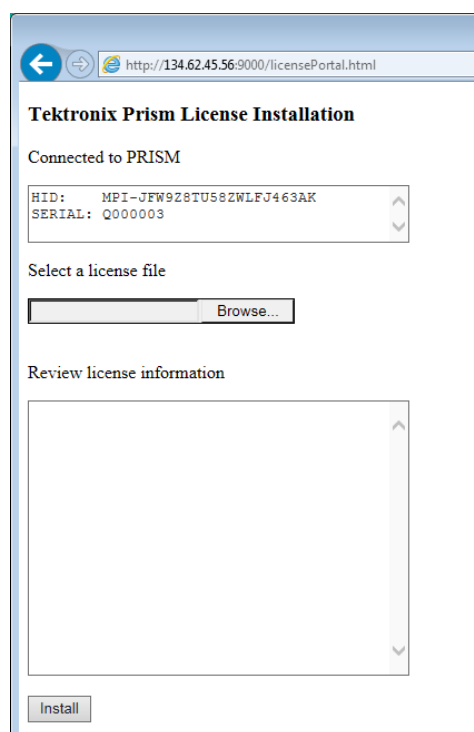
Figure 35: PRISM License Installation Web page – initial view

5. Click the **Browse...** button, and then navigate to the location of the software license file.

6. Select the software license file and click **Open**.

7. The license installation Web page displays the new license information in the **Review license information** box. The example below shows an instrument that is being upgraded with two software options: MPI-IP-STD and MPI-IP-MEAS.
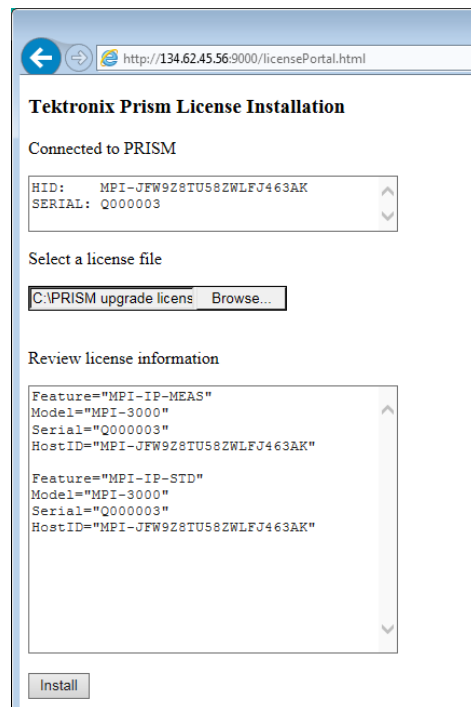
Figure 36: PRISM License Installation Web page – license upgrade information review

8. If the license information is correct, click **Install** to start the license installation.

9. When the license(s) is installed, the bottom of the license installation Web page displays a message that the license was installed successfully.
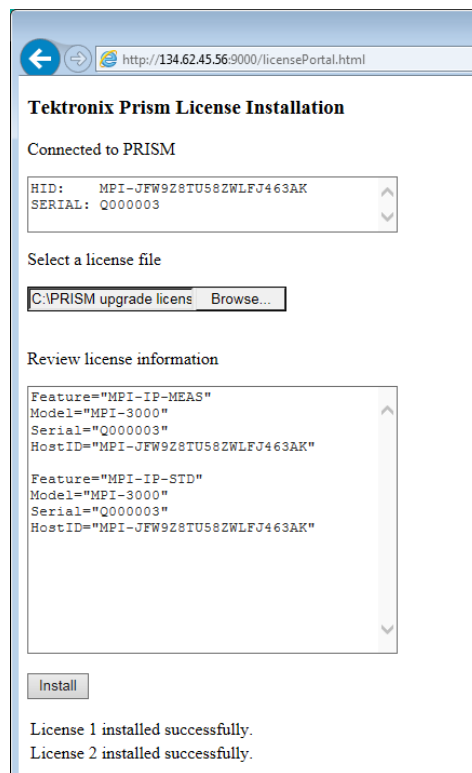
Figure 37: PRISM License Installation Web page – license install message

10. After the upgrade is installed, close the PRISM License Installation Web page.

Verify the software license upgrade

Perform the following procedure to verify the software license upgrade:

1. Touch the **Settings** icon to open the Settings menu.

2. Touch **Utilities** icon to open the Utilities submenu.

3. Touch **Options** to open the Options display.

4. Verify that the displayed option(s) match the option(s) you installed.
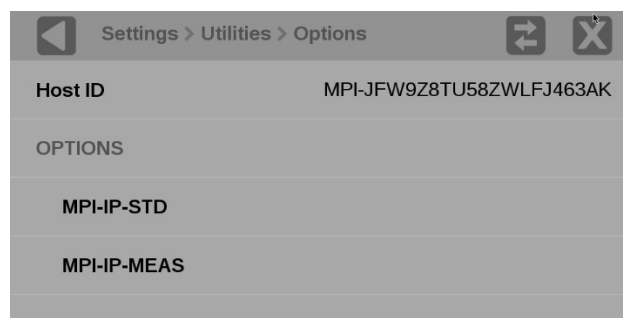
Figure 38: Verifying the software license upgrade

Application display information

This section describes each of the available applications on the PRISM monitor. All applications can be viewed in four-tile mode as well as full-screen mode. Double tap in an application to toggle between these two modes.

NOTE. Some displays require a specific option to be installed. For example, the IP Status display is not accessible unless you have Option MPI-IP-STD.

Base instrument applications

The following applications are available on every PRISM monitor:

- **Waveform**. Use this application to view the Luma (Y) and color difference (Pb, Pr) components of the video signal. (See page 52, *Waveform application display*.)

- **Picture**. Use this application to view the picture generated by the video signal. (See page 53, *Picture application display*.)

- **Audio**. Use this application to view a level meters display of the audio in the monitored signal using True Peak ballistics. Also included are Test level and Peak program level indicators. (See page 54, *Audio application display*.)

- **Video Session**. Use this application to view various performance parameters of the SDI video signal or the decoded IP stream. (See page 56, *Video Session application display*.)

- **Event Log**. Use this application to view a log of detected errors. (See page 62, *Event Log application display*.)

Option MPI-IP-STD application

The following additional application is available when Option MPI-IP-STD is installed:

- **IP Status**. Use this application to see an overview of the monitored IP stream and see the status of each program in the stream. (See page 64, *IP Status application display*.)

Option MPI-IP-MEAS applications

The following additional applications are available when Option MPI-IP-MEAS is installed (requires Option MPI-IP-STD):

- **IP Session**. Use this application to view various performance parameters of the IP stream including Layer 2, video and PTP parameters. (See page 66, *IP Session application display*.)

- **IP Graphs**. Use this application to view trend graphs of various performance parameters of the IP stream including total bit rate, session bit rate, PIT, RTP sequence errors, video CRC errors, and TS-DF (Time Stamped Delay Factor).

- **PIT Histogram**. Use this application to view a histogram of the PIT (Packet Interval Time) to monitor network delay variation statistics.

Status indicators

Many of the application displays include status icons, which provide a quick method for viewing signal status. The following icons may appear:

- : Indicates that the signal parameter has not been in an error condition.

- : Indicates that the signal parameter was in an error condition but the error has now cleared.

- : Indicates that the signal parameter is currently in an error condition.

- : Indicates that the signal parameter is not being monitored for an error condition.

Waveform application display

The Waveform display is a voltage versus time display of the video signal.
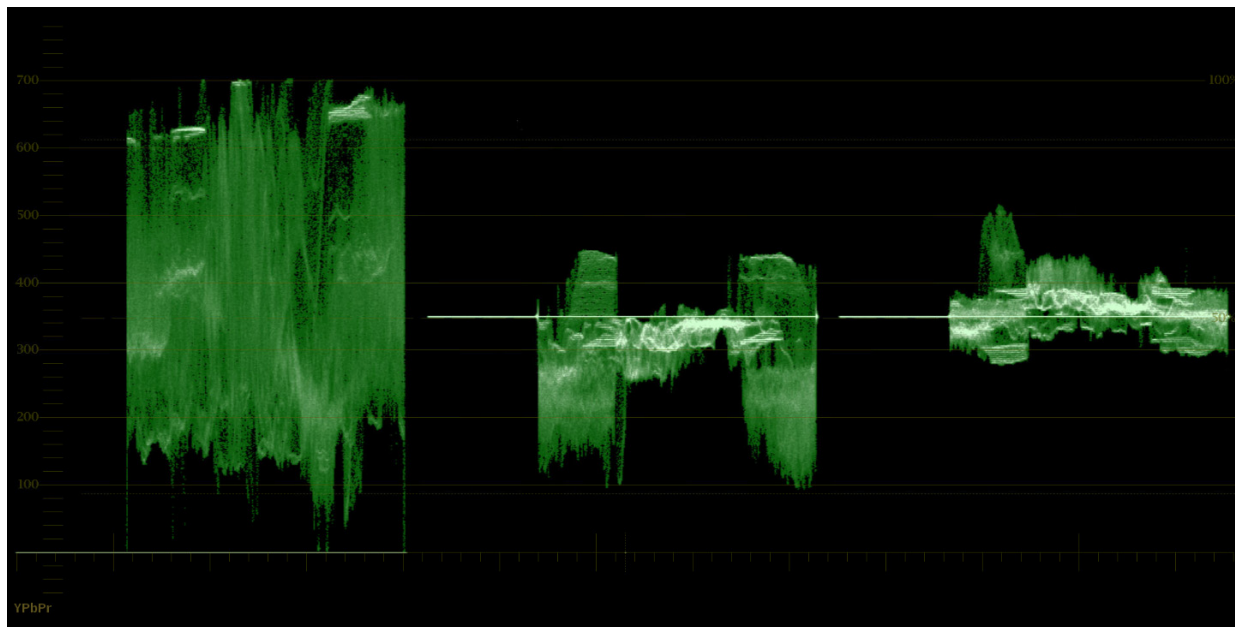
Figure 39: Waveform application display of a video signal

Elements of the Waveform application display

- **YPbPr**. Lists the default display format, which shows the Luma (Y) and color difference (Pb, Pr) components of the video signal.

- **Scale and units**. By default, the vertical units are in mV (0 mV to 700 mV).

Picture application display

The Picture display lets you see the picture generated by the video signal. (See Figure 40.) In full-screen mode, there is no cropping. Pictures are decimated horizontally or vertically to obtain the correct aspect ratio. This decimation may cause some artifacts. This behavior may be evident on a sweep signal.

Figure 40: Picture display of a Big Buck Bunny video

Audio application display

The Audio application provides a level meters display using True Peak ballistics for monitoring audio signals. Also included are Test level and Peak program level indicators.
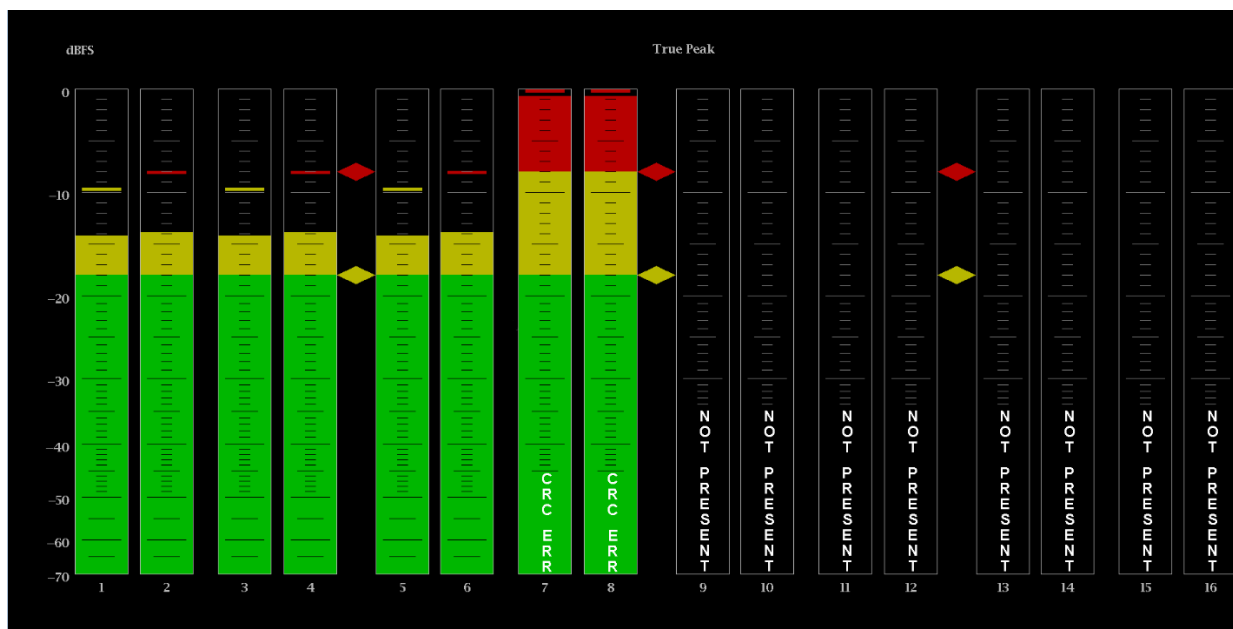
Figure 41: Audio application display

Elements of the Audio display

- **True Peak**: Displays the default level meter dynamic response characteristic (ballistics type). You cannot change the ballistics type.

- **Level meters**: Level meters are vertical bar graphs on which the height of the bar indicates the amplitude of the audio program in the corresponding input channel. The meter levels are color coded based on their relationship to the Test Level and Peak Program level indicators as follows.

  - Below the Test level, the meter bars are displayed in a green color.

  - Between the Test level and the Peak Program level, the meter bars are displayed in a yellow color.

  - Above the Peak Program level, the meter bars are displayed in a red color.

- **Test level and Peak program level indicators**: Diamond-shaped markers between the level bars indicate the default Test Level and Program level limits for the display. Test level is also known as Reference level or Line-up level.

- **Level meter scale and units**: By default, the units are in dB relative to full scale (dBFS). The 0 dB mark is digital Full scale.

In-bar warning messages

This instrument displays warning messages within the level meter bars. The warning messages that can appear are shown below in order of priority.

- **UNLOCKED**. The instrument is not locked to an incoming signal on the indicated input channel. Data cannot be decoded and all data and other errors are ignored. This means that if an AES input is selected, nothing recognizable is present on the input, or if embedded audio is selected, the VIDEO input is unrecognizable.

- **AES PARITY.** The incoming subframe does not have even parity as specified by the digital audio standards. The data sample is unreliable and is ignored. The level meters and Lissajous display treat the sample as a zero sample.

- **AES CRC ERROR.** The CRC code in the AES channel status packet is incorrect. Sometimes the CRC code is set to zero, indicating that the signal is missing; when this is the case, this message is not displayed.

- **MUTE.** The number of consecutive all-zero samples equals or exceeds the # Samples for Mute setting.

- **SILENCE.** The signal is at or below the specified Silence Level for a time exceeding the Duration for Silence setting.

- **DISABLED.** Indicates that an audio bar is not active. This message is mainly seen with a Dolby Digital source when a listening mode is selected with a reduced number of channels.

- **AES V BIT.** Indicates that the Validity bit is set high for one or more data samples. In the AES/EBU standard, a set validity bit indicates that the sample is not suitable for conversion to audio. By default, the level meter bars and Lissajous display treat the affected samples as zero samples.

- **NO AUDIO.** Indicates that an AES or embedded input has the Non audio bit set.

- **NOT PRESENT.** Indicates that an audio bar is not present in the current audio input. This can be present if a Dolby Digital input has a coding mode indicating a reduced number of channels.

Video Session application display

Use this application to view various performance parameters of the SDI video signal or the decoded IP stream. Touch any of the four tab titles to view the associated information: SDI Format, VPID 352, Bit Level, or CRC Status.
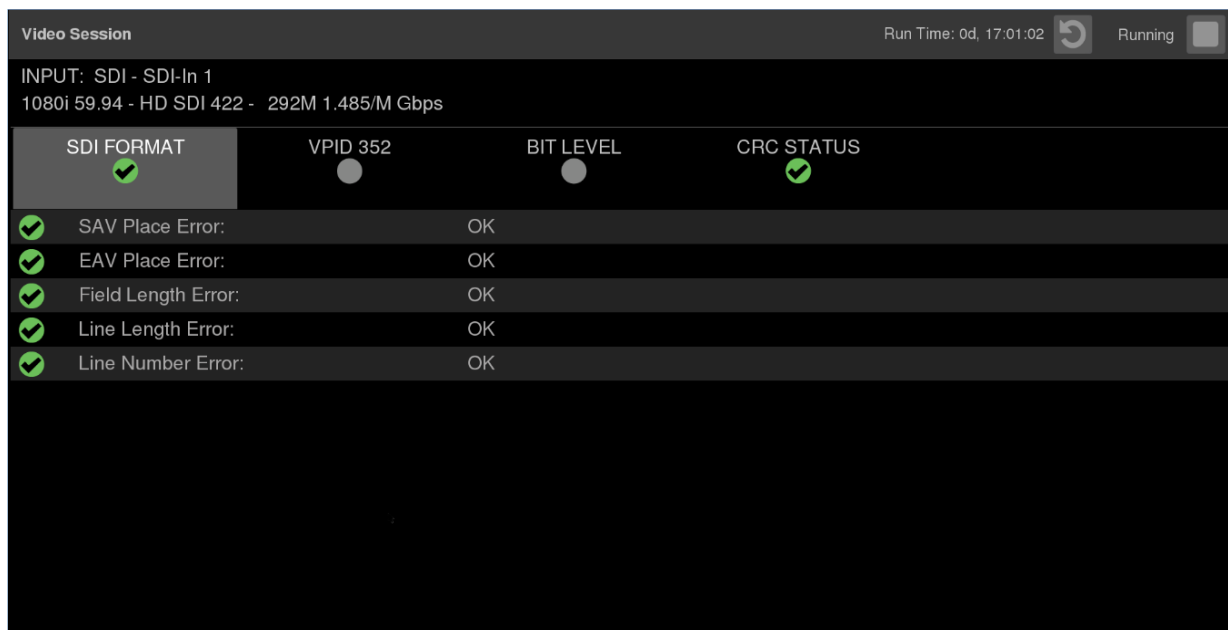
Figure 42: Video Session application – SDI FORMAT tab display

Elements of the top-level Video Session application display

The elements at the top of the Video Session application are shared between the four tabs:

■ **INPUT**: Shows the selected input source on the top line and shows the detected format, sample structure, and transport of the input signal on the second line.

■ **Display tabs**: Click on one of the four tabs to view the associated display. Each of the tabs has a status indicator to provide a quick view of the status of the parameters contained in each tab.

  – **SDI FORMAT**. Use this tab to view the status of various SDI signal parameters on the input signal.

  – **VPID 352**. Use this tab to view the status of the SMPTE352M VPID on the input signal. For 3G-SDI signals, VPID is required on the primary link (Link A).

- **BIT LEVEL**. Use this tab to view if there are any stuck bits in the input signal.

- **CRC STATUS**. Use this tab to view the status of CRC and Checksum errors in the video signal.

■ **Run Time**. The instrument maintains a running monitoring session for the Video Session application. The Run Time readout displays the amount of time that has elapsed during the current monitoring session. The time is displayed as "DD, HH:MM:SS", where DD is the number of days, HH is the number of hours, MM is the number of minutes, and SS is the number of seconds.

■ **Clear icon**. Use the [icon] icon to clear or reset the monitoring session.

■ **Running / Stopped icons**. When the monitoring session is running (collecting error data), use the [icon] icon to stop the session. When the monitoring session is stopped (no error data collection and no display updates), use the [icon] icon to restart the session.

SDI FORMAT tab display

Use the SDI FORMAT tab display to view the status of various SDI signal parameters on the input signal. (See Figure 42 on page 56.)

Elements of the SDI FORMAT tab display.

■ **SAV Place Err**: Indicates whether a Start-of-Active-Video Placement Error has occurred.

■ **Field Length Err**: Indicates whether a Field Length Error has occurred.

■ **Line Length Err**: Indicates whether a Line Length Error has occurred.

■ **Ancilliary Data**: Indicates whether Ancillary Data is present in the video signal. The displayed values are either Present or None for SD signals, or Y and C Present and None for HD and 3 Gb/s signals.

■ **Statistics**: This section of the display shows the status and statistical values for certain errors. For information about the errors in this section, view the help file in your instrument: while the Video Session is active in a tile, press the HELP button.

■ **Status**: Shows the status of the associated error as either OK, Invalid, Missing, or Error.

VPID 352 tab display Use the VPID 352 tab display to view the VPID values of the SMPTE352M payload. For 3G-SDI signals, VPID is required on the primary link (Link A).
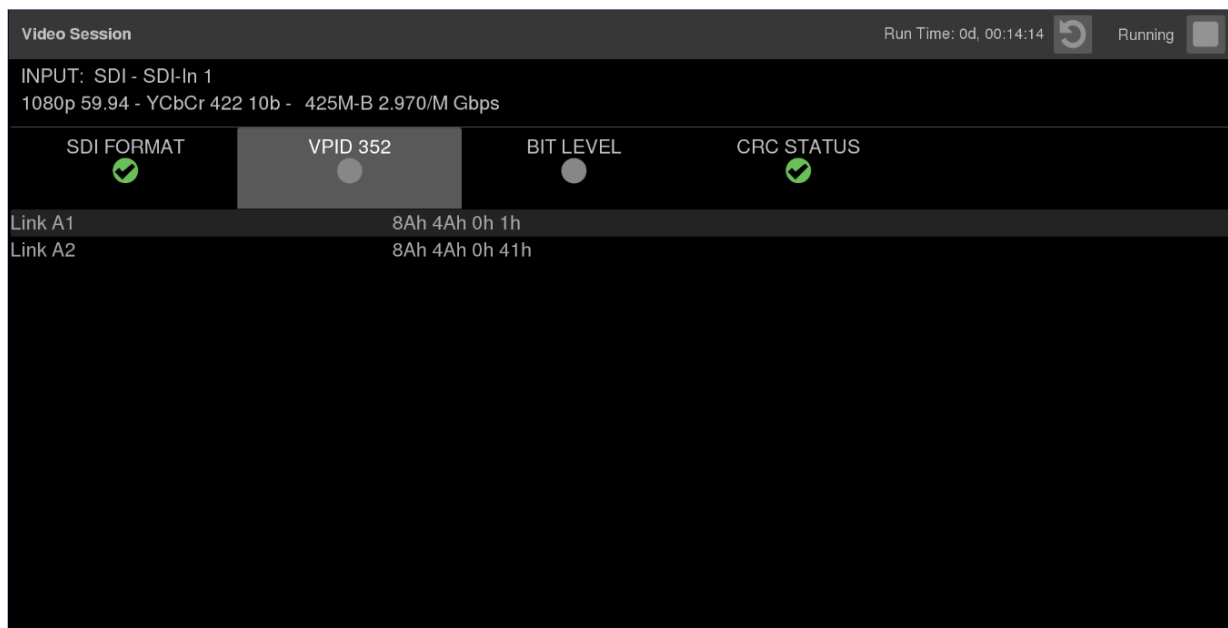
Figure 43: Video Session application – VPID 352 tab display for 3G-SDI Level B signal

Elements of the VPID 352 tab display.

■ **Link A1**: Indicates the presence and status of a SMPTE 352M payload on Link A1 and lists the VPID values in hex.

■ **Link A2**: Appears only for 3G-SDI Level B signals. Indicates the presence and status of a SMPTE 352M payload on Link A2 and lists the VPID values in hex.

BIT LEVEL tab display   Use the BIT LEVEL tab display to view if there are any stuck bits in the input signal.
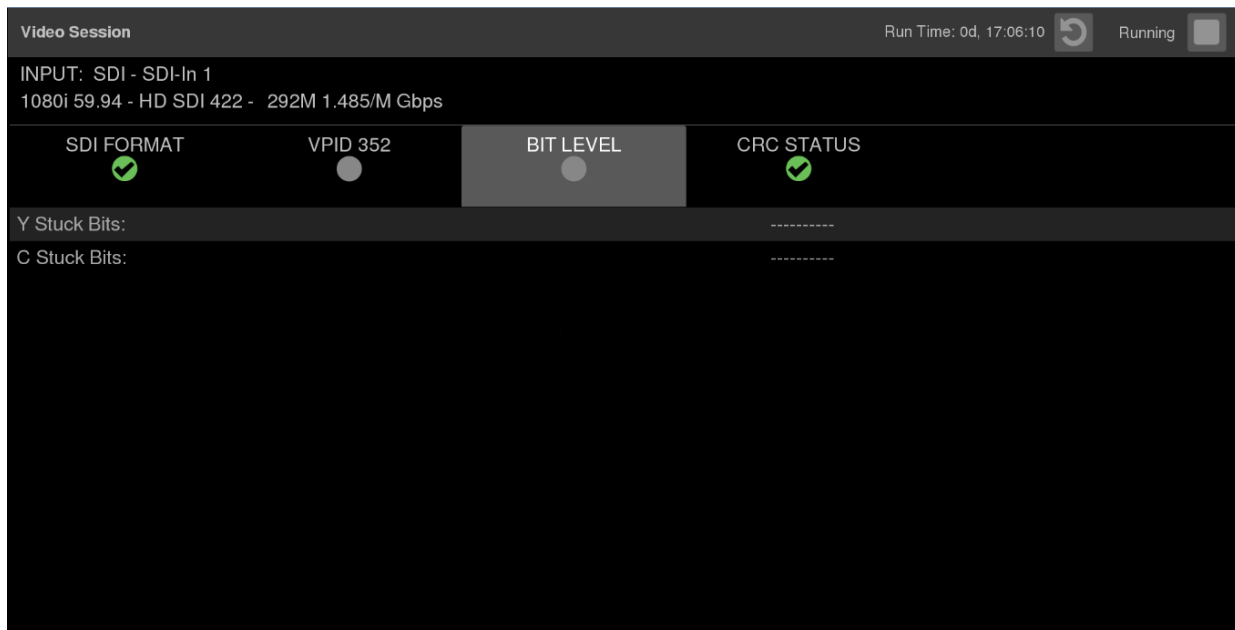
Figure 44: Video Session application – BIT LEVEL tab display

Elements of the BIT LEVEL tab display.

■   **Y Stuck Bits**: Displays which of the luminance video bits are stuck. If the readout is "`--------`", then none of the bits are stuck.

NOTE. For 8-bit video, since the unused bits are always low, "--------LL" is displayed when no other bits are stuck.

■   **C Stuck Bits**: Displays which of the chrominance video bits are stuck. If the readout is "`--------`", then none of the bits are stuck.

CRC STATUS tab display   Use the CRC STATUS tab display to view the status of CRC and Checksum errors in the video signal.
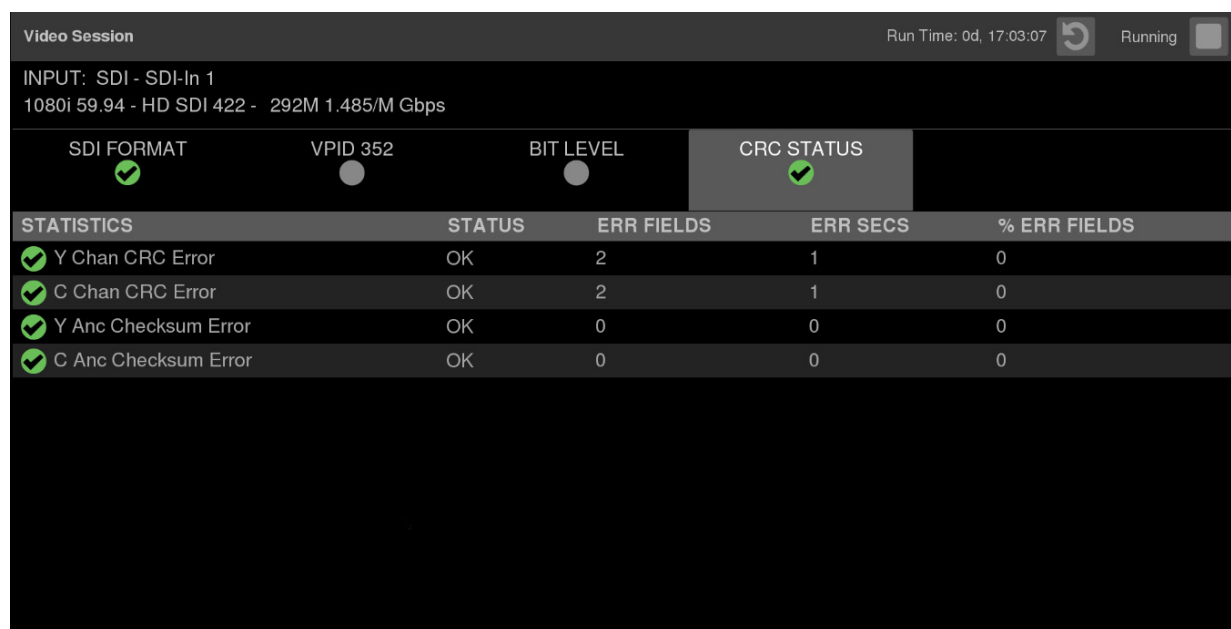
Figure 45: Video Session application – CRC STATUS tab display

Elements of the CRC STATUS tab display.

- **Y Chan CRC Error**: Displays the status of the Y channel embedded CRC (Cyclical Redundancy Check) that was calculated for the video signal. Using a known test signal, the CRC status can be used to verify integrity through a system. An error means that the Y Channel embedded CRC value does not match the calculated CRC value, which indicates that a transmission error has occurred.

NOTE. The instrument uses the SMPTE RP165 standard for error checking. For HD and 3 Gb/s signals, the CRCs change on every video line.

- **C Chan CRC Error**: Displays the status of the C channel embedded CRC (Cyclical Redundancy Check) that was calculated for the video signal. Using a known test signal, the CRC status can be used to verify integrity through a system. An error means that the C Channel embedded CRC value does not match the calculated CRC value, which indicates that a transmission error has occurred.

- **Y Anc Checksum Error**: Displays the status of the Y channel ancillary embedded checksum value that was calculated for the video signal. Using a known test signal, the checksum status can be used to verify integrity through a system. An error means that the Y Channel embedded checksum value does not match the calculated checksum value, which indicates that a transmission error has occurred.

- **C Anc Checksum Error**: Displays the status of the C channel ancillary embedded checksum value that was calculated for the video signal. Using a known test signal, the checksum status can be used to verify integrity through a system. An error means that the C Channel embedded checksum value does not match the calculated checksum value, which indicates that a transmission error has occurred.

The CRC Status display is also divided into the following four columns:

- **Status**: Shows the status of the associated error:

  - **OK**: No error is currently detected.

  - **Invalid**: The data for the item is currently invalid.

  - **Missing**: The data for the item is currently missing.

  - **Error**: The associated error is currently in an error state.

- **Err Secs**: The number of seconds, since the last reset, that contained at least one error.

- **Err Fields**: The number of fields, since the last reset, that contained at least one error.

- **% Err Fields**: Shows a calculated number showing the percentage of all fields since the last reset that contained at least one error.

Event Log application display

The Event Log application provides a view of detected errors. The display buffer for the application holds 100 log entries.

Event Log				▼
EVENT	SOURCE	DATE	TIME	
SDI_ALARM_CCRC_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_FIELD_LEN_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_ACTFD_LEN_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_LINE_LEN_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_EAV_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_SAV_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_LNUM_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_YCRC_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_CCRC_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
SDI_ALARM_FIELD_LEN_ERROR	SDI Video 0:1	2016-10-11	12:17:17	
IOSLAVE_ALARM_SIG_LOSS	IP Video	2016-10-11	12:17:34	
IOSLAVE_ALARM_SIG_LOSS	IP Video	2016-10-11	12:17:39	
IP_ALARM_RTP_SEQUENCE	IP Video	2016-10-11	12:17:39	
IP_ALARM_RTP_MARKER	IP Video	2016-10-11	12:17:39	
IOSLAVE_ALARM_SIG_LOSS	IP Video	2016-10-11	12:17:40	

Figure 46: Event Log application display

Elements of the Event Log display

- **Go to Bottom icon**. Use the icon to go to the end of the currently displayed Event Log buffer where you can monitor any new events. The most recent events are at the bottom of the event list.

- **Slider control**. When the Event Log contains more than 1,000 entries, you can touch the top of the application display to activate a down arrow as shown below. Touch and swipe down near the arrow to open a slider control which allows you to quickly navigate through the Event Log entries. Use the slider control for approximate positioning within the Event Log, and then swipe up or down to fine tune the position.

  The readout to the left of the slider control shows the date and time, according to the internal clock, of the current position in the Event Log. The date is displayed as YYYY-MM-DD and the time is displayed as HH:MM:SS. Use the slider to reposition the Event Log display buffer to a different location in the log, where a new set of 100 events will be displayed.

  When the slider control is displayed, touch and swipe the up arrow at the bottom of the slider to close the control.

The Error Log is also divided into the following four columns:

- **Event**: Shows the current state of the log entries:

  - **Red** ⟋ (rising edge) items are detected errors.

  - **Green** ⟍ (falling edge) items are errors that have cleared.

  - **Red / Green** ⊓ (rising and falling edge) items indicate a momentary error that requires no action.

  - **White** items are informational and identify a change in instrument state.

- **Source**: Shows the inputs on which the errors have occurred.

■ **Date**: Shows the date and time, according to the internal clock, that the error occurred in the form YYYY-MM-DD.

■ **Time:** Shows the time, according to the internal clock, that the error occurred in the form HH:MM:SS.

IP Status application display

The IP Status application provides an overview of the monitored IP stream and shows the status of each program in the stream.
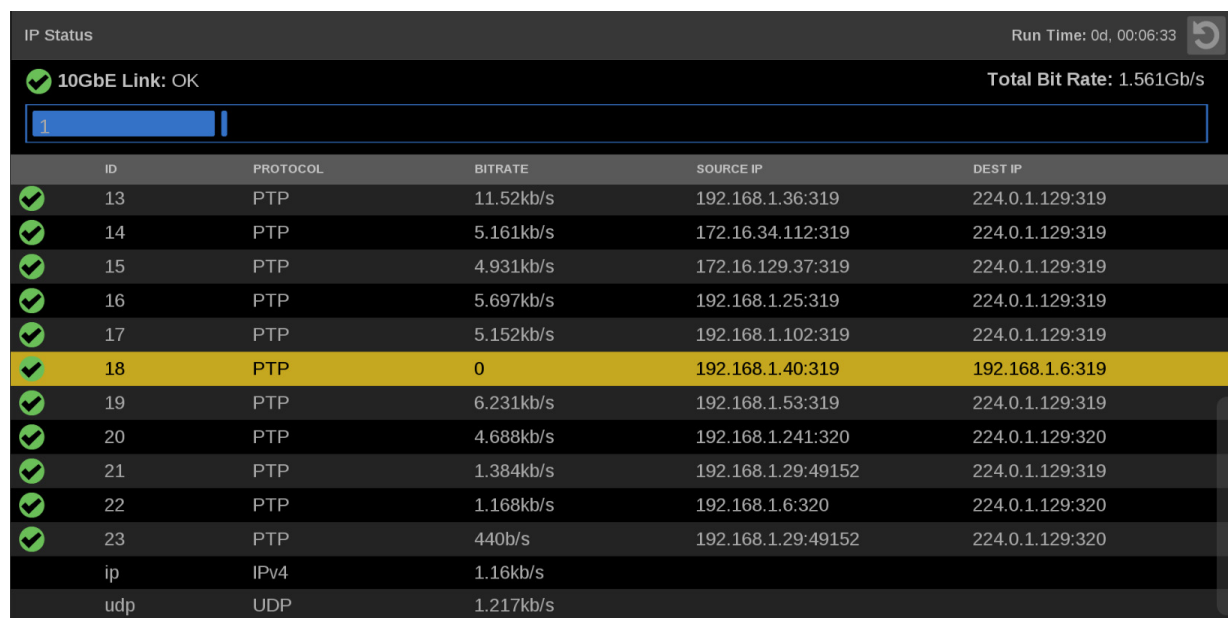
Figure 47: IP Status application display

Elements of the IP Status display

■ **10GbE Link**: Shows the status of the link connection.

■ **Total Bit Rate**: Shows the total bit rate of the video in the IP stream.

■ **IP stream bandwidth bar**: The blue bar outline at the top of the display represents the total bandwidth of the 10GbE pipe (10.3125 Gb/s). The blue bars inside the outline show the relative bandwidth size of items in the IP stream compared to the total available bandwidth of the stream. Numbers inside the blue bars correspond to the ID numbers listed in the display.

■ **Run Time**. The instrument maintains a running IP Status Session. The Run Time readout displays the amount of time that has elapsed during the current IP Status Session. The time is displayed as "DD, HH:MM:SS", where DD is the number of days, HH is the number of hours, MM is the number of minutes, and SS is the number of seconds.

- **Clear icon**. Use the ⟳ icon to reset the status session. After a reset, items will appear in the list in the order they are detected.

- **Yellow highlighting**: When an item in the list is highlighted in yellow, as shown above for ID number 18, that indicates the item was previously detected in the stream but is no longer present. The yellow highlighting can also indicate messages, which occur only for a few seconds. Use the ⟳ icon to reset the display to view only the items currently in the stream.

The IP Status application is also divided into the following five columns:

- **ID**: Shows the ID number of each item in the IP stream. The ID numbers correspond to the numbers in the blue bar at the top of the display.

- **Protocol**: Shows the protocol being used by each item in the IP stream.

- **Bitrate**: Shows the bitrate of each item in the IP stream.

- **Source IP**: Shows the source IP address and port number of the monitored stream in the form <source IP address>:<port number>.

- **Dest IP**: Shows the destination IP address and port number of the monitored stream in the form <destination IP address>:<port number>.

IP Session application display

The IP Session application uses three tabs to display status of various IP stream parameters. Touch any of the three tab titles to view the associated information: Layer 2 (L2), Video, or PTP.
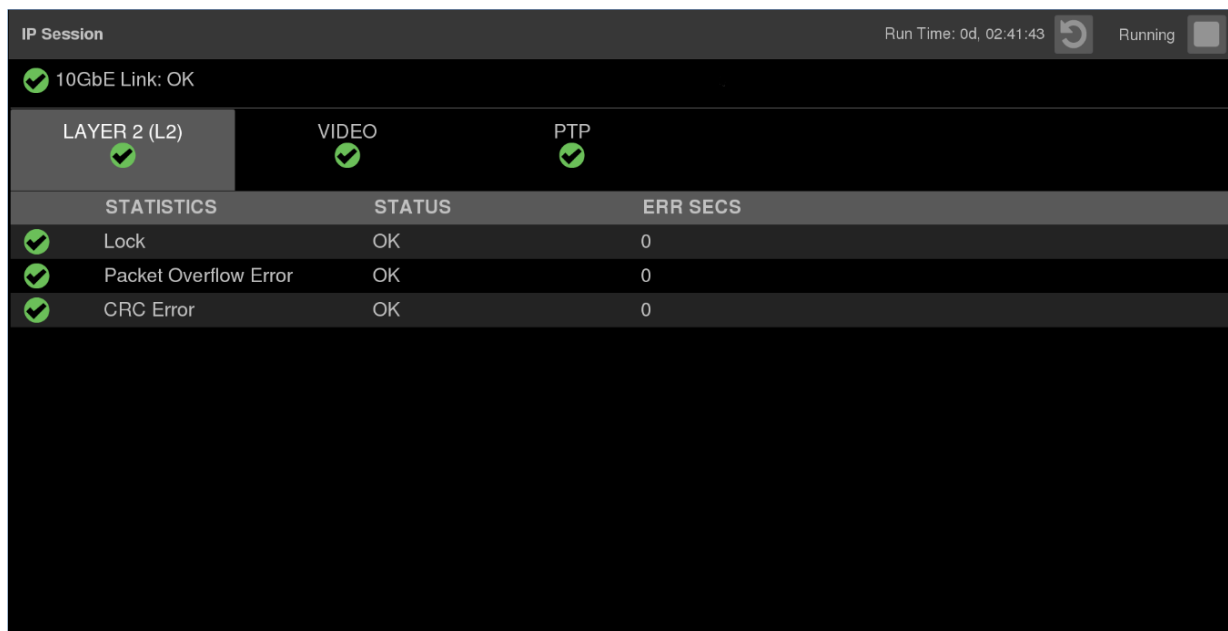
Figure 48: IP Session application – Layer 2 (L2) tab display

Elements of the top-level IP Session application display

The elements at the top of the IP Session application are shared between the three tabs:

- **10GbE Link**: Shows the status of the link connection:

  - **OK**: The optical carrier signal is detected.

  - **No Signal**: The SFP module is installed, but no optical carrier signal is detected.

  - **Disconnected**: The SFP module is not installed.

- **Display tabs**: Click on one of the three tabs to view the associated display. Each of the tabs has a status indicator to provide a quick view of the status of the parameters contained in each tab.

  - **Layer 2 (L2)**. Use this tab to view the status of various signal parameters in the Link layer.

  - **Video**. Use this tab to view the status of the video in the stream.

  - **PTP**. Use this tab to view PTP parameters.

- **Run Time**. The instrument maintains a running monitoring session for the IP Session application. The Run Time readout displays the amount of time that has elapsed during the current monitoring session. The time is displayed as "DD, HH:MM:SS", where DD is the number of days, HH is the number of hours, MM is the number of minutes, and SS is the number of seconds.

- **Clear icon**. Use the icon to clear or reset the monitoring session.

- **Running / Stopped icons**. When the monitoring session is running (collecting error data), use the icon to stop the session. When the session is stopped (no error data collection and no display updates), use the icon to restart the session.

Layer 2 (L2) tab display   Use this tab to view the status of the following signal parameters: (See Figure 48 on page 66.)

Elements of the Layer 2 (L2) tab display.

- **Lock**: Shows the lock status of the link:

  - **OK**: The 10G Ethernet Phy Rx port is successfully locked to the inbound Ethernet signal.

  - **ERROR**: The 10G Ethernet Phy Rx port lost lock to the incoming Ethernet signal during the last second. This indicates there is likely a physical layer problem with the link.

- **Packet Overflow Error**: Shows the status of Layer 2 packet overflow errors:

  - **OK**: There have been no overflow errors in the Ethernet MAC during the last second.

  - **ERROR**: An overflow error has occurred in the Ethernet MAC during the last second. This indicates that there is a hardware issue with the instrument and that the instrument should be serviced.

- **CRC error**: Shows the status of Layer 2 CRC errors:

  - **OK**: There have been no CRC errors on the 10G Ethernet receive port during the last second.

  - **ERROR**: There have been one or more CRC errors detected on the 10G Ethernet receive port during the last second.

The Layer 2 (L2) display is also divided into the following two columns:

- **STATUS**: Shows the status of the associated statistic as OK or ERROR.

- **ERR SECS**: Increments for each second that an active error condition persists.

VIDEO tab display   Use this tab to view the status of the video in the stream.

IP Session		Run Time: 0d, 02:41:54	Running
✓ 10GbE Link: OK			

LAYER 2 (L2) ✓	VIDEO ✓	PTP ✓

L3 IP	
Source/Destination Addr	10.10.10.21 / 239.0.1.1
L4 UDP	
Source/Destination Port	20000 / 20000
✓ L5 RTP	
Version	2
Padding	false
Extension	false
CSRC	0
✓ Marker	0
Payload type	S2022.6 (98)
✓ Sequence Number	0x7DD4
✓ Time Stamp	3171760216

Figure 49: IP Session application – VIDEO tab display

Elements of the VIDEO tab display.

■ **L3 IP Source/Destination Addr**: Lists the source and destination addresses for the L3 IP layer.

■ **L4 UDP Source/Destination Port**: Lists the source and destination ports for the L4 UDP layer.

■ **L5 RTP**: Lists the following parameters of the L5 RTP (Real Time Protocol) layer. RTP Datagrams are defined in IETF RFC 3550.

‒ **Version**: Identifies the version of RTP and should be a value of 2.

‒ **Padding**: Indicates whether padding bytes are present. Possible values are:

  ‒ **false**: Indicates no extra padding bytes are at the end of the RTP packet.

  ‒ **true**: Indicates that padding octets have been added to the RTP packet that are not part of the payload.

‒ **Extension**: Indicates whether an extension is present. Possible values are:

  ‒ **false**: Indicates no extension is present.

  ‒ **true**: Indicates an extension is present.

- **CSRC**: Identifies the Contributing Source IDs. This value should be set to zero.

- **Marker**: This value should be set to "1" to indicate the last Media Datagram of the video frame. The value is set to 0 for all other Media Datagrams and should be 0 for most packets.

- **Payload type**: Identifies the type of RTP payload:

    - **98**: Indicates a SMPTE 2022.6 High Bit-rate Media transport.

    - **99**: Indicates a SMPTE 2022.5 High Bit-rate Media Forward Error Correction (FEC) payload.

    - **33**: Indicates a SMPTE 2022.2 Constant Bit Rate MPEG-2 Transport Stream Adaptive Sample Picture Encapsulation (ASPEN) payload.

- **Sequence number**: RTP sequence counter that increments by one for each RTP Media Datagram that is sent.

- **Time Stamp**: The timestamp reflects the sampling instant of the first octet in the RTP datagram. This value can be used to determine packet sequence errors and jitter calculations to be made.

- **SSRC**: Identifies the Synchronization Source ID and is set in compliance with RFC3550. This identifier is chosen randomly and should be unique so that no two SSRC have the same value with an RTP session.

- **HBRMT**: Lists the following parameters of the High Bit Rate Media Payload Header:

NOTE. The HBRMT parameters do not apply to ASPEN streams.

- **Extension**: Identifies if the payload is extended:

    - **0**: Indicates no extension.

    - **0001** to **1111**: Indicates the number of x4 octets by which the payload is extended.

- **Video Source Format**: Identifies whether source formatting is present:

    - **Not Present**: Indicates no Source Format information is present.

    - **Present**: Indicates source formatting is present.

- **Video Source ID**: Identifies the video source:

    - **Primary (0x0)**: Indicates a primary stream.

    - **Protect (0x1)**: Indicates a protected stream.

    - **Reserved (n)**: When *n* is a number other than 0 or 1, indicates that a reserved value is being used.

- **Frame Count**: The Video Frame counter increments in value for the next RTP sequence and rolls over after 255.

- **Reference for time stamp**: Identifies the time stamp reference:

  - **Unlocked (0x0)**: Indicates the time stamp is not locked to any particular source.

  - **Reserved (0x1)**: Indicates an illegal value.

  - **UTC (0x2)**: Indicates the time stamp is locked to a UTC time source.

  - **Private (0x3)**: Indicates the time stamp is locked to a private time source.

- **Video Payload Scrambling**: Identifies the payload scrambling status:

  - **Unscrambled (0x0)**: Indicates the payload is not scrambled.

  - **Reserved (n)**: When *n* is a number other than 0, indicates a reserved value is being used.

- **FEC usage**: Identifies the FEC usage status:

  - **No FEC (0x0)**: Indicates no forward-error correction is being used.

  - **Column (0x1)**: Indicates column FEC is being used.

  - **Col/Row (0x2)**: Indicates column and row FEC are being used.

  - **Reserved (n)**: When *n* is a number greater than 2, indicates a reserved value is being used.

- **Clock Frequency**: Identifies the video word clock frequency of the payload video. Possible values are: No Timestamp (0x0), 27 MHz (0x1), 148.5 MHz (0x2), 148.5/M MHz (0x3), 297 MHz (0x4), 297/M MHz (0x5), or Reserved (n).

- **Reserved**: This value should be set to 0.

- **Video Source Format fields**: The following Video Source Format field values are displayed:

  - **MAP**: Identifies which SMPTE mapping scheme is used. Possible values are: Direct (0x0), LevelB (0x1), 2xHD (0x2), or Reserved (n).

  - **FRAME**: Identifies the raster size. Possible values are: Unspecified (0x0), 720x480i (0x10), 720x576i (0x11), 1920x1080i (0x20), 1920x1080p (0x21), 1920x1080sf (0x22), 2048x1080p (0x23), 2048x1080sf (0x24), or 1280x720p (0x30).

- **F rate**: Identifies the frame rate. Possible values are: Unspec(2.97 G) (0x0), Unspec(2.97/M G) (0x1), Unspec(1.485 G) (0x2), Unspec(1.485/M G) (0x3), Unspec(270 M) (0x4), 60FPS (0x10), 59.94FPS (0x11), 50FPS (0x12), 48FPS (0x14), 47.96FPS (0x15), 30FPS (0x16), 29.97FPS (0x17), 25FPS (0x18), 24FPS (0x1A), or 23.98FPS (0x1B).

- **Sample**: Identifies the pixel sampling/quantization scheme. Possible values are: Unspecified (0x0), 4:2:2/10bit (0x1), 4:4:4/10bit (0x2), 4:4:4:4/10bit (0x3), 4:2:2/12bit (0x5), 4:4:4/12bit (0x6), 4:4:4:4/12bit (0x7), or 4:2:2:4/12bit (0x8).

- **Fmt-Reserve**: This bit is reserved for future use and is set to 0.

- **Video TimeStamp**: Shows the value of a free running counter that is synchronous with the interface word clock of the encapsulated video. This timestamp is fixed at the transmitter to the first information contained in the datagram.

- **Header Extension**: Indicates the number of 4-octet Header Extension words which follow the HBRMT payload.

PTP tab display   Use this tab to view the status of the PTP elements in the stream.

IP Session			Run Time: 0d, 02:42:06	Running
✔ 10GbE Link: OK				

LAYER 2 (L2) ✔	VIDEO ✔	PTP ✔	
✔ Lock Status		Locked	
PTP time		2016-10-06 21:07:34 (UTC)	
Master/ Slave Phase Lag		+ 21 ns	
Master ID		08:00:11:ff:fe:21:b9:27	
Steps Removed		1	
Domain		127	
Profile		ST2059	
Delay Message Interval		Follow Master	
Grandmaster BMCA Values			
Priority 1		128	
Clock Class		6	
Clock Accuracy		< 100 ns	
Clock Variance		15652	

Figure 50: IP Session application – PTP tab display

Elements of the PTP tab display.

■ **Lock Status**: Indicates whether the instrument PTP slave is locked to the master PTP signal for the selected domain. The following values may appear:

  – **No master present**: Indicates that the master PTP clock has not been detected on the selected domain.

  – **Locked**: Indicates that the master PTP clock is detected and there is less than 1000 ns of phase lag between the master clock and the instrument.

  – **Unlocked**: Indicates that the master PTP clock is detected and there is greater than 1000 ns of phase lag between the master clock and the instrument.

■ **PTP time**: Shows the time derived from the PTP Master as UTC (Coordinated Universal Time).

■ **Master/Slave Phase Lag**: Shows the detected offset between the master and slave clocks.

■ **Master ID**: Shows the MAC Address of PTP Master with the bytes "ff:fe" inserted in the middle. This ID is also used in the BMCA as a tiebreaker when all of the parameters match down through priority 2.

■ **Steps Removed**: Shows the number of communication paths traversed between the local clock and the Grandmaster clock.

- **Domain**: Shows the domain being used. Domains allow multiple PTP services to coexist simultaneously on one physical Ethernet connection.

- **Profile**: Shows the profile being used: General, AES67, or ST2059. This is the user-selected profile set on the Settings > Reference configuration menu page and is not detected on the input.

- **Delay Message Interval**: For Multicast communication mode, the only delay message interval allowed is "Follow Master". In this mode, the slave will set the delay request rate according to the information sent by the master in the delay response message.

NOTE. The PRISM monitor currently supports only Multicast communication mode. In later firmware releases, other communication modes will be supported.

- **Grandmaster BCMA Values**: Lists the following values for the Grandmaster BCMA (Best Master Clock Algorithm) in order of precedence:

  - **Priority 1**: This parameter defines which clocks are allowed to be considered as masters. To be considered as a master, the value should be set to 128 or less. Priority 1 is the first criteria in the BMCA, so if Priority 1 is set to a lower value than other devices on the system, then it will be chosen even if the clock quality is poor. Typically, all the masters in a domain should have the same value for the Priority 1 parameter.

  - **Clock Class**: This value characterizes the TAI (International Atomic Time) traceability. The clock class value varies to indicate the type of reference in use by the Grandmaster clock. For example, when locked to GPS the PTP grandmaster will report a class 6. However, if in holdover mode after locking to GPS, then it will report a class of 7.

  - **Clock Accuracy**: This value characterizes the clock accuracy for the purpose of determining the best master clock.

  - **Clock Variance**: This value is reported by the PTP master to indicate the variance of the clock over a one second interval. A lower number indicates a more stable clock and will be preferred by the BMCA.

  - **Priority 2**: This parameter is used to break the tie between masters that have the same clock quality. Several values may be used to define a hierarchy of devices. Most profiles use 128 as a default, so a value of 127 or lower would indicate a preferred master.

- **Clock Source**: The clock source field is not used by the BMCA. The field is set to indicate the type of reference in use by the Grandmaster clock.

■ **Communication Mode**: There are three basic message modes for PTP: Multicast, Unicast, and mixed Multicast and Unicast. For full Multicast or Unicast modes, all of the PTP messages are sent in the selected mode type.

NOTE. *The PRISM monitor currently supports only the Multicast communication mode.*

For some profiles, such as some telecom profiles and the SMPTE ST2059 profile, a mixture of Multicast and Unicast are allowed. On the SMPTE profile unique mixed mode, the Announce and Sync messages are sent as multicast. However, the Delay request and Delay Response messages are sent as Unicast.

Some points to understand about communication modes:

– Whatever mode is chosen, the master and slave must match or be compatible

– Multicast and Mixed mode may need IGMP joins and leaves

– Full Unicast must have the master address in all slave AMTs

– Unicast without negotiation does not allow master to regulate load

– Two masters can be used on different domains to serve slaves on different communication modes

■ **Delay Mechanism**: Shows the delay mechanism mode being used:

NOTE. *The PRISM monitor currently supports only the End-to-End delay mechanism.*

– **End-to-End**: In this mode, the sync, follow up, delay request and delay response messages go through the network all the way between the master and slave. End-to-End mode is useful in PTP networks where some or all devices are not PTP aware.

– **Peer-to-Peer**: In this mode, the Pdelay request and Pdelay response messages are local to each link in the network. Each device determines the local link and device delays. The sync message from the master then collects the corrections as it propagates from the master to slave. Peer-to-Peer mode is useful in PTP networks where the routing configuration changes. For Peer-to-Peer mode to work well, all of the devices need to be PTP aware.

IP Graphs application display

Use the IP Graphs application to view various graphs that show aspects of the IP stream. As you scroll through the various graphs, the top of the selected graph will jump to the top of the display area to aid in viewing the complete graph. The displayed graph will be included in a saved preset.
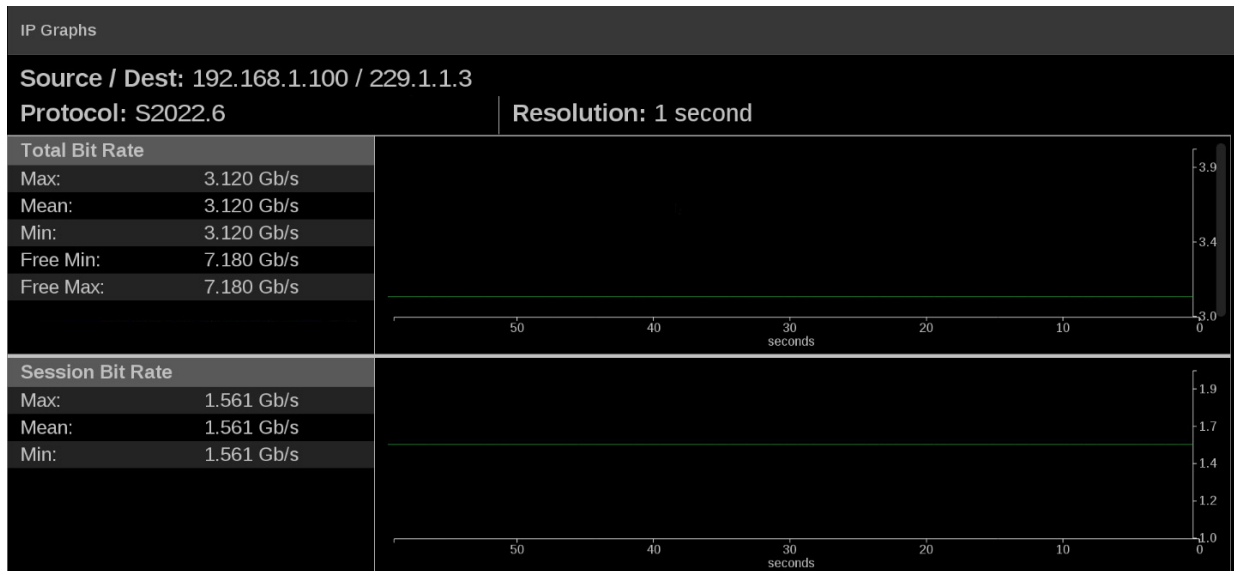

Figure 51: IP Graphs application – Total Bit Rate and Session Bit Rate graphs

Elements of the top-level IP Graphs application display

The elements at the top of the IP Graphs application are shared between all graphs:

- **Source/Dest**: Lists the source and destination addresses of the IP stream.

- **Protocol**: Lists the protocol being used by the monitored stream.

- **Resolution**: Lists the resolution of the graph display.

Total Bit Rate graph

The Total Bit Rate graph shows the total bit rate currently being consumed within the 10GbE input. (See Figure 51.) The maximum available bandwidth is 10.3 Gb/s. The following readouts appear:

- **Max**: Shows maximum bandwidth used during the time window.

- **Min**: Shows the minimum bandwidth used during the time window.

- **Free Min/Max**: Shows the minimum and maximum available bandwidth that is not being consumed by data.

Session Bit Rate graph

The Session Bit Rate graph shows the data rate of the currently selected input stream. (See Figure 51.)

PIT graph   The PIT (Packet Interval Time) graph shows the difference in arrival time between sequential packets of the active stream. This is one indication of the packet jitter and dropped packet rate. The colored bars represent the range from minimum to maximum for all of the packets within that time interval.
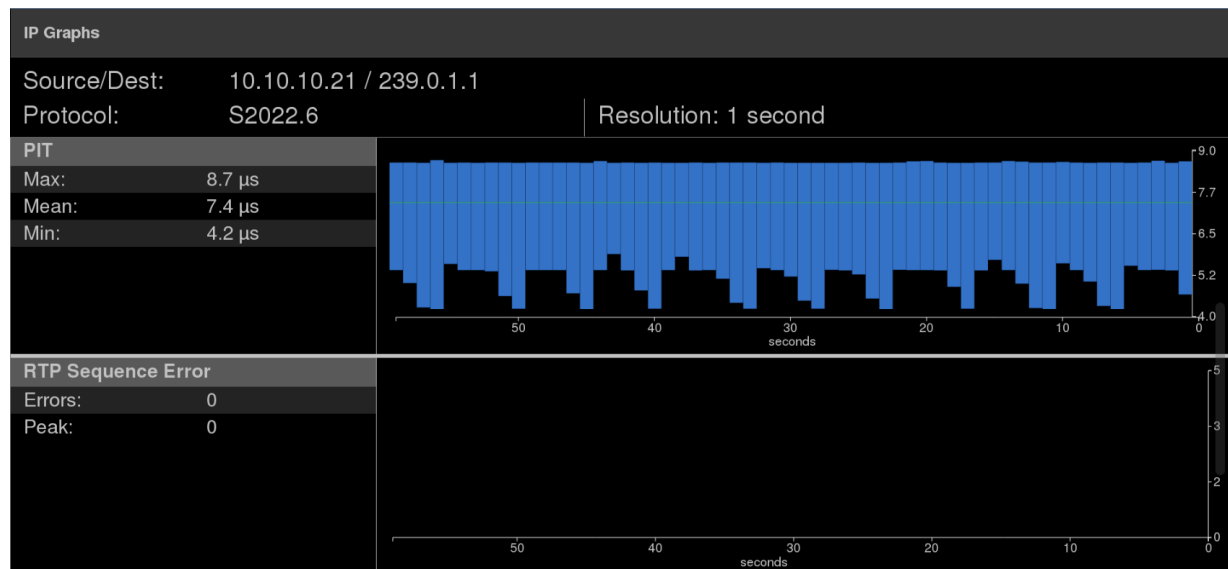

Figure 52: IP Graphs application – PIT and RTP Sequence Error graphs

RTP Sequence Error graph   The RTP Sequence Error graph shows the RTP sequence information and reports if any packet is received out of order. (See Figure 52.)

Video CRC Error graph The Video CRC Error graph shows any present CRC errors within the currently decoded signal and can be compared to other time graphs such as RTP Sequence Errors.
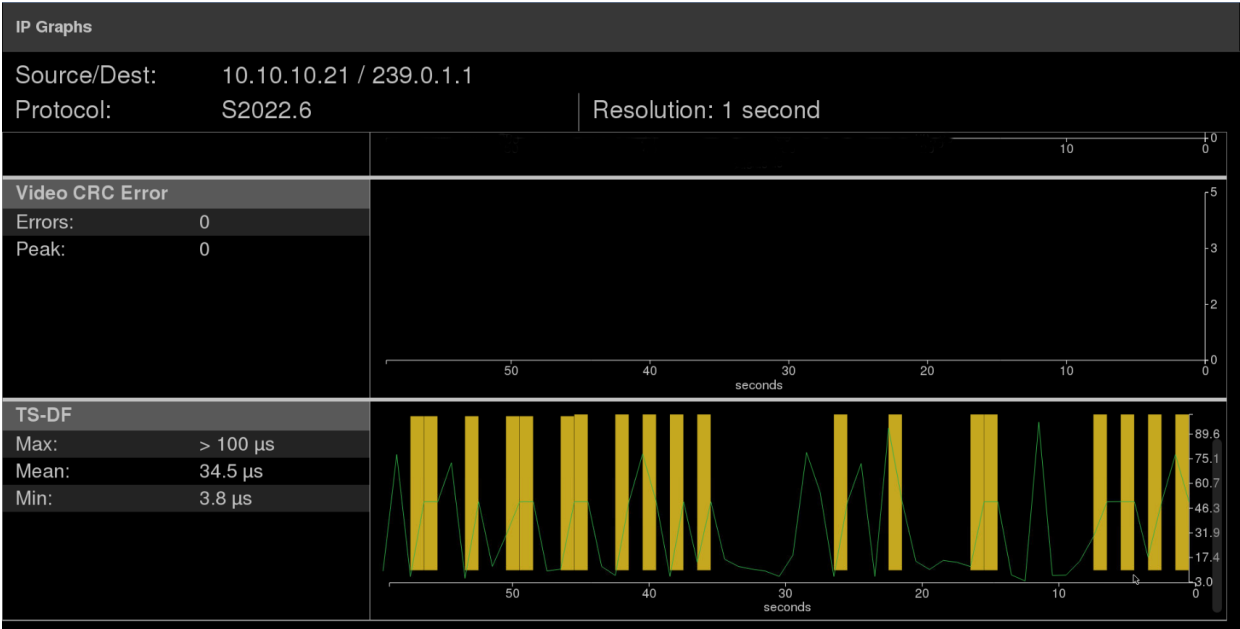
Figure 53: IP Graphs application – Video CRC Error and TS-DF graphs

TS-DF graph The TS-DF graph shows the Time Stamped Delay Factor, as defined in EBU Tech 3337, which is a method for measuring network jitter in RTP streams. (See Figure 53.)

The graph uses yellow highlighting to indicate an error condition. The example image above is from a stream with timestamp errors.

PIT Histogram application display

Use the PIT (Packet Interval Time) Histogram application to monitor the network delay variation statistics.

Figure 54: PIT Histogram application display

Elements of the PIT Histogram display

- **Source/Dest**: Lists the source and destination addresses of the IP stream.

- **Protocol**: Lists the protocol being used by the monitored stream.

PTP operational overview

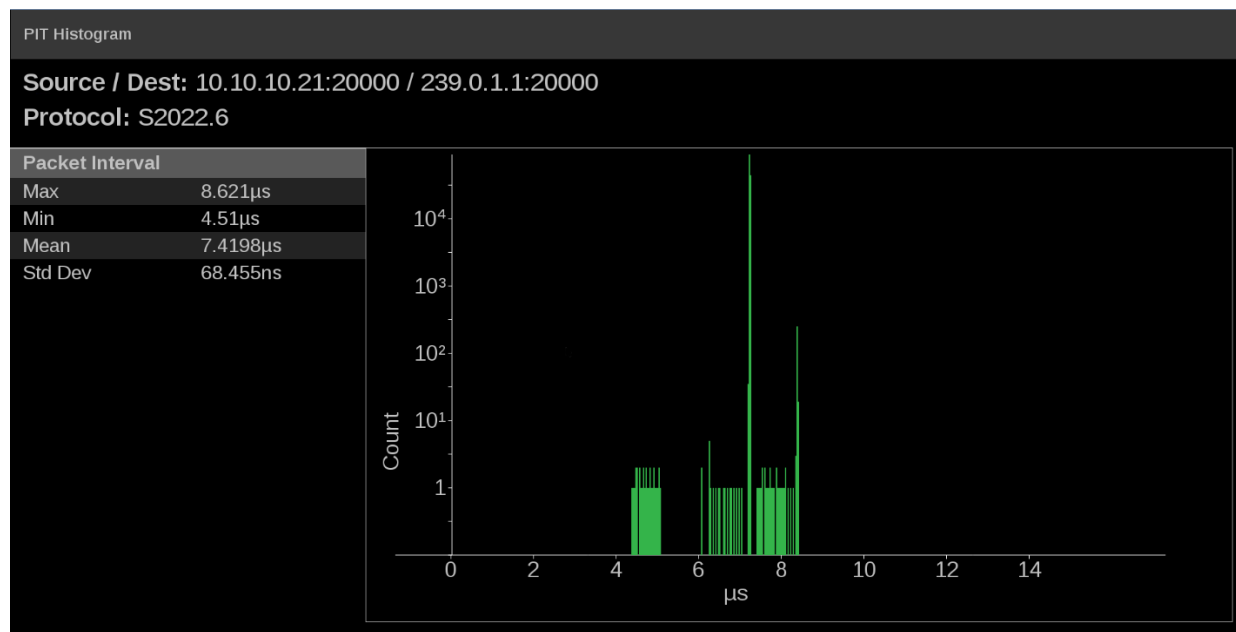This section provides an overview of PTP network operation. Not all of the functionality described is currently available in the PRISM monitor.

PTP introduction

PTP master selection

In a PTP network, all the masters on the network are evaluated by the Best Master Clock Algorithm (BMCA). The BMCA runs on all devices, and chooses a master based on several parameters. Some of the parameters relate to clock quality; conversely the Priority 1 and Priority 2 parameters are set by the user to influence the choice of a master:

NOTE. *The PRISM monitor has no role in setting the priority parameters or in providing information to the BMCA.*

▪ Priority 1. This parameter defines which clocks are allowed to be considered as masters. To be considered as a master, the value should be set to 128 or less. Priority 1 is the first criteria in the BMCA, so if Priority 1 is set to a lower value than other devices on the system, then it will be chosen even if the clock quality is poor. Typically, all the masters in a domain should have the same value for the Priority 1 parameter.

▪ Priority 2. This parameter is used to break the tie between masters that have the same clock quality. Several values may be used to define a hierarchy of devices. Most profiles use 128 as a default, so a value of 127 or lower would indicate a preferred master.

▪ The final tie-breaker in the BMCA is the clock ID. This is usually the MAC address so it provides a unique value by which the BMCA can choose.

Network topology

In a typical IEEE1588 PTP network, many devices may be either masters or slaves. If the current master stops working, all the devices that are capably of being a master broadcast their clock quality and a new master is selected.

For video networks it may make sense to depart from the telecom-style PTP topology and dedicate devices to be only masters or slaves. This is the approach supported by the PRISM monitor, which allows for a more traditional primary and backup master structure controlling a range of slave devices. The BMCA is still used to select the active master and the network still takes the place of the ECO in the legacy Black-burst/Tri-level network. The PRISM monitor is a slave-only device.

The five basic PTP timing messages

The five basic timing messages in a PTP system are described below. Other messages are present in some instances. For example, grant requests and responses appear in unicast systems, and Type Length Value (TLV) management messages appear in SMPTE ST2059 profile systems.

Announce message
The Announce message is sent by the master to advertise its capability. This message contains the clock quality and priority settings needed for the BMCA to evaluate which device is the best master.

Sync message
The Sync message is sent by the master and is used to measure the propagation delay from the master to slave. The sync message may contain the timestamp indicating when it was sent, or that time may be in the Follow-up message. The receiver must timestamp the sync message upon receipt. These two timestamps are usually called "t1" and "t2" and provide the first delay measurement.

Follow-up message
The Follow-up message is sent only in cases where the PTP network hardware is not capable of inserting the timestamp or corrections into the Sync message. (See page 82, *One-step and two-step operation*.)

Delay request message
The Delay request is sent by the slave. The time at which it is sent is noted by the slave, but is not included in the message. This time is usually called "t3." When the delay request is received by the master, the master timestamps the receive time. This timestamp is usually called "t4."

Delay response message
The delay response is sent from the master to the slave. The response contains the t4 time stamp from when the master received the delay request. Once the slave receives the delay response, it has the second pair of timestamps needed to calculate the second delay measurement of the slave to master delay.

Message timing   The following figure show the relationships between the five PTP timing messages.
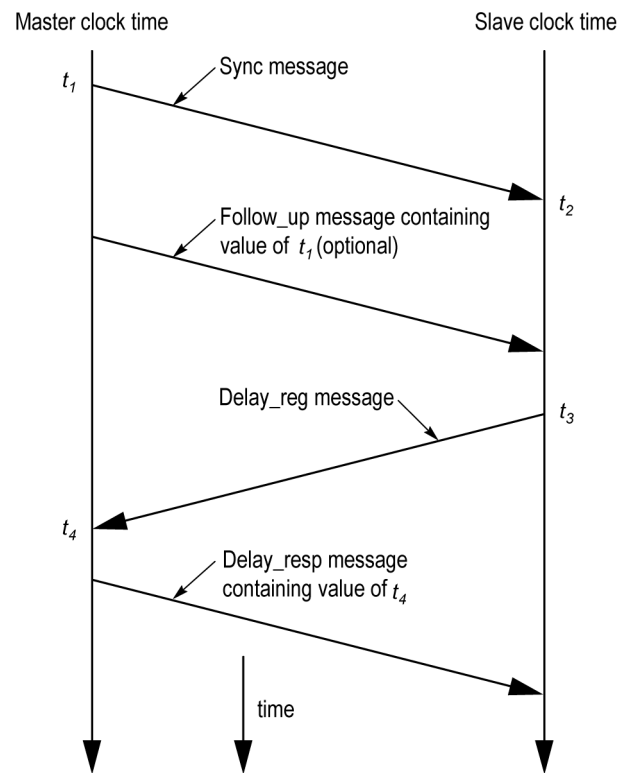
Profiles and domains

Multiple domains and profiles can coexist on the same network.

Profiles The IEEE1588 standard defines multiple parameters, such as the rates for Sync and Announce messages, and optional functions such as grandmaster clusters. Specific industries wanting to use PTP are encouraged to define their own "profile," which allows the PTP standard to be tuned for specific applications. The profile defines the default and range of each parameter, and defines with options are required, allowed or prohibited.

In the Prism monitor, the user should select the PTP profile (General, ST2059, or AES67). The user can then modify the profile parameters and save as part of an instrument preset. The allowed range of the parameters is restricted to that which is allowed for the selected profile type.

Domains The IEEE1588 standard defines "domains," which allow multiple PTP services to coexist simultaneously on one physical Ethernet connection. For example, on a given network one master and several slaves can be using domain 0 while a second master and other slaves are using domain 1. These two PTP services are independent. One use for this is to have masters on different domains provide PTP on different profiles. For example, domain 0 might be an AES67 profile, domain 1 could be a master using the AVB (802.1AS) profile, and domain 127 could be a master on the SMPTE ST2059 profile.

One-step and two-step operation

Some PTP messages have a time stamp associated with them. This time stamp indicates the time of the local clock when the message was sent or received. In some cases, the hardware is capable of embedding the time stamp in the message as it is sent. This is known as "one-step" mode since the message and its associated time are sent together.

In other cases, the hardware is not capable of inserting the time into the message, so instead it is sent in a second follow-up message. This is called "two-step" mode since there are two messages.

It is interesting to note that in End-to-End mode, only the Sync message is effected by the one-step and two-step setting since it is the only message that needs the transmit time stamp inserted. In a similar fashion, Peer-to-Peer mode has some messages that may require follow-up support.

The IEEE1588 standard specifies that all slaves are required to operate with either one-step or two-step message types. One type of device which often requires two-step operation is a Transparent Clock, since it has to calculate the residence time of a message and insert that time into the message or the follow up message.

Multicast, Unicast, and Mixed Communication modes

There are three basic message modes for PTP: Multicast, Unicast, and mixed Multicast and Unicast. For full Multicast or Unicast modes, all of the PTP messages are sent in the selected mode type.

For some profiles, such as some telecom profiles and the SMPTE ST2059 profile, a mixture of Multicast and Unicast are allowed. On the SMPTE profile unique mixed mode, the Announce and Sync messages are sent as multicast. However, the Delay Request and Delay Response messages are sent as Unicast.

Some points to understand about communication modes:

■ Whatever mode is chosen, the master and slave must match or be compatible

■ Multicast and Mixed mode may need IGMP joins and leaves

■ Full Unicast must have the master address in all slave AMTs

■ Unicast without negotiation does not allow master to regulate load

■ Two masters can be used on different domains to serve slaves on different communication modes

All of the master and slave devices on a given domain must use compatible communication modes. For most profiles, this means the master and slave communication modes need to match exactly. On the SMPTE profile, the Multicast and Mixed modes are compatible, so a master in any of these modes should work with a slave in any of those modes.

Multicast system messages

Multicast messages are broadcast and so they can be received without knowing the address of the sender. This allows a slave to hook up to the network, receive the announce messages and discover the identity of the master. Multicast in some networks requires the devices to use IGMP to join and leave the multicast group.

In Multicast PTP systems, the master sets the rate of the announce and sync messages. The master also sends the maximum allowed delay request rate in the delay response message. Ideally, the slave will use that value to set the delay request rate although some slave set this rate independently. The delay request rate is typically the same as the sync rate, but may be higher or lower.

Unicast system messages

Unicast messages require the address of the master be entered into the Acceptable Master Table (AMT) in each slave. If there are multiple masters, the IP address for each master must be entered in the AMTs of all the slaves.

In Unicast PTP systems, the slave must have the address of the master in its acceptable master table because the slave initiates the communication with the master. The slave sends several grant requests to the master requesting specific rates for each message type. If the master accepts the grant requests, it will send grant acknowledges. If the master denies the grant, the slave may send a new grant request at a lower rate. This process may continue for several iterations until the master and slave agree on a rate. The master and slave will then start exchanging the PTP messages. If the master cannot support any of the rates requested by the slave, then the slave will not be able to lock to the master.

Mixed mode system messages

In Mixed Mode systems, some messages are Multicast and some are Unicast. For the SMPTE ST2059 profile, the Announce and Sync messages are sent as Multicast. This allows devices to discover the active master. The Delay Request messages are configured as Unicast, in some case with negotiation, and in other cases without negotiation.

SMPTE profile system messages

For SMPTE profile systems, a given domain must use one type of message for all Announce, Sync and Follow up messages. Therefore, all masters and slaves on that domain must be configured for either Multicast or they all must be configured for Unicast.

For SMPTE mixed mode, the Announce, Sync, and Follow up messages are configured as Multicast, whereas the delay requests can be Multicast, Unicast, or Unicast without negotiation. To use this combination with a Tektronix SPG8000A master clock generator, set the master and slave to any of the modes: Multicast, Mixed, or Mixed without negotiation. The masters will support all of the slave modes simultaneously.

BMCA operation

The Best Master Clock Algorithm (BMCA) is used to choose the active master on the domain. This is partially explained in the introduction to this document. The BMCA operation varies somewhat as function of communication mode.

Multicast mode

In Multicast mode, the active master sends announce messages which all other masters and slaves can receive. So all devices can evaluate the BMCA and decide on the best master. If any device detects that its BMCA rating is better than the current master, it will send an announce and take over as the active master.

Unicast mode

In Unicast mode, slaves only get Announce messages if they establish a grant from the master. Therefore, each slave must set up a grant with every device in its AMT. Since the masters do not set up grants from other masters, they do not have the information to evaluate the BMCA and know if they are the active master. It is up to the slaves to evaluate the BMCA based on the announce message they get from each master in their AMT. Each slave then decides which master is the best and then set up grants for the other message types. If slaves on a given network have a different list of masters in their AMT, then they may choose a different master.

Mixed mode

In a SMPTE ST2059 mixed environment, the announce message is Multicast. Therefore, the BMCA can follow the Multicast conventions.

Compensating for causes of asymmetric delay

Several factors can cause the PTP message delay to be different for the messages sent from the master to slave as opposed to the messages the other direction from the slave to master. Unless corrected, this propagation delay asymmetry will cause an offset in the clock phase equal to ½ the difference in the two path delays. There are 4 main causes of asymmetric delay: Rate mismatch in the ports on a switch, Traffic mismatch on the two paths, message type mismatch, and cable delay variation. The paragraphs below contain hints on how to design the system to minimize the delay asymmetry. Alternatively, some slaves provide a way to manually enter a correction value to cancel the delay error.

Rate mismatch

Rate mismatch in a switch causes a delay asymmetry due to the fact that the switch does a "store and forward" on messages. This means the entire message must be stored in the buffer before it starts to be "forwarded" or sent out. For example, for a 100 Mb input and 1 Gb output, the switch must wait for the entire message to clock in at the slow rate before it can start outputting the message at the high rate. Conversely for a 1 Gb/s input and 100 Mb/s output, the entire packet is quickly read in at the faster rate, so then the output can start sooner, albeit at a lower rate.

While the total time is the same for both directions, the delay on the fast-in, slow-out direction is shorter on the packets which contain the PTP timestamps. This effect is significant on a 100 Mb/1 Gb rate mismatch, but much less significant on a 1 G/10 G switch since the message time at 1 Gb/s is quite short. If the switch supports Transparent Clock (TC) mode, then this rate mismatch delay effect is corrected by the TC delay correction.

Traffic mismatch

Another cause of asymmetric delay is traffic mismatch on the two paths. If there is a high percentage of traffic utilization on the master to slave path, then most of the PTP messages may be delayed significantly. If the traffic on the other direction is significantly different, then the messages on the path may not suffer the same delay.

This effect can be quite large depending on the traffic, the quality of the switch, and the number of switches in the network. To reduce this effect, a user should avoid large loading on the PTP network, use high-quality switches that avoid this delay variance, or use PTP Transparent mode switches which will insert residence time information to allow the slave to correct for this delay.

Setting the Diff Serve QoS on the switch and configuring the PTP messages with an appropriate DSCP can also mitigate the effects of traffic delay.

Message type mismatch

Another cause of delay asymmetry is message type mismatch. For example, if the sync message is Multicast and the delay request is Unicast, then some switches may process the messages differently and cause a differential delay. Since the SMPTE profile allows a mixed mode operation, switches should be evaluated to ensure they do not have this effect. If transparent mode switches are used, then this effect should be corrected by the slave.

Cable delay variation

The actual propagation delay through Cat 5 cable can be significantly different in one direction versus the other direction. This can be due to the twist rate on the pairs, routing inside the sheath, material differences, etc. The PTP system is incapable of removing this effect, so the best way to prevent this is to use high-quality cable with a minimum variation in the physical propagation delay.

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