THE 11A34V

HIGH BANDWIDTH VIDEO AMPLIFIER

User Reference

Tektronix®
COMMITTED TO EXCELLENCE

Part No. 070-8178-00
Product Group 47

THE 11A34V

HIGH BANDWIDTH VIDEO AMPLIFIER

User Reference

Please check for CHANGE INFORMATION at the rear of this manual.

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Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

Instruments manufactured for Tektronix by external vendors outside the United States are assigned a two digit alpha code to identify the country of manufacture (e.g., JP for Japan, HK for Hong Kong, etc.).

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

Printed in U.S.A.

Contents

List of Figures

List of Tables

General Information

This supplement to the mainframe *User Reference* describes the features and operation of the Tektronix 11A34V High Bandwidth Video Amplifier. The *11A34V Service Reference* provides service information and test procedures for the 11A34V Amplifier.

Functions common to all plug-in amplifiers, such as offset, sensitivity, input impedance and coupling, are described in the *User Reference* for each mainframe. This manual discusses the performance of systems that are configured using the 11A34V Amplifier.

Features

- Four channel inputs
- Up to 300 MHz bandwidth
- Calibrated sensitivities from 1 mV to 10 V/division
- 75 Ω or 1 MΩ input impedance
- High-resolution, calibrated DC offset (0.25 division/increment, coarse; 0.025 division/increment, fine)
- Fast overdrive recovery
- Works in conjunction with the 11T5H Multistandard Video Trigger Plug-in to provide video triggering and back porch clamping on two channels

Functions

Signals applied to the input connectors can be displayed or removed from the display by pressing the display on/off buttons adjacent to the input connectors.

All other 11A34V functions are controlled through the host mainframe. Such mainframe-controlled functions are:

- Sensitivity, Coarse and Fine, over a range of 1 mV to 10 V/division
- Vertical Offset
- Coupling: AC, DC, or Off
- Impedance (input termination): 75 Ω or 1 MΩ
- Bandwidth Limit: 100 MHz or 20 MHz
- Display Polarity: normal or inverted
- Trigger Polarity: normal or inverted
- Combination of Display Channels: See *Operating Information* section of mainframe *User Reference* manual
- Combination of Trigger Channels: same as Display Channels; see *Operating Information* section of mainframe *User Reference* manual

General Video Signal Theory

This section describes the fundamental principles of television transmission. This information is described from the perspective of the United States National Television Systems Committee (NTSC) broadcast standards. These standards are common for many non-NTSC broadcast standards.

The Video Waveform

A composite video signal contains both picture and synchronizing information.

Picture – Image information is both amplitude and position coded along each horizontal line. A picture to be transmitted is scanned by a camera. At lighter spaces of the picture a high amplitude signal is generated, darker spaces generate low amplitude signals.

When measured across 75 ohms, video signals are a standard amplitude of 1 V peak to peak. They are measured from the most negative point on the synchronizing pulse (see Sync) to the reference white (high amplitude) level.

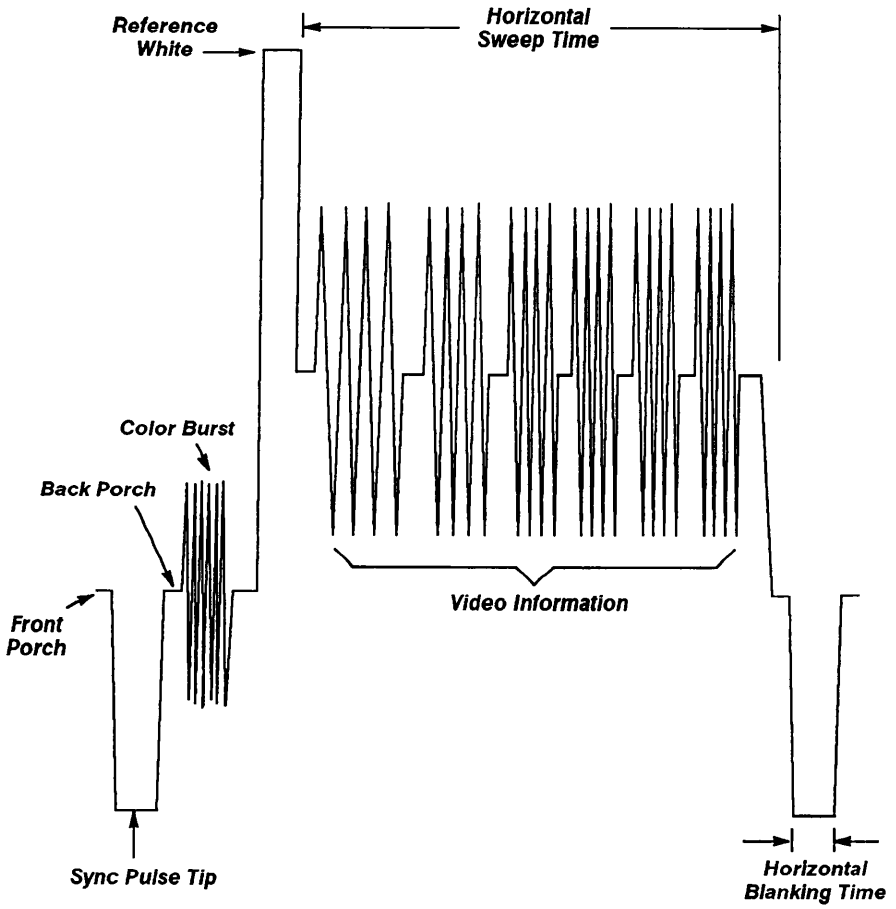

Figure 1-1 – A Video Waveform

Sync – The video signal contains synchronizing information referred to simply as sync. In a television receiving set, the image must be synchronized with the camera. The sync pulses keep the image precisely timed. If sync information were not present the image would appear scrambled.

Horizontal-sync (or line-sync) pulses define the beginning and the ending of each sequential picture scanning line. These pulses cause the scanner to move from the left to the right of the screen to begin another horizontal scan (horizontal retrace). Vertical-sync pulses cause the scanner of the television to move from the bottom to the top of the screen to begin another picture (vertical retrace).

Front Porch – Before each horizontal-sync pulse is the area called the front porch. This area marks the beginning of the horizontal blanking interval (horizontal retrace). The front porch isolates the horizontal-sync pulse from picture information of the previous line. This prevents unstable horizontal-sync triggering.

Back Porch – Following the horizontal-sync pulse is the area called the back porch. Its amplitude is at the blanking level and serves as the reference for all other parts of the video waveform.

When a transmitted video signal is AC coupled or carried through long cable runs where it may be distorted, it is necessary for the signal to contain its own reference level on each horizontal line. The 11T5H Multistandard Video Trigger (which can be used in conjunction with the 11A34V) stabilizes the video signal by incorporating a back-porch clamp circuit (DC restorer). This circuit recreates the DC reference amplitude on the back porch level.

The back porch provides additional picture blanking time (horizontal retrace) for the camera and television set. The back porch may contain a color-reference signal called the color burst. The color burst indicates that the signal contains color information.

Color – Picture color information is transmitted by two separate components of the video waveform: the chrominance signal and the luminance signal. Chrominance contains hue (basic color content) and saturation (degree the color is diluted by white light). Luminance contains brightness information transmitted as white or shades of gray.

Chrominance is derived from a 3.579545 MHz subcarrier generated by color video equipment. The resultant sine wave signal varies in both amplitude and phase relative to a reference signal. The reference signal is a 40 IRE color burst transmitted on the back porch. Picture colors are decoded from the reference signal. The decoding is accomplished by processing the phase differences between the transmitted color burst and the chrominance signal. The amplitude of the luminance signal component determines brightness.

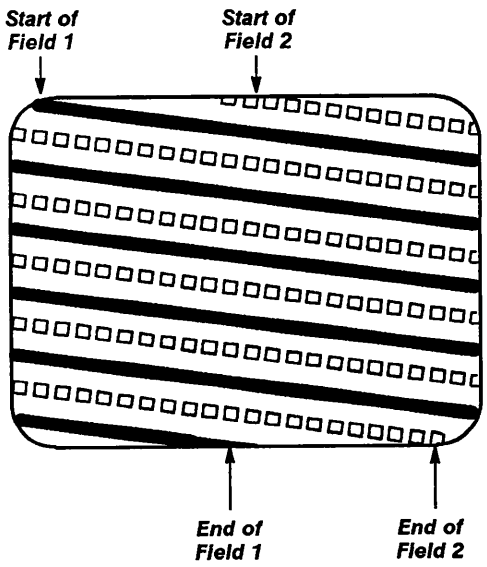

Figure 1-2 – Typical Interlaced Picture Scan Pattern

Fields and Frames – In the NTSC color-television standard 525 scan lines constitute one field and two fields create a frame (two frames create a picture). Each field is offset a half scan line from the other in a way that they become interlaced. Fields are drawn one at a time by the scanning beam, each with its own vertical-sync format. The interlace method reduces flicker and increases picture quality without requiring greater bandwidth.

Analyzing Video Signals

Monitoring and analyzing video signals is necessary in order to maintain and troubleshoot video equipment. Waveform assessment is accomplished by injecting known test signals in the video path. By monitoring the test signal at the output it is possible to determine the extent of deviation or distortion caused by the video equipment.

Test Signals – Scan lines 10 through 20 of Field 1 and Field 2 are outside the normal viewing area. Test signals can be placed onto these lines without interrupting video signal transmission. These test signals can then be monitored.

Triggering – The trigger point for viewing any video line is the horizontal-sync pulse at the beginning of the respective line. Before a line can be viewed with a mainframe it is necessary to select the beginning of the line as the trigger point. To arrive at the desired field, the vertical-sync pulse must be detected.

Variations from the NTSC 525-line standard complicate the location and count of line numbers. In the NTSC and CCIR System M standards, line count starts three lines prior to vertical-sync pulse and is reset at the beginning of each field. In CCIR System B, PAL, and other 625-line standards, line count starts at the beginning of the vertical-sync pulse and is reset only at the beginning of Field 1.

For non-interlaced standards there is no differentiation between fields. Other triggering factors include differences in field rates, and number of lines per frame.

Safety Summary

The general safety information in this summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms in Manuals

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

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

Terms on Equipment

CAUTION warns you of possible hazards to the equipment or to yourself (but you are not exposed as you read the marking).

DANGER indicates that you are exposed to a personal injury hazard as you read the marking.

Symbols in Manuals

Static Sensitive Devices

Symbols on Equipment

DANGER
High Voltage

Protective ground (earth) terminal

ATTENTION
Refer to manual

Power Source

The amplifier is intended to operate in a mainframe connected to a power source that will not apply more than 250 V rms between the supply conductors or between either supply conductor and ground. A protective ground connection, through the grounding conductor in the mainframe power cord, is essential for safe system operation.

Grounding the Amplifier

The amplifier is grounded through the grounding conductor of the mainframe power cord. To avoid electric shock, plug the mainframe power cord into a properly wired receptacle before installing the amplifier. A protective-ground connection, through the grounding conductor in the mainframe power cord, is essential for safe operation.

Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating), can render an electric shock.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate the amplifier in an atmosphere of explosive gasses.

Do Not Remove Covers or Panels

To avoid personal injury, do not operate this amplifier without the panels or covers. Operating the amplifier without the covers in place may cause overheating and damage to the amplifier.

Contents of this Supplement

This Supplement contains the following five sections:

General Information describes mainframe to plug-in unit compatibility, explains how to install and remove the 11A34V from a mainframe, outlines any options available for the 11A34V, and gives details about packaging for shipment.

Most 11A34V functions, and their use, are described in the *Operating Information* section of the mainframe *User Reference* manuals. These functions are common to all amplifier plug-in units. Examples of common functions are offset, sensitivity, input impedance (where selectable), coupling, and bandwidth limit. Only functions unique to the 11A34V-mainframe combinations are explained in the following sections.

Operation In Analog Oscilloscopes explains how to operate the 11A34V in an 11300 Series oscilloscope.

Operation In Digitizing Oscilloscopes explains how to operate the 11A34V in an 11400 Series oscilloscope.

Operation with the 11T5H explains how to operate the 11A34V in conjunction with the 11T5H Multistandard Video Trigger.

Specification gives detailed specifications of all 11A34V-mainframe oscilloscope combinations.

Plug-in to Mainframe Compatibility

The 11A34V is designed for use in all 11000 Series mainframes, CSA 404 Communications Signal Analyzers, and DSA 600 Series mainframes. 11A34V bandwidth varies depending on the host mainframe. Details about bandwidth are included in Section 5, *Specification*, of this supplement, and in the Tektronix Corporate Catalog. Refer to the Tektronix Corporate Catalog for complete compatibility information.

Initial Inspection

The 11A34V was inspected mechanically and electrically before shipment, and should meet all electrical specifications. First, inspect the 11A34V for physical damage incurred in transit. Second, to verify that the instrument is functioning properly, perform the Functional Test portion of the Checks and Adjustments in the *Service Reference*. This brief procedure verifies most instrument functions and checks the internal auto-calibration references. If you find instrument damage or deficiency, contact your local Tektronix Field Office or representative.

Operating Temperature

The 11A34V can be operated where the ambient air temperature is between 0° and +50°C and can be stored in ambient temperatures from -40° to +75°C. After storage at temperatures outside the operating limits, allow the chassis to reach operating temperature limits before applying power.

Installing and Removing the 11A34V

When installed in the center or right plug-in compartment of the 11301, 11301A, 11302, or 11302A, the 11A34V also provides the X (horizontal) part of an X-Y display, or provides a trigger signal for the mainframe time base.

To install the 11A34V in any 11000 Series oscilloscope, CSA 404 Communications Signal Analyzer, or DSA 600 Series Digitizing Signal Analyzer, set the mainframe ON/STANDBY switch to STANDBY. Align the grooves in the top and bottom of the 11A34V with the guides in the mainframe plug-in compartment, then insert the 11A34V into the mainframe until its front panel is flush with the front panel of the mainframe.

CAUTION

To avoid instrument damage set the mainframe ON/STANDBY switch to STANDBY before installing or removing the 11A34V.

If the green indicator light remains ON when the STANDBY position is selected, the switch has been internally disabled. To re-enable the ON/STANDBY switch, refer the mainframe to qualified service personnel.

To remove or reinstall plug-in units while the ON/STANDBY switch is disabled, use the mainframe PRINCIPAL POWER SWITCH (rear panel) to shut OFF the power. This prevents damage to either the plug-in or the mainframe.

When installed in an 11000 Series, CSA 404, or DSA 600 plug-in compartment, the 11A34V provides a conventional display.

To remove the 11A34V from a mainframe, set the mainframe ON/STANDBY switch to STANDBY. Then pull the release latch (see Fig. 1-3) to disengage the unit from the mainframe, and pull the 11A34V straight out of the plug-in compartment.

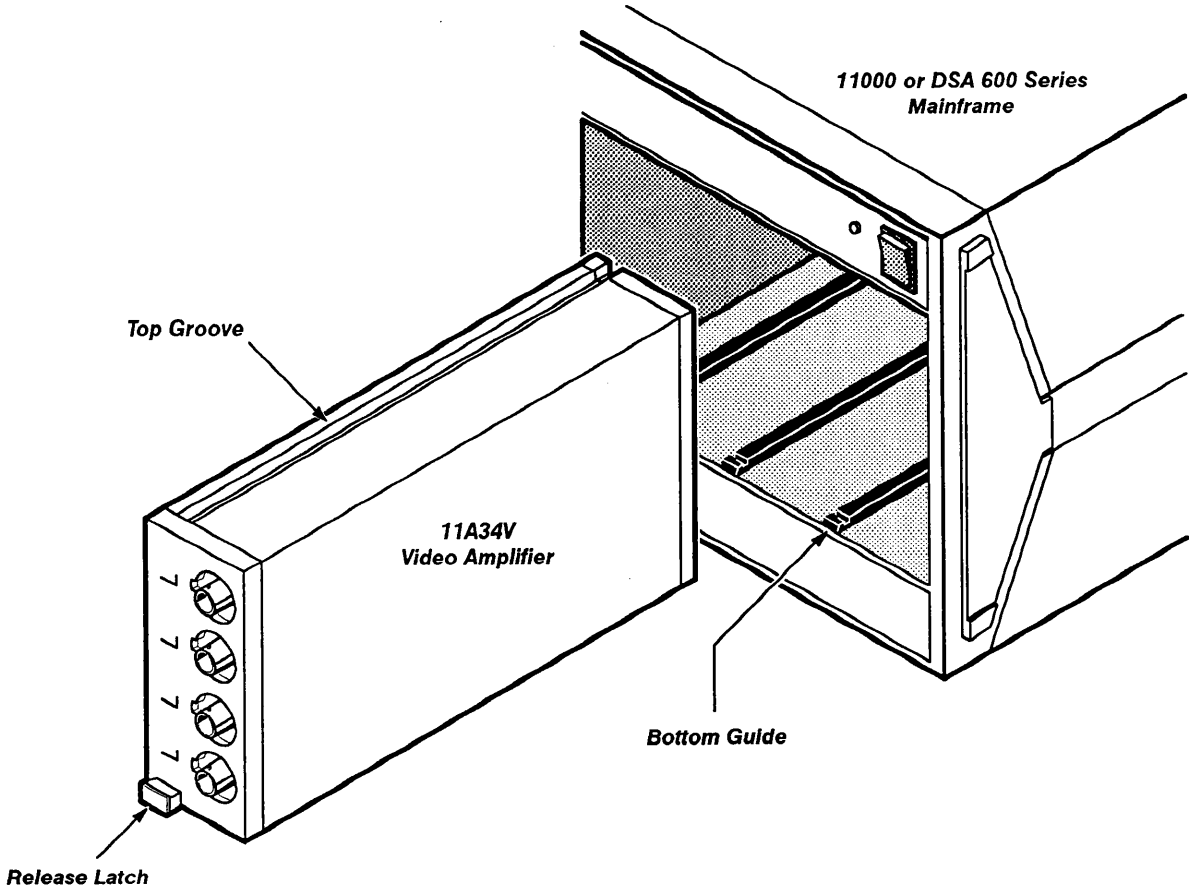

Figure 1-3 — Installing and Removing the 11A34V

Instrument Options

Option 23 includes four P6134C probes.

Packaging for Shipment

If this instrument is to be shipped by commercial transportation, we recommend that it be packaged in the original manner. The original carton and packaging material should be saved and reused for this purpose.

Note: *Package and ship plug-in units and mainframes separately.*

If the 11A34V is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument. On the tag, include the following information:

- Name and address of the instrument owner
- Name of a person at your firm who can be contacted about the instrument
- Complete instrument type and serial number
- A description of the service required

If the original package is not available or is not fit for use, package the 11A34V as follows:

1. Obtain a corrugated cardboard carton with inside dimensions at least six inches greater than the instrument dimensions. Use a carton with a test strength of at least 200 pounds.
2. Fully wrap the 11A34V with anti-static sheeting, or its equivalent, to protect the finish.
3. Cushion the 11A34V on all sides by tightly packing dunnage or urethane foam between the carton and the instrument. Allow three inches of packing on each side.
4. Seal the carton with shipping tape or with industrial staples.
5. Mark the address of the Tektronix Service Center and your return address on the carton in one or more prominent places.

Operation in Digitizing Oscilloscopes

Display On/Off

The 11A34V has four display on/off buttons: one for each channel. Pressing a display on/off button causes its channel and signal to be displayed or removed from the display (the function toggles). When a channel is displayed, its label (CH 1 to CH 4) is lighted.

Other Functions

All other 11A34V functions are controlled within the 11400 Series oscilloscopes, CSA 404, and DSA 600 Series Digitizing Signal Analyzers. Their operation is described in their respective *User Reference* manuals. Table 2-1 shows where to find information about operating the 11A34V.

Table 2-1 *– Functions and Where They are Described*

Function	Described Under Heading
Vertical Offset	Vertical Controls.
Vertical Size (sensitivity)	Vertical Controls.
Coupling (AC, DC, Off)	Plug-in Units.
Select 11A34V Channel	Waveform Definition and Management (an alternative to pressing the 11A34V display on/off button).
Combine Channels	Waveform Definition and Management.
Input Impedance	Plug-in Units.
Offset	Vertical Controls.
BW Limit	Plug-in Units.
Display Polarity	Waveform Definition and Management.

Vertical Offset

Digitizing oscilloscopes use offset to position the trace on the screen. In YT (signal vs. time) mode, offset determines vertical position, but when a plug-in unit provides the X component of an XY display, offset controls horizontal position.

Offset is an input-signal-related control, and its units are those of the input signal (usually volts).

Offset subtracts a precision voltage from the input signal. To access the offset function, touch the Vertical icon at the left edge of the screen. Control of offset is then assigned a Control knob.

Changing the vertical deflection factor magnifies or compresses the displayed signal about screen center. To examine a portion of the input signal in greater detail, use Vertical Offset to position the area of interest to screen center. Use the Vertical Size to adjust the display to the size needed for detailed examination.

BW Limit

Two four-pole (24 dB/octave) bandwidth limit (low-pass) filters are available for each 11A34V channel. The purpose of these filters is to reduce the amplitude of unwanted noise or interference occurring at frequencies above the frequency of the signal of interest. The user has a choice of cut-off (-3 dB) frequencies: 20 MHz, 100 MHz, or 300 MHz for each channel. The trigger, auxiliary trigger, and display signal bandwidths for a channel are always the same. The auxiliary trigger is the signal sent to the right plug-in compartment.

DC Circuit Loading

AC coupling capacitors are connected differently in the 11A32, 11A34, and 11A34V than in the11A52 and 11A71. Figure 2-1 shows this difference.

In the 11A52 and 11A71, the coupling capacitor isolates both the input termination and the amplifier from external DC voltages. The coupling capacitor in the 11A32, 11A34, and 11A34V does not isolate both the input termination and the amplifier from external DC voltages.

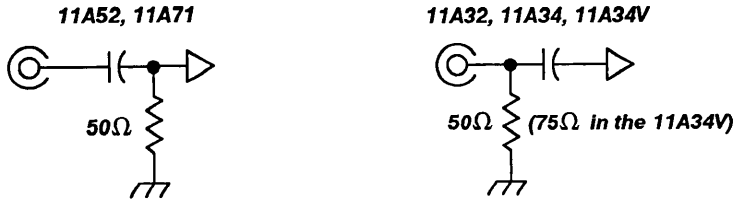

Figure 2-1 *— Location of AC Coupling Capacitors in Plug-in Amplifiers*

CAUTION

Always use caution when working with voltages in excess of 25 volts.

When 75 Ω Impedance mode is selected and input coupling is set to AC or DC, a 75 Ω termination resistance is connected directly from the 11A34V input connector to ground. Take care that the circuit connected to the 11A34V input will not be damaged by the 75 Ω load.

Switching from 1 MΩ to 75 Ω Impedance mode when more than 25 VDC is present at the 11A34V input will exceed the peak input voltage specification and may damage the 11A34V input relay. A damaged relay can cause calibration errors.

Adding and Subtracting Waveforms

Each plug-in compartment has an associated sampler. Samples are taken simultaneously by each sampler. A channel from one plug-in unit may be added to or subtracted from that of another plug-in unit by this simultaneity. Thus noise and other signals unrelated to the trigger are canceled when channels in different plug-in units are subtracted.

Signals from different channels within a plug-in unit are sampled at different times. Signals that are entirely repetitive and related to the trigger signal however may be successfully added or subtracted. Signals that are not repetitive or related to the trigger will not be sampled at the same time, and may not be displayed correctly. Therefore it is preferable that signals to be added or subtracted are selected from different plug-in compartments.

The best common-mode rejection is obtained with a differential amplifier plug-in unit because its hardware subtracts the signals at its two inputs, passing only the result to the mainframe.

Even when using channels from different plug-in compartments, the following two problems limit the accuracy of sums or differences:

1. Each waveform in memory is constantly being updated. Thus, some points are older than others. Although samples can be taken simultaneously, there is a chance that a correct sample may be replaced in memory with a newer value before the waveform is processed and displayed.
2. Differences in probe cable lengths can cause delay differences between channels of different plug-in units. These differences are normally removed by deskewing the probes and the associated amplifier channel. Samples are still taken simultaneously, but the display is manipulated to remove time differences. Signals correlated to the trigger signal are correctly restored to their proper time relationship, but there is no way for signals unrelated to the trigger to be corrected with this deskewing technique. High-frequency rejection of signals unrelated to the trigger is not improved by deskewing.

The solution to both problems is to invoke averaging. The averaging process suppresses all signals and noise unrelated to the trigger.

Overdrive Recovery

Overdrive occurs when any 11A34V channel is driven out of its linear range of approximately ±15 divisions.

Any amplifier will ultimately reach an equilibrium value after an input step (although its accuracy will determine how far that equilibrium value is from the correct value). The 11A34V's ability to settle quickly to within a very small fraction of its equilibrium value is exceptional. The time it takes the 11A34V to settle to within a stated fraction of the equilibrium value is its overdrive recovery time.

The 11A34V has extraordinarily good overdrive recovery, and this feature may be used to greatly extend measurement resolution. For example, suppose a signal changes from −1.7 V to +0.8 V in 1 ns. The 11A34V can determine if the signal stabilized immediately at +0.8 V or had a small aberration following the transition. By setting the 11A34V offset to +0.8 V and the sensitivity to 1 mV/div, aberrations of just 0.1% of the original transition will be 2.5 divisions in amplitude (0.1% of 2.5 V is 2.5 mV or 2.5 divisions at 1 mV/div).

75 Ω Overload

When the input impedance is set to 75 Ω and the input voltage substantially exceeds 5 V rms, the 11A34V will sense the overload, disconnect the 75 Ω input termination and connect the 1 MΩ termination. The Impedance menu shows 1 MΩ, and the mainframe displays the message:

Input channel N overload on LEFT/CENTER/RIGHT plug-in

where N is an integer from 1 to 4.

To reset the input impedance to 75 Ω, first correct the overload condition, then select 75 Ω from the Impedance menu.

Active Probes

There are no active probes that expect an input impedance of 75 Ω; therefore, the use of active probes is not advised.

Probe ID

The Probe ID function provides a means of selecting how the oscilloscope responds to an ID button-push of recommended probes. (The Probe ID Function is part of the Probes pop-up menu, which is selected from the Utility Major Menu.) All or some combination of the following operations may be set to start in response to probe ID buttons. To display the Utility Major Menu, press the front-panel UTILITY button. For details, see the Probes and Cables Section in the mainframe *User Reference*.

Pressing the probe ID button initiates one of the following operations:

1. If the Probe ID function (in the Probes pop-up menu of the Utility Major Menu) is set to **Sequence Settings**, the next front-panel setting is recalled. If the Probe ID Function is not set to **Sequence Settings**, then operation 2 or 3, which involves a new waveform and waveform selection, occurs.

   If the Sequence Settings option is enabled, front-panel settings can be sequentially recalled via the Probe ID function. The settings must be stored as explained under *Storing and Recalling Waveforms* in the mainframe *User Reference*.

2. If the Probe ID Function (in the Probes pop-up menu of the Utility Major Menu) is set to **Waveform Select/New Wfm**, a waveform is selected. Figure 2-2 shows the sequence of decisions used to select a new waveform.

3. If the Probe ID Function is set to **Select/New & AutoSet**, then the decisions shown in Figure 2-2 are made, and the resulting selected waveform is autoset.

   Events 1, 2, and 3 are mutually exclusive. Event 4 may be combined with any one of them.

4. If the IDPROBE SRQMASK is enabled, an appropriate event will be returned to the GPIB and RS-232-C ports.

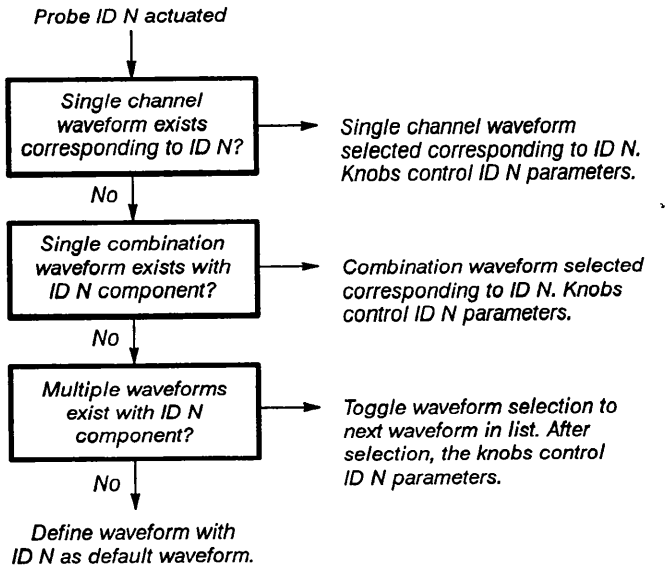

***Figure 2-2** — Sequence of Decisions in Response to Pressing the Probe ID Button*

Front-Panel Error Messages

Internal DAC overflow on channel N of LEFT, CENTER, or RIGHT plug-in unit, where N = 1 to 4.

A plug-in unit detected that a requested setting overflowed an internal DAC. A DAC overflow usually indicates defective hardware. In this situation, the plug-in unit sets the DAC to the limit nearer the requested setting.

Bad Level 2 probe checksum on channel N of LEFT, CENTER, or RIGHT plug-in unit, where N = 1 to 4.

A plug-in unit detected that a Level 2 TEKPROBE had failed or was improperly connected.

GPIB and RS-232-C Commands and Syntax

The following table lists commands that set parameters of a specified channel.

***Table 2-2** — Channel Parameter Commands (for Digitizing Oscilloscopes)*

Header	Link	Argument		
CH LN | CN | RN (N is 1 to 4)	COUPLING:	AC | DC | OFF		
	OFFSET:[1]	<NRx>[2]		
	Volts/div	Offset Range	Resolution via RS-232-C, GPIB, or Numeric Entry	Step size via front-panel Control knob
	1 mV to 99.5 mV 100 mV to 995 mV 1 V to 10 V	±1 V ±10 V ±100 V	25E-6 250E-6 2.5E-3	Coarse: 0.25 div. Fine: 0.025 div.
	BWHI:	<NRx> ≤24E6 >24E6 to ≤120E6 >120E6		HF Limit 20E6 100E6 300E6, 11401 300E6, 11402
	IMPEDANCE:	<NRx> <1E3 ≥1E3		Impedance 75 1E6
	SENSITIVITY:[1]	Sensitivity 1E-3 to 1.99E-3 2E-3 to 4.98E-3 5E-3 to 9.95E-3 10E-3 to 19.9E-3 20E-3 to 49.8E-3 50E-3 to 99.5E-3 100E-3 to 199E-3 200E-3 to 498E-3 500E-3 to 995E-3 1 to 1.99 2 to 4.98 5 to 10		Resolution (step size) 10E-6 20E-6 50E-6 100E-6 200E-6 500E-6 1E-3 2E-3 5E-3 10E-3 20E-3 50E-3
	UNITS	The 11A34V answers a Units query with a units status message, which indicates the units of conversion of a probe connected to its Ch N input.		
	PROBE	The query form of this link returns a quoted string indicating what type of probe is connected to the input. If a Level 1 TEKPROBE is connected, the query response is "Level 1." If a Level 2 TEKPROBE is connected, the query response is "Level 2/<probe_type>/<serial_number>." When neither Level 1 nor Level 2 TEKPROBE is connected, the query response is "NONE."		

[1]The numbers listed are those available at the input connectors. Connecting an attenuating probe will change the value by the probe attenuating factor (e.g., a 10X probe will change the value ±10 to ±100).

[2]A legend for this table appears on the next page.

Legend

CHLN | CN | RN	L, C, and R mean Left, Center, and Right plug-in compartments; N is a channel number from 1 to 4. The brackets and vertical bars are not part of the syntax, they indicate that only one of the set may be used at a time (for example, CHL3 means channel 3 of the left plug in).
COUPLING	Sets the specified channel input coupling.
OFFSET	Sets the specified channel offset.
BW	Sets the HF Limit (bandwidth) of the specified channel.
NRx	A number. The range is specified in the table.
IMPEDANCE	Sets the input impedance of the specified channel.
SENSITIVITY	Sets the deflection factor of the specified channel. Sensitivity is a channel-specific command that does not apply to compound waveforms.

Operation in Analog Oscilloscopes

Display On/Off

The 11A34V has four display on/off buttons: one for each channel. Pressing a display on/off button causes its channel and signal to be displayed or removed from the display (the function toggles). When a channel is displayed, its label (CH 1, CH 2, CH 3, or CH 4) is lighted.

Note: *The 11A34V cannot be used in conjunction with the 11T5H in an 11300-series oscilloscopes. (The 11T5H is not designed to be used in analog oscilloscopes.) Therefore, both trigger and clamp functions are unavailable.*

Selecting Coupling, HF Limit, and Impedance

To select the desired setting for Coupling, HF Limit, or Impedance, proceed as follows:

1. If no trace is displayed, press any plug-in display on/off button to create a trace.

   If several traces are displayed, select a channel by touching the desired trace description at the top of the CRT.

2. On the 11301 and 11302 oscilloscopes press any VERTICAL button once—OFFSET, SIZE, or POS. On the 11301A and 11302A oscilloscopes press any VERTICAL button twice. This causes the Control Menu to be displayed.

3. Touch the desired function's label. Successive touches will change its state.

Other Functions

Other 11A34V functions are controlled within the 11300-series mainframe, and their operation is described in detail in Section 2, *Operating Information*, of the 11301 and 11302 *User Reference* manual, and the 11301A and 11302A *User Reference* manual. Table 3-1 shows where to find information about operating the 11A34V.

Table 3-1 *—Functions and Where They are Described*

Function	Described Under Heading
Offset, Size (V/div)	Waveform Acquisition: Vertical Menu; or for X-Y Display: Horizontal Menu.
Display ± CH 1 – ± CH 4	Waveform Acquisition: Vertical Menu.
Polarity	Waveform Acquisition: Waveform Menu.
Trigger Selection	Trigger Source Major Menu and Polarity.

Position and Offset

All 11300-series oscilloscopes assign position control to the Left Control knob when you press the VERTICAL POSition button once. The VERTICAL POSition control moves the trace as a user convenience. For example, when displaying multiple channels it may be desirable to set ground references for each trace on separate graticule lines. Position is a screen-related function; its units are divisions.

The offset function, accessed by pressing the VERTICAL OFFSET button, subtracts a precision voltage from the input signal. Changing offset moves the trace just as does the position control. However, if the deflection factor is subsequently changed, the effect is different.

Changing the sensitivity increases or decreases the size of the display around the screen level (for example, two divisions above graticule center) set by the Position control. When using a sensitivity that makes the displayed waveform larger than the screen, the Offset control is used to bring the waveform area of interest to the screen location established by the Position control.

The Position control has a range of plus and minus four divisions from graticule center, but the Offset control has a range defined in volts. Offset can be as much as 1000 divisions at 1 mV/division. The Offset control range is 1 V for all sensitivities from 1 mV to 99.5 mV/division, but increases to 10 V for sensitivities from 100 mV to 995 mV/division. For sensitivities from 1 V to 10 V/div, Offset control range increases to 100 V.

The 11A34V attempts to maintain the user-selected offset voltage even though the offset range changes due to a change in sensitivity. An offset voltage of less than one volt will be maintained as the sensitivity is changed over the entire range of 1 mV/division to 10 V/division. A selected offset of greater than one volt is beyond the offset range for the most sensitive settings and will be reset to one volt when the sensitivity is increased to any value between 99.5 mV and 1 mV/division.

LF Limit

Two four-pole (24 dB/octave) bandwidth limit (low-pass) filters are available for each 11A34V channel. The purpose of these filters is to reduce the amplitude of unwanted noise or interference occurring at frequencies above the frequency of the signal of interest. The user has a choice of cut-off (–3 dB) frequencies, either 20 MHz, 100 MHz, or 300 MHz, independently for each channel. The trigger and display signal bandwidths for a channel are always the same.

DC Circuit Loading

AC coupling capacitors are connected differently in the 11A32, 11A34, and 11A34V than in the 11A52 and 11A71. Figure 3-1 shows this difference.

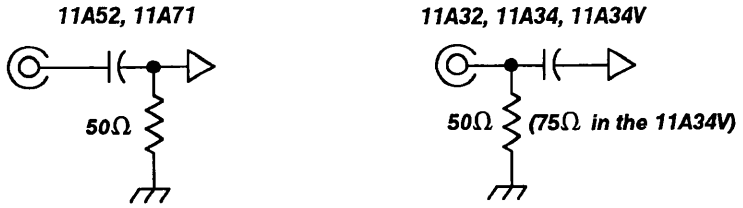

Figure 3-1 — Location of AC Coupling Capacitors in Plug-in Amplifiers.

In the 11A52 and 11A71, the coupling capacitor isolates both the input termination and the amplifier from external DC voltages. However, the coupling capacitor in the 11A32, 11A34, and 11A34V does not.

CAUTION

Always use caution when working with voltages in excess of 25 volts.

When 75 Ω Impedance mode is selected and input coupling is set to AC or DC, a 75 Ω termination resistance is connected directly from the 11A34V input connector to ground. Take care that the circuit connected to the 11A34V input will not be damaged by the 75 Ω load.

Switching from 1 MΩ to 75 Ω Impedance mode when more than 25 VDC is present at the 11A34V input will exceed the peak input voltage specification and may damage the 11A34V input relay. A damaged relay can cause calibration errors.

Adding Waveforms

Note: *Before adding waveforms, check that each channel is displayed independently on the screen.*

The 11300-series oscilloscopes allow the addition of any two channels. That is, one channel may be added to a channel from another plug-in unit. A simple restriction applies. Each channel must be in its linear operating range. This is assured if each channel separately is within the screen area before addition.

Those portions of a trace that are off screen will not be valid when brought back on screen using another channel's input signal or Offset control. This general restriction applies to any dual-channel oscilloscope.

Overdrive Recovery

Overdrive occurs when any 11A34V channel is driven out of its linear range of approximately ± 15 divisions.

Any amplifier will ultimately reach an equilibrium value after an input step (although its accuracy will determine how far that equilibrium value is from the correct value). The 11A34V's ability to settle quickly to within a very small fraction of its equilibrium value is exceptional. The time it takes the 11A34V to settle to within a stated fraction of the equilibrium value is known as the overdrive recovery time.

The 11A34V has extraordinarily good overdrive recovery, and this feature may be used to greatly extend measurement resolution. For example, suppose a signal changes from −1.7 V to +0.8 V in 1 ns. The 11A34V could be used to determine if the signal stabilized immediately at +0.8 V, or perhaps had some small aberration following the transition. By setting the 11A34V offset to +0.8 V and the sensitivity to 1 mV/division, aberrations of just 0.1% of the original transition will be 2.5 divisions in amplitude (0.1% of 2.5 V is 2.5 mV or 2.5 divisions at 1 mV/division).

75 Ω Overload

When the input impedance is set to 75 Ω and the input voltage substantially exceeds 5 V rms, the 11A34V will sense the overload, disconnect the 75 Ω input termination, and connect the 1 MΩ termination. The Impedance Menu will show 1 MΩ, and the mainframe will display the message:

Input channel N overload on LEFT/CENTER/RIGHT plug-in

where N is an integer from1 to 4.

To reset the input impedance to 75 Ω, first correct the overload condition, then select 75 Ω from the Impedance Menu.

Active Probes

There are no active probes that expect an input impedance of 75 Ω; therefore, the 11A34V does not support active probes.

Probe ID

The Probe ID section of the Utility Menu specifies how an 11300-series oscilloscope responds to an ID button-push of recommended probes. All or some combination of the following operations may be set to start in response to probe ID buttons. To display the Utility Menu, press the front-panel UTILITY button (once on 11301 or 11302 oscilloscopes, twice on 11301A or 11302A oscilloscopes). For details, see the Probe ID section of the Waveform Acquisition subsection in the mainframe *User Reference* manual.

Pressing the probe ID button can initiate one or more of the following operations:

1. **Present a new display or if that channel is already displayed, select the existing trace.** Pressing the ID button of a probe connected to an undisplayed left or center compartment channel will cause that channel to be displayed, unless doing so would exceed the maximum number or traces. Unlike the 11A34V display on/off button, pressing the probe ID button a second time will not remove the display. Probe ID button-presses for displayed channels will do two things: a) select the trace(s) using this channel, and b) momentarily brighten all traces using this channel.
2. **Stored settings can be sequentially recalled.** Pressing the probe ID button can cause a sequential recall of stored settings. The stored settings feature must be enabled using the Probe ID Utility Menu. Settings must be stored as explained under the STORE/RECALL Major Menu in the *User Reference* manual.

3. **The mainframe can Autoset to accommodate the input signal introduced by the probe.** The Autoset feature can be enabled or disabled using the Probe ID Utility Menu. Autoset is the automatic setup of vertical deflection factor, triggering, and sweep speed to produce a meaningful display, for example, two to five divisions of vertical deflection and two to five repetitions of the input signal. For more information, refer to Autoset in the *User Reference* manual.

4. **The mainframe can automatically measure the selected trace.** Automatic measurements of the selected trace can be initiated by pressing a probe ID button. The Automatic Measurements feature can be enabled or disabled using the Probe ID Utility Menu. Such measurements are peak-to-peak, maximum, middle, and minimum voltages; frequency, period, pulse width, and duty cycle. For full information about automatic measurements, see Measure in the *User Reference* manual.

5. **An interrupt to the GPIB and RS-232-C can be generated.** Pressing a probe ID button will cause the mainframe to produce an SRQ to the GPIB and RS-232-C. For more information, refer to the GPIB/RS-232-C section of the *User Reference* manual.

Front-Panel Error Messages

Internal DAC overflow on channel N of LEFT, CENTER, or RIGHT plug-in unit, where N = 1 to 4.

A plug-in unit detected that a requested setting overflowed an internal DAC. Such overflow usually indicates defective hardware. In this situation, the plug-in unit sets the DAC to the limit nearest the requested setting.

Bad Level 2 probe checksum on channel N of LEFT, CENTER, or RIGHT plug-in unit, where N = 1 to 4.

A plug-in unit detected that a Level 2 TEKPROBE has failed or is improperly connected.

GPIB and RS-232-C Commands and Syntax

The following table lists commands that set parameters of a specified channel.

Table 3-2 – Channel Parameter Commands (for Analog Oscilloscopes)

Header	Link	Argument		
CH{LN|CN|RN} (N is 1 to 4)	COUPLING:	AC|DC|OFF		
	OFFSET:[1]	<NRx>[2]		
	Volts/div	Offset Range	Resolution via RS-232-C, GPIB, or Numeric Entry	Step size via front-panel Control knob
	1 mV to 99.5 mV 100 mV to 995 mV 1 V to 10 V	±1 V ±10 V ±100 V	25E-6 250E-6 2.5E-3	Coarse: 0.25 div. Fine: 0.025 div.
	BWHI:	<NRx> ≤24E6 >24E6 to ≤120E6 >120E6	HF Limit 20E6 100E6 250E6, 11301 250E6, 11302	
	IMPEDANCE:	<NRx> <1E3 ≥1E3	Impedance 75 1E6	
	SENSITIVITY:[1]	Sensitivity 1E-3 to 1.99E-3 2E-3 to 4.98E-3 5E-3 to 9.95E-3 10E-3 to 19.9E-3 20E-3 to 49.8E-3 50E-3 to 99.5E-3 100E-3 to 199E-3 200E-3 to 498E-3 500E-3 to 995E-3 1 to 1.99 2 to 4.98 5 to 10	Resolution (step size) 10E-6 20E-6 50E-6 100E-6 200E-6 500E-6 1E-3 2E-3 5E-3 10E-3 20E-3 50E-3	
	UNITS	The 11A34V answers a Units query with a units status message, which indicates the units of conversion.		
	PROBE	The query form of this link returns a quoted string indicating what type of probe is connected to the input. If a Level 1 TEKPROBE is connected, the query response is "Level 1." If a Level 2 TEKPROBE is connected, the query response is "Level 2/<probe_type>/<serial_number>." When neither Level 1 nor Level 2 TEKPROBE is connected, the query response is "NONE."		

[1]The numbers listed are those available at the input connectors. Connecting an attenuating probe will change the value by the probe attenuating factor (e.g., a 10X probe will change the value ±10 to ±100).

[2]A legend for this table appears on the next page.

Legend

CH{LN | CN | RN}	L, C, and R mean Left, Center, and Right plug-in compartments; N is a channel number from 1 to 4.The brackets and vertical bars are not part of the syntax, they indicate that only one of the set may be used at a time (for example, CHL3 means channel 3 of the left plug in).
COUPLING	Sets the specified channel input coupling.
OFFSET	Sets the specified channel offset.
BWHI	Sets the HF Limit (bandwidth) of the specified channel.
NRx	A number. The range is specified in the table.
IMPEDANCE	Sets the input impedance of the specified channel.
SENSITIVITY	Sets the deflection factor of the specified channel. Sensitivity is a channel-specific command that does not apply to compound waveforms.

Operation with the 11T5H

In digitizing oscilloscopes, the 11A34V can be used in conjunction with the 11T5H Multistandard Video Trigger. The 11T5H Multistandard Video Trigger provides the 11A34V with a selectable trigger source, and signal clamping for two channels. If two 11A34V plug-ins are used in conjunction with the 11T5H, a total of four channels can be clamped. Trigger and clamp are independent.

The 11A34V provides accurate termination, and enables precise horizontal and vertical control of the displayed waveform. The 11T5H provides line, frame, and polarity selection, and signal clamping.

Setup

When inserted into a digitizing oscilloscope mainframe, the 11A34V and 11T5H are internally connected within that mainframe.

Note: *When used in conjunction with the 11A34V, the 11T5H must be inserted in the rightmost plug-in compartment.*

The 11A34V can be in the left or center plug-in compartment. Two 11A34V plug-ins can be installed simultaneously.

Operation

Signal inputs can be connected to CH 1 through CH 4 on the 11A34V. The mainframe waveform description should be set accordingly. For example, if the signal input is CH 2 of the center plug-in, the waveform description should be C2. The front panel of the 11T5H specifies the plug-in unit and channel number of the trigger or clamp source. Only channels 1 and 2 provide triigger or clamp. For information on operation of the 11T5H, refer to the *11T5H User Reference Supplement*.

Note: *Mainframe trigger source must be specified as R1 (right plug-in, channel 1).*

Example

The following procedure is an example of using the 11A34V in conjunction with the 11T5H to measure amplitude and ringing of a 2T pulse (see Fig. 4-1) of a video waveform. Vertical and horizontal settings used in this example were selected while testing an HDTV Pulse and Bar video waveform generated from a Tektronix TSG 1250 HD Television Generator. These settings should be modified when testing different video signals.

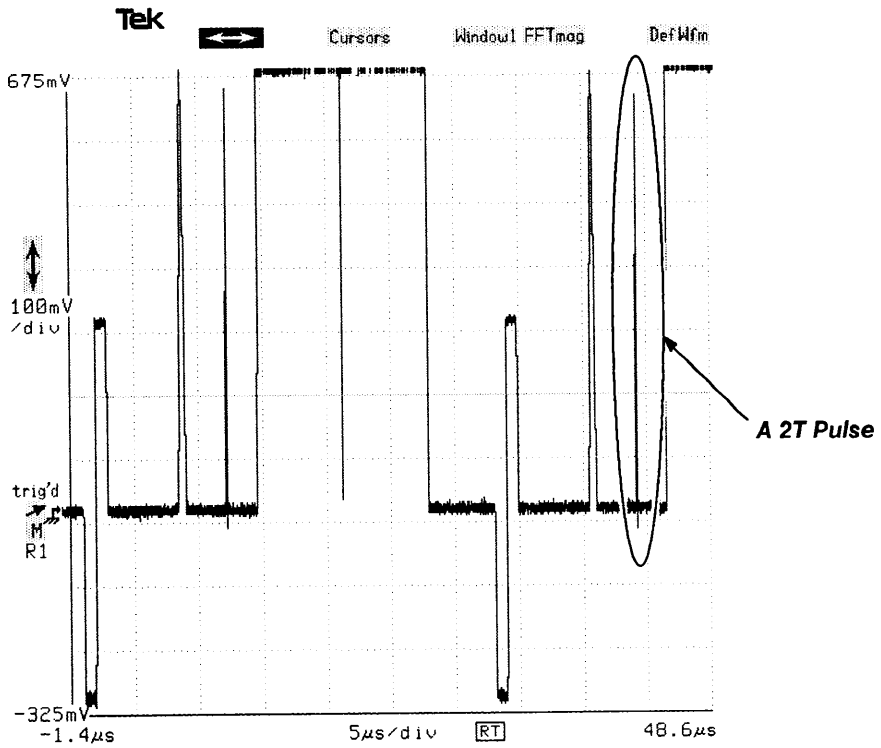

***Figure 4-1** — A 2T Pulse*

☐ Step 1: While the mainframe ON/STANDBY switch is OFF, insert the 11A34V in the leftmost plug-in compartment. Insert the 11T5H in the rightmost plug-in compartment. Switch the mainframe ON/STANDBY switch to ON.

☐ Step 2: Initialize the mainframe (use the **Initialize** selector in the Utility major menu.)

☐ Step 3: On the 11T5H, check for the following settings:

Video Pol ..... NORM
Line 1 Locations ..... AUTO
Fields:Frame 2:1

Use the knob to adjust the settings as needed.

☐ Step 4: Set the HDTV Generator to Pulse and Bar.

☐ Step 5: Connect the signal source to CH 1 on the front panel of the 11A34V. Press the CH 1 button on the front panel of the 11A34V.

☐ Step 6: Press the **WAVEFORM** button on the front panel of the mainframe. Set the impedance to 75 Ω. On 11400-series oscilloscopes: touch **Impedance**, and touch **75** Ω. On DSA 600-series oscilloscopes: touch **Input Parameters**, and touch **75** Ω under the **Impedance** column.

☐ Step 7: Press the **TRIGGER** button on the mainframe front panel. Press the **Source Desc** menu selector on the mainframe touch screen. A pop-up menu appears. Press **R1**, then press **Enter Desc**.

☐ Step 8: On the mainframe touch screen, use the horizontal and vertical icons in conjunction with the knobs to set the horizontal size to 5 µs/div, and the vertical size to 100 mV/div. Adjust the vertical offset as needed to place the waveform within the display.

☐ Step 9: Using the MODE button on the 11T5H, set the mode to FIELD 1. Toggle the center SETUP button until TRIGGER SOURCE is lighted. Use the knob on the front panel of the 11T5H to select L1 as the trigger source.

☐ Step 10: On the 11T5H, toggle the leftmost SETUP button until LINE SELECT is lighted. Use the knob on the 11T5H to select Line 50, which has a 2T pulse.

☐ Step 11: On the mainframe touch screen, touch the horizontal icon and use the knobs to expand the horizontal size to 2 µs/div.

☐ Step 12: On the mainframe touch screen, touch the Window icon to open a window. Touch the horizontal icon and use the knobs to expand the horizontal size to 200 ns/div and position the window on the 2T pulse (see Fig. 4-2).

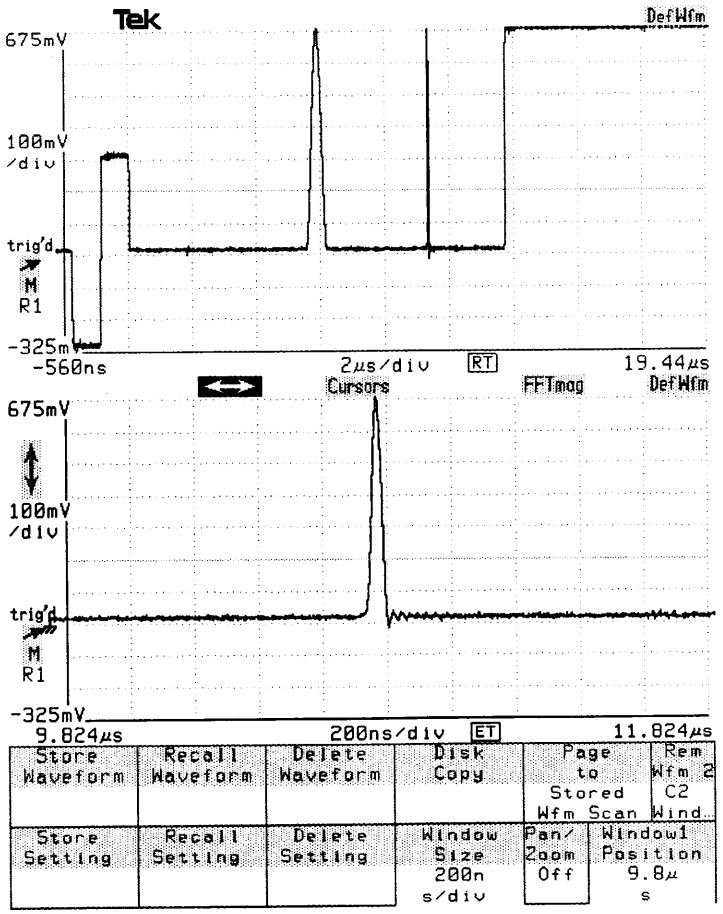

***Figure 4-2** — The 2T Pulse Displayed in a Window*

☐ Step 13: To measure the 2T pulse amplitude, press the MEASURE button on the front panel of the mainframe. Touch the **Measurements** menu selector on the mainframe touch screen. Touch **Peak-Peak**. Touch **Exit Menu**.

☐ Step 14: Touch **Peak-Peak** in the major menu area of the mainframe touch screen. A pop-up menu will appear. Touch **Left Limit**. Touch **Peak-Peak** to remove the pop-up menu. Use the knobs to position the left and right limits. Position the left limit at the start of the 2T pulse. Position the right limit at the center (peak) of the 2T pulse. The number that appears below **Peak-Peak** in the menu is the amplitude of the 2T pulse.

☐ Step 15: To measure the 2T pulse ringing, touch the main (upper) waveform. Touch the vertical icon on the mainframe touch screen and use the knobs to set the vertical size to 10 mV/div. Make sure the vertical offset is 0 V.

☐ Step 16: Touch the window (lower) waveform. Touch **Peak-Peak** in the major menu area of the mainframe touch screen. A pop-up menu will appear. Touch **Left Limit**. Touch **Peak-Peak** to remove the pop-up menu. Use the knobs to position the left and right limits. Position the left limit at the start of the 2T pulse ringing. Position the right limit at the end of the 2T pulse ringing. The number that appears below **Peak-Peak** in the menu is the amplitude of the 2T pulse ringing.

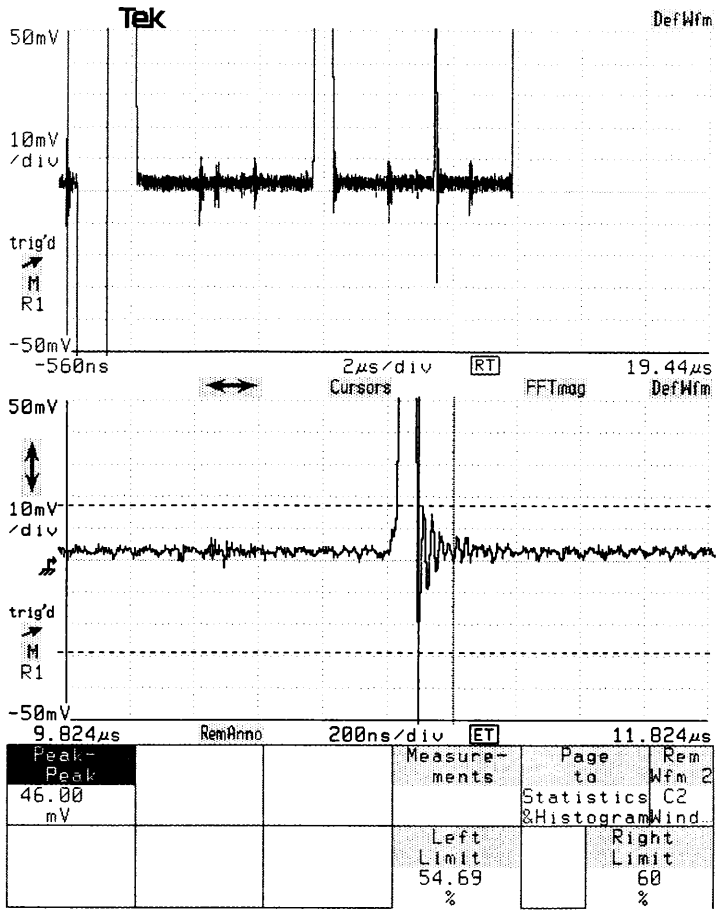

***Figure 4-3** — Measurement of the 2T Pulse Ringing*

In Case of Difficulty

If the 11A34V and 11T5H do not seem to be functioning correctly, check the following:

Are both plug-ins inserted correctly?

Make sure the plug-ins are firmly seated.

Do both plug-ins pass the mainframe power-up diagnostic tests?

The mainframe diagnostic tests will indicate a faulty plug-in that requires service.

Is the 11T5H inserted in the rightmost plug-in compartment?

The 11A34V can be used in conjunction with the 11T5H only if the 11T5H is in the rightmost plug-in compartment.

Is the trigger source set correctly on the 11T5H?

If the 11T5H is triggering from the 11A34V, the trigger source must be L1 (left plug-in, channel 1), L2 , C1 or C2 (center plug-in channel 2).

Is the trigger source set correctly on the mainframe?

If the 11T5H is the trigger source, the mainframe trigger source must be R1 (right plug-in, channel 1). Note that if all channels are turned off and a new channel is turned on, the mainframe trigger will automatically reset even though R1 was previously specified.

Is the signal source set correctly on the mainframe?

If the 11T5H is the trigger source, the signal source must be L1 (left plug-in, channel 1), L2 , C1 (center plug-in channel 1) or C2. If the signal source is connected to EXT 1 on the 11T5H, R1 (right plug-in, channel 1) is the signal source. If no signal is displayed, make sure the channel button is pressed (illuminated).

Are the Video Polarity, Line 1 Location, and Fields:Frame set correctly for your application?

NORM, AUTO, and 2:1 are the most common settings. Triggering may not occur if the Video Polarity is not set correctly.

Specifications

Performance Conditions

The specifications in Tables 5-1, 5-2, and 5-3 apply to the 11A34V Amplifier in all mainframes. These specifications apply when the mainframe is in the Enhanced Accuracy state. System specifications that depend on the type of mainframe and probes used are listed in *System Specifications*, later in this section.

Enhanced Accuracy is initiated by pushing the Enhanced Accuracy button on the mainframe after the system has reached thermal equilibrium. Enhanced Accuracy is indicated on the display and remains in effect as long as the internal temperature of the mainframe is within ±5°C of the temperature at which the calibration was performed. When a 5°C change does occur, the system reverts to Normal accuracy. In the Normal accuracy condition, those characteristics that are temperature sensitive may not remain within the limits of these specifications. The specifications are valid at an ambient temperature of 0° to 50°C, unless otherwise stated.

Table 5-1 *– Electrical Characteristics*

Function	Characteristic	Performance Requirement
Offset	Accuracy	Refer to tables 5-4 and 5-5.
	Range	1 – 99.5 mV/div. ± 1V. 100 – 995 mV/div ± 10V. 1 – 10 V/div. ± 100V.
	Resolution	Coarse: 0.25 divisions. Fine: 0.025 divisions.
Input	Maximum Input Voltage, AC or DC Coupled, Z = 75 Ω	5 V rms (0.33 W) or 0.33 watt-second pulses not exceeding 25 V peak.
	Maximum Input Voltage, AC or DC Coupled, Z = 1 MΩ	±500 V DC (DC + peak AC) Derate at 20 dB per decade from 1 MHz to 5.0 V at 100 MHz.
	Input Disconnect Threshold	5 V rms minimum.
	Impedance (75 Ω DC coupled)	75 Ω within 0.5%.
	Impedance (1 MΩ, DC coupled)	1 MΩ within 0.5%, in parallel with approximately 15 pF.
	Impedance (1 MΩ, AC coupled)	1 MΩ within 0.5%, in series with 0.022 μF and in parallel with approximately 15 pF.

Table 5-1 — Electrical Characteristics(cont)

Function	Characteristic	Performance Requirement
Input (cont.)	Impedance Bias Current (0° to 30°)	≤100 pA.
Miscellaneous	Typical Noise	.12 div 1 mV .06 div 2 mV .025 div 5 mV .014 div 10 mV - 10 V
	Channel Isolation	At least 50:1 display ratio[1] for DC to 300 MHz.
	Common Mode Rejection Ratio	At least 20:1, for DC to 50 MHz with 10 division reference signal on each channel.
	Probe Compatibility	Compatible with Level 1 and passive Level 2 TEKPROBES.[2]
Step Response	Overdrive Recovery Time	Typically <50 ns to within 1.0% of signal. At sensitivities ≥1 mV/div, for signals up to 200 V.

[1]*Display ratio* = $\frac{\text{Amplitude(V)(driven channel)}}{\text{V/div (driven channel)}} \Big/ \frac{\text{Error Amplitude(V)(undriven channel)}}{\text{V/div (undriven channel)}}$

[2]*TEKPROBE is the Tektronix name for the interface used with probes designed for the 11000-Series, CSA 404, and DSA 600-series mainframes and amplifiers. TEKPROBEs have output connectors with one or more spring-loaded coding pins.*

The Level 1 TEKPROBE uses analog encoding to communicate the probe's scale factor to the amplifier.

The Level 2 TEKPROBE uses an EEPROM to store data about the probe's transfer units, scale factor, and output voltage scale factor.

Active probes are not supported.

Table 5-2 *— Environmental Characteristics*

Characteristic	Information
Ambient Temperature (External to Mainframe)	
Operating	0° to +50°C, mainframe ambient
Nonoperating	-40° to +75°C
Humidity, Operating and Non-operating	Five days, per MIL-T-28800C. Type III, class 5 as described in 3.9.2.2 and 4.5.5.1.2.2
Altitude	
Operating	To 4,570 m (15,000 ft.)
Nonoperating	To 15,200 m (50,000 ft.)
Vibration	
Operating, installed on Flexible Extender	MIL-T-28800C, Sec. 4.5.5.3.1, Type III, class 5
Shock, Nonoperating (not Installed in mainframe)	MIL-T-28800C, Sec. 4.5.5.4.1, Type III, class 5
Bench Handling (Operating and Nonoperating)	MIL-T-28800C, Sec. 4.5.5.4.3, Type III, class 5
Packaged Product Vibration and Shock	
Vibration and bounce of Packaged Product	Meets ASTM D999-75, Method A, Paragraph 3.1 (NSTA Project 1A-B-1)
Drop of Packaged Product	Meets ASTM D775-61, Method 1, Paragraph 5 (NSTA Project 1A-B-2)
Electromagnetic Compatibility	MIL-STD-461BFCC Part 15, Subpart J, Class A VDE 0871/6.78, Class B

Table 5-3 — *Physical Characteristics*

Characteristic	Information
Weight (max)	2 lb. 10 oz (1.2 kg)
Weight of Packaged Product (max)	5 lb. 12 oz. (2.7 kg)
Dimensions (max)	See Figure 5-1.

Recommended Probes

Tektronix recommends that the following probe be used with the 11A34V:

P6134C Subminiature 10X Passive Probe with ID. With 1 MΩ inputs, the P6134's input impedance is 10 MΩ in parallel with 10.5 pF. The P6134 is a Level 1 probe. Active probes are not supported. (75 Ω active probes are not available.)

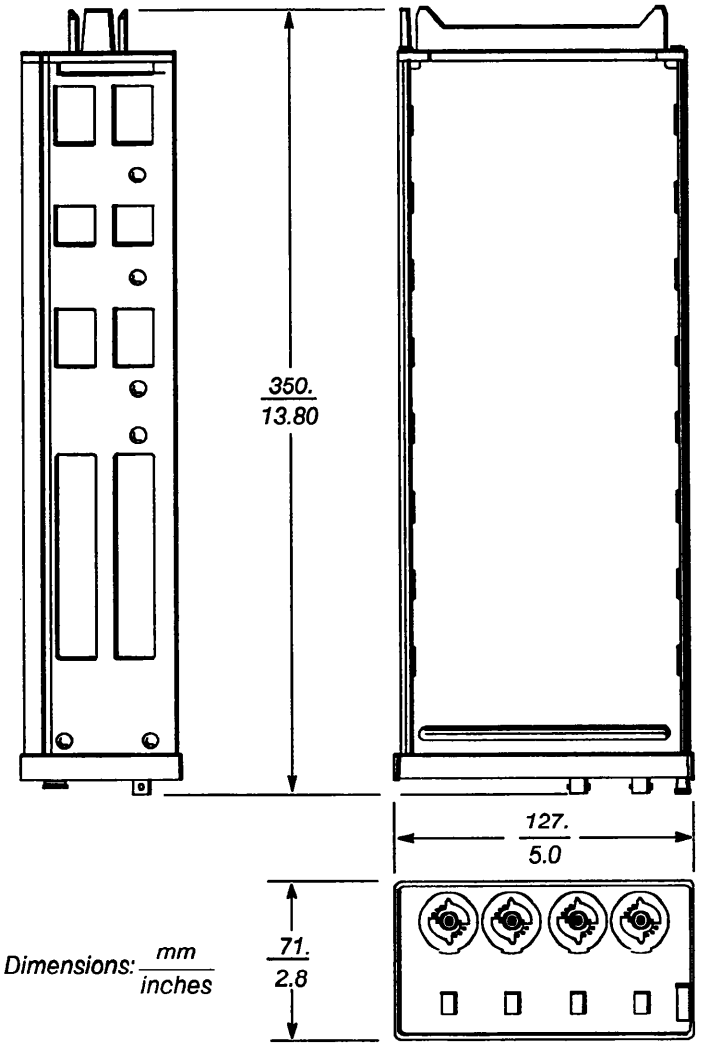

Figure 5-1 — *Dimensions of the 11A34V Amplifier*

System Specifications

System specifications depend on the combination of mainframe, amplifier, and probe. Tables 5-4 and 5-5 contain the specifications of a system consisting of the mainframe, the 11A34V Amplifier, and probes (if any). Tables 5-4 and 5-5 contain information relating to the ΔV DC Accuracy, DC Offset Accuracy, DC Balance, and Bandwidth of the system.

Table 5-4 *— Electrical Characteristics of the 11A34V Amplifier in* ***Digitizing*** *Oscilloscopes*

Characteristic	Performance Requirement			
Deflection Factor (Sensitivity)	Calibrated Range: Enhanced DC Accuracy[1], either polarity, any BW Limit. The calibrated range is 1 mV/div to 10 V/div.			
	Without Probes			
	Volts/Division	**ΔV DC Accuracy**	**DC Balance**	**DC Offset Accuracy**
	1 mV to 99.5 mV	± (0.9% + 0.012 div)	± (1 mV + 0.10 div)	± (0.20% + 0.50 mV)
	100 mV to 995 mV	± (0.9% + 0.012 div)	± (10 mV + 0.10 div)	± (0.25% + 5 mV)
	1 V to 10 V	± (0.9% + 0.012 div)	± (100 mV + 0.10 div)	± (0.25% + 50 mV)
	With P6134C Probe calibrated from 11400 or DSA 600 Series Oscilloscope Calibrator output.			
	Volts/Division	**ΔV DC Accuracy**	**DC Balance**	**DC Offset Accuracy**
	1 mV to 995 mV	± (0.9% + 0.012 div)	± (7.0 mV + 0.10 div)	± (0.25% + 5 mV)
	1 V to 9.95 V	± (0.9% + 0.012 div)	± (70 mV + 0.10 div)	± (0.25% + 50 V)
	10 V to 100 V	± (0.9% + 0.012 div)	± (0.7 V + 0.10 div)	± (0.25% + 0.5 V)
	Probe tip TC term	100 ppm/°C	NA	NA

[1]*For absolute DC accuracy of single-point measurements using Offset, add the DC Offset Accuracy, DC Balance and ΔV DC Accuracy terms.*

Table 5-5 *— Electrical Characteristics of the 11A34V Amplifier in* ***Analog*** *Oscilloscopes*

Characteristic	Performance Requirement			
Deflection Factor (Sensitivity)	Calibrated Range: Enhanced DC Accuracy,[1] either polarity, with on-screen cursors. The calibrated range is 1 mV/div to 10 V/div.			
	Without Probes			
	Volts/Division	**ΔV DC Accuracy**	**DC Balance**	**DC Offset Accuracy**
	1 mV to 99.5 V	± (1.0% + 0.04 div)	± (1 mV + 0.13 div)	± (0.20% + 0.50 mV)
	100 mV to 995 mV	± (1.0% + 0.04 div)	± (10 mV + 0.13 div)	± (0.25% + 5 mV)
	1 V to 10 V	± (1.0% + 0.04 div)	± (100 mV + 0.13 div)	± (0.25% + 50 mV)
	With P6134C Probe calibrated from 11300 Series Oscilloscope Calibrator output.			
	Volts/Division	**ΔV DC Accuracy**	**DC Balance**	**DC Offset Accuracy**
	10 mV to 995 mV	± (1.0% + 0.04 div)	± (12 mV + 0.13 div)	± (0.25% + 5 mV)
	1 V to 9.95 V	± (1.0% + 0.04 div)	± (120 mV + 0.13 div)	± (0.25% + 50 mV)
	10 V to 100 V	± (1.0% + 0.04 div)	± (1.2 V + 0.13 div)	± (0.25% + 0.5 V)
	Probe tip TC term	100 ppm/°C	NA	NA

[1] *For absolute DC accuracy of single-point measurements using Offset, add the DC Offset Accuracy, DC Balance and ΔV DC Accuracy terms. ΔV DC Accuracy applies to the difference between the Vertical Position setting and the measurement point.*