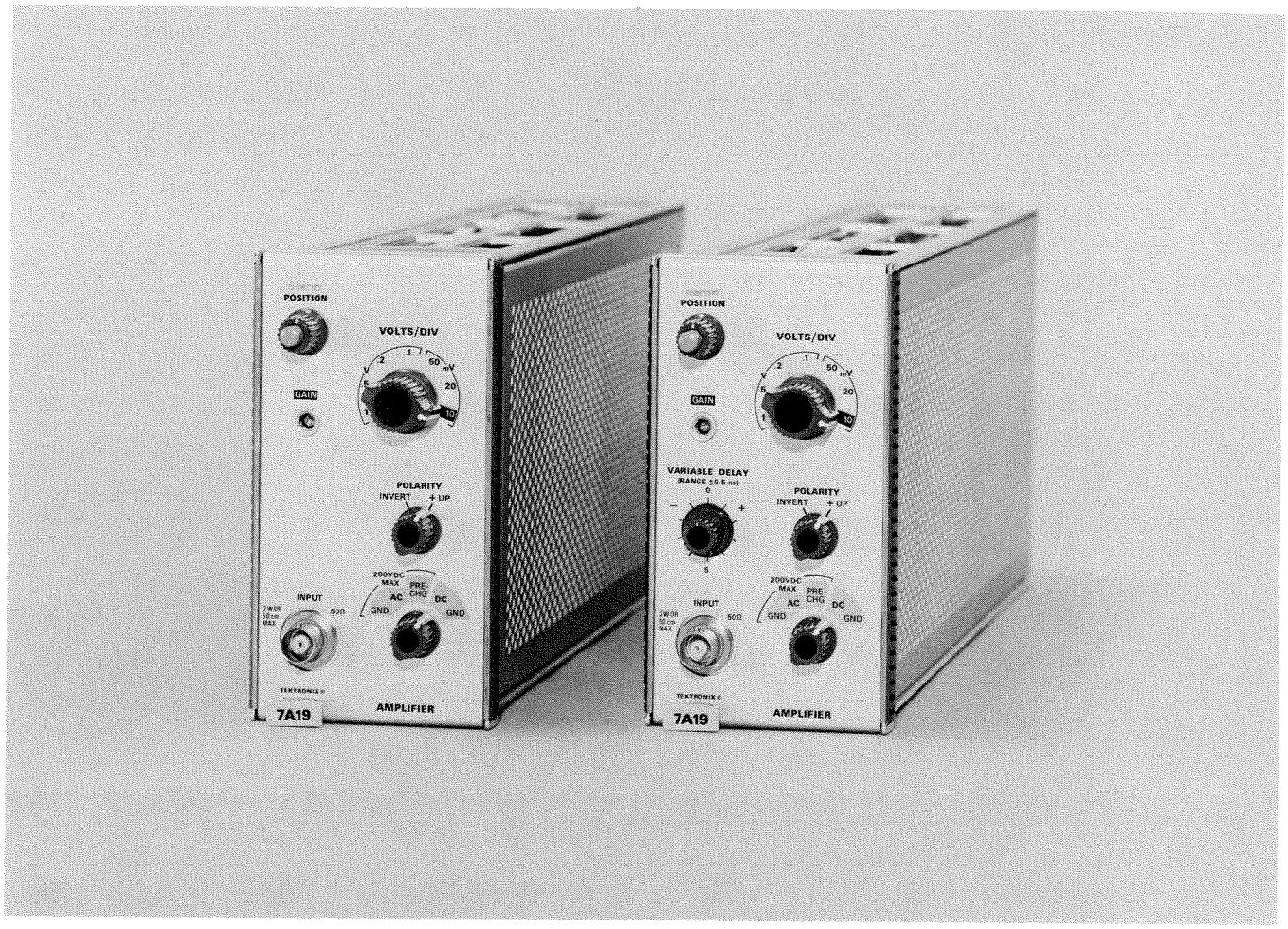
INSTRUCTION MANUAL

7A19 AMPLIFIER

OPERATORS

Serial Number _____

Tektronix, Inc. ◆ P.O. Box 500 ◆ Beaverton, Oregon 97005 ◆ Phone: 644-0161 ◆ Cables: Tektronix
070-1400-00



WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

U.S.A. and foreign TEKTRONIX products covered by U.S. and foreign patents and/or patents pending.

SPECIFICATION

Introduction

The 7A19 Amplifier plug-in unit is a wide band amplifier designed for use with Tektronix 7000-Series oscilloscopes. Readout encoding circuitry is provided in the 7A19 to allow probe coding, deflection factor readout, and IDENTIFY functions. The 7A19 can be operated in any compartment of the 7000-Series oscilloscopes, but is primarily intended for use in the vertical plug-in compartments.

The following electrical characteristics are valid over the stated environmental range for instruments calibrated at an ambient temperature of +20°C to +30°C, and after a five minute warmup unless otherwise noted.

Option 1

An optional VARIABLE DELAY may be ordered with the 7A19 to provide a signal delay of up to ±500 ps.

TABLE 1-1

ELECTRICAL

Characteristic	Performance Requirement	Supplemental Information
Deflection Factor		
Calibrated Range	10 mV/div to 1 V/div, 7 steps in a 1, 2, 5 sequence	Pre-Charge circuit may be used as a calibrated 100X attenuator
Gain Ratio Accuracy	Within 3% with GAIN adjusted at 10 mV/div when driven from 50 ohm source.	Front panel GAIN control allows calibration to mainframe.
Frequency Response (8 division reference, mainframe dependent)		
Upper Bandwidth AC or DC coupled 10 mV/div to 1 V/div	With 7400, 65 MHz; With 7500, 100 MHz; With 7700, 175 MHz; With 7900, 500 MHz	
Lower Bandwidth AC Coupled	1 kHz or less	
Maximum Input Power		
Power (AC or DC)	2 watts RMS of 50 divisions peak deflection.	
Voltage (AC coupled)	200 volts (DC + peak AC) not to exceed 2 watts RMS or 50 div. peak.	
Input Impedance		
Resistance (DC or DC GND)	50 ohms ±1 ohm	VSWR is typically less than 1.25 @ 500 MHz
Reflection Coefficient (Time Domain)	Less than 0.1 peak to peak	
Maximum Input Current	Less than 0.2 mA	

TABLE 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
IDENTIFY		Deflects trace approximately 0.3 division
Trace Positioning		At least ±8 divisions
Display Noise (Tangentially Measured)		Less than 0.1 division
DC Drift		
Drift with ambient temperature (line voltage constant)	100 μV/C° or less	
Variable Delay (option 1)		
Range	Variable from −0.5 ns to +0.5 ns	
Accuracy	To 1 ns within ±0.05 ns of dial setting	
Input Polarity		Front panel switch selects +UP or INVERT

TABLE 1-2

ENVIRONMENTAL CHARACTERISTICS

Refer to the specifications for the associated oscilloscope.

TABLE 1-3

PHYSICAL

Size	Fits all 7000-Series plug-in compartments
Weight	7A19: .9 kilograms or 2.1 lbs. 7A19 (option 1): 1.3 kilograms or 2.9 lbs.

OPERATING INSTRUCTIONS

General

To effectively use the 7A19, the operation and capabilities of the instrument must be known. This section describes front-panel control functions, general information on signal input connections, and other subjects that pertain to various measurement applications.

Installation

The 7A19 is calibrated and ready for use as received. It can be installed in any compartment of Tektronix 7000-Series Oscilloscopes, but is intended for principal use in vertical plug-in compartments. To install, align the upper and lower rails of the 7A19 with the oscilloscope tracks and insert it. The front panel will be flush with the front of the oscilloscope and the latch at the bottom left corner will be in place against the front panel when the 7A19 is fully inserted.

To remove the 7A19, pull on the latch (inscribed with the unit identification "7A19") and the 7A19 will unlatch. Continue pulling to slide the 7A19 out of the oscilloscope.

FRONT PANEL CONTROLS AND CONNECTORS

VOLTS/DIV	Selects calibrated deflection factors from 10 mV/Div to 1 V/Div; 7 steps in a 1-2-5 sequence.
POSITION	Controls the position of the trace.
IDENTIFY	Deflects the trace about 0.3 division for trace identification. In instruments with readout, also replaces readout with the word "IDENTIFY".
GAIN Adjustment	Screwdriver adjustment permits calibration of deflection factor.
POLARITY	Provides a means of inverting the display. +UP: A positive-going signal at the INPUT connector deflects the CRT display upward. INVERT: A positive-going signal at the INPUT connector deflects the CRT display downward.
Input Coupling Switch	Selects signal input coupling mode. AC: The AC component of the signal is coupled to the amplifier input while the DC component is blocked. AC GND: Grounds the amplifier input while maintaining the same AC load for the input signal. PRE-CHG: Provides a charge path for the AC coupling capacitor to pre-charge the input circuit before switching the Input coupling switch to AC. DC: Both AC and DC components of the signal are coupled to the amplifier input. DC GND: Grounds the amplifier input while maintaining the same DC load for the input signal.
INPUT Connector	Provides a means for connecting a signal.
VARIABLE DELAY (Option 1)	Delays the signal up to ±500 picoseconds by using a calibrated 10 turn dial.

OPERATING INSTRUCTIONS and CHECKOUT

Probes

Probes recommended for use with the 7A19 are the P6056 (10X) or P6057 (100X). Both probes are compatible to 50 ohm systems, and will allow optimum frequency response. These probes also contain trace IDENTIFY and readout encoding functions.

A one megohm input impedance may be achieved by using the P6051 FET Probe. With this probe, the system bandwidth of the 7A19/7904 is 450 MHz.

Vertical Gain Check and Adjustment

To check the gain of the 7A19, set the VOLTS/DIV switch to 10 mV and connect 20 mV, 1 kHz signal from the oscilloscope Calibrator to the INPUT connector. The vertical deflection should be exactly two divisions. If not, adjust the front panel GAIN control for exactly two vertical divisions.

Input Coupling

The input coupling switch allows a choice of input coupling methods. The type of display desired and the applied signal will determine the coupling to use.

The DC coupling position can be used for most applications. For AC signals with frequencies below about 1 kHz, and square waves whose low-frequency components are important to the display, it is necessary to use DC coupling to obtain a satisfactory presentation.

DC GND position disconnects the signal source from the amplifier and connects it to a resistive 50 ohm termination, thus providing the same type of load to the signal source. The input to the amplifier is also provided with a ground reference.

In the AC coupling position, the DC component of the signal is blocked by a capacitor in the input circuit. The AC coupling position provides the best display of signals with a DC component much larger than the AC component.

The PRE-CHG feature should be used when there is a possibility of having a residual charge on the input capacitor of the opposite polarity to the intended input, and when the algebraic sum of the charges may be greater than the maximum input limitations of the amplifier. To use this feature, first set the coupling switch to PRE-CHG, then connect the signal source to the INPUT and wait about two seconds for the coupling capacitor to charge, set the coupling switch to AC.

Another useful feature of the PRE-CHG position is that it can be used as a calibrated 100X attenuator having an input impedance of five kilohms in series with two microfarads. This extends the Low Frequency response to less than 20 Hz. Input power should be limited to 1/8 watt in this mode.

The AC GND position disconnects the signal source from the amplifier and connects it to a capacitive coupled 50 ohm termination, thus providing the same type of load to the signal source. The input to the amplifier is also provided with a ground reference.

VOLTS/DIV Switch

The amount of deflection produced by a signal is determined by the signal amplitude, the attenuation factor of the probe, the setting of the VOLTS/DIV switch, and the setting of the Input Coupling switch. Calibrated deflection factors represented by the VOLTS/DIV switch apply only when the probe attenuation is X1 and when the Input Coupling switch is not in the PRE-CHG position (the PRE-CHG position has an attenuation of 100X).

POLARITY Switch

The POLARITY switch provides a means of inverting the displayed signal. With the POLARITY switch set to +UP, a positive-going signal at the INPUT produces an upward deflection of the CRT display. With the POLARITY switch set to INVERT, a positive-going signal will produce a downward deflection of the CRT display.

Trace Identification and Readout Functions

When the IDENTIFY button is pressed, the trace is deflected upward about 0.3 division to identify the 7A19 trace. This feature is particularly useful when multiple traces are displayed on the CRT. In mainframes with readout, it also replaces the deflection factor readout with the word "IDENTIFY".

The 7A19 is equipped with probe encoding circuitry that, when used with a coded probe, corrects the deflection factor readout.

VARIABLE DELAY (Option 1)

The optional VARIABLE DELAY line provides a means for delaying the signal applied to the INPUT for up to ±500 ps.

APPLICATIONS

General

The following information describes the procedures and techniques for making measurements with a 7A19 and the associated Tektronix oscilloscope and time-base. These applications are not described in detail, since each application must be adapted to the requirements of the individual measurements. This instrument can also be used for many applications which are not described in this

manual. Contact your local Tektronix Field Office or representative for assistance in making specific measurements.

Peak-to-Peak Voltage Measurements (AC)

To make peak-to-peak voltage measurements, use the following procedure:

1. Apply the signal to the INPUT connector.

2. Set the Coupling switch to AC.

NOTE

For low-frequency signals below about 1 kHz, use the DC position to prevent attenuation of the signal.

3. Set the VOLTS/DIV switch to display about five vertical divisions of the waveform.

4. Set the time-base Triggering controls for a stable display. Set the time base to a sweep rate which displays several cycles of the waveform.

5. Turn the 7A19 POSITION control so the lower portion of the waveform coincides with one of the graticule lines below the center horizontal line, and the top of the waveform is within the viewing area. With the time base Position control, move the display so one of the upper peaks lies near the center vertical line (see Fig. 2-1).

6. Meausre the divisions of vertical deflection peak to peak.

NOTE

This technique can also be used to make measurements between two points on the waveform, rather than peak to peak.

7. Multiply the distance measured in step 6 by the VOLTS/DIV switch setting. Include the attenuation factor of the probe, if used.

EXAMPLE: Assume that the peak to peak vertical deflection is 4.5 divisions using a 10X attenuator probe, and the VOLTS/DIV switch is set to 1 V.

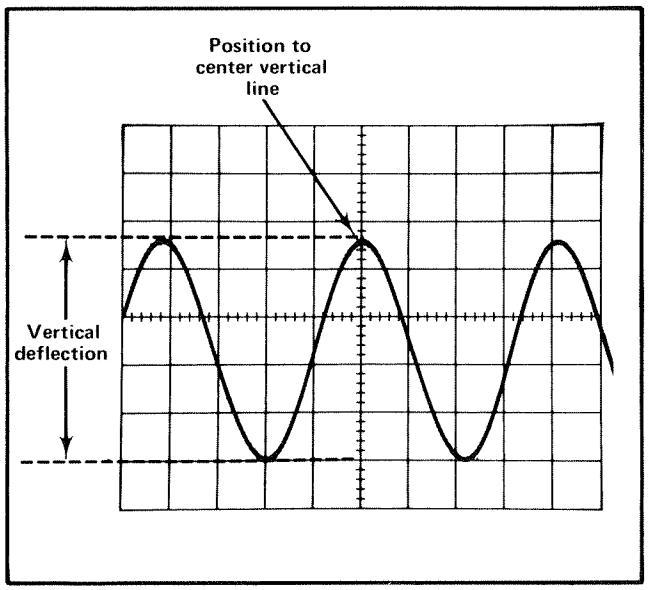


Fig. 2-1. Measuring the peak to peak voltage of a waveform.

$$\text{Volts} = \begin{matrix}\text{vertical}\\ \text{deflection}\\ \text{(divisions)}\end{matrix} \times \begin{matrix}\text{VOLTS/DIV}\\ \text{setting}\end{matrix} \times \begin{matrix}\text{probe}\\ \text{attenuator}\\ \text{factor}\end{matrix}$$

Substituting the given values:

Volts Peak to Peak = 4.5 X 1 X 10

The peak-to-peak voltage is 45 volts.

When using a coded probe and an oscilloscope equipped with readout, simply multiply the distance measured in step 6 by the deflection factor displayed on the CRT.

Instantaneous Voltage Measurements (DC)

To measure the DC level at a given point on a waveform, proceed as follows:

1. Connect the signal to the INPUT connector.

2. Set the VOLTS/DIV switch to display about five divisions.

3. Set the Coupling switch to GND, and position the trace to the bottom graticule line or other reference line. If the voltage is negative with respect to ground, position the

trace to the top graticule line. Do not move the POSITION control after this reference line has been established.

4. Set the Coupling switch to DC. The ground reference line can be checked at any time by switching to the GND position.

NOTE

To measure a voltage level with respect to another voltage rather than ground, make the following changes to Step 4. Set the Coupling switch to DC and apply the reference voltage to the INPUT connector. Then position the trace to the reference line and disconnect the reference voltage.

5. Set the time-base Triggering controls for a stable display. Set the Time Base sweep rate for an optimum display of the waveform.

6. Measure the distance in divisions between the reference line and the point on the waveform at which the DC level is to be measured. For example, in Fig. 2-2 the measurement is between the reference line and point A.

7. Establish the polarity of the waveform. With the POLARITY switch in the NORM position, any point above the reference line is positive.

8. Multiply the distance measured in step 6 by the VOLTS/DIV switch setting. Include the attenuation factor of the probe, if used.

EXAMPLE: Assume the vertical distance measured is 3.6 divisions (see Fig. 2-2) and the waveform is above the reference line, using a 10X probe with a VOLTS/DIV switch setting of 0.5 V.

Using the formula:

Instantaneous voltage	=	vertical distance (divisions)	X polarity X	VOLTS/DIV setting	X	probe attenuation factor

Substituting the given values:

Instantaneous Voltage = 3.6 X 1 X 0.5 V X 10

The instantaneous voltage is 18 volts.

Matching transit times using two 7A19's, one having VARIABLE DELAY (Option 1)

In some applications it is necessary to view the time relationship of two signals, one with respect to the other.

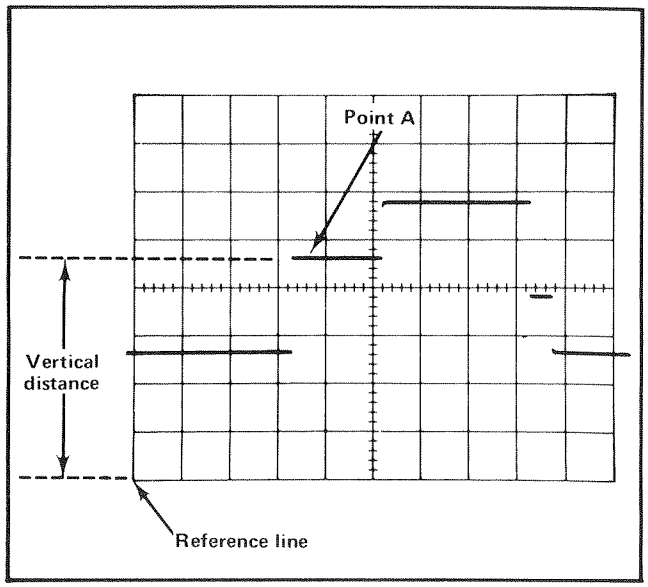


Fig. 2-2. Measuring instantaneous voltage with respect to same reference.

With high speed signals, the transit times of the probes and amplifiers can distort the true time relationship of the two signals. By using the VARIABLE DELAY (option 1), the transit times between two units can be matched to within 50 ps, thus giving a true time relationship of the signals being viewed.

For matching transit times of two 7A19 with probes, proceed as follows:

1. Install the 7A19 without the VARIABLE DELAY option in the left vertical plug-in compartment.

2. Install the 7A19 with VARIABLE DELAY option in the right vertical plug-in compartment.

3. Connect the probes to a common signal source of greater than 100 kHz and adjust the time-base unit for the fastest sweep available.

4. Set the Trigger Source switch to left Vert, and Vertical Mode to Alternate.

5. Set both 7A19's to the same deflection factor settings.

6. Center both displays vertically.

7. Adjust VARIABLE DELAY so that the two displays are superimposed. The transit times of both units are now matched.