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User Manual

Tektronix

11A16
Two-Channel Current Amplifier

070-7763-00

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

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General Information

This supplement to the *User Reference* manual for your mainframe describes the features and operation of the Tektronix 11A16 Two-Channel Current Amplifier. The *11A16 Service Reference* manual provides service information and test procedures for the 11A16 Amplifier.

This manual discusses the performance of 11000 and DSA Series Mainframes that are configured with the 11A16 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. Unique capabilities and limits of the 11A16 are discussed in this manual.

Features

- Two independent current amplifier channels
- Coarse and fine sensitivities from 1 mA to 2 A/division with the A6302 probe and 5 mA to 10 A/division with the A6303 probe
- Calibrated DC offset adjustment (0.25 divisions/increment, coarse; 0.025 divisions/increment, fine)
- DC to 50 MHz bandwidth (with the A6302 Current Probe); DC to 15 MHz bandwidth (with the A6303 Current Probe)
- Convenient probe degaussing
- Display and trigger polarity can be individually inverted
- Coupling: AC, DC, or Off
- Programmable over the mainframe GPIB and RS-232 interfaces

Mainframe Compatibility

The 11A16 amplifier is designed for use in 11300, 11400, DSA 600, and some CSA Series mainframes; it is not compatible with 11800 Series mainframes. Many performance parameters, such as vertical accuracy, and some functions, such as channel deskew, depend on the mainframe and probes used. Detailed performance specifications for different systems are included in the System Specifications section at the end of this manual.

Mainframe Firmware

The 11A16 Amplifier will work best when your mainframe has an updated firmware version. However, your mainframe will operate properly with the 11A16 when the firmware versions listed in Table1-1 are installed in your mainframe.

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Table 1-1 — Mainframe Firmware Compatibility

Mainframe	Firmware Version
11301/11302	2.4 or later
11301A/11302A	1.0 or later
11401/11402	3.0 or later
11402A/11403	2.2 or later
11403A, CSA 404	3.0 or later
DSA 601/DSA 602	1.1 or later

Contact your Tektronix field office for the most recent firmware version for your mainframe.

Degauss in 11300 Series – If you change any 11A16 settings during the two second probe Degauss process, it can result in a **Plugin Communication Failure** error which is displayed. The error occurs because the 11A16 ignores mainframe requests during deskew. Commands sent to the 11A16 over the ASCII interface can also produce this error.

When degauss is complete, the 11A16 is fully operational. If an error does occur it can be easily cleared after degauss by changing any 11A16 setting.

Probe Calibration and Deskew

When you select the probe calibration function **Probes** from the mainframe UTILITY menu, the mainframe performs vertical probe calibration and time deskew on the channel you select. Calibration adjusts sensitivity and offset parameters for greatest accuracy. Then the deskew operation attempts to match the time delay between the selected channels.

The deskew operation of most mainframes will correct for delay differences up to 15 ns between channels. This delay includes the cable propagation time and rise time of the probes and amplifiers. If the delay difference between channels is greater than 15 ns, a complete automated deskew will not be possible. Refer to *Probe Operation* on page 2-5 for detailed information on probe degauss, calibration and deskew.

Certain mainframes have unique deskew limitations as follows:

11300 Series – The deskew range is ±0.5 ns, which is insufficient to accommodate the delays in the 11A16 and current probes.

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DSA600 Series—In addition to the ± 15 ns compensation limit between channels, deskew can fail when the 11A16 is in the LEFT compartment, interleaved sampling is invoked (1 or 2 GSample/second), and you attempt to deskew a current probe. During deskew calibration, in this configuration, the digitizer Interleave algorithm performs a rise time measurement on the current probe signal looking for a rise time of 3 ns or less. The low-bandwidth current probes will fail this rise time test and cause the deskew operation to terminate. Installing the 11A16 Amplifier in the CENTER or RIGHT compartment resolves this problem.

Refer to the Tektronix Corporate Catalog for complete information about compatibility of amplifiers and mainframes.

Components of this Supplement

This supplement contains the following sections:

- **General Information**—discusses information that you should know about the 11A16 Amplifier before using it, such as safety information, compatibility with 11000 and DSA Series Mainframes, installation and removal, operating temperature, and available accessories.
- **Operation**—explains how to operate the amplifier in 11400 and DSA Series Digitizing Mainframes and 11300 Series Analog Oscilloscopes. This section also explains the use of probes.
- **Specifications**—lists electrical, environmental, physical, and system specifications of the amplifier.

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Safety Summary

This general safety information applies to all operators and service personnel. Specific warnings and cautions are found throughout this supplement, but do 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

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

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Grounding the Amplifier

The 11A16 Amplifier is grounded through the grounding conductor of the mainframe power cord. To avoid electrical 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 insulators) can cause an electrical shock.

Do Not Operate in Explosive Atmospheres

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

Do Not Remove Covers or Panels

To avoid personal injury and damage to the amplifier from overheating, do not operate this amplifier without the panels or covers.

Initial Inspection

After unpacking, inspect the amplifier for physical damage that may have occurred in transit. This amplifier was inspected mechanically and electrically before shipment to meet all specifications. To check that the amplifier is working correctly, perform the Checks and Adjustments procedure in the *11A16 Service Reference* manual. If the amplifier has a problem, contact your local Tektronix field office or representative.

Operating Temperature

The 11A16 Amplifier 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. If stored at temperatures outside the operating limits, allow the chassis to reach the specified operating temperature range before applying power.

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Installing and Removing the Amplifier

To install the amplifier in the mainframe, set the mainframe ON/STANDBY switch to STANDBY. Align the grooves in the top and bottom of the amplifier with the guides in the mainframe plug-in compartment, then insert the amplifier into the mainframe until its front panel is flush with the front panel of the mainframe. (See Fig. 1-1.)

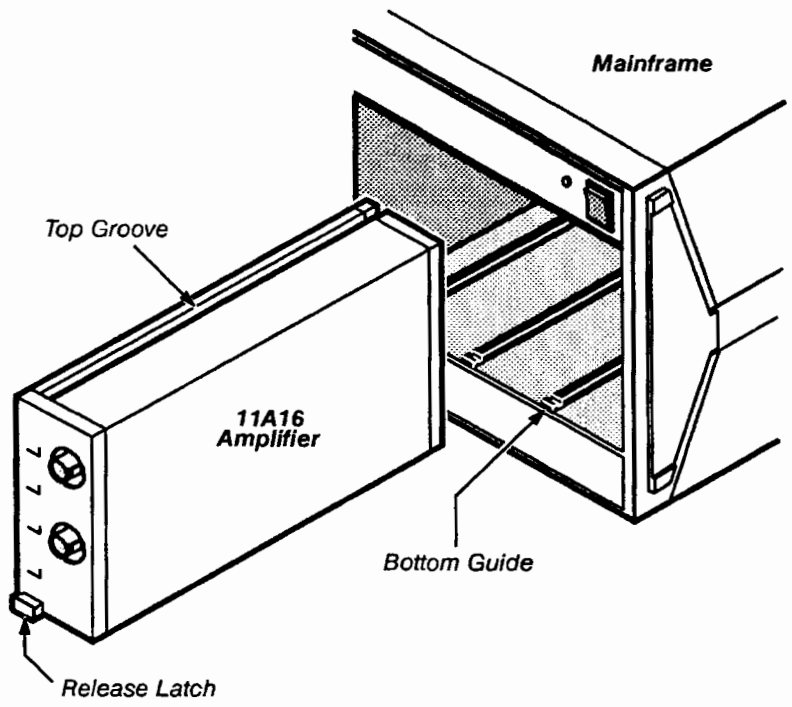


***Figure 1-1** — Installing and Removing the Amplifier*

CAUTION

Always set the mainframe ON/STANDBY switch to STANDBY before installing or removing the amplifier. This prevents damage to the amplifier and the mainframe.

If the green indicator light remains ON when the STANDBY position is selected, then the switch has been disabled internally. In this case, to install or remove the amplifier, use the mainframe PRINCIPAL POWER SWITCH on the rear panel to shut OFF the power. This prevents damage to the amplifier and the mainframe. To enable the ON/STANDBY switch, contact qualified service personnel.

When the amplifier is installed in the right compartment of an 11300 Series Oscilloscope, it provides the X (horizontal) component of an XY display, or it provides a trigger signal for the time base of the oscilloscope.

To remove the amplifier from the mainframe, set the mainframe ON/STANDBY switch to STANDBY. Pull the release latch to disengage the amplifier from the mainframe, then slide the amplifier straight out of the compartment.

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Instrument Accessories

- **Voltage Adapter** (Tektronix part number 015-0598-00)—used by service personnel during instrument calibration. When using the Voltage Adapter, the input impedance of each channel is 50 Ω. (See Fig. 1-2.)

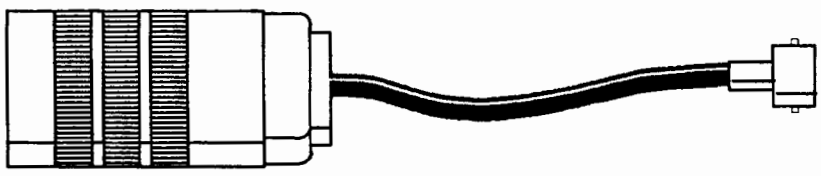


***Figure 1-2** — Voltage Adapter*

- **Current Loop Adapter** (Tektronix part number 015-0601-00)—converts the voltage calibration output of 11000 and DSA Series Mainframes into a current source for calibrating 11A16-compatible current probes. The Current Loop Adapter has a connection bar to directly accept the measuring head of most Tektronix current probes. (See Fig. 1-3.)

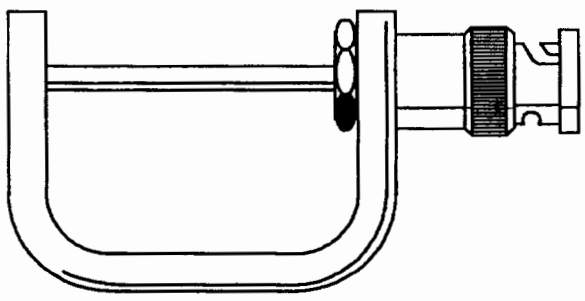


***Figure 1-3** — Current Loop Adapter*

CAUTION

Use the 0 Ω Current Loop Adapter with the 11A16 Amplifier only during probe calibration. If the adapter is connected to the mainframe during power-up or Enhanced Accuracy calibration, the instrument calibration may become corrupted.

- **Current Probes**—A6302 current probes with Serial Numbers greater than B050000, and A6303 probes are recommended for use with the 11A16 Amplifier. The recommended A6302 probes have nickel-plated connectors which provide superior immunity from electromagnetic noise.

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Packaging for Shipment

If shipping the 11A16 Amplifier to your local Tektronix service center for repair, attach a tag to it with the following information:

- Name and address of the amplifier owner
- Name of a person at your firm who can be contacted about the amplifier
- 11A16 Amplifier type and serial number
- Description of the service required

Save and reuse the original carton and packaging material when shipping the 11A16 Amplifier by commercial transportation. If the original carton is not available, then package the 11A16 Amplifier as follows:

☐ Step 1: Obtain a corrugated-cardboard carton with inside dimensions at least six inches (15 cm) greater than the 11A16 Amplifier dimensions. Use a carton with a bursting test strength of at least 200 pounds per square-inch.

☐ Step 2: Wrap the 11A16 Amplifier with anti-static sheeting, or its equivalent, to reduce the risk of static damage and to protect the finish.

☐ Step 3: Tightly pack dunnage or urethane foam between the carton and the 11A16 Amplifier to cushion it on all sides. Allow three inches of packing on each side.

☐ Step 4: Seal the carton with shipping tape or with industrial staples.

☐ Step 5: Mark the address of the Tektronix service center and your return address on the carton in one or more prominent places.

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Operation

This section discusses using the 11A16 Amplifier in 11400 and DSA Series Digitizing Mainframes. It also notes when operation differs for 11300 Series Analog Oscilloscopes. Channels can be displayed and probes can be degaussed from the amplifier front panel, while all other functions are controlled from the mainframe.

Displaying Waveforms

The 11A16 Amplifier has two channel buttons on its front panel the CH 1 and CH 2 buttons. (Refer to Fig. 2-1.) Pressing the button turns display of the channel on or off. When displaying a channel, the label next to the channel's button is lit.

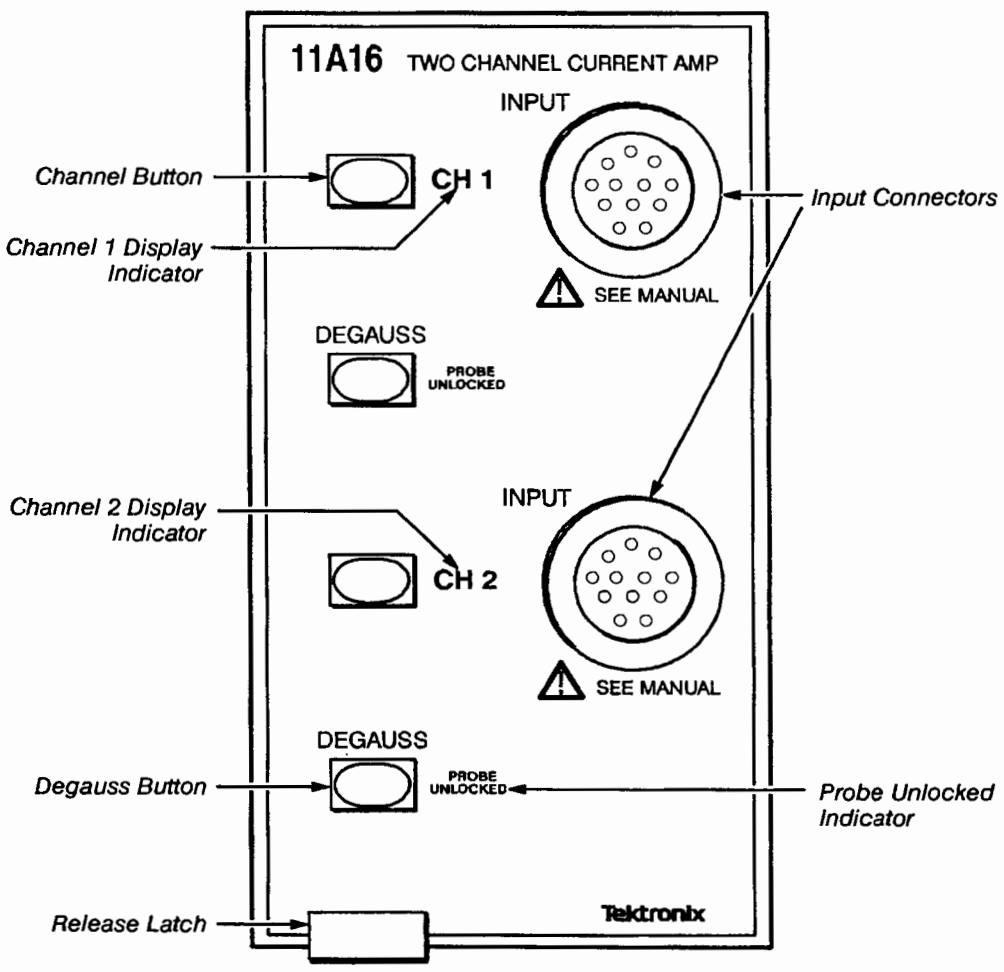


Figure 2-1 — 11A16 Amplifier Front Panel

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Alternatively, you can turn the display of a channel on or off from the mainframe. For 11400 and DSA Series Mainframes, you can display a waveform using the **DefWfm** icon and you can remove a waveform using the **Rem Wfm** selector in the knob menu. For 11300 Series Oscilloscopes, you can display a waveform using the **Scope** selector in the **Waveform** major menu.

Functions Controlled by the Mainframe

Most functions of the amplifier are controlled by the mainframe, and their operation is described in detail in the *User Reference* manual for your mainframe. The mainframe controls the following functions:

- Sensitivity (vertical size), with a range of 1 mA to 2 A/division for the A6302 Current Probe and a range of 5 mA to 10 A/division for the A6303 Current Probe
- Offset and vertical position
- Bandwidth limit (upper limit of 50 MHz for the A6302 Current Probe and 20 MHz for the A6303 Current Probe)
- Display and trigger polarity (normal or inverted)
- Combining waveforms
- Coupling (AC, DC, or Off)

This section provides information specific to the 11A16 Amplifier for these functions.

Sensitivity and Offset

Offset has the units of the input signal, which are amperes for an 11A16 Amplifier using a current probe. Mainframes use offset to position the waveform on the screen by subtracting a specified current from the input signal. In YT (signal vs. time) mode, offset determines vertical position, but when the amplifier provides the X component of an XY display, offset determines horizontal position.

Sensitivity, or vertical size, magnifies or compresses the signal about the vertical center of the graticule. The units of sensitivity are amperes/division.

Vertical position is a display feature of the mainframe that places the waveform on a specified graticule line. The units of vertical position are divisions with a range of ± 4 divisions from graticule center. For example, to simultaneously view two waveforms, use vertical position to place the waveforms one above the other on the mainframe display.

To control offset and sensitivity, touch the vertical icon on the mainframe display and adjust the Position and Size control knobs. For example, to examine a portion of the input signal in greater detail, adjust the sensitivity to magnify the desired portion of the signal and then adjust the offset to position the signal to the display location established by the vertical position. (For 11300 Series Oscilloscopes, press the VERTICAL POSition, VERTICAL OFFSET, or VERTICAL SIZE button to access the **Control** menu.)

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Sensitivity and offset have coarse and fine settings. The fine setting changes the sensitivity 1%. For example, if the sensitivity is set to 1 A/division, rotating the fine-control knob one increment adds or subtracts 0.01 A/division to the sensitivity. The coarse setting changes the sensitivity in a 1, 2, 5 sequence. For example, if the sensitivity is set to 490 mA/division, rotating the coarse-control knob one increment changes the setting to either 200 or 500 mA/division. For the A6302 Current Probe, the sensitivity range is 1 mA/division to 2 A/division; for the A6303 Current Probe, the sensitivity range is 5 mA/division to 10 A/division. For offset, the coarse knob changes the setting 0.25 divisions/increment and the fine knob changes the setting 0.025 divisions/increment.

Bandwidth Limit

Bandwidth limits reduce the unwanted noise or interference occurring above a specified frequency. Two four-pole bandwidth limit filters are available for each channel of the amplifier. To set the bandwidth on 11400 and DSA Series Mainframes, use the **Bandwidth** selector of the **Input Parameters** pop-up menu on the **Waveform** major menu; on 11300 Series Oscilloscopes, set the bandwidth (or HF limit) using the **Control** menu.

Bandwidth limits vary with your amplifier configuration as follows:

- With the A6302 Current Probe: 50 MHz and 20 MHz
- With the A6303 Current Probe: 15 MHz and 10 MHz

Since the current probe limits the upper bandwidth to at least 50 MHz, the 100 MHz filter is automatically enabled to reduce noise.

Display and Trigger Polarity

Display and trigger signals can be independently inverted and summed. To invert a display signal, touch the **DefWfm** icon on 11400 and DSA Series Mainframes or the **Scope** selector of the **Waveform** major menu on 11300 Series Oscilloscopes. Enter a minus sign (–) from the numeric keypad before selecting a channel, then touch the **Enter Desc** selector to enter the waveform description.

To invert a trigger signal, use the **Trigger** major menu (**Source Description** pop-up menu for 11400 and DSA Series Mainframes or the **Slope** selector for 11300 Series Oscilloscopes). Once again, enter a minus sign (–) before selecting a channel.

Adding and Subtracting Waveforms

Signals can be combined by passing each current through the probe jaw, although this method may introduce coupling errors. Alternatively, addition and subtraction of input signals can be controlled by defining complex waveforms in the mainframe. However, the complex waveform may be inaccurate if the input signals are sampled at different times. This section provides techniques to reduce errors when combining signals with the mainframe.

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For 11400, CSA 400 and DSA Series Mainframes, the individual channels need not be displayed before entering a waveform description that combines them. Use the **DefWfm** icon's **Vertical Description** pop-up menu to enter a waveform description.

For 11300 Series Analog Oscilloscopes, each channel must be displayed within its linear operating range before combining the waveforms. Use the **Scope** selector of the **Waveform** major menu to enter a waveform description.

The following guidelines should be used when combining waveforms. When you are adding or subtracting waveforms, use signals from separate plug-in amplifiers, instead of using different channels from the same plug-in amplifier. Samples from one channel of each plug-in compartment are acquired simultaneously, so each channel of the 11A16 Amplifier is sampled at a different time. Therefore, a complex waveform that is composed of signals from the two channels of an 11A16 Amplifier may be inaccurate. Signals that are entirely repetitive and related to the trigger can be added or subtracted accurately, even if sampled at different times.

When using channels from different plug-in compartments, the following two problems limit the accuracy of the complex waveform:

- Each waveform in memory is constantly being updated, so some waveform points are older than others. Even if samples are taken simultaneously, it is possible for a sample to be replaced in memory with a newer value before the waveform is processed and displayed.
- Delay differences can occur between channels of different amplifiers due to differences in the length of the probe cables. These delays are normally removed by deskewing the probes and amplifier channels. In this case, samples are taken simultaneously, but the display is manipulated to correct for timing differences. The A6303 probe has a long cable length that can cause a time difference of up to 14 ns; the A6303 approaches the maximum delay difference that the mainframe can compensate.

The solution to both problems is to invoke averaging to suppress signals and noise unrelated to the trigger. On 11400 and DSA Series Mainframes, invoke averaging from the **Acquire Description** pop-up menu of the **Waveform** major menu.

Effects of Input Coupling Mode on DC Circuit Loading

The A6302 and A6303 Current Probes use Hall effect sensors to isolate the test circuit from the amplifier; hence, test circuit loading is very small. Selection of AC and DC coupling determines the signal components passed to the mainframe, not circuit loading.

AC Coupling Mode – Use AC coupling to display the AC component of your signal. The lower frequency limit is 10 Hz.

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Off Coupling Mode—Off mode connects the amplifier input to instrument ground. Always use the Off mode when connecting the amplifier input to a circuit that may have more than the maximum current rating of the probe. Wait a few seconds before switching to AC or DC coupling.

DC Coupling Mode—Use DC coupling to display AC and DC components of your signal, therefore displaying the full bandwidth. Two ways of unintentionally invoking DC coupling in the amplifier are:

- Selecting Autoset, which searches for a DC voltage.
- Recalling a stored setting that uses DC coupling.

CAUTION

Always use caution when working with currents in excess of the maximum input current specification (10 A), since they may damage the amplifier input relay. To prevent amplifier damage, switch coupling to DC when more than 10 A is present at the amplifier input.

Probe Operation

The 11A16 Amplifier has two 12-pin connectors for attaching current probes. You should degauss and calibrate current probes before taking measurements with them. This section discusses how to degauss and calibrate current probes. It also discusses how to invoke mainframe functions with the Probe ID button. For more information about probe operation, refer to the *User Reference* for your probe.

To connect a current probe to the amplifier, align the tongue on the inner connector and turn the outer connector clockwise.

Note: *After connecting the probe, always let it warm up for about 10 minutes before you degauss and calibrate it. Probe performance will drift some during this warm-up period.*

When you select probe calibration from the mainframe UTILITY menu, the mainframe performs vertical probe calibration and time deskew on the channel you select. Calibration adjusts gain and offset parameters for greatest accuracy. Then the deskew operation attempts to match the time delay between the selected channels.

The deskew operation of most mainframes will correct for delay differences up to 15 ns between channels. This delay includes the cable propagation time and rise time of the probes and amplifiers. If the delay difference between channels is greater than 15 ns, a completely automated deskew will not be possible

You should be aware of the following limitations and interactions:

- Always deskew current probes first, then calibrate the voltage amplifier channels that you plan to use.
- Current probes with cables longer than two meters can not be deskewed against voltage probes with short cables. This is due to the long propagation time through the two meter cables.

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- A6303 probes can not be deskewed because of the slow rise time inherent in this 15 MHz bandwidth probe.
- Deskew values set in probe calibration and deskew are maintained until the channel is again calibrated.
- An electrically or magnetically noisy environment can cause deskew failure.

Degaussing the Probe

The 11A16 Amplifier front panel has a DEGAUSS button for each channel. Degaussing a probe removes the stored probe-core-magnetism and corrects for any offset errors in the probe and amplifier. The probe should be degaussed every time it is connected to the amplifier. The probe should be degaussed immediately before calibration to minimize DC drift.

Degauss a probe as follows:

☐ Step 1: Connect a current probe to an 11A16 Amplifier input. Do not connect the probe to a signal source. Let the probe warm up for about 10 minutes after connection.

☐ Step 2: Lock the probe. If the probe is unlocked, the PROBE UNLOCKED indicator on the 11A16 Amplifier front panel is lit.

☐ Step 3: Turn on the channel display using the channel button on the 11A16 Amplifier front panel.

☐ Step 4: Press the DEGAUSS button to degauss the probe. (The channel display will not be operational until the DEGAUSS button is pressed.)

Note: *When degaussing a current probe in an 11300 Series mainframe, do not change any 11A16 settings while the degauss process is running. Doing so can result in a* ***Plug-in Communication Failure*** *error. This error results from the 11A16 ignoring mainframe requests during degauss. Change any 11A16 setting to remove the displayed error.*

Calibrating the Probe with Digitizing Mainframes

You must calibrate and deskew a probe before using it with an amplifier. Current probes cannot be deskewed when either a 2 meter or longer probe is compared to a short BNC connection on a voltage channel or when a 25 meter probe cable is compared to anything shorter. For information on the limitations of mainframe deskew and related topics, refer to *Probe Calibration and Deskew* on page 1-2. For a list of calibration error messages, refer to Table 2-1 on page 2-8.

With 11400 Series, CSA404 and DSA Series Mainframes, the procedure for calibrating current probes is as follows:

☐ Step 1: Ensure that the EA (Enhanced Accuracy) icon is displayed. If not, press the ENHANCED ACCURACY button on the front panel of the mainframe.

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CAUTION

Enhanced Accuracy should NOT be invoked when the Current Loop Adapter is connected to the CALIBRATOR output of the mainframe. The Current Loop Adapter places a considerable load on the precision voltage reference in the mainframe. During probe calibration, the output voltage demand of the amplifier is sufficiently low that the reference remains in its linear operating range. However, some plug-in units (such as the 11A30 Series Amplifiers, which have 1 MΩ input impedance) demand approximately 10 V during an Enhanced Accuracy calibration. These large voltage demands may result in a calibration error.

Ensure that Enhanced Accuracy is in **Manual** mode by checking the **Instrument Modes** pop-up menu of the **Utility 1** major menu. Errors may occur if Enhanced Accuracy is automatically invoked during probe calibration.

☐ Step 2: Attach the probe to the amplifier, let the probe warm up for at least 10 minutes, and then degauss it. Refer to *Degaussing the Probe* on page 2-6.

☐ Step 3: Install the Current Loop Adapter on the CALIBRATOR output BNC connector on the mainframe front panel. To install the adapter, align the grooves in the BNC connector and turn clockwise.

☐ Step 4: Attach the current probe head to the round test bar of the Current Loop Adapter. The arrow on the probe indicates the direction of positive "current" flow. The arrow must be pointing away from the mainframe. If the polarity of the probe is incorrect or if the probe is not connected, the following warning message will be displayed during calibration:

Connect Probe to Calibrator and Restart Operation

To correct this problem, reverse the current probe connection and restart the calibration procedure.

☐ Step 5: Select the **Probes** pop-up menu in the **Utility 1** major menu.

☐ Step 6: Select the channel to calibrate in the **Calibrate**, **Deskew**, and **Compensate Probes** section of the **Probes** pop-up menu. (For example, L1 for left plug-in compartment, channel 1.)

☐ Step 7: Successful completion of probe calibration and deskew is indicated in different ways depending on the mainframe/probe combination. For example, the A6302 Current probe will typically pass calibration and deskew, while the A6303 Current probe will pass calibration, but not deskew.

Their are three possible cases when calibrating a mainframe/current probe combination. They are:

a. Passed gain calibration and passed deskew.

b. Failed gain calibration and deskew not attempted.

c. Passed gain calibration but failed deskew.

Table 2-1 shows how to determine the result of A6302 and A6303 probe calibration.

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Table 2-1 — Determining Probe Calibration Results

11400, CSA404 Message	DSA 600 Series Message	A6302 Status	A6303 Status
Probe Cal Complete. Deskew Passed	Probe Cal. Passed.	Passed Gain and Deskew.	Passed Gain and Deskew. *(Not expected for A6303.)*
Probe Calibration Error	Probe Calibration Failed: Probe Gain/Offset Calibration Error.	Failed Gain, Deskew not run. Degauss and rerun. Try good probe and check connections. Otherwise, needs service.	Failed Gain, Deskew not run. Degauss and rerun. Probe Gain low, adjust probe Step Response. Otherwise, needs service.
Probe Cal Complete. Deskew Failed.	Probe Calibration Failed: *(and one of the following error messages)* DIG high frequency compensation failed. DIG risetime too slow for high frequency compensation. DIG interleaf alignment calibration failed. DIG trigger IC internal path skew failed. DIG failure, unrecognized type. No channel selected. Unable to acquire calibrator signal. DIG deskew. Coarse channel deskew. Fine channel deskew. Coarse main trigger deskew. Fine main trigger deskew. Coarse window trigger deskew. Fine window trigger deskew.	Passed Gain, failed Deskew. Check connections. Degauss and rerun.Too great a difference in probe length. Otherwise, needs service. See list following Step 10 for additional deskew failure causes.	Passed Gain, failed Deskew. *(Expected result for A6303 in all mainframes due to slow probe risetime.)*

☐ Step 8: Ignore any probe compensation message as current probes do not have voltage-probe-type compensation.

☐ Step 9: Repeat the procedure for a second probe by selecting **Select Next Chan** in the **Probe Compensation** pop-up menu, or select **Exit Comp** to finish the procedure.

☐ Step 10: When all current probes have been calibrated, remove the Current Loop Adapter. If Enhanced Accuracy calibration is invoked when the Current Loop Adapter is attached, the calibration can be corrupted.

Deskew failures could also be caused by one of the following:

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- When calibrating the A6303 Probe, the deskew fails because the deskew range of all mainframes is insufficient to handle the slow rise time of the probe.
- The deskew fails when the 11A16 is in the LEFT compartment of a DSA Series mainframe.This is because interleaved sampling is invoked (1 or 2 GSample/second) when you initiate probe deskew. During deskew calibration, in this configuration, the digitizer Interleave algorithm performs a rise time measurement on the current probe signal looking for a rise time of 3 ns or less. The low-bandwidth current probes will fail this rise time test and cause the deskew operation to terminate. Installing the 11A16 Amplifier in the CENTER or RIGHT compartment resolves this problem.
- The current probe was not degaussed recently.
- An incompatible software version on the mainframe.
- An electrically or magnetically noisy environment.

If resolving these conditions does not correct the problem, then the equipment probably has a hardware failure.

Calibrating the Probe with Analog Oscilloscopes

You must calibrate a probe before using it with an amplifier. Note that the deskew range in 11300 Series Analog Oscilloscopes is ±0.5 ns, which is insufficient to accommodate the delays in the 11A16 and current probes. The procedure for calibrating probe gain in 11300 Series mainframes is as follows:

☐ Step 1: If the EA (Enhanced Accuracy) icon is not displayed, then press the ENHANCED ACCURACY button on the front panel of the mainframe.

CAUTION

Enhanced Accuracy should NOT be invoked when the Current Loop Adapter is connected to the calibrator output of the mainframe. The Current Loop Adapter places a considerable load on the precision voltage reference in the mainframe. During probe calibration, the output voltage demand of the amplifier is sufficiently low that the reference remains In its linear operating range. However, some plug-in units (such as the 11A30 Series Amplifiers, which have 1 MΩ input impedance) demand approximately 10 V during an Enhanced Accuracy calibration. These excess voltage demands may result in a calibration error.

Ensure that Enhanced Accuracy is in **Manual** mode by checking the **Cal**ibration menu of the **Utility** major menu. Errors may occur if Enhanced Accuracy is automatically invoked during probe calibration.

☐ Step 2: Attach the probe to the amplifier and let it warm up for about 10 minutes. Then degauss it as described under *Degaussing the Probe* earlier in the section.

☐ Step 3: Install the Current Loop Adapter on the CALIBRATOR output BNC connector on the mainframe front panel. To install the adapter, align the grooves in the BNC connector and turn clockwise.

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☐ Step 4: Attach the current probe head to the round test bar of the Current Loop Adapter. The arrow on the probe indicates the direction of positive "current" flow. The arrow must be pointing away from the mainframe.

☐ Step 5: Select probe calibration in the Utility major menu, by touching **Probe Cal**.

☐ Step 6: You will be prompted to press the Probe ID button which is not implemented on current probes. Instead, press the appropriate channel (CH 1 or CH 2) and DEGAUSS buttons *simultaneously* to start the calibration. Refer to the *Probe ID* section of this manual for a further description of this function.

If the polarity of the probe is incorrect or if the probe is not connected, the following warning message is displayed during the calibration:

No cal signal detected: Attach probe to hook

To correct this problem, reverse the current probe and restart the calibration procedure.

☐ Step 7: After the probe calibration is successfully completed, the following message is displayed:

Probe cal completed: check LF compensation

This compensation is not required for a current probe.

If an error occurs during the calibration process, the following error message may appear on the mainframe display:

Probe cal failed

The calibration error could be caused by:

- A probe that is not properly degaussed.
- An A6303 whose probe gain is too low. The *A6303 Current Probe Adjustment* described in the Service Reference is needed. Refer the probe to your service department for adjustment.
- The Current Loop Adapter is faulty.

If these solutions do not correct the problem, then the equipment probably has a hardware failure.

☐ Step 8: Remove the Current Loop Adapter. If Enhanced Accuracy is invoked when the Current Loop Adapter is attached, the calibration may become corrupted.

Probe ID

The Probe ID function invokes a specified mainframe action. The 11A16 Amplifier implements the Probe ID function in a unique manner for the A6302 and A6303 probes, since they do not have Probe ID buttons.

To invoke the Probe ID function, simultaneously press the channel display (CH1 or CH2) and the DEGAUSS buttons for CH 1 or CH 2 on the amplifier front panel. The probe must be connected and locked before the Probe ID function will work.

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The **Probes** pop-up menu of the **Utility 1** major menu is used to set the action that the **Probe ID** button invokes. One of the following actions can be selected:

- **Waveform Select/New Wfm** displays and selects the waveform from the channel connected to the probe.
- **Waveform Select/New Wfm & Autoset** displays, selects, and invokes Autoset on the selected channel.
- **Sequence Settings** invokes the next stored setting in the **Store Setting** pop-up menu of the **Store/Recall** major menu.
- For 11300 Series Analog Oscilloscopes, **Measure** performs a variety of measurements that you have specified on the selected waveform. Refer to the section on the **Measure** major menu in the *User Reference* for your mainframe.

Front-Panel Error Messages

When an error occurs involving a plug-in amplifier, the mainframe displays an error message at the top of its display. This section discusses the errors that can occur.

Input Overload

When the input signal exceeds the limits for specific sensitivities, the amplifier disconnects the input and the mainframe displays the message:

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

where N = 1 or 2.

For the A6302 probe, the limit is 2 A peak at sensitivities less than 100 mA/division or 10.5 A peak at sensitivities greater than or equal to 100 mA/division. For the A6303 probe, the limit is 10 A peak at sensitivities less than 500 mA/division or 52.5 A peak at sensitivities greater than or equal to 500 mA/division.

To reconnect the input, first correct the overload condition, then select AC or DC coupling.

CAUTION

Do not allow an overload condition to continue too long, since this may damage the 11A16 attenuator auxiliary 50 Ω terminator.

This error message also displays when the + 15 V or the -15 V fuse has blown. In this case, the coupling for both channels of the amplifier switches to the Off mode and it is not possible to change the coupling until the blown fuse has been replaced. A blown fuse can be verified by running the Self-Test.

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DAC Overflow

If a plug-in amplifier detects that a requested setting overflowed an internal DAC, then the following error message is displayed on the mainframe:

> **Internal DAC overflow on channel N of LEFT/CENTER/RIGHT plug-in unit**

where N = 1 or 2.

Such overflow usually indicates either defective hardware or a calibration error. If running Enhanced Accuracy does not correct the condition, then there is a hardware problem. In this case, the amplifier sets the DAC to the limit closer to the requested setting.

Probe Calibration and Deskew Errors

The errors that can occur during probe calibration vary with the mainframe. For a complete description of Probe calibration and a list of possible error messages during probe calibration and deskew, refer to the appropriate discussion for your mainframe under *Probe Operation* starting on page 2-5. For additional information on probe and mainframe compatibility refer to the discussion *Probe Calibration and Deskew* on page 1-2.

11400 and DSA 600 Series Mainframes—If an error occurs while calibrating current probes on an 11400, CSA400 or DSA 600 Series mainframe, refer to the discussion *Calibrating the Probe with Digitizing Mainframes* on page 2-6for a discussion of the possible error messages.

11300 Series Oscilloscopes—If an error occurs while calibrating current probes on an 11300 Series Oscilloscope, refer to the discussion *Calibrating the Probe with Analog Oscilloscopes* on page 2-9 for a discussion of the possible error messages.

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GPIB and RS-232-C Commands and Syntax

The CH (Channel) command sets the parameters of a specified channel.

CH {L|C|R}{1|2} <link>:<argument>

Table 2-2 and Table 2-3 list the links and arguments of the CH command.

***Table 2-2** — CH Command Links*

Link	Argument	Argument Ranges
BWHi:	<NRx>	BW Limit (when queried) A6302 Current Probe: 50E+6 A6303 Current Probe: 20E+6
COUpling:	AC | DC | OFF	
IMPedance:	<NRx>	50
OFFSet:[1]	<NRx>	**Amps/div** — **Offset Range** — **Resolution** A6302 Current Probe: 1 mA to 99.5 mA — ±1 A — 25E–6A 100 mA to 2 A — ±10 A — 250E–6A Resolution is for GPIB, RS-232-C, or numeric entry.
SENsitivity:	<NRx>	A6302 Current Probe: 1E-3, 2E-3, 5E-3, 10E-3, 20E-3, 50E-3, 100E-3, 200E-3, 500E-3, 1, 2 A6303 Current Probe: 5E-3, 10E-3, 25E-3, 50E-3, 100E-3, 250E-3, 500E-3, 1, 2.5, 5, 10

***Table 2-3** — CH Command Query-Only Links*

Query-only Link	Response	Meaning
? PRObe	<qstring>	Returns a description of the probe connected to the channel. For a Level 1 TEKPROBE, the query returns "Level 1." If a TEKPROBE is not connected, the query returns "NONE."
? UNIts	<qstring>	Returns the units of conversion for the probe connected to the specified channel input.

[1]*The numbers listed are those available at the input connectors. Connecting an attenuating probe will change the value proportional to the probe's attenuation factor (for example, a 10X probe changes the value ±10 to ±100).*

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Specifications

This section lists the performance specifications, environmental requirements, and physical dimensions of the 11A16.

Performance Conditions

The specifications listed in Tables 3-1, 3-2, 3-3, and 3-4 apply to the 11A16 Amplifier in all digitizing mainframes. These specifications are valid only when the oscilloscope is in the Enhanced Accuracy state.

Enhanced Accuracy

All performance specifications in this section assume the 11A16 and mainframe are in the Enhanced Accuracy state. Enhanced Accuracy calibration is initiated by pushing the ENHANCED ACCURACY button on the mainframe after a 20-minute warmup period necessary to achieve thermal equilibrium. Enhanced Accuracy is indicated on the mainframe display with the **EA** symbol. Enhanced Accuracy remains in effect while the mainframe internal temperature is within ±5°C of the calibration temperature. If a 5°C change occurs, the system reverts to Normal accuracy in which characteristics that are temperature sensitive may not remain within specifications.

This section contains the following types of performance specifications:

Probe/System Specifications – describes performance of the 11A16 with A6302 and A6303 Current Probes installed. Probe and mainframe contributions to performance are included in these specifications except where noted.

Plug-in/Mainframe Specifications – describes performance of the 11A16 when the Voltage Adapter (Tektronix part number 015-0598-00) is installed. These Plug-in/Mainframe Specifications are intended to aid service personnel in verifying the 11A16 performance without current probes connected. The Voltage Adapter is a calibration aid included with the 11A16.

Physical Characteristics – describes the physical dimensions of the 11A16.

Environmental Characteristics – defines the operating environment of the 11A16.

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Probe/System Specifications

The Probe/System specifications define performance with the various digitizing mainframes and current probes that can be used with the 11A16. Table 3-1 contains specifications for using the 11A16 Amplifier with either the A6302 or A6303 Current Probe. Probes must be adjusted to meet their performance specifications and they must be calibrated with the Utility menu **Probes** function as described on page 2-6.

Table 3-1 *— Electrical Characteristics of the 11A16 Amplifier with Probes*

Characteristic	Performance Requirement	
	With A6302 Probe, an active DC to 50 MHz, DC-coupled current probe:	
Deflection Factor (Sensitivity)	Calibrated Range:	Enhanced DC Accuracy, either polarity. 1 mA/div to 2 A/div.
	Coarse Resolution: 1, 2, 5 sequence	
	Accuracy: signal frequency $\leq$ 1 kHz; ±2% at all sensitivities	
Offset Accuracy	**Amps/Division**	**Offset Accuracy**
	1 - 99.5 mA	±(2% + 1.2 mA)
	100 - 995 mA	±(2% + 12 mA)
	1 - 2 A	±(2% + 120 mA)
Typical Noise	Typical RMS Noise for Display, Trigger, and Aux Trigger	
	RMS Noise	**Sensitivity**
	0.30 div	1 mA/div
	0.20 div	2 mA/div
	0.10 div	5 mA/div
	0.05 div	10 mA - 2 A/div
Frequency Response	High Frequency Limit: Gain at 50 MHz will be $\geq$ 74% of the gain at 500 kHz	
Step Response	High Frequency Aberrations (first 100 ns) for Display, Trigger, and Auxiliary signals: 1 mA - 2A/div: ±5%, 7% p-p (8 division reference)	
	Low Frequency Aberrations (after first 100 ns) for Display, Trigger, and Auxiliary signals: ±3%, 4% p-p (8 division reference)	
DC Balance (after Probe Degauss)	1 mA/div to 2 A/div: 0.25 mA + 0.05 div (measured in 11400 Series mainframe)	

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Table 3-1 — Electrical Characteristics of the 11A16 Amplifier with Probes (Cont.)

Characteristic	Performance Requirement	
	With A6303 Probe[1], an active 5X attenuating DC to 15 MHz, DC-coupled current probe:	
Deflection Factor (Sensitivity)	Calibrated Range:	Enhanced DC Accuracy, either polarity. 5 mA/div to 10 A/div.
	Coarse Resolution: 5, 10, 25 sequence	
	Accuracy: signal frequency $\leq$1 kHz; ±2% at all sensitivities	
Offset Accuracy	**Amps/Division**	**Offset Accuracy**
	5 mA - 495 mA	±(2% + 1.2 mA)
	0.5 - 4.95 A	±(2% + 60 mA)
	5 - 10 A	±(2% + 600 mA)
Typical Noise	Typical RMS Noise for Display, Trigger, and Aux Trigger	
	RMS Noise	**Sensitivity**
	0.30 div	5 mA/div
	0.20 div	10 mA/div
	0.10 div	25 mA/div
	0.05 div	50 mA - 10 A/div
Frequency Response	High Frequency Limit: Gain at 15 MHz will be $\geq$ 74% of the gain at 500 kHz	
Step Response	High Frequency Aberrations (first 200 ns) for Display, Trigger, and Auxiliary signals: 5 mA - 10 A/div: ±6%, 10% p-p (8 division reference)	
	Low Frequency Aberrations (after first 200 ns) for Display, Trigger, and Auxiliary signals: ±5%, 7% p-p (8 division reference)	
DC Balance (after Probe Degauss)	5 mA/div to 10 A/div: 1.25 mA + 0.10 div (measured in 11400 Series mainframe)	

[1]*The A6303 probe must be properly adjusted. Refer to the adjustment procedure in the 11A16 Service Reference.*

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Plug-in/Mainframe Specifications

The Plug-in/Mainframe specifications depend only on the 11A16 and the digitizing mainframe in which it is installed. The specifications in Tables 3-2 apply when the Voltage Adapter (Tektronix part number 015-0598-00) is used to couple test signals and the mainframe is in Enhanced Accuracy. The Voltage Adapter is a calibration aid included with the 11A16. It is described under *Instrument Accessories* in Section 1 of this manual. Table 3-1 lists System Specifications that describe performance with current probes installed.

***Table 3-2** – Electrical Characteristics (With Voltage Adapter[1])*

Function	Characteristic	Performance Requirement
Deflection Factor	Calibrated Range	1 mV to 2 V
	Resolution	Coarse: 1, 2, 5 sequence Fine: 1% increments of next more sensitive coarse step
	Accuracy ≤1 kHz	±0.78% @ 1 mV/div ±0.53% ≥ 2 mV/div
	Gain Accuracy Match between 20 MHz and 100 MHz/Full Bandwidth	≤0.17% difference
Offset Accuracy	**Sensitivity**	**Deviation**
	1 – 99.5 mV/div	0.2% + 0.4 mV
	100 – 995 mV/div	0.25% + 4 mV
	1 V – 2 V/div	0.25% + 40 mV
Frequency Response	Full Bandwidth	Gain at 120 MHz ≥78% of gain at 500 kHz
	Trigger and Auxiliary Path	Within 5% of signal path
	100 MHz Bandwidth Limit	100 MHz +30%, -12%
Frequency Response (cont.)	20 MHz Bandwidth Limit	20 MHz ±30%
	AC Coupled, Signal and Trigger Path	Attenuated to .707 at ≤10 Hz, from 50 Ω source

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Table 3-2 – Electrical Characteristics (With Voltage Adapter[1])(Cont.)

Function	Characteristic	Performance Requirement
Step Response	Display Aberrations in first 40 ns using 5 division reference	
	Sensitivity	**Signal Aberrations**
	1 – 99.5 mV	±4.5%, 7% p-p
	100 – 995 mV	±5%, 8% p-p
	Trigger Aberrations in first 40 ns using 5 division reference	
	Sensitivity	**Trigger Aberrations**
	1 – 99.5 mV	±4.5%, 7% p-p
	100 – 995 mV	±5%, 8% p-p
	Low Frequency Aberrations After First 40 ns	±2% with ±2% match among sensitivities (8 division Reference)
Input (with Voltage Adapter)	Impedance (AC and DC coupled)	50 Ω within ±1.5%
	Input Off Input Impedance	50 Ω within ±2%
	Input Bias Current	≤4.0 μA maximum
Display	DC Balance	
	Sensitivity	**Deviation**
	1 – 99.5 mV/div	0.2 mV + 0.1 div
	100 – 995 mV/div	2.0 mV + 0.05 div
	1 – 2 V/div	20 mV + 0.05 div
	AC Balance	
	Sensitivity	**Deviation**
	1 – 99.5 mV/div	0.2 mV + 0.1 div
	100 – 995 mV/div	2.0 mV + 0.05 div
	1 – 2 V/div	20 mV + 0.05 div

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Table 3-2 — Electrical Characteristics (With Voltage Adapter[1])(Cont.)

Function	Characteristic	Performance Requirement
Miscellaneous	Typical Noise RMS for Display, Trigger, and Aux Trigger	
	RMS Noise	**Sensitivity**
	0.20 div	1 mV/div
	0.10 div	2 mV/div
	0.04 div	5 mV/div
	0.02 div	10 mV – 10 V/div
	Channel Isolation	At least 50:1 display ratio[2] from DC to 50 MHz at any coarse sensitivity setting
	Common Mode Rejection Ratio	At least 20:1, for DC to 50 MHz at any sensitivity with 10 division reference signal on each channel.
	Trigger Deflection Factor	Within 2% of display path
	Trigger DC Offset	Within 0.25 div of display path

[1]*The Voltage Adapter (Tektronix part number 015-0598-00) is a calibration aid shipped with the 11A16.*

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

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Environmental Characteristics

The Environmental Characteristics listed in Table 3-3 define the operating environment of the 11A16.

Table 3-3 *— Environmental Characteristics*

Characteristic	Information
Ambient temperature (External to mainframe)	
Operating	0° to +50°C, mainframe ambient
Non-operating	−40° to +75°C
Humidity, Operating and Non-operating	Meets 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.)
Non-operating	To 15,200 m (50,000 ft.)
Shock, Non-operating (not installed in mainframe)	MIL-T-28800C, Sec. 4.5.5.4.1, Type III, class 5
Bench Handling (operating, installed on Flexible Extender)	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-461B FCC Part 15, Subpart J, Class A VDE 0871/6.78, Class B; electromagnetic susceptibility is an exception.

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Physical Characteristics

The Physical Characteristics listed in Table 3-3 describe the physical dimensions of the 11A16.

Table 3-4 *— Physical Characteristics*

Characteristic	Information
Weight (max)	2 lb. 2 oz (0.97 kg)
Weight of Packaged Product (max)	5 lb. 2 oz. (2.3 kg)
Dimensions (max)	See Figure 3-1

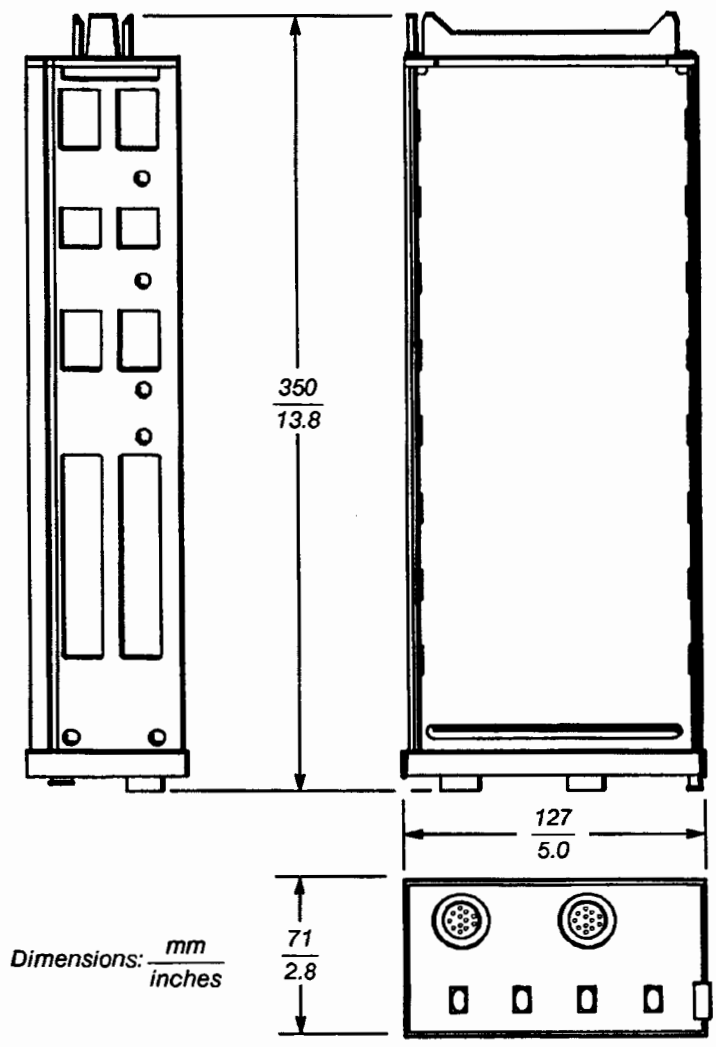


Figure 3-1 *— Dimensions of the 11A16 Amplifier*

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MANUAL CHANGE INFORMATION

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Effective For All Serial Numbers

ADD the additional attached pages to the back of your manual.

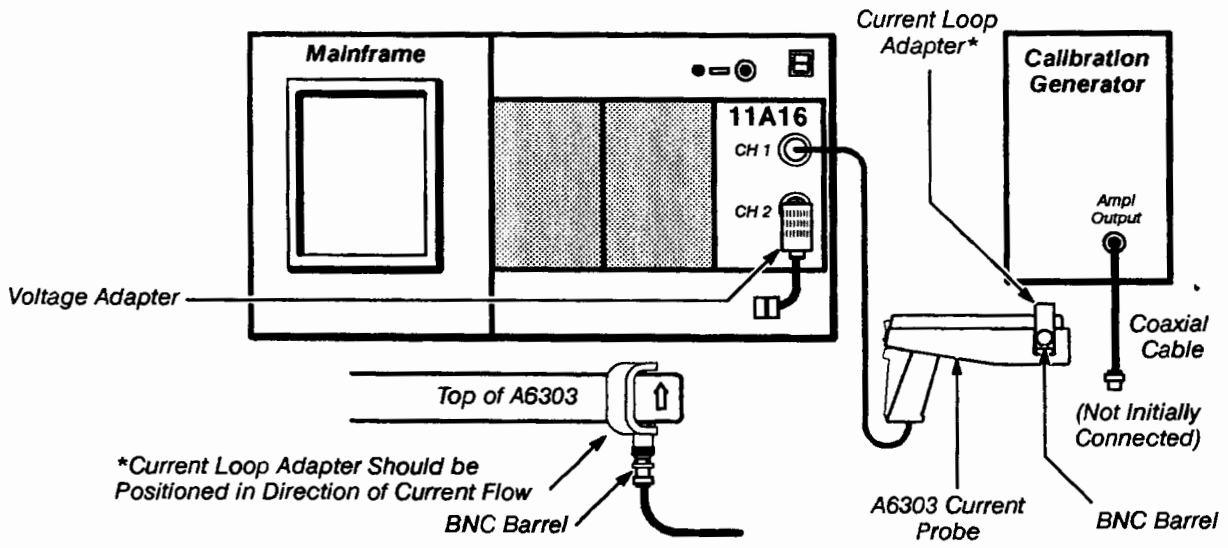
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A6303 Current Probe Adjustment

This procedure adjusts the A6303 for optimum operation in an 11A16 Amplifier. You should adjust an A6303 if it is used with an 11A16 for the first time. This procedure assumes a fully calibrated 11A16 is installed in the Right plug-in compartment of a 11400 or DSA 600 Series mainframe. The equipment required and its connection are shown in the setup illustration below.

Note: *The A6303 transient response adjustment will be set to different positions when used with an 11A16 as compared to an AM503. Therefore the A6303 transient response should be adjusted if it is switched between the AM503 and the 11A16.*

Setup for A6303 Current Probe Adjustment



CAUTION

Use the 0 Ω Current Loop Adapter with the 11A16 Amplifier only during probe calibration. If the adapter is connected to the mainframe during power-up or Enhanced Accuracy calibration, the instrument calibration can be corrupted.

The adjustment procedure has three parts: offset adjustment, transient response adjustment, and verification.

Procedure to Adjust Offset

- ☐ Step 1: Power up the oscilloscope mainframe, 11A16, A6303 probe and test equipment, and let them warm up for at least 10 minutes.
- ☐ Step 2: Set the Calibration Generator Pulse Amplitude to Min (minimum).
- ☐ Step 3: Press the display CH 1 button on the 11A16 to enable the channel.
- ☐ Step 4: Set the **Vert Size** to 100 mA/div.
- ☐ Step 5: Set the vertical **Coupling** to **Off**.
- ☐ Step 6: Adjust the **Vert Offset** to position the trace at the graticule center.
- ☐ Step 7: Set **Coupling** back to **DC**.

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☐ Step 8: Remove the current probe plug that covers R45. See Figure 1.

☐ Step 9: Now degauss the probe by pressing the CH 1 DEGAUSS button.

☐ Step 10: Select **Extended Diagnostics** from the Utility major menu.

☐ Step 11: Select Right 11A16 Plug-in Subsystem or Block, the **CH1 CAL B** Area, and the **AUTO BAL** Routine.

☐ Step 12: Select **Run** and record the value from the **ACTUAL** column (+1000 to −1000 milliunits).

☐ Step 13: Exit the **Extended Diagnostics** menu.

☐ Step 14: Adjust R45 based on the value recorded in Step 12 as follows:

- If the recorded value (X) is negative, adjust R45 to bring the trace down (Xmilli-units/2) mA.
- If the recorded value (X) is positive, adjust R45 to bring the trace up (Xmilli-units/2) mA.

☐ Step 15: Degauss the probe again by pressing the CH 1 DEGAUSS button.

☐ Step 16: Repeat Steps 10 through 14 until the value obtained in the diagnostic test (Step 12) is less than 100 milliunits.

☐ Step 17: Replace the plug over R45. Proceed to the Transient Response adjustment.

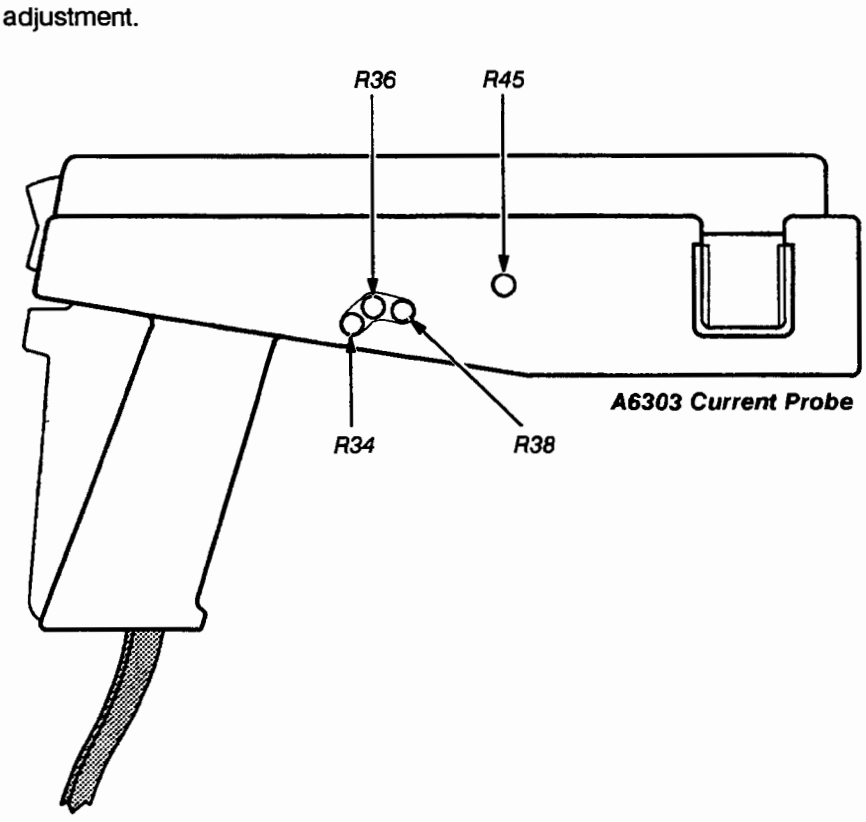


***Figure 1** — Location of Adjustments on the A6303 Current Probe*

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Procedure to Adjust Transient Response

☐ Step 18: Connect the coaxial cable from the Calibration Generator to the CH 2 input through the Voltage Adapter. Leave the current probe connected to CH 1. Press the display CH 2 button on the 11A16.

☐ Step 19: Set CH 2 **Vert Size** to 1 V/div, **Main Size** to 2 ms/div, and **Coupling** to **DC**.

☐ Step 20: Set the Calibration Generator Period to 0.1 ms and the Pulse Amplitude to 5 divisions (5 V p-p).

☐ Step 21: Press the display CH 2 button on the 11A16 to disable the channel.

☐ Step 22: Now degauss the probe by pressing the CH 1 DEGAUSS button.

☐ Step 23: Move the CH 2 input end of the coaxial cable to the Current Loop Adapter which should already be locked in the jaws of the A6303 probe.

☐ Step 24: Set the CH 1 **Vert Size** to 25 mA/div and bandwidth limit to 15 MHz. If desired, waveform **Averaging** may be enabled to reduce the displayed noise. (Select **Acquire Desc** in the Waveform major menu, and then **Average N** and **Set AvgN** in the **Acquire Description** pop-up menu. Set the **Average N** knob for **8**.)

☐ Step 25: Set the Calibration Generator Period to 10 ms.

☐ Step 26: Remove the A6303 access plugs for adjustments R34, R36, and R38. Refer to Figure 1.

☐ Step 27: Adjust R38 for maximum flatness on the displayed signal.

☐ Step 28: Set the Calibration Generator Period to 0.1 ms.

☐ Step 29: Set **Main Size** to 10 μs/div and adjust R34 for optimum transient response.

☐ Step 30: Set **Main Size** to 1 μs/div and adjust R36 for optimum transient response.

The adjustments R34, R36, and R38 interact and may require readjustment for optimum transient response with the proper gain.

☐ Step 31: Repeat Steps 25 through 30 to optimize the transient response.

Procedure to Verify Probe Gain

To verify the adjustments, you will run automated probe calibration by following Procedure 13 in the Checks and Adjustments section.

☐ Step 32: Calibrate channel **R1**, the channel to which the current probe is connected, by running Steps 1 through 8 of probe calibration procedure on page 2-6.

☐ Step 33: Examine that the probe calibration portion passes. Note that with an A6303 the deskew portion will probably not pass due to the long signal delay time through the A6303 probe. If probe gain calibration passes, the probe gain is satisfactory. If probe gain calibration failed, perform the following steps. Refer to Table 2-1 to verify probe gain calibration passed.

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☐ Step 34: Examine the probe gain value with Diagnostics by selecting **Extended Diagnostic** from the Utility major menu.

☐ Step 35: Select the **Right** Subsystem, the 11A16 Block, the **CH1 CAL B** Area and the **Probe Gain** Routine.

☐ Step 36: Select **Run** and record the value shown in the **ACTUAL** column. The **ACTUAL** value should be between MIN and MAX (−15% to −5%). Values of −10% to −12% are typical.

☐ Step 37: If the **ACTUAL Probe Gain** value is within the acceptable range, and probe gain calibration failed in Step 32, then the 11A16 should be examined by a Tektronix service center.

If the **ACTUAL Probe Gain** value is *less than* −15%, adjust R38 to increase the DC signal amplitude slightly and compromise step flatness. Now optimize transient response by performing Steps 18 through 30, while skipping Step R27. *DO NOT* readjust R38 in Step 27, as you have just set it to meet probe gain requirements.

☐ Step 38: Ensure that Probe Gain is now correct by repeating the gain check in Steps 34 through 36.

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