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# **Instruction Manual**

**Tektronix**

**CT-4**  
**High-Current Transformer**

**070-6478-02**



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# ***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 do not appear in this summary.*

## ***Terms In This Manual***

**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.

## ***Do Not Operate In Explosive Atmospheres***

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

## ***Do Not Remove Covers Or Panels***

Do not operate this product without the covers and panels properly installed.

## ***The CT-4***

The CT-4 High Current Transformer is designed to extend the current measuring capability of the Tektronix A6302, A6302XL, A6312, TCP202, and P6021 Current Probes. The CT-4 extends the measurement range up to 1000 times.

The CT-4 includes a pistol-grip handle with two receptacles to accept the current probe in either the 1000:1 or 20:1 current ranges. A sliding jaw on the transformer permits insertion of the current-carrying conductor without breaking the circuit under test.

The core and shield assembly is insulated from the windings and the handle, allowing measurements on bare conductors with potentials to 3000 volts. The high-voltage insulation accessory may be used to extend the allowable voltage by several times. The optional DC Bucking Coil (015-0190-00), which slips over the front of the CT-4, nullifies the saturating effects of steady-state dc currents to 300 amperes.



# Characteristics

## Electrical Characteristics

The electrical characteristics listed in Table 1-1 are valid when the CT-4 is used with a calibrated oscilloscope and a calibrated A6312/A6302/A6302XL current probe with the AM503X amplifier, TCP202 current probe, or P6021 current probe. The instruments must be operated within the environmental limitations stated in Table 1-3.

**Table 1-1**  
**Electrical Characteristics**

Characteristic	Performance Requirement	Supplemental Information
Bandwidth (–3 dB) with TCP202 or A6302/A6312 and AM503X	0.5 Hz to 20 MHz	
A6302XL and AM503B or AM5030	0.5 Hz to 17 MHz	
P6021	120 Hz to 20 MHz	
TCP202/A6312/A6302/ A6302XL and optional DC Bucking Coil	1 Hz to 1 MHz	
Transient Response		17.5 ns (calculated from bandwidth)
Current Ranges with A6312/A6302/A6302XL and AM503/A/B or AM5030 20:1 Receptacle		20 mA to 100 A/div
1000:1 Receptacle		1 A/div to 5,000 A/div
TCP202 20:1 Receptacle		200 mA/div to 100 A/div
1000:1 Receptacle		10 A/div to 5,000 A/div
P6021 20:1 Receptacle		20 mA/div to 20 A/div
1000:1 Receptacle		1 A/div to 1,000 A/div
Accuracy	$\pm 4\%$ with less than 20 A dc current present.	(In addition to system accuracy.) Accuracy deteriorates with higher dc current; see Fig. 2-11.
Maximum Continuous Input Current (25°C ambient)	2,000 A peak-to-peak at 1 kHz (sinewave).	Derated with frequency (see Figs. 2-3 through 2-6). Calculated from the magnetic materials. Tested to 500 A p-p.

**Table 1-1 (cont.)  
Electrical Characteristics**

Characteristic	Performance Requirement	Supplemental Information
Maximum Pulse Current	20,000 A peak, not to exceed 50% duty factor	Calculated from the magnetic materials. Derated with repetition rate and pulse duration. Maximum pulse limitation of the associated current probe must also be considered (with respect to the stepped-down amplitude). See Section 2.
Maximum Ampere-Second Product (CT-4 Only)		5 Ampere-Seconds. Calculated from the magnetic materials. Refer to the probe manuals for system limitations.
Insertion Impedance		Typically $20\ \mu\Omega$ at 60 Hz, increasing to $30\ m\Omega$ at 1 MHz. See Fig. 2-9. Dependent on conductor placement in the sense loop cross-sectional area. Review circuit under test for adverse effects.
Maximum Input Voltage	1,000 V CAT III with uninsulated conductor	3,000 V peak, < 11% duty factor, < 100 msec period
With HV Insulation included	10 kV (rms) or 14 kV (peak).	
External Magnetic Field Susceptibility		Typically $\pm 35\ mA$ on the output signal when the probe is in an external field of 1 Gauss (20:1 receptacle).
Voltage Feedthrough Susceptibility		Typically < 3 mA/V to 5 MHz, < 30 mA/V at 20 MHz.
CT-4 With DC Bucking Coil (optional) Maximum DC Bucking Current		300 ampere turns. (300 mA $\times$ 1,000 turns.)

**Table 1-1 (cont.)  
Electrical Characteristics**

Characteristic	Performance Requirement	Supplemental Information
CT-4 With Optional DC Bucking Coil (cont.) Power Supply Requirement		1 V for 20 A bucking, 300 mA 15 V maximum. (1,000 turns.)
External Magnetic Field Susceptibility		Typically 500 mA/Gauss. May be improved by selecting physical placement.

**Table 1-2  
Physical Characteristics**

Characteristic	Information
Dimensions	
CT-4	10.5 inches L × 2.2 inches W × 9.7 inches H (includes handle).
DC Bucking Coil (optional)	
Coil	3 inches L × 3.5 inches W × 1.6 inches H.
Base	5.4 inches L × 3.6 inches W × 1.7 inches H.
Maximum Conductor Size	
CT-4 Only	1.5 inch × 1.6 inch rectangle.
with DC Bucking Coil	0.89 inch × 1.6 inch rectangle.
Weight	
CT-4	4 lbs, 4 oz.
DC Bucking Coil	2 lbs, 5 oz.

**Table 1-3  
Environmental Characteristics**

<b>Characteristic</b>	<b>Information</b>
Temperature	
Non-Operating	
In Carrying Case	– 40°C to + 60°C
CT-4 Only	– 55°C to + 75°C.
Bucking Coil	– 40°C to + 60°C.
Operating	0°C to + 50°C.
Altitude	
Non-Operating	To 15,240 m (50,000 ft)
Operating	4,572 m (15,000 ft) 600 V CAT III or 1,000 V CAT II 2,000 m (6,562 ft) 1,000 V CAT III
Vibration (Non-Operating)	15 minutes along each axis to 0.015 inch total displacement with frequency varied from 10 Hz to 55 Hz to 10 Hz in 1 minute cycles. Three minutes at any resonant point or at 50 Hz (probe locked).
Shock (Non-Operating)	30 g's, one-half sine, 11 ms duration, 3 shocks per axis (with probe locked). Per Tek Standard 062-2858-00, Class 5.
Packaged Product Vibration and Shock	The packaged product qualifies under the National Safe Transit Association's Pre-Shipment Test Procedures, Project 1A-B-1. Tek Standard 062-2858-00.

**Table 1-4  
Certifications and compliances**

EC Declaration of Conformity – Low Voltage	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC as amended by 93/68/EEC.</p> <p>EN 61010-1:1993/A2 Safety requirements for electrical equipment for measurement, control, and laboratory use.</p> <p>EN 61010-2-032:1995 Particular requirements for hand-held current clamps for electrical measurements and test.</p>
--	---

# Operation

## General

The CT-4 High Current Transformer may be used with the A6312, A6302 or A6302XL<sup>a</sup> Current Probes and the AM 503/A/B<sup>b</sup> or AM 5030<sup>c</sup> Current Probe Amplifiers. The CT-4 can also be used with the TCP202 AC/DC Current Probe or the P6021 AC Current Probe. Some of the electrical characteristics are different depending on the current probe you select (see page 1-1).

## Probe Receptacles

At the rear of the CT-4 are two probe receptacles for two different current ranges. The A6302, for example, has a current range of 20 mA/div to 100 A/div in the 20:1 receptacle (assuming the current probe normal range is 1 mA/div to 5 A/div) and 1 A/div to 5,000 A/div in the 1000:1 receptacle. See Fig. 2-1.

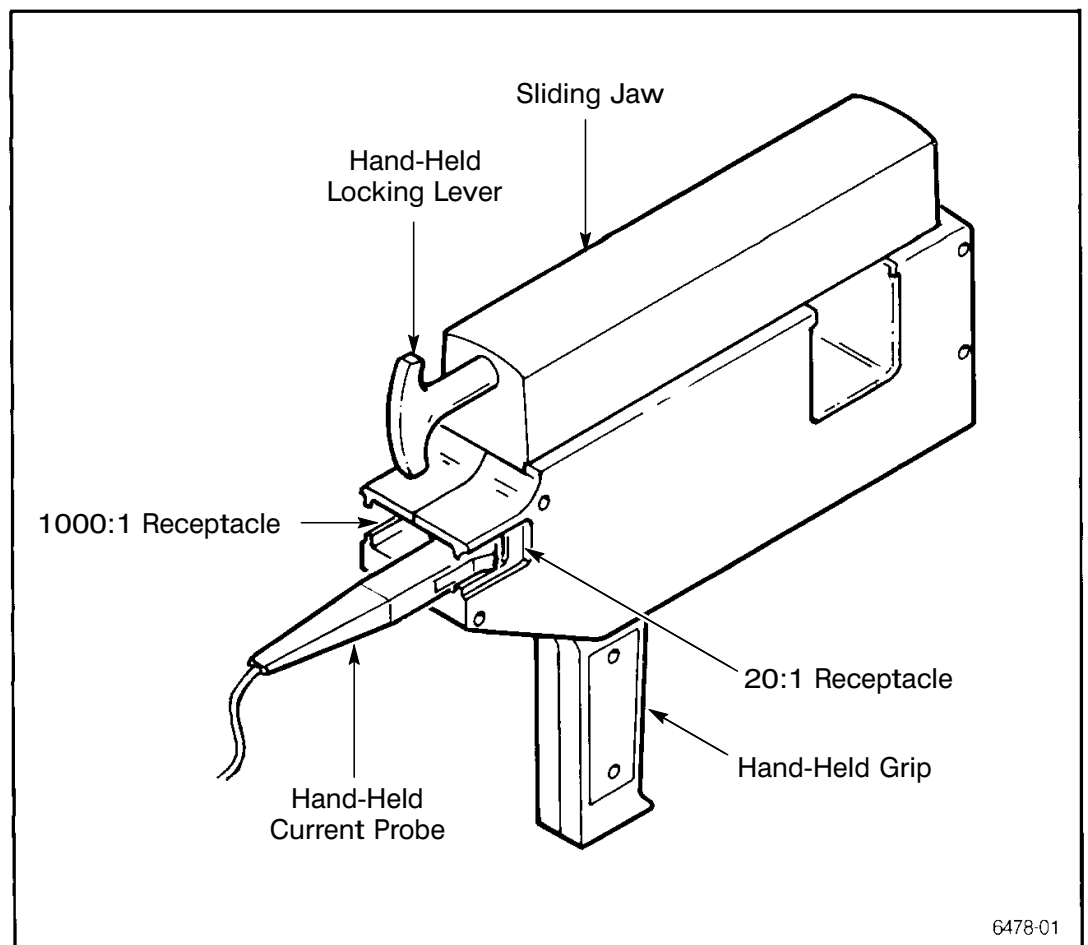


Fig. 2-1. The CT-4 with current probe attached.

<sup>a</sup>A6302XL is only compatible with AM 503B or AM 5030 amplifiers.

<sup>b</sup>AM 503/A/B requires a TM 500 or TM 5000 Series Power Module Mainframe.

<sup>c</sup>AM 5030 requires a TM 5000 Series Power Module Mainframe.



The 20:1 receptacle is recommended for all current measurements within the dynamic range of the associated current probe (see host probe derating charts). One advantage for using the 20:1 receptacle is that the stray field susceptibility of the associated current probe is less noticeable when operated in the higher current/div ranges. For measurements where large dc currents are present, refer to “DC Bucking Coil” in this section. The DC Bucking Coil is an optional accessory to the CT-4.

## **Probe Installation**

Install the current probe in the CT-4 as follows:

1. Degauss the probe (if so equipped).
2. Select the appropriate receptacle based on the anticipated current magnitude.
3. Open the thumb-controlled probe slider, insert the probe into the selected receptacle, and hook the probe jaw over the enclosed conductor.
4. Press the probe slider fully forward to ensure that the core is closed. See Fig. 2-1. Always insert the current probe so that the probe slider faces outward from the CT-4. This will ensure correct current polarity.

## **Connecting the CT-4**

### **WARNING**

*To prevent electrical shock hazard, disconnect the power from a bare conductor under test before connecting the CT-4. Energize the circuit only when the CT-4 and your hands are in a safe position.*

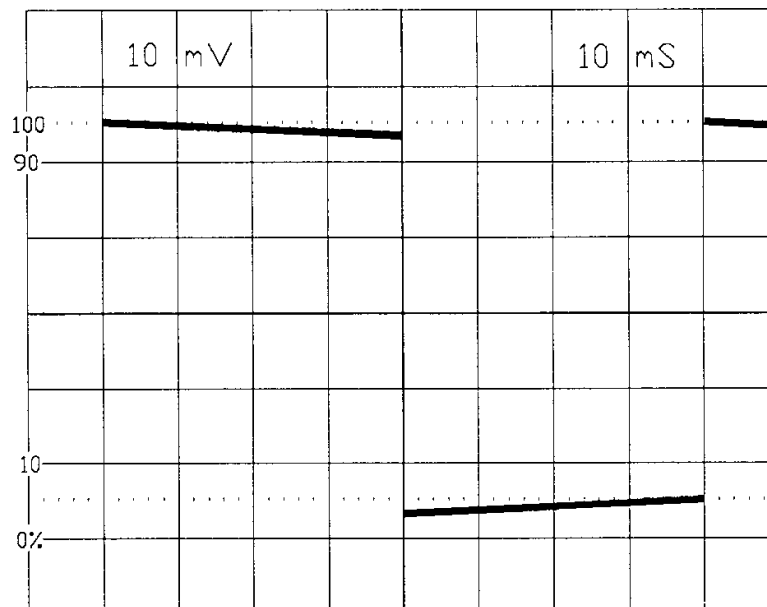
*Do not allow the CT-4 transformer core to touch a bare conductor when the sliding jaw is open. The core is not insulated until it is fully closed and locked.*

*When measuring bare conductors, touch the CT-4 and current probe at the “hand-held” areas only. Refer to Fig. 2-1*

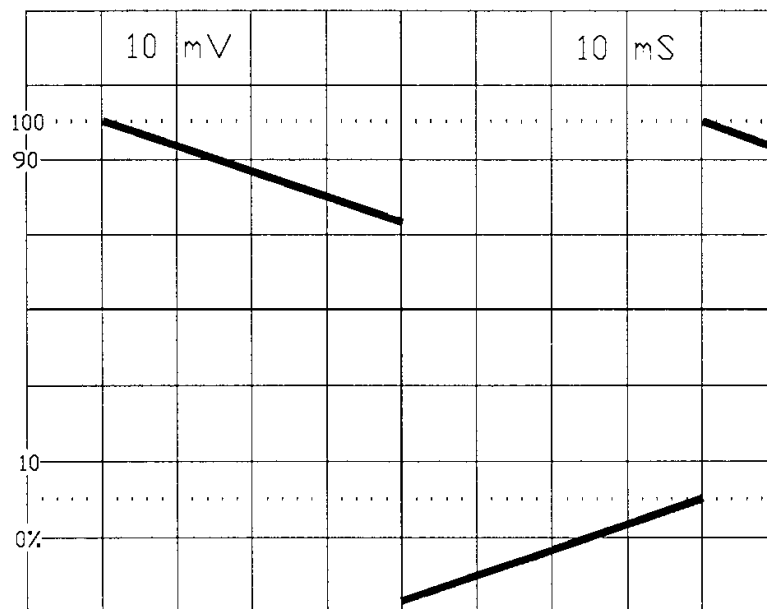
With a current probe installed in one of the receptacles, turn the CT-4 Locking Lever 1/4 turn counter-clockwise to unlock and pull the sliding jaw back to the stop. Hook the test conductor into the CT-4 transformer opening and push the sliding jaw fully closed. Then, turn the Locking Lever 1/4 turn clockwise to lock. Fig. 2-2 shows the effect on low-frequency response when the CT-4 sliding jaw is not properly closed.

## **Measurements on High-Voltage Conductors**

The CT-4 is insulated to withstand bare test conductor voltages to 1000 V CAT III (3000 V peak). For measurements on conductors at higher voltages, a length of high-voltage insulation is provided. This insulation should be wrapped around the test conductor at the test point before attaching the CT-4. To ensure protection, the insulation should be wrapped around the conductor at least three turns or a minimum insulation length of six inches. The



(A) Low frequency response with the sliding jaw fully closed and locked. Current range is 40 mA/div.



(B) Same signal as (A), with the sliding jaw locked in a position just short of fully closed.

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Fig. 2-2. CT-4 response to a 12.5 Hz square wave.

length supplied as a standard accessory will provide approximately three layers when wrapped around the largest conductor that the CT-4 will accept. Center the CT-4 on at least a six-inch width of insulation.

When wrapped around a large conductor, the natural coiling tendency of the insulation will usually hold it in place on the conductor. On smaller conductors, it may be necessary to tape the insulation to prevent sliding.

With the insulation wrapped around a bare test conductor, current measurements may be made with the conductor at potentials up to 14 kV peak. The CT-4 must be centered on the insulation. Do not use damaged insulation wrap.

### Maximum Continuous Input Current

The main factor limiting the maximum continuous input current which may be applied to the CT-4 is heating effect. This is, of course, affected by ambient temperature and signal frequency. Fig. 2-3 shows the derating curves over a broad range of frequencies at 25°C and 50°C ambient. The solid lines of the curves represent tests which have been made under actual operating conditions. The dashed lines are projections of the measured data, indicating performance to be expected.

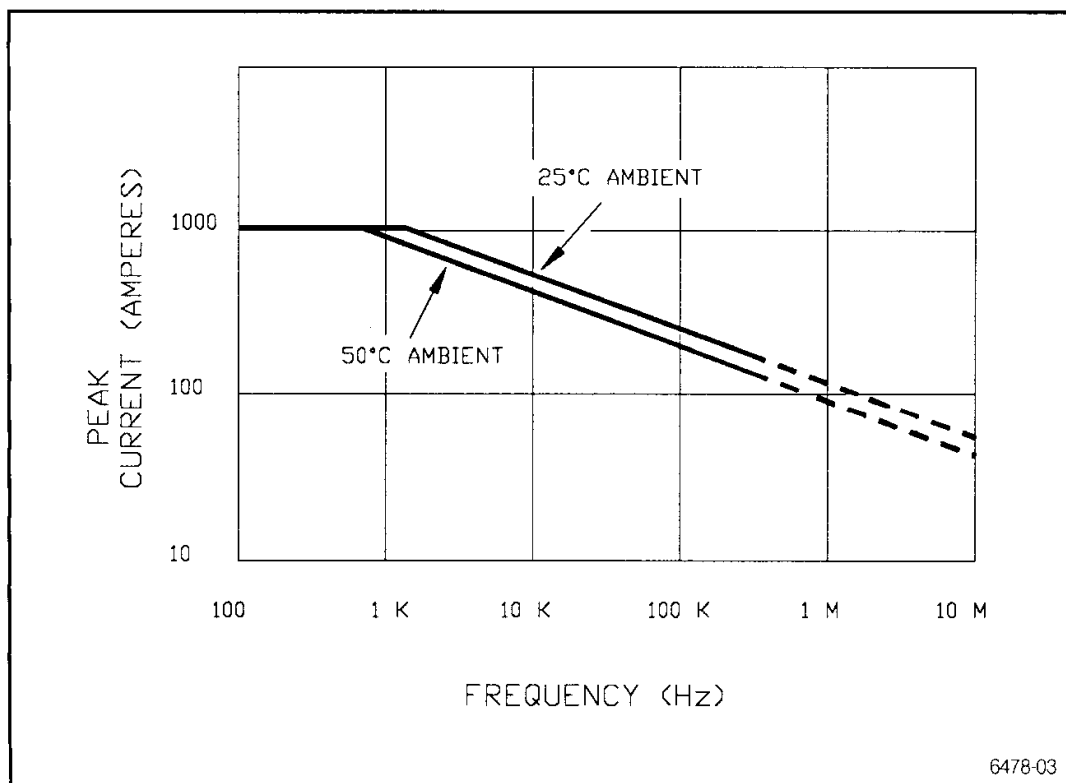


Fig. 2-3. Maximum continuous sinewave input current versus frequency, A6302/CT-4 1000:1 receptacle.

Fig. 2-4 shows the maximum recommended measurement duration for a 1000 A peak-to-peak sinewave with the A6302, A6302XL, A6312, or TCP202 on the 1000:1 receptacle. Figs. 2-5 and 2-6 are derating curves for the P6021.

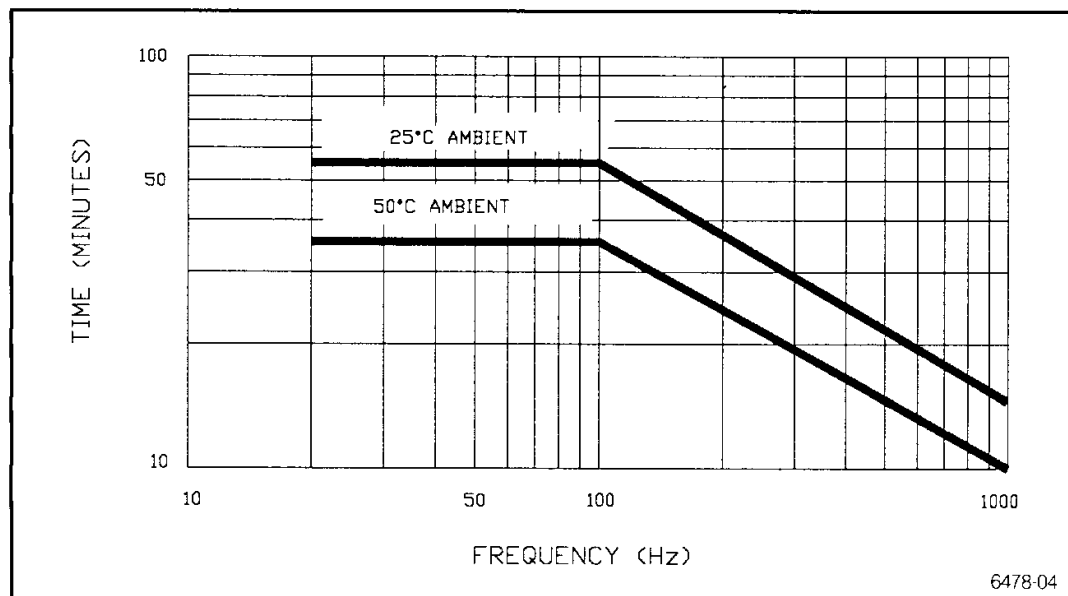


Fig. 2-4 . Maximum recommended measurement duration for a 1000 A peak sinewave with the A6302, A6302XL, A6312, or TCP202 in the 1000:1 receptacle.

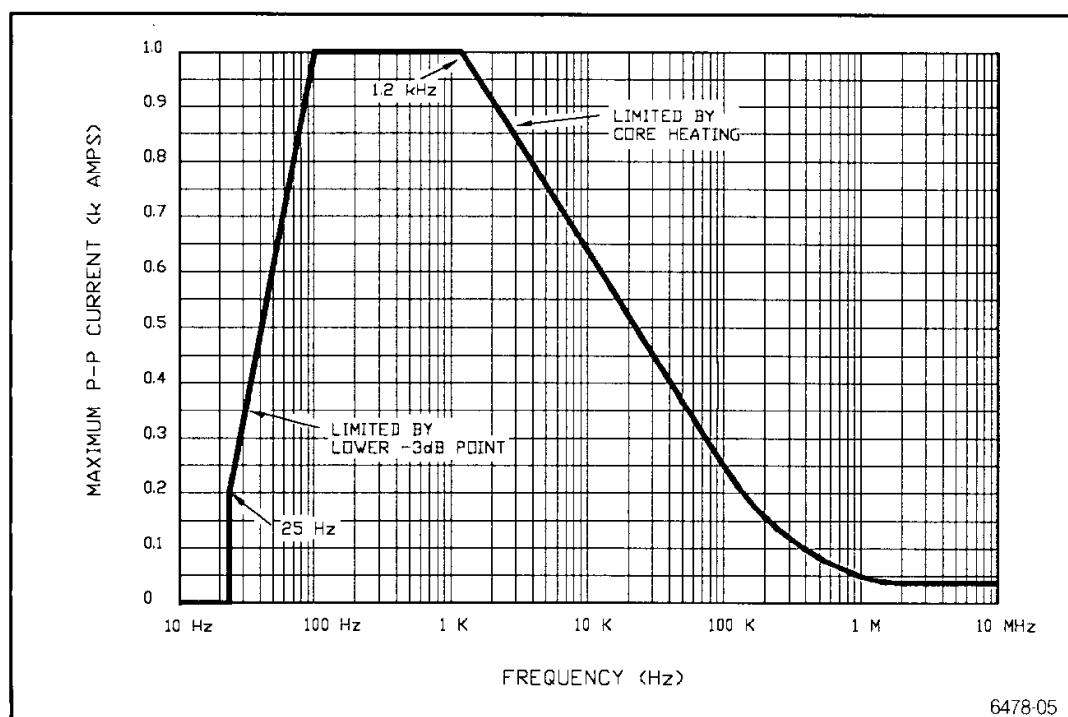


Fig. 2-5. Maximum continuous sinewave input current versus frequency, P6021/CT-4 1000:1 receptacle.

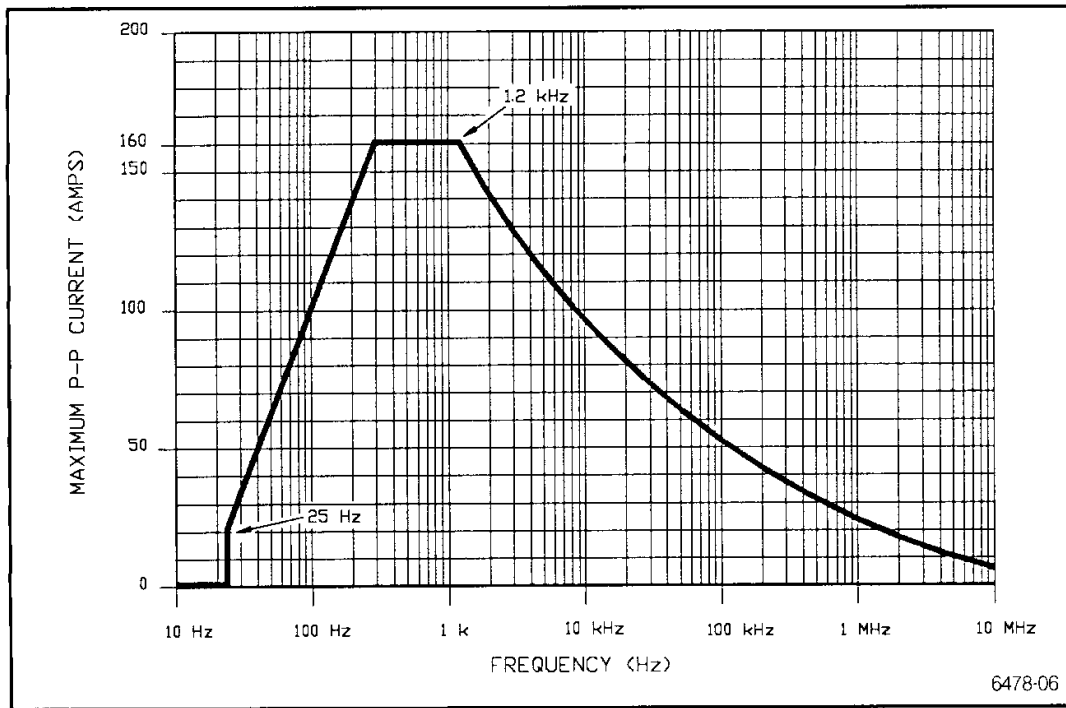


Fig. 2-6. Maximum continuous sinewave input current versus frequency, P6021/CT-4 20:1 receptacle.

## Maximum Pulse Current

The maximum pulse current that can be measured using the CT-4 is limited by transformer core saturation. Figs. 2-7 and 2-8 are graphs of maximum pulse amplitude versus duration for the A6302, A6302XL, A6312, and TCP202. The amp-second product specification provides a basis for calculating the current limitation with any given pulse width. Although the CT-4 has an amp-second product of 5 ampere seconds, the real limit is that of the associated current probe. The amp-second products of the probes are listed in the "Characteristics" section of the probe manuals.

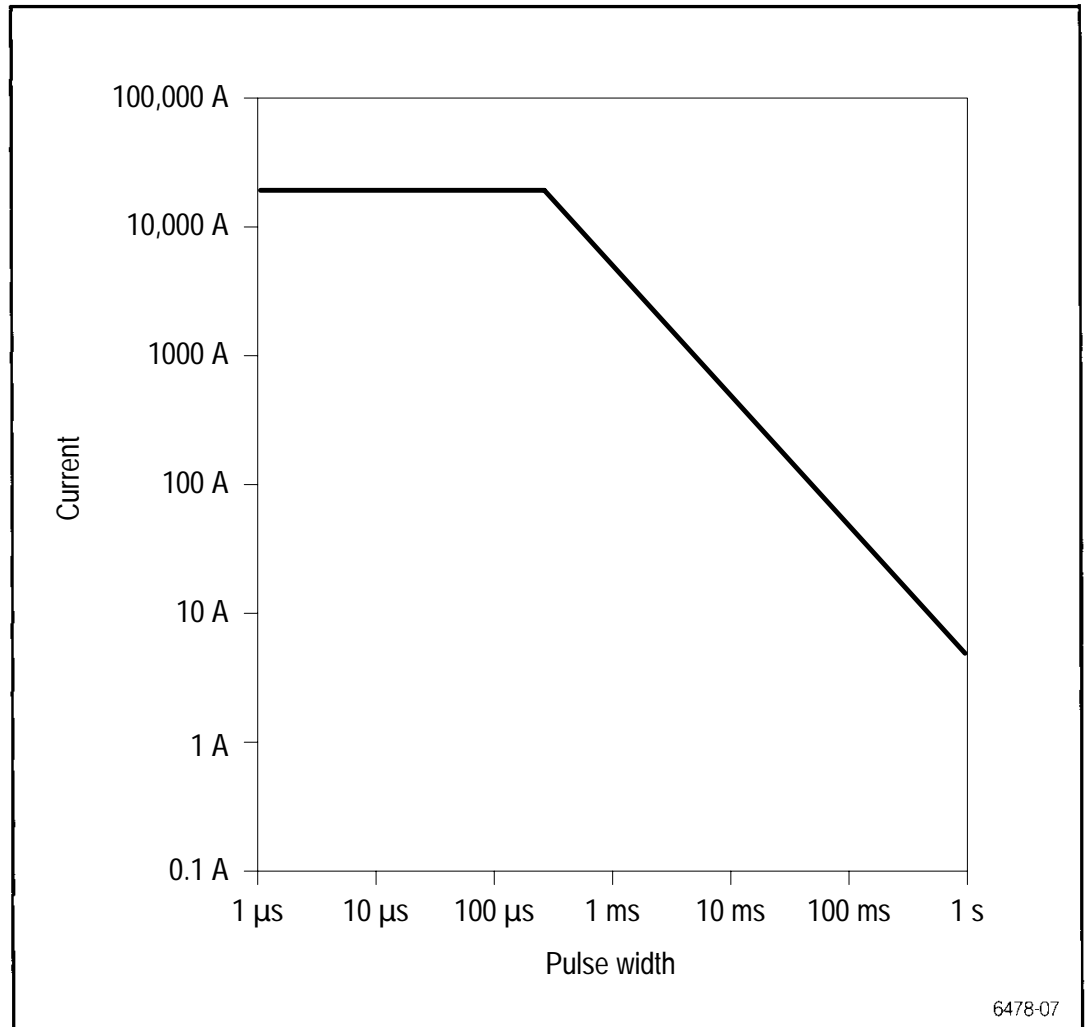
For example, using the CT-4 1000:1 receptacle, the probe amp-second rating is multiplied by 1000. In the case of the A6302/A6302XL/A6312, which has an amp-second rating of 100  $\mu$ A-s, the system amp-second rating would be 0.1 amp-seconds. An example of applying this specification follows:

Problem: Calculate the maximum pulse width for the CT-4 with an A6302, A6302XL, or A6312 current probe for a current pulse of 1,000 A peak.

$$0.1 \text{ (amp-seconds)} = I \times t$$

$I$  = current in  
amperes

$t$  = pulse width  
in seconds



**Fig. 2-7. Maximum pulse amplitude versus duration with A6302/A6302XL/A6312 in the 1000:1 receptacle of the CT-4**

$$t = \frac{0.1}{I}$$

$$t = \frac{0.1}{1,000}$$

$$t = 100 \mu\text{s}$$

Solution: The maximum allowable pulse width for a current pulse of 1,000 amperes peak is 100 μs.

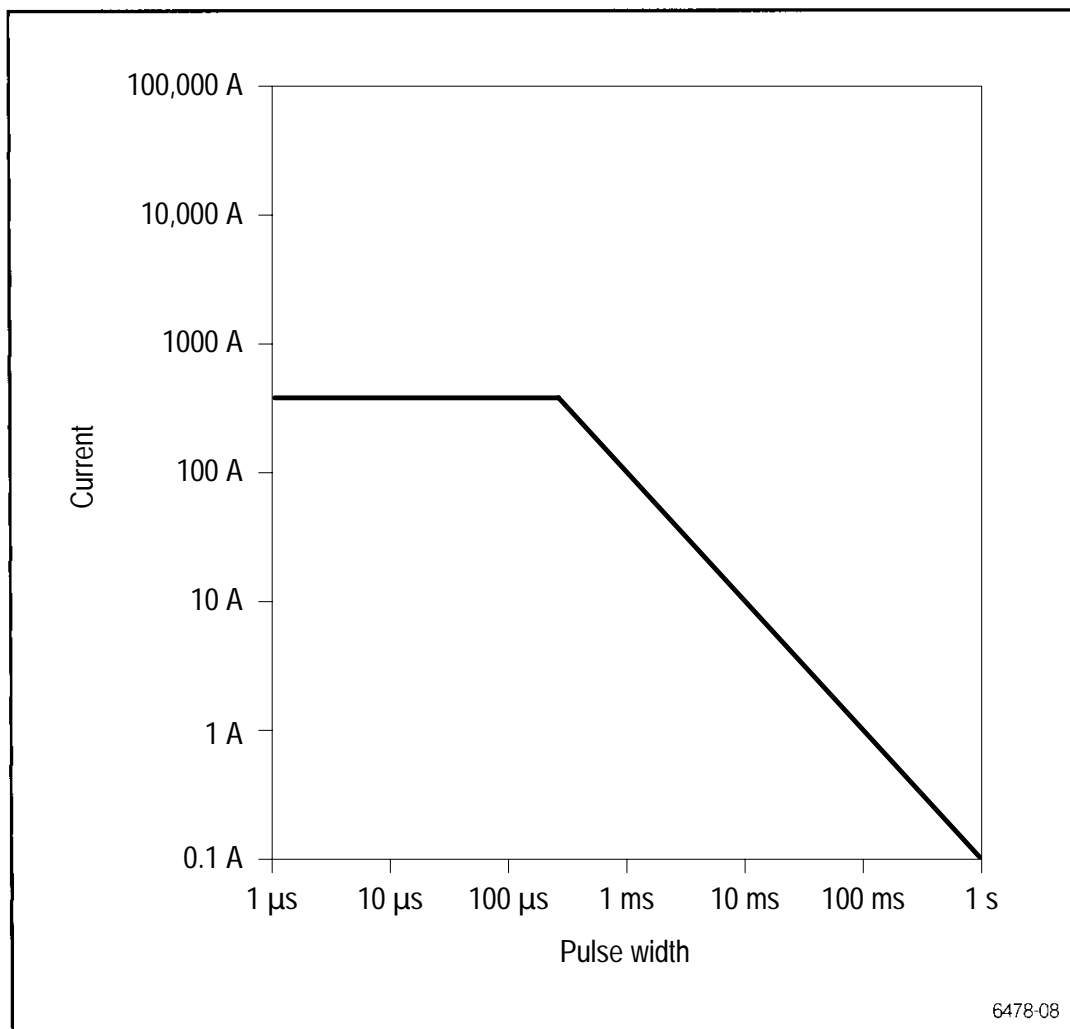


Fig. 2-8. Maximum pulse amplitude versus duration with A6302/A6302XL/A6312 in the 20:1 receptacle of the CT-4

## Insertion Impedance

Fig. 2-9 shows the typical insertion impedance versus frequency. Insertion impedance may be a factor to consider when measuring high current amplitudes, especially at higher frequencies. Voltage drop due to insertion impedance could represent a significant percentage of the source voltage when working with a low-voltage source. For example, at 100 kHz the insertion impedance is approximately 4 mΩ. If a peak current of 250 amperes is to be measured, approximately 1 volt will be dropped across the section of the test conductor passing through the CT-4. Insertion impedance should be minimized by placing the test conductor in the center of the sense loop cross-sectional area.

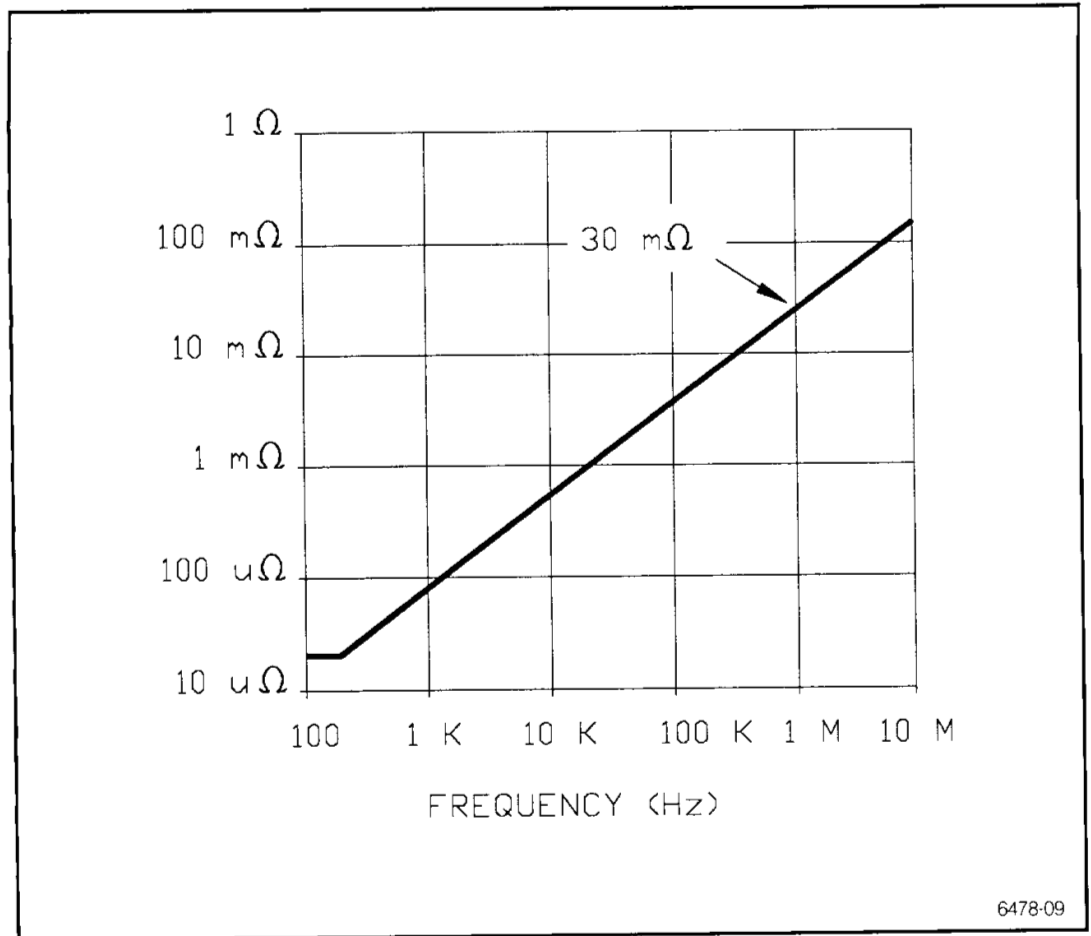


Fig. 2-9. Typical insertion impedance versus frequency.

### ***External Magnetic Field Susceptibility***

This characteristic is affected by physical position of the CT-4 in relation to the external magnetic field. The specification of 35 mA/Gauss covers the most susceptible position. Best position can be determined by placing the CT-4 in various positions in relation to the field (without inserting the test conductor) while observing the oscilloscope display. In practice, the induced current may be too small to be of concern.

### ***Minimizing Loading Effect***

To minimize loading of critical circuits, connect the CT-4 at the low or ground end of the system being tested wherever possible. This will minimize the voltage feedthrough.



## Increasing Sensitivity

To measure low current levels in conductors too large for the A6302/A6302XL/A6312 and TCP202 core openings, two or more loops may be passed through the CT-4. Sensitivity increases directly with the number of turns. Remember, however, that the impedance reflected back into the primary (circuit being measured) from the secondary (probe winding) varies a square function of the primary turns. When observing high-frequency current waveforms or fast-rise pulses, the inductance added to the primary circuit by the additional turns may be significant.

## DC Current Distortions

The CT-4 will tolerate up to approximately 20 amperes of dc current without appreciable effect on the frequency response characteristics. Above this level, saturation increasingly affects the low-frequency performance. Fig. 2-10 illustrates the effect of dc current on low-frequency response. Measurement error also increases with dc currents above 20 amperes over the full bandwidth of the CT-4. Fig. 2-11 shows the typical measurement error with increasing dc current. Use of the DC Bucking Coil is recommended when significant dc currents are present in the test conductor.

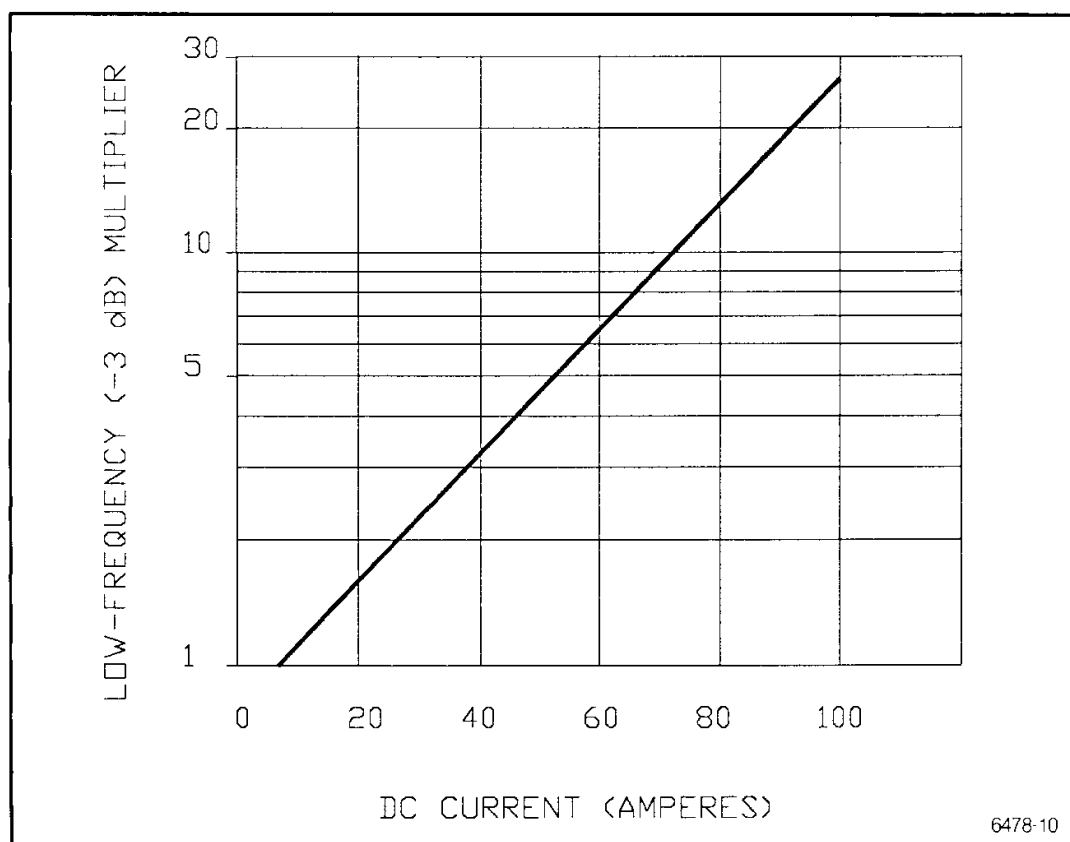


Fig. 2-10. Change in low-frequency response with dc current present in the test conductor. For example, the low-frequency response has moved up by a factor of 10 with 72 amperes of dc current.

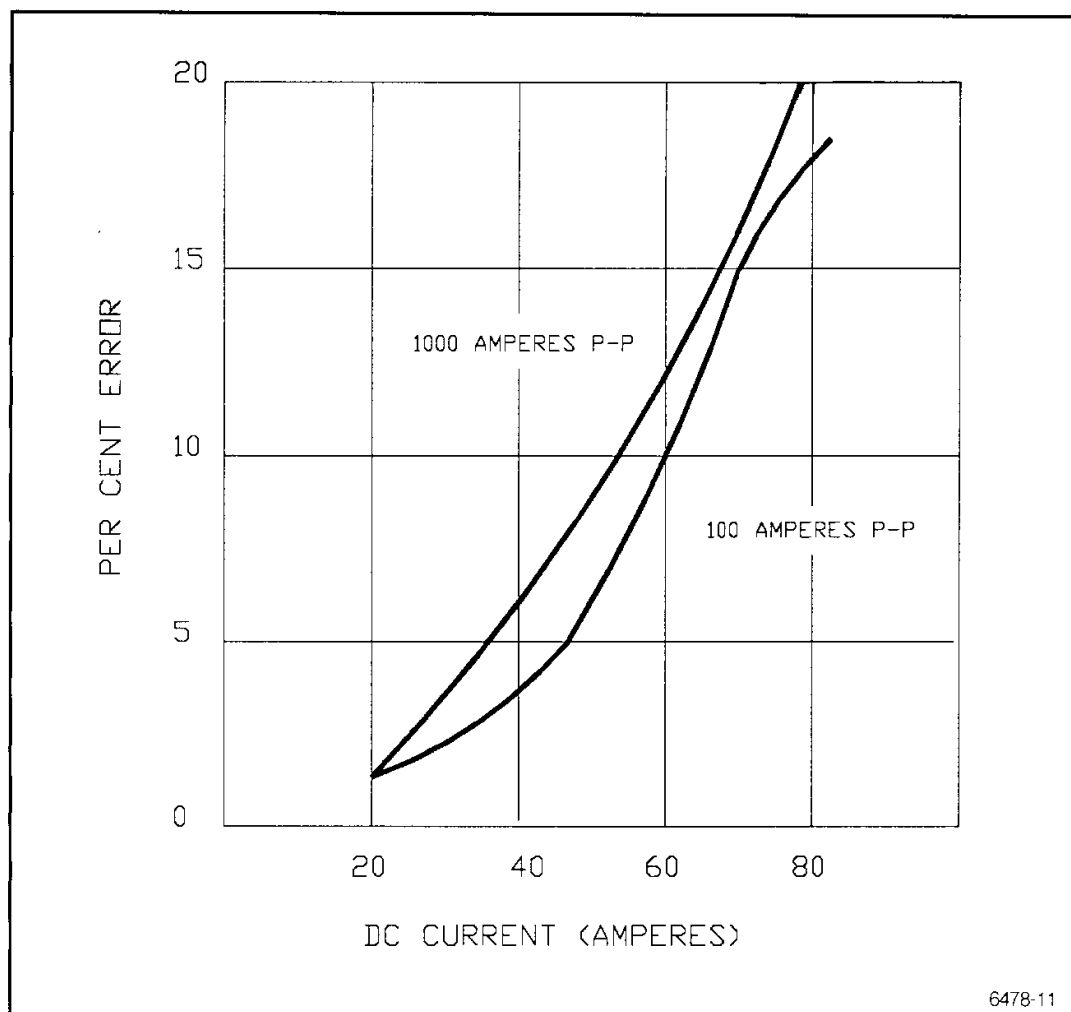


Fig. 2-11. Typical error introduced versus dc current in the test conductor.

## DC Bucking Coil (Optional)

The DC Bucking Coil (Tektronix Part No. 015-0190-00) is an optional accessory to the CT-4. Normally, distortions due to core saturation occur when attempting to observe or measure ac signal currents in the presence of dc currents exceeding approximately 20 amperes. The DC Bucking Coil can negate saturating effects of steady-state dc currents up to 300 A, extending the maximum tolerance of the CT-4 to 320 A.

The Bucking Coil assembly includes a 1000-turn coil which slides over the stationary core of the CT-4, and a base unit which contains current-limiting resistors and a compensation network. An external power supply is required, with a variable output of 0 to 15 V, capable of supplying output current to 300 mA. The DC Bucking Coil requires 1 volt per 20 amperes bucking current, and presents a 50-ohm load to the power supply.

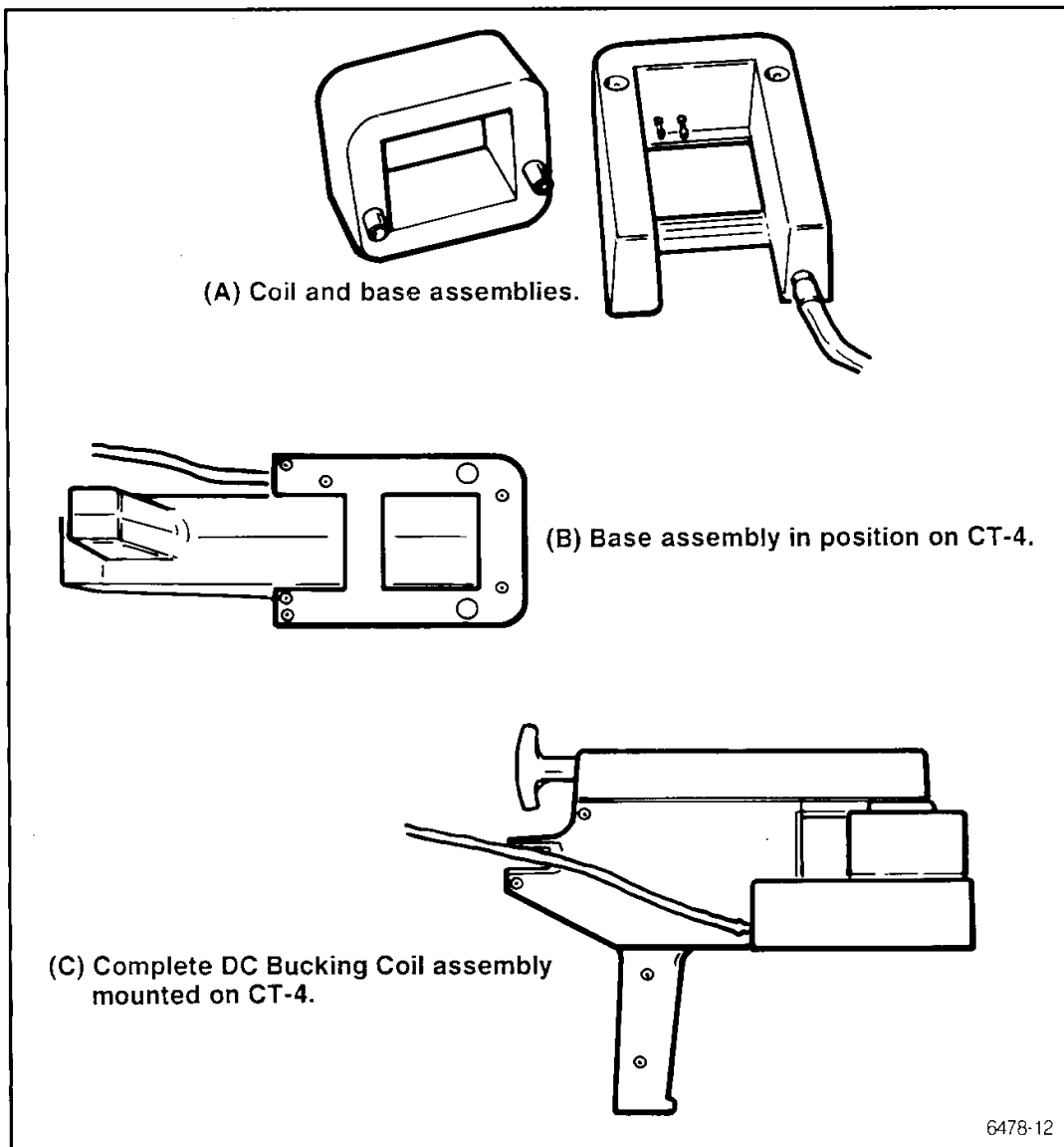


Fig. 2-12. Optional DC Bucking Coil assembly

Only the 1000:1 current ratio receptacle should be used when using the DC Bucking Coil. When the Bucking Coil is mounted on the CT-4, a sample of its ac signal current is internally coupled back to the 1000:1 loop, compensating for objectionable aberrations which would otherwise be present. (See the rear of this manual for circuit diagrams.)

### ***Adjusting for Optimum DC Bucking Current***

When measuring sinusoidal signals, optimum dc bucking current is determined by adjusting the bucking current for maximum amplitude of the sine wave display. For low-frequency flat-topped pulses, the bucking current should be set for minimum tilt of the pulse.

## ***Mounting the DC Bucking Coil***

Attaching the DC Bucking Coil assembly to the CT-4 requires only a screwdriver. To attach, refer to Fig. 2-12 and proceed as follows:

- a. Slide the base over the lower front of the CT-4 core, engaging the two plugs on the base with the connector sockets on the front of the CT-4.
- b. Release the Locking Lever and pull the sliding jaw of the CT-4 back to the stop.
- c. Slide the bucking coil over the stationary core section so the mounting studs on the coil mate with the mounting screws on the base. Push the sliding jaw fully forward and lock.
- d. Turn the CT-4 upside-down and firmly tighten the two mounting screws in the base. If a torque wrench is used, tighten to a maximum of 15 inch-pounds. Attach the power cable to the outer lip of the 20:1 Current Ratio receptacle.

### ***NOTE***

*The power cable clip is intended to both support the cable and prevent the use of the 20:1 Current Ratio receptacle while using the DC Bucking Coil.*

## ***Measuring DC Currents***

The CT-4 with the DC Bucking Coil can be used to determine an approximation of the dc current in a test conductor. To perform this measurement, proceed as follows:

1. Connect the CT-4 to a current loop which is driven by a low-frequency square wave generator (10 to 15 Hz). The TEKTRONIX PG506 as used in Section 4 of this manual provides a good example. Note the amount of tilt in the square wave.
2. With the square wave current loop still connected in the CT-4, also connect the test conductor. Apply current to the DC Bucking Coil and increase until the square wave displays the same degree of tilt noted in step 1.
3. The bucking current may be metered directly at the power supply (this current is 1/1000 of the effective bucking current), or can be determined from the source voltage (20 amperes per volt).

Accuracy of this method is greater at higher dc current levels.



# ***Maintenance***

## ***Introduction***

This section contains information for performing preventive and corrective maintenance on the CT-4 and the base assembly for the optional DC Bucking Coil.

### **WARNING**

*The following service instructions are for qualified personnel only. To avoid electrical shock, do not perform any maintenance on the CT-4 while it is clamped around a current-carrying conductor or on the Bucking Coil or Base Assembly while they are connected to a power source.*

## ***Preventive Maintenance***

Preventive maintenance consists of cleaning, visual inspection, and lubrication of the CT-4 sliding surfaces. The environment in which the CT-4 is used will determine how frequently it should be cleaned and lubricated. For typical conditions, the unit should be serviced every 12 months or 2000 hours of use, whichever comes first. The optional Bucking Coil and Base Assembly normally do not require any preventive maintenance.

### ***CT-4 Disassembly***

To clean and lubricate the CT-4, it must be completely disassembled. To perform this operation, remove the DC Bucking Coil (if used). Referring to the exploded view in the rear of this manual, remove the 7 exterior and 4 interior screws, using 7/64-inch and 3/32-inch hex wrenches. To separate the stationary transformer subassembly from the left body half, the conductor held in the 1000:1 loop should be removed by uncrimping the loop. Disassemble the individual components as indicated in the exploded view.

### ***Cleaning Procedure***

Use a soft bristle brush to dislodge the dust and wipe clean with a lint-free cloth. An alcohol-type cleaner may be used to remove persistent dirt. Avoid the use of chloride cleaning agents as they may craze or discolor the plastic. No abrasives should be used in areas containing printing. Do not submerge the CT-4 or any of the parts.

### ***CT-4 Lubrication and Reassembly***

Areas requiring lubrication are indicated by the small diamond-shaped symbols and arrows on the CT-4 exploded view. The recommended lubricant is Lubriplate A Type 105 (Tektronix Part Number 006-0617-00). This type is commonly available at your local hardware store.

Reassemble, again using the exploded view as a guide. Don't forget to replace the conductor in the 1000:1 loop and rerimp the loop. If a torque wrench is available, tighten all assembly screws to 15 inch-pounds (over-tightening may crack the plastic components).

## ***Corrective Maintenance***

The CT-4 is a very rugged device and should remain trouble-free when used within the specified limits. However, if the CT-4 becomes damaged, replacement parts are available. Refer to the exploded view and parts list in the rear of this manual for Tektronix part numbers.

### ***Bucking Coil and Base Disassembly***

The Bucking Coil by itself is a sealed unit; there are no replaceable parts inside. To disassemble the Base Assembly, first remove it from the CT-4 and Bucking Coil. Remove the six screws from the top of the unit using a 7/64-inch hex wrench. Carefully pry off the top housing half.

### ***Visual Inspection and Repair***

Using the exploded view as a guide, inspect the components for breakage, heat damage, or loose or shorted connections. Most components may be tested individually with an ohmmeter. Refer to the schematic diagram and the exploded view. The exploded view and accompanying parts list can be used as aids in the repair of defective connections or replacement of defective components.

If it is necessary to replace the 600  $\mu$ F capacitors or surrounding 4-turn wire loop, refer to the Bucking Coil exploded view and proceed as follows:

1. Unsolder the capacitors and the wire loop from their terminals.
2. Tape the 3 new capacitors with 4 inches of 1/2-inch wide, electrical grade, acetate cloth tape (3M #11, Permacel #P242, or Tektronix Part Number 253-0064-00).
3. Fashion the wire in a 4-turn loop around the tape in the direction shown in the exploded-view. Make sure to leave the correct lengths for connection to the terminals.
4. Place the capacitor/loop assembly into the lower housing, dressing the capacitor leads through the terminal lug and around the terminal pin. Dress the wire through its terminal lug and around the terminal pin as shown. Solder and clean the connections. Remove excess leads.

## ***Repackaging for Shipment***

If the CT-4 is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing the owner (with address), the name of an individual at your firm who may be contacted, complete instrument serial number and a description of the service required.

Save and reuse the original packaging. If the original packaging is unfit for use or not available, repackage the instrument as follows:

1. Obtain a corrugated cardboard carton having inside dimensions of no less than 2 inches more than the instrument dimensions to for allow cushioning. Use a carton having a test strength of at least 200 pounds.
2. Surround the instrument with polyethylene sheeting to protect the finish.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument, allowing 2 inches on all sides.
4. Seal the carton with shipping tape or an industrial stapler.





# Performance Check

## Introduction

Characteristics of the CT-4 are fixed, no calibration adjustments are needed. High-frequency response, current-handling capability, breakdown voltage, and other characteristics should remain unchanged with time and normal usage.

The only moving parts on the CT-4 are the sliding core segment and the locking lever. If foreign material, such as a small piece of insulation or wire clipping becomes lodged in the jaw area, or if the locking lever fails to work properly, the low-frequency response of the CT-4 will be adversely affected. Since either of these conditions could occur without being obvious, it is recommended that the low-frequency response be checked periodically.

**Table 4-1**  
**Test Equipment Required**

Item	Minimum Requirements	Recommended Example
Oscilloscope	Sensitivity: 10 mV/div, dc coupled.	TEKTRONIX TDS 460A
Square Wave Generator	Output current capability 100 mA into 50 $\Omega$ , variable. Repetition rate 10 Hz to 100 Hz, continuously variable.	Wavetek 9100 Universal Calibration System with Oscilloscope Calibration Module (Option 250)
Current Probe Amplifier	TEKTRONIX AM503B <sup>a</sup> .	
Current Probe	TEKTRONIX A6302.	
50 $\Omega$ BNC Feed-Through Termination (2 required)		Tektronix Part No. 011-0049-00.
BNC Cable		Tektronix Part No. 012-0482-00.
Adapter	BNC male-to-dual banana jack.	Tektronix Pat No. 013-0035-00.
Adapter	BNC female-to-dual banana plug.	Tektronix Part No. 013-0090-00.
Patch Cord	Dual banana plugs.	Tektronix Part No. 012-0031-00.

<sup>a</sup>Requires a TM500- or TM5000-Series Power Module Mainframe.

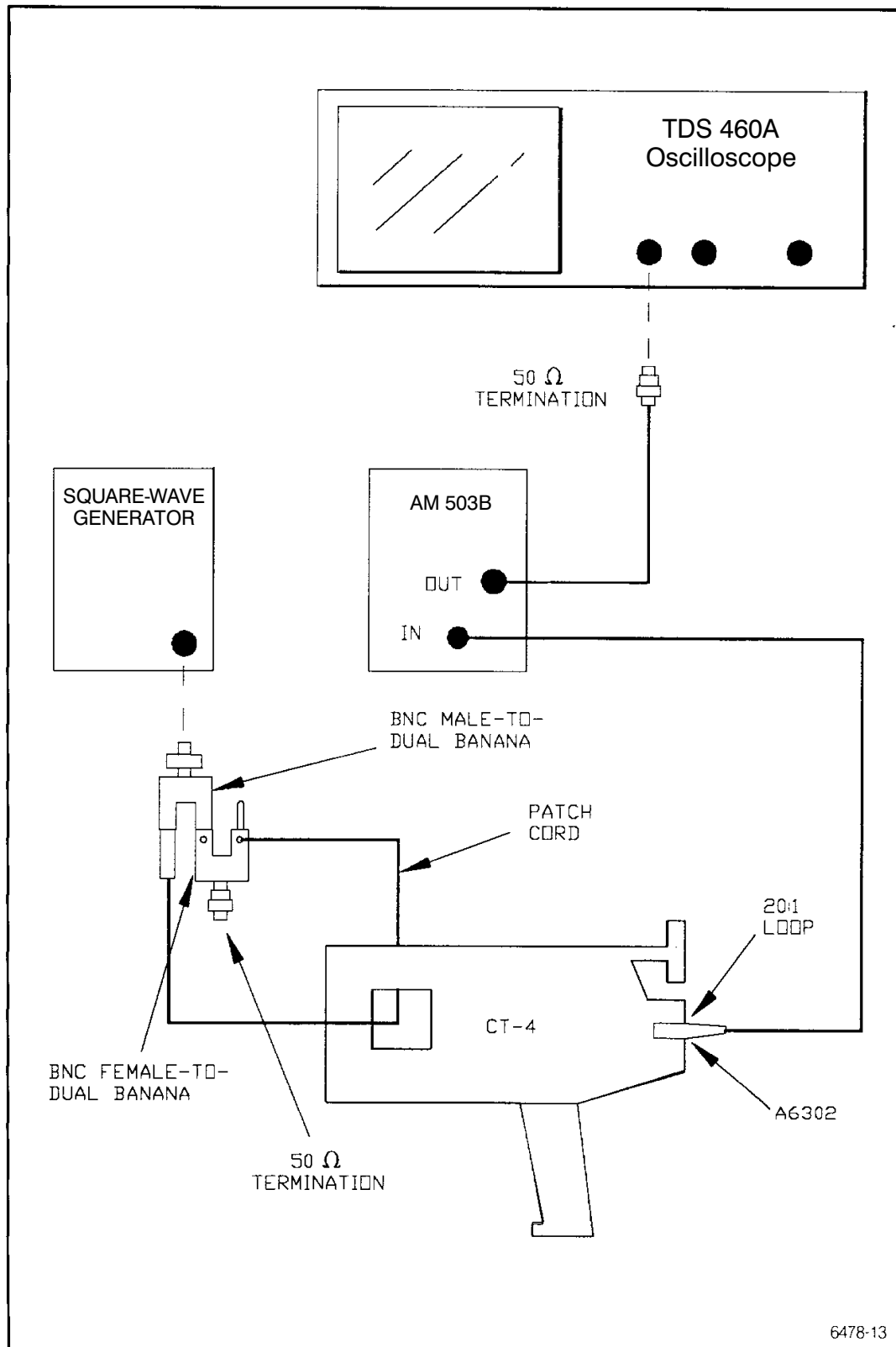


Fig. 4-1. Equipment setup for checking low-frequency response.

## Test Equipment Required

The test equipment listed in Table 4-1, or its equivalent, is required for completion of this procedure. If equipment is substituted, control settings or test equipment setup may need to be altered. Substitute equipment must meet or exceed the minimum requirements given.

### CT-4 Only

- Connect the CT-4 and test equipment as shown in Fig. 4-1.
- Set the oscilloscope time/div to 10 ms/div and volts/div to 10 mV/div. Set the input coupling to dc.
- Set the CURRENT/DIV on the AM503X to 1 mA/div. The A6302 should be clamped onto the 20:1 Current Ratio Loop of the CT-4.
- Set the frequency of the square-wave generator to 100 Hz and adjust the amplitude for 5 divisions of vertical deflection on the oscilloscope.

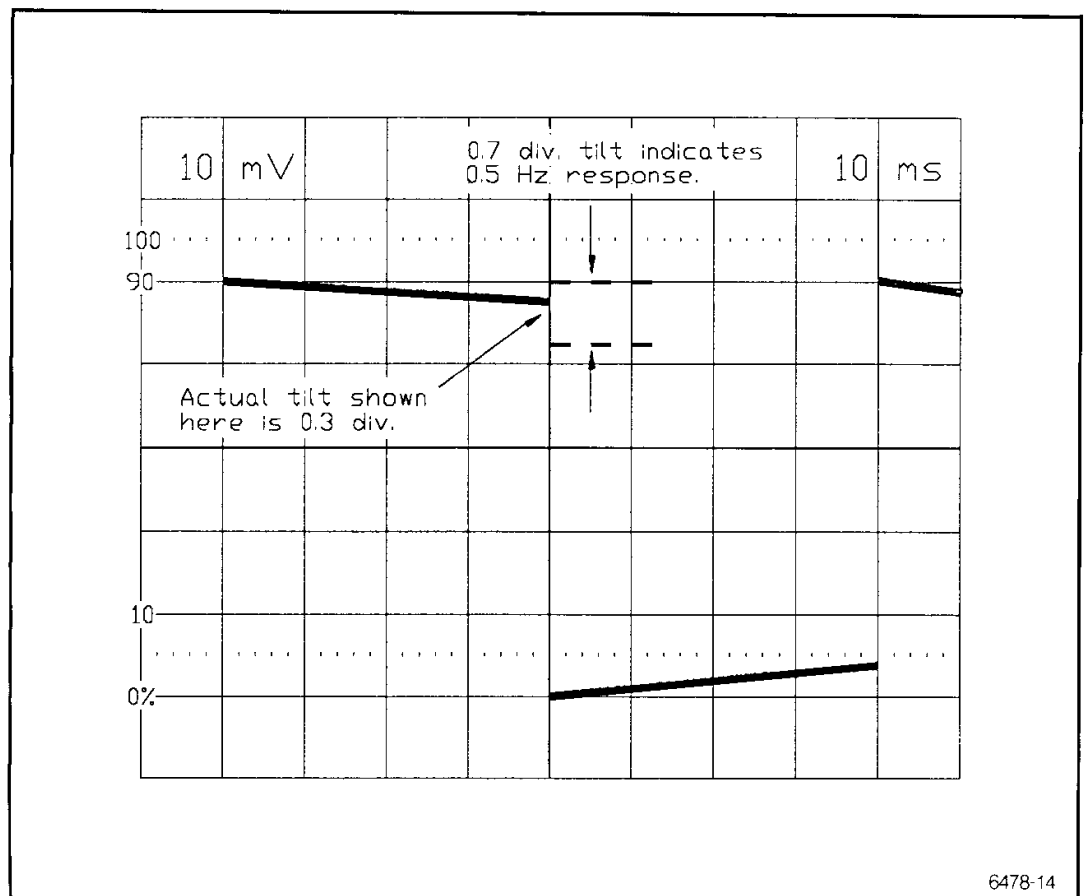


Fig. 4-2. Typical response of the CT-4 with the A6302/AM503B to a low-frequency square wave. A tilt of 0.7 division indicates a  $-3$  dB response of 0.5 Hz.

e. Adjust the frequency of the square-wave on the generator so that one complete cycle occurs in 8 major divisions on the screen (80 ms).

f. Position the display horizontally so that the positive half-cycle ends on the graticule center line. Position the display vertically to place the start of the top of the square wave on the line 2 major divisions above the center line.

g. Measure the tilt of the positive half-cycle. The tilt should be 0.7 division or less, indicating a low-frequency response of 0.5 Hz or lower (see Fig. 4-2).

### ***CT-4 with Optional DC Bucking Coil***

Attach the DC Bucking Coil assembly to the CT-4. The bucking coil power leads should be connected to a dc power supply with the voltage set to 0 V, or the leads should be shorted together with a jumper. Connect the A6302 probe to the 1000:1 ratio loop.

The low-frequency response is checked in the same manner as for the CT-4 (previously described). The tilt should be 1.1 division or less, indicating a low-frequency response of 1 Hz or lower.

# ***Replaceable Parts***

## ***Parts Ordering Information***

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

## ***Item Name***

In the Parts List, an Item Name is separated from the Description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## ***Figure and Index Numbers***

Items in this section are referenced by figure and index numbers to the illustrations.

## ***Indentation System***

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5                      *Name & Description*

*Assembly and/or Component*

*Attaching parts for Assembly and/or Component*

*END ATTACHING PARTS*

*Detail Part of Assembly and/or Component*

*Attaching parts for Detail Part*

*END ATTACHING PARTS*

*Parts of Detail Part*

*Attaching parts for Parts of Detail Part*

*END ATTACHING PARTS*

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

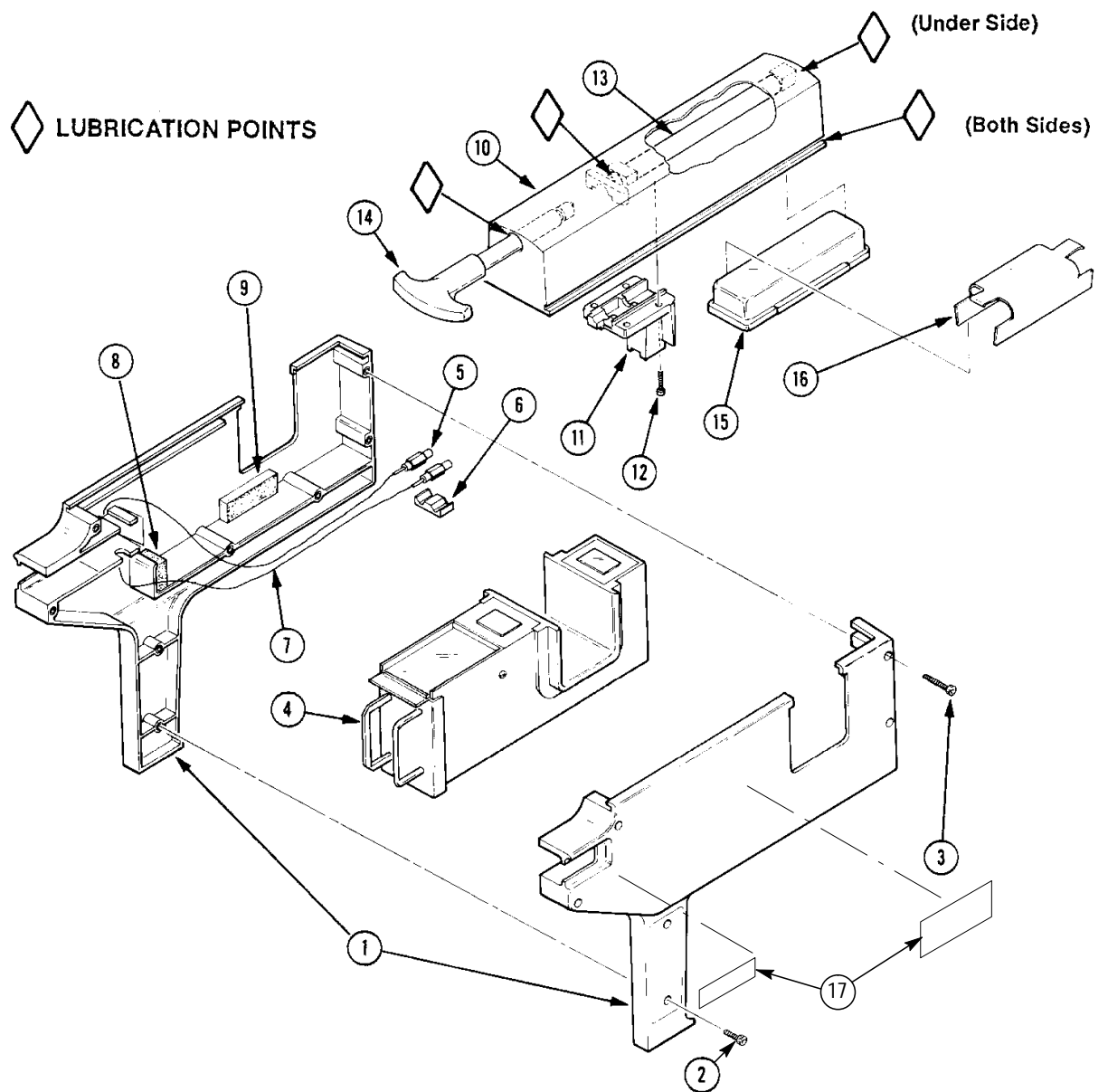
**Attaching parts must be purchased separately, unless otherwise specified.**

## ***Abbreviations***

Abbreviations conform to American National Standards Institute Y1.1.

# CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204
04713	MOTOROLA INC	5005 E MCDOWELL RD	PHOENIX AZ 85008
	SEMICONDUCTOR GROUP		
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
44655	OHMITE MFG CO	3601 W HOWARD ST	SKOKIE IL 60076
50394	SPS TECHNOLOGIES INC UNBRAKO DIV	HIGHLAND AVE	JENKINTOWN PA 19046
56289	SPRAGUE ELECTRIC CO	87 MARSHALL ST	NORTH ADAMS MA 01247
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
77900	SHAKEPROOF	SAINT CHARLES RD	ELGIN IL 60120
	DIV OF ILLINOIS TOOL WORKS		
79136	WALDES KOHINOOR INC	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
		2527 GRANT AVE	
85471	BOYD INDUSTRIAL RUBBER		SAN LEANDRO CA 94579
	DIV OF A B BOYD CO		
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201
TK0282	SONIC WIRE SALES INC	2698 MARINE WAY	MOUNTAINVIEW CA 94043

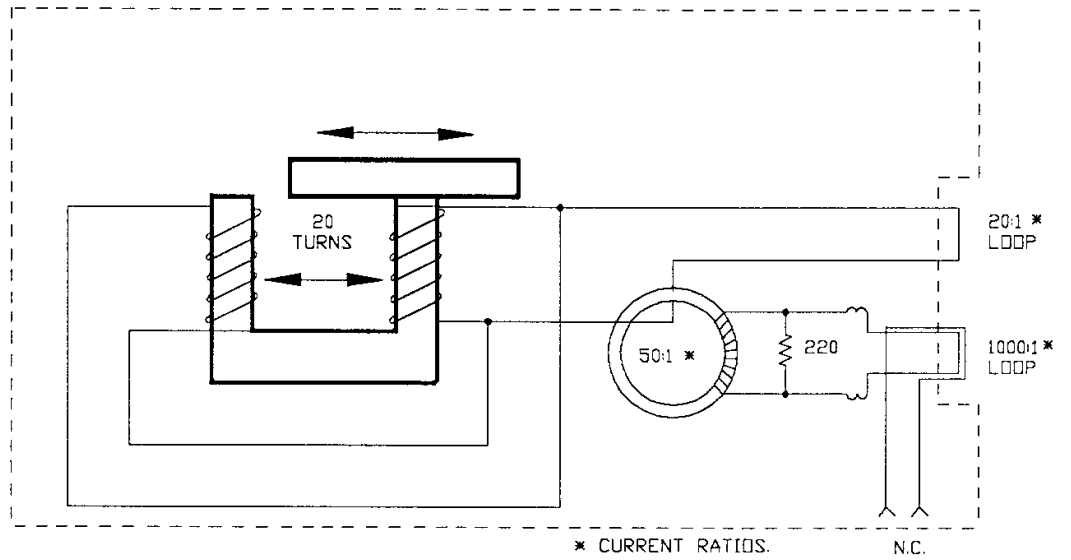


**Fig. 1. CT-4 exploded view.**

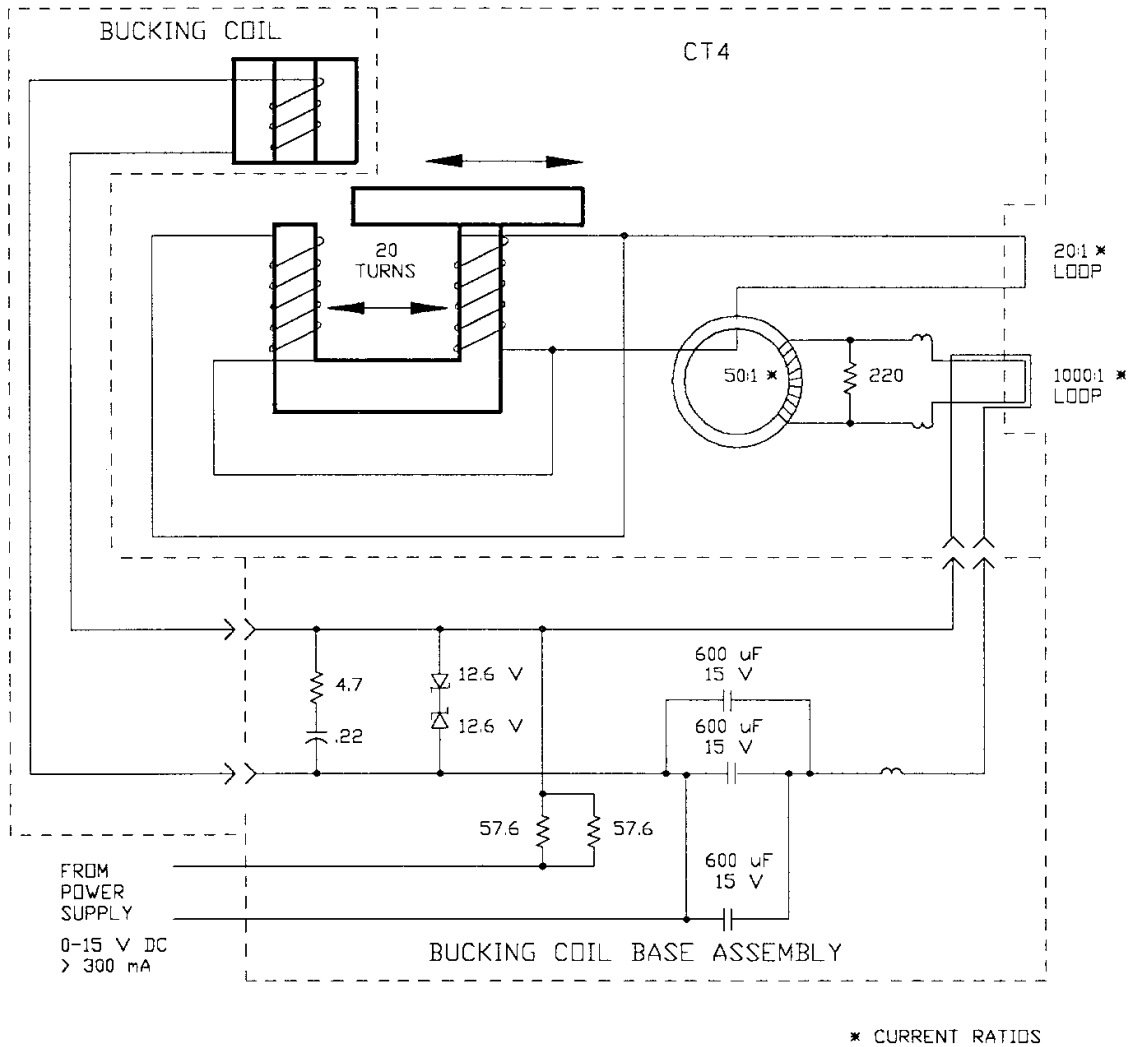


Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective    Dscont	Qty	12345    Name & Description	Mfr. Code	Mfr. Part No.
1-1	204-0448-04		1	BODY, HALF CT: RIGHT & LEFT, DOVE GRAY ATTACHING PARTS	80009	204-0448-03
-2	211-0627-00		2	SCREW, CAP: 6-32 X 0.5, SCH, STL, CD PL, HEX REC	50394	ORDER BY DESCR
-3	211-0592-00		5	SCREW, CAP: 6-32 X 1.0, SCH, STL, CD PL, HEX REC END ATTACHING PARTS	50394	ORDER BY DESCR
-4	120-0733-00		1	TRANSFORMER, CUR: STATIONARY HALF	80009	120-0733-00
-5	131-1014-00		2	CONTACT, ELEC: CONN, BRASS TIN PL	80009	131-1014-00
-6	343-0319-00		2	RTNR, ELEC CONT: ABS PLASTIC	80009	343-0319-00
-7	175-0602-00		1	WIRE, ELECTRICAL: SOLID, 22 AWG, 600V RMS, WHITE	TK0282	ORDER BY DESCR
-8	348-0090-01		1	PAD, CUSHIONING: 0.69 X 0.46 X 0.312 SI RBR	85471	ORDER BY DESCR
-9	348-0070-01		2	PAD, CUSHIONING: 2.03 X 0.69 X 0.18 SI RBR	85471	ORDER BY DESCR
-10	351-0277-01		1	SLIDE, CUR XFMR: 8.765 X 1.95 X 1.6, NYLON	80009	351-0277-01
-11	343-0300-00		1	RETAINER, HANDLE: NYLON ATTACHING PARTS	80009	343-0300-00
-12	211-0183-00		4	SCREW, CAP: 4-40 X 0.5, SCH, STL, CD PL, HEX REC END ATTACHING PARTS	50394	ORDER BY DESCR
-13	384-0791-00		1	SHAFT, LATCH: 5.215 L X 0.437 OD, AL	80009	384-0791-00
-14	367-0137-02		1	HANDLE, RELEASE: CURRENT XFMR, SLATE GRAY	80009	367-0137-02
-15	120-0732-00		1	TRANSFORMER, CUR: UPPER HALF	80009	120-0732-00
-16	214-1500-00		1	SPR, XFMR LOCATE: SLIDE HALF	80009	214-1500-00
-17	334-9574-00		1	MARKER, IDENT: LABEL STANDARD ACCESSORIES	80009	334-9574-00
	015-0194-00		1	BUSHING, HV: 12 IN	80009	015-0194-00
	070-6478-XX		1	MANUAL, TECH: INSTR, CT4	80009	070-6478-XX
				OPTIONAL ACCESSORIES		
	015-0194-01		1	BUSHING, HV: 48 IN	80009	015-0194-01
	015-0190-00		1	COIL, DC BUCKING:	80009	015-0190-00

# Schematics



CT-4 schematic diagram.



CT-4 with DC Bucking Coil schematic diagram.



