

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

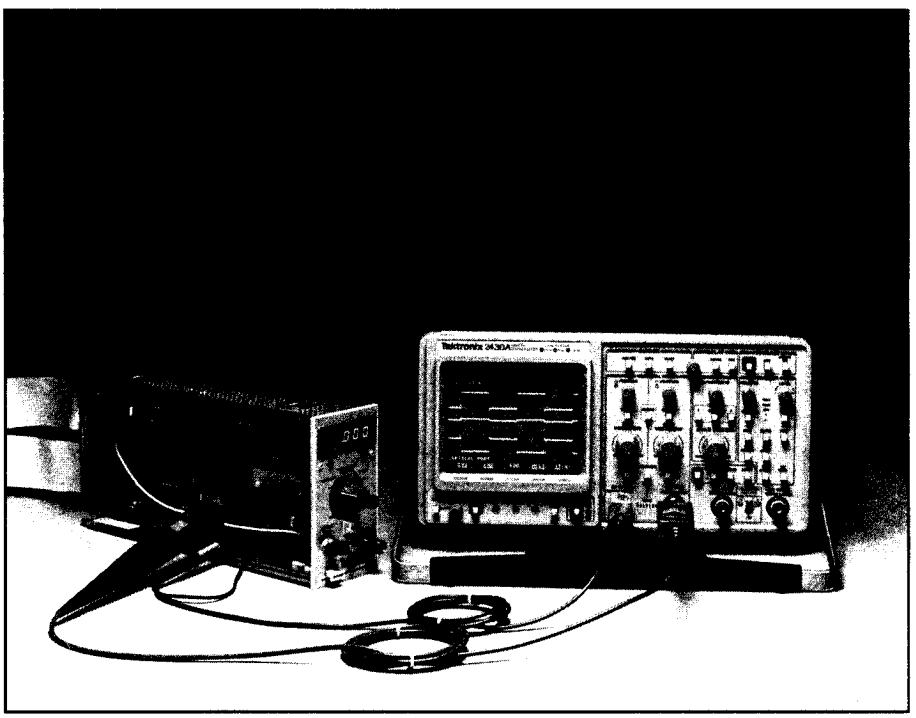
Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

- **General purpose clip-on probes**
- **Continuous AC or single-shot pulse measurements**
- **120 Hz TO 60 MHz (P6021)**
- **935 Hz TO 120 MHz (P6022)**
- **Low insertion impedance**
- **For use with 1 M Ohm systems**

P6021 AND P6022 AC CURRENT PROBES



General Purpose Clip-on Probes

The **P6021** and **P6022** AC current probes are designed to access current-carrying components and conductors without breaking the circuit under test. A spring-loaded slide opens to accept conductors and other components, such as resistors; up to 0.15″ diameter with the P6021, and up to 0.1″ diameter with the P6022. Insulated construction enables bare wires to be accessed up to a maximum of 600V. The exposed shield is not grounded in the open position.

Continuous AC or Single-Shot Pulse Measurements

The P6021 can make continuous AC current measurements up to 5.3 A RMS when the frequency is within the limits shown in the Major Characteristics Overview. (Also see Current vs Frequency Derating Curves.)

The P6021 can also make single-shot and low duty-cycle pulse measurements up to 250 A Peak, provided that the Amp-Second Product (Current-Time Product) does not exceed the limits shown in the Major Characteristics Overview.

The physically smaller, higher bandwidth P6022 can make continuous current measurements up to 2.12 A RMS when the frequency is within the limits shown in the Major Characteristics Overview. (Also see Current vs Frequency Derating Curves.)

The P6022 can also make single-shot and low rep-rate pulse measurements up to 100 A Peak, provided that the Amp-Second Product (Current-Time Product) does not exceed the limits shown in the Major Characteristics Overview.

Bandwidth

The P6021 has a useful bandwidth of 120 Hz to 60 MHz (−3dB points). The physically smaller P6022 has a useful bandwidth of 935 Hz to 120 MHz (−3dB points).

Both these probes have Current vs Frequency derating curves that take effect before the −3dB (bandwidth) limits are reached. (See the Major Characteristics Overview and the Current vs Frequency Derating Curves for detailed information.)

Low Insertion Impedance

Both probes have very low insertion impedance (very small effect on the device under test). The P6021 has an insertion impedance of 0.03 ohm or less at 1 MHz, and 1.0 ohm or less at 60 MHz. The P6022 has an insertion impedance of 0.03 ohm or less at 1 MHz, and 0.2 ohm or less at 120 MHz. These probes therefore provide a far superior method of determining current than measuring the voltage drop across a sampling resistor.

For use with 1 M Ohm input Scopes and other Measuring Devices

The standard P6021 and P6022 current probes are supplied with a passive termination for direct connection to 1 M ohm input systems.

Two switchable sensitivity settings are provided on the passive termination to provide optimum sensitivity or low frequency response, depending upon your application.

Tektronix®
COMMITTED TO EXCELLENCE

The P6021 provides 1mV out for each 10mA of input current, with a −3dB low frequency rolloff of 120 Hz; or 1mV out for each 2mA of input current, with a −3dB low frequency rolloff of 450 Hz.

The higher frequency P6022 provides 1mV out for each 10mA of input current, with a −3dB low frequency rolloff of 935 Hz; or 1mV out for each mA of input current, with a −3dB low frequency rolloff of 8.5 KHz.

Preferred Switch Positions

Maximum low frequency response and minimum aberrations are obtained by using the 10mA/mV positions on the P6021 and the P6022 Passive Terminations.

Note: Passive terminations are not required when using the P6021 or P6022 with the 134 Current Probe Amplifier; or when using the P6021 with the 5A21N Differential Amplifier. (See Other Useful Accessories.)

TYPICAL SYSTEMS

The P6021 and P6022 Current Probes are AC current measuring devices, typically used with compatible 1 M ohm input scopes and other devices to measure current without breaking circuit connections. Low insertion impedance provides minimum impact on the circuit under test.

Portable or Lab. Scopes

Any 1 M ohm input scope can be used with the P6021 or P6022. The scope bandwidth should be greater than the probe upper bandwidth to ensure specified performance.

1 M Ohm/50 Ohm Input Scopes

The P6021 and P6022 with their Passive Terminations are designed to work into 1 M ohm inputs only. Select the 1 M ohm input impedance position (AC or DC coupled) when using these two probes with their Passive Terminations, or when using the 134 Current Probe Amplifier. (See Other Useful Accessories.)

Tektronix 5000 Series Scopes

The P6021 with Passive Termination is recommended for use with all 5100 Series and 5400 Series Plug-in Amplifiers, except the 5A19N and the 5A21N. The 5A21N accepts the P6021 directly, via its Current Probe Input. The 5A21N/P6021 combination provides increased sensitivity and improved low frequency response. (See Other Useful Accessories.)

As a general guide, upper frequency response will be limited by the plug-ins used.

TYPICAL APPLICATIONS

Single-Shot and Low Rep-Rate Measurements

Measurements of peak current, risetime, pulse width and general waveshape are easy to make with the P6021 or P6022. In selecting the correct probe for the job, consider its pulse handling ability, (Amp-Second Product/Current-Time Product) its risetime, and its low-frequency rolloff characteristics (droop).

Refer to the Major Characteristics Overview; Single-Shot and Low Rep-Rate Applications Section for detailed information.

If your pulse falls outside the limits handled by the P6021 or P6022, consider the range-extending CT-5 High Current Transformer/P6021 combination. (See Other Useful Accessories.) If your pulse has significant DC content, or if the pulse is longer than about 100 microseconds; consider the A6302/AM503 DC Current Probe.

Displayed Waveform Droop

All AC current probes will exhibit low-frequency droop (tilt) if the pulse width encroaches upon the low frequency time constant of the probe.

The L/R Time Constant figures shown in the Major Characteristics Overview indicates the time it takes for a flat-topped input pulse to drop (droop-tilt) to 63% of its original level, therefore it is very important to keep the pulse width short in relation to the low-frequency Time Constant of the probe.

As a guide, the pulse width should not be longer than 1/10 to 1/100 of the probe's L/R Time Constant in order to avoid excessive displayed droop. However, if displayed droop is evident, peak current can still be determined by measuring the leading or falling edges of the pulse.

Differential Measurements

Current probes offer two basic methods of making differential current measurements.

(1) One Probe/Single-Ended Amplifier.

The P6021 or P6022 can be clamped over two current-carrying conductors to measure the sum or difference, depending upon the relative direction of the two currents.

Current balance in push-pull amplifiers can be verified by passing the outputs (in the same direction) through the split core of a single P6021 or P6022.

Copyright©1987. Tektronix, Inc. All rights reserved.

(2) Two Probes/Differential Amplifier.

Two identical current probes and probe cables can be used with differential amplifiers to measure sum or difference currents in circuits that are physically separated (precluding the use of a single probe).

Sum and difference measurements are made by reversing one of the probes, or by using the ADDED, CH2 INVERT function on some Dual-Trace Amplifiers.

Noise Reduction

The P6021 and P6022 are mu-metal shielded for maximum noise immunity. However, in a high EMI environment (Electro-Magnetic Interference) it is possible to reduce the common mode interference by using a second identical probe and a differential amplifier.

Connect the second current probe to the minus input of the amplifier and place the probe head in proximity with the measuring probe (with the jaws closed). Orient the second probe for minimum EMI.

Other Noise Reduction Techniques

In addition to the use of differential amplifiers for common-mode noise reduction, selective filtration can be used to reduce high and low frequency noise to a minimum. (See Measuring Small Currents; 7A22 and 5A22N.) These filters can be used in the single-ended or differential input modes.

Signal Averaging

The Tektronix 2430 and 7854 Digitizing Scopes provide signal averaging as a means of greatly reducing random noise. A combination of techniques can be used to reduce undesired signals and noise to a minimum.

Isolated Measurements

The P6021 and P6022, and most current probes are inherently isolated from the device under test; in comparison to single-ended voltage probes; where required ground leads and resistive and capacitive loading can impact the signal.

The P6021 and P6022 can make isolated measurements to 600V (DC plus Peak AC) bare wire; or higher, when used on insulated wires.

Insertion impedance is typically less than one ohm, and capacitive loading, although not specified for the P6021 or P6022, is typically less than two or three picofarad.

A ground lead is provided to reduce high frequency ringing and noise, but it is not part of the signal path.

The net result is maximum isolation and minimum impact on the device under test. (See Major Characteristics Overview.)

Small Current Measurements

The P6021 and P6022 AC Current Probes are inherently low noise passive devices; enabling them to be used with high gain differential amplifiers, to obtain maximum sensitivity for making current measurements in the micro-amp range.

For example, when the P6021 is used with the Tektronix 7A22 or 5A22N Differential Amplifiers at their 10 micro-volt/cm sensitivity settings; currents of 20 micro-amp/cm can be displayed. (P6021 Passive Termination in the 2mA/mV position.)

The 7A22 and 5A22N Differential Amplifiers incorporate high and low frequency rolloff filters to help reduce undesirable signals to the minimum. (Also see Differential Measurements for other noise reduction techniques.)

DC Current Cancellation

DC current cancellation, or current bucking can be used with the P6021 or P6022 to offset DC currents in excess of 0.5A for the P6021, and 200mA for the P6022.

AC current probes are inherently intolerant to DC current. If the maximum figures are exceeded, the core will saturate and the output signal will become non-linear.

DC currents can be offset by passing an equal and opposite current through an additional winding on the probe jaw primary. A practical method is to wind five or ten turns on the open jaw and apply the Ampre-Turns rule. For example, if you need to offset 2A DC; wind on ten turns, and pass exactly 200mA through the winding from an external source. Make sure the bucking current is in opposition to the DC signal current.

Note: Too many added turns will increase the insertion impedance and affect the high frequency response of the probe.

If you need to **measure** DC current as part of your signal, you must use a DC current probe, such as the A6302/AM503 or A6303/AM503.

MAJOR CHARACTERISTICS OVERVIEW

For CW (Continuous Wave) Applications

PARAMETER	P6021 with Passive Termination		P6022 with Passive Termination	
Sensitivity (within 3%)	2mA/mV	10mA/mV*	1mA/mV	10mA/mV*
Bandwidth (–3dB points. Current derated with frequency.)	450 Hz to 60 MHz	120 Hz to 60 MHz	8.5 KHz 100 MHz	935 Hz 120 MHz
Max. Continuous Current (RMS)	1.8A	5.3A	2.12A	2.12A
From	1.2 KHz	300 Hz	10 KHz	3 KHz
To	5 MHz	5 MHz	10 MHz	10 MHz
Max. DC Current (Saturation Current)	0.5A	0.5A	200 mA	200 mA
Max. Conductor Size	0.15″ dia		0.1″ dia	
Max. Bare Wire Voltage	600 V (DC + Peak AC)		600 V (DC + Peak AC)	
Insertion Impedance	0.03 ohm at 1 MHz 1.0 ohm at 60 MHz		0.03 ohm at 1 MHz 0.2 ohm at 120 MHz	

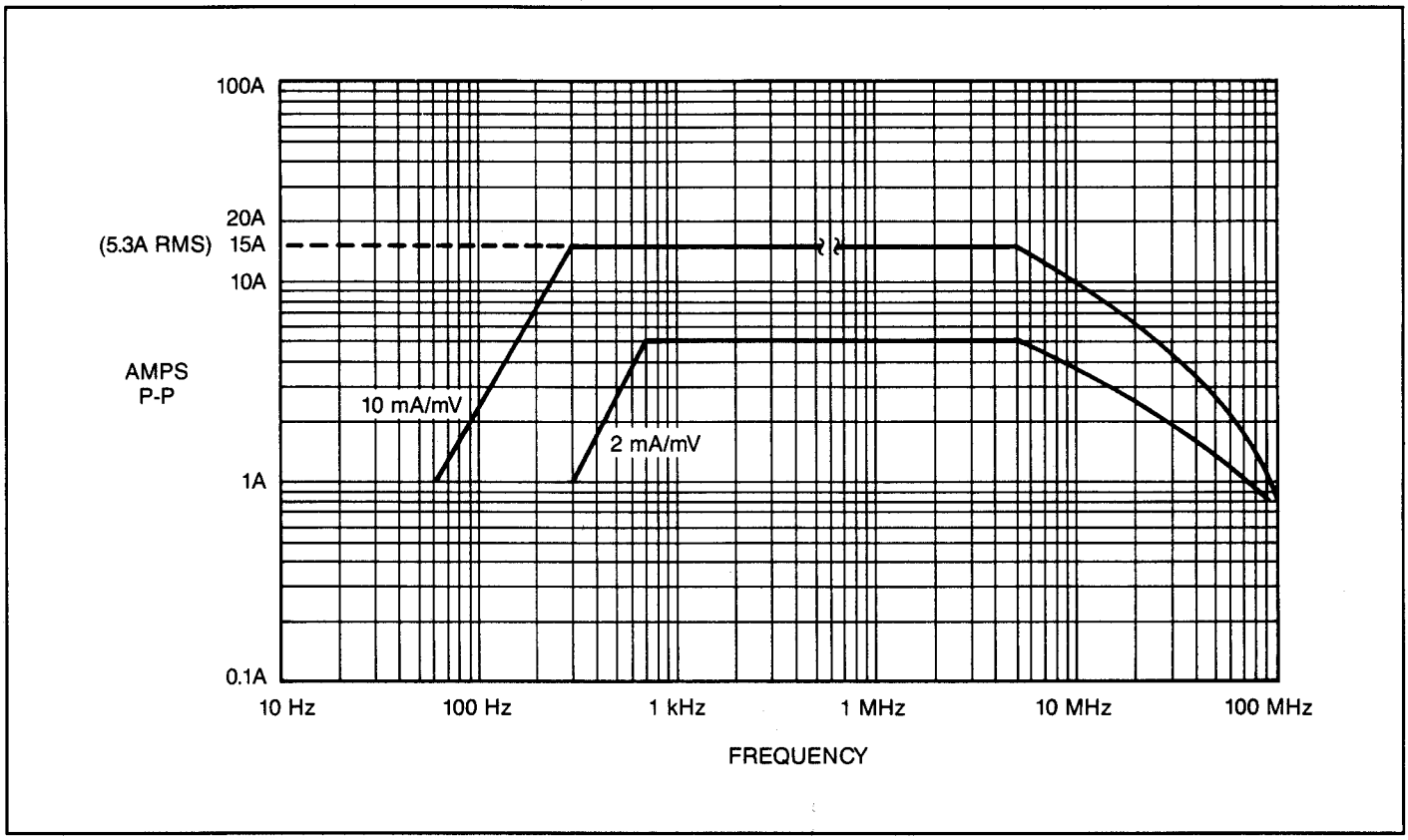
*NOTE: Preferred switch position.

MAJOR CHARACTERISTICS OVERVIEW

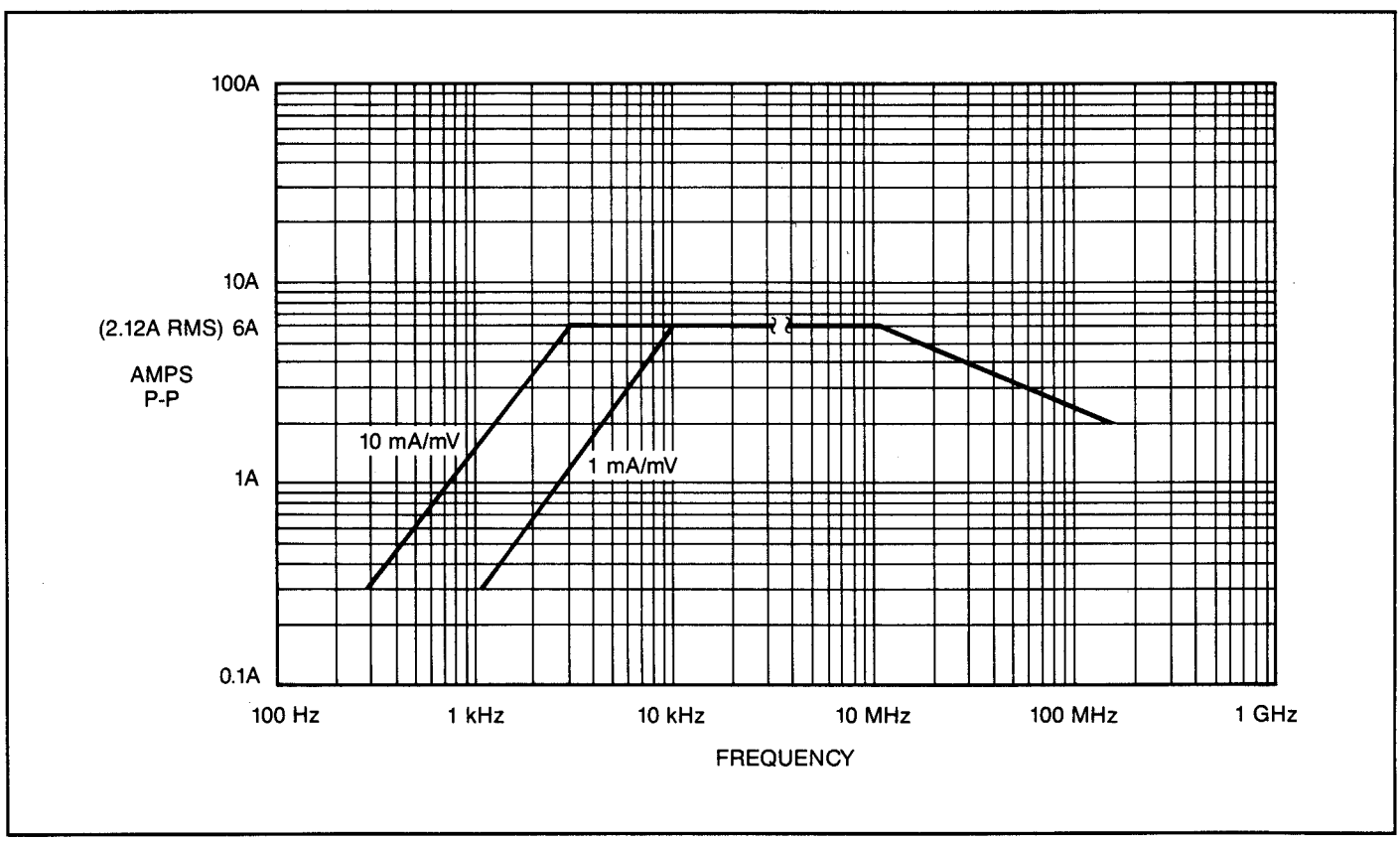
For Single-Shot and Low Rep-Rate Pulse Applications

PARAMETER	P6021 with Passive Termination		P6022 with Passive Termination	
Sensitivity (within 3%)	2mA/mV	10mA/mV*	1mA/mV	10mA/mV*
Max. Pulse Current (not to exceed the Amp-Second Product/Current-Time Product)	N/A	250A	N/A	100A
Amp-Second Product	500×10^{-6} Sec		9×10^{-6} Sec	
Risetime	5.8 nS	5.8 nS	3.5 nS	2.9 nS
Max. DC Current (Saturation Current)	0.5A	0.5A	200 mA	200 mA
L/R Time Constant (droop)	0.35 mS	1.3 mS	18.7 μS	0.17 mS
Propagation Delay				
5 ft	9 nS	9 nS	9 nS	9 nS
9 ft	15 nS	15 nS	15 nS	15 nS

* Note: Preferred switch position.



P6021/Termination Input Current vs Frequency Derating.



P6022/Termination Input Current vs. Frequency Derating.

Amp-Second Product Guidelines

1) Only apply the A-S Product rule if your pulse amplitude is in excess of the specified Max. Continuous Current for the probe; for example; P6021. 5.3A RMS = 7.5A Peak.

2) Do not exceed the specified Max. Pulse Current for the probe; for example; P6021. 250A Peak.

3) To find the max. allowable pulse width. (Note: It is more convenient to deal in Amp-microseconds)

Width μs = Amp-μs Product/I peak

Taking the P6021 as an example; Width = 500/250 = 2 microseconds.

4) To find Max. allowable pulse amplitude for a given width;

Amplitude = Amp-μs Product/Width, in micro-seconds

For example; Pulse width is 25 μs. What is the allowable pulse amplitude?

Max. allowable Amplitude = 500/25 = 20A peak

Notes: Signal risetime must not exceed the risetime of the probe. Signal must be single-shot or low rep-rate.

The chart at the right shows the Amp-Second limits of the P6021 with the Passive Termination in the 10 mA/mV switch position.

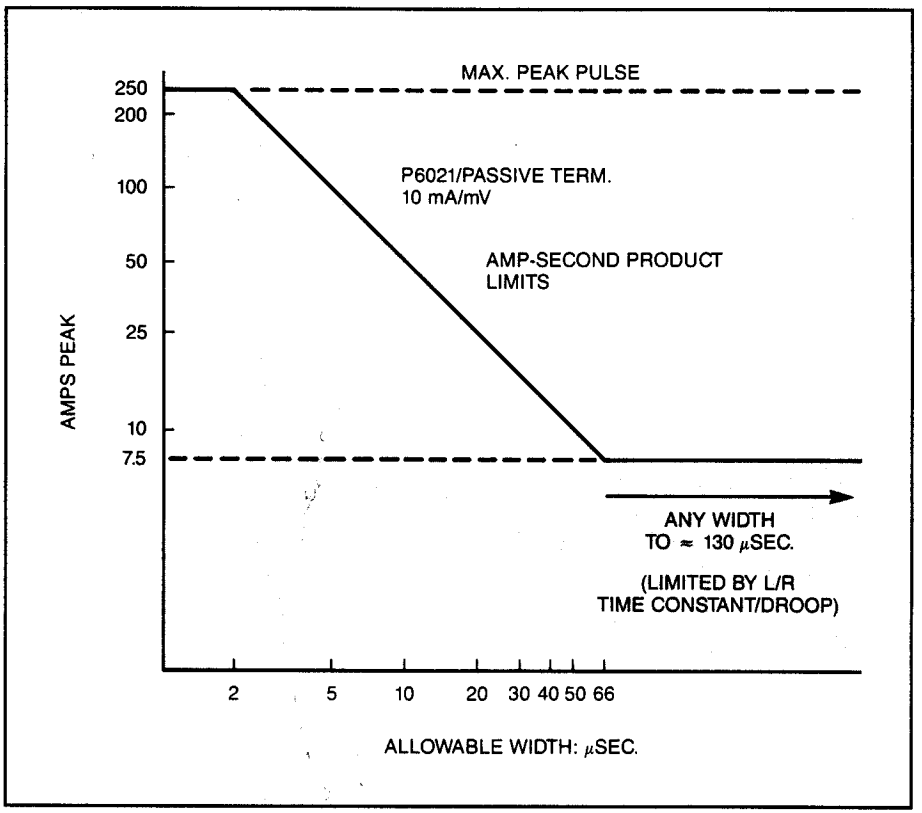
Extending the Range of the P6021 AC Current Probe

Continuous currents up to 700A RMS, and pulsed currents up to 1000A Peak can be measured with the CT-5/P6021 combination. (See Other Useful Accessories.)

The CT-5 High Current Transformer is designed to work with the P6021 AC Current Probe or the A6302/AM503 DC Current Probe System. It is not compatible with the smaller P6022 AC Current Probe. In operation, the P6021 probe head is inserted in one of two receptacles in the CT-5, providing a choice of either 20:1 or 1000:1 step-down ratios.

The sliding jaw of the CT-5 opens to accept conductors up to 1.5″ dia. without breaking circuit connections. In addition to increased current-handling ability, the CT-5 provides Amp-Second Product multiplication of the host probe (P6021) of up to 1000X.

The table on page 7 lists the major characteristics of the CT-5/P6021 combination. For further information on the CT-5, ask for Data Sheet CT-5 High Current Transformer.



Amp-Second limits of the P6021 System.

MAJOR CHARACTERISTICS

CT-5/P6021/Passive Termination

PARAMETER	CT-5/P6021 with Passive Termination (20:1 Receptacle)		CT-5/P6021 with Passive Termination (1000:1 Receptacle)	
Termination Switch Position	2mA/mV	10mA/mV*	2mA/mV	10mA/mV*
Combined Sensitivity	40mA/mV	200mA/mV	2A/mV	10A/mV
Combined Accuracy within 7%				
Bandwidth (−3dB point. Current derated with frequency	450 Hz to 20 MHz	120 Hz to 20 MHz	450 Hz to 20 MHz	120 Hz to 20 MHz
Max. Continuous Current (RMS) at 1 KHz. Current derated with fequency.	36A	106A	700A	700A
Max. Peak Pulse Current	N/A	1000A	N/A	1000A
(not to exceed the Amp-Second Product/Current-Time Product)				
Amp-Second Product	0.01 A-Sec		0.5 A-Sec	
Insertion Impedance	30 milli-ohm at 1 MHz		30 milli-ohm at 1 MHz	
Max. DC Current (with DC Bucking Coil) Note: Reflected impedance of bucking coil limits upper freq. response to about 1 MHz.	N/A	300A	N/A	300A
Max. Conductor Size	1.5″ dia.		1.5″ dia.	
Max. Voltage Bare Wire With HV Bushing	3000V peak 10 KV RMS or 14 KV peak		3000V peak 10 KV RMS or 14 KV peak	

* Note: Preferred switch position.

Environmental Characteristics

Operating Temperature: 0°C to +50°C.

Nonoperating Temperature: −40°C to +65°C

Altitude Operating: 4,600 meters (15,000 feet)

Altitude Nonoperating: 15,000 meters (50,000 feet)

Vibration Operating: 15 minutes each axis at 0.015″ 10 to 50 to 10 Hz, in 1 minute cycles.

Shock Nonoperating: 30 g's, ½ sine, 11 mS duration, 2 shocks per axis. Total 6 shocks.

Physical Characteristics

Probe Body P6021: 2.1cm (0.83″) H × 1.62cm (0.64″) W × 19.93cm (7.85″) L.

Probe Body P6022: 1.5cm (0.59″) H × 1.02cm (0.40″) W × 15.62cm (6.15″) L.

Probe Cable:
P6021 Std. 152.4cm (5 feet)
P6021 Opt. 274,3cm (9 feet)
P6022 Std. 152.4cm (5 feet)
P6022 Opt. 274.3cm (9 feet)

Passive Termination (P6021 and P6022): 6.16cm (0.85″) H × 2.8cm (1.10″) W × 8.79cm (3.46″) L.

Connectors: Probes and Passive Terminations BNC Male and Female.

Shipping Weights: P6021 or P6022 with Std. Accessories 0.9 Kg (2 Lbs).

Other Useful Accessories

CT-5 High Current Transformer: Extends range of P6021 to 700A RMS. (See Extending the Range of the P6021 AC Current Probe.)

134 Current Probe Amplifier: Extends the low frequency response and sensitivity of the P6021 and P6022 AC Current probes. For 1 M ohm inputs only.

5A21N Differential Amplifier with Current Probe Input: Provides 0.5 mA/div and increased low frequency response for the P6021. Max. Continuous Current is 1.4A RMS.

5A21N Opt 01 includes P6021 AC Current Probe (5 ft.). (Note: 5A21N works with Tektronix 5000 Series Oscilloscopes)

Optional Accessories

Carrying Case (for P6021 or P6022, and a 134 Amplifier)	016-0087-01
Passive Termination	
P6021	011-0105-00
P6022	011-0106-00
Power Supply	
110 V AC	015-0058-01
230 V AC	015-0059-01

ORDERING INFORMATION

P6021 Current Probe

With 5 ft. Cable and Termination
Order P6021

With 9 ft. Cable and Termination
Order P6021 Option 03

With 5 ft. Cable and no Termination
Order P6021 Option 12

With 9 ft. Cable and no Termination
Order P6021 Option 13

P6021, Termination only
Order 011-0105-00

P6022 Current Probe

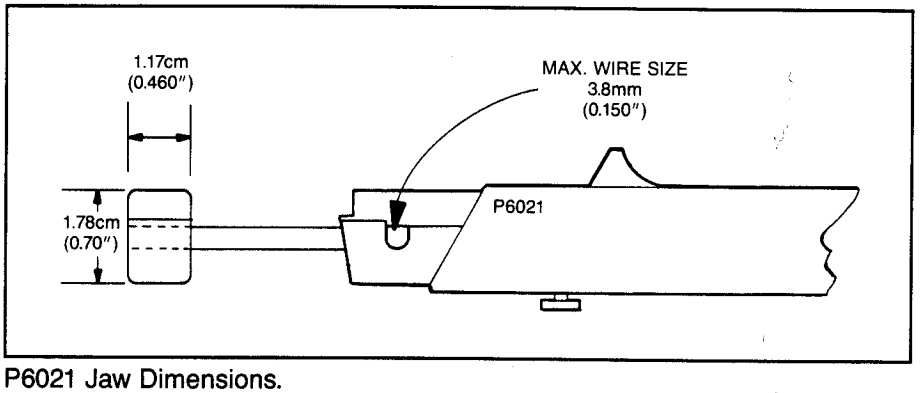
With 5 ft. Cable and Termination
Order P6022

With 9 ft. Cable and Termination
Order P6022 Option 03

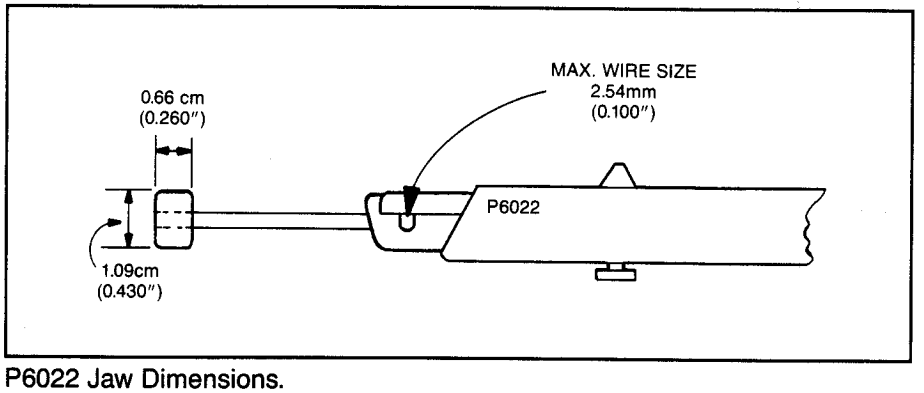
With 5 ft. Cable and no Termination
Order P6022 Option 12

With 9 ft. Cable and no Termination
Order P6022 Option 13

P6022 Termination Only
Order 011-0106-00



P6021 Jaw Dimensions.



P6022 Jaw Dimensions.

Call Now: 1-800-426-2200
In Oregon Call Collect: 627-9000

For further information, contact:

U.S.A., Asia, Australia, Central & South America, Japan
Tektronix, Inc.
P.O. Box 1700
Beaverton, Oregon 97075
For additional literature or the address and phone number of the Tektronix Sales Office nearest you, contact:
Phone: (800) 547-1512
Oregon only: (800) 452-1877
TWX: (910) 467-8708
TLX: 151754

Europe, Africa, Middle East
Tektronix Europe B.V.
P.O. Box 406
2130AK Hoofddorp
The Netherlands
Phone: (2503) 15644
Telex: 74876/74886

Canada
Tektronix Canada Inc.
P.O. Box 6500
Barrie, Ontario L4M 4V3
Phone: (705) 737-2700

Tektronix sales and service offices around the world:
Algeria, Argentina, Australia, Austria, Bahrain, Bangladesh, Belgium, Bolivia, Brazil, Canada, Peoples Republic of China, Chile, Colombia, Costa Rica, Denmark, Ecuador, Egypt, Federal Republic of Germany, Finland, France, Greece, Hong Kong, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Korea, Kuwait, Lebanon, Malaysia, Mexico, The Netherlands, New Zealand, Nigeria, Norway, Oman, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Qatar, Republic of South Africa, Saudi Arabia, Singapore, Spain, Sri Lanka, Sweden, Switzerland, Syria, Taiwan, Thailand, Turkey, Tunisia, United Arab Emirates, United Kingdom, Uruguay, Venezuela, Zimbabwe.

Copyright© 1987, Tektronix, Inc. All rights reserved. Printed in U.S.A. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX, TEK, PLOT 10, TEKTEST, SCOPE-MOBILE, and ® are registered trademarks. For further information, contact Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077. Phone: (503) 627-7111; TWX: (910) 467-8708; TLX: 151754. Subsidiaries and distributors worldwide.

Tektronix®
COMMITTED TO EXCELLENCE

7/87 60W-6647

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP