

# AC/DC Current Measurement Systems

► TCPA300 • TCP312 • TCP305 • TCP303 • TCPA400 • TCP404XL



## Increased Performance and Simplicity

The TCP300 and TCP400 series AC/DC Current Measurement family is a highly advanced current measurement system for today's current measurement needs. The split-core probes incorporate both transformer and Hall effect technology to provide broad bandwidth measurement capabilities from DC up to 100 MHz at current levels as low as 1 milliamp to thousands of amps (when used with CT4 current transformer). When connected to Tektronix TDS Oscilloscopes with TEKPROBE Level II or TekConnect (w/TCA-BNC) interfaces, current measurements and calculations are simple and easy.

Additional measurement power is available with add-on software such as the TDSPWR2 power measurements package. With all this measurement power current measurements have never been easier.

## Meets Today's AC/DC Current Measurement Applications

The TCPA300 amplifier, when used with TCP312, TCP305, or TCP303 probes, provide a wide range of current measurement capability and spans the gap between low level milliamp measurements to very high current levels. These three probes provide current measurement capabilities of 30A, 50A, and 150A DC continuous. For even higher current levels, the TCPA400 amplifier with the TCP404XL current probe measures 500A DC continuous and 750A DC continuous, derated with duty cycle.

Higher frequency performance is available with the TCP312 w/TCPA300 providing  $\geq 100$  MHz bandwidth and a maximum current of 30A DC.

## ► Features & Benefits

### AC/DC Measurement Capabilities

DC – 100 MHz, Current Probe Amplifier (TCPA300) Uses:

- DC – 100 MHz, 30 A DC (TCP312)
- DC – 50 MHz, 50 A DC (TCP305)
- DC – 15 MHz, 150 A DC (TCP303)

DC – 50 MHz, Current Probe Amplifier (TCPA400) Uses:

- DC – 2 MHz, 750<sup>\*1</sup> A DC (TCP404XL)
- (500 A DC Continuous)

Direct Scaling and Units<sup>\*2</sup> – Oscilloscope On-screen Readout Reduces Measurement Errors by Eliminating Hand Calculations

### AC/DC Input Coupling

Low Insertion Impedance – Reduces Device Under Test Loading

Small Mechanical Package – Less Desktop Space, Easier Storage and Handling

Split-core Construction – Allows Easy Circuit Connection

Status Indicators Provide Notification of Potential Error Conditions

Lower DC Drift and Noise

Certified for U.S., Canada, and Europe

<sup>\*1</sup>Derated with Duty Cycle.

<sup>\*2</sup>Requires a TDS TEKPROBE Oscilloscope or a TekConnect Oscilloscope with TCA-BNC.

## ► Applications

Development and Analysis for: Power Supplies, Semiconductor Devices, Power Inverters/Converters, Electronic Ballasts, Industrial/Consumer Electronics, Mobile Communications, Motor Drives, Transportation Systems

COMPUTING

COMMUNICATIONS

VIDEO

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## Measurement Errors and Manual Calculations Are Now a Thing of the Past

With this new series of current measurement tools, automatic control and on-screen scaling and units is provided for users of Tektronix TDS3000, TDS400A, TDS500, TDS600, TDS700, TDS5000, TDS6000 and TDS7000 series oscilloscope systems.

Status LEDs quickly show you TCP300/400 series operating status or potential error conditions that may have caused measurement errors in the past.

The TCP300 / TCP400 Current Measurement Systems seamlessly integrate with your TDS series oscilloscope and the TDSPWR2 software

package to easily make those time consuming power measurements and calculations for you.

Even non-TEKPROBE systems can use the TCPA 300/400 series to make proper current measurements by simply multiplying the measured output voltage on the oscilloscope by the TCPA 300/400 series range setting.

## ► Characteristics

	TCP312 w/TCPA300	TCP305 w/TCPA300	TCP303 w/TCPA300	TCP404XL w/TCPA400
Bandwidth (–3 dB)	DC – 100 MHz	DC – 50 MHz	DC – 15 MHz	DC – 2 MHz <sup>1</sup>
Rise Time	≤3.5 ns	≤7 ns	≤23 ns	≤175 ns
Maximum Current Ratings:				
High Current Sensitivity Range	10 A/V Range	10 A/V Range	50 A/V Range	1A/mV Range
DC (continuous)	30A	50A	150A	500A (750A*)
RMS (sinusoidal)	21.2A	35.4A	150A	500A
Peak Pulse	50A	50A	500A	750A
Low Current Sensitivity Range	1 A/V Range	5 A/V Range	5 A/V Range	N/A
DC (continuous)	5A	25A	25A	
RMS (sinusoidal)	3.5A	17.7A	17.7A	
Peak Pulse	50A	50A	500A	
DC Accuracy (Operating temp 0 °C to 50 °C)	±3% of reading	±3% of reading	±3% of reading (10 °C to 50 °C) +3%/–6% of reading (0 °C to <10 °C)	±3% of reading
DC Accuracy, Typical (Operating temp 23 °C ±5 °C)	±1% of reading	±1% of reading	±1% of reading	±1% of reading
<b>Nominal</b>				
Maximum Bare Wire Voltage	For Use With Insulated Wires Only		600V RMS CAT I & II 300V RMS CAT III	
Lowest Measurable Current (at ±3% accuracy at DC)	1 mA <i>Scope Set To 1mV/div and 20 MHz BW Limited</i>	5 mA <i>Scope Set To 1mV/div and 20 MHz BW Limited</i>	5 mA <i>Scope Set To 1mV/div and 20 MHz BW Limited</i>	1A <i>Scope Set To 1mV/div and 20 MHz BW Limited</i>
Insertion Impedance (See Curves Below)	0.08 Ω at 1 MHz 0.15 Ω at 10 MHz 0.27 Ω at 50 MHz 0.7 Ω at 100 MHz	0.035 Ω at 1 MHz 0.12 Ω at 10 MHz 0.4 Ω at 50 MHz	0.01 Ω at 1 MHz 0.025 Ω at 5 MHz 0.1 Ω at 15 MHz	0.1 mΩ at 10 kHz 0.6 mΩ at 100 kHz 8 mΩ at 1 MHz 16 mΩ at 2 MHz
<b>Typical</b>				
Maximum Amp-Second Product (Based on Amplifier Range Setting)	50A*μS – 1A/V 500A*μS – 10A/V	500A*μS – 5A/V NA – 10A/V	3,000A*μS – 5A/V 15,000A*μS – 50A/V	NA – 1A/mV
AC Coupling Low Frequency Bandwidth	<7 Hz (Low Pass – 3 dB point)			
Displayed RMS Noise (at 20 MHz Bandwidth Limit)	≤250 μA <sub>RMS</sub>	≤1.25 mA <sub>RMS</sub>	≤2.5 mA <sub>RMS</sub>	≤250 mA <sub>RMS</sub>
Signal Delay (Delay to Output BNC)	17 ns	19 ns	53 ns	103 ns
Inputs (Probe Amplifier)	1			
Probe Open Indicator	YES			
Overload Indicator	YES			
Termination Indicator	YES			
Non-compatible Probe Indicator	YES			

▶ Characteristics continued

	TCP312 w/TCPA300	TCP305 w/TCPA300	TCP303 w/TCPA300	TCP404XL w/TCPA400
<b>Safety Certifications</b>				
U.S. NRTL Listing	UL3111-1 (Amplifier)		UL3111-2-032 ; UL3111-1 (Probe and Amplifier)	
Canadian Certification	CAN/CSA C22.2 No.1010.1 (Amplifier)		CAN/CSA C22.2 No.1010.2.032 CAN/CSA C22.2 No.1010.1 (Probe and Amplifier)	
European Union Compliance	EN61010-1/A2 (Amplifier)		EN61010-1/A2; EN61010-2-032 EN61010-1/A2 (Probe and Amplifier)	
Other	IEC61010-1/A2 (Amplifier)		IEC61010-2-032 IEC61010-1/A2 (Probe and Amplifier)	
Electromagnetic Compatibility	Meets: EC Council Directive 89/336/EEC, FCC Part 15, Subpart B Class A, AS/NZS 2064.1/2			
Power Requirements (TCPA300/TCPA400 Amplifiers)	90 V to 264 V; 47 to 440 Hz; 50 W Maximum CAT II (Auto Switch)			
Power Requirements (Probes)	Requires TCPA300 Amplifier		Requires TCPA400 Amplifier	
Probe Model	TCP312	TCP305	TCP303	TCP404XL
Warranty	1 Year			
<b>Probe Mechanical Characteristics</b>				
Probe Cable Length	1.5 meters (60 in.)		2 meters (78.7 in.)	8 meters (315 in.)
Probe Jaw Size (Max Conductor Size)	3.8 mm (0.15 in.)		21 mm x 25 mm (0.83 x 1.0 in.)	
Length	20 cm (7.87 in.)		26.8 cm (10.55 in.)	26.8 cm (10.55 in.)
Width	1.6 cm (0.625 in.)		4.1 cm (1.60 in.)	4.1 cm (1.60 in.)
Height	3.2 cm (1.25 in.)		15.6 cm (6.13 in.)	15.6 cm (6.13 in.)
Weight	0.15 kg (0.33 lbs.)		0.66 kg (1.45 lbs.)	0.88 kg (1.90 lbs.)
<b>TCPA300 and TCPA400 Mechanical Characteristics</b>				
Length	17.3 cm (6.8 in.)			
Width	16.7 cm (6.6 in.)			
Height	9.14 cm (3.6 in.)			
Weight	1.14 kg (2.5 lbs.)			
<b>Environmental Characteristics</b>				
Temperature – Operating	0 °C to +50 °C (32 °F to 122 °F)			
Temperature – Nonoperating	–40 °C to +75 °C (–40 °F to 167 °F)			
Humidity – Operating	5% to 95% R.H. to +30 °C (86 °F) 5% to 85% R.H. +30 °C to +50 °C (86 °F to 122 °F)			
Humidity – Nonoperating	5% to 95% R.H. to +30 °C (86 °F) 5% to 85% R.H. +30 °C to +75 °C (86 °F to 167 °F)			
Altitude – Operating	2000 m (6800 ft.) maximum			
Altitude – Nonoperating	12,192 m (40,000 ft.) maximum			

\*1 Calculated from Rise Time.

\*2 Derated w/ duty cycle and frequency.

# AC/DC Current Measurement Systems

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## ▶ Ordering Information

### TCP312

Probe: AC/DC Current, DC to 100 MHz; 30A DC (Requires TCPA300 Amplifier).

### TCP305

Probe: AC/DC Current, DC to 50 MHz; 50A DC (Requires TCPA300 Amplifier).

### TCP303

Probe: AC/DC Current, DC to 15 MHz; 150A DC (Requires TCPA300 Amplifier).

### TCP404XL

Probe: AC/DC Current, DC to 2 MHz; 500A DC (750A DC De-rated With Duty Cycle) (Requires TCPA400 Amplifier).

**All TCP300/TCP400 Current Probes Include:** AC/DC Current Probe; Instruction Sheet; Probe Cover; Certificate of Traceable Calibration.

### TCPA300

Amplifier: AC/DC Current Probe, DC to 100 MHz, (Requires TCP305 or TCP312 or TCP303 Probes).

### TCPA400

Amplifier: AC/DC Current Probe, DC to 50 MHz, (Requires TCP404XL Probe).

**All TCPA300/TCPA400 Current Probe Amplifiers Include:** AC/DC Current Probe Amplifier; Instruction/Service Manual; TEKPROBE Interface Cable; Male-to-Male BNC cable (50  $\Omega$ ); 50  $\Omega$  feedthrough termination; Certificate of Traceable Calibration.

## Options

### TCPA300/TCPA400

#### Power Plug Options

**Opt. A1** – Euro Plug, 220 V, 50 Hz.

**Opt. A2** – UK Plug, 240 V, 50 Hz.

**Opt. A3** – Australian Plug, 240 V, 50 Hz.

**Opt. A5** – Swiss Plug, 220 V, 50 Hz.

**Opt. A6** – Japanese Plug, 100 V, 110/120 V, 60 Hz.

**Opt. AC** – China Plug, 50 Hz.

**Opt. A99** – No Power Cord.

#### Language Options

**Opt. L5** – Japanese Manual.

## All TCP300/TCPA300/TCP400/TCPA400 Series

### Service Options

**Opt. C3** – Calibration Service 3 Years.

**Opt. C5** – Calibration Service 5 Years.

**Opt. D1** – Calibration Data Report.

**Opt. D3** – Calibration Data Report 3 Years (with Option C3).

**Opt. D5** – Calibration Data Report 5 Years (with Option C5).

**Opt. R3** – Repair Service 3 Years.

**Opt. R5** – Repair Service 5 Years.

### Recommended Accessories

**016-1923-00** – Cover, small Probe Protective; (for TCP305, TCP312, A6302, A6302XL, A6312, TCP202).

**016-1924-00** – Cover, large Probe Protective; (for TCP303, TCP404XL, A6303, A6303XL, A6304XL).

**016-1922-00** – Case, transit; Current Measurement Systems.

**011-0049-02** – 50  $\Omega$  feedthrough termination.

**012-0117-00** – 50  $\Omega$  BNC-to-BNC coaxial cable.

**012-1605-00** – TEKPROBE Interface Cable, TCPA300 or TCPA400 Amplifier to TDS series oscilloscopes.

**015-0601-50** – Current loop, 1 turn, 50  $\Omega$ , BNC Connector (for TCP305, TCP312, A6302, A6302XL, A6312, TCP202, TCP303, A6303, A6303XL).

**174-4765-00** – TCPA300/TCPA400 Amplifier calibration adapter.

**067-1478-00** – Power Measurements Deskew Fixture, for TCP202, TCP305, TCP312, TCP303, A6302, A6312, A6303, Series Probes.

**CT4** – AC current transformer, 20 k Amp (for use with TCP305, TCP312, TCP202, A6302, A6312).

**TDSPWR2** – Power Measurement and Analysis Software for TDS5000 and TDS7000 Oscilloscopes.

#### To order when purchasing oscilloscope:

**Order:** TDS5052PW2, TDS5054PW2, TDS7054PW2, TDS7104PW2.

#### To order as upgrade:

**Order:** TDS5UP PW2, TDS7UP PW2.

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Our most up-to-date product information is available at:  
[www.tektronix.com](http://www.tektronix.com)

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