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AC/DC Current Measurement Systems

TCPA300, TCP312A, TCP305A, TCP303, TCPA400, TCP404XL Datasheet



The TCP300 and TCP400 Series AC/DC current measurement family is a highly advanced current measurement system for today's current measurement needs. When connected to Tektronix oscilloscopes with TEKPROBE Level II, TekConnect (w/ TCA-BNC), or TekVPI (w/ TPA-BNC) interfaces, current measurements and calculations are simple and easy.

Key performance specifications

AC/DC measurement capabilities

- DC - 100 MHz, Current Probe Amplifier (TCPA300) uses:
  - DC - 100 MHz, 30 A DC (TCP312A)
  - DC - 50 MHz, 50 A DC (TCP305A)
  - DC - 15 MHz, 150 A DC (TCP303)
- DC - 50 MHz, Current Probe Amplifier (TCPA400) Uses:
  - DC - 2 MHz, 750 A DC [1] (TCP404XL) (500 A DC Continuous)

Key features

- Automatic scaling and units [2] - Oscilloscope on-screen readout of magnitude and amps reduces measurement errors with no more hand calculations
- AC/DC input coupling
- Low insertion impedance reduces device under test loading
- Split-core construction allows easy circuit connection
- Status indicators provide visual operating status and notification of potential error conditions - degauss, probe open, overload, not terminated into 50 Ω, noncompatible probe type
- Low DC drift and noise allows improved low-level current measurements
- 3rd party safety certification

Applications

- Development and analysis solutions for designers, installers, and service personnel in telecom, data comm, computer, and semiconductor power electronics environments for:
  - Power supplies (switching and linear)
  - Semiconductor devices (SCRs, IGBTs, MOSFETs, CMOS, BJTs)
  - Power inverters/converters
  - Electronic ballasts
  - Industrial/consumer electronics
  - Mobile communications (phone, satellite, relay stations)
  - Motor drives
  - Transportation systems (electronic vehicles, electric trains, locomotives, avionics)

Meets today's AC/DC current measurement applications

The TCPA300 amplifier, when used with TCP312A, TCP305A, or TCP303 probes, provides 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 30 A, 50 A, and 150 A DC continuous. For even higher current levels, the TCPA400 amplifier with the TCP404XL current probe measures 500 A DC continuous and 750 A DC continuous, derated with duty cycle.

Higher-frequency performance is available with the TCP312A w/ TCPA300 providing ≥100 MHz bandwidth and a maximum current of 30 A DC.

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, TDS500, TDS600, TDS700, TDS5000, TDS6000, and TDS7000B series oscilloscope systems (the DPO3000, MDO/MSO/

[1] Derated with duty cycle

[2] Requires a TDS TEKSCOPE oscilloscope or a TekConnect oscilloscope with TCA-BNC adapter

DPO4000, MSO/DPO5000, and DPO7000 series oscilloscopes, the TPA-BNC adapter is required).

The TCP300/TCP400 current measurement systems seamlessly integrate with your TDS series oscilloscope.

Even non-TEKPROBE systems can use the TCPA300/400 series to make proper current measurements by simply multiplying the measured output voltage on the oscilloscope by the TCPA300/400 series range setting.

Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

Model overview

	TCP312A w/ TCPA300	TCP305A w/ TCPA300	TCP303 w/ TCPA300	TCP404XL w/ TCPA400
Bandwidth	DC – 100 MHz	DC – 50 MHz	DC – 15 MHz	DC – 2 MHz
Rise time	≤3.5 ns	≤7 ns	≤23 ns	≤175 ns
DC accuracy	±3% of reading	±3% of reading	±3% of reading	±3% of reading
Accuracy, typical	DC: ±1% of reading DC to 60 Hz, ≤5 A: ±1% 60 Hz – 5 kHz, ≤5 A: ±1.5% DC – 5 kHz, >5 A: ±1.5%	DC: ±1% of reading DC to 60 Hz, ≤5 A: ±1% 60 Hz – 5 kHz, ≤5 A: ±1.5% DC – 5 kHz, >5 A: ±1.5%	DC: ±1% of reading	DC: ±1% of reading
Lowest measurable current (at ±3% accuracy at DC) Scope set to 1 mV/div and 20 MHz BW limited	1 mA	5 mA	5 mA	1 A
Maximum Amp-Second product, typical (based on amplifier range setting)	50 A*µS – 1 A/V 500 A*µS – 10 A/V	500 A*µS – 5 A/V NA – 10 A/V	3,000 A*µS – 5 A/V 15,000 A*µS – 50 A/V	NA – 1 A/mV
Maximum wire voltage				
Bare	150 V CAT II	150 V CAT II	600 V CAT I & II	600 V CAT I & II
Insulated	300 V CAT II	300 V CAT II	300 V CAT III	300 V CAT III
AC-coupling low-frequency Bandwidth, typical (Low pass – 3 dB point)	<7 Hz	<7 Hz	<7 Hz	<7 Hz
Displayed RMS noise, typical (at 20 MHz bandwidth limit)	≤75 μA_{RMS}	≤1.25 mA_{RMS}	≤2.5 mA_{RMS}	≤250 mA_{RMS}
Signal delay (to output BNC)	17 ns	19 ns	40 ns	80 ns
Insertion impedance	0.11 Ω at 1 MHz 0.12 Ω at 10 MHz 0.35 Ω at 50 MHz 0.7 Ω at 100 MHz	0.02 Ω at 1 MHz 0.1 Ω at 10 MHz 0.35 Ω at 50 MHz	0.01 Ω at 1 MHz 0.025 Ω at 5 MHz 0.1 Ω at 15 MHz	0.1 m Ω at 10 kHz 0.6 m Ω at 100 kHz 8 m Ω at 1 MHz 16 m Ω at 2 MHz

Characteristics

Maximum current ratings

High-current sensitivity

	TCP312A w/ TCPA300	TCP305A w/ TCPA300	TCP303 w/ TCPA300	TCP404XL w/ TCPA400
Range	10 A/V	10 A/V	50 A/V	1 A/mV
DC (continuous)	30 A	50 A	150 A	500 A (750 A)
RMS (sinusoidal)	21.2 A	35.4 A	150 A	500 A
Peak	50 A	50 A	500 A	750 A

Low-current sensitivity

	TCP312A w/ TCPA300	TCP305A w/ TCPA300	TCP303 w/ TCPA300	TCP404XL w/ TCPA400
Range	1 A/V	5 A/V	5 A/V	N/A
DC (continuous)	5 A	25 A	25 A	N/A
RMS (sinusoidal)	3.5 A	17.7 A	17.7 A	N/A
Peak	50 A	50 A	500 A	N/A

Physical characteristics

Amplifiers

TCPA300/TCPA400	
Length	17.3 cm (6.8 in)
Width	9.14 cm (3.6 in)
Height	16.7 cm (6.6 in)
Weight	1.14 kg (2.5 lb)

Probes

	TCP305A/TCP312A	TCP303	TCP404XL
Length	14.99 cm (5.86 in)	26.8 cm (10.55 in)	26.8 cm (10.55 in)
Width	1.59 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 lb)	0.66 kg (1.45 lb)	0.88 kg (1.90 lb)

Maximum conductor size

TCP312A	TCP305A	TCP303	TCP404XL
5.0 mm (0.197 in)	5.0 mm (0.197 in)	21 mm x 25 mm (0.83 x 1.0 in)	21 mm x 25 mm (0.83 x 1.0 in)

Cable length

TCP312A	TCP305A	TCP303	TCP404XL
1.5 m (60 in)	1.5 m (60 in)	2 m (78.7 in)	8 m (315 in)

EMC environment and safety

Safety compliance

	TCP312A/305A probe and amplifier	Amplifiers	TCP303/404XL probe and amplifier
U.S. NRTL listing	UL61010-2-032, UL61010-1	UL3111-1, first edition	UL3111-2-032, UL3111-2-031; UL3111-1
Canadian certification	CAN/CSA C22.2 No. 61010-1, CAN/CSA C22.2 No. 61010-2-032	CAN/CSA C22.2 No.1010.1-92	CAN/CSA C22.2 No.1010.1-92
European Union compliance	EN61010-1, EN61010-2-032	EN61010-1:2001	EN61010-1/A2, EN61010-2-031, EN61010-2-032
Other			IEC61010-2-032

Electromagnetic compatibility, amplifiers only EC Council Directive 89/336/EEC, FCC Part 15, Subpart B Class A, AS/NZS 2064.1/2.

EMC environment and safety

Temperature

Operating 0 °C to +50 °C (32 °F to 122 °F)

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)

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

Nonoperating 12,192 m (40,000 ft.) maximum

Ordering information

Models

Probes

TCP312A Probe AC/DC current, DC to 100 MHz; 30 A DC (Requires TCPA300 amplifier)

TCP305A Probe AC/DC current, DC to 50 MHz; 50 A DC (Requires TCPA300 amplifier)

TCP303 Probe	AC/DC current, DC to 15 MHz; 150 A DC (Requires TCPA300 amplifier)
TCP404XL Probe	AC/DC current, DC to 2 MHz; 500 A DC (750 A DC derated with duty cycle) (Requires TCPA400 amplifier)

All TCP300/400 probes include: compliance and safety instructions, certificate of traceable calibration.

Amplifiers

TCPA300 Amplifier	AC/DC current probe, DC to 100 MHz, (Requires TCP305A or TCP312A 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, compliance and safety instructions, TEKPROBE interface cable, certificate of traceable calibration.

Recommended accessories

Cover, large probe protective; (for TCP303, TCP404XL)	016-1924-00
Case, transit; current measurement systems	016-1922-00
50 Ω feedthrough termination	011-0049-02
50 Ω BNC-to-BNC coaxial cable	012-0117-00
TEKPROBE interface cable, TCPA300 or TCPA400 amplifier to TDS series oscilloscopes	012-1605-00
Current loop, 1 turn, 50 Ω, BNC connector (for TCP305A, TCP312A, TCP202A)	067-2396-00
Current loop, 1 turn, 50 Ω, BNC connector (for TCP303, TCP404XL)	015-0601-50
TCPA300/TCPA400 amplifier calibration adapter	174-4765-00
Power measurements deskew fixture for TCP202A, TCP305A, TCP312A, TCP303 probes	067-1478-00

Warranty

One year parts and labor.

Power requirements

Amplifiers	90 V to 264 V, 47 to 440 Hz, 50 W; Maximum CAT II (auto switch)
Probes	TCP312A, TCP305A, TCP303 probes require a TCPA300 Amplifier; TCP404XL probe requires a TCPA400 Amplifier

Options

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

ServiceOptions

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 Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R3DW	Repair Service Coverage 3 Years (includes product warranty period). 3-year period starts at time of instrument purchase
Opt. R5	Repair Service 5 Years (including warranty)
Opt. R5DW	Repair Service Coverage 5 Years (includes product warranty period). 5-year period starts at time of instrument purchase
Opt. SILV400	Standard warranty extended to 5 years (TCP305A, TCP312A, TCPA300, TCPA400)
Opt. SILV600	Standard warranty extended to 5 years (TCP303, TCP404XL)

Tektronix is ISO 14001:2015 and ISO 9001:2015 certified by DEKRA.

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