

2461A

Frequency and Time Interval Counter

The Astronics Test Systems 2461A is a high performance, 2-channel, universal 200 MHz counter, a functional replacement for the Racal Instruments™ 2461.

Occupying a single C-size VXI slot, the frequency & time interval/counter (FTIC) offers twelve easy-to-use automatic measurement functions, including phase, pulse, peak, rise/fall time, time interval and ratio measurement, all with extremely high resolution.

Product Information

Brief Description

The 2461A includes a high-performance Universal Counter offering twelve automatic measurement functions:

- Frequency & Period
- Time Interval
- Time Interval, Delayed
- Rise Time
- Fall Time
- Pulse Width
- Duty Cycle
- Frequency Ratio channels; 1 to 2 or 2 to 1
- Totalize
- Phase
- DVM (MAX, MIN and DC voltages)



KEY FEATURES

- Meets requirements for joint services military ATE programs
- Perform precision timing measurements with unsurpassed resolution
- Automate testing using the automatic measurements including peak signal
- Key specifications include:
 - 200 MHz frequency measurement
 - 9 digits per second resolution
 - 1 ns time interval resolution (100 ps with averaging)
 - 2.5 mV trigger resolution
 - Programmable measurement timeout
 - 9 different arming modes
 - 200 Volt peak input range



Outstanding Resolution

The 2461A counter offers 200 MHz frequency measurements with up to 9 digits of resolution per second. In time interval, the resolution is 1 ns in single shot and 100 ps in average mode.

High Speed Time Measurement

By using Time Error Correction (TEC) in combination with traditional recipromatic techniques, measurement time is minimized without any performance compromise.

Measurement Timeout

Programmable measurement timeout enables system performance to be optimized where input signals are missing.

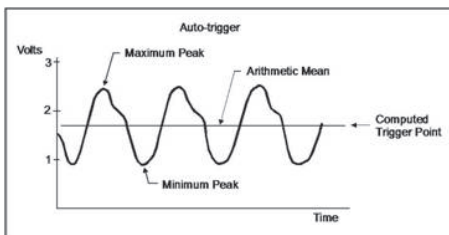
High-Performance Trigger

In manual mode, the trigger level is programmable from -5.1 V to +5.1 V (-51 V to +51 V in x 10 mode and -200 V to +200 V in x 40 mode) with a resolution of 2.5 mV (25 mV in x10 mode and 100 mV in x40 mode).

An automatic trigger mode is also available covering frequencies to 20 MHz with the minimum frequency selectable (as DC, 50 Hz, or 1 kHz) to optimize measurement speed.

Automatic Attenuation Selection

Auto trigger mode automatically switches attenuator settings if the input signal level crosses ± 5.1 V.



DVM Measurements

Automatic triggering is used to establish the peak voltages for setting trigger points. This feature

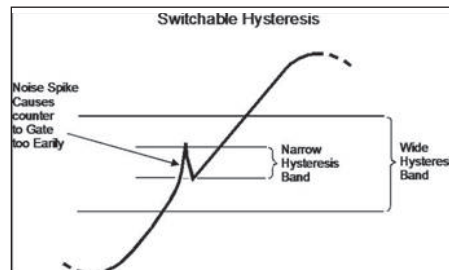
is used to measure MAX, MIN and DC voltage levels.

Individual Channel Filtering

The 2461A counter offers independent 50 kHz low pass filters on each channel to allow measurements in noisy environments.

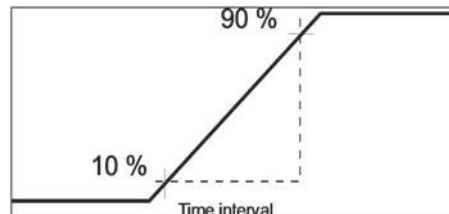
Selectable Sensitivity

The sensitivity of the counter can be reduced to optimize the front end for low-level or low slew rate signals with noise. This feature is also very important for system applications, where noisy signals are encountered. Standard sensitivity settings are provided, and custom settings are available for use in matching the performance of a legacy measurement.



Pulse Characterization

The 2461A provides automatic pulse characterization including rise time, fall time, duty cycle and pulse width measurements.

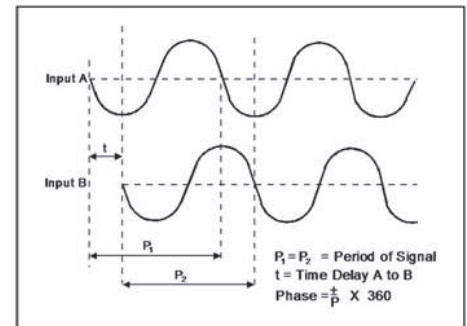


Phase Measurement

Phase measurements are performed automatically.

Legacy Replacement

The 2461A is configured to directly replace the 2461 models, including the -Cd, -Ce, S-2276B and S-2391B variants. Software compatibility is provided both at the SCPI command and at the API level. The 2461A also functionally replaces two Keysight models, the E1420B-000 (2461A-Cd) and the E1420B-010 (2461A-Ce) for EU applications that require RoHS.



Powerful Arming Capability

The 2461A counter offers powerful arming capability. Nine different modes are provided with the ability to select the arming source between the external arming input and the VXI TTL trigger lines.

Software Calibration

The 2461A stores software calibration factors in non-volatile memory to maintain its trigger level and hysteresis settings. Hysteresis settings can be re-calibrated to match the sensitivity of a legacy system.

Specifications

Note: The Astronics Test Systems policy is one of continuous development and improvement. Consequently, the equipment may vary in detail from the description and specifications in this publication.

Measurements

Frequency (Channels 1 and 2)

- Channel 1: 600 μ Hz to 200 MHz
- Channel 2: 600 μ Hz to 200 MHz
- LSD: $F \times 10^D$ Where D is the number of digits selected (3 to 10)
- Resolution: $\pm(1.4 \times \text{Trigger Error} \times \text{Frequency}/\text{Gate Time}) \pm 1 \text{ LSD}^*$
* $\pm 2 \text{ LSD}$ with 6-10 digits selected
- Accuracy: $\pm(\text{Resolution} \pm \text{Timebase Error} \times \text{Frequency})$

Period

- Channel 1: 5 ns to 1700 s
- Channel 2: 5 ns to 1700 s
- Resolution: $\pm(1.4 \times \text{Trigger Error} \times \text{Frequency}/\text{Gate Time}) \pm 1 \text{ LSD}$
- Accuracy: $\pm(\text{Resolution} \pm \text{Timebase Error} \times \text{Frequency})$

Time Interval

- Range: 2 ns to 800,000 s
- Slope (Start & Stop): (+) or (-)
- Start \rightarrow Stop Configurations: N1 \rightarrow IN2, IN2 \rightarrow IN1 or IN1 \rightarrow IN1
- LSD: 1 ns (Average Mode: 100 ps)
- Resolution: $\pm 1 \text{ ns}_{\text{rms}} \pm \text{Trigger Error} \pm 1 \text{ LSD}$
- Accuracy: $\pm \text{Resolution} \pm (\text{Timebase Error} \times \text{TI}) \pm \text{Trig Level Timing Error} \pm 2 \text{ ns}$

Time Interval Delay

- Range: 200 μ s to 1.078576 s

Rise/Fall Time

- Range: 20 ns to 20 ms
- Trigger Points:
- Rise: 10% \rightarrow 90%*
- Fall: 90% \rightarrow 10%*
- Minimum Pulse Height: 500 mV_{pk-pk}
- Minimum Pulse Width: 20 ns at Peak

- LSD: 1 ns (100 ps in Average Mode)
- Resolution: $\pm \text{Start Trigger Error} \pm \text{Stop Trigger Error} \pm 1 \text{ LSD} \pm 1 \text{ ns}_{\text{rms}}$
- * % of measured pk-pk

Pulse Width

- Range: 5 ns to 20 ms
- Minimum Pulse Height: 150 mV_{pk-pk}
- LSD: 1 ns (100 ps in Average Mode)
- Resolution: $\pm \text{Start Trigger Error} \pm \text{Trigger Error} \pm 1 \text{ LSD} \pm 1 \text{ ns}_{\text{rms}}$

Frequency Ratio (Channel 1 to Channel 2)

- Range: 600 μ Hz to 100 MHz
- LSD: $(10 \times \text{Ratio})/(\text{F1} \times \text{Gate Time})$
- Resolution: $\pm(1.4 \times \text{Trigger Error} 2/ \text{Gate Time}) \pm 1 \text{ LSD}$
- Accuracy: $\pm \text{Resolution}$
- Maximum Ratio: 6.8×10^{10}

Totalize

- Channel 1 by 2: Pulse triggered
- Channel 2 by 1: Cycle triggered
- Channel 1 by Arm input: Pulse triggered
- Range: 1 to $(10^{12} - 1)$ events/s
- Maximum Rate: 10^8 events/s
- Pulse Width: 5 ns min. at Trig. Points
- Accuracy: ± 1 count

Duty Cycle

- Range: 0.01% to 99.99%
- LSD:
 - Fin < 1 MHz: 0.01%
 - Fin < 10 MHz: 0.1%
 - Fin < 100 MHz: 1%

Phase (Channel 1 rel 2 or rel 1)

- Range: 0.1 $^\circ$ to 360 $^\circ$
- LSD:
 - Fin < 1 MHz: 0.1 $^\circ$
 - Fin < 10 MHz: 1 $^\circ$
 - Fin < 100 MHz: 10 $^\circ$

DVM Functions (Subject to Autotrigger Restrictions)

- Functions: +Peak, -Peak, DC
- Range: -200 V to +200 V

- LSD: 0.6 mV
- Resolution: $\pm 2.5 \text{ mV} (\times 1) \pm 25 \text{ mV} (\times 10) \pm 100 \text{ mV} (\times 40)$
- Accuracy: $\pm 6\% V_{\text{pk-pk}} \pm 500 \text{ mV} (\times 10)$

Math Mode

- Result: (Reading - Offset)/Scale

Averaging Mode

- Availability: all functions except DVM, Totalize & Phase
- Sample Size: 100
- Resolution: 1 extra digit relative to non-averaged mode

Input Characteristics

Frequency Range (DC Coupling)

- Channel 1: DC to 200 MHz
- Channel 2: DC to 200 MHz

Frequency Range (AC Coupling)

- Channel 1: 10 Hz to 200 MHz
- Channel 2: 10 Hz to 200 MHz

Input Conditioning (Channels 1 and 2)

- Impedance: 50 Ω or 1 M Ω
- Channels Commoned: 500 k Ω
- Coupling: AC or DC
- Attenuation: x1, x10 or x40
- Low Pass Filter: None or 50 kHz

Sine Wave Sensitivity (Channels 1 & 2, x1Atten., 0 $^\circ$ C to 50 $^\circ$ C)

- <100 MHz: 25 mV_{rms}
- <160 MHz: 50 mV_{rms}
- <200 MHz: 75 mV_{rms}

Pulse Sensitivity (Channels 1 & 2, 5 ns Width, x1 Atten.)

- 75 mV_{pk-pk}

Nominal Hysteresis Settings

- 20 mV_{pk-pk}
- 40 mV_{pk-pk}
- 45 mV_{pk-pk}
- 65 mV_{pk-pk}

Dynamic Range (x1 Atten.)

- <50 MHz: 5 V_{pk-pk} min.
- <100 MHz: 2.5 V_{pk-pk} min.
- <200 MHz: 1.5 V_{pk-pk} min.

Dynamic Range (x10 Atten.)

- <50 MHz: 50 V_{pk-pk} min.
- <100 MHz: 25 V_{pk-pk} min.
- <200 MHz: 15 V_{pk-pk} min.

Damage Level Input (Channels 1 & 2)

- 1 MΩ (x1):
 - ≤2 kHz: 260 V (DC + AC_{rms})
 - ≤100 kHz: (5 × 10⁵/Fin)V_{rms}
 - >100 kHz: 5 V_{rms}
- 1 MΩ (x10):
 - ≤20 kHz: 260 V (DC + AC_{rms})
 - ≤100 kHz: (5 × 10⁶/Fin)V_{rms}
 - >100 kHz: 50 V_{rms}
- 1 MΩ (x40):
 - ≤200 kHz: 260 V (DC + AC_{rms})
 - ≤1 MHz: (20 × 10⁶/Fin)V_{rms}
 - >1 MHz: 500 V_{rms}
- 50 Ω: DC to 200 MHz: 5 V_{rms}

Crosstalk

- (Channel 1 to 2, 100 MHz @ 50 Ω)
<36 dB

Triggering Characteristics

General (Manual or Autotrigger)

- x1
 - Range: ±5.1 V
 - Resolution: 2.5 mV
 - Accuracy: ±(1% of rdg ±300 mV)
- x10
 - Range: ±51 V
 - Resolution: 25 mV
 - Accuracy: ±(1% of rdg ±300 mV)
- x40 (Manual only)
 - Range: ±200V
 - Resolution: 100 mV
 - Accuracy: ±(1% of rdg ±1.2 V)

Trigger Level Outputs (Scale by 10 for x10 or 40 for x40 attenuation mode)

- Range: ±5.1 VDC
- Resolution: 2.5 mV
- Accuracy: ±1% V_{out} ±10 mV

Autotrigger

- Frequency Range: DC and 50 Hz/ 1 kHz* to 200 MHz
- Minimum Amplitude: 150 mV_{pk-pk}
* min. freq. selectable as 50 Hz or 1 kHz to optimize acquisition time

Auto Attenuation (valid when Autotrigger enabled)

- x1: [peaks] <±4.6 VDC and amplitude <4.4 V_{pk-pk}
- x10: [peaks] >±5.1 VDC and amplitude >5.1 V_{pk-pk}

Arming Characteristics

External Arming Sources

- Front Panel "Arm" Input or VXI TTL Trig0-7

Arming Modes

- Start: Self Arm, Rise/Fall Edge
- Stop: Self Arm, Rise/Fall Edge
- External Gating: Start/Stop Arm are both set to an edge

Input Logic Levels

- V_{il} (max): 0.4 V
- V_{ih} (min): 2.4 V

Measurement Timeout

- 1 to 10⁵ s

Time Base Characteristics

Timebase selectable as follows:

Default

- VXI CLK10

External Input

- Frequency: 10 MHz
- Input Level: 100 mV min
- Input Impedance: 1 kΩ nom
- Coupling: AC

Interface

Backplane Signal Support

- TTLTRG0-7: External Arm Input, Gate Output
- CLK10: Default Time Base

Memory Storage

- 64k readings

Cooling (10° C Rise)

- Min. Airflow: 4 l/s

Peak Current & Power Consumption

- Total Power: 16 Watts

	I _{Pm} (A)	I _{Dm} (A)
+24	0.165	0.01
+5	1.28	0.05
-2	0.02	0.01
-5.2	0.38	0.06
-24	0.14	0.01

Front Panel I/O

FTIC Inputs

- Channels 1 & 2: BNC, 50 Ω or 1 M Ω
- Arm: MCX, 1k Ω 19V_{rms} max, DC coup
- Clock: MCX, 1 kΩ, 100 mV_{rms}

FTIC Outputs

- Clock: MCX, 1 V_{pk-pk} into 50 Ω
- Trig. Level 1 & 2: MCX, -5.1 V to +5.1 V

Environmental

(All Environmental Conditions Tested to MIL-PRF-28800F, Class 3)

Temperature

- Operating: 0° C to 50° C
- Storage: -40° C to 71° C

Relative Humidity

- 5% to 95% RH non-condensing $\leq 30^{\circ}$ C
- 5% to 75% RH above 30° C
- 5% to 45% RH above 40° C

Altitude

- Operating: 15,000 ft
- Non-Operating: 15,000 ft

Shock

- 30 g peak, half sine, 11 ms pulse

Vibration

- Random: 5 to 500 Hz

Bench Handling

- 4-inch drop at 45°



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ORDERING INFO

408638 : Racal Instruments™
2461A-Cd 200 MHz FTIC

408638-001 : Racal Instruments™
2461A-Ce 200 MHz FTIC w/TCXO

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