# Trig-Tek™

# 311A
# Frequency Multiplier
## User Manual

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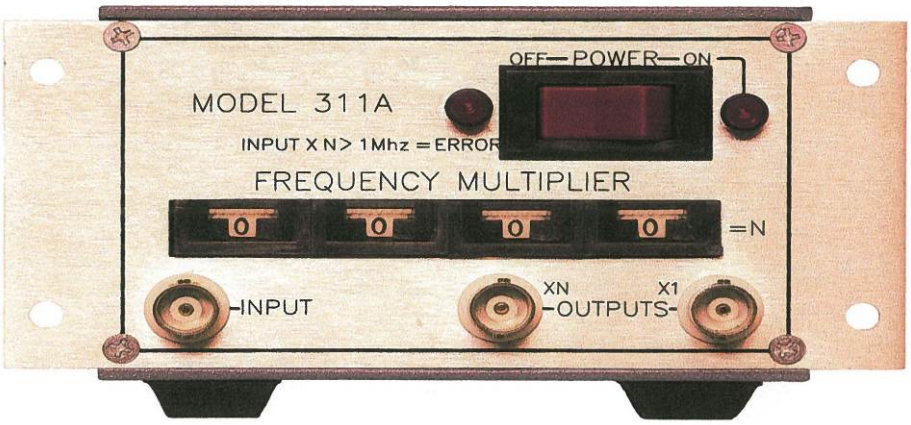


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For the specific terms of your standard warranty, contact Customer Support. Please have the following information available to facilitate service.

1. Product serial number
2. Product model number
3. Your company and contact information

You may contact Customer Support by:

| | | |
|---|---|---|
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| Telephone: | +1 800 722 3262 | (USA) |
| Fax: | +1 949 859 7139 | (USA) |

## RETURN OF PRODUCT

Authorization is required from Astronics Test Systems before you send us your product or sub-assembly for service or calibration. Call or contact Customer Support at 1-800-722-3262 or 1-949-859-8999 or via fax at 1-949-859-7139. We can also be reached at: atshelpdesk@astronics.com.

If the original packing material is unavailable, ship the product or sub-assembly in an ESD shielding bag and use appropriate packing materials to surround and protect the product.

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# FOR YOUR SAFETY

Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNINGS** and **CAUTION** notices.


This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.

Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.


Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuit points.

Before operating this instrument:

1. Ensure the proper fuse is in place for the power source to operate.
2. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

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# DOCUMENT CHANGE HISTORY

| Revision | Date | Description of Change |
|---|---|---|
| A | 11/3/2012 | Document Control release |
| | | |
| | | |

# Chapter 1
# Introduction

The Trig-Tek™ 311A Frequency Multiplier (**Figure 1-1**) is designed for use where exact multiplication of frequency is required. Also it can be used where increased resolution is required when making frequency measurements. The Block Diagram in **Figure 1-2** shows the basic system used to accomplish the multiplication.

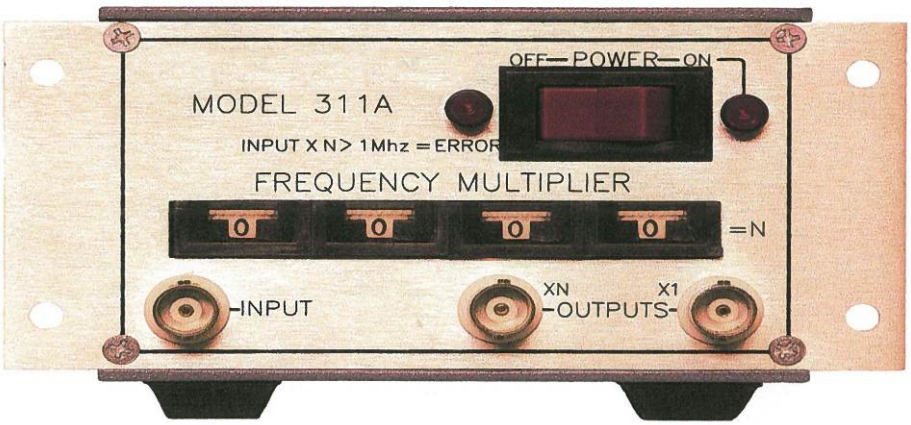


**Figure 1-1. Trig-Tek 311A Frequency Multiplier**

The Model 311A Frequency Multiplier provides a means of multiplying a frequency by an "N" numerator of 0001 to 9999 in integer steps. The Loop is phase locked to an input frequency signal and the output is the exact multiple of the setting at "N".

Input Levels from 30 mV PK to 100 V PK of any recurring wave is required for normal operation. An ERROR LED illuminates the loop is not locked. The XN output maximum frequency is one megahertz. If the multiplication of the Input frequency times the "N" exceeds one megahertz, the error light will illuminate.

Two 5-Volt TTL outputs bring out the X1 which is same frequency as the Input and XN which is the Input frequency times the "N" numerator.

The signal is brought into the input buffer amplifier. This circuit has protection to guard against damage with the inputs up to 110 Volts RMS. The buffered signal is amplified at the limiter to drive the frequency discriminator and phase detector. The frequency discriminator provides a signal which causes the voltage controlled oscillator frequency to be moved toward the frequency of the input signal. When the frequencies are within plus or minus one Hertz, the discriminator becomes a phase detector with a linear voltage versus phase output. The phase detector, loop filter, voltage controlled oscillator, and selected divider are then a phase-lock-loop system. The phase lock system with the digital dividers in the loop between the voltage controlled oscillator and the phase detector provides a means of accomplishing exact multiplication of the input frequency by the integer number set

for "N".

# Specifications

## Input

| | |
|---|---|
| Frequency Range | 5 Hz to 10 KHz |
| Level | 30 mV to 100 V sine wave, square wave, or pulse |
| Impedance | 100,000 Ohms (guarded to 110 VRMS) |

## X1 Output Signals

| | |
|---|---|
| Level | 5 V TTL |
| Impedance | Less than 200 Ohms (25 mA) |

## XN Output Signals

| | |
|---|---|
| Level | 5 V TTL |
| Impedance | Less than 200 Ohms (25 mA) |
| ERROR Light | LED illuminates when the Input frequency times the setting at “N” exceeds 1 mHz. |

## Operating Temperature

| |
|---|
| 0° to 70° C |

## Power

| |
|---|
| ±115 or 230 VAC (switch selectable)<br>Approximately 3 watts<br>Optional: DC-powered 12 or 24 VDC |

## Dimensions

| |
|---|
| 5.25" wide x 2.75” high wide x 6" deep<br>(13 cm x 7 cm x 15 cm) |

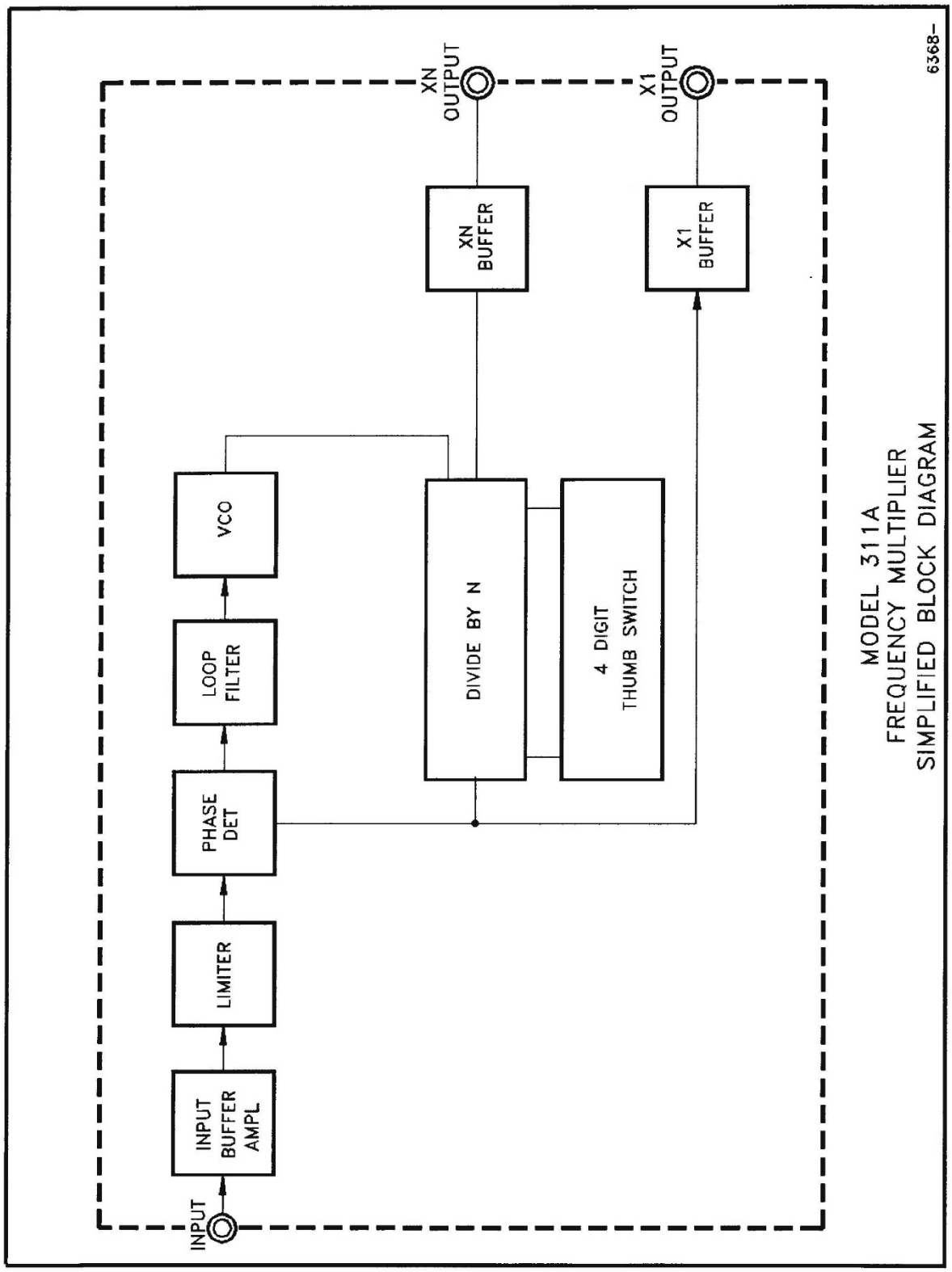


**Figure 1-2. Simplified Block Diagram**

# Chapter 2
# Operation

## DC Operation

Apply the proper DC voltage (12 V or 24 V) to the unit.

Turn the POWER switch to the ON position.

Note that the POWER light is illuminated.

## AC Operation

Before applying power, verify that the 115-230 Volts switch (Rear Panel) is in the proper position for your use.

**CAUTION**

**If you apply 230 Volts to the unit when the switch is in the 115 V position, you might damage the unit.**

Connect the power cord to the line and turn the POWER switch to the ON position. Note that the POWER light is illuminated.

## Frequency Multiplier Thumber Switch = N

The Frequency Multiplier thumb switch, on the front panel, sets the multiplication factor between the Input signal frequency and the XN Output signal frequency. Selections for "N" are 0001 to 9999.

When the Input frequency times the multiplier selected for "N" exceeds the upper VCO frequency the ERROR LED illuminates.

## X1 Output

The X1 output is a TTL square wave at the same frequency as the Input signal.

## XN Output

The XN Output is a TTL Square wave signal “N” times the Input Signal frequency, as selected by the N (Multiplier Thumb Switch).

# Chapter 3
# Peformance

This performance test procedure should be run to verify that the unit is performing within the manufacturer's specifications. The unit uses integrated circuits and very stable parts. There is no adjustment in the Model 311A. If a part of the procedure is not in tolerance, contact the Customer Service Department of Astronics Test Systems for service.

## Test Equipment

***Note: Equivalent equipment can be substituted.***

| | |
|---|---|
| Counter | Triplett Model 7000 |
| Function Generator | Trig-Tek 346B Synthesized Calibrator |

## Procedure

1. Connect a 1.00 ±0.1 Volt signal of 5 ± 0.05 Hz to the INPUT jack.
2. Set the Multiplier thumb switch to 100.
3. Connect the counter to the X1 output.
4. Observe an indication of 5 ±0.1 Hz on the counter.
5. Connect the counter to the XN output.
6. Observe an indication of 500 ±5 Hz on the counter.
7. Set the Multiplier thumb switch to 60.
8. Observe an indication of 300 ±3 Hz on the counter.
9. Set the Multiplier thumb switch to 10.
10. Observe an indication of 50 ± 1 Hz on the counter.
11. Change the input frequency to 2000 ± 1 Hz.
12. Observe an indication of 20000 ±10 Hz on the counter.
13. Reduce the generator input level to 50 millivolts RMS.
14. Observe an indication of 20000 ±10 Hz on the counter.

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