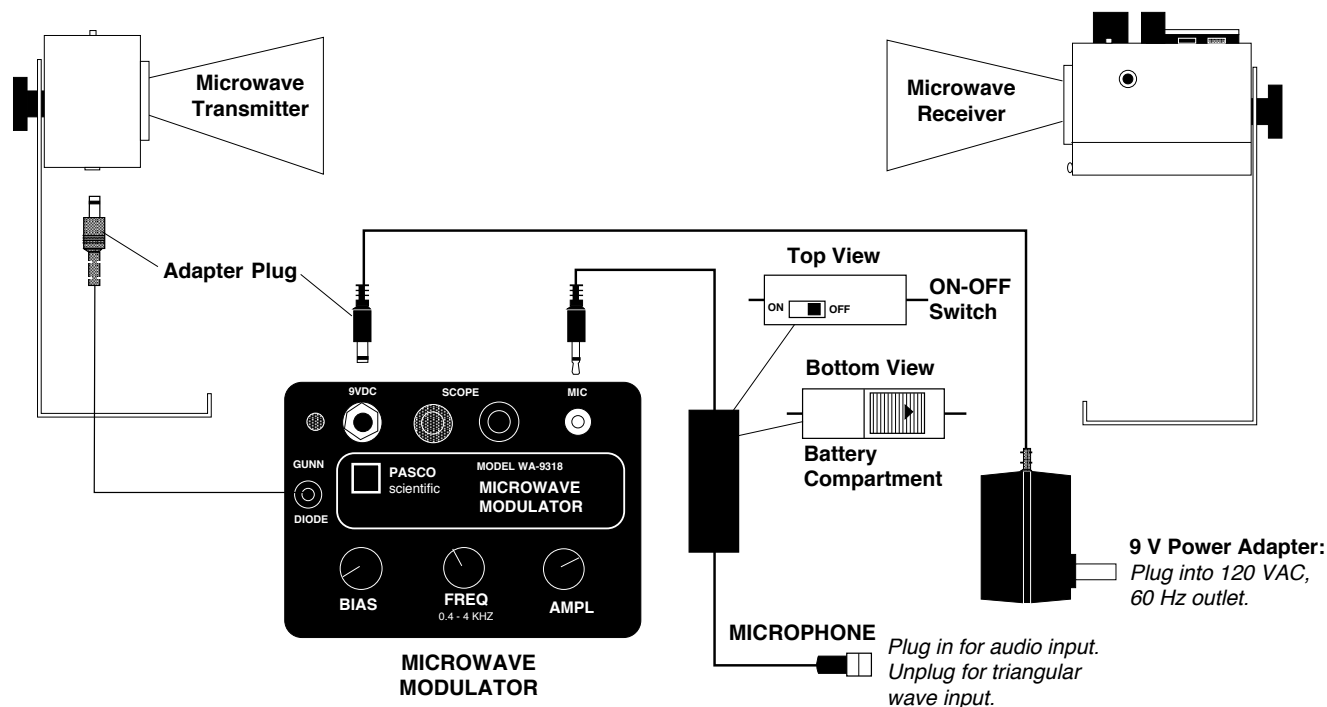


**Instruction Sheet  
for the PASCO  
Model WA-9318**

# MICROWAVE MODULATION KIT



## Introduction

The WA-9318 Microwave Modulation Kit turns your PASCO Microwave Transmitter and Receiver into a microwave communications system. Talk into the microphone and your voice modulates the amplitude of the transmitted microwaves, sending the signal through space to the receiver. You can monitor the signal at the modulator using an oscilloscope. The signal at the receiver can also be monitored with an oscilloscope, or you can use an audio amplifier and speaker to provide an audible output. (The oscilloscope, amplifier, and speaker are not provided.)

For more quantitative investigations, the modulator provides a triangular wave output with variable frequency (0.4 - 4 kHz), amplitude (0 - 6 V peak-to-peak), and bias (a DC offset to demonstrate "clipping"). Using this triangular wave with an amplifier

and speaker, you can add an audible output to your standard microwave experiments—a useful addition to class demonstrations.

## Equipment

**Your WA-9318 Microwave Modulation Kit includes (see above):**

1. Microwave Modulator
- \*2. Microphone
3. Adapter Plugs

\* Microphone: low impedance, 50-15,000 Hz frequency response (replacement battery = 1.5 V Eveready A76 or equivalent)

### Additional Equipment Needed:

- \*4. PASCO Microwave Transmitter
  - \*5. PASCO Microwave Receiver
  - \*6. 9 V Power Adapter
  - 7. an oscilloscope, or an audio amplifier and speaker, to monitor the output.
  - 8. Banana plug connectors. (between the oscilloscope and the modulation)
- \* Items 4-6 are provided in the PASCO Microwave Optics System (WA-9314B or WA-9316)

### Operation

Set up the equipment as shown in the preceding illustration. Turn on the microphone with the ON/OFF switch found on the microphone battery compartment. Point the Microwave Transmitter toward the Microwave Receiver. Then:

- To monitor the modulating signal, plug your oscilloscope into the banana plug connectors labeled SCOPE on the Microwave Modulator. (see Figure)
- To monitor the signal at the receiving end, plug your oscilloscope or audio amplifier w/speaker (not included) into the banana plug connectors labeled OUTPUT on the top of the Microwave Receiver. (see Figure)
- If you wish to modulate the microwaves with the triangular wave signal, unplug the microphone. Adjust the frequency, amplitude, and bias of the modulating signal using the controls on the Microwave Modulator. (The BIAS control adjusts the DC voltage level of the Gunn Diode in the Microwave Transmitter. The modulating signal then varies the Gunn Diode voltage about this DC voltage. Proper adjustment of the BIAS is necessary to produce a linear, unclipped microwave signal from the Gunn diode.)

### Experiments

#### 1. ADDING AN AUDIBLE OUTPUT TO MICROWAVE EXPERIMENTS

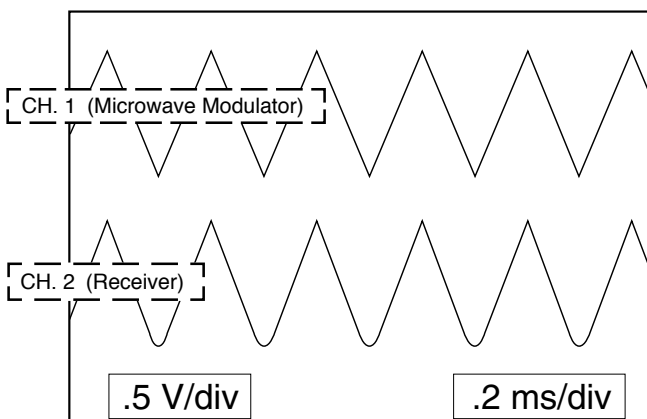
The impact of most microwave experiments can be improved by adding an audible output. The maxima and minima of an interference pattern, for example, seem somehow more real when they can be heard in the variations in loudness of an audible tone, instead of just seen as fluctuations in a meter reading.

Any of the experiments in the manual that accompanied your PASCO Microwave Optics System can be performed with an audible output. Just follow the instructions listed above for using the triangular wave output of the Modulator with an audio amplifier and speaker.

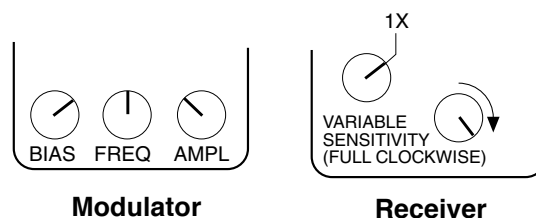
#### 2. MICROWAVE COMMUNICATIONS

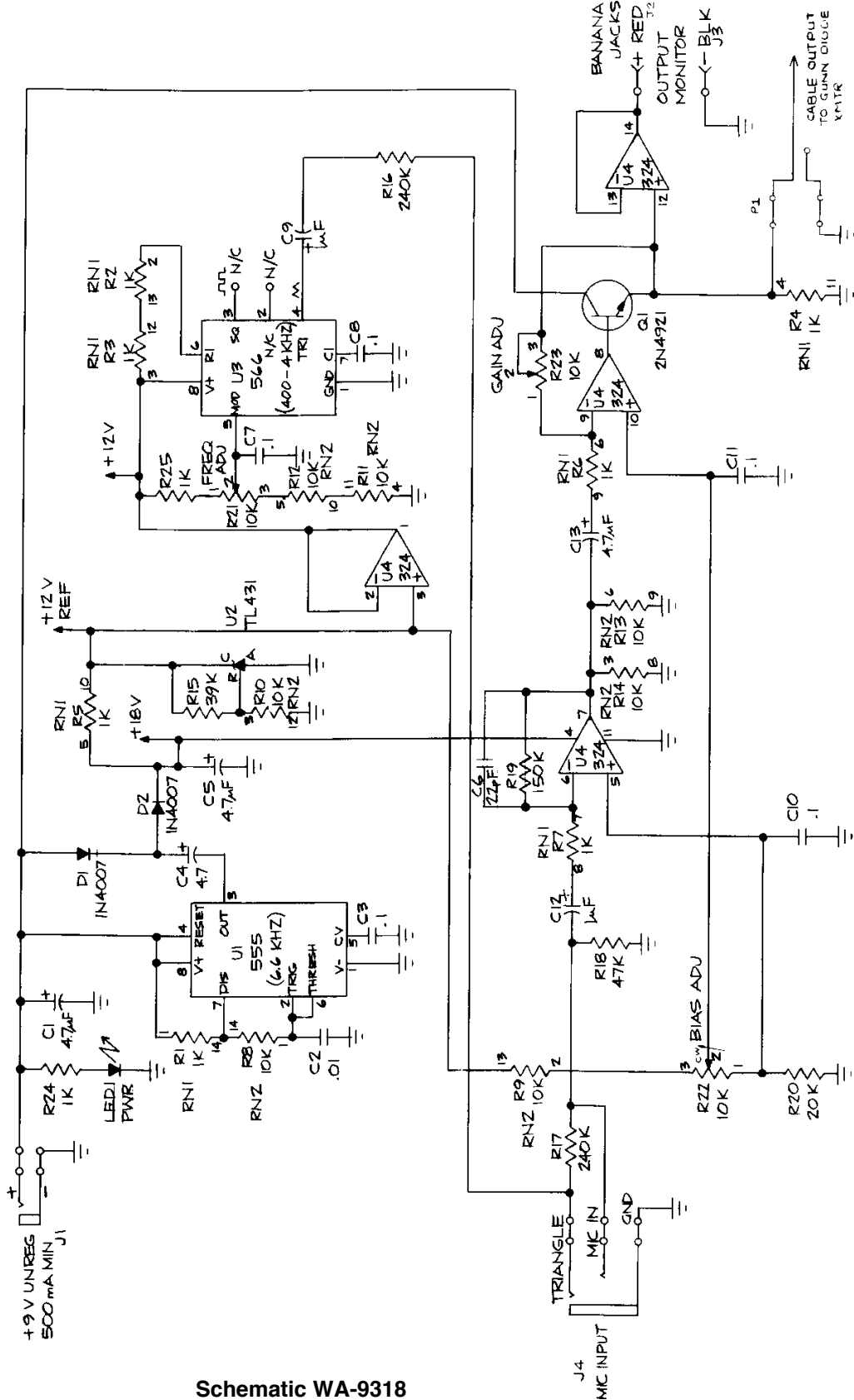
With the simultaneous use of an oscilloscope and an audio amplifier and speaker, this system is excellent for demonstrating microwave communications. The input signal can be the triangular wave output of the modulator, or it can come from the microphone or even a tape player.

#### Typical View of Dual Trace Oscilloscope



#### Typical Equipment Settings





Schematic WA-9318  
(Drawing No.956-02857)

## Limited Warranty

PASCO scientific warrants this product to be free from defects in materials and workmanship for a period of one year from the date of shipment to the customer. PASCO will repair or replace, at its option, any part of the product which is deemed to be defective in material or workmanship. This warranty does not cover damage to the product caused by abuse or improper use. Determination of whether a product failure is the result of a manufacturing defect or improper use by the customer shall be made solely by PASCO scientific. Responsibility for the return of equipment for warranty repair belongs to the customer. Equipment must be properly packed to prevent damage and shipped postage or freight prepaid. (Damage caused by improper packing of the equipment for return shipment will not be covered by the warranty.) Shipping costs for returning the equipment, after repair, will be paid by PASCO scientific.

## Equipment Return

Should this product have to be returned to PASCO scientific, for whatever reason, notify PASCO scientific by letter or phone BEFORE returning the product. Upon notification, the return authorization and shipping instructions will be promptly issued.

**NOTE: NO EQUIPMENT WILL BE ACCEPTED FOR RETURN WITHOUT AN AUTHORIZATION.**

When returning equipment for repair, the units must be packed properly. Carriers will not accept responsibility for damage caused by improper packing. To be certain the unit will not be damaged in shipment, observe the following rules:

1. The carton must be strong enough for the item shipped.
2. Make certain there is at least two inches of packing material between any point on the apparatus and the inside walls of the carton.
3. Make certain that the packing material can not shift in the box, or become compressed, thus letting the instrument come in contact with the edge of the box.

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