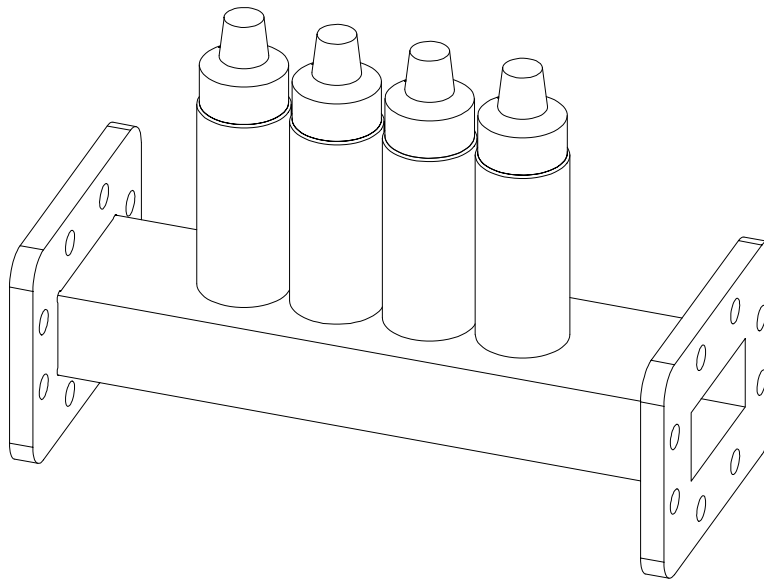

Product User Manual

◆

Model GA1019

Precision 4-Stub Tuner, CPR159



Document # 930037, Rev. 1



Gerling Applied Engineering, Inc.
P.O. Box 580816 ◆ Modesto, CA 95358
www.5800mhz.com

REVISION HISTORY			
REV.	DESCRIPTION	DATE	APPROVAL
1	PROTOTYPE RELEASE	15JAN04	JFG

WARRANTY

Products manufactured and sold by Gerling Applied Engineering, Inc. (“GAE”) are warranted to be free of defects in materials and workmanship under normal use and service for a period of twelve (12) months from the date of original shipment. GAE’s obligation under this warranty is limited to repairing or replacing, at GAE’s option, all non-consumable component parts. Consumable parts are specifically excluded from this warranty and may include, but are not be limited to, magnetrons, fuses, lamps, seals, o-rings, v-belts, and fluids. All warranty repairs are to be done at GAE’s facility or as otherwise authorized by GAE. All shipping charges for warranty repair or replacement are the purchaser’s responsibility unless otherwise agreed to by GAE.

This warranty supercedes all other warranties, expressed or implied. No warranty is given covering the product for any particular purpose other than as covered by the applicable product specifications. GAE assumes no liability in any event for incidental or consequential damages, financial losses, penalties or other losses incurred in conjunction with the use of GAE products.

DOCUMENT CONVENTIONS



NOTE: Means the reader should take note. Notes contain helpful information, suggestions, or references to other sections, chapters, or documents.



CAUTION: Means the reader should be careful. You are doing something that might result in equipment damage or loss of data.



WARNING: Means danger. A situation exists that could cause bodily injury or death. All personnel must be aware of the hazards involved with high voltage electrical circuitry and high power microwave devices.



WARNING

All waveguide tuners manufactured by GAE, Inc. are intended for use with other equipment capable of producing a microwave field that is potentially hazardous to operating personnel. They must never be connected or operated in a manner that allows a field in excess of 10 milliwatts per square centimeter to be generated in an area accessible to operating personnel. Contact GAE, Inc. for technical support prior to installation and/or operation of these units if there is any question or concern about microwave leakage.

All waveguide flange and electrical cable connections throughout the system must be secure prior to operation. Never operate the microwave generator without a properly rated absorbing load attached. To ensure safe operation and prevent microwave leakage, the equipment must be periodically inspected and maintained as required or recommended.

TABLE OF CONTENTS

EQUIPMENT DESCRIPTION	5
General Specifications	5
Outline Drawing	5
INSTALLATION	6
Preliminary Inspection	6
Waveguide Configuration	6
Flange Connections	6
OPERATION	8
Basic Operation	8
Standard Tuning Procedure	8
False Null	9
High Power Operation	9
MAINTENANCE AND CALIBRATION	10

EQUIPMENT DESCRIPTION

GAE’s family of precision multi-stub tuners are designed for load impedance matching in high power microwave heating systems. Their simple yet rugged design makes these tuners ideal for a variety of laboratory, production and OEM applications.

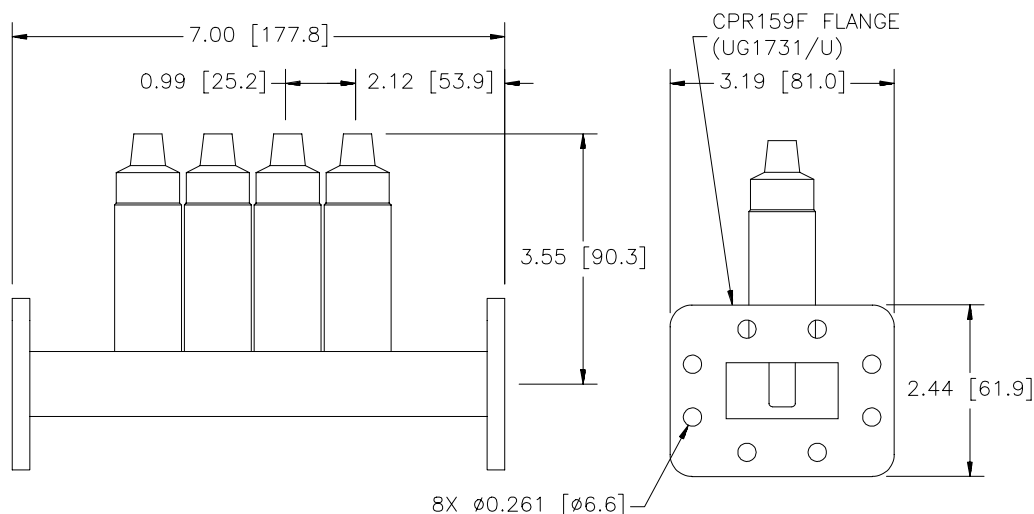
The stubs are effectively spaced at 1/8-guide wavelength intervals (3/8-guide wavelength actual spacing) and offset 1/32-guide wavelength from center. This configuration is capable of tuning a broader range of impedances than standard tuners having no offset.

A precision drive mechanism and locking multi-turn dial are provided on each tuning stub enabling highly accurate and repeatable tuning. The stub housings are designed with 1/4-wave reactive chokes allowing use in high “Q” applications.

General Specifications

Waveguide	WR159
Flange	GA1019: CPR159F (UG-1731/U)
Frequency	5.8 GHz +/- 75 MHz
Power (continuous)	1 kW
Impedance Matching	4 stubs with 1/4-wave chokes on 3/8-guide wavelength spacing
Construction	Aluminum waveguide, brass stubs
Finish	Chemical conversion coating; textured black paint

Outline Drawing



INSTALLATION

Preliminary Inspection

Upon arrival at the installation site the GA1019 tuner should be thoroughly inspected for damage or wear caused during shipping. Any visible damage to the packaging material or the tuner itself should be noted and reported immediately to the shipping company in accordance with standard claims procedures. The following components are included:

- a) GA1019 Precision 4-Stub Tuner
- b) Product User Manual (this document)

Waveguide Configuration

The 4-stub tuner can be connected to and used with any common waveguide component having a compatible flange (see below). Mounting can be in any convenient position and orientation with either flange positioned towards the process load. Ideally, the tuner should be located as close to the process load as possible. Figure 1 illustrates a typical waveguide configuration.

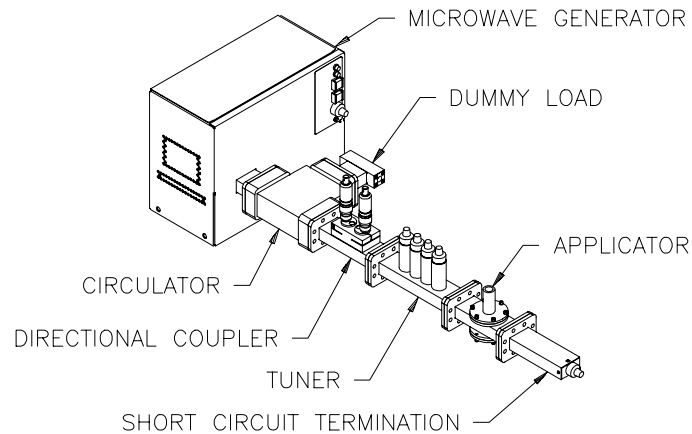


Figure 1. Typical waveguide configuration for process load impedance tuning.

Flange Connections

Both flanges of the 4-stub tuner must be properly connected to another waveguide component. Bolts and nuts must be installed at all flange bolt holes on both flanges and tightened securely prior to operation.



Microwave Leakage – Regulatory limits for microwave leakage relate to standards for human safety and interference with other electronic devices. Standards for human safety as adopted by OSHA, the International Electrotechnical Commission (IEC) and

other regulatory agencies limit leakage to 5 mW/cm² measured at 5 cm from the leakage source under normal operating conditions, and 10 mW/cm² at 5 cm from the source under abnormal operating conditions. The U.S. Federal Communications Commission (FCC) has established regulations limiting the emission of energy at frequencies outside the ISM bands. All GAE waveguide components meets these requirements when properly connected to another waveguide component.

OPERATION

Basic Operation

The most common intended function of the GA1019 tuner is to provide an impedance match to the process load. Operating the 4-stub tuner for this purpose is a procedure involving the adjustment of one or more tuning stubs while monitoring power reflected from the process load. However, predicting the best stub or combination of stubs to adjust is nearly impossible without the aid of additional impedance analysis equipment. Thus, choosing which stub to adjust at any point during the tuning procedure is a matter of either trial and error or prior experience with a given load.

Note that, in most cases of impedance matching, no more than two stubs are required to achieve an impedance match. Four stubs are provided with the GA1019 tuner to cover a broader range of possible impedances. If difficulty is experienced in achieving a match with these stubs then a possible solution is to reverse the orientation of the tuner in the waveguide setup (turn the tuner end for end) so as to shift the stub positions by 1/16 guide wavelength.



CAUTION: *Care must be taken to avoid operating the microwave generator at power levels exceeding the rating of the tuner. Excessive power levels can cause damage to the tuning stubs.*

Standard Tuning Procedure

A recommended tuning procedure for first-time matching of a given load is as follows:

1. Begin with all stubs adjusted to the fully extracted position (fully clockwise).
2. Slowly adjust stub 1 while monitoring the level of reflected power. If reflected power increases then return the stub to its original position and proceed to step 6. If reflected power decreases then continue adjusting until the reflected power stops decreasing.
3. Slowly adjust stub 2 while monitoring reflected power. If reflected power increases then return the stub to its original position and try again with stub 3. If reflected power decreases then continue adjusting until the reflected power stops decreasing.
4. Return to stub 1 and adjust in whatever direction causes reflected power to decrease. Continue adjusting until reflected power stops decreasing.

5. Repeat steps 2 through 4 until reflected power no longer decreases by adjusting stubs 1 and 2. Make note of the stub positions and the level of reflected power.
6. Return all stubs and repeat the process except to start with a different stub. Continue until reflected power has again been minimized and make note of the stub positions and reflected power level. Compare to the results obtained in step 5.
7. Repeat step 6 as many times as necessary until reflected power has been reduced to a satisfactory minimum.

False Null

The above procedure can sometimes lead to a false indication of reflected power minimization. That is, it may appear that adjusting any one stub will result in an increase of reflected power. This “false null” can be overcome by detuning one stub and retuning another in order to find another null using a different combination of stubs.

High Power Operation

The GA1019 tuner is designed for continuous use at microwave power levels up to 1kW. However, under certain high power conditions, such as a high Q factor, it may be possible to cause excessive heating that may be hazardous to operating personnel and/or result in damage.

The electric field strength in any waveguide device is a function of both power level and Q factor. Excessively high electric fields can result in discharge (arcing) and/or overheating due to resistive losses. High Q may be tolerable at low power while the same Q can be damaging at high power. Although the tuners are expected to perform satisfactorily under moderate Q factors at higher power levels, the operator should exercise caution to prevent damage due to arcing or overheating under these conditions.

MAINTENANCE AND CALIBRATION

The GA1019 tuner is designed to be maintenance free and does not require any user maintenance under normal operating conditions. No calibration is necessary.

Although the GA1019 tuner is a very rugged and stable device, it can be subject to damage due to excessive power levels or mishandling. If damage occurs, the circulator should be returned to GAE for repair. Contact GAE for information on repair services.