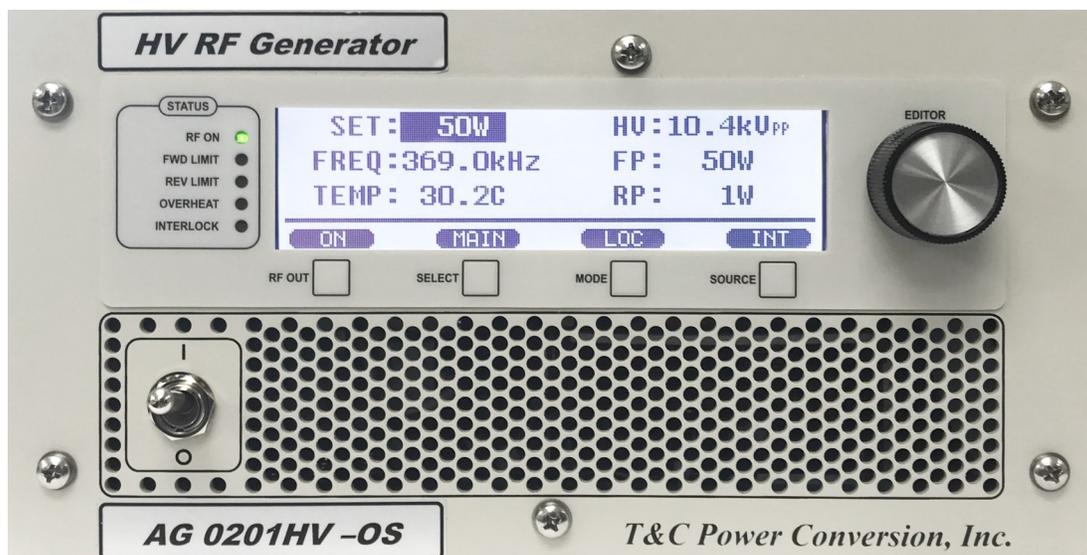


AG 0201 HV-OS

RF HV GENERATOR

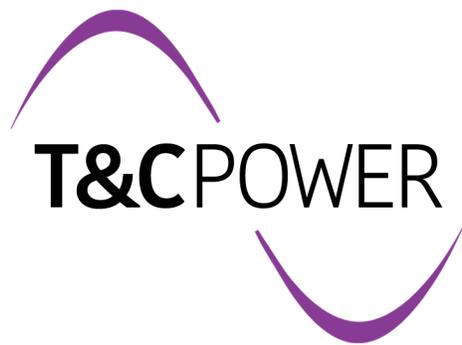


OPERATION MANUAL

T&C Power Conversion Support Team

support@tcpowerconversion.com

(585) 482 - 5551



www.tcpowerconversion.com

AG0201HV-OS

HIGH VOLTAGE RF POWER SOURCE



HIGH RF VOLATAGES MAY BE PRESENT AT THE OUTPUT OF THIS UNIT. All operating personnel should use extreme caution in handling these voltages and be thoroughly familiar with this manual.



DO NOT USE ANY CFC (CHLOROFLUOROCARBON) SOLVENT IN THE MAINTENANCE OF THIS PRODUCT. The no-clean flux used in manufacturing this product may leave a small inert residue, which will not affect the performance of the product. The use of CFC's for cleaning or maintenance may result in partial liquefaction of the no-clean flux residue, which will damage the unit and void the warranty.

This product is manufactured at T&C Power Conversion's Rochester, NY plant, following ISO 9001 Quality System principals.

Applicable EC Directives:

**According to EC EMC Directive 2004/108/CE
And according to EC Low Voltage Directive 2006/95/CE**



**Applicable Harmonized Standards:
EN 61010-1:2001 (2nd Edition), UL 61010-1
EN 61326-1:1997 + A1:1998 + A2:2001 + A3:2003**

UL IEC 61010-1, Edition 3.0, 2010-6

NOTICE:

The material contained in this manual is subject to change without notice. No part of this manual may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying or electronic transmission or other means of reproduction or distribution without prior written consent of T&C POWER CONVERSION, INC.

The drawings, specifications and other technical information contained in this manual are the property of T&C POWER CONVERSION, INC. and shall not be copied, reproduced or used in any way, in whole or in part, as basis of manufacture or sale of similar items without the prior written consent of T&C POWER CONVERSION, INC.

© 2020 T&C POWER CONVERSION, INC.

WARRANTY

T&C POWER CONVERSION, INC. warrants to original Purchaser/User for a period of 12 months from the date of delivery, each instrument to be free from defects in materials and workmanship.

For a period of 12 months T&C will, at its opinion, adjust, repair, or replace defective parts, without charge to the original purchaser, so that the instrument performs according to its specification. When warranty service is required, the instrument must be returned, transportation prepaid, to the factory.

If, in our opinion, the instrument has been damaged by accident, unreasonable use– inconsistent with user’s manual, improper site preparation or maintenance, or abnormal condition of operation – repairs will be billed at the standard rate to Purchaser. In these cases, an estimate will be submitted to User before the work is started.

SERVICE AND TECHNICAL ASSISTANCE

For service or repair, contact T&C directly or a local representative with the following information:

- Model and serial number,
- Purchase order number,
- Detailed description of malfunction.

For technical Assistance for your particular application contact the factory. The following information will help us provide you with prompt and efficient service:

- Detailed description (e.g. physical damage and/or performance anomalies, quantitative and/or qualitative deviation from specification), including miscellaneous symptoms, dates and times,
- The environment and circumstances under which the issue developed,
Supporting test data and/or records that are available.

Sales & Service Locations

Look for our currently updated Sales and Service Representatives around the world on our website.

www.tcpowerconversion.com

TABLE OF CONTENTS

| | |
|--|----|
| Warranty | 4 |
| Service and Technical Assistance | 4 |
| Introduction | 6 |
| Chapter 1: Safety | 7 |
| 1.1 Labels | 7 |
| 1.1.1 Important Operating and maintenance cautions | 7 |
| 1.1.2 Electric Shock Warnings | 7 |
| 1.1.3 Caution Warning - Safety Ground | 7 |
| 1.1.4 AC INPUT | 8 |
| 1.1.5 REMOTE CTL IN | 8 |
| 1.1.6 HV OUTPUT | 8 |
| 1.1.7 Miscellaneous Symbols | 8 |
| 1.1.8 Service | 8 |
| 1.1.9 Name Plate | 9 |
| Chapter 2: System Installation | 10 |
| 2.1 Initial Installation | 10 |
| 2.1.1 Mechanical Inspection | 10 |
| 2.1.2 Claim for Damage | 10 |
| 2.1.3 Packaging for Reshipment | 10 |
| 2.2 Installation Requirements | 11 |
| 2.3 Cooling and Ventilation | 11 |
| 2.4 Power Line Voltage | 12 |
| 2.5 Initial Turn-On Procedure | 12 |
| Chapter 3: Operation | 13 |
| 3.1 Rear Panel | 13 |
| 3.2 Front Panel | 14 |
| 3.3 Tips for Operating AG0201HV-OS. Remote MODE: REM | 16 |
| 3.4 Interface Connector Signal Description | 17 |
| 3.5 Tips for Operating AG0201HV-OS. Local MODE: LOC | 18 |
| Appendix | |
| Specifications | 19 |
| Specifications. RF Pulse (Burst) Operations | 20 |
| High Voltage Power Reference Calculations | 21 |
| Sine Wave Conversion Chart | 22 |
| Mounting and Outline Drawing | 23 |
| Product Manual Revision Control Form | 24 |

INTRODUCTION

AG0201HV Model TS is a unique source of RF high voltage suitable for a wide variety of applications in industry and research. It combines a number of features to simplify establishment and control of gas plasma. A very accurate broadband power meter senses the power transfer from the power amplifier to the matching network and onto the plasma discharge.

The microprocessor-based controller monitors the transfer and maintains a safe operating condition for the AG0201HV. It displays the levels of Forward Power (FP) and Reverse Power (RP) in watts and the amplitude of the High Voltage in kilovolts (kVp-p). All of this information is available from the front panel LCD display; see Front Panel description on page 14.

The controller is responsible for the meter and control of all critical parameters of the high voltage generation, resulting in maintenance of an accurate, repeatable plasma process control, while being user friendly as well. The AG0201HV-OS is controlled from the **Remote Control** interface connector on the rear panel.

This manual is divided into three chapters and an appendix. Please refer to the following descriptions to help you locate the information you need.

| Chapter | Description |
|----------|---|
| 1 | Deals with safety details. Please read if you are unfamiliar with the AG0201HV or T&C Power Conversion's warranty procedures. |
| 2 | Explains how to install and power up the system for the first time. |
| 3 | Describes the operating details of the AG0201HV-OS. |
| Appendix | Technical Specifications |

1.1 Labels

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

1.1.1 Important Operating or Maintenance Caution



Definition: Attention, consult accompanying document

The exclamation point within a triangle is to alert the user, operator or service personnel to the presence of important operating and/or maintenance instructions in the User's Manual.

1.1.2 Shock Hazard Warning



Definition: Caution, risk of electric shock

The lightning bolt within a triangle is to alert the user, operator or service personnel to the presence of unprotected voltage points within the enclosure of sufficient magnitude to cause dangerous electric shock.

Only authorised service personnel with the schematic diagram and knowledge of the voltages within the equipment shall remove covers or panels bearing this symbol.

1.1.3 CAUTION WARNING



Do not operate this amplifier with the cover removed. Lethal voltages are present beneath the cover. The cover protects against **electrical shock** due to AC line voltage, high RF potential in the hundreds of Volts at the output transformer, coupler and output connections. Also the DC supplies produce high voltages in the conversion process and are capable of producing more than 20 Amps of current at nominal output voltage. The cover is an integral part of the air ducting system that keeps components cool. Without the cover in place, insufficient air flows between and around the two DC power supplies causing overheating of the internal components.

This label should remain affixed to the rear panel area just above or below the RF output connector. Always connect the load to the RF output connector before connecting the RF input to the amplifier. This will ensure that high voltage at the center pin of the HV output connector will not be exposed.

1.1.4 AC INPUT – Alternating current input

Definition: AC Input ratings for operation 100 to 120 and 200 to 240 VAC $\pm 10\%$,
(min 90 - max 132 VAC and, min 180 - max 264 VAC) 47 to 63 Hz

1.1.5 REMOTE CTL IN

Definition: Input

The Input Label is to identify the signal input port for the user, operator or service personnel.

1.1.6 HV OUTPUT

Definition: HV Output

The HV Output symbol is to identify the High Voltage signal output port for the user, operator or service personnel.



1.1.7 Miscellaneous Symbols

AC Power Toggle Switch

AC Power Off Symbol

AC OFF

Definition: Off (power: disconnection from the AC main)

or



The Off symbol on the AC Power Switch is to identify the functional configuration of the toggle switch (when the switch handle is pointing towards “AC OFF”) for the user, operator or service personnel.

AC Power On Symbol

AC ON

Definition: On (power: connection to the AC main)

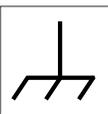
or



The On symbol, next to the AC Power Switch is to identify the functional configuration of the toggle switch (when the switch handle is pointing towards “AC ON”) for the user, operator or service personnel.

SAFETY GROUND

Be sure the chassis is grounded to a reliable earth ground using the grounding stud provided on the rear panel. In addition, be sure the grounding wire remains connected securely between the cover of the chassis and the base of the chassis.



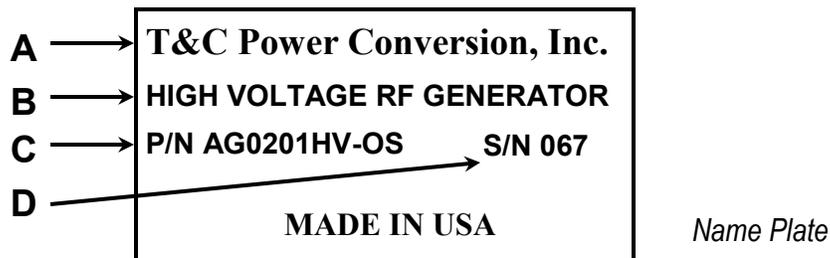
1.1.8 Service

T&C POWER CONVERSION, INC. is responsible for safety and performance of the equipment only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by authorised personnel.
- The electrical installation is made in accordance with User's Manual and the room in which the equipment is installed complies with the environmental requirements,
- The equipment is used strictly in accordance with the instructions in this manual or associated test documents.

1.1.9 Name Plate

The AG0201HV-OS can be identified by a name plate on its rear side panel with the following information:



A. MANUFACTURER

T&C POWER CONVERSION, INC
132 Humboldt Street
Rochester, NY 14610
USA

B. TYPE OF EQUIPMENT

This line holds the description of what the equipment is intended to be used for.

C. MODEL NUMBER

The assembly number which uniquely identifies product configuration is entered on this line.

D. S/N

This line contains a number which is sequentially assigned as the product is manufactured.

Chapter 2 is for authorized personnel only qualified in electrical installation.

2.1 Initial Installation

2.1.1 Mechanical Inspection

If damage to the shipping carton is evident, request the carrier' agent be present when the unit is unpacked. Check for equipment damage and inspect the cabinet and panels for dents and scratches.

2.1.2 Claim for Damage

Please notify T&C Power Conversion, Inc. directly or your authorized T&C representative if the product is mechanically damaged or fails to meet specifications upon receipt. Retain the shipping carton and packing material for the carrier's inspection as well as for subsequent use to return the unit should this become necessary.

2.1.3 Packaging for Reshipment

Whenever possible, the original shipping carton and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If a cardboard carton is used, it should be at least 200 lbs. test material.

Use shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping carton. Make sure that the instrument cannot move in the container during shipping. Seal the carton with a good grade of shipping tape and mark the container:

FRAGILE DELICATE INSTRUMENTS

2.2 Installation Requirements

The AG0201HV-OS is designed for bench or system operation. To guarantee the best performance, make sure there is adequate clearance for the entrance of cooling air to the rear of the unit as well as for the exhaust out the front of the unit. (6"/150mm min.)

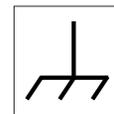
The AG0201HV-OS is set for single phase operation of 50/60 Hz AC Line of 100 to 120 VAC or 200 to 240VAC $\pm 10\%$. The power supply switches automatically to the line voltage applied to the unit. Unit does not require any special internal adjustments if operated within the specified voltage ranges.

Please check the following items before applying AC power to the AG0201HV-OS:

- Check Unit for any physical damage that could affect safety.
- Ensure the AC power cord is an IEC type with a 10 Amp or greater rating with a proper safety ground connection.
- Ensure the AC power cord is plugged into a properly grounded outlet..
- Connect AG0201HV-OS chassis to a proper safety ground. The grounding stud is on the rear panel.) A green insulated 18-gauge wire or heavier, and less than 50 feet in length is recommended.

WARNING

- ⊗ Do not place unit on metal table or any surfaces referencing earth or building safety ground
- ⊗ Ensure output cable is either properly connected to a load
- ⊗ Please use one hand at a time when operating high voltage equipment such as this
- ⊗ Always connect / disconnect output cable with the AC Power OFF
- ⊗ Do not use any personal electrostatic discharge equipment when operating this unit



2.3 Cooling and Ventilation

The AG0201HV-OS is protected against damage caused by lack of air flow. If inadequate air flow causes the temperature to rise over the OVERHEAT threshold, the generator senses the OVERHEAT fault, and RF power is automatically shut off. RF power will be restored automatically after the temperature falls below threshold.

For proper ventilation, adequate clearance of at least 6 inches /152.4 mm should be provided for the cool air intake on the front panel of the amplifier/generator. The ports located on the rear panel of the unit, should have at least 6 inches /152.4 mm of clearance and also be free from obstruction. To reduce potential overheating, do not allow exhausted warm air from the back to re-circulate to the front of the unit.

Maximum Ambient Temperature: 40°C

2.4 Power Line Voltage

The AG0201HV-OS is designed for operation from a single-phase, 3-wire electrical network with the following parameters: 100 to 120 VAC or 200 to 240 VAC $\pm 10\%$ at 50/60 Hz.

2.5 Initial Turn-On Procedure

The following procedure outlines a simple test to check for proper operation of the AG0201HV generator. It is assumed that the generator is already connected to an appropriate AC power source, and a suitable load (Lamp tester and its controller).

With an Interlock closed via Remote CTL interface (pins C and E connected) all RF Output power and High Voltage levels can be setup using local mode (MODE: *LOC* see page 18 for instructions) or in remote mode (MODE: *REM* see page 16 for instructions) via the test process external controller CT 6001S and AG0201HV-OS front panel EDITOR.

1. Pre-set AG0201HV generator as follows:

- AC Power to **OFF**
- INTERLOCK to **OPEN** (that defines RF Out OFF)
- If external controller is applied, RF Level Adjust on External Process Controller set to 0% (FWD=0W HV=0V)
- Ensure there is 0 Vdc applied to pin D, in reference to pin E of the Remote CTL remote interface in order to disable RF Out operation.

2. Place AG0201HV generator AC power switch to the ON position.

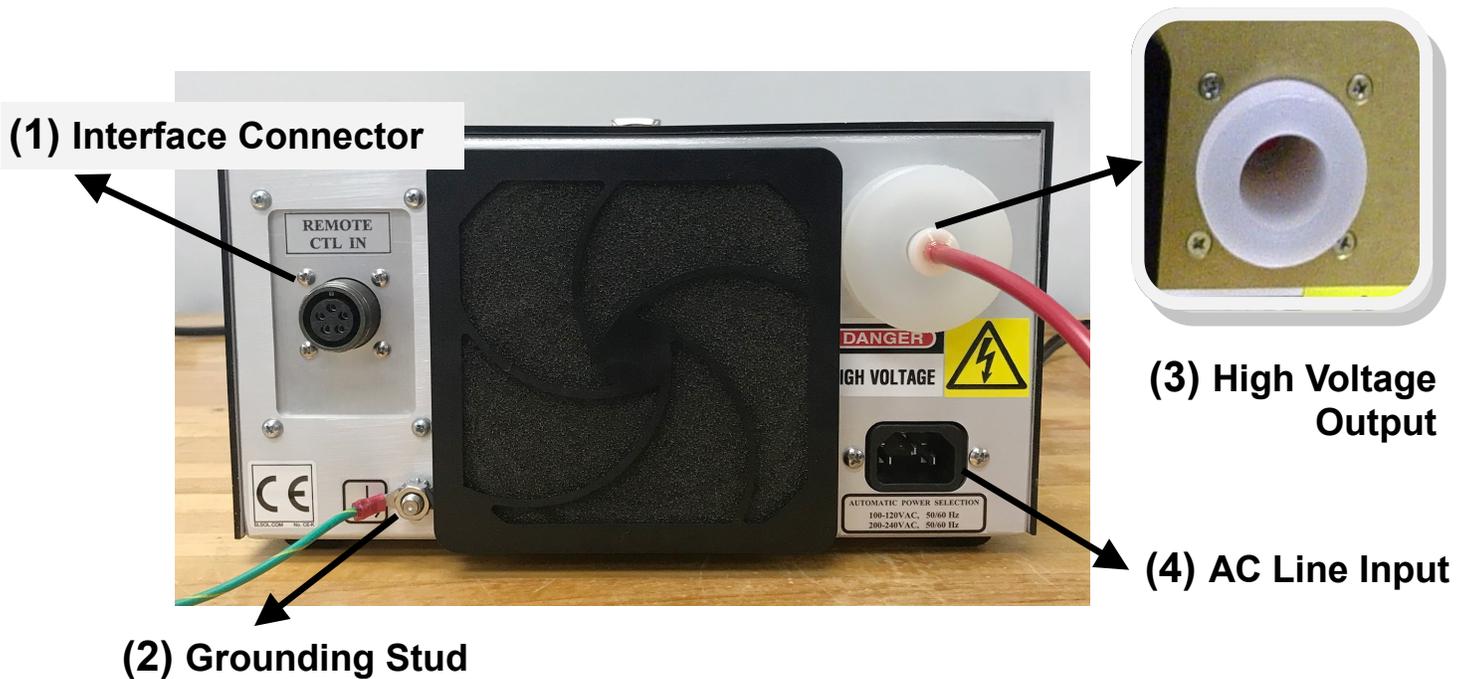
AG0201HV-OS should be AC ON at this point, no red Interlock LED should be present, unit should be in MODE: *REM*, RF OUT should be in OFF, cursor on LCD display should appear in *FREQ:* field. For quick test, the best is to push the MODE switch and change the mode to MODE: *LOC*. Push EDITOR knob to change the cursor field to SET: Set power output to some low level, for example 10W. Switch cursor field back *FREQ:* and set adjust it to about 365 kHz of operation if it is not there. **WARNING. From this point on there is a potential hazard for High Voltage Shock.**

LOAD MATCHING, PRE-TEST

3. When Interlock requirement is met (closed contacts Pin C to E), push the membrane switch RF OUT to ON. AG0201HV-OS is ready to generate High Voltage Output. (HV = $\sim 5\text{kVp-p}$)
4. Best matching: check the field of RP meter at this point. If it is above 0W, adjust the frequency of operation *FREQ* field with EDITOR knob (push EDITOR to switch the cursor field to *FREQ*), up and down if necessary, on the AG0201HV-OS generator until you achieve a minimum reading on the reverse RP meter. Once you have a good match, keep that frequency of operation for now, increase further your Front Panel SET: [W] power request signal until the AG0201HV-OS front panel display FP show the desired power level. Example: $\sim \text{SET} = \sim 60\text{W}$ in a good matching = 10 to 11 kVp-p. Be Aware that different loads and different power levels may require re-tuning of the AG0201HV-OS *FREQ* Frequency knob. Please repeat that tuning procedure at a new high power/voltage level for the best matching, always go for min RP and max HV level. With the new good match, keep the frequency of operation *FREQ* unchanged. Your AG0201HV-OS will remember that frequency.

Matching Test Complete

Push RF OUT to OFF state. OPEN Interlock, that will place **RF Out to OFF**, AG0201HV will become quiet, no fan operation, red Interlock LED will lit. Place AC Power to **OFF**.



3.1 Rear Panel:

1. **Interface Connector** – Amphenol 14S-5S. Controller. See “*Interface Connector Signal Description Table*” for more details. Must be connected properly in order to close INTERLOCK (Pin C to E) and receive control signals.
2. **Grounding Stud** (1/4"-20)
3. **High Voltage Output** – HV RF Connector. Round flanged receptacle with threaded stud. 12.5 kV peak-peak maximum.
4. **AC Line Input** – 47 to 63 Hz, 100 to 120 VAC or 200 to 240 VAC $\pm 10\%$ (Changes Automatically). 15A IEC Standard Power Entry Module.

WARNING



DO NOT TOUCH. Dangerous voltages can be present here whenever unit is plugged into an AC source and AC is turned ON, **regardless of RF ON / RF OFF switch position** on the front panel and/or "**mute**" computer card connected to rear panel Control Input.

3.2 Front Panel

MODE: LOC Indicates that the Local Control for RF power/HV voltage is enabled via front panel Human Interface.

MODE: REM Indicates that the Remote Control is *enabled*.

RF power and HV voltage are defined via Pin D analog signal amplitude and timing.



EDITOR knob offers two movements. Left and right rotations, to decrease and increase the value in the cursor field. By pushing that knob, cursor changes the adjusting field, for example from SET: to FREQ:

SET:

LOC Mode operation. RF Power Level requested via EDITOR knob, is displayed in this field. It's [W] scale means power output and High Voltage level from 0 to 150 Watts of generator output capacity when operating in LOC local Mode of operation. When adjusting, use HV and FP fields as your reference for the value.

By default, that level is always at 0W on AC ON. When INTERLOCK contacts will open, it will go to 0W. For operation of the unit, it must be always SET to desired [W] level with EDITOR knob.

REM Mode Operation. Default on AC ON. When in REM Mode, AG 0201 HV-OS is set for power output from external CT 6001S controller via Pin D of REM CTL IN interface connector. That Pin D signal defines two parameters of the generator output: Amplitude and BURST (amplitude and RF pulse timing). The amplitude scale for this port is 0V to 5V = 0W to 150W. The pulse operation is from 0.5 ms to continues operation. Rising and falling edges are ~250 us delayed and speed of the rising/falling pulses is $\sim 5kV/0.00025s = 20kV/ms$.

FREQ: Frequency of operation is displayed in this field. Adjust it with EDITOR knob, up or down, for the best matching, the most of High Voltage. See next page for more on this field.

MODE: MAIN unit is in operation mode, ready to receive request for Output power and frequency. Other modes available, service mode SVC MODE by depressing SELECT switch when unit is in LOC Mode.

Note: when unit is in RF ON state in LOC Mode, depressing SELECT switch will follow with RF OFF state and switch the screen to SVC.

HV: High Voltage in kilo Volts peak-peak for actual voltage level delivered to the external load.

FP: Forward Power Meter indicates the forward power level in Watts delivered to the internal matching system circuitry for conversion into the high voltage (*NOTE: The power level reading (in Watts) will not be the actual power delivered to the load due to losses in the internal matching system circuitry.*)

RP: Reverse Power Meter indicates reflected power level or mismatch during operation. Always adjust with FREQ for minimum of RP.

...Continued on page 15

3.2 Front Panel, continued:

SVC Service Screen:

Access to it from
MODE: LOC /SELECT

FMIN: adjustable 200 to 425 kHz

FMAX: adjustable 200 to 425 kHz

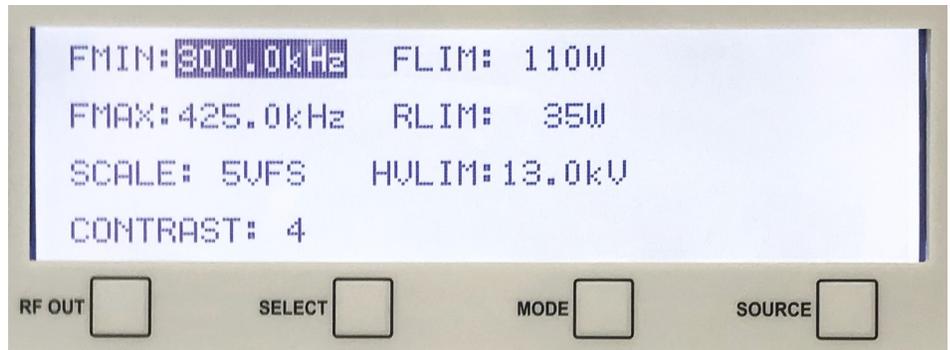
SCALE: Analog Input 5V = 150W

CONTRAST: 1 to 9 scale for LCD adjustment

FLIM: Forward power limit 10 to 150W

RLIM: Reverse power limit 10 to 35W

HVLIM: HV output limit 0.1 to 15kV



LEDs of Front Panel STATUS Field:



AC ON - when LCD display is lit, that indicates AC power is applied to the unit.

RF ON - Indicates RF power enabled, DC power is applied to the RF circuits, FP is expected to match the setting level of SET [%] field as soon as Analog Signal command is applied to one of the pin: Pin D (alternatively A or B) on Remote CTL Interface Connector.

FWD Limit - Indicates Forward Power Limit has reached the 150 Watt Max or HV Limit has reached 15 kVp-p Max.

NOTE! FP Limit and HV Limit can be set to the new Limit level by the user in service SVC screen. See above!

FP Limit range = 10 W to 150 W (set to 110W at the factory)

HV Limit range = 0.1 kV p-p to 15 kV p-p (set to 13.5 kV p-p at the factory)

REV Limit - Indicates Reverse (or Reflected Power) which is 35 Watt max. Once this REV Power or HV Limit is reached, it will automatically limit the forward power at that point.

NOTE! RP Limit can be set to the new Limit level by the user in service SVC screen. See above!

RP Limit range = 10 W to 35 W (set to 35 W at the factory)

OVERHEAT - Indicates the Internal Heatsink Temperature sensor has reached a temperature exceeding 165°F(73°C), which will disable RF circuit power.

INTERLOCK - Red LED ON indicates that condition for operation is not met, contacts on Remote CTL, external circuit between Pin C and E is OPEN. Unit will not generate any output until contacts are closed. Simultaneously, RF is in OFF state for this unit as long as INTERLOCK circuit is open.

WARNING

DO NOT TOUCH. When the heatsink temperature drops below »150°F (65°C), RF circuit power is automatically restored, delivering High Voltage to the output.

3.3 Tips for Operating AG0201HV-OS. Remote MODE:REM

MODE: REM Indicates that the Remote Control is *enabled*.

RF power and HV voltage are defined via Pin D analog signal for amplitude and timing.



ADJUSTING THE OUTPUT POWER AND HIGH VOLTAGE IN **MODE: REM**

CT 6001S controller is the best to be used for this test. Make sure HV GENERATOR CTL Cable is connected between the CT 6001S controller and AG 0201HV-OS generator REM CTL IN interface.

To control the RF power and High Voltage amplitudes for your operation ensure these steps are completed:

- (1) AG 0201HV-OS is in AC ON state. CT 6001S controller is in AC ON state as well, its process switch is in CONT RF position and display is showing EDIT & TEST/PLASMA HOLD-UP V (ENTER) into [%].
- (2) INTERLOCK is closed on Pins C and E of Remote CTL Interface Connector, rear panel of AG 0201HV-OS.
- (3) Note! CT 6001S Controller generates analog signal via PLASMA HOLD-UP V command 0% to 100% that represents of 0V to 5V brought to the Pin D on Remote CTL Interface Connector. These signals are so called “train signals” and define the amplitude and shape/timing of RF power pulses at the output of AG0201HV-OS. Make sure that value is set for 0% in initial moment.
- (4) Push AG 0201 HV-OS “RF OUT” front panel membrane switch to ON. See picture above.
- (5) External Controller (CT 6001S) PLASMA HOLD-UP V: is at 0% level in initial moment. Change it with EDITOR “OK” knob for some significant level (40% to 60%) to strike the plasma in the lamp. For typical conversion of % scale to Wattage or HV please refer to the table on page 20 in the specification section of this manual. When PLASMA HOLD-UP V [%] level is satisfying your process requirements, take note of it for future lamp production testing.
- (6) When in step (5) of the operation, observe AG 0201HV-OS generator RP power level. If it is >>0W, adjust the FREQ: for the lowest RP level displayed; the goal is to be as close to RP: 0W as possible. To adjust FREQ, the cursor must be in FREQ adjusting field (black field).
- (7) Turn EDITOR “OK” left (freq down) or right (freq up) and observe your RP reading. Adjust frequency for the minimum RP you can make it during your test. At that RP min, your matching is the best and the highest High Voltage is generated for your Lamp Tester. Please note: Typical tuning process may require adjustment within +/-15kHz. When in FREQ tuning, observe RP for min and HV for max.

A properly freq. adjusted system must have **RP close to 0W and **HV** at the highest peak you can achieve.**

FREQ - Frequency Adjust allows the operator to vary the output frequency in order to optimize operation for the best match of the output of AG0201HV-OS to the load (Lamp Tester). Best match = the best High Voltage. Tune it by varying frequency.

Your lamp tester will operate in the same conditions for the same lamp test. Controller will remember that frequency and always come back to it, until you change it for a different test.

SET: When SET [W] level is satisfying your process requirements, take note of it for future testing. Do not change the value in that field. Your AG0201HV-OS will remember it as long as the unit is AC ON and INTERLOCK is closed. Opening INTERLOCK will reset the SET [%] to 0%, and you will need to re-enter a value.

Watch a video demonstration of these tips on our YouTube channel.

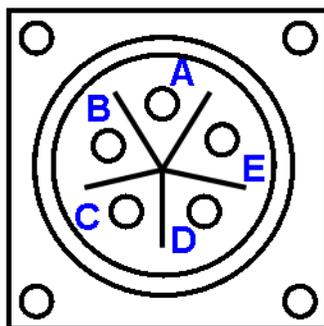
Click the YouTube channel link button on the homepage of our website.



3.4 Interface Connector Signal Description:

| Pin# | Name of Signal | Signal Description |
|----------|--------------------------------|---|
| A | N/U | No function associated with this pin |
| B | N/U | No function associated with this pin |
| C | REMOTE INTERLOCK ENABLE | Remote Interlock Enabled when Pin C tied to GND (Pin E or Chassis GND) (Main Power Supply is Enabled/Activated) |
| D | Control Voltage IN | INPUT 0V to 5V required for operation. DC for Continues Output operation or unipolar pulses defining BURST RF and its amplitude. |
| E | GND | Connects GROUND between CT 6001B Controller and Chassis, and Earth Ground |

REMOTE CTL IN



3.5 Tips for Operating AG0201HV-OS. Local MODE:LOC

MODE: LOC Indicates that the Local front panel Control is *enabled*.

RF power and HV voltage are defined by application of EDITOR knob in SET: and FREQ: fields.



ADJUSTING THE OUTPUT POWER AND HIGH VOLTAGE IN **MODE: LOC**

MODE: LOC of operation is recommended as a tool of convenience for test-and-try when defining the best test parameters of Wattage, HV voltage and frequency FREQ of operation for a particular lamp. When finished with that process, depress the MODE switch again to switch AG0201HV-OS to MODE: REM for operation with CT 6001S controller.

To control the RF power and High Voltage amplitudes for your operation from the front panel ensure these steps are completed:

- (1) AG 0201HV-OS is in AC ON state. RF OUT is in OFF. Depress MODE front panel switch to change operation to LOC.
- (2) INTERLOCK is closed on Pins C and E of Remote CTL Interface Connector, rear panel of AG 0201HV-OS.
- (3) Note! CT 6001S Controller when connected with AG 0201HV-OS by interface cable offers closed INTERLOCK circuit.
- (4) Push AG 0201 HV-OS "RF OUT" front panel membrane switch to ON. See picture above.
- (5) With all the safety measures applied and with application of EDITOR knob increase **SET:** to some significant level (50W to 80W) to strike the plasma in the lamp. For typical conversion of Wattage to HV please refer to the table on page 20 in the specification section of this manual.
- (6) When in step (5) of the operation, observe AG 0201HV-OS generator RP power level. If it is $\gg 0W$, adjust the **FREQ:** for the lowest RP level displayed; the goal is to be as close to RP: 0W as possible. To adjust FREQ, the cursor must be in **FREQ:** adjusting field (black field).
- (7) Turn EDITOR left (freq down) or right (freq up) and observe your RP reading. Adjust frequency for the minimum RP you can make it during your test. At that RP min, your matching is the best and the highest High Voltage is generated for your Lamp Tester. Please note: Typical tuning process may require adjustment within $\pm 15kHz$. When in FREQ tuning, observe RP for min and HV for max.

A properly freq. adjusted system must have **RP** close to 0W and
HV at the highest peak you can achieve.

FREQ - Frequency Adjust allows the operator to vary the output frequency in order to optimize operation for the best match of the output of AG0201HV-OS to the load (Lamp Tester). Best match = the best High Voltage. Tune it by varying frequency.

Your lamp tester will operate in the same conditions for the same lamp test. AG 0201HV-OS Controller will remember that frequency and always come back to it, until you change it for a different test. NOTE. Different lamps may require a new frequency of operation.

SET: When SET [W] level is satisfying your process requirements, take note of it for future testing.

Note. Opening INTERLOCK will reset the SET [W] to 0W, as well as changing between the MODE: LOC to MODE: REM and back again, you will need to re-enter SET: value.

Watch a video demonstration of these tips on our YouTube channel.

Click the YouTube channel link button on the homepage of our website.



AG0201HV-OS Specifications:

| | |
|------------------------------------|--|
| Frequency: | DDS = 200 kHz to 450 kHz, user adjustable. Typical for tester operation ~350 kHz to 375 kHz |
| Frequency stability: | within 10Hz |
| Interfacing: | LOC front panel and REM analog remote interface |
| Output Power: | FWD = 0 to 150 Watts (REV Limit = 35W) |
| Ignition Power: | up to 150 Watts for ~1 ms |
| Output Impedance: | Designed for the best power transfer into high impedance loads by varying frequency. |
| RF POWER Meter accuracy: | ± 1.5W Typical in the best match condition |
| HV Meter accuracy: | Within 10% of a set point in a matched condition. |
| High Voltage RF connection: | 48" of High Voltage cable. 25 kV RF Connector, round flanged receptacle. |
| Line Regulation: | 0.5% @ Full POWER |
| Forward Power Regulation: | ± 1% |
| Load Mismatch Tolerance: | Continuous |
| Harmonic Distortion: | < -45 dBc (Standard load @ 100 W FWD, 8 kVp-p) |
| Noise Ham and Ripple: | < -40 dBc (Standard load @ 100 W FWD, 8 kVp-p) |
| Protection: | Short and Open Circuit, HV Output - Over voltage |
| Spurious Radiation: | Designed to Meet FCC part 18 |
| Operating Temp: | 0°C to 40°C |
| Cooling: | Forced Air |
| Acoustic Level: | 72 dBa @ Max Fan Speed & Temp |
| Humidity: | 80 % |
| Power Required: | 100 to 120 and 200 to 240 VAC ±10%, 50/60 Hz, Single Phase - typical, No adjustments necessary. (min 90 - max 132 VAC and min 180 - max 264 VAC) |
| Power Consumption: | » 400 VA@ Full POWER Output |
| Circuit Protection: | 15A Fuse on Main Power Supply, 2A on Signal Power Supply |
| Output Voltage: | 0 to 6 kV peak (12 kV p-p), max output 15 kV p-p in open load (14kVp-p in pulses). OPERATION >10 kVp-p in 25% DUTY CYCLE ONLY |
| Dimensions: | H 5.25" x W 10" x D 15" 134mm x 254mm x 381mm |
| Weight: | 15.5 lbs. / 7.5 kg |

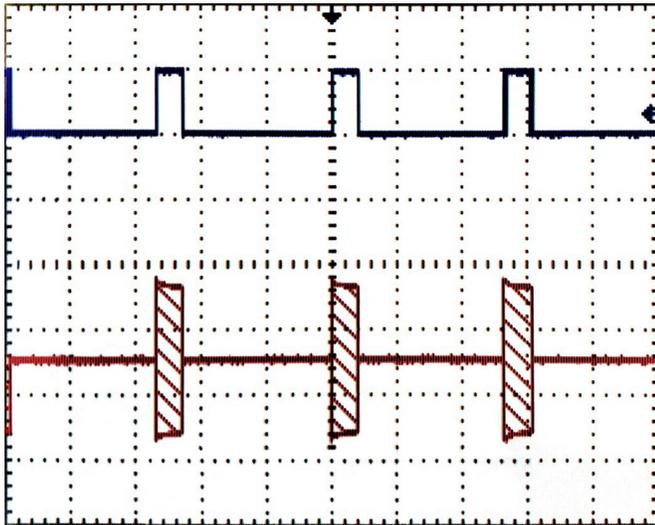
Specifications: RF Pulse (Burst) Operation

High Voltage Output response when control “train” signal is applied to INTERFACE Rear Panel connector, Pin D.

In this example Control signal F=15 Hz, TTL 10ms “train” pulses, 100% modulation.

Output level = 12.2 kV p-p.

Typical output rise time for TS unit is 6-kV/20 μ s.



CH1: 5.00V CH2: 5.00kV M: 25.0ms

Channel 1: 10 ms “train” pulses applied to Input D, rear panel interface connector.
(Freq= 15 Hz, REM Control Voltage 0V to 5 V Rectangle pulses as “train” signal for amplitude and duty cycle control)

Channel 2: 10 ms generator output RF Bursts
(Pk-pk = 12.2 kV)

Specifications: typical Continues HV RF Output and RF Pulse (Burst) Operation into incandescent 150W lamp.

Based on test report for AG 0201HV-OS S/N 063 at 360 kHz, June 26, 2020.

| CT 6001S PLASMA HOLD-UP V [%] | FWD Power | REV Power | High Voltage reading on Front Panel | High Voltage reading on outside probe | BURST | |
|-------------------------------------|--------------|--------------|--|---|---|------------------|
| | | | | | 50% Duty Cycles 1kHz repetition rate Front Panel power | HV: FP and probe |
| 10% | 11 W | 0 W | 4.8 kV _{p-p} | 4.96 kV _{p-p} | F 6W / R 0W | 4.4kV/4.9kV |
| 20% | 24 W | 0 W | 6.6 kV _{p-p} | 6.9 kV _{p-p} | F 13W / R 2W | 6.1kV/6.9kV |
| 30% | 38 W | 0 W | 8.3 kV _{p-p} | 8.5 kV _{p-p} | F 21W / R 3W | 7.6kV/8.5kV |
| 40% | 51 W | 1 W | 9.6 kV _{p-p} | 9.7 kV _{p-p} | F 27W / R 2W | 8.2kV/9.7kV |
| 50% | 65 W | 2 W | 11.3 kV _{p-p} | 10.7 kV _{p-p} | F 35W / R 2W | 9.3kV/10.7kV |
| 60% | 83 W | 7 W | 12.2 kV _{p-p} | 12 kV _{p-p} | F 46W / R 8W | 10.2kV/12kV |
| 70% | 96 W | 8 W | 13.3 kV _{p-p} | 13 kV _{p-p} | F 54W / R 9W | 11.1kV/13kV |
| 80% | 109 W | 10 W | 14.5 kV _{p-p} | 14.2 kV _{p-p} | F 63W / R 10W | 12kV/14.2kV |
| 90% | 125 W | 12 W | 15 kV _{p-p} | 15 kV _{p-p} | F 72W / R 12W | 12.9kV/15kV |
| 100% | 141 W | 14 W | 15 kV _{p-p} | 15.8 kV _{p-p} | F 82W / R 13W | 13.8kV/15.8kV |

High Voltage Power Reference Calculations

This is a reference sheet to assist in the operation and understanding of the AG 0201HV Series High Voltage RF Output Power. There is still a need for a High Voltage-High Impedance measuring device able to handle 20KV of AC voltage.

Typically the Output Impedance into a standard Bulb-Type Load can be anywhere between 100K Ohm to 250K Ohm, which is what you need to know in order to calculate the Power consumed by your load, as well as the voltage reading at your load in Effective RMS. There is a sine wave conversion chart on the opposite page to assist with whatever sine wave level you are using. If you are using an oscilloscope, you are most likely measuring in peak to peak. Do not forget to factor in the conversion for the High Voltage scope probe (Typically 1000x for a 20KV probe).

Normally the load impedance we have calculated out is about 125KOhm, and this will be the number we use in our power calculation:

Where:

$$P - \text{Power in Watts} \quad P = \frac{E^2}{R}$$

E - Measured AC Voltage in RMS

R - Load Resistance in Ohms (125KOhm)

Example:

Measured AC V in peak to peak = 5000Vp-p

5000Vp-p x 0.354 = 1770 VRMS

P = 25.0632 Watts

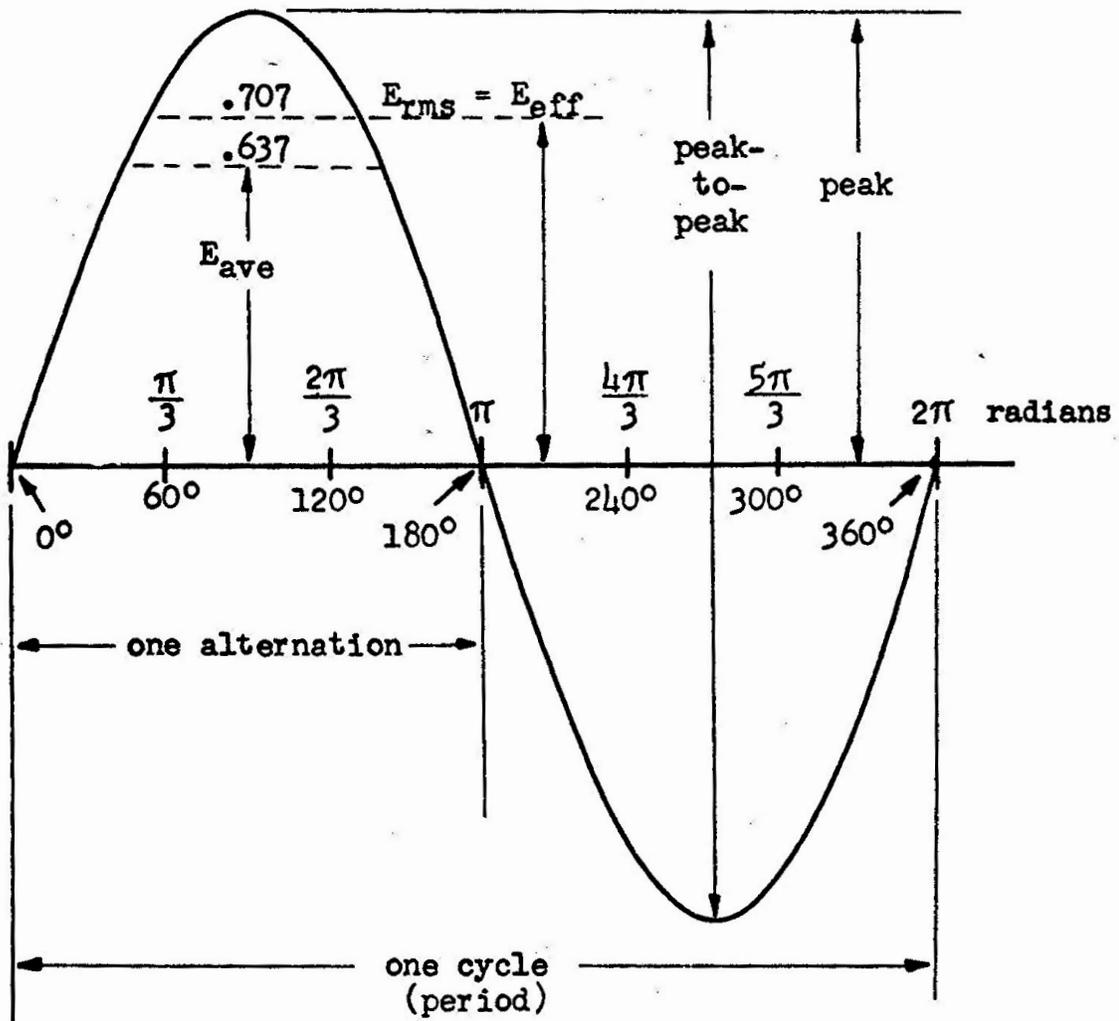
$$\frac{1770 \text{ VRMS}^2}{125\text{KOhm}} = 3132900$$

If you have any questions, contact us at support@tcpowerconversion.com

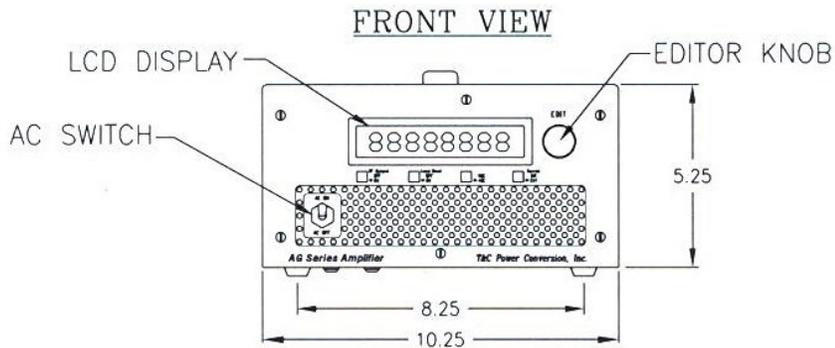
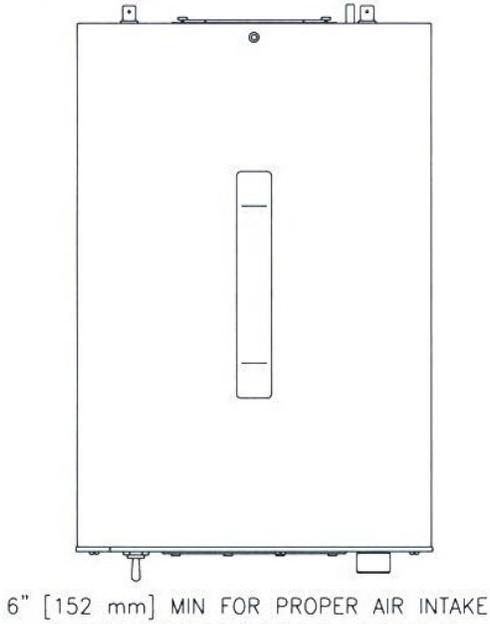
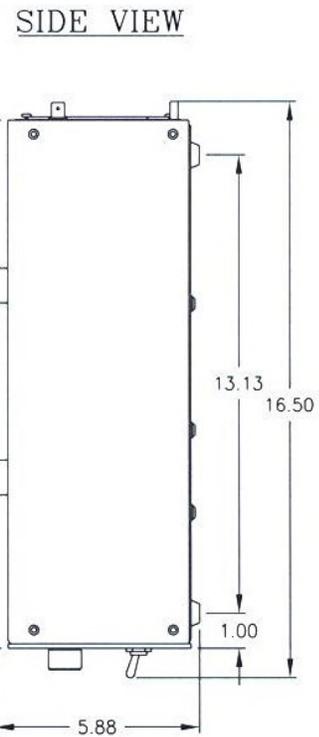
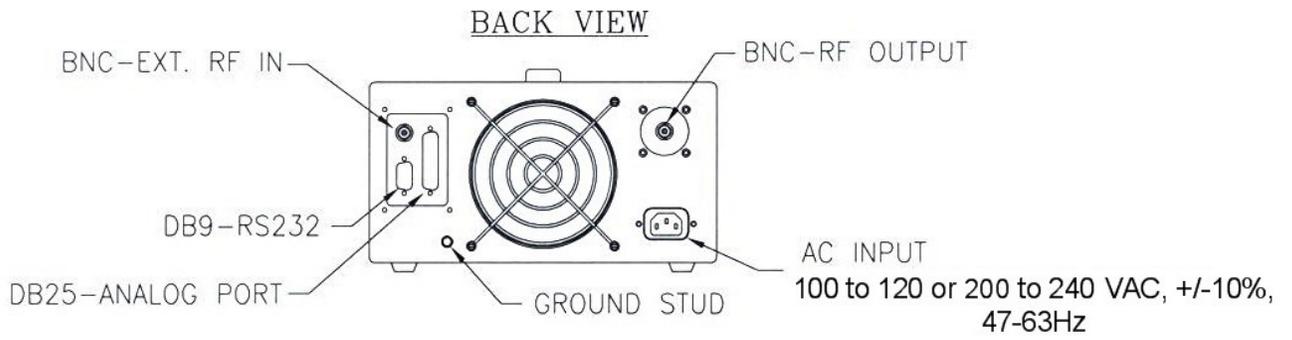
Sine Wave Voltage Conversion Chart

| From | To | | | |
|-----------------|-----------------|---------|-------|----------|
| | Effective (RMS) | Average | Peak | Pk-to-Pk |
| Effective (RMS) | | 0.900 | 1.414 | 2.828 |
| Average | 1.110 | | 1.571 | 3.142 |
| Peak | 0.707 | 0.637 | | 2.000 |
| Pk-to-Pk | 0.354 | 0.318 | 0.500 | |

Sine Wave Illustration



Outline Drawings



PRODUCT MANUAL REVISION CONTROL FORM

Document Title: AG0201HV-OS Operation Manual

Document Number: 9081 0008

Document Status: Open

Revision History

| ECO | Rev | Description | Effective Date |
|-----|-----|---|----------------|
| | A | First production release | 8/2004 |
| | B | Format update to meet EN61010-1 requirements | 12/3/04 |
| | C | Updated Remote Operation Descriptions | 04/12/07 |
| | D | Added High Voltage Power Reference Calculations | 08/23/07 |
| | N/A | Editorial changes. No change of Fit, Form, Function | 06/26/13 |
| | E | Production release of Revision B, HV-OS generator | 07/10/20 |

| | Name / Title | Signature | Date |
|--------------------|-----------------------------------|--------------------------|----------|
| Written By | Tomasz J. Mokrzan | <i>Tomasz J. Mokrzan</i> | 07/11/20 |
| Checked By | Zee Mokrzan | <i>Z Mokrzan</i> | 07/13/20 |
| Approved By | Tomasz J. Mokrzan/General Manager | <i>Tomasz J. Mokrzan</i> | 07/13/20 |