

INSTRUCTION MANUAL

Model 700A

Stimulator

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***** WARNING *****

**SAFE OPERATING PROCEDURES AND PROPER USE OF THE
EQUIPMENT ARE THE RESPONSIBILITY OF THE
USER OF THIS SYSTEM.**

**Aurora Scientific Inc. provides information on its
products and associated hazards, but it assumes no
responsibility for the after-sale operation and safety practices.**

**ALL PERSONNEL WHO WORK WITH OR ARE EXPOSED
TO THIS EQUIPMENT MUST TAKE PRECAUTIONS TO PROTECT
THEMSELVES AGAINST POSSIBLE SERIOUS
AND/OR FATAL BODILY INJURY.**

NOT FOR HUMAN USE.

1.0 Safety

The high voltage/high current nature of this device dictates the use of caution when operating or servicing this equipment.

**OBSERVE ALL SAFETY PRECAUTIONS LISTED BELOW. FAILURE TO DO SO
COULD RESULT IN SERIOUS INJURY.**

Precautions

- 1) The 700A stimulator should be serviced only by personnel experienced in high voltage pulsed power systems.
- 2) Service personnel should be instructed to observe all safety precautions as stated in the operating instructions, and those safety precautions standard to the high voltage pulsed power community. Failure to do so could result in serious injury.
- 3) Do not handle the load or terminations, or remove the input or output cables, while the stimulator is in operation. Ensure that the high voltage power supplies have fully discharged before handling the load. Failure to observe these precautions can result in potential electric shock to personnel, arcing, and damage to the connectors and system.
- 4) The stimulator contains reference planes that are elevated to the potential of the output pulse. Extreme caution should be exercised when servicing the equipment.
- 5) Pulsed power systems are capable of random triggering via transients and therefore when the stimulator is turned on, or high voltage is present in the module; assume it is possible to get a pulse on the output cable.

2.0 Introduction

The 700A stimulator is a compact pulse generator module that can provide a positive voltage pulse of up to 125V at up to 1 ampere of current. At 1-ampere output the stimulator will generate a 1-millisecond long pulse, with a voltage droop at 1 millisecond not to exceed 10%. The unit can generate pulses with pulse rise times of less than 15 nanoseconds, and pulse widths continuously adjustable from less than 40 nanoseconds to DC. The stimulator includes a +24VDC switching power supply and features integrated DC high voltage power supplies.

A DC voltage monitor signal is provided with a scaling of 100:1. This monitor can be used for setting the DC power supply voltage prior to enabling the output. The monitor output should be terminated into a 10 Meg-ohm input impedance (such as a digital voltmeter (DVM) or an A/D card).

The 700A was designed to be computer controlled. The Dynamic Muscle Control (DMC) software includes a module that allows the stimulator to be controlled via simple on-screen controls. Precise timing and synchronization of stimulation and muscle lever control is assured with our DMC control program and a 700A stimulator. The program provides complete control of all parameters affecting muscle stimulation including: pulse width, pulse frequency, frequency duration, train, train frequency, and train duration.

The stimulator is controlled by a TTL gate signal. The width and frequency of the stimulator's output pulses follow the width and frequency of the TTL input gate. The amplitude of the output pulse voltage is adjustable from 0 to 125V using a front panel-mounted potentiometer that includes a turns counting dial with a dial lock. When the dial is set to 0 the output voltage is 0 volts. A dial setting of 10 corresponds to an output voltage of 125 volts. Optionally the potentiometer can be replaced with a BNC connector that accepts a 0 to +5 VDC input control signal from an A/D card. When the A/D card outputs 0 volts the stimulator output voltage is 0 volts. An A/D output of +5 volts corresponds to an output voltage of 125 volts. **Input voltages outside the range of 0 to +5 volts will damage the stimulator.**

For safety and control flexibility, a front panel-mounted switch is used to enable and disable the DC power supply. When the switch is in the disabled position the stimulator will not generate an output pulse but the voltage monitor will reflect correct output voltage.

The unit provides equally fast pulse rise and fall times, low power dissipation, and virtually no over-shoot, under-shoot or ringing. The 700A has over-current detection and shutdown circuitry to protect the stimulator against potential damage due to arcs and shorts in the load or interconnect cables.

Unlike some competing solid-state switches, the 700A is a complete pulser solution with high voltage power supplies, energy storage and output network, ready for use. It can be connected directly to the load, and does not require series or shunt resistors, impedance-

matching networks between the stimulator and the load, or additional energy storage (capacitor banks). All of this is taken care of within the 700A. The stimulator is housed in a 1U (1.7") high rack-mount steel and aluminum enclosure. A power switch is located on the front panel along with an LED that lights to indicate that the power is on.

The 700A is a direct-coupled, all solid-state design using air as the primary insulating medium. Its conservative design margin gives you long component life. The circuitry within the 700A is not potted or encapsulated which makes it easy to service if a component ever does require replacement. Some competing products are potted, and must be replaced if they fail. The 700A is compact and durable and provides exceptional pulse fidelity with virtually no ringing, over-shoot or under-shoot. It also includes protection against arcs, shorts and load transients in a reliable, economical module.

3.0 Specifications

Model 700A

Output Pulse Electrical Characteristics

Output Voltage:	0 to +125V
Output Voltage Adjustment:	Front panel-mounted potentiometer with locking turns-counting dial. Optional: Front panel-mounted BNC connector that accepts a 0 to +5 VDC control signal.
Pulse Width:	<40 ns to DC, controlled by input gate
Pulse Rise and Fall Time:	≤15 ns, 10-90%
Pulse Recurrence Frequency:	Single Shot to 20kHz continuous, 5 MHz burst, controlled by input gate
Pulse Droop:	<1%
Over/Undershoot:	<5%
Jitter:	<1 ns Shot-to-Shot
Throughput Delay: (Delay from leading edge of input gate to leading edge of output pulse)	93 ns typical
Maximum Duty Cycle:	Continuous
Maximum Average Power:	4 W
Pulse Output Connector:	BNC, front panel

Gate

Gate Source:	External
Gate Input:	TTL
Gate Rise Time:	<20 ns
Gate Connector:	BNC, front panel

General

Dimensions (Excluding Connectors):	19" W (rack-mount) x 10" D x 1.7" H (1U) (48cm W x 25cm D x 4.3cm H)
Weight (Approximate):	4.4 lb (2 kg)
Power Requirements:	100-240 VAC @ 50-60 Hz
Fuse:	IEC 127-III. 5x20 mm
Rating:	85/265 VAC – T2.0A

4.0 Operating Instructions

*** WARNING ***

- 1) Do not remove the input or output cables while the stimulator is in operation. Never intentionally short-circuit the high voltage output of the stimulator. Failure to observe these precautions can result in potential electric shock to personnel, arcing, and damage to the connectors and system.
- 2) Pulsed power systems are capable of random triggering via transients and therefore when the stimulator is turned on, or high voltage is present in the chassis, assume it is possible to get a pulse on the output connector.

4.1 Output Cabling

The 700A is designed to drive capacitive loads with fast rise times. Since the current out of the 700A is limited, the lower the capacitance, the faster the rise time. Given fixed load characteristics, only the interconnecting cable type and length will vary the output capacitance. The unit is series terminated for the characteristic impedance of 75Ω cables. ASI recommends that the shortest length of cable possible be used to ensure the fastest possible rise times and best pulse fidelity. It is preferable to use 75Ω coaxial cable to connect the output of the stimulator to the load.

4.2 Load Interconnection

The load should be connected using 75Ω coaxial cable (RG-59 or equivalent). Any inductance introduced into the circuit through the use of wire interconnections, or impedance mismatches caused by using cable with impedance other than 75Ω , may cause ringing on the output pulse, or a general degradation of waveform fidelity. For optimal waveform fidelity, the ends of the coaxial cable should be connected directly to the load to minimize interconnection inductance and impedance mismatches. If it is necessary to use wire leads between the coaxial cable and the load, the leads should be kept as short as possible. Twisting the leads together (i.e., using twisted pair wire) will reduce the lead inductance and help to preserve waveform fidelity.

4.3 Power-up Procedures

The unit should be powered up using the following procedure.

- 1) Before connecting the input TTL gate signal to the 700A, set up the gate pulse generator output to deliver a TTL level pulse, with a repetition rate less than

- 20KHz, and a pulse width greater than 45ns. If using the ASI DMC software set up the stimulation parameters using the on-screen stimulator controls. Connect the gate signal to the Gate BNC connector on the front panel.
- 2) Ensure that the Output Enable switch is set to the Disable position.
 - 3) Connect the stimulator output to an appropriate load, prior to turning the power on.
 - 4) Switch on the power switch.
 - 5) Connect a digital voltmeter to the Voltage Monitor BNC connector and then adjust the output voltage using the front panel Voltage Adjust potentiometer. Note: the monitor has a scale factor of 100:1 (1.25 volts out equals 125 volts of pulse output). If the optional BNC voltage adjust connector is installed then apply a control voltage in the range 0 to +5 VDC to the connector. Ensure that the polarity is set correctly so that the central conductor is positive. Do not apply voltages outside of the range 0 to +5 VDC.
 - 6) Move the Output Enable switch to the up position. The stimulator should start producing output pulses with an amplitude equal to 100 times the Voltage Monitor output and with a pulse width and pulse recurrence frequency that follows that of the incoming gate signal.
 - 7) If there is no output from the stimulator, disable the high voltage using the Output Enable switch. Leave the power switch turned on with all connectors in place for approximately one minute to bleed off the stored energy, then turn off the power switch and refer to the Troubleshooting Section of this manual.

5.0 Troubleshooting

*** WARNING ***

The 700A stimulator contains capacitors that are used as energy storage elements. When charged, these capacitors contain in excess of 0.02 Joules of stored energy. This is sufficient energy to cause injury. Assure that the power switch is off, the power cable removed from the stimulator, the capacitor bank is fully discharged, and a shorting strap installed before any repairs or adjustments are attempted. Verify with a voltmeter that all circuits are de-energized before servicing. Dangerous voltages, floating ground planes and energy storage exist at several locations in the module. Touching connections or components could result in serious injury.

5.1 Troubleshooting Procedure

The table below summarizes potential problems and their solutions. If these recommendations do not resolve the problem please contact Aurora Scientific Inc. for further assistance.

Table 5.1 Troubleshooting Table

Problem	Recommended Action
700A does not switch ON, "Power" LED does not light.	<ol style="list-style-type: none"> 1. Ensure AC power cord is firmly plugged into the wall receptacle and the power supply receptacle. 2. Ensure the power switch is in the ON position. 3. Ensure the line voltage is between 100 and 240 VAC. 4. Ensure the power source you plugged the power supply into is energized. 5. Check the fuse in the rear panel and also the fuse mounted on the power supply.
No Output Pulse.	<ol style="list-style-type: none"> 1. No input trigger. 2. The Output Enable switch is in the disable position. Flip the switch to the up position. 3. Voltage Adjust potentiometer is set to 0 (0 volts output). Increase the setting. 4. For the optional Voltage Adjust BNC connector ensure the input control voltage is in the range 0 to +5 VDC. 5. Input trigger voltage is too low. Ensure the GATE Input is 5 volts. 6. Input trigger pulse width is too short. Increase the width. 7. Input Gate trigger frequency is too high. Reduce the frequency. 8. Output not connected correctly. Check all cables and connections.

5.2 Technical Assistance

Technical assistance is available by regular mail, email, phone, or fax. Use the information below to contact Aurora Scientific Inc.

Address: Aurora Scientific Inc.
Technical Assistance
P.O. Box 2724
Richmond Hill, Ontario, CANADA
L4E 1A7

Phone: 1-905-727-5161
Toll Free: 1-877-878-4784
FAX: 1-905-713-6882
E-mail: info@AuroraSci.com
Web site: www.AuroraScientific.com

6.0 Warranty

The 700A stimulator is warranted to be free of defects in materials and workmanship for three years from the date of shipment. Aurora Scientific Inc. will repair or replace, at our option, any part of the system that upon our examination is found to be defective while under warranty. Obligations under this warranty are limited to repair or replacement of the instrument. Aurora Scientific Inc. shall not be liable for any other damages of any kind, including consequential damages, personal injury, or the like. Damage to the system through misuse will void this warranty. Aurora Scientific Inc. pursues a policy of continual product development and improvement therefore we reserve the right to change published specifications without prior notice.

7.0 Terms and Conditions for Returning Equipment

1. Aurora Scientific Inc. **will not** accept any equipment returned without prior authorization in the form of a return material authorization number.
1. **Please call Customer Service at (905) 727-5161 or toll free at 1-877-878-4784 to obtain an RMA#. Please specify the product line.**
2. Please package equipment properly. Goods that are damaged in shipment are the responsibility of the shipper.
3. **Aurora Scientific, Inc. withholds the right to assess charges for the repair or replacement of such damaged goods, regardless of warranty status.**
4. Warranty repairs will be shipped back to the customer via FedEx. If you require or request another form of shipment, the cost of such service is your full responsibility.
5. Aurora Scientific, Inc. **will not** be responsible for any return or replacement **shipping charges** incurred due to an incorrect order placed by the customer.

Return Shipping Address:

Aurora Scientific Inc.
360 Industrial Pkwy. S., Unit 4
Aurora, ON, Canada
L4G 3V7
Attn: RMA Returns

Drawings

This section consists of the following drawings:

- | | |
|------------------------------------|-------------------|
| 1. 700A Front Panel | AS700-002, Rev. 0 |
| 2. 700A Electrical Interconnection | AS700-E01, Rev. 1 |