



# A395D, A395R

*Linear Stimulus Isolator*

www.wpiinc.com

## INSTRUCTION MANUAL

Serial No. \_\_\_\_\_

092608



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**World Precision Instruments**

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**DECLARATION OF CONFORMITY**

We: World Precision Instruments, Inc.  
 175 Sarasota Center Boulevard  
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 USA

as the manufacturers of the apparatus listed, declare under sole responsibility that the product(s):

**Title: A395R (containing rechargeable batteries)**

to which this declaration relates is/are in conformity with the following standards or other normative documents:

- Safety:** EN 61010-1:1993 (IEC 1010-1:1990)
- EMC:** EN 50081-1:1992  
 EN 50082-1:1992

and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility and Council Directive 73/23/EEC relating to safety requirements.

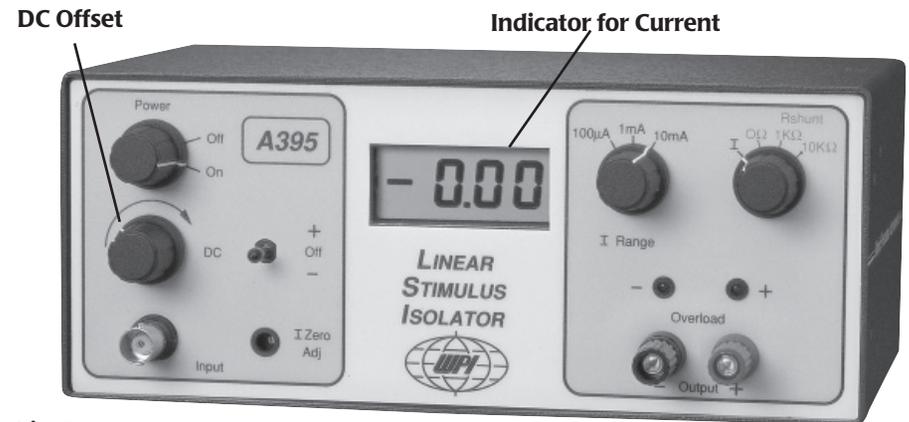
**Issued on: 18<sup>th</sup> February 2000**

*Dr. Mark P. Broderick*  
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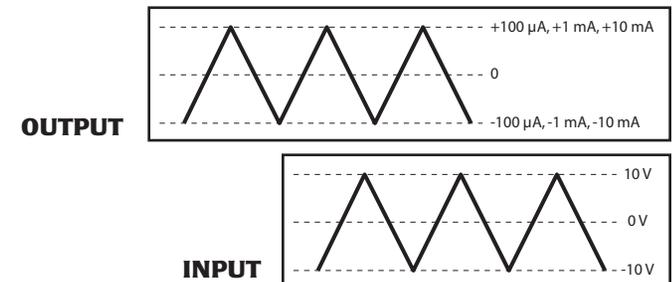
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**Introduction**

All WPI stimulus isolators are designed to supply constant current because current threshold (not voltage) is the most quantitatively reproducible parameter for stimulation of nerve and muscle. Model A395 dispenses current reproducibly from its Output terminals; the amplitude being determined by the selected current RANGE and the input voltage. Current amplitude is "constant", that is, load resistance independent, provided that the  $I \times R$  (load) product does not exceed the available battery supply voltage. A visual indicator (the compliance LEDs) displays if  $I \times R$  reaches this limit. When the unit is out of compliance, one of the two LEDs (labeled - and +) illuminate, depending in which direction the current is flowing. Model A395 D can generate a voltage of 70 volts or more across its OUTPUT terminals. Thus, the user can be sure that the amplitude of the current will be as dialed as long as the voltage drop across the load (stimulus electrode path) does not reach the magnitude of the supply voltage. The compliance LED would then be visible. The user would then know that (a) too much current was dialed for a given load or (b) inter-electrode resistance was too high or the electrode circuit path was open (this is illustrated by the Quick Instrument Test below).



**Fig. 1**

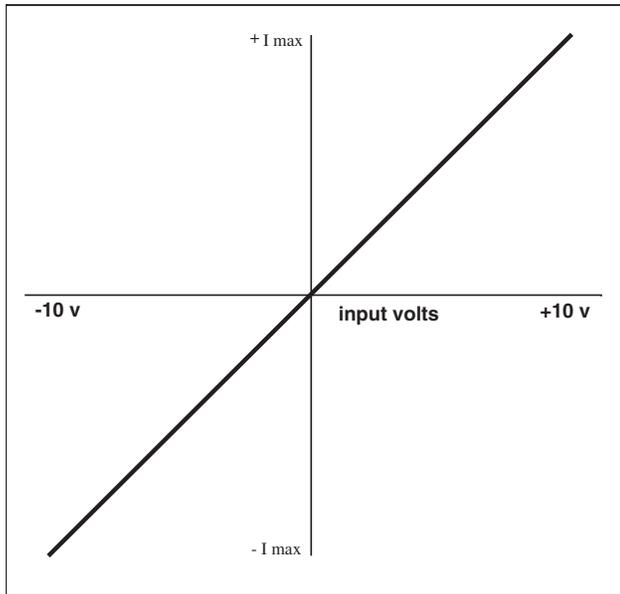


Model A395 can generate electrically isolated current of arbitrary waveform; DC, AC, pulse and combinations thereof. Battery operated, and photoelectrically-isolated from the input voltage drive, the instrument regenerates waveforms provided by the user's D/A converter or signal generator into proportional current waveforms. As shown in Figure 1 below, the instrument converts an input command voltage into a proportional electrically isolated current. A voltage of 10 volts applied to the input will produce the maximum output current for the current range selected, i.e., 100  $\mu$ A, 1 mA or 10 mA. Front panel controls also allow DC current to be manually initiated at the instrument panel (+/- switch). Externally applied signals can result in a variable current superimposed on the panel controlled DC current. Warning lamps will indicate open-circuit or voltage-limited current conditions.

**Brief Instrument Test**

Place the R shunt switch in the 0  $\Omega$  (short circuit output) position. Select 1 mA on the I Range switch. Place the DC toggle switch in the Off (center) position and switch Power switch to On. The digital panel ammeter should read approximately zero current. If necessary, the zero current reading may be adjusted using a small screwdriver in the I

Zero Adj. access. Toggling the DC switch from Off to + or - should yield current readings on the panel meter which vary when the DC knob is rotated. If the "low-battery" indicator is not showing on the face of the digital ammeter, the instrument battery pack is presumed operational.



**turn off power when the instrument is not in use.**

**To preserve battery life, remember to**



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**DECLARATION OF CONFORMITY**

We: World Precision Instruments, Inc.  
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USA

as the manufacturers of the apparatus listed, declare under sole responsibility that the product(s):

**Title: A395D (containing dry batteries)**

to which this declaration relates is/are in conformity with the following standards or other normative documents:

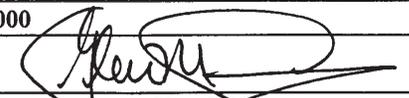
- Safety:** EN 61010-1:1993 (IEC 1010-1:1990)
- EMC:** EN 50081-1:1992  
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and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility and Council Directive 73/23/EEC relating to safety requirements.

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## Warranty

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year\* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

## Claims and Returns

- Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. In some instances, photographic documentation may be required. Some items are time sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container.
- WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.
- Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.
- Goods returned for repair must be reasonably clean and free of hazardous materials.
- A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.
- Equipment which was built as a special order cannot be returned.
- Always refer to the RMA# when contacting WPI to obtain a status of your returned item.
- For any other issues regarding a claim or return, please contact the RMA department.

**Warning: This equipment is not designed or intended for use on humans.**

*\* Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*

## Digital Panel Ammeter

The meter reading for different selected current ranges are as follows:

Range	Max. Reading
100 $\mu$ A.....	100.0 microamperes
1 mA.....	1.000 milliamperes
10 mA.....	10.00 milliamperes

## Controls

INPUT: An external command voltage level of approx.  $\pm 10$  volts applied to this connector enables current flow from the OUTPUT when an AC signal will be faithfully reproduced.

RANGE: 0.1, 1 or 10 milliamperes can be selected as a maximum current.

+/-OFF/-: Allows DC current offsets to be manually controlled. During normal bipolar operation this switch is left in the OFF position.

## Using the Instrument

It is good practice to keep the Rshunt switch in the 0  $\Omega$  position when not generating current through the output connectors. DC current level can be preset without current flowing into the output current path if the switch remains in the 0  $\Omega$  position. Current flow through the Output binding post terminals is enabled when the Rshunt switch is placed in the I (current) position. Current flow will be essentially independent of load resistance as long as the resultant load voltage does not exceed the battery stack voltage range (approximately  $\pm 70$  volts). Either of the two overload lamps would light in that case. *Note particularly that the Overload lamps may light if the output connectors are unconnected to a closed current flow path even if the ammeter reads "zero". This may occur because small currents below the minimum resolution of the ammeter may cause the Overload (voltage) sensor to indicate.*

**Voltage**

A395 can approximate a voltage source by switching a low resistance “dummy” load across the OUTPUT terminals. Resistors such as 1000 and 10,000 Ω when placed across the OUTPUT terminals convert the generated constant current amplitudes to voltage levels. For example 1 milliampere flowing through 1000Ω will produce 1 volt across the Output terminal pair. Thus, models A395D/R can be used as low noise sources of reproducible voltage pulses. To keep the output voltage constant under load, assure that the Rshunt load resistor is not shunted by loads less than 100 times its nominal resistance value.

**Batteries**

Batteries should be recharged or replaced (D model) when the “Low Battery” indicator appears on the face of the digital panel meter.

Charging the Nickel-Cadmium (NiCad) battery stack, Model A395R: With moderate instrument use, freshly charged A395R isolators will often be able to operate for several weeks before the “Low Battery” indicator on the panel meter appears and recharging becomes necessary. To recharge the battery stack of the A395R, a companion charger, model A362 is required. The charger cable terminates in a four-pin plug which inserts into the charging receptacle on the rear panel of the instrument\*. Two red lamps on the charger will light when charging is in progress. The POWER switch on A395R must be OFF for the charger to operate. The A395R battery stack can be recharged in 14 hours (overnight, for example) from a completely discharged state. No serious damage to the batteries will occur owing to overcharge. Do not attempt to charge alkaline dry cell batteries. They may explode!

**Changing the batteries**

Model A395D requires 17 nine-volt batteries. Alkaline batteries are recommended. Depending on load current usage, the battery stack in model A395D will often operate satisfactorily for two or three months or more. Replace batteries when required or annually. Alkaline batteries in model A395D should not be replaced with NiCad rechargeable batteries as model A395D is not equipped for charging. Batteries are replaced as follows:

Turn POWER switch to OFF. Remove four screws on the bottom surface of the instrument case. Gently remove the entire internal instrument assembly from the outer case by sliding the front panel forward. Unscrew and remove padded cover plate over battery assembly. Firmly, but without wrenching excessively, remove all batteries. Insert new batteries with firm but moderate force. Match the male and female connectors on the

battery tops to the mating connectors on the battery printed circuit board. When all batteries have been installed, test the instrument by repeating the “Brief Instrument Test” outlined above. Reinsert the instrument assembly into the outer case and secure the bottom screws.

**Model A395R** requires 17 NiCad 9 volt batteries. General Electric (USA) type TRB-SD1 or equivalent is recommended. Do not remove NiCad batteries from the instrument until they can no longer be recharged. Use WPI’s model A362 charger which is specifically designed to charge all of the NiCad batteries together. NiCad rechargeable batteries may require an initial charge depending on their condition when purchased.

*\*Disconnect the battery charging cable from the A320R while the instrument is in use. This avoids the possibility that mains frequency noise may be introduced from the charger cable. TURN POWER SWITCH OFF WHEN INSTRUMENT IS NOT IN USE TO PRESERVE BATTERY LIFE.*

**A395 Specifications**

OUTPUT CURRENT, $I_{max}$ .....	3 ranges: 100μA, 1 mA, and 10 mA
OUTPUT VOLTAGE RANGE .....	± 70 V
OUTPUT BANDWIDTH.....	10 kHz (measured across 1KΩ load R)
INPUT RESISTANCE .....	> 20 MΩ
INPUT VOLTAGE @ $I_{max}$ .....	± 10 volts
INPUT/OUTPUT LINEARITY ERROR .....	< 0.5%
RISE, FALL TIME.....	26 μs @ 10 K Ω
POWER	
Model A395D .....	17 alkaline 9 V batteries
Model A395R .....	17 rechargeable NiMH 9 V batteries
DIMENSIONS .....	6.5 x 4 x 3.5 in. (16 x 10 x 9 cm)
SHIPPING WEIGHT .....	4 lb (1.8 kg)