Model ESA-C
Ultra-Resolution
Actuator Controller

INSTRUCTION MANUAL

Newport®

Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of one year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

This warranty does not apply to defects resulting from modification or misuse of any product or part. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

Statement of Calibration

This instrument has been inspected and tested in accordance with specifications published by Newport Corporation.

Part No. 19574-01, Rev. D
IN-02911 (01-00)

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EC DECLARATION OF CONFORMITY

Model ESA-C

We declare that the accompanying product, identified with the "CE" mark, meets the intent of the Electromagnetic Compatability Directive, 89/336/EEC and Low Voltage Directive 73/23/EEC.

Compliance was demonstrated to the following specifications:

EN50081-1 EMISSIONS:

Radiated and conducted emissions per EN55011, Group 1, Class A

EN50082-1 IMMUNITY:

Electrostatic Discharge per IEC 1000-4-2, severity level 3
Radiated Emission Immunity per IEC 1000-4-3, severity level 2
Fast Burst Transients per IEC 1000-4-4, severity level 3
Surge Immunity per IEC 1000 4-5, severity level 3

IEC SAFETY:

Safety requirements for electrical equipment specified in IEC 1010-1.

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Warning and Safety Messages

Definitions

— Sentences preceded by **WARNING** describe dangers that could result in personal injury or death.

— Sentences preceded by **CAUTION** describe hazards that could damage the product.

— Sentences preceded by **NOTES** highlight important information required for the successful use of the product.

General Warnings and Cautions

The following general warnings and cautions are applicable to this instrument:

WARNING

Opening or removing covers will expose you to hazardous voltages. Refer all servicing internal to this instrument enclosure to qualified service personnel, who should observe the following precautions before proceeding:

- **Turn off power switch and unplug the unit from its power source**
- **Disconnect all cables**
- **Remove any jewelry from hands and wrist**
- **Use only insulated hand tools**
- **Expect a hazardous voltage to be present in any unknown circuit**

WARNING

To prevent the possibility of electrical shock, the system must be properly grounded. The system's three-pronged power cord must be connected only to a matching three-wire grounded outlet or any 18-gauge wire from earth ground must be connected to the rear panel ground post.

CAUTION

This instrument is equipped with an AC line voltage selector switch. Before connecting the instrument to your AC power lines, be sure the line selector switch is set properly. Damage to the product due to failure to set this switch properly is not covered by Newport's warranty.

CAUTION

Do not remove covers. No user serviceable parts inside.

Specifications

Number of outputs:	3 (X,Y,Z)
Output voltage/channel:	10 to 160 VDC
Minimum load impedance:	10 kΩ
Front panel display:	Three-channel, 3.5-digit LCD
Input resolution:	40 mV
External input:	Three-channel via BNC connectors
Output monitor:	Three-channel via BNC connectors
Bandwidth:	Load dependent, see figures 1.2.3 and 1.2.4
CPU:	8-bit Zilog Z80
Dimensions:	5.8" (147 mm) H x 12.3" (313 mm) W x 11.1" (282 mm) D
Weight:	13.9 lb (6.3 kg)
Communications interface:	IEEE-488.1 and IEEE-488.2 compliant
Power requirements:	90 to 265 VAC; 110 W
Power supply type:	Switching and linear regulators
Cooling:	Temperature-controlled forced air
Operating temperature range:	15 to 40°C
Operating humidity range:	15 to 85% RH
Manual controls:	Three ten-turn potentiometers

Section 1
Operation

1. Prior to using the ESA-C controller for the first time, please read and understand all instructions.
2. The following precautions should be observed at all times:
   - — Care must be taken as high voltages are present inside the controller and at the actuators. Do not operate the unit with damaged cables or with the controller case removed.
   - — Do not operate the unit with a damaged cord or if it has been dropped or damaged. Return to Newport for service.
   - — If an extension cord is necessary, a cord with a suitable current rating should be used.
   - — Never yank the cord to pull the plug from an outlet. Grasp the plug and pull it to disconnect.
   - — Prior to turning the power off, it is advisable to turn the manual voltage settings to their minimum to avoid sharp changes in position on power up.

1.1 Actuator Compatibility

This unit is intended for use only with Newport Model ESA1330 electrostrictive actuators. These feature a special micrometer-style bezel which is compatible with Newport ULTRAlign™ Series stages such as Models 461, 462, and 561.

CAUTION

Clamp-type actuator mounts are capable of very high clamping forces. Do not over-clamp the actuators; tighten the clamp only as much as necessary to firmly grip the actuator. The actuators will not operate if the clamps are too tight.

1.2 Front Panel

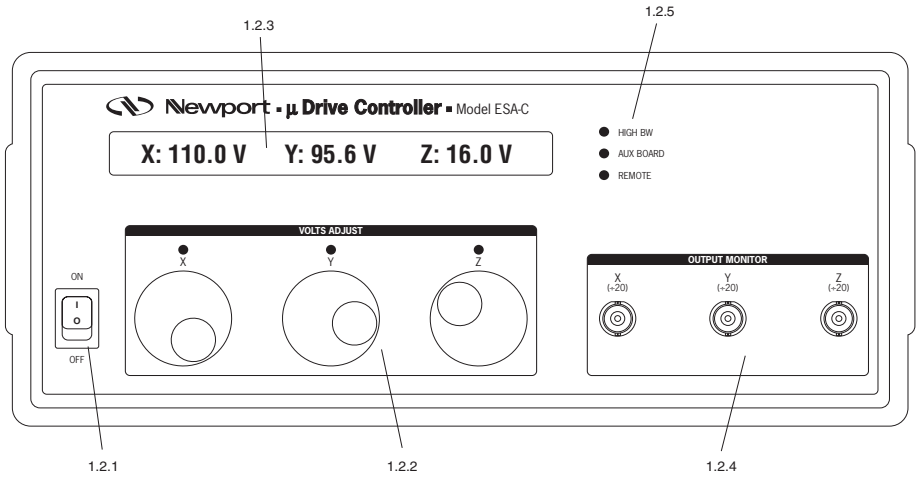


Figure 1.2.1 ESA-C front panel

1.2.1 ON/OFF Switch

Turns the power of the ESA-C on and off.

1.2.2 VOLTS ADJUST

The output voltage can only be set if the output DIN-connector is plugged in. Otherwise, for safety reasons, the voltage remains at 0 V.

The voltage range for each axis is limited to 10 to 160.6 V.

— REMOTE mode
The Model ESA-C is equipped with an IEEE-488.2-compliant GPIB interface. The manual adjustment knobs remain active as long as the GPIB controller does not issue the REMOTE mode command. If the REMOTE mode is activated, adjustments of the ESA-C front-panel knobs have no effect.

— LOCAL mode
The DC voltage can be adjusted with the front panel knob from approximately 10 V to 160.6 V for each axis. The minimum voltage may vary between 9.5 V and 11.5 V because of tolerances in the controller. The actuator is insensitive to voltages less then 10 V; hence the 10 V minimum.

1.2.3 LCD Display

The voltage which is set by the potentiometer or the IEEE interface in REMOTE mode is displayed on the LCD display for the three axes X, Y and Z. The resolution of the display is 0.1 V which equals approximately 0.02 µm. (Refer to figure 1.2.2)

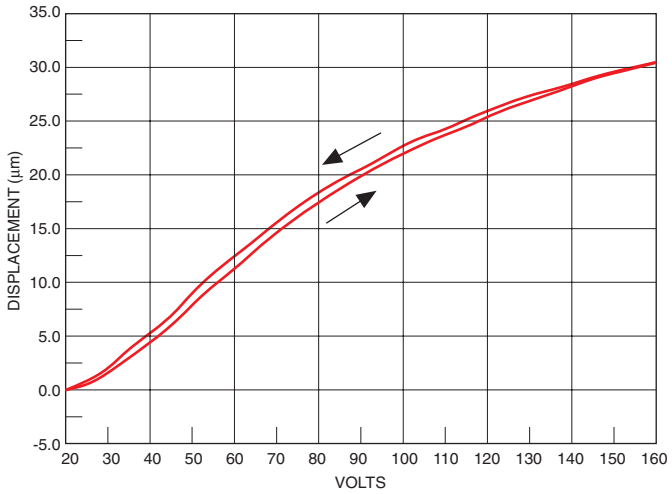


Figure 1.2.2 Typical actuator response curve

1.2.4 OUTPUT MONITOR

The output voltage at the monitor BNC is 1/20 of the voltage which is applied to the actuators. This means the voltage varies between 0.5 V and 8 V. The BNC connectors can be directly connected to an oscilloscope to monitor the output voltage. This may be of interest, for example, if an AC signal is superimposed with a DC voltage.

CAUTION

Do not connect a load with an impedance less than 10 kohm to the monitor ports. Do not apply any voltage to the monitor ports. Safety hazards or damage to the ESA-C controller may result.

The maximum allowable AC amplitude decreases with increasing frequency. (Refer to figures 1.2.3 and 1.2.4.) If the DC voltage is turned completely up or down, the signals may saturate depending on the AC amplitude.

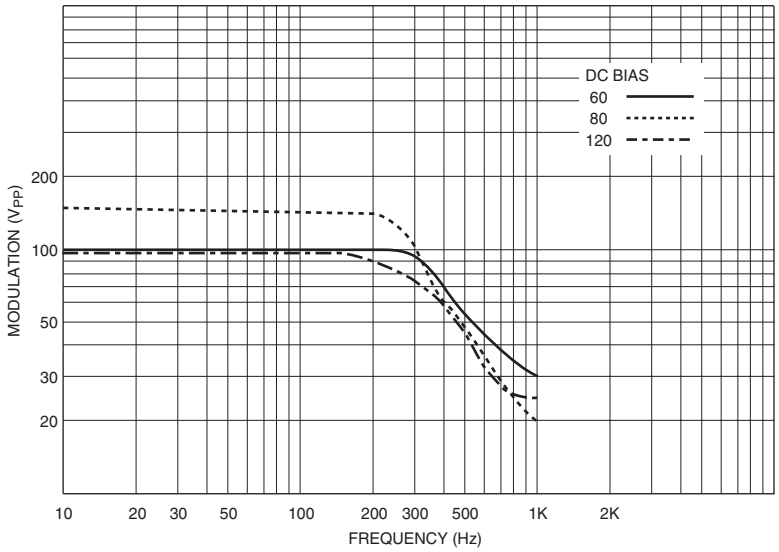


Figure 1.2.3 Bandwidth of the high-voltage output amplifier, 1 µF load

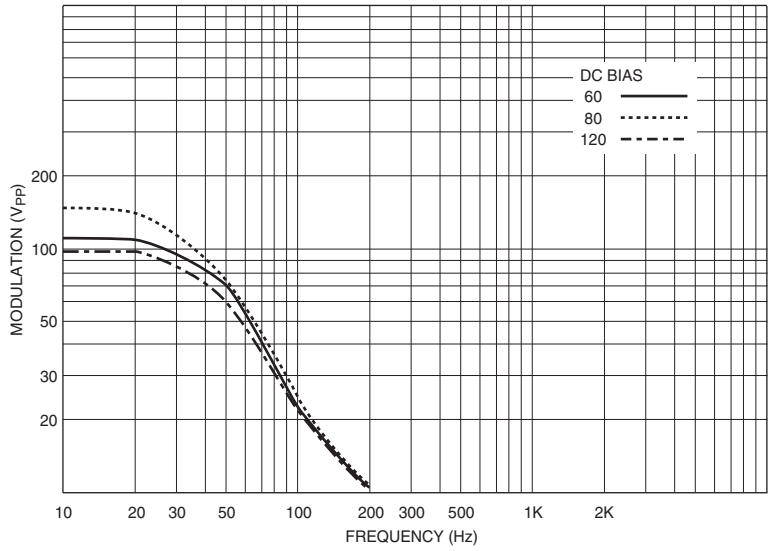


Figure 1.2.4 Bandwidth of the high-voltage output amplifier, 10 µF load

1.2.5 Function LEDs

The HIGH BW LED indicates when frequency response is greater than 30 Hz at 20 volts peak to peak. High bandwidth mode is controlled by rear panel DIP switch position 6. Refer to Section 1.3.5.

The AUX BOARD LED indicates when an internal option board is installed.

The REMOTE LED indicates when GPIB software commands the remote mode. Front panel controls are disabled when this LED is on. Note, however, that if the front panel controls are changed while the unit is in REMOTE, the actuator will return to the LOCAL mode position of the changed control knobs.

1.3 Rear Panel

The ESA-C rear panel is shown in Figure 1.3.1.

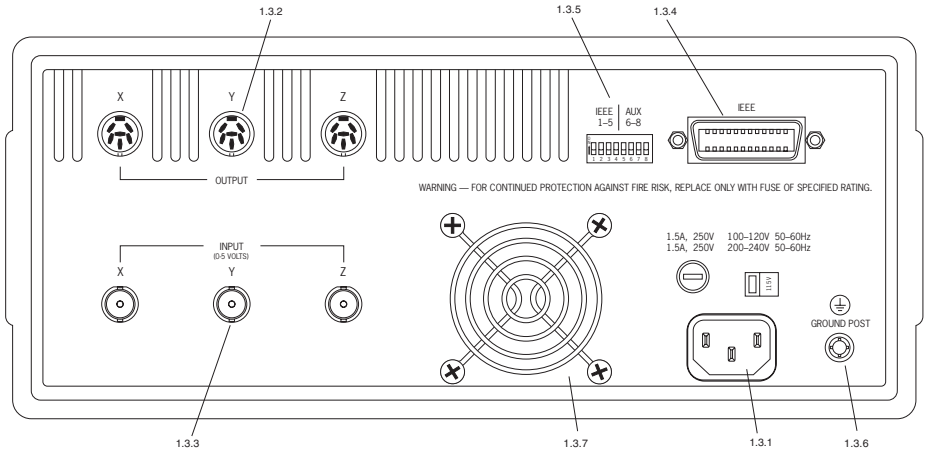


Figure 1.3.1 ESA-C rear panel

1.3.1 Power Input Module

The power module incorporates a universal voltage selector to accommodate local line voltages.

The voltage is adjustable to the international standards. (220 V for Europe, 110 V for USA, Canada, Japan)

To select the line voltage:

- — Remove the power cord.
- — Select the desired voltage setting with the power selection switch on the rear panel
- — Reinstall the power cord.

The power entry module is single-fused.

CAUTION

Select your local voltage before applying power to the ESA-C. Damage will result if an improper line voltage setting is selected.

WARNING

ESA-C is designed for the use with a grounded supply. The ground line in the power connector is the central prong. Do not operate without the power connector ground prong or the case connected to a good earth ground.

1.3.2 Actuator Drive

The high voltage output is applied to the DIN connectors. The output is only active when the corresponding connector is plugged in. The DIN connector pin-out is:

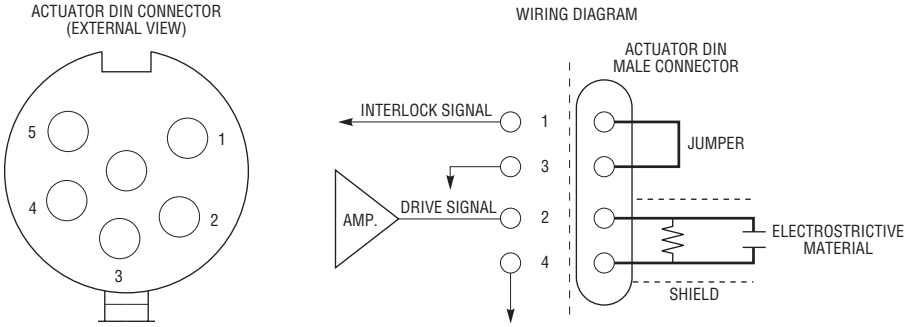


Figure 1.3.2 DIN connector pin-out and wiring diagram.

CAUTION

Do not connect or disconnect actuators while power is applied. Damage to the actuators and/or controller may result.

1.3.3 Input

Any positive input may be applied to the actuator using these inputs. The internal gain of the ESA-C amplifier is set to 32.1. This means that a 5 V input will result in an output voltage of 160.5 V.

CAUTION

The frequencies and voltages shown in figures 1.2.3 and 1.2.4 may not be exceeded, otherwise internal damage may occur.

1.3.4 IEEE Connector

Via this connector the ESA-C can communicate to a computer. For details see the GPIB operation in Section 2.

1.3.5 Rear Panel DIP Switch

Positions 1 through 5 are used to select the GPIB port address. Switch 1 is the least-significant bit. One is ON, zero is OFF. Position 6 is set to ON for HIGH BW mode. Positions 7 and 8 are not used.

1.3.6 Ground Post

This connection is to be used as a chassis ground connection to earth ground. Not to be used for a signal return path.

1.3.7 Cooling Fan

The rear panel cooling fan is controlled by an internal thermostat. The fan will operate if amplifier heatsink temperature exceeds 60°C.

1.4 Manual Operation

Manual operation of the ESA-C is simple:

- Set the proper line voltage as directed in Section 1.3.1.
- Connect the actuators.
- Turn the power switch on.
- Adjust actuator position as desired via front-panel knobs.

CAUTION

Actuators will return to their zero position (fully retracted) when power is turned off, but will recover their set position to within a few nanometers when power is re-applied.

Note that front-panel adjustment is disabled if the GPIB port has activated the REMOTE mode and will be resumed at the manual settings present at the time when the GPIB port activates the LOCAL mode command.

1.5 Manual Operation with Analog Input

Position may also be controlled via the rear-panel analog inputs. The position settings of the front panel controls are simply added to the position commanded via the analog inputs.

As discussed in 1.3.3, the analog inputs have a range of 0 to 5 V. Actuator voltage increases by 32.1 V for each volt of the analog input.

Analog inputs have maximum input frequency of 500 Hz at 0.15 V peak to peak. Somewhat higher frequencies may be accommodated at lower amplitudes. When used with the ESA1330 electrostrictive actuators and an ULTRAlign positioning stage, the system has a bandwidth of ≤ 20 Hz.

Section 2
GPIB Command Reference

2.1 Introduction

The Model ESA-C controller can work in either LOCAL or REMOTE mode. The LCD display always reports the actual voltages applied to all three axes, regardless of the mode of operation.

In LOCAL mode, the voltage (or the position of actuator) on each axis is controlled independently by its own VOLTS ADJUST knob on the front panel.

The REMOTE mode is implemented through a GPIB (IEEE-488) interface that is interrupt-driven. The ESA-C controller is a device that can listen as well as respond to your IEEE-488 interface. The device address can easily be set by following Section 1.3.5 instructions.

In the REMOTE mode, two types of motion are available: velocity controlled motion and immediate motion. The “immediate motion” (see VEL command) option allows the V command or the DV command to immediately change the voltage on each actuator to the desired voltage. The “velocity control motion” option allows the actuator voltage to be changed at a slow rate until the destination voltage is reached.

The current system has eight types of commands (see Section 2.2). The exact mnemonics and the syntax for all valid commands are listed along with their parameters in Section 2.3. Each read (query) and write command is described with an example.

Many commands are axis specific, such as V1, V2 and V3. The numbers in these commands relate to the axis such that V1 applies to axis X, V2 applies to axis Y, and V3 applies to axis Z.

The ESA-C controller loses its command values after its power is turned off. When the ESA-C is powered up, the default settings are LOCAL, and IMMEDIATE velocity mode. The query commands work in either LOCAL or REMOTE modes, but the motion commands (V, DV, VEL series) function in REMOTE mode only.

Once GPIB communication has been established, a typical series of commands might be in the following order. The *IDN? message may be different depending on the software version installed in the controller.

*IDN?	Provides firmware revision information. Receive: Newport Corporation, ESA-C,0,1.0_052091.
REMOTE	Controller front LED labeled REMOTE should go on.
R?	This requests the present voltages on axes X, Y, Z. Receive: 10.4, 10.5, 10.3.
VEL 2	This sets the voltage velocity to 2 volts/second.
V 50	This sets the desired voltage to 50 volts on all three axes. It will take about 20 seconds to do this.

CAUTION

When switching between REMOTE and LOCAL, the actuator voltage settings may differ significantly depending on the front panel VOLTS ADJUST knob settings versus the GPIB commanded settings. This results in an immediate motion by the actuators to their new position, which may result in damage to components mounted for an application.

2.2 Command Groups

There are eight groups of commands:

2.2.1 Mode control or mode query command

LOCAL
REMOTE
MODE?

2.2.2 Actual voltage value query command

R1?
R2?
R3?
R?

2.2.3 Remote set absolute voltages or query command

V1 <number>	V1?	
V2 <number>	V2?	
V3 <number>	V3?	
V <number>	V?	
V12 <number>	<number>	V12?
V13 <number>	<number>	V13?
V23 <number>	<number>	V23?

2.2.4 Remote set voltage change value or query command

DV1 <number>	DV1?	
DV2 <number>	DV2?	
DV3 <number>	DV3?	
DV <number>	DV?	
DV12 <number>	<number>	D12?
DV13 <number>	<number>	DV13?
DV23 <number>	<number>	DV23?

2.2.5 Remote set voltage change rate or query command

VEL1 <number>	VEL1?
VEL2 <number>	VEL2?
VEL3 <number>	VEL3?
VEL <number>	VEL?

2.2.6 Remote stop actuator motion command

STOP1
STOP2
STOP3
STOP

2.2.7 Calibration Command

CAL

2.2.8 GPIB standard command or query command

*CLS	*ERR?
*ESE	*ESE?
	*ESR?
	*IDN?
	*IST?
*OPC	*OPC?
*PRE	*PRE?
*SRE	*SRE?
	*STB?

2.3 Command Descriptions

The following is a listing of the commands. In the command descriptions, several abbreviations are used:

<NL>	new line.
<SP>	one ASCII space character.
<EOI>	end of identify.
<SRQ>	service request.
<string>	an ASCII character string.
<number>	data parameter (see Section 2.5 for details).

IMPORTANT NOTES:

- Any “white space” character with a binary value less than an ASCII space character is not allowed, except for the <NL> character.
- Only one <SP> character between a command name and its parameter or between parameters is accepted.
- When commands are received from the GPIB port, either an <EOI> or <NL> is treated as the end of sequence character. Each command sequence must be terminated by the end of sequence condition. The preferred method is for the <EOI> line to be active with the <NL> character.
- The syntax of the data returned by the ESA-C follows that shown by the individual query commands. In general, all returned data is terminated by the <NL> character. When queries are returned over the GPIB port, the <EOI> line is always active when the <NL> character is transmitted.

2.3.1 DV

Syntax: DV<SP><number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 in voltage units.

Function: To increase or decrease the voltages of all three axes by the amount of <number>, according to the sign. After adding or subtracting the amount, the values of the voltages are checked. If any axis is out of the range, the command will not be executed. This command is executed in the REMOTE mode only. This command can be executed under immediate motion or velocity control conditions. For velocity control motions (VEL), all three axes have to have the same voltage change rate.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R?<NL>
Receive: 53.4,23.3,79.2<NL>
Send: DV<SP>-10.0<NL>
All axes are reduced by 10 volts from their current values. The motions can be under velocity control if all axes have same voltage change rate and the rate is not larger than 10.0. Otherwise, the motions will be immediate. After these commands are executed, the voltage of the first axis will be 43.4, the second one 13.3, and the third one 69.2 volts. NOTE: The actual values may be slightly different from 43.4, 13.3, 69.2 because of the tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV1?, DV2?, DV3?, DV12?, DV13?, DV23?, VEL

2.3.2 DV?

Syntax: DV?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change of all three axes.

Return: <number>,<number>,<number><NL>
<number> is evaluated as a signed floating point value in volts. If there has been no previously set voltage change for any of the axes via the GPIB, spaces are returned.

Example:
Send: DV<SP>-35.2<NL>
Send: DV?<NL>
Receive: -35.2,-35.2,-35.2<NL>

Related commands: DV, DV1, DV2, DV3, DV12, DV13, DV23

2.3.3 DV1

Syntax: DV1<SP>< number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 volts.

Function: To increase or decrease the voltage of the **first** axis by the amount of <number>, according to the sign. After adding or subtracting the amount, the value of the voltage is checked. If it is out of the range, the command will not be executed. This command is executed in REMOTE mode only. This command can be executed under immediate motion or velocity control conditions.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R1?<NL>
Receive: 105.3<NL>
Send: DV1<SP>-15.3<NL>

The first axis has been reduced by 15.3 volts from its previous voltage of 105.3. This motion can be under velocity control if the voltage change rate of the first axis has been set to a value not larger than 10.0. Otherwise, the motion will be immediate. After this command is executed, the voltage of the first axis will be 90.0 volts. NOTE: The actual voltage value may be slightly different from 90.0 because of tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV1?, DV12?, DV13?, VEL1

2.3.4 DV1?

Syntax: DV1?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change value of the first axis.

Return: <number><NL>
<number> is evaluated as a signed floating point value in volts. If there has been no previously set value for the first axis via the GPIB, then spaces are returned.

Example:
Send: DV1<SP>20.0<NL>
Send: DV1?<NL>
Receive: 20.0<NL>

Related commands: DV, DV1, DV12, DV13

2.3.5 DV12

Syntax: DV12<SP><number><SP><number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 in volts.

Function: To increase or decrease the voltage of the **first** axis by the amount of the first <number> and the **second** axis by the second <number>, according to the signs. After adding or subtracting the amount, the values of the voltage are checked. If either axis is out of the range, the command will not be executed. This command is executed in REMOTE mode only. This command can be executed under immediate motion or velocity control conditions. For velocity control motion, these two axes have to have the same voltage change rate.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R?<NL>
Receive: 45.3,66.7,127.4<NL>
Send: DV12<SP>15.0<SP>-22.2<NL>
The first axis has been increased by 15.0 and the second axis reduced by 22.2 volts from their previous voltage settings of 45.3 and 66.7. The motions can be under velocity control if both axes have the same voltage change rate and the rate has been

set to a value not larger than 10.0. Otherwise, the motion will be immediate. After this command is executed, the voltage of the first axis will be 60.3 and the second axis will be 44.5 volts. NOTE: The actual voltage values may be slightly different because of tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV1?, DV2?, DV12?, DV13?, DV23?, VEL1, VEL2

2.3.6 DV12?

Syntax: DV12?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change values of both the **first** and the **second** axes.

Return: <number>,<number><NL>
<number> is evaluated as a signed floating point value in volts. If there was no previously set value for either axis via GPIB, a blank space is returned.

Example:
Send: DV12<SP>154.3<SP>73.9<NL>
Send: DV12?<NL>
Receive: 154.3,73.9<NL>

Related commands: DV, DV1, DV2, DV12, DV13, DV23

2.3.7 DV13

Syntax: DV13<SP><number><SP><number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 in volts.

Function: To increase or decrease the voltage of the **first** axis by the amount of the first <number> and the **third** axis by the second <number>, according to the signs. After adding or subtracting the amount, the values of the voltage are checked. If either axis is out of the range, the command will not be executed. This command is executed in REMOTE mode only. This command can be executed under immediate motion or velocity control conditions. For velocity control motion, these two axes have to have the same voltage change rate.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R?<NL>
Receive: 45.3,66.7,127.4<NL>
Send: DV13<SP>15.0<SP>-22.2<NL>
The **first** axis has been increased by 15.0 and the **third** axis reduced by 22.2 volts from their previous voltage settings of 45.3 and 127.4. The motions can be under velocity control if both axes have the same voltage change rate and the rate has been set to a value not larger than 10.0. Otherwise, the motion

will be immediate. After this command is executed, the voltage of the first axis will be 60.3 and the third axis will be 105.2 volts. NOTE: The actual voltage values may be slightly different because of tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV1?, DV3?, DV12?, DV13?, DV23?, VEL1, VEL3

2.3.8 DV13?

Syntax: DV13?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change values of both the **first** and the **third** axes.

Return: <number>,<number><NL>
<number> is evaluated as a signed floating point value in volts. If there was no previously set value for either axis via GPIB, a blank space is returned.

Example:
Send: DV13<SP>154.3<SP>73.9<NL>
Send: DV13?<NL>
Receive: 154.3,73.9<NL>

Related commands: DV, DV1, DV3, DV12, DV13, DV23

2.3.9 DV2

Syntax: DV2<SP><number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 in volts.

Function: To increase or decrease the voltage of the **second** axis by the amount of <number>, according to the sign. After adding or subtracting the amount, the value of the voltage is checked. If it is out of the range, the command will not be executed. This command is executed in REMOTE mode only. This command can be executed under immediate motion or velocity control conditions.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R2?<NL>
Receive: 95.3<NL>
Send: DV2<SP>15.3<NL>
The second axis has been increased by 15.3 volts from its previous voltage of 95.3. This motion can be under velocity control if the voltage change rate of the second axis has been set to a value not larger than 10.0. Otherwise, the motion will be immediate. After this command is executed, the voltage of the second axis will be 110.6 volts. NOTE: The actual voltage value may be slightly different from 110.6 because of tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV2?, DV12?, DV23?, VEL2

2.3.10 DV2?

Syntax: DV2?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change value of the **second** axis.

Return: <number><NL>
<number> is evaluated as a signed floating point value in volts. If there has been no previously set value for the second axis via the GPIB, then a blank space is returned.

Example:
Send: DV2<SP>88.0<NL>
Send: DV2?<NL>
Receive: 88.0<NL>

Related commands: DV, DV2, DV12, DV23

2.3.11 DV23

Syntax: DV23<SP><number><SP><number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 in volts.

Function: To increase or decrease the voltage of the **second** axis by the amount of the first <number> and the **third** axis by the second <number>, according to the signs. After adding or subtracting the amount, the values of the voltages are checked. If either axis is out of the range, the command will not be executed. This command is executed in REMOTE mode only. This command can be executed under immediate motion or velocity control conditions. For velocity control motion, these two axes have to have the same voltage change rate.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R?<NL>
Receive: 45.3,66.7,127.4<NL>
Send: DV23<SP>15.0<SP>-22.2<NL>
The **second** axis has been increased by 15.0 and the **third** axis reduced by 22.2 volts from their previous voltage settings of 66.7 and 127.4. The motions can be under velocity control if both axes have the same voltage change rate and the rate has been set to a value not larger than 10.0. Otherwise, the motion will be immediate. After this command is executed, the voltage of the second axis will be 81.7 and the third axis will be 105.2 volts. NOTE: The actual voltage values may be slightly different because of tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV2?, DV3?, DV23?, VEL2, VEL3

2.3.12 DV23?

Syntax: DV23?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change values of both the **second** and the **third** axes.

Return: <number>,<number><NL>
<number> is evaluated as a signed floating point value in volts. If there was no previously set value for either axis via GPIB, a blank space is returned.

Example:
Send: DV23<SP>154.3<SP>73.9<NL>
Send: DV23?<NL>
Receive: 154.3,73.9<NL>

Related commands: DV, DV2, DV3 DV12, DV13, DV23

2.3.13 DV3

Syntax: DV3<SP><number>

Parameter: <number> is evaluated as a signed floating point value which has a range from 0 to 150.6 and from –150.6 to 0 in volts.

Function: To increase or decrease the voltage of the **third** axis by the amount of <number>, according to the sign. After adding or subtracting the amount, the value of the voltage is checked. If it is out of the range, the command will not be executed. This command is executed in REMOTE mode only. This command can be executed under immediate motion or velocity control conditions.

Return: NONE

Example:
Send: REMOTE <NL>
Send: R3?<NL>
Receive: 25.3<NL>
Send: DV3<SP>105.3<NL>
The third axis has been increased by 105.3 volts from its previous voltage of 25.3. This motion can be under velocity control if the voltage change rate of the third axis has been set to a value not larger than 10.0. Otherwise, the motion will be immediate. After this command is executed, the voltage of the third axis will be 130.6 volts. NOTE: The actual voltage value may be slightly different from 130.6 because of tolerances in the circuitry electronics and the D/A conversion accuracy.

Related commands: DV?, DV3?, DV13?, DV23?, VEL3

2.3.14 DV3?

Syntax: DV3?

Parameter: NONE

Function: This command requests the previous GPIB set voltage change value of the third axis.

Return: <number><NL>
<number> is evaluated as a signed floating point value in volts. If there has been no previously set value for the third axis via the GPIB, then spaces are returned.

Example: Send: DV3<SP>-35.2<NL>
Send: DV3?<NL>
Receive: -35.2<NL>

Related commands: DV, DV3, DV13, DV23

2.3.15 LOCAL

Syntax: LOCAL

Parameter: NONE

Function: To change the ESA-C into LOCAL mode allowing the user to change the voltages via the front panel knobs. When power is turned on, the ESA-C is initialized (default) in LOCAL mode.

Return: NONE

Example: Send: LOCAL<NL>
After this command is executed, the ESA-C will be in LOCAL mode regardless of current mode.

Related commands: MODE?, REMOTE

CAUTION

Special care must be taken when switching between LOCAL and REMOTE modes. Since voltage applied to the actuators is controlled by the front panel knobs in LOCAL mode and the GPIB in remote mode, the actuators may change their position suddenly when switching modes and cause damage to shock sensitive equipment. A suggested work around is to always set the front panel knobs to their minimum value when working with GPIB, and command the controller to these values before changing modes.

2.3.16 MODE?

Syntax: MODE?

Parameter: NONE

Function: This command is a query for the current mode. The execution of the command will not change the ESA-C mode.

Return: <string><NL>
<string> is either “LOCAL” or “REMOTE”, which is the mode status of the ESA-C.

Example: Send: MODE?<NL>
Receive: LOCAL<NL>

Related commands: LOCAL, REMOTE

2.3.17 R?

Syntax: R?

Parameter: NONE

Function: This command requests the present voltages of all three axes. When the ESA-C is in LOCAL mode, the voltage values are determined by the knobs on the front panel. When in the REMOTE mode, the voltages are defined by the values set via GPIB. NOTE: When a voltage change command (V or DV) is issued in IMMEDIATE mode just before an R? command, the value received may not represent a stable value. Sending several consecutive R? commands will ensure that the correct value is read.

Return: <number>,<number>,<number><NL>
<number> is the current value (in volts) of the three axes.

Example: Send: R?<NL>
Receive: 137.2,14.7,76.9<NL>

Related commands: LOCAL, REMOTE, V, V1, V2, V3, V12, V13, V23, DV, DV1, DV2, DV3, DV12, DV13, DV23

2.3.18 R1?

Syntax: R1?

Parameter: NONE

Function: This command requests the present voltage of the **first** axis. When the ESA-C is in LOCAL mode, the voltage value is determined by the knob on the front panel. When in the REMOTE mode, the voltage is defined by the value set via GPIB. NOTE: When a voltage change command (V or DV) is issued in IMMEDIATE mode just before an R1? command, the value received may not represent a stable value. Sending several consecutive R1? commands will ensure that the correct value is read.

Return: <number><NL>
<number> is the current voltage value of the first axis.

Example: Send: R1?<NL>
Receive: 131.1<NL>

Related commands: LOCAL, REMOTE, DV, DV1, DV12, DV13, V, V1, V12, V13, STOP, STOP1

2.3.19 R2?

Syntax: R2?

Parameter: NONE

Function: This command requests the present voltage of the **second** axis. When the ESA-C is in LOCAL mode, the voltage value is determined by the knob on the front panel. When in the REMOTE mode, the voltage is defined by the value set via GPIB. NOTE: When a voltage change command (V or DV) is issued in IMMEDIATE mode just before an R2? command, the value received may not represent a stable value. Sending several consecutive R2? commands will ensure that the correct value is read.

Return: <number><NL>
<number> is the current voltage value of the second axis.

Example: Send: R2?<NL>
Receive: 150.9<NL>

Related commands: LOCAL, REMOTE, DV, DV2, DV12, DV23, V, V2, V12, V23, STOP, STOP2

2.3.20 R3?

Syntax: R3?

Parameter: NONE

Function: This command requests the present voltage of the **third** axis. When the ESA-C is in LOCAL mode, the voltage value is determined by the knob on the front panel. When in the REMOTE mode, the voltage is defined by the value previously set via the GPIB. NOTE: When a voltage change command (V or DV) is issued in IMMEDIATE mode just before an R3? command, the value received may not represent a stable value. Sending several consecutive R3? commands will ensure that the correct value is read.

Return: <number><NL>
<number> is the current voltage value of the third axis.

Example: Send: R3?<NL>
Receive: 101.5<NL>

Related commands: LOCAL, REMOTE, DV, DV3, DV13, DV23, V, V3, V13, V23

2.3.21 REMOTE

Syntax: REMOTE

Parameter: NONE

Function: Change the ESA-C controller into the REMOTE mode.

Return: NONE

Example: Send: REMOTE<NL>
After this command is executed, the ESA-C controller will be in the REMOTE mode regardless of the current mode.

Related commands: MODE?, LOCAL

CAUTION

Special care must be taken when switching between LOCAL and REMOTE modes. Since voltage applied to the actuators is controlled by the front panel knobs in LOCAL mode and the GPIB in REMOTE mode, the actuators may change their position suddenly when switching modes and cause damage to equipment sensitive to mechanical shock. A suggested work around is to always set the front panel knobs to their minimum value when working with GPIB, and command the controller to these values when changing modes.

2.3.22 STOP

Syntax: STOP

Parameter: NONE

Function: This command stops the motions of all three axes initiated by any command via the GPIB port. The actuators will maintain the position they are in when the STOP command takes effect.

Return: NONE

Example:

Send:	R?<NL>
Receive:	94.7,159.9,77.3<NL>
Send:	VEL<SP>0.5<NL>
Send:	V<SP>35.8<NL>
	(Wait ~30 sec. before proceeding)
Send:	STOP<NL>
Send:	R?<NL>
Receive:	80.3,145.7,62.9<NL>

While the three axes decrease their voltage values to 35.8 volts at a rate of 0.5 volts per second, the STOP command aborts all motions. Now the three axes hold their positions (corresponding to 80.3v, 145.7v, 62.9v) where the STOP command took effect.

Related commands: *OPC, *OPC?, R?, R1?, R2?, R3?

2.3.23 STOP1

Syntax: STOP1

Parameter: NONE

Function: This command stops the motion of the **first** axis initiated by any command via the GPIB port. It holds the position where the STOP1 command takes effect.

Return: NONE

Example:

Send:	VEL1?<NL>
Receive:	0.8<NL>
Send:	R1?<NL>
Receive:	25.4<NL>
Send:	V1<SP>87.8<NL>
	(Wait ~40 sec. before proceeding)
Send:	STOP1<NL>
Send:	R1?<NL>
Receive:	59.1<NL>

While the first axis increases its voltage value to 87.8 volts at a rate of 0.8 volts per second, the STOP1 command aborts the motion. Now the first axis holds its position (59.1v) where the STOP command took effect.

Related commands: *OPC, *OPC?, R?, R1

2.3.24 STOP2

Syntax: STOP2

Parameter: NONE

Function: This command stops the motion of the **second** axis initiated by any command via the GPIB port. It holds the position where the STOP2 command takes effect.

Return: NONE

Example:
Send: R2?<NL>
Receive: 160.0<NL>
Send: VEL2?<NL>
Receive: 1.0<NL>
Send: V2<SP>17.8<NL>
(Wait ~2 min. before proceeding)
Send: STOP2<NL>
Send: R2?<NL>
Receive: 46.7<NL>
While the second axis decreases its voltage value to 17.8 volts at a rate of 1.0 volts per second, the STOP2 command aborts the motion. Now the second axis holds its position (46.7v) where the STOP2 command takes effect.

Related commands: *OPC, *OPC?, R?, R2

2.3.25 STOP3

Syntax: STOP3

Parameter: NONE

Function: This command stops the motion of the **third** axis initiated by any command via the GPIB port. It will hold the position where the STOP3 command takes effect.

Return: NONE

Example:
Send: R3?<NL>
Receive: 17.6<NL>
Send: VEL3?<NL>
Receive: 0.9<NL>
Send: V3<SP>93.3<NL>
(Wait ~80 sec. before proceeding)
Send: STOP3<NL>
Send: R3?<NL>
Receive: 88.4<NL>
While the third axis increases its voltage value to 93.3 volts at a rate of 0.9 volts per second, the STOP3 command aborts the motion. Now the third axis holds its position (88.4v) where the STOP3 command takes effect.

Related commands: *OPC, *OPC?, R?, R3

2.3.26 V

Syntax: V<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.00 to 160.00 volts.

Function: To set the voltages of all three axes to a specified value <number>. If the <number> is out of the voltage range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the current mode. This command can be executed under immediate motion or velocity control conditions. For velocity control motion (VEL), all three axes have to have the same voltage change rate.

Return: NONE

Example: Send: V<SP>89<NL>
After this command is executed, all axes will be set to 89.0 volts. The motions can be under velocity control if all axes have same voltage change rate and the rate is not greater than 10.0v per sec. Otherwise, the motions will be immediate. The ESA-C controller will now be in REMOTE mode regardless of its previous mode. The actual value may be slightly different from 89.0v because of circuit tolerances and the D/A conversion accuracy.

Related commands: V?, V1?, V2?, V3?, V12?, V13?, V23?, VEL

2.3.27 V?

Syntax: V?

Parameter: NONE

Function: This command requests the previous GPIB set voltages for all three axes.

Return: <number>,<number>,<number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there were no previously set values for any of the axes via the GPIB port, blank spaces are returned.

Example: Send: V<SP>20.0<NL>
Send: V12<SP>156.2<SP>87.8<NL>
Send: V?<NL>
Receive: 156.2,87.8,20.0<NL>

Related commands: V, V1, V2, V3, V12, V13, V23

2.3.28 V1

Syntax: V1<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.0 to 160.0 volts

Function: Sets the voltage of the **first** axis to the value <number>. If the <number> is out of range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the previous mode. This command can be executed under either immediate motion or velocity control conditions.

Return: NONE

Example: Send: V1<SP>154.3<NL>

Related commands: V?, V1?, V12?, V13?, VEL1

2.3.29 V1?

Syntax: V1?

Parameter: NONE

Function: This command requests the previous GPIB set voltage value of the **first** axis.

Return: <number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there was no previously set value for the first axis via the GPIB port, a blank space is returned.

Example: Send: V1<SP>20.0<NL>
Send: V1?<NL>
Receive: 20.0<NL>

Related commands: V, V1, V12, V13

2.3.30 V12

Syntax: V12<SP><number><SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.0 to 160.0 volts

Function: Sets the voltages of the **first** and **second** axes to their respective values <number> <number> (for axes <1> <2>). If the <number> is out of range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the previous mode. This command can be executed under either immediate motion or velocity control conditions. Under velocity control conditions (VEL), both axes must be set to the same voltage change rate.

Return: NONE

Example: Send: V12<SP>77.4<SP>25.6<NL>
After executing this command, the voltage of the first axis will be 77.4v and the second axis will be 25.6v.

Related commands: V?, V1?, V2?, V12?, V13?, V23?, VEL1, VEL2

2.3.31 V12?

Syntax: V12?

Parameter: NONE

Function: This command requests the previous GPIB set voltage value of the **first** and **second** axes.

Return: <number>,<number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there were no previously set values for the first or the second axes via the GPIB port, blank spaces are returned.

Example: Send: V12<SP>120.0<SP>98.3<NL>
Send: V12?<NL>
Receive: 120.0,98.3<NL>

Related commands: V, V1, V2, V12, V13, V23

2.3.32 V13

Syntax: V13<SP><number><SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.0 to 160.0 volts

Function: Sets the voltages of the **first** and **third** axes to their respective values <number> <number> (for axes <1> <3>). If the <number> is out of range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the previous mode. This command can be executed under either immediate motion or velocity control conditions. Under velocity control conditions (VEL), both axes must be set to the same voltage change rate.

Return: NONE

Example: Send: V13<SP>77.4<SP>25.6<NL>
After executing this command, the voltage of the first axis will be 77.4v and the third axis will be 25.6v.

Related commands: V?, V1?, V3?, V12?, V13?, V23?, VEL1, VEL3

2.3.33 V13?

Syntax: V13?

Parameter: NONE

Function: This command requests the previous GPIB set voltage value of the **first** and **third** axes.

Return: <number>,<number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there were no previously set values for the first or the third axes via the GPIB port, blank spaces are returned.

Example: Send: V13<SP>120.0<SP>98.3<NL>
Send: V13?<NL>
Receive: 120.0,98.3<NL>

Related commands: V, V1, V3, V12, V13, V23

2.3.34 V2

Syntax: V2<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.0 to 160.0 volts

Function: Sets the voltage of the **second** axis to the value <number>. If the <number> is out of range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the previous mode. This command can be executed under either immediate motion or velocity control conditions.

Return: NONE

Example: Send: V2<SP>59.7<NL>

Related commands: V?, V2?, V12?, V23?, VEL2

2.3.35 V2?

Syntax: V2?

Parameter: NONE

Function: This command requests the previous GPIB set voltage value of the **second** axis.

Return: <number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there was no previously set value for the second axis via the GPIB port, a blank space is returned.

Example: Send: V2 <SP>40.3<NL>
Send: V2?<NL>
Receive: 40.3<NL>

Related commands: V, V2, V12, V23

2.3.36 V23

Syntax: V23<SP><number><SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.0 to 160.0 volts

Function: Sets the voltages of the **second** and **third** axes to their respective values <number> <number> (for axes <2> <3>). If the <number> is out of range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the previous mode. This command can be executed under either immediate motion or velocity control conditions. Under velocity control conditions (VEL), both axes must be set to the same voltage change rate.

Return: NONE

Example: Send: V23<SP>77.4<SP>25.6<NL>
After executing this command, the voltage of the second axis will be 77.4v and the third axis will be 25.6v.

Related commands: V?, V2?, V3?, V12?, V13?, V23?, VEL2, VEL3

2.3.37 V23?

Syntax: V23?

Parameter: NONE

Function: This command requests the previous GPIB set voltage value of the **second** and **third** axes.

Return: <number>,<number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there were no previously set values for the second or the third axes via the GPIB port, blank spaces are returned.

Example: Send: V23<SP>120.0<SP>98.3<NL>
Send: V23?<NL>
Receive: 120.0,98.3<NL>

Related commands: V, V2, V3, V12, V13, V23

2.3.38 V3

Syntax: V3<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value which has a range from 10.0 to 160.0 volts

Function: Sets the voltage of the **third** axis to the value <number>. If the <number> is out of range, the command will not be executed. When this command is executed, the ESA-C will be in the REMOTE mode regardless of the previous mode. This command can be executed under either immediate motion or velocity control conditions.

Return: NONE

Example: Send: V3<SP>29.0<NL>

Related commands: V?, V3?, V13?, V23?, VEL3

2.3.39 V3?

Syntax: V3?

Parameter: NONE

Function: This command requests the previous GPIB set voltage value of the **third** axis.

Return: <number><NL>
<number> is evaluated as an unsigned floating point value in volts. If there was no previously set value for the third axis via the GPIB port, a blank space is returned.

Example: Send: V3<SP>91.9<NL>
Send: V3?<NL>
Receive: 91.9<NL>

Related commands: V, V3, V13, V23

2.3.40 VEL

Syntax: VEL<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value. Only values ranging from 0.05 to 10.0 are valid.

Function: This command sets the approximate rate of change in voltage (volts per second) of all three axes if <number> is in the range from 0.05 to 10.0. After this command is executed, the motions of all three axes will be under velocity control. If the <number> is greater than 10.0 or a non-numeric character is entered (Section 2.5), then the <number> is not valid and the motions revert to Immediate.

Return: NONE

Example: Send: VEL<SP>0.6<NL>
After this command is executed, the rates of all three axes will be set to change approximately 0.6 volts per second.

Related commands: VEL?, VEL1?, VEL2?, VEL3?

2.3.41 VEL?

Syntax: VEL?

Parameter: NONE

Function: This command requests the current rate of change values in volts per second of all three axes as previously set via the GPIB port.

Return: <number>,<number>,<number><NL>

Example: Send: VEL<SP><NL>
Send: VEL?<NL>
Receive: IMED, IMED, IMED
Sending a <SP> with the VEL command will put the controller into IMMEDIATE mode.

Related commands: VEL, VEL1, VEL2, VEL3

2.3.42 VEL1

Syntax: VEL1<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value. Only values ranging from 0.05 to 10.0 are valid.

Function: This command sets the approximate rate of change in voltage (volts per second) of the **first** axis if <number> is within the range from 0.05 to 10.0. After this command is executed, the motion of the first axis will be under velocity control. If the <number> is greater than 10.0 or a non-numeric character is entered, then the <number> is not valid and the motion reverts to Immediate.

Return: NONE

Example: Send: VEL1<SP>0.1<NL>
After this command is executed, the rate of first axis will be set to change approximately 0.1 volts per second.

Related commands: VEL?, VEL1?

2.3.43 VEL1?

Syntax: VEL1?

Parameter: NONE

Function: This command requests the current rate of change value in volts per second of the **first** axis as previously set via the GPIB port.

Return: <number><NL>

Example: Send: VEL1<SP>0.6<NL>
Send: VEL1?<NL>
Receive: 0.6<NL>

Related commands: VEL, VEL1

2.3.44 VEL2

Syntax: VEL2<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value. Only values ranging from 0.05 to 10.0 are valid.

Function: This command sets the approximate rate of change in voltage (volts per second) of the **second** axis if <number> is in the range from 0.05 to 10.0. After this command is executed, the motion of the second axis will be under velocity control. If the <number> is greater than 10.0 or a non-numeric character is entered, then the <number> is not valid and the motion reverts to Immediate.

Return: NONE

Example: Send: VEL2<SP>0.1<NL>
After this command is executed, the rate of second axis will be set to change approximately 0.1 volts per second.

Related commands: VEL?, VEL2?

2.3.45 VEL2?

Syntax: VEL2?

Parameter: NONE

Function: This command requests the current rate of change value in volts per second of the second axis as previously set via the GPIB port.

Return: <number><NL>

Example: Send: VEL2<SP>0.08<NL>
Send: VEL2?<NL>
Receive: 0.08<NL>

Related commands: VEL, VEL2

2.3.46 VEL3

Syntax: VEL3<SP><number>

Parameter: <number> is evaluated as an unsigned floating point value. Only values ranging from 0.05 to 10.0 are valid.

Function: This command sets the approximate rate of change in voltage (volts per second) of the **third** axis if <number> is in the range from 0.05 to 10.0. After this command is executed, the motion of the third axis will be under velocity control. If the <number> is greater than 10.0 or a non-numeric character is entered, then the <number> is not valid and the motion reverts back to Immediate.

Return: NONE

Example: Send: VEL3<SP>0.7<NL>
After this command is executed, the rate of third axis will be set to change approximately 0.7 volts per second.

Related commands: VEL?, VEL3?

2.3.47 VEL3?

Syntax: VEL3?

Parameter: NONE

Function: This command requests the current rate of change value in volts per second of the **third** axis as previously set via the GPIB port.

Return: <number><NL>

Example: Send: VEL3<SP>0.08<NL>
Send: VEL3?<NL>
Receive: 0.08<NL>

Related commands: VEL, VEL3

2.3.48 CAL

Syntax: CAL

Parameter: NONE

Function: To allow more accurate agreement between commanded voltages versus actual voltage applied to actuators. The CAL command is performed during power-up automatically. An actuator does not need to be connected during this process. After many hours of operation, use the CAL command to reassure optimal operation, especially important when velocity controlled, small displacement repeatability is desired. NOTE: During this calibration, voltage on each axis will drop several volts temporarily.

Return: NONE

Example: Send: CAL<NL>
All axes are disconnected from the power amplifiers during this test. The controller is placed into the high bandwidth mode and REMOTE mode. The amplifier chain offset is then calculated, and the amplifier gain is measured. These constants are stored in memory. All user settings are reset to their pre-CAL condition at conclusion of this test which lasts about one second.

Related commands: R?, VEL, V

2.4 GPIB Standard Command or Query

2.4.1 *CLS

Syntax: *CLS

Parameter: NONE

Function: This command clears the Status Byte Register and Standard Event Status Register. The *CLS command also removes the error from the error buffer. The *CLS command is mainly used to clear the bit(s) that generated a request for serial or parallel poll. The Message Available (bit 4) of the status byte is not affected.

Return: NONE

Example: Send: V<SP>190<NL>
Send: *CLS<NL>
Send: *STB?<NL>

Receive: 0<NL>
Send: *ESR?<NL>
Receive: 0<NL>

Related commands: *ERR?, *ESR?, *STB?

2.4.2 *ERR?

Syntax: *ERR?

Parameter: NONE

Function: This command returns the error message in the error buffer for the most current command. The ESA-C checks the syntax and data range for each command entered and updates the error message in the error buffer. When an error occurs, bit 4 or bit 5 of the Standard Event Status Register will be set. The Status Byte Register will be updated, and <SRQ> will be issued if the corresponding enable bits are set. The *CLS command will clear the error buffer.

Return: <string><NL>

Example: Send: V<SP>190<NL>
Send: *ERR?<NL>
Receive: -222, Data out of range<NL>
Send: *STB?<NL>
Receive: 96<NL>

Related commands: *CLS, *ESR?

2.4.3 *ESE

Syntax: *ESE<SP><number>

Parameter: <number> is an integer in the range from 0 to 255. This value is written to the Standard Event Status Enable Register which is the mask for the Standard Event Status Register. Use this command to generate the ESB (Event Status Byte) bit of the Status Byte Register. (See Section 2.6)

Function: The Standard Event Status Enable Register is AND'ed with the Standard Event Status Register, producing the ESB bit (bit 5) of the Status Byte Register. The Status Byte Register is used in conjunction with the Service Request Enable Register for the generation of the serial or parallel poll. Any bit set to one in the Standard Event Status Enable Register enables the corresponding condition bit in the Standard Event Status Register to set the ESB bit of the Status Byte Register. Any bit set to zero disables the corresponding bit in the Standard Event Status Register from setting the ESB bit of the Status Byte Register. (See Section 2.6 for details).

Return: NONE

Example: Send: *ESE<SP>48<NL>
Send: *ESE?<NL>
Receive: 48<NL>
Either a Command Error or an Execution Error will cause the ESB bit in the Status Byte Register to be set to "1".

Related commands: *ESE, *ESR?, *IST?, *SRE?, *STB?

2.4.4 *ESE?

Syntax: *ESE?

Parameter: NONE

Function: Returns the current value of the Standard Event Status Enable Register. The Standard Event Status Enable Register is AND'ed with the Standard Event Status Register, producing the ESB bit (bit 5) of the Status Byte Register. (See also Section 2.4.3.)

Return: <number><NL>
<number> is evaluated as an unsigned integer from 0 to 255, representing the value of the Standard Event Status Enable Register.

Example: Send: *ESE<SP>48<NL>
Send: *ESE?<NL>
Receive: 48<NL>
Either a Command Error, or an Execution Error will cause the ESB bit in the Status Byte Register to be set to one.

Related commands: *ESE, *IST?, *SRE, *STB?

2.4.5 *ESR?

Syntax: *ESR?

Parameter: NONE

Function: Returns the value stored in the Standard Event Status Register. After returning the current value, the Standard Event Status Register is cleared to zero. The *CLS command also clears the Standard Event Status Register to zero. (See also Section 2.4.3).

Return: <number><NL>
<number> is evaluated as an unsigned integer from 0 to 255, representing the value of the Standard Event Status Register.

Example: Send: V1234<NL> *(NOTE: This is a command error)*
Send: *ESR?<NL>
Receive: 32<NL>
Send: *ESR?<NL>
Receive: 0<NL>
The command Error bit is set. The second query returned zero because the first query cleared the Standard Event Status Register.

Related commands: *CLS, *ERR?, *ESE, *IST?, *SRE?

2.4.6 *IDN?

Syntax: *IDN?

Parameter: NONE

Function: This query causes the ESA-C controller to return identification information.

Return: <manufacturer>,<model>,<serial>,<version>,<NL>
<serial> is always a '0', as the serial number is not returned.
<version> consists of two sections, separated by an underline. The first is the version level, and the second is revision date.

Example: Send: *IDN?<NL>
Receive: Newport Corp,ESA-C,0,1.0_032092<NL>

Related commands: NONE

2.4.7 *IST?

Syntax: *IST?

Parameter: NONE

Function: This query returns the current state of the IEEE 488.1 <IST> local message. The <IST> message is generated by the parallel poll status system. The *PRE command is used to define the Parallel Poll Enable Register used with the Status Byte Register to generate the <IST> message. If any bit is set in the Status Byte Register and its corresponding bit is set in the Parallel Poll Enable Register, then the <IST> message is set true (a value of one). Otherwise the <IST> message is set false (a value of zero). The <IST> message is compared to the <S BIT> register, and if they are the same and the Parallel Poll Register has a non-zero value in it, then a Parallel Poll is requested. The Parallel Poll Register will be returned when the ESA-C has been polled in a parallel poll. Both the <S BIT> and the Parallel Poll Register may be configured by the IEEE 488.1 Parallel Poll remote configuration command.

Return: <number><NL>
<number> is an unsigned integer with value of 0 or 1. A value of zero indicates that no bit is set in the Status Byte Register or its corresponding bit is zero in the Parallel Poll Enable Register. A value of one indicates that a bit is set in the Status Byte Register and its corresponding bit is set in the Parallel Poll Register.

Example: Send: *CLS<NL>
Send: *PRE<SP>32<NL>
Send: V1234<NL> *(NOTE: This is a command error)*
Send: *IST?<NL>
Receive: 1<NL>

Related commands: *ESE, *ESR?, *PRE, *PRE?, *STB?

2.4.8 *OPC

Syntax: *OPC

Parameter: NONE

Function: This command sets the Operation Complete bit (OPC bit) of the Standard Event Status Register when all pending operations have been finished. This is to allow for synchronization of operations between the ESA-C and the remote host. Bit 0 of the Standard Event Status Register is the OPC bit. Normally this bit is set to zero. The *OPC command forces the ESA-C to set the OPC bit when all pending operations have been finished. A pending operation is any command (such as V, DV, etc) which causes the actuators to move. The STOP command will terminate all pending operations. By enabling bit 0 of the Standard Event Status Enable Register, the *OPC command allows for the OPC bit (bit 0) of the Status Byte Register to be set when all

pending operations are finished. The *OPC command and *OPC? query operate differently in how they signal an operation complete to the remote host. The *OPC? generates a message (1<NL>) when all operations are complete, which also sets the MAV bit (Bit 4) in the Status Byte Register.

Return: NONE

Example:
Send: *ESE<SP>1<NL>
Send: *SRE<SP>32<NL>
Send: V2<SP>73.6<NL>
Send: *OPC<NL>
Send: *STB?<NL>
Receive: 96<NL>
When the V2 command has finished executing, bit 0 of the Standard Event Status Register will be set. Since bit 0 of the Standard Event Status Enable Register is also set, bit 5 of the Service Request Enable Register is set, a GPIB <SRQ> will be generated.

Related commands: STOP, STOP1, STOP2, STOP3, V, V1, V2, V3, V12, V13, V23, DV, DV1, DV2, DV3, DV12, DV13, DV23

2.4.9 *OPC?

Syntax: *OPC?

Parameter: NONE

Function: This query generates a response when all pending operations have been completed. The Message Available bit (bit 4) of the Status Byte Register will also be set because a response is generated. A pending operation is any command (such as V, DV, etc) which causes the actuators to move. The STOP command will terminate all pending operations. By enabling bit 4 of the Service Request Enable Register, the *OPC? command can cause the generation of a GPIB <SRQ>. The *OPC command and *OPC? query operate differently in how they signal an operation complete to the remote host. The *OPC? generates a message (1<NL>) when all operations are complete, which also sets the MAV bit (BIT 4) in the Status Byte Register. The *OPC command sets the OPC bit (bit 0) of the Standard Event Status Register when all pending operations are completed.

Return: <number><NL>
<number> is an unsigned integer with the value “1”. The response is only generated when all pending operations are complete.

Example:
Send: V2<SP>73.6<NL>
Send: *OPC?<NL>
Receive: 1<NL>
When the V2 command has finished executing, the *OPC? command will generate the response. The generation of the response will set the Message Availiable bit (bit 4) in the Status Byte Register. Also, a GPIB <SRQ> will be generated, indicating a message is available.

Related commands: STOP, STOP1, STOP2, STOP3, V, V1, V2, V3, V12, V13, V23, DV, DV1, DV2, DV3, DV12, DV13, DV23, *STB?

2.4.10 *PRE

Syntax: *PRE<SP><number>

Parameter: <number> is an integer from 0 to 255 and is placed into the Parallel Poll Enable Register.

Function: This command sets the Parallel Poll Enable Register, which is used in conjunction with the Status Byte Register for the generation of the IST (Individual Status) byte. The IEEE 488.2 standard allows the Parallel Poll Enable Register to be up to sixteen bits in size. The ESA-C only uses and retains the lower eight bits as a mask for the Status Byte Register. The Parallel Poll Enable Register is preset at power-on. The Parallel Poll Enable Register is bit mapped (see Section 2.6 for details).

Return: NONE

Example: Send: *PRE<SP>112<NL>
Send: *PRE?<NL>
Receive: 112<NL>
If the MAV bit, the ESB bit, or the Request for Service bit in the Status Byte Register is set, then the IST is also set.

Related commands: *IST?, *PRE?, *STB?

2.4.11 *PRE?

Syntax: *PRE?

Parameter: NONE

Function: This command requests the return of the contents of the Parallel Poll Enable Register. The IEEE 488.2 standard allows the Parallel Poll Enable Register to be up to sixteen bits in size. The ESA-C only uses and retains the lower eight bits as a mask for the Status Byte Register. The Parallel Poll Enable Register is preset at power-on. The Parallel Poll Enable Register is bit mapped (see Section 2.6 for details).

Return: <number><NL>
<number> is an unsigned integer from 0 to 255 which represents the bit mask value.

Example: Send: *PRE<SP>112<NL>
Send: *PRE?<NL>
Receive: 112<NL>
If the MAV bit, the ESB bit, or the Request for Service bit in the Status Byte Register is set, then the IST is also set.

Related commands: *IST?, *PRE, *STB?

2.4.12 *SRE

Syntax: *SRE<SP><number>

Parameter: <number> is an integer from 0 to 255 and is placed into the Service Request Enable Register which is masked with the Status Byte Register to generate the <SRQ>. Bit 6 of <number> is not used and set to 0 (see Section 2.6).

Function: This command sets the Service Request Enable Register, which is used in conjunction with the Status Byte Register to generate IEEE 488.1 Service Requests. The Status Byte Register is used to record current system conditions for the status reporting system. The register is bit mapped, each condition represented by a bit (see Section 2.6 for details). When a bit is set, or has a value of one, then the condition is true. The Service Request Enable Register is used to define the conditions that will generate an IEEE 488.1 <SRQ>. Bit 6 in the Service Request Enable Register is not used and is always read as a zero. If a bit is set in the Status Byte Register and its corresponding bit is set in the Service Request Enable Register, then an <SRQ> will be generated. When an <SRQ> is generated, bit 6 in the Status Byte Register is set.

Return: NONE

Example:
Send: *SRE<SP>128<NL>
Send: *SRE?<NL>
Receive: 128<NL>

Related commands: *SRE?, *STB?

2.4.13 *SRE?

Syntax: *SRE?

Parameter: NONE

Function: The query returns the value stored in the Service Request Enable Register. The Status Byte Register is used to record current system conditions for the status reporting system. The register is bit mapped, each condition represented by a bit (see Section 2.6 for details). When a bit is set, or has a value of one, then the condition is true. The Service Request Enable Register is used to define the conditions that will generate an IEEE 488.1 <SRQ>. Bit 6 in the Service Request Enable Register is not used and is always read as a zero. If a bit is set in the Status Byte Register and its corresponding bit is set in the Service Request Enable Register, then an <SRQ> will be generated. When an <SRQ> is generated, bit 6 in the Status Byte Register is set.

Return: <number><NL>
<number> is an unsigned integer from 0 to 255, except that bit 6 is always a zero.

Example:
Send: *SRE<SP>128<NL>
Send: *SRE?<NL>
Receive: 128<NL>

Related commands: *SRE, *STB?

2.4.14 *STB?

Syntax: *STB?

Parameter: NONE

Function: This command query returns the contents of the Status Byte Register. The query will not modify the contents of the Status Byte Register, except for the MAV bit (bit 4). The generation of the query will subsequently reset the MAV bit after the response has been generated. The Status Byte Register is used to record current system conditions for the status reporting system. The register is bit mapped, each condition represented by a bit (see Section 2.6 for details). When a bit is set, or has a value of one, then the condition is true. The Service Request Enable Register is used to define the conditions that will generate an IEEE 488.1 <SRQ>. Bit 6 in the Service Request Enable Register is not used and is always read as a zero. If a bit is set in the Status Byte Register and its corresponding bit is set in the Service Request Enable Register, then an <SRQ> will be generated.

Return: <number><NL>
<number> is an unsigned integer from 0 to 255 which represents the value of the Status Byte Register.

Example:
Send: *ESE<SP>32<NL>
Send: *SRE<SP>32<NL>
Send: V1234<NL> *(NOTE: This is a command error)*
Send: *STB?<NL>
Receive: 96<NL>

Related commands: *CLS, *ESE, *ESR?

2.5 <number>

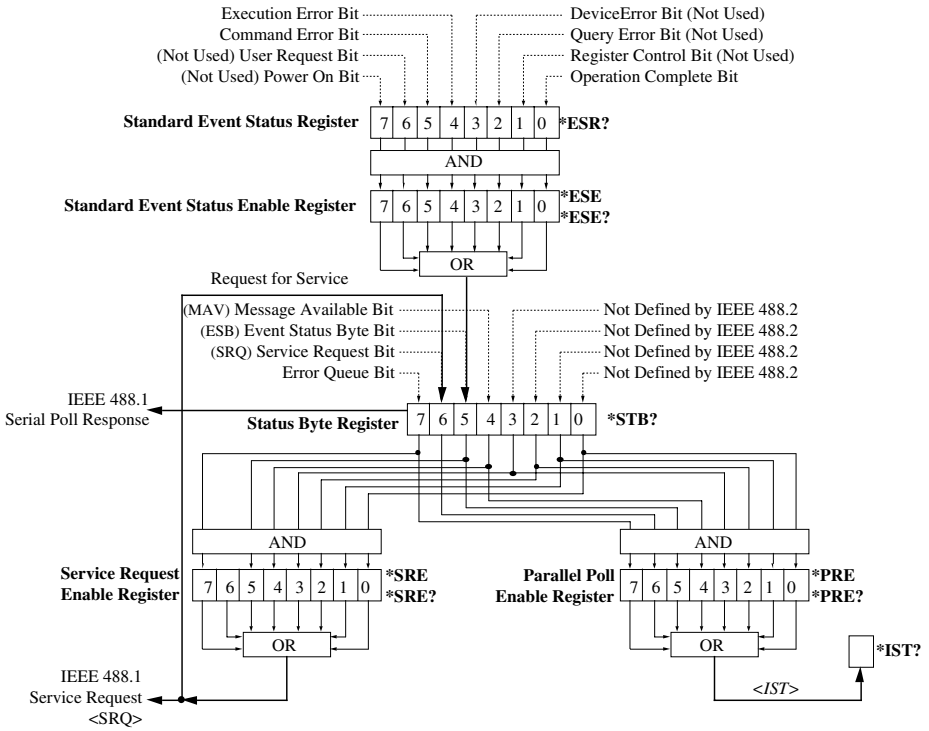
A <number> is a floating point which has a range from 10.0 to 160.6 for a voltage value, and from 0.05 to 10.0 for a voltage change rate (in units of "volts per second").

A <number> can be signed or unsigned, which is defined by the individual command.

The formats of <number> are limited in that an exponent indicator is not allowed, but the integer format is accepted and converted to a floating point.

Example: The <number>s accepted:
159.7 142 73.8 65 035.4 085

2.6 Standard Event Status Register



Section 3
Maintenance and Troubleshooting

3.1 Maintenance/ Adjustment Procedures

The Model ESA-C contains no user-serviceable parts. Any problems which cannot be resolved using the guidelines listed should be referred to Newport Corporation factory service personnel. Contact Newport Corporation or your Newport representative for additional assistance.

3.2 Frequently Asked Questions

Why is my AUX BOARD front panel LED not on?

The AUX BOARD LED indicates the presence of an auxiliary circuit board inside the controller. The controller has been designed with future expansion in mind. Currently, there are no boards, such as an internal dither oscillator, available to fill this internal slot.

How do I replace the fuse on the rear panel?

The fuse is replaced by lightly pressing and rotating the fuse retention cap counter-clockwise. After the cap is off, the fuse will pop out and can be replaced with any compatible 1.6-amp, 250-volt fuse.

Why isn't the fan operating?

The fan is controlled by an internal thermostat. The fan will only operate when the amplifier heat sink temperature of the controller exceeds 60° C.

Why do my actuators move when I change from LOCAL to REMOTE mode or conversely from REMOTE to LOCAL mode?

When the controller is in LOCAL mode, the voltage to the actuators is controlled by the front panel knobs. When the actuator is in REMOTE mode, the voltage is controlled by the GPIB commands issued from the host computer. In either case, the front panel display always reflects the voltage being applied to the actuators. When switching from LOCAL to REMOTE, you should first query the controller for the voltages on each axis you are using. By setting and then commanding the controller via the GPIB to those voltages, disturbances will be minimized. When switching from REMOTE to LOCAL, the problem is slightly more complicated. Since there is no way to read the front knob settings via the GPIB, you must make a "blind" switch. If you record the original voltages before switching to REMOTE, you can command the controller to this position before switching back to LOCAL. However, if the knobs have been moved since you switched to REMOTE, you will not know their values when switching to LOCAL and the actuators will move when the controller assumes the LOCAL mode values. Be careful to avoid this situation if you are positioning shock-sensitive equipment. One work-around is to consistently turn the knobs to their minimum position when working with GPIB and commanding the controller to these values before changing modes.

Why does the least-significant digit on my front panel display toggle between two values?

This is because the actual voltage to the actuators is somewhere between the two values that the display toggles between. The toggling occurs in the display only. The actuators are not moving.

3.3 Troubleshooting Procedures

Failure	Possible Cause
Display is blank with no backlighting; no front panel LEDs are lit.	Check rear panel fuse. Check power cord. Check voltage selector on rear panel.
Display shows voltages greater than 9 V but front panel controls do not adjust.	Check for REMOTE LED on. Use GPIB LOCAL command to enable front panel controls.
Display voltages adjust but X, Y, or Z LEDs are not lit.	Check transducer connections on rear panel. CAUTION: DO NOT CONNECT/ DISCONNECT TRANSDUCERS WHILE POWER IS APPLIED.
Display voltages read less than 8 V and do not adjust, or display reads 160 volts.	High voltage power failure. RETURN FOR SERVICE.

Section 4
Factory Service

4.1 Introduction

This section contains information regarding factory service for the ESA-C controller.

4.2 Obtaining Service

To obtain information concerning factory service, contact Newport Corporation or your Newport representative. Please have the following information available:

1. Instrument or component model number
2. Instrument or component serial number (if any)
3. Description of the problem.

If the system is to be returned to Newport Corporation, you will be given a Return Authorization Number, which you should reference in your shipping documents.

Please fill out the service form in Section 4.4 and have the information ready when contacting Newport Corporation. Return the completed service form with the instrument.

4.3 Packaging Instructions

If an ESA-C needs to be returned to Newport for any reason, these packaging instructions should be followed to ensure the safe arrival and timely processing of the returned unit:

1. If possible, return the unit in its original packaging.
2. If the original packaging is damaged or otherwise unusable, duplicate the original packaging to the greatest extent possible. Err on the side of safety where padding and other protection is concerned.
3. Remember to include the Newport Return Authorization Number on the outside of the shipping carton, and on the service form inside the container to assist us in returning your unit to you as quickly as possible.

4.4 Service Form

Newport Corporation
U.S.A. Office: 949/863-3144
FAX: 949/253-1800

Name _____ RETURN AUTHORIZATION # _____

Company _____ (Please obtain prior to return of item)

Address _____

Country _____ Date _____

P.O. Number _____ Phone Number _____

Item(s) being returned:

Model # _____ Serial # _____

Description _____

Reason for return of goods (please list any specific problems) _____

_____

Please complete the below, as appropriate.

List all control settings and describe problem _____

_____

_____

_____ (Attach additional sheets as necessary).

Show a block diagram of your system including all instruments connected (whether power is turned on or not).

Where is the system operating? (controlled laboratory, etc.) _____

What power line voltage is used? _____ Variation? _____

Frequency? _____ Ambient Temperature? _____

Variation? _____ °F Rel. Humidity? _____ Other? _____

Any additional information. (If special modifications have been made by the user, please describe below.)

_____

_____

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