

## 2150/2160 VideoBridge® Impedance Test Instruments

- Over 3000 frequencies from 20Hz to 150kHz
- CRT display
- $\pm 0.02\%$  Basic accuracy
- Fully automatic setup mode
- Variable test voltage and current levels
- 13 Bin sorting
- Remote control via IEEE-488 or RS-232
- Non-Volatile Memory Option
- 2160's Tape drive stores setups
- Turnkey statistics and analog display software

Higher frequency applications are putting new demands on component test equipment. ESI meets these demands with the new 2150 and 2160 VideoBridges, our most flexible and accurate bridges. Now you can test capacitors, resistors and inductors from 20Hz to 150kHz, so you know they work at their higher operating frequencies. Test conditions and readings are always visible on the full-information CRT display.

Microprocessor control gives you unmatched flexibility to measure 16 factors of impedance with a basic accuracy of 0.02%. Wide measurement ranges are illustrated by 0.001pF resolution on the lowest range to 10F full scale on the highest C range.

The VideoBridge allows you to test parts under simulated working



conditions. Measurements can be made with a test frequency from 20Hz to 150kHz at voltages selectable to 1500mV and current selectable to 100mA.

Yet with all this capability, we've made the VideoBridge very easy to use. Setup is a snap with simple keyboard commands or fully automatic with the 2160's built-in tape drive.

Other new features that make the VideoBridge easy to use include test fixture zeroing for all ranges with one simple process, and Auto LRC that automatically selects the proper test parameters: C and D, L and Q, or R.

To make sure test setups are correct, critical test conditions are displayed along with test results on the CRT monitor. Test results such as a measurement value or a sort-

ing bin are displayed in large characters for easy readability.

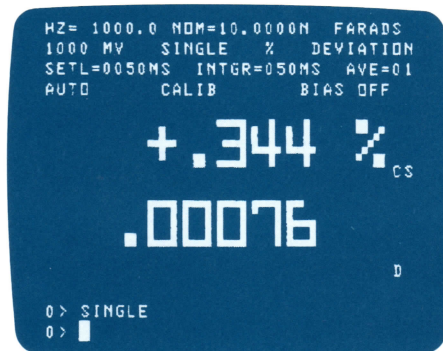
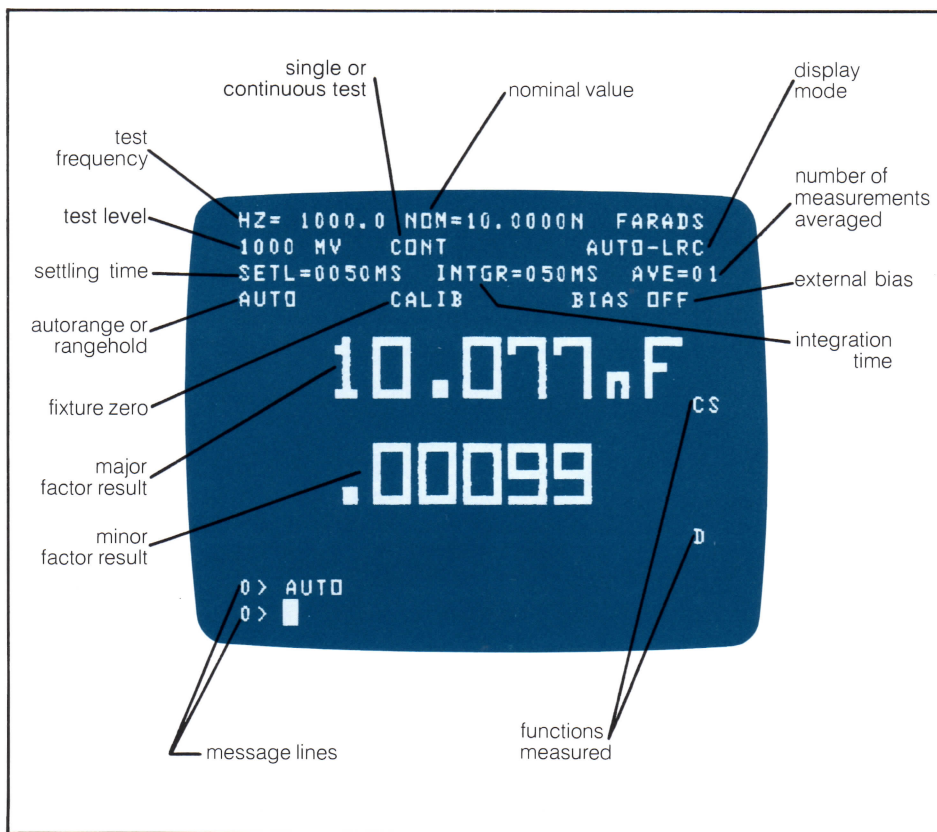
Standard software allows sorting into as many as 13 bins. Measured values can also be displayed in absolute deviation or percent deviation. Interfaces are available for most component handlers.

The Non-Volatile Memory O protects valuable test information. If a power failure should occur, it allows testing to resume quickly when power returns, without loss of data or setup information.

IEEE-488 and RS-232C interfaces allow for remote programming and communication with peripheral equipment. One RS-232 port is standard on the Model 2160.

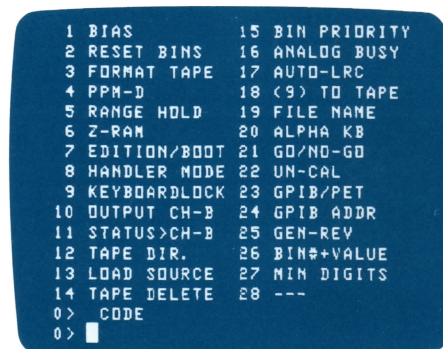
Both VideoBridges feature one joule of input protection from charged capacitors.

# VideoBridge Display Modes



## Deviation Display

The test result can be viewed in terms of absolute deviation or percent deviation from the nominal value. A second measurement function may be displayed below the deviation page reading. See chart on specifications page for possible combinations.

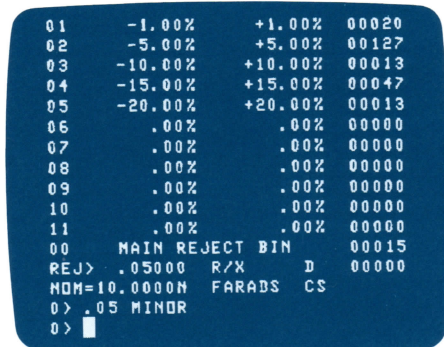


## Test Code Help Display

Test codes provide access to special functions that are not available through the standard function keys. This display provides a handy reference to the available tests codes and their functions.

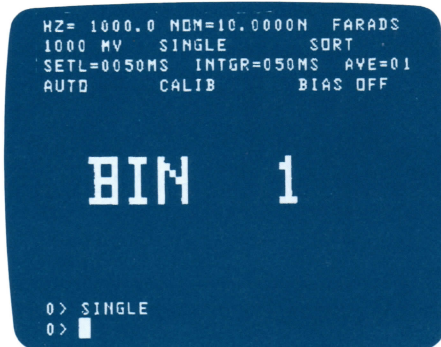
## Direct Display

Two functions of impedance are displayed simultaneously. Possible combinations are shown in chart on specifications page. Test conditions are continuously displayed for monitoring the set-up.



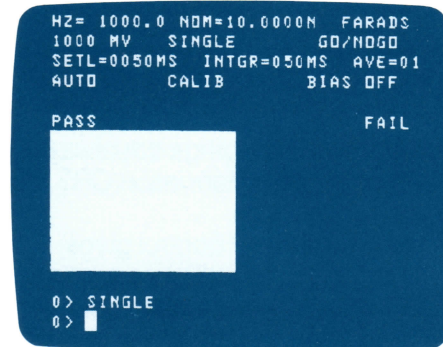
## Status Display

This display is used when setting limits for bin sorting. Up to 11 bins plus major and minor reject may be used. Limits may be set in percent or in absolute. A part count is tallied for each bin and displayed in the right hand portion of the screen.



## Sort Display

Multi-bin hand testing is made easy with the Sort Display. The test result is displayed as a bin location in large characters. Measured values can also be displayed with the bin number.



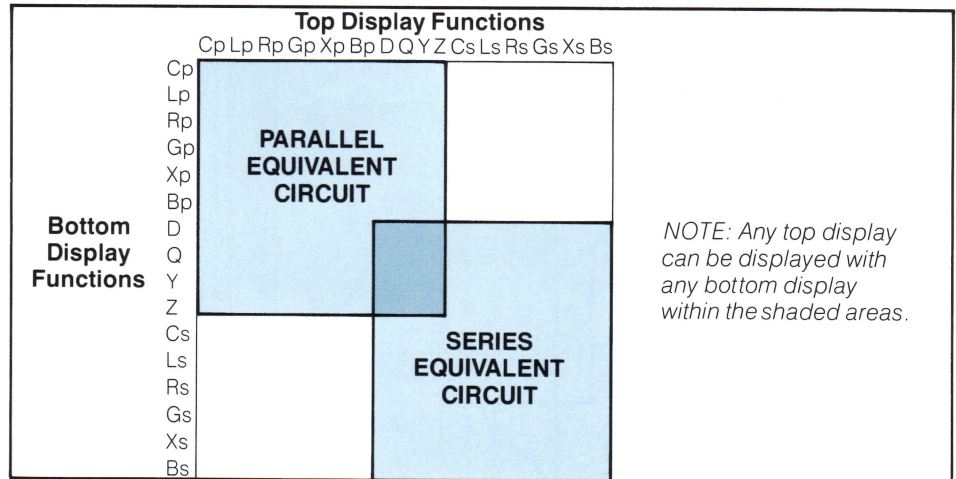
## GO/NO-GO Display

A large block under "pass" or "fail" indicates the test result for fast, accurate GO/NO-GO testing. Bin counts are tallied on the status display.

## VideoBridge Specifications

### Parameters Measured and Displayed

Cs	Series Capacitance
Cp	Parallel Capacitance
Ls	Series Inductance
Lp	Parallel Inductance
Rs	Series Resistance
Rp	Parallel Resistance
D	Dissipation Factor
Q	Quality Factor
Gs	Series Conductance
Gp	Parallel Conductance
Xs	Series Reactance
Xp	Parallel Reactance
Bs	Series Susceptance
Bp	Parallel Susceptance
Y	Admittance
Z	Impedance



### Ranges

<b>L</b>	100pH resolution on lowest range to 100kH full scale on highest range.
<b>R, X and Z</b>	1 $\mu\Omega$ resolution on lowest range to 100M $\Omega$ full scale on highest range.
<b>C</b>	0.001pF resolution on lowest range to 10F full scale on highest range.
<b>D</b>	resolution to 0.000001 = 1ppm
<b>Q</b>	to 1,000,000 counts maximum reading.

### Test Signals

#### Frequency

20Hz to 150kHz in 3023 discrete steps.

#### Voltage Level

5mV to 1500mV in 1mV steps.

Accuracy:  $\pm(4\% + 2mV)$

#### Current Level

0.1mA to 100mA in 0.1mA steps.

Accuracy:  $\pm 4\% + \left( \frac{2mA}{\text{Range}^*} \right)$

\* = Range resistor value in ohms for range of measured part.

### Speed

	DIRECT	SORT and PASS/FAIL	HANDLER*
<b>FAST</b>	~4 measurements/second	~9 measurements/second	~6 meas./second ~9 meas./second**
<b>MEDIUM</b>	~2 measurements/second	~2 measurements/second	~2 measurements/second
<b>SLOW</b>	~5 seconds/measurement	~5 seconds/measurement	~5 seconds/measurement

\*Single mode only

\*\*With 2ms setting time and 2ms integration time

Required test conditions to attain specified measurement speeds are as follows: frequency—1kHz, signal level—1000mV, value of component-under-test—1nF, ranging status—RANGE HOLD, measurement mode—Continuous (except where indicated).

*Note: For remote GPIB communications, add ~350ms per measurement*

### Loads to Guard

The total load impedance (Z) to the guard point must be greater than or equal to the impedance of the device under test.

### Input Protection

Protection Circuitry absorbs up to 1 joule from a charged component. Maximum voltage is 1kV at 2.0 $\mu$ F and decreases with increasing capacitance according to:

$$V_{\max} = \sqrt{2/C}$$

### External Bias

+50VDC maximum (+200VDC optional), limit 100mA.

### Integration Time

Selectable from 2ms to 600ms (as a multiple of the period of selected test frequency).

### Settling Time

Selectable from 2ms to 1500ms in 1:ms steps.

### Number of Averages

Selectable from 1 to 20

### Display

Up to 6 digits selected automatically for measurement results, dependent on measurement speed and frequency.

### Power Requirements

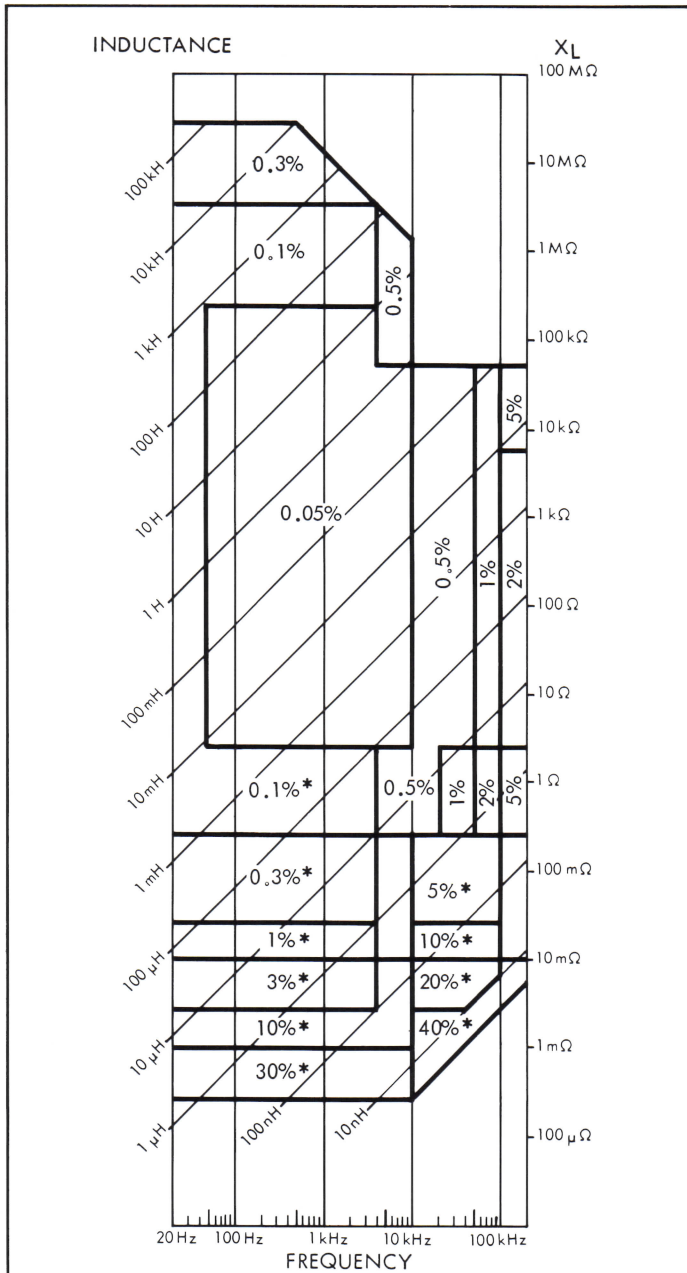
115VAC (+15%, -22%), 48-66Hz, 100W  
230VAC (+9%, -22%), 48-66Hz, 100W

### Dimensions

Height	13.3cm	(5.25in)
Width	32.4cm	(12.75in)
Depth	46.4cm	(18.25in)
Weight	14.5kg	(32lbs)

# VideoBridge Accuracy Specifications

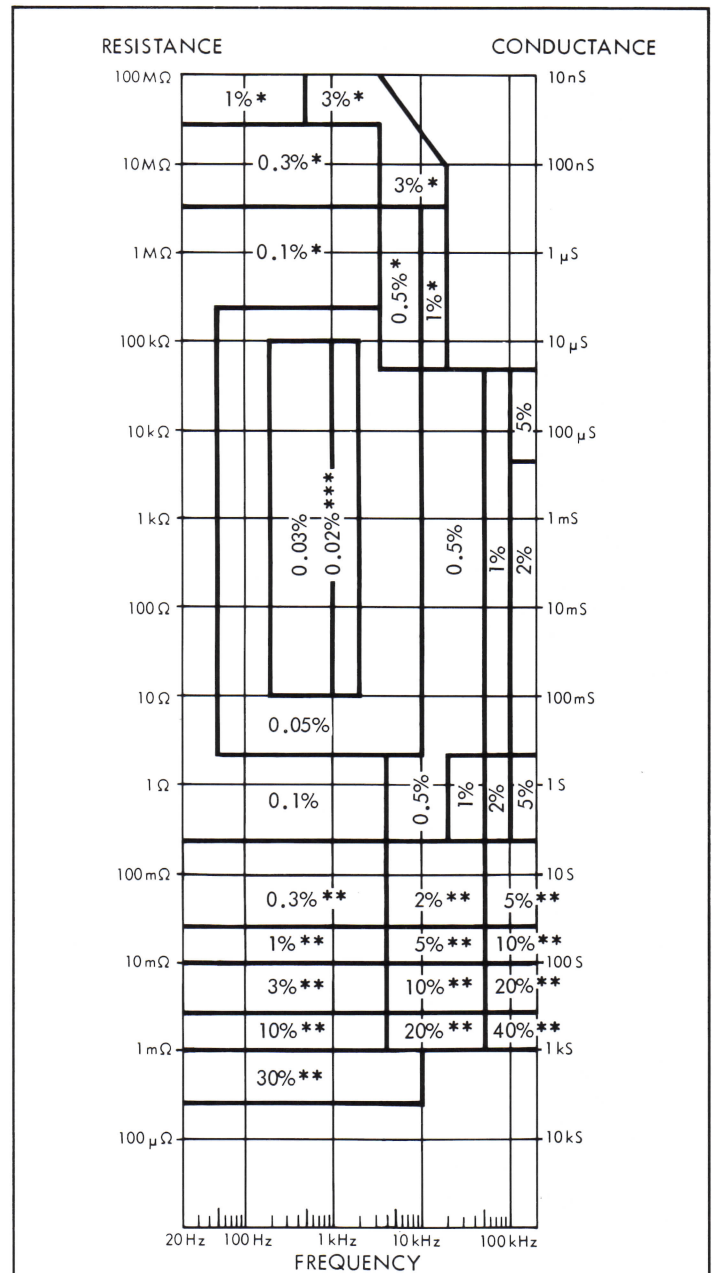
Inductance Measurement Accuracy



$$* + \left( \frac{0.01 \mu\text{H}}{f(\text{kHz})} + 0.01 \mu\text{H} \right)$$

If  $D > 1$ , add  $[0.1\% (1 + 0.3D^2)]$  to accuracies shown

Resistance/Conductance Measurement Accuracy



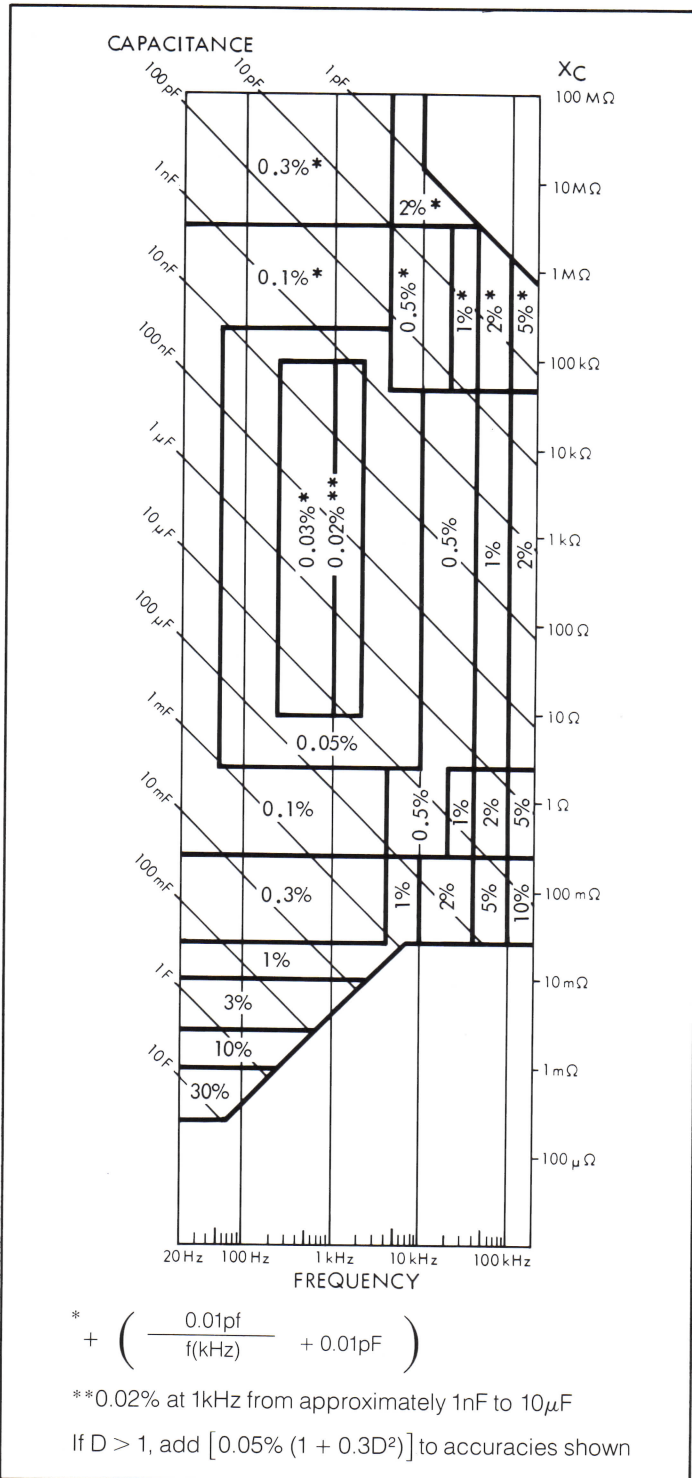
$$* + [0.01 \text{nS} \times f(\text{kHz}) + 0.5 \text{nS}]$$

$$** + [0.01 \text{m}\Omega \times f(\text{kHz}) + 0.1 \text{m}\Omega]$$

\*\*\*0.02% at 1 kHz for 10Ω to 100kΩ

If  $Q > 1$ , add  $[0.1\% (1 + 0.3Q^2)]$  to accuracies shown

## Capacitance Measurement Accuracy



## Accuracy

### Test Conditions:

Level	1000mV/100mA	Zero	Calibrated
Speed	Medium	Connections	Fully shielded
Range	Auto	$V_{\text{test}} = 800\text{mV}$ to $1500\text{mV}$	
Bias	Off	$I_{\text{test}} = 50\text{mA}$ to $100\text{mA}$	

For  $V_{\text{test}} < 800\text{mV}$  Multiply Basic Accuracy by:

$$\left( 1 + \frac{300}{\text{mV}} \right) \left( 1 + \frac{\text{kHz}}{10} \right)$$

For  $I_{\text{test}} < 50\text{mA}$  ( $Z > 16\Omega$ ) Multiply Basic Accuracy by

$$\left( 1 + \frac{300}{\text{mA} \times Z(\Omega)} \right)$$

For  $I_{\text{test}} < 50\text{mA}$  ( $Z \leq 16\Omega$ ) Multiply Basic Accuracy by

$$\left( 1 + \frac{30}{\text{mA}} \right)$$

### Basic Accuracy

$\pm 0.02\%$  at 1kHz

### Basic D Accuracy

(in C Mode)  $\pm 0.00025(1+D^2)$

(100kHz)  $\pm 0.003(1+D^2)$

### Correction factors

For high impedance, ( $Z \geq 10\text{M}\Omega$ ), add the following correction factor to the basic D or Q accuracy:

$$\left[ 0.0005 \left( \frac{Z \text{ (in megohms)}}{10\text{M}\Omega} \right) \right]$$

For low impedance measurements, ( $Z \leq 1\Omega$ ), add the following to the basic D or Q accuracy:

$$\left[ 0.0005 \left( \frac{1}{Z \text{ (in ohms)}} \right) \right]$$

For test frequencies  $> 1\text{kHz}$  and  $\leq 10\text{kHz}$ , multiply the basic D or Q accuracy by:

$$\left( 1 + \frac{\text{Frequency (in Hz)}}{3000} \right)$$

For test frequencies  $\leq 200\text{Hz}$ , multiply basic D or Q accuracy by:

$$\left( 1 + \frac{60}{\text{Frequency (in Hz)}} \right)$$

For test frequencies  $> 10\text{kHz}$  multiply basic D or Q accuracy by:

$$\left( 1 + \frac{\text{Frequency (in kHz)}}{3} \right) \left( 1 + \frac{Z \text{ (in k}\Omega\text{)}}{100\text{k}\Omega} \right)$$

For test voltage  $< 800\text{mV}$ , multiply basic D or Q accuracy by:

$$\left( 1 + \frac{300}{\text{Test voltage (in mV)}} \right)$$

For test current  $\leq 100\text{mA}$ , multiply basic D or Q accuracy by:

$$\left( 1 + \frac{300}{\text{Test current (in mA)} \times Z \text{ (in ohms)}} \right)$$

### Basic Q Accuracy

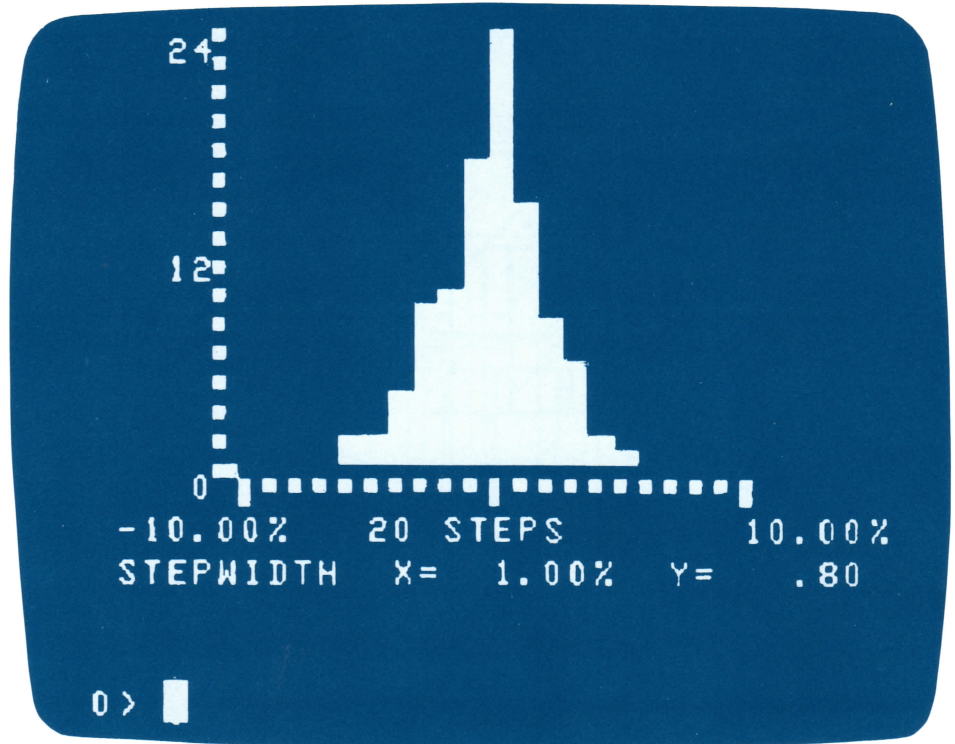
All components (Medium, slow speed):  $\pm 0.035 \left( Q + \frac{1}{Q} \right) \%$

All components (fast speed):  $\pm 0.05 \left( Q + \frac{1}{Q} \right) \%$

*Note: Properly shielded test leads and connections are required to achieve maximum specified accuracy.*

## 2160 VideoBridge Statistics Software

- For incoming inspection or production QC
- Complete component test statistics —  
Mean values  
Standard deviation  
Histogram  
Yield prediction
- 2160 VideoBridge does all computations
- Alphanumerics and prompts for easy setup
- Configurable to meet your needs
- Tape storage of bridge and program setups
- Display results on 2160 CRT or send to a printer
- Compatible with manual testing or a parts handler



Monitoring component quality is now faster and easier with VideoBridge Statistics Software. You get complete component lot and test sample statistics automatically and at a reasonable cost — without a computer.

Just load the Statistics Software into your ESI Model 2160 VideoBridge. Then configure it for the measurements and statistics you want. The VideoBridge does all the data collection and statistical analysis.

You can get component lot yield prediction for any sample size tested. Test recording and lot statistics are all taken care of by the Statistics Software. No more hand calculations. Lot qualification has never been so quick or easy.

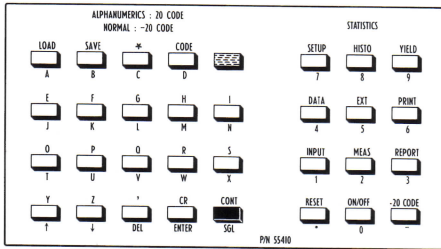
You get the data you need for strict quality control — a test setup record, mean values of primary and secondary measurements, standard deviation, yield prediction for various tolerance limits, and a histogram of parts distribution around nominal.

In all, there are four pages of output data. Each can be displayed on the VideoBridge. For permanent records, each can be output to an RS-232C compatible printer.

Measurements can be triggered manually or by a parts handler interfaced to the VideoBridge. The ESI Model 410 Auto LRC Meter can also be used with the VideoBridge for 1MHz measurements and statistics.

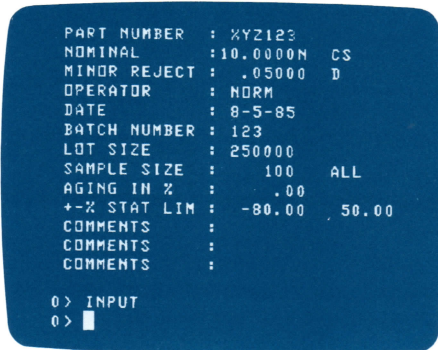
Setting up any configuration is easy. Bridge test and sort parameters are entered in the usual manner. Alphanumerics and a keyboard overlay are used to set up the Statistics Software. On-screen prompts guide you through it.

Plus, standard setups need only to be input once. Just save them on a microcassette tape. They can then be automatically loaded again when needed.



## Keyboard Overlay

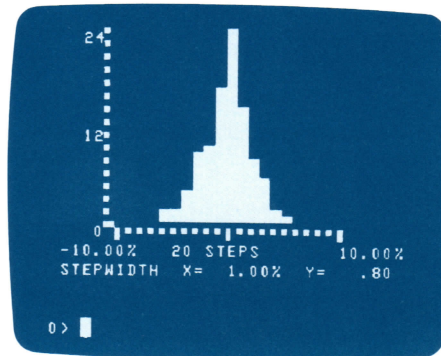
Alphanumeric mode and a keyboard overlay are used for setting up the Statistics Software. Prompts on the VideoBridge screen direct alphanumeric input. Single buttons are provided for input and output functions. For example, SETUP, HISTO, YIELD, and DATA display each output page on the VideoBridge. PRINT causes the display to be output over the RS-232C. MEAS puts the VideoBridge in the measurement mode to begin testing.



## SETUP Page

Press SETUP and the SETUP page is displayed. Then press INPUT to get the cursor prompt on the display. The cursor can be moved up or down with the arrow keys.

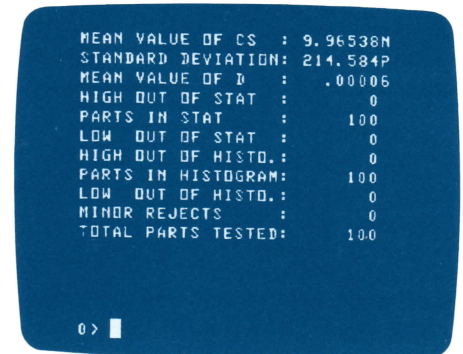
Data entry is straightforward with alphanumeric keys. Information about the part being tested, operator identification, test date, lot and sample size, aging constant, and test limits are entered on this page. Three blank lines for additional comments are also provided.



## Histogram Page

At setup,  $\pm$  limits are entered for the histogram display. Also, the horizontal scale can be set for the best resolution for your sample.

The histogram output will be computed from measurements falling between the entered limits. The graph is a measurement distribution about the nominal part value.

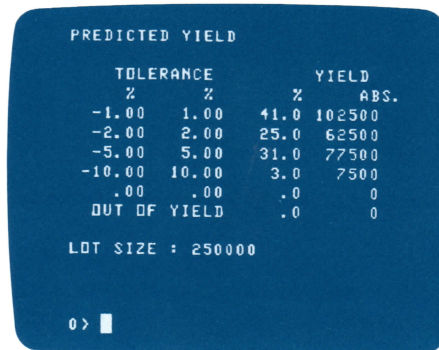


## Data Summary

The DATA page contains a summary of test statistics. Mean values are given for the primary and minor measurements, standard deviation, number of parts measured, etc.

## Printer Output

All of the above output pages can be displayed directly on the VideoBridge or output over an RS-232C interface to your printer. Each page can be printed individually or in combination as a full report.



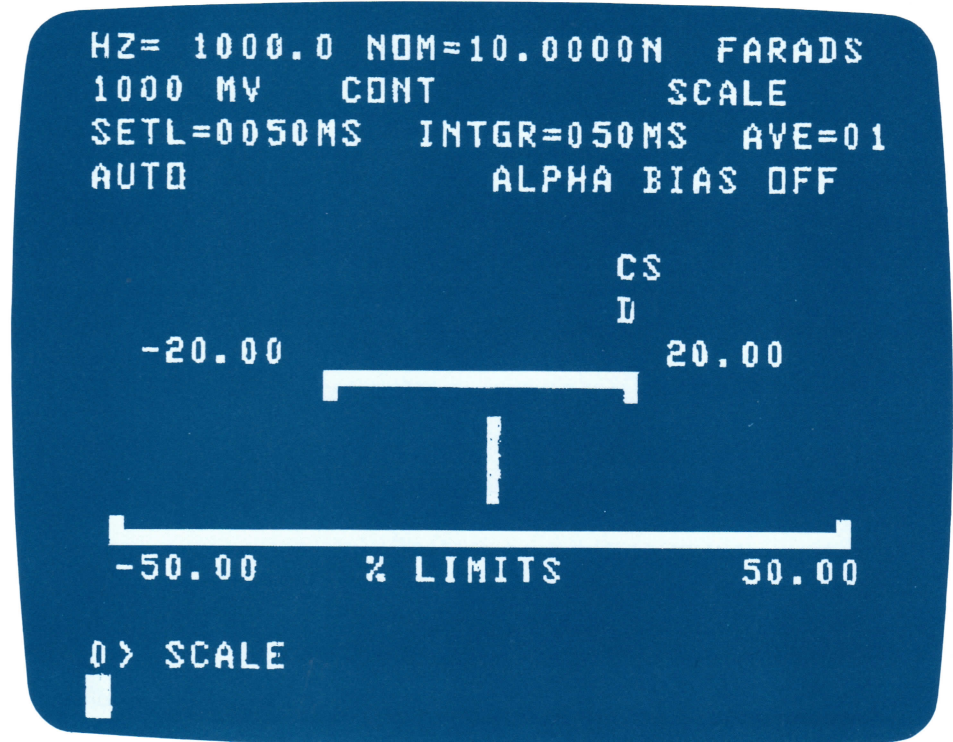
## Yield Prediction

At setup, the percent tolerances of interest are entered here. Typically, these are set to match the bin limits set for sorting.

Predicted yield is automatically computed and entered on this page after the samples have been measured. The prediction is given both as percent of lot size and as an absolute number of parts.

# 2160 VideoBridge Analog Display Software

- Designed for precision tuning of passive components
- Easy-to-read analog display
- Replaces analog comparator bridges
- No external standards required
- 3 Convenient scale and cursor formats
- Menu-driven setup
- Tape storage of bridge and program setup
- Measurement results displayed on CRT and sent to a printer



The Analog Display Software speeds passive component tuning by providing an easily interpreted scale and cursor display on the 2160 VideoBridge. This package replaces analog comparator bridges so there is no need for external standards.

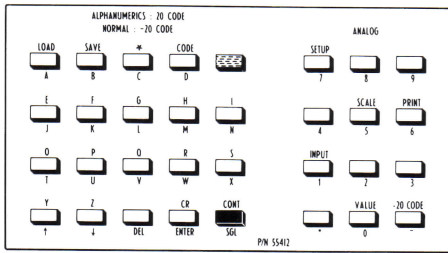
VideoBridge measurements are displayed in an analog scale. You simply make component adjustments until the cursor lines up with the nominal value mark. Adjustment of inductors and trimming film capacitors is quick and easy with this method.

Three scale configurations are available. The simplest is a scale between limits with the nominal value marked. Another has a bracket spanning a tolerance limit. The third configuration uses two scales, one for coarse tuning, and a second, high-resolution scale for fine adjustments.

In all three scale configurations, maximum travel of the cursor during tuning is also marked.

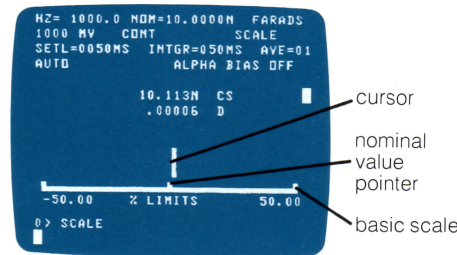
Software setup is menu-driven, and setups can be stored on tape by the 2160. The 2160 measurement configuration can also be included in the setup and stored as an autoload file. Autoload files allow the system to be brought up fully configured and running. This is a great convenience for often used configurations. Full details for creating various working tape configurations are given in the instruction manual provided with the Analog Display Software.





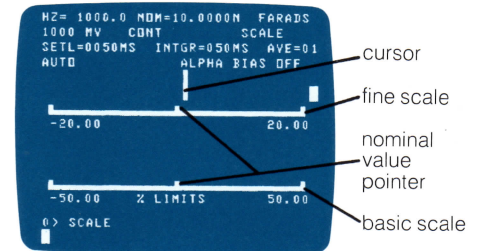
## Keyboard Overlay

An alphanumeric mode and VideoBridge keyboard overlay are used for setting up the Analog Display Software. Single buttons are provided for special input and output functions. For example, SETUP causes the SETUP to be displayed. INPUT causes a cursor prompt to appear for entering the nominal value and SCALE limits. VALUE causes the most recently measured values to be displayed, and PRINT causes those values to be output to a printer.



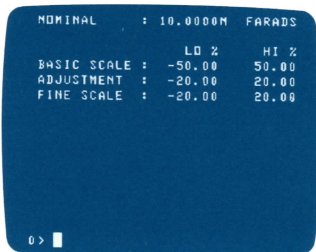
## BASIC Scale

The BASIC Scale display includes the VideoBridge test parameters as well as the BASIC analog scale display. The scale includes indicators and labeling for the nominal value and the minimum and maximum percent of nominal. Cursor position indicates percent deviation from nominal. For underrange or overrange indications, the cursor remains at the scale limit and changes to an arrow shape. This scale is useful for adjusting to nominal value or for tuning maximum and minimum values on variable components.



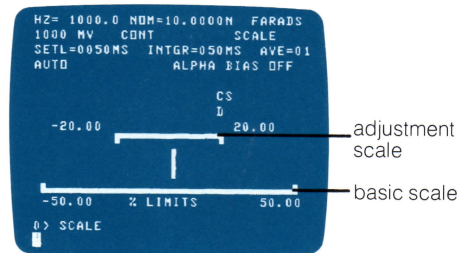
## FINE Scale

The FINE Scale display provides two scales: the BASIC scale and a fine adjustment scale above it. The nominal value is indicated on both scales. Rough adjustments, those outside the limits set for the fine scale, are indicated by cursor movement relative to the BASIC scale.



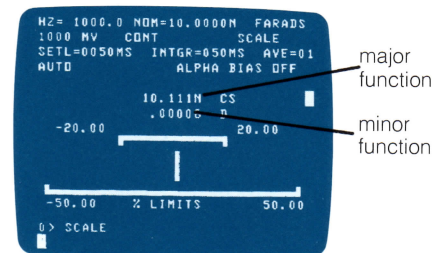
## SETUP Page

Press SETUP and the SETUP page is displayed. Then press INPUT to raise the cursor prompt. This page is used to program the desired nominal value and limits. It also controls which scale is displayed. Selections are made by using the INPUT key and arrow keys to move a cursor to the desired parameter for entry.



## ADJUSTMENT Scale

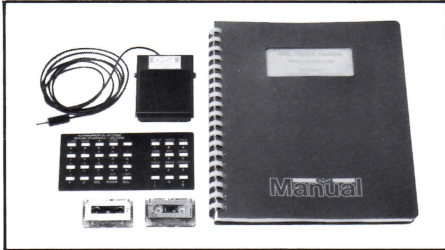
The ADJUSTMENT Scale is the BASIC scale with a tolerance bracket added. This tolerance bracket indicates a range for desired adjustment. A nominal value indication is not provided since component adjustment with this scale is to a desired range rather than a nominal value.



## VALUE and PRINT Functions

When the VALUE Option is selected, the current measured major and minor parameters are shown on the display above the analog scale. These parameters may also be output over the VideoBridge RS-232C interface to your printer. Printer output is initiated with the PRINT key on the Analog Display overlay.

# VideoBridge Options



## 55104 Statistics Software for Model 2160

ESI Statistics Software comes as a complete package. Included in the package are the following items: Statistics Software on a microcassette tape, a manual, a footswitch assembly, a blank, formatted microcassette tape, and a keyboard overlay.



## 55103 Analog Software for Model 2160

ESI Analog Display Software comes as a complete package. Included in the package are the following items: Analog Display Software master tape, one blank tape for creating a working copy of the software, and Analog Display Software Keyboard Overlay, and a software manual.

## 55843 Non-Volatile Memory Option

A factory installed option that stores test set-ups and bin counts for protection from power failures. A test code retrieves set-up and bin count data present at the time of power loss.

## SP5240 200VDC Bias Option

This option increases the external bias limit to +200VDC.

## SP2634 Rack Mount Kit

This option allows installation in a standard 19-inch rack cabinet. Includes mounting brackets and hardware.

## 46725 General Purpose Interface Bus—GPIB(IEEE-488 1978)

A GPIB interface allows the 2150/2160 to communicate with other instruments and controllers for automatic testing applications. The GPIB option meets IEEE-488 1978 specifications. Supports: Talk, Listen, SRQ.

## 46724 RS-232C/Teletype Interface

This interface option (standard in 2160) enables the VideoBridge to operate with any 3 wire, serial bus system. Available baud rates are: 150, 300, 600, 1200, 2400, 4800, 9600.

## Handler Interface Options

Handler interfaces enable operation with automatic parts handling equipment. Consult ESI for interfaces to custom designed parts handlers and handlers not listed here.

## 47895 General Purpose Handler Interface.

Used for 2150/2160 connection to many handlers, including most manufactured by Q-Corporation, Engineered Automation, Ismecca and Heller.

## 47896 Daymarc Handler Interface.

Interfaces 2150/2160 directly to Daymarc handlers.

## 47897 MCT Browne Handler Interface.

Interfaces 2150/2160 directly to MCT Browne handlers.

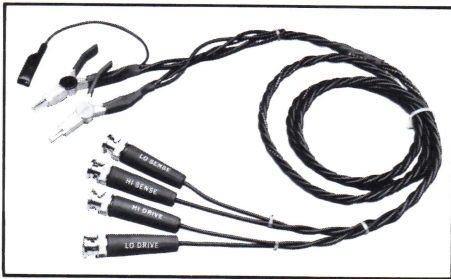
*Note: 2160 can have only one of the following options—IEEE or Handler Interface.*

*2150 can have two of the following options—IEEE, RS 232C or Handler Interface.*

## VideoBridge Accessories

### Standard Equipment

The Model 2150/2160 comes equipped with a 47454 Kelvin Klip® set and an instruction manual, P/N 54327. The Model 2160 also includes 16K of memory and one RS-232C I/O port.



### 47454 Kelvin Klips

Kelvin Klips allow you to make solid four-terminal connection to leaded components. Four-terminal technique allows precision measurement of component by minimizing effects of lead resistance.

They are particularly useful for hand testing electrolytic capacitors and inductors, but can be used for most components. Gold plated, hardened beryllium-copper jaws ensure low contact resistance, low thermal emf to copper, high corrosion resistance and long service life. Alligator clip allows connection of passive guard. Assembly includes a 1.5m (5 ft.) cable assembly for connection to 2150/2160.

Note: Loss of accuracy may result when Kelvin Klips are used under certain measurement conditions. To ensure specified instrument accuracy we recommend using a test fixture 2001, 2003, 2004 or 2005 chip component tweezers whenever:

- C < 100pF
- L < 100μH
- R > 1MΩ
- Frequency > 10kHz

### 55852 Formatted Microcassette Tape

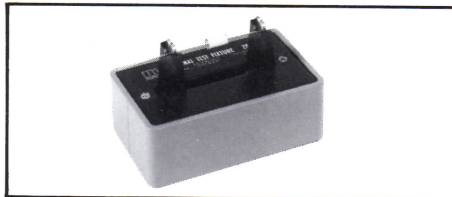
Computer grade tape, formatted for use with Model 2160.

### 52155 Footswitch

Operates start switch while leaving hands free during hand testing.

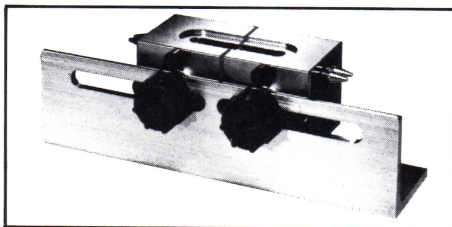
### 52070 Extender Card

Allows easy access to PC boards during service and required for calibration.



### 2001 Sorting Fixture

Speeds handling time while ensuring solid four-terminal connection. Can be used with axial-leaded components as long as 66mm (2.6 in.) and radial-leaded components as small as 20mm (0.78 in.) between leads. Socket for banana plug provides means of grounding to chassis. Drive and sense connections are made through BNC connectors. Requires BNC-to-BNC cables for connection to 2150/2160.



### 2003 Sorting Fixture

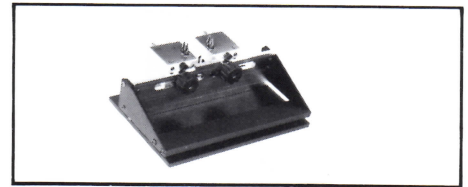
When you need a four-terminal test fixture flexible enough to sort large axial leaded and small radial components, the 2003 is recommended. Rotation of the test heads allows the Model 2003 to accommodate axial or radial leaded components.

The versatility of this fixture allows it to accept up to 110mm (4.3 in.) long axial leaded components and radial leaded components with lead spacing as small as 5mm (0.2 in.). Rugged construction makes this fixture excellent for high-volume, hand sorting applications. Requires BNC-to-BNC cables for connection to 2150/2160.

### SR1 Resistance Standards

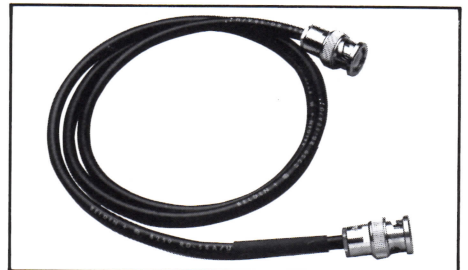
The following resistance standards are recommended for calibrating Models 2150 and 2160.

- SR1/1Ω
- SR1/10Ω
- SR1/100Ω
- SR1/1kΩ
- SR1/10kΩ
- SR1/100kΩ
- SR1/1MΩ



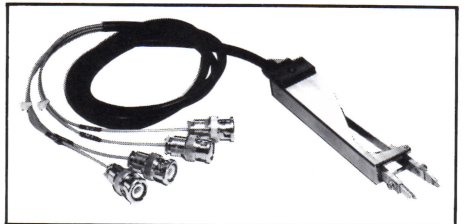
### 2004 Zero-Insertion-Force Sorting Fixture

This fixture is a Model 2003 sorting fixture with the addition of a lever. A touch of the lever opens the jaws for insertion of the part, reducing the possibility of damaging the component leads. The 2004 is particularly useful for small components with fragile leads. Test heads accept components up to 110mm (4.3 in.) long and as small as 5mm (0.2 in.) between leads on radial leaded components. Requires BNC-to-BNC cables for connection to 2150/2160.



### BNC-to-BNC Coaxial Cables

BNC-to-BNC cables are required for connection of the 2150/2160 to the 2001, 2003, and 2004 sorting fixtures. Five foot cables are recommended to maintain calibration accuracy. P/N 53155 1.5m (5 ft.) BNC-to-BNC cables, set of 4.



### 2005 Chip Component Tweezer Set

This four-terminal tweezer set makes solid connections to chip components in hand sorting applications. Capacity of jaws is 12.7mm (0.5 in.). The 2005 Chip Component Tweezer Set includes a 1.0m (39 in.) cable for connection to the 2150/2160. Contact tips are replaceable, P/N 47422.

### Warranty of Quality

Electro Scientific Industries, Inc. warrants its products to be free from defects in material and workmanship. Rigorous quality control permits the following standard new equipment warranties: 1. One year on components and instruments utilizing active circuitry. 2. Two years on components and instruments utilizing exclusively passive circuitry.

During the warranty period, we will service or, at our option, replace any device that fails in normal use to meet its published specifications. Batteries, tubes and relays that have given normal service are excepted. Special systems will have warranty periods as listed in their quotation.

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Unless specifically requested by the customer, ESI does not inspect or test an

instrument for compliance with applicable safety standards of the Bureau of Radiological Health or with any other governmental or industry standard. Customers who desire an inspection or test for conformity to a standard should specify the standard with particularity. Not all instruments can be modified to conform with standards adopted after the instrument was manufactured, and such modifications are not repairs, nor is failure to comply with a standard adopted after the date of manufacture a defect.

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