Table 1-3. General Specifications (cont)

5442A:

Output Uncertainty Compared to Calibration Standards, ±5°C

RANGE	UNCERTAINTY SPECIFICATION: ±(PPM OF OUTPUT + MICROVOLTS)			
	30 DAYS	90 DAYS	180 DAYS	1 YEAR
0V to 11V	2.5 + 5 μV	3.0 + 5 μV	4.5 + 5 μV	6.5 + 5 μV
11V to 22V	2.5 + 8 μV	3.0 + 8 μV	4.5 + 8 μV	6.5 + 8 μV
22V to 275V	3.0 + 100 μV	3.5 + 100 μV	5.0 + 100 μV	7.0 + 100 μV
275V to 1100V	3.0 + 400 μV	4.0 + 400 μV	5.5 + 400 μV	8.0 + 400 μV
DIVIDED OUTPUT				
0-220 mV	6 + 0.5 μV	7 + 0.5 μV	9 + 0.5 μV	12 + 0.5 μV
0.22-2.2V	4 + 1 μV	6 + 1.0 μV	8 + 1.0 μV	11 + 1.0 μV

Uncertainty of Calibration Standards (Fluke 732A and 752A) Compared to National Standards

RANGE	UNCERTAINTY OF STANDARDS
0V to 11V	1.5 PPM
11V to 22V	1.5 PPM
22V to 275V	1.7 PPM
275V to 1100V	2.0 PPM
0V to 220 mV	4.0 PPM
0.22 to 2.2V	2.0 PPM

Output Stability

Specifications apply for initial stabilizations of two hours, constant ambient temperature of ±1°C, constant line voltage, constant load, and measurement bandwidth of 0.1 Hz to 1 Hz.

RANGE	±(PPM OF SETTING + FLOOR)		
	10 MINUTES	24 HOURS	30 DAYS*
0V to 11V	0.2 +2 μV	0.3 + 3 μV	0.5 + 3 μV
11V to 22V	0.2 + 3 μV	0.4 + 4 μV	0.5 + 4.5 μV
22V to 275V	0.3 + 40 μV	0.3 + 50 μV	1.0 + 60 μV
275V to 1100V	0.3 + 200 μV	0.3 + 200 μV	1.0 + 300 μV
DIVIDED OUTPUT			
0 mV to 220 mV	0.5 + 0.2 μV	0.5 + 0.2 μV	2 + 0.3 μV
0.22V to 2.2V	0.5 + 0.2 μV	0.5 + 0.5 μV	2 + 0.7 μV

*For best results, use internal calibration for periods exceeding one day.

Temperature Coefficient of Output

These specifications apply for ambient temperatures outside the ±5°C range of the uncertainty specifications listed earlier.

RANGE	±(PPM OF SETTING) PER °C			
	0-10°C	10-30°C	30-40°C	40-50°C
0V to 11V	0.15 ppm	0.1 ppm	0.4 ppm	1.0 ppm
11V to 22V	0.15 ppm	0.1 ppm	0.4 ppm	1.0 ppm
22V to 275V	0.2 ppm	0.2 ppm	0.6 ppm	1.5 ppm
275V to 1100V	0.2 ppm	0.2 ppm	1.0 ppm	1.5 ppm
DIVIDED OUTPUT				
0-220 mV	0.5 ppm	0.5 ppm	0.5 ppm	1.2 ppm
0.22-2.2V	0.5 ppm	0.5 ppm	0.5 ppm	1.2 ppm

Table 1-3. General Specifications (cont)

Linearity

These specifications apply for the ambient temperature range of 15° C to 30° C within ±5° C of the external calibration temperature.

RANGE	±PPM OF OUTPUT + MICROVOLTS)
0 mV to 220 mV	0.5 ppm + 0.2 μV
0.22V to 2.2V	0.7 ppm + 0.3 μV
0V to 11V	0.5 ppm + 1.5 μV
11V to 22V	0.5 ppm
22V to 275V	0.5 ppm + 40 μV
275V to 1110V	1.0 ppm

RESOLUTION

RANGE	RESOLUTION	MAXIMUM SETTING	MAXIMUM LOAD OR OUTPUT RESISTANCE
0V to 11V	1 μV	11.000000V	60 mA
11V to 22V	1 μV	22.000000V	60 mA
22V to 275V	10 μV	275.000000V	25 mA
275V to 1100V	100 μV	1100.0000V	25 mA
DIVIDED OUTPUT			
0 to 220 mV	0.01 μV	220.00000 mV	495Ω
0.22V to 2.2V	0.1 μV	2.2000000V	450Ω

OUTPUT NOISE

RANGE	BANDWIDTH	
	0.1 HZ TO 10 HZ	10 HZ TO 10 KHZ
0 mV to 220 mV	0.1 μV	5 μV
0.22V to 2.2V	0.2 μV	15 μV
0V to 11V	1.5 μV	30 μV
11V to 22V	3.0 μV	50 μV
22V to 275V	35 μV	150 μV
275V to 1100V	100 μV	300 μV

Output Settling Time

Time to settle within a given uncertainty band of final value, for a change in programmed output within a given range.

RANGE	±PARTS PER MILLION OF CHANGE*		
	3 SECONDS	5 SECONDS	10 SECONDS
0 mV to 220 mV, 0.22V to 2.2V, 0V to 11V, and 11V to 22V	7 ppm	2 ppm	0.5 ppm
22V to 275V 275V to 1110V	7 ppm	2 ppm	3 ppm

*Add 0.5 seconds for any change in range up to 22V, 1.0 second for a change from 22V up, and 0.5 seconds for a change from STBY to OPER.

Table 1-4. Physical and Environmental Specifications

Line Power Requirements

NOMINAL SETTING	VOLTAGE LIMITS	FUSE	TYPICAL POWER
100V	90-110V	2A/250V	84 watts when in standby at nominal line, 145 watts when in 1100V range 25 mA output and high line
110V	99-121V	2A/250V	
115V	103.5-126.5V	2A/250V	
120V	108-132V	2A/250V	
200V	180-220V	1A/250V	
220V	198-242V	1A/250V	
230V	207-253V	1A/250V	
240V	216-264V	1A/250V	

Line Regulation

Less than ±0.1 ppm of range for a line voltage change ±10% of nominal.

Temperature and Humidity

CONDITION	TEMPERATURE	% RELATIVE HUMIDITY (NON-CONDENSING)
Non-Operating	-40°C to +75°C	Not controlled
	0°C to +50°C	≤95% ±5%
Operating	0 to 30°C	≤95% ±5% [1]
	+30 to +40°C	≤75% ±5%
	+40 to +50°C [2]	≤45% ±5%

Notes: [1] Accuracy degradation above 80% R.H.
[2] Instrument accuracy is degraded above 40°C due to loss of oven regulation.

Altitude

Non-Operating 0-12,200m (40,000 feet)
Operating 0-3,050m (10,000 feet)

Vibration

FREQUENCY	FORCE FREQUENCY	DOUBLE AMPLITUDE
5-15 Hz	0.7G at 15 Hz	0.06 in
15-25 Hz	1.3G at 25 Hz	0.04 in
25-55 Hz	3G at 55 Hz	0.02 in

Shock: 18 shocks, 20G, 1/2 sinewaves.
Size: 61cm L x 43cm W x 24cm H (24.0in L x 17.0in W x 8.75in H).
Weight: 30.2 kg (66.4 lb)
Warranty: 1 year, parts and labor (see specific warranty policy).
Compliance with External Standards
ANSI C39.5 Dec 1980
IEC 348 Second Edition 1978

EMI/RFI Review Standards
FCC Rules Part 15, Subpart J
VDE 0871
MIL STD 461B

EMI/RFI Conducted Emissions
VDE 0871
FCC Part 15 J Class
CISPR 11

Radiated EMI/RFI Emissions
Meets or exceeds all VDE and FCC requirements.

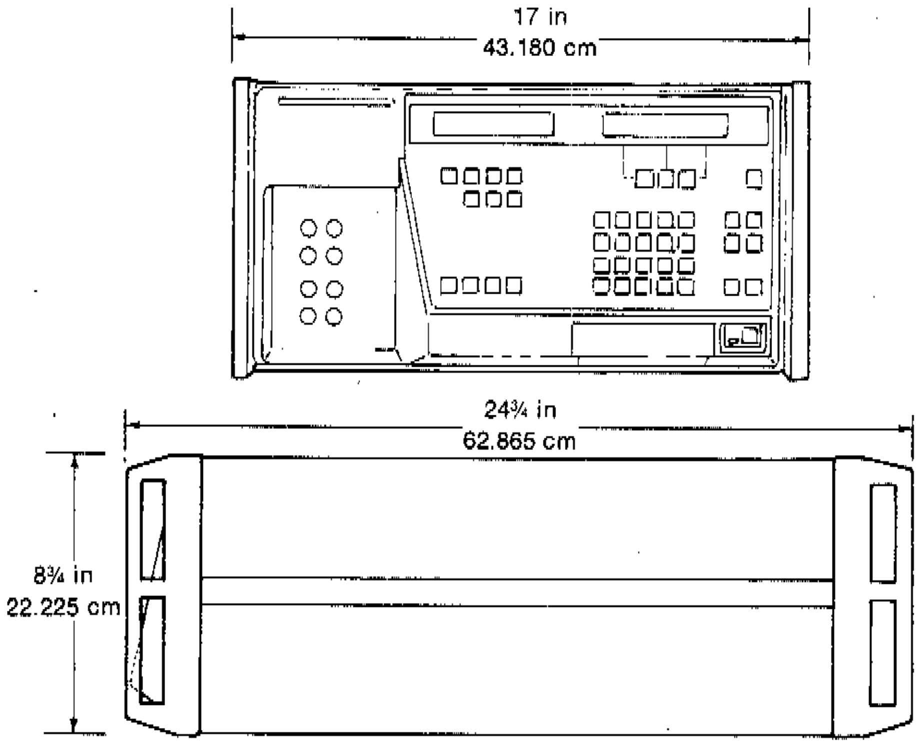

Figure 1-1. Outline Dimensions

INTERPRETING SPECIFICATIONS 1-9.

An industry-wide standard for specifications has not yet been accepted. Therefore, the following paragraphs provide information to help you understand the general specifications in Table 1-3.

Interpreting specifications involves translating the general data provided by the manufacturer (Fluke, in this case) into the specific data you require. The translation process varies according to the type of specifications and the number of independent contributions to the final result. Independent contributions include the range, uncertainty, stability, traceability, etc.

Accuracy and Uncertainty 1-10.

Specifications for calibration instruments include a statement describing their freedom from error, usually expressed as a percentage or absolute value. This freedom from error is frequently expressed as "accuracy." However, a more useful expression of error is "uncertainty," which is the allowed deviation from a known value.

Uncertainty is equal to one minus the percent of accuracy. To illustrate, a soap which is 99.9% pure ("accurate") is 0.1% impure ("uncertain"). Whereas accuracy is typically a large number, uncertainty is typically a small number.

An uncertainty specification can be difficult to interpret because it may be expressed using three different types of statements, which can be combined in several different ways:

- Percent of output
- Percent of full scale
- Number expressed in units (e.g., microvolts)

Uncertainty specifications are further obscured through the use of various terms like percent or parts per million (or ppm) and the use of various units (like μV).

Absolute Uncertainty 1-11.

Absolute (or "total") uncertainty refers to the deviation of a calibrator's output from a national standard (the national standard volt, in this instance). Absolute uncertainty provides a direct measure of the calibrator's traceablility to national standards.

Absolute uncertainty is the combination of two main factors: the uncertainty of the calibrator itself (the relative uncertainty), and the uncertainty of the reference standard used to calibrate the calibrator (the reference standard's traceability). In addition, absolute uncertainty must include the uncertainty added by the calibrator's drift over time (its "stability"), as well as the the drift of the reference standard over time.

The 5440 Series Calibrators are normally calibrated with the 732A Direct Voltage Reference Standard. In this case, the absolute uncertainty specifications of the 5440 Series Calibrators must include the uncertainty of the 732A.

Relative Uncertainty 1-12.

Relative uncertainty specifications describe the uncertainty of the calibrator itself. They do not include the uncertainty of the standards used to calibrate the calibrator.

The benefit of relative uncertainty specifications is that they let you calculate a calibrator's absolute uncertainty when the calibrator is calibrated with other than the manufacturers' specified standards. If you use a set of standards different from those recommended by the manufacturer, you will need to know what contribution the standards make to the final specification of absolute uncertainty.

Table 1-3 presents the 5440 Series specifications so that you will easily be able to discern both the absolute and relative specifications of the calibrator, depending on your needs.

Stability 1-13.

Whereas absolute uncertainty refers to the deviation from a national standard, stability refers to the shifts that occur over time. Generally, a good precision source requires good stability.

The 5440 Series has a 30-day stability of 1.5 ppm + 3 μV. This means its uncertainty will not be degraded by more than $\pm$(1.5 ppm + 3 μV) over a period of 30 days from the last external calibration, provided the 5-minute Internal Calibration procedure is performed the day of the measurement. The sources of the 5440 Series' stability include their internal reference, d/a converter, and precision dc amplifier.

The stability of the reference standards (e.g., the 732A Reference Standard used to calibrate the 5440 Series) also contribute uncertainty due to their own drift. This uncertainty depends upon the length of time between the calibration of the standard and the use of the standard to calibrate the calibration instrument.