



732A & 752A

732A DC Reference Standard and 752A Reference Divider

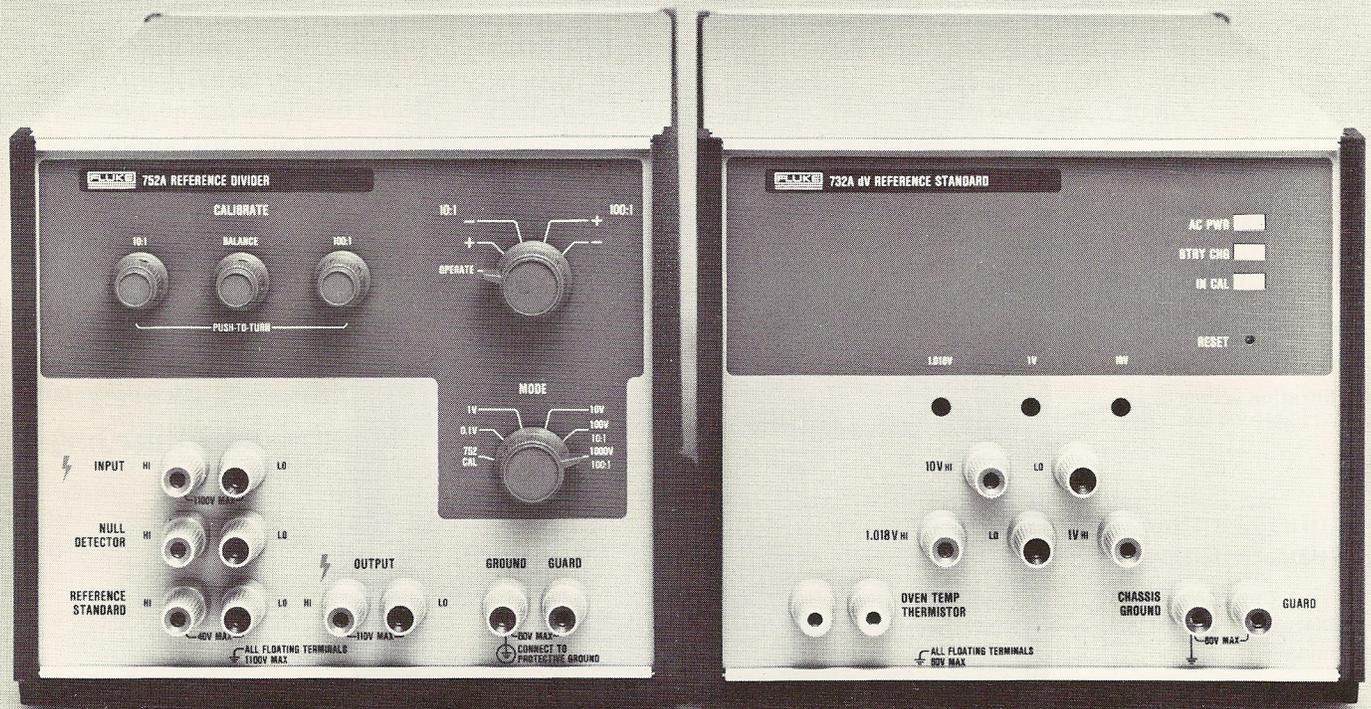
Instrument Specifications

752A Features

- 10:1 and 100:1 divider outputs
- Output uncertainty 0.2 ppm and 0.5 ppm
- "Self Calibration"
- DYNAMIC RESISTOR MATCHING™
- System switching for ease of use

732A Features

- 10V, 1.018V, 1.0V outputs
- 0.5 ppm 30-day stability
- 23°C ± 5°C operating range
- Transportable





732A DC Reference Standard

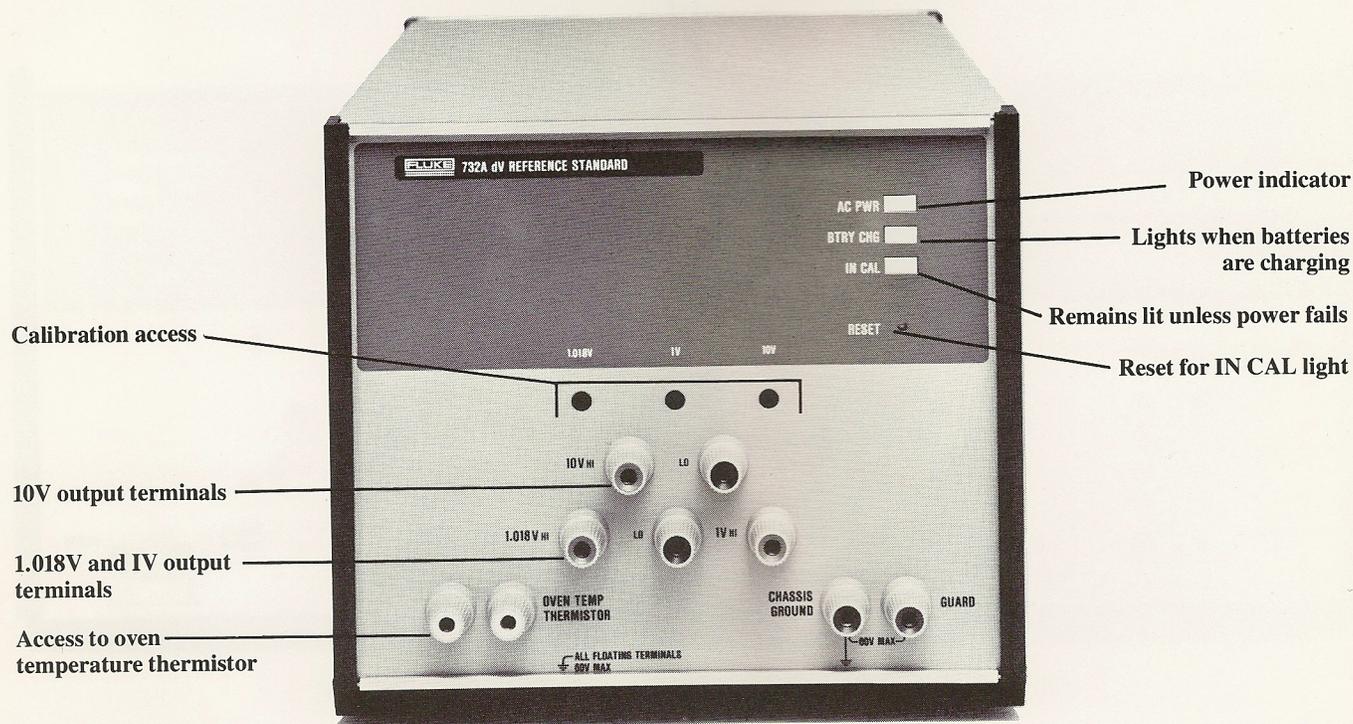
The Fluke 732A is a solid state, dc voltage reference standard which provides significant performance improvements in stability, ruggedness, and transportability. Its 10V output offers better resolution, lower noise, and simpler operation than standard cells. The 732A also includes outputs of 1.0 and 1.018 volts.

The accuracy and stability of the 732A allows direct substitution for saturated standard cells in many applications. Its stability of 0.5 ppm for 30 days provides the confidence necessary to calibrate high-performance instrumentation. In addition, the use of the 10V output as a primary reference standard means that the effect of thermal emf's and noise are reduced.

The 732A can be shorted, even for extended periods of time, without damage and recovers without loss of stability. The unit may be powered by line voltage or will operate 12 hours on its internal battery and even longer on external batteries. Either line power or the battery may be removed without affecting the output.

Saturated standard cells are fragile and susceptible to change from shock and vibration during travelling. The 732A was designed for air or ground shipment with no special handling. The high thermal gain oven allows full accuracy to be specified over an operating range of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$. Therefore, this new reference device may be used outside of the traditional standards laboratory environment in areas where saturated cells (or traditional, less rugged transfer standards) would not be reliable.

The 732A DC Reference Standard was originally developed by Fluke to transfer "the volt" into its own manufacturing facility. The unprecedented success achieved by this effort led to the development of the 732A for the commercial market. Fluke has developed a worldwide network of regional support centers to provide calibration support for the 732A where local standards are not available. These centers maintain volt transfer programs with the national standards laboratories.





732A DC Reference Standard Specifications

Output Uncertainty

The basic stability and uncertainty of the 732A are functions of stable reference amplifiers and resistors and very tight temperature control of the reference amplifier assembly. Additional design features have been added to enhance this circuitry. Additional information is available in Fluke Technical Bulletin B0152.

Stability

Output	Output Stability (23°C ±5°C) in ppm			
	30 days	90 days	6 months	1 year
10V	0.5	1.5	3.0	6.0
1.018V	1.5	4.0	8.0	12.0
1V	1.5	4.0	8.0	12.0

These specifications assume the unit has been continuously powered up with either ac, battery or both.

These specifications include effects of ±10% line voltage variations.

Note:

The 732A is normally shipped from the factory with the battery switch turned off. Upon receipt, the 732A must be powered up and stabilized for 24 hours before calibration against traceable standards. For calibration by the Fluke Standards Laboratory and shipment under power, consult your local Fluke Sales Representative for information about the Fluke Direct Voltage Maintenance Program.

Temperature Coefficient of Output

These specifications define the degradation of the 732A in ranges outside the 18°C to 28°C range.

Output	Temperature Coefficient (ppm/°C)	
	0°C to 18°C	28°C to 40°C
10V	±0.05	±0.05
1.018V	±1.0	±1.0
1V	±1.0	±1.0

Output Adjustment

Output	Adj Range	Adj Resolution
10 Volts	±50 μV	<0.05 ppm
1.018 Volts	±50 μV	<0.25 ppm
1.0 Volts	±5 μV	<0.10 ppm

Output Impedance

Output Impedance is less than 5 milliohms for 10V output: equal to 1 kΩ for 1V and 1.018V outputs.

Load Regulations

For output current from 0 to 12 mA, output voltage changes less than 6 ppm at 10V output.

Output Current

12 mA maximum at 10V output. Divider output current limited by 1kΩ output impedance at 1V and 1.018V output.

Output Protection

The output may be shorted indefinitely without damage to the instrument. The instrument is protected against high voltage transients up to 1100V. The net current through the 732A must not exceed 30 mA.

Line Regulation

Less than or equal to 0.05 ppm of output for ±10% nominal power line variation.

Output Noise

Less than or equal to 1 μV rms at 10V output from 0.1 Hz to 10 Hz.

Line Power Requirements AC volts, 50 to 400 Hz

Nominal Setting	Voltage Limits	Fuse
100V	90 to 110V	0.375A/250V SLO-BLO
120V	108 to 132V	0.375A/250V SLO-BLO
220V	198 to 242V	0.25A/250V SLO-BLO
240V	216 to 264V	0.25A/250V SLO-BLO



Low Voltage Alternative Power Requirements

The 732A DC Reference Standard may be operated through low-power connectors on the rear panel.

- 24V to 40V dc
- 24V to 30V ac, 50 to 60Hz

Internal Batteries

Gelled-electrolyte 24V lead-acid batteries operate the instrument for 12 hours at 23°C when fully charged.

Weight

Net 12.3 kg (27 lbs.) including battery pack.
Shipping 18.2 kg (40 lbs.)

Size

60.3cm L X 22.1cm W x 19.1cm H
(23.75in L X 8.69in W X 7.53in H)

Compliance With Standards

ANSI C39.5, 1980
IEC 348, 2nd edition, 1978

Temperature and Humidity

Condition	Temperature	Relative Humidity (Non-condensing)
Non-operating	-40°C to 0°C	Not controlled
	0°C to 60°C	95 ± 5% max.
Operating	0°C to 30°C	95 ± 5% max.
	30°C to 40°C	75 ± 5% max.

Note: At temperatures above 40°C the 732A battery pack should be switched off to prevent internal overheating.

Altitude

Operating 0 to 3,050m (10,000 feet)

Vibration

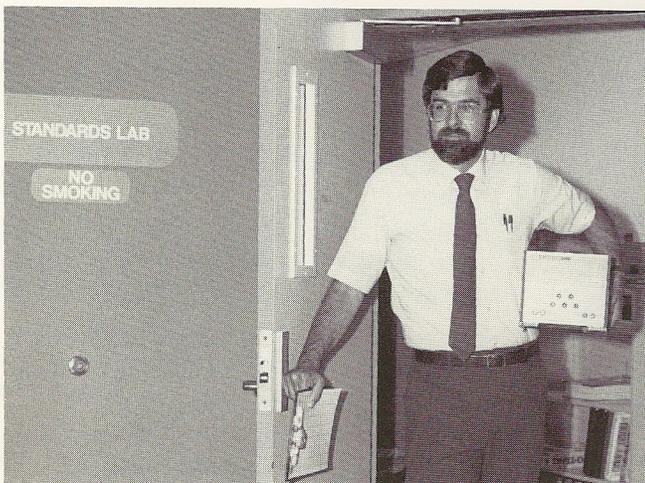
Per MIL-T-28800C, Type III, Class 5, Style E.

752A Reference Divider

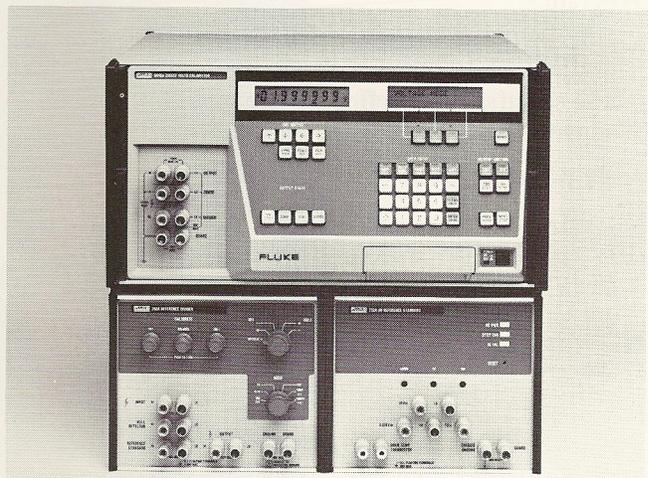
The Fluke 752A Reference Divider sets new standards for ratio accuracy and ease of use. It offers two divider outputs, 10:1 and 100:1 with output uncertainties of less than 0.2 ppm and 0.5 ppm respectively.

Before each use, the 752A is easily calibrated with only a stable source and null detector. The entire procedure requires only 5 minutes and does not require external standards.

The 752A also includes internal switching for calibrating the 100 mV, 1V, 10V, 100V, and 1000V ranges of a voltage source to a 10V reference (such as the Fluke 732A DC Reference Standard). It provides the voltage division capability required to calibrate state-of-the-art instrumentation.



Fluke takes high accuracy metrology out of the cal lab.



5440A/732A/752A/Precision Direct Voltage Calibration System



752A Reference Divider Specifications

These specifications apply for the lifetime of the instrument over the temperature range of 18°C to 28°C.

Ratio Ranges

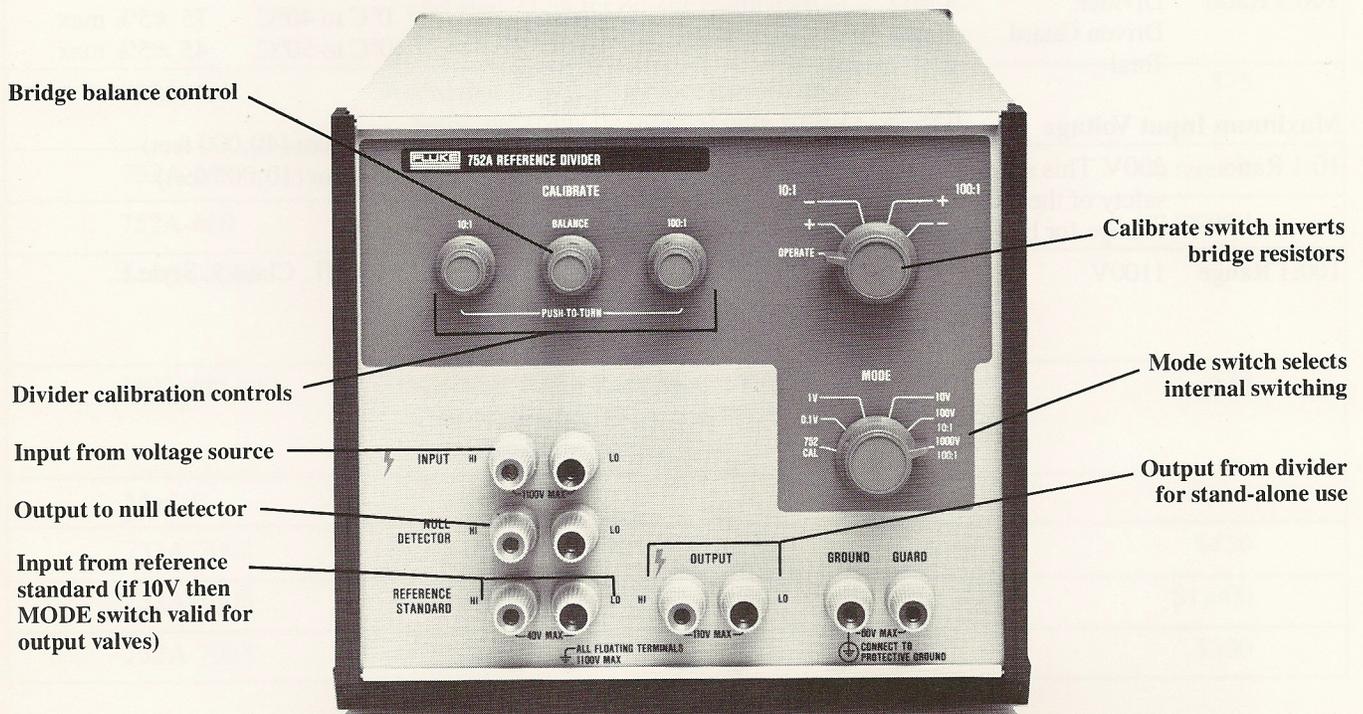
10:1
100:1

In addition to the divider ranges noted above, the 752A incorporates switching modes used in the cardinal point calibration of direct voltage calibrators. The points provided for on the 752A are 0.1V, 1V, 10V, 100V and 1000V. When the 752A is combined with a direct volts calibrator, a 10V reference standard and a null detector, the 752A configures the equipment to provide for calibration without having to physically change the lead connections.

Output Uncertainty

The "self calibration" procedure compensates for long term changes in value of the divider resistors. The upper leg of the divider is configured into three equal groups which, when placed in parallel, form a resistor of equal value to the output resistor. These two resistors form one half of a Wheatstone bridge. The other half is composed of two calibration resistors whose positions can be interchanged in the circuit. This interchange allows correction for any difference in the values of the calibration resistors through use of the BALANCE pot on the front panel. The upper leg resistors are then matched to the output resistor with the 10:1 or 100:1 potentiometers respectively.

Additional information is included in Fluke Technical Bulletin B0152.





Ratio Uncertainty

The 752A may be self calibrated and operated in the normal temperature range of 18°C to 28°C. The following table describes the ratio uncertainty of the 752A that applies for a temperature variation of less than $\pm 1^\circ\text{C}$ from the self calibration temperature for up to 8 hours following self calibration.

Range	Input Voltage	Ratio Uncertainty	Null Uncertainty ¹
10:1	100V	0.2 ppm	$\pm 0.5 \mu\text{V}$
100:1	1000V	0.5 ppm	$\pm 1.0 \mu\text{V}$

¹Null uncertainty refers to the required accuracy of the null detector reading during Self-Calibration.

Temperature Coefficient of Ratio

Temperature coefficient of ratio is $< \pm 1 \text{ ppm}/^\circ\text{C}$ over the entire operating range. Typical performance from 15°C to 30°C is 0.1 ppm/°C.

Input Resistance

10:1 Ratio	380 k Ω $\pm 1\%$
100:1 Ratio	Divider 4 M Ω
	Driven Guard 4 M Ω
	Total 2 M Ω $\pm 1\%$

Maximum Input Voltage

10:1 Ratio 200V. This specification applies to the safety of the unit only. The maximum voltage for best accuracy is 100V.

100:1 Range 1100V

Power Coefficient Effect on Ratio

10:1 Ratio < 0.05 ppm of output with 100V applied.

100:1 Ratio < 0.3 ppm of output with 1000V applied.

Note: These specifications are already included in the Ratio Uncertainty Specifications.

Weight

Net 8.4 kg. (18.5 lbs.)

Shipping 13.6 kg. (30 lbs.)

Size

60.3cm L X 22.1cm W X 19.1cm H
(23.75 in L X 8.69in W X 7.53in H)

Compliance With Standards

ANSI C39.5, 1980

IEC 348, 2nd edition, 1978

Temperature and Humidity

Condition	Temperature	%Relative Humidity (Non-condensing)
Non-Operating	-40°C to +75°C 0°C to 50°C	Not controlled 95 $\pm 5\%$ max.
Operating	0°C to 40°C 40°C to 50°C	75 $\pm 5\%$ max. 45 $\pm 5\%$ max.

Altitude

Non-Operating 0 to 12,200m (40,000 feet)

Operating 0 to 3,050m (10,000 feet)

Vibration

Per MIL-T-28800C, Type III, Class 5, Style E.



732A & 752A Ordering and Planning Guide

Instrument	Description	Price
732A	DC Reference Standard with battery pack 10V, 1.018V and 1.0V Reference Standard Used with 752A and 845AR to calibrate 5440A	\$2,995
752A	Reference Divider 10:1 and 100:1 voltage division capability Used with 732A and 845AR to calibrate 5440A	\$3,995
732A Options		
732A-000	Calibrated 732A Includes calibration in Fluke Standards Lab, Traceability Test Report and shipment under power	\$3,245
732A-100	Calibrated and Drift Rate Characterized 732A Includes calibration and drift rate characterization for a period of 60 days in Fluke Standards Lab, Traceability Test Report and shipment under power	\$3,495
732A-200	Direct Voltage Maintenance Program 10 Volt Reference Certification Includes 1-week use of a Fluke owned and certified 732A for on-site calibration of a 10 Volt Reference and Traceability Test Report	\$350
732A-201	Additional 10 Volt Reference Certification. Same site (May be ordered only with 732A-200)	\$75
732A-600	Extra Instruction Manual for 732A	on request
752A-600	Extra Instruction Manual for 752A	on request
5440A-7003	Low Thermal EMF Spade Lug Cables 3 special-length cables with shielded leads for external calibration of 5440A	\$315
M07-200-603	7 inch, Full Width Rack Mount Kit Used for bolting 732A and 752A together and rack mounting the pair.	\$75
Models		
732A-7002	Transport Case	\$430
732A-7003	Battery Charger	\$1,000
732A-7005	Battery Pack	\$330

Transport Case and Battery Charger

The 732A-7002 Transport Case is a ruggedized, fiberglass, foam-lined case capable of holding a 732A dV Reference Standard and a 732A-7003 Battery Charger, complete with up to four 732A-7005 Battery Packs. This extra battery capacity plus the heat-conserving insulation of the foam lined case will extend the off-line operating time of the 732A to about 72 hours.

The 732A-7003 Battery Charger is specially designed to hold and charge from one to four Battery Packs with the proper constant current, constant voltage cycle to avoid damage from over-charging. Fully discharged batteries are returned to approximately 95% charge in 24 hours. The charger provides the necessary isolation diodes and interconnections to provide the optimum charge to battery packs which may have unequal capacities or states of charge and to connect the batteries to the 732A dc power input connector.

Specifications

732A-7002 Transport Case

Size: 77cm x 61cm x 31cm (30in x 24in x 12in)

Weight: 12kg (26lb)

732A-7003 Battery Charger

Input Power: 100V, 110V, 115V, 120V, 200V, 220V, 230V or 240V ac $\pm 10\%$, 50 to 400 Hz, 100W max.

Size: 61cm x 19cm x 22cm (24in x 8in x 9in)

Weight: 5.9kg (13lb) alone. 23kg (50lb) when equipped with four battery packs (732A-7005)



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For more product information — or where to buy Fluke products call:

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206-356-5400 from AK, HI, WA

206-356-5500 from other countries

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P.O. Box 5053, 5004 EB, Tilburg, The Netherlands

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Phone or write for the name of your local Fluke Representative.

