

Service and Reshipment Information

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Warning

Service procedures, including replacing the batteries, are to be done by qualified service personnel only. To avoid electric shock or fire, do not service the 732B unless you are qualified to do so.

If your standard ever needs service, you may return it to Fluke for Warranty or after-warranty repair. Addresses for authorized service centers are in Section 6. If you are qualified to troubleshoot electronic equipment, you can refer to Section 5 for theory, troubleshooting, and calibration information. Schematic diagrams are in Section 7.

The 732B and 734A are designed to withstand the shock and vibration of air and ground shipment, provided that you protect the equipment with a proper shipping container. When you return a 732B or 734A to Fluke for service or calibration, use the original shipping carton, a replacement carton obtained from Fluke, or the accessory transit case. Transit Case Model 732B-7002 holds two 732B DC Standards or 732B-7001 External Battery/Chargers.

Caution

Do not charge a 732B or 732B-7001 while it is in the transit case. Doing so can cause overheating and possible equipment damage, and in the case of the 732B, loss of the state of calibration.

Specifications

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Output Voltages

10V and 1.018V are provided at separate binding post pairs with the following characteristics:

Note

A potential difference of approximately $<200\ \mu\text{V}$ exists between the floating 1.018V LO and 10V LO terminals. Consequently, buck measurements cannot be made between these sources without taking this into account.

Stability

Stability for a given period of time is defined as the output uncertainty minus the calibration uncertainty at the 99% Confidence Level. When the output voltage is characterized by a regression model, stability is given by the following equation:

$$\left| b \left(\frac{P}{365} \right) + 2.65 S_1 \sqrt{\left[\frac{S_{ra}}{S_1} \right]^2 + \left(\frac{1}{n} \right) + \frac{(\bar{x} + P - x_1)^2}{\sum (X_j - \bar{x})^2}} \right|$$

where b = slope of regression in ppm/year

S_1 = standard deviation about the regression (SDEV)

S_{ra} = SDEV of data filtered with 7-day moving average filter (MAF)

P = Period of time under consideration in days

\bar{x} = mean time for regression data

n = 180 period (typically 2 measurements per day)

X_j = j th period

X_1 = time at beginning of data

Each data point for the computation of the regression parameters is the average voltage of 50 readings taken in a 50-second measurement period.

Stability for the 732B outputs at $23 \pm 1^\circ\text{C}$ is specified as follows:

Output Voltage	Stability (\pm ppm)		
	30 Days	90 Days	1 Year
10V	0.3	0.8	2.0
1.018V	0.8	NA	NA

Noise at the Output Terminals

Output noise is specified for both day-to-day observations and for short-term observations. The former is given by the standard deviation of a 90-day regression model. The latter is in terms of its rms value in a bandwidth as follows:

Output Voltage	S_1 (\pm ppm)	S_{ra} (\pm ppm)	Noise (0.01 Hz to 10 Hz (\pm ppm rms))
10V	0.068	0.05	0.06
1.018V	0.1	NA	0.03

Output Current and Limits

Output Voltage	Output Current Limit	Output Impedance
10V	12 mA (Note)	$\leq 1 \text{ m}\Omega$
1.018V	20 pA	$\leq 1 \text{ k}\Omega$

Note: Limit output current to $\leq 0.1 \text{ mA}$ to realize 72 hour battery operation.

Output Adjustability

- 10V: 0.15 ppm resolution
- 1.018V: Set at nominal ± 1 mV. No adjustment is provided.

The 10V adjustment is done with a set of four decade-control switches with a range of at least 4 mV.

Retrace (Hysteresis) Error

The following table shows the change in 10V output voltage following a power outage (with the battery turned off) with temperature held constant in the normal operating range.

Period that Power is Turned Off	Change in 10V Output Value
10 minutes or less	$\leq \pm 0.1$ ppm
10 minutes to 24 hours	$\leq \pm 0.25$ ppm

Stabilization Time Requirements

The following information specifies the warmup times required after ac line and battery power has been turned off. The IN CAL indicator will be off, and recalibration will be necessary. The previously specified retrace error specification can be used in the case of brief power interruptions.

With no power interruption:	No stabilization time is required after moving into another environment.
Power off for less than 1 hour:	1-hour warmup required
Power off for 1 to 24 hours:	24-hour warmup required

Electromagnetic Compatibility

This instrument is designed to operate in Standards Laboratory environments where the radio frequency (RF) environment is highly controlled. If used in environments with field strengths > 0.18 V/m, there could be errors in measurements.

Temperature Coefficient (TC) of Output

In the temperature range of 15°C to 35°C, the magnitude of the TC is bounded by the following:

- 10V Output: $TC \leq 0.04$ ppm/°C
- 1.018V Output: $TC \leq 0.1$ ppm/°C

Load Regulation

10V Output Load Change	Maximum 10V Output Change
0 mA to 12 mA (no load to full load)	± 1 ppm
0 mA to 2 mA	± 0.1 ppm

Line Regulation

The outputs will change no more than 0.05 ppm for any 10% line voltage change or for the entire operating range of the battery.

Output Protection

All outputs can be shorted indefinitely without damage to the instrument. The 10V output can withstand voltages from other sources as follows:

1. For voltages $\leq 220\text{V}$ dc, the unit is protected for up to 50 mA continuous current.
2. For voltage $\leq 1100\text{V}$ dc, the unit is protected for up to 25 mA continuous current or up to 0.6 joules for short periods of time.

Environment

	Temperature Range	Relative Humidity	Altitude
Normal Operation	15°C to 35°C	15% to 80%	0 to 6,000 ft
Safe Operation	0°C to 50°C	15% to 90%	0 to 10,000 ft
Storage (With battery removed)	-49°C to 50°C	Noncondensing	0 to 40,000 ft

Compliance to Standards

ANSI/ISA-S82
CSA C22.2 #231
IEC348
IEC 1010
UL 1244

Line Power Requirements

Line voltage is accepted in the two ranges 90 to 132V and 180 to 264V, at 47 to 63 Hz as shown in the table below. AC line current at 120V ac is 0.13A.

732B Line Voltage Setting	Line Voltage Accepted	Frequency Accepted
100V	90 to 110V	47 to 63 Hz
120V	108 to 132V	47 to 63 Hz
220V	180 to 235V	47 to 63 Hz
240V	225 to 264V	47 to 63 Hz

Battery Operation

When fully charged, the internal batteries will operate the 732B for a minimum of 72 hours at $23 \pm 5^\circ\text{C}$, with 0 to 0.1 mA current drain at the 10V output. Model 732B-7001 contains the same battery and charger as Model 732B.

Charging Time

The batteries are rechargeable in less than 36 hours with a self-contained automatic battery charger.

External DC Input

A rear panel input for external 12 to 15V dc allows for powering the 732B indefinitely. The dc source must be rated for 300 mA or more.

Isolation

The resistance from any of the 732B binding posts to earth (chassis) ground or to ac line power is greater than 10,000 M Ω shunted by less than 1000 pF.

Guard and Ground Terminals

Chassis ground connections are provided on both the front and rear panels. Access to the internal guard is provided by a front panel binding post.

Mechanical Specifications

	Model 734A*	Model 732B*	Model 732B-7001
Height	17.8 cm (7.0 in)	13.4 cm (5.28 in)	13.4 cm (5.28 in)
Width	43.2 cm (17.0 in)	9.8 cm (3.85 in)	9.8 cm (3.85 in)
Depth	50.3 cm (19.8 in) including handles	40.6 cm (16.0 in)	40.6 cm (16.0 in)
Weight	30.4 kg (67 lb)	5.91 kg (13 lb)	5.91 kg (13 lb)
Refer to Figure 1-1.			