

# 732C/734C

DC Reference Standard

## Product Specifications

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## Specifications

### General Specifications

#### Mains

Line voltage is accepted as shown in Table 1. AC line current at 120 V ac is typically 0.13 A.

**Table 1. Mains**

732C Line Voltage Setting	Line Voltage Accepted	Frequency Accepted
100 V	90 V to 110 V	50 Hz/60 Hz
120 V	108 V to 132 V	50 Hz/60 Hz
220 V	198 V to 242 V	50 Hz/60 Hz
240 V	216 V to 264 V	50 Hz/60 Hz

#### Battery

Battery Operation..... At full charge, the internal battery operates the Product for a minimum of 72 hours at 23 ±5 °C, with 0 mA to 0.1 mA total current drain at the outputs.  
 Charging Time <36 hours with self-contained automatic battery charger

**External DC Input**..... Rear-panel input for external 12 V dc to 15 V dc powers the Product indefinitely. The dc source must be rated ≥300 mA.

**Isolation** ..... Resistance from any of the Product binding posts to earth (chassis) ground or to ac line power is >10,000 MΩ shunted by <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.

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

1. For voltages ≤220 V dc, the Product is protected for a maximum of 50 mA continuous current.
2. For voltage ≤1100 V dc, the Product is protected for a maximum of 25 mA continuous current or up to 0.6 joules for short periods of time.

#### Environmental

##### Specified Operation

Temperature Range ..... 15 °C to 35 °C

Relative Humidity..... 0 % to 90 % to 28 °C, to 80 % to 35 °C, and to 50 % to 50 °C, Noncondensing

Altitude..... 0 m to 1830 m (0 ft to 6000 ft)

##### Non-specified Operation

Temperature Range ..... 0 °C to 50 °C

Relative Humidity..... 0 % to 90 % Noncondensing

Altitude..... 0 m to 3050 m (0 ft to 10 000 ft)

##### Storage (Battery Removed)

Temperature Range ..... -40 °C to 50 °C

Relative Humidity..... Noncondensing

Altitude..... 0 m to 12 200 m (0 ft to 40 000 ft)

**Electromagnetic Compatibility (EMC)**

The Product operates in Standards Laboratory environments where the radio frequency (RF) environment is highly controlled.

(International).....	IEC 61326-2-1; CISPR 11: Group 1, Class A Controlled Electromagnetic Environment <i>Group 1 equipment has intentionally generated and/or use conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.</i> <i>Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.</i> <i>Emissions which exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object. The equipment may not meet the immunity requirements of 61326-1 when test leads and/or test probes are connected.</i>
USA (FCC).....	47 CFR 15 subpart B, this product is considered an exempt device per clause 15.103
Korea (KCC) .....	<i>Class A Equipment (Industrial Broadcasting &amp; Communication Equipment)</i> <i>This product meets requirements for industrial (Class A) electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.</i>

**Safety**

Safety.....	IEC 61010-1, Installation Category II, Pollution degree 2
Ingress Protection .....	IEC 60529: IP20

**Mechanical Specifications**

**734C Dimensions**

Height .....	17.8 cm (7.0 in)
Width.....	43.2 cm (17.0 in)
Depth .....	50.3 cm (19.8 in) including handles

**732C and 732C-7001 Dimensions**

Height .....	13.4 cm (5.28 in)
Width.....	9.8 cm (3.85 in)
Depth .....	40.6 cm (16.0 in)

**Weight**

734C .....	30.4 kg (67 lb)
732C and 732C-7001 .....	5.91 kg (13 lb)

## Performance Specifications

### Output Voltages

10 V, 1 V, and 0.1 V are provided at separate binding posts referenced to the VCOM binding post.

### Stability

Stability for the 732C outputs at Tcal  $\pm 1$  °C and IN CAL indicator on is specified in Table 2.

**Table 2. Standard Stability**

Output Voltage	Stability ( $\pm \mu\text{V/V}$ )		
	30 Days	90 Days	1 Year
10 V	0.3	0.8	2.0
1 V	0.6	1.2	3.0
0.1 V	1.2	2.9	9.8

**Table 3. Select Stability**

Output Voltage	Stability ( $\pm \mu\text{V/V}$ )		
	30 Days	90 Days	1 Year
10 V	0.3	0.8	1.0
1 V	0.6	1.2	2.5
0.1 V	1.2	2.9	8.0

### Noise at the Output Terminals

Output noise is specified for both day-to-day observations and for short-term observations, at k=1.

**Table 4. Noise at the Output Terminals**

Output Voltage	S1 ( $\pm \mu\text{V/V}$ ) <sup>[1]</sup>	Sra ( $\pm \mu\text{V/V}$ ) <sup>[2]</sup>	Noise (0.01 Hz to 10 Hz) ( $\pm \mu\text{V/V rms}$ )
10 V	0.07	0.05	0.06
1 V	0.16	0.14	0.15
0.1 V	1.4	1.3	1.0

[1] S1 is the standard deviation about the regression (SDEV) of 90 days of at least twice daily stability test data.  
[2] Sra is the SDEV of the stability test data with a 7-day moving average filter (MAF).

To obtain the best performance, use the Product in controlled environments with good system grounding and shielding practices. For radiated EMI fields from 0.25 to 1 V/m from 80 to 130 MHz, add 9  $\mu\text{V}$  to the 1 V output, and 3.6  $\mu\text{V}$  to the 0.1 V output. For ac mains conducted EMI of 1 Vrms from 75 to 80 MHz, add 1  $\mu\text{V}$  to the 1 V output, and 0.7  $\mu\text{V}$  to the 0.1 V output. The 10 V output is mostly unaffected by EMI fields up to 1 V/m or by conducted EMI up to 1 Vrms.

### Output Current and Impedance

**Table 5. Output Current and Impedance**

Output Voltage	Output Current Limit	Output Impedance
10 V	12 mA <sup>[1]</sup>	$\leq 1 \text{ m}\Omega$
1 V	1.2 mA <sup>[1]</sup>	$\leq 1 \text{ m}\Omega$
100 mV	20 pA	$\leq 100 \Omega$

[1] Limit total output current to  $\leq 0.1 \text{ mA}$  to realize specified battery operation

### Retrace (Hysteresis) Error

Table 6 shows the change in 10 V output voltage following a power outage (with the battery turned off) and temperature held constant in a 23 °C to 35 °C range.

**Table 6. Retrace (Hysteresis) Error**

Period that Power is Turned Off	Change in 10 V Output Value ( $\pm \mu\text{V/V}$ )
$\leq 10 \text{ min}$	0.1
10 min to 24 hr	0.25
24 hr to 14 days	0.25

**Stabilization Time Requirements**

Warmup times required after ac line and battery power have 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 power interruptions.

With no power interruption ..... No stabilization time is required after the Product is moved to another environment.

Power off for <1 hr ..... 1-hr warmup required

Power off for >1 hr ..... 24-hr warmup required

**Temperature Coefficient (TC) of Output**

From 15 °C to 35 °C, the temperature coefficient is bound by the information in Table 7.

**Table 7. Temperature Coefficient**

Output Voltage	Temperature Coefficient ( $\pm\mu\text{V/V per } ^\circ\text{C}$ )
10 V	0.04
1 V	0.1
0.1 V	0.2

**Output Change with Altitude**

For an altitude change from calibration altitude, the output voltage change is bound by the information in Table 8.

**Table 8. Output with Altitude**

Output Voltage	Output Change ( $\pm\mu\text{V/V per 1000 ft}$ )
10 V	0.05
1 V	0.09
0.1 V	0.18

**Load Regulation**

10 V Output Load Change	Maximum 10 V Output Change ( $\pm\mu\text{V/V}$ )
0 mA to 12 mA (no load to full load)	1
0 mA to 2 mA	0.1

**Line Regulation**

The outputs will change no more than 0.05  $\mu\text{V/V}$  for any 10 % line voltage change or for the entire operating range of the battery.

