



- DC Voltage and Current
- Stability:  $\pm 1$ ppm
- Resolution:  $7\frac{1}{2}$  Digits
- Maximum Output Current: 110mA

- 2 and 4-Wire Output
- Optional Output Voltage Limits: 17V to 100V
- Auto Zero Offset Calibration (AZOC)
- Automated "Covers On Calibration"

## GENERAL DESCRIPTION

The Krohn-Hite Model 523 Precision DC Source is a highly stable and repeatable dc voltage source and dc current source providing N.I.S.T. traceable voltages and currents for use in production, calibration labs, QA and QC departments, design labs, or any place where an accurate voltage and current source is needed.

Using Krohn-Hite's state-of-the-art reference, the 523 provides accurate and stable voltages from  $\pm 10$ nVdc to  $\pm 110.99999$ Vdc to within  $\pm 4$ ppm for 90 days ( $\pm 8$ ppm for 1 year), and precise currents from  $\pm 10$ nA to  $\pm 110.99999$ mA to within  $\pm 8$ ppm for 90 days ( $\pm 16$ ppm for 1 year). It is an extremely quiet source with  $< 7\mu$ Vrms of noise measured over a 10Hz to 100kHz bandwidth ( $< 2\mu$ Vrms 0.1Hz to 10Hz).

The 523 features a user friendly  $7\frac{1}{2}$  digit display and a membrane keyboard entry of all settings. Output settings can be modified using a plus/minus delta function, multiply/divide function and cursor control keys that allow placing a curse on any digit to increment or decrement its value. Output 2-wire, 4-wire and chassis grounding are accomplished with one

keystroke or over the GPIB interface bus. A crowbar function places the output in a safe mode when desired. The 523 output can be set to 0 volts, allowing the output sense to maintain a true 4-wire low impedance zero output. It is also quickly forced to zero before a range change to prevent any "surprise voltages" from appearing.

An AUTO ZERO OFFSET CALIBRATION (AZOC) returns any thermally generated offsets to within specified limits and is accessible via the front panel or over the GPIB interface bus. The unit is designed for a "Covers On Calibration" using the KH523CAL Test and Calibration Software Program. With the KH523CAL program and either an HP3458 or Fluke 8508A Digital Voltmeter, unattended calibrations can be made in approximately 15 minutes.

The 523 provides for the storage of up to 31 output settings that can be recalled at any time. Internal operating temperature, serial number, last calibration date and firmware version can all be called to the display for quick access when needed. Error messages are displayed when incorrect or out-of-range entries are made.

**OPTIONS**

The 523 offers a maximum voltage limit (523-11 option) that limits the output voltage from exceeding a value defined by the customer from 10Vdc to 100Vdc (values defined can only be in 1V increments; example: 11V, 19V, 53V, and so on, not 11.2V, 19.5V, etc.)

Also offered is a 100 ohm precision resistor (PCR100) that is a precise, thermally stable 100 ohm resistor used during the

calibration of current on Model 523.

**APPLICATIONS**

Krohn-Hite's NEW Model 523 is well suited for many applications where an extremely accurate and stable dc voltage or dc current is needed. At a cost much less than most sources in its class, the 523 can be a valuable asset to any company's production line, calibration lab, QA and QC department and design.

**SPECIFICATIONS**

(Specifications apply when the internal temperature is 40°C ±1°C, <70% relative humidity.)

Range	Res.	Relative Uncertainty ±1°C ( see Note 1 )		Absolute Uncertainty±1°C from calibration temperature ( see Note 2 )			Stability ±1°C *
		90 Days	1Yr	24 Hours	90 Days	1Yr	24 Hours
		----- ±(ppm output + µV or nA) -----					
<b>DC Voltage</b>							
111.11119mV	10nV	4 + 2	8 + 2	3 + 2	6 + 2	10 + 2	1 + 1
1.111119V	100nV	4 + 3	8 + 3	3 + 2	6 + 3	10 + 3	1 + 1
11.11119V	1µV	4 + 20	8 + 20	3 + 10	6 + 20	10 + 20	1 + 10
110.99999V	10µV	6 + 200	10 + 200	5 + 100	8 + 200	12 + 200	1 + 100
<b>DC Current (Note 3)</b>							
11.11119mA	1nA	8 + 40	16 + 40	4 + 20	10 + 40	18 + 40	2 + 20
110.99999mA **	10nA	8 + 200	16 + 200	±24, +400	±30, +400	±38, +400	2 + 100

\* Non-Additive  
 \*\* For values between 12mA and 110mA use graph provided with PCR100 Precision Current Resistor.

**Note 1:** The RELATIVE ACCURACY specifications are to the HP3458A Digital Voltmeter used for calibration.

**Note 2:** The absolute accuracies and traceability to N.I.S.T. include the traceability accuracies of the calibration standard and the maintained RELATIVE accuracies of the HP3458A added to the 523 RELATIVE specifications.

**Note 3:** Current calibration uses an external precision 100-ohm resistor (Krohn-Hite Model PCR100) and measures the voltage using a 4-wire Kelvin connection to the resistor.

Range	Temperature Coefficient		Linearity ±1°C	Noise		Equivalent Output Z <sub>0</sub> (ohms)
	18°C - 28°C	0°C - 40°C		0.1Hz - 10Hz	10Hz - 100kHz	
	±(ppm output + µV or nA)/°C			p-p	rms	
<b>DC Voltage</b>						
111.11119mV	1 + 0.2	2 + 0.2	1 + 1	2µV	7µV	0.1µ
1.111119V	1 + 0.5	2 + 0.5	1 + 1	2µV	7µV	1µ
11.11119V	1 + 1	2 + 1	1 + 10	4µV	15µV	10µ
110.99999V	2 + 10	4 + 10	1 + 100	40µV	100µV	100µ
<b>DC Current (Note 3)</b>						
11.11119mA	2 + 5	4 + 5	1 + 20	20nA	150nA	10G
110.99999mA	2 + 10	4 + 10	1 + 100	200nA	300nA	1G

Temperature coefficient is best straight line fit method.

## OUTPUT

The following specifications are with a constant internal operating temperature equal to 40°C ±1°C. The HP3458A NPLC is set for 100 and AUTO CAL cycle (ACAL) run. The Model 523's calibration is normally done at a room temperature of 23°C ±1°C. The internal Cal Temp is saved at the time of calibration and can be displayed with the present internal temperature using the [TEMP] key.

The 90 day and 1 year specifications are within 24 hours of a zero CQL (AZOC) cycle, and a constant internal operating temperature equal to 40°C ±1°C. The zero CAL (AZOC) cycle takes out the effect of internal DC offset drift.

**Settling Time:** <10ms.

**Line Regulation:** <±0.1ppm change for a 10% change from normal line voltage, typically no measurable change.

**Load Regulation 4-Wire operation:** <±0.1ppm change from no load to 100mA full load, typically no measurable change. Measurements must be made at sense lead connection point to the load.

### Compliance Voltage Effect On Current Output:

<10nA change for a 100V change in compliance voltage for output currents <11.11112mA, equivalent to >10 Gig-ohm output impedance; <100nA change for a 100V change in compliance voltage for output currents ≥11.11112mA, equivalent to >1 Gig-ohm output impedance.

**Compliance Voltage Limit:** Settable in 1V steps from 1V to 110V. Compliance limits approximately 15% +0.25V above the setting.

**Warm-Up Time from a Cold Start:** 1 Hour to within 5ppm of final value. 4 Hours to rated accuracy and final value.

**Maximum Output Current:** ±110mA. Output protected from damage with a current limiter. Output may be shorted to ground indefinitely.

**Calibration:** The Model 523 is specified with a 1-year calibration cycle. An AUTO ZERO OFFSET CALIBRATION (AZOC) is provided that returns any thermally generated offset to within specified limits, and can be accessed via front panel controls or over the GPIB interface bus. The Model 523 is designed for a "Covers On" calibration using the

KH523CAL Test and Calibration Software Program (license required). The KH523CAL software, together with an HP3458A or Fluke 8508A Digital Voltmeter, allows virtually unattended calibration to be performed in approximately 15 minutes. The calibration date and internal temperature is stored in memory and can be called to the display or over the GPIB interface bus.

### "Covers-On Calibration" Temperature Limits:

Internal Temperature (T Cal): 40°C ±1°C, controlled by internal heater. Ambient Temperature (T Amb): 18°C to 28°C in order for internal heater to operate properly. Outside of these conditions the accuracy is substantially reduced.

**Protection:** Voltage mode, short-circuit and over-load protected. Current mode, open circuit protected, indication by display message; automatic recovery.

## GPIB PROGRAMMING

**Switching Time:** Typically 300ms.

**Subsets:** SH1, AH1, T6, SR1, RL1, PP1, DC1, DC1, DT1, CO, E1.

**Line Termination:** The GPIB OEI signal is always sent with the last character on a line.

**Talker Function:** Allows interrogation of the Model 523 by a controller.

## TERMINALS

Output Terminals are mounted on both the front and rear panels. Only one set of terminals may be used at a time. Both terminal sets are configured for remote sensing of the output as follows:

High Output and High Sense  
Low Output and Low Sense  
Case Ground.

## GENERAL

**Display:** LCD, 7.5 digits. Displays output settings and other pertinent information.

**Isolation:** Power transformer-to-analog output, control logic-to-analog output, optically isolated.

**SAFETY**

The Model 523 is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control and laboratory use: IEC61010-1, EN61010-1.

**ELECTROMAGNETIC COMPATIBILITY**

**Emissions and Immunity:** EN61326-1, EMC, 61000-4-2; ESD, 61000-4-3; Radiated Immunity, 61000-4-4; EFT, 61000-4-5; Surge, 61000-4-6; Conducted Immunity, 61000-4-8; Magnetic Immunity, 61000-4-11; Voltage Interruption EN61010-1. CE Compliant for Class B Equipment.

**MECHANICAL**

**Power Requirements:** Selectable 105-130 or 210-260 volts ac, single phase, 50Hz to 60Hz, 60 watts.

**Dimensions and Weights:** 3.5" (9cm) high, 14" (36cm) wide, 12.5" (32.13cm) deep; 12 lbs (5.4kg) net, 14 lbs (6.3kg) shipping.

**Operating Temperature Range:** 0°C to 50°C.

**OPTIONS**

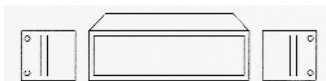
**523-11:** Limits the output maximum voltage to any customer defined value from 10Vdc to 100Vdc. Factory install only.

**KH523CAL:** Calibration and test software, totally automatic, needed to calibrate the Model 523.

**PCR100:** 100 Ohm Precision Current Resistor.



**RK-314:** Rack Mount Kit permits the installation of the Model 523 into a 19" rack spacing.



**CAB005:** Cable, 2 conductor shielded balanced line, multi-stacking double banana plug.



**CAB018:** Cable: multi-stacking double banana plug.



**CAB023:** The CAB023 is a low thermal EMF retractable sheath banana plug patch cord set. These low thermal cables minimize thermal errors so accurate low voltage measurements can be made. Each set includes 2 test leads (one black and one red).



**CAB024 (most popular):** The CAB024 is a low thermal EMF spade lug patch cord set for low voltage measurements. These low thermal cables minimize thermal errors so accurate low voltage measurements can be made. Each set includes 2 test leads (one black and one red).



**CASE-2720B:** Protective carrying case, Black, light weight strong HPX Resin, water tight with telescoping handle and in-line wheels.



**ACCESSORIES**

3 terminal line cord.  
 Operating manual.

Specifications are subject to change without notice.

