Excellence in Resistance

Instruction Manual

Model KVVB

Compact High Voltage Divider

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Ohm-Labs, Inc. 611 E. Carson St. Pittsburgh, PA 15203-1021 Tel. 412-431-0640 www.ohm-labs.com

1) Description:

Description:

Ohm-Labs' model KVVB is a dc high voltage divider used for accurate measurement of high voltages. A recent design upgrade improved the accuracy and changed to a safety input.

The KVVB consists of precision resistors encapsulated in silicon resin in a diallyl phthalate housing. Careful internal layout and design minimize leakage and corona effects. All dividers are tested up to full voltage. The KVVB is equipped with three output binding posts (ground, low and output) and one ceramic post terminal (input). The input terminal a locking high voltage plug with high voltage cable terminated in a ring terminal. The output posts are gold plated tellurium copper to reduce thermal emf errors.

The original Julie Research Labs design KVVB, with threaded post terminals and anti-corona ball input post, is fully supported and available by special order.

2) Model Selection Guide:

Standard Model KVVB 0-10 kV in = 0-10 V out 1000:1 ratio

Non-Standard Models

KVVB – [A] – [B]

KVVB	=	KVVB series compact voltage divider
A	=	Rated input voltage in kilovolts
B	=	Output voltage at rated input

Examples:

KVVB-10-1	=	10 kV input / 1 V output
KVVB-5-5	=	5 kV input / 5 V output

3) Specifications:

Input Impedance:	5 KΩ/V (50 MΩ for 10 kV model)
Output Impedance:	5 KΩ/V (5 KΩ for 1 V output, 50 KΩ for 10 V output)

Output impedance may be specified to match a customer's meter

Ratio Accuracy:	< 0.01 % through full voltage range
Ratio Temperature Coefficient:	< 0.000 5 %/°C (< 5 ppm/°C, 0-45 °C)
Dielectric Test Voltage:	>15,000 volts, input terminal to ground plane
Physical:	4.375 x 2.9375 x 2.7 inches including input terminal
	11.1 x 7.5 x 7 cm including input terminal
	Weight: 12 oz. / 340 g
Environmental:	10-60 °C, 15-85 %RH
Storage:	-55 to +85 °C, 0-95 %RH
Warrantee:	Two years from date of shipment

4) Operation:

It is assumed that the user is familiar with the safety and cautionary practices required with high voltage systems and devices. Always exercise extreme caution when working with high voltages.

WARNING: ALWAYS INSURE THAT HIGH VOLTAGE SOURCE IS OFF AND GROUNDED BEFORE CONNECTING. INJURY OR DEATH CAN RESULT FROM HIGH VOLTAGE.

To use the divider, connect the green Ground binding post to a secure earth ground common with the high voltage source. Connect the high voltage input lead wire terminated in a #10 ring terminal to the high voltage source. Connect the Low and Output binding posts of the KVVB to the meter or measuring system. Note that output Low is at Ground potential. See figure 1.

The KVVB divider may be operated in any position. Four corner mounting holes can be provided to accept #10 or M4 screws.

To determine the input voltage from the measured output, use the following formula:

Volts Input = (V Output) x (Divider Ratio)

Example (for KVVB-10-1):

Output	=	0.775 V
Ratio	=	10,000:1
Input	=	0.775 x 10,000 = 7,750 Volts

Care should be taken not to exceed the rated input voltage for the KVVB Divider. Note that the low terminal is internally connected to ground.

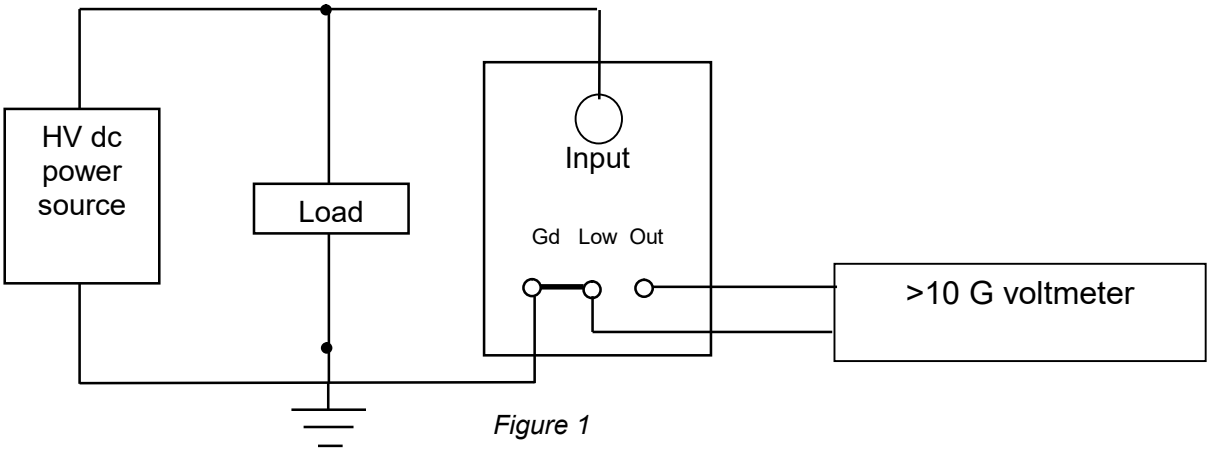


Figure 1

Any meter or non-potentiometric measurement system will load the output of the KVVB, affecting its ratio accuracy. To limit the error due to meter loading to less than 0.01 %, the meter impedance should be greater than 10 GΩ. For best accuracy, the loading effect on the KVVB can be calculated, and a correction can be applied to the measured result. To determine this correction, apply the below equation (1/X = 1/A + 1/B):

1 / (result)= 1 / (KVVB output impedance) + 1 / (meter input impedance)

Example: (KVVB output 50 KΩ; meter input impedance 10 MΩ):

1 / (result)= 1 / (10,000,000) + 1 / (50,000) = 0.000 020 1

Result = 1/0.000 020 1 = 49,751.24 ohms (= loaded output impedance of KVVB)

The 1,000:1 ratio is based on a resistance ratio of 50 MΩ (total) to 50 KΩ (output). If the loaded output resistance is 49,751.24 ohms, the actual ratio will be:

50,000,000 / 49,751.24 = 1,005.00 : 1

Measuring 10,000 volts in this example will read on the meter as 9.950 25 volt, or 1/1,005 of the actual voltage. If using a voltmeter, insure that the input impedance is set to >10 G ohm to minimize loading errors.

5) Calibration:

Either of two calibration methods may be used. One is comparison against a calibrated high voltage divider; the other is calibration using a high voltage Wheatstone bridge circuit.

For comparison calibration:

1) Connect the KVVB and a calibrated standard high voltage divider (such as Ohm-Labs HVS) to a secure ground using ground cables of equal length and gauge.
2) Connect two calibrated voltmeters to the outputs of the standard and the KVVB.
3) Connect the high voltage source to the standard and to the KVVB inputs.
4) Apply a low setting of the high voltage supply to verify operation.
5) Apply high voltage to both units. Allow applied voltage to settle for 15 minutes to allow full stabilization of the KVVB. Use the ratio of the calibrated standard and the meter readings to determine the KVVB ratio.

(Standard Divider Output Voltage x Standard Divider Ratio) / KVVB voltage = Ratio

To use the high voltage Wheatstone bridge method, use a calibrated high voltage resistance standard (such as Ohm-Labs HVS), a calibrated decade box and an isolated null detector.

This method is described in NIST Technical Note 1215, “High-Voltage Divider and Resistor Calibrations,” M. Misakian, Natl. Bur. Stand. (U.S.).

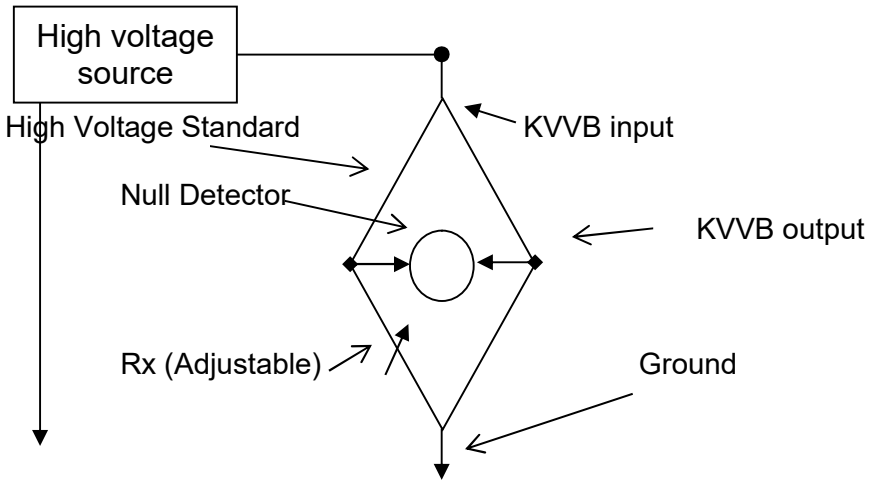


Figure 2

1) Connect the KVVB and the low side of a calibrated decade resistor (Rx) to a secure ground using cables of equal length and gauge.
2) Connect the high side of the decade resistor to the low terminal of the high voltage standard (HVS).
3) Connect an isolated null detector to the high side of the decade resistor and to the KVVB output terminal.
4) Connect high voltage to the HVS standard and to the input of the KVVB.
5) Apply a low setting of the high voltage supply to verify operation.
6) Apply high voltage to both units. Allow applied voltage to settle for 15 minutes to allow full stabilization of the KVVB.
7) Adjust the decade resistor for null.
8) Use the value of the standard and the decade box to determine the KVVB ratio.

Example: (HVS = 100.000 megohms)

Voltage	Rx	Ratio = (Rx + HVS)/Rx
2 kV	100,094	1000.06 : 1
4 kV	100,097	1000.03 : 1
6 kV	100,100	1000.00 : 1
8 kV	100,105	999.95 : 1
10 kV	100,110	999.90 : 1

A limited verification of the KVVB's ratio can be performed by connecting a calibrated voltage source to the input and comparing it to the KVVB output voltage.

The KVVB may be returned to the manufacturer for calibration. The calibration cycle will depend on the customer’s requirements. Annual re-calibration is recommended.

6) Service:

The KVVB is sealed and contains no user serviceable parts. Replacement high voltage input cables are available in case the original is damaged or lost.

7) Warrantee:

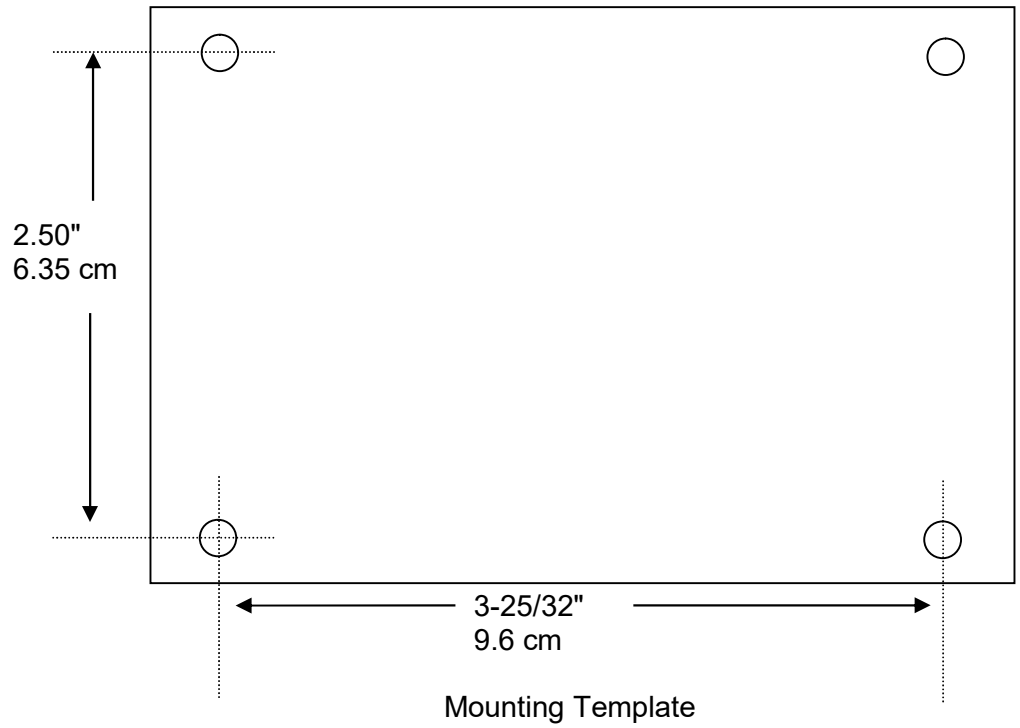
This divider is warranted against defects in manufacture for a period of two years from date of shipment. This warrantee does not cover damage due to abuse, misuse or neglect, or damage caused by application of voltages above its rated input. The manufacturer expressly disclaims liability for any consequent or subsequent damages caused by the use or misuse of this device.

If warrantee or other service is needed, package the divider securely and ship to:

Ohm-Labs, Inc.
611 E. Carson St.
Pittsburgh, PA 15203-1021

Tel: 412-431-0640
Fax:412-431-0649
url: www.ohm-labs.com

Drilling template for mounting:



Mounting Template

Figure 3