

Instruction Manual  
**Model KVVB**  
Compact High Voltage Divider



## 1) Description:

Based on a design by Julie Research Laboratories, the KVVB is a fixed, high stability, high accuracy voltage divider used to allow safe measurement of high voltages. The instrument consists of high precision resistors encapsulated in silicon resin in a diallyl phthalate housing. Careful internal layout and design reduce leakage and corona effects. All dividers are tested at full voltage. The KVVB is equipped with two stud terminals (ground and output) and one ceramic post terminal (input). The input terminal is fitted with an anti-corona ball to reduce risk of arcing. Four mounting holes are provided at the corners.

## 2) Model Selection Guide:

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:	2,000 Ohms / Volt (20 megohms for 10 kV model)
Output Impedance:	2,000 Ohms / Volt (2,000 ohms for 10 kV / 1 V output)
Ratio Accuracy:	< 0.025 % (standard models)
Ratio Temperature Coefficient:	< 0.000 5 %/°C (< 5 ppm / °C, 0 - 45 °C)
Dielectric Test Voltage:	15,000 volts, input terminal to ground
Physical:	4.5 in. W x 3 in. D x 1.5 in. H (2.75 in. including input terminal) 11.4 cm W x 7.6 cm D x 4 cm H (7 cm H incl. input term.) Weight: 12 ounces / 340 g
Environmental:	10 to 60 °C, 15 - 85 %RH
Storage:	-55 to +85 °C, 0 - 95 %RH
Warranty:	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.

To use the divider, connect the ground or low voltage terminal of the high voltage source to the low terminal of the voltage divider (see figure below). Connect the high voltage lead wire to the input terminal of the KVVB by securing it under the anti-corona ball on the ceramic insulator. Connect the output of the KVVB to the measuring system. Note that the low terminal is both input low and output low. See figure 1.

**Caution: Do not apply more than 20 oz.-in. torque to 1 V or Low terminals. Finger tighten anti-corona ball. Excess torque may break connections and void warrantee.**

The KVVB voltage divider may be operated in any position. The four corner mounting holes will accept #10 screws (M4).

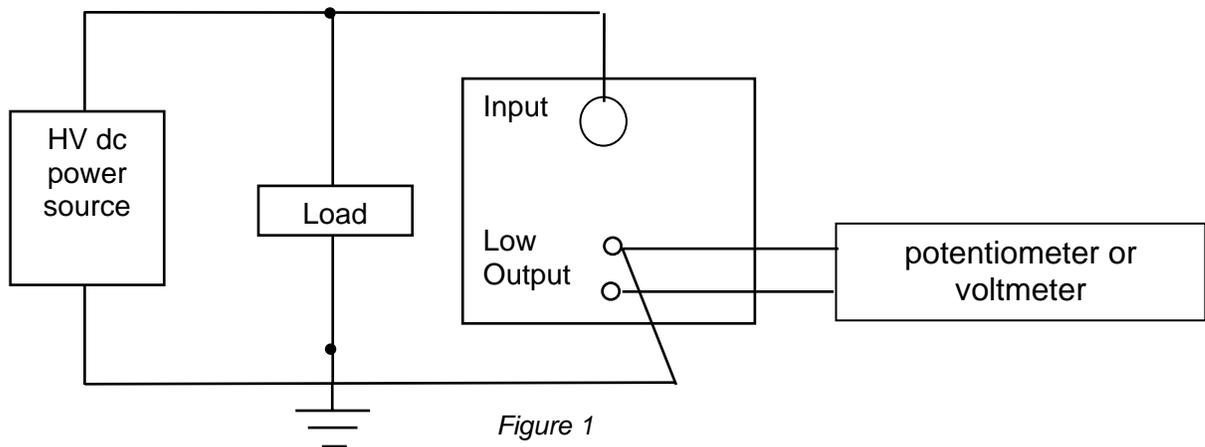
To determine the input voltage from the measured output use the following formula:

$$\text{Volts Input} = (\text{V Output}) \times (\text{Divider Ratio})$$

Example (for KVVB-10-1):

Output	=	0.775 V
Ratio	=	10,000:1
Input	=	$0.775 \times 10,000 = 7,750$ Volts

Care should be taken not to exceed the rated input voltage for the KVVB Divider. Note that the low terminal is in the center location.



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 ( $1/X = 1/A + 1/B$ ):

$$1 / (\text{result}) = 1 / (\text{KVVB output impedance}) + 1 / (\text{meter input impedance})$$

Example: (KVVB output 20 KΩ; meter input impedance 10 MΩ):

$$1 / (\text{result}) = 1 / (10,000,000) + 1 / (20,000) = 0.000 050 1$$

$$\text{Result} = 1 / 0.000 050 1 = 19,960.08 \text{ ohms ( = loaded output impedance of KVVB)}$$

The 1,000:1 ratio is based on a resistance ratio of 20 MΩ (total) to 20 KΩ (output). If the loaded output resistance is 19,960.08 ohms, the actual ratio will be:

$$20,000,000 / 19,960.08 = 1,002.00 : 1$$

Measuring 10,000 volts in this example will show on the meter as 9.980 04 volt, or 1/1,002 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, connect the KVVB to a calibrated high voltage divider and voltmeter. Connect the KVVB output to a second calibrated voltmeter. Apply high voltage to both units. Apply the ratio of the calibrated standard to determine the actual applied voltage. Divide by the KVVB output to determine the KVVB ratio.

Allow the applied voltage to settle for >15 minutes to allow temperature stabilization of the KVVB.

$$(\text{Standard Divider Output Voltage} \times \text{Standard Divider Ratio}) / \text{KVVB voltage} = \text{Ratio}$$

To use the high voltage Wheatstone system, use a calibrated high voltage resistor, a calibrated decade box and an isolated null detector. A simplified diagram of this test system is below:

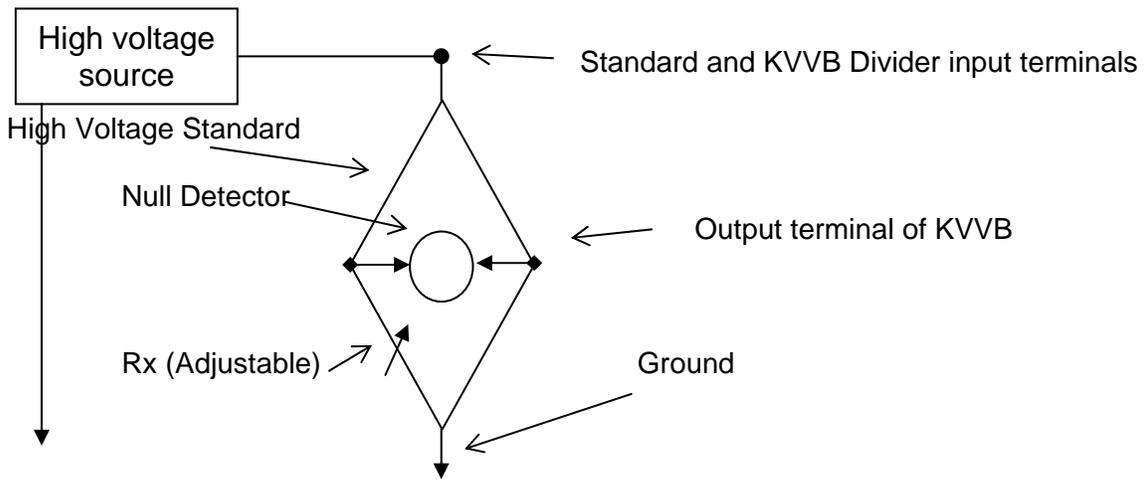


Figure 2

Connect the KVVV high voltage terminal to the high voltage terminal of a High Voltage Resistance Standard (such as HVA High Voltage Standard). Connect the output terminal of the KVVV and the low end of the HVS to a battery operated null detector, isolated from ground. Connect the low end of the HVS to the high end of a calibrated decade box with 0.01 ohm minimum resolution. Connect the low end of the decade box and the low of the KVVV to ground, using equal resistance wires to a common point.

Set Rx for a ratio to the HVS nominally equal to the ratio of the KVVV.

With the system connected as shown above, slowly apply 25% voltage. Allow 15 minutes to elapse. Adjust Rx for null. Record the value of Rx. Repeat at 50%, 75% and 100% of the KVVV's rated input voltage. To obtain the ratio, divide the sum of the resistances of the decade resistor and the high voltage standard resistor by the resistance of the decade resistor.

Example: (HVS = 100 megohms)

Voltage	Rx Setting	Ratio = (Rx + HVS)/Rx
2.5 KV	9,999	10,002.0 : 1
5 KV	10,000	10,001.0 : 1
7.5 KV	10,002	9,999.0 : 1
10 KV	10,005	9,996.0 : 1

A simple verification of the KVVV's ratio can also be performed by connecting a calibrated voltage source to the input and comparing its ratio to the output voltage.

6) Service:

The KVVB is sealed and contains no user serviceable parts. The following replacement parts are available from the manufacturer:

- HV3032      1" dia. anti-corona ball
- Other        #10-32 nickel plated brass nuts, washers and lock washers on low and output terminals, commercially available

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.	Tel: 412-431-0640
611 E. Carson St.	Fax: 412-431-0649
Pittsburgh, PA 15203-1021	url: <a href="http://www.ohm-labs.com">www.ohm-labs.com</a>

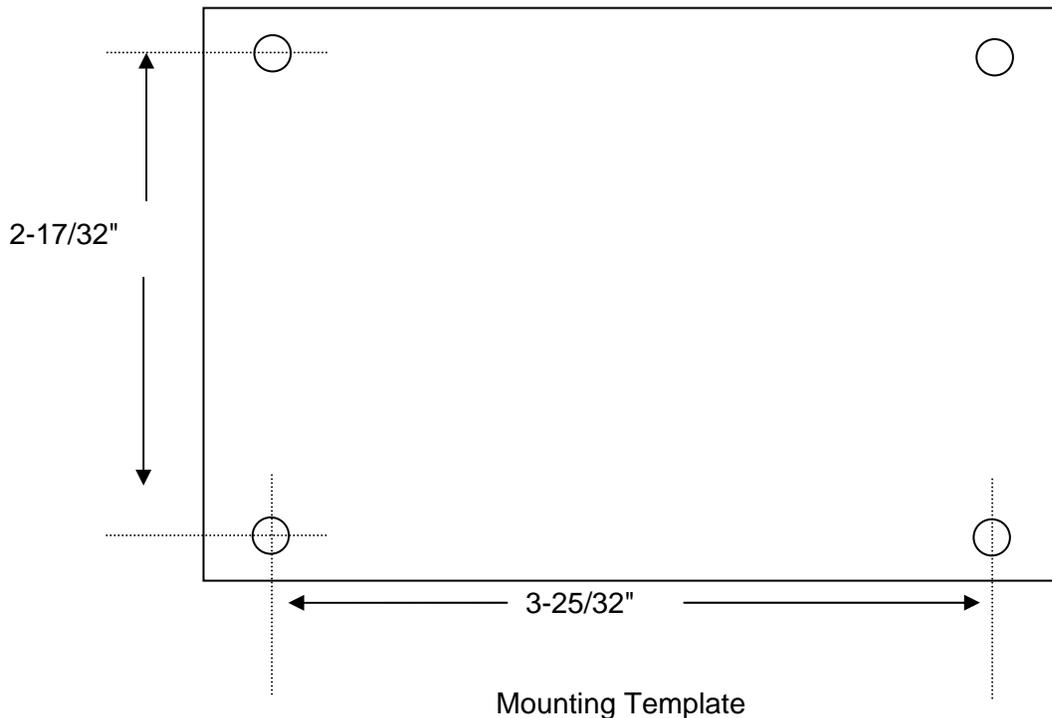


Figure 3