BOTTER Designs

APPLICATION NOTE 11

by Jacques Botte V1.00

HIGH VOLTAGE INSULATION METERS

VERIFY & CALIBRATE WITH RCB-1

What is R.C.B.-1 ?

Simply, this is the Resistor Calibration Box #1. RCB-1 is SEW's newest baby.

What is it used for ?

The RCB-1 can be utilised to calibrate very accurately all the High Voltage Insulation Meters manufactured by Standard Electric Works, Analogs and Digitals.

The RCB-1 is also used to verify and proof any High Voltage Insulation Meter, made by Standard Electric Works or any other second source.

Why SEW did it ?

SEW's first motivation to design the RCB-1 was to have a proofing calibrator to demonstrate the performances of SEW High Voltage Insulation Meters to the prospective established customers.

The proofing resistor box sold on the market has only about 5 resistors going to, not more than 10G . It cost 2 to 3 time more than our RCB-1.

The meters manufactured at the SEW factory can measure accurately to 500G .
SEW decided to build a "State of the Art" High Voltage Resistor Calibration Box which could be used for ***calibration*** and ***proofing*** in the field.

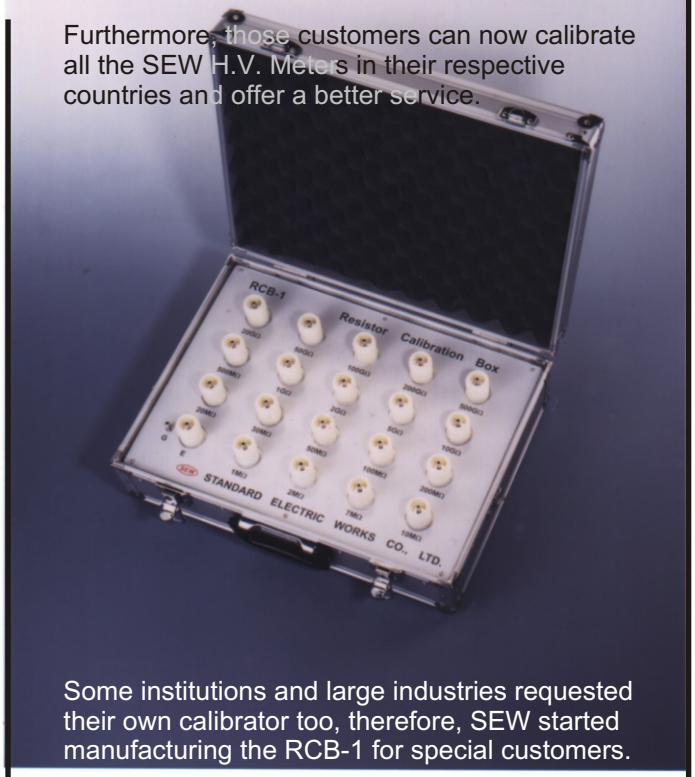
The result is RCB-1, a portable calibrator useable up to 10Kv with many resistors combinations..

Very quickly, some major customers requested RCB-1 to demonstrate the performances of our High Voltage Insulation Meters to their customers.

RCB-1 is now used by those very successful leading instrument companies to compare competitive products with ours and proof the superiority of our products for less than ½ the price and in some case for less than the ¼ of the price.

Read application note #1
WHY AND WHERE TO USE THEM

Furthermore, those customers can now calibrate all the SEW H.V. Meters in their respective countries and offer a better service.



Some institutions and large industries requested their own calibrator too, therefore, SEW started manufacturing the RCB-1 for special customers.

Large manufacturing plants require to check their H.V. Insulation Meter regularly so that they can be sure of the readings taken in the field.

Please remimber that not all the calibration laboratories have access to H.V. resistors of the values needed to calibrate H.V. Insulation Meters accurately.

What is so special about it ?

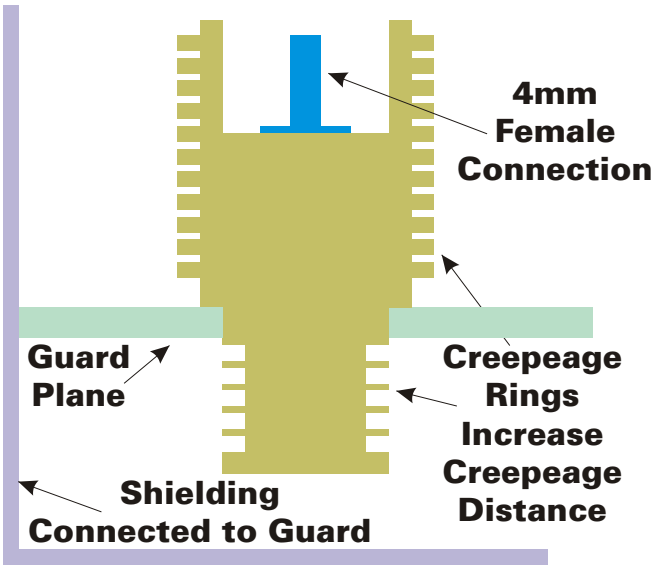
Firstly, the RCB-1 is compact and designed for High Voltage Insulation Reference measurement.

The RCB-1 is enclosed into an attractive and shielded carry case which has an integral guard circuitry.

Each High Voltage Reference Resistor is custom made and encapsulated into a highly insulating material.

Each individual resistor is housed into a specially shaped cylinder with increased creepage distance.

The connection to each resistor is made using the AL-30 or AL-50 4mm test lead (or compatible).



Read application note # 2

USE THE GUARD - IT'S BETTER !

What is inside ?

Each single High Voltage Resistor is connected to a common point.
The power rating of each Resistor is 3W.
Each resistor can have a maximum working voltage of 10Kv applied on it.
The value of the resistors are :

R1	=	1	M	±1% ± 25PPM/ºC
R2	=	2	M	±1% ± 25PPM/ºC
R3	=	7	M	±1% ± 25PPM/ºC
R4	=	10	M	±1% ± 25PPM/ºC
R5	=	20	M	±1% ± 25PPM/ºC
R6	=	30	M	±1% ± 25PPM/ºC
R7	=	50	M	±1% ± 25PPM/ºC
R8	=	100	M	±1% ± 25PPM/ºC
R9	=	200	M	±1% ± 50PPM/ºC
R10	=	500	M	±1% ± 50PPM/ºC
R11	=	1	G	±1% ±100PPM/ºC
R12	=	2	G	±1% ±100PPM/ºC
R13	=	5	G	±1% ±200PPM/ºC
R14	=	10	G	±1% ±200PPM/ºC
R15	=	20	G	±1% ±200PPM/ºC
R16	=	50	G	±1% ±200PPM/ºC
R17	=	100	G	±1% ±200PPM/ºC
R18	=	200	G	±1% ±400PPM/ºC
R19	=	500	G	±1% ±400PPM/ºC

361 H.V. Precision Resistors !

Yes, that's right, with RCB-1 you can have up to 361 resistor combination.
R1 to R19 = 19 individual resistors
18 x 19 = 342 added resistors (2 each time)
Total = 361 combined resistors.

Examples:

For 3M ; Instead of using the common, use 1M terminal and 2M terminal, so R1 + R2 = 3M

For 700G , use R18+R19

For 9M , use R2+R3

For 150M , use R7+R8

For 200.5G , use R18+R10

For 120G , use R17+R15

For 52M , use R7+R2

WHEN USING COMBINED RESISTORS, ACCURACY DETERIORATE !

RCB-1, up to 700G !

Yes, that's right, with RCB-1 you can have a High Voltage Precision Resistor of 700G

Connect one probe on the R18 terminal and the other on the R19 terminal.
Make sure to use the guard.
and -Voila-.

LINK CABLES SHOULD BE GUARDED.

Use the Guard Connection

Although RCB-1 has been designed to minimize the leakage currents, in case of high humidity levels, the leakage can be eliminated using the guard connection.

The guard connection collect the unwanted current which otherwise would lower the measured resistor of the calibrator.

Using the guard improve accuracy in difficult conditions.

Use AL-50 Test Lead.

The AL-50 has been designed for High Voltage Insulation Meters and has an integrated guard connection built into the "Coaxial Silicone".

BOTTER Safer

HELPING YOU MAKING OUR WORLD
SAFER, EVERYDAY, DAY AFTER DAY.
TOGETHER,
WE CAN MAKE THE DIFFERENCE

Calibration Points.

Digital High Voltage Insulation Meters:
6210IN, 6211IN, 6212IN, 2803IN, 2804IN

500V 1M .
10M .
100M .
1G .
10G .

1000V 2M .
20M .
200M .
2G .
20G .

2500V 7M .
50M .
500M .
5G .
50G .

5000V 30M .
100M .
1G .
10G .
100G .

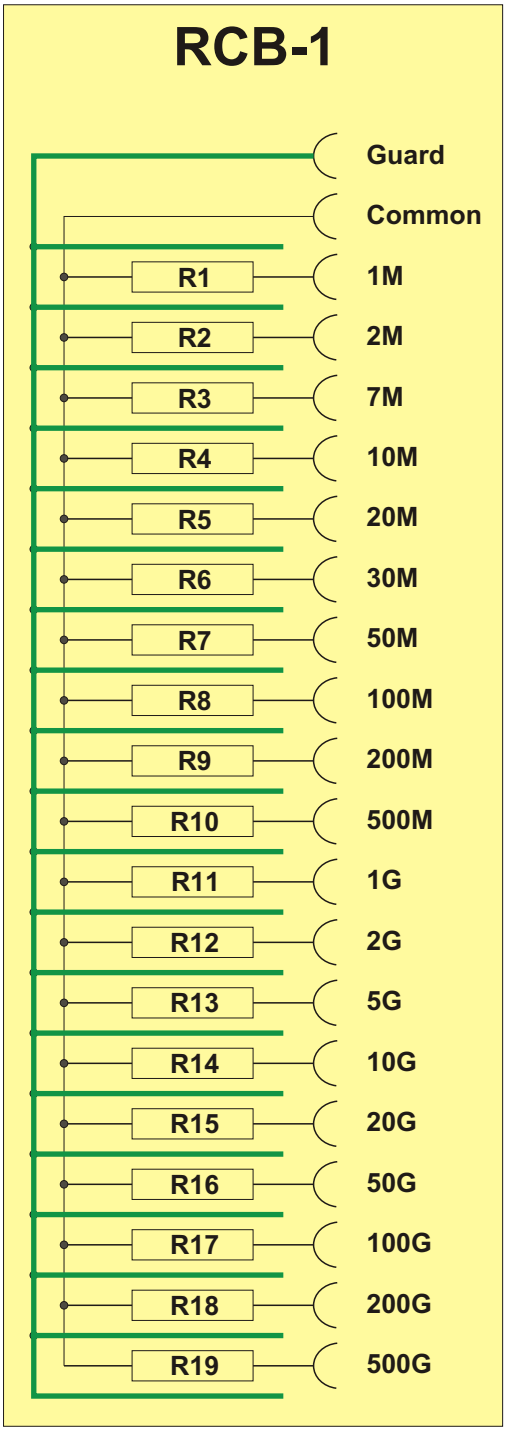
10000V
200M .
2G .
20G .
200G .

Analog High Voltage Insulation Meters:
6200IN and 6201IN

5000V 2G .
5G .
Short Circuit

With RCB-1, the calibration of our H.V. Insulation Meters can be done anywhere in the world.
The calibration of the Digital H.V.I.M. is saved in Eeprom and no potentiometer is used.

Next time we will show you how to get even more calibration values from RCB-1 by using serie or parallel connections.



SEW® STANDARD

STANDARD ELECTRIC WORKS CO. LTD

Calibrate without RCB-1.

It is possible to calibrate the Digital High Voltage Insulation Meters without a resistive calibrator.

However, the operation is complex and not always very accurate.

The Digital High Voltage have 5 current shunts which are used automatically.

Those current shunts measure from pA to mA. It is possible to simulate the calibration resistor by injecting and accurate current into the shunt.

The Instruments are calculating the correction factors and this correction factors will be as accurate as the simulation of the resistor seen by the shunt.

For Example:

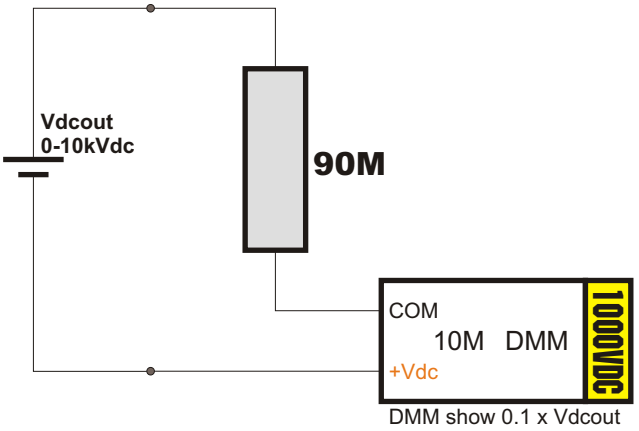
500V	500µA	(simulate 1M)
	50µA	(simulate10M
	5µA	(simulate 100M
	500nA	(simulate 1G
	50nA	(simulate 10G
1000V	500µA	(simulate 2M
	50µA	(simulate 20M
	5µA	(simulate 200M
	500nA	(simulate 2G
	50nA	(simulate 20G

To make this calibration accurate, the voltage measurement must be done between Line and Guard. That would be Vout (dc).
The injected current would be I=U/R
U is the measured voltage minus the voltage on the shunt.
R is the simulated resistor.
The I is injected with a High Precision programmable constant current source.
If you do not have access to such instrument, contact me, there is an other method of calibration.which could be explained in detail for our distributors only.

Measuring Vout(dc).

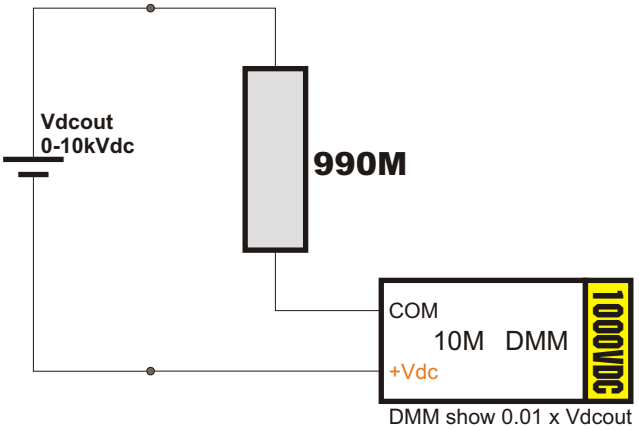
DO NOT USE THIS METHOD FOR Vac!

What you need for a 100M test probe:
1 x 10M D.M.M.
1 x 90M 10kV resistor.
The real voltage on the probes will be what you read multiplied by 10.



DMM show 0.1 x Vdcout

What you need for a 1G test probe:
1 x 10M D.M.M.
1 x 990M 10kV resistor.
The real voltage on the probes will be what you read multiplied by 100.



DMM show 0.01 x Vdcout