

Editorial

Dr. Aswal, Director NPL visits Vaiseshika Calibration Facility

17th February 2018 was a Red Letter Day in the history of Vaiseshika Electron Devices, Ambala Cantt. **Dr. Dinesh Kumar Aswal, Director, National Physical Laboratory, New Delhi** visited **ISO /IEC 17025 : 2017** Accredited Vaiseshika Metrology Laboratory and Manufacturing Facility. Dr. Aswal was received at Vaiseshika by Dr. Anil Jain, President; Mr. Praveen Jain, Chief Executive and the entire staff.

Subsequently Dr. Aswal witnessed various Calibration Standards and their live demonstration and performance were made by the Quality Assurance Team. The 15 Ton Morehouse Load Cell Calibration Facility was a special demonstration. It is a matter of great pride and honour for Vaiseshika that our engineering experts had successfully installed a 450 Ton Morehouse Load Cell Calibration Facility at Satish Dhawan Space Centre, Sriharikota in 2010 and 50 kN Morehouse Dead Weight Calibrator at the National Physical Laboratory, New Delhi in 2001.

Thereafter Dr. Aswal was taken around the Optical Instruments Laboratory and he was satisfied to see the various sophisticated Hardness Testers and Stereo Zoom Microscopes for material microstructure examination and testing system with measurement software.

Vaiseshika Electro - Technical Metrology Laboratory has world class calibration standards comprising of 0.0001 ohm Standard Resistor having uncertainty of 20 ppm and Precision Reference Resistors upto 10 Tera ohm having traceability to the National Metrology Institute. **Thereafter Dr. Aswal inaugurated and released a new Resistance Calibration Standard having range from 10 micro-ohm to 10 Tera ohm having uncertainty of 1.6 %.** This Micro ohm Resistor Standard Calibrator has been indigenously designed at Vaiseshika and Dr. Aswal was appreciative of the fact that such a Calibration Standard will go a long way in serving the needs of defence, research, calibration Laboratories and industries.

Vaiseshika Resistance and Load Cell Calibration Standards and Material Testing and Examination Microscopes have been extensively used and accepted across the most Prestigious Space and Defence Projects of the country like the **Satellite Launch Missions Laboratories of the Indian Space Research Organisation at**



(Left to Right) Mr. Praveen Jain, Chief Executive & Dr. Anil Jain, President, presenting welcome bouquet to Dr. D.K. Aswal, Director, NPL

Sriharikota, Trivandrum, Alwaye, Mahendragiri and Valiamala and Missile Testing & Research Laboratories at Chandipur, Jagdalpur, Nasik, Pune and Hyderabad.

During the last three years, Vaiseshika has installed their Calibration Standards in various **ISO 17025 : 2017** compliant Laboratories in the US, Europe, South East Asian Countries and Middle East Countries.

The customer satisfaction is a priority at Vaiseshika. Therefore our team of engineers and experts undertake installation, commissioning, demonstration, training and maintainability of the Calibration Standards and Optical Instruments for many years after the date of first supply. At most of the places, the application engineering requirements of the customer are understood and custom-built design and aesthetics are provided. In certain critical requirements, we have repaired and recommissioned our instruments even upto a period of ten years .

It is relevant to mention here that the stability and drift record of our Reference Calibration Standards are maintained and we have been able to maintain a stability of the order of 0.00002 % over the



Dr. D.K. Aswal, releasing the inaugural unit of precision Milli/Micro Ohm-Meter Calibrator



Dr. Anil Jain (Left) explaining the principle of Load Cell Force Calibration to Dr. Aswal on 15 Ton Morehouse Load Cell Calibration System.

Continue on next page.....

Brought forward from previous page.....

last 20 years in our Metrology Laboratory. Further our engineers undergo regular training programmes at the National Physical Laboratory, New Delhi; the Quality Council of India and in the ISO 17025 : 2017 A2LA Accredited Laboratory in York, Pennsylvania US to strengthen their metrology expertise .

Dr. Aswal told that Metrology is the Pillar of Quality Infrastructure in India. India can become a super-power provided precision measurements and protocols are adhered to by the industry, research and academia. He said that the quantum of exports from India can increase many times if precision metrology is employed in industrial production. The experience of interaction and listening to Dr. D.K. Aswal, the Director, National Physical Laboratory, New Delhi was a great learning and motivational experience for everyone at Vaiseshika.

- Anil Jain
Ph.D. (BITS, Pilani)
President
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Dr. D.K. Aswal looking at the Load Cell Calibration procedure on Morehouse Universal Calibrating Machine



Dr. D.K. Aswal discussing the significance of Quality & Reliability in Calibration with Vaiseshika Metrology team.



Dr. D.K. Aswal and Mrs. Neelam Aswal with Vaiseshika Metrology team.



Dr. D.K. Aswal delivering the 28th Gian Chand Jain Memorial Lecture on 17th February 2018 on the topic Metrology: the Pillar of Quality Infrastructure at the auditorium of Sanatan Dharam College, Ambala Cantt.



He who can listen to the music in the midst of noise can achieve great things.

-Vikram Sarabhai

Vaiseshika Defines Real Meaning of Calibration

Metrology- the Science of Measurement is the pillar of Quality Infrastructure in a Country. Calibration is an activity which delivers the benefits of Metrology to Industry and determine the Quality of a product in a given area of engineering. In fact it is more logical to term Calibration as a process to compare a device under test (DUT) of an unknown value with a reference standard of a known value and ultimately determining the error or verifying the accuracy of the DUT of unknown value. The Calibration process involves adjustment or true-up the instrument to reduce the measurement error.

Bureau International des Poids et Mesures (BIPM) at Paris defines the meaning of calibration as an “operation that, under specified conditions, in a first step establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication.”

Hence Master Measurement Standards used in calibration must be of known uncertainty. Vaiseshika Metrology Laboratory provides traceable calibrations through an unbroken chain connected to the pertinent SI Units through the National Physical

Laboratory, New Delhi. This is the reason that Vaiseshika Master Reference Standards have a remarkably low drift of the order of **0.0002% over the last 20 years** and we have proven our **Calibration Measurement Capability (CMC) between 0.0016% to 1.6% compliant to ISO 17025:2017 standards.** Please refer to our scope at www.nabl-india.org

This is the secret and main strength of the Pedigree of the Vaiseshika Calibration Standards.

MAINTAINABILITY, REPEATABILITY, STABILITY AND REPRODUCEABILITY ARE THE FOUR MAJOR STRENGTHS OF VAISESHIKA RESISTANCE CALIBRATION STANDARDS which provide the customer a distinct advantage and niche over all other Indian manufacturers.

Highly Qualified Man Power : The Vaiseshika Calibration team consist of highly qualified manpower with distinguished academic qualifications and sterling experience of more than 30 years.

Vaiseshika Electron Devices has the **distinction of 45 years of producing world class Resistance Standards since 1974.** We provide Resistance Calibration Standards of sufficiently low uncertainty so that the user has the confidence in the calibration results.

Scope of Accreditation for Temperature & Pressure

Parameter/Device under calibration	Range(s) of measurement	Calibration Measurement Capability (±)	Method used / Remarks+
Thermal Parameter (At Laboratory & At Site)			
RTD, Digital Thermometers , Thermocouple with & without Indicator, Controllers/ Recorder, Temperature Gauges	25°C to 200°C 200°C to 600°C	0.62°C 1.1°C	By Comparison method
Temperature indicator with sensor of Liquid Bath, Dry Block	25°C to 200°C 200°C to 600°C	1.0°C 1.1°C	By Comparison method
Temperature indicator with sensor of Oven/Incubator/ Freezer/Chamber/ Autoclave	-40°C to 100°C	0.9°C	By Comparison method
Pressure Parameter (At Laboratory & At Site)			
HYDRAULIC PRESSURE Digital/ Analog Pressure Gauges/ Indicators	0 to 20 bar 0 to 600 bar	0.1 bar 0.7 bar	As per DKD-R6-1 Standard
PNEUMATIC PRESSURE Digital/ Analog Pressure Gauges/ Indicators	0 to 60 bar	0.2 bar	As per DKD-R6-1 Standard

For more details visit - <http://vaiseshika.com/home/product/1032>

Scope of Accreditation for Electro-Technical Parameters

Quantity Measured/ Instrument	Range/ Frequency	Calibration Measurement Capability ($\pm$)	Remarks
Source Mode (At Laboratory)			
DC Resistance	0.0001 Ω 0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω	0.015 % 0.015 % 0.015 % 0.021 % 0.004 % 0.004 % 0.004 % 0.004 % 0.004 % 0.004 % 0.004 % 0.0065 %	By Direct method
DC Resistance	0.01 Ω to 100 k Ω 100 k Ω to 1 G Ω 1 G Ω to 1 T Ω	1% to 0.008% 0.008% to 1.4% 1.4% to 3 %	By Direct method
Temperature Simulation T/C K-Type J-Type T-Type R-Type S-Type RTD (PT 100)	-160°C to 1200°C -190°C to 1100°C -130°C to 400°C 150°C to 1700°C 170°C to 1700°C -200°C to 850°C	0.7°C 0.5°C 0.5°C 1.2°C 1.2°C 0.43°C	By Direct method
Measure Mode (At Laboratory)			
DC Resistance (4 Terminal)	0.00001 Ω to 1k Ω 1 k Ω to 10 M Ω	1.6 % to 0.0016% 0.004% to 0.006%	By Potentiometric / Comparison method
DC Resistance (2 Terminal)	0.01 Ω to 1 k Ω 1 k Ω to 10 M Ω	0.93 % to 0.002 % 0.002 % to 0.01 %	By Direct method
DC High Resistance (Upto 10 kV)	0.1 M Ω to 500 G Ω 500 G Ω to 1 T Ω 1 T Ω to 10 T Ω	0.03 % to 2.1 % 0.9 % to 1.25 % 2.1 % to 1.5 %	By V/I Method
DC Voltage	1 mV to 10 V 10 V to 1000 V 1 kV to 10 kV	0.06 % to 0.006 % 0.006 % to 0.007 % 0.65 %	By Direct method
AC Voltage (50 Hz)	1 mV to 700 V	0.6 % to 0.04 %	By Direct method
DC Current	10 μ A to 1 mA 1 mA to 1 A	0.05 % to 0.03 % 0.03 % to 0.12 %	By Direct method
AC Current (50 Hz)	1 mA to 1 A	0.05 % to 0.1 %	By Direct method

For more details visit - <http://vaiseshika.com/home/product/1032>

High Precision Decade Resistance Box : 7400

Description :

"Vaiseshika" High Precision Decade Resistance Box : 7400 has been designed and fabricated to meet the standard calibration requirements. This Decade Resistance Box can serve the purpose of Precision Resistance Simulation and substitution in electrical circuits, Sensors calibrations in Test & Calibration Laboratories.



Features :

- Calibration & Precision obtained through High Stability and Low Drift Reference Standards.
- Calibration verification on 20 years stability data of the Master Calibration Standards
- High Precision **Calibration and Measurement Capability (CMC)** of the order of 0.002% with NABL approval
- Construction: Portable in metallic cabinet

Applications :

- RTD / Temperature Sensors, Simulation and Calibration.
- Load Cell and Strain Gauge Calibration.
- Meter Calibrations.
- NABL Accredited Laboratories compliant to ISO 17025:2017 for Electro Technical Parameter
- More than 1,000 installations in India, United States of America, Europe, Gulf and Asia Pacific National Metrology Accredited Laboratories.
- Calibration of Earth Resistance Meter.

Technical Description :

- Function : Calibration Resistance Standard
- Resistance Range : 0.01 Ω to 111.1111 k Ω in Seven decades
- Resolution : 0.01 Ω
- Switches : Silver to Silver or Gold plated switches
- Switch Resistance : ≤ 2 m Ω
- Temperature Coefficient : ≤ 10 ppm/ $^{\circ}\text{C}$
- Construction/Housing Case : Portable in metallic cabinet or custom
- Maximum Voltage to Case : 2000 volts
- Stability : 1/3 of Accuracy (yearly)
- NABL Compliant CMC : 0.93% to 0.002%

Custom & Special
configuration
available
on request.

Specification :

Decade	Resistance Per Step (Ω)	Total Resistance (Ω)	Max. Current (A)	Max. Voltage (V)	Max. Power (W)	Accuracy: Precision	Accuracy: Standard	Accuracy: Economy
First	0.01	0.1	4	0.04	0.16	$\pm 1\%$	$\pm 2\%$	$\pm 5\%$
Second	0.1	1.0	1.6	0.16	0.256	$\pm 0.2\%$	$\pm 0.5\%$	$\pm 1\%$
Third	1.0	10.0	800 m	0.8	0.64	$\pm 0.02\%$	$\pm 0.05\%$	$\pm 0.5\%$
Fourth	10.0	100.0	250 m	2.5	0.625	$\pm 0.02\%$	$\pm 0.05\%$	$\pm 0.5\%$
Fifth	100.0	1.0 k	80 m	8	0.64	$\pm 0.02\%$	$\pm 0.05\%$	$\pm 0.5\%$
Sixth	1.0 k	10.0 k	23 m	23	0.53	$\pm 0.02\%$	$\pm 0.05\%$	$\pm 0.5\%$
Seventh	10.0 k	100 k	7 m	70	0.49	$\pm 0.01\% + 2\text{m}\Omega$	$\pm 0.05\%$	$\pm 0.5\%$
Total Resistance Available: 111.1111 k Ω								

For more details visit - http://vaiseshika.com/home/product_details/21

High Resistance Decade Megohm Box : 8400 HV (5 kV & 10 kV Models)

Description :

"Vaiseshika" Decade Megohm Box has been designed and fabricated for the First Time in India to provide Calibration Standard for High Resistance Substitution. This instrument employs silver alloy silver plated and silver alloy gold plated switches mounted on high insulation ceramic wafers / phenolic material.

Features :

- Calibration & Precision obtained through High Stability and Low Drift Reference Standards.
- Calibration verification on 20 years stability data of the Master Calibration Standards
- High Precision **Calibration and Measurement Capability (CMC)** of the order of 0.03% to 1.5% with NABL approval
- Construction: Portable in metallic cabinet



8400 HV

Technical Description :

- Function : Calibration Resistance Standard
- Resistance Range : 0.1 MΩ to 11.111111 TΩ in Eight decades
- Resolution : 100.0 kΩ
- Switches : Silver to Silver or Gold plated switches
- Switch Resistance : ≤ 5 mΩ
- Temperature Coefficient : ≤ 25 ppm/°C from 0.1 MΩ to 1.0 GΩ
: ≤ 100 ppm/°C from 1.0 GΩ to 1 TΩ, 250 ppm/°C above 1TΩ
- Voltage Coefficient : ≤ 3 ppm/volt upto 1TΩ, ≤ 12 ppm/volt above 1TΩ
(Applicable above 5 kV)
- Construction/Housing Case : Metallic cabinet
- Maximum Voltage to Case : 1000 Volt for 8400 & 5000/10000 Volt for 8400HV
- Dielectric Voltage : 500 Volt AC for one minute
- Stability : 1/3 of Accuracy (yearly)
- NABL Compliant CMC : 0.03% to 1.5%

Applications :

- For the calibration of;**
- Meggers (upto 10 kV)
 - Megohm Meters
 - Insulation Testers
 - Digital Meters
 - Insulation Bridges
 - Components comparison

**Custom & Special
configuration
available
on request.**

Specification :

Decade	Decade Step Resistance	Total Resistance	Maximum Voltage			Accuracy: Precision	Accuracy: Standard	Accuracy: Economy
			8400	8400-5 kV	8400-10 kV			
First	0.1 MΩ	1.0 MΩ	1000 V	1000 V	1000 V	±0.5%	±0.5%	±2%
Second	1.0 MΩ	10.0 MΩ	1000 V	1000 V	1000 V	±0.5%	±0.5%	±2%
Third	10.0 MΩ	100.0 MΩ	1000 V	5000 V	5000 V	±0.5%	±1%	±3%
Fourth	100.0 MΩ	1000.0 MΩ	1000 V	5000 V	10000 V	±0.5%	±1%	±3%
Fifth	1.0 GΩ	10.0 GΩ	1000 V	5000 V	10000 V	±0.5%	±1%	±3%
Sixth	10.0 GΩ	100.0 GΩ	1000 V	5000 V	10000 V	±0.5%	±1%	±5%
Seventh	100.0 GΩ	1.0 TΩ	1000 V	5000 V	10000 V	±1.5%	±2%	±5%
Eight	1.0 TΩ	10.0 TΩ	1000 V	5000 V	10000 V	±3%	±5%	±10%
Total Resistance Available: 11.111111 TΩ								

For more details visit - http://vaiseshika.com/home/product_details/1748

Milli & Micro - Ohm Meter Calibrator : 9409 CAL

Description :

"Vaiseshika" Milli & Micro-Ohmmeter Calibrator is an accurate and reliable calibration instrument suitable for calibration of Kelvin Bridges, Ductor Testers and Micro-Ohmmeter. It employs values of high current standard resistors that ensure precision and reliable calibrations.

The instrument consists to two potential terminals and two current terminals. High quality Gold / Silver plated terminals are used to achieve very low contact resistance and thermal EMF. The instrument employs high stability manganin resistance wire and strips to provide precision calibration & stability to the instrument.

The whole instrument is housed in a portable cabinet for safe working and onsite calibrations.

Applications :

- RTD / Temperature sensors, Simulation and Calibration.
- Load Cell and Strain Gauge Calibration.
- Micro/Milli ohm Meters Calibration.
- Earth Resistance Meter Calibration.
- Kelvin Bridge and Ductor Tester Calibration.
- Components comparison.
- Digital Meters Calibration.

Technical Description :

- Function : Calibration Resistance Standard
- Resistance Range : 0.000001 ohm to 2.0 ohms
- Temperature Coefficient : ≤ 10 ppm/°C
- Stability : 1/3 of accuracy (Yearly)
- Construction/Housing Case : Portable in metallic cabinet
- Maximum Voltage to Case : 2000 volts
- NABL Compliant CMC : 1.6% to 0.0016%



9409 CAL

Specification :

Resistance (Ω)	Maximum Current (A)	Accuracy (±)
0.000001	200	5%
0.00001	200	2%
0.0001	200	0.5%
0.001	31.6	0.1%
0.01	10	0.05%
0.1	3.16	0.02%
1.0	1.0	0.02%
2.0	1.0	0.02%



Your Attention Please !

The user engineer must specify the fixed/discrete resistance values required by him, at the time of inviting Budgetary Quotation from us.



Custom & Special configuration available on request.

For more details visit - http://vaiseshika.com/home/product_details/1025

Standard Resistor : 9409 (Oil Cooled/Air Cooled)

Description :

"Vaiseshika" DC STANDARD RESISTOR 9409 has been designed and fabricated to meet the standard calibration requirements. These Standard Resistors can be used for calibration.

To ensure stringent accuracy, high degree of stability and utmost reliability, the Manganin wire and strips have been used to construct Standard resistors. These Standards incorporate the manganin coils which have been subjected to prolonged ageing and heat treatment, to improve stability and to reduce temperature coefficient. Joints are silver soldered with copper being used for connection to terminals. Resistance elements are sealed in aluminium container having moisture free oil. Use of oil improves cooling effect which in turn imparts greater stability to resistance.

Technical Description :

Function	: Calibration Resistance Standard
Resistance Range	: 0.000001 Ω to 100.0 T Ω
Element	: Stain free, Manganin coil/wire immersed in oil upto 100 k Ω and above 100 k Ω epoxy coated high voltage resistors, hermetically sealed
Terminals	: Brass/Copper
Temperature Coefficient	: ≤ 10 ppm/ $^{\circ}\text{C}$ (upto 100 k Ω) ≤ 25 ppm/ $^{\circ}\text{C}$ (from 100 k Ω to 1 G Ω) ≤ 100 ppm/ $^{\circ}\text{C}$ (from 1 G Ω to 1 T Ω) 250 ppm/ $^{\circ}\text{C}$ (above 1 T Ω)
Voltage Coefficient	: 3 ppm/volt ≥ 100 k Ω to 1 T Ω (Applicable above 5 kV) 12 ppm/volt > 1 T Ω
Maximum Voltage to Case	: 2000 volt
Dielectric Voltage	: 500 volt AC for one minute
Stability	: 1/3 of Accuracy (yearly)



9409



9409

**Motorised Oil Cooled
Micro Ohm Standard Resistor**

Specification :

Type	Resistance (Ω)	Maximum Current (A)	Maximum Voltage (V)	Max. Power Dissipation (W)	Accuracy ($\pm$)	Calibration & Measurement Capabilities ($\pm$)
9409HP	0.000001	2000	—	4.0	5.0 %	5.0% Non NABL
9409HP	0.00001	2000	—	40.0	1.0 %	1.6% to 0.0016%
9409HP	0.0001	1000	—	100.0	0.5 %	
9409A	0.001	31.6	—	1.0	0.1 %	
9409B	0.01	10	—	1.0	0.05 %	
9409C	0.1	3.16	—	1.0	0.02 %	
9409D	1	1.0	—	1.0	0.01 %	
9409E	10	0.316	—	1.0	0.01 %	
9409F	100	0.1	—	1.0	0.01 %	
9409G	1 k	0.0316	—	1.0	0.01 %	
9409H	10 k	0.01	—	1.0	0.01 %	0.004% to 0.006%
9409I	100 k	3.16 m	—	1.0	0.05 %	
9409J	1 M	—	1000 V	—	0.1 %	
9409K	10 M	—	1kV/5kV/10kV	—	0.5 %	0.6% to 1.5%
9409L	100 M	—	1kV/5kV/10kV	—	1.0 %	
9409M	1 G	—	1kV/5kV/10kV	—	2.0 %	
9409N	10 G	—	1kV/5kV/10kV	—	5.0 %	
9409O	100 G	—	1kV/5kV/10kV	—	5.0 %	
9409P	1 T	—	1kV/5kV/10kV	—	5.0 %	
9409Q	10 T	—	1kV/5kV/10kV	—	10 %	

**Custom & Special
configuration
available
on request.**

For more details visit - http://vaiseshika.com/home/product_details/45

Application of Resistance Calibration Standards in Industry & Metrology Laboratories

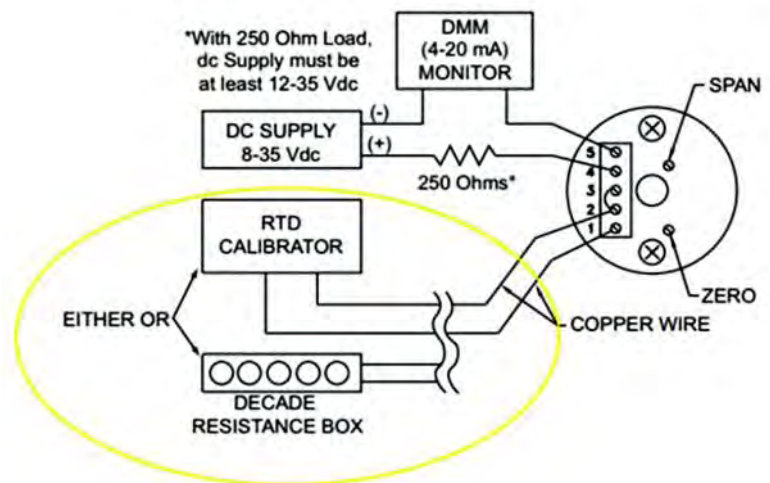
by
Anil Jain,
Ph.D. (BITS, Pilani)

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The High Precision Decade Resistance Box, High Resistance Decade Megohm Box, Milli & Micro-Ohm meter Calibrator, Standard Resistor, Fixed Value Insulation Tester Calibration System and DC Shunt are the major calibration standards offered by Vaiseshika for the ISO 17025:2017 Metrology Laboratories. Here are the glimpses of the various applications for your study:

1. To Calibrate an RTD Transmitter :

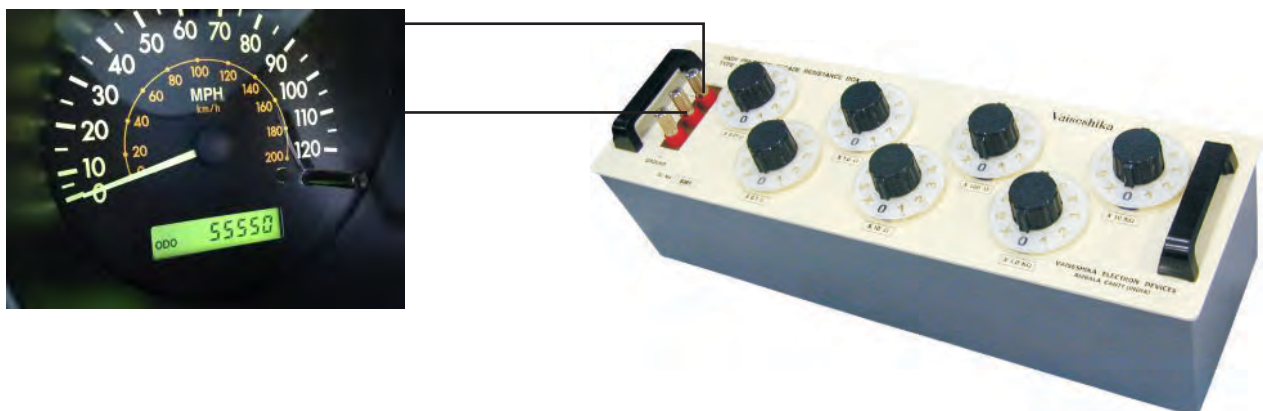
A resistance box can be used as a RTD simulator to provide standard values of resistance for simulation and calibration. RTD simulators provide a resistance simulating the output of a resistance temperature detector (RTD) at a particular temperature.



Connection Diagram of a Resistance Box to a Transmitter

2. To Calibrate RTD based automobile Panel Meters :

In automotive industry these are used for the testing and calibration of speedometers. Today speedometers are having electronic circuit to display the speed of the automobile. Therefore feeding predetermine values of precision resistance in the input of the speedometer will be used to calibrate the speedometers.



Instrumentation setup for Precision Calibration of RTD based Panel Meters & Temperature Indicators

3. To Calibrate Insulation Testers :

The High Resistance Decade Megohm Boxes are used in the precise calibration of Meggers, Insulation Testers, Insulation Bridges, Megohm Meters, Digital Meters and Components Comparison.

These High Resistance Decade Megohm Boxes are having high voltage rating. This helps in calibration of the above mentioned instruments with latest technology and high voltages upto 10,000 V DC (Resistance from 0.1 Meg Ohm to 10 Tera Ohm).



Calibration setup of a Decade Megohm Box for Insulation Tester Calibration

4. To Calibrate Micro Ohm Meters and Milli Ohm Meters :

Vaiseshika Milli & Micro Ohm Meter Calibrator can be used by quality control and quality assurance laboratories in manufacturing, plant maintenance and field use to calibrate your micro ohm meters and milli ohm meters using the four wire Kelvin Measurement Method. Vaiseshika Calibrators can simulate low resistance and check accuracy and reliability of bench top, portable handheld meters with various resolutions, ranges, accuracies and operational modes involving the safety, quality and cost implications for reporting consistently accurate results in the digital milli ohm meters and micro ohm meters.



Calibration setup for Micro ohm Meter Calibration

5. Shunt Calibration of Strain Gage Sensor (Load Cell) :

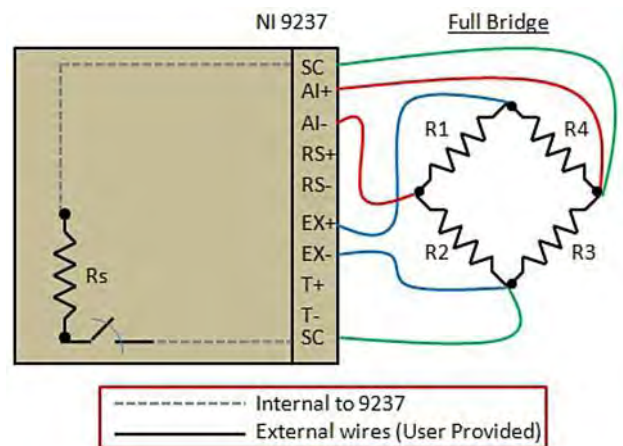
Since a strain gage load cell is a passive electrical device, there exists a simple, yet effective, method for checking the calibration of a load cell system in the field or when a means of applying actual forces is unavailable. Inducing an electrical imbalance in the cells bridge circuit will simulate the bridge imbalance caused by the application of actual forces to the load cell. Then the system gain may be adjusted so that the system output signal or display indicates a known force on the load cell.

To perform a Shunt Calibration, use the following procedure :

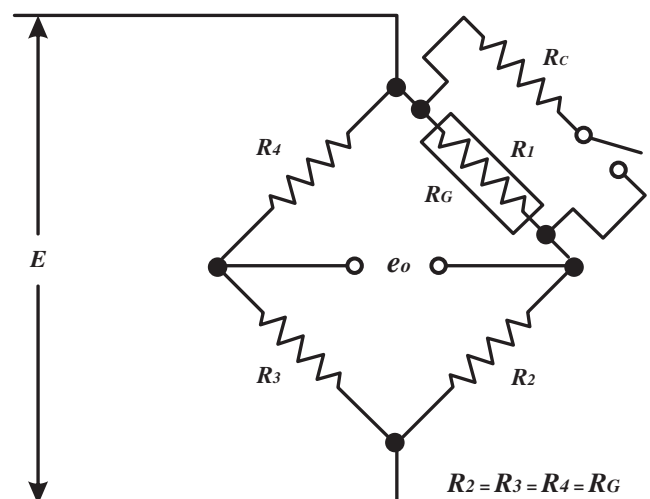
1. Remove or Stabilize all forces on the load cell.
2. Adjust the display or indicator ZERO to read exactly zero.
3. Connect the Shunt Calibration Resistor to the Terminals specified on the Calibration Certificate, and adjust the SPAN or GAIN until the display reads the force value stated on the Certificate.
4. Repeat the procedure to insure a valid Calibration.

Shunt calibration is accepted throughout the industry as means of constant calibration of a signal conditioner and transducer between calibrations of known, applied, traceable, mechanical, input values. It's important to remember that the shunt resistor can simulate either a tension or compression input in the Wheatstone Bridge. Thermal EMF and TCR errors can affect the process and should be minimized by choosing a proper resistor. The shunt calibration can be applied conveniently and at any moment and most important during the test programs.

Consequently, strain-gage and transducer manufacturers supply shunt calibration data, along with a shunt calibration precision resistor, as a standard feature. Of course, regular physical calibration is recommended as well to ensure the accuracy, stability, reliability and linearity of the instrument itself.



Shunt-calibration resistors are chosen to accurately simulate resistance change in a strain gage subjected to specified levels of compressive strain. Strain indicators generally will produce a linear output with a fully active half-bridge or full-bridge input circuit, and will be slightly in error when a single active arm is used. The same nonlinearity occurs whether the gage is actually strained in compression or simulated by shunting the gage with the corresponding calibration resistor



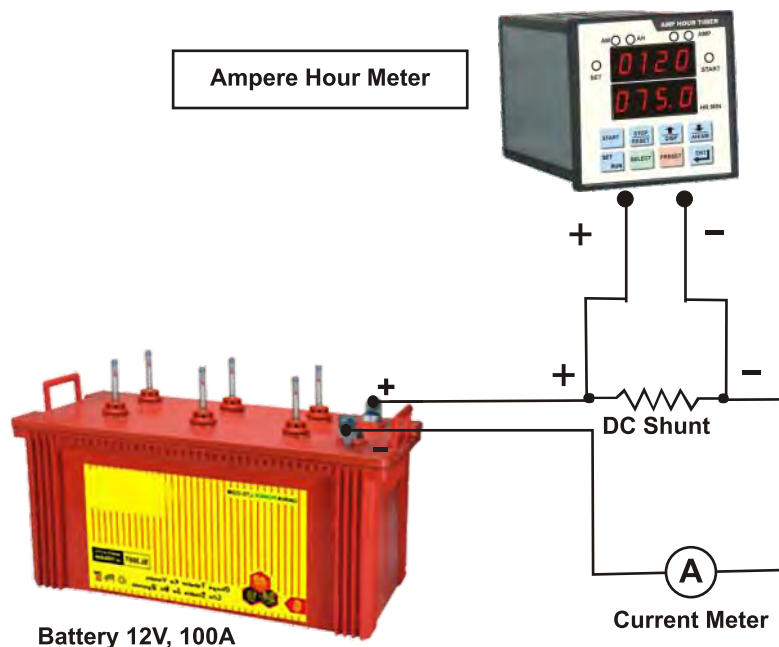
6. To estimate the Charging and Discharging Rate of a Battery :

Air Cooled DC Shunt is also used for fast and controlled Discharging of Batteries.

The battery capacity, that battery manufacturers print on a battery, is usually the product of 20 hours multiplied by the maximum constant current that a new battery can supply for 20 hours at 68 F° (20 C°), down to a predetermined terminal voltage per cell. A battery rated at 100 A·h will deliver 5 A over a 20 hour period at room temperature.

However, if it is instead discharged at 50 A, it will have a lower apparent capacity to last for two hours.

The Vaiseshika DC Shunt is the heart of the below mentioned circuit which is used to verify the ampere-hour capacity of the battery:



Discharging of Battery using Vaiseshika DC Shunt

The charge and discharge current of a battery is measured in C-rate. Most portable batteries are rated at 1C. This means that a 1000mAh battery would provide 1000mA for one hour if discharged at 1C rate. The same battery discharged at 0.5C would provide 500mA for two hours. At 2C, the 1000mAh battery would deliver 2000mA for 30 minutes. 1C is often referred to as a one-hour discharge; a 0.5C would be a two-hour, and a 0.1C a 10- hour discharge. When discharging a battery with Vaiseshika DC Shunt that allows the setting of different discharge C-rates, a higher capacity reading is observed if the battery is discharged at a lower C-rate and vice versa. By discharging the 1000mAh battery at 2C, or 2000mA, the analyzer is scaled to derive the full capacity in 30 minutes. The manufacturer plots the voltage versus the discharge time curve. Using this curve the rated capacity is verified.

Vaiseshika DC Shunts can be used for the testing and calibrations of Charger / Discharger Panel Meters, Battery Testers, Battery Performance Testing Devices, Clamp-on-Meters, Insulation Testers and Tong Testers.

Vaiseshika Air Cooled DC Shunt is also used as a Reference Calibration/Master Standard for comparing and calibrating the Battery Discharging Resistors/Rheostats (of the manufacturers) at their workshops.

Air Cooled DC Shunt is also used for measuring the specification of transformer like its power, voltage and current.

Fixed Value Insulation Tester Calibration System : 9409 FV

Description :

"Vaiseshika" has designed a Fixed Value Insulation Tester Calibration System which can be suitably used for the purpose of calibration & testing of Insulation testers and megohm meters with impressed test voltages upto 10000 volt. This instrument provides single point fixed high resistance values anywhere between 100 kohm to 10 Tera ohm. The fixed point values can be selected by the customer. Custom built instrument can also be designed and manufactured, by Vaiseshika, for the calibration laboratory. The instrument is constructed in metallic / rugged high strength polymer case, for field calibration.



9409 FV

Technical Description :

Function	: Calibration Resistance Standard
Resistance Range	: Any Discrete value from 100 kΩ to 10 TΩ (user can select the set of values as per his requirement)
Temperature Coefficient	: ≤ 25 ppm/°C from 0.1 MΩ to 1.0 GΩ ≤ 100 ppm/°C from 1.0 GΩ to 1 TΩ, 250 ppm/°C above 1TΩ
Voltage Coefficient	: 3 ppm/volt ≥ 100 kΩ to 1 TΩ (Applicable above 5 kV) 12 ppm/volt > 1 TΩ
Stability	: 1/3 of Accuracy (Yearly)
Construction/Housing Case	: Portable in metallic cabinet or as per customer's requirement
Maximum Voltage to Case	: 2k/5k/10kV(as per the Instrument supplied)

⚠ Your Attention Please !
The user engineer must specify the fixed/discrete resistance values required by him, at the time of inviting Budgetary Quotation from us.
👉 Custom & Special configuration available on request.

Specification :

Nominal Value	Max Voltage			Accuracy	NABL Compliant CMC (±)	Resistor Type
	1kV Model	5kV Model	10kV Model			
1kΩ	50V	50V	50V	± 0.05%	0.002% to 0.01%	Enamelled Manganin wire
10kΩ	150V	150V	150V	± 0.05%		
>10kΩ to 100kΩ	500V	500V	500V	± 0.05%		
>100kΩ to 1MΩ	1000V	1000V	1000V	± 0.3%	0.03% to 1.5%	High Voltage Epoxy Coated Resistors
>1MΩ to 100MΩ	1000V	500V	10000V	± 0.3%		
>100MΩ to 10GΩ	1000V	5000V	10000V	± 0.5%		
>10GΩ to 100GΩ	1000V	5000V	10000V	± 1%		
>100GΩ to 1TΩ	1000V	5000V	10000V	± 1.5%		
>1TΩ to 10TΩ	1000V	5000V	10000V	± 10%		

For more details visit - http://vaiseshika.com/home/product_details/1750

Air Cooled DC Shunt : 9410

Description :

"Vaiseshika" DC Shunt 9410 has been designed and fabricated to meet the standard calibration requirements.

To ensure stringent accuracy, high degree of stability and utmost reliability, the Manganin wire and strips have been used to construct DC Shunts. These Standards incorporates the manganin coils which have been subjected to prolonged ageing and heat treatment, to improve stability and to reduce temperature coefficient. Joints are silver soldered with copper being used for connection to terminals. Resistance elements is sealed in aluminium container having moisture free oil. Use of oil improves cooling effect which inturn imparts greater stability to resistance.

Technical Description :

- Construction: Portable, Compact and sturdy construction designed in metallic cabinet for easy operation and storage.
- Well- aged, Heat-treated & insulated manganin strips.
- Current Range: 1.5 Amp. to 5000 Amp.
- High Precision **Calibration and Measurement Capability (CMC)** of the order of 0.0016% to 1.6% with NABL approval.
- Maintainability of DC Shunt up to 10 years.
- Excellent performance versus cost.
- Stability 1/3 of Accuracy (yearly).
- Temperature Coefficient : 10 ppm/°C.

Applications :

- For Charging & discharging the batteries.
- For use as current flow source at selected resistance.
- Measurement of precise current.
- Quality Assurance and Calibration laboratories.
- Load testing of batteries & transformers.



9410

Specification :

Current (A)	Resistance (Ω)	Voltage Drop (V)	Wattage (W)	Accuracy	NABL Compliant CMC (±)
1.5	1.0	1.5	2.25	± 0.05 %	0.0016% to 1.6%
5	0.2	1.0	5.0	± 0.05 %	
15	0.1	1.5	22.5	± 0.05 %	
15	0.01	0.15	2.25	± 0.05 %	
50	0.01	0.5	25.0	± 0.05 %	
50	0.02	1.0	50.0	± 0.05 %	
75	0.002	0.15	11.25	± 0.05 %	
150	0.01	1.5	225.0	± 0.5 %	
150	0.001	0.15	22.5	± 0.5 %	
300	0.001	0.3	90.0	± 0.5 %	
500	0.0002	0.10	50.0	± 0.5 %	
750	0.0002	0.15	112.5	± 1.0 %	
1000	0.0001	0.1	100.0	± 1.0 %	
1500	0.0001	0.15	225.0	± 1.0 %	
2000	0.00005	0.1	200.0	± 1.0 %	
5000	0.00002	0.1	500.0	± 1.0 %	
5000	0.000001	0.005	25.0	± 5.0 %	5% Non NABL



9410

For more details visit - http://vaiseshika.com/home/product_details/43

Decade Resistor Box : 8400 HVSD

Description :

Vaiseshika 8400HVSD is an economical version of set of precision high resistance values designed for Calibration & Testing of Insulation Testers, Megohm-Meters or other similar Instruments; Discrete values are incorporated up to 10 TΩ with special protection from effects of moisture & other environmental conditions.

Technical Description :

Function	: Calibration Resistance Standard
Range	: Set of Eleven Resistors (1kΩ to 10TΩ)
Operating Temperature	: (25±2)°C
Switches	: Silver to Silver or Gold Plated Contact
Switch Resistance	: ≤5 mΩ
Temperature Coefficient	: ≤ 10ppm upto 10kΩ ≤ 25 ppm/°C from 0.1 MΩ to 1.0 GΩ ≤ 100 ppm/°C from 1.0 GΩ to 1 TΩ, 250 ppm/°C above 1TΩ
Voltage Coefficient (Applicable above 5 kV)	: ≤ 3 ppm/volt upto 1TΩ 12 ppm/volt above 1TΩ
Housing	: Metallic or as per the requirement of customer
Maximum Voltage to Case	: 5kV/10kV as per the Instrument supplied
Traceability Drift	: 07-18 Years with documentary proof



8400HVSD

Specification :

Nominal Value	Maximum Voltage		Accuracy			NABL Compliant CMC (±)	Resistor Or Type
	8400 HVSD -5kV	8400 HVSD -10kV	Precision	Standard	Economy		
1kΩ	50V	50V	±0.01% to ±0.02%	±0.05%	±0.05%	0.002% to 1.5%	Enamelled Manganin Wire
10kΩ	150V	150V	±0.01% to ±0.02%	±0.05%	±0.05%		
100kΩ	1kV	1kV	±0.01% to ±0.03%	±0.5%	±2%		
1MΩ	1.5kV	1.5kV	±0.018% to ±0.3%	±0.5%	±2%		High Voltage Epoxy Coated Resistors
10MΩ	5kV	5kV	±0.03% to ±0.4%	±1%	±3%		
100MΩ	5kV	10kV	±0.1% to ±0.4%	±1%	±3%		
1GΩ	5kV	10kV	±0.2% to ±0.5%	±1%	±3%		
10GΩ	5kV	10kV	±0.2% to ±1%	±2%	±5%		
100GΩ	5kV	10kV	±0.5% to ±2%	±3%	±5%		
1TΩ	5kV	10kV	±3% to ±5%	±5%	±10%		
10TΩ	5kV	10kV	±10%	±15%	±20%		

For more details visit - http://vaiseshika.com/home/product_details/1847

Spectrum of Prestigious Projects, Organizations and Institutions using Vaiseshika Calibration Standards

SUKHOI SU-30 & PRESTIGIOUS AVIONICS PROJECTS

- SU-30 Sukhoi Aircraft, Jaguar Aircraft, MIG Aircraft, Light Combat Aircraft (LCA) and Advanced Jet Trainer (AJT), Advanced Light Helicopter (ALH) Projects of the Hindustan Aeronautics Limited at their factories at Bangalore, Barrackpore, Hyderabad, Korwa, Kanpur, Koraput, Lucknow and Nasik.

POLAR SATELLITE & SPACE RESEARCH PROJECTS

- Polar Satellite Launch Vehicle, Geosynchronous Launch Vehicle and National Satellite Projects at the Space Research Stations of Vikram Sarabhai Space Centres at Ahmedabad, Thiruvananthapuram, Mahendragiri and Sriharikota.

NUCLEAR POWER PROJECTS

- Nuclear Power Generation Projects and Research Centres at Kota (Rawatbhatta), Surat (Vyara), Mysore, Bulandshar (Narora), Thane (Boisar) & Bhabha Atomic Research Center at Mumbai.

INDIAN AIR FORCE, INDIAN NAVY & INDIAN ARMY

- Base Repair Depots of Indian Airforce at Chandigarh, Coimbatore (Sullur), Jabalpur, and Tughlakabad and Indian Airlines Limited, Kolkatta and Mumbai. Indian Navy, Port Blair and Army Base Workshop, Agra etc.

NATIONAL HYDEL & SUPER THERMAL POWER PROJECTS

- Bhakra Dam, Bhakra Beas Project; Korba Super Thermal Power Project, Korba; Koyna Dam Maintenance Division, Satara; National Thermal Power Corporation Limited, New Delhi; National Hydroelectric Power Corporation Limited, Chamera (Himachal Pradesh); Super Thermal Power Project, Kahalgaon; Thermal Power Project, Dhenkanal (Orissa); Vindhyachal Super Thermal Power Project, Sindhi and Karnataka Power Corporation Limited.



Prestigious Industrial Organizations in India



National Metrology Institutions

NATIONAL, REGIONAL, STATE & NABL/ISO 17025 ACCREDITED CALIBRATION LABORATORIES IN INDIA & OVERSEAS COUNTRIES

- More than 50 NABL Accredited Laboratories in India and ISO 17025 laboratories in Bulgaria, Dubai, Saudi Arabia & Singapore. ctronics Test and Development Centres (ETDC) at Aurangabad, Chennai, Goa, Guwahati, Hyderabad, Mohali, Mumbai, Pune and Solan.



هيئة الإمارات للمواصفات والمقاييس
Emirates Authority For Standardization & Metrology



Saudi Accreditation Committee
اللجنة السعودية للاعتماد



Singapore
Accreditation
Council

Thumb Wheel Decade Resistance Box : 7400A

Description :

"Vaiseshika" Thumb Wheel Resistance Box, Type: 7400A is a Resistance Standard substitution instrument. It can be used as a source of resistance of a known accuracy of the order of $\pm 1\%$. It is used for selected test applications in R&D or Pt100 simulation, in the process industries.

Technical Description :

Function	:	Calibration Resistance Standard
Resistance Range	:	0.1 Ω to 999.9999 k Ω
Resolution	:	0.1 Ω
Switches	:	Selectable Thumb Wheel
Temperature Coefficient	:	≤ 25 ppm to 150 ppm/ $^{\circ}$ C
Construction/Housing Case	:	Portable in metallic cabinet or as per customer's requirement
Maximum Voltage to Case	:	2000 volts



7400A

Decade Dial	Total Decade Resistance	Max. Current	Max. Power	Max. Voltage	Accuracy	NABL Complaint CMC ($\pm$)
0.1 Ω	0.9 Ω	1.0A	1.0W	250 Volts FSD	$\pm 5\%$	0.013% to 0.004%
1.0 Ω	9.0 Ω	1.0A	1.0W		$\pm 1\%$	
10.0 Ω	90.0 Ω	0.3A	1.0W		$\pm 1\%$	
100.0 Ω	900 Ω	0.1A	1.0W		$\pm 1\%$	
1.0 k Ω	9.0 k Ω	31 mA	1.0W		$\pm 1\%$	
10.0 k Ω	90.0 k Ω	10 mA	1.0W		$\pm 1\%$	
100.0 k Ω	900.0 k Ω	3 mA	1.0W		$\pm 2.5\%$	

For more details visit - http://vaiseshika.com/home/product_details/22

High Voltage Probe : 8401

Description :

"Vaiseshika" High Voltage Probe is designed to measure the voltage of an AC/DC voltmeter from 100 volts to 15000 Volts (15 kV). As per the Principle of High Voltage Probe, Input of Probe is connected to the High Voltages Sources (Range ≥ 1000 Volts), where Multimeters cannot measure the voltage beyond 1000 Volts & output is connected to the Voltmeter.

Our High Voltage Probe has been designed at an ratio of 1000:1. This means, if the input is 1000 Volts then output will be 1.0 volt. A 1000:1 voltage divider provides the probe with high input impedance. The divider also provides high accuracy when used with a voltmeter. Probe can only be used to make measurements on energy limited circuits within equipment, Testing & calibration of High Voltage Power Supplies & Sources. A molded Glass Epoxy body houses the divider and protects the user from the voltage being measured.



8401

Technical Description :

Function	:	Calibration Voltage Standard
Voltage Range	:	100 Volt to 15 kilo Volts
Accuracy	:	$\pm 1\%$
Stability	:	1/3 of Accuracy (Yearly)
Input Impedance	:	≥ 1000 M Ω
Construction/ Housing Case	:	Portable in Glass Epoxy Material
Maximum Voltage to Case	:	15 kV
Cable Length	:	1 Meter
Operating Temperature	:	0 $^{\circ}$ C to 50 $^{\circ}$ C
Storage Temperature	:	-10 $^{\circ}$ C to 60 $^{\circ}$ C

For more details visit - http://vaiseshika.com/home/product_details/1777

Decade Capacitance Box: 7500

Description :

Decade Capacitance boxes are test instruments which use a series of capacitors to simulate very specific electrical values. Measured in farads, capacitance is important in a number of applications. Capacitance boxes widely used in electronic circuits for blocking direct current while allowing alternating current to pass. Other applications for capacitors include power factor correction, signal coupling, tuned circuits and many types of sensors.

"Vaiseshika" Decade Capacitance boxes can quickly and accurately simulate capacitance for quickly testing the accuracy of multimeters and other instruments that measure capacitance. Capacitance decade boxes are also commonly used for product design as they can be easily inserted into a circuit and function as a capacitor of any value (within its range) to assist in identifying the optimal size for the circuit.

Technical Description :

Decade Capacitance Box - 6 Dial

Range: 1nF to 1000 μ F

Decades of 1nF, 10nF, 100nF, 1 μ F, 10 μ F, 100 μ F

Accuracy: $\pm 1\%$



7500

Decade Inductance Box : 7600

Description :

Inductance is an electrical property by which voltage is induced in a circuit, or a nearby circuit, by a changing magnetic field. Measured in henrys, inductance can be classified as self-inductance when the voltage is induced in the circuit itself, or as mutual inductance when the voltage is induced in a nearby circuit.

Decade Inductance boxes can quickly and accurately simulate inductance for quickly testing the accuracy of multimeters and other instruments that directly measure inductance. Decade Inductance Box is designed to calibrate Inductance Meters and Inductance ranges of LCR meters.

Technical Description :

Decade Inductance Box - 6 Dial

Range: 10 μ H to 10H

Decades of 10 μ H, 100 μ H, 1mH, 10mH, 100mH, 1H

Accuracy: $\pm 1\%$



7600



Dr. Anil Jain (Left) is felicitating Mr. Anil Vij (Right),
Minister of Science & Technology,
Govt of Haryana at a public function in Ambala Cantt.



Dr. Anil Jain is delivering the Convocation Address
at the Graduation Ceremony of engineering graduates
of Kurukshetra University.

Our Distinguished Visitors and Activities



Dr. Anil Jain, President, Vaiseshika is speaking at the National Physical Laboratory, New Delhi on the subject "Application of Metrology and Quality System in Industries"



(Left to Right) Mr. V.N. Pandey (Technical Assessor) and Mr. B.S. Srivastava (Lead Assessor) from NABL, New Delhi on a visit to Vaiseshika Facility



Mr. Pani Kumar, Dr. Anil Jain (Vaiseshika), Mr. Vijay Kumar and Mr. Ram Kumar Scientists from Satish Dhawan Space Centre, Sriharikota are understanding Morehouse Load Cell Calibration System



Dr. Anil Jain, President, Vaiseshika is explaining Vaiseshika Instruments to Dr. R.A. Mashelkar, former Director General, CSIR



(Left to Right) Mr. N.B. Subramaniam, Mr. Zvi Mishliborsky Deputy Director, R&D (VPG Transducers), Dr. Anil Jain, President (Vaiseshika) and Mr. MS Tamilarasu, Manager Engineering (VPG Transducers) at a technical meeting at the Vishay Precision Transducers India Pvt. Ltd., Oragadam, Sriperumbudur



Dr. Anil Jain, President (Vaiseshika) is explaining the instruments to Dr. K. Kasturirangan, Former Chairman, Indian Space Research Organization and Member, Planning Commission, Govt. of India

Vaiseshika®

Spectrum of Vaiseshika Material Inspection & Testing Instruments



Vaiseshika Calibration Laboratory



Panoramic View of Vaiseshika Metrology Laboratory Compliant to ISO 17025:2017 Protocols

For further information on all the products in this Bulletin, please write us on :

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