Model 9333 Series

Precision Resistance Standards

Technical Manual

TM9333-1-00
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1. INTRODUCTION

This manual provides an overview of the 9333 Series of Air Resistance Standards and also contains the necessary information required to perform a calibration or verification test. General product information, description of case styles and performance specifications are also included.

This manual applies to all models of the 9333 Series of Resistance Standards unless otherwise noted. This includes custom values that are ordered.

The phone number in the USA and Canada to obtain Product Support, Calibration Service or Replacement Parts is (800) 310-8104.

To Contact Guildline Instruments, the following information is provided.

USA and Canada Telephone: (613) 283-3000
USA and Canada Fax: 1-613-283-6082

Outside US and Canada Telephone: + [0] [1] 613 283-3000
Outside US and Canada Fax: + [0] [1] 613 283-6082

You can also contact Guildline Instruments Limited via their Email or Website.

Email is: sales@guildline.com
Website is: www.guildline.com

1.1. Unpacking and Inspection

Every care is taken in the choice of packing material to ensure that your equipment will reach you in perfect condition. If the equipment has been subject to excessive handling in transit, the fact will probably be visible as external damage to the shipping carton.

In the event of damage, the shipping container and cushioning material should be kept for the carrier's inspection.

Carefully unpack the equipment and check for external damage to the standard. If the shipping container and packing material are undamaged, they should be retained for use in return shipments. If damage is found notify the carrier and Guildline immediately.

1.2. Warranty

Guildline Instruments warrants its products to be free of defects in manufacture and normal operation for a period of two (2) years from the date of purchase, except as otherwise specified. This warranty applies only in the country of original purchase and only to the original purchaser, who is also the end user. Equipment, which is defective or fails within the warranty period, will be repaired or replaced at our factory without charge at the discretion of Guildline Instruments.

In addition, standards and systems manufactured by Guildline Instruments are warranted to be free of defects in overall system operation for a period of one (1) year from the date of receipt by the original purchaser.

Third party system components purchased by Guildline carry the warranty of the original equipment manufacturer and will be accepted for claim by Guildline Instruments at our factory only after warranty authorization by the original manufacturer.

Limitation of Warranty

Warranty coverage does not apply to equipment which has failed due to misuse, neglect, accident or abnormal conditions of operation or if modifications or repairs have been made without prior written authorization of Guildline instruments.

Damage in Shipment to Original Purchase

Instrument(s) should be thoroughly inspected immediately on receipt for visible damage. Any damage should be reported to the carrier and further inspection and operational tests should be carried out if appropriate to determine if there is internal damage. Contact Guildline Instruments before returning for repair. The Customer or purchaser must complete all final claims with the carrier.

Regular charges will apply to non-warranty service. External service charges and expenses will be billed at cost plus handling.

1.3. To Obtain Warranty or Calibration and Repair Service

Call for a Return Material Authorization (RMA) number. RMA's are required for all Warranty Returns and/or Calibration and Repair Service Requests. Telephone, Fax and email addresses to contact Guildline are provided previously.

Guildline Instruments will pay for all warranty costs including shipping from Guildline to the original shipment point. However, if the instrument is purchased within one country and shipped to another, Guildline will only pay for shipping to the original ship to country or customer point. The customer is responsible for paying for the shipping costs to return an item to Guildline.

USA Warranty Return Address.

USA Customers should use the following address to return instruments for warranty service or calibration support.

Guildline Instruments Limited
C/O AN Deringer
835 Commerce Park Drive
Ogdensburg, NY 13669

Mark on the outside of the box:
RMA # _____
Model #_____
Serial #_____

The Statement: "Canadian manufactured goods being returned for repair."

For all other countries, including Canada please ship to:

Guildline Instruments Limited
21 Gilroy Street, PO Box 99
Smiths Falls, ON K7A 4S9

Mark on the outside of the box:
RMA # _____
Model #_____
Serial #_____
The Statement: "Canadian manufactured goods being returned for repair."

1.4. Safety Information

These Standards can be used with Equipment capable of voltages up to 1000 V. The operator should be aware of the environment in which these standards are used.

WARNING: Use caution when working with voltages above 30 V ac rms, 42 V ac peak, or 42 V dc. These voltages pose a shock hazard.

The 9333 Resistance Standards are designed to work within specifications to 100 mW of power and 1000 Vdc or less. Applying more than the recommended power or voltage will damage the unit and voids the warranty.

Do not use the Resistance Standard in wet environments.

Never use the Resistance Standard with the cover removed or the case open.

When making electrical connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.

Inspect the Resistance Standard for damage such as cracked connectors prior to use. If unit has a burned smell or smoke is visible during use, discontinue use immediately.

If test equipment used with Resistance standards overloads or trips, this could be a sign that the resistance standard requires repair..

Inspect all test leads used with the Resistance Standard for damaged insulation or exposed metal. Check all test leads for continuity.

Ensure all test leads are correctly connected prior to applying current or voltage.

Do not use resistance standards around explosive gas, vapor or dust.

2. 9333 SERIES STANDARD SPECIFICATIONS

2.1. 9333 Series Uncertainty Specifications

Tables 2.1, 2.2 and 2.3 show the specifications for the 9333 Series. For custom models, please consult your calibration certificate to determine stabilities and maximum limits.

Model (Nominal Ω)	Initial [1] Tolerance (± ppm)	Stability (± ppm) [2]	Maximum Limits [3]		Temperature Coefficient ppm/± 1 °C	Voltage [4] Coefficient ± ppm/Vdc
			Current (Adc)	Voltage (Vdc)		
9333-0.001	50	35	10 A	0.01	20	NA
9333-0.01	20	12	3 A	0.03	6	NA
9333-0.1	15	10	1 A	0.1	5	NA
9333-1	10	5	320 mA	0.32	2	NA
9333-10	10	5	100 mA	1	2	NA
9333-100	10	5	32 mA	3.2	2	NA
9333-1k	10	5	10 mA	10	2	NA
9333-10k	10	5	3.2 mA	32	2	0.01
9333-100k	15	7	1 mA	100	2	0.03
9333-1M	15	22	0.32 mA	320	5	0.05

Table 2-1 : Specifications for 9333 - 0.001 to 1M Ohm (4-Wire Configurations)

Model (Nominal Ω)	Initial [1] Tolerance (± ppm)	Stability (± ppm) [2]	Maximum Limits[3]		Temperature Coefficient ppm/± 1 °C	Voltage [4] Coefficient ± ppm/Vdc
			Current (µAdc)	Voltage (Vdc)		
9333-10M	20	25	100	1000	6	0.3
9333-100M	35	50	15	1500	6	1.0
9333-1G	100	500	1.5	1500	25	1.5

Note 1: Nominal initial tolerance is defined as the maximum variation of resistance mean values as initially adjusted at the point of sale.

Note 2: Calibrated in air at 23 °C traceable to the SI unit of electric resistance, calibration uncertainties expanded and expressed at the 95 % level of confidence. An ISO/IEC 17025 accredited certificate and report of calibration stating the calibrated value and estimated uncertainty is provided with each resistor.

Note 3: Resistance Standards are typically calibrated at 10 mW of power or less.

Note 4: Voltage hysteresis: negligible to < 0.1 ppm. Temperature hysteresis: < 0.3 ppm between 0 °C and 40 °C.

Note 5: Special/Custom Values available upon request including 1.9x values.

Table 2-2 : Specifications for 9333 - High Values (2-Wire)

GENERAL SPECIFICATIONS										
Temperature (All Models)			Operating Humidity (Non-Condensing)				Storage Humidity (Non-Condensing)			
Operating	Storage		(Models ≤1 MΩ)		(Models ≥10 MΩ)		(Models ≤1 MΩ)		(Models ≥10 MΩ)	
10 °C to 40 °C	-40 °C to 70 °C		15 % to 70 % RH		15 % to 50 % RH		15 % to 80 % RH		15 % to 80 % RH	
Dimensions	Height		Width		Depth		Weight		Shipping Weight	
All Models	88 mm	3.5"	124 mm	4.9"	79 mm	3.1"	.63 kg	1.4 lbs	1 kg	2.2 lbs

Table 2-3 : General Specifications for 9333

3. OVERVIEW

3.1. General

The Guildline Model 9333 series of Resistance Standards are designed as very high stability calibration laboratory standards for high accuracy resistance calibration in air, between 1 mΩ and 1 GΩ, without the need for stabilization in a temperature controlled bath (see Figure 1). If necessary, the ambient temperature adjacent to the enclosure may be monitored, and a correction factor applied to the value of the resistance.

The 9333 Series can be used as working standards, or highly reliable and rugged transportable transfer standards. They are extremely useful for the calibration of the resistance ranges of multi-function calibrators and high accuracy digital multimeters, as well as for use in more classical standards and calibration laboratory applications where the need for high accuracy resistance values are required. They are very stable and are designed to be used across a wide temperature range.

Each 9333 discrete resistance value is enclosed in a compact and ruggedized case. With the Series low temperature coefficient, makes this Series ideal for applications outside of a laboratory environment or for education institutes that typically encounter a wider temperature environment.

All models include 5-way beryllium copper, gold plated binding posts constructed of low-thermal emf material for Voltage Measurements as well as current connections. One additional terminal is provided for a case ground connection.

For Resistance Values of 1 MΩ and below, four 5-way binding posts are used for true 4-Wire resistance measurements. These terminals are compliant with standard banana cable size spacing and are color coded for easy visual connections.

Values from 10 MΩ and above have two binding posts for the resistance with one additional terminal for guard/ground. Guildline's unique design for these resistance values include the use of high insolation to allow for voltages up to 1500 V.

The design of Guildline's 9333 Series Resistance Standards is based on over 60 years of innovation, design knowledge, and manufacturing experience in building resistance standards. Guildline resistance standards are made with multiple elements in parallel or series rather than using a single element as per competitive products.

This approach lowers the drift that is seen with a single element and reduces the internal noise generated inside the reference resistor. The result is industry leading annual drift rates.

The design starts with every resistance element going through an exacting process that ensures quality and long term stability. This process is diagrammed as shown:

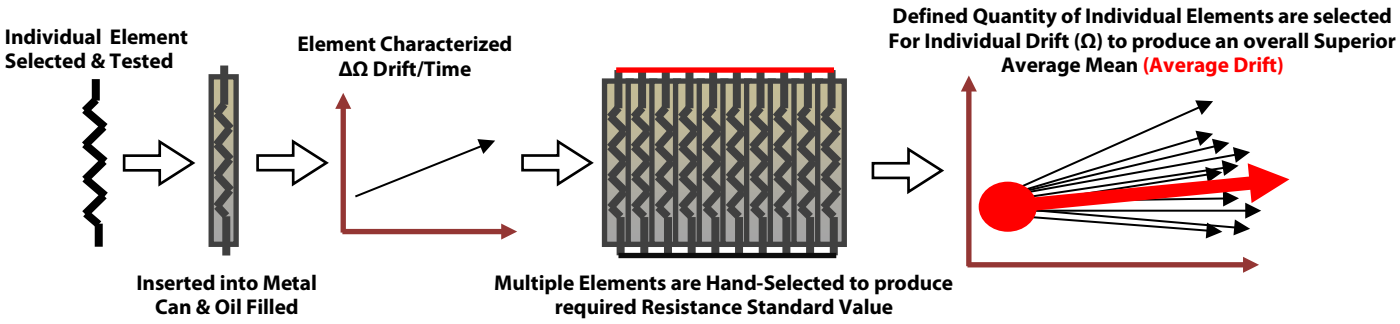
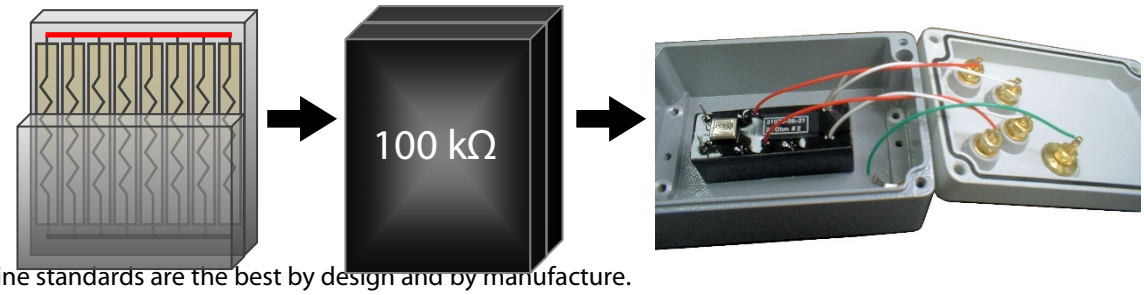


Figure 3-2 : Resistance Element Build Up

The multiple elements are sealed in epoxy for protection against humidity, are bonded to a thermal block, and are placed into the provided EMI shielded outer case with high quality terminals attached.



Guildline standards are the best by design and by manufacture.
One key advantage of Guildline Resistance Standards is that each Resistance Value is made up from multiple resistance elements, not just a single element which is the technique used by most manufacturers.

The 9333 Series are designed for use with Direct Voltage or Direct Current. For AC Voltage and AC Current applications see our 7334A Series of AC Resistance Standards and 7340 / 7350 Series of AC Shunts. For Higher Accuracy DC Resistance Standards (Air) please refer to the 9334A Series.

3.2. Series Design Layouts

3.2.1. 0.001 Ω to 1 MΩ Standard Values

The resistor elements are securely mounted to the inside of a hermetically sealed aluminum enclosure. For resistances up to 1 MΩ, five binding post connections on the top of the resistance standard are provided (refer to Figure 3-2). The C1 and C2 connections are used to apply the test current or voltage to the resistor. The P1

and P2 connections are used to measure the voltage drop and thus the resistance. The fifth connection is for chassis ground.

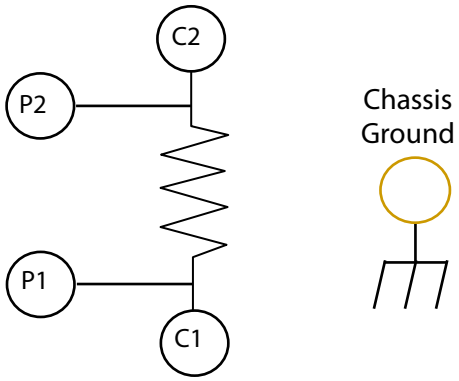


Figure 3-3 : 9333 Series from 0.001 Ω to 1 MΩ

3.2.2. 10 MΩ to 1 GΩ Standard Values

For resistances greater than 1 MΩ, three binding post connections on the top of the resistance standard are provided (see Figure 3-3). The P1 and P2 connections are used to both apply the test voltage to the resistor and to measure the resistance. The third connection is for chassis ground. The schematics in Figures 3-3 and 3-4 also appear on the top of the respective enclosures and identify the internal connections of the Model 9333 to the banana plugs as viewed from the plug side of the enclosure.

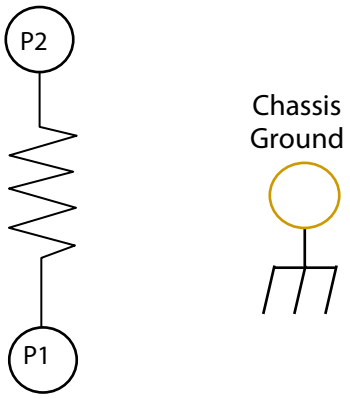


Figure 3-4 : 9333 Series from 1 MΩ to 100 GΩ

4. CALIBRATION AND PERFORMANCE VERIFICATION

4.1. Introduction

The following section describes the calibration and performance verification procedures for the 9333 Series of Resistance Standards. It is recommended that Resistance Standards be calibrated at 10 mW of power or less. The listed points in Table 4-1 are for 10 mW of Power for most values.

4.2. Calibration Overview

This calibration procedure covers the entire range of the 9333 Series of Resistance Standards. The 9333 calibration procedure typically is broken into four distinct resistance ranges with each procedure requiring high order level standards. These ranges are not broken out in the same ranges as the specification table, but instead are listed with respect to the Standards and Procedures required to calibrate the unit's values.

The four resistance ranges of the 9333 Series are:

Low Ohms Resistance: Resistance values from 1 mΩ to 0.1 Ω with currents above 145 mA and less than 100 Amperes. Values in this range are calibrated in controlled air environment at 23 °C. These values require a range extender with a DCC Bridge.

Normal Ohms Resistance: Resistance values in the range 0.1 Ω to 100 kΩ with currents less than 145 mA. Values in this range are calibrated in controlled air environment at 23 °C. These values are in a DCC Bridge current mode of operation.

High Ohms Resistance: Resistance values from 100 kΩ to 1 GΩ with voltages from 10 V to 1000 V. High (and ultra-high) resistance requires voltage vs current as the stimulus. Values in this range are calibrated in controlled air environment at 23 °C. The values are in a DCC Bridge Voltage Mode of operation. Note that the 100 kΩ model can be calibrated with either current or voltage.

4.3. Calibration Interval and Performance

It is recommended that the 9333 series be calibrated or verified on the manufacturer's recommended 12 month interval. As with all resistance standards it is highly recommended that past history be used to determine drift rates. Generally, resistance standards will drift in value more significantly in the first 12 months. After the initial 12 months, drift rates typically become smaller for all models.

It is highly recommended that each 9333 Series be calibrated within a highly controlled temperature environment.

Each 9333 is manufactured to provide some of the best (i.e. lowest) uncertainties when compared to other commercially available resistance standards. After recalibration the user should determine the Resistance Calibration Uncertainties by applying an uncertainty calculation that includes: uncertainties for drift, standards and equipment used; the calibration and laboratory environment; and other uncertainties applicable to that calibration.

Guildline offers ISO/IEC 17025 Accredited DC Resistance Calibration Services from its Smiths Falls, Canada Location. We can provide very good turn-around times with some of the lowest uncertainties available today. 9333 Users may find the use of Guildline Calibration Services an excellent convenience as well as a great alternative

to maintaining their own calibration facilities to support these standards. US customers can ship to a US address and Guildline makes all of the arrangements for shipping to and from Canada and for import and export.

4.4. Calibration Temperature Point

The 9333 Series of Resistance Standards are normally calibrated at 23 °C.

The Guildline Instruments 5032 Temperature Air Bath (shown to the right) is recommended to provide the best calibration environment for "air-style" Resistance Standards. This Standard Laboratory Grade Air Bath maintains the temperature environment around the resistance standard to ± 0.03 °C of set point and also provides a highly desirable RF and EMI Shielded environment.

The calibration currents or voltages points for each standard value is listed in Table 2.

4.5. Equipment and Standards Required for Calibration

The following Resistance Standards and Test Equipment are required for calibration.

4.5.1. Normal Ohms Calibration Standards (0.1 Ω to 100 kΩ)

Note: Normal Ohms Resistance – 4-Wire resistances in the range 0.1 Ω to 100 kΩ with currents less than 145 mA. Values in this range are calibrated in a controlled temperature air environment at 23 °C.

Use Standards:

Complete 6625A Resistance Measurement System (See Below for Alternative Acceptable Equipment Models)

5030 Series Laboratory Grade Temperature Air Bath

Or (Alternative Standards):

(a) Direct Current Comparator Resistance Bridge (Acceptable Models)

Guildline Instruments 6622A Series DCC Resistance Bridge
Guildline Instruments 6675 or 6675A Series DCC Resistance Bridge
Guildline Instruments Model 9975A Resistance Bridge

(b) Laboratory Grade Primary Resistance Standard (Acceptable Models)

Guildline Instruments 6634A Temperature Stabilized Resistance Standard
Guildline Instruments 6634TS Traveling Standard (Temperature Stabilized)
Guildline Instruments 9334/A, 7334, 9333, 9333 Standards maintained in a Guildline 5030 Air Bath
Guildline Instruments 9330, 7330 Oil Standards maintained in a Guildline Oil or Fluid Bath

(c) Low Thermal Lead Sets or Low Thermal Wire (Acceptable Models)

Guildline 6675A-12 : Precision Lead Set For Resistance Bridge
SCW-30:18AWG : 18 Gauge Low Thermal Wire

(d) Optional (For Automation and Connections)

Guildline 6664B/C 4-Wire, 8 or16 Channel Low Thermal Scanner (For Automation)
(Note – the Scanner model must be capable of operating at 1000 V)
Guildline Bridgeworks Software

4.5.2. Low Ohms Calibration Standards (1 mΩ to 0.1 Ω)

Note: Low Ohms Resistance – resistances in the range 1 mΩ to 0.1 Ω with currents above 145 mA and less than 100 A. Values in this range are calibrated in a controlled temperature air environment at 23 °C.

Use Standards and Equipment Listed In Normal Ohms Calibration and:

6623A Series of Range Extenders from 3A through to 10,000 A
6623-100A Range Extender

Or (Alternative Standards):

Guildline 6623-2A Direct Current Comparator Range Extender with Power Supply (allows current support to 2 Amperes DC and is fully programmable).

4.5.3. High Ohms Calibration Standards (100 kΩ to 1 GΩ)

Note: High Ohms Resistance – resistances in the range 100 kΩ to 1 GΩ with voltages from 10 V to 1000 V. High (and ultra-high) resistance requires voltage vs current as the stimuli. Values in this range are calibrated in a controlled temperature air environment at 23 °C. It is highly recommended that Standards are enclosed in an EMI shielded environment.

Use Standards and Equipment Listed In Normal Ohms Calibration:

Or Alternative Standards:

Note: On Resistance Bridge for Measurement to 100 MΩ, the following Bridges are acceptable alternatives:

6622A-XR
6622A-XPR
6622A-HV
6675 or 6675A Series

For Measurements to 1 GΩ, the following DCC Resistance Bridges are acceptable alternatives:

6622A-HV
6675 or 6675A Series

4.6. Routine Calibration

This routine calibration procedure describes the calibration currents and/or voltages required for the 9333 Resistance Standards. The procedure is intended to be used as a reference for qualified metrology personnel who have a primary level standards laboratory with equipment available to support an instrument of this level of standards accuracy.

Qualified personnel means that the technician or metrologist performing the calibration has the necessary level and understanding on Direct Current Comparator Resistance Measurements and full understanding of the DCC Bridge operation's and will take precautions to avoid introducing errors from sources such as guard errors, thermal emfs, temperature and or EMI errors, connector and lead errors, and other sources of measurement errors. The procedure assumes operators will make adequate allowance for equipment stabilization and measurement settling times.

For the best uncertainties with least influence on the measurements, it is recommended that the procedure use automation technologies such as Bridgeworks Software, IEEE Control and 6664B/C or 6564 Low Thermal Scanners.

Calibration Notes For All Models

Always check availability of equipment and standards prior to starting the calibration If the required equipment is not available, do not proceed with the calibration.

Ensure all equipment used is within the calibration validity interval.

Before beginning the calibration, inspect the UUT and all leads for damage and cleanliness. If the UUT is not in suitable condition for calibration, please clean or repair before proceeding.

Most of Table 4-1 recommended calibration points are for 10 mW of Power. For higher values (when Bridge is used in Voltage Mode), points listed may be less than 1 mW due to limitations of the Bridge and/or usage factors. While Table 2 lists recommended calibration points, actual calibration points should include consideration for the intended and/or application of the resistance standards. For example, if a high value resistor is intended to be used from 5 V to 100 V, then the calibration should include enough points that the voltage coefficient of the resistor is minimized or accounted for.

9333 Model	Recommended Current or Voltage	Foot Note	Comments
9333-0.001	3 Adc	1	6623 or 6623A Series
9333-0.01	1 Adc	1,2	6623 or 6623A Series
9333-0.1	150 mAdc	1,2	
9333-1	100 mAdc	3	
9333-10	31.6 mAdc	3	
9333-100	10 mAdc	3	
9333-1k	3.16 mAdc	3	
9333-10k	1 mAdc	3	
9333-100k	0.1 mAdc	4	Using Voltage Requires 6622A-XR, XPR or HV model.
Optional Cal Point	32 Vdc	4,8	If 6675A or 9975A Available, also use 66001
9333-1M	100 Vdc	4	
9333-10M	100 Vdc	4	1 mW
Optional Point	316 Vdc	5	10 mW - If 6675A or 9975A Available, also use 66001
9333-100M	100 Vdc	4,5	0.1 mW - Can use or add optional Cal Points
Optional Cal Point	316 Vdc	5,7	1 mW - If 6675A or 9975A Available, also use 66001
Optional Cal Point	990 Vdc	5,7	10 mW - If 6675A or 9975A Available, also use 66001
9333-1G	100 Vdc	5,6,7	6622A-HV Model or Teraohmmeter Optional
Optional Cal Point	990 Vdc	5	If 6675A or 9975A Available, also use 66001

1 – Requires 6623A Series Range Extender

2 – Requires either 6623A Series Range Extender or 6623A-2A (With Built in Supply)

3 – Can use any of the recommended Bridges

4 – For 6622A Series DCC Bridge, must be 6622A-XR or 6622A-XPR Series

5 – Voltages above 100 V are only available in the 6622A Series from the 6622A-HV Bridge. If using a 6675 Series or 9975 Series DCC Bridge it is recommended that the 66001 Lead Compensator be used.

6 – Alterative Method can use 6530, 6520 or 6500A Teraohmmeter with Resistance Standard using Short Term Transfer Methods

7 – Optional Calibration Points can be used in place of the standard calibration point or added to the standard point for calibration

Table 4-1 : List of Recommended Test Currents or Voltages For Resistance Values

4.7. Low Ohms Calibration

(a) Place 9333 into 5030 Series Temperature Stabilized Air Chamber.

(b) Setup DCC Bridge and Range Extender for appropriate measurement (refer to Standards Manuals used).

(c) Set chamber temperature to 23 °C and allow to thermally stabilize. Once temperature has stabilized, allow a minimum of 24 hours to soak the resistor.

(d) While Stabilizing record last calibration date and values as listed in Table 4-2.

(e) After equipment and readings have stabilized, record the resistance in the Table 4-2 reading for temperature of 23 °C in the column for Temp Value.

(f) When all readings are recorded, go to Data Evaluation and Uncertainty Calculation.

Note: Measurement Tips

Consider the following when setting up the measurement:

Verify that the maximum voltage or current applied in the measurement will not exceed the specs for the UUT or the STD. In no case should you exceed 100 mW of applied power.

Verify the reversal rate is appropriated for the measurement and the uncertainty desired.

Ensure that you know whether the measurement you are reading on the Bridge is either a ratio or actual ohms value.

If using a PC, verify that the number of samples and logging delay are appropriate.

If using a PC, set the environmental parameters in BridgeWorks .

Verify guard and ground connections (see 6622A Manual).

If using a Scanner, ensure that the proper channels for Rx and Rs are selected.

4.8. Normal Ohms Calibration

(a) Place 9333 into 5030 Series Temperature Stabilized Air Chamber.

(b) Setup DCC for appropriate measurement (refer to Standards Manuals used).

(c) Set chamber temperature to 23 °C and allow to stabilize a minimum of 12 hours.

(d) While Stabilizing record last calibration date and values as listed in Table 4-2.

(e) While Resistor is stabilizing, set bridge to appropriate settings as referred to in the operators manual for the DCC Bridge that is being used.

(f) After equipment, and readings have stabilized, record the resistance in Table 4-2 reading for temperature of 23 °C in the column for Temp Value.

(g) When all readings are recorded, go to Data Evaluation and Uncertainty Calculation.

Note: Measurement Tips

Consider the following when setting up the measurement:

Verify that the maximum voltage or current applied in the measurement will not exceed the specs for the UUT or the STD. In no case should you exceed 100 mW of applied power.

Verify the reversal rate is appropriated for the measurement and the uncertainty desired.

Ensure that you know whether the measurement you are reading on the Bridge is either a ratio or actual ohms value.

If using a PC, verify that the number of samples and logging delay are appropriate.

If using a PC, set the environmental parameters in BridgeWorks .

Verify guard and ground connections (see 6622A Manual).

If using a Scanner, ensure that the proper channels for Rx and Rs are selected.

4.9. High Ohms Calibration

(a) Place 9333 into 5030 Series Temperature Stabilized Air Chamber.

(b) Setup DCC Bridge for appropriate measurement (refer to Standards Manuals used).

(c) Set chamber temperature to 23 °C and allow to stabilize a minimum of 60 minutes.

(d) While Stabilizing record last calibration date and values as listed in Table 4-2.

(e) While Resistor is stabilizing, set Bridge to appropriate settings as referred to in the operators manual for the DCC Bridge that is being used.

(f) After equipment, and readings have stabilized, record the resistance in Table 4-2 reading for temperature of 23 °C in the column for Temp Value.

(g) When all readings are recorded, go to Data Evaluation and Uncertainty Calculation.

Note: Measurement Tips

Consider the following when setting up the measurement:

Verify that the maximum voltage or current applied in the measurement will not exceed the specs for the UUT or the STD. In no case should you exceed 100 mW of applied power.

Verify the reversal rate is appropriated for the measurement and the uncertainty desired.

Ensure that you know whether the measurement you are reading on the Bridge is either a ratio or actual ohms value.

If using a PC, verify that the number of samples and logging delay are appropriate.

If using a PC, set the environmental parameters in BridgeWorks .

Verify guard and ground connections (see 6622A Manual).

If using a scanner, ensure that the proper channels for Rx and Rs are selected.

9333 Model ►		Serial Number ►	
Calibration Dates ►		**LAST CALIBRATION**	**CURRENT CALIBRATION**
Applied Current/Voltage (Table 2) ►			
Current (I^2R)	Calculated Power ►		
Voltage (E^2/R)			

		LAST CALIBRATION	**CURRENT CALIBRATION**
Actual Readings	Temp Value 23 °C ►		

Drift Specification From Table 1 ►		_____ ppm/_____	◄ Note Time Frame(1 Year/6 Months Etc)
Calculated[1]	Drift @ 23 °C ►	ppm	

Note 1 – To Calculate Drift Specifications using the following formula:

For Drift @ 23 °C (In ppm) Calculate Change (PPM) Using formula:

((Current Cal $_{\text{Temp Value 23 °C}}$ – Last Cal $_{\text{Temp Value 23 °C}}$)/Last Cal $_{\text{Temp Value 23 °C}}$)*1E^6

Table 4-2 : Calibration Data Worksheet

9333 Model ►				Serial Number ►			
Previous Cal Date ►				Current Cal Date ►			
Test Parameters[1]	Voltage	V	Cap	pF	Thresh	V	
Reference Resistor Serial Number ►				Calibration Date			
Charted Reference Value[2]				Reference Uncertainty			

65220 Environmental Monitor Readings	Temperature	Humidity	Barometric Pressure

Current Cal	Ref1 Measurement	UUT Measurement	Ref2 Measurement	Corrected Reading[2]
Temp Value 23 °C ►				

		LAST CALIBRATION	CURRENT CALIBRATION
Corrected Readings	Temp Value 23°C ►		

Drift Specification From Table 1 ►		_____ ppm/_____	◄ Note Time Frame(1 Year/6 Months Etc)
Calculated[3]	Drift @ 23 °C ►	ppm	

Note 1 – Teraohmmeter Transfer method:

*For the transfer method to remain valid the test setting with respect to **capacitor** and **threshold MUST** remain the same for both reference and UUT measurements.*

Note 2 – To Calculate Corrected Reading using the following formula:

For Corrected Reading (In Ω) Calculate Value Using formula:

UUT Measurement + [Charted Reference Value - ((Ref1 Measurement + Ref2 Measurement)/2)]

Note 3 – To Calculate Drift Specifications using the following formula:

For Drift @ 23 °C (In ppm) Calculate Change (PPM) Using formula:

$$((\text{Current Cal}_{\text{Temp Value 23 °C}} - \text{Last Cal}_{\text{Temp Value 23 °C}})/\text{Last Cal}_{\text{Temp Value 23 °C}})*1E^{6}$$

Table 4-3 : Teraohmmeter Calibration Data Worksheet

5. MAINTENANCE

Maintenance of the resistor consists only of routinely inspecting the unit for physical damage and cleanliness. Cleanliness is especially important on the high value resistors (1 MΩ and greater). These should be cleaned with isopropanol and a soft brush or cloth. Special care should be taken to ensure that the terminal connectors are clean and are not cracked or damaged.

5.1. Replaceable Parts

The following tables list the replaceable parts. **Note that once a part has been replaced, the unit may be required to be recalibrated.**

To Contact Guildline Instruments, the following information is provided.

USA and Canada Telephone: (613) 283-3000
USA and Canada Fax: 1-613-283-6082

Outside US and Canada Telephone: +[1] 613 283-3000
Outside US and Canada Fax: [1] +613 283-6082

You can also contact Guildline Instruments Limited via their Email or Website.

Email is: sales@guildline.com
Website is: www.guildlinecom

5.1.1. Common Parts (All Models)

Part Number (GPN#)	Description
813-31082	Case Screws
925-23468	Desiccant
841-04000	Split Lock Washer
19746-01-01	Terminal Washer
30175-01-15	Insulator Top Post
30176-01-15	Insulator Bottom Post
018-02200	Rubber Feet

5.1.2. Terminals 0.001 Ω to 100 GΩ

Part Number (GPN#)	Description
010-24073	Binding Post (Red)
010-24074	Binding Post (Black)
010-21519	Ground Terminal (Gold)