



Transportable & Affordable QHR Standard

MODEL 6800A

- Accuracy to < 0.02 PPM
- Features Accubridge® Technology
- Built in Vxx (uVolt) Measurements for Sweep Check, Contact Resistance Measurements
- Built in Vxy (nVolt) Measurements for Dissipation Measurements
- QHR Samples Produced and Certified By NMI
- Direct Transfer to 1 k Ω and 10 k Ω Std.
- System Range 0.1 Ω to 100 k Ω
- Power Failure Battery Backup Detection
- Built in Safety Shutdown Feature
- Fully automated build up or build down from QHR Value
- Manual or IEEE488 Controlled
- 8 Tesla or 9 Tesla Magnet Requires Less Liquid Helium Consumption
- Room Temperature DCC Requires no Liquid Helium to Operate
- Built in Persistent Mode for Lower Liquid Helium Use
- Sample Interchange Design
- System, Bridge, Samples Calibrated/Verified by NMI
- Graphic Compatible



Model 6800A QHR Standard

The Quantized Hall Resistance Standard is internationally recognized as the representation of the ohm and is the most stable resistance standard known. Many National Laboratories and industries are finding a need to provide highly accurate, traceable reference standards in support of their “hi-tech” environments. The 6800A system has been developed to meet the needs of National Laboratories and Primary Industrial Laboratories around the world.

In the International System of units, the ohm is derived from the Volt and the ampere. In practice, quantised Hall resistors have been used in national laboratories to represent resistance since 1990. These resistors are semiconductor devices which, when cooled to 1.2 Kelvin or less in a magnetic field of several Tesla, yield values of resistance which are essentially invariant, and which are believed to be multiples of fundamental constants. By international agreement, the first multiple is taken to be equivalent to 25812.807 Ω .

The MI 6800A (Quantized Hall Resistance Standard) is a fully automated primary standard developed as an economical means to provide a highly reproducible resistance standard. This system is a completely “turn-key” system and requires little to no manual intervention. A wide neck storage Dewar and instrumentation rack are mounted on castors for portability.



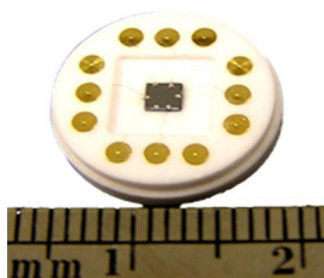
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A variable temperature pumped ^4He refrigerator with integral 8, 9 Tesla or optional 12 Tesla magnet can be installed. Alternatively the system can be operated continuously if a supply of helium exists in the facility. The cryostat is designed to operate over a 4 to 7 day period on one fill. Typically all measurements can be performed in two days. System preparation can be completed easily within half a day and cool down the second half of the day. Within two days you can have the system cold and the complete measurement of QHR vs $1\text{ k}\Omega$ as well as scaling down to $0.1\ \Omega$ or up to $100\text{ k}\Omega$!

The 6800A system provides an economical means to accurately and precisely establish and measure resistance values from $0.1\ \Omega$ to $100\text{ k}\Omega$. The system is a development of many years of experience in Quantized Hall System Design, Resistance Measurements and Cryogenics.

The 6800A System is the first portable Quantized Hall Resistance Standard in the world and consists of three parts, all of which are supplied and described on the following page.

Sample: 6800A Resistance Standard provides the absolute value of resistance related to the Von Klitzing constant of $25812.807\ \Omega$. Operating on step $I = 2$ the 6800A compares the QHR value of $12906.4035\ \Omega$ to a $1\text{ k}\Omega$ resistor. The reference or sample, developed at the National Research Council of Canada (NRCC) is maintained at 1.2 Kelvin in a mobile 55 liters Helium filled dewar, fields to 8 Tesla or 9 Tesla being supplied by the integral magnet. The system is designed to operate over a period of 3 to 7 days. Special precautions have been taken to avoid contaminating or damaging the sample.



Cryogenics: The 6800A consists of a 55 liters dewar with a pumped ^4He refrigerator, an 8, 9 Tesla or optional 12 Tesla superconducting magnet with support assembly, temperature sensor, heater and a 19" instrument rack with superconducting magnet power supply, temperature controller, helium level sensor and an oil free mechanical vacuum pump.

The Dewar is mounted on heavy-duty castors for transportability from one room to another. The system can also be shipped cold from one facility to another as a primary reference transfer standard.

Recent design improvements to the system have been implemented to allow for the addition of an easier method for Sample Interchange. By including this into the design users of the 6800A can now easily interchange samples at their convenience without exposing the sample to atmosphere until it has reached room temperature.

Measurement System: An improved Direct Current Comparator Bridge (Model **AccuBridge® 6020Q**) operating in room temperature air which allows two resistors to be compared with accuracy's to 2 part in 10^{-8} . The 6020Q Bridge is used to compare the QHR device directly to a $1000\ \Omega$ standard resistor. The bridge can also be used to measure the field dependence of R_{xx} and R_{xy} , to make precision measurements of R_{xx} and to measure the contact resistance of the QHR device: in short, to carry out all the measurements necessary to ensure the accuracy of the QHR resistor. The bridge and low thermal matrix scanner can then be used to build up or down from the $1000\ \Omega$ resistor to establish values for $1\ \Omega$, $10\ \Omega$, $100\ \Omega$, $1\text{ k}\Omega$, $10\text{ k}\Omega$ and $100\text{ k}\Omega$ primary resistors to a very high level of accuracy. The 6020Q can be used stand-alone or with Measurements International's 6800A software for automated measurements.





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Accessories: (Please view the data sheets at our website for complete specifications)

9400

Standard Resistor Oil Bath



9210A-1 (PRIMARY)

1 Ω Resistor with Carrying Case



9331R (PRIMARY)

Series of Four Terminal Air Resistors from 1 Ω to 100 k Ω



9300A

Temperature Controlled Standard Resistor Air Bath with GPIB



9331 (SECONDARY)

Series of Four Terminal Air Resistors from 1 m Ω to 100 M Ω





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Specifications: Rev 1

Accuracy QHR to 1 k	$< 2 \times 10^{-8}$
Stability	$< 1 \times 10^{-8}$
Insulation Resistance	$> 10^{13}$ Ohms
Magnet Strength	8, 9 or 12 Tesla
Plateaus	i=2, i=4
Temperature	⁴ He, 1.2 Kelvin
Dewar Size	55 liters
Operating Environment	18 to 34 °C, 10 to 80% RH
Warranty	1 Year Parts & Labor

Note: Either Rs or Rx can be selected as the standard. Uncertainties specified at 2 sigma level (95%) includes all secondary specifications such as linearity and noise with a ± 2 °C temperature variance	0.1 Ω to 100 k Ω			
	Rs or Rx	Ratio & Uncertainty (ppm)		
		0.1:1	1:1	10:1
1 Ω	<0.015	<0.02	<0.015	<0.02
10 Ω	<0.015	<0.02	<0.015	<0.02
100 Ω	<0.015	<0.02	<0.015	<0.02
1k Ω	<0.015	<0.02	<0.02	<0.02
10k Ω	<0.02	<0.02	<0.05	

Measurement Mode	4-Wire
Linearity	<0.005 ppm of full scale
Operating Conditions	10 °C to 35 °C, 10% to 90% RH non-condensing
Test Current Range	10 μ A to 150 mA
Test Current resolution	18-bit
Interface	IEEE488.2
Display	Touch Screen Display (No external keyboard), Resolution 0.001 ppm

Refer to 6020Q Spec Rev 0

Dimensions:
122 x 49 x 46 cm (Rack)

Weight:
115 kg

Shipping Weight:
137 kg

Operating Power:
100, 120, 220, 240V - 50/60Hz

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