Measurements International

A Metrology Company

The QuantΩ

Transportable & Affordable
QHR Standard

Manual or IEEE488 Controlled
Vxx and Vxy Measurements
Accuracy to 0.02 PPM
Modular "Turn-Key" System
Direct Transfer to 1 and 10KΩ Std.

General Description:

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

The MI QuantΩ (Quantized Hall Resistance Standard) is a fully automated primary standard developed as an economic 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. A variable temperature pumped ^{4}He refrigerator with integral 8T magnet can be installed and removed easily, allowing the Dewar to be sent for filling as required. 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 5 day period on one fill. Typically all measurements can be performed in two days.

The QuantΩ system provides an economical means to accurately and precisely establish and measure resistance values from 0.1 to 13K Ohms. The system is a development of many years of experience in Quantized Hall System Design, Resistance Measurements and Cryogenics.

The QuantΩ 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.

Revision 2

Model The QUANTΩ

Sample: QuantΩ Resistance Standard provides the absolute value of resistance related to the Von Klitzing constant of 25812.807 ohms. The reference or sample, developed at the National Research Council of Canada (NRCC) is maintained at 1.2K in a mobile 60 liter Helium filled dewar, fields to 8 tesla being supplied by the integral magnet. The system is designed to operate over a period of 3 to 4 days or it can be operated continuously. Special precautions have been taken to avoid contaminating or damaging the sample.

Cryogenics: The QuantΩ consists of a 60 liter dewar with a pumped ^{4}He refrigerator, an 8T 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.

The system may also be purchased with a nine Tesla magnet, which will allow the system to be used with other samples. The support assembly can be easily removed which allows other samples to be tested.

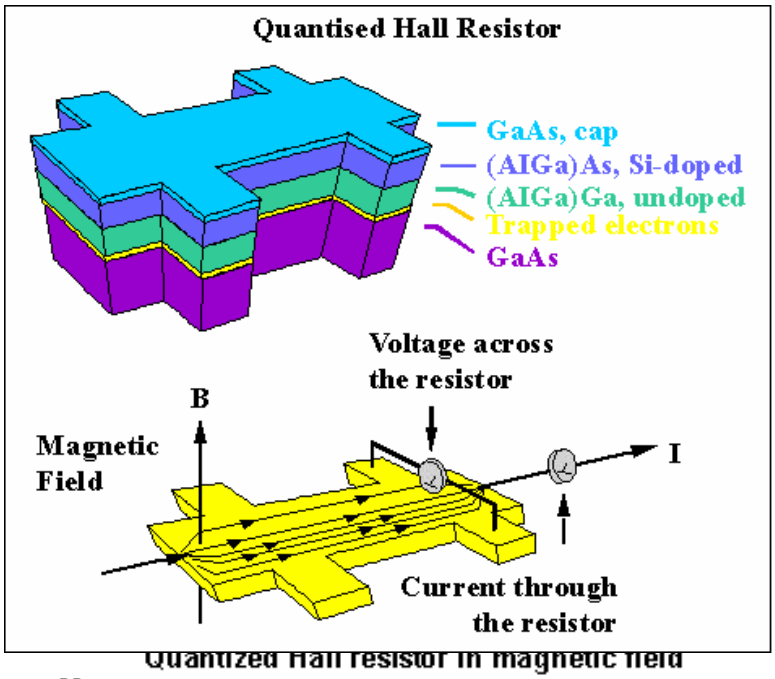
Measurement System: An improved Direct Current Comparator Bridge (Model 6010Q) operating in room temperature air which allows two resistors to be compared with accuracy's to 2 part in 10^{-8}. The 6010Q Bridge is used to compare the QHR device directly to a 1000-ohm standard resistor. The bridge can also be used to measure the field dependence of Rxx and Rxy, to make precision measurements of Rxx 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 ohm resistor to establish values for 1, 10, 100, 1K, and 10K Ohm primary resistors to a very high level of accuracy. The QuantΩ Bridge can be used stand-alone or with Measurements International's QuantΩ software for automated measurements.

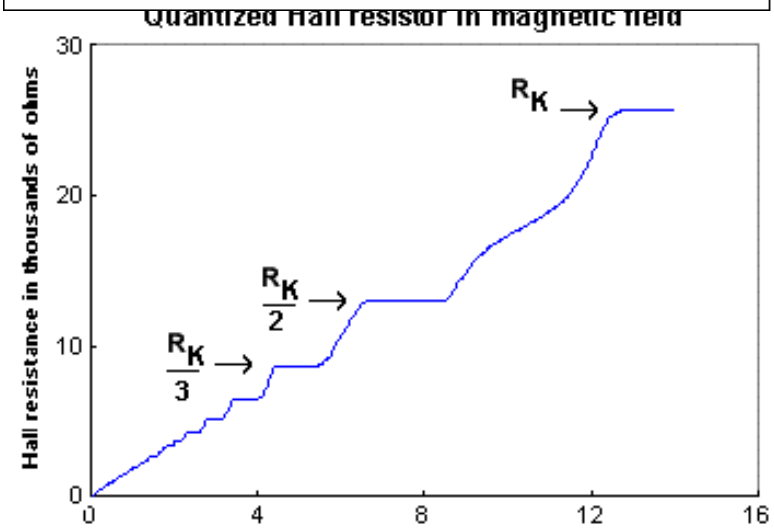
The QuantΩ system is modular in design and the three parts, the QuantΩ sample, the QuantΩ Cryogenics and the QuantΩ Bridge may be purchased separately. Several options are available to the user including extra QHR samples, QuantΩ software, a stainless steel liquid helium transfer line to allow continuous operation and a bench-top oil resistor bath (Model 9303JW) and a 100 liter fill dewar if required.

Measurements International
118 Pirelli Dr., PO Box 2359, Prescott, Ontario, Canada K0E 1T0
Ph. 613.925.5934 • Fx. 613.925.1195 • North America: 1.800.324.4988

Form MI 67, Rev. 1, Dated 01-11-15 (QAP 19, App. "O")

Model The QUANTΩ





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 1.5 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 ohms.

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Specifications:

Accuracy	2×10^{-8}
Stability	$< 1 \times 10^{-8}$
Insulation Resistance	$>10^{13}$ Ohms
Magnet Strength	8 Tesla
Plateaus	i=2, i=4
Temperature	^{4}He, 1.2K
Dewar Size	60 liter
Operating Environment	18 to 34°C, 10 to 80% RH
Warranty	1 Year Parts & Labor

Dimensions:
122 x 49 x 46 cm (Rack)

Weight:
115 kg

Shipping Weight:
137 kg

Accessories:
4220A
QHR Sample
9303JW
QuantΩ Software
Helium Transfer Line
SPSCW – XX – YY 4 Conductor, Teflon, Shielded Cable
(Where XX represents length of cable, YY represents number of cables)

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

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