MODEL 6820T
COMPACT DRY QHR SYSTEM

Figure 1
**Option shown 6820T-6020Q-4210B*

6820T

- Cryogen-Free Dry System
- System Accuracy to < 0.003 ppm with CCC Model 6200A
- System Accuracy to < 0.015 ppm with DCC Model 6020Q
- 5 Tesla Standard System Magnet
- Stable Controlled Sample Environment
- Base Temperature < 3.6 K
- Low Operating Costs
- Direct Transfer to 100 Ω, 1 kΩ, 10 kΩ, and 100 Ω Standards
- System Range 0.1 Ω to 100 kΩ
- Graphene Device values 1 kΩ, 10 kΩ, 12.9064037 kΩ and 100 kΩ
- Triple Sample Device Mounting

Introducing the Revolutionary MI 6820T QHR System: Your New Intrinsic Resistance Standard in today's rapidly evolving world, precision and accuracy are paramount, National laboratories and industries around the globe demand reliable, traceable reference standards to ensure the integrity of their measurements. That's where Measurements International (MI) steps in with the measurement-changing 6820T QHR Table Top System.

Let's talk about efficiency. With the 6820T, you can say goodbye to the headaches of liquid helium shortages, unpredictable deliveries, and skyrocketing prices. These challenges have become all too common, impeding the progress of countless labs. The 6820T requires no liquid helium to operate, ensuring uninterrupted and cost-effective performance. Drawing upon years of expertise in Quantized Hall System design, resistance measurements, and cryogenics, the MI 6820T is a fully automated primary standard. It has been meticulously engineered to deliver highly reproducible resistance standards, empowering you to achieve your measurement goals with ease. The system has a modular design, consisting of three essential components: the QHE samples, cryogenics system, and bridge measurement system. This seamless integration guarantees a streamlined workflow and allows for effortless customization to suit your specific requirements. Each component can be ordered individually to meet your laboratory needs and requirements.

The MI 6820T QHR System is backed by our unwavering commitment to customer satisfaction. We provide comprehensive support, ensuring a smooth installation process, extensive training, and ongoing assistance whenever you need it. With us by your side, you can focus on what matters most – advancing your research and calibration, and exceeding your performance targets.

Cryogenics and Magnet System

The 6820T offers customers ultra-reliable and high-performance range of cryogen-free magnet systems with sample space temperature of 3.6 K, and magnetic fields up to 5 Tesla in our standard system – all without the need for liquid cryogens. Reliable, precise and highly stable temperature control is achieved during normal measurement sequences. Once connected to mains power these systems can be turned on and operational within several hours. With service intervals ≥ 30,000 hours, the system may be used continuously over very long periods, or simply as needed, providing complete freedom to plan research work and optimize running costs.

Operation of the cryogenics is simple and easy to use. Once system is evacuated and ready for cooldown, simply turn on the compressor and wait for the temperature to drop to operation value. Typical cooldown time is under 7 hours. Once cold the system can run 24 hours a day, 7 days a week without intervention.

Magnet Specifications

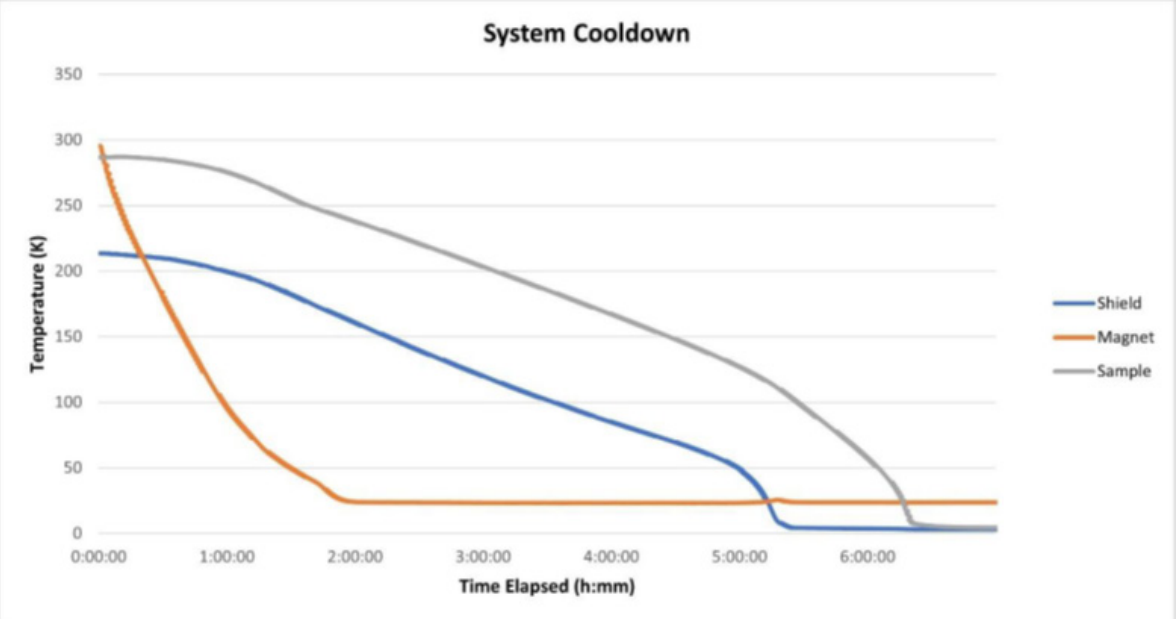
Superconducting Magnet	
Magnet Type	Solenoid
Rated Central Field	5.0 T
Rated Operating Current @ 6.0 T	25.45 A
Total Inductance	10.526 H
Homogeneity	± 0.2 % 1 cm DSV
Superconductor	Twisted Multi-filamentary Nb Ti/Cu
Fabrication	Wet wound with epoxy to prevent training
Quench Protection	Adiabatic protection using copper matrix and diodes

Example Magnet Specifications

Rated Central Field*	5.0 T
Maximum Test Field	5.0 T
Measured Current at 6.0 T	25.45 A
Inductance	11.03 H
Field-to-Current Ratio	2357.5 G/A
Charging Rates	0.0901 A/s (1.0V) 0-25.45 A
Persistent Switch Heater Current	NA
Persistent Switch Heater Resistance	NA
Magnet Resistance (at input leads)	1.9 kΩ
System Cooldown Time	7 hours
Cryogenics System Weight	67.3 lbs

Example Magnet Specifications

System Cooldown



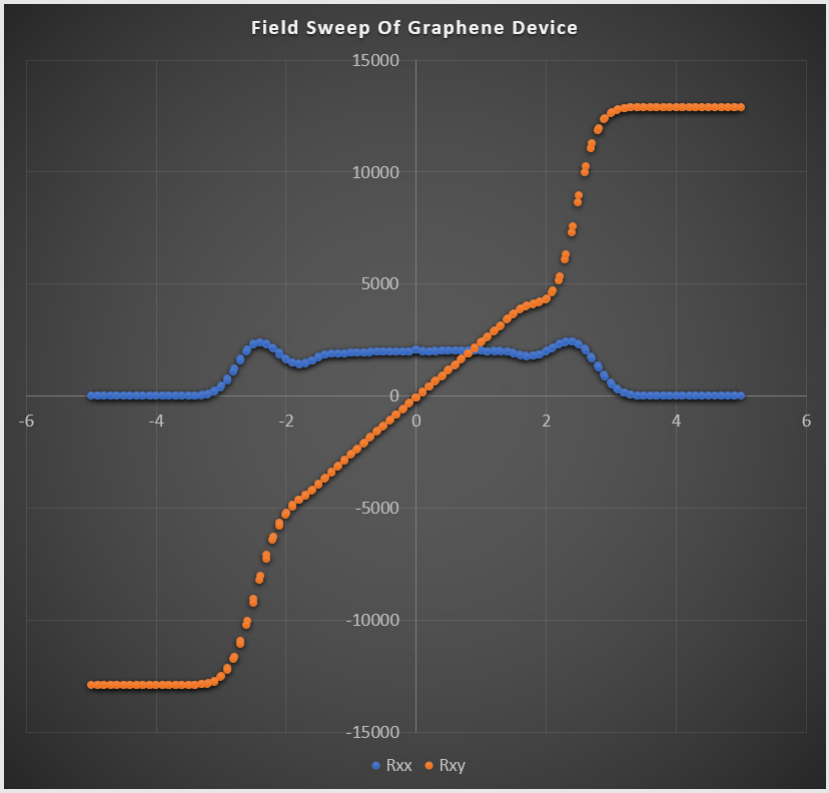
Cryocooler Specifications

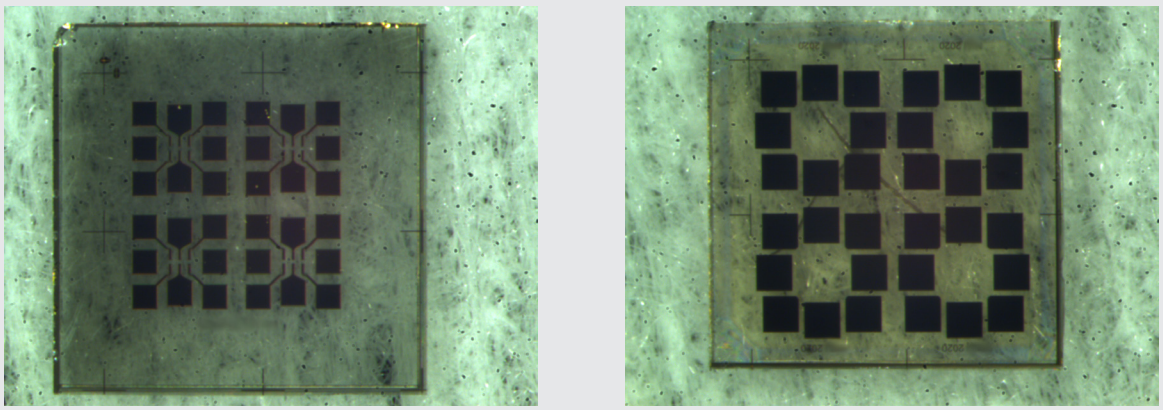
Cryocooler	
Cooling Powers at 50 Hz	1st Stage: 35 W @ 45 K 2nd Stage: 0.9 W @ 4.2 K
Base Temperature	< 3.6 K
Orientation	Vertical Only
Maintenance Interval	30,000 hrs - 40,000 hrs
Ambient Temperature	5 °C to 35 °C

Compressor - F70LP/H (Water Cooled)	
Main Power Requirement	7.2 kW (steady), 8.5 kW (max), 3-phase F70LP: 200 V @ 50 Hz & 60 Hz F70H: 380 - 415 V @ 50 Hz - 480 V @ 60 Hz
Water Cooling	6.8 - 9 L/min
Ambient Temperature	5 °C to 35 °C
Charcoal Absorber Life	30,000 hrs
Flexible Gas Lines	20 A x 20 m
Compressor Dimensions	W 444 mmm, L 529 mm, H 576 mm
Weight	100 kg

QHE Devices

Measurements International has signed a partnership agreement with a world leading National Metrology Institute in the supply of Graphene Devices. The devices are fabricated with multiple values on each device providing not only the 12.9064037 kΩ value, but also offering QHARS values of 100 Ω, 1 kΩ, 10 kΩ and 100 kΩ. These values replace the need for air or oil resistors at those levels. Up to three devices can be mounted in the system.





A QHARS device that contains a hall bar and 100 Ω , 1 kΩ, and 10 kΩ arrays

Measurements Bridges

The 6820T operates using either the 6200A Cryogenic Current Comparator system or the 6020Q room temperature DCC bridge, both offered by Measurements International. Both measurement bridges are simple, and easy to use.

For more information on the measurement bridges, visit https://mintl.com/products/6200a-cryogenic-current-comparator-ccc/ and https://mintl.com/productcategories/metrology/resistance-measurement/resistance-bridges/ or contact sales@mintl.com

Each system is offered with optional equipment like the MI 10-channel or 20-channel scanner allowing you full automation of scaling down to 0.1 Ω and up to 100 kΩ without the need for manual insurtion when using the 6020Q.

Bridge Specifications

6200A

Range (1:1 Ratio)	Accuracy (μΩ/Ω)	Range (1:10 Ratio)	Accuracy (μΩ/Ω)	Ratio (1:100 Ratio)	Accuracy (μΩ/Ω)
0.1 Ω to 0.1 Ω	0.01	0.1 Ω to 1 Ω	0.01	1 Ω to 100 Ω	0.003
1 Ω to 1 Ω	0.003	1 Ω to 10 Ω	0.003	100 Ω to 10 kΩ	0.003
10 Ω to 10 Ω	0.003	10 Ω to 100 Ω	0.003	1 kΩ to 100 kΩ	0.003
100 Ω to 100 Ω	0.003	100 Ω to 1 kΩ	0.003	10 kΩ to 1 MΩ	
1 kΩ to 1 kΩ	0.003	1 kΩ to 10 kΩ	0.003		
10 kΩ to 10 kΩ	0.003	1 kΩ to 13 kΩ	0.003		
100 kΩ to 100 kΩ	0.005	10 kΩ to 100 kΩ	0.005		
1 MΩ to 1 MΩ	0.01	100 kΩ to 1 MΩ	0.01		

6020Q

Note: Either R_s or R_x can be selected as the standard. 6020Q uncertainties in the bridge and software are specified at the 2σ level (95 %) this includes all secondary specifications such as linearity and noise with a ± 2 °C temperature variance.	0.1 Ω to 100 kΩ			
	R_x	Ratio & Accuracy (ppm)*		
	-	1:1	10:1	14:1
	0.1 Ω	< 0.02	-	-
	1 Ω	< 0.015	< 0.015	< 0.015
	10 Ω	< 0.015	< 0.015	< 0.015
	100 Ω	< 0.015	< 0.015	< 0.015
	1 kΩ	< 0.015	< 0.015	< 0.015
	10 kΩ	< 0.02	< 0.015	-
	100 kΩ	-	< 0.05	-

Ordering Information

Each item can be ordered individually or as a system

Item	Description
6820T	Table Top QHR System
6200A	Cryogenic Current Comparator Bridge
6020Q	DCC Resistance Ratio Bridge
QHR_01	Graphene Device 12.9 kΩ
QHR_02	Graphene Device 12.9 kΩ, 100 Ω
QHR_03	Graphene Device 12.9 kΩ, 100 Ω, 1 kΩ, 10 kΩ
QHR_04	Graphene Device 12.9 kΩ, 1 kΩ, 10 kΩ, 100 kΩ

Options

Item	Descrption
Chiller	Water Chiller Required if Suitable Cold Water Supply is Not Available
4210A	10-Channel Matrix Scanner
4220A	20-Channel Matrix Scanner
9300	50 mk Temperature Controlled Air Bath - 50 Litres
9300A	15 mK Temperature Controlled Air Bath - 106 Litres
9400	2 mK Temperature Controlled Oil Bath
9210A/1	Evanohm Resistor (1 Ω and 0.1 Ω)
9210B	Oil Resistors 10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ
9331R	Air Resistors 1 Ω, 10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ
SPSCW30/100	4-Conductor Teflon Cable, 30 m or 100 m
6020Q-NMI-Cal	6020Q NMI Calibration 5 Points

How to Order:

Full System order includes selections from A+B+C
Items can also be ordered individually

A	B	C	D
6820T	6200A 6020Q	QHR_01 QHR_02 QHR_03 QHR_04	SEE OPTIONS TABLE FOR SELECTIONS
Cryogenics	Measuring Bridge	QHR Device	Additional Items