

HPD

High-Precision Cryogenic Integrated Measurement Solutions

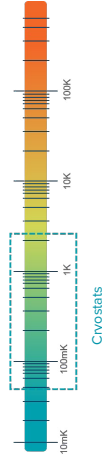
Full-featured line of cryostat models

HPD ADR Cryostats

Adiabatic Demagnetization Refrigerator (ADR) Cryostats for Easy, Affordable Access to mK Temperatures

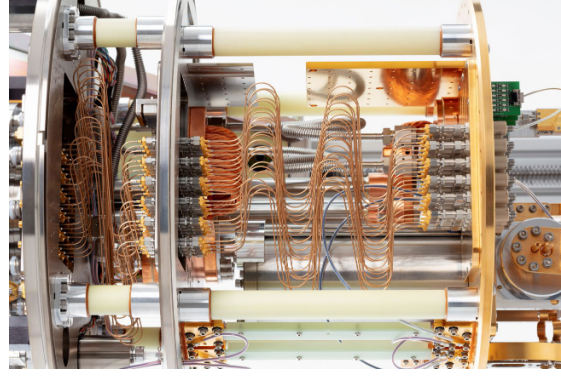
HPD Adiabatic Demagnetization Refrigerators (ADR) complement dilution refrigerators (DR) in many cryogenic labs. ADRs provide a fast, compact, solid-state, cryogen-free, reliable, and lower cost alternative for applications which do not need the full power of a DR, but still require sub-Kelvin temperatures. Our solutions for interfacing with your samples eliminate time-consuming steps such as wire bonding. Our ADRs provide a faster, more compact, and less costly path to integrated measurement solutions at temperatures a fraction of a degree above absolute zero.

Operating Temperature



Customer Applications

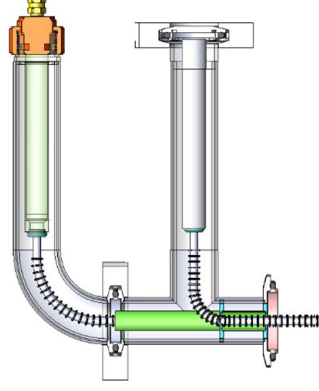
- / Astronomy
- / Spin QC
- / Photonic QC
- / Material Characterization
- / Condensed Matter
- / Physics
- / Superconducting QC
- / Quantum Computing Development



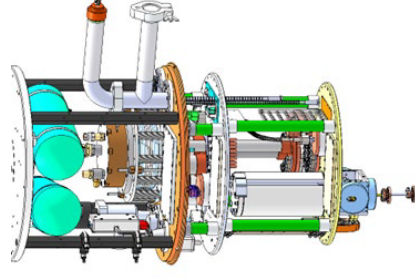
HPD Model 106 ADR Cryostat

Model	Base Temperature	Cooling Energy	Sample Space Volume (all dimensions in mm)
106	<30 mK	120 mJ @ 100 mK	490 x 340 (HxØ)
107	<25 mK	270 mJ @ 100 mK	200 x 340 (HxØ)

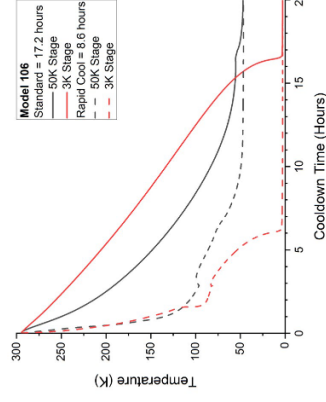
Rapid Cool Option



Rapid Cool Transfer Tube Receiver (top) and Outlet (bottom)



HPD Model 106 Rapid Cool Cryostat option and additional connector box



Cooldown time graph for a Model 106, with and without Rapid Cool

Rack Mounted Control System with CryoBoss®

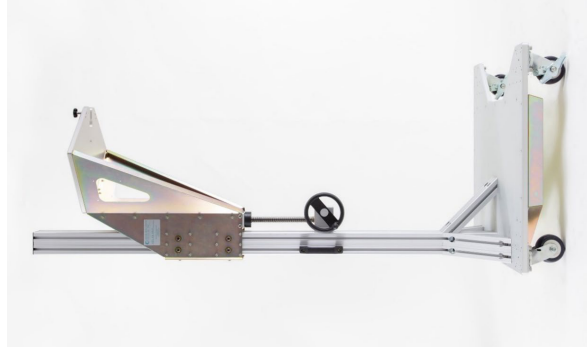
CryoBoss® enabled cryostat control systems provide plug-and-play control and automation of your cryostat. HPD provides a variety of systems that are adaptable to your needs. Consider things such as temperature range, stability, and additional sensors that you may be interested in.

All control systems include the following:

- CryoBoss® software provides intuitive temperature controls, and TC/IP or LabView shared variables for system integration and remote operation.
- Cable kit for connections of cryostat and control system.
- HPD Model 1510 Cryo-Junction Box provides convenient and customizable interconnects between the cryostat and the components of the control system and instrumentation.
- Equipment is rack-mounted and includes an uninterruptible power supply for magnet protection.
- Rack-mounted computer, keyboard, mouse, and monitor.

Model 154 Lakeshore Control System

- < 10 μ K RMS temperature fluctuations on the ADR stage.
- High resolution, continuously adjustable ADR temperature from base temperature to 3K stage temperature.
- Lakeshore 625 Superconducting Magnet Power Supply for the ADR magnet.
- Lakeshore 372 Resistance Bridge for RuOx measurements and control signal for the magnet power supply.
- Lakeshore 218 Temperature monitor reads and displays the signals from the silicon diode sensors.



Model 100 Atlas Cryostat Service Stand

The top plate of the cryostat has mounting provisions that allow the cryostat to be attached to the service stand. This mount consists of a plate and ball attached to rods extending from the top plate of the vacuum jacket. The Service Stand attaches to the ball for lifting. Three jack screws on the top plate of the Service Stand allow for tilt adjustment and for locking the cryostat. The ball allows for rotating, and some slight swinging, of the cryostat. The service stand has casters to allow it to be rolled into position for attaching the cryostat.

The Service Stand has a vertical height adjustment capability that allows for placing the cryostat on a bench or other support structure. The vertical travel is about 30".

Spacious Floor Stand

Enjoy more working area around the cryostat with a larger floor stand. The spacious floor stand is designed to put the coldest stage of the cryostat at a comfortable, work height when sitting in an office chair.



Model 119 Overhead Stand.
Dimensions: 1.5m width, 1.23m depth, 2.21m inside height, 2.69m total height

Model 181 Compressor Doghouse

HPD cryostats are supplied with quiet He lines between the compressor and pulse tube.

The HPD Compressor Doghouse helps create a more enjoyable workspace by reducing the noise from the compressor down 84% to about 50 dB, a quiet conversation level.

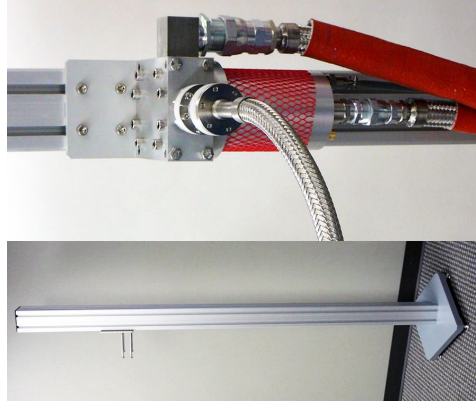
This sound-dampening enclosure is lined with special sound-attenuating foam and has an exhaust fan to ensure adequate airflow. The front panel is flexible and has slots to accommodate the compressor hoses.



Compressor Doghouse; access panel closed

Model VS 150 Rotary Valve Stand

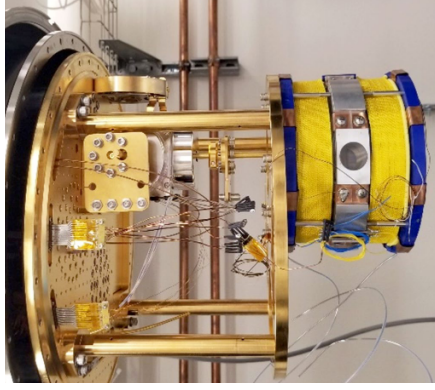
The Atlas Stand can hold the external rotary valve for the PT cooler. This stand has a weighted base to provide stability.



Model 150 Valve Stand and typical valve installation on stand

Magnetic Integration

- 5T solenoid superconducting magnet
- Compatible with ADR cryostats
- Provides out-of-plane magnetic field for a sample at < 50 mK temperatures
- 0.3T Helmholtz coil
- Second coil can be added to the front and back-facing aluminum frames
- Compatible with Model 12X probe stations
- Accommodates the use of nanopositioners



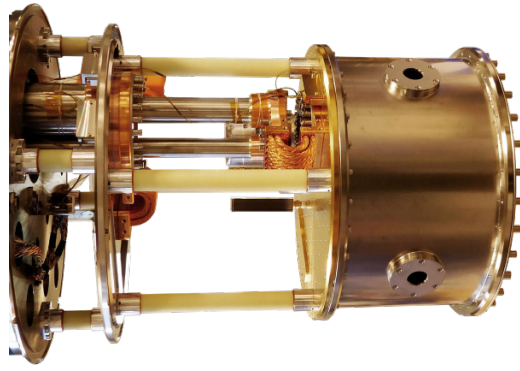
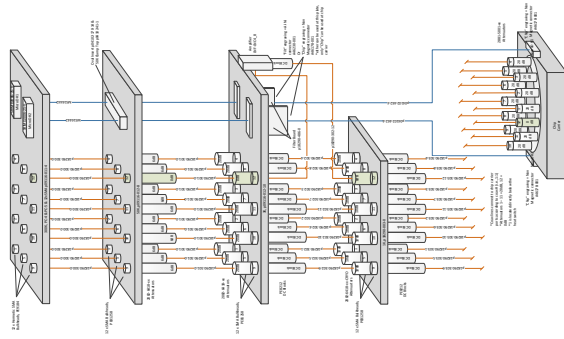
Magnetic Shielding

- Magnetic shielding for sensitive measurements
- Ensure minimal disturbance to the qubit environment
- Typically require a 3:1 length-to-diameter ratio
- Double-layer shielding
- 100X reduction in earth's magnetic field
- Passive MuMetal® is common



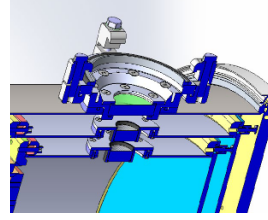
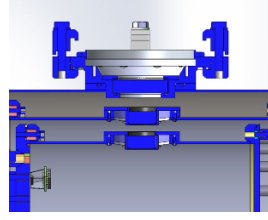
Tailored Cryostat Wiring Schemes

- Configure in-line RF and DC elements
- High-density feedthroughs
- Different materials for high bandwidth coax lines up to 18 GHz
 - o BeCu coax lines from 300K to 3K
 - o NbTi coax lines from 3K to mK stage
- Different materials for twisted pair DC Cryoloom®
 - o PhBr Cryoloom® from 300K to 3K
 - o NbTi superconducting Cryoloom® from 3K to mK stage

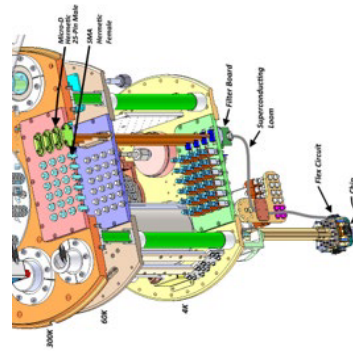


View Ports

- Varieties of viewport options



Example wiring diagram



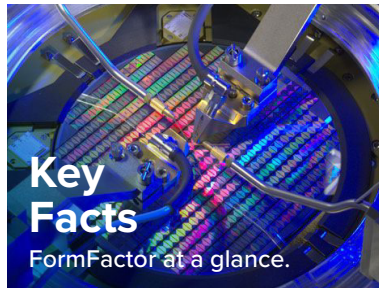
High density wiring

FormFactor, Inc.

FormFactor, Inc. (NASDAQ:FORM), is a leading provider of essential test and measurement technologies along the full IC life cycle – from metrology and inspection, characterization, modeling, reliability, and design debug, to qualification and production test.



- / We constantly strive to help our customers solve the advanced test and measurement challenges of the broader semiconductor industry.
- / Our focus on customer partnership, innovation, agility, and operational excellence allows us to earn sustainable business every day.



- / Founded in 1993, IPO 2003
- / #1 Advanced Probe Card Supplier
- / #1 Engineering Probe Systems Supplier
- / Named as a BEST Supplier in customer satisfaction surveys, year-after-year
- / Ship >50 million MEMS probes annually
- / Over 10,000 probe systems installed
- / 2021 Revenue \$770 million (USD)



- / Enable customer success through technology, partnerships, “First Time Right” product quality, global customer support
- / 2300 employees
- / 23 service and repair centers
- / 13 sales offices
- / 10 design centers

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