# PPMS® DynaCool®

Product Description

Cryogen-Free Physical Property Measurement System

**The PPMS DynaCool** is Quantum Design's next generation of Physical Property Measurement System. It is a completely redesigned instrument that provides all the capabilities of the PPMS without the need for any liquid cryogens. The system uses a single, two-stage pulse tube cryocooler for both the superconducting magnet and the temperature control system, providing an efficient, low vibration environment for sample measurements that simultaneously provides lower maintenance costs.

**Utilizing a new approach** to cryocooler equipment design, the PPMS DynaCool employs a minimum amount of condensed liquid He4 for cooling both the sample chamber and superconducting magnet. As a result, the system requires only a small volume of bottled helium gas for its fully automated startup and operation. The PPMS DynaCool also comes standard with an integrated cryopump allowing the PPMS DynaCool to be compatible with all existing Quantum Design cryogenic hardware, as well as other user-designed experiments.

## Temperature Control

A novel gas flow regulation system improves both cooling power and temperature stability as compared to the already state-of-the-art PPMS temperature control our customers have come to expect. Along with sophisticated control software, this system provides seamless transitions between high temperatures (400 K) with minimal cooling power needs, intermediate temperatures with rapid slewing and large cooling needs, and stable operation near the base temperature (1.8 K) with cooling provided by evaporating liquid helium. With this new control system PPMS DynaCool is capable of cooling a standard PPMS sample puck from 300 K to a stable 1.9 K, in under 40 minutes. The sample chamber design has also been improved for better thermal uniformity at both low and high temperatures while maintaining the robust 12-pin sample puck interface from the original PPMS. Multiple thermometers and heaters manage temperature gradients and ensure smooth temperature control throughout the accessible temperature range. In addition, the PPMS DynaCool offers better than 2X improved noise performance at temperatures below 20K than previous PPMS models.

## Magnet Control

The PPMS DynaCool comes equipped with either a 9 T, 12 T or 14 T conduction-cooled superconducting switch-less magnet system. This system includes a hybrid digital/analog magnet controller, designed for precise, quiet control of the magnetic field. The bipolar design also allows smooth continuous ramping through zero field. Magnet control software monitors the temperature of the magnet and cryostat at 3 locations to ensure proper operation of the magnet system.

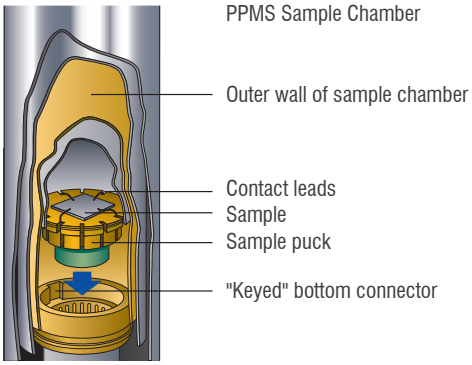
The PPMS DynaCool-9T now includes an integrated magnetic shield capable of maintaining the 5 gauss line very near to the surface of the cryostat cabinet allowing these systems to be installed closer to other sensitive instruments for better lab space utilization.

## Integrated High-Vacuum

The PPMS DynaCool comes with an integrated cryopump and vacuum gauge for controlling the sample environment. Equivalent to the High-Vacuum option for PPMS, the cryo-pump evacuates the sample chamber to less than $10^{-4}$ Torr in under 10 minutes. And this feature is fully integrated, allowing you to change the chamber environment during a programmed sequence or script.

## Sample Mounting

The PPMS DynaCool uses our innovative style of sample mounting by providing at the bottom of the sample chamber a 12-pin connector pre-wired to the system electronics. This connector allows you to plug in a removable sample insert (or “puck”) for convenient access to electrical leads and sample mounting.




## MultiVu Software

Quantum Design has taken the powerful and already popular MultiVu software found in its other measurement platforms and further improved it for more efficient magnet and temperature control in the PPMS DynaCool. MultiVu comes complete with pre-written sequences for automated measurements as well as the capability to create custom sequences for your individually designed experiments. New on the DynaCool are integrated scripts in MultiVu to simplify routine system maintenance and troubleshooting. This automated control software allows you to spend your valuable time analyzing your data and reporting results, rather than being tied to your experiments as they run. In addition, MultiVu allows you to remotely control and monitor your experiments over any internet connection.

## Open Architecture

The flexibility of the PPMS DynaCool allows you to create your own experiments and easily interface them to the sample chamber using inserts such as the Multi-Function Probe which provides a fully customizable sample interface. Meanwhile, the cryostat functions such that the temperature and magnetic field can be controlled from external programs such as LabVIEW or other third party software.

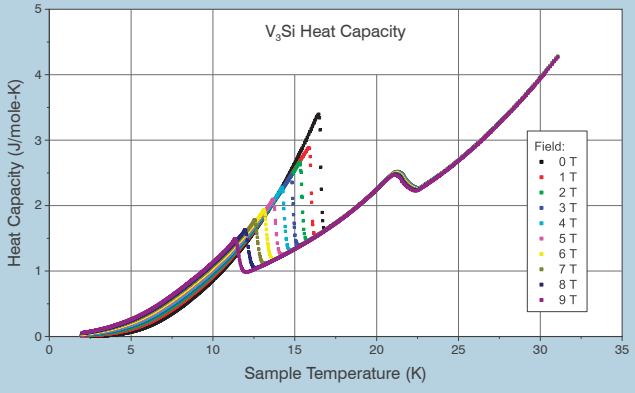



**Figure 1.** Heat capacity of $V_3Si$ showing structural transition (21 K) and superconducting transition (11 – 17 K, depending on magnetic field). High density data were obtained using simultaneous solution of heat and cooling curves from the heat capacity relaxation measurement.

# PPMS® DynaCool®

A History of Innovation
Industry Leading Design
Cryogen Free
Automated Operation
Precision & Speed


## Measurement Options

- Vibrating Sample Magnetometer
- Heat capacity
- AC & DC Electrical Transport
- He3-Refrigerator – continuous operation down to 0.5 K
- Dilution Refrigerator – continuous operation from 4 K down to 50 mK
- Thermal Transport
- AC Susceptibility
- Horizontal Rotator
- Torque Magnetometry
- Multi-Function Probe
- Magneto-Optic Measurements (light source and FOSH)
- VSM Oven – continuous operation up to 1000 K

# PPMS® DynaCool® Specifications*

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|---|---|
| **Temperature Control** | |
| Range: | 1.8 to 400 K @ 60Hz; 1.85 to 400 K @ 50Hz (Continuous Low Temperature Control and Temperature Sweep modes) |
| Stability: | +/-0.1% for T < 20 K (typical)<br>+/-0.02% for T > 20 K (typical) |
| Sample Cool Down Time: | 300 to 1.9 K (stable) in 40 minutes (typical) |
| System Startup Time: | 9 T: 16 hours (typical); 12 T: 30 hours (typical); 14 T: 40 hours (typical) |
| **Magnet Options** | |
| Range and Orientation: | Longitudinal: ±9 T, ±12 T, ±14 T |
| Control Modes: | Driven Mode: Linear, Oscillating, No Overshoot |
| Min Time to Full Field: | 9 T: less than 8 min (typical)<br>12 T: less than 25 min (typical)<br>14 T: less than 40 min (typical) |
| Field Uniformity: | 9 T: ±0.01% over 3 cm on axis; magnet center located 4 cm above puck surface<br>12 T: ±0.1% over 5.5 cm on axis; magnetic center located 4 cm above puck surface<br>14 T: ±0.1% over 5.5 cm on axis; magnet center located 4 cm above puck surface |
| Power Supply: | 9 T: 60 A; 12 T: 120 A; 14 T: 120 A |
| **General System Details** | |
| Sample Space Size: | Clear bore 2.5 cm (1 inch) diameter |
| Maintenance Interval: | ~2 years for the Cryocooler compressor (maintenance includes replacement of the adsorber in the compressor unit) and;<br>~4 years for the Pulse Tube cryocooler (designed for maintenance every 40,000 to 60,000 hours – this assumes that the cryocooler compressor is connected to a water chiller at 20°C.)<br>~6 months scroll pump tip-seal replacement |
| Power Requirements*: | System Cabinet: 200-230 V, 50/60 Hz, 30 A, single phase<br>Compressor: 3 Phase. *Consult with your local sales/service representative regarding voltage and current configurations.* |
| System Dimensions and Weights*: | Cabinet: 67 cm x 70 cm x 100 cm (D x W x H); ~70 kg<br>Cryostat & Can Rack 9 T: 92 cm x 123 cm x 127 cm; ~271 kg<br>Cryostat & Can Rack 12 T: 94 cm x 132 cm x 127 cm; ~318 kg<br>Cryostat & Can Rack 14 T: 94 cm x 132 cm x 127 cm; ~328 kg<br>Compressor: 69 cm x 50 cm x 62 cm (D x W x H); ~134 kg |

*Please contact your local sales/service representative for more detailed information about product specifications and laboratory layout requirements.*


Quantum Design

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*For complete specifications, contact your local Quantum Design office.

Specifications subject to change without notice 1307-010 Rev. G0