

Cryogenic Systems and Capabilities

Product Overview

JANIS

A LAKE SHORE COMPANY

The experience and the expertise to supply the system best suited for your cryogenic requirements



Janis manufacturing facility in Woburn, MA, USA

Founded in 1961, Janis is recognized as one of the foremost suppliers of cryogenic equipment in the world. Through the years, Janis has been continually dedicated to the design, fabrication, and delivery of the best systems and components in the industry. Using state-of-the-art CAD/CAM systems, Janis has developed the broadest range of cryogenic products in the business. With an installed base of over 8,000 systems and a staff of highly skilled scientists, Janis has the experience and the expertise to supply the system best suited to meet your cryogenic requirements.

We recognize that obtaining a cryogenic system represents a long-term commitment for most scientists; therefore, we are devoted to providing you with the highest level of quality and customer support. Just a few of the ways we accomplish this are:

- Sales and service are provided through a worldwide network of trained and knowledgeable representatives.
- A dedicated sales engineer is responsible for each system from conceptual design through post-installation support.
- A stable workforce draws on decades of combined service and applies this experience to the assembly of each cryogenic system.
- Customer approval of the final design drawing is obtained for all customized systems.
- Records on all systems, modifications, and design improvements are meticulously maintained for the reference of any future user.
- Turnkey systems are supplied by offering a full line of cryogenic accessories.
- Each system is fully integrated and tested before shipping.

Janis systems are available for a broad range of applications, with cooling provided by liquid nitrogen, liquid helium, or mechanical refrigerators. Each cooling mechanism has distinct advantages and preferred applications, and an engineer can assist in choosing the best cooling method for your application. Some of our key products include:

- Custom-engineered cryogenic solutions
- Superconducting magnet systems
- Cryogenic and vacuum micro-manipulated probe stations
- Continuous flow and reservoir cryostats, using liquid helium or liquid nitrogen
- 10 K and 4 K mechanical closed-cycle refrigerators (CCRs)
- Low-vibration pulse tube refrigerators

In August of 2020, Janis' lab cryogenics business become part of Lake Shore Cryotronics, a move that united two of the world's leading providers of cryogenic and material characterization solutions for low-temperature research. Engineers from the two companies now work together to innovate, create new products, and enhance existing ones as new applications requiring cryogenic equipment are developed.

For the most detailed and up-to-date information on Janis products (including specific performance specifications and key physical dimensions), please visit www.lakeshore.com.



Vibration-isolated Continuous Flow Probe Cryostat



Mechanically Cooled Cryogenic Cold Trap

Custom Engineered Cryogenic Systems

From our earliest days, Janis has been committed to the design and supply of custom cryogenic systems to support the specialized needs of the low-temperature community. Our customized designs have resulted in two NASA Public Service Group Achievement Awards and an R&D 100 Award for systems that were developed and manufactured at our facilities. With in-house engineering analysis, computer-optimized designs, and comprehensive manufacturing capabilities, our experienced physicists and engineers are readily available to discuss your special requirements for nearly any type of cryogenic application. Typical examples of custom-engineered projects include:

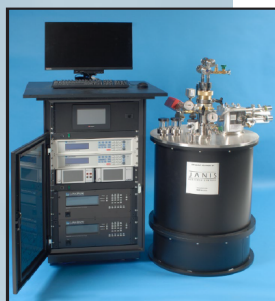
- Ultra-high vacuum cryostats and superconducting magnet systems for scanning probe, atomic force, and scanning tunneling microscopes
- Ultra-low loss cryostats and continuous transfer systems for operation at very low (nanometer) vibration levels
- Cryogenic cold traps with single or multiple chambers for adsorption of noble gases from geological samples, or various oxygen isotopes from meteorites and polar ice caps
- Cryostats for neutron or X-ray beam lines with or without superconducting magnets
- Cryogen-free vibration-isolated superconducting magnet systems with variable-temperature inserts
- Balloon-borne helium cryostats with solid neon shielding for ultra-long hold times for cosmic microwave background observations
- Ruggedized cryostats designed for space shuttle micro-gravity experiments in superfluid helium

New and enhanced systems are continuously under active design and construction. Please contact us with your requirements.





Optical Split Pair Magnet



Cryogen-free DryMag System

Superconducting Magnet Systems

These systems feature designs that fully integrate the cryostat, magnet, automatic temperature controller, and magnet power supply, complemented by a complete line of ancillary equipment. Our renowned SuperVariMag, OptiMag, and SuperOptiMag systems offer temperatures between 1.5 K and 325 K (with options to 475 K or higher) and can be supplied with or without optical access. Our NbTi systems offer magnetic fields between 5 and 9 T, while our Nb₃Sn magnets offer fields of 17 T and beyond. Ultra-low loss variable-temperature systems are offered for temperatures between 0.3 K to 300 K. Existing Janis magnet system designs include:

- Cryogen-free DryMag system with vertical, horizontal, or vector field configuration
- Standard top-loading systems with samples in helium vapor
- UHV-compatible systems with split magnets and solenoids
- Systems for scanning probe, atomic force, and scanning tunneling microscopy
- Vector field systems with multiple split magnets
- Systems for X-ray and gamma ray diffraction
- Room temperature (vertical and horizontal) bore systems

Cryogenic & Vacuum Micro-manipulated Probe Systems

We also offer a comprehensive line of Janis vacuum and cryogenic probing systems for chips, wafers, and packaged devices. These platforms are used by government, industry, and university labs around the world in various fields, including semiconductor, MEMS, superconductivity, electronics, ferroelectrics, materials science, physics, and optics research.

Standard cryogenic probing systems and custom-designed units are available to match your specific requirements. They include an ultra-high efficiency continuous-flow cryostat system, which utilizes liquid helium or liquid nitrogen and offers fast cooldown without introducing vibrations to the sample. Standard systems offer temperatures from below 3 K to 325 K (or 450 K), and include an automatic temperature controller for excellent control of the cold stage temperature throughout the entire range. The probes are manipulated using high-precision ball bearing or crossed roller bearing linear stages, resulting in a typical probe placement resolution of 3 μ m (with optional 0.3 μ m resolution available).

Several different probes are available for use with signals ranging from DC to microwave, and a combination of both low- and high-frequency probes can be supplied with a single system. Designs with four probes are the most commonly supplied configuration, though two, six, or more probes can be included. The modular design offers the advantage of using the same cryostat in a variety of experiments, including LCC, fixed-probe, probe cards, DLTS, optical, and magnetic field-dependent studies.



Micro-manipulated Probe Stations

Typical Applications

FTIR, ESR, optical microscopy, Mössbauer, NMR, VSM, UV/VIS/NIR, Hall measurements, matrix isolation, neutron scattering, x-ray diffraction, nanoscale measurements.

Cryostats for Spectroscopy and Electrical Measurements

Janis manufactures a comprehensive range of products specifically designed for spectroscopic measurements. Cooled by liquid helium, liquid nitrogen, or a closed-cycle refrigerator (CCR), a Janis cryostat is available for most spectrometer-based applications. In addition, electrical access and suitable sample holders add the capability for resistivity and Hall measurements, and other electrically-based techniques.

LIQUID HELIUM COOLED SYSTEMS

Continuous-Flow Cryostats

Janis SuperTran (ST) sample in vacuum and SuperTran-VP (STVP) sample in flowing vapor systems are reliable and flexible tools for reaching low temperatures in the laboratory. These continuous-flow cryostats offer quick sample cooldown, compact designs, and maximum LHe efficiency. (ST and some STVP systems can also be operated with LN₂ when lower temperatures are not required.)

SuperTran sample in vacuum models cover <2 K to 800 K. In addition to general-purpose systems, we offer SuperTran systems designed for specific applications, including FTIR, ESR, NMR, UHV, Hall effect, atomic force, microscopy, and more. SuperTran-VP models provide sample in vapor cooling from 1.5 K to 300 K and higher, and include a top-loading sample probe. Rapid sample changes are possible, and samples with poor thermal characteristics (i.e., liquids and powders) or irregular shapes can easily be cooled. Application-specific models include NMR, ESR, and FTIR.



FTIR Cryostat with Motorized Sample Manipulation



Low Vibration Microscopy Cryostat



High Efficiency Variable Temperature Reservoir Cryostat



Liquid Nitrogen Pourfill Reservoir Cryostat



Sample in Vapor Continuous Flow Cryostat

Reservoir Cryostats

The SuperVariTemp cryostat has long been a recognized standard in research labs and institutes around the world. Key features include sample in dynamic helium gas, rapid sample exchange, long hold time, and excellent sample temperature stability. Other reservoir cryostat models include the VariTemp system, available in either static helium gas or vacuum sample environment, and VSRD helium vapor shielded research Dewars for use in conjunction with superconducting magnets, variable temperature probes, and ultra-low temperature inserts.

LIQUID NITROGEN COOLED SYSTEMS

Pourfill Systems

The VPF sample in vacuum cryostat is an economical, variable-temperature liquid nitrogen-cooled system, with models covering the temperature range from 65 K to 800 K. VPF cryostats are simple to operate, and standard models offer f -1 optics. A compact tail extension is available for use with electromagnets, and a built-in sample manipulator can also be incorporated for use with FTIR spectrometers.

The VNF sample in flowing vapor cryostat is ideal for liquid or powder samples, which are difficult to thermally anchor in a conventional cold finger cryostat. The top-loading sample positioner permits quick sample change without warming the cryostat. Like the VPF cryostat, the VNF can be equipped with compact tails for use with narrow gap magnets.

"I have used Janis cryostats for 18 years, including continuous flow and SuperVariTemp models. My workhorse 10DT has been a gem; it never gave [us] any trouble, and the LHe and N₂ hold times were everything they were promised to be. I have been very pleased with it."
- Jim McWhirter, formerly at Union College, Schenectady, New York USA

CRYOGEN-FREE SYSTEMS

Closed-Cycle Refrigerators

Janis closed-cycle refrigerator (CCR) systems provide low temperature environments (as low as 2.7 K) without the need for liquid helium or nitrogen. As a result, these systems are simple to operate and inexpensive to maintain. CCR models are available in both sample in vacuum and sample in exchange gas (top-loading) configurations.



10 K Closed-Cycle System for Magneto-optical Experiments

7 K and 10 K Closed-Cycle Refrigerators

Janis CCR designs begin with cryocoolers supplied by several of the world's leading manufacturers of cryogenic refrigerators. Unlike most other cryostat manufacturers, we are not restricted to a single cryocooler supplier, and can therefore suggest the most suitable cryocooler for any particular application. We have designed and built CCR systems for an extremely broad range of applications including VSM, Mössbauer, matrix isolation, Hall measurements, microwave device cooling, detector cooling, x-ray and neutron diffraction, and many more. Temperature ranges are available from 7 K to 800 K.



Original APD Cryogenics Cryocoolers



Top-Loading 4 K Closed-Cycle System

4 K Closed-Cycle Refrigerators

Janis 4 K CCR designs can be used as a direct replacement for liquid helium cooled systems. Depending upon the cost of liquid helium and hours of operation, typical annual cost savings can range from \$5,000 to \$50,000 or more. We offer a broad range of 4 K CCR systems, with cooling powers ranging from 0.1 to 1.5 watts at 4.2 K. In addition to complete cold finger and exchange gas-cooled cryostats, bare 4 K cryocoolers can be provided for use in cryostat shield cooling, helium recondensing, astronomical applications, and more.



Compact Optical 4 K Closed-Cycle System

Pulse Tube Refrigerators

Pulse tube refrigerators are available in single-stage (to about 50 K) and two-stage (to 3 K) designs, and are especially useful where vibrations must be controlled. Pulse tube refrigerators eliminate the moving internal regenerator found in most other types of cryocoolers, resulting in lower mechanical vibrations (especially as measured at the vacuum mounting flange). When combined with vibration-isolation techniques such as flexible thermal braids, pulse tube cooler displacements can be reduced to a level compatible with sensitive detectors and nanoscale devices.

"We were able to sit down with the Janis technical staff to work out system details... Working cooperatively we obtained the needed system on a fairly short time scale and at reasonable cost." - Gary S. Phipps, MPIR Project Manager, Sandia National Laboratories, Albuquerque, New Mexico USA

Ancillary Products

Flexible Helium Transfer Lines

Liquid Helium Storage Dewars and Accessories

Liquid Nitrogen Storage Dewars

Mechanical Pumping Stations

High Vacuum Pumping Stations

Temperature Controllers

Liquid Helium and Liquid Nitrogen Level Indicators

Cryogenic Accessories and Supplies



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