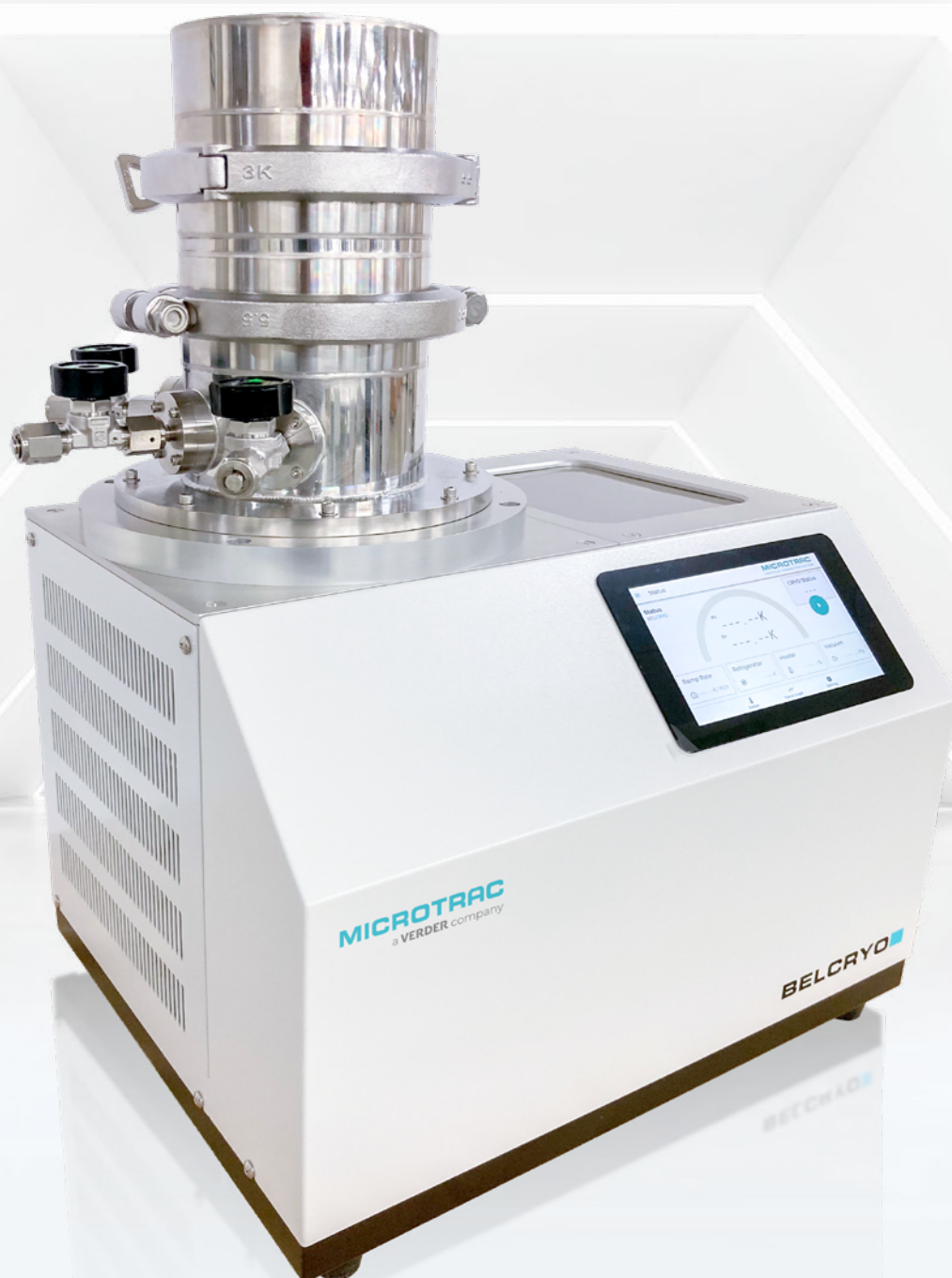




BELCRYO X

HIGH-PRECISION CRYOGENIC UNIT

**HIGH STABILITY TEMPERATURE CONTROL ($\pm 1 - 10$ MK)
FOR PRECISE ADSORPTION MEASUREMENTS ACROSS
35 – 473 K FOR THE BELSORP SERIES**

FEATURES

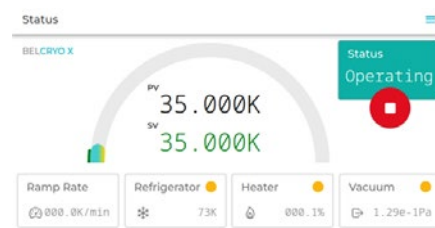
BELCRYO X is a cryostat designed to deliver high-precision temperature control optimized for gas adsorption measurements. With excellent temperature stability and a wide controllable temperature range, it enables various gas adsorption isotherm measurements when used with instruments from the **BELSORP series**. This makes it suitable for evaluating the surface area and pore size distribution of porous materials (such as MOFs, zeolites, and carbons), differential isosteric heats of adsorption, as well as gas separation and carbon capture & storage (CCUS/CCS) performance.

The salient features of the **BELCRYO X** are:

- | Operates without any requirement for cryogenics/refrigerants such as liquid nitrogen, allowing for gas adsorption measurements at any temperature from 35 K to 473 K
- | Highly stable temperature control (± 1 mK to ± 10 mK) during adsorption measurements. This is achieved using a vacuum-insulated chamber and radiation shielding.
- | Supports simultaneous gas adsorption measurements of up to three samples.
- | An intuitive LCD touch panel display that provides real-time visibility of the control temperature, vacuum level of the vacuum-insulated chamber, and the status of heaters and the cryocooler.
- | Significant improvement in measurement efficiency through simple sample setup steps.
- | Supports continuous adsorption measurements with no time limitations.
- | Seamless, fully automated operation from pretreatment to measurement can be performed through the dedicated **BELControl** software for the **BELSORP series**.



**BELSORP MAX X – BELCRYO X
System Connection Example**



**Touch Panel Control Screen of
BELCRYO X**

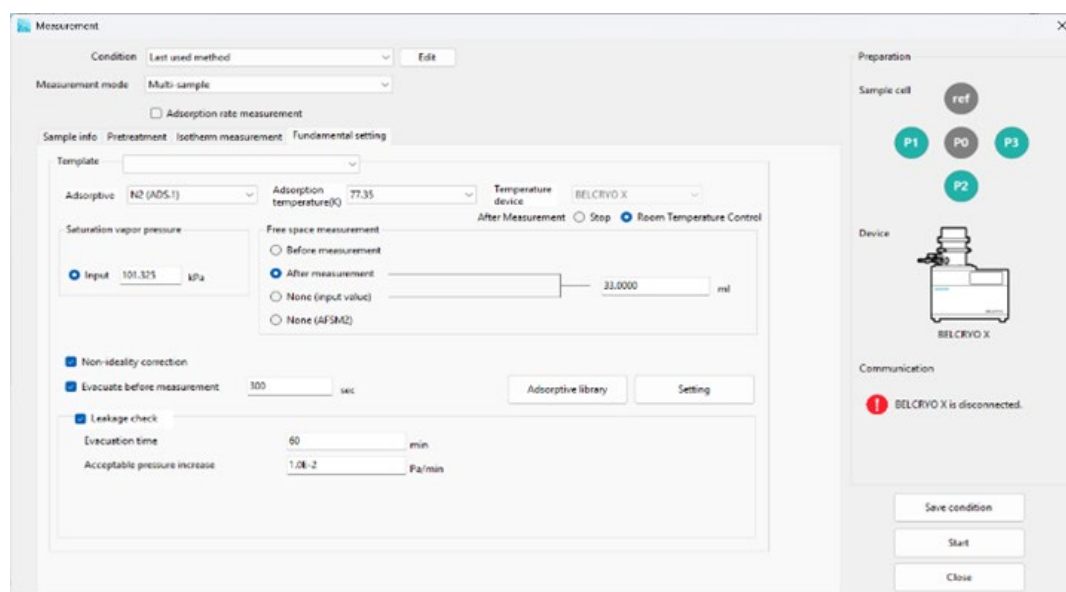
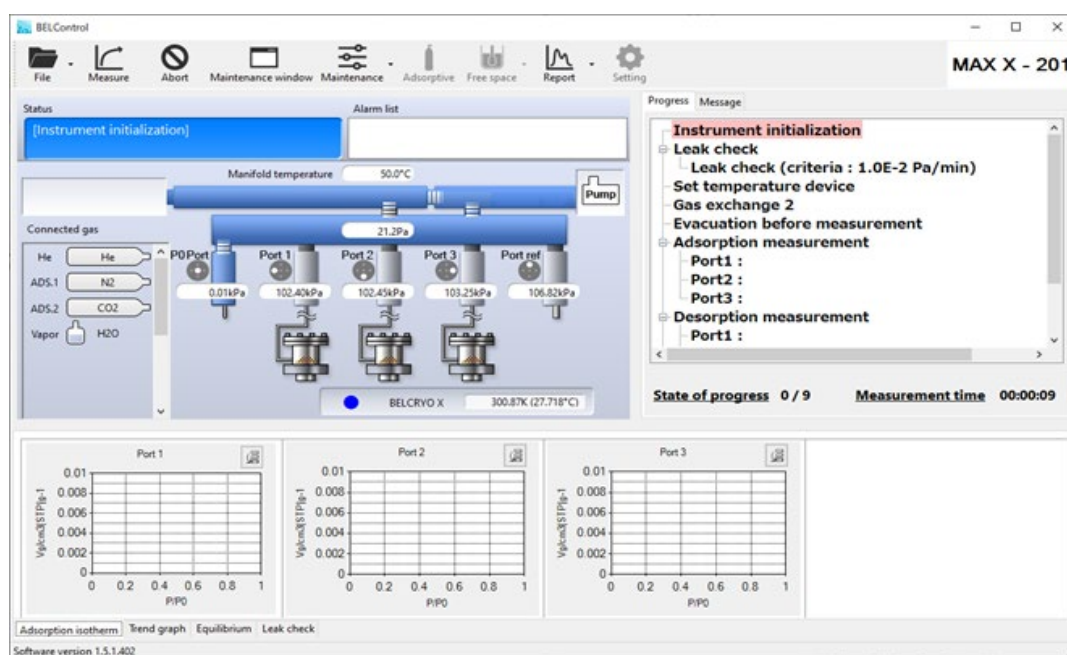


**BELCRYO X Sample Cell
(Volume: 1.8 cm³)**

SOFTWARE

BELCRYO X is fully automated and controlled through **BELControl** software, shared across the **BELSORP series**. The main functions of the software include:

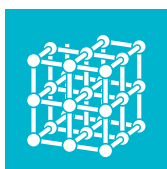
- Setting measurement parameters, including sample cell registration, number of samples, pretreatment conditions, and measurement conditions (temperature, pressure, adsorption/desorption settings).
- Fully automated operation from pretreatment to measurement, requiring no human interaction during the system operation.
- Real-time display of temperature stability and adsorption/desorption isotherms for monitoring of progress.



Measurement and Settings Screens of BELControl

APPLICATIONS

BELCRYO X can be widely utilized for gas adsorption isotherm measurements of various gases under diverse temperature conditions in varied porous materials. It supports **BET** surface area and pore size distribution analysis, differential isosteric heat evaluation of various adsorbents, and provides a simple solution to study low-temperature storage of next-generation energy gases such as hydrogen and methane. It is also suitable for CO₂ sequestration research in CCUS/CCS applications.



MOF/PCP



GAS STORAGE



GAS SEPARATION



CCUS/CCS

- | By combining **BELCRYO X** with instruments such as the **BELSORP MAX X HP**, a wide range of gas adsorption isotherms—including hydrogen and methane storage studies and CO₂ separation—is obtainable across a broad temperature range and pressure conditions, from cryogenic to high temperature and from low to high pressure.
- | Since no cryogenics/refrigerants are required for running the adsorption measurements, it saves operational costs of instrumentation in the long run.
- | Wide range of adsorption isotherms can be measured under various temperature conditions (e.g., N₂ at 77.4 K, Ar at 87.3 K, CO₂ at 273 K) which can be directly used for BET surface area determination and pore size distribution analysis using advanced GCMC/QSDFT models.
- | High-precision isosteric heat of adsorption can be evaluated from adsorption isotherms measured at different temperatures (e.g., 77.4 K, 82.4 K, 87.4 K). This enables highly reliable characterization of material surface properties under cryogenic conditions.
- | **BELCRYO X** also supports coupled measurements with X-ray Powder Diffraction (XRPD) of powder samples, allowing simultaneous observation of gas adsorption behavior and structural changes, including gated adsorption and phase transitions.

MEASUREMENT EXAMPLES

Beyond 77.4 K for liquid nitrogen (LN₂) and 87.3 K for liquid argon (LAr), the system enables adsorption measurements at temperatures such as 194.7 K and 119.7 K—conditions that are difficult to achieve with conventional cryogenic refrigerants.

The system enables highly accurate evaluation of hydrogen adsorption behavior under cryogenic conditions (e.g., 35 K and 40 K). In addition, adsorption isotherms measured at multiple temperatures can be used to determine the isosteric heat of adsorption.

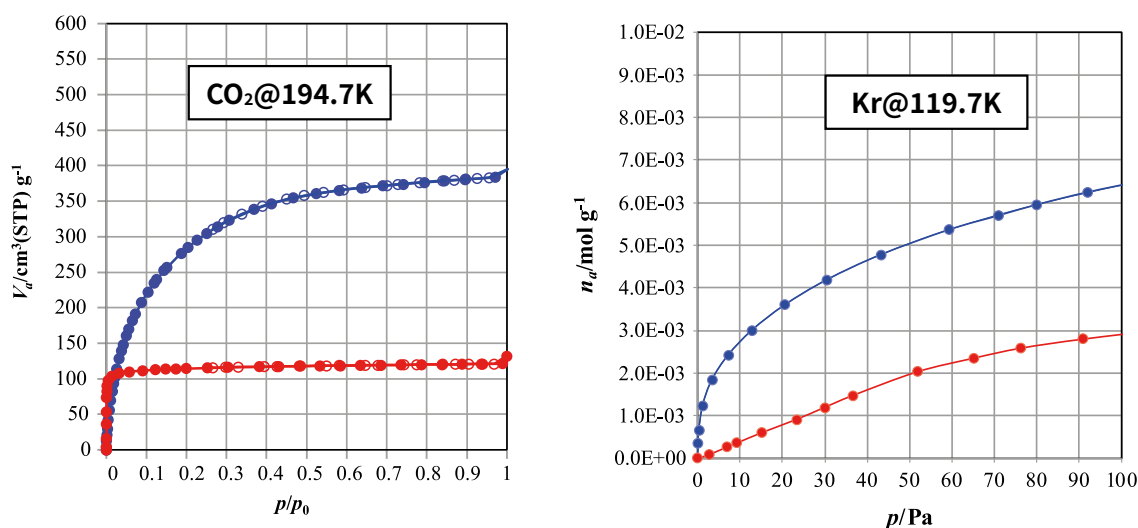


Fig. Various kinds of gas adsorption isotherms for **activated carbon (blue)** and **FAU zeolite (red)** by BELSORP MAX X and BELCRYO X

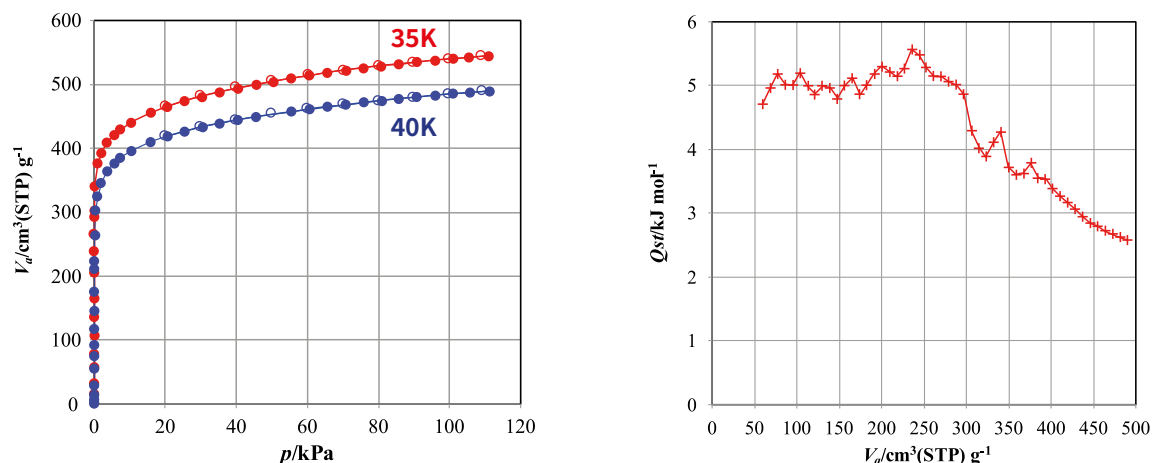
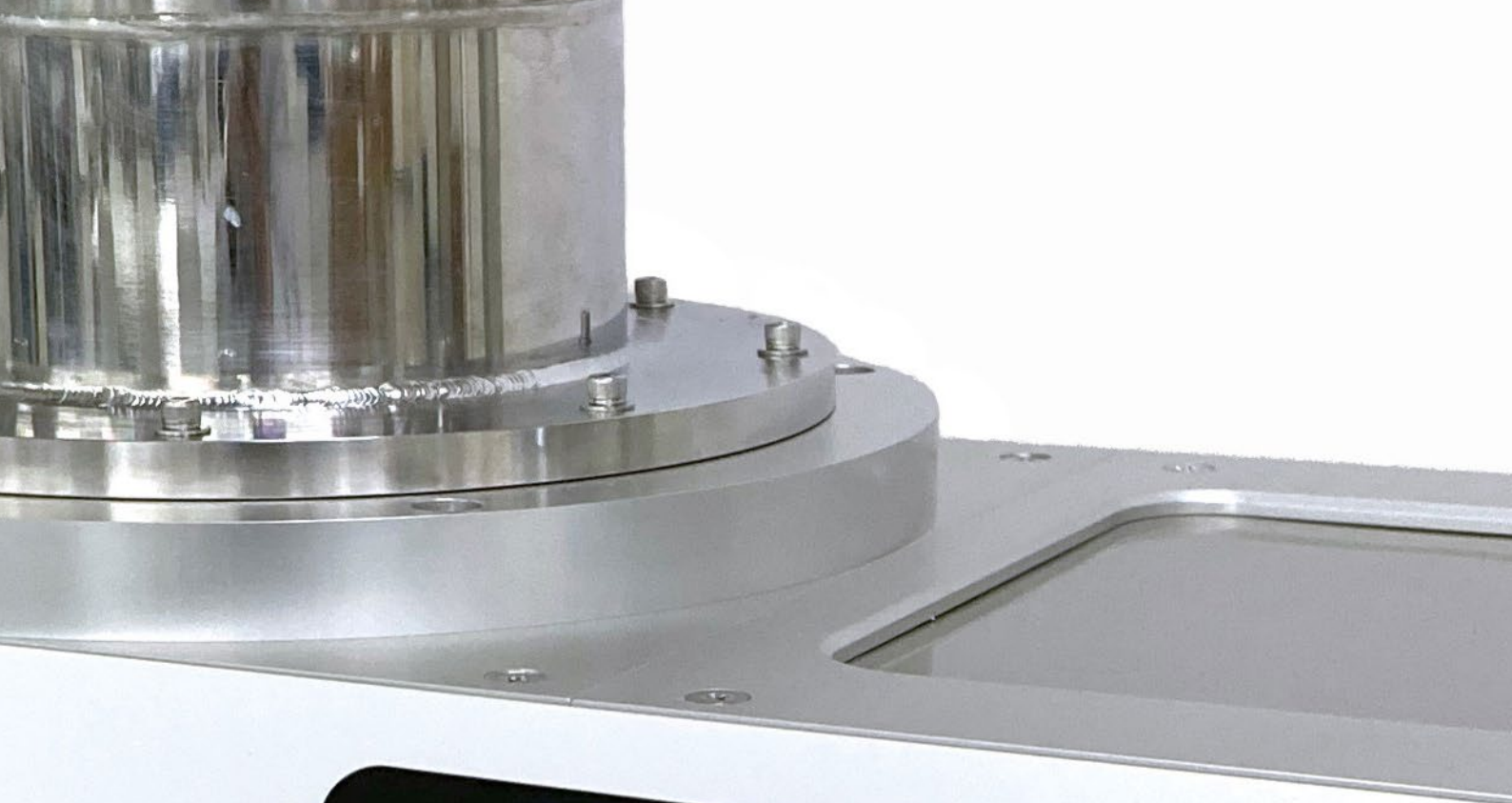


Fig. H₂ Adsorption Isotherms of Activated Carbon at 35 K and 40 K

Fig. Isosteric Heat of Hydrogen Adsorption on Activated Carbon (Calculated from hydrogen adsorption isotherms measured at 35 K and 40 K)

Pretreatment conditions: 473 K, 3 h with CRYO X

Weighing: Weigh after measurement (Recalculate with BELMaster after measurement at each temperature)



CONSUMABLES

Model No.	Item Name	Specification	Qty
075-20003-0-0	CRYO Sample Cell	Made of Cu, with a volume of 1.8 cm ³	1 unit
900-00088-0-0	Aluminum Gasket	Made of Al	Minimum order quantity: 10 units

SPECIFICATIONS

Control System	Single-stage GM (Gifford–McMahon) Cryocooler with Heater
Temperature Range	35 K to 473 K
Temperature Stability	±0.001 K (< 100 K), ±0.01 K (≥ 100 K)
Cooling Time	Cooling from 298 K to 35 K: less than 120 minutes (For reference)
Number of samples/specimens	3
Pressure resistance	Below 1 MPa (G)
Measurable Gases	N ₂ , Ar, Kr, Xe, CO ₂ , H ₂ , CH ₄ , CO, and other non-corrosive gases
Sample Cells	Volume: 1.8 cm ³ (ID: Ø13.5 mm, Depth: 14.5 mm)
Compatible BELSORP Series*	BELSORP MAX X (including HP versions) / MAX G / MINI X
Dimensions (W × H × D) & Weight	BELCRYO X: 450 × 590 × 360 mm, 50 kg Compressor: 320 × 610 × 450 mm, 75 kg
Power supply	BELCRYO X: AC 100 V-240 V, 1200 VA, 50/60 Hz Compressor: AC 100 V-120 V, 1500 VA, 50/60 Hz
Conforming standards	CE/UKCA

| **BELControl** is a trademark of MICROTRAC, a Verder company.

| Please contact us regarding the connection of **BELSORP MAX** or **MAX II** to **BELCRYO X**.

| Products and services listed in this catalog may be subject to export control regulations under the Foreign Exchange and Foreign Trade Act of Japan, depending on the country of export or intended use. Exporting regulated products (goods or services) may require prior review and approval from the Japanese government.

2026.03



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