

# Automatic Gas Flow Control Flow Cryostat Temperature Controller

## Flow SHOGUN 流将軍

*A New Gas Controller Has Been Developed  
for USM1400!*



*Control the Flow,  
Move Forward*

Model Name: PVC100

### Key Features

- Working Principle
- PID-Controlled Flow Regulation

Data : Helium Flow Control Performance

Data : Temperature Stability Comparison (LHe)

Data : Temperature Control (LN<sub>2</sub>)

Comparison with Previous Model

Components

Setup Configurations

Specifications

# Key Features

- Linear flow valve control maintains a stable 1 K pot temperature
- PID feedback automatically regulates refrigerant flow to match the setpoint
- Optimized low flow operation extends cryogen holding time
- Excellent temperature stability ensures reliable STM performance
- Simple and flexible temperature control via setpoint adjustment

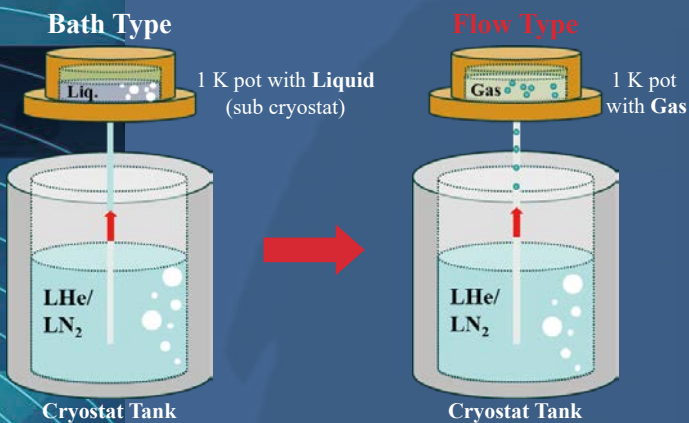
## Working Principle

The USM1400 is equipped with a main cryostat that stores liquid refrigerant internally.

The refrigerant is supplied to the 1 K pot (sub-cryostat) by gas pressure, cooling the STM stage as the 1 K pot temperature decreases.

When the refrigerant supply rate is increased, liquid accumulates in the 1 K pot, resulting in a cooling mode similar to a conventional bath cryostat (left figure).

In contrast, when the supply rate is reduced, the 1 K pot is filled with gas and operates as a flow cryostat (right figure).

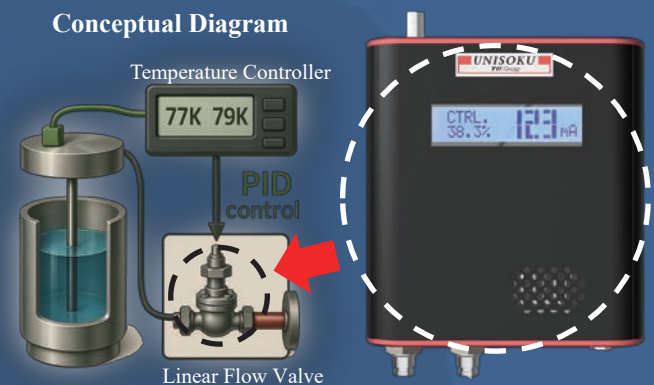


## PID-Controlled Flow Regulation

This flow cryostat controller is designed to precisely regulate temperature during gas cooling operation.

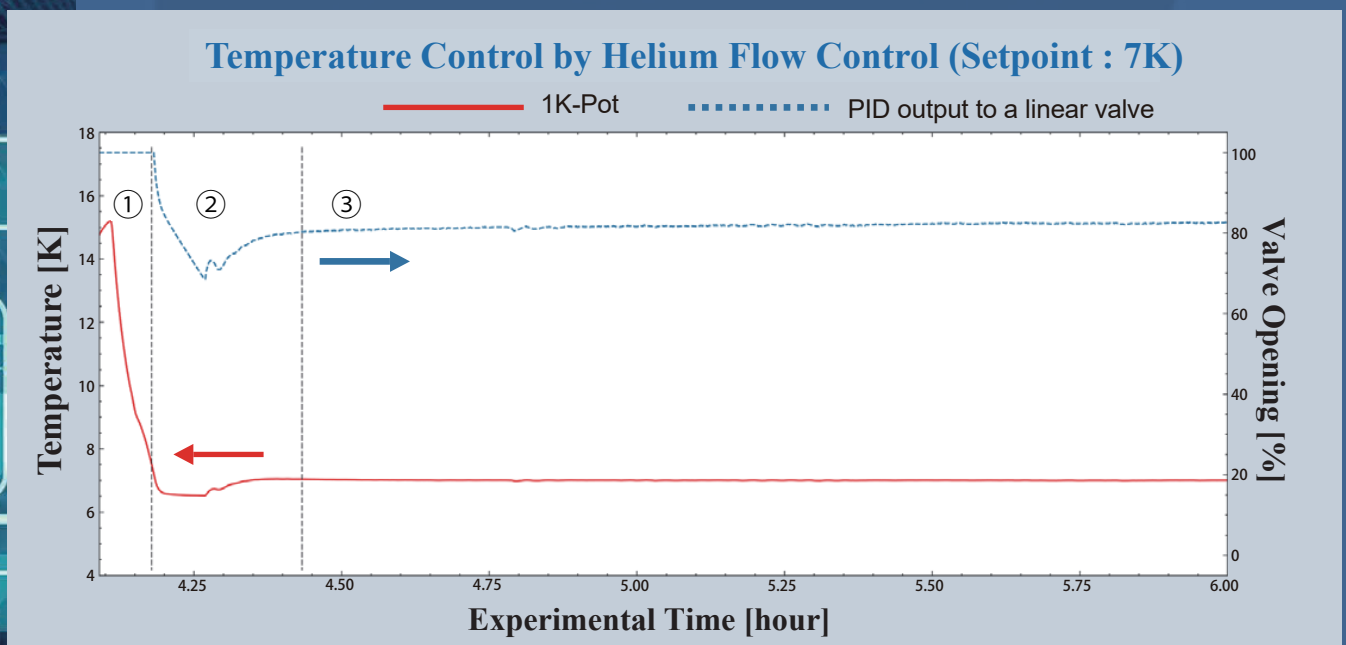
A proportional valve is integrated into the controller, with its opening controlled by an external analog voltage input. As illustrated in the conceptual diagram, the controller functions like a faucet, regulating the gas flow rate to maintain a constant temperature.

In operation, the valve opening is driven by the PID output from the temperature controller, enabling automatic adjustment of the flow rate so that the 1 K Pot reaches and maintains the user-defined setpoint.

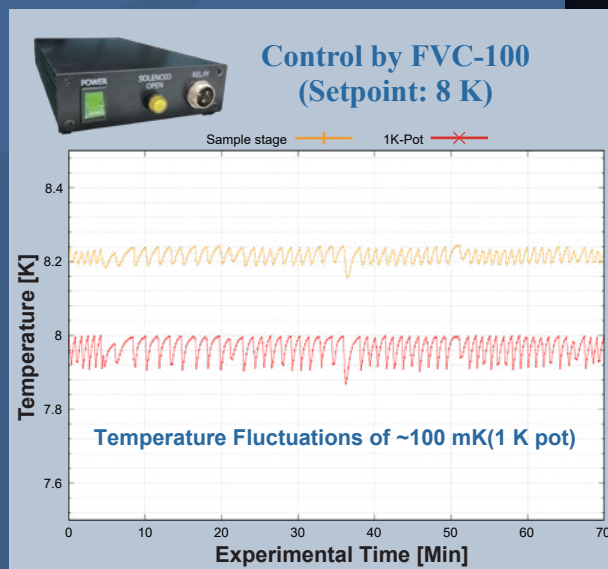
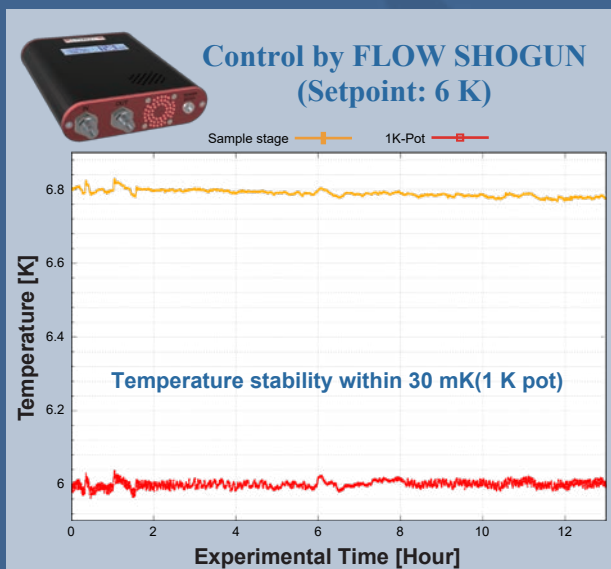


## Data: Helium Flow Control Performance

- ①: Rapid cooling of the 1 K pot with 100% valve opening
- ②: Valve opening adjusted via PID control to reach 7 K at the 1 K pot
- ③: Stable maintenance of T1 K pot at 7 K as helium level decreases

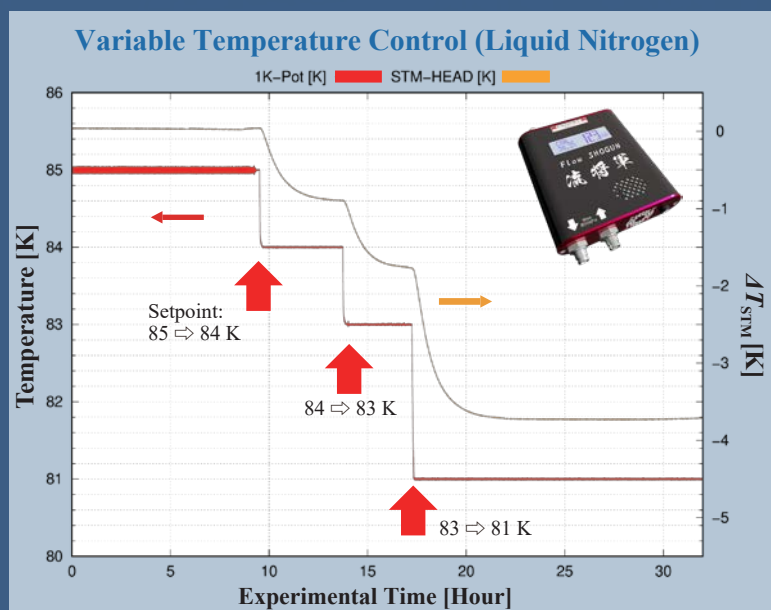


# Data: Temperature Stability Comparison (LHe)



# Data: Temperature Control (LN<sub>2</sub>)

- Rapid response to setpoint changes, reaching target temperature within ~1 hour
- Stable temperature control even under low nitrogen gas flow conditions
- Reduced flow extends liquid nitrogen holding time, similar to helium operation
- No liquid nitrogen storage required, enabling quick transition to helium operation



# Comparison with Previous Model

PVC-100 /Flow SHOGUN (New Model)



FVC-100 (Previous Model)



Valve Control	0 ~ 100 % (Continuously)	Digitally Open/Close (On/OFF)
Usability/Purpose	Fully Automated/Long Term STM	Manual Settings/ Temperature Maintained in Stand-by Mode
Temperature Stability	$\Delta T_{\text{Fluctuation}} < 30 \text{ mK}$	$\Delta T_{\text{Fluctuation}} \sim 100 \text{ mK}$
Helium Consumption from 1K pot	Automatically Minimized	Manual Control

# Components

PVC-100



Power Supply Cable  
(AC - DC Converter)



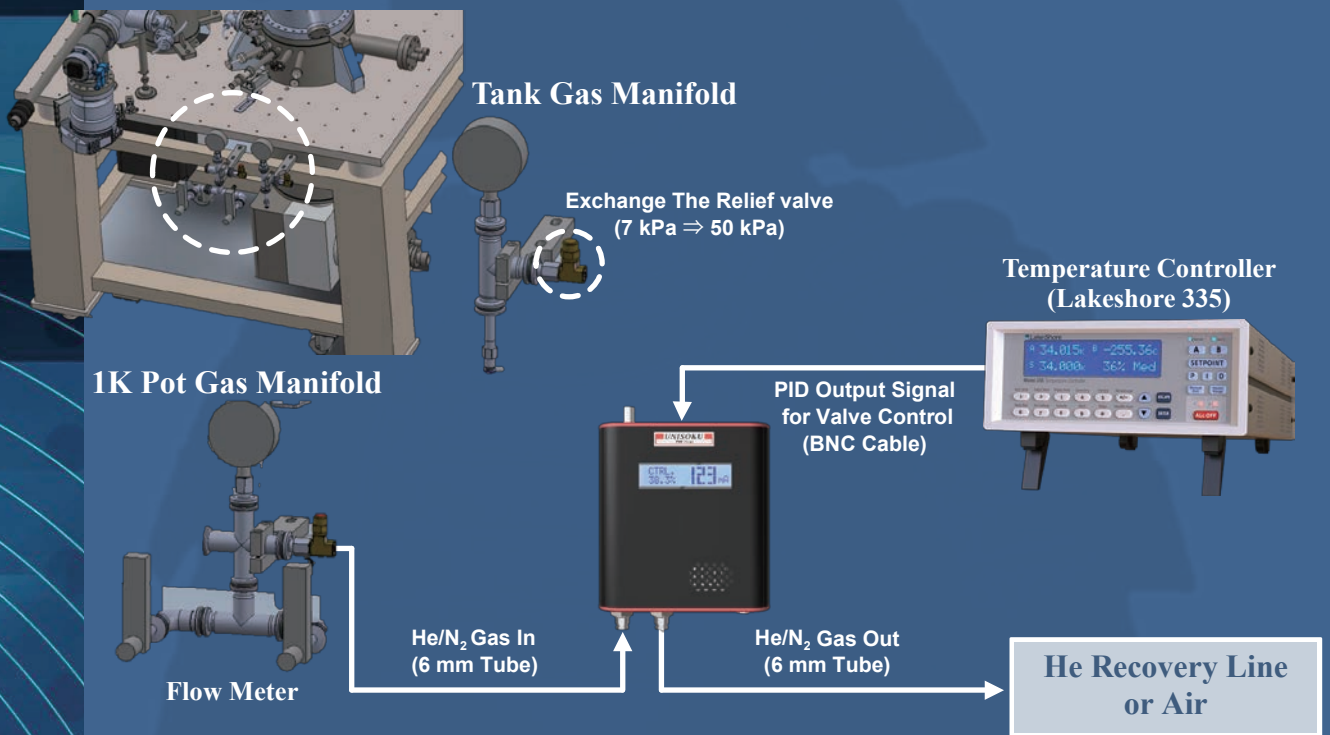
50 kPa Relief Valve

BNC Cable with Connector and  
40 kPa Overpressure Valve  
(From Temperature Controller to PVC-100)



\* Please note that delivery and installation services are not included with the purchase.

# Setup Configuration



# Specifications

Product Name	Flow Cryostat Temperature Controller (PVC-100, Flow SHOGUN)
Applicable System	USM1400* * Not compatible with early USM1400 models without a 1 K pot
Controllable Temperature Range	84 K ~ 100 K (LN <sub>2</sub> ) 6 K ~ 20 K (LHe) * Lower temperature limit depends on thermal configuration (especially in LHe operation) * Higher temperatures are possible with heater activation
Temperature Fluctuation	< 30 mK guaranteed * < 10 mK achievable
Temperature Controller	Cryocon22C / Lakeshore 335

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