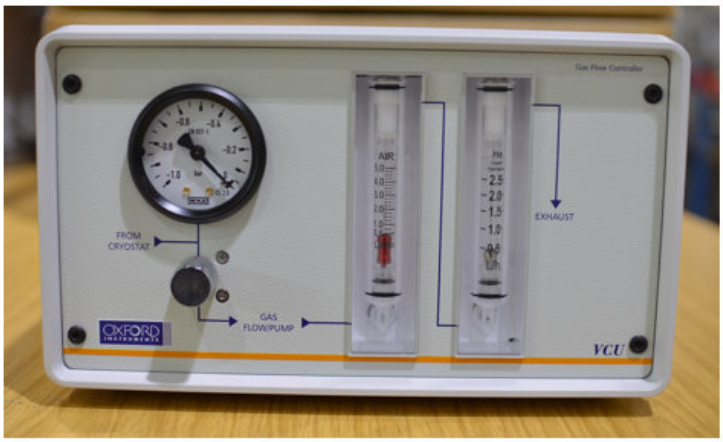
User Manual - Original Instructions

VCU Flowmeter



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VCU Flowmeter Manual

Oxford Instruments Nanoscience

Sep 2017

Contents

1 VCU Flowmeter - Principles of Operation

Flow meter for Helium and Nitrogen continuous flow cryostats.

1.1 Revision history

Always use the latest issue of the manual. Check for updates online at https://support.myoxinst.com.

1.2 Copyright

1.3 Contents

2 Introduction

This manual contains user and technical information for the VCU gas flow controller, designed for use with continuous flow cryostats or variable temperature inserts to monitor and control the cryogen flow through the system. The cryostat pressure and the flow rate are displayed on the front panel of the controller.

The information provided in this manual supplements the information given in the other manuals supplied with your system. The cryostat manual will explain how to set up and operate your system, and the Mercury iTC manual will give details of the temperature controller. If you have purchased a complete system then you should not need to use this manual unless you need to make any adjustments.

This manual contains important information for the safe operation of your system. We recommend that you read this manual carefully before operating the system for the first time.

Please keep all the manuals supplied with your system and make sure that you check for updated information and incorporate any amendments. If you sell or give away the product to someone else, please give them the manuals too.

If you have bought a complete system from Oxford Instruments, separate manuals will have been supplied describing the other components. Please ensure you have reviewed the information supplied in all of the manuals before you attempt to operate your system.

2.1 Copyright Notice

2.2 Statement of Intended Use

The equipment has been designed to operate within the process parameter limits that are outlined in the user manual. The equipment is intended to be installed, used and operated only for the purpose for which the equipment was designed, and only in accordance with the instructions given in the manual and other accompanying documents. Nothing stated in the manual reduces the responsibility of users to exercise sound judgement and best practice. It is the user’s responsibility to ensure the system is operated in a safe manner. Consideration must be made for all aspects of the system’s life-cycle including, handling, installation, normal operation, maintenance, dismantling, decontamination and disposal. It is the user’s responsibility to complete suitable risk assessments to determine the magnitude of hazards.

The installation, use and operation of the equipment are subject to laws in the jurisdictions in which the equipment is installed and in use. Users must install, use and operate the equipment only in such ways that do not conflict with said applicable laws and regulations. If the equipment is not installed, used, maintained, refurbished, modified and upgraded as specified by the manufacturer, then the protection it provides could be impaired. Any resultant non-compliance damage, or personal injury would be the fault of the owner or user.

Use of the equipment for purposes other than those intended and expressly stated by Oxford Instruments, as well as incorrect use or operation of the equipment, may relieve Oxford Instruments or its agent of the responsibility for any resultant non-compliance damage or injury. The system must only be used with all external covers fitted.

2.3 Restrictions on Use

The equipment is not suitable for use in explosive, flammable or hazardous environments. The equipment does not provide protection against the ingress of water. The equipment must be positioned so that it will not be exposed to water contact.

2.4 Maintenance and Adjustment

Only qualified and authorised persons should service or repair this equipment. Under no circumstances should the user attempt to repair this equipment while the electrical power supply is connected.

2.5 Warranty

The Oxford Instruments customer support warranty is available to all our customers during the first 12 months of ownership from date of delivery. This warranty provides repair to faults that are a result of manufacturing defects at Oxford Instruments NanoScience.

2.6 Acknowledgements

All trade names and trademarks that appear in this manual are hereby acknowledged.

2.7 Support

If you have any questions, please contact us with the following details :

- **System type** :
- **Serial number** : The Sales Order (SO) number and/or other identifiers of your system.
- **Installation/Shipment Address** :
- **Contact information** : How we can contact you, email/telephone details.
- **Details of your query** : The nature of your problem, part numbers of spares required, etc.

Please contact Oxford Instruments first before attempting to service, repair or return components.

2.8 Contact information

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2.9 Acronyms

A number of acronyms may be used throughout this document. Please refer to the document Practical Cryogenics for a glossary of terms.

2.10 Safety information

Before you attempt to install or operate your system, please make sure that you are aware of all safety precautions listed in this manual together with the warnings and cautions set out in other documents supplied with the system.

All cryogenic systems are potentially hazardous and you must take precautions to ensure your own safety.

The general safety precautions required when working with cryogenic systems are given in the OINS' *Safety Matters* document. We recommend that all users should read this document, become thoroughly familiar with the safety information provided and be aware of the potential hazards.

It is the responsibility of customers to ensure that the system is installed and operated in a safe manner. It is the responsibility of customers to conduct suitable risk assessments to determine the nature and magnitude of hazards.

2.11 Disclaimer

Oxford Instruments assumes no liability for use of any document supplied with the system if any unauthorised changes to the content or format have been made.

Oxford Instruments policy is one of continued improvement. The Company reserves the right to alter without notice the specification, design or conditions of supply of any of its products or services. Although every effort has been made to ensure that the information in this document and all accompanying documents is accurate and up to date, errors may occur. Oxford Instruments shall have no liability arising from the use of or reliance by any party on the contents of this these documents (including this document) and, to the fullest extent permitted by law, excludes all liability for loss or damages howsoever caused.

Oxford Instruments cannot accept responsibility for damage to the system caused by failure to observe the correct procedures laid down in this manual and the other manuals supplied with the system. The warranty may be affected if the system is misused, or the recommendations in the manuals are not followed.

2.12 General hazards

The following general hazards must be considered when planning the site for installation. Please take notice of the following relevant warnings.

2.12.1 Warning notices

Warning notices draw attention to hazards to health. Failures to obey a warning notice may result in exposure to the hazard and may cause serious injury or death. A typical warning notice is shown below:

The warning triangle highlights dangers which may cause injury or, in extreme circumstances, death.

2.12.2 Caution notices

Caution notices draw attention to events or procedures that could cause damage to the equipment. Failure to obey a caution notice may result in damage to the equipment. A typical caution notice is shown below:

The general caution symbol highlights actions that you must take to prevent damage to the equipment. The action is explained in the text.

2.13 Specific hazards

Each cryogenic system will have a number of specific hazards associated with the product. For full details please refer to the system manual. You will receive this at the time of installation and it should be read by all users before operating the system.

2.14 Description

The controller is connected between the cryostat outlet and the pump. A 0 to 1000mbar (absolute) pressure gauge measures the pressure in the cryostat. The control valve can be used to adjust the flow rate through the system.

The exhaust of the pump then passes through the controller again. The VCU contains a flow meter for helium gas (calibrated from 0 to 2.5 l/hour liquid equivalent). This meter can be used to estimate the flow of nitrogen by multiplying the apparent flow by a factor of 0.5. There is also a flow meter for air (calibrated from 0.5 to 5 l/minute for gas flow), in parallel with the helium flow meter.

The outlet of the controller can then be connected to a helium recovery system or safely piped away.

2.15 Installation

The gas flow controller is often used with a continuous flow cryostat which also has a valve on its inlet. Make sure that you do not leave both of these valves closed, as a high pressure can develop if cold gas or liquid trapped in the cryostat warms and expands. The controller is fitted with a pressure relief device to prevent this situation becoming dangerous, but should not be relied upon for normal operation.

A high internal pressure may result in damage to the pressure gauge in the controller.

2.15.1 Mounting the gas flow controller

Make sure that the cryostat is rigidly supported. The lines between the cryostat and controller can be quite rigid and may cause the cryostat to tip over.

VCU controllers are built into a freestanding case and cannot be mounted directly in an electronics rack without a suitable adaptor.

2.15.2 Pumps

An oil-free diaphragm pump (such as Oxford Instruments GF4 pump) is usually used to promote the gas flow by reducing the pressure at the cryostat exhaust.

If the gas flow meter is contaminated with oil its calibration will change. Therefore, if you use another type of pump (for example an oil-sealed rotary pump), it is essential to fit an effective oil-mist filter between the pump exhaust and the controller.

2.15.3 Making connections to the VCU

All connections are made on the back panel of the controller. “Quick coupling” connectors are used, designed for use with plastic pipe with 10mm outer diameter and 7mm inner diameter. The elbows on the back panel of the controller can be rotated to point in any direction.

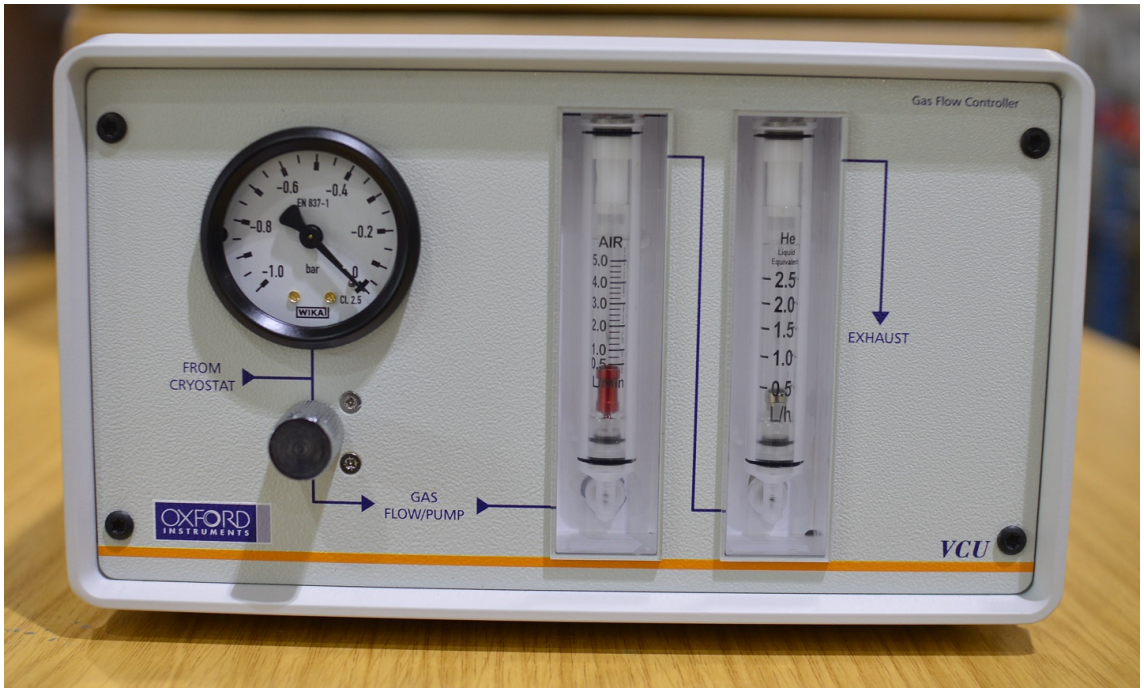

Figure 2.1: VCU front panel

Connect the controller into your system as shown in the cryostat manual. Push the plastic tube into the quick couplings until you feel it click. The tube is then locked in place and cannot easily be pulled out of the coupling by accident.

If you have to cut the tubes prepare the ends of the plastic tubes carefully. Use a sharp knife so that the tube is not flattened as you cut it. The end face of the tube should be square (perpendicular to the tube axis).

The back panel is clearly labelled for making connections to the pump and other system components. The plastic tube is often a tight fit on the transfer siphon or cryostat fitting, and may be difficult to remove. Therefore an in-line connector is supplied to allow the tube to be disconnected easily. This connector should be fitted at least 1.5m from the cryostat or transfer siphon outlet, so that there is no risk of it freezing and leaking.

If you are using the controller with an older system which is designed for use with plastic tube of a different diameter, then the new tubes may be a loose fit. A short piece of rubber tube of a suitable diameter can be used to make the connection, but you should make sure that it is not subjected to mechanical shock while it is cold, as it is likely to shatter.

2.15.4 Disconnecting the quick couplings

The plastic tube is normally locked into the quick couplings to make sure that it is not accidentally pulled out, but it can be disconnected easily. Push the release ring in, and gently pull the tube out of the coupling. The position of the release ring is shown below.

2.15.5 Testing the system for leaks

After you have connected the pump and controller together (but before you connect the transfer siphon and cryostat) you should check that there are no air leaks. Put a rubber bung into the open end of tube which will be connected to the cryostat. Switch on the pump and open the valve on the controller. The reading on the pressure gauge should drop.

When the base pressure of the pump is reached, close the valve on the controller and watch the pressure gauge. If the pressure starts to rise, this indicates a leak. Check all the external fittings and then, if necessary, check the internal connections.

Figure 2.2: VCU rear panel

2.16 Operation

2.16.1 Controlling the gas flow rate

On some systems it is best to use the needle valve on the cryogen transfer siphon or the cryostat itself to control the flow through the system. On others, the valve on the VCU should be used. Refer to your cryostat system manual for further instructions. In either case, the gauge on the controller indicates the pressure in the cryostat.

2.17 Maintenance

2.17.1 Testing the system for blockages

If the cryogen flow rate does not increase as expected during cooldown it is possible that the cryostat or transfer siphon is blocked. Make sure that the needle valve on the transfer siphon (or cryostat) and the valve on the controller are fully open and observe the pressure on the gauge. Then close the valve on the controller. If the pressure reading on the gauge does not rise to atmospheric pressure quickly there is a blockage in either the transfer siphon or the cryostat. Refer to the cryostat manual for troubleshooting advice.

2.17.2 Spare plastic lines

If you are ordering spare plastic lines to use with your VCU it is important that you specify the size of tube that you require. The tube has an outer diameter of 10mm and an inner diameter of 7mm. Earlier versions of these controllers used different connectors and lines, which may not be directly compatible.

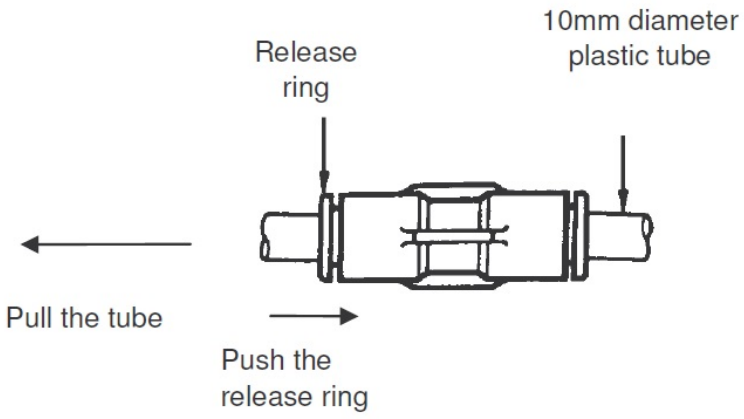

Figure 2.3: Tube Connections