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# QUEST GASEOUS REACTION AND CONCENTRATION MANIFOLD

***GRCM — User Manual***

PN 103952
Rev 1.0
28 October 1999

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Quest™ Gaseous Reaction & Concentration Manifold — User Manual

Part Number 103952

Revision 1.0 28 October 1999

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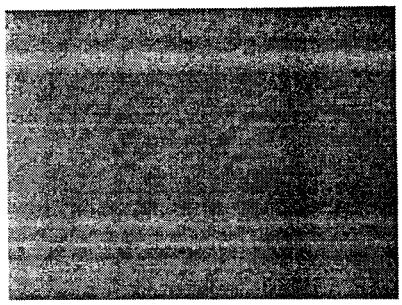
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# WARRANTY

## ARGONAUT WARRANTY AGREEMENT

### Limited Warranty

All individual instrument parts, consumables and the like are subject to the provisions of the Seller Limited Ninety (90) Days Warranty as outlined below. Resin consumable products or the like are only warranted to conform to the quantity and content stated on the label at the time of delivery. All instrument system products are provided subject to the provisions of the SELLER Limited One (1) Year Warranty, a copy of which is available to Buyer and which is incorporated herein in its entirety by this reference.

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## Exclusions

This limited warranty covers normal use. Exclusions from this limited warranty may include:

- Servicing or modification by anyone other than a qualified Argonaut Technologies Service Representative;
- Non-conformance to recommended instrument operating procedures as noted throughout this manual;
- Failure to perform routine preventative maintenance;
- Any natural disaster, including earthquake, lightning, tornado, flood, or fire; electrical surges or the use of improper power sources.



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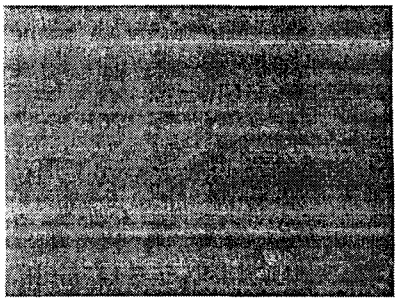
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# INTRODUCTION

## OVERVIEW

The Quest™ Gaseous Reaction and Concentration Manifold (GRCM) is designed for use on the Quest 210 SLN organic synthesizer, and on the standard Quest 210 with the Lower Manifold Luer Upgrade.

The GRCM enables gaseous reactions (e.g., hydrogenation, carbonylation, etc.) and sparging to be to be carried out. It also enables products to be concentrated and evaporated directly, simplifying solvent exchanges and the transition from synthesis to purification.

The GRCM consists of the following components:

- **Control Box.** The control box has two gas inputs, a three position valve, a pressure gauge, and two gas outlets each with a needle valve to regulate gas flow. The gas supplies for concentration and gaseous reactions connect to the control box. The User selects either gas input 1, gas input 2, or closed using the three-way valve. One gas outlet connects to the gas delivery manifold via 1/8" Teflon tubing, and the other is for use with an additional gas delivery manifold.
- **Gas Delivery Manifold.** The gas delivery manifold attaches to the Quest 210 lower manifold luers and delivers gas to the reaction vessels. The delivery manifold has a gas input, a manifold to distribute gas to 10 reaction vessels, and 10 gas outlets with female luers which mate with the male luers of the Quest 210 lower manifold. Each gas outlet has a check-valve to prevent its reaction vessel from draining while allowing gas delivery.
- **Solvent Trap Manifold.** The solvent trap manifold attaches to the Quest 210 upper manifold and vents the reaction vessels during concentration. The solvent trap manifold has a port for each reaction vessel, a manifold to collect the exiting gas, and an outlet which connects to a solvent trap.

The GRCM can be used to concentrate or add a gaseous reagent to a single bank of ten Quest reaction vessels (10 RVs) and has a maximum operating pressure of 10 psig (1.69 barr).

An Expansion Kit is available which provides additional delivery and solvent trap manifolds to expand the number of parallel concentrations and gaseous reactions to twenty (20 RVs).



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## INTERFERENCE INFORMATION

This equipment does not generate or use radio frequency energy.

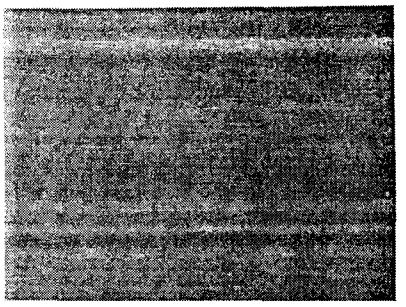
## YEAR 2000 SOFTWARE AND FIRMWARE COMPLIANCE

The Gaseous Reaction and Concentration Manifold has no related software or firmware. For a detailed Year 2000 Compliance Report, please contact the Argonaut Technologies office listed in Appendix A, "Service."Appendix A:





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# SAFETY

This chapter discusses safety issues related to the operation and use of the Quest Gaseous Reaction and Concentration Manifold (GRCM) when used in conjunction with a Quest 210 SLN or a Quest 210 with the Lower Manifold Luer Upgrade. Please read it carefully before attempting to operate the system.

**Warning!**

**This chapter only discusses safety issues related to the *Quest Gaseous Reaction and Concentration Manifold* (GRCM). Users of the GRCM must be familiar with the safety issues related to the Quest synthesizer equipment on which it is used.**

## USER ATTENTION WORDS

"User attention words" appear in the text of this manual. Careful attention to these entries while consulting the user manual will help ensure the safety of the user and the instrument. Each word implies a particular level of observation or action described as follows:

**Note:** *This word is used to call attention to information.*

**Caution**

This word informs the user that damage to the instrument could occur if the user does not comply with the information.



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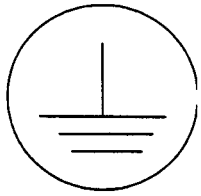
**Warning!**

**This word informs the users that physical injury or death could occur to themselves or others if the required precautions are not taken.**

## WARNING LABELS

Warning labels are applied to the equipment in specific areas where the user must observe safety precautions. Following is a list of these labels and their meanings:



| Label | Picture |
|---|---|
| This symbol indicates a hot surface. Use caution when working on or near locations with this symbol. |   |
| Earth ground. |  |



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## SYSTEM SAFETY

During operation of the GRCM, hazardous chemicals are stored and manipulated, heavy objects shake and move, and high voltage electricity is present. Caution must be exercised by trained personnel at all times.



**Warning!**

**Failure to use the GRCM with adequate ventilation may result in instrument damage and personal injury.**

**Caution**

Do not heat Reaction Vessels above the boiling point of their contents, and do not cool the Reaction Vessels to the freezing point of their contents. Instrument operation will be adversely affected. Quest software and hardware does not control temperature based upon the boiling point and freezing point of the contents of reaction vessels.

**Caution**

The GRCM is designed to work only with non-corrosive gases (e.g., hydrogen, etc.). Using corrosive gases with the GRCM will result in instrument damage and personal injury and is not covered under warranty.

## SAFETY EQUIPMENT

The GRCM has been designed to handle chemicals that may be deemed hazardous, but should only be operated by personnel trained to safely handle such chemicals. Protective hand and eye equipment should be worn during instrument operation.



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We recommend that the following safety equipment be readily available during instrument operation: fire extinguisher, eye wash station, safety shower, eye and hand protection, adequate ventilation, and protection from sources of radiation (e.g. lasers, radioisotopes, contaminated equipment, radioactive waste).

**Warning!**

**If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Wear adequate eye and hand protection during instrument operation.**



## OPERATING ENVIRONMENT

The Quest™ Gaseous Reaction and Concentration Manifold has been tested and validated in the following operating environments. Argonaut does not recommend operation of the Quest™ Gaseous Reaction and Concentration Manifold in environmental conditions outside these ranges.

| Operational Requirement | Specification |
|---|---|
| Laboratory Temperature | 18 °C to 30 °C |
| Laboratory Humidity | <= 70% RH |
| Gas Reaction Pressure | <= 10 psig (1.69 barr) |
| Gas Input Pressure | <= 30 psig (3.08 barr) |



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## RV SEALING CAPABILITIES

The GRCM has been tested and validated in the following operational conditions. Argonaut does not recommend operation of the GRCM in environmental conditions outside these ranges.

| Operational Requirement | Specification |
|---|---|
| Reaction Vessel sealing, with Gas Delivery Manifold installed. | 10 psig (1.69 barr) |



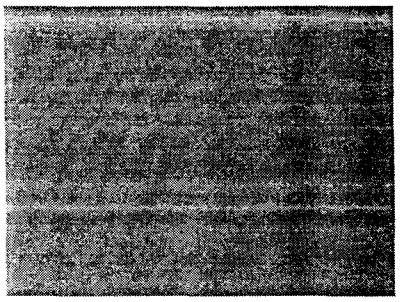
## MATERIAL SAFETY DATA SHEETS (MSDS)

The MSDS associated with each chemical used with this equipment must be kept at your facility for easy reference by employees. Adherence to the safety precautions listed in the MSDS for each of these chemicals is mandatory for the safe operation of this equipment and for the safety of the people operating it.



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# GRCM INSTALLATION

This chapter describes the Quest Gaseous Reaction and Concentration Manifold (GRCM) and how it is installed by the user. Installation of the Expansion Kit (available separately) is described at the end of this chapter.

## LIST OF PARTS

### COMPONENTS AND PARTS SUPPLIED BY ARGONAUT

The GRCM consists of the following components:

- **Control Box** - Controls which of the two gas inputs is used and regulates the gas flow rate from the selected input to the Quest Reaction Vessels (RVs). A pressure gauge allows the user to monitor the gas pressure delivered to the gas delivery manifold. (Part number 300678)
- **Gas Delivery Manifold** - This manifold attaches to the reaction vessel drain luers to allow the delivery of gas to a bank of reaction vessels. (Part number 300676)
- **Solvent Trap Manifold** - This manifold is inserted into the luer fittings of the Quest upper manifold to trap gases during solvent evaporation or concentration. (Part number 300677)

Also included are one of each of the following tubing and fittings required to attach the GRCM to the reaction gas regulator and the Quest inert gas supply:

- Gas Delivery Manifold Line (part number 300794)
- Inert Gas Inlet Line (part number 300795)
- Reagent Gas Inlet Line (part number 300796)
- Inert Gas Extension Line (part number 300797)
- 1/8 inch "T" (part number 104027)



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- Two plugs: for the "T" when the gas manifold is not in use, and for the Gas Out B port when the Expansion Kit is not in use (part number 100083)
- 1/4 inch ID tubing for solvent trapping, 3 feet (part number 103954)
- Barbed fitting adapter (1/4 - 3/8 inch) for solvent trap (part number 103669)

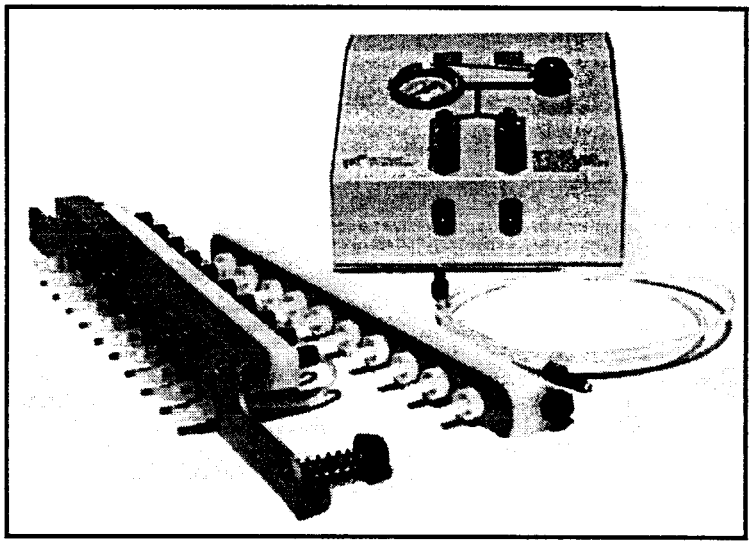


**Figure 1: GRCM — Three Main Components**

## PARTS SUPPLIED BY USER

The user must provide the following items:

- An external gas tank for gaseous reagents, with a 0-30 psig (1.01-3.08 barr) regulator to control the input pressure.
- Nitrogen gas for sparging. A house-supply is preferred.
- A solvent recovery condensor. Suggested parts for the solvent condensor (available from ChemGlass):

  - 2-Neck 24/40 round-bottom flask (CG-1520-04)

  - Dewar type condenser (CG-1290-A-26)

  - Inner joint 24/40 Adapter (CG-1014-01)



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**Caution**

Do not use corrosive gases, e.g., hydrogen chloride, ammonia, or ozone with the GRCM. Using corrosive gases will damage the GRCM and void the warranty.

## OVERVIEW

The Control Box fits neatly on the top of the Quest controller. It must be placed within four feet of the external reagent gas tank, and within four feet of the Quest 210 Reactor.

The control box has two gas inputs:

- **Input 1** is the inert gas input which connects to the Quest controller using the supplied "T" and Teflon® tubing.
- **Input 2** is the reagent gas input which connects to a user-provided regulator. We recommend using a regulator designed for low pressure, allowing no more than 30 psig (3.08 barr) for reagent gases.

The Gas Delivery Manifold is installed onto the lower manifold luers of the Quest reactor and receives gas from the GRCM Control box.

The Solvent Trap Manifold is installed onto the upper manifold of the Quest reactor. It combines the gas used for product concentration from each reaction vessel and diverts it to the Solvent Trap Manifold outlet for trapping and reclaiming.



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# INSTALLATION STEPS



## Control Box

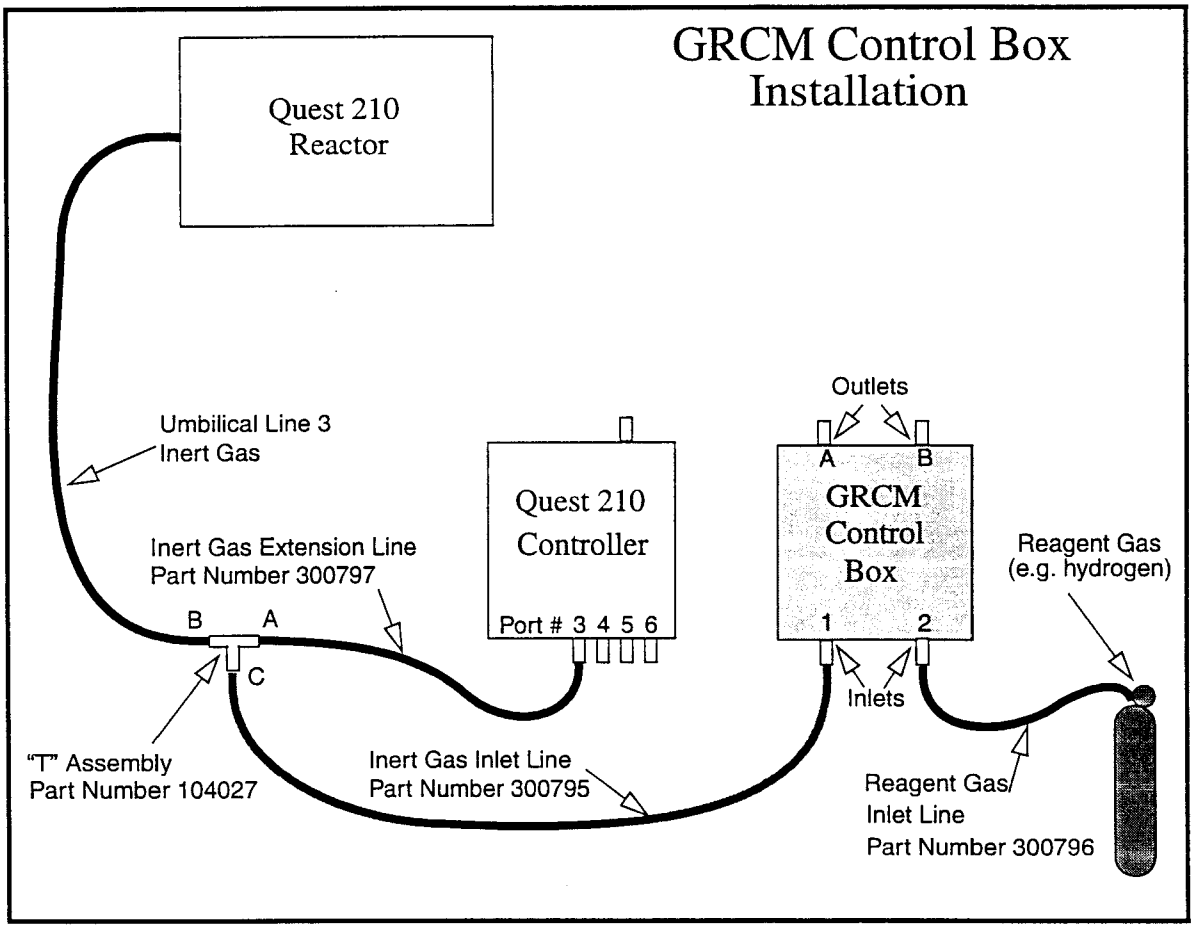



**Figure 2: GRCM Control Box Installation**

1. **On the front of the Quest controller, locate the ports for the five 1/8 inch Teflon lines from the Reactor Umbilical.**
2. **Remove the line from port #3 by unscrewing the 1/8 inch PEEK fitting.**



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3. **Attach the end of that line to side B of the "T" (Part number 101955) and make it finger-tight.**
4. **Insert one end of the Inert Gas Extension Line (Part number 300797) into side A of the "T" and make finger-tight. Insert the other end of the line into port #3 of the Quest controller and make finger-tight.**
5. **Attach one end of the Inert Gas Inlet Line (Part number 300795) to side C of the "T". Connect the other end to input 1 of the GRCM Control box. See Figure 3 below.**
6. **Insert the 1/8 inch PEEK fitting of the reagent gas inlet line (Part number 300796) to input #2 of the Control box and make finger-tight. Connect the compression fitting on the other end of this Teflon tubing to the outlet of the reagent gas regulator. Do not set the regulator above 30 psig (3.08 barr). See Figure 3 below.**

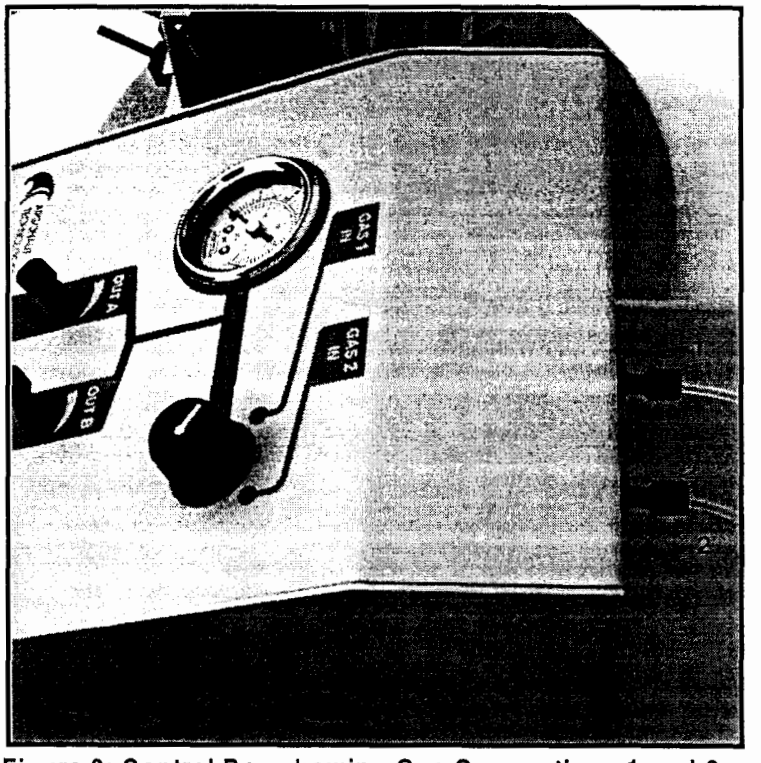



**Figure 3: Control Box showing Gas Connections 1 and 2**



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## Gas Delivery Manifold

1. **Connect one end of the Gas Delivery Manifold line (Part number 300794) to the outlet of the GRCM control box. Connect the other end to the inlet port of the Gas Delivery Manifold. Install a plug on the other outlet of the GRCM Control Box if it is not being used.**
2. **Push in the two buttons on the waste tray handles and lower the waste tray.**
3. **Remove the waste container and set it aside.**
4. **Select the side of the Quest reactor which you will be using.**
5. **Align the female luers of the Gas Delivery Manifold with the male luers of the reaction vessel outlets.**
6. **Gently push the Gas Delivery Manifold onto the male luers until it is held in place.**
7. **Raise the waste tray to lock the Gas Delivery Manifold in place.**

Figure 4 below shows a schematic of the Quest Lower Manifold with the Gas Delivery Manifold: A separated and B installed.



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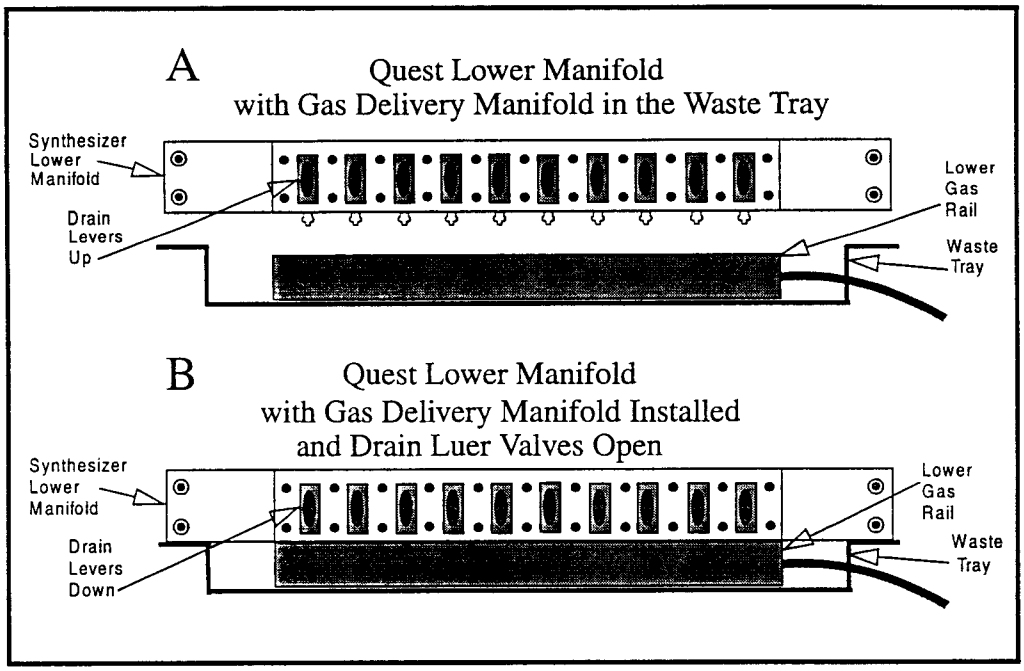



**Figure 4: Gas Delivery Manifold and the Quest Lower Manifold**

## Solvent Trap Manifold

The installation of this component is required for concentration by evaporation.

1. **Remove the luer plugs from the upper manifold of the reaction bank which you will be using.**
2. **Align the male fittings of the Solvent Trap Manifold with the upper manifold ports.**
3. **Gently push down on the Solvent Trap Manifold to seat it onto the upper manifold.**
4. **Connect one end of the ¼ inch Tygon® tubing (Part number 103954) to the barbed outlet fitting of the Solvent Trap Manifold. Connect the other end to the user-supplied vapor trap.**



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Figure 5 on the following page shows a schematic of the Quest Upper Manifold with the Gas Delivery Manifold separated and fitted.

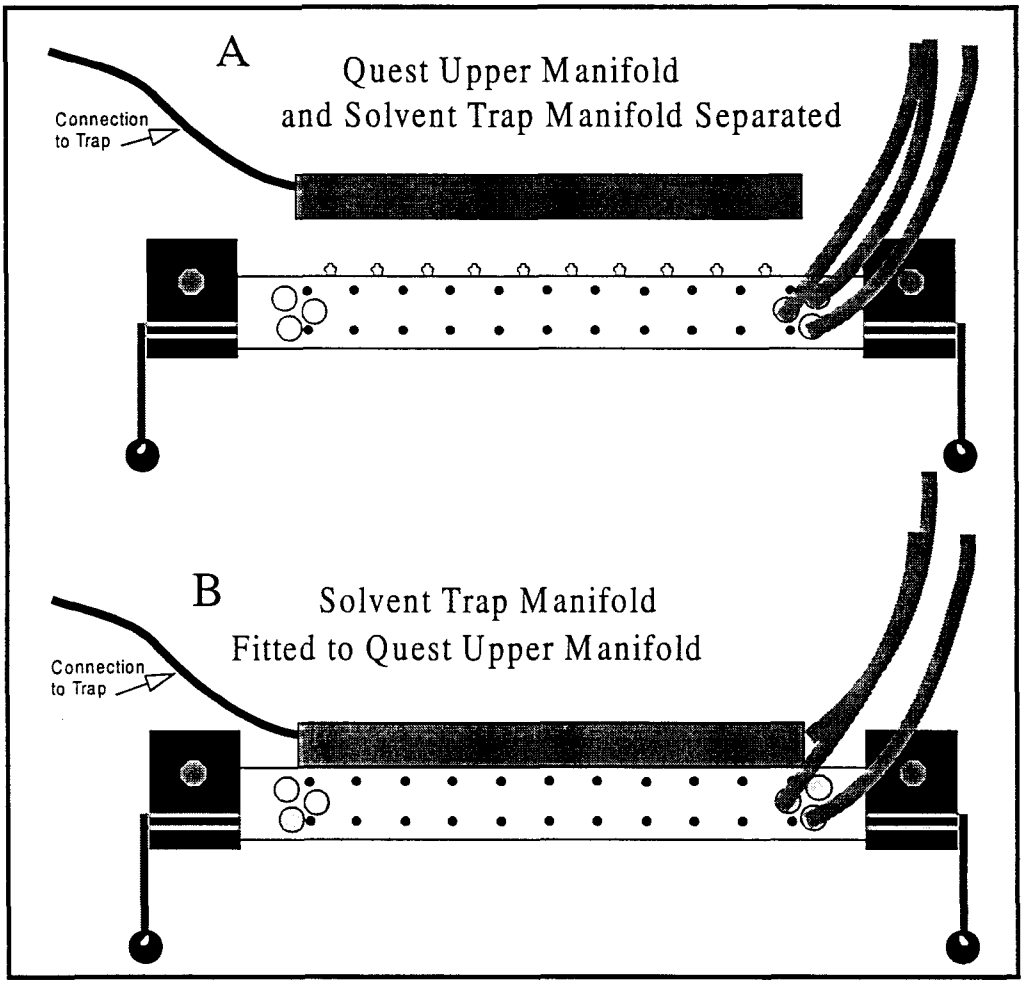



**Figure 5:Solvent Trap Manifold and the Quest Upper Manifold**



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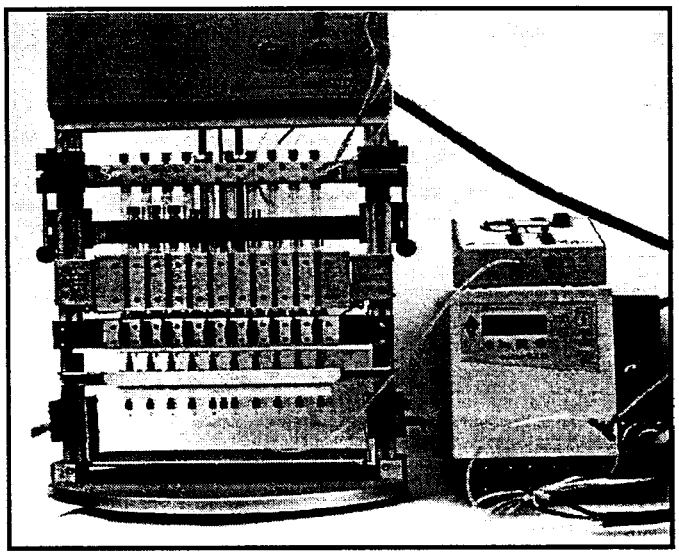


**Figure 6: The Gas Delivery Manifold Installed**

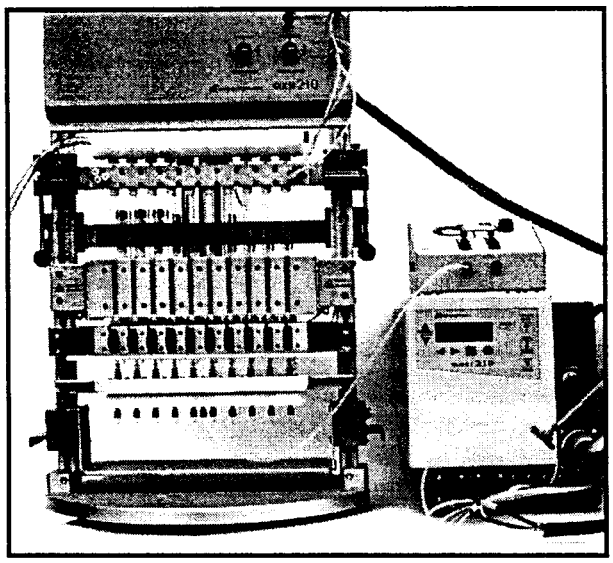


**Figure 7: Gas Delivery and Solvent Trap Manifolds Installed**



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## EXPANSION KIT

This Expansion Kit enables reactions and concentrations to be carried out on all twenty reaction vessels in the Quest 210 synthesizer. It consists of a Gas Delivery Manifold and a Solvent Trap Manifold with the necessary lines and fittings. It should be installed only after the original GRCM components, including the Control Box, have been properly installed.

### Gas Delivery Manifold

1. **Connect the Gas Delivery Manifold Line (Part Number 300794) to Outlet 2 of the GRCM Control Box. Remove the plug on the other outlet of the GRCM Control Box, if it is present.**
2. **Attach the other end of the line to the gas inlet of the Gas Delivery Manifold of the Expansion Kit.**
3. **Attach the Gas Delivery Manifold to the Lower Manifold Luers for the appropriate reaction bank.**

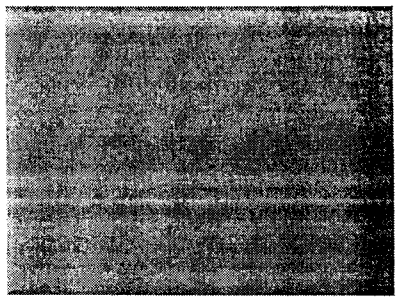
### Solvent Trap Manifold

If you are carrying out concentration, install the Solvent Trap manifold as follows:

1. **Remove the luer plugs from the Upper Manifold of the appropriate reaction bank.**
2. **Align the male fittings of the Solvent Trap Manifold with the Upper Manifold ports and seat it onto the upper manifold.**
3. **Connect one end of the ¼ inch Tygon tubing (Part number 103954) to the barbed outlet fitting of the Solvent Trap Manifold, and connect the other end to the user-supplied vapor trap.**
4. **Use the needle valves to control gas flow to each bank of Reaction Vessels.**



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# USING THE GRCM

This chapter describes the application of the Quest Gaseous Reaction and Concentration Manifold when used with the Quest 210 in two processes: Hydrogenation, and Concentration by Evaporation. Hydrogenation requires the Control Box and the Gas Delivery Manifold. Concentration requires the Control Box, the Gas Delivery Manifold and the Solvent Trap Manifold, together with a user-supplied solvent trap.

Before attempting to follow the steps in this chapter, you must be familiar with the installation procedures described in Chapter 3 "GRCM Installation".

## HYDROGENATION

This section describes an example of a procedure for hydrogenation. It is intended solely as an example and should not be interpreted as a definitive or recommended method.

Setup The figure below shows the setup in schematic form. For details of the installation procedures, see Chapter 3 "GRCM Installation".



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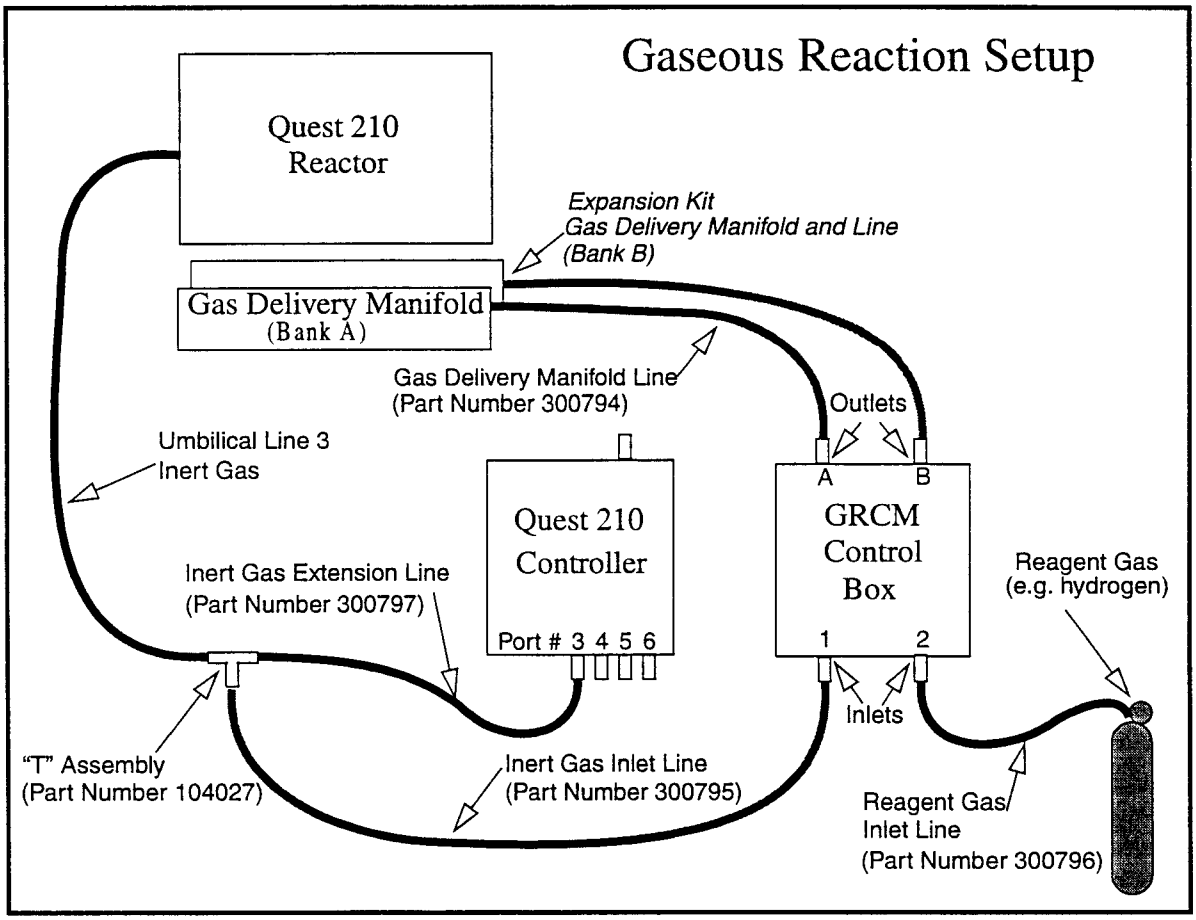



**Figure 8: Setup for Hydrogenation**



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Operation The following list shows the step-by-step procedure for carrying out hydrogenation with the setup shown above.

1. **Set up the Quest and GRCM as shown in Figure 8.**
2. **Make sure that the apparatus is clean and free of debris. (See the section "Cleaning the GRCM" below.)**
3. **Control Box inlets:**
   a. Gas 1 – Nitrogen
   b. Gas 2 – $H_2$ Gas
4. **Add catalyst(s ) to reaction vessels:**
   a. Pre-weigh Pd/C into 10 ml µFrit™ reaction vessels.
   b. Insert the reaction vessels into the Quest and drop an agitation magnet into each one.
5. **Purge RVs with nitrogen:**
   a. Turn the metered gas needle valve clockwise until it is completely closed.
   b. Turn Quest control valves to Metered Gas and Utility 1.
   c. Slowly turn the metered gas needle valve counterclockwise to purge the reaction vessels with $N_2$.
6. **Add solvent under nitrogen via syringe:**
   a. Remove the Upper Manifold luer plugs from the reaction vessels.
   b. To each reaction vessel, add the reaction solvent followed by the hydrogenation substrate in solution.
7. **Replace the luer plugs in the Quest Upper Manifold Luer ports, and tighten.**
8. **Turn the Quest reactor Control Valve 2 from METERED GAS to CLOSED (leave Control Valve 1 on Utility 1).**
9. **Connect the $H_2$ tank to inlet port 2 on the GRCM Control Box.**
10. **Turn the gas selection valve on the Control Box to Gas 1 ($N_2$).**



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**11. Purge with nitrogen:**

a. Slowly turn the Out A needle valve counterclockwise approximately ¼ turn to deliver nitrogen.

**Caution**

Excessive opening of the Out A needle valve at this time may cause the liquids in the RV to "bump" (bubble excessively).

b. Carefully open the lower manifold drain valves of the Quest reactor to start purging the reaction vessels with nitrogen.

**12. Hydrogenation:**

a. Before starting the hydrogenation, make sure that the $H_2$ pressure on the external gas regulator is set to a maximum pressure of 10 psig (1.69 barr) or desired lower value.

b. Turn the Gas Selection valve of the GRCM Control Box to Gas 2 ($H_2$) and turn the Out A needle valve counterclockwise to open it.

c. Switch the Quest Control Valve 1 from UTILITY 1 to CLOSED.

d. Move the membrane switch (above the Quest control valves) from OPEN to CLOSED.

e. Program the desired mixing rate on the Quest controller and start the agitation.

**13. Venting the reaction:**

a. Turn the Out A needle valve on the GRCM control box clockwise to close it.

b. Move the membrane pressure switch (above the two Quest control valves) from CLOSED to OPEN.

c. Turn the Quest reactor Control Valve 1 from CLOSED to UTILITY 1.

**14. Purge with nitrogen:**

a. Rotate the Gas selection valve of the GRCM Control Box to GAS 1.

b. Turn the Out A needle valve counterclockwise to open it and purge the reaction vessels for one (1) minute.

c. Close the lower manifold drain valves of the Quest reactor.

d. Turn the Out A needle valve of the GRCM control box clockwise to CLOSED

**15. Remove the Gas Delivery Manifold from the Quest reactor.**



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# CONCENTRATION BY EVAPORATION

This section describes an example of a procedure for concentration by evaporation. It is intended solely as an example and should not be interpreted as a definitive or recommended method.

**Setup** The figure below shows the setup in schematic form. For details of the installation procedures, see Chapter 3 "GRCM Installation".

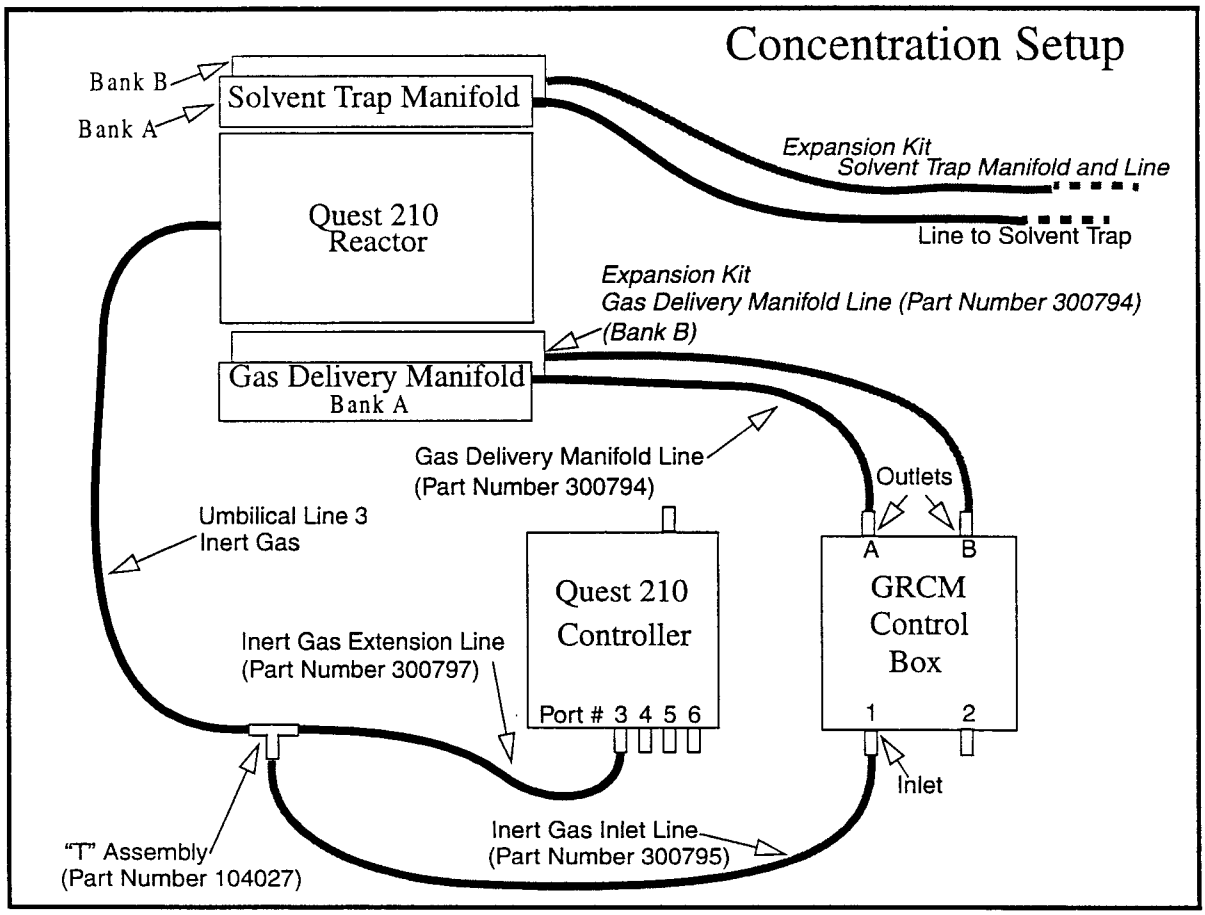



**Figure 9: Setup for Evaporation (Concentration)**



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Operation The following list shows the step-by-step procedure for carrying out concentration by evaporation with the setup shown above.

1. **Set up the Quest and GRCM as shown in Figure 9**
2. **Connect the Solvent Trap Manifold to a solvent trap.**
3. **Turn each of the two Quest Control valves to CLOSED.**
4. **Turn the Gas Selection valve on the GRCM Control Box to Gas 1 (Nitrogen).**
5. **Slowly turn the Out A needle valve counterclockwise approximately ¼ turn to deliver nitrogen.**

**Caution**

Excessive opening of the Out A needle valve at this time may cause the liquids in the RV to "bump" (bubble excessively).

6. **Carefully open the Quest Lower Manifold.**
7. **Slowly turn the Out A needle valve counterclockwise to adjust the gas flow. To achieve fastest evaporation rates, maximize the gas flow without allowing the liquid to bubble over. As the liquid level decreases, the gas flow can be readjusted to maintain maximum evaporation rates.**
8. **If necessary, apply mild heating (approx. 2/3 of boiling point) for efficient evaporation.**
9. **When the solvent is evaporated, close the Lower Manifold drain levers on the Quest reactor.**
10. **Close the Out A needle valve by turning it clockwise until it stops.**
11. **Remove the Solvent Trap and Gas Delivery Manifolds from the Quest reactor.**
12. **Clean the apparatus as decribed in the section "Cleaning the GRCM" below.**



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**Solvent Evaporation Results** The following table shows the results of an experiment involving the evaporation of several different solvents at one time. The process was carried out over a period of one hour at 45 °C. Up to 80% of the solvent was recovered by the recommended solvent trap. These are representative results. Actual results may vary.

| RV# | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Solvent[a] | MeOH | MeOH | EtOAc | EtOAc | IPA | IPA | THF[b] | THF | toluene | toluene |
| b.p. °C | 65 | 65 | 77 | 77 | 82 | 82 | 65 | 65 | 110 | 110 |
| Evaporation of solvent (%) | 100% | 100% | 100 | 100 | 50% | 50% | 100 | 100 | 20% | 20% |

a. The initial solvent volume was 7 ml.

b. The THF was concentrated within 40 minutes.

**Figure 10: Evaporation at 45 °C for One Hour**

## CLEANING THE GRCM

It is essential to clean the GRCM thoroughly after each use to avoid contaminating future processes.

**Warning!**

**Cross-contamination of some solvents with the residue of previous synthesis may cause unexpected and hazardous consequences.**

**Caution**

Use only alcohols (methanol, ethanol , etc.) as cleaning solvents for the Gas Delivery Manifold. Use of other solvents may cause permanent damage to the manifold assembly.



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## GAS DELIVERY MANIFOLD



### Using the Quest 210

1. **Detach the Manifold Delivery Line from the bulkhead fitting on the Quest reactor unit.**
2. **Detach the Gas Delivery Manifold Line from the proper Out A or Out B outlet on the GRCM control box, and attach it to the Quest 210 at the bulkhead connector.**
3. **Rest the Gas Delivery Manifold over the Quest waste tray.**
4. **Start the flow of solvent by turning the Quest 210 Control Valve 1 to SOLVENT for 10-30 seconds.**
5. **Turn Control Valve 1 to DRAIN GAS for 10-30 seconds to clear the solvent. Alternate between solvent and drain gas for 3 to 6 repetitions.**
6. **Complete the cleaning process by turning Control Valve 1 to DRAIN GAS for 2 to 5 minutes to ensure that all solvent is removed from the Gas Delivery Manifold.**
7. **Turn Control Valve 1 to CLOSED.**
8. **Detach Gas Delivery Manifold Line from the Quest 210 and reattach to outlet on the GRCM control box.**
9. **Reattach Upper Manifold Delivery Line to Quest 210.**

### Using the Quest ASW

1. **Detach the Manifold Delivery Line from the bulkhead fitting on the Quest reactor unit.**
2. **Detach the Gas Delivery Manifold Line from the proper Out A or Out B outlet on the GRCM control box, and attach it to the Quest 210 at the bulkhead connector.**
3. **Rest the Gas Delivery Manifold over the Quest waste tray.**
4. **Select the switch corresponding to the solvent bottle on the ASW tray containing alcohol.**
5. **Start solvent flow by turning the Quest 210 Control Valve 1 to SOLVENT for 10-30 seconds.**
6. **Turn Control Valve 1 to DRAIN GAS for 10-30 seconds to clear the solvent. Alternate between solvent and drain gas for 3 to 6 repetitions.**



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7. **Purge the ASW Tray Delivery line:**
   a. On the ASW tray, turn off the solvent switch and turn on the purge switch.
   b. Turn Control Valve 1 to SOLVENT for 1 minute.
   c. Turn off the purge switch on the ASW tray.
8. **Purge the Gas Delivery Manifold:**
   a. Turn Control Valve 1 to DRAIN GAS for 2 to 5 minutes to remove all solvent from the Gas Delivery Manifold.
   b. Turn Control Valve 1 to CLOSED.
9. **Detach Gas Delivery Manifold Line from the Quest 210 and reattach to outlet on the GRCM control box.**
10. **Reattach Upper Manifold Delivery Line to the Quest 210.**

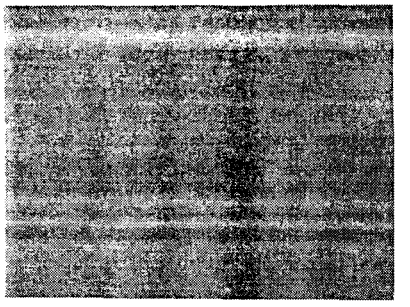
## FEMALE LUERS ON THE QUEST LOWER MANIFOLD

1. **Wash the luers with solvent using a squeeze bottle**
2. **Wipe them clean with cotton tips as used used to clean the Quest.**



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# APPENDIX A: SERVICE

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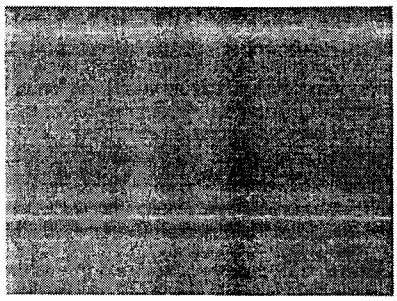
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# APPENDIX B: LIST OF COMPONENTS

## BASIC GRCM

The basic Gas Reaction and Concentration Manifold (GRCM) consists of the following components.

| Quantity | Description |
|---|---|
| 1 | Control Box (300678) |
| 1 | Gas Delivery Manifold (300676) |
| 1 | Solvent Trap Manifold with ¼-inch barb fitting (300677) |
| 1 | 1/8 inch "T" (High Pressure Input Line) (104027) |
| 1 | Reagent Gas Inlet Line:<br>7 feet of 1/8 inch Teflon tubing with 1/8 inch PEEK fittings and associated Tefzel ferrules (300796) |
| 1 | Inert Gas Inlet Line:<br>2½ feet of 1/8 inch Teflon tubing<br>1/8 inch PEEK fittings and associated Tefzel (300795) |
| 1 | Gas Delivery Manifold Line:<br>7 feet of 1/8 inch Teflon tubing<br>1/8 inch PEEK fittings and associated Tefzel ferrules (300794) |
| 1 | Solvent Trap Connection:<br>3 feet of ¼ inch I.D. Tygon tubing for Solvent Trap connection (103954) |
| 1 | Inert Gas Extension Line:<br>2½ inches of 1/8 inch Teflon tubing with fittings and associated Tefzel ferrules (interconnection from Controller to "T") (300797) |
| 2 | Plug fittings for "T" when GRCM is not in use, and for the Gas Out B port when the Expansion Kit is not in use. (100083) |
| 1 | Barbed fitting adapter to connect 3/8 inch tubing to Solvent Trap if 3/8 inch tubing is used (103669) |
| 1 | Installation, testing and maintenance instructions (103952) |
| 1 | Warning sign, "Gaseous Reaction in Progress" (300731) |



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# EXPANSION KIT

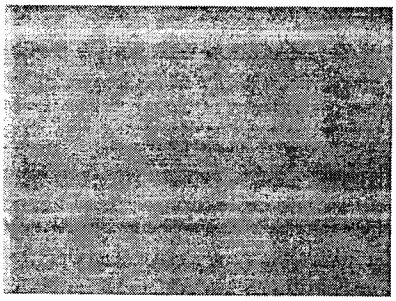


The GRCM Expansion Kit allows you to perform reactions or concentrations on all twenty of the reaction vessels. The Expansion Kit consists of the following components:

| Quantity | Description |
|---|---|
| 1 | Gas Delivery Manifold (300676) |
| 1 | Solvent Trap Manifold with ¼-inch barb fitting (300677) |
| 1 | Gas Delivery Manifold Line:<br>7 feet of 1/8 inch Teflon tubing<br>1/8 inch PEEK fitting and associated Tefzel ferrules (300794) |
| 1 | 3 feet of ¼-inch I.D. Tygon tubing (103594) |
| 1 | Barbed fitting adapter to connect 3/8 inch tubing to Solvent Trap if 3/8 inch tubing is used (103669) |
| 1 | Installation, testing and maintenance instructions (103952) |



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