RapidTrace+
User Manual

Biotage®

Preface

Product Information

Keep your product information readily available in case you have to contact Biotage for any reason. Record the product information below.

Model: _____
(name of product)

Serial Number: _____
(found on the product)

Your Customer ID Code: _____
(found on your shipping documents)

RapidTrace+ Software Version: _____
(see the information printed on the RapidTrace+ software CD)

Copyright

Trademarks

The following trademarks are owned by Biotage AB: Biotage, Advancer, AFFINILUTE, Endeavor, EVOLUTE, ExploraSep, Firefly design (), FLASH+, FlashMaster, FlashVac, HPFC, HP-SIL, Initiator, Isolera, ISOLUTE, IST, IST design (), Kiloprep, KP-C18-HS, KP-C18-WP, KP-C4-WP, KP-NH, KP-Sil, MIP4SPE, MIP Rule of 6, MIP[4]Process, MIP[4]Proteins, PathFinder, PRESSURe+ 48, PRESSURe+ 96, RapidTrace, Resolux, Samplet, SIM, SNAP, SP1, SP4, SP *Wave*, Syro *Wave*, TurboVap, VacMaster, V-10, ZIF, ZIF-SIM, ZIP, and 1-Point Support.

Other product and company names mentioned herein may be trademarks or registered trademarks and/or service marks of their respective owners, and are used only for explanation and to the owners' benefit, without intent to infringe.

Statement of Proper Use

RapidTrace+ is a high-throughput workstation dedicated to solid phase extraction (SPE). It is a rugged, automated platform for quick development of reliable, automated procedures from manual laboratory methods.

WARNINGS

- *To reduce the risk of electric shock, do not remove the cover. No user serviceable parts are inside. Refer to an authorized Biotage service engineer if help is required.*
- *Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

Contact Biotage 1-Point Support

Before you contact Biotage 1-Point Support, please check the online help and the manual for a probable cause and solution to your question.

Call, fax or e-mail Biotage 1-Point Support or request support online (www.biotage.com). When contacting 1-Point Support, please have the following information ready:

- Company name and contact information.
- Serial number(s).
- Software version (found by selecting **About RapidTrace** from the **Help** menu in the RapidTrace^{+} Methods Development software).
- A brief description of the symptoms or technical problems you are experiencing.

1-Point Support USA

Phone: +1 800 446 4752 press (3) at the auto attendant

Outside US: +1 704 654 4900

Fax: +1 704 654 4917

E-mail: US-1-pointsupport@biotage.com

1-Point Support Europe

Phone: +46 18 56 59 11

Fax: +46 18 56 57 11

E-mail: EU-1-pointsupport@biotage.com

1-Point Support Japan

Phone: +81 3 5627 3123

Fax: +81 3 5627 3121

E-mail: JP-1-pointsupport@biotage.com

Rest of the World

Please contact your local distributor.

Biotage Product Repair Depot

Biotage Product Repair Depot offers product repair services, upgrades, refurbishment and installation at reasonable costs and with quick turnaround for all customer-owned equipment and accessories. For further information or to obtain a quotation for services, contact Biotage 1-Point Support (see above).

Features of Biotage Product Repair Depot:

- Factory-trained repair technicians
- Two week turnaround from receipt at Biotage

Shipping: Customers are responsible for shipments both to and from Biotage, specifying the carrier and choice of service.

Return Policy: To ensure a safe environment for all our technicians, it is mandatory for each returned product to include our chemical questionnaire stating contact chemicals, chemicals used during application and cleaning steps taken prior to shipment.

Processing: Once the product is returned, it is evaluated for necessary repairs. The customer is contacted with an estimate and may choose to go ahead with the repair or decline service. If service is denied, a minimum evaluation charge may apply. Upon completion of the repair, a purchase order or appropriate means of payment is required before return shipment.

RapidTrace+ Service and Customer Support Plans

Biotage offers a full range of services to ensure your success. From our original factory warranty through a comprehensive line of customer support plans, Biotage offers you Field Support Engineers and In-house Specialists who are dedicated to supporting your hardware, software, and application development needs.

Our programs can include such useful services as:

- preventative maintenance
- diagnostic servicing performed on-site by an authorized Biotage service engineer
- extended use of Biotage 1-Point Support
- automated, remote troubleshooting
- software updates
- after-hour, weekend, and holiday support
- repair depot servicing
- parts, labor, and travel expense coverage
- other customized services upon request

For further information, contact Biotage 1-Point Support (see page 2).

FCC

This device complies with part 15 of the FCC (United States Federal Communications Commission) rules. Operation is subject to the following two conditions:

1 this device may not cause harmful interference, and

2 this device must accept any interference received, including interference that may cause undesired operation.

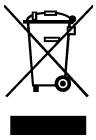
CE

This device complies with all CE rules and requirements.

NOTE

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WEEE Compliance Statement



Valid for customers in EU countries

We are committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted a directive on product recycling, Waste Electrical and Electronic Equipment (WEEE), and over time this directive will be implemented in the national laws of each EU member state.

Products falling under the scope of the WEEE Directive are identified with a crossed over “wheelie” bin symbol on the product label, as indicated to the left. To forward the products for recycling or proper disposal, use an authorized collection system or return them to Biotage Sweden AB.

Table of Symbols

Table 1 contains symbols that identify particularly important information and alert you to the presence of hazards. These symbols may appear in this manual and/or on the product it describes.

Table 1. Important Symbols

Symbol	Description
	**DANGER:** An imminently hazardous situation, which, if not avoided, will result in death or serious injury.
	**WARNING:** Caution, risk of danger. Refer to the user documentation.
	**NOTE:** A cautionary statement; an operating tip or maintenance suggestion; may result in instrument damage if not followed.
	Hazardous voltage; risk of shock injury.
	Crush hazard. Risk of body parts, hair, jewelry, or clothing getting caught in a moving part.
	Risk of exposure to biohazards.
	Risk of eye injury; wear safety glasses.
	Risk of fire.
	Risk of poison.
	Risk of explosion.

Table 1. Important Symbols (Continued)

Symbol	Description
	Hazardous fumes.
	Lifting hazard. May result in injury.
	Protective ground symbol.
	Ground symbol.
	Fuse.
	Alternating current.
	On (supply).
	Off (supply).
	CE compliance mark.
	Signifies that the RapidTrace+ module has passed safety tests for grounding, power line transience, and current leakage.
	Input.
	Output.
Equipment labels are color coded:	**Yellow** Caution, risk of danger. **Red** Stop. **Blue** Mandatory action. **Green** Safe condition or information.
☞	Helpful hints, additional information.

Safety

The following safety information about RapidTrace+ is included in this documentation. Read and review all safety information before operating the workstation.

Required Training

Ensure that all personnel involved with the operation of the RapidTrace+ workstation have:

- Received instruction in general safety practices for laboratories.
- Received instruction in specific safety practices for the equipment.
- Read and understood all related SDSs.

WARNING

Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Chemical and Biological Safety

WARNING

In some applications, chemicals or samples used with the RapidTrace module are potentially hazardous and can cause illness.

- Read and understand the safety data sheet (SDS) provided by the chemical manufacturer before you store, handle, or work with any chemical or hazardous material.
- Minimize contact with and inhalation of chemicals and chemical waste.
- Wear appropriate personal protective equipment when handling chemicals or samples (e.g., safety glasses, gloves, or clothing). For additional safety guidelines consult the SDS.
- Handle all samples using good laboratory practices to prevent biohazards.
- Do not leave chemical containers open. Use only with adequate ventilation, including a fume hood, if necessary.
- Check regularly for chemical leaks or spills. If a leak or spill occurs, follow the chemical manufacturer's cleanup procedures as recommended in the SDS.
- Dispose of chemical or infectious waste in accordance with good laboratory practices and local, state/provincial, or national environmental and health regulations.

- After emptying waste reservoirs, seal the waste reservoirs appropriately.
- Comply with all local, state/provincial, or national laws and regulations related to chemical and waste storage, handling, and disposal.

Electrical Safety

The wall outlet or the power cable connector on the back of the RapidTrace module should be accessible after the installation, to enable an authorized Biotage service engineer to safely disconnect power from the module during servicing.

The computer sold with the RapidTrace+ module has internal lithium batteries. Batteries should not be incinerated.

WARNING

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer's instructions.

Mechanical Safety

WARNING

Instrument components may move during operation. Always keep body parts, hair, jewelry, and clothing away from the RapidTrace+ module during operation.

Procedures which could result in injury may be performed only by operators who have been warned of the potential hazards and have received adequate training in performing the procedures in the safest possible manner.

Table of Contents

Unpack and Site Preparation

Unpack the Workstation and Check the Parts

Unpack the shipping boxes and verify receipt of all the parts listed below. Inspect the parts for any evidence of physical damage.

NOTE

Lift the RapidTrace+ module only at the designated lift points. Do not lift by the top plastic cover. Use care when unpacking the RapidTrace+ workstation.

Item	Quantity
RapidTrace+ Modules	Quantity ordered
RapidTrace+ Notebook Controller	Quantity ordered
RapidTrace+ Start-Up Kit (P/N C52006) including one RapidTrace+ Software CD (P/N C125300), Validation CD, and tubing kit	1 per order
Start-Up Kit for 1 ml and 3 ml (P/N C59815), or Start-Up Kit for 6 ml (P/N C125810)	1 per module
Any racks ordered; see available racks on page 12	Quantity ordered
Any accessory kits ordered	Quantity ordered

Site Preparation

This section provides complete information regarding site preparation. A location meeting these requirements should be available prior to delivery of the RapidTrace workstation. When setting up the RapidTrace modules, space for reagents and storage space for waste containers (located below the modules) must be available.

Confirm that an appropriate location is available with gas (if necessary) and electrical sources as specified in "Specifications" on page 87 before installing the RapidTrace workstation.

For instructions on installing additional modules, see "Add or Move RapidTrace+ Modules" on page 65.

Computer Requirements

Windows XP,

Windows Vista, or

Windows 7.

Space

Minimum bench space for each RapidTrace+ module:

- Height: 60 cm (23.6 in)
- Width: 10 cm (3.9 in)
- Depth: 55 cm (21.7 in)

Additional Space Requirements

Provide space to access the power cord, power switch, RS-232 communications cable ports, and tubing at the back of the workstation.

Provide space for reagents on the bench. The RapidTrace+ modules can be individually plumbed and use up to 8 reagents, or they can be manifolded together so the entire workstation uses up to 8 reagents.

Work Area

Flat, stable, level surface.

Weight

14.5 kg (32 lbs) per module.

Compressed Gas Supply (optional feature)

Clean, dry, regulated air, nitrogen, etc.

WARNING

Never use hydrogen or other flammable gases. Use of incorrect gasses may cause combustion or an explosion.

Fitting for Gas Supply

For connection of gas supply to fit 1/8" ID gas tubing.

Compressed Gas Supply Inlet Pressure

- 0.7 bar (10 psi) minimum
- 2.8 bar (40 psi) maximum

WARNING

To avoid personal injury or damage to the RapidTrace+ module, DO NOT exceed the maximum inlet pressure of 2.8 bar (40 psi).

Communications Cables

A standard 1.5-meter (5-foot) RS-232 communications cable with male and female 9-pin connector ends is supplied with each RapidTrace+ module.

Racks and Vessels

Each RapidTrace+ module requires one rack. The following racks are available.

Description	Sample Positions	Fraction Positions
13x100 mm sample test tube and 12x75 mm fraction test tube	10	10
13x100 mm sample test tube and 13x100 mm fraction test tube	10	10

Description	Sample Positions	Fraction Positions
16x100 mm sample test tube and 16x100 mm fraction test tube	10	10
13x100 mm sample test tube and 12x75 mm fraction test tube (chilled rack)	9	9
40 ml scintillation vial and 16x100 mm fraction test tube*	5	10

* Can only be used on modules if the new opto sensor has been installed.

All the racks above can be magnetically encoded. This enables the user to designate a specific procedure to a rack instead of assigning a procedure to each sample. For more information, see "Use Magnetically Encoded Racks" on page 49.

Note that the test tubes and vials are not supplied with the racks.

Columns

You must supply the appropriate syringe-barrel type processing columns:

- 3 ml RapidTrace+: 1 or 3 ml columns. Each RapidTrace+ module is set up for 1 ml columns. A 3 ml column plunger is provided for easy conversion.
- 6 ml RapidTrace+: 1, 3, or 6 ml columns.Each RapidTrace+ module is set up for 6 ml columns. A 1 ml and a 3 ml column plunger can be ordered for easy conversion.

Waste Reservoirs

You must supply the waste reservoirs.

Each RapidTrace+ module has four (4) waste lines. You determine the destination of lines 1, 2, and 3. Line 4 carries the results of any "purge and clean cannula" operation. You should consider a separate reservoir for this line.

For more information, refer to "Specifications" on page 87.

WARNING

- *To avoid eye injury, wear safety glasses when working with reagents. Always use extreme care when handling fluids in the laboratory.*
- *Dispose of chemical or infectious waste in accordance with good laboratory practices and local, state/provincial, or national environmental and health regulations.*

Power

Appropriate power outlets for the RapidTrace+ modules, the computer, and the monitor must be available. See "Specifications" on page 87.

Install RapidTrace+ Hardware

During installation, the computer is connected to the RapidTrace+ modules (up to ten modules) and diagnostics are run to confirm the operation of the hardware. To add a module, see page 72. For assistance with installation, please contact Biotage 1-Point Support (see page 2).

Reagent Line Configuration

Before the modules are installed, decide the plumbing arrangement for the reagent lines. There are two options:

1 **Manifold Setup:** Use this setup when you want to use the same reagents for all modules in the workstation. Each module is plumbed together with a manifold and has a check valve in the reagent bottle. The check valve prevents reagent from flowing out of the reagent line if you remove a module from the workstation. Each reagent bottle should have a stopper to prevent contamination and to help keep the check valve at the bottom of the bottle.

2 **Individual Reagent Lines:** Use this setup when you want to use different reagents for each module. Kits of tubing weights can be ordered (P/N C50973) to keep the reagent lines at the bottom of the reagent bottles. Each kit comes with eight (8) weights, i.e., order one kit per RapidTrace+ module. See "Contact Biotage 1-Point Support" on page 2.

WARNING

Liquid exiting the solvent and sample lines can be infectious, toxic, flammable, and/or corrosive. Refer to the SDS (Safety Data Sheet) for detailed information regarding chemicals used in applications.

- *Do not touch waste.*
- *Keep waste from heat or flame.*
- *Dispose of waste properly.*
- *Periodically check waste lines for damage.*
- *Make sure that the flow is not inhibited and that the waste reservoirs are large enough to hold waste generated.*

Always exercise extreme caution when handling fluids in the laboratory.

Install RapidTrace+ Software

The RapidTrace+ software can be installed on a computer with Windows XP, Windows Vista, or Windows 7.

Your RapidTrace+ Start-Up Kit (P/N C52006) contains one CD. To install the software, follow the instructions below.

NOTE

For the RapidTrace+ software to work properly, the computer has to use U.S. format for numbers, dates, and time (see "Set the Format for Numbers, Dates and Time" below).

Install the RapidTrace+ Software

1 Insert the RapidTrace+ Software CD into the computer's CD drive.

2 If the computer has AutoRun enabled, either the installation starts automatically or the **AutoRun** dialog box opens. If the **AutoRun** dialog box opens, click the RapidTrace+ software option to start the installation.

3 If the computer has AutoRun disabled, open My Computer, navigate to the CD drive, and double-click the **setup.exe** file to begin the installation.

4 Click the **Next** button in the Welcome window.

5 Select the **I accept the terms in the license agreement** option to accept the terms of the displayed software license agreement and click the **Next** button.

6 Fill in the customer information and select the installation permissions (anyone or only for me) and click the **Next** button in the **Customer Information** window.

7 Select the setup type (complete or custom) and click the **Next** button in the **Setup Type** window.

8 Click the **Install** button. The installation process may take several minutes to complete.

9 When installation is complete, click the **Finish** button. The installation adds shortcuts to the RapidTrace+ programs to the **Start** menu and desktop; see "Start RapidTrace+ Software" on page 28.

Set the Format for Numbers, Dates and Time

For the RapidTrace+ software to work properly, the computer has to use U.S. format for numbers, dates, and time.

1 Press the ⊞+**R** keys. The **Run** dialog box opens.

2 Enter "intl.cpl" in the **Open** text box and click **OK**.The **Regional and Language** dialog box opens.

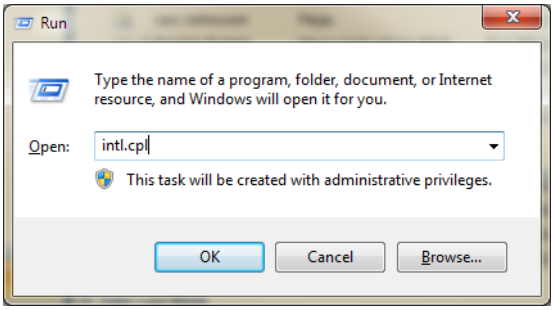


Figure 1. Run Dialog Box (Windows 7)

3 Select the **Regional Options** tab (Windows XP) or the **Formats** tab (Windows 7 and Vista).

4 Select "English (United States)" from the drop-down list in the **Standards and Formats** area (Windows XP) or from the **Formats/Current format** drop-down list (Windows 7 and Vista).

5 Click the **OK** button to save the change.

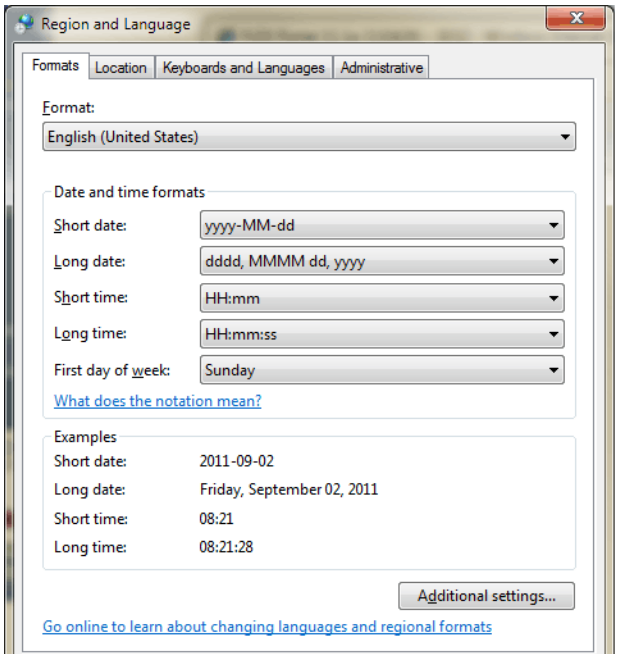


Figure 2. Regional and Language Dialog Box (Windows 7)

Set the Communications Port

The **Comm Port** menu in the RapidTrace+ Methods Development software enables you to set the communications port that the RapidTrace+ module is connected to on the computer.

NOTE

For the computer to communicate with a RapidTrace+ module, the RS-232 communications cable must be attached to the assigned communications port on the computer and to the module.

1 Open the RapidTrace+ Methods Development software; select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon.

2 Select the **Comm Port** menu. The **Port Number** drop-down list is displayed as shown in Figure 3.

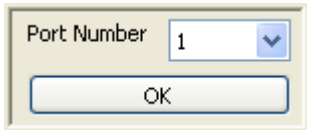


Figure 3. Comm Port Window

3 Select the communications port that the RapidTrace+ module is connected to on the computer from the **Port Number** drop-down list.

4 Click the **OK** button.

Set the Flow Rate Units

The **Flow Rate Units** menu in the RapidTrace+ Methods Development software enables you to set the flow rate units to ml/sec or ml/min. The default flow rate is ml/sec.

1 Open the RapidTrace+ Methods Development software; select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon.

2 Select the **Flow Rate Units** menu. The flow rate units options are displayed as shown in Figure 4.

Figure 4. Flow Rate Units Menu

3 Select either **ml/sec** or **ml/min** to display all flow rates in the selected units.

4 Click the **OK** button.

Set the Working Folder

The **Settings** menu in the RapidTrace+ Methods Development software enables you to set the working folder, i.e., the folder where all your procedures are saved. The default working folder is C:\SPE.

1 Open the RapidTrace+ Methods Development software; select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon.

2 Select the **Settings** menu. The **Settings** dialog box opens as shown in Figure 5.

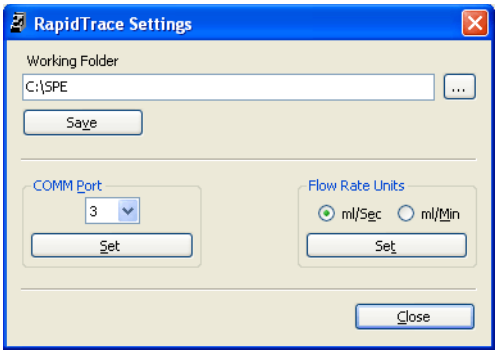


Figure 5. Settings Dialog Box

3 Click the ... button to browse for the desired working folder. The **Browse For Folder** dialog box is opened.

4 Select the desired working folder and click the **OK** button.

5 Click the **Save** button in the **Settings** dialog box.

RapidTrace+ Parts and Functions

Front View

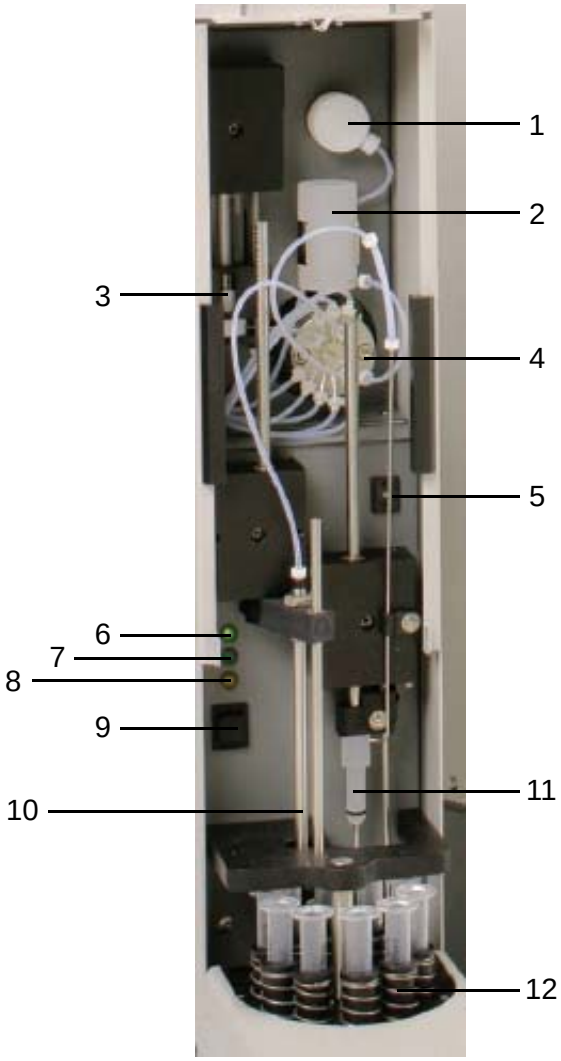


Figure 6. Front View of the RapidTrace+ Module

WARNING

The valve, syringe, and syringe drive contain pressurized liquids, and components may move during operation. Always keep body parts, hair, jewelry, and clothing away from the RapidTrace+ module during operation.

Table 2. Front Parts and Functions

Item	Part	Function
1	Gas Valve	Activates gas drying of the column bed if the valve is plumbed into the module and you use the **Dry Column** step.
2	Mixing Vessel	Creates a mixed reagent when you use the **Add Reagent to Mixing Vessel** and **Mix Reagents in Mixing Vessel** steps.
3	Syringe Drive and Liquid Sensor	Performs all dispense and aspirate functions. The syringe draws up either sample or reagent through the 12-port valve, as specified in the procedure, and dispenses it back through the 12-port valve to the column plunger or cannula, as specified in the procedure. If you set **Liquid Sense** in a procedure to "Yes", the sensor detects the presence of liquid in the syringe. If it does not detect liquid, an error occurs and the procedure stops.
4	12-Port Valve	Directs the liquid flow from the syringe to one of the following ports, as specified in the procedure: • Reagents 1 through 8 (8 different ports) • Vent • Cannula • Column plunger • Mixing vessel
5	Thumb Wheel Switch	Selects a module address of 0 through 9.
6	Power LED	Lit when the power is on.
7	Run LED	Lit when the module is running a procedure.
8	Error LED	Lit when an error occurs.
9	Start/Stop Switch	Starts the procedure for a magnetically encoded rack, or stops any procedure if it is running. When using magnetically encoded racks, the modules must be connected to the computer.
10	Column Plunger	Delivers the sample or reagent to the column. The column plunger moves into the column and places the reagent or sample directly onto the column bed. There are three different plunger sizes (1, 3, and 6 ml). Use the correct plunger size for your columns.
11	Cannula	Accesses the sample test tube or vial to add reagents to the sample, mix the sample, or to draw the sample into the syringe and load it onto the column, as specified in the procedure.
12	Column Turret	Holds the columns. The 3 ml RapidTrace holds up to ten 1 ml or 3 ml columns. The 6 ml RapidTrace holds up to five 1 ml, 3 ml, or 6 ml columns.

Side View

Table 3. Side View of the RapidTrace+ Module

Item	Part	Function
1	Front Cover	Covers the valve, syringe, and syringe drive.
2	Service Panel	Provides access to shuttle to change internal tubing.
3	Rack	Holds the sample test tubes or vials and the fraction test tubes. For a list of all available racks, see "Racks and Vessels" on page 12. **WARNING**  *Always keep body parts, hair, jewelry, and clothing away from the RapidTrace+ module during operation.*

Rear View

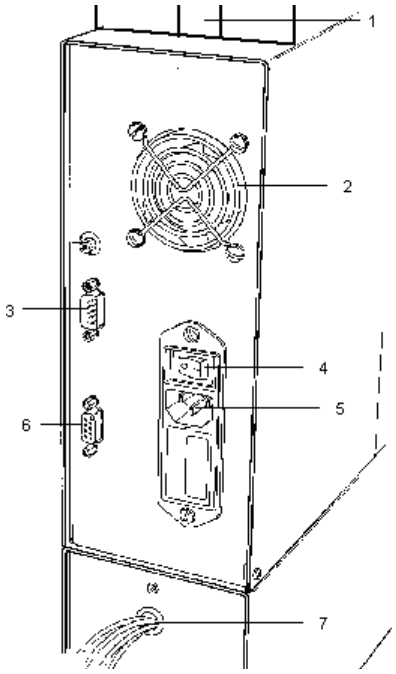


Figure 7. Rear View of the RapidTrace+ Module

WARNING

Hazardous voltage still exists within the workstation when the AC power is switched off. Always unplug the power cord before changing fuses or servicing the equipment.

Table 4. Rear Parts and Functions

Item	Part	Function
1	Hole for Reagent and Gas Lines	• 8 reagent lines • Gas line
2	Exhaust Fan	Ventilates the internal electronic components.
3	RS-232 Communications Cable Port (Output)	When multiple modules are used, the RS-232 output is used to connect the communications cable to the next module.
4	Power Switch	Switches the module AC power on or off.
5	Power Entry	Connects the module to power source via an AC power cord and houses the fuses.
6	RS-232 Communications Cable Port (Input)	Connects the module to the computer if it is the first module, or connects the module to the output of the previous module.
7	Waste Lines	3 column waste lines and 1 cannula waste line.

External Plumbing

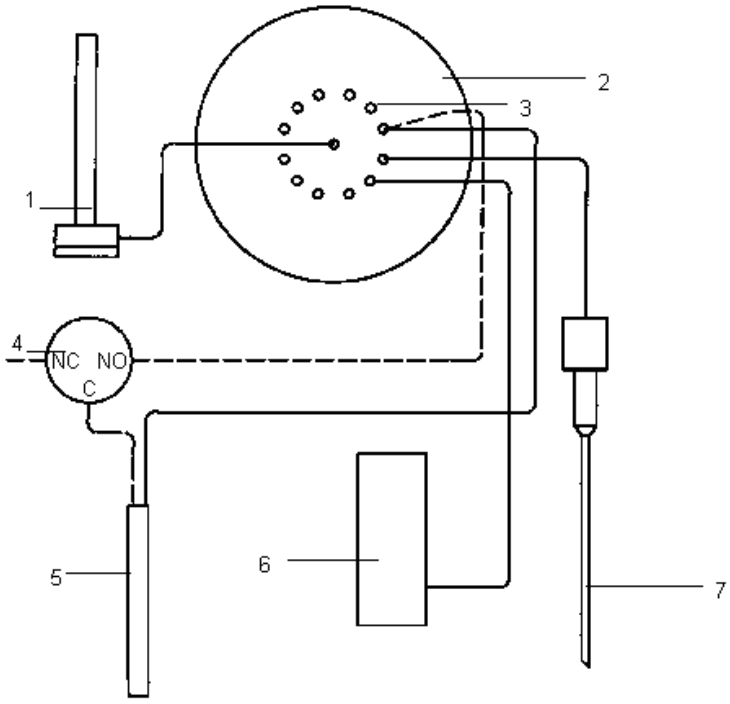


Figure 8. External Plumbing Diagram

WARNING

Never use hydrogen or other flammable gases. Use of inappropriate gas may cause combustion or an explosion.

WARNING

Liquid exiting the solvent and sample waste lines can be infectious, toxic, flammable, and/or corrosive. Refer to the Safety Data Sheet (SDS) for detailed information regarding chemicals used in your applications.

- *Do not touch waste.*
- *Keep waste from heat or flame.*
- *Dispose of waste properly.*
- *Periodically check waste lines for damage.*
- *Make sure that the flow is not inhibited and that the waste reservoirs are large enough to hold waste generated.*

Table 5. External Plumbing Parts and Functions

Item	Part	Function
1	Syringe	Syringe and liquid sensor.
2	12-Port Valve	Directs the liquid flow from the syringe to one of the following ports as specified in the procedure: • Reagents 1 through 8 (8 different ports) • Vent • Cannula • Column plunger • Mixing vessel
3	Vent Port on 12-Port Valve	Syringe draws air from the vent as required.
4	Gas Valve	Activates gas drying of the column bed if the valve is plumbed into the module and the **Dry Column** step is used in a procedure.
5	1 ml, 3 ml, or 6 ml Column Plunger	Places reagents or samples on the column bed. There are three different plunger sizes. Use the correct plunger size for your columns.
6	Mixing Vessel	Creates a mixed reagent when the **Add Reagent to Mixing Vessel** and **Mix Reagents in Mixing Vessel** steps are used in a procedure.
7	Cannula	Accesses the sample test tube or vial to add reagents to the sample, mix the sample, or to draw the sample into the syringe to load it onto the column, as specified in the procedure.

Start the RapidTrace+ Workstation

Software Overview

The RapidTrace+ software has the following distinct characteristics:

- Employs Windows-based software with user-friendly interfaces.
- Allows for all samples to be run under the same procedure or individual samples to be run under different procedures.
- Simultaneously processes up to ten samples in a ten module workstation.
- The 3 ml RapidTrace+ collects one to ten fractions per sample. The 6 ml RapidTrace+ collects one to five fractions per sample.
- Controls the flow rate for each step in the procedure.
- Segregates up to three types of waste from the column and one type from the cannula.
- Links procedures to magnetically encoded racks for ease of operation.

RapidTrace Start Menu

The following options are found when selecting **Start→Programs→Biotage→RapidTrace SPE**:

- MAGASIGN (used for assigning procedures to coded racks)
- Procedure Checker (used for checking procedure files for errors)
- SPE (used for methods development)
- SPERUN (used for production)
- User Manual

RapidTrace+ Icons

There are three RapidTrace+ software icons on the desktop – SPE, SPERUN, and Procedure Checker. Some users may not have access to all the icons due to security levels at your company.

Table 6. RapidTrace+ Software Icons on the Desktop

Icon	Name	Description
 SPE	RapidTrace+ Methods Development (SPE)	Allows access to: • Setup reagents • Create procedures • Select communications port • Select flow rate units • Setup racks • Run and monitor • Reports • Manual control • Online help

Table 6. RapidTrace+ Software Icons on the Desktop(Continued)

Icon	Name	Description
 SPERUN	RapidTrace+ Production (SPERUN)	Allows access to: • Setup racks • Run and monitor • Reports • Manual control • Online help
 Procedure Checker	RapidTrace+ Procedure Checker	Checks the procedure files for errors and suggests improvements.

NOTE

RapidTrace+ software does not contain volume checking for exceeding the volumes of your sample test tubes or vials, fraction test tubes, and mixing chamber.

Turn on the RapidTrace+ Modules

Before you start the RapidTrace+ software, you must turn on all of the RapidTrace+ modules.

To turn on each RapidTrace+ module:

1 Switch the power switch on the back of each module to on (1).

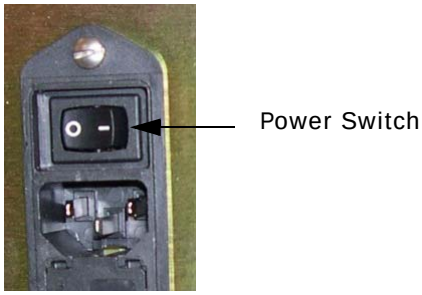


Figure 9. Power Switch on Rear of the RapidTrace+ Module

2 Each module initializes when it is switched on. See "Initialization" below for a description of the initialization process.

3 When initialization is complete, check the hardware to confirm that the RapidTrace+ workstation is ready to run procedures. See "Hardware Check" on page 27 for a list of items to check.

Initialization

Initialization is a module "self test" that occurs every time a RapidTrace+ module is switched on. The self test checks that all components of the module are in the correct position to start running samples, and confirms that the module is functioning properly.

If an error is encountered during initialization, the error LED illuminates (see Figure 10).

For initialization, the RapidTrace+ module requires that a rack be placed into the shuttle. The computer does not need to be switched on, and no test tubes, vials, or columns are necessary. When the power is switched on (or a **Warm Start!** command is sent from the **Manual Control** window), the RapidTrace+ module goes through the initialization process.

During initialization, listen to the module to assure that the shuttle is moving smoothly, and check that the error LED does not illuminate.

If an error LED is on, refer to "Troubleshooting" on page 82.

Hardware Check

After initialization of all RapidTrace+ modules, check the hardware to confirm that the RapidTrace+ workstation is ready to run procedures.

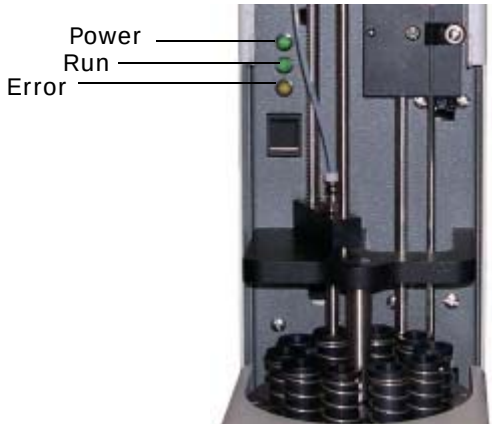


Figure 10. Power, Run and Error LED

Item	Confirm that...
Power LED	Green light is illuminated. If not, check that the RapidTrace+ module is switched on.
Run LED	Run light is off. If not, a run is in progress. Wait until the run is complete or stop the run.
Error LED	Error light is off. If not, go to the **Manual Control** window, select **STATUS?**, and correct the problem.
Module ID	Each module has a unique module identification number. If not, assign a unique number to each module using the switch at the front of each module.
Syringe	Syringe is at the HOME position. If not, go to the **Manual Control** window and move the syringe to the HOME position (the plunger is at the bottom of the syringe, 0 ml, with a small gap). The syringe plunger is clean, and no liquid is on top of the syringe plunger. If the syringe is not clean, run the cleanup procedure as described in "Post-Run Cleanup Procedure" on page 56.

Start RapidTrace+ Software

You use different software to run the RapidTrace+ workstation depending on what you want to do:

To set up the racks, run a procedure, or create reports:

- Select **Start→Programs→Biotage→RapidTrace SPE→SPERUN** or double-click the **SPERUN** desktop icon to open the RapidTrace+ Production software (see page 44 for details). You cannot define reagents or create procedures using the RapidTrace+ Production software.

  To use the RapidTrace+ Production software, a procedure must be created using the RapidTrace+ Methods Development software (see below).

To define reagents, create procedures, set up the racks, run a procedure, or create reports:

- Select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon to open the RapidTrace+ Methods Development software (see page 29 for details).

To create magnetic rack codes:

- Select **Start→Programs→Biotage→RapidTrace SPE→MAGASIGN** to open the Assign Magnetic Rack Codes to Procedures window (see page 49 for details).

To re-load the firmware:

- See "Upgrade the RapidTrace+ Firmware" on page 80 for details on upgrading the firmware.

Get Help

Online help can be accessed at any time in the RapidTrace+ software by clicking the **Help** button in the lower-right corner of each screen.

Create, Edit, and Assign Procedures

This section describes how to create and edit procedures, assign procedures to samples, and explains the **Create procedure** window. Consult the online help for further software information.

Open the RapidTrace+ Methods Development Software

1 Select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon. The main window opens as shown in Figure 11.

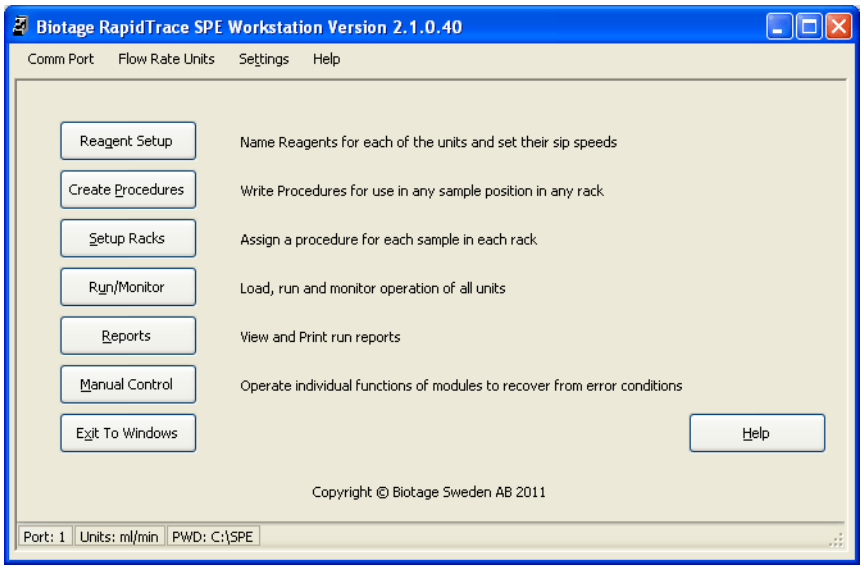


Figure 11. RapidTrace+ Methods Development Software

2 See one of the following sections:

- "Define the Reagents" on page 30.
- "Create Procedures" on page 32.
- "Assign Procedures to Samples" on page 42.

NOTE

*If you open the RapidTrace+ Production software (the **SPERUN** icon), the **Comm Port** menu, **Flow Rate Units** menu, **Reagent Setup** button, and **Create Procedures** button are not displayed.*

Define the Reagents

The following procedure demonstrates how to define the reagents used in a procedure:

1 Click the **Reagent Setup** button in the main window to open the **Reagent setup** window as shown in Figure 12.

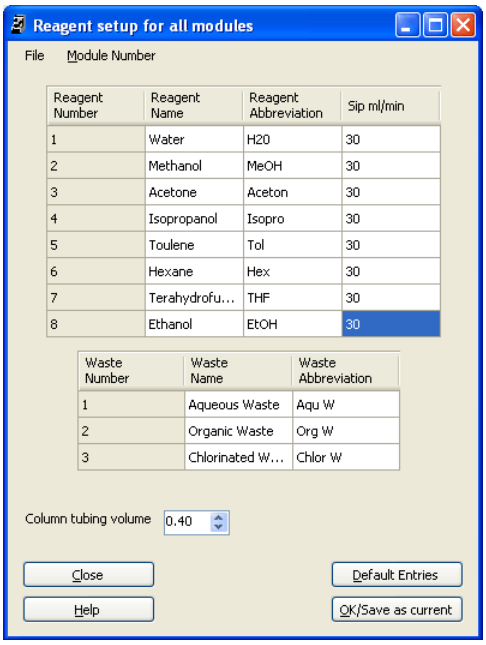


Figure 12. Reagent Setup Window

2 For each reagent used in the procedure, enter the following information on the row corresponding to the line the reagent uses:
- the reagent name,
- the desired abbreviation,
- the sip speed at which the syringe will pull the reagent out of the bottle. The speed range is 0.6 to 42 ml/min (0.01 to 0.7 ml/sec). The default setting is 30 ml/min (0.5 ml/sec).

3 For each waste line, enter the following information:
- the waste name,
- the desired abbreviation.

4 Enter the amount of liquid present in the line between the 12-port valve and the column plunger in the **Column tubing volume** text box. Use 0.4 ml when the tubing for gas drying is not connected. Change this value to 0.9 ml when the gas valve is plumbed into the fluid path. Refer to the online help for further information.

5 If you want to save the settings as current for all modules, click the **OK/Save as current** button.

6 If you only want to use the settings for one or several individual modules or save the settings for later use, save the settings in a ".set" file (see "Save the Reagent Setup as a ".Set" File" on page 31). Once the settings are saved in a file, they can be assigned to any module.

Save the Reagent Setup as a ".Set" File

The settings in the **Reagent setup** window can be saved as a data file for later use. This procedure describes how to save the entered settings as a ".set" file. Once the settings are saved as a ".set" file, they can be assigned to any module at any time.

1 Select **File→Save As** in the **Reagent setup** window. The **Save As** dialog box opens.

2 Enter the desired file name in the **File name** text box. The software automatically attaches the ".set" extension to the file name. Name the files so you can easily find them. Consider naming the file to reflect the function of the procedure or the class of the agents; for example, a drugs of abuse procedure might be named "doa.set".

3 Click the **Save** button to save the file and return to the **Reagent setup** window.

4 To close the **Reagent setup** window and return to the main window, click the **Close** button.

Recall a Saved ".Set" File and Make it the Active File

NOTES

- *Since the default in the **Module Number** menu (in the **Reagent setup** window) is **Module All**, any update made in the **Reagent setup** window, that is followed by clicking the **OK/Save as Current** button affects all modules, unless a specific module is chosen first.*
- *When **Module All** is selected in the **Module Number** menu, the **Reagent setup** window displays the last settings saved even if these settings may only be used by one individual module. To see the settings for each module, select one module at the time in the **Module Number** menu.*

The reagent setup file must be recalled and made active before a procedure can be created or run. The following steps demonstrates how to recall a saved reagent setup file and make it active.

1 Click the **Reagent Setup** button in the main window to open the **Reagent setup** window as shown in Figure 12.

2 If you do not want to use the reagent setup for all modules:

   a Select the **Module Number** menu to display a list of all modules; see Figure 13.

   b Select the desired module and click the **OK** button. The title bar changes to **Reagent setup for module number *no***.

3 In the **Reagent setup** window, select **File→Open**. The **Open File** dialog box opens.

4 Select the desired reagent setup file and click the **Open** button. The settings in the selected file is displayed.

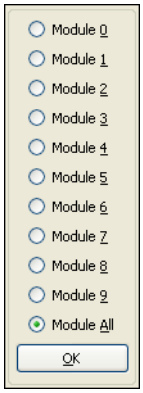


Figure 13. Module Number List

5 To use the settings, click the **OK / Save as current** button. The settings will be used until you select the default settings (click the **Default Entries** button) or another ".set" file.

6 If you assign the reagent setup to a single module and want to assign it to another module, repeat steps 2 through 5.

7 To close the **Reagent setup** window and return to the main window, click the **Close** button.

NOTE

*Once you click the **OK / Save as Current** button, this instructs the software to use these setup parameters when creating and running a procedure.*

Create Procedures

The following sections describe how to create a procedure for RapidTrace+:

- "Name the Procedure" below
- "Add Reagent to Sample and Mix" on page 33
- "Condition the Column" on page 36
- "Load the Sample onto the Column" on page 37
- "Purge and Clean the Cannula" on page 37
- "Save the Procedure" on page 38

The **Create procedure** window is described on page 39.

Name the Procedure

To create a new procedure and name the procedure:

1 Click the **Create Procedures** button in the main window. The **Create procedure** window opens as shown in Figure 14. See "Create Procedure Window" on page 39 for a detailed description of the window.

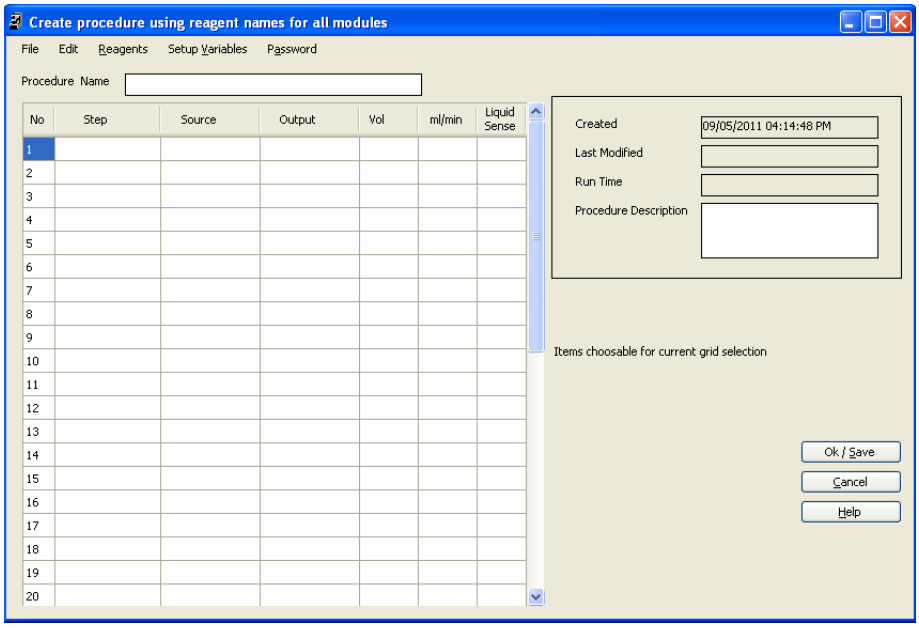


Figure 14. Create Procedure Window

2 Enter the desired name for the procedure in the **Procedure Name** text box. For example, type “SPE1” as shown in Figure 15.

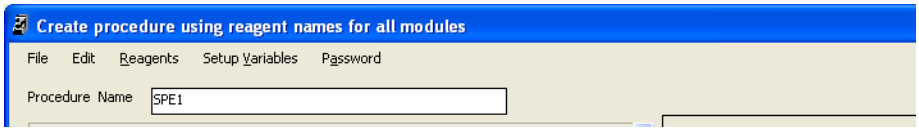


Figure 15. Procedure Name

Add Reagent to Sample and Mix

1 Select the **Step** text box in the first row and select the **Add reagent to sample and mix** command. The list of possible commands is displayed in the lower-right corner of the window. This is the first step in the sample procedure.

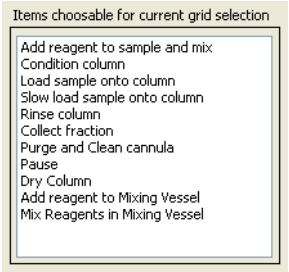


Figure 16. Steps Command List

“Cannula” displays as a default in the **Output** column as shown in Figure 17.

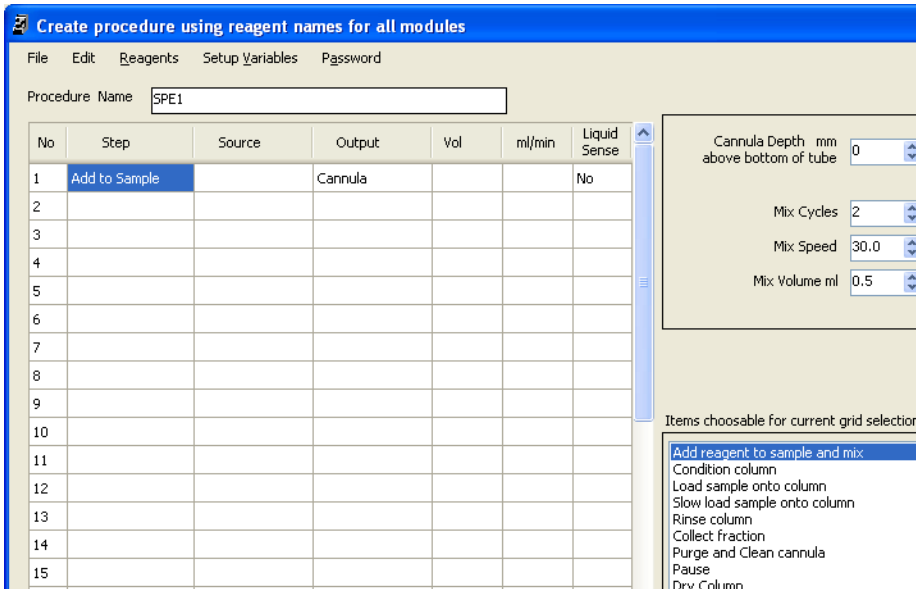


Figure 17. Create Procedure Window - Adding a Step

2 Enter the cannula depth above the bottom of the test tube or vial in the **Cannula Depth mm above bottom of tube** text box, in mm. If you wish the cannula to go to the bottom of the test tube or vial, leave the value at 0 (zero).

3 Enter the number of mixing cycles in the **Mix Cycles** text box. Entering "0" causes no mixing of the sample and reagent mixture to occur.

4 Enter the mix speed in the **Mix Speed** text box. The flow rate units depends on your setting (ml/sec or ml/min) in the **Flow Rate Units** menu in the main window.

5 Enter the mixing volume (the amount of the sample and reagent mixture the cannula aspirate and dispense) in the **Mix Volume ml** text box, in ml.

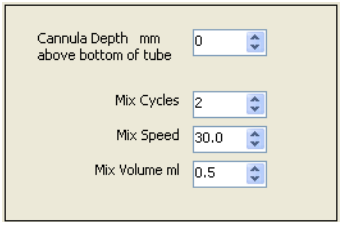


Figure 18. Settings for the Add Reagent to Sample and Mix Command

6 Select the **Source** text box in the first row and select the reagent to be added to the sample. The list of possible sources (the reagents specified in the **Reagent setup** window - see "Define the Reagents" on page 30) is displayed in the lower-right corner of the window.

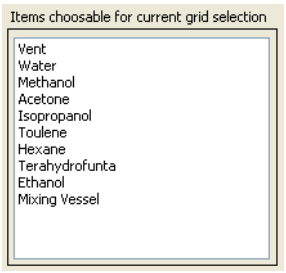


Figure 19. Source List

7 Select the **Vol** text box in the first row and enter the amount of reagent (in ml) to be added to the sample.

8 Select the **ml/min** or **ml/sec** text box in the first row and enter the flow rate at which the reagent is added to the sample.

NOTE

The rate at which reagent is aspirated (pulled out of the reagent bottle) is defined by the sip speeds in the **Reagent setup** *window.*

9 If you want to turn on the liquid sensor and detect if there is liquid in the syringe, click on “No” in the **Liquid Sense** text box in the first row. “No” changes to “Yes”.

Failure to pull liquid occurs if the reagent bottle is empty or the fluid path is blocked. If the sensor does not detect liquid, it assumes that the reagent has run out. The sensor sends a signal to stop the procedure and lights the error LED.

The liquid sensor should not be turned on for volumes of 1.2 ml or less. Switch the sensing option off by clicking again on “Yes”. The sensor is off when the text box displays “No”.

In the example shown in Figure 20, 5 ml of water is added to the sample at 30 ml/min using the cannula with the liquid sensor turned off.

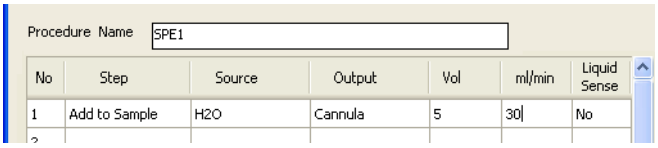


Figure 20. Add To Sample Command

NOTE

The flow rate range when using the ***Add reagent to sample and mix*** *command is 0.36 to 42 ml/min (0.006 to 0.7ml/sec).*

For more information on flow rates, refer to the “Clean the RapidTrace+ Modules” on page 56.

Condition the Column

1 Select the **Step** text box in the second row and select the **Condition column** step. The list of possible steps is displayed in the lower-right corner of the window. This row represents the second step in the procedure.

2 Select the **Source** text box in the second row and select the reagent to be used to condition the column. A list of possible sources is displayed in the lower-right corner of the window.

3 Select the **Output** text box in the second row and select where you want the reagent to go after being loaded onto the column bed. A list of possible outputs is displayed in the lower-right corner of the window. The output can be any of the three waste reservoirs or a fraction test tube. Waste names are defined in the **Reagent setup** window.

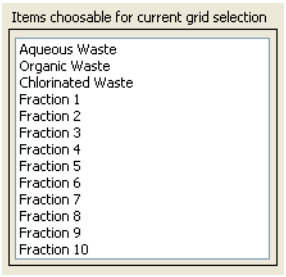


Figure 21. Output List

4 Select the **Vol** text box in the second row and enter the amount of reagent (in ml) to be used to condition the column.

5 Select the **ml/min** or **ml/sec** text box in the second row and enter the flow rate at which the reagent is loaded onto the column bed.

NOTE

*When writing procedures, the files "1ml.spe" and "3ml.spe" can be opened in the **Create procedure** window and used as templates. These procedures provide suggestions on a starting point for flow rates. Use the "1ml.spe" template if you are using a 1 ml column plunger. Use "3ml.spe" as a template for use with a 3 ml column plunger. When using the 6 ml column plunger, you can use the 1 or 3 ml template, but ensure to change the volume (in the **Vol** column) and the flow rates to appropriate values.*

In the example shown in Figure 22, 5 ml of methanol is loaded onto the column at 5 ml/min. When the methanol has passed through the column, it is collected in the reservoir for organic waste.

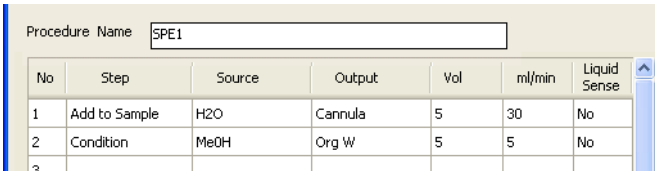


Figure 22. Create Procedure Window

Load the Sample onto the Column

1 Select the **Step** text box in the third row and select on of the following commands:

- **Load sample onto column**. The flow rate range is 0.36 ml/min to 42 ml/min (0.006 ml/sec to 0.7 ml/sec).
- **Slow load sample onto column**. The flow rate range is 0.048 ml/min to 4.2 ml/min (0.0008 ml/sec to 0.07 ml/sec).

The list of possible commands is displayed in the lower-right corner of the window. This is the third step in the procedure.

"Sample" displays as a default source in the adjacent **Source** column.

2 Enter the cannula depth from the bottom of the test tube or vial in the **Cannula Depth in mm from bottom** text box. If you wish the cannula to go to the bottom of the test tube or vial, leave the value at 0 (zero).

3 Select the **Output** text box in the third row and select where you want the sample to go after being loaded onto the column. A list of possible outputs is displayed in the lower-right corner of the window. The output can be any of the three waste reservoirs or a fraction test tube.

4 Select the **Vol** text box in the third row and enter the amount of sample (in ml) to be loaded onto the column.The volume range is 0.1 to 5.8 ml.

5 Select the **ml/min** or **ml/sec** text box in the third row and enter the flow rate at which the sample i loaded onto the column bed.

In the example shown in Figure 23, 5.8 ml of sample is loaded onto the column at 1.2 ml/min. When the sample has passed through the column, waste is collected in the reservoir for aqueous waste. Continue writing the procedure according to the information below. When the procedure has been completed, enter a short description of the procedure in the **Procedure Description** text box.

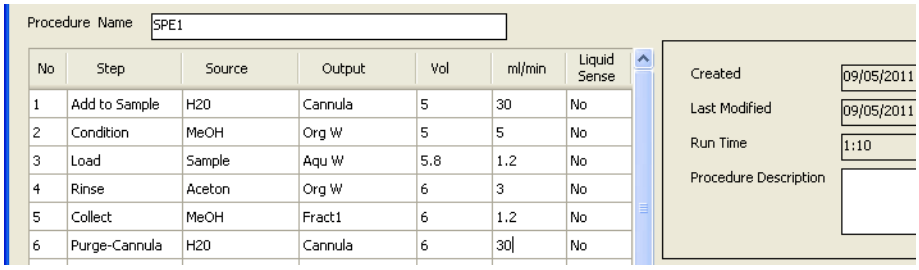


Figure 23. Create Procedure Window

Purge and Clean the Cannula

A **Purge and Clean cannula** step with water should always be the last step in your procedure, as it helps prevent carryover between samples. This step cleans the liquid handling syringe, the 12-port valve, and the cannula.

☞ We recommend that all procedures contain multiple **Purge and Clean cannula** steps.

For more information about purge and clean operations, refer to "Carryover Prevention" on page 41.

Save the Procedure

There are two ways of saving the procedure:

1 Select **File→Save As**. The **Save As** dialog box opens showing where the file will be saved and the file name. Click the **Save** button to save the file. After saving the procedure, the **Create procedure** window, with the saved procedure, remains open.

Or

2 Click the **OK/Save** button. The **Save As** dialog box opens showing where the file will be saved and the file name. Click the **Save** button to save the file and return to the main window.

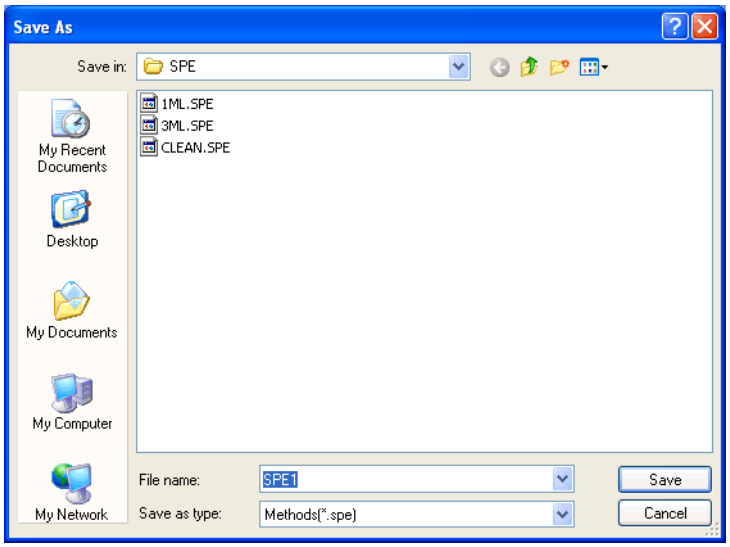


Figure 24. Save As Dialog Box

Edit a Procedure

The following steps demonstrate the process of editing a procedure:

1 Click the **Create Procedures** button in the main window. The **Create procedure** window opens.

2 Select **File→Open**. The **Open File** dialog box opens.

3 Select the procedure you wish to edit and click the **Open** button.

4 Make the desired changes.

To add a step, select the step to insert the step above and select **Edit→Insert**. A new row is added above the highlighted step.

To delete a step, select it and select **Edit→Delete**. The selected step is deleted.

5 After edits have been made, click **OK/Save** to save the edits to the file.The edited version of the file can also be saved under another name by selecting **File→Save As**.

Create Procedure Window

The **Create procedure** window is used to write, edit, and save procedures. To access this window, open the RapidTrace+ Methods Development software (select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon) and click the **Create Procedures** button.

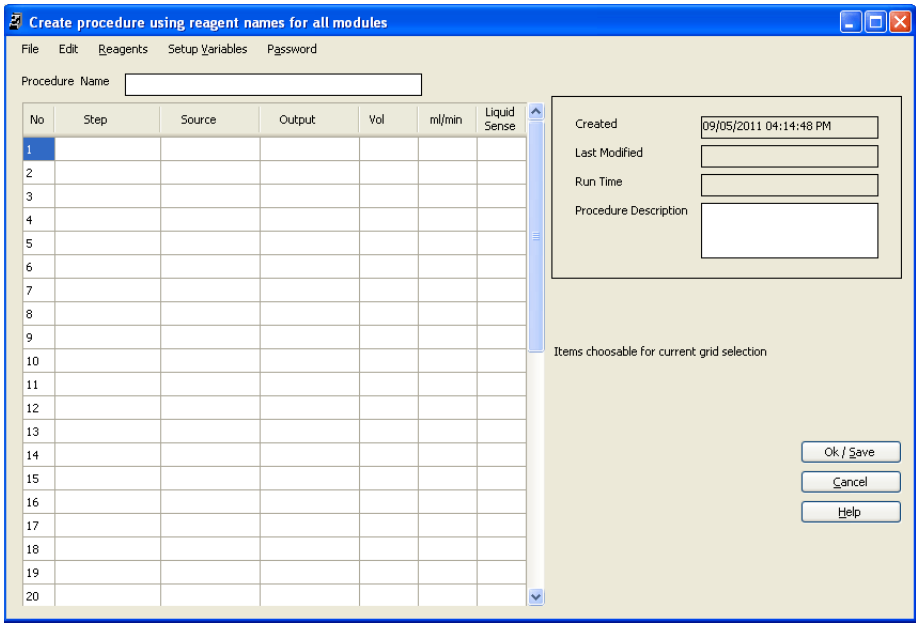


Figure 25. Create Procedure Window - New Procedure

Procedure Name

The procedure name is the same as the file name. The software automatically attaches the ".spe" extension to the file name.

Created

When a new procedure is created, the software automatically accesses the time and date from the computer's operating system and places the information in this text box.

Last Modified

When an existing procedure is changed, the software automatically accesses the time and date from the computer's operating system and places the information in this text box.

Run Time

When the procedure is saved, the software estimate the time to run the procedure.

Procedure Description

Specific information about the procedure, such as reagent set used or the column type, may be entered into this text box. The software displays this description when you assign the procedure to samples.

Create Procedure Window Menus

The Create procedure window has five main menus;

- **File** – Opens a new file, opens an existing file, deletes a file, saves the current procedure as another file name, and prints the current procedure.
- **Edit** – Inserts a step in a procedure or deletes a step from a procedure.
- **Reagents** – Allows you to use previously defined reagents while writing a procedure.

  If you have a reagent setup active for an individual module, you can pull down the **Reagents** menu and select the module number to use the reagent setup as you write your procedure. The software defaults to the setup for all modules.
- **Setup Variables –** Sets the sip speed for the mixer vessel and sample, the column air push volume, and the column air speed multiplier. See "Setup Variables Window" below.
- **Password** – Allows you to set a password for your procedures and reagent setups, i.e., you will need the password to open the **Create procedure** and **Reagent setup** windows. See "Assign Password Window" on page 41.

Setup Variables Window

To open the setup variables window, select the **Setup Variables** menu in the **Create procedure** window. The following parameters are available:

- **Sip Speeds**

  The flow rates at which the syringe aspirates (pulls) the reagent mixture from the mixing vessel or the sample. The flow rate range is 0.6 to 42 ml/min (0.01 to 7 ml/sec).
- **Column Air Push Volume**

  Air is used to push reagents or sample through the fluid path to the column to clear the reagent line. The air push volume is specified in ml, depending on the size of the column barrel and the depth of the column bed. The volume range is 1 to 6 ml. The default value is 2 ml.
- **Column Air Push Speed Multiplier**

  This factor increases the airflow rate through the column after a reagent or sample step. The slow, liquid flow rates required to push reagents or samples through the column are not usually necessary for the air push after a reagent or sample step. This parameter can be used to speed up the run time for the procedure without decreasing recovery.

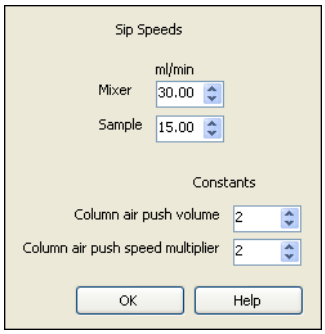


Figure 26. Setup Variables Window

Assign Password Window

Procedures and reagent setups can be password protected, i.e., you will need the password to open the **Create procedure** and **Reagent setup** windows. The password may be any 128-character string of printable keyboard characters. Do not forget your password! If you forget your password, call Biotage 1-Point Support (see "Contact Biotage 1-Point Support" on page 2).

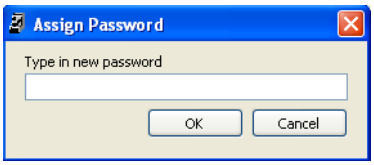


Figure 27. Assign Password Window

Carryover Prevention

Carryover is a type of contamination that occurs when some of a sample remains in the system, which can *carryover* into the next sample. The fluid path transports both reagents and samples; therefore, you should check for carryover as part of transferring a method to the RapidTrace+ workstation.

The strongest organic reagent should be used when cleaning and purging the cannula. This will most effectively clean the fluid path of any remaining sample.

NOTE

*If the sample contains proteins (i.e., plasma or serum samples), a **Purge and Clean cannula** step should be performed with water prior to performing a **Purge and Clean cannula** step with a strong organic solvent. The water "rinse" helps remove protein from the fluid path. Proceed with caution when using protein samples to prevent any protein precipitation.*

The following is a general procedure to determine carryover:

1 Run a blank sample (one that contains no analyte).

2 Run a sample that contains a very high concentration of analyte.

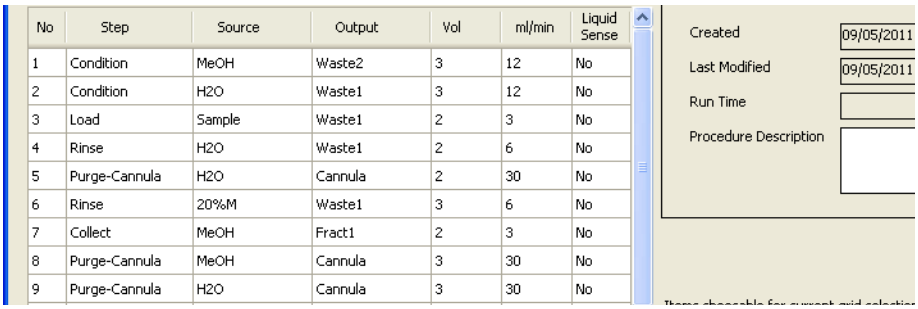
3 Run two additional blank samples.

4 Analyze the blank samples for carryover of analyte.

The carryover measured is from the entire process of preparing the sample, not just the RapidTrace+ procedure. For most applications, the carryover measured could come from any manual sample preparation step, the RapidTrace+ procedure, any sample evaporation or derivation, and/or the final sample analysis. It is important to determine what each portion of the sample preparation contributes to the total carryover.

If carryover is detected in the RapidTrace+ procedure, examine the steps used to wash out the fluid path and clean as described in "Clean the RapidTrace+ Modules" on page 56.

To prevent carryover between samples, we recommend that **Purge and Clean cannula** steps be used in the procedure. The purge steps should be placed in three locations of the procedure as shown in Figure 28.



No	Step	Source	Output	Vol	ml/min	Liquid Sense
1	Condition	MeOH	Waste2	3	12	No
2	Condition	H2O	Waste1	3	12	No
3	Load	Sample	Waste1	2	3	No
4	Rinse	H2O	Waste1	2	6	No
5	Purge-Cannula	H2O	Cannula	2	30	No
6	Rinse	20%M	Waste1	3	6	No
7	Collect	MeOH	Fract1	2	3	No
8	Purge-Cannula	MeOH	Cannula	3	30	No
9	Purge-Cannula	H2O	Cannula	3	30	No

Figure 28. Purge Steps

Step	Description
First Purge-Cannula (step 5 in the procedure above)	The first **Purge and Clean cannula** step is done with the first rinse reagent used, often water or an aqueous buffer, *after* the first rinse step occurs. This first rinse step allows any sample still present in the syringe after the load step to be moved onto the column with the rinse step.
Second Purge-Cannula (step 8 in the procedure above)	The second **Purge and Clean cannula** step occurs after the collect step, and should use the elution solvent, typically a strong solvent to thoroughly strip the cannula of any remaining analyte, eliminating carryover between samples.
Third Purge-Cannula (step 9 in the procedure above)	The third **Purge and Clean cannula** step occurs as the last step in the procedure, and **always** uses water. **Never** use a buffer as a last step, because that would leave buffer salts in the fluid path.

Assign Procedures to Samples

NOTE

When using the 6 ml RapidTrace+, only use samples 1, 3, 5, 7, and 9.

The **Setup Procedure Sequence** window is used to assign procedures to samples. The same procedure can be assigned to all samples in a rack, or a different procedure can be assigned to each sample in the rack.

The following steps demonstrate the process of assigning procedures to samples:

1 Click the **Setup Racks** button in the main window. The **Setup Procedure Sequence** window opens.

2 Select the desired procedure in the **Procedures Available** list. The list contains all saved procedures. Refer to the **Selected Procedure Description** text box for a description of the selected procedure (if entered when the procedure was created).

3 Select the sample(s) to assign the procedure to in the **Procedures assigned to: Module 0** list. The list corresponds to the sample positions in the rack.

To select several samples, hold down the **Ctrl** key while selecting. To select a range of samples (e.g. samples 1 through 5), select the first sample (e.g. sample 1), hold down the **Shift** key, then select the final sample (e.g. sample 5).

Procedures must be assigned consecutively, beginning at sample 1, unless there are multiple fractions. Refer to "Multiple Fractions" on page 44 for more information. When using the 6 ml RapidTrace+, only use samples 1, 3, 5, 7, and 9.

4 Select the modules you do want to assign the procedure to in the lower-left corner of the window. If there are less than ten modules in your workstation, it is still acceptable to select all ten modules.

5 Click the arrow button between the two lists. The selected procedure is assigned to the selected sample(s) for the selected module(s).If the procedure is assigned to several modules, the list title changes to **Procedures assigned to: Module *no* and selected group**.

6 Repeat steps 2 through 5 until a procedure has been assigned to all samples. In the example shown in Figure 29, the procedure "SPE1.spe" has been assigned to samples 1 through 5 and procedure "1ml.spe" to samples 6 through 10 for all modules.

To remove a procedure from a sample, select the sample and click the **Delete Selected Items** button.

7 Click the **OK/Save** button to save the setup and return to the main window.

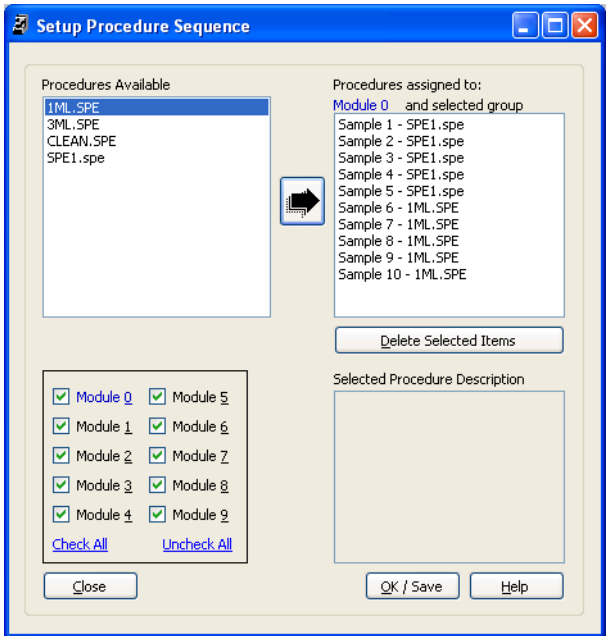


Figure 29. Setup Procedure Window

Close Without Saving

Clicking the **Close** button closes the window without saving the setup you have established.

Multiple Fractions

Multiple fractions require that sample positions on the rack are skipped. For example, if the procedure collects two fractions, the procedure should be assigned to samples 1, 3, 5, 7, and 9. Five sample test tubes or vials must be placed in these positions in the rack, five columns in these positions on the turret, and 10 fraction test tubes in the rack.

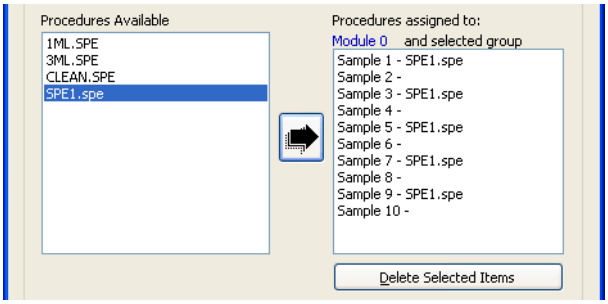


Figure 30. Multiple Fractions

NOTE

The 6 ml RapidTrace+ does not support multiple fraction test tubes per sample.

Run Methods and Monitor Operations

Run and Monitor Procedures on Up to Ten Modules

The main functions of the **Run RapidTrace** window are to load, run, and monitor the operation of modules.

The **Run RapidTrace** window displays a box representing each module in a 10-module workstation. Each module box has both a **Run** and a **Stop** button.

The window shows which RapidTrace+ modules are active (powered on and attached to the computer through RS-232 communications cables) by showing the assigned procedures. The computer "polls" the modules every few seconds for updates.

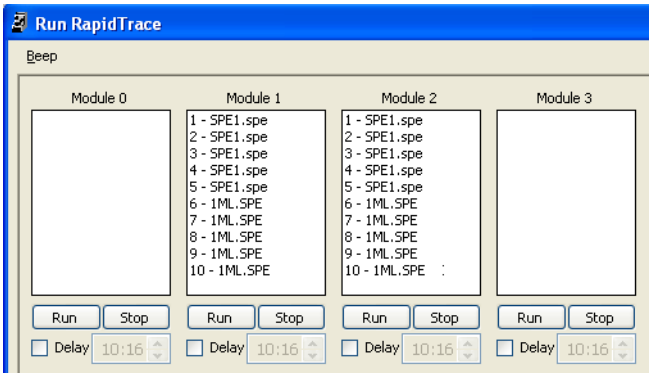


Figure 31. Run RapidTrace Window

Figure 31 shows a two-module workstation with the modules addressed as numbers 1 and 2. In the example shown in Figure 31, the "SPE1.spe" procedure has been assigned to samples 1 through 5, and the "1ml.spe" procedure to samples 6 through 10.

NOTES

- *If RapidTrace+ modules are switched off and/or are not attached to the computer, no procedures can be assigned to those modules.*
- *The 6 ml RapidTrace+ only uses samples 1, 3, 5, 7, and 9.*

To RUN an individual module, click the **Run** button for that module. To delay the run, set the **Delay** check box and enter the start time.

☞ *Double-clicking the **Run** button issues a STOP command.*

WARNING

Always keep body parts, hair, jewelry, and clothing away from the RapidTrace+ module during operation.

To STOP an individual module, click the **Stop** button for that module.

To run all modules, click the **Run All** button. Note that any entered delay times will be ignored, i.e., all runs will start immediately. If different procedures are assigned to individual modules, the **Run All** button is not available.

WARNING

Always keep body parts, hair, jewelry, and clothing away from the RapidTrace+ module during operation.

To stop all modules, click the **Stop All** button.

Follow these steps to run your procedures:

1 Place columns in the turret and load the sample test tubes (or vials) and the fraction test tubes into the rack. Make sure to place the number of vials and/or test tubes in the rack equal to the number of samples you want to extract.

2 Place the rack into the RapidTrace+ module.

3 Ensure the correct column plunger size is used for the columns. If not, replace it with the correct one.

4 Select **Start→Programs→Biotage→RapidTrace SPE→SPE** or **SPERUN**, or double-click the **SPE** or **SPERUN** desktop icon. The RapidTrace+ Methods Development or Production software opens.

5 Click the **Setup Racks** button. The **Setup Procedure Sequence** window opens.

6 Click the **Setup Racks** button. The **Setup Procedure Sequence** window opens.

7 Assign a procedure to each sample; see "Assign Procedures to Samples" on page 42.

8 When you have assigned a procedure to all samples, click the **OK/Save** button to save and return to the main window.

9 Click the **Run/Monitor** button. The **Run RapidTrace** window opens; see the example in Figure 32.

10 To delay a run, set the **Delay** check box and enter the start time.

11 To run all modules, click the **Run All** button. Note that any entered delay times will be ignored, i.e., all runs will start immediately. If different procedures are assigned to individual modules, the **Run All** button is not available.

12 To run an individual module, click the **Run** button for that module.

☞ Once a module is running, the computer has downloaded the necessary information into the module, and you can use the computer for other purposes. However, for module monitoring purposes, you may remain in or return to the **Run RapidTrace** window at any time. Each module's box displays information on the step that the module is performing or any errors that have occurred.

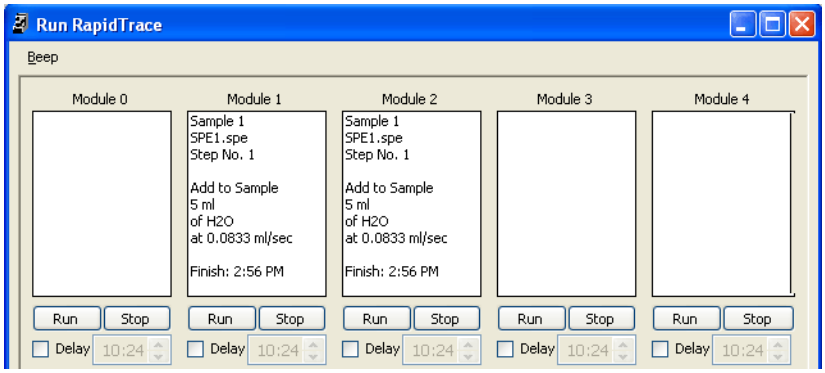


Figure 32. Two Modules Running SPE1.SPE Procedure

Setup the Beep Control

The beep control allows a beeper to sound when a module encounters an error and when the modules in your workstation have completed the procedures. Any number between 0 and 100 may be entered into the text box. This value represents the number of repeats per signal. Test the beep to determine the preferred setting. Entering “0” disables the option, and no beep sounds.

When a module has an error, it beeps in the same manner as the test beep. When all modules are finished running, they beep ten times longer than the test beep.

NOTE

Since the RapidTrace+ module is controlled from a computer, the beep can sound only if a sound card has been installed on the computer.

To set and test the beep:

1 Select the **Beep** menu. The **Beep Control** window opens.

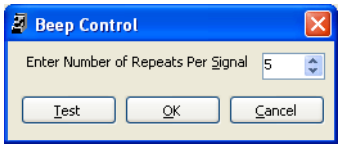


Figure 33. Beep Control Window

2 Enter the desired number of beeps.

3 Click the **Test** button. The computer sounds the test beep.

4 To save the setting, click the **OK** button.

View and Print Run Reports

The **RapidTrace Reports** window displays the last three reports from each module.

☞ Pay close attention to the date and time to determine which report you wish to see.

The main functions of the **RapidTrace Reports** window are to view and print run reports and to access the sample counter for each module with the **View Usage Log** button.

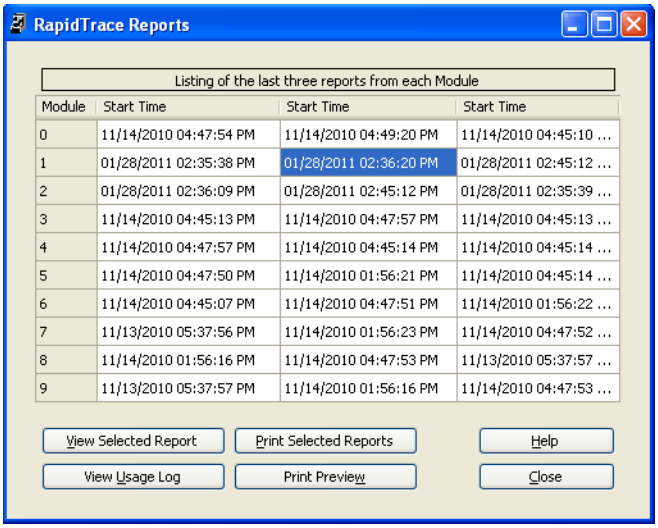


Figure 34. RapidTrace Reports Window

View the Selected Report

☞ Only one report can be viewed at a time.

1 Select **Start→Programs→Biotage→RapidTrace SPE→SPE** or **SPERUN**, or double-click the **SPE** or **SPERUN** desktop icon. The RapidTrace+ Methods Development or Production software opens.

2 Click the **Reports** button. The **RapidTrace Reports** window opens.

3 Select the cell of the report you want to view, then click the **View Selected Report** button. The **View Report** window opens and displays the rack layout and the event log:

- The rack layout, in the box on the left, identifies the procedures that are assigned to the samples and if a sample test tube or vial is present. If no sample test tube or vial is present, the procedure does not run on that sample. In this example (see Figure 35), there were only one sample present (sample 1).

- The event log shows the date and time the procedure ran, a running log of the times each sample began, when the module stopped, and any errors that occurred. In this example, the procedure was stopped 13 minutes and 34 seconds after it began. The log also shows a Rack ID, representing the code assigned to a magnetically encoded rack.

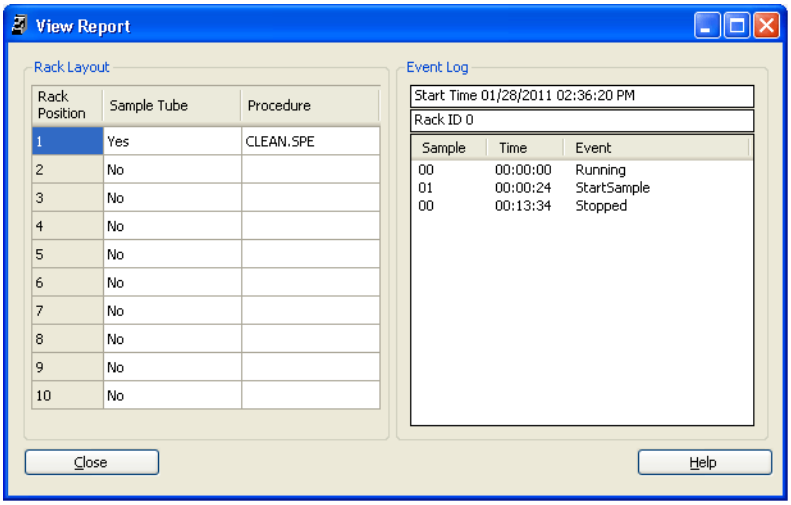


Figure 35. View Report Window

☞ If a magnetically encoded rack was not used, the Rack ID displays a 0.

Print the Selected Reports

One report may be printed at a time when a printer is connected to the computer. To print, select the report you wish to print in the **RapidTrace Reports** window, then click the **Print Selected Reports** button. The report prints to the Windows default printer.

Use Magnetically Encoded Racks

Magnetically encoded racks enable the user to designate a specific procedure to a rack. Many laboratories find this useful in production mode.

When using magnetically encoded racks, the procedure does not have to be assigned to samples in the **Setup Procedure Sequence** window, because the module reads the magnets and automatically knows which procedure to run. The module runs the number of samples corresponding to the number of sample test tubes or vials placed in the rack.

☞ Only one procedure may be assigned per rack.

Follow these steps to magnetically encode a rack:

1 Write the procedure you wish to magnetically encode using the RapidTrace^{+} Method Development software (SPE icon), as you would any procedure. All magnetically encoded procedures must contain at least one **Collect fraction** step.

2 Encode the rack by placing magnets in the rack in a sequence representing a code; see the next section.

3 Assign the procedure that includes at least one **Collect fraction** step to the code chosen in step 2 using the RapidTrace+ MAGASIGN software; see "Assign a Procedure to the Code" on page 52.

Encode the Rack

To magnetically encode a rack the following items are needed:

- A RapidTrace+ rack.
- Kit of magnets provided in your start-up kit.
- A slotted flat-bladed screwdriver.
- The code number to be assigned.

Using this picture of a rack with 13x100 mm sample test tubes and 12x75 mm fraction test tubes as a reference, follow the steps below:

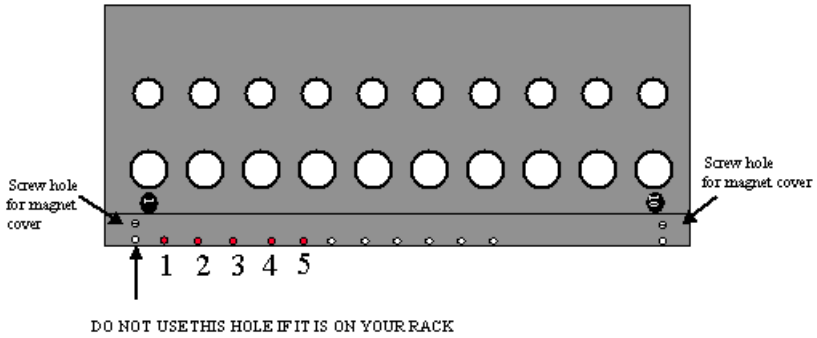


Figure 36. Magnetically Encoding the Rack

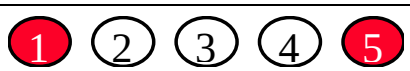
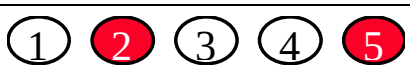
1 Remove the two screws from both ends of the rack, and remove the magnet cover. Below the cover are several holes for magnets. The five holes, used to encode the rack, are shaded and numbered 1 through 5 in the picture above. The first hole, which is directly next to the screw hole, may not be on your particular rack. However, if the rack has this hole, disregard it.

2 Follow the magnet table below to properly code your rack. Place a magnet in each of the holes that are shaded in the table.

3 Remount the magnet cover.

4 Label your rack appropriately so you can identify either the procedure or the code number you are running.

Magnet Table

MAGNETS	CODE
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
	12
	13
	14
	15
	16
	17
	18
	19
	20

Assign a Procedure to the Code

1 Select **Start→Programs→Biotage→RapidTrace SPE→MAGASIGN**. The **Assign Magnetic Rack Codes to Procedures** window opens as shown in Figure 37.

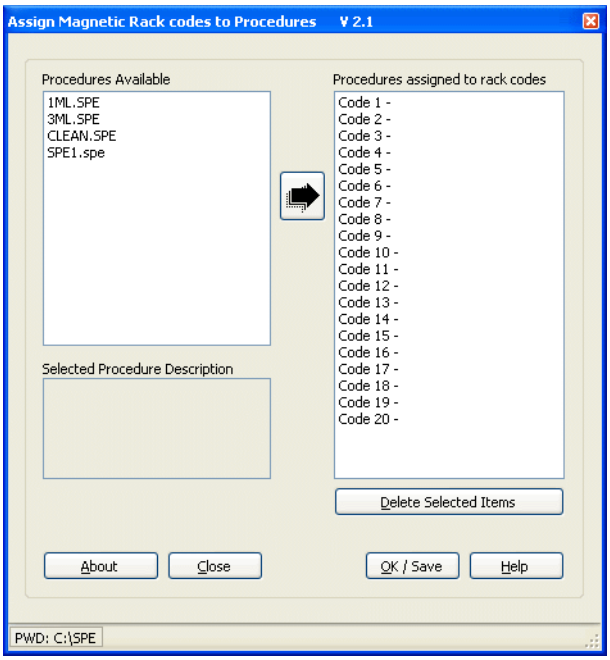


Figure 37. Assign Magnetic Rack Codes Window

2 Select the desired procedure in the **Procedures Available** list.

3 Select the code number to be assigned in the **Procedures assigned to rack codes** list.

4 Click the arrow button between the two lists. The procedure name is displayed next to the code number.

5 To assign the procedure to the selected code, click the **OK/Save** button.

Run a Procedure with Magnetically Encoded Racks

1 Place columns in the turret and load the sample test tubes (or vials) and the fraction test tubes into the rack. Make sure to place the number of vials and/or test tubes in the rack equal to the number of samples you want to extract.

2 Place the rack into the RapidTrace^{+} module.

3 Ensure the correct column plunger size is used for the columns. If not, replace it with the correct one.

4 Push the **Start/Stop** button, located on the front of the module to start the magnetically encoded procedure.

NOTES

- *Set up the computer in the **Run RapidTrace** window using either the RapidTrace+ Production software or the RapidTrace+ Methods Development software.*
- *Do not use the **Run** or **Run All** button in the **Run RapidTrace** window to start a run with magnetically encoded racks.*

☞ *When you press the **Start**/**Stop** button on the front of the module, the magnets are only read. A rack with magnets in place may be used in non-magnetic mode by using the **Setup Procedure Sequence** window and the **Run** or **Run All** button in the **Run RapidTrace** window to start the run.*

Daily Operations

Many of the steps below are performed in specific RapidTrace+ windows. You can access all windows from the main window in the RapidTrace+ Methods Development software. To open the Methods Development software, select **Start→Programs→Biotage→RapidTrace SPE→SPE** or double-click the **SPE** desktop icon.

Prepare the RapidTrace+ Workstation

When preparing the RapidTrace+ workstation, check the reagents to verify they are fresh, correct for the procedure, sufficient to run the desired number of samples, and on the correct numbered line.

WARNING

To avoid eye injury, wear safety glasses when working with reagents.

Always use extreme care when handling fluids in the laboratory.

WARNING

Liquid exiting the solvent and sample waste lines can be infectious, toxic, flammable, and/or corrosive. Refer to the SDS (Safety Data Sheet) for detailed information regarding chemicals used in your applications.

- *Do not touch waste.*
- *Keep waste from heat or flame.*
- *Dispose of waste properly.*
- *Periodically check waste lines for damage.*
- *Make sure that the flow is not inhibited and that the waste reservoirs are large enough to hold waste generated.*

Follow these steps to prepare the RapidTrace+ workstation for running procedures:

1 Confirm that the waste reservoirs are empty.

2 If the workstation has not been used for ten hours or more or if new reagents have been placed on the workstation, purge the reagent lines before running samples (see "Purge Reagent Lines" on page 66).

3 Confirm that all sample test tubes or vials are clean and that the correct number of fraction test tubes needed are on hand.

4 Confirm that all columns are new and of the correct type for the procedure. Verify there is a sufficient number of them available to run the samples.

5 Perform a post-run cleanup at the end of the day (see "Post-Run Cleanup Procedure" on page 56).

Prime the Reagent Lines

Prime the reagent lines before running samples on a daily basis. Also, prime reagent lines whenever changing reagents.

To prime reagent lines, create a procedure using the **Purge and Clean cannula** step for each reagent line that must be primed. The recommended volume for each **Purge and Clean cannula** step is 6 ml with a flow rate of 30 ml/min (0.5 ml/sec).

The procedure shown below is an example that primes four reagent lines (1 to 4) with 6 ml of each of four reagents. Biotage recommends that this procedure be run with two samples, which would prime each of the reagent lines with 12 ml, a volume that is sufficient for either individual- or manifolded-reagent lines.

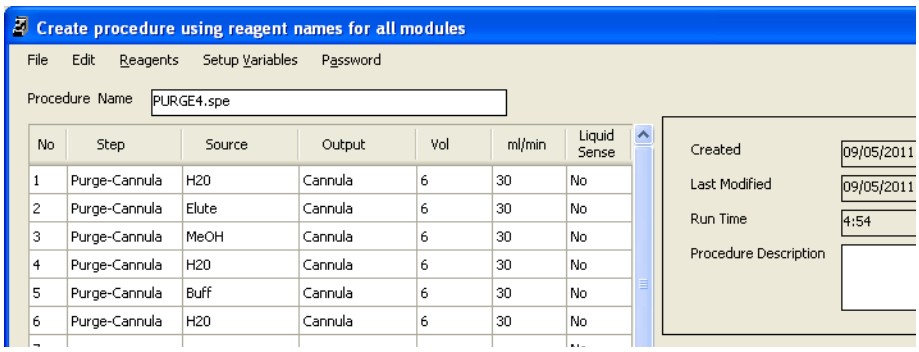


Figure 38. Prime Reagent Lines

NOTE

To prevent "salting-out" of buffers, confirm that organic solvents are always preceded and followed by water, not buffers. Always use water as the first and last reagent to purge the lines.

Use the **Procedure Description** text box to describe the prime procedure.

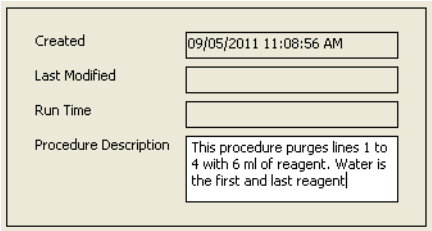


Figure 39. Prime Procedure Description

☞ All waste generated from a **Purge and Clean cannula** step exits through waste line #4. It is advisable to have this line in a waste reservoir that contains mixed waste. Both aqueous and organic waste exits through this line as the lines are primed.

Clean the RapidTrace+ Modules

The following post-run cleanup procedure is recommended with routine maintenance. Cleaning the modules removes any proteins that may have built up in the fluid path.

NOTE

Do not leave a module inactive for more than one day without cleaning.

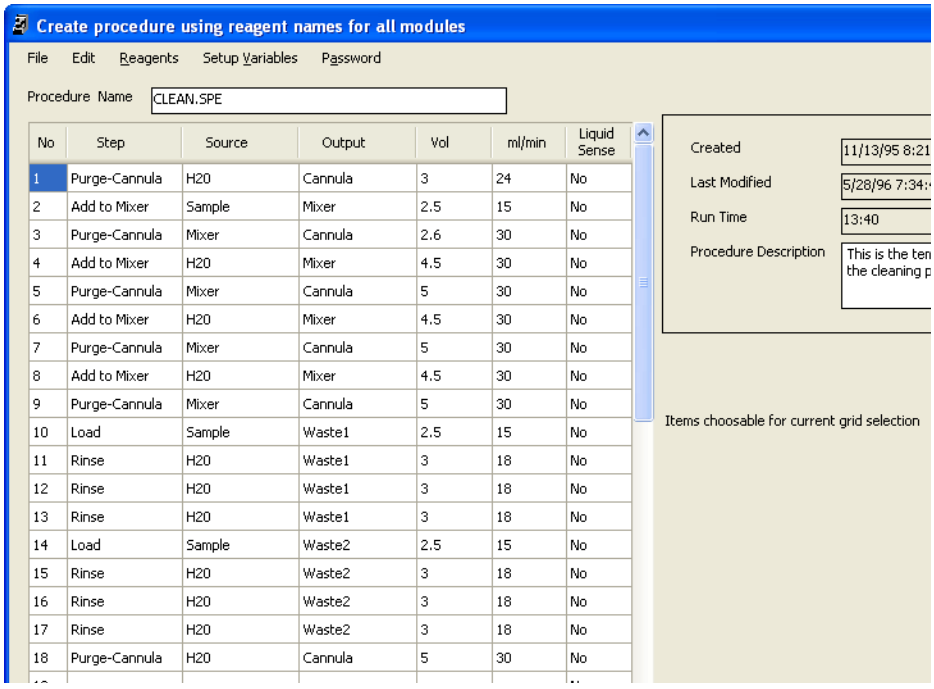
Post-Run Cleanup Procedure

NOTE

As both biological and organic waste may contain proteins, it is important that the waste lines are cleaned.

At least 50 ml water and at least 8 ml of both 2M sodium hydroxide (NaOH) and 2M nitric acid (HNO_3) are required for the cleanup procedure.

☞ Sodium hydroxide and nitric acid eliminate protein buildup in the fluid path and neutralize each other. Water flushes the pathway for effective cleanup.



No	Step	Source	Output	Vol	ml/min	Liquid Sense
1	Purge-Cannula	H20	Cannula	3	24	No
2	Add to Mixer	Sample	Mixer	2.5	15	No
3	Purge-Cannula	Mixer	Cannula	2.6	30	No
4	Add to Mixer	H20	Mixer	4.5	30	No
5	Purge-Cannula	Mixer	Cannula	5	30	No
6	Add to Mixer	H20	Mixer	4.5	30	No
7	Purge-Cannula	Mixer	Cannula	5	30	No
8	Add to Mixer	H20	Mixer	4.5	30	No
9	Purge-Cannula	Mixer	Cannula	5	30	No
10	Load	Sample	Waste1	2.5	15	No
11	Rinse	H20	Waste1	3	18	No
12	Rinse	H20	Waste1	3	18	No
13	Rinse	H20	Waste1	3	18	No
14	Load	Sample	Waste2	2.5	15	No
15	Rinse	H20	Waste2	3	18	No
16	Rinse	H20	Waste2	3	18	No
17	Rinse	H20	Waste2	3	18	No
18	Purge-Cannula	H20	Cannula	5	30	No

Figure 40. Procedure Window for Cleaning

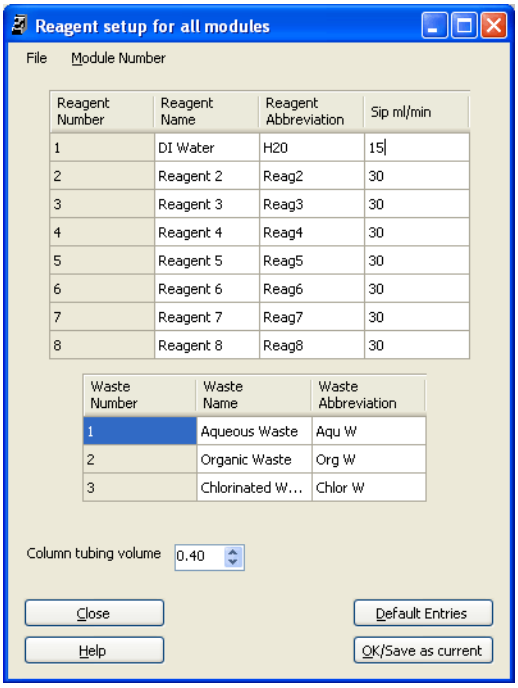


Figure 41. Reagent Setup Window for Cleaning

1 Click the **Reagent Setup** button in the main window to open the **Reagent setup** window and define the reagents as shown in Figure 41.

2 Place two sample test tubes in the first two rack positions.

3 Pour 8 ml of 2M sodium hydroxide (NaOH) into the first sample test tube and 8 ml of 2M nitric acid (HNO_3) into the second test tube.

4 Place two empty columns with spacers in the positions for sample 1 and 2 in the turret. Empty columns with spacers can be found in the start-up kit.

5 Open the **Setup Procedure Sequence** window (click the **Setup Racks** button in the main window) and assign the “clean.spe” procedure (supplied with the software) to sample 1 and 2.

6 Run the method using the reagent setup created in step 1.

Clean the Exterior of the RapidTrace+ Modules

Always wipe up spills immediately. Wipe the exterior surfaces of the RapidTrace+ modules with a damp cloth after each use.

WARNING

Liquid used with the RapidTrace+ workstation can be infectious, toxic, flammable, and/or corrosive. Refer to the SDS (Safety Data Sheet) for detailed information regarding chemicals used in your applications.

Manual Control

Features of the Manual Control Window

To access the **Manual Control** window, click the **Manual Control** button in the main window of the RapidTrace+ Methods Development or Production software.

The **Manual Control** window operates individual module functions to recover from error conditions. Macros group the individual operations together to perform a task. (See “Use Macro Routines” on page 63.)

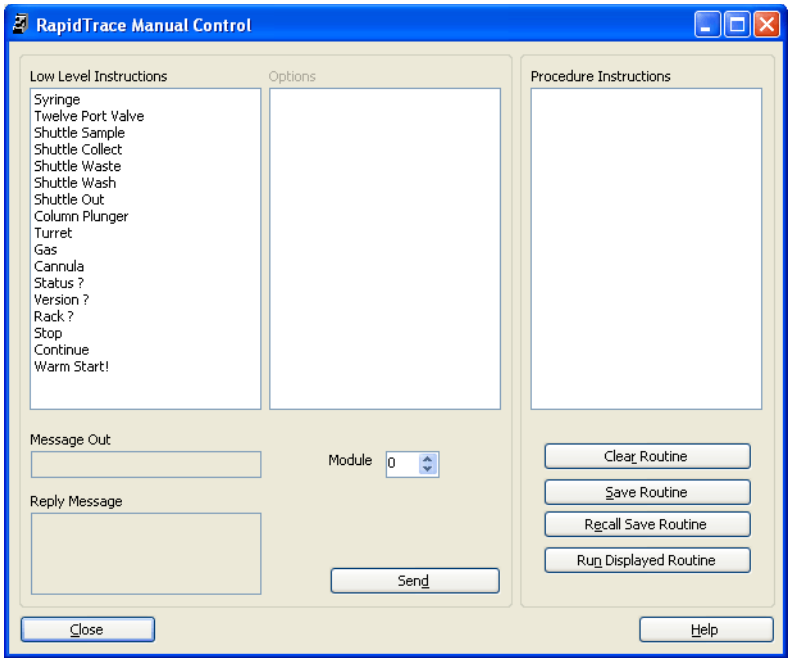


Figure 42. Manual Control Window

NOTE

*There is no error checking when operating in the **Manual Control** window.*

Functions

The **Low Level Instructions** field in the upper-left corner of the **Manual Control** window lists the individual modular functions.

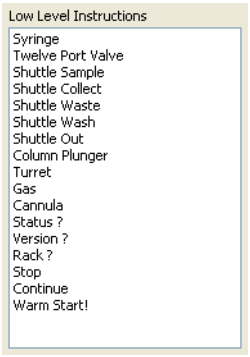


Figure 43. Functions List

Module Number

The **Module** text box in the middle of the **Manual Control** window shows the module number to be operated. Only one module can be operated at a time unless “10” is entered in this text box. Entering “10” in this text box causes all the modules to run.

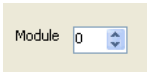


Figure 44. Module Number

Macro Routine Buttons

The four buttons in the lower-right corner of the **Manual Control** window are for clearing, saving, recalling, and running a macro routine. See “Use Macro Routines” on page 63 for more information.

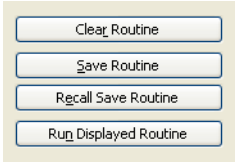


Figure 45. Macro Routine Buttons

Perform Individual Operations

To perform an individual operation on one or all modules:

1 Click the **Manual Control** button in the main window of the RapidTrace+ Methods Development or Production software.

2 Enter the module number in the **Module** text box in the middle of the **Manual Control** window or use the up and down arrows to select another module. Entering "10" in this text box causes the operation to run on all modules.

3 Select the operation in the **Low Level Instructions** field and any additional choices that are necessary for that operation.

4 Click the **Send** button to send the command to the selected module(s).

Each operation or command and their function are described below:

Operation/Command	Function
Cannula	Three options are available with this command: • ***Up*** – Moves the cannula up to the home position (out of the sample test tube or vial). • ***Into Wash*** – Moves the cannula into the wash station. To avoid damaging the cannula, confirm that the rack is in the wash position before lowering the cannula (see **Shuttle Wash** below). • ***Into Sample*** – Moves the cannula into the sample. To avoid damaging the cannula, confirm that the rack is in the sample position before lowering the cannula (see **Shuttle Sample** below).
Column Plunger	Before performing the first column plunger operation, move the turret to the sample position using the **Turret** command and the shuttle to the waste or wash position using the **Shuttle Waste** or **Shuttle Wash** command. Three options are available with this command: • ***Up*** – Moves the column plunger up into the home position, that is, completely out of the column. • ***Lock Turret*** – Moves the column plunger about halfway into the column and locks the turret. • ***Squash Column*** – Moves the column plunger as tightly as possible onto the top of the column bed. The column must be in place, test tubes and/or vials must be in the rack, and the turret must be locked (using the **Turret** or **Lock Turret** command).

Operation / Command	Function
Continue	If an error occurs, the **Continue** command re-starts the procedure run, at the selected sample, after you correct the error. This operation does not work with macros; it only works with procedures run individually. A report cannot be generated after using the **Continue** command. To obtain a report, set up the rack and columns to run, starting at sample 1. Edit the **Setup Procedure Sequence** window appropriately and re-run the procedure using the **Run RapidTrace** window.
Gas	Turns gas valve ON or OFF, listed in minutes.
Rack ?	Queries the module to determine how many magnets, sample test tubes or vials, and fraction test tubes are present in the rack. The hexadecimal “xxxx xxxx xxxx” in the **Reply Message** field indicates:
Magnets Present	**Samples Present**	**Fractions Present**
Example:	“0000	03FF	03FF”
Meaning:	0 magnets	10 sample tubes or vials	10 fraction tubes
Shuttle Collect	Moves the shuttle to the assigned (designated) fraction test tube. ☞ *Before using the **Shuttle Collect** command, the test tube must be in the assigned position and the shuttle in the waste or wash position (use the **Shuttle Waste** or **Shuttle Wash** command).*
Shuttle Out	Sends the shuttle out (rest position).
Shuttle Sample	If the shuttle is out, first send the shuttle to the waste or wash position (using the **Shuttle Waste** or **Shuttle Wash** command) before sending it to a sample position.
Shuttle Wash	Moves the shuttle to the cannula wash position, and the cannula above the cannula waste station.
Shuttle Waste	Moves the shuttle to the designated waste line.
Status ?	While the RapidTrace^{+} module is running a procedure, the module's current status, such as “Stopped”, displays here. If there is an error condition and you select **Status ?** and then click the **Send** button, an error message displays in the **Reply Message** field. Make sure that you have selected the correct module in the **Module** text box.

Operation / Command	Function
Syringe	Three options are available with this command: • ***Syringe Speed and Low Syringe Speed –*** Sets the speed that you want the syringe to use when delivering liquids. The range for syringe speed is 0.36 to 42 ml/min (0.006 to 0.7 ml/sec) when using the **Syringe Speed** command and 0.048 ml/min to 4.2 ml/min (0.0008 ml/sec to 0.07 ml/sec) when using the **Low Syringe Speed** command. During manual control, the syringe speed may need to be adjusted. The syringe speed remains at the speed of the previous procedure until it is changed. • ***Syringe Position –*** Positions the syringe plunger in the barrel. For example, a value of 0 places the syringe plunger directly at the bottom of the barrel, and a value of 1 ml places the syringe plunger about 0.24 ml above the bottom of the barrel. Valid range is 0 to 6 ml. This command functions with the shuttle in any position. ☞ *Whenever a procedure stops running, the syringe position should be reset to 0 (zero) before resuming the procedure run.*
Turret	Moves the turret to the designated column number. The rack must be in the waste or wash position (use the **Shuttle Waste** or **Shuttle Wash** command), and tubes and/or vials must be in the rack.
Twelve-Port Valve	Turns the valve position to the designated position. This command functions with the shuttle in any position.
Version ?	Displays the firmware version in the **Reply Message** field. Example: “RT136 Aug 19 2011 11:33:35 ROM 10/17/94 11:33:47” The first date and time is when the firmware was created and the second when the bootloader was created. If “RT136” is displayed in the **Reply Message** field, the firmware used with the new opto sensor is installed on the module. The new opto sensor is used with the 40 ml scintillation vials rack (P/N C133989). If “RT13” is displayed, the firmware used with the “old” opto sensor is installed.

Operation/Command	Function
Warm Start!	Re-initializes the RapidTrace+ module. A warm start is almost the same as switching the power button off and on. A warm start moves the module to a ready-to-run condition. During a warm start, the module empties the syringe, empties the mixing chamber, and moves the rack to its out position. After a self-check, the module is fully operational and ready for you to run samples, perform maintenance procedures, or initiate a system shutdown.

Use Macro Routines

A macro is a series of commands that are grouped together under a single command, making running tasks quicker and easier.

Note

There is no error checking in the macro mode of operation.

***Example**: A macro is run that has been written to perform operations on two samples. After processing sample 1, the computer finds that a test tube or vial is not in position 2 on the rack. The computer will "hang" (cease to function) and need to be rebooted.*

Create and Save a Macro

If an incorrect message is sent during the creation of a macro routine, the entire routine macro must be rewritten. To create and save a macro:

1 Enter the module number in the **Module** text box in the **Manual Control** window. Only one module can be operated at a time unless "10" is entered. Entering "10" in this text box causes the macro to run on all modules.

2 Select an operation in the **Low Level Instructions** field and any additional choices that are necessary for that operation.

3 Click the **Send** button. The module selected performs the operation.

4 Repeat steps 2 and 3 for each operation that you want to include in the macro. All of the operations that are included in the selected macro are listed in the **Procedure Instructions** field.

5 Click the **Save Routine** button to save the macro. The **Save As** dialog box opens.

6 Enter the desired macro name in the **File name** text box and click the **Save** button. The software adds an ".err" extension, which is the default extension in RapidTrace+ software for macros.

Run a Macro

1 Click the **Recall Saved Routine** button. The **Open** dialog box opens.

2 Select the desired macro and click the **Open** button.

3 Enter the module number in the **Module** text box. Only one module can be operated at a time unless “10” is entered. Entering “10” in this text box causes the macro to run on all modules.

4 To run the macro, click the **Run Displayed Routine** button.

5 To clear the macro from the **Manual Control** window, click the **Clear Routine** button.

Add or Move RapidTrace+ Modules

Overview

You can move or relocate your RapidTrace+ workstation. To make re-installation easier, review the module's plumbing prior to disassembly, so you can put it back together. There are colored labels in the start-up kit to help with line identification.

NOTES

- *Only qualified personnel should move a RapidTrace+ module.*
- *Before moving a module, confirm that power has been switched off and that the power cord and the RS-232 communications cables have been unplugged.*

Identify Reagent Plumbing Setup

There are two module setups:

- **Manifold Setup –** Reagent lines between modules are connected. The workstation uses the same set of reagent bottles with one line that draws up reagent through a check valve.
- **Individual Reagent Lines** – Each module has eight reagent lines leading directly from the module to the reagent bottle(s).

1 Determine which plumbing setup your workstation uses. On the back of each module, there is a cutout for the reagent lines (1/16" diameter tubing) and the gas line (1/8" diameter tubing).

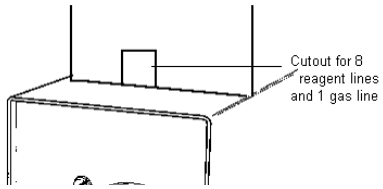


Figure 46. Cutout for Reagent and Gas Lines

2 If you have manifold pieces (shown in Figure 47) connected to your reagent lines, follow the instructions in "Moving Manifolded Modules" on page 67. Otherwise, follow the instructions in "Move Modules with Individual Reagent Lines" on page 68.

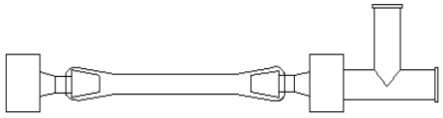


Figure 47. Manifold Plumbing Piece

The entire workstation or just a part of it can be moved. To move a part of the workstation only, a check-valve kit (P/N C55076) is needed. This kit contains tubing and fittings for additional lines to place in your reagent bottles for your second workstation.

Purge Reagent Lines

WARNING

Exercise caution when handling fluids in the laboratory.

Before moving modules or adding a module to a manifolded workstation, liquids must be removed from the reagent lines. To remove fluid from the lines complete the following steps:

1 Remove all the lines from the reagent bottles and place them into a clean, empty container.

2 Write a procedure to purge the reagent lines taking the miscibility of the reagents into account. An example of a procedure for eight reagents is shown Figure 48.

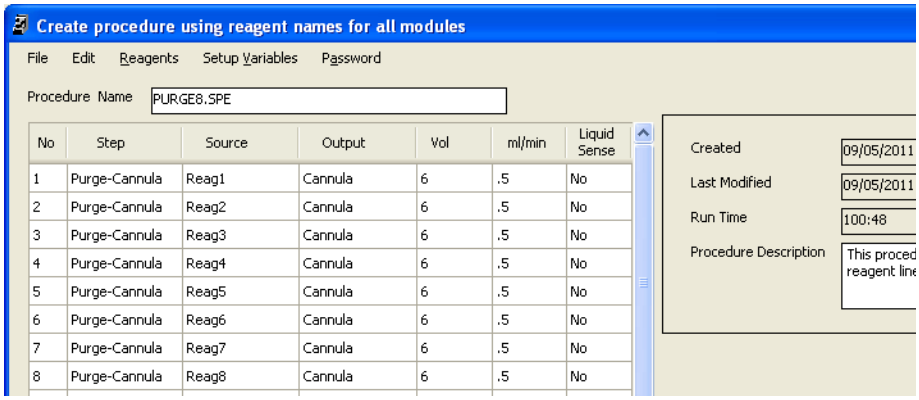


Figure 48. Purge Reagent Lines

3 If moving manifolded modules or adding a module to a manifolded workstation:

   a Assign the procedure to sample 1 in the **Setup Procedure Sequence** window.

   b Run the procedure for all modules in the workstation. A test tube must be in sample position 1 on your racks.

4 If moving modules with individual reagent lines:

   a Assign the procedure to sample 1 and 2 in the **Setup Procedure Sequence** window.

   b Run the procedure for all modules to be moved.

5 When the modules complete the procedure, check the reagent lines for fluid.

Moving Manifolded Modules

Purge Reagent Lines

Before moving modules, liquids must be removed from the reagent lines. To remove fluid from the lines, see "Purge Reagent Lines" on page 66.

Disconnect Plumbing

When liquid has been removed from the reagent lines and the power switched off, unplug the power cords and the RS-232 communications cables, and disconnect the plumbing.

WARNING

If gas is being used, turn off the gas at the gas tank first, then disconnect the gas line attached to the tank.

Disconnect Reagent and Gas Lines

WARNING

Confirm that gas has been turned off before removing the gas connection.

Locate the modules to be moved. It is easiest to remove the modules at the end of the workstation furthest from where the reagent lines are placed into the reagent bottles.

☞ *If the entire workstation is moved, it is not necessary to attach the plugs mentioned below in steps 1 and 2.*

1 Locate the plugs that came in the start-up kit in the bag labeled "Manifold pieces and plugs". There should be nine plugs per bag.

Figure 49. Plug

2 Locate the manifold pieces (see Figure 50), as described in "Identify Reagent Plumbing Setup" on page 65, and detach them from the module. Insert an extra plug in the opening. There can be up to 9 manifold pieces per module:

- 8 manifolds for reagents 1 through 8.
- 1 manifold for the gas line (if gas drying is used).

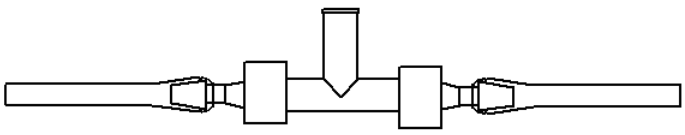


Figure 50. Manifold Plumbing Piece

3 Untwist all connectors attaching the reagent lines to the manifold pieces for the modules that are being relocated, and attach plugs to those positions on the manifold pieces.

4 If gas drying is being used, turn off the gas and then disconnect the gas lines for the modules that are being relocated (see Figure 51), and attach plugs to those positions.

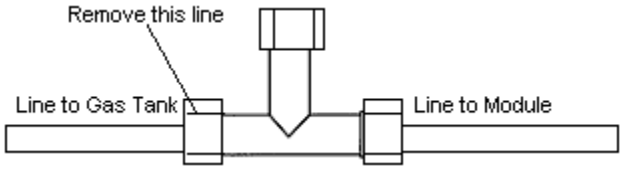


Figure 51. Gas Line

Disconnect Waste Lines

The four waste lines extend from a cutout at the base of the back of each module.

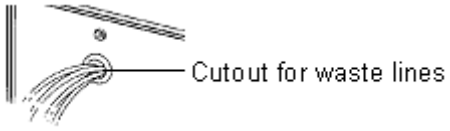


Figure 52. Cutout for Waste Lines

The lines have a twist connection, located several centimeters from the back of the module, to make the module easier to move. Locate the fittings and untwist the connection. The 3-meter (10-foot) lines remain in the waste reservoir.

You can now move the modules.

Move Modules with Individual Reagent Lines

Purge Reagent Lines

Before moving modules, liquids must be removed from the reagent lines. To remove fluid from the lines, see "Purge Reagent Lines" on page 66.

Disconnect Plumbing

When the fluid has been removed from the reagent lines and the power switched off, unplug the power cord and the RS-232 communications cables, and disconnect the plumbing.

WARNING

If gas is being used, turn off the gas at the gas tank first, then disconnect the gas line attached to the tank.

Disconnect Reagent and Gas Lines

WARNING

Confirm that gas has been turned off before removing the gas connection.

Locate the plumbing as described in "Identify Reagent Plumbing Setup" on page 65. There can be up to 9 lines per module:

- Reagents 1 through 8.
- Gas line (if gas drying is used).

Untwist each of the reagent line connections, located several centimeters from the back of the module.

If gas drying is being used, turn off the gas and then disconnect the gas lines for the modules that are being relocated (see Figure 53).

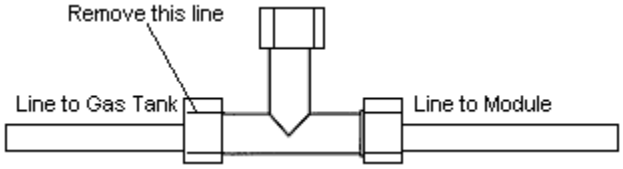


Figure 53. Gas Line

Disconnect Waste Lines

The four waste lines extend from a cutout at the base of the back of each module.

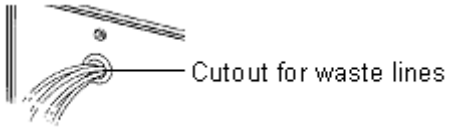


Figure 54. Cutout for Reagent and Cannula Waste Lines

The lines have a twist connection, located several centimeters from the back of the module, to make the module easier to move. Locate the fittings and untwist the connection. The 3-meter (10-foot) lines remain in the waste reservoir.

You can now move the modules.

Reconnect Modules

Reconnect the Communications Cables

1 Connect one RS-232 communications cable to the 9-pin port on the computer.

2 Plug the other end of the RS-232 cable into the bottom 9-pin port on the back of the first module.

3 For additional RapidTrace+ modules:

a Connect a second RS-232 communications cable to the top 9-pin port of the first module.

b Plug the other end of RS-232 cable into the bottom 9-pin port of the next module.

c Repeat until all modules are connected together.

Reconnect the Power Cords

Connect the power cords to entry port on the back of the RapidTrace+ modules and to the power source.

Reconnect the Reagent Lines

Reconnect the RapidTrace+ modules using the individual reagent lines provided in your start-up kit. The assembled manifolds may be used if they were in use prior to the move.

Reconnect Individual Reagent Lines

1 Match the corresponding labeled reagent line on the RapidTrace+ module with the line from the start-up kit. Tightly twist the two connectors together. Repeat for all eight lines.

2 Place the reagent lines in the reagent bottles.

For additional information on individual reagent lines, refer to “Reagent Line Configuration” on page 14.

Reconnect Assembled Manifolds

Follow the instructions below to switch manifolds from a four-module workstation to two workstations each composed of two modules.

☞ Skip to step 2 if the entire workstation has already been moved.

1 Modify the manifold string for two separate workstations by disconnecting the string at the length appropriate for the new workstation; see Figure 55.

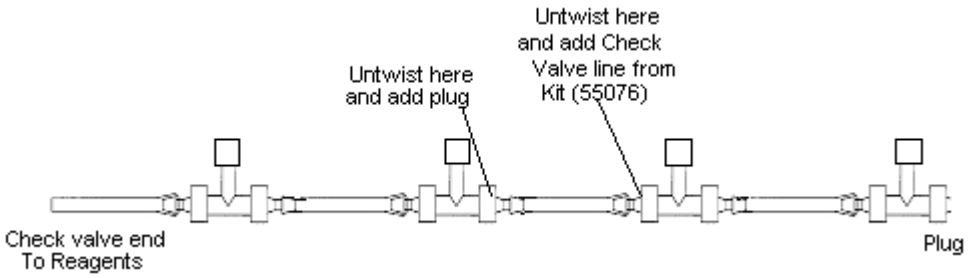


Figure 55. Disconnecting Manifold String

2 To reconnect the manifolds, work on one manifold string at a time, as each string is for a different reagent. Lay the manifold for reagent 1 on the back of the workstation with the check valve end closest to the reagent bottles.

3 If plugs are attached, remove them and connect the line for reagent 1 from each module in the workstation to the manifold. Labels in the start-up kit can be used to help identify lines. For example, if you have a two module workstation, connect the lines as shown in Figure 56.

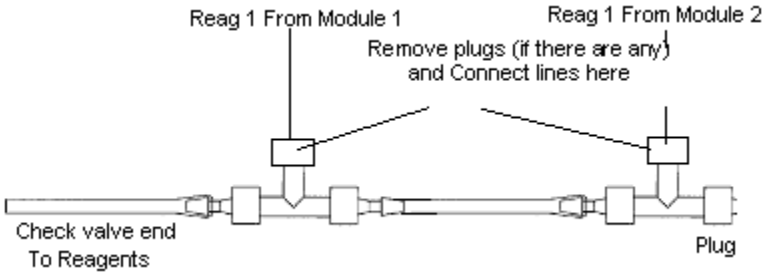


Figure 56. Reassembling Manifold String

4 Continue placing manifolds on the workstation, connecting them to each successive reagent line until all eight reagents have been completed.

5 Connect the check valves to the manifold and place them in the appropriate reagent bottle.

NOTE

Skip the following "Reconnect the Gas Lines" on page 72 section if gas drying is not to be used.

Reconnect the Gas Lines

If gas drying is to be used, connect the gas lines to the gas tank using the appropriate fittings. Follow the instructions below to reconnect the gas lines to your modules.

Reconnect a Gas Manifold

Reconnect the manifold to the gas line using the instructions for reconnecting manifolded reagents (see "Reconnect Assembled Manifolds" on page 70).

NOTE

The 1/8-inch (3.175 mm) tubing is for the gas line; while the 1/16-inch (1.59 mm) tubing is for reagents.

Reconnect an Individual Gas Line

Attach the individual gas fitting (2 types of fittings are included in the start-up kit) between the line to the gas tank and the line to the module, as shown in Figure 57.

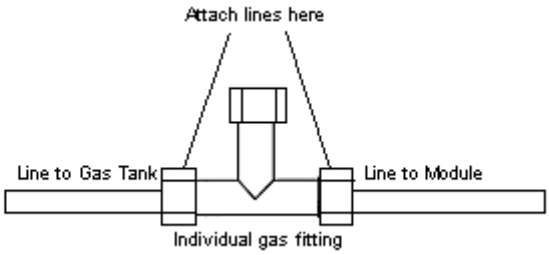


Figure 57. Connecting the Gas Line

Reconnect the Waste Lines

The 3-meter (10-foot) waste lines remained with the waste reservoirs when the modules were moved.

1 Move the 3-meter (10-foot) lines to the modules, ensuring that each line is attached to its corresponding numbered line on the module.

2 Place the line in the appropriate waste reservoir.

3 Check the **Reagent setup** window for your designation of waste 1, 2, and 3.

Add a Module to the Workstation

NOTE

Only qualified personnel should install RapidTrace+ modules.

Add the module to the end of the workstation furthest from where the reagent lines enter into the reagent bottles. Set the address of the module appropriately.

Connect the Communications Cable

1 Locate the RS-232 communications cable that goes to the computer. Disconnect this cable from the bottom 9-pin port of the module adjacent to the new module and place it into the bottom 9-pin port of the new module.

2 Attach the new RS-232 cable from the start-up kit to the top 9-pin port of the new module.

3 Plug the other end of the RS-232 cable into the bottom 9-pin port of the next adjoining module.

Connect the Power Cord

Connect the power cord to the power entry port on the back of the new module and to the power source.

Connect the Reagent Lines

You may connect the new module using individual reagent lines provided in your start-up kit, or you may add the new module to your manifolded workstation.

Connect Individual Reagent Lines

1 Match the corresponding labeled reagent line on the module with the line from the start-up kit, and tightly twist the two connectors together. Repeat for all eight lines.

2 Place the reagent lines in the reagent bottles and place them in an empty container to keep them clean.

For additional information on, refer to “Reagent Line Configuration” on page 14.

Connect a Manifold

1 Remove fluid from the reagent lines, see “Purge Reagent Lines” on page 66.

2 Locate the manifold pieces and plugs in the start-up kit. Remove two manifold pieces.

3 Insert the Luer fitting on the end of one manifold piece onto the T-connector of the next piece (Figure 58) and twist until the two manifold pieces are connected firmly.

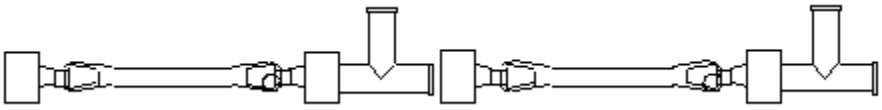


Figure 58. Connecting Two Manifold Pieces Together

4 Work on one manifold string at a time, as each string is for a different reagent. Lay the new manifold piece for reagent 1 along the back of the new module, so the tubing end faces its adjacent module.

5 Connect the line for reagent 1 from the new module to the manifold (Figure 59). Use the labels in the start-up kit to help identify the lines.

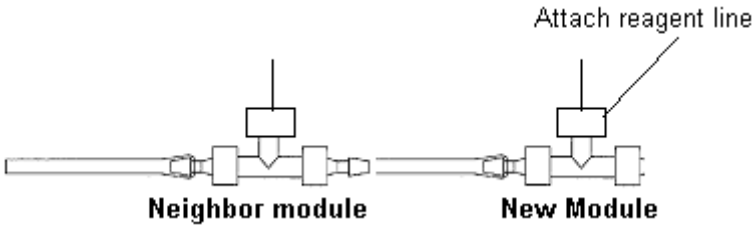


Figure 59. Connecting Two Modules Together

6 Continue placing manifolds on the workstation and connecting them to each successive reagent line until all eight reagents have been completed.

7 After appropriately cleaning the check valves, place them in the new reagent bottles.

Connect the Gas Line

If gas drying of the column bed is being used, follow the instructions below to connect the gas line to the new module.

Connect a Gas Manifold

Connect a gas manifold to the gas line at the rear of the module that is being added, as per the instructions on page 73, "Connect a Manifold", steps 2 through 5.

☞ *The gas line should already be attached to the gas tank.*

NOTE

The 1/8-inch (3.175 mm) tubing is for the gas line and the 1/16-inch (1.59 mm) tubing is for reagents.

Connect an Individual Gas Line

The start-up kit includes a 3-meter (10-foot) gas line, two types of fittings to connect the gas line to a gas supply, and an individual gas fitting.

1 Attach the 3-meter (10-foot) gas line to the gas tank using the appropriate fitting.

2 Attach the individual gas fitting between the line to the gas tank and the line to the module (Figure 60).

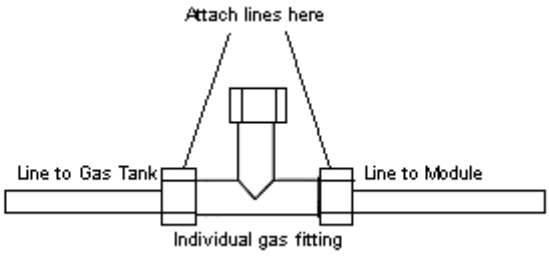


Figure 60. Connecting Gas Lines

Connect the Waste Lines

The four waste lines extend from a cutout at the base of the back of each module.

1 Locate the waste line kit within the start-up kit. These lines are 3 meters (10 feet) long and are labeled 1 through 4.

2 Attach each waste line to its corresponding numbered line on the module.

3 Place each waste line in the appropriate waste reservoir.

4 Check the **Reagent setup** window for the designation of waste lines 1, 2, and 3. There are colored labels in the start-up kit to help identify the lines.

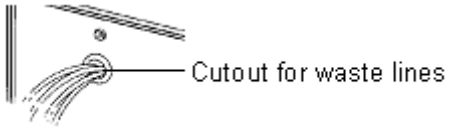


Figure 61. Cutout for Reagent and Cannula Waste Lines

Operations After Moving or Adding Additional Modules

After moving the workstation or adding additional modules, you need to run a purge test and a waste test. Begin by turning on the modules. Observe them as they initialize. Initialization is a “self test” run by a module every time it is switched on. It assures that all components of the module are in correct position to start running samples, and it confirms that the module is properly functioning. If an error is encountered during initialization, the error LED illuminates. (Refer to “Initialization” on page 26.)

Purge Test

Run a purge test for all modules in your workstation to prime the lines with reagent and check for leaks.

1 Write a procedure to purge the reagent lines taking the miscibility of the reagents into account. An example of a procedure for eight reagents is shown in Figure 62.

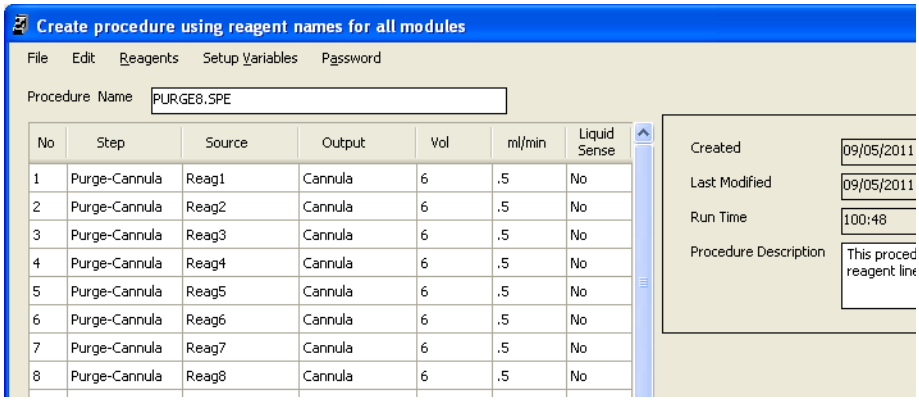


Figure 62. Purge Reagent Lines

2 In the **Setup Procedure Sequence** window, assign the procedure to samples 1 and 2.

While the test is running:

- Check that there are no leaks in the fluid path.
- Check that air is not being pulled in once the lines are primed.
- The lines should be fully primed by the start of the second sample.

☞ *If leaks are noted, retighten fittings.*

Waste Test

Write a procedure to test for leaks in the waste lines using appropriate reagents for specific waste lines (i.e., aqueous, organic, etc.).

While performing the test, check the back of the modules for leaks in the waste fluid path and retighten fittings as necessary.

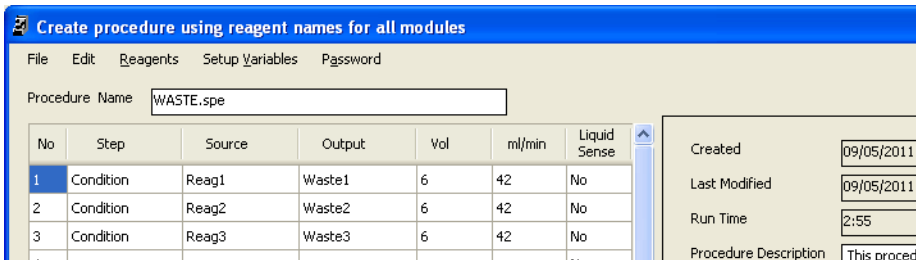


Figure 63. Waste Test

Service

Remove the Front Cover

The front cover on the RapidTrace+ module protects the valve, syringe, and syringe drive. If you need to access any of these parts, you must remove the front cover. You do not have to remove the front cover to access the **Run** button on the front of the RapidTrace+ module.

WARNING

Reassemble all covers before operating the RapidTrace+ module.

To remove the front cover:

1 Grasp the lower sides of the front cover.

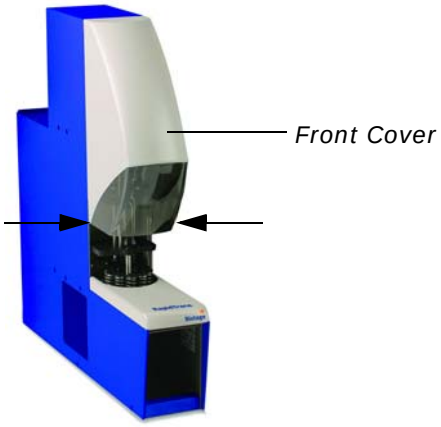


Figure 64. Front Cover

2 Lift the cover straight up to clear the cover locating pins (shown in Figure 65) at the top of the RapidTrace+ module, then toward the front, away from the RapidTrace+ module.

Figure 65. Front Cover Locating Pins

Gas Drying Conversion

As shipped, the RapidTrace+ modules are not set up for gas drying of the column bed. To use gas drying, you must change the plumbing.

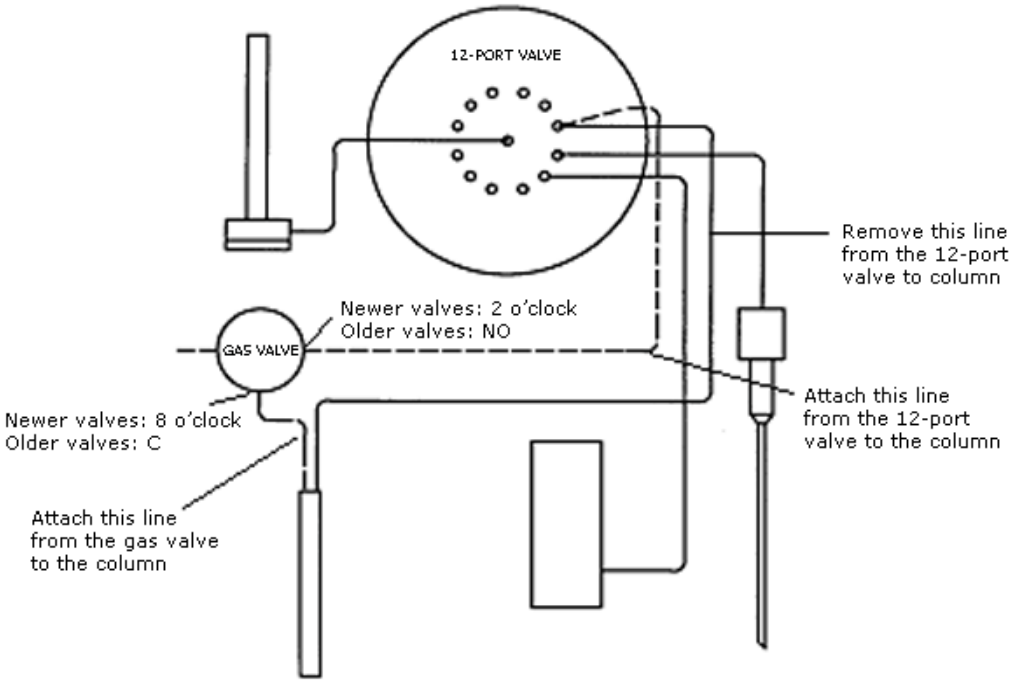


Figure 66. External Plumbing Diagram

WARNING

Never use hydrogen or other flammable gases. Use of inappropriate gas may cause combustion or an explosion.

WARNING

Liquid exiting the solvent and sample waste lines can be infectious, toxic, flammable, and/or corrosive. Refer to the Safety Data Sheet (SDS) for detailed information regarding chemicals used in your applications.

- *Do not touch waste.*
- *Keep waste from heat or flame.*
- *Dispose of waste properly.*
- *Periodically check waste lines for damage.*
- *Make sure that the flow is not inhibited and that the waste reservoirs are large enough to hold waste generated.*

1 Remove both ends of the line that connects the 12-port valve to the column plunger. See the diagram above and "RapidTrace+ Parts and Functions" on page 19 for the location of parts.

2 Locate the 37 cm(14.6 in) line in the gas conversion kit (labeled #3) and attach it as follows:.

   a Attach the line end with the compression screw to the gas valve port located at approximately the eight o'clock position. On older valves, connect to the valve's Common (C) port.

   b Attach the other end of the line to the column by pushing it onto the column plunger.

3 Locate the 16.5 cm (6.5 in) line in the gas conversion kit (labeled #1) and attach it as follows:.

   a Attach the line end with the compression screw to the gas valve port at approximately the two o'clock position. On older valves, connect to the valve's Normally Open (NO) port.

   b Attach the other end of the line to the 12-port valve position that you removed the line from in step 1.

Unblock a Syringe Discharge Tube

The syringe discharge tube is the horizontal stainless steel tube that connects the base of the syringe to the 12-port valve. If this tube becomes blocked, a “blocked syringe discharge” error message displays.

WARNING

Always use extreme care when handling fluids in the laboratory.

To unblock the syringe discharge tube, follow the procedure below.

1 Click the **Manual Control** button in the main window of the RapidTrace+ Methods Development or Production software.

2 Turn the 12-port valve to the reagent bottle containing water using the **Twelve Port Valve** command.

☞ *For most applications, water should be “Reagent1”.*

3 Fill the syringe with 6 ml of water using the **Syringe Position** command.

4 Place a small beaker or other appropriate vessel under the syringe discharge tube to collect liquid.

5 Disconnect the small length of PTFE tubing running from the syringe discharge tube to the 12-port valve.

6 Set the syringe speed to 42 ml/min or 0.7 ml/sec using the **Syringe Speed** command. This is the fastest syringe speed.

7 Set the syringe position to 0 ml using the **Syringe Position** command, to rapidly empty the syringe and removing the blockage to the beaker.

8 Reconnect the PTFE tubing to the syringe and the 12-port valve.

9 Send the **Warm Start!** command to re-initialize the module and confirm that the syringe discharge is unblocked.

10 If the syringe discharge is still blocked, repeat the above steps, but change the syringe speed in step 6 to 6 ml/min or 0.1 ml/sec. The slower motor speed produces more torque, which may help to remove the blockage.

11 If the blockage cannot be removed, replace the syringe assembly.

Upgrade the RapidTrace+ Firmware

☞ *Firmware can only be downloaded to one module at a time.The firmware always loads to module 0; therefore, set the number switch of each module to 0 when loading the firmware. Only one module at the time can be designated as module 0; ensure that each module has a unique number assigned to it before starting the download.*

NOTE

A maximum of five modules can be connected when downloading the firmware to a module.

The following procedure downloads the RapidTrace+ firmware to each of the modules.

1 If you have more than 5 modules, disconnect module 5 from module 4.

2 Ensure that all connected modules are switched on and that they have a unique number between 0 and 4 (if having 5 modules connected). To change a number, use the switch on the front of the module.

3 To load the firmware onto module 0, double-click the `Load_rt13.bat` or `Load_rt136.bat` file in the `C:\Program Files\Biotage\RapidTrace SPE\RLoad` directory. The `Load_rt136.bat` file must be used if the new opto sensor used with the 40 ml scintillation vials rack (P/N C133989) is installed on the module. If the new opto sensor is not installed, the `Load_rt13.bat` file must be used.

4 A DOS window displays the message `Loading RapidTrace Firmware. Please Wait…` Watch module 0 as the firmware is being loaded. Confirm that the power, run, and error LEDs at the front of the module are lit, indicating that loading is occurring. The computer displays a “busy” cursor.

5 When loading stops (the cursor on the computer stops spinning), check that module 0 initializes.

6 If any of these steps in steps 4 and 5 do not perform, check your setup and double-click the `Load_rt13.bat` or `Load_rt136.bat` file again.

7 When the firmware has been loaded onto module 0, set the number switch on the front of module 0 to the number that is used on the next module to be upgraded and set the switch on the next module to be upgraded to 0.

8 Repeat steps 3 through 7 for each additional module that are connected.

9 When all the modules have been upgraded, set the number switches back to as they where before you started loading firmware to the modules.

10 If you have more than 5 RapidTrace^{+} modules:

a Disconnect module 0 from the computer.

b Connect module 5 directly to the computer.

c Using the switch on the front of each module, set modules 5 through 9 to modules 0 through 4,

d Repeat the above download procedure for all modules; see steps 2 through 7.

e When all the modules have been upgraded, set the number switches back to as they where before you started loading firmware to the modules.

f Connect module 0 to the computer and connect module 5 to module 4.

Troubleshooting

This section shows some potential problems and gives possible solutions for each problem. If other problems occur or if the problem is not corrected, contact Biotage 1-Point Support for assistance (see page 2).

Problem	Possible Solution
Sample/fraction test tube/vial not detected	• Check for missing test tube or vial, or wrong test tube or vial type. • Ensure that all fraction and sample test tubes or vials are in place. • Use glass test tubes or vials if possible. • Clean the opto sensor with a cotton swab dipped in isopropyl alcohol. • Go to the **Manual Control** window. Fill the rack with test tubes or vials. Send the **Shuttle Waste** command. Send the **Rack?** command. The **Reply Message** should read “Rack XXXX 03FF 03FF”. If not, adjust the opto sensor position by loosening the thumbscrew located at the bottom of the opto sensor.
12-port valve positioning error	• Turn the brass disc on the back of the 12-port valve through 2 full rotations. Access this valve through the slit in the side of the module, or by removing the upper section cover. • Resume the run.
Blocked syringe discharge	• See “Unblock a Syringe Discharge Tube” on page 79.
Rack missing or not centered on shuttle	• Confirm that the rack is properly engaged on the two pins of the shuttle. • In the **Manual Control** window, send the **Shuttle Waste** command. The error LED should not be lit. Send the **Status?** command. The **Reply Message** should show “Stopped” not “Error”.
Column bed not aligned, not sensed, or too small	• Confirm that the columns are properly installed and that the turret is aligned with the column plunger. • In the **Manual Control** window, send the **Warm Start!** command. When initialization is complete, restart the run. Refer to “Column Bed - General” on page 88 for more information.
Magnetic rack error messages display, or wrong procedure runs	• If magnetically encoded racks have not been configured, do not use the **Start**/**Stop** button on the module. Instead, start and stop runs by using the buttons in the **Run RapidTrace** window. • If magnetically encoded racks have been configured, re-check the procedure assignments and make any necessary changes before re-starting. See “Use Magnetically Encoded Racks” on page 49.
Run All button disappears in the **Run RapidTrace** window	• The **Run All** button is only available when all modules are running the same procedure. • The **Run All** button may not display in earlier versions of the RapidTrace+ software. Upgrade to the latest version.
Module does not start after the **Run** button is pressed	• Check to ensure that the correct procedure is assigned to the correct module and that all vials and/or test tubes and columns are in place. • Go to the **Manual Control** window. Send the **Warm Start!** Command to re-initialize the module. Restart the run from the **Run RapidTrace** window when initialization is complete.

Problem	Possible Solution
`Device Unavailable` message displays, or assigned procedures disappear when **Run RapidTrace** window initializes	• Check and tighten the connections between the modules and the computer. • Delete and re-enter the communications port number. Confirm that the proper port is assigned under the **Comm Port** menu. • Switch communications port to rule out port failure. • Switch all modules and the computer off, wait 10 seconds, and restart the computer and the modules.
Syringe leaking above plunger	• Remove knurled nuts from bottom of syringe to remove the black plate and the syringe base. Turn the glass barrel to reset the PTFE seal and reassemble. • Restart the run. If the syringe continues to leak, replace the syringe.
Syringe leaking at base	• Remove knurled nuts from bottom of syringe to remove the black plate and the syringe base. Re-seat the syringe base and reassemble. • Restart the run. If the syringe continues to leak, replace the syringe. Attempt to determine the cause of the syringe leakage, and resolve the problem before restarting the run. The most common reasons are: • Particulate in the sample. • The flow rate in the procedure is too fast causing excessive pressure. If the particulate in the sample caused the problem, evaluate the initial sample preparation to prevent this from happening. If the flow rate is too fast, reduce the flow rate.
Clogged fluid path at cannula, column plunger, or waste station	• Run a test sample using water to determine exactly where the clog occurs. • Run the appropriate “plunger routine” command in the **Manual Control** window. Before running, fill a sample test tube and the mixing vessel with 2M NaOH and place the waste lines in a beaker of 2M NaOH.
Air bubbles in reagent lines Tubing falls out of fittings Lines do not stay primed	• Order retaining clips from Biotage (P/N C38413) and install them on fittings to hold tubing in place.
O-rings on column plunger need to be replaced often	• Inspect the columns. Look for packing material on inside of column. Discontinue using those columns. • For 1 ml columns, order replacement O-ring (P/N C60969). For 3 ml columns, order replacement O-ring (P/N C45096). For 6 ml columns, order replacement O-ring (P/N C46643).

Replace the Fuses

Each RapidTrace+ module is equipped with a universal AC power entry port. The same fuses are used for 100 - 240 VAC. This section describes how to replace the fuses.

WARNING

Electrical shock hazard; switch the power off and disconnect the power cord before changing the fuses. For continued fire protection and correct functioning of the module, replace fuses only with fuses of the same type and rating.

Tools needed: Small, flat-bladed screwdriver.

To replace the fuses on a RapidTrace+ module:

1 Switch the power off and unplug the power cord from the power source and the power entry port on the back of the module.

2 Using a small, flat-bladed screwdriver, gently pry the fuse cover open. The fuse cover is connected to the power entry port, and does not come off. Open the fuse cover fully. The power cord must be removed before the fuse cover will open.

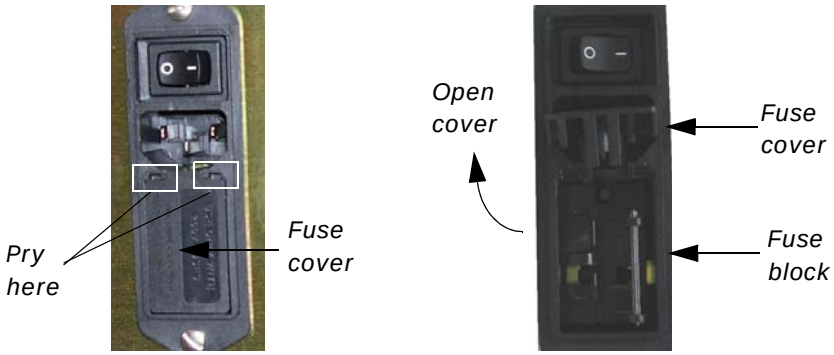


Figure 67. Opening the Fuse Cover

3 Using a small, flat-bladed screwdriver, gently pry the fuse block out of the power entry port housing.

4 Remove the two 1.6 A fuses.

5 Install two new 1.6 A fuses as shown in Figure 68.

100 - 240 VAC	(2) 1.6 Amp, 5 x 20 mm, Fast Acting, (P/N C47254)

Figure 68. Fuse Configuration

6 Place the fuse block into the power entry port with the fuses toward the inside of the power entry port. The hole in the fuse block must line up with the pin in the power entry port housing as shown in Figure 69.

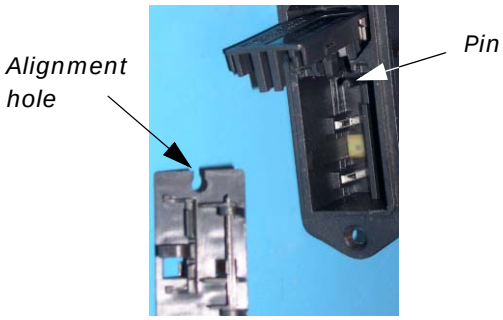


Figure 69. Installing the Fuse Block

7 Close the fuse cover and press so it snaps into place.

8 Connect the power cord to the power entry port on the back of the module and to the power source.

9 Switch the RapidTrace+ module on. The module should initialize immediately.

☞ *If the RapidTrace+ module does not immediately initialize, confirm that the correct fuses have been installed and that the fuses are correctly seated.*

Long Term Shutdown

Occasionally the RapidTrace+ workstation may be taken out of service for a prolonged period. It is very important to prepare the modules for downtime.

To prevent “salting-out” of buffers and corrosion from any acid used, rinse the reagent lines with water. Removing the standard reagent set and rinsing with water is essential.

NOTES

- *Do not allow water to sit in the fluid path and valve with no movement for an extended period of time (i.e., approximately ten days or more).*
- *Standing water in the lines can cause bacteria growth (especially in warm, humid environments). Rust may form in the brazed fittings of the 12-port valve.*

If a RapidTrace+ workstation will not be used for an extended period of time (i.e., approximately ten days or more), it must be kept clean and **dry**. Follow the procedure below.

Shutdown Procedure

Use the following procedure to safely and effectively prepare the RapidTrace+ workstation for long-term shutdown. By removing all traces of water, the chance of bacterial growth and/or rust is eliminated. The methanol disinfects the fluid path and any traces quickly evaporate. Run this procedure on all modules.

NOTE

If running 6 ml columns, ensure that sample positions 1, 3, 5, 7, and 9 are selected.

1 Run CLEAN.SPE - one sample of 8 ml 2M NaOH, one sample of 8 ml 2M HNO_3.

2 Create the procedure shown in Figure 70.

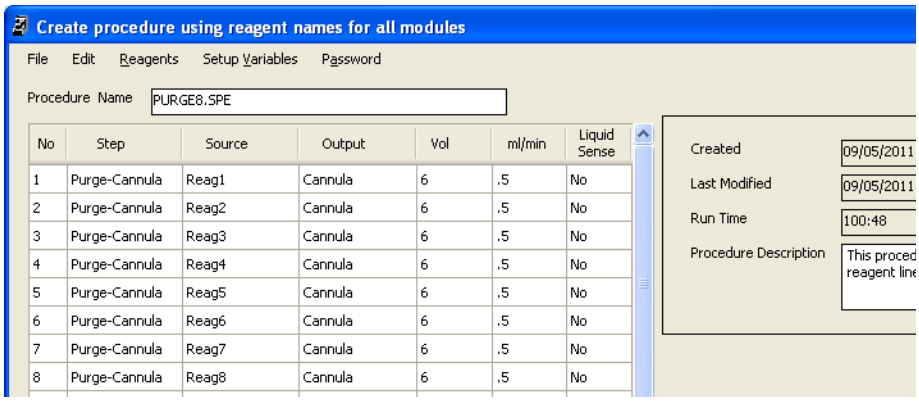


Figure 70. Purge Reagents

3 Remove all reagent lines from the reagent bottles and run the procedure created in step 2 above (PURGE8.SPE).

4 Place all reagent lines into a large beaker of deionized water and run PURGE8.SPE.

5 Remove all reagent lines from water beaker and run PURGE8.SPE.

6 Place all reagent lines into a large beaker of methanol and run PURGE8.SPE.

7 Remove all reagent lines from the methanol beaker and run PURGE8.SPE.

8 Turn all modules off.

9 Decontaminate the exterior of the RapidTrace$^+$ module based on the use of the module and the samples and reagents used.

WARNING

Liquids used with the RapidTrace$^+$ workstation can be infectious, toxic, flammable and/or corrosive. Refer to the SDS (Safety Data Sheet) for detailed information regarding chemicals used in your applications. Handle all samples using good laboratory practices to prevent biohazards.

Reference Data

Specifications

Power	100–240 VAC ± 10%
Frequency	50–60 Hz
Fuses	1.6 Amp, 5 x 20 mm, fast acting, P/N C47254
Weight (per Module)	14.5 kg (32 lbs)
Dimensions (W x D x H per Module)	10 x 55 x 60 cm (3.9 x 21.7 x 23.6 in)
Operating Temperature	59°F to 95°F (15°C to 35°C)
Operating Humidity	0% to 85% relative humidity, non-condensing
Storage Temperature	50°F to 122°F (10°C to 50°C)
Altitude	Up to 2000 m
Indoor Use Only	
Column Size	1, 3, or 6 ml
Sample Size	0.1 to 14 ml or 0.1 to 40 ml*) * If upgraded with the new opto sensor (P/N C133967)
Syringe Pump	Load volumes between 0.1 ml and 5.8 ml
Flow Rates	0.048 ml/min to 42 ml/min (0.0008 ml/sec to 0.7 ml/sec)
Liquid Handling Accuracy	3.0 ml ± 1%
Mixing Capability Cycle	Maximum mixing volume of 5.0 ml in mixer
Liquid Sensing	Volumes of 1.2 ml or larger
Solvent Inlets	8 reagent inlets, individually configurable aspirate/dispense rates
Waste Outlets	4 separate, organic, aqueous and biological waste
Gas Inlet (Optional Feature)	1-gas inlet, 2.8 bar (40 psi) maximum
Compressed Gas Supply Inlet Pressure	0.7 bar (10 psi) minimum 2.8 bar (40 psi) maximum
Connections	RS232 Input: Connects the module to the computer RS232 Output: Used when multiple modules are connected
Heat Output (per Module)	50-100 watts
Ventilation/Cooling	RapidTrace is cooled by the exhaust fan located at the rear of the module.
Grounding	RapidTrace$^+$ is grounded through the three-pronged power cord and through the grounding terminal in the power entry module located at the rear of the module.
Mounting	RapidTrace$^+$ should be mounted only in a horizontal position on a flat, sturdy surface.

Column Bed - General

The 3 ml RapidTrace^{+} is capable of running any column in the 1 or 3ml syringe type format, with a bed height between 0.14 cm and 5.9 cm.

The 6 ml RapidTrace^{+} is capable of running any column in the 1, 3, or 6 ml syringe type format, with a bed height between 0.14 cm and 5.9 cm.

To measure the bed height, measure from the Luer tip to the top of the frit in the column.

Solvent Compatibility Chart

The RapidTrace+ fluid path contains PTFE, stainless steel and polypropylene. Refer to the chart below for reagent compatibility with these materials.

Solvent		PTFE Lines	Stainless Steel	Polypropylene[1]
Acetic Acid	CH_3COOH	YES	YES	YES
Acetone	$(CH_3)_2CO$	YES	YES	YES
Acetonitrile	CH_3CN	YES	YES	Can cause problem
Ammonia	NH_3	YES	YES	YES
Ammonium hydroxide	NH_4OH	YES	YES	YES
Aqueous Buffer Solutions		Rinse with H_2O before using organic solvents	YES	YES
Chloroform	$CHCl_3$	YES	YES	Can cause problem
Dichloromethane (DCM)	CH_2Cl_2	YES	YES	Can cause problem
Ethyl Acetate (EA)	$CH_3COOCH_2CH_3$	YES	YES	YES
Formic Acid 0.1%	HCO_2H	YES	YES	YES
Hexane	C_6H_{14}	YES	YES	YES
Hydrogen Chloride	HCl	YES	YES[2]	YES
Isopropanol (IPA)	C_3H_8O	YES	YES	YES
Methanol (MeOH)	CH_3OH	YES	YES	YES
Nitric Acid (to 2M)	HNO_3	YES	Rinse with H_2O after use	YES
Sodium Hydroxide (to 2M)	NaOH	YES	YES	YES
Sulfuric Acid	H_2SO_4		YES[3]	
Water	H_2O	YES	YES	YES

NOTES

1 *Polypropylene is used in the check valve housing, mixing chamber, and wash and waste stations.*

2 *HCl at concentrations greater than 0.1M can attack stainless steel and is not recommended. Always rinse the entire fluid path with water immediately after using solutions containing HCl.*

3 *H_2SO_4 at concentrations greater than 0.01M can attack stainless steel and is not recommended. Always rinse the entire fluid path thoroughly after use.*

4 *For best performance, always rinse the entire fluid path thoroughly after use.*

5 *For information on compatibility with other solvents, contact the Biotage 1-Point Support (see page 2).*

Flow Rate Conversion Chart

ml/sec	ml/min
0.0008	0.048
0.0009	0.054
0.001	0.06
0.002	0.12
0.003	0.18
0.004	0.24
0.005	0.3
0.006	0.36
0.007	0.42
0.008	0.48
0.009	0.54
0.01	0.6
0.02	1.2
0.03	1.8
0.04	2.4
0.05	3.0
0.06	3.6
0.07	4.2
0.08	4.8
0.09	5.4
0.1	6.0
0.2	12
0.3	18
0.4	24
0.5	30
0.6	36
0.7	42

Accessories and Kits

NOTE

All part numbers are subject to change without notice.

For ordering information, please refer to "Contact Biotage 1-Point Support" on page 2.

Part Number	Description	Comments
C60969	1 ml SPE O-Ring, CHEMRAZ™	Replacement O-ring for the syringe plunger, qty 1
C45096	3 ml SPE O-Ring, CHEMRAZ	Replacement O-ring for the syringe plunger, qty 1
C46643	6 ml SPE O-Ring, CHEMRAZ	Replacement O-ring for the syringe plunger, qty 1
C58526	Waste Station O-Ring, CHEMRAZ	Qty 3
C50973	Tubing Weight Kit for Reagent Lines	Set of eight weights
C38413	Retaining Clips	Hold tubing in place
C50974	Rack, 13x100 mm Sample Tube & 12x75 mm Fraction Tube	Qty 1
C50976	Tube Rack, 13x100 mm Sample Tube & 12x75 mm Fraction Tube	Qty 5
C58309	Rack, 13x100 mm Sample Tubes & 13x100 mm Fraction Tube	Qty 1
C56786	Rack, 16x100 mm Sample Tubes & 16x100 mm Fraction Tube	Qty 1
C56536	Rack, 13x100 mm Sample Tubes & 12x75 mm Fraction Tube (9 Position Chilled Rack)	Qty 1
C133989	Rack, 40 ml Scintillation Vial & 16x100 mm Fraction Tubes	Qty 1
C54405	Magnet Kit for Encoding Racks	10 magnets for encoding racks
C44651	12x75 mm Test Tubes, Uncapped	Qty 1000
C40707	13x100 mm Test Tubes, Uncapped	Qty 1000
C40708	16x100 mm Test Tubes, Uncapped	Qty 1000
C55091	11 mm Vial Adapter	For use with the standard rack (C50974) to collect fractions directly into GC vials, qty 10
C55827	4 ml Vial Adapter	For use with the standard rack (C50974) to collect fractions directly into GC vials, qty 10
C52229	1 ml Column Plunger	

Part Number	Description	Comments
C52231	3 ml Column Plunger	
C69983	6 ml Column Plunger	
C52006	RapidTrace^{+} Start-Up Kit w. Software	Contains one RapidTrace^{+} Software CD (P/N C125300), Validation CD, and tubing kit
C52232	Cannula Replacement Kit	
C52234	Syringe Kit	Available through service only
C52689	RapidTrace^{+} Notebook Controller	Contact Biotage 1-Point Support
C55076	Check Valve Kit for Manifold Reagent Lines	Set of 8 check valves
C57144	Spare Fittings and Tubing Kit	
C57145	1 ml Blank Columns and Spacers	Contains 10 each
C59806	Gas Conversion Lines Kit	
C59807	1 ml Adapter Sleeve Kit	Qty 11
C58728	3 ml SPE Gel adapter kit	
C58759	1 ml SPE Gel adapter kit	
C133967	40 ml Rack Upgrade with Sensor	Contains sensor, software and one 40 ml sample rack
C133969	6 ml Turret Upgrade Kit	Contains 6 ml turret, software and adaptors for 1 and 3 ml columns

Glossary

Analyte	The molecule of interest in the sample that is to be isolated.
Anion Exchange	An ionic exchange mechanism whereby the functional groups on the sorbent are cationic, or positively charged.
Bed Size	The mass of packing material in the column.
Cartridge	The container holding the phase. The cartridge may be referred to as “tube” or “column”. This manual uses the term “column”.
Cation Exchange	An ionic exchange mechanism where the functional groups on the sorbent are anionic, or negatively charged.
Collect	The action used to remove analyte(s) of interest from the column. May be done in single or multiple steps. May be referred to as “collecting fraction(s)”.
Column Bed	Refers to the material packed into the column.
Condition	The step(s) used to prepare the column bed to bind the analyte(s) of interest, which is/are the first step(s) in most SPE procedures. Referred to as “solvation” or “activation” of the column bed.
Derivatize	A step done, post extraction, to bind a group to the analyte to enhance detection.
Elute	The step(s) used to remove analyte(s) of interest from the column. May be done in single or multiple steps.
Fraction	When analyte(s) are eluted from the column, they are eluted into volumes called fractions. Single or multiple fractions may be collected.
Ion Exchange	This interaction occurs between an analyte carrying a charge (positive or negative) and a sorbent with the opposite charge.
Load	The step when the sample is put onto the column bed.
Matrix	The initial sample, which is most commonly plasma, urine, or serum. May also be tissue extracts, or other bodily fluids such as bile, meconium, etc.
Mixed Mode	The chemistry used to achieve the separation in “multiple” modes, or more than one mode. The two or more “modes” are “mixed” together in the column.
Mode	Means used to achieve the separation, for example, in a reverse phase separation, the mode of the separation is reverse phase.
Normal Phase	Refers to the chemistry occurring when polar interactions, such as hydrogen bonding, dipole/dipole, and a variety of other interactions, occur between the functional group of the sorbent group and the bonds of the analyte. Common normal phase sorbents are CN, NH_2, and Si.

Packing Material	The material used to achieve the separation.
Particle Size	The size of the silica (and other packing material) in the column. In most SPE columns, the particle size is 40-120 microns. HPLC columns are 4 microns and larger.
Phase	The type of packing material in the column.
Polymeric Resin	Some SPE columns are based on a solid phase made of polymers, rather than silica.
Reverse Phase	Refers to the chemistry occurring when non-polar interactions occur between the carbon-hydrogen bonds on the functional group of the sorbent group and the carbon-hydrogen bonds of the analyte. Common reverse phase sorbents are C18, C8, CH, and PH.
Rinse	The step(s) used to flush the column with reagent to remove unwanted species after the sample is applied. Sometimes called “wash”.
Silica	The base material used for the binding of functional groups.
Soft Gel	Some SPE columns are packed with a gel based material, rather than silica.
Sorbent	The material packed into the column, commonly a silica with a functional group bound to it.
Syringe Type Format	The design of the column used on the RapidTrace^{+} workstation, which looks like the barrel of a syringe.
Wash	The step(s) used to flush the column with reagent to remove unwanted species after the sample is applied. May be called “rinse”.

Appendix

RapidTrace+ Procedure Checker - Overview

RapidTrace+ Procedure Checker software assists the user in creating optimal and efficient procedures for the RapidTrace+ workstation. RapidTrace+ Procedure Checker is installed with the RapidTrace+ software.

RapidTrace+ Procedure Checker offers valuable assistance to the user in two important ways:

- Identifies procedural oversights and errors.
- Suggests ways to optimize and improve procedure efficiency.

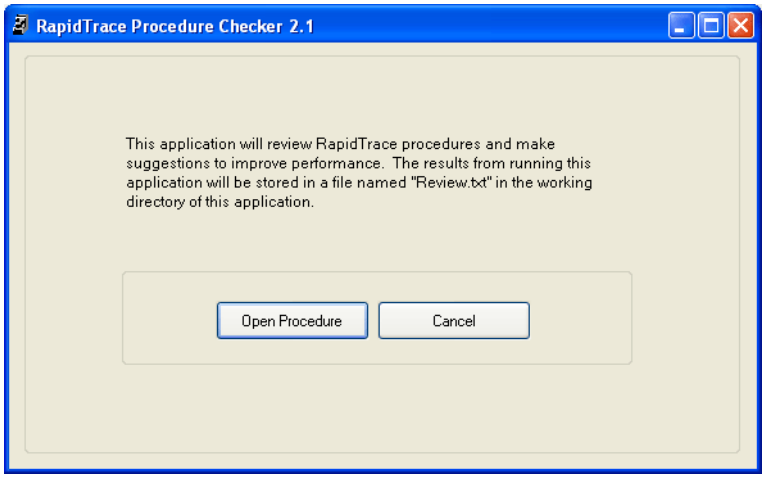
The goal for any RapidTrace+ procedure is an extraction that yields a reproducible result, with a high recovery and low levels of carryover. If the procedure analyzed by RapidTrace+ Procedure Checker meets these requirements, carefully review the recommendations made by the software to determine if they are applicable for that procedure.

A RapidTrace+ procedure may be checked with RapidTrace+ Procedure Checker either before or after the procedure has been run. If the procedure operates effectively, no changes need to be made.

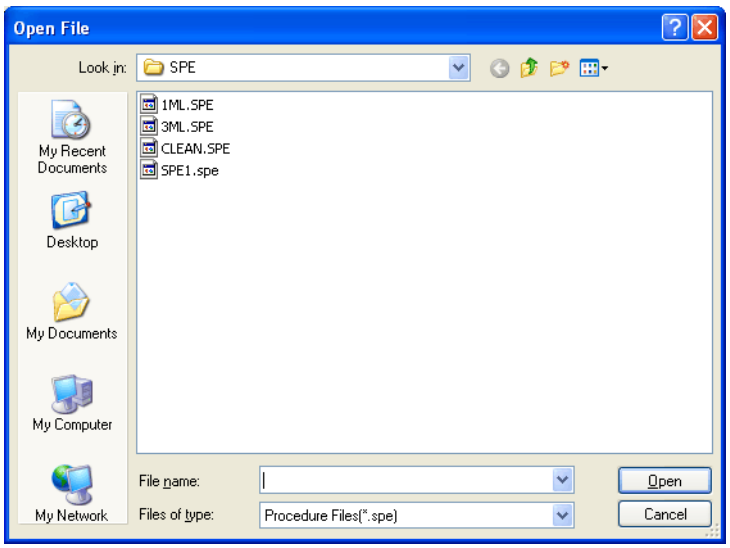
RapidTrace+ Procedure Checker recommends changes if shortcomings or errors are encountered. Suggestions made by the software should be considered as guides to improving procedure performance. It is not necessary to incorporate any or all suggestions offered by RapidTrace+ Procedure Checker.

Use RapidTrace+ Procedure Checker

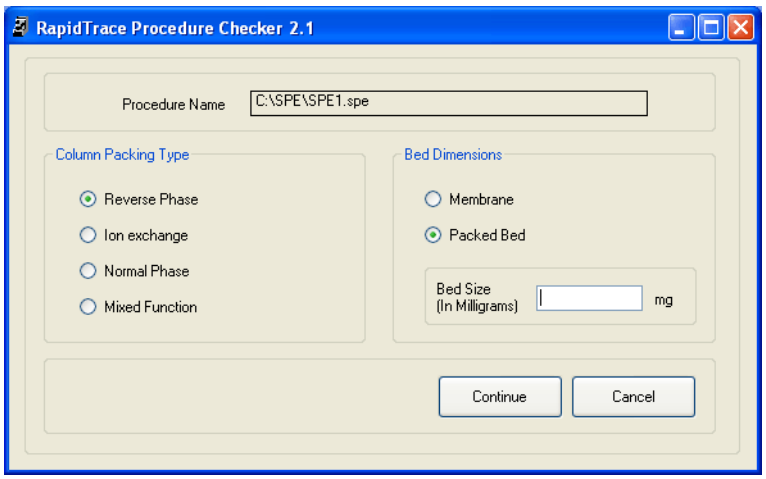
1 Select **Start→Programs→Biotage→RapidTrace SPE→Procedure Checker** or double-click the **Procedure Checker** desktop icon. The Rapid Procedure Checker software opens.



2 Click the **Open Procedure** button.The **Open File** dialog box opens and lists all of the RapidTrace+ procedures in the `C:\SPE` directory. The extension for procedure files in RapidTrace+ is ".spe".



3 Select the desired procedure file in the **File name** text box and click the **Open** button. The procedure is opened in the RapidTrace+ Procedure Checker software.



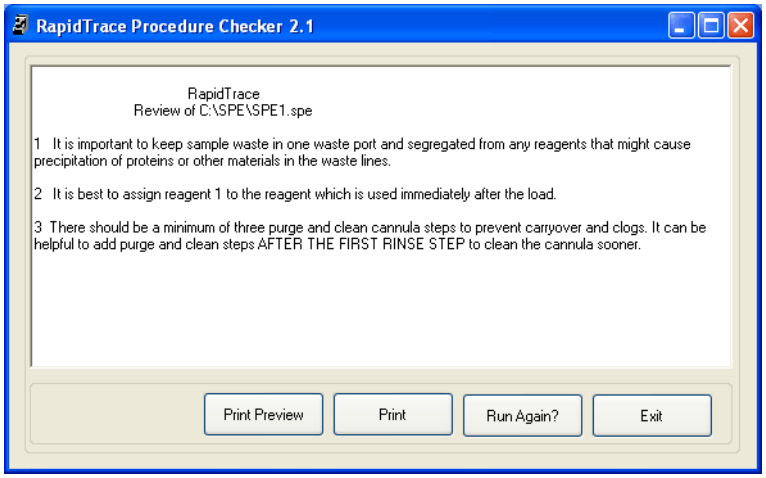
4 Select the desired **Column Packing Type** option: Reverse Phase, Ion Exchange, Normal Phase, or Mixed Function.

5 Select the desired **Bed Dimensions** option: Membrane or Packed Bed.

6 If the **Packed Bed** option is selected, enter the volume of packing material in milligrams in the column, or the bed volume, in the **Bed Size** text box.

Bed volume must be less than 1500 mg.

7 Click the **Continue** button to review the selected procedure. When the review is completed, the results are displayed.



8 To print the comments and suggestions, click the **Print** button.

The software stores these comments and suggestions in an automatically generated file called `review.txt` in the `C:\SPE` directory. This file can be read by opening it in a word processor. Each time a procedure is run through RapidTrace+ Procedure Checker, a new `review.txt` file is generated.

To save the `review.txt` file for later reference, rename it in Windows Explorer. This will prevent it from being overwritten the next time a procedure is reviewed.

9 To check another procedure, click the **Run Again?** button.

10 To close RapidTrace+ Procedure Checker, click the **Exit** button.

11 To edit the procedure using suggestions from RapidTrace+ Procedure Checker, see "Edit a Procedure" on page 38.

Support

North America
Phone: +1 800 446 4752 press 3
Outside US: +1 704 654 4900
Fax: +1 704 654 4917
US-1-pointsupport@biotage.com

Europe
Phone: +46 18 56 59 11
Fax: +46 18 56 57 11
EU-1-pointsupport@biotage.com

Japan
Phone: +81 3 5627 3123
Fax: +81 3 5627 3121
JP-1-pointsupportjpn@biotage.com

Order

North America
Phone: +1 704 654 4900
Fax: +1 704 654 4917
ordermailbox@biotage.com

Europe
Phone: +46 18 56 57 10
Fax: +46 18 56 57 05
order@biotage.com

Japan
Phone: +81 3 5627 3123
Fax: +81 3 5627 3121
jp_order@biotage.com

Distributors

Please visit our website
www.biotage.com
for contact details.

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