



INSTRUCTION MANUAL

**SC110 SPEEDVAC® CONCENTRATOR
SC110A/SC210A SPEEDVAC® PLUS CONCENTRATORS**

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1.0 DESCRIPTION

The Savant SC110 SpeedVac® and SC110A/SC210A SpeedVac® Plus centrifugal vacuum concentrators rapidly evaporate liquids to concentrate or dry solutes, analytes, and residues in aqueous and organic solvents.

Vacuum, applied to the sample chamber from an external source, promotes solvent evaporation. As the rotor in the concentrator spins, centrifugal force keeps samples from foaming or bumping, preventing sample loss. Superior analyte recovery results.

Typical applications include concentrating or drying oligonucleotides, ethanol precipitates of DNA, hydrolysates of proteins, chromatography fractions, solid phase eluants, liquid/liquid extracts, and samples for analysis by HPLC, GC/MS, immunoassay, and bioassay. SpeedVac® concentrators are also used in organic chemistry residue analysis, such as pesticide and drug testing.

- The SpeedVac® SC110 model includes a built-in manual bleeder valve on top of the unit to the right rear. This instruction manual contains an explicit operating sequence (see section 3.4, **SPEEDVAC® SC110 OPERATION**) that the user must follow to ensure vacuum is applied to the sample chamber only when the samples are spinning.
- The SpeedVac® Plus SC110A/SC210A models include an automatic valve that ensures application of vacuum at the appropriate time, without user intervention.

All SpeedVac® concentrators include a chamber heater to effectively counteract evaporative cooling and accelerate drying rate. The operator can select low (chamber at ambient temperature), medium (chamber at 43°C), or high (chamber at 65°C). For even shorter drying times, an optional Radiant Cover further hastens drying rate by adding energy to the sample chamber.

SpeedVac® concentrators can be operated manually or attached to Savant's SC1021 SpeedVac® System Controller unit for totally automatic operation.

The SC110/SC110A units hold up to 100 sample tubes; the larger SC210A holds up to 200 tubes (1.6 liters total volume). A variety of available rotors accommodates microcentrifuge tubes, test tubes, microvials, and mini and standard scintillation vials. A line of large-volume (up to 500 ml), multi-sample rotors hold Savant's recovery flasks or pear-shaped flasks with receptacle ends. A prep rotor is available for concentrating large batch amounts of solution.

2.0 INSTALLATION

Receiving. Inspect the shipping carton upon receipt. If the carton is damaged in any way, **do not accept delivery**. Call Savant at 1-800-634-8886, 516-249-4600, or (Fax) 516-249-4639.

Unpacking. Carefully remove the instrument and rotor from the shipping carton. Compare the packing list to the box contents. If there is a discrepancy, call Savant at 1-800-634-8886, 516-249-4600, or (Fax) 516-249-4639.

Inspection. Inspect the unit for any damage that may have occurred during shipment. Should there be any damage, report it to the carrier and contact Savant immediately. Make sure the carrier inspects the damage and leaves an inspection report. Register any claims for shipping damage against the carrier or his agent. Save the shipping carton in the event a return is necessary.

Set-up. To assure safe operation and best results, read this manual in its entirety before operating this instrument.

- Install the SpeedVac® on a clean, dry, level, stable surface within 4 ft (1.2 m) of a compatible electrical outlet.
- Place the unit in a convenient location with access to a vacuum source. Typically, the SpeedVac® sits on a countertop or on the mobile Savant CC120/DX Deluxe Convenience Cart. Overhead clearance, roughly equal to the unit's depth, is required for raising the cover. The SC110/SC110A concentrators may be placed on top of the optional SC1021 SpeedVac® System Controller.
- Make sure the ON/OFF switch on the front of the SpeedVac® is in OFF position. Connect power cord to instrument and plug into appropriate outlet. The safety lid locking mechanism on SC110/SC110A 240 V and SC210A 120 V and 240 V units will automatically disengage.

WARNING: Before connecting the SpeedVac® concentrator to an outlet, make certain that voltage, frequency, and amperage match the requirements indicated on the label on the rear of the instrument (SC110/SC110A: 120 V AC / 60 Hz, 6 A or 240 V AC / 50 Hz, 3 A; SC210A: 120 V AC / 60 Hz, 8 A or 240 V AC / 50 Hz, 4 A).

If there are any questions, please consult an electrician.

Note: To manually open the lid prior to applying power, use the interlock override tool. **This tool may also be used to open the unit during a power outage.** Insert the tool at an upward angle (approximately 45°) into the small hole in the upper right-hand panel of the SpeedVac® concentrator. While lifting up on the lid, pivot the tool handle upward, creating a downward movement within the SpeedVac®. This manually disengages the locking mechanism.

- Lift the lid and clean the chamber of any packing material or foreign items that may be present from shipping. Lightly coat the drive shaft and rotor center with vacuum grease. This protects these surfaces from corrosive vapors. **Do not lubricate the cover O-ring.**

- Attach the concentrator to a vacuum system (vapor trap plus vacuum pump). Read this entire section before proceeding:

General directions. Connect the 0.5 inch (1.27 cm) O.D. hose fitting at the rear of the unit to the vacuum system. Coat fitting with a thin film of vacuum grease. Thread vacuum tubing through the hole in the instrument right side panel. Without twisting, carefully push vacuum tubing straight on over fitting.

Note: Read the Reconfiguration section of this manual (see **APPENDIX 2**, page 13) before disconnecting or replacing vacuum hose.

Protecting the vacuum pump. A vacuum pump experiences loss of efficiency and ultimate damage if evaporated solvents from samples are allowed to enter. **To prevent damage and extend pump life, a vapor trap that condenses and preferably freezes solvent vapors must be placed in-line between the SpeedVac® concentrator and vacuum pump.** A complete line of vacuum pumps and refrigerated vapor traps is available from Savant.

A chemical trap, placed in-line between the vapor trap and the vacuum pump, further protects the pump from any vapors pulled through the trap. Savant's SCT120 Chemical Trap may be used with the DC120A cartridge to adsorb aqueous vapors and neutralize corrosive acid vapors, or with the DC120R cartridge to adsorb radioactivity and volatile organic vapors.

- System configuration may vary depending on the needs, preferences, and application requirements of the user. If uncertain of the optimal set-up, call Savant Technical Services at 1-800-634-8886, 516-249-4600, or (Fax) 516-249-4639 for additional information.

3.0 OPERATION

The SpeedVac® or SpeedVac® Plus concentrator is an important component in a sample drying/concentration system that should also include vacuum gauge, refrigerated vapor trap, chemical trap, and vacuum pump, and may contain other equipment. Please refer to operating instructions of each component for details on use.

3.1 CONTROL PANEL

Two switches on the instrument front panel govern operation of the SpeedVac® SC110/SC110A/SC210A concentrators:

- The **CONCENTRATOR** switch controls rotation (ON/OFF).
- The **DRYING RATE** switch regulates sample chamber temperature (HIGH/MEDIUM/LOW).

Indicator lights illuminate when a function is switched on.

3.2 ROTORS

A wide variety of SpeedVac® rotors is available to suit every sample drying application. These rotors are designated by the RH prefix followed by numbers denoting vial capacity and tube diameter. For example, the RH100-6 rotor accommodates 100 tubes of 6 mm diameter. Also available are horizontal rotor heads (HRH prefix) for swing-out carriers, microplate rotors (MPR/MPTR prefix), and a prep rotor (PREP-100) for batch processing.

CAUTION: Only these rotor series should be used in the SpeedVac®. DO NOT use other rotors, even if they seem to fit the instrument.

CAUTION: Always balance rotor loads. An unbalanced rotor causes vibration that will wear out the bearings and may seriously damage the SpeedVac®.

Load the rotor uniformly. There need not be a tube in each place, but the tubes must be evenly spaced around the rotor. When using a rotor with aluminum tube holders, insert tube holders symmetrically. When drying different types of sample in the same drying run, distribute each type symmetrically so that their different drying rates do not introduce precession into the rotor's rotation. Always select a rotor into which the sample tubes fit snugly.

To install or change a rotor:

- Verify that **CONCENTRATOR** switch is in **OFF** position.
- Open the lid. Unscrew the rotor hold-down knob and remove the existing rotor (if any). Select desired replacement rotor. Align the notches in the rotor base with the drive pin of the motor shaft. Place the rotor on the shaft; be sure the pins engage the notches. **Hand-tighten** the rotor hold-down knob until firmly seated.

3.3 PREHEATING

Evaporative sample cooling that occurs under vacuum actually decreases sample drying rate. The sample chamber heater counteracts this effect to accelerate drying rate. If desired, operate the **DRYING RATE** switch at least 15 minutes before starting the concentration run.

- **LOW** leaves the chamber at ambient temperature (i.e., chamber heater is off).
- **MEDIUM** heats the chamber to 43°C.
- **HIGH** heats the chamber to 65°C.

3.4 SPEEDVAC® SC110 OPERATION

Load samples symmetrically. Verify that the rotor is firmly seated and the hold-down knob is hand-tight. Close the cover and set the **CONCENTRATOR** switch to **ON**. Allow rotor to reach full speed (approximately 20 seconds) before manually applying vacuum with the bleeder valve. This valve exposes spinning samples in the sample chamber to vacuum from the vacuum system and, at the end of the run, bleeds the chamber back to atmospheric pressure. Premature application of vacuum can cause bumping and foaming; in some cases, sample could boil out of the tubes. The blue bleeder valve is located on the top right toward the rear of the instrument. Turn arrowhead indicator toward concentrator (**OPEN**) to apply vacuum. If necessary, select **DRYING RATE** as described in section 3.3.

Continue the run until a predetermined time has elapsed, or until a vacuum gauge, configured in-line between the SpeedVac® and vapor trap, indicates a predetermined vapor pressure in the sample chamber. To devise a standardized endpoint (time or vapor pressure) for a specific application when repeatability of results is important, conduct one or more test runs with expendable batches of sample.

At the end of the run, turn arrowhead indicator on bleeder valve toward the left (**CLOSED**) to bleed the sample chamber to atmosphere; allow 10 seconds for pressurization. Stop the run by setting the **CONCENTRATOR** switch to the **OFF** position. The rotor brakes until rotation decreases to 6 RPM. **Do not open the cover until rotation has completely stopped.** All 240 V units have a cover lock that prevents cover release at stopped speeds >6 RPM. To shut off chamber heater, set **DRYING RATE** switch to **LOW**.

3.5 SPEEDVAC® PLUS SC110A/SC210A OPERATION

Load samples symmetrically. Verify that the rotor is firmly seated and the hold-down knob is hand-tight. Close the cover and set the **CONCENTRATOR** switch to **ON**. Bleeder valve operation in SpeedVac® Plus models is automatic. A speed sensor inside the concentrator applies vacuum when the rotor reaches 800 RPM. If necessary, select **DRYING RATE** as described in section 3.3.

When the run is stopped by setting the **CONCENTRATOR** switch to the **OFF** position, the unit immediately bleeds the rotor chamber, then waits 10 seconds before braking the rotor. **Do not open the cover until rotation has completely stopped.** Shut off chamber heater by setting **DRYING RATE** switch to **LOW**.

3.6 OPERATION WITH THE SC1021 SPEEDVAC® SYSTEM CONTROLLER

With vacuum tubing, connect the hose fitting at the rear of the SpeedVac® concentrator to the other instruments as described in the SC1021 instruction manual.

Move the SpeedVac® **CONCENTRATOR** switch to the **ON** position and leave it there; the SC1021 will operate its motor. The **CONCENTRATOR** switch can be shut **OFF** as an emergency stop for the rotor. The **DRYING RATE** switch will still control the concentrator's chamber heater.

Remove the small metal plate at the rear of the concentrator cabinet (SC110A/SC210A only), exposing the 9-pin connector. Attach the control cable from the SC1021.

Plug the line cord into the SC1021.

The text display of the SC1021 gives you step-by-step guidance. The SC1021 operates the concentrator, sequences rotation and application of vacuum, automatically ends the run according to your specifications, and provides advanced features such as stored programs and run statistics. Refer to the SC1021 instruction manual for details.

4.0 SPECIFICATIONS

Dimensions (W x H x D):

SC110/SC110A	11.4 in x 13.0 in x 17.6 in (29.0 cm x 33.0 cm x 44.5 cm)
SC210A	18.3 in x 18.1 in x 25.3 in (46.5 cm x 46.0 cm x 64.1 cm)

Weight:

SC110/SC110A	36 lbs (16 kg)
SC210A	97 lbs (44 kg)

Electrical Requirements:

SC110/SC110A	120 V AC / 60 Hz, 6 A or 240 V AC / 50 Hz, 3 A
SC210A	120 V AC / 60 Hz, 8 A or 240 V AC / 50 Hz, 4 A

Cabinet:

Chemical-resistant, coated steel construction

Cover:

Transparent 0.75 in (1.91 cm) acrylic (standard)
Safety interlock on SC110/SC110A (240 V models)
and SC210A (120 V and 240 V models)

CAUTION: DO NOT apply heat to this cover - serious deformation will occur under vacuum. Optional Radiant Cover available for all units. Optional Glass Safety Cover available for SC110/SC110A.

Vacuum Chamber:	Chemical-resistant, impregnated aluminum casting with inert, fluorocarbon coating (Teflon®)
Vacuum Fitting:	0.5 in (1.27 cm) O.D. vacuum fitting
Controls:	
Concentrator	Two-position switch (ON/OFF)
Drying rate	Three-position switch (HIGH/MEDIUM/LOW) (65°C/43°C/Ambient)
Drive:	Seal-less magnetic coupling drive
Rotors:	Over 40 available. See section 5.0, ACCESSORIES AND ROTORS , for selection. Custom rotors available; contact Savant for details [1-800-634-8886, 516-249-4600, or (Fax) 516-249-4639].

5.0 ACCESSORIES AND ROTORS

5.1 ACCESSORIES

RC110A	Radiant Cover for SC110A SpeedVac® Plus
RC210A	Radiant Cover for SC210A SpeedVac® Plus
GSC110	Glass Safety Cover for SC110/SC110A
SC1021	SpeedVac® System Controller
SCT120	Chemical Trap
DC120A	Disposable Cartridge for SCT120 when trapping acid and water vapors
DC120A/4	Disposable Cartridge for SCT120 when trapping acid and water vapors (4 pack)
DC120R	Disposable Cartridge for SCT120 when trapping radioactivity and organic solvent vapors
DC120R/4	Disposable Cartridge for SCT120 when trapping radioactivity and organic solvent vapors (4 pack)

5.2 ROTORS FOR SPEEDVAC® SC110 AND SPEEDVAC® PLUS SC110A/SC210A

RH40-6	Rotor for 40 each 6 × 50 mm tubes (includes carriers)
RH100-6	Rotor for 100 each 6 × 50 mm tubes
RH100-8	Rotor for 100 each 8 × 29 mm tubes
RH40-11	Rotor for 40 each 1.5 ml microcentrifuge tubes (includes adapters)
RH64-11	Rotor for 64 each 1.5 ml microcentrifuge tubes
RH120-11	Rotor for 120 each 1.5 ml microtubes
RH20-12	Rotor for 20 each 12 × 75 mm or 10 each 13 × 100 mm tubes (includes carriers)
RH40-12	Rotor for 40 each 12 × 75 mm tubes
RH60-12-40	Rotor for 60 each 12 × 32 mm or 12 × 40 mm vials
RH72-12	Rotor for 72 each 12 × 75 mm tubes
RH32-13	Rotor for 32 each 13 × 100 mm tubes
RH24-15	Rotor for 24 each Waters WISP® autosampler vials
RH8-17.5	Rotor for 8 each 15 ml Corning Corex® (17.5 × 102 mm) tubes
RH8-18	Rotor for 8 each 17 × 100 mm tubes (includes carriers)
RH10-15	Rotor for 10 each 15 ml conical centrifuge tubes (17 × 120 mm)
RH24-18	Rotor for 24 each 18 × 52 mm mini scintillation vials
RH12-20	Rotor for 12 each 20 × 60 mm reaction vials or 20 × 47 mm vials
RH6-25	Rotor for 6 each 30 ml Corning Corex® (25 × 105 mm) tubes
RH12-28	Rotor for 12 each 28 × 60 mm scintillation vials
RH4-18-150	Rotor for 4 each 18 × 150 mm tubes
RH6-50	Rotor for 6 each 50 ml conical centrifuge tubes (30 × 115 mm)
RH8-50	Rotor for 8 each 50 ml pear-shaped flasks
PSF50R	Pear-shaped flasks (50 ml) with receptacles, 8 each
RH4-100	Rotor for 4 each 100 ml pear-shaped flasks
PSF100R	Pear-shaped flasks (100 ml) with receptacles, set of 4
PSFA-100	Adapters for use of PSF100R flasks in RH4-100 rotor
RC50	Rotor for 50 each Beckman Ready Caps™
HRH4	Horizontal rotor head. Holds up to 4 each swing-out carriers (always order 2 each of same carrier)
MCM22	Swing-out carrier for 22 each 0.4 ml tubes
MCR5	Swing-out carrier for 5 each 1.0 ml tubes
MCM8	Swing-out carrier for 8 each 1.5 ml tubes
PREP100	Prep rotor for large-volume evaporation; includes package of 5 prep rotor liners (Radiant Cover recommended)
PRL100	Prep rotor liners

5.3 ROTORS FOR SPEEDVAC® PLUS SC210A

RH200-12	Rotor for 200 each 12 × 75 mm tubes or 118 each 13 × 100 mm tubes or 200 each 1.5 ml microcentrifuge tubes
RH60-17-100	Rotor for 60 each 17 × 100 mm tubes
RH52-15	Rotor for 52 each 15 ml conical centrifuge tubes (17 × 120 mm)
RH48-18-125	Metal rotor for 48 each 16 × 125 mm tubes or 18 × 125 mm tubes (includes carriers)
RH32-18-150	Metal rotor for 32 each 18 × 150 mm tubes or shorter (includes carriers)

RH50-28-60	Rotor for 50 each 28 x 60 mm scintillation vials
RH12-29	Metal rotor for 12 each 28 x 150 mm tubes or 50 ml conical centrifuge tubes (includes carriers)
RH26-50	Rotor for 26 each 50 ml conical centrifuge tubes (30 x 115 mm)
RH8-100	Metal rotor for 8 each 100 ml recovery flasks or 250 ml plastic centrifuge bottles
RF8-100	Recovery flasks, conical base, 100 ml, set of 8
RFA-8	Recovery flask adapters required for RF8-100, set of 8 cushions and collars
RH8-200	Rotor for 8 each 100 ml pear-shaped flasks
PSF100R	Pear-shaped flasks with receptacles (100 ml)
PSFA-200	Adapter for use of PSF100R flask in RH8-200 rotor
AB250	Amber glass bottles (250 ml)
RH6-400	Rotor for 6 each 250 ml pear-shaped flasks with receptacles
PSF250R	Pear-shaped flasks with receptacles (250 ml)
PSFA-400	Adapter for use of PSF250R flask in RH6-400 rotor
RH4-500	Rotor for 4 each 500 ml pear-shaped flasks with receptacles
PSF500R	Pear-shaped flask with receptacles (500 ml)
PSFA-500	Adapter for use of PSF500R flask in RH4-500 rotor
MPR4-200	Microplate rotor (includes 4 carriers)
MPTR8-210	Rotor for Marsh plates (includes 4 carriers)
MPTR12-210	High-capacity microplate rotor (includes 4 carriers)

6.0 WARRANTY AND LIABILITY STATEMENTS

All Savant products (excluding glassware) are warranted against defects in material and workmanship for one year after the date of delivery to the original purchaser. Savant's warranty is limited to defective materials and workmanship. Warranty work is subject to our inspection of the unit. No instruments, equipment, or accessories will be accepted without a Return Material Authorization (RMA) number issued by Savant. The warranty obliges you to follow the precautions in this manual.

When returning apparatus that may contain hazardous materials, you must pack and label them following U.S. Department of Transportation (DOT) regulations applying to transportation of hazardous materials. Your shipping documents must also meet DOT regulations. **All returned units must be decontaminated and free of radioactivity.**

Under no circumstances shall Savant be liable for damages due to the improper handling, abuse, or unauthorized repair of its products. Savant assumes no liability, express or implied, for your use of this equipment.

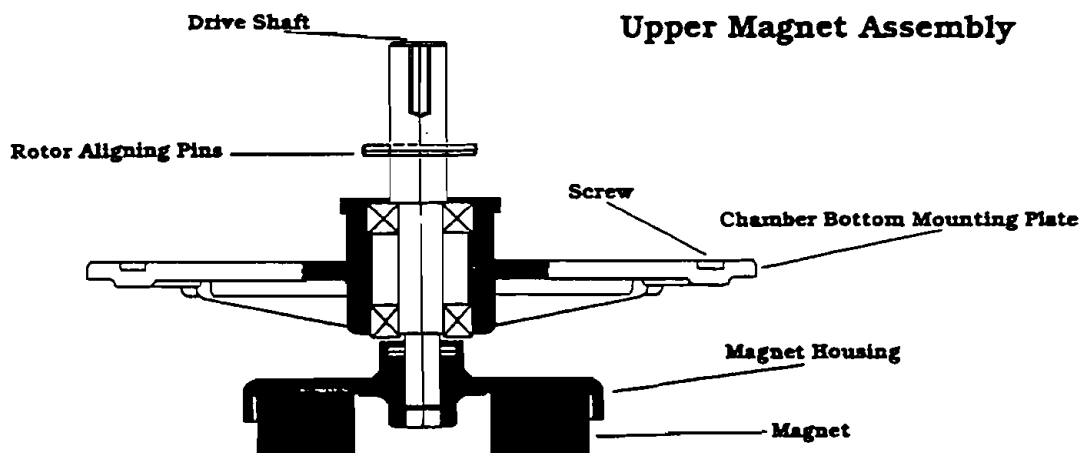
APPENDIX 1 MAINTENANCE AND SERVICE

Maintenance: Maintaining a clean instrument is crucial for dependable results. Clean spills immediately. Dried solvents can build up, impairing rotor rotation. Periodic cleaning of the sample chamber prevents problems. Use a detergent solution on a sponge or gauze, then thoroughly wipe the chamber dry. Excess moisture in the chamber is removed on the next SpeedVac® run, but can alter the performance of this run. As described under section 2.0, **INSTALLATION**, keep the drive shaft and rotor center lightly coated with vacuum grease. **Do not lubricate the cover O-ring.**

Upper Magnet Assembly: Although the Upper Magnet Assembly (UMA) is equipped with sealed bearings, using the SpeedVac® with aggressive acids and bases can cause bearings to corrode over time. Should this occur, the UMA may need replacement (frequency depends on individual usage patterns). Call Savant's Service Department [1-800-634-8886, 516-249-4600, or (Fax) 516-249-4639] for parts or repair. For the SC110/SC110A, order Savant part #UMA100. For the SC210A, order part #UMA200.

To determine if bearings are worn: Open the sample chamber cover. Unplug the instrument. Remove the rotor hold-down knob, rotor, and three screws (Phillips) on the chamber bottom mounting plate. This plate of blue-white plastic forms the top portion of the UMA, which houses the bearings. Replace the hold-down knob. Using the knob as a handle, pull the drive shaft upward until the UMA comes free. Pull carefully to release the magnetic attraction between the UMA and the Lower Magnet Assembly (not visible), located beneath the metal plate in the SpeedVac® floor. Hold the plastic mounting plate rigid and attempt to pivot the magnet (bottom portion of the UMA) around it. If there is excessive "play" (wobble) between the plate and magnet, replace with new UMA.

To replace the UMA: Align holes, then secure new UMA with the three screws. Replace rotor. Verify that rotor is seated properly on the aligning pins and that the hold-down knob is **hand-tight**. Reconnect the instrument to an appropriate electrical outlet. Resume operation.



APPENDIX 2 APPLICATION INFORMATION

Dislocation due to braking: When highly discrete solutes are dried using ordinary rotors and the total rotor mass is small, some users note that the minute solute pellet is dislocated by the concentrator's braking action, impeding recovery. For these critical applications, Savant recommends the use of a heavier rotor, such as the RH64-11 or the HRH4 rotor head, which holds two or four swing-out buckets. The conical tip of the sample tube swings out horizontally as rotation increases. This draws solute to the tip of the tube, minimizing pellet dislocation on braking.

Typical results: The following data were gathered using Savant's SC110 SpeedVac® concentrator, RVT100 (-55°C) Refrigerated Vapor Trap, VP100 (113 liter/min) vacuum pump, the RH20-12 rotor, and 20 glass tubes of 12 × 75 mm, each containing 2 ml of solvent. Time is shown as hours:minutes.

SOLVENT	SETTING OF DRYING RATE SWITCH		
	LOW	MEDIUM	HIGH
WATER	3:45	3:07	2:01
METHANOL	0:55	0:43	0:33

These approximate drying times are presented as a guide only. Results will differ depending on type of vacuum pump, temperature and capacity of vapor trap, integrity of seal between fittings and connections, degree of contamination, number of tubes per run, and other factors.

Further improvements in evaporation rate: Rotors with aluminum tube carriers, such as the RH20-12, conduct more heat to the samples and enhance evaporation.

To speed evaporation further, use a Savant Radiant Cover:

For the SC110/SC110A, order the Savant RC100 Radiant Cover.
For the SC210A, order the Savant RC200 Radiant Cover.

WARNING: Never shine a lamp or heat lamp through the standard acrylic chamber cover. The cover absorbs heat and will deform, especially while the sample chamber is under vacuum.

Reconfiguration: The polypropylene vacuum fittings do not withstand strong lateral force. Should you ever need to remove a vacuum line, carefully pull straight out to slide the tubing off the fitting. Reconfigure the SpeedVac® and system components as desired. To reattach the line, place a thin film of vacuum grease on the fitting; carefully slide new tubing straight on over fitting.

APPENDIX 3 TIPS TO ENHANCE PERFORMANCE

1. TO INCREASE THE RATE OF SOLVENT EVAPORATION AND SHORTEN DRYING TIME, TRY ONE OR MORE OF THE FOLLOWING:

- Use glass tubes and vials in place of plastic.
- Install and use a Radiant Cover on the SpeedVac®.
- Preheat the SpeedVac® chamber and rotor using MEDIUM DRYING RATE.
- Use rotors with metal tube carriers instead of plastic rotors (e.g., RH12-20, RH8-18). These rotors conduct and transfer heat to tubes for faster sample drying.
- Prewash plastic tubes with methanol to remove materials that inhibit or prevent evaporation of aqueous samples.

2. TO KEEP VACUUM PUMP OIL CLEAN, TRY THE FOLLOWING:

- Empty solvent(s) collected in the Refrigerated Vapor Trap as frequently as possible.
- Change the oil in the vacuum pump when it becomes brown in color or smells of solvents being evaporated.
- Attach a Savant VPOF100 Vacuum Pump Oil Filter/Recirculator to your vacuum pump when evaporating acids (e.g., HCl, acetic, TFA) in the SpeedVac®.
- Attach a Savant SCT120 Chemical Trap with acid neutralization cartridge when evaporating acids (i.e. HCl, acetic, TFA) in the SpeedVac®.
- If you are using a gel dryer with your SpeedVac®, remove the gel dryer from the system. Use an oil-free/maintenance-free Savant Gel Pump™ GP110 for the gel dryer.

SC110 SpeedVac (R) Concentrators
SC110A and SC210A SpeedVac Plus (R) Concentrators

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Preface

This manual explains how to detect, diagnose, and correct malfunctions, to the component level, in the Savant SC110 SpeedVac (R) and the SC110A and SC210A SpeedVac Plus (R) concentrators. It is written for Savant manufacturing personnel and for Savant field service personnel. It is also available to trained customers who wish to perform their own maintenance.

The manual is designed to provide a step-by-step procedure for generalists to evaluate a unit. Later sections also give more applied information, such as solutions to specific problem reports, and detailed theory.

The manual does not explain how to repair individual components, such as circuit boards. Failed circuit boards can be returned to Savant, where the Service Department uses customized testers to determine whether the board can be repaired and returned to service. Other components should not be returned to Savant.

Organization. All Savant service manuals are divided into these parts:

- o Part 1, Theory of Operation, describes the unit's purpose, principles of design, and sequence of operation. Part 1 describes the diagnostic tools that are built into the unit.
- o Part 2, Service Procedures, shows how to determine whether a unit has failed, how to identify and replace the faulty component, and how to perform other required maintenance procedures.
- o Part 3, Tables, provides specifications for each model. These specifications include acceptable measurements for each measurable parameter, and specifications and characteristics of the component subsystems and fluids. Part 3 also lists order numbers for spare parts for each model.
- o Technical drawings appear at the end of the manual.

Service notes, updating this manual, will be issued from time to time by Savant. Service notes will reflect important changes in procedures or production. Each service note will replace or add specific pages to this manual. Insert these pages into the manual as specified. Discard any replaced pages.

Each service note will have as its first page a change history, including it and all previous service notes. Place the first page of the service note just after the cover page of this manual, to show that the manual incorporates that and all previous service notes.

PART 1

----- THEORY OF OPERATION

1.1 The Application

The Savant SC110/SC110A/SC210A concentrators spin one of a variety of rotors. The rotors contain sample test tubes. Vacuum can be applied to the sample chamber to withdraw vapors as the liquids evaporate. Rotation of the tubes prevents bumping and foaming as vacuum is applied. The units isolate the motor from the vacuum chamber. The units include a two-level electric heater. Applying heat to the sample chamber encourages evaporation. In addition, the samples cool as some liquid evaporates; applying heat counteracts this cooling and can protect the samples from freezing.

A rule that the Instruction Manual emphasizes is that vacuum should only be applied to the sample chamber when the rotor is spinning. If this rule is not followed, samples can bump, foam, and boil out of the tube. The SC110A and SC210A SpeedVac Plus (R) concentrators have an internal bleeder solenoid; the unit automatically controls this solenoid to comply with this rule. The SC110 SpeedVac (R) concentrator does not have such a solenoid; vacuum is applied manually using a Savant bleeder valve.

The SC110A and SC210A models differ only in size. The SC110 and SC110A hold smaller rotors, some of which hold up to 100 sample tubes. The SC210A holds larger rotors and can accommodate up to 200 tubes.

(A refrigerated trap is always used with the apparatus to protect the vacuum pump, but this is not important in servicing the concentrator.)

1.2 Theory of Operation

The concentrators have two modes of operation:

- o Manual mode. The operator activates rotation and chamber heating using the switches on the concentrator's front panel. On the SC110, the operator operates a manual bleeder valve at the top of the concentrator, and must sequence the application of rotation and vacuum manually. On the SC110A/SC210A, an internal vacuum solenoid operates automatically.
- o Slave mode (SC110A/SC210A). The user attaches a Savant SC1021 controller to the 9-pin connector at the rear of the unit and connects the sample chamber vacuum line to the controller. The controller operates the rotor and gives the

user many options for automatic or timed operation. However, the front-panel DRYING RATE switch still controls the concentrator's chamber heater.

A circuit board inside the concentrator contains relays by which the unit rotates or brakes the rotor; controls the chamber heater; and activates the internal vacuum solenoid (SC110A/SC210A only). LEDs monitor the state of each relay. SC110s and SC110As configured for 220VAC, and all SC210As, have a cover lock, driven from the board without using a relay; this line is also monitored by an LED.

A PAL integrated circuit on the board ensures correct operation in each of the operating modes.

1.3 Sequence of Operation

Each device in the controller can be considered separately:

Rotor. The concentrator can select rotation or braking. Rotation is enabled only if all of the following are true: (1) the ROTOR switch on the front panel is ON; (2) the chamber cover is closed; (3) any attached SC1021 controller permits rotation. In Slave mode, the user leaves the ROTOR switch ON and the SC1021 controls rotor rotation. The front-panel ROTOR switch serves as an emergency stop. In Manual mode, the front-panel ROTOR switch controls rotation. On the SC110A/SC210A, switching the unit ON also starts the sequence for evacuating the chamber (see below).

Switching the SC110 OFF immediately begins braking the rotor. Switching the SC110A/SC210A OFF releases vacuum, waits for a factory-set interval, and then begins braking. In both cases, the unit releases the brake when the rotor slows to 6 RPM. Dynamic braking is achieved by applying DC voltage to the AC motor.

Chamber heater. In both operating modes, the DRYING RATE switch on the concentrator front panel controls the chamber heater. Switching it to LOW disables the heater; switching it to MED or HIGH enables the heater. The MED and HIGH settings enable circuits factory-set at 43°C or 60°C, respectively. The circuit board switches off the chamber heater when the chamber achieves the respective temperature.

When a radiant cover is attached to the SC110A/SC210A, the effect of the HIGH setting changes. In the HIGH setting, neither the radiant cover nor the chamber heater will operate until the chamber rotation reaches 1000 RPM.

Rotation sensor. A Hall-effect switch senses rotation of the rotor. The SC110A/SC210A provide an "up-to-speed" signal, based on this switch, at the 9-pin connector in case an SC1021 controller is connected. On SC110s and SC110As configured for

220VAC, and on all SC210As, the unit unlocks the cover only when this switch detects that rotor speed is less than 6 RPM. The cover is normally locked; it is locked when the power is off. Whether or not there is a cover lock, a switch senses whether the cover is closed. This signal goes to the 9-pin connector in case an SC1021 controller is connected.

Vacuum solenoid. The controller uses three of the 9-pin connectors to operate the vacuum solenoid inside the SC110A/SC210A. The controller switches the solenoid to vacuum only when rotor rotation reaches 1000 RPM.

The concentrator does not include a vacuum gauge. The SC1021 controller or an external vacuum gauge such as the Savant VG5 is used to read vapor pressure in the vacuum line going to the concentrator chamber.

The concentrator does not have any special power-on/power-off sequence.

1.4 Overview of Maintenance

Since the unit's behavior differs depending on the attached equipment, it simplifies service to follow these rules:

- o Always ask the customer which concentrator model is in use; and in the case of the SC110A/SC210A, whether an SC1021 controller or radiant cover is attached.
- o Always detach any such apparatus before evaluating failed units. If the customer reports a failure in Slave mode, verify that the unit works in Manual mode, then determine whether the unit sends correct signals to the connector.

PART 2

----- SERVICE PROCEDURES

2.1 Safety Precautions

The concentrator uses AC power, and some of the service procedures in this chapter require operation with the cover off, exposing power lines. This raises the risk of electrical shocks. The unit should only be plugged into a circuit protected by a Ground-Fault Interruptor (GFI). This minimizes injury from shock. In addition, you should not touch exposed wires at all without first unplugging the unit.

An additional hazard to the equipment is as follows: The circuit board and indicator panel contain electronics that can be damaged by static electricity (by giving it a shock). When removing a circuit board, always hold it by the sides. Persons doing extensive maintenance on circuit boards should be grounded, such as by wearing wrist straps. When shipping a circuit board, always enclose it in a static-protective bag.

2.2 Environmental Checks

The only required environmental check is that the unit be level. Vibration and poor performance can be caused by operating the unit on a tilted surface. If this is the case, correct the environment and then retest the unit.

2.3 Recommended Service Equipment

- o Volt-ohm meter (VOM)
- o Variable-frequency strobe light
- o Blade and Phillips screwdriver

2.4 Troubleshooting Aids

There are five discrete LEDs on the circuit board that are numbered. The function of these LEDs are as follows:

- LED 1 Front-panel LED; always on if the DRYING RATE switch is HIGH. (If the radiant cover is installed, LED 1 is ON only when the chamber heater and the radiant cover are both activated. The LED is off whenever the rotor rotation is below 1000 RPM.)
- LED 2 Front-panel LED; always on if the DRYING RATE switch is MEDIUM
- LED 3 Always on if the DRYING RATE switch is LOW
- LED 4 Front-panel LED; always on if the ROTOR switch is ON
- LED 5 Always on if the ROTOR switch is OFF

There are also two banks of LEDs that provide additional status. They are labeled on the circuit board.

The LEDs in bank LEDS1 have the following functions:

SLND	On if the chamber cover solenoid is actuated to unlock the cover (220VAC units only)
CVR	On if the chamber cover is closed
SAV	On if relay 1 is actuated (if the unit has switched the internal SpeedVac Automatic Valve to apply vacuum to the concentrator chamber)

The LEDs in bank LEDS2 have the following functions:

HTR	On if relay 2 is actuated (if the chamber heater is on)
RCO	On if relay 3 is actuated (if the radiant cover is on)
BRK	On if relay 4 is actuated (if the unit is braking the rotor)
MOTOR	On if relay 5 is actuated (if the unit is rotating the rotor)

2.5 Troubleshooting Sequence

The presence of optional attachments affects the operation of the concentrator. Therefore, to simplify troubleshooting, first remove any SC1021 controller connected to the rear of the concentrator. Also disconnect any radiant cover from the rear of the concentrator. Plug the unit into an operating electrical outlet of the proper voltage.

Quickly check the circuit board's voltage and logic by operating the DRYING RATE switch. When there is no controller or radiant cover attached, and when the chamber is at approximately ambient temperature, the LEDs by the legends HIGH and MED should light up when you put the switch in the respective position. In the LOW position, neither LED should be lit.

- o If neither LED is lit in any switch position, look for a power fault. Verify that the electrical outlet is operating by plugging a lamp or other appliance into it. Unplug the unit, remove the bottom plate and inspect the fuse (F1, 0.5 amp, 250VAC) on the circuit board. If it is blown, replace it and retest. If the fuse is not blown, plug the unit back in and carefully verify that AC is present at the power connector, J8. If so, return the circuit board. If not, replace the power cord or cable to the circuit board.
- o Other abnormal patterns of LED lighting mean that you should return the circuit board to Savant.

Before checking the rotor operation, ensure that a rotor is installed in the concentrator chamber, and tightly held in place

using the rotor hold-down knob. Close the cover and switch the ROTOR switch ON. Listen for excessive noise. Allow 20 seconds for the SC110/SC110A to come up to speed; allow 45 seconds for the SC210A to come up to speed. Use the variable-frequency strobe light to measure the rotation speed: Shine the light into the rotor chamber and adjust the knob until the rotor appears to be stationary, then read RPM off the knob.

If the unit is noisy when rotating or if the rotating speed is 20% less than its rated speed, then service the motor as described in the next sections.

2.5a Disassembly and Replacement

Access to the interior of the concentrator requires that the blue casing be separated from the white cover. Most of the internal devices are fastened to the white cover. To separate the casing from the cover, follow these steps:

- o Use a Phillips screwdriver to remove the four screws from the base of the concentrator. (Do not remove the four recessed screws.)
- o At the rear of the white cover, there are two bolts on the underside. They are visible from the rear of the unit. Use a 1/4" nut driver to remove these two nuts.
- o On the SC110A/SC210A, the vacuum solenoid must be disconnected from the white cover, by removing both the vacuum tubing and the electrical connector. Alternatively, you can unscrew the four recessed screws at the base of the concentrator to detach the vacuum solenoid from the blue casing.
- o Take hold of the white cover and lift it straight up. This is necessary because there are two guide pins beneath it.

To remove the chamber cover, slide out the hinge pins, using pliers or wire cutters. Use a wood block or pencil to provide leverage and avoid damaging the paint finish.

2.6 Upper Magnet Assembly

The Upper Magnet Assembly, accessible from the sample chamber, contains bearings that can wear out since they are typically operated in a vacuum. The Instruction Manual advises the user to lightly apply vacuum grease to the rotor shaft to extend the life of this assembly. The Upper Magnet Assembly is a possible source of resistance to rotation, and of noise.

Open the chamber cover. Remove the hold-down knob, rotor, and

three Phillips screws on the mounting plate. Replace the hold-down knob. Pull the shaft upward until the magnet comes free. You have removed the Upper Magnet Assembly. Hold the magnet rigid and rotate the mounting plate. If the rotation is difficult or uneven, replace the assembly with a spare Upper Magnet Assembly.

For the SC110 or SC110A, order Savant UMA100.
For the SC210A, order Savant UMA200.

2.7 Lower Magnet Assembly

If manual rotation of the Upper Magnet Assembly seems normal, do not reinstall the Upper Magnet Assembly yet. The assembled unit can fail even though failures are not evident in the disassembled pieces. This is because, when assembled, the upper and lower magnets pull toward each other. A failure or misadjustment of the set screws on the Lower Magnet Assembly can impede rotation only when the unit is assembled.

Close the chamber cover and switch the ROTOR switch to ON without the Upper Magnet Assembly installed. If the motor rotates, or rotates quietly, when this was not the case before, then unplug the unit, remove the bottom plate and remove the four screws that secure the motor mounting bracket. Adjust the two #8-32 set screws so that the drive magnet is exactly 1/16" from the stainless steel closure plate. (This plate covers the hole to the vacuum chamber.)

While the unit is apart, verify that switching the ROTOR switch ON turns the LED labeled MOTOR on and the one labeled BRAKE off. This verifies that the circuit board is trying to rotate the rotor and that the brake is off. If these LEDs light inappropriately, return the circuit board to Savant, indicating a logic error in rotor rotation or braking, as the case may be.

Reassemble the unit. If the motor is slow or noisy even when the Upper Magnet Assembly is removed, then replace the motor and Lower Magnet Assembly.

2.8 Vacuum Problems

If the apparatus fails to achieve or maintain vacuum and if the fault is traced to the concentrator, there are only four locations where leaks or obstructions can occur. Inspect them, starting with the easiest to reach:

- o Cover. Open the cover and visually inspect the O-ring for wear or degradation. Replace it if necessary. The cover O-ring should never be greased.

- o Rear vacuum fitting. (This fitting is rarely the source of the leak.) Inspect this fitting and replace it if necessary.
- o Vacuum solenoid (SC110A/SC210A only). To verify that the internal vacuum solenoid is not obstructing vacuum or leaking, take it out of the circuit: Connect the vacuum lines that lead to the vacuum solenoid to each other using a two-ended tubing connector. Then apply vacuum to the concentrator and see if adequate vacuum is reached. If it is, replace the solenoid.
- o Bottom seal. Remove the motor as described in Section 2.7. Remove the stainless steel closure plate, exposing the hole in the sample chamber. Visually inspect the O-ring between these surfaces for wear or degradation. Replace it if necessary. Lightly apply vacuum grease to this O-ring.

2.9 Heater Assembly

The heater is in the sample chamber casting. Gain access to it by disconnecting power and removing the bottom plate. The heater can burn out over time. In addition, the heater is protected by a thermal fuse that blows if the chamber temperature ever reaches 98°C. Either event can impede chamber heating.

The heater needs replacement if its resistance is greater than the value specified in Section 3.1.

Test the resistance across the thermal fuse. If the fuse is blown (infinite resistance), then replace it. Any time you replace a blown thermal fuse, look for an underlying problem: Test the thermistor and ensure that it is connected to the circuit board. Resistance across the thermistor should be about 10K ohms when the ambient temperature is 25°C. Replace the thermistor if it appears to be bad. Repairing or reattaching the thermistor will correct a runaway request for heat and will prevent blowing another thermal fuse.

After any repair concerning chamber heating, check the operation of chamber heating after you replace the Heater Assembly. Switch the ROTOR OFF, place a thermometer in the chamber, and test the MED and HIGH switch positions. The chamber temperature should stabilize at 43°C or 60°C, respectively. If during this test the chamber ever exceeds 70°C, and you have tested the thermistor, replace the circuit board. Return the old circuit board to Savant, indicating a logic error in chamber heating.

2.10 All Other Problems

Problems with a single device. Problems may occur with:

- o the cover lock (220VAC units only)
- o operation of the internal vacuum solenoid

In these cases, look at the corresponding LED on the circuit board (the one labeled COVER for the cover lock, or SAV for the vacuum solenoid) to verify that the circuit board is trying to operate the device appropriately. If not, replace the circuit board. Return the old circuit board to Savant indicating a logic failure in the operation of that device.

Analyzing the relay contacts or circuit board connectors may reveal a bad relay. Handle this problem by replacing the circuit board. If the signals are good at the connectors, then repair or replace the affected device.

SC1021 problems. If problems occur only when the SC1021 is attached, use the VOM or oscilloscope to analyze the signals on the 9-pin connector to ensure they are correct.

Pins enabling remote control of the concentrator

Pin 1	Grounded by SC1021 controller if it is present
Pin 2	GROUND reference for pins 1-6, produced by concentrator
Pin 3	Grounded by SC1021 controller to start a concentrator run; switched to high impedance by controller to start the braking sequence
Pin 4	Grounded by the concentrator if it is present
Pin 5	Grounded by the concentrator when the cover is closed
Pin 6	Grounded by the concentrator when the rotor reaches 67% of its maximum RPM

Pins enabling remote operation of the vacuum solenoid

Pin 7	Return (neutral)
Pin 8	Switched AC power to the solenoid
Pin 9	GROUND

SECTION 3

TABLES

3.1 Specifications	SC110/SC110A	SC210A
PHYSICAL		
Height	12.9" (32.8cm)	18.1" (46.0cm)
Width	11.3" (28.7cm)	18.2" (46.2cm)
Depth	17.6" (44.7cm)	25.3" (64.3cm)
Weight	36 lbs. (16 kg)	97 lbs. (44 kg)
Maximum capacity of sample tubes with standard Savant rotor	100	200
Maximum shaft RPM, no rotor		
Typical figure for 60Hz units	1675 RPM	1675 RPM
Typical figure for 50Hz units	1400 RPM	1400 RPM
End of run detection setting	6 RPM	6 RPM
TIMING		
Typical time to maximum RPM, no load	20 seconds	20 seconds
Delay before braking cycle starts	10 seconds (SC110A only)	10 seconds
ELECTRICAL		
Resistance of heater coil		
115VAC units	50 ohms	25 ohms
220VAC units	200 ohms	100 ohms
TEMPERATURES		
Medium chamber heating setting	43°C	43°C
High chamber heating setting	60°C	60°C
Thermal fuse cutout setting	98°C	98°C

3.2 Spare Parts Order Numbers

	SC110 SC110A	SC210A
COVER HARDWARE		
Lucite cover with hook (USA)	095-6012-00	090-6012-00
Lucite cover with hook (Int'l)	095-6068-00	
Cover hook	088-6019-00	087-6050-00
Cover hook nut	088-6020-00	088-6020-00
Groove pin	M40-0022-01	M40-0003-01
Cover switch assembly (115 VAC)	095-1041-00	095-1041-00
Switch	M60-0002-01	M60-0002-01
Cover lock assembly (220 VAC)	095-1061-00	095-1061-00
Cover lock release tool	M90-0074-00	M90-0074-00
SAMPLE CHAMBER COMPONENTS		
Chamber	095-6064-00	90-600-1
Chamber O-ring seal	095-6004-00 (ORS100)	095-6006-00 (ORS200)
Heater coil (115 VAC)	M60-0005-01	M60-0015-01
Heater coil (220 VAC)	M60-0005-02	M60-0015-02
Thermistor	E60-0006-01	E60-0006-00
Thermal fuse, 98°C	M60-0006-01	M60-0006-01
Rubber foot	M50-0023-01	M50-0023-01
MOTOR AND ROTOR COMPONENTS		
Motor assembly (115 VAC)	095-1058-00	090-1021-00
Motor assembly (220 VAC)	095-1059-00	090-1022-00
Hold-down knob	095-1005-00	095-1005-00
Washer for hold-down knob	M50-0020-01	M50-0020-01
Upper magnet assembly	095-1007-00	090-1003-00
Bearing plate for UMA	095-6053-00	95-670-2
Bearing for UMA	M20-0001-01	M20-0001-01
Closure plate	095-6005-00	095-6005-00
O-ring for closure plate	M80-0002-01	M80-0002-01
CONTROL		
Circuit board (115 VAC)	090-1031-01	090-1031-03
Circuit board (220 VAC)	090-1031-02	090-1031-04
Fuse, 4A Slo Blo	E70-0004-06	E70-0004-06
Fuse holder	E70-0020-01	E70-0020-01
VACUUM		
SpeedVac Automatic Valve (115)	095-1057-00 *	095-1057-00
SpeedVac Automatic Valve (220)	095-1060-00 *	095-1060-00
Vacuum fitting	M60-0044-02	M60-0044-02

* This part is not applicable to the SC110.