

# SNAP Vacuum Controller



**Vacuum Control and Pressure Regulation in One**

**Operational Manual**

**YOU MUST READ THIS MANUAL BEFORE USE**

March 2021

**TABLE OF CONTENTS**

<b>Section 1. Description and Principles of Operation</b>	<b>2</b>
<b>Section 2. Unpacking and Inspecting</b>	<b>3</b>
<b>Section 3. Installation</b>	<b>5</b>
<b>Section 4. Controlling with the SNAP Vacuum Controller</b>	<b>6</b>
Watch a video of the feature-set here.	6
RECIPE CONTROL	7
SET POINT CONTROL	7
CLOSE CONTROL MODE (Isolate)	7
FULL VAC	7
VENT	7
<b>Controlling at a Set-Point</b>	<b>8</b>
Setting PID Variables to Optimize Performance	8
<b>Section 5. Troubleshooting</b>	<b>11</b>
<b>Section 6. Servicing and Maintenance</b>	<b>13</b>
<b>Section 7. Specifications</b>	<b>14</b>
<b>Section 8. Understanding Torr</b>	<b>15</b>
<b>Section 9. Terms of Use</b>	<b>16</b>

## Section 1. Description and Principles of Operation

The **SNAP Vacuum Controller** combines *precise vacuum control with pressure regulation all in one without sacrificing flow rate*. Patent pending integrated valve that delivers superior flow rate but with precise proportional control for the rough vacuum range.

### Mission control at your fingertips with the SNAP (Simple, Nimble, Automatic Process Controller)



#### SIMPLE

- Easy set-up and push button process control: Vent, Close Valve, Full Vac (Open)
- Enables use of reliable and long lasting rotary vane oil pumps & dry scroll pumps in applications where diaphragm pumps were previously required
- Keeps vacuum pumps near their base pressure resulting in greater longevity

#### NIMBLE-MAXIMIZE THROUGHPUT & PUMPDOWN SPEED

- Largest flow paths available to ensure maximum flow for faster evaporation
- Maximize throughput and pump down speed with a 20 mm vacuum path

#### AUTOMATIC PROCESS CONTROLLER

- Vent your vacuum chamber or equalize your system with the touch of a button instead of pulling hoses or turning valves
- Treat material in chamber more gently by implementing kinder ramp rate controls
- Vacuum Controller with onboard ramp rate recipe control. Program up to 10 recipes based on time and pressure setpoints.
- Dashboard push button control allows you to automatically pumpdown, vent, or isolate your system with a push of a button
- Ideal for automating and simplifying vacuum chamber pressure control.

## PRECISION CONTROL & INTUITIVE DESIGN

- Easy-to-use precise, automated control with realtime graphing of pressure levels, numerical readings, and one-touch start, stop and release buttons
- Innovative valve control performs both proportional throttle vacuum and vent control
- The integrated vent design allows you to quickly vent to atmosphere to stop “bumping” during processing or when the process is complete

## Section 2. Unpacking and Inspecting

After the instrument is received, it should be carefully unpacked and inspected for damage during shipment and to confirm that all components are present. *The warranty pertains only to the instrument and does not cover losses in shipping.*

### Each SNAP comes with:

- KF25 vacuum ports for vacuum connection, vent port hose barb, 7” touch screen with knob control, USB output, analog in/out communication, and external sensor upgradability
- Power supply
- Quick start guide



## Section 3. Installation

**Now, it's time to connect the SNAP Vacuum Controller:** The only required connections for operation are power, a vacuum pump, and a vacuum system.

**Hooking the SNAP up to a system is a simple process:**

1. **Mounting:** Find a suitable location for mounting the SNAP. In its standard, landscape mode, SNAP sits on rubber feet. It should be put in a place that easily allows access to the touch screen, but has minimal process vibration. A mounting bracket or pole clamp can be added-on to allow for direct mounting to certain vacuum ovens or rotovaps. These options are best used in SNAP's portrait mode.
2. **Connect to Vacuum Pump:** Connect your vacuum pump to the KF25 input labeled "Vacuum Pump".
3. **Connect to Vacuum System:** Connect your vacuum system to the KF25 vacuum output labeled "System".
4. **Vent Port (optional):** If you would like to use a gas other than ambient air to vent your system, connect that vent gas to the hose barb.. Many customers may choose to vent with dry Nitrogen.
5. **Data Capture (optional):** Attach USB connection for data to a PC or other system.
6. **Analog In/Out (optional):** Connect to a PLC and use specified voltages to control.
7. **External Sensor (optional):** Connect an external sensor (e.g. 10 Torr Capacitance Manometer for improved accuracy
8. **Power:** Plug in to Power and turn on



## Section 4. Controlling with the SNAP

After installation, the unit is ready for immediate operation. This section will go over how to control channels with your SNAP, focusing on the different display buttons.

SNAP is feature-rich with multiple control options. It is the **1st touch screen vacuum controller with onboard recipes**.

*Watch a video of the feature-set [here](#).*

### Control Set Options:



1. Recipe Control
2. Set-Point Control
3. Vent to ATM (Bleed Control) or ability to vent with an inert gas
4. Close all valves and isolate the system
5. Full Vacuum



## RECIPE CONTROL

This mode is a highly innovative feature that allows users to set recipes based on their desired process parameters.

Watch this video on how to select recipes easily [here](#)



## SET POINT CONTROL

This mode uses both vacuum pump suction and ambient air/supplied gas pressure to control the system's vacuum level to the chosen set point (desired pressure level).

## CLOSE (Isolate)

This mode isolates the system by fully closing both the vacuum and the vent ports. The system is isolated from both Atmosphere (ATM) and the vacuum pump with this mode activated.

## FULL VAC

This mode fully closes the vent port and fully opens the vacuum port, allowing rapid and complete pumpdown of the system.

## VENT

This mode fully closes the vacuum port and fully opens the vent port, allowing for rapid and complete ventilation of the system to Atmosphere (ATM). This mode is very helpful to stop bumping in a rotary evaporator or when your process is complete.

## Controlling at a Setpoint

1. You can either control in setpoint mode or in one of the modes outlined above. The button highlighted on the screen is the mode you are in.
2. There's a button that is below the vacuum reading. It says "S-XX" and then lists the set point. You can adjust it how you'd like
3. Dial in the desired setpoint, then **Push the Dial** in to save the set-point or press the **SAVE** button on the screen. When you return back to the home screen you will see the updated setpoint on the screen.
4. You are now ready to begin controlling vacuum

## Setting PID Variables to Optimize Performance

SNAP ships with PID variables that are optimized for average vacuum hose lengths for 20 and 50 liter vessels. The SNAP is capable of controlling much smaller and larger vessels, but may require some PID tuning to optimize the control.

For more background on PID check out this white paper [Here](#).

You can access PID variables from the Setpoint (S - xxx) button when in Setpoint mode. To adjust:

- Click on S - xxx button
- Click on PID
- To put in a different number, input that number in the dialogue box
- Touch the value box of the variable you want to change (P, I, D)
- Click OK
- Your new PID variable is set.

In general, if you seem to be hunting around the set point, but never hitting it, reduce P. If you can't seem to ever get to your set point, increase P. There are dissertations in the art of tuning PID, so feel free to leverage them, or call us to help.

## Using Recipe Mode



To control in Recipe mode, press the Recipe button.

### Recipe quick keys:

- Play shall run/resume the selected recipe
- Pause shall pause the selected recipe and maintain the current pressure level. When play is then pressed, the selected recipe will pick up from it left off and resume
- Stop shall end the selected recipe, reset the clock, and maintain the current pressure level. When play is then pressed, the selected recipe will start at step 1
- If during a process, set point, recipe, vent, close, or full vac is pressed, the current recipe will be paused. Recipes operate in a radio button configuration – when mode is selected, all others modes are not active

**Play, Pause and Stop are only associated with recipes (i.e. only work in recipe mode)**

### Creating Custom Recipes (up to 10)

1. From the home screen, press the **GEAR ICON**
2. Select the recipe number to edit, then press **EDIT RECIPE**.
3. Customize the selected recipe by **TIME** (in minutes) and **PRESSURE** (in Torr) and whether you want to **RAMP** or **HOLD**



**RAMP:** pressure will change over the time frame in a ramp-wise fashion). **Example:** You want to go from 60 Torr to 40 Torr in 2 minutes. SNAP will moderate pressure down to the new set-point so the pressure change is spread out linearly over the 2 minutes. The setpoint ramp is a  $y = mx + b$  function where  $m = dP/dT$ .

**HOLD:** Pressure change will go quickly to the next pressure point and hold for the specified time. When the recipe ends, it maintains the final setpoint of the recipe.

Watch a video on creating custom recipes [here](#)



## USB Operation

The SNAP can be easily remote controlled via USB by simply connecting a cable to the Micro-USB interface.

When connecting SNAP to a windows PC, the drivers will automatically install and then a terminal session may be initiated. Below is a summary of the commands.

**Note:** recipes can currently only be input and activated from the touch screen, but set points may be activated by command line if you are in set-point mode only (not available in Recipe mode).

## CONCERTO DVCUP CHEAT SHEET

## SENSOR AND VALVE CONTROLS:

## Sensors:

## Channel 1:

Vac1? ..... Get vacuum reading of sensor 1

## Channel 2:

Vac2? ..... Get vacuum reading of sensor 2

## Channel 3:

Vac3? ..... Get vacuum reading of sensor 3

## Channel 4:

Vac4? ..... Get vacuum reading of sensor 4

## Control Valves:

## Channel 1:

SPS1? ..... Get the setpoint for Channel 1

SP1S=1 ..... Set the Channel 1 setpoint to 1

## Channel 2:

SPS2? ..... Get the setpoint for Channel 2

SP2S=180 ..... Set the Channel 2 setpoint to 180

## Channel 3:

SPS3? ..... Get the setpoint for Channel 3

SP3S=30 ..... Set the Channel 3 setpoint to 30

## Channel 4:

SPS4? ..... Get the setpoint for Channel 4

SP4S=300 ..... Set the Channel 4 setpoint to 300

## UNITS, TIMING, AND MODE:

## Units:

## Query Units:

U? ..... Get the current units.\*

\*Response will be "U=0", "U=1" or "U=2". 0 = Torr, 1 = mBar, 2 = kPa

## Setting Units:

U = 0 ..... Set the units as Torr

U = 1 ..... Set the units as mBar

U = 2 ..... Set the units as kPa

## Timing:

## Query Data Rate:

T? ..... Get the current data rate for DVCUP

## Set Data Rate:

T = 0.25 ..... Data will be sent 4 times per second

T = 1 ..... Data will be sent 1 time per second

## Mode:

M? ..... Get the current mode for DVCUP\*

\*The mode can either be Automatic, in which data is sent at the specified T rate, or Manual, in which data is only sent when queried.

M = A ..... Data will be sent automatically at the specified T

M = M ..... Data will only be sent when queried

## Section 5. Troubleshooting

Observation	Possible Causes
System does not light up	Verify the system is plugged in, and all the cords are tight
System takes too long between set points	Take SNAP out of the configuration Time how long it takes for system without Snap to get from the first vacuum level to the second vacuum level <ul style="list-style-type: none"> <li>• Re-install the SNAP and run same test</li> <li>• If the last 2 test are close, that means the SNAP is performing as it should. If the last 2 tests are different, it means the SNAP is not performing optimally. <b>Please consult your vendor for technical assistance.</b></li> </ul>

My readings are erratic	Check reading with another gauge to see if the readings are indeed erratic. If the other gauge does not show erratic readings, consult your vendor.
My SNAP is really noisy	The valves might make a whiny or buzzing sound at startup. This is normal.
My Snap can't seem to run wild swinging all over the place, and can't seem to hit a set point.	Adjust PID variables, probably reduce variable "P"
My Snap seems to be "breathing"	The base pressure of the pump is probably high as well. This can be solved by resetting the PID. If SNAP is controlling too aggressively, try setting $P=p/2$ . Want to learn more see our white paper on PID

## Section 6. Servicing and Maintenance

### Sensor and Plumbing

In many cases, a sensor may become fouled with oil or other foreign matter. It is often possible to restore the functionality of contaminated probes with cleaning. If the contaminant is known, the SNAP plumbing should be filled with a fluid that is known to be a solvent to that contaminant. Ethanol/alcohol are very powerful solvents and are highly effective against some contaminants.

After cleaning with solvents, the plumbing should be completely dried or flushed with a volatile solvent to assure that it is dry prior to reinstalling it. If this is not done, contamination of the system may result.

### Maintenance

Your vacuum instrument should give you many years of trouble-free service. There are no regularly scheduled maintenance intervals. If consistent accuracy is required, it is recommended that the SNAP and power supply be returned for an annual calibration check.

### Notes on calibration

There is inherent drift in all sensors. Repeatability is specified in the datasheet, but the specification is typically a worst case scenario as drift is not easily predicted and depends on the operating environment. Depending on your accuracy requirements, it makes sense to set up a calibration interval to obtain as found data, and get a fresh calibration. Having this information will allow you to determine the optimal calibration interval. The accepted interval is 1 year, but depends on the accuracy you require and what you have defined in your standard operating procedures (SOPs).

Note the sensors have excellent accuracy by themselves. Additional accuracy is gained by calibrating the sensor controller (sensor is integral on SNAP) to the sensor. The sensor itself cannot be calibrated, but the sensor-controller pair is. See our blog on sensor interchangeability effects on accuracy for the Bullseye Precision Gauge Piezo for more information.



## Section 7. Specifications

<b>Valves</b>	Wetted materials: 304 Stainless Steel, Viton, and PTFE (teflon)
<b>Range of control</b>	2 Torr to 775 Torr
<b>Accuracy, control</b>	+/- 5% of reading
<b>Time to converge within 5% after disturbance</b>	<30 seconds
<b>Integral sensor</b>	SEN-775i
<b>Integral Sensor Accuracy</b>	+/- 2 Torr
<b>Integral Sensor Range</b>	0.5-775 Torr
<b>Vacuum Path Orifice</b>	Minimum orifice of 20mm
<b>Minimum Bleed Valve Orifice</b>	¼" or 6.35mm hose barb I.D.
<b>Power</b>	100-240VAC 50/60Hz
<b>Dual Vacuum Control</b>	Proportional throttle and proportional bleed control (vent to atmosphere) delivered from an integral dual valve module per channel
<b>External Sensor</b>	Upgrade to a 10 torr capacitance manometer for improved accuracy
<b>Output</b>	Ability to be controlled remotely via USB or analog in/out for integration into larger systems
<b>Recipes</b>	Program ramps and holds vacuum at different duration and vacuum levels
<b>Enclosure</b>	9 ¼" width, 4 ¼" depth, 4 ¾" height
<b>Certifications</b>	CE, UL, CSA, (planned for 1H 2022) RoHS

## Section 8. Understanding Torr

This instrument and many similar instruments are calibrated in Torr.

**The pressure of the atmosphere is 14.696 or approximately 14.7 pounds per square inch at sea level. One TORR is an absolute pressure of one millimeter of mercury. A milliTorr is equal to one thousandth of a TORR. A MICRON is the same as a milliTorr.**

This pressure is due to the weight of all of the air in the earth's atmosphere above any particular square inch. This 14.696 PSI is equivalent to the pressure produced by a mercury column of approximately 29.92 inches high or .76 meters (~ 3/4 of a yard) or 760 millimeters of mercury.

Atmospheric pressure varies greatly with altitude. It decreases approximately 1 inch of mercury per thousand feet of altitude. It also varies widely with local weather conditions. (Variations of one half inch in a single day are common.)

The word "vacuum" means pressure lower than atmosphere or "suction." However, in describing negative pressure, the atmosphere is only a satisfactory reference if we are dealing with values of vacuum down to about 27 inches of mercury. Below that, it is much more useful to talk in terms of absolute pressure, starting from absolute zero



## Section 9. Terms of Use

**THE DIGIVAC COMPANY ("DIGIVAC")** offers all of its products with the following terms and conditions and notices as follows. By accepting and/or using a DIGIVAC product, you hereby acknowledge and agree to the following terms and conditions, and acceptance of these terms and conditions are a condition precedent to any purchase/sale agreement between you and DIGIVAC.

**Exclusive Obligation:** The DIGIVAC product you are purchasing has been designed for a specific use within a set of suitable operating conditions, as set forth in its User Manual, or as indicated otherwise by DIGIVAC. Any use of the DIGIVAC Product for any purpose or under any conditions, other than those specified, shall render any limited warranty void, and shall expressly invalidate any liability of DIGIVAC for damages as a result of such misuse. **User limitation:** You may not modify, copy, distribute, transmit, display, perform, reproduce, publish, license, create derivative works from, transfer, or sell, any information, software, products or services obtained from or created by DIGIVAC to any third party, without the express written consent of DIGIVAC to do otherwise. Any violation of this provision shall give rise to an indemnification of DIGIVAC by you, for any third party claims arising out of such violation. **THIRTY (30) DAY LIMITED Warranty:** All DIGIVAC products are warranted against any manufactured defect for a period of thirty (30) days from date of purchase, unless such product is a custom-work for you and not a standard DIGIVAC product. Any product qualifying as a custom-work shall not be warranted against any defects for any purpose, and your acceptance of such custom-work shall relieve DIGIVAC of any liability for any purpose. WITH THE EXCEPTION OF THE LIMITED WARRANTY ABOVE, YOU AGREE ANY DIGIVAC PRODUCT IS PROVIDED AS IS, EXCLUSIVE OF ANY WARRANTY, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED. **Limitation Of Liability:** You agree and acknowledge, DIGIVAC shall have no liability to you whatsoever for any direct, indirect, punitive, incidental, special consequential damages arising out of or connected with the use or misuse of its products. In particular, given the nature of DIGIVAC products, you agree and acknowledge, under no circumstances whatsoever shall DIGIVAC be liable to you for any consequential damages for damage to any non-DIGIVAC product or service, arising from the failure, use or misuse of a DIGIVAC product, including, but not limited to, any vacuum system, engine, vehicle, factory, or the like. In the event, a court of law with proper jurisdiction finds DIGIVAC liable to you for any purpose, you agree and acknowledge DIGIVAC's maximum liability shall not exceed the purchase price of one unit of product giving rise to such liability, or \$250.00, whichever is greater. **Entire Obligation:** These terms and conditions express the entire obligation of DIGIVAC with respect to its products. If any part of these terms and conditions are deemed void, invalid, unenforceable or illegal, including, but not limited to, the warranty disclaimers, liability disclaimers and liability limitations set forth above, then the unenforceable clause or sentence may be disregarded with the remainder of these terms and conditions valid and enforced. In the event the unenforceable clause or sentence leaves a void in these terms and conditions, a provision closely matching the intent of the unenforceable provision should be deemed inherent within these terms and conditions, slightly modified to render such provision valid and enforceable. General: These terms and conditions are governed by the laws of the State of New Jersey, USA. You hereby consent to the exclusive jurisdiction and venue of the Courts of New Jersey, in all disputes arising out of or relating to the use of this product. Use of this product is unauthorized in any jurisdiction that does not give effect to all provisions of these terms and conditions. **Modification of Terms and Conditions:** DIGIVAC reserves the right to change the terms, conditions, and notices under which their products are offered.