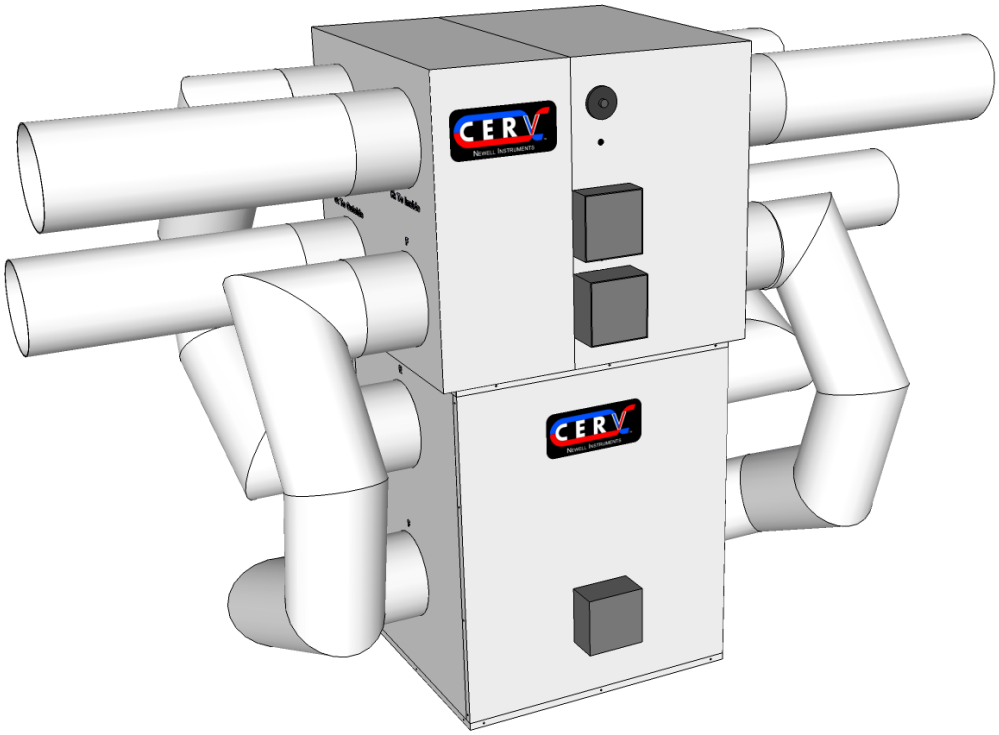
OPERATION GUIDE

MODEL CERV-001-PARTA, CERV-001-PARTB

CONDITIONING ENERGY RECOVERY VENTILATOR (CERV)



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CERV™

OPERATION GUIDE

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OVERVIEW

Managing a home's air quality is a demanding job. Between the resident's preferences, the occupancy activity, and the time of year, your home's fresh air ventilation system needs to be flexible enough to handle a dinner party, while being smart enough to know when to cut back and save energy if fresh air is not needed. **Build Equinox's CERV** is precisely that kind of system. Designed from the ground up to serve you, the CERV's primary mission is to ensure that your home is both healthy and comfortable in a highly energy efficient manner.

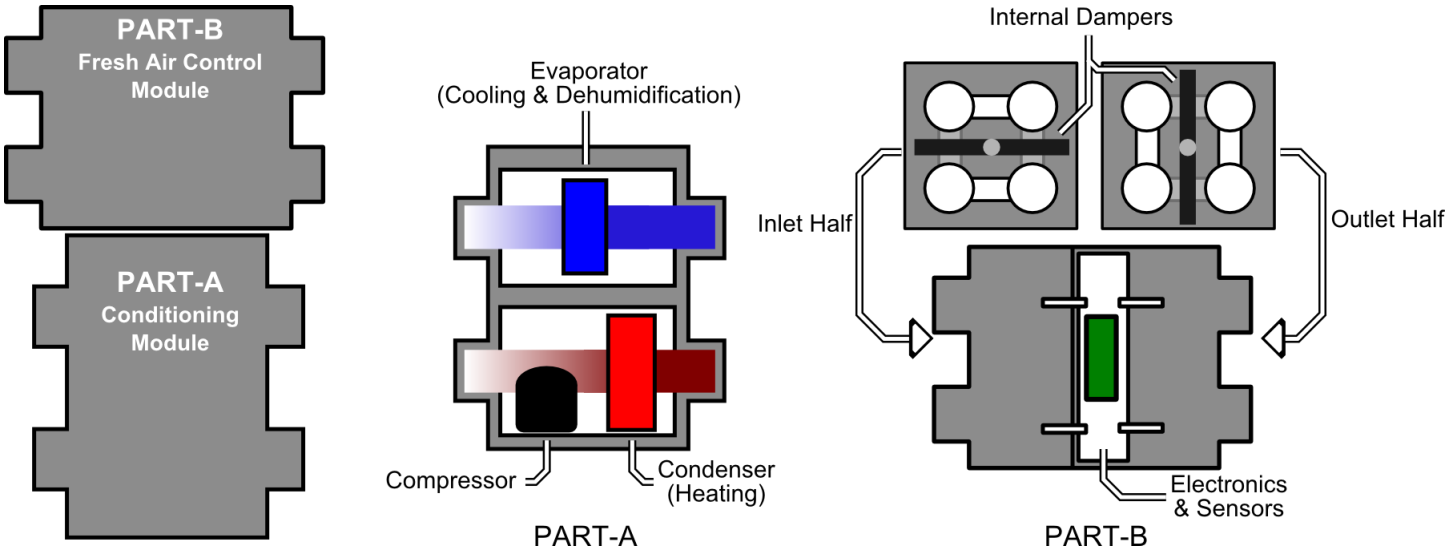
Most Energy Recovery Ventilators (ERVs) and Heat Recovery Ventilators (HRVs) simply have a fixed ventilation rate for your home, regardless of your occupancy level. Gone for the day? Your ERV/HRV chugging away, needlessly ventilating your home and placing an unnecessary load on your conditioning system. Maybe now you have a few friends over, or you are exercising. Your pollutant level is going to rise, and your fixed ERV/HRV is just going to be sitting there, oblivious to the fact that the home is in desperate need of some fresh air. Not the CERV.

The brains of the CERV lie in the Fresh Air Control Module. By constantly monitoring the home's inside and outside temperature, relative humidity, Carbon Dioxide (CO2), and Volatile Organic Compound (VOC) levels, the CERV is able to always maintain a high level of air quality and comfort in the most efficient way. Gone for the day? No problem, the CERV automatically sees the CO2 and VOC levels dropping, and decreases its ventilation rates accordingly. Having friends over? CO2 and VOC levels increase, indicating to the CERV that you need more ventilation.

The CERV can take a sizeable load off of the home's conditioning system as well with its conditioning module. Instead of using a typical heat exchanger core, the CERV exchanges energy through air streams with the use of its heat pump, which can actively heat or cool the air if it sees that the house is out of your desired comfort range.

This document is meant as a guide, to help you understand what the CERV is, and how it functions to keep your home a healthy and comfortable living environment.

CERV MODULES



CONDITIONING MODULE (PART-A)

Fresh air conditioning and Energy Recovery are both accomplished through the use of the Heat Pump Conditioning Module. This module heats, cools, dehumidifies, and exchanges energy efficiently and quietly, utilizing high quality, long lasting components.

The bottom half of the conditioning module contains both the Compressor and the Condenser, which heats the passing air to be supplied inside or exhausted out. At the same time, the top half of the module contains the evaporator, which cools and dehumidifies the passing air to be rejected outside or supplied inside. The refrigeration system is made from high quality appliance components and is a fully sealed system (meaning there are no refrigerant lines to run). Due to the small size of the system, the compressor operates practically without noise. Please see the Operation Modes section below for more information on how this incorporates into the whole system.

On the outside of the unit, you will also notice the electrical junction box, which contains the power supply wiring and low voltage frequency input, as well as a threaded PVC drain pipe and white nylon overflow tube. The PVC drain pipe **must** have an appropriate water trap (as to keep air from being sucked through the drain tube) and can be run either directly to a drain or to a condensate pump. In the chance that the drain becomes plugged, the white nylon overflow tube will allow water to escape the unit. If you ever see water coming out of the overflow tube, immediately shut off the unit and check the PVC drain.

FRESH AIR CONTROL MODULE (PART-B)

The Fresh Air Control Module contains the intelligence and control capabilities required to maintain a comfortable and healthy indoor environment. The module is composed of two halves, an inlet half and outlet half, which each contain air direction dampers. These dampers are what allow the CERV to move between recirculation/ventilation and heating/cooling modes. Additionally, this module contains the controls electronics as well as the temperature, relative humidity, VOC, and CO2 sensors.

OTHER COMPONENTS

PANASONIC WHISPERLINE FANS

The Panasonic FV-30NLF1 Whisperline fans, included with the purchase of the CERV system, typically provide around 250-300 CFM of air flow for the CERV. In addition to being some of the quietest home ventilation fans available, the Whisperline Fans are Energy Star Qualified, with a power consumption of approximately 0.29 watts per cfm. The Fans are simply wired directly to the Fresh Air Control Module's fan output wires and ducted into the system. Both fans for the system should be independently insulated (if the fans are stacked, there should be insulation separating the two).

WIRELESS TOUCHSCREEN CONTROLLER

While the CERV contains the complex algorithms to keep your air healthy and comfortable, the CERV Wireless Touchscreen Controller exists as your interface to customize the CERV to fit your needs best. The wireless controller allows you to set your heating and cooling setpoints, VOC and CO2 ventilation setpoints, as well as configure the CERV for use with its auxiliary add-ons like the back-up electric duct heater and the wireless ventilation switches. The touchscreen interface was designed from the ground up to be simple and intuitive, retaining a high degree of usability without having to worry about getting lost in a series of menus. Please see the CERV Wireless Touchscreen Controller Guide for more information.

OPTIONAL – AUXILIARY DUCT HEATER

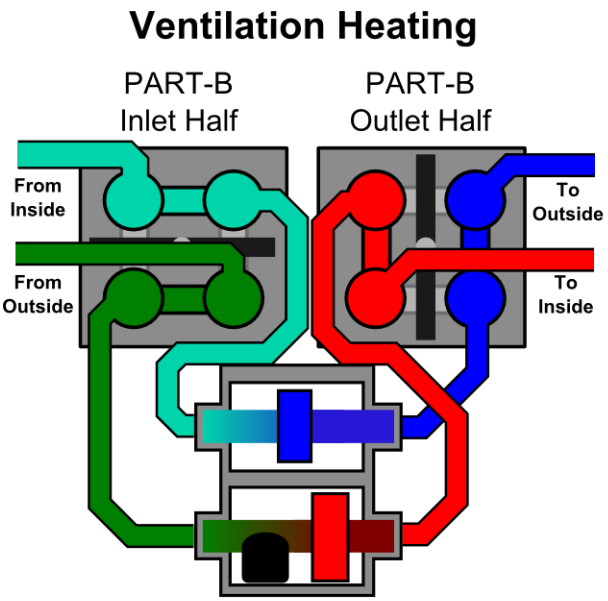
When the outside temperatures start to get very low, it may be desired to use the Auxiliary Duct Heater to add some heating capacity back into the system. The Auxiliary Duct Heater is a 5kW, 240V inline electric heater, which can be configured by the CERV Wireless Touchscreen Controller in a similar manner as the heating setpoint. Again, the CERV Wireless Touchscreen Controller Guide will provide more information on how the auxiliary heater is set up with your system. Additionally, the CERV Installation Manual details the wiring and installation necessary for the Duct Heater.

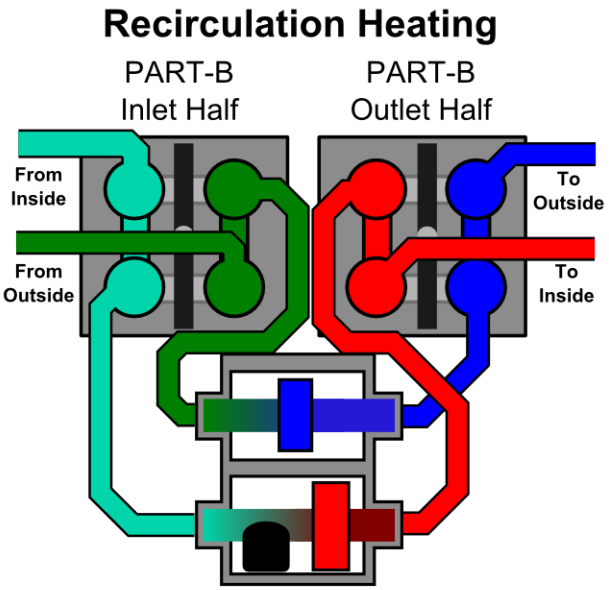
OPTIONAL – WIRELESS VENTILATION SWITCHES

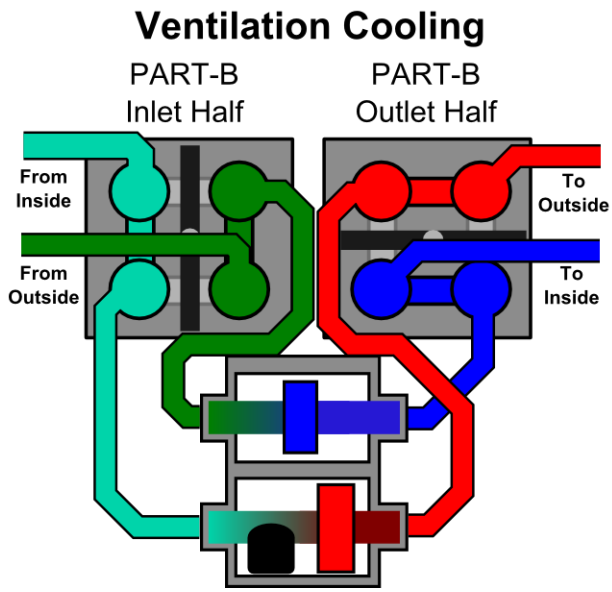
Through the use of the Wireless Ventilation Switch add-on, the user gains an extra degree of flexibility with the CERV. Typically, these switches are installed in bathrooms, kitchens, work out rooms, etc., where the occupant knows that they will be producing excess moisture or odors that they want to immediately expel from the building. Triggering the switch will send the CERV into a timed ventilation mode, configurable by the user with the Wireless Controller. In addition to the switches, a small wireless relay box is also required, and is installed in the low voltage junction box of the Fresh Air Control Module.

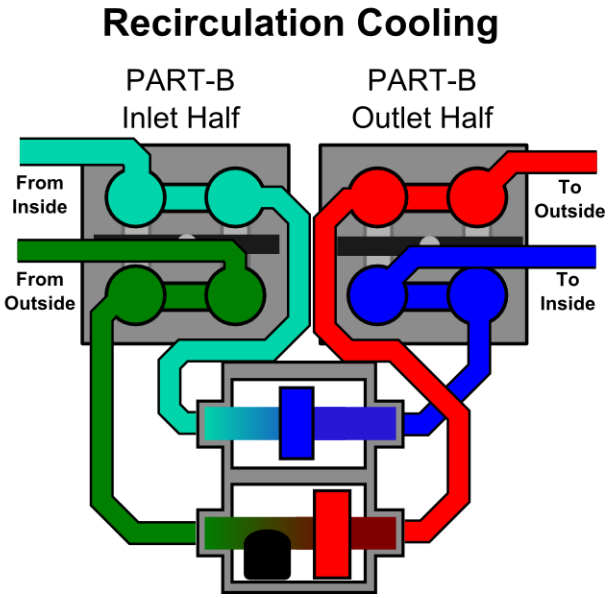
There are two styles of ventilation switches, the PTM-265 Rocker Switch and the Active Circuit Transmitter. The PTM-265 is a battery-free rocker style switch, which can be easily mounted inside an existing junction box, or even kept in a drawer or somewhere out of sight. The Active Circuit Transmitter is a small box that wires in-line with an existing light switch, detecting when the switch is turned on or off. Either or both styles may be used, and there is no limit to the number of switches that can be used in the building.

OPERATION MODES









MODES – VENTILATION

Air quality management is the CERV's top priority. Once you set your indoor air quality setpoint (measured in parts per million, or ppm), the CERV is always watching to make sure that if the pollutant level exceeds your limit, it is promptly dealt with. What level should the setpoint be set? Studies have shown that levels above 1000ppm can indicate a home may have bad odors and indicate negative effects on productivity, alertness, and general comfort.

Depending on the sensitivities of the occupant, the air quality setpoint may vary. Some people may be producing "good" VOCs, such as incense, cooking smells, etc, and allow their setpoint to reach, say, 1500 ppm, while others may be more sensitive and want tighter control. In the case that the CO2 and VOC sensors do not pick up specific elements that you may be sensitive to, you may also set a minimum ventilation level. A

minimum ventilation level will devote a portion of the CERV's operating cycle to ventilation, whether or not the sensors indicate it is needed.

There is a balance between ventilation and energy usage, which is important for the homeowner to understand. In general, a lower air quality setpoint will result in better quality air and higher energy consumption, while a higher air quality setpoint will result in lower quality air and lower energy consumption. On one hand, you do not want to be over-ventilating your house and producing unneeded conditioning demands on your systems, while on the other hand, you should not sacrifice your air quality and health in order to save a little bit of energy.

In some situations, it will actually be nicer outside than it is inside. The CERV can use this to its advantage by either utilizing Free Heating/Cooling mode, in which the heat pump is disabled, or Vent Heating/Cooling mode, in which the heat pump is actively conditioning the air. With these modes, the CERV is able to operate with a very high efficiency, contributing a significant heating or cooling to the home with very little energy usage. A standard ERV or HRV system will often not have the capability to perform in this way.

MODES – RECIRCULATION

If the indoor air quality pollutant level is below the iaq setpoint, but your heating or cooling setpoint is not satisfied, the CERV will enter a Recirculation mode. In this mode, the CERV will simply heat or cool your air, while recirculating it throughout the house. This will significantly impact the comfort and air quality of the home, keeping it uniform throughout all the living areas. This works especially well when the CERV is working in tandem with a point-source mini split heat pump, where the CERV is able to spread the conditioning power of the mini split to all of the living spaces, eliminating the need for zone control.

MODES – HEATING / COOLING

With the CERV's heat pump module, a small amount of heating or cooling capacity can be efficiently contributed to the home. It is important to note that in some cases the CERV may be able to handle the entire heating and cooling demands *on average*, it is often recommended to have an additional heating/cooling source (such as a mini split heat pump) for times of very high heating and cooling demands. The compressor operates at a maximum of around 500w, so even with a high COP, the CERV may only deliver 1500-2500w of heating (5000-8500 BTU/hr) or 1000-1500w (3500-5000 BTU/hr) cooling capacity.

MODES – OFF

When there is no demand for heating, cooling, or ventilation, the CERV may simply shut itself off in order to save energy. In this mode, the CERV will move its internal dampers into the Recirculation position, as to keep outside air from coming in, and then turn its fans off. Approximately every 10 minutes, the CERV will perform an Assessment, in which the fans are turned back on for a few minutes (still in Recirculation, but with the heat pump off). If the indoor temperature and air quality is still satisfactory after the assessment period, the CERV will turn back off; otherwise it will enter one of its various other modes depending on the conditions. This assessment period additionally acts as a way to periodically help mix the inside air to create a more uniform comfort and air quality.

ENERGY RECOVERY

While typical ERVs and HRVs use a simple heat exchanger core or heat recovery wheel, the CERV uses its integrated heat pump for energy recovery. Instead of using a direct heat exchanging methods, which may accomplish a heat recovery effectiveness of 80-90%, the CERV indirectly uses the refrigerant in the heat pump to transfer the heat between air streams, and is able to accomplish a heat recovery effectiveness greater than 100%.

As an example, say it is 68F inside and 40F outside; a cool fall day. A typical ERV/HRV will be exchanging energy, but even at a very high efficiency, will be delivering air that is cooler than the inside temperature (~65F for 90% efficiency). The CERV, on the other hand, will be using its heat pump to exchange energy, allowing a heat recovery efficiency closer to 160% (delivering ~85F air inside). This ensures that conditioned air is delivered to your living spaces, increasing your comfort level, rather than feeling cool air being delivered when your home needs to be heated.

There may be some times of the year in which it is beneficial to not exchange any energy when ventilating the home. For example, take a cool summer night (60F outside) when your home is still in need of air conditioning (78 inside). A typical ERV/HRV with a high efficiency will be heating the outside air up to ~76F, when it would be much more effective to simply ventilate the home with the 60F outside air. The CERV is able to determine when scenarios like this occur, and promptly act as to maximize comfort and minimize energy consumption in the best way possible. It would simply enter a ventilation cooling mode, but leave the compressor off, so that no energy is being exchanged and fresh, cool air is brought directly into your living areas.