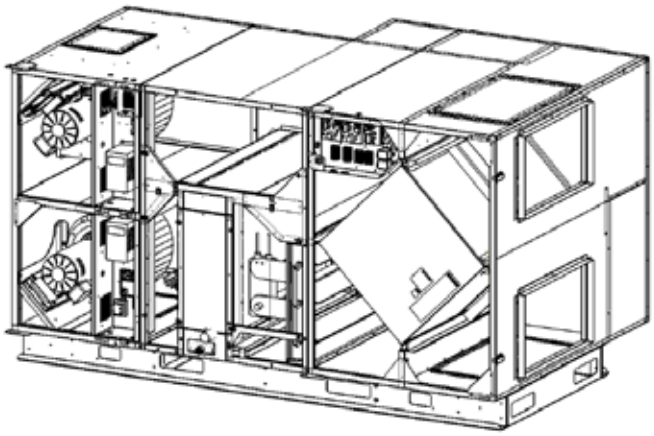
RenewAire
Energy Recovery Ventilation
The Natural Choice for Fresher Air

4510 Helgesen Drive, Madison, WI, 53718
608.221.4499, 800.627.4499, Fax: 608.221.2824
support@renewaire.com www.renewaire.com

RD MODELS: INSTALLATION AND OPERATION MANUAL

BOOK 5

START-UP, COMMISSIONING, MAINTENANCE



ABOUT BOOK 5:

This book covers Start-Up, Commissioning and Maintenance of the RD MODELS.

Please see Book 1 for an overview of the RD MODELS and system design considerations.

See Book 2 for product and performance specifications.

See Book 3 for basic mechanical installation.

See Book 4 for basic electrical connections and Wiring Schematics.

This book does not cover all system design or system integration issues. Some of these issues are discussed here and in Book 1, but in general, specification documents provided by a qualified specifying engineer are to be considered the Basis of System Design.

Following these instructions does not necessarily assure compliance with local codes and standards, which must always be observed.

Table of Contents

The RD Models are Energy Recovery Ventilators with available features designed for Dedicated Outdoor Air Systems.

Standard features include:

- Energy recovery by fixed-plate enthalpic energy exchanger
- Enthalpy- and temperature-controlled bypass of energy recovery
- Isolation dampers that shut down when ventilation is not needed
- Variable-Frequency Drive (VFD)-controlled direct-drive fresh air and exhaust air blowers
- Integrated disconnect switch
- Airflow measurement stations

Available features include:

- Heating and/or cooling coils for post-treatment of fresh air
- Double-wall construction

The RD Models can operate in up to four modes depending on options installed:

- Energy Recovery mode: the unit transfers heating or cooling energy from the exhaust air to the fresh air.
- Recovery Bypass mode: the unit takes advantage of free cooling from the outside air and doesn't transfer energy between air streams.
- Dehumidification mode: the unit conditions the fresh air to 53°F.
- Heating mode: the unit tempers the fresh air to 75°F.

PRINCIPLE OF OPERATION

RD Models operates automatically. The unit receives an external call for ventilation. Its isolation dampers open and turn on the variable frequency drives and blowers. The unit determines the operating mode by continuously monitoring the air streams for temperature and enthalpy.

The RD Models do not include a condensing unit, chiller, heat pump or boiler. When a coil for dehumidification or cooling is part of the RD unit, the condensing unit, chiller, heat pump or boiler is separately installed to meet the needs of the complete system. RD Models units equipped with coils include connection points to call for operation of the separate heating or cooling equipment. **However, no fluid or refrigerant flow control valve (TX valve) is provided, and must be specified by the designer of the overall system for separate sourcing.**

OPERATING CONTROLS

A wide variety of low voltage (24VAC) control schemes may be selected to meet the ventilation needs of the facility. These may include time clock, occupancy sensor, carbon dioxide sensor, and others. DDC systems may also control the unit with external control by other. **TX valves are not provided.**

⚠ WARNING

RISK OF FIRE, ELECTRIC SHOCK, OR INJURY.

OBSERVE ALL CODES AND THE FOLLOWING:

1. Before servicing or cleaning the unit, switch power off at disconnect switch or service panel and lock-out/tag-out to prevent power from being switched on accidentally. More than one disconnect switch may be required to de-energize the equipment for servicing.
2. This installation manual shows the suggested installation method. Additional measures may be required by local codes and standards.
3. Installation work and electrical wiring must be done by qualified professional(s) in accordance with all applicable codes, standards and licensing requirements.
4. Any structural alterations necessary for installation must comply with all applicable building, health, and safety code requirements.
5. This unit must be grounded.
6. Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment that might be installed in the area affected by this equipment. If this unit is exhausting air from a space in which chimney-vented fuel burning equipment is located, take steps to assure that combustion air supply is not affected. Follow the heating equipment manufacturer's requirements and the combustion air supply requirements of applicable codes and standards.
7. Use the unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
8. This unit is intended for general ventilating only. Do not use to exhaust hazardous or explosive materials and vapors. Do not connect this unit to range hoods, fume hoods or collection systems for toxics.
9. When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
10. If installed indoors this unit must be properly ducted to the outdoors.

⚠ CAUTION

To avoid motor bearing damage and noisy and/or unbalanced impellers, keep drywall spray, construction dust etc, out of unit.

NOTE Instructions on this page are duplicated in Book 4 BASIC ELECTRICAL INSTALLATION.

UNIT CHECKS BEFORE 1ST START-UP

1. Turn the blower module door load switch to the "OFF" position and open the blower door.
2. Verify the supply wire to the unit is the correct gage.
3. Verify the control wire to the unit is the correct gage.
4. In the blower module, check for obstructions in the blowers. Remove any foreign objects.
5. Rotate the blower wheels. They should rotate freely. Check for rubbing.
6. Check the blower wheels are secure on the motor shaft.
7. Open the core module door.
8. In the core module, check for obstructions to the dampers. Remove any foreign objects.
9. Check the filters are clean. Replace if necessary.
10. Close the core module door and blower module door.
11. Check that the unit is level.

⚠ WARNING

Danger of Electrical Shock when servicing unit. ALWAYS DISCONNECT POWER SOURCE BEFORE SERVICING! More than one disconnect switch may be required. Proper wiring size selection and wiring installation are the responsibility of the electrical contractor.

UNIT CONTROL CHECK AT 1ST START-UP

1. The RD unit can be connected to various devices that provide an external call for ventilation. See the section on External Controls. For the Unit Control Check use a jumper contact switch and connect it to position 2 (C) and position 3 (NC) on the ***left*** terminal block in the top electrical box of the blower module.
2. With the dry contact switch open, apply power to the unit. Remove the inverter covers in the blower door. The VFD displays should be lit. The unit should not operate.
3. Change Parameter 140 (P140) to 12 on the top (EA) VFD. This enables the relay output of the VFD. See section "TO CHANGE VFD PARAMETERS" on page 9 to change P140.
4. Close the dry contact switch. The VFDs and motors/blowers should not turn on. The isolation dampers are opening inside the unit. It will take less than 60 seconds for the dampers to open. Once they open the VFDs will automatically turn on. This is indicated by the blowers starting and the VFD displays showing increasing hertz.
5. Within 10 seconds the motors should be at the factory-preset speed (typically 45 hertz).

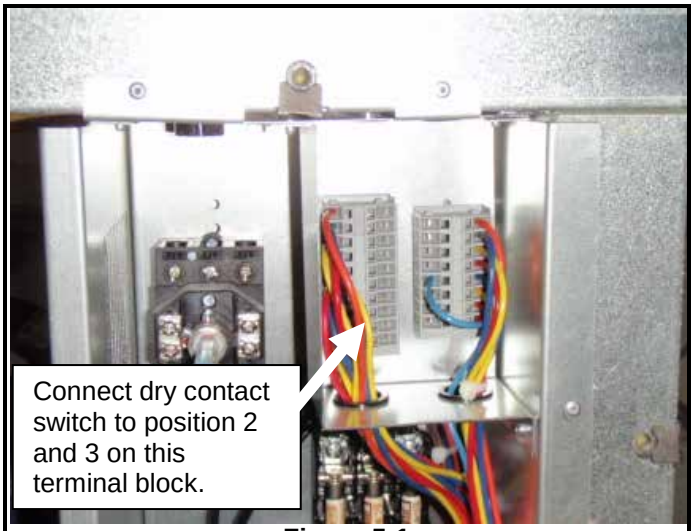


Figure 5-1
BLOWER MODULE LOW VOLTAGE COMPARTMENT

⚠ WARNING

Danger of Electrical Shock! Variable Frequency Drive capacitors retain charge after power is removed. Disconnect power and wait a minimum of three minutes before servicing drive.

Do not cycle input power to drive more than once every two minutes.

OPERATIONAL CHECK AT 1ST START-UP

1. With the unit operating check for duct noise.
2. With the unit operating check for blower vibration.
3. With the unit operating and the air flows set at the desired rates, record the start-up amperage and voltage. Record the differential pressures for the Fresh Air and the Exhaust Air.
4. Record the unit model and serial number, start-up date, start-up person's name, company, and phone number.
5. Remove the dry contact switch used for the Unit Control Check and make final connections for the external control device. See the section on External Controls for connections of the type of device used.

The RD unit is preset at the factory to operate at maximum speed.

Airflows must be measured and the unit's Variable Frequency Drives (VFDs) must be adjusted so that it operates at the airflow volumes specified for the installation.

Use the pressure taps in the core door and lower coil door to determine the air flow. You will use the charts on the next page to translate the pressure drop across the energy recovery core to the actual air flow volume.

NOTE If the operating controls for the unit have already been installed, you may not be able to turn on the blower or control their speed using the VFD keypad. See REGAINING CONTROL OF THE BLOWERS, page 5.

MEASURING AIRFLOW:

1. Connect flexible tubing to each pressure tap. Use a manometer or other differential pressure measurement tool to measure pressure differential between the ports.
   The differential pressure between tap 1 (high) and tap 2 (low) determines the Fresh Air flow.
   The differential pressure between tap 3 (high) and tap 4 (low) determines the Exhaust Air flow.
2. Adjust air flow by changing the frequency setting of the VFD for that air stream.
   To adjust a VFD's frequency setting, press the UP and DOWN buttons on the front of the VFD display.
3. Once the desired air flows are obtained re-install the inverter covers in the blower door to provide an air tight thermal seal. Re-check the differential pressure reading.
4. ENTER AIRFLOW READINGS AND FREQUENCY SETTINGS IN THE COMMISSIONING RECORDS TABLE on PAGE 8.

Figure 5-2
PRESSURE TAP LOCATIONS (RD2XIN Shown)

CAUTION

Make sure clean filters are installed in the RD Unit before balancing air flow. Dirty or clogged filters reduce air flow through the unit.

CAUTION

Very low air flow rates may result in fouling of the energy exchanger core. Do not reduce air flow to below 500cfm.

NOTE For best performance the air flow rate for both the Fresh Air and the Exhaust Air should be roughly equal ("balanced"). In some facilities a slight positive or negative pressure in the building is desired. RenewAire energy recovery ventilators can generally operate with a flow imbalance of up to 20% without significant loss in energy recovery efficiency.

Figure 5-3
VFD UP-DOWN BUTTONS

	AIRFLOW PREDICTED BY PRESSURE DROP ACROSS CORE (SCFM)							
	RD2XIN		RD2XRT		RD4XIN		RD4XRT	
DP ("H_2O)	FA	RA	FA	RA	FA	RA	FA	RA
0.20	450	450	450	450	870	860	900	860
0.25	560	560	560	560	1080	1070	1120	1060
0.30	670	680	670	680	1290	1270	1340	1260
0.35	780	790	780	790	1500	1480	1560	1470
0.40	900	900	900	900	1710	1680	1770	1670
0.45	1010	1020	1010	1020	1920	1890	1990	1870
0.50	1120	1130	1120	1130	2130	2090	2210	2070
0.55	1230	1240	1230	1240	2340	2290	2430	2260
0.60	1340	1360	1340	1360	2550	2490	2640	2460
0.65	1450	1470	1450	1470	2760	2690	2860	2660
0.70	1570	1580	1570	1580	2970	2890	3080	2850
0.75	1680	1690	1680	1690	3170	3090	3290	3050
0.80	1790	1810	1790	1810	3380	3290	3510	3240
0.85	1900	1920	1900	1920	3590	3490	3730	3440
0.90	2010	2030	2010	2030	3790	3690	3940	3630
0.95	2130	2150	2130	2150	4000	3890	4160	3830
1.00	2240	2260	2240	2260	4210	4090	4370	4020
1.05	-	-	-	-	-	4290	-	4210

Figure 5-4
CHART: AIRFLOW vs. PRESSURE DROPS

REGAINING CONTROL OF THE BLOWERS

If you cannot start a blower by pressing the RUN button on its Variable Frequency Drive (VFD), you must change a parameter of the VFD.

First, see HOW TO VIEW VFD PARAMETERS and HOW TO CHANGE VFD PARAMETERS on page 9.

Next, change Parameter P100 to "0". This allows the RUN button on the front of the VFD to provide the START command.

If you cannot change the blower speed by using the UP and DOWN buttons on the VFD keypad to adjust its operating frequency, you must change a different parameter.

Change Parameter P101 to "0". This allows the UP and DOWN buttons on the VFD to control its operating frequency.

After determining the frequency settings required to provide the specified airflow, you should set P100 and P101 as required for the specific control configuration used in this installation.

RD Models comes standard equipped with a bypass temperature controller. In addition, it may also have a coil temperature controller depending on the options chosen for the unit. See the section on Sequence of Operation for a methodology on RD Model modes of operation.
All temperature controllers come from the factory with preset temperature set points that can be adjusted in the field for the particular application and installation. Adjusting the set points is as easy as turning a dial.

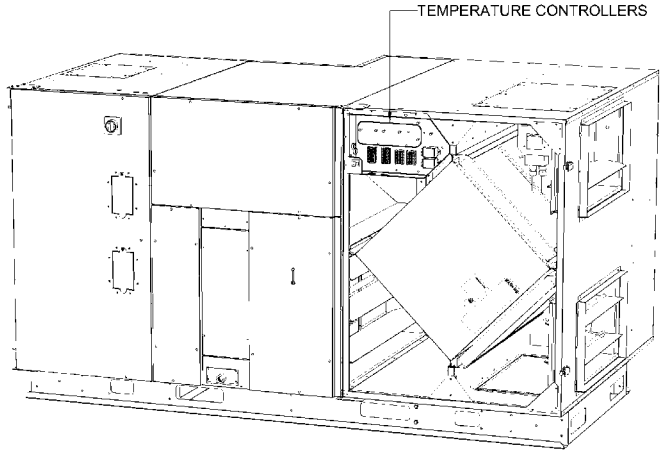


Figure 5-5
LOCATIONS OF ON-BOARD CONTROLLERS
(RD2XIN Shown)

CONTROL SETPOINTS

Control	Range	Factory Setting
OA/RA Differential Enthalpy	n/a	28 BTU
OA Bypass Low Limit Temperature	-20°F to 120°F	53°F
Dehumid Coil Low Limit Dry Bulb Temperature	-20°F to 120°F	53°F
Heat Coil High Limit Dry Bulb Temperature	-20°F to 120°F	50°F
Dehumid Coil Low Limit Dew Point	48°F to 58°F	53°F

BYPASS ENTHALPY AND TEMPERATURE CONTROLLERS

Two controllers work together to operate the energy recovery bypass damper.

1. The **Enthalpy Controller** attempts to open the Bypass Damper whenever the outside air **enthalpy** is lower than that of the room air (as measured at the RD Unit). The Enthalpy controller is not adjustable.
2. The **Bypass Temperature Controller** locks out Recovery Bypass operation whenever the outside air **temperature** is below a user-adjustable setpoint. Its temperature sensor is located in the Outside Air (OA) compartment of the unit. The factory set point for the Bypass Temperature Controller is 53°. The set point can be adjust to any temperature between -20°F and 120°F simply by turning the dial on the bypass temperature controller.

Bypass is locked out when there is no call for outside air ventilation.

(Continued on next page)

DEHUMIDIFICATION COIL TEMPERATURE CONTROLLER

(The Dehumidification Coil Temperature Controller is provided only when a dehumidification coil is part of the RD Unit.)

The Dehumidification Coil Temperature Controller is used to determine when conditions are right for the RD Unit to be in Dehumidification mode. The dehumidification coil temperature controller sensor in located in the Fresh Air (FA) compartment of the unit between the bypass damper and coil. It senses the fresh air temperature leaving the energy recovery core or the bypass compartment. The set point for the dehumidification coil temperature controller is set at 53°F at the factory. When the FA temperature is above the set point the unit can go into Dehumidification mode. The controller closes a contact to signal external equipment (provided by others) to operate the coil. The set point can be adjust to any temperature between -20°F and 120°F by turning the dial on the coil temperature controller. If the unit is equipped with the optional dew point sensor then the set point can be adjusted to any temperature between 48°F and 58°F by turning the trim pot on the dehumidification coil temperature controller.

HEATING COIL TEMPERATURE CONTROLLER

(The Heating Coil Temperature Controller is provided only when a heating coil is part of the RD Unit.)

The Heating Coil Temperature Controller is used to determine when conditions are right for the RD Unit to be in Heating mode. The heating coil temperature controller sensor in located in the Fresh Air (FA) compartment of the unit between the bypass damper and coil. It senses the fresh air temperature leaving the energy recovery core or the bypass compartment. The set point for the heating coil temperature controller is set at 50°F at the factory. When the FA temperature is below the set point the unit can go into Heating mode. The controller closes a contact to signal external equipment (provided by others) to operate the coil. The set point can be adjust to any temperature between -20°F and 120°F simply by turning the dial on the heating coil temperature controller.

RECORD INITIAL SETTINGS

Use the “Commissioning and Service Records” in this book, starting on page 48, to record the initial settings of the on-board controllers.

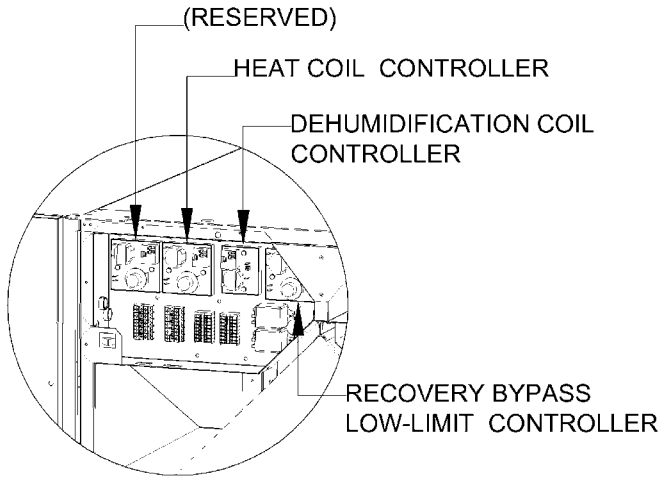


Figure 5-5.5
LOCATIONS OF ON-BOARD CONTROLLERS
(RD2XIN Shown)

"START" AND "FREQUENCY" COMMANDS

RD Model unit operation is dependent on two signals: a START command and a FREQUENCY command. The sources and types of these signals can vary. When the unit receives a START command the on-board relay coil is energized and power is provided to the isolation damper actuators. The isolation dampers open. When the dampers are fully open a signal is sent to the variable frequency drives (VFD) to start forward rotation of the motors. The VFDs then operate at the FREQUENCY command established for each drive. The RD Unit operates in different modes depending on conditions monitored by the on-board controllers.

PRINCIPLES OF EXTERNAL CONTROL

RD Models can be operated by various external control devices including remote switch or relay, digital time clock with relay, occupancy sensor with relay, and carbon dioxide sensor with relay and analog output. These devices are commonly known as 2-wire, 3-wire, and 4-wire devices.

The external control devices can be connected to the RD Unit to operate each blower independently or for one blower to act as leader and the other blower to act as follower. When operating independently, a single external switch or relay calls for operation but each VFD can respond independently to keypad, presets, or analog signal source.

When acting as leader-follower, again, a single external switch or relay calls for operation and then one VFD responds to keypad, presets, or analog signal. The other VFD follows the leader's response either exactly or at an offset above or below the leader's response. The RD Unit has the versatility that either the exhaust air (EA) VFD or the fresh air (FA) VFD can act as leader.

Connection of an external control device to the RD Unit is simple. All external control device wires are connected to a terminal block(s) in the blower module. Then the VFD's are programmed depending on the type of external control. The VFD's are pre-programmed at the factory so only a few parameters need change for a specific installation.

BASIC STEPS TO COORDINATE THE EXTERNAL CONTROLS AND THE VFD PARAMETERS

1. Determine the type of external control.
2. Adjust the air flows to the specified Design Maximums. (See "BALANCE AIRFLOW", page 4.) Record the airflows and corresponding hertz readings in the table below.
3. Adjust the air flows to the specified Design Minimums (which must exceed 500 CFM). Record the airflows and corresponding hertz readings in the table below.

	Design Airflow	Required VFD Hz Setting
Maximum Design Exhaust Airflow		
Minimum Design Exhaust Airflow	*	
Maximum Design Outside Airflow		
Minimum Design Outside Airflow	*	

* Minimum Design Airflows must exceed 500 CFM.

4. Program the VFDs for the type of external control connected and the desired air flow. The VFD parameters affected by the type of external control are listed in Table 1, VFD Parameters, on page 10. Not all parameters are affected for all controls.
5. Connect the external control according to the wiring schematics.

TO VIEW VFD PARAMETERS

VFD must be powered up – something will be showing on the LED display.
Push MODE button – PASS will flash on screen followed by “0000”.
Push MODE button again to display P498.
Use UP or DOWN arrows to scroll through the Parameters.
Press MODE button to display the Parameter value.
Press MODE to exit – STOP will display.
To view other parameters start process over.

TO CHANGE VFD PARAMETERS

VFD must be powered up – something will be showing on the LED display.
Push MODE button – PASS will flash on screen followed by “0000”.
Press and hold Up Arrow to scroll to password 225.
Press MODE to display P100
Use Up Arrow to scroll to Parameter of interest.
Press Mode again to display Parameter value.
Use Up/Down Arrow button to change parameter value.
Press MODE button to display STOP (in some cases the display will be different).

CAUTION

After changing all parameters of interest, it is good practice to power down by turning off the Load Switch for two minutes, then turn the power back on.

TO RESET VFD PARAMETERS TO FACTORY SETTINGS USING KEYPAD

1. VFD must be powered up – something will be showing on the LED display.
2. Push MODE button – PASS will flash on screen followed by “0000”.
3. Press and Hold UP ARROW button to scroll to password 225.
4. Press MODE button to display P100.
5. Press and Hold UP ARROW button to scroll to Parameter 199.
6. Press MODE button again to display 00.
7. Press and Hold UP ARROW button to reach 02.
8. Press MODE button to display STOP (in some cases the display will be different).
9. Turn VFD power off, wait thirty seconds, then turn VFD back on. (Use the door-mounted Disconnect Switch to turn on and turn off power to the VFD.)

VFD PARAMETER OVERVIEW

"VFD Parameters" are instructions that the Variable Frequency Drives follow. They can be adjusted by using the keypads on the VFDs. In some control configurations, they will need to be changed from the settings as shipped in the RD Unit product. Following are the VFD Parameters that are most likely to be of use in the RD Unit.

Parameter	Description	Settings as Shipped	FUNCTION
P100	Start Control Source	4	Sets the source of the START command as either the keypad on the VFD or inputs to its terminal strip.
P101	Standard Reference Source	4	Sets Preset #2 as the reference source for the default speed.
P102	Minimum Frequency	15	Determines the minimum operating speed for the blower.
P103	Maximum Frequency	60	Determines the maximum operating speed for the blower.
P121	TB-13A	0	Determines what action the VFD takes when a TB-13x is shorted to terminal 4. Setting "0" means VFD ignores these terminals.
P122	TB-13B	0	
P123	TB-13C	0	
P131	Preset Speed #1	30	Determines VFD speed when the Preset is selected. Parameter value equals operating speed in hertz.
P132	Preset Speed #2	45	
P133	Preset Speed #3	60	
P140	Relay Output, TB-16, TB-17	0	"0" disables the output. "12" enables the output.
P150	TB-30 Output	0	Determines what the 0-10VDC or 4-20mA signal available at Terminal 30 indicates VFD Frequency, Load, Torque or Power; value of 0 disables all output from Terminal 30.
P152	TB-30 Scaling: Frequency	60	Used to scale the analog signal at TB-30 (when used).
P160	Speed at Minimum Signal	0	When analog input is used to control VFD speed, sets VFD speed in hertz when analog signal is 0%.
P161	Speed at Maximum Signal	60	When analog input is used to control VFD speed, sets VFD speed in hertz when analog signal is 100%.
P201	PID Feedback Source	0	Indicates type of signal from analog controller. Set to "0" for 4-20mA signals, set to "1" for 0-10vdC signals.
P204	Feedback at Minimum Signal	0	Set to match the range of the feedback signal being used.
P205	Feedback at Maximum Signal	20	
P215	Maximum Alarm Level	0	When analog controls are used, this parameter controls whether ventilation occurs continuously or only when the analog signal is above a specific level.

Table 1. VFD Parameters

NOTE VFD Manufacturer instructions list the many other parameters. Two copies of the complete manufacturer's instructions for the VFD in the RD Unit are shipped with the unit, and are also available on-line.

⚠ WARNING

DANGER OF MOTOR OVERLOAD LEADING TO SMOKE AND FIRE!
Do not change P108 from the factory default setting. This parameter controls the Motor OVERLOAD PROTECTION provided by the VFD.

CONTROL FROM ON/OFF TYPE SWITCH OR RELAY

RD Models can be controlled by a remote switch or relay for on/off operation. This type of switch is also known as a "dry contact switch." No voltage should be applied to the switch or relay except from the RD Unit. All control wire connections are made to the terminal block in the low voltage compartment of the top electrical box in the blower module. The relay common wire should be attached to terminal #2 on the Left-Side terminal block and the relay normally open (NO) wire should be attached to terminal #3 on the Left-Side terminal block as in Figure 5-6.

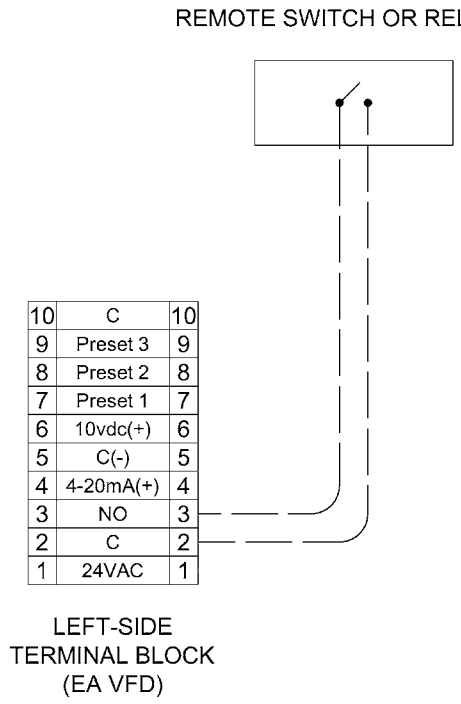


Figure 5-6
BLOWER MODULE LOW VOLTAGE COMPARTMENT
LEFT-SIDE TERMINAL STRIP

INDEPENDENT VFD OPERATION.

VFD's will run independently of each other at the frequency settings made during air flow balancing. Any frequency changes (blower speed) are made at the KEYPAD of the respective VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P101	Changes to: 0	Allows speed adjustment from keypad.

EA LEADER – FA FOLLOWER.

1. BOTH VFDS AT THE SAME SPEED

EA VFD will run at the frequency setting made at the keypad.

FA VFD will follow exactly the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P101	Changes to: 0	Allows speed adjustment from keypad.
FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

2. FA VFD RUNS FASTER OR SLOWER THAN EA VFD

EA VFD will run at the frequency setting made at the keypad. FA VFD will run at a specified ratio above or below the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P152	Changes to: X	X = an offset ratio as calculated below.
P101	Changes to: 0	Allows speed adjustment from keypad.
FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

$$X = \frac{[Desired\_Maximum\_EA\_speed]}{[Desired\_Maximum\_FA\_speed]}, \quad 60$$

CONTROL FROM DIGITAL TIME CLOCK

RD Models can be controlled by a digital time clock with relay such as the RenewAire Accessory TC7D. All control wire connections are made to the terminal block in the low voltage compartment of the top electrical box in the blower module. If the RD Unit is to provide 24VAC to the time clock then the red wire from the time clock should be attached to terminal #1 on the Left-Side terminal block. The red wire from the time clock should be attached to terminal #2 on the Left-Side terminal block. The relay's normally open (NO) yellow wire from the time clock should be attached to terminal #3 on the Left-Side terminal block. See Figure 5-7.

If the time clock gets its power from a separate external Class 2 source of 24VAC then the black wire from the time clock should be attached to terminal #2 on the Left-Side terminal block and the relay's normally open (NO) yellow wire from the time clock should be attached to terminal #3 on the Left-Side terminal block. No connection is made to terminal #1.

NOTE VFD parameter settings are the same as for Control From ON/OFF Type Switch or Relay. See page 11.

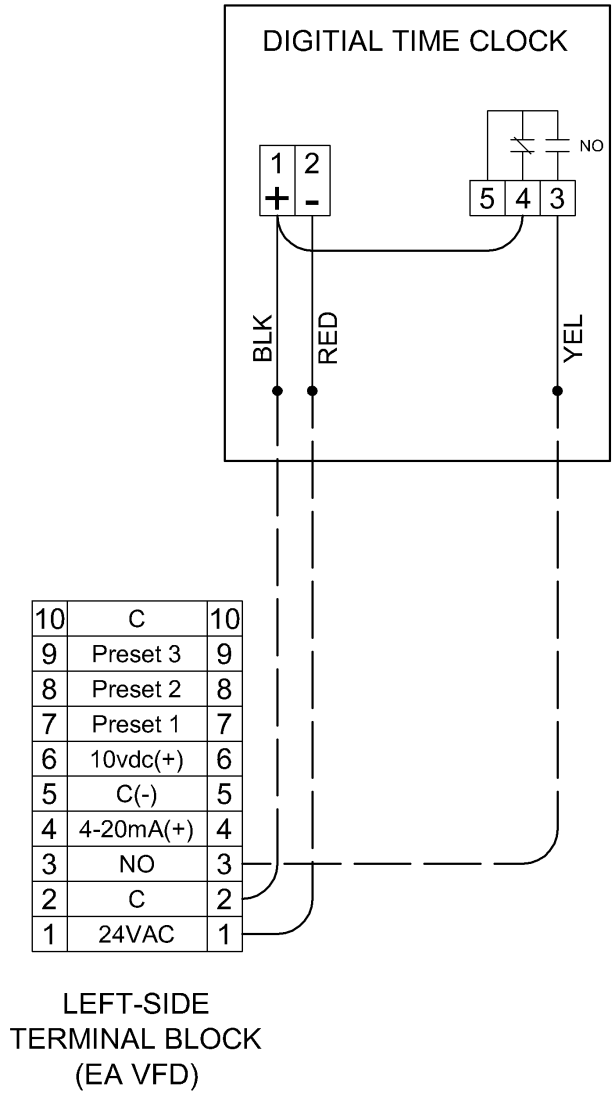


Figure 5-7
BLOWER MODULE LOW VOLTAGE COMPARTMENT
LEFT-SIDE TERMINAL STRIP

CONTROL FROM OCCUPANCY SENSOR WITH RELAY

RD Models can be controlled by an occupancy sensor with relay such as the RenewAire Accessories MC-C or MC-W. All control wire connections are made to the terminal block in the low voltage compartment of the top electrical box in the blower module. If the RD Unit is to provide 24VAC to the occupancy sensor then the black wire from the occupancy sensor should be connected to the orange wire (Common) of the sensor and also attached to terminal #2 on the Left-Side terminal block. The red wire from the occupancy sensor should be attached to terminal #1 on the Left-Side terminal block. The relay's normally open (NO) yellow wire from the occupancy sensor should be attached to terminal #3 on the Left-Side terminal block. See Figure 5-8.

NOTE VFD parameter settings are the same as for Control From ON/OFF Type Switch or Relay. See page 11.

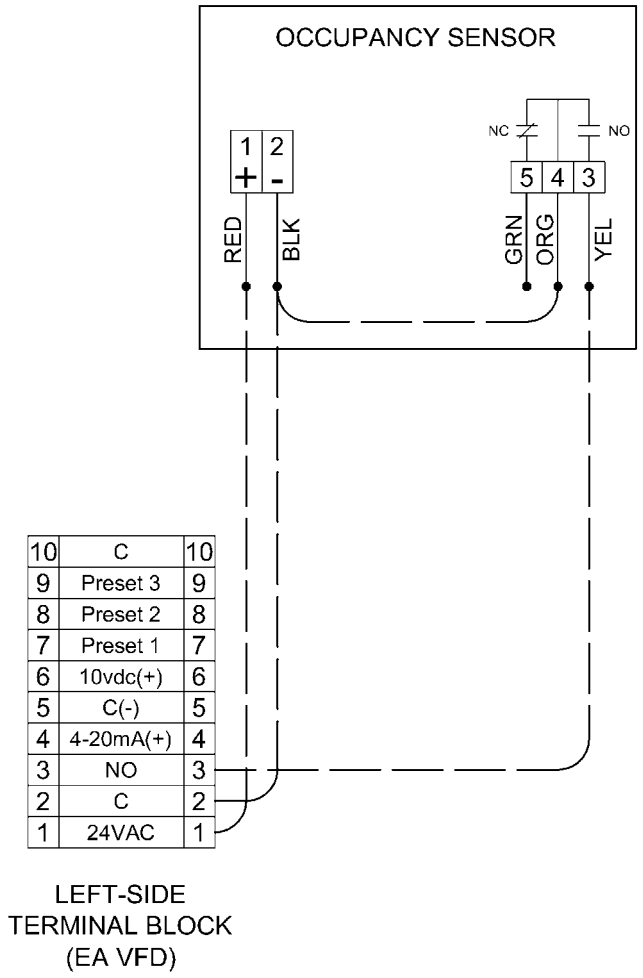


FIGURE 5-8
BLOWER MODULE LOW VOLTAGE COMPARTMENT
LEFT-SIDE TERMINAL STRIP

CONTROL FROM LO-MED-HI SWITCH WITH ON/OFF

RD Models can be controlled with an ON/OFF switch or relay and a-multi-position switch to operate at up to three preset speeds. All control wire connections are made to the **left** terminal block in the low voltage compartment of the top electrical box in the blower module.

- The relay common wire should be attached to terminal #2 on the **left** terminal block.
- The relay normally open (NO) wire should be attached to terminal #3 on the **left** terminal block.
- The common wire for the preset speed switches should be attached to terminal #10 on the **left** terminal block.
- The low speed switch should be attached to terminal #7 on the **left** terminal block.
- The medium speed switch should be attached to terminal #8 on the **left** terminal block.
- The high speed switch should be attached to terminal #9 on the **left** terminal block.
- Three Jumpers should be installed between terminals #7, #8 & #9 on the **left** terminal block and terminals #5, #6 & #7 on the **right** terminal block. See Figure 5-9, this page.

NOTE Method shown provides for up to (3) preset speeds for each VFD. Other schemes can provide up to (7) preset speeds. Call factory for more information.

NOTE To customize the preset speed settings for each VFD, change parameters P131, P132, and P133 from the factory settings of 30 Hz, 45 Hz, and 60 Hz, respectively.

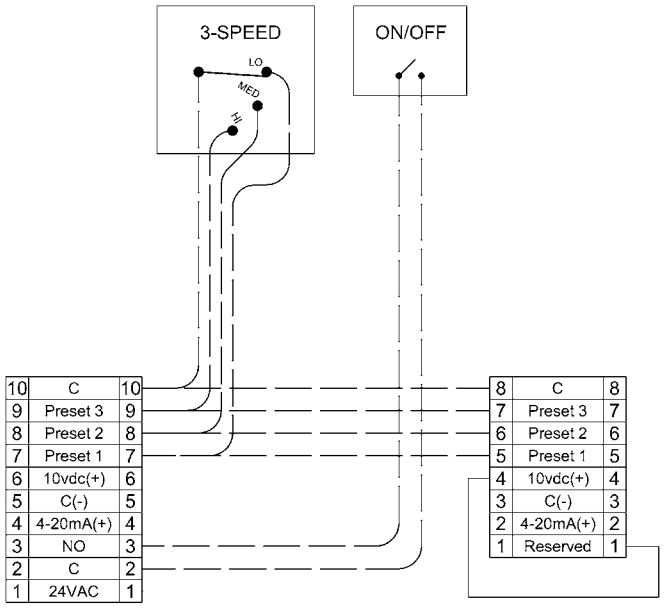


Figure 5-9
BLOWER MODULE LOW VOLTAGE COMPARTMENT

INDEPENDENT VFD OPERATION.

VFD's will run independently of each other at the preset speeds.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P131 & P133.
P122	Changes to: 3	
P123	Changes to: 3	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
FRESH AIR BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P131 & P133.
P122	Changes to: 3	
P123	Changes to: 3	

EA LEADER – FA FOLLOWER.

1. BOTH VFDS AT THE SAME SPEED

EA VFD will run at the preset speeds.
FA VFD will follow exactly the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P132 & P133.
P122	Changes to: 3	
P123	Changes to: 3	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

NOTE To customize the preset speed settings for each VFD, change parameters P131, P132, and P133 from the factory settings of 30 Hz, 45 Hz, and 60 Hz, respectively.

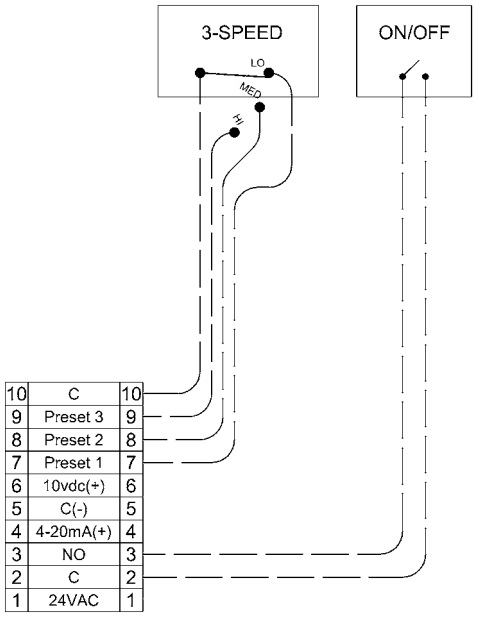


Figure 5-10
BLOWER MODULE LOW VOLTAGE COMPARTMENT
LEFT-SIDE TERMINAL STRIP
NO JUMPERS BETWEEN TERMINAL STRIPS

2. FA VFD RUNS FASTER OR SLOWER THAN EA VFD

EA VFD will run at the preset speeds.
FA VFD will run at a specified ratio above or below the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P132 & P133.
P122	Changes to: 3	
P123	Changes to: 3	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P152	Changes to: X	X = an offset ratio as calculated below.
FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

$$P152 = X = \frac{[Desired\_Maximum\_EA\_speed]}{[Desired\_Maximum\_FA\_speed]}, 60$$

NOTE When P152 is greater than 60, the Exhaust Blower runs faster than the Fresh Air Blower. When P152 is less than 60, the Exhaust Blower runs slower than the Fresh Air Blower.

NOTE For the control schemes on this page, the jumpers shown in Figure 5-9, previous page, are not needed.

The Variable Frequency Drive (VFD) for each blower in the RD Unit can be controlled by an analog input signal. The blowers can be controlled independently; one blower can be controlled by an analog input signal and the other blower can be controlled with up to three preset speeds; or the EA blower can be established as the leader and the FA blower can follow the EA. No separate ON/OFF switch or relay is required to control the operation of the unit. A minimum analog signal threshold serves this function.

All control wire connections are made to the two terminal blocks in the low voltage compartment of the top electrical box in the blower module. The left terminal block is for connecting the control for the EA or top blower. The right terminal block is for connecting the control for the FA or bottom blower.

NOTE Whenever the analog signal is providing the unit's on/off control function: install a jumper between terminal #2 and terminal #3 on the right side of the ***left*** terminal block.

The ***left*** terminal block is used to control the top EA blower from the analog controller. If the RD Unit is to provide 24VAC to the analog controller then the 24VAC (+) wire from the controller should be attached to terminal #1 on the terminal block. The 24VAC (-) Common wire from the controller should be connected to terminal #2 on the terminal block.

If a 4-20mA signal is provided from the controller then the Signal Ground wire from the controller should be attached to terminal #5 on the ***left*** terminal block. The 4-20mA Output wire from the controller should be attached to terminal #4 on the ***left*** terminal block.

If a 0-10VDC signal is provided from the controller then the Signal Ground wire from the controller should be attached to terminal #5 on the ***left*** terminal block. The 0-10VDC Output wire from the controller should be attached to terminal #6 on the ***left*** terminal block. See Figure 5-11.

The ***right*** terminal block is used to control the bottom FA blower. It can be controlled from the keypad, by preset speed switches, analog control, or it can follow the EA VFD and blower.

If the FA blower is to be controlled from its keypad or is to follow the EA VFD then no further wire connections need be made.

If the FA blower is to be controlled by preset speed switches make connections to the ***right*** terminal block. The common wire for the preset speed switches should be attached to terminal #8 on the left side of the terminal block. The low speed switch should be attached to terminal #5 on the ***right*** terminal block. The medium speed switch should be attached to terminal #6 on the terminal block. The high speed switch should be attached to terminal #7 on the terminal block. See Figure 5-14.

NOTE The left-side terminal block has (10) terminals.
The right-side terminal block has (8) terminals.

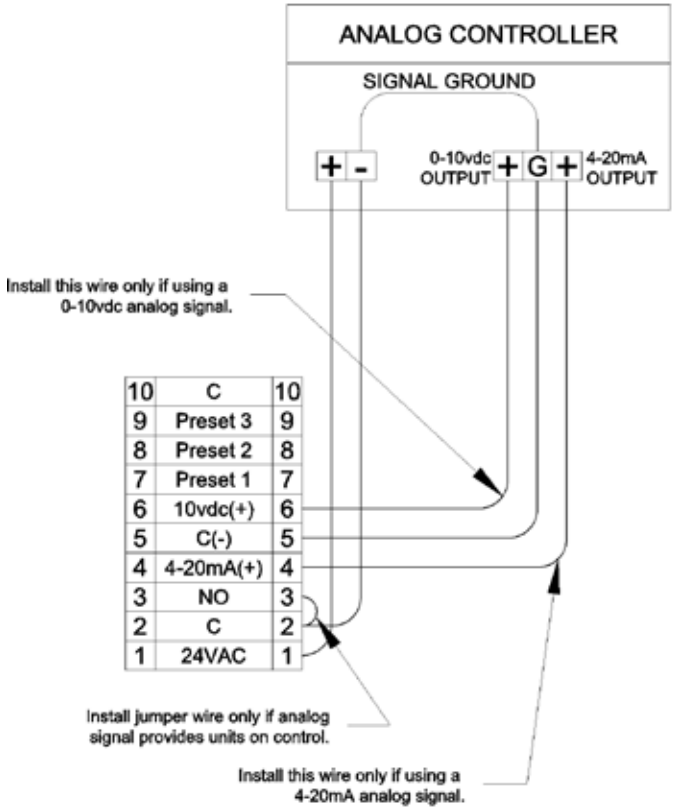


Figure 5-11
BLOWER MODULE LOW VOLTAGE COMPARTMENT
USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.
USE RIGHT-SIDE TERMINAL STRIP FOR SEPARATE ANALOG CONTROL OF FA VFD.

The most likely reason to control the VFD from an analog signal is automatically change the amount of outside air ventilation to meet the actual needs for each time period.

If one or both of the VFDs will be controlled by an analog input from an external Control Device (e.g. a CO_2 controller or a Building Management System), you may need to "scale" the rate of response of the VFD(s) to the rate of change of the analog signal. Usually only one of the two VFDs requires scaling.

We need to introduce two concepts relating to the amount of outside air ventilation needed in the building:

- The "ACTION LEVEL" (AL) is the level of measurement of indoor air quality or occupancy at which the RD Unit should start to deliver more than the "Design Minimum Supply Airflow";
- The "MAXIMUM RESPONSE LEVEL" (MRL) is the level of measurement of indoor air quality or occupancy at which the RD Unit should be operating at the "Design Maximum Supply Airflow".

ADDITIONAL JOB INFORMATION NEEDED:

1. INPUT TYPE (IT) of analog signal: **vdc** or **mA**
2. MINIMUM SIGNAL VALUE (MinSV) of the analog signal: e.g. **0vdc** or **4mA**.
3. MAXIMUM SIGNAL VALUE (MaxSV) of the analog signal: e.g. **10vdc**, **20mA**
4. MEASUREMENT RANGE (MR): the range of the values that <u>can</u> be measured by the Control Device (e.g. a controller set to measure CO_2 from 0ppm to 1100ppm). [1]
5. ACTION LEVEL SIGNAL (ALS): the value of the analog signal corresponding to the "Action Level".
6. MAXIMUM RESPONSE LEVEL SIGNAL (MRLS): the value of the analog signal corresponding to the "Maximum Response Level".
7. MAXIMUM HERTZ (MaxH): VFD frequency setting at maximum design airflow. This was determined during the initial balancing process (see BALANCE AIRFLOWS, page 4).
8. MINIMUM HERTZ (MinH): setting corresponding to minimum design airflow, again determined during the initial balancing process.
9. Whether ventilation should stop whenever air quality is below the "Action Level", or should continue at minimum design airflow.

[1] This does not mean the range of values that <u>will</u> be measured. For example, a CO2 controller might be set so that it <u>can</u> measure from 0ppm to 1100ppm. The Measurement Range is therefore 0-1100ppm. In the field the controller might never read a value below 400ppm or above 1000ppm, but this is not the meaning of Measurement Range.

NOTE In addition to the example below, see the worksheets on pages20 - 21 for assistance with the required calculations for scaling parameters.

APPLICATION EXAMPLE: CO2 CONTROLLER

Consider the following building provided with outside air ventilation by an RD Unit:

- The engineer requires a minimum outside air ventilation rate of 700 CFM at all times in order to control the level of indoor air pollutants generated by the furnishings.
- To address the higher level of ventilation required when the building is occupied, the engineer specifies that a CO_2 controller shall be used to increase ventilation if CO_2 levels rise above 600ppm.
- The engineer specifies a maximum outside air ventilation rate of 1500 CFM and expects this to restrain CO2 levels to 1000ppm.

In short, the ventilation requirements call for the RD Unit to be running at no less than 700CFM at all times. When CO_2 levels increase above 600ppm, the airflow volume should increase, reaching a maximum of 1500CFM at a CO_2 level of 1000ppm. Turning to the equipment itself:

- The CO2 controller is set up to deliver a linear 0-10vdc signal over a measurement range of 0 to 1100ppm.
  THEREFORE: the "INPUT TYPE" (IT) = <u>vdc</u>.
  The MINIMUM SIGNAL VALUE (MinSV)= 0vdc.
  The MAXIMUM SIGNAL VALUE (MaxSV)= 10vdc.
  The MEASUREMENT RANGE (MR) = 0 – 1100ppm.
- During Balancing we recorded VFD frequencies of 50hz at 1500 CFM, and 20hz at 700CFM.
  THEREFORE: "MAXIMUM HERTZ (MaxH) = 50.
  "MINIMUM HERTZ" (MinH) = 20.
- From the engineer's requirements:
  the "ACTION LEVEL" = <u>600ppm</u>;
  the "MAXIMUM RESPONSE LEVEL" = <u>1000ppm</u>.

We must <u>calculate</u> the ACTION LEVEL SIGNAL (ALS), the value of the analog signal coming from the controller when CO_2 = 600ppm:

$$ALS = MinSV + \left[\frac{ACTION\_LEVEL}{MR} \times MaxSV\right]$$

Or, in this example:

$$ALS(vdc) = 0(vdc) \frac{600(ppm)}{1100(ppm)} \times 10(vdc) = 5.5(vdc)$$

APPLICATION EXAMPLE (cont.):

We must calculate the MAXIMUM RESPONSE LEVEL SIGNAL (MRLS): the value of the analog signal coming from the controller when CO_2 = 1000ppm:

$$MRLS = MinSV + \left[\frac{MRL}{MR} \times MaxSV\right]$$

Or, in this example:

$$MRLS(vdc) = 0(vdc) + \left[\frac{1000(ppm)}{1100(ppm)} \times 10(vdc)\right] = 9.1(vdc)$$

Now we can set the VFD parameters that will scale the response of the VFD to the inputs from the CO_2 controller (see CHANGING VFD PARAMETERS, page 9, and table to right):

Set Parameter 101 STANDARD REFERENCE SOURCE to "1", telling the VFD to expect a 0-10vdc signal.

Set Parameter 102 MINIMUM HERTZ: to "20". The VFD will never operate the motors below this speed.

Set Parameter 103 MAXIMUM HERTZ to "50". The VFD will never operate the motors above this speed.

Set Parameter 160 SPEED AT MINIMUM SIGNAL to the following calculated value:

$$P160 = P102 - \left[\frac{(P103 - P102)}{(MRLS - ALS)} \times (ALS - MinSV)\right]$$

Or, in our example:

$$P160(hz) = 20(hz) - \left[\frac{(50 - 20)(hz)}{(9.1 - 5.5)(vdc)} \times (5.5(vdc) - 0(vdc))\right] = -25.8(hz)$$

Do not be concerned if this P160 is a negative number or is lower than the desired minimum – Parameter 102 will maintain VFD speed above this level.

Set Parameter 161 SPEED AT MAXIMUM SIGNAL to the following calculated value:

$$P161 = P103 + \left[\frac{(P103 - P102)}{(MRLS - ALS)} \times (MaxSV - MRLS)\right]$$

Or, in our example:

$$P161(hz) = 50(hz) + \left[\frac{(50 - 20)(hz)}{(9.1 - 5.5)(vdc)} \times (10 - 9.1)(vdc)\right] = 57.5(hz)$$

Do not be concerned that this setting is higher than the desired maximum – Parameter 103 will cap VFD speed below this level.

To control whether ventilation continues at analog signals below the ACTION LEVEL.

In this application example the RD Unit is intended to run continuously. If the measured CO_2 concentration is below the ACTION LEVEL, the unit should run at the MINIMUM DESIGN AIRFLOW established by P102. To ensure that this happens, P215 MAX ALARM LEVEL should be set equal to P102 MINIMUM HERTZ.

However, if it were desired to shut down the RD Unit at all CO_2 levels below the ACTION LEVEL, set P215 MAX ALARM LEVEL equal to the ACTION LEVEL SIGNAL.

PARAMETERS USED IN SCALING		
PARAMETERS		VALUES
P101	Standard Reference Source	0 = Keypad 1 = 0-10vdc 2 = 4-20mA 3-5 = Preset #1 - #3 6 = Network
P102	Minimum Frequency	Input the value in hertz
P103	Maximum Frequency	Input the value in hertz
P160	Speed at Minimum Signal	Input the value in hertz. This value may be negative but this does not call for reverse rotation.
P161	Speed at Maximum Signal	Input the value in hertz. This value may be higher than the desired maximum blower speed.
P215	Max Alarm Level	Input the value in vdc or mA, whichever you are using.

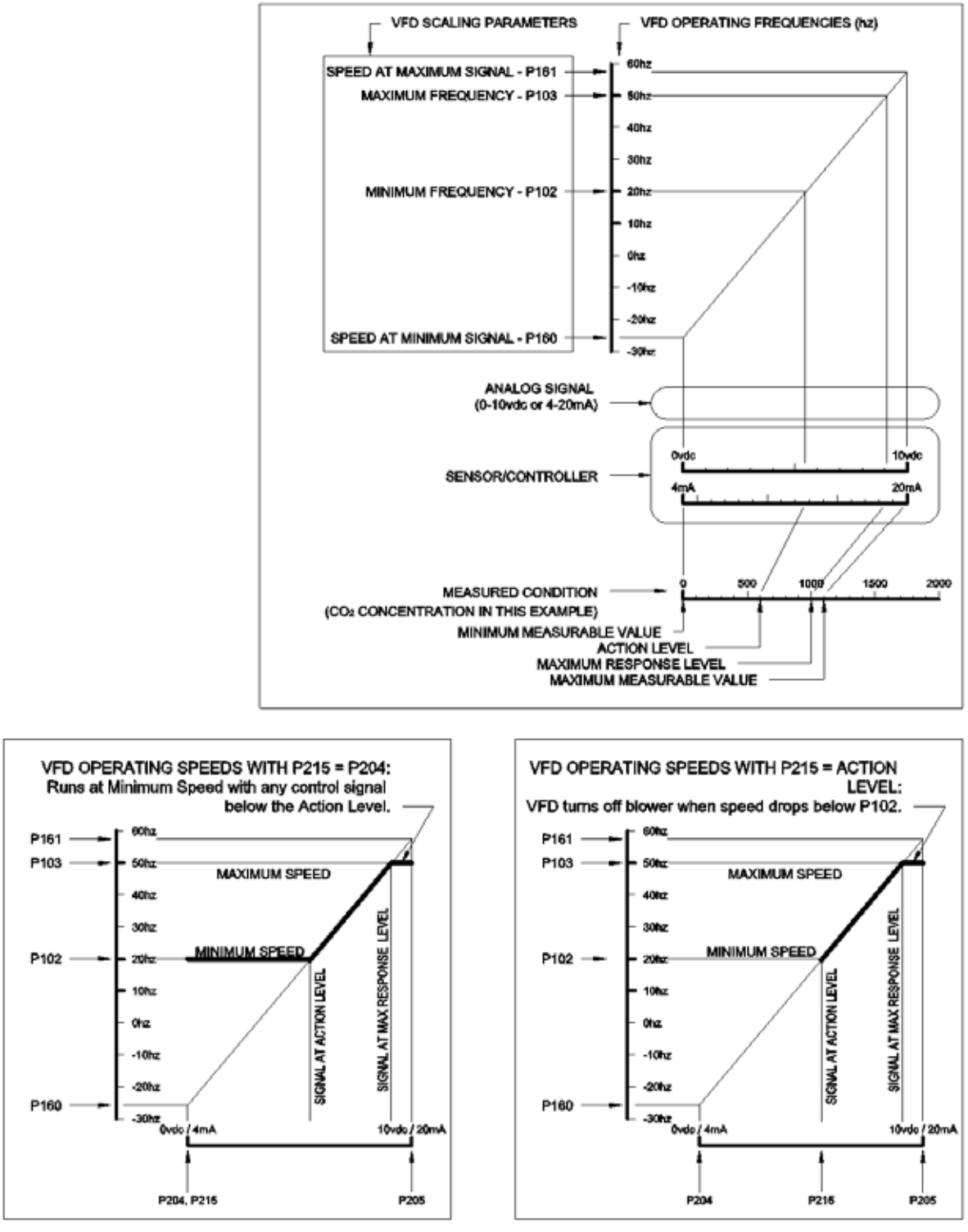


Figure 5-12
Examples of VFD SCALING

BOOK 5: START-UP, COMMISSIONING, MAINTENANCE

SCALING VFD RESPONSE TO ANALOG INPUTS

NOTE: You may not need to fill out both EA and FA worksheets; in many cases only one of the VFDs requires scaling.

CALCULATION WORKSHEET – EXHAUST AIR VFD

			A1 Minimum Signal Value	**A2** Max Signal Value	**A3** Signal Value Range	Units
A	VALUE RANGE (VR) of the analog signal (check one row):	o	0	10	10	vdc
		o	4	20	16	mA
			P204	**P205**		

		Minimum Value	Maximum Value	Range: (Max - Min)	Units
B	MEASUREMENT VALUES: the range of the values that can be measured by the Control Device.	**B1**	**B2**	**B3**	

		ACTION LEVEL	MAX RESPONSE LEVEL
C	MEASURED VALUES for ACTION and for MAXIMUM RESPONSE	**C1**	**C2**

		MINIMUM OPERATING FREQUENCY	MAXIMUM OPERATING FREQUENCY
D	MINIMUM and MAXIMUM Exhaust Air (EA) Blower Speeds in hertz, as determined during balancing (see BALANCE AIRFLOWS, page 4).	**P102 = (hz)**	**P103 = (hz)**

Eq.1 ALS (ACTION LEVEL SIGNAL) = MINIMUM SIGNAL VALUE A1 + [(ACTION LEVEL C1 - MIN MEAS VAL B1) / MEASUREMENT RANGE B3] x SIGNAL VALUE RANGE A3

Units are vdc or mA

Eq.2 MRLS (MAX RESPONSE LEVEL SIGNAL) = MINIMUM SIGNAL VALUE A1 + [(MAX RESP LEV C2 - MIN MEAS VAL B1) / MEASUREMENT RANGE B3] x SIGNAL VALUE RANGE A3

Units are vdc or mA

Eq.3 P160 = P102 - [(P103 - P102) / (MRLS - ALS) x (ALS - MINIMUM SIGNAL VALUE A1)]

Units are hertz

Eq.4 P161 = P103 + [(P103 - P102) / (MRLS - ALS) x (MAXIMUM SIGNAL VALUE A1 - MRLS)]

Units are hertz

E	Should Ventilation Stop whenever air quality is below the "Action Level", or should it continue at minimum design airflow? (check one)	o	Ventilation CONTINUES at the MINIMUM AIRFLOW: è SET P215 = P204 (Row A, above).
		o	Ventilation STOPS è SET P215 = ALS (Eq. 1, above).

BOOK 5: START-UP, COMMISSIONING, MAINTENANCE

SCALING VFD RESPONSE TO ANALOG INPUTS

NOTE: You may not need to fill out both EA and FA worksheets; in many cases only one of the VFDs requires scaling.

CALCULATION WORKSHEET – FRESH AIR VFD

			A1 Minimum Signal Value	**A2** Max Signal Value	**A3** Signal Value Range	Units
A	VALUE RANGE (VR) of the analog signal (check one row):	o	0	10	10	vdc
		o	4	20	16	mA
			P204	**P205**		

		Minimum Value	Maximum Value	Range: (Max - Min)	Units
B	MEASUREMENT VALUES: the range of the values that can be measured by the Control Device.	**B1**	**B2**	**B3**	

		ACTION LEVEL	MAX RESPONSE LEVEL
C	MEASURED VALUES for ACTION and for MAXIMUM RESPONSE	**C1**	**C2**

		MINIMUM OPERATING FREQUENCY	MAXIMUM OPERATING FREQUENCY
D	MINIMUM and MAXIMUM Fresh Air (FA) Blower Speeds in hertz, as determined during balancing (see BALANCE AIRFLOWS, page 4).	**P102 = (hz)**	**P103 = (hz)**

Eq.1 ALS (ACTION LEVEL SIGNAL) = MINIMUM SIGNAL VALUE A1 + [(ACTION LEVEL C1 − MIN MEAS VAL B1) / MEASUREMENT RANGE B3] x SIGNAL VALUE RANGE A3

Units are vdc or mA

Eq.2 MRLS (MAX RESPONSE LEVEL SIGNAL) = MINIMUM SIGNAL VALUE A1 + [(MAX RESP LEV C2 − MIN MEAS VAL B1) / MEASUREMENT RANGE B3] x SIGNAL VALUE RANGE A3

Units are vdc or mA

Eq.3 P160 = P102 − [(P103 − P102) / (MRLS − ALS)] x (ALS − MINIMUM SIGNAL VALUE A1)

Units are hertz

Eq.4 P161 = P103 + [(P103 − P102) / (MRLS − ALS)] x (MAXIMUM SIGNAL VALUE A1 − MRLS)

Units are hertz

E	Should Ventilation Stop whenever air quality is below the “Action Level”, or should it continue at minimum design airflow? (check one)	o	Ventilation CONTINUES at the MINIMUM AIRFLOW: è SET P215 = P204 (Row A, above).
		o	Ventilation STOPS è SET P215 = ALS (Eq. 1, above).

INDEPENDENT VFD OPERATION

4-20mA SIGNAL CONTROLS EA VFD; KEYPAD CONTROLS THE FA VFD.

1. EA VFD 4-20MA ANALOG SIGNAL; FA VFD KEYPAD

The EA VFD will follow the 4-20mA signal (see EA CALCULATION WORKSHEET 20).
The FA VFD will run at the keypad setting.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.	
FRESH AIR BLOWER VFD PARAMETER CHANGES		
NO CHANGES		

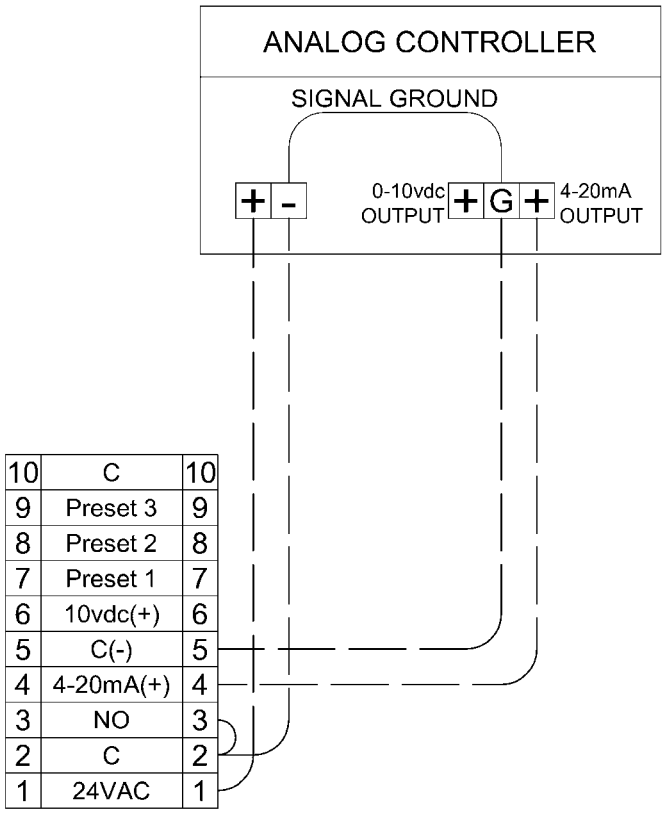


Figure 5-13
BLOWER MODULE LOW VOLTAGE COMPARTMENT USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.

INDEPENDENT VFD OPERATION (cont.)

4-20mA SIGNAL CONTROLS ONE VFD; PRESET SPEED(S) CONTROL THE SECOND VFD.

2. EA VFD 4-20MA SIGNAL; FA VFD PRESETS.
The EA VFD will follow the 4-20mA signal (see EA CALCULATION WORKSHEET page 20). The FA VFD will run at preset speed settings.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P131 & P133.
P122	Changes to: 3	
P123	Changes to: 3	

NOTE To customize the preset speed settings for each VFD, change parameters P131, P132, and P133 from the factory settings of 30 Hz, 45 Hz, and 60 Hz, respectively.

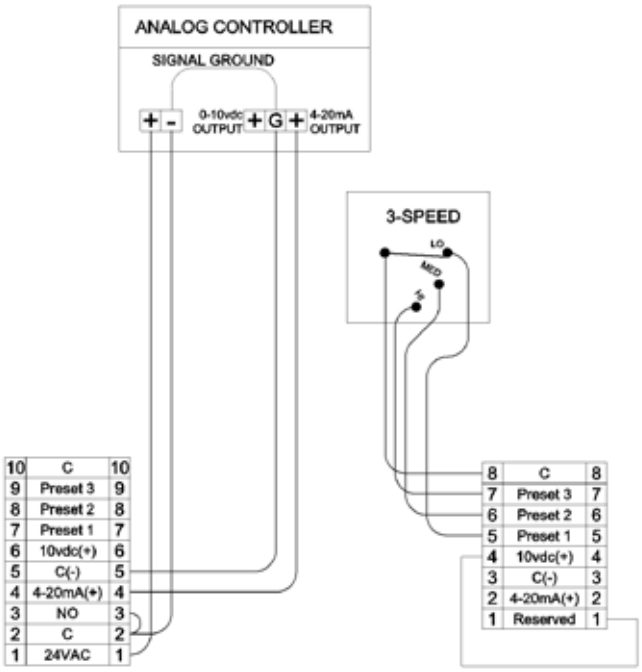


Figure 5-14
BLOWER MODULE LOW VOLTAGE COMPARTMENT
ANALOG CONTROL OF EA VFD;
PRESETS CONTROL FA VFD.

LEADER-FOLLOWER OPERATION

4-20mA SIGNAL CONTROLS LEAD VFD

1. BOTH VFDS RUN AT SAME SPEED.
EA VFD will run at the frequency setting determined by the 4-20mA signal from a control.
(see EA CALCULATION WORKSHEET page 20).
FA VFD will follow exactly the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

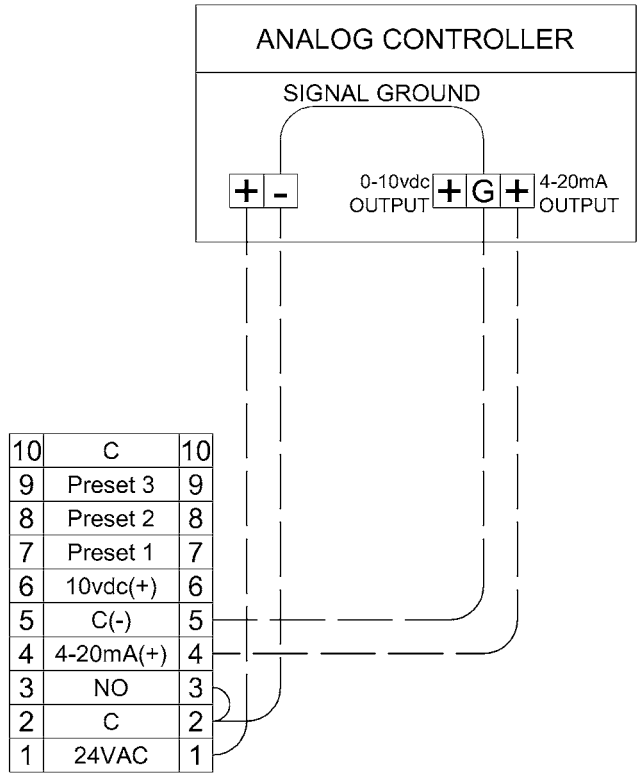


Figure 5-15
BLOWER MODULE LOW VOLTAGE COMPARTMENT.
USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.

LEADER-FOLLOWER OPERATION (cont.)

4-20mA SIGNAL CONTROLS LEAD VFD

2. FA VFD RUNS FASTER OR SLOWER THAN EA VFD

EA VFD will run at the frequency setting determined by the 4-20mA signal from a control.
(see EA CALCULATION WORKSHEET page 20).
FA VFD will run at a specified ratio above or below the frequency setting of the EA VFD.
See Figure 5-15.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P152	Changes to: X	X = an offset ratio as calculated below.
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)

EA VFD PARAMETER CHANGES (continued)	
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.

$$P152 = X = \frac{[Desired\_Maximum\_EA\_speed]}{[Desired\_Maximum\_FA\_speed]}, \quad 60$$

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

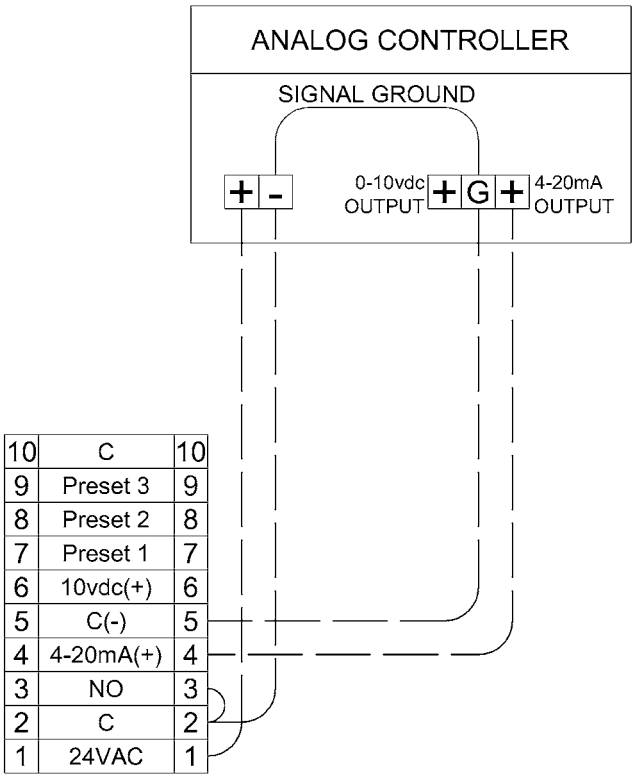


Figure 5-15 (Repeated)
BLOWER MODULE LOW VOLTAGE COMPARTMENT.
USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.

INDEPENDENT VFD OPERATION

0-10vdc SIGNAL CONTROLS ONE VFD; KEYPAD CONTROLS THE SECOND VFD.

1. EA VFD 0-10vdc ANALOG SIGNAL; FA VFD KEYPAD.

The EA VFD will follow the 0-10vdc signal.
(see EA CALCULATION WORKSHEET page 19).
The FA VFD will run at the keypad setting.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P201	Changes to: 1	Indicates analog control signal is 0-10vdc type.
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10VDC. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.	

FRESH AIR BLOWER VFD PARAMETER CHANGES
NO CHANGES FROM FACTORY DEFAULTS

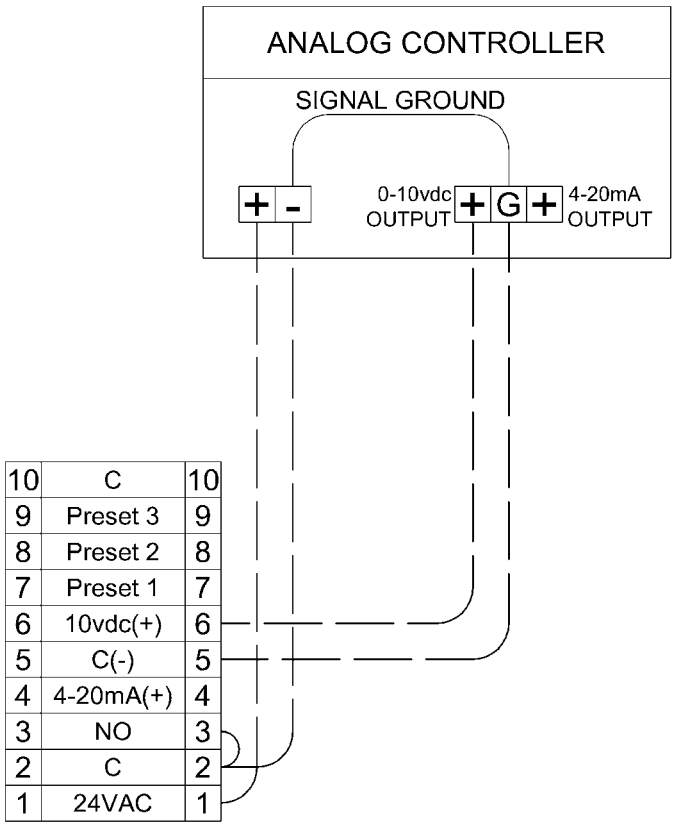


Figure 5-16
BLOWER MODULE LOW VOLTAGE COMPARTMENT USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.

0-10vdc SIGNAL CONTROLS ONE VFD; PRESET SPEED(S) CONTROL THE SECOND VFD.

1. EA VFD 0-10vdc SIGNAL; FA VFD PRESETS.
The EA VFD will follow the 0-10vdc signal.
(see EA CALCULATION WORKSHEET page 20).
The FA VFD will run at preset speed settings.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P201	Changes to: 1	Indicates analog control signal is 0-10vdc type.
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10VDC. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P131 & P133.
P122	Changes to: 3	
P123	Changes to: 3	

NOTE To customize the preset speed settings for each VFD, change parameters P131, P132, and P133 from the factory settings of 30 Hz, 45 Hz, and 60 Hz, respectively.

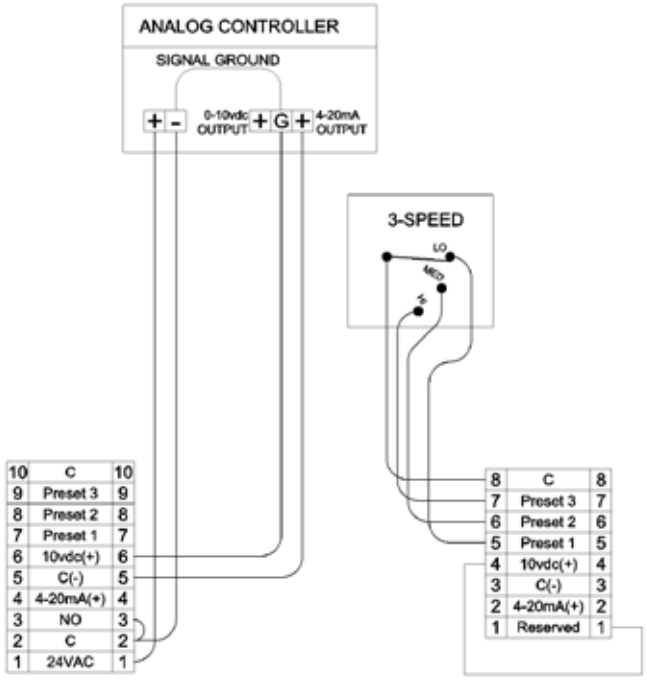


Figure 5-17
BLOWER MODULE LOW VOLTAGE COMPARTMENT

LEADER-FOLLOWER OPERATION

0-10vdc SIGNAL CONTROLS LEAD VFD

1. BOTH VFDS RUN AT SAME SPEED.
EA VFD will run at the frequency setting determined by the 0-10vdc signal from a control.
(see EA CALCULATION WORKSHEET page 20).
FA VFD will follow exactly the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P201	Changes to: 1	Indicates analog control signal is 0-10vdc type.
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10VDC. (See also Row A, EA CALC WORKSHEET)

EA VFD PARAMETER CHANGES (continued)	
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

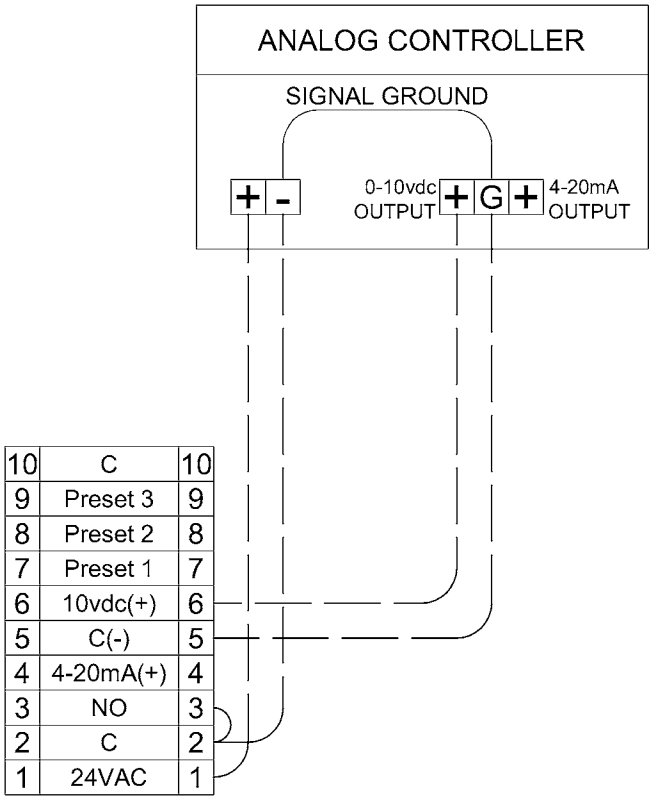


Figure 5-18
BLOWER MODULE LOW VOLTAGE COMPARTMENT USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.

0-10vdc SIGNAL CONTROLS LEAD VFD (cont.)

2. FA VFD RUNS FASTER OR SLOWER THAN EA VFD

EA VFD will run at the frequency setting determined by the 0-10vdc signal from a control.
(see EA CALCULATION WORKSHEET page 20).
FA VFD will run at a specified ratio above or below the frequency setting of the EA VFD.
See Figure 5-18.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 20	Enables Relay Output, TB-16, TB-17 when analog signal from control is greater than P215.
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P152	Changes to: X	X = an offset ratio as calculated below.
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P201	Changes to: 1	Indicates analog control signal is 0-10vdc type.
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10VDC. (See also Row A, EA CALC WORKSHEET)

EA VFD PARAMETER CHANGES (continued)	
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level.

$$P152 = X = \frac{[Desired\_Maximum\_EA\_speed]}{[Desired\_Maximum\_FA\_speed]}, \quad 60$$

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

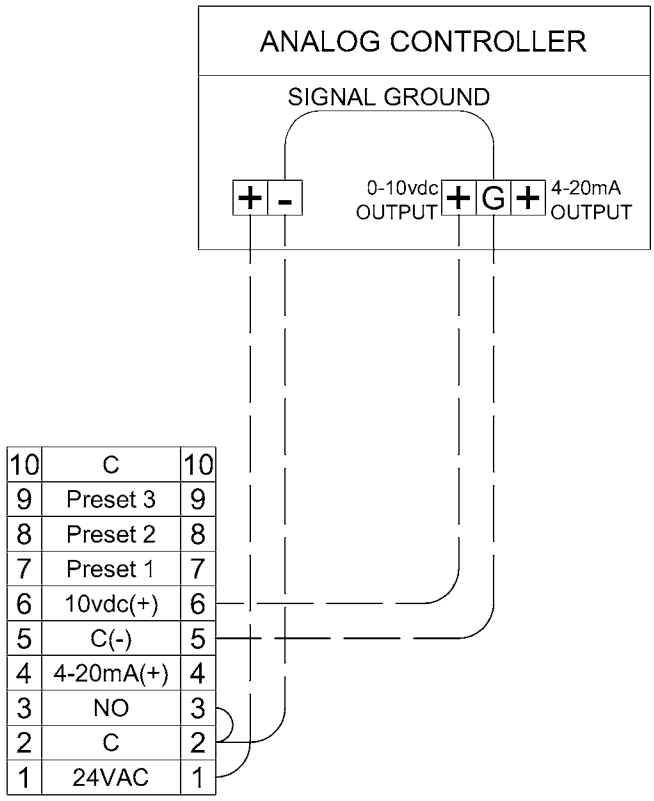


Figure 5-18 (Repeated)
BLOWER MODULE LOW VOLTAGE COMPARTMENT USE LEFT-SIDE TERMINAL STRIP FOR ANALOG CONTROL OF EA VFD OR EA LEADER/FA FOLLOWER.

CONTROL FROM CARBON DIOXIDE CONTRILLER WITH RELAY AND ANALOG OUTPUT

RD Models can be controlled by a Carbon Dioxide (CO_2) Controller such as the RenewAire accessories CO2-W or CO2-D. These controllers provides both an analog output and also an on/off relay.

With this or any type of controller that can deliver both an analog signal and a on/off relay, the analog signal can provide the FREQUENCY COMMAND and the on/off relay can provide the START COMMAND (see page 8 for more on START and FREQUENCY commands).

Alternately, the on/off relay can be left unused, and the controller can be connected like other analog controllers as shown in the examples above.

NOTE

The RenewAire CO2-W and CO2-D (TelAire Ventostat® 8000 Series) can be programmed to:
1) scale the analog signal to the measured CO_2 level;
2) set the CO2 level at which the relay switches from on to off;
3) set the hysterisis of the relay switching.
See the Installation and Operation Instructions provided with the CO_2 Controller for more information.

All control wire connections are made to the terminal block in the low voltage compartment of the top electrical box in the blower module. If the RD Unit is to provide 24VAC to the CO_2 sensor then the 24VAC (+) wire from the CO_2 sensor should be attached to terminal #1 on the Left-Side terminal block. The 24VAC (-) Common wire from the CO_2 sensor should be connected to the relay's common wire from the CO_2 sensor and then attached to terminal #2 on the Left-Side terminal block. The relay's normally open (NO) wire from the CO_2 sensor should be attached to terminal #3 on the Left-Side terminal block.

The RenewAire CO2-W and CO2-D provide both 0-10vdc and 4-20mA analog control signals.

If the 4-20mA signal from the CO_2 sensor is used, the Signal Ground wire from the CO_2 sensor should be attached to terminal #5 on the Left-Side terminal block. The 4-20mA Output wire from the CO_2 sensor should be attached to terminal #4 on the Left-Side terminal block.

If the 0-10VDC from the CO_2 sensor is used, then the Signal Ground wire from the CO_2 sensor should be attached to terminal #5 on the Left-Side terminal block. The 0-10VDC Output wire from the CO_2 sensor should be attached to terminal #6 on the Left-Side terminal block. See Figure 5-20 page 33.

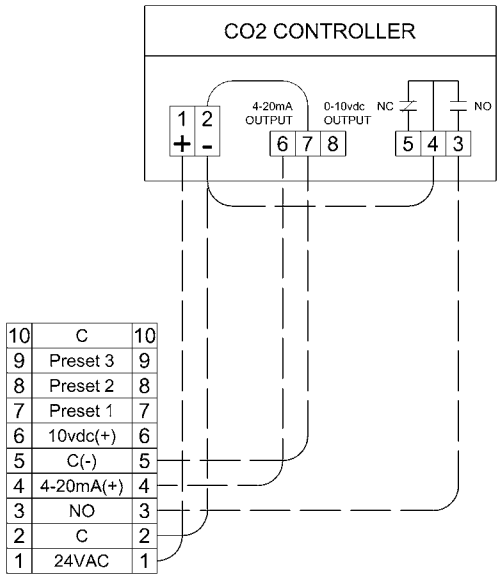


Figure 5-19
BLOWER MODULE LOW VOLTAGE COMPARTMENT USE LEFT-SIDE TERMINAL BLOCK

INDEPENDENT BLOWER CONTROL 4-20MA SIGNAL CONTROLS EA VFD KEYPAD CONTROLS FA VFD

EA VFD will run at the frequency setting determined by the 4-20mA signal from the CO_2 Control.
(see EA CALCULATION WORKSHEET page 20).
FA VFD will run at the frequency set at its keypad.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level. **Note:** If relay is used for ON-OFF control then set P215 = 0.	

FRESH AIR BLOWER VFD PARAMETER CHANGES
NO CHANGES FROM FACTORY DEFAULTS

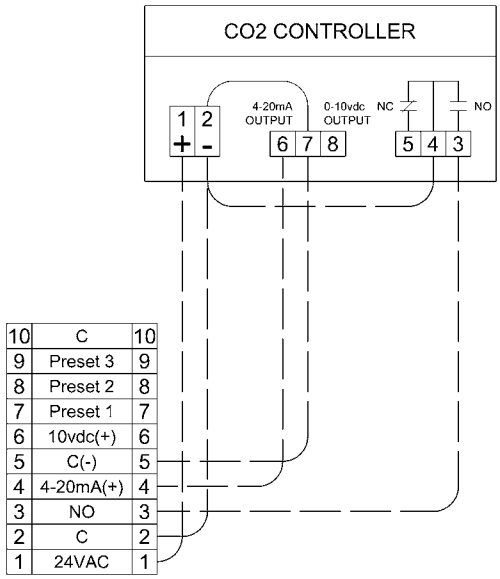


Figure 5-19 (REPEATED)
BLOWER MODULE LOW VOLTAGE COMPARTMENT
USE LEFT-SIDE TERMINAL BLOCK

NOTE

The RenewAire CO2-W and CO2-D (TelAire Ventostat® 8000 Series) can be programmed to:
1) scale the analog signal to the measured CO_2 level;
2) set the CO2 level at which the relay switches from on to off;
3) set the hysterisis of the relay switching.
See the Installation and Operation Instructions provided with the CO_2 Controller for more information.

CONTROL FROM CARBON DIOXIDE SENSOR (cont.)

LEADER-FOLLOWER 4-20mA SIGNAL CONTROLS LEAD VFD

1. BOTH VFDS RUN AT SAME SPEED.
EA VFD will run at the frequency setting determined by the 4-20mA signal from the CO_2 Control. (see EA CALCULATION WORKSHEET page 20). FA VFD will follow exactly the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level. **Note:** If relay is used for ON-OFF control then set P215 = 0.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

2. FA VFD RUNS FASTER OR SLOWER THAN EA VFD.
SAME AS EXAMPLE AT LEFT, EXCEPT:
FA VFD will run at a specified ratio above or below the frequency setting of the EA VFD.

ADDITIONAL CHANGES TO EXHAUST BLOWER VFD PARAMETERS		
P152	Changes to: X	X = an offset ratio as calculated below.

$$P152 = X = \frac{[Desired\_Maximum\_EA\_speed]}{[Desired\_Maximum\_FA\_speed]}, 60$$

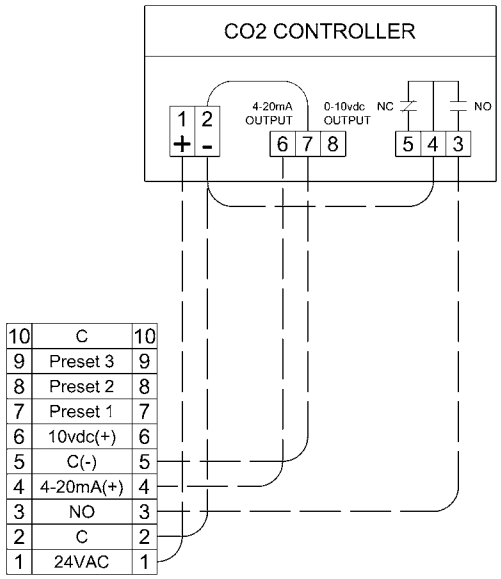


Figure 5-19 (REPEATED)
BLOWER MODULE LOW VOLTAGE COMPARTMENT

NOTE

The RenewAire CO2-W and CO2-D (TelAire Ventostat® 8000 Series) can be programmed to:
1) scale the analog signal to the measured CO_2 level;
2) set the CO2 level at which the relay switches from on to off;
3) set the hysterisis of the relay switching.
See the Installation and Operation Instructions provided with the CO_2 Controller for more information.

CONTROL FROM CARBON DIOXIDE SENSOR (cont.)

INDEPENDENT BLOWER CONTROL 0-10vdc SIGNAL CONTROLS EA VFD KEYPAD CONTROLS FA VFD

EA VFD will run at the frequency setting determined by the 0-10vdc signal from the CO_2 Control.
(see EA CALCULATION WORKSHEET page 20).
FA VFD will run at the frequency set at its keypad.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10vdc. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level. **Note:** If relay is used for ON-OFF control then set P215 = 0.	

FRESH AIR BLOWER VFD PARAMETER CHANGES
NO CHANGES

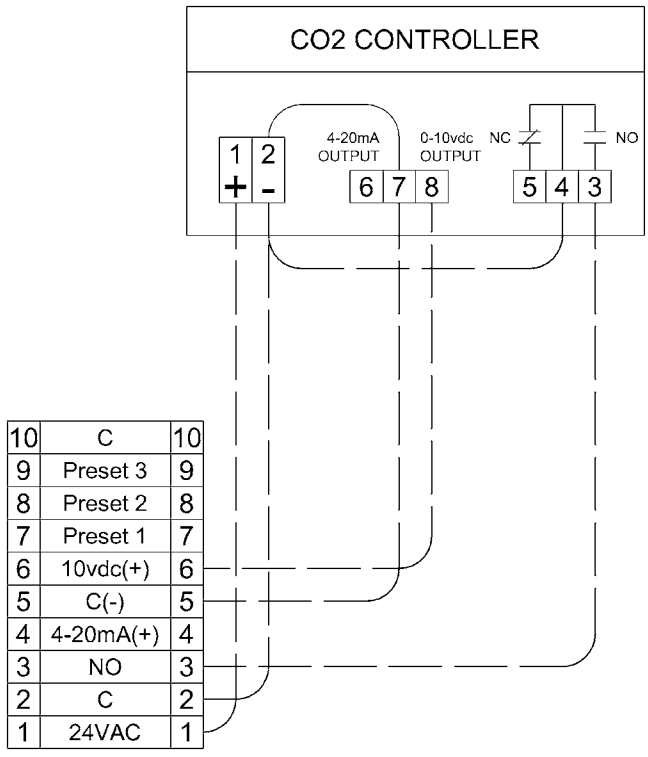


Figure 5-20
BLOWER MODULE LOW VOLTAGE COMPARTMENT

NOTE

The RenewAire CO2-W and CO2-D (TelAire Ventostat® 8000 Series) can be programmed to:
1) scale the analog signal to the measured CO_2 level;
2) set the CO2 level at which the relay switches from on to off;
3) set the hysterisis of the relay switching.
See the Installation and Operation Instructions provided with the CO_2 Controller for more information.

CONTROL FROM CARBON DIOXIDE SENSOR (cont.)

LEADER-FOLLOWER 0-10vdc SIGNAL CONTROLS LEAD VFD

1. BOTH VFDS RUN AT SAME SPEED.
EA VFD will run at the frequency setting determined by the 0-10vdc signal from the CO_2 Control. (see EA CALCULATION WORKSHEET page 20). FA VFD will follow exactly the frequency setting of the EA VFD.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P150	Changes to: 1	Enables TB-30 Output at 0-10VDC
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10vdc. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level. **Note:** If relay is used for ON-OFF control then set P215 = 0.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10VDC

2. FA VFD RUNS FASTER OR SLOWER THAN EA VFD.
SAME AS EXAMPLE AT LEFT, EXCEPT:
FA VFD will run at a specified ratio above or below the frequency setting of the EA VFD.

ADDITIONAL CHANGES TO EXHAUST BLOWER VFD PARAMETERS		
P152	Changes to: X	X = an offset ratio as calculated below.

$$P152 = X = \frac{[Desired\_Maximum\_EA\_speed]}{[Desired\_Maximum\_FA\_speed]} \times 60$$

FOR WIRING SCHEMATIC:
See Figure 5-20, Page 33

NOTE

The RenewAire CO2-W and CO2-D (TelAire Ventostat® 8000 Series) can be programmed to:
1) scale the analog signal to the measured CO_2 level;
2) set the CO2 level at which the relay switches from on to off;
3) set the hysterisis of the relay switching.
See the Installation and Operation Instructions provided with the CO_2 Controller for more information.

CONTROL FROM ANALOG 4-20MA OR 0-10V INPUT SIGNAL WITH RELAY OR ON/OFF SWITCH AND CONTROL FROM LO-MED-HI SWITCH

RD Models can be set up to have the blowers controlled independently. One blower can be controlled by an analog input signal and the other blower can be controlled with up to three preset speeds. A single ON/OFF switch or relay controls the operation of the unit.

All control wire connections are made to the two terminal blocks in the low voltage compartment of the top electrical box in the blower module. The left terminal block is for connecting the control for the EA or top blower. The right terminal block is for connecting the control for the FA or bottom blower. The relay common wire should be attached to terminal #2 on the ***left*** terminal block and the relay normally open (NO) wire should be attached to terminal #3 on the ***left*** terminal block.

Determine the blower to be controlled by the preset speed switches and make connections to the correct terminal block for that blower. Figure 5-21 depicts connections for an analog control to the EA terminal block (Left-Side) and preset speed control to the FA terminal block (Right-Side). To allow analog control of FA make connections to Right-Side terminal block.

The common wire for the preset speed switches should be attached to terminal #10 on the Left-Side terminal block. The low speed switch should be attached to terminal #7 on the terminal block. The medium speed switch should be attached to terminal #8 on the terminal block. The high speed switch should be attached to terminal #9 on the terminal block. See Figure 5-21.

The other terminal block is used to control the other blower from the analog controller. If the RD Unit is to provide 24VAC to the analog controller then the 24VAC (+) wire from the controller should be attached to terminal #1 on the terminal block. The 24VAC (-) Common wire from the controller should be connected to terminal #2 on the terminal block.

If a 4-20mA signal is provided from the controller then the Signal Ground wire from the controller should be attached to terminal #5 on the terminal block. The 4-20mA Output wire from the controller should be attached to terminal #4 on the terminal block.

If a 0-10VDC signal is provided from the controller then the Signal Ground wire from the controller should be attached to terminal #5 on the terminal block. The 0-10VDC Output wire from the controller should be attached to terminal #6 on the terminal block. See Figure 5-21.

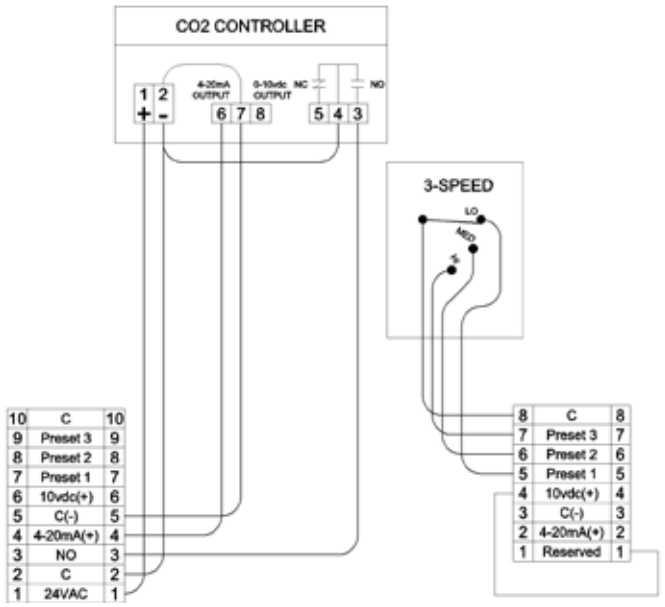


Figure 5-21
BLOWER MODULE LOW VOLTAGE COMPARTMENT LEFT-SIDE TERMINAL STRIP USED FOR ANALOG CONTROL OF EA VFD.
RIGHT-SIDE TERMINAL STRIP USED FOR THREE-SPEED SWITCH SELECTION OF THREE PRESET SPEEDS IN FA VFD.

4-20MA SIGNAL CONTROLS EA VFD; PRESET SPEEDS CONTROL THE 2ND VFD

EA VFD will run at the frequency determined by the 4-20mA signal from the Analog Control.
(see EA CALCULATION WORKSHEET page 20).
The FA VFD will run at preset speed settings.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 2	Enables Standard Reference Source at 4-20mA
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 4	Indicates minimum signal from Reference Source = 4mA. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 20	Indicates maximum signal from Reference Source = 20mA. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level. **Note:** If relay is used for ON-OFF control then set P215 = 0.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P131 & P133.
P122	Changes to: 3	
P123	Changes to: 3	

NOTE To customize the preset speed settings parameters P131, P132, and P133 can be changed from the factory settings of 30hz, 45hz, and 60hz, respectively.

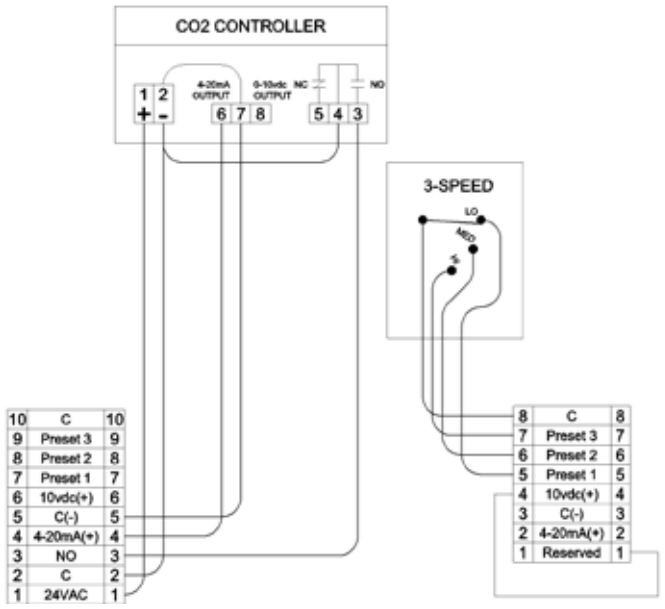


Figure 5-21 (REPEATED)
BLOWER MODULE LOW VOLTAGE COMPARTMENT LEFT-SIDE TERMINAL STRIP USED FOR ANALOG CONTROL OF EA VFD.
RIGHT-SIDE TERMINAL STRIP USED FOR THREE-SPEED SWITCH SELECTION OF THREE PRESET SPEEDS IN FA VFD.

0-10vdc SIGNAL CONTROLS EA VFD; PRESET SPEEDS CONTROL FA VFD

EA VFD will run at the frequency determined by the 0-10vdc signal from the Analog Control. (see EA CALCULATION WORKSHEET page 20). The FA VFD will run at preset speed settings.

EXHAUST BLOWER VFD PARAMETER CHANGES		
P101	Changes to: 1	Enables Standard Reference Source at 0-10vdc
P102	Set to Minimum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P103	Set to Maximum Operating Frequency, (see EA CALCULATION WORKSHEET, Row D)	
P140	Changes to: 12	Enables Relay Output, TB-16, TB-17
P160	Set to Speed at Minimum Signal (hertz), (see Eq. 3, EA CALCULATION WORKSHEET).	
P161	Set to Speed at Maximum Signal (hertz), (see Eq. 4, EA CALCULATION WORKSHEET)	
P204	Changes to: 0	Indicates minimum signal from Reference Source = 0vdc. (See also Row A, EA CALC WORKSHEET)
P205	Changes to: 10	Indicates maximum signal from Reference Source = 10vdc. (See also Row A, EA CALC WORKSHEET)
P215	Controls operation below the action level. If P215 = P204, ventilation continues at the minimum speed set by P102. If P215 = ALS (see Eq. 1, EA CALCULATION WORKSHEET), ventilation stops whenever the analog control signal drops below the Action Level. **Note:** If relay is used for ON-OFF control then set P215 = 0.	

FRESH AIR BLOWER VFD PARAMETER CHANGES		
P121	Changes to: 3	Enables VFD to reference the preset speeds set at P131, P131 & P133.
P122	Changes to: 3	
P123	Changes to: 3	

NOTE To customize the preset speed settings parameters P131, P132, and P133 can be changed from the factory settings of 30 hz, 45 hz, and 60 hz, respectively.

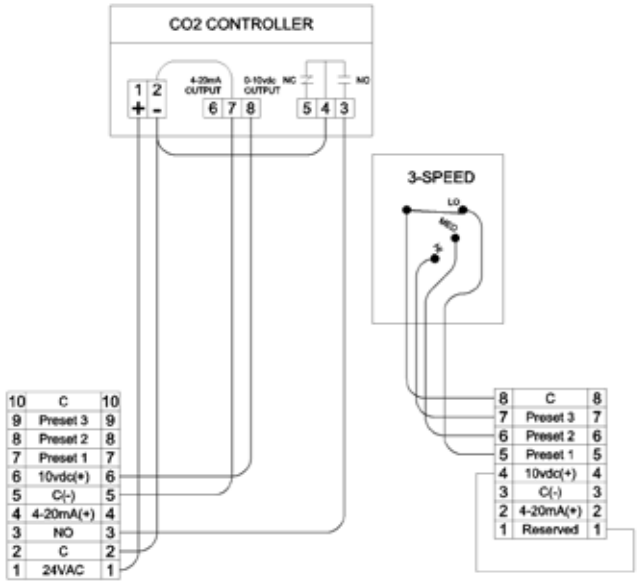


Figure 5-22
BLOWER MODULE LOW VOLTAGE COMPARTMENT LEFT-SIDE TERMINAL STRIP USED FOR ANALOG CONTROL OF EA VFD.
RIGHT-SIDE TERMINAL STRIP USED FOR THREE-SPEED SWITCH SELECTION OF THREE PRESET SPEEDS IN FA VFD.

TO RESET VFD PARAMETERS TO FACTORY SETTINGS USING KEYPAD

1. VFD must be powered up – something will be showing on the LED display.
2. Push MODE button – PASS will flash on screen followed by “0000”.
3. Press and Hold UP ARROW button to scroll to password 225.
4. Press MODE button to display P100.
5. Press and Hold UP ARROW button to scroll to Parameter 199.
6. Press MODE button again to display 00.
7. Press and Hold UP ARROW button to reach 02.
8. Press MODE button to display STOP (in some cases the display will be different).
9. Turn VFD power off, wait thirty seconds, then turn VFD back on. (Use the door-mounted Disconnect Switch to turn on and turn off power to the VFD.)

WARNING

Danger of Electrical Shock when servicing unit. ALWAYS DISCONNECT POWER SOURCE BEFORE SERVICING! More than one disconnect switch may be required.

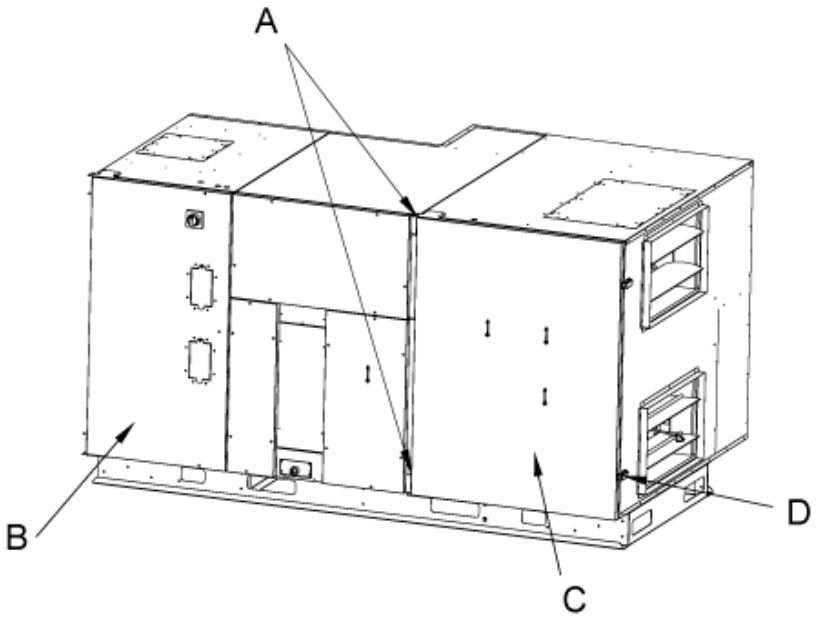


Figure 5-24
EXTERIOR SERVICE PARTS-INDOOR RD UNITS (RD2XIN shown)

24-A	Hinge Set (2)	24-C	Door Core Compartment
24-B	Door Blower Compartment	24-D	Draw Latch Set (2)

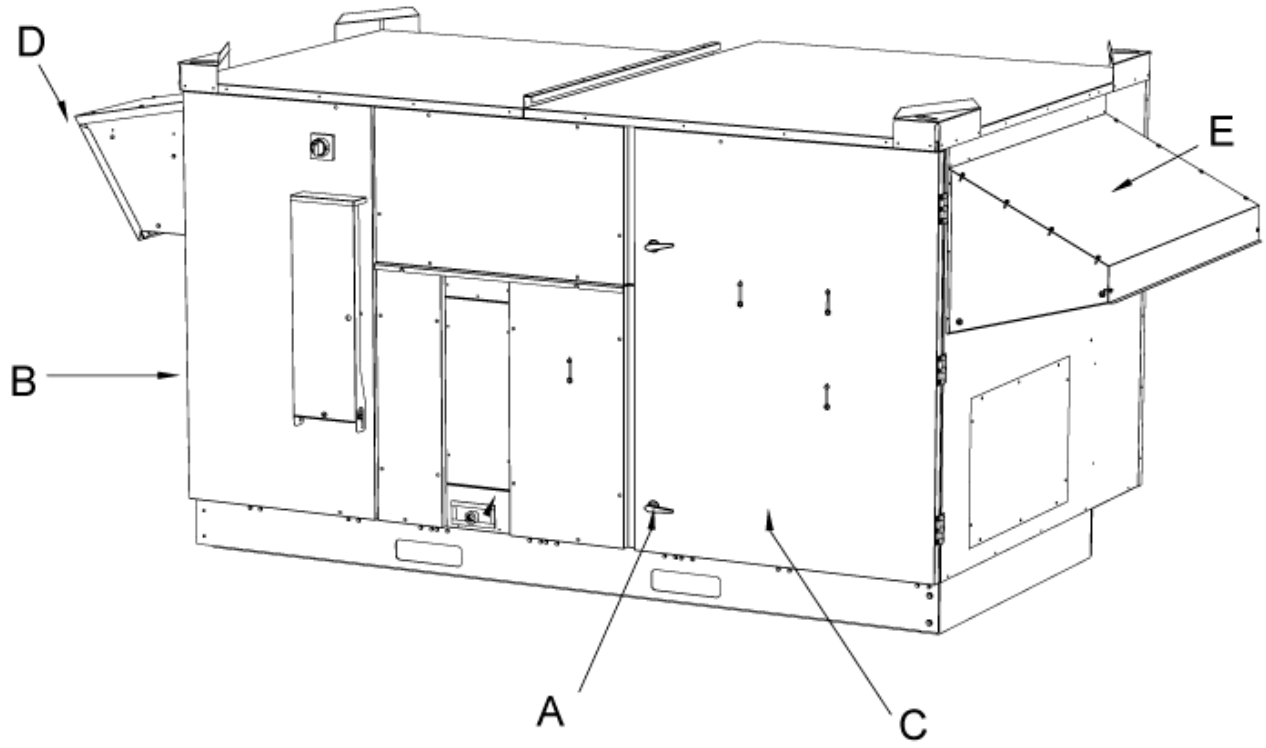


Figure 5-25 EXTERIOR SERVICE PARTS-ROOFTOP RD UNITS (RD2XRT shown)			
25-A	Turn Latch	25-D	Hood Exhaust
25-B	Door Blower Compartment	25-E	Hood Inlet
25-C	Door Core Compartment		

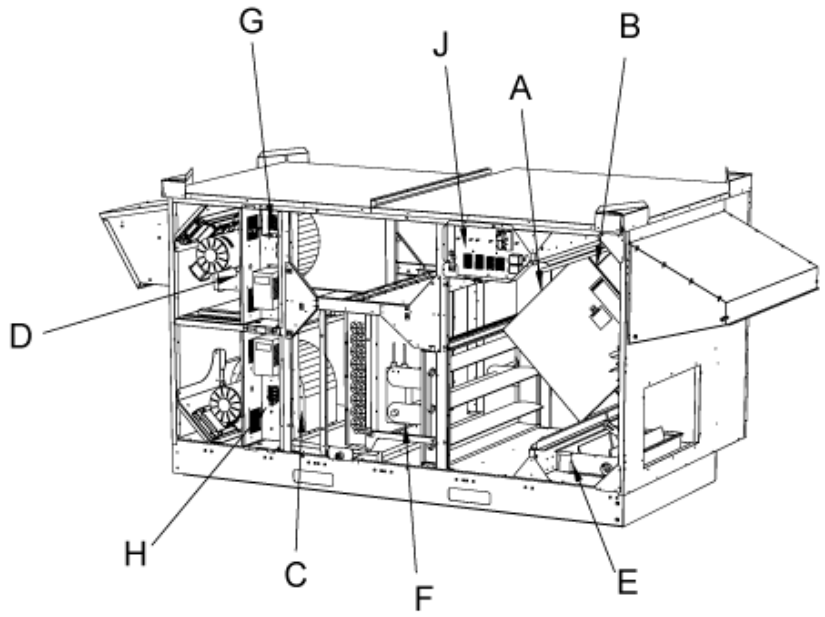


Figure 5-26
INTERIOR SERVICE PARTS RD UNITS (RD2XRT shown)

26-A	Energy Recovery Core	26-F	Damper Recovery Bypass (SEE DETAIL PAGE)
26-B	Filter Set	26-G	E-box High Voltage Upper (SEE DETAIL PAGE)
26-C	Blower Assembly Lower (SEE DETAIL PAGE)	26-H	E-box High Voltage Lower (SEE DETAIL PAGE)
26-D	Blower Assembly Upper (SEE DETAIL PAGE)	26-J	E-box Low Voltage (SEE DETAIL PAGE)
26-E	Damper Inlet Isolation (SEE DETAIL PAGE)		

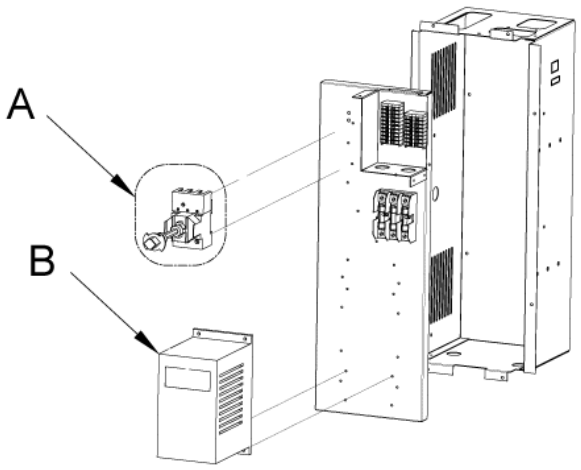


Figure 5-27 E-Box High-Voltage Upper Assembly (Typical)	
27-A	Disconnect Switch with Shaft
27-B	Variable Frequency Drive

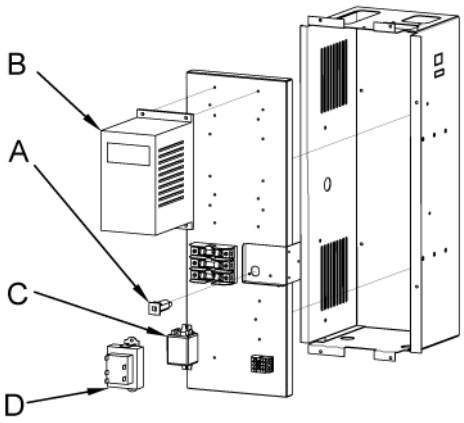


Figure 5-28 E-Box High-Voltage Lower Assembly (Typical)			
28-A	Circuit Breaker 3A	28-C	3PDPT Relay
28-B	Variable Frequency Drive	28-D	Transformer Class II

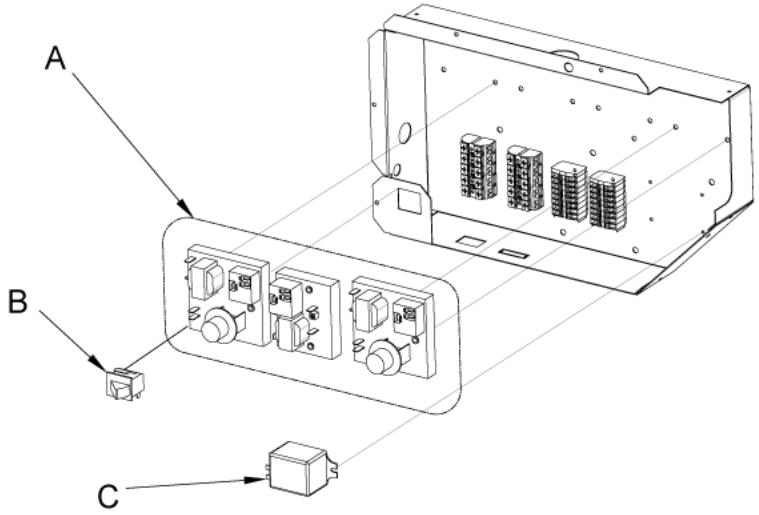


Figure 5-29 E-Box Low-Voltage Assembly (Typical)	
29-A	Controls (See Figure 5-30)
29-B	Door Interlock Switch
29-C	3PDPT Relay

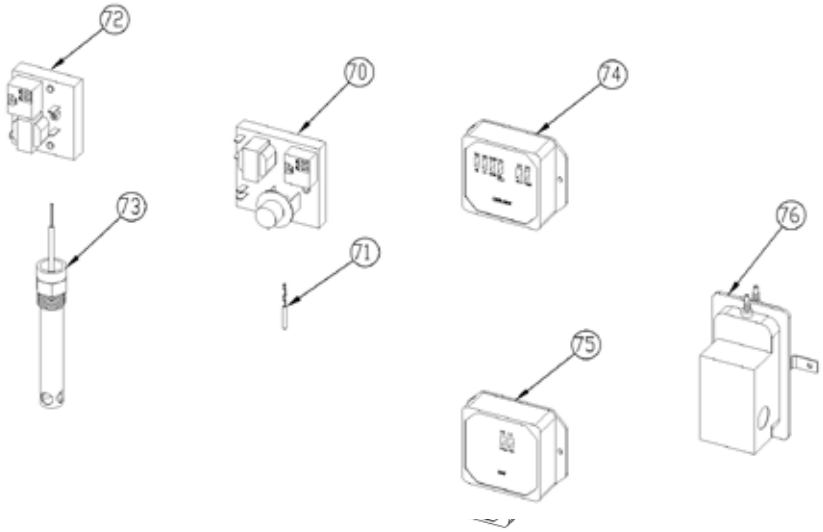


Figure 5-30. Controls			
30-A	Dewpoint Control	30-E	Room Enthalpy Sensor
30-B	Temperature Control	30-F	Temperature Sensor
30-C	Enthalpy Control/OA Sensor	30-G	Dewpoint Sensor
30-D	Differential Pressure Sensor		

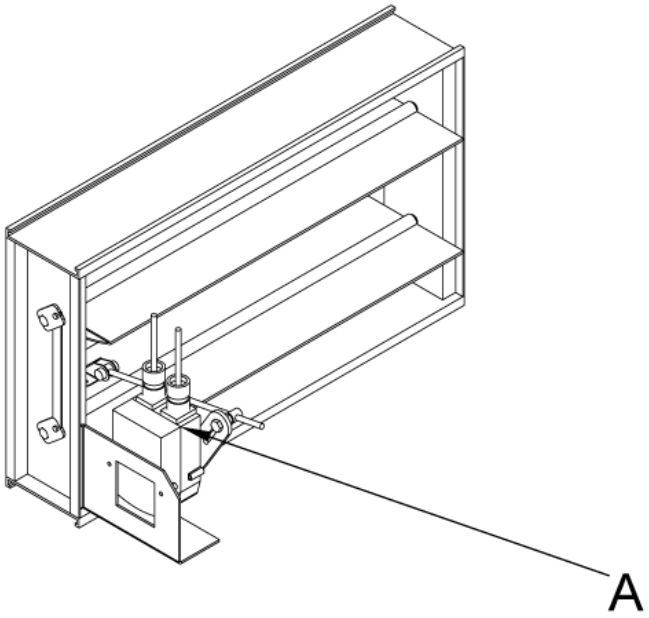


Figure 5-31 Damper Inlet Isolation	
31-A	Actuator

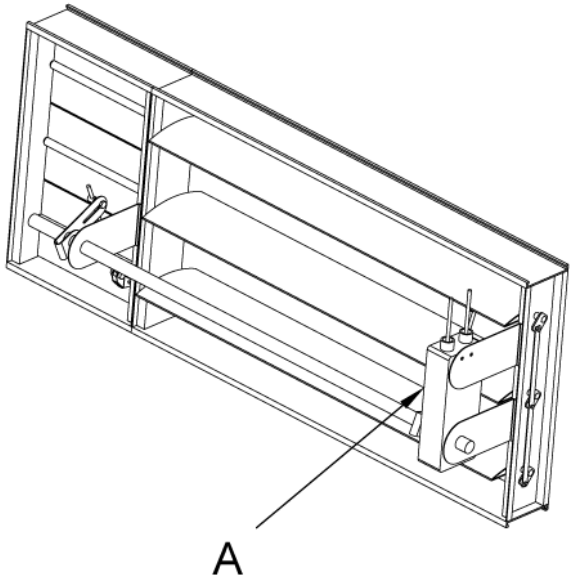


Figure 5-32 Damper Recovery Bypass	
32-A	Actuator

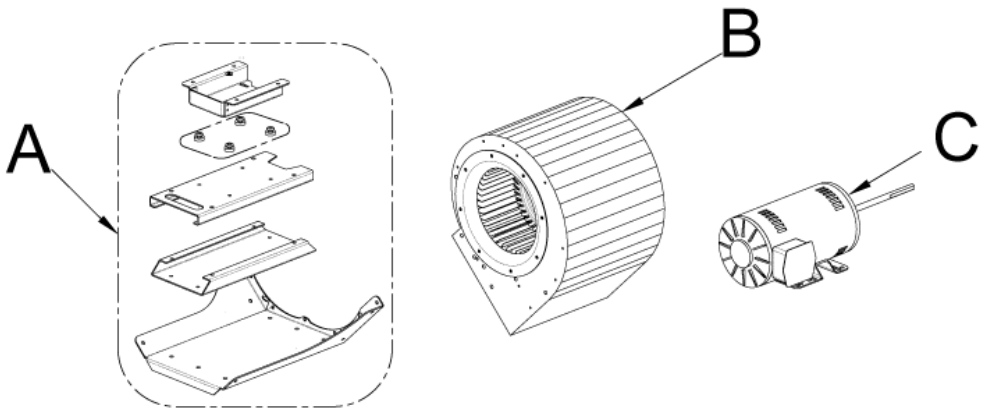


Figure 5-33 Blower Assemblies for RD2x Units	
33-A	Motor Mount Assembly
33-B	Blower
33-C	Motor

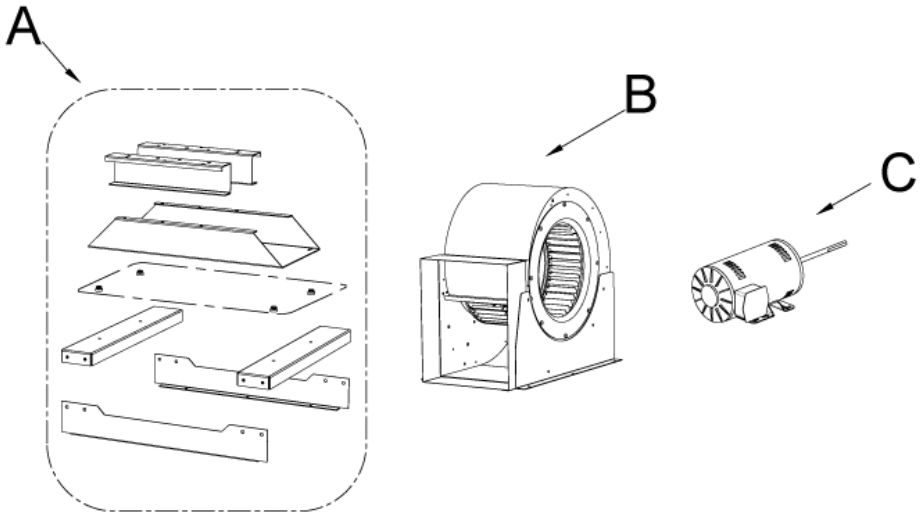


Figure 5-34 Blower Assemblies for RD4x Units	
34-A	Motor Mount Assembly
34-B	Blower
34-C	Motor

BOOK 5: START-UP, COMMISSIONING, MAINTENANCE

LIMITED WARRANTY

RENEWAIRE VENTILATION EQUIPMENT

1. (a) TWO YEAR PARTS WARRANTY – RenewAire LLC warrants to the original end user of this product that should this product prove defective due to improper workmanship and/or material under normal use for a period of two years from the date of installation, RenewAire LLC will repair or replace, at its option, any defective part without charge for the part. Replacement parts are warranted for the remainder of the original warranty period.
(b) THIS WARRANTY DOES NOT INCLUDE LABOR or other costs incurred for servicing, repairing, removing, installing, shipping or handling of either defective or replacement parts, or complete unit. Such costs may be covered by a separate warranty provided by the installer.
(c) EXTENDED 10-YEAR CORE WARRANTY – During the third through tenth year from the date of installation, should the core prove defective due to improper workmanship and/or material, RenewAire LLC will repair or replace core, at no charge, which is warranted for the remainder of the original warranty period. LABOR AND OTHER COSTS ARE NOT INCLUDED – See (b) above.
(d) NOTICE. To obtain warranty services and/or parts replacement, you must notify a qualified RenewAire dealer or contractor of any defect within the applicable warranty period.

2. Any defective part to be replaced must be made available to RenewAire LLC in exchange for the replacement part. You must present proof of the original date of installation of the product in order to establish the effective date of the warranty. Otherwise the effective date will be deemed to be the date of manufacture plus thirty (30) days. The return of the owner registration card is not a condition of warranty coverage. However, please detach and return it so that we can contact you should a question of safety arise which could affect you.

3. TO OBTAIN WARRANTY SERVICE, please contact your dealer or contractor who installed this product. If your dealer or contractor needs assistance, his distributor is available for consultation, and RenewAire LLC supports his distributor's efforts.

4. This limited warranty applies only while the unit remains at the site of the original installation (except for mobile home installations) and only to units installed within the continental United States, Alaska, and Hawaii. This limited warranty applies only if the unit is installed and operated in accordance with RenewAire LLC's instructions and in compliance with applicable local installation and building codes and good trade practices.

5. THIS WARRANTY DOES NOT COVER damages caused by:
(a) accident, abuse, negligence, or misuse;
(b) operating the product in a corrosive atmosphere containing chlorine, fluorine or any other damaging chemicals;
(c) modification, alteration, repair or service by anyone other than an authorized RenewAire dealer or contractor;
(d) improper matching or application of the product or components;
(e) failure to provide proper maintenance and service to the product according to manufacturer's instructions;
(f) installation or operating of the product in a manner contrary to the instructions of the manufacturer;
(g) lightning, fluctuations in electrical power or other acts of God.
This limited warranty also excludes all costs of installation, disconnection or dismantling the product, parts used in connection with normal maintenance such as filters or belts and owner-required maintenance. Consult the instructions enclosed with the product for information regarding recommended maintenance.

6. No one is authorized to change this LIMITED WARRANTY in any respect, or to create for use any other obligation or liability in connection with this product.

7. YOUR ONLY REMEDIES ARE PROVIDED IN THIS LIMITED WARRANTY. ANY EXPRESS WARRANTY NOT PROVIDED HEREIN, AND ANY REMEDY WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION OR OPERATION OF LAW, IS HEREBY EXCLUDED AND DISCLAIMED. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR ANY PARTICULAR PURPOSE ARE EXPRESSLY LIMITED TO A TERM OF ONE YEAR FROM THE DATE OF ORIGINAL INSTALLATION. UNDER NO CIRCUMSTANCES SHALL RENEWAIRE LLC BE LIABLE TO THE OWNER OR ANY OTHER PERSON FOR ANY INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THIS PRODUCT, WHETHER ARISING OUT OF BREACH OF WARRANTY, BREACH OF CONTRACT OR OTHERWISE.

8. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental, special, or consequential damages, so the above limitations or exclusions may not apply to you.

9. This warranty gives your specific legal rights, and you may also have other rights that vary from state to state. This warranty is valid only in the U.S.A. and is not transferable.

BOOK 5: START-UP, COMMISSIONING, MAINTENANCE

COMMISSIONING RECORDS

UNIT CONFIGURATION CODE				
UNIT SERIAL NUMBER				

COMMISSIONING RECORDS – EXHAUST AIR

PARAMETERS	FACTORY SETTING	DATE	DATE	DATE
P100				
P101				
P102				
P103				
P121				
P122				
P123				
P131				
P132				
P133				
P140				
P150				
P152				
P160				
P161				
P201				
P204				
P205				
P215				
P___				
P___				
STATIC PRESSURE DIFFERENCE #3-#4				
DESIGN AIRFLOW	MAXIMUM:			
	MINIMUM:			
MEASURED AIRFLOW	MAX: MIN:	MAX: MIN:	MAX: MIN:	MAX: MIN:

NOTE

VFD PARAMETERS are explained in this Book, starting on page 8.

Measurement of Airflows is explained in this Book, page 4.

COMMISSIONING RECORDS – FRESH AIR

PARAMETER	FACTORY SETTING	DATE	DATE	DATE
P100				
P101				
P102				
P103				
P121				
P122				
P123				
P131				
P132				
P133				
P140				
P150				
P152				
P160				
P161				
P201				
P204				
P205				
P215				
P___				
P___				
STATIC PRESSURE DIFFERENCE #1-#2				
DESIGN AIRFLOW	MAXIMUM:			
	MINIMUM:			
MEASURED AIRFLOW	MAX: MIN:	MAX: MIN:	MAX: MIN:	MAX: MIN:

NOTE VFD PARAMETERS are explained in this Book, page 8.
Measurement of Airflows is explained in this Book, page 4.

COMMISSIONING RECORDS – ON-BOARD SET-POINTS

	FACTORY SETTING	DATE	DATE	DATE
Bypass temperature Controller				
Dehumidification Temperature Controller				
Heating Temperature Controller				

We recommend the following tasks be performed **quarterly**.

- Change Filters
- Perform General Inspection and Light Cleaning

For some installations it may be necessary to perform these tasks more often.

CHANGING FILTERS:

Inspect and/or replace filters every two or three months when the unit is in regular use, or as needed.

- Turn off unit completely! Lock-out and tag-out the unit disconnect switch.
- Open the door to the Core Module.
- Remove and dispose of all filters. Replace all filters.
  RD2X Tip: In the OA compartment, install a 20"x20" filter first and then the 14"x20" filter followed by another 20"x20" filter.
  RD4X Tip: Install (2) 20"x20" filters first and then (2) 14"x20" filters followed by (2) 20"x20" filters.
- Close door.

FILTER SPECIFICATIONS:

RD2X:
(4) 20"x20"x2" (nominal) pleated filters;
(1) 14"x20"x2" (nominal) pleated filter.
RD4X:
(8) 20"x20"x2" (nominal) pleated filters;
(4) 14"x20"x2" (nominal) pleated filters.
Actual sizes 19.5" x19.5"x1.75" and 13.5"x 19.5"x1.75"
Unit shipped with MERV-8 filters, with initial pressure drop of 0.16" H_2O at 375 fpm.
Do not replace with filters rated less than MERV-6.

CAUTION

Filters must be used or the energy exchange core will become blocked by dust and the unit will not do its job. In extreme cases components may be damaged.

GENERAL INSPECTION AND CLEANING:

Perform general cleaning and inspection when changing filters.

- Remove foreign objects from unit.
- Remove paper, leaves, etc. from inlet and outlet screens.
- Inspect for insect nests in unit, inlets and outlets.
- Inspect Door Gaskets.
- Check drain pans for overflow or pooling.
- Check all motor and blower wheel mounting bolts are tight.

WARNING

Danger of Electrical Shock when servicing unit. ALWAYS DISCONNECT POWER SOURCE BEFORE SERVICING! More than one disconnect switch may be required.

MAINTENANCE LOG

ENTER DATES OF SERVICE

OA Filter Change	RA Filter Change	Inspection/ Cleaning	Initials

SEE PREVIOUS PAGE FOR INFORMATION ON CHANGING FILTERS, GENERAL INSPECTION AND CLEANING.

WARNING

Danger of Electrical Shock when servicing unit. ALWAYS DISCONNECT POWER SOURCE BEFORE SERVICING! More than one disconnect switch may be required.

MAINTENANCE LOG (cont.)			
ENTER DATES OF SERVICE			
OA Filter Change	RA Filter Change	Inspection/ Cleaning	Initials

We recommend the following tasks be performed **annually**.

- Clean Energy Exchange Cores.
- Clean Blower Wheels.
- Clean VFD Cooling Fins and Fans.
- Clean Dampers
- Clean Drain Pan and Trap.
- Clean Coil.

For some installations it may be necessary to clean the drain pans, trap, and coils more often.

⚠ WARNING

Danger of Electrical Shock when servicing unit. ALWAYS DISCONNECT POWER SOURCE BEFORE SERVICING! More than one disconnect switch may be required.

CLEANING ENERGY EXCHANGE CORES:

- Turn off unit completely! Lock-out and tag-out the unit disconnect switch.
- Remove the filters.
- Vacuum the exposed faces of the energy exchange core with a soft brush.
- Vacuum out dust from the rest of the unit case.
- Install new filters.

CAUTION

Do not wash the energy exchange core. Keep it away from water or fire to avoid damaging it. Always handle the core carefully.

CLEANING BLOWER WHEELS:

Inspect the blower wheels for dust build up. Vacuum the wheel with a soft brush. The motor and wheel assembly slides out of the blower housing.

To clean the wheel:

§ Remove (4) bolts from the motor rails.
§ Remove (6) or (8) bolts (depending on model) from the blower inlet ring.
§ Slide the motor and wheel assembly partially out of the blower housing.
§ Vacuum the wheel with a soft brush.
§ Slide the motor and wheel back into the housing.
§ Re-attach the inlet venturi with all the bolts.
§ Secure the motor in place on the rails with (4) bolts.

⚠ CAUTION

Motor is heavy. Do not drop during wheel cleaning. Personal injury or damage to the equipment can occur.

CLEANING VFD COOLING FINS & FANS:

VFDs supplied with some RD Models are equipped with cooling fins and/or cooling fans. Gently blow them clean. You may use cans of compressed air intended for cleaning computer keyboards.

CLEANING DRAIN PAN AND TRAP:

Periodically inspect the drain pan for build up.

To clean the drain pan:

§ Remove condensate line from drain pan outlet.
§ Remove four (4) screws from front of drain pan.
§ Slide drain pan out of unit.
§ Clean drain pan and trap.
§ Install drain pan into unit.
§ Attach with four screws.
§ Re-attach condensate drain line.

CLEANING COIL:

Periodically inspect the coil for cleanliness. Vacuum the entering air side fins with a soft brush. Be careful not to bend or damage the fins. The coil can also be cleaned with a chemical agent.

To clean the coil with a chemical agent:

§ Remove or cover the heat exchanger cores.
§ Cover the dew point sensor, if installed.
§ Wash down the coil with cleaning agent.
§ Wash down fresh air compartment as necessary.
§ Uncover dew point sensor.
§ Re-install cores.

If necessary, straighten fins with a fin comb.

CAUTION

Do not expose the cores to the cleaning fluid.

CLEANING DAMPERS:

Periodically inspect the isolation dampers and face and bypass damper for cleanliness. Remove any debris from the damper blades and linkage.

SEE PREVIOUS PAGE FOR INFORMATION ON ANNUAL MAINTENANCE TASKS

MAINTENANCE LOG						
ENTER DATES OF SERVICE						
CLEAN CORES	CLEAN BLOWERS	CLEAN VFD FINS & FAN	CLEAN DRAIN PANS & TRAP	CLEAN COIL	CLEAN DAMPERS	INITIALS

BOOK 5: START-UP, COMMISSIONING, MAINTENANCE

MISCELLANEOUS SERVICE NOTES

DATE	SERVICE	INITIALS

THIS PAGE LEFT BLANK INTENTIONALLY.

THIS PAGE LEFT BLANK INTENTIONALLY.