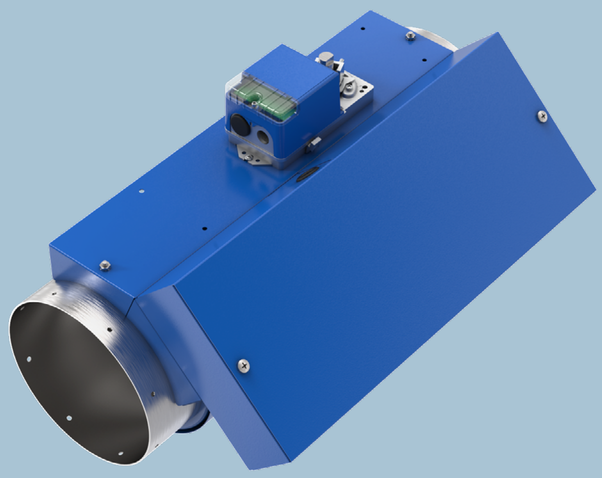
EcoAir Valve

INSTALLATION GUIDE



INSTALLATION CHECKLIST

DATA
- Project information
- Submittals
- Manuals for product

TOOLS
- Wire strippers
- Flat screw driver set with various size larger drivers
- Phillips screw driver with various size larger drivers
- Small vise grips
- Channel locks
- Needle nose pliers
- Crescent wrench
- Pocket knife
- Nut driver set
- Butane or electric soldering iron
- Fine tip markers
- Metal strap to support the air valve

ADHERENTS
- Solder
- Electrical tapes
- Duct tape
- Foil tape
- ASHRAE approved duct sealant

ELECTRONICS AND COMPONENTS
- Cell phone
- Digital camera
- Flashlight
- Digital volt meter
- DC and AC voltmeter
- DC and AC ameter
- Resistance measurement with tone
- Extra terminal connectors
- Wire labels
- Windows PC with USB port
- USB to RS485 cable
- EVM PC tool installed

SAFETY
- Ladders
- Arrest harness
- Safety glasses
- Hardhat
- Steel toed shoes

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OVERVIEW

The EcoAir Valve is an air flow control device, engineered for critical applications such as room pressure containment and fume hood exhaust systems. The valve provides ultra-low pressure drop and accurate, real-time airflow metering. The EcoAir Valve is indispensable to maintain safe, reliable, and energy-efficient operations in critical environments.

VENTURI HALO TECHNOLOGY

The EcoAir Valve incorporates the Venturi Halo, a key innovation in airflow metering valves. This feature, integrated into the valve's body, induces the Venturi effect which enables precise and reliable airflow measurements. The Venturi Halo has 12 strategically positioned pickup holes radially spaced and oriented perpendicular to the airflow. This orientation reduces the impact of debris and dust, which impedes conventional sensors that sit directly in the airstream, and improves measurement accuracy and valve longevity.

ADVANCED FLOW SENSING TECHNOLOGY

At the core of the EcoAir Valve's technology is the Superior Sensor Module (SSM), a differential pressure transducer. The SSM utilizes the Bernoulli principle to precisely measure the pressure differential across the Venturi Halo. This system ensures that the valve can consistently provide accurate airflow measurements, with a degree of accuracy within ±5% across an airflow range of 0 cfm to 350,000 cfm at up to 10 in. W.C.

ENHANCED DURABILITY AND MAINTENANCE-FREE OPERATION

The EcoAir Valve airflow sensor is located outside the airstream. This placement protects the sensor from the accumulation of dust and debris which extends its operational life and reduces the frequency of maintenance. This design feature eliminates the need to access the panel for regular cleaning and reduces maintenance requirements and system downtime.

PRECISION AIRFLOW CONTROL

The valve's design includes a serrated air fin blade, engineered for precise airflow control, even when nearly closed. This consistent precision across the entire operating pressure range from 0.01 in. W.C to 10 in. W.C., enables the EcoAir Valve to adapt seamlessly to various duct conditions and ensures stable and accurate airflow management.

SEAMLESS INTEGRATION WITH BUILDING AUTOMATION SYSTEMS

The EcoAir Valve is a fully integrated unit. It combines the factory mounted sensor, controller, and actuator. This integration facilitates a smooth and efficient installation process and guarantees compatibility with existing Building Automation Systems (BAS). It enhances system-wide management of critical environments which improves the valve's role in applications where compliance and safety are vital.

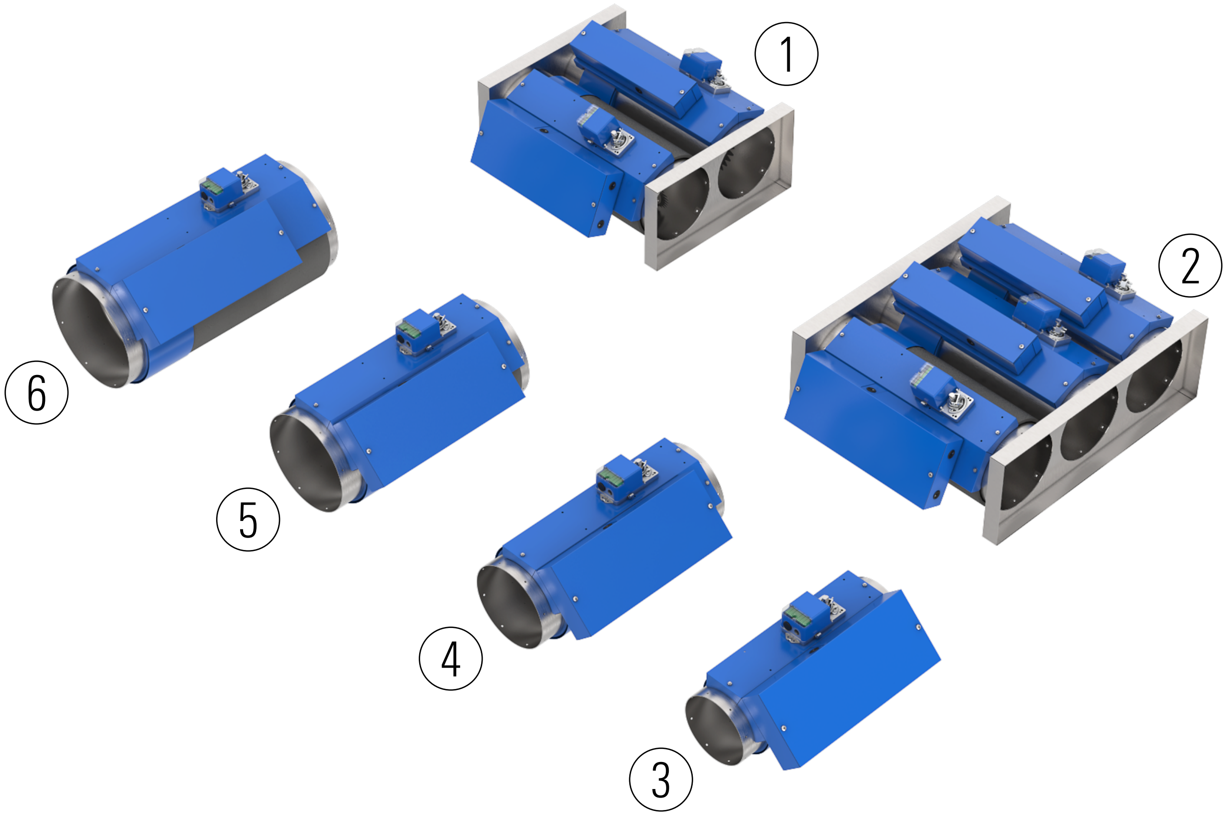
VERSATILE APPLICATION

You can use the EcoAir Valve in conjunction with Venturi Valves in various critical settings such as healthcare facilities and laboratories. This combination delivers comprehensive solutions for room pressure containment and fume hood exhaust and ensures the stringent demands of these environments are consistently met.

In summary, the EcoAir Valve is a crucial component in the design of HVAC systems for critical environments, where its precision, reliability, and energy efficiency play vital roles in the maintainence of optimal conditions.

GENERAL ASSEMBLY

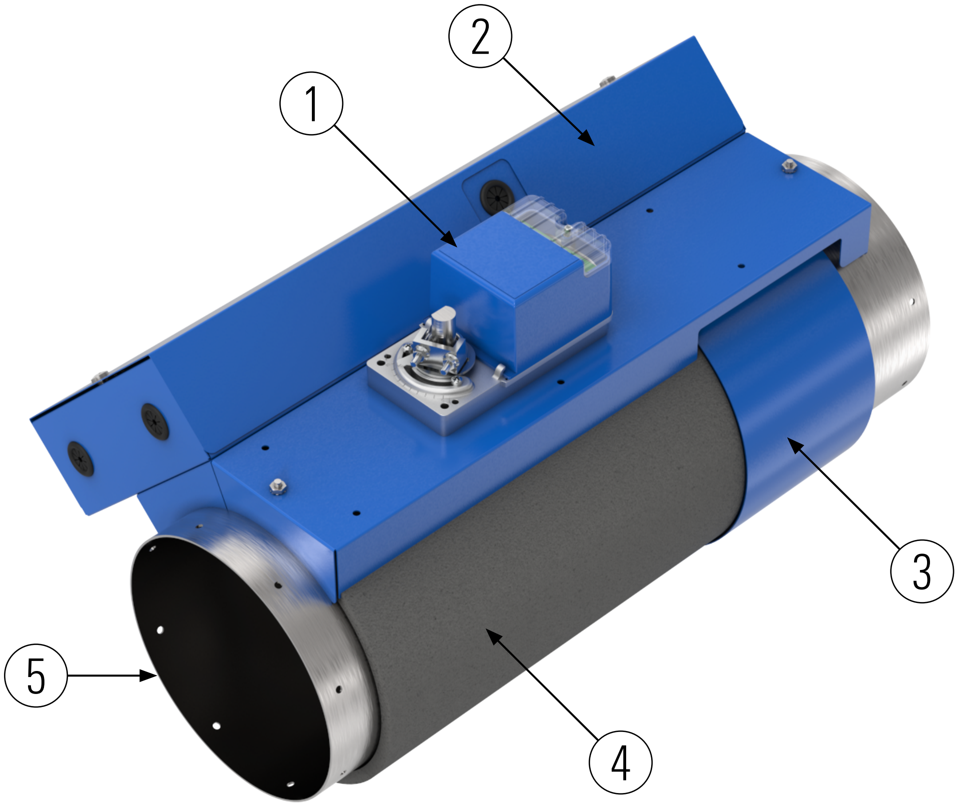
FIGURE 1: ECOAIR VALVE SIZES



Callout	Component
1	Dual
2	Triple
3	Single 8 in.
4	Single 10 in.
5	Single 12 in.
6	Single 14 in.

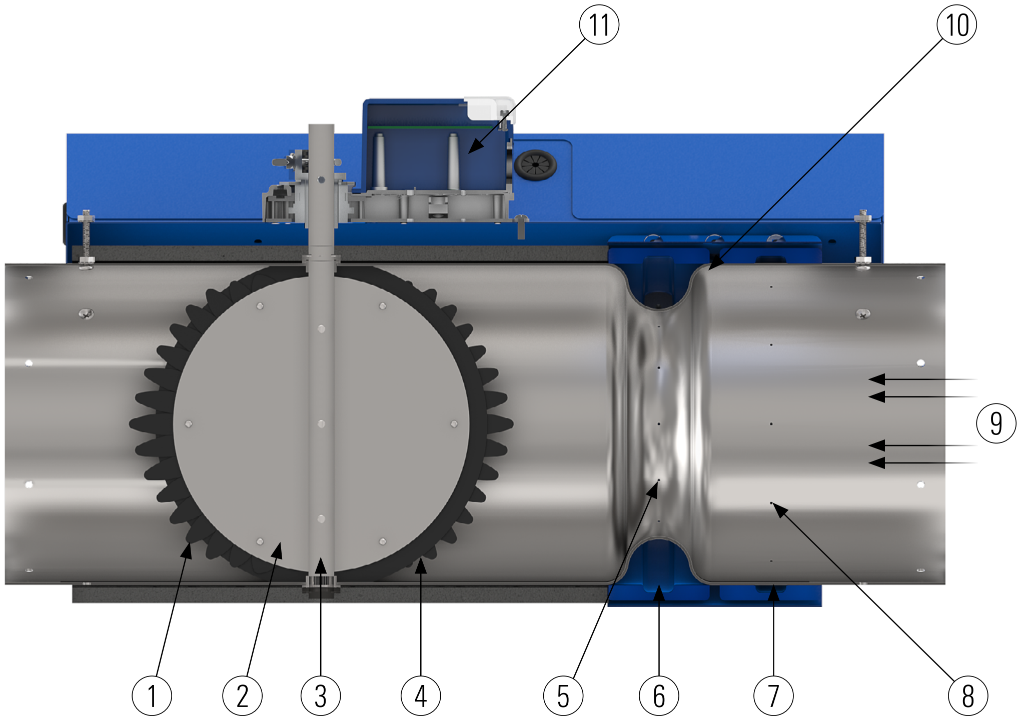
GENERAL ASSEMBLY

FIGURE 2: VALVE OVERHEAD VIEW



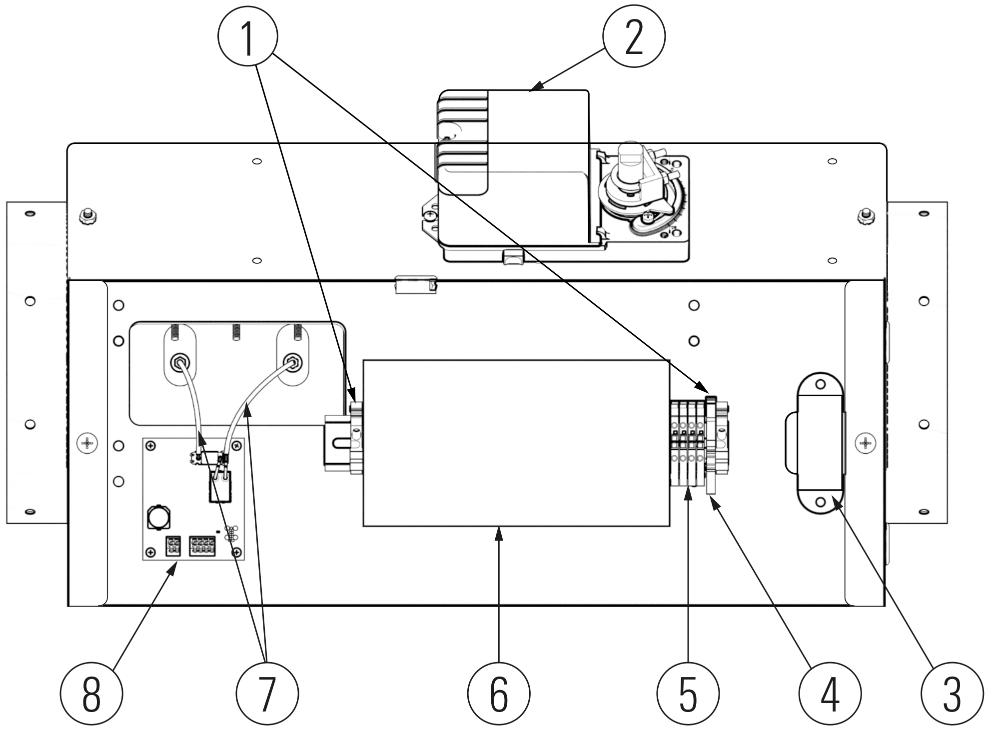
Callout	Component
1	Fast acting actuator with capacitor fail safe
2	Valve panel to house the sensor, controller, and device level wiring
3	Venturi Halo
4	Valve body with spun in Venturi Halo
5	Air outlet

FIGURE 3: VALVE SIDE VIEW



Callout	Feature	Description
1	Air fins	The unique air fin design ensures precise airflow control across the entire operating pressure range of the EcoAir valve and optimizes performance.
2	Damper	Constructed from 316 stainless steel, the damper blade can endure the harshest HVAC environments and provide durability and reliability.
3	Shaft	The 5/16 in. machined damper shaft, made from 316 stainless steel, offers robust structural stability and ensures smooth modulation of the damper blade under various duct conditions.
4	Full shut-off gasket	Ensures a near-perfect seal, effectively restricts airflow through the EcoAir valve and enhances control and efficiency.
5	Venturi Halo	Integrated into the valve body, it induces the Venturi effect and enables precise airflow measurement and enhances control accuracy.
6	Low pressure averaging channel	Part of the Venturi Halo technology, this channel enables accurate pressure averaging which essential for precise airflow measurement.
7	High pressure averaging channel	Utilizes the Venturi effect to provide accurate pressure averaging which ensures precise airflow measurements in the duct.
8	High pressure pick-up holes	An integral component of the Venturi Halo designed to remain debris-proof for reliable operation in various environments.
9	Air flow direction	The valve can facilitate correct airflow direction to ensure effective and accurate airflow management.
10	Venturi Halo	Integrated into the valve body, it induces the Venturi effect and enables precise airflow measurement and enhances control accuracy.
11	Fast-acting actuator	Responds quickly to changes in airflow demand and instantly adjusts to deliver the correct amount of airflow which maintains safety and performance.

FIGURE 4: PANEL CONTENTS VIEW



Callout	Description
1	DIN rail end stops
2	Actuator
3	Isolation transformer
4	DIN rail fuse holder and fuse
5	DIN rail terminal blocks
6	Controller
7	Pressure tubing
8	SSM-100

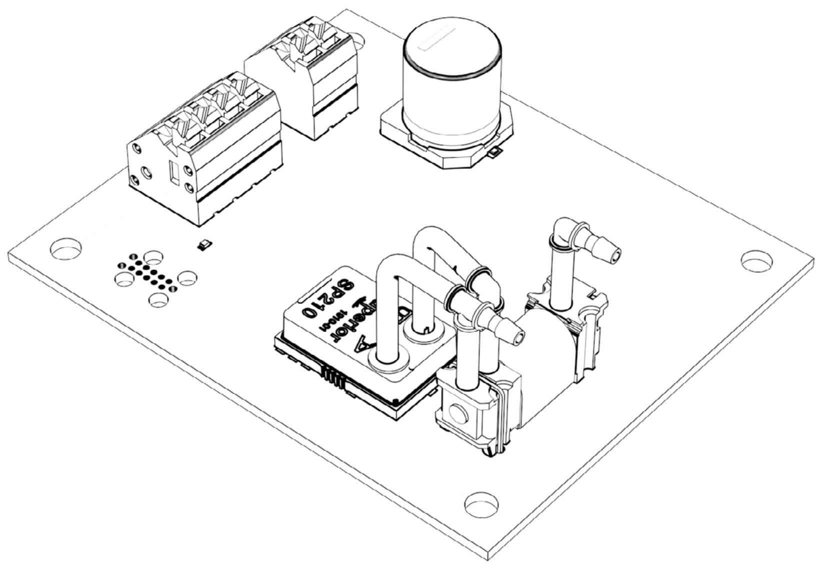
SUPERIOR SENSOR MODULE

Important

Any EcoAir valve units sold without the factory-mounted and factory-wired controller option (no controller option (N)), the field installer is responsible to provide, mount, wire, program, calibrate, and commission a third-party controller. The manufacturer of the EcoAir Valve is not liable for any performance issues from the device, system, or fume hood application level that results from the use of a third-party field-provided controller.

The manufacturer's warranty applies only to the supplied components, including the EcoAir Valve body, damper blade, Superior Sensor Module, and fast-acting actuator. Any performance concerns related to the control, operation, or system dynamics that involve a third-party controller which has not been factory integrated as part of the full EcoAir Valve package are outside the scope of the manufacturer's responsibility. Third-party vendor or on-site integrator must support external systems and field-supplied components, including controllers.

FIGURE 5: SUPERIOR SENSOR MODULE



The Superior Sensor Module (SSM), enhanced by NimbleSense™ technology, is a highly advanced pressure sensor solution designed for precise and reliable measurements across multiple pressure ranges within a single device. This smart technology has auto-range capabilities. The sensor can dynamically adjust to different pressure levels which ensures consistent accuracy and optimal performance. NimbleSense™ also offers low noise, high-resolution measurements, and long-term stability, which makes the SSM ideal for critical applications in HVAC, industrial settings, and other environments that require precise pressure monitors and controls. For more information on how the SSM operates, refer to the *SSM-100 Data Sheet, LIT-12014444*.

Suggested SSM use with a third party controller:

Suggested typical sequence of operation for the use of SSM:

1. Read A01 for range.
2. Read A02 for pressure value.
3. Read A01 for range comparison to A01 reading 1.
4. If A01 range reading 1 is not equal to A01 range reading 2, read A02 pressure and use the second A02 pressure reading together with second A01 range reading. If A01 range reading 1 is equal to A01 range reading 2, the range has not changed. The pressure reading is correct according to the range reading.

SSM AUTO-ZERO

There are 30s minimum intervals between the auto-zero events, this is the shortest interval to initiate an auto-zero cycle. The minimum interval ensures that the system control loop does not experience excessive auto-zero events during a fast thermal transient.

Auto-zero DeltaT = 0.5°C is the threshold to perform an early auto-zero. If the temperature changes more than 0.5°C from the last auto-zero, this triggers another autozero if at least 30s have elapsed. Overflow and underflow are mutually exclusive. Both are lowest priority.

FAST ACTING ACTUATOR

The fast-acting actuator integrated into the EcoAir valve is specifically engineered for critical HVAC applications that demand rapid airflow adjustments, particularly in settings like laboratories and research facilities with chemical fume hoods. This actuator uses advanced brushless DC motor technology with impedance protection to ensure efficient and reliable operation. With a 24 VAC power supply, it delivers a torque of 50 inch-pounds (5.6 N·m) that ensures robust performance suitable for dynamic environmental conditions.

A key feature of this actuator is its capacitor based fail-safe mechanism, which is crucial in the event of power outages. With this feature, the air valves automatically move to a predetermined fail condition and maintain safety and regulatory compliance in critical environments.

For example, in negative pressure labs, the supply air valves fail closed, while fume hood exhaust and general exhaust air valves fail open. Conversely, in positive pressure environments like clean rooms and patient rooms, the supply air valves fail open, and the general exhaust air valves fail closed. This fail-safe functionality enhances the operational reliability of the EcoAir Valve. The valve maintains controlled environments that are critical to safety and precision in specialized facilities.

TABLE 1: TITUS SKUS

Document number	Titus SKU	Description
LIT-12014151	BM060-TT6	Titus actuator TT6 50 in. lb O/C

TABLE 2: DIP SWITCHES

DIP switch number	Feature	OFF	ON
1	Rotation	CW	CCW
2	Fail-safe return	at 0	At 90
3	Control input signal	VDC	mA
4	Feedback	VDC	mA

Note: Based on the application requirements, the DIP switches are set in the field during the EcoAir Valve start up and commissioning.

TABLE 3: STATUS LED

State	Description
ON	Auto-stroke
Flash	Normal operation
Rapid flash	While capacitors charge

TABLE 4: ALARM LED

State	Description
Flash	Error or Configuration mode

TABLE 5: NORMAL OPERATION

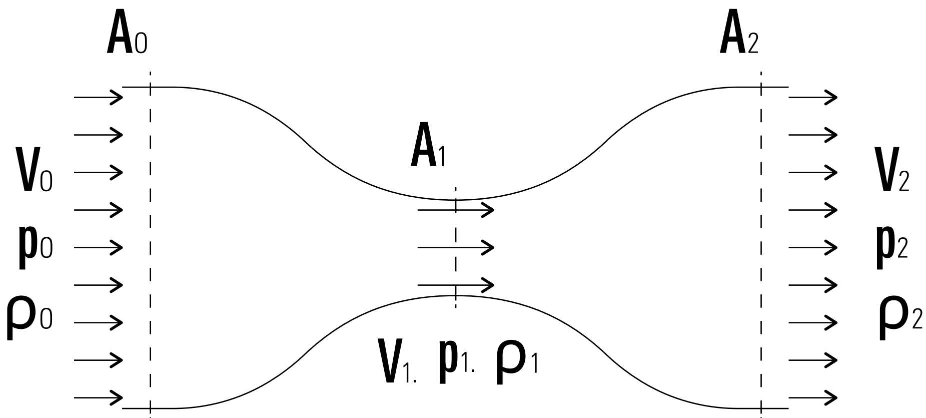
Control state	Number of status LED pulses
Analog	1
Digital ON/OFF or floating	2
PWM 5 seconds	3
PWM 25 seconds	4

THEORY OF OPERATION

The EcoAir valve is a real-time air flow metering device designed to maintain precise mass airflow setpoints in various HVAC applications, particularly in critical environments where maintainance of stable room pressure and a safe operational environment is essential.

At the core of its functionality is the innovative Venturi Halo design that induces the Venturi effect where the air velocity increases as it passes through a constricted section of the valve, which results in a corresponding decrease in pressure. This pressure differential, measured across the Venturi Halo by the SSM, is central to EcoAir valve's operation. The valve controller can calculate mass airflow with high accuracy by applying Bernoulli's principle.

FIGURE 6: VENTURI EFFECT



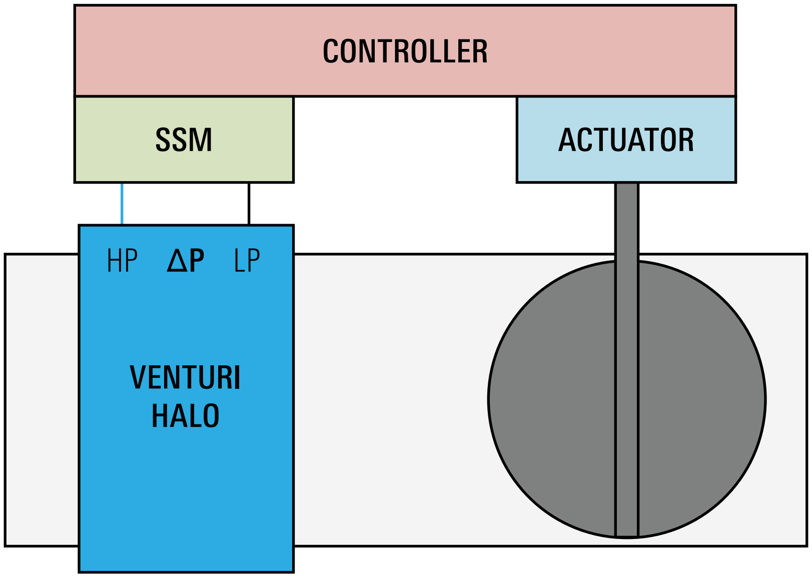
A = Area, P = Pressure, V = Velocity

A1 < A0, P1 < P0, V1 > V0

Bernoulli's principle, which mathematically relates the pressure drop (△P) to the velocity of airflow, enables the valve controller to continuously monitor and calculate the mass flow rate in near real-time. The controller takes into account the differential pressure across the Venturi Halo, air density, and the valve's cross-sectional area to ensure precise airflow measurements.

The EcoAir valve's real-time aireflow calculation with a fast actuator can dynamically modulate airflow and deliver the exact amount of air required to the designated room or zone within the building.

FIGURE 7: VENTURI HALO



The EcoAir valve's ability to maintain reliable mass airflow measurements and adapt to varying duct conditions makes it an indispensable component in the design of life safety HVAC systems. Such speed and precise control is critical in maintaining consistent environmental conditions, especially in sensitive settings such as laboratories, cleanrooms, and healthcare facilities, where adherence to stringent safety and regulatory standards is non-negotiable.

UNDERSTANDING BERNOULLI'S EQUATION

Bernoulli's equation for incompressible fluid flow, like air under most HVAC conditions, is:

FIGURE 8: BERNOULLI'S EQUATION

$$P_1 + \frac{1}{2}\mathrm{r}\,\mathrm{u}_1^2 + \mathrm{r}gh_1 = P_2 + \frac{1}{2}\mathrm{r}\,\mathrm{u}_2^2 + \mathrm{r}gh_2$$

Where:

- P1 and P2 are the static pressures at two points
- r is the air density
- v1 and v2 are the air velocities at two points
- g is the gravitational acceleration
- h1 and h2 are the heights above a reference point

In most HVAC applications, you can simplfy the equation to:

FIGURE 9: SIMPLIFIED BERNOULLI'S EQUATION

$$P_1 + \frac{1}{2} r u_1^2 = P_2 + \frac{1}{2} r u_2^2$$

You can then relate the pressure drop ΔP=P1−P2 to the velocity.

RELATING VELOCITY TO FLOW RATE

You can derive the air velocity v through the valve from the pressure drop as:

FIGURE 10: VELOCITY TO FLOW RATE EQUATION

$$V = \sqrt{\frac{2\Delta P}{r}}$$

Where:

- v is the velocity of air
- ΔP is the pressure drop across the valve
- r is the density of air, which you can assume is constant at standard conditions

CALCULATING VOLUME FLOW RATE

You can calculate the volumetric flow rate Q in cfm by multiplying the air velocity v by the cross-sectional area A of the valve opening:

FIGURE 11: VOLUME FLOW RATE EQUATION

$$Q = V \times A$$

Given that:

FIGURE 12: DETAILED VOLUME FLOW RATE EQUATION

$$Q = A \times \sqrt{\frac{2\Delta P}{r}}$$

This formula gives the volume flow rate in cubic feet per second. To convert to cfm, multiply the result by 60.

MASS FLOW RATE CALCULATION

You can calculate the mass flow rate m with the volumetric flow rate Q and the air density p:

FIGURE 13: MASS FLOW RATE CALCULATION

$$\dot{m} = \mathrm{r} \times Q$$

Where:

- m is the mass flow rate, in pounds per minute or kilograms per second
- r is the density of air, in slugs/ft³ or kg/m³
- Q is the volumetric flow rate in cfm

Example:

If you have a pressure drop across an air valve of 0.5 in. W.C, a valve opening area A of 0.1 sq ft, and an air density of 0.075 lb/ft³ at standard conditions, the steps are:

1. Convert pressure drop to velocity, where 1 in WC ≈ 5.2 lb/ft² and 144 is to convert square inches to square feet.

$$\mathbf{u} = \sqrt{\frac{2 \times 0.5 \times 5.2 \times 144}{0.075}} \approx 201 \text{ feet per second}$$

2. Calculate flow rate

$$Q = 201 \times 0.1 = 20.1 \text{ cubic feet per second}$$

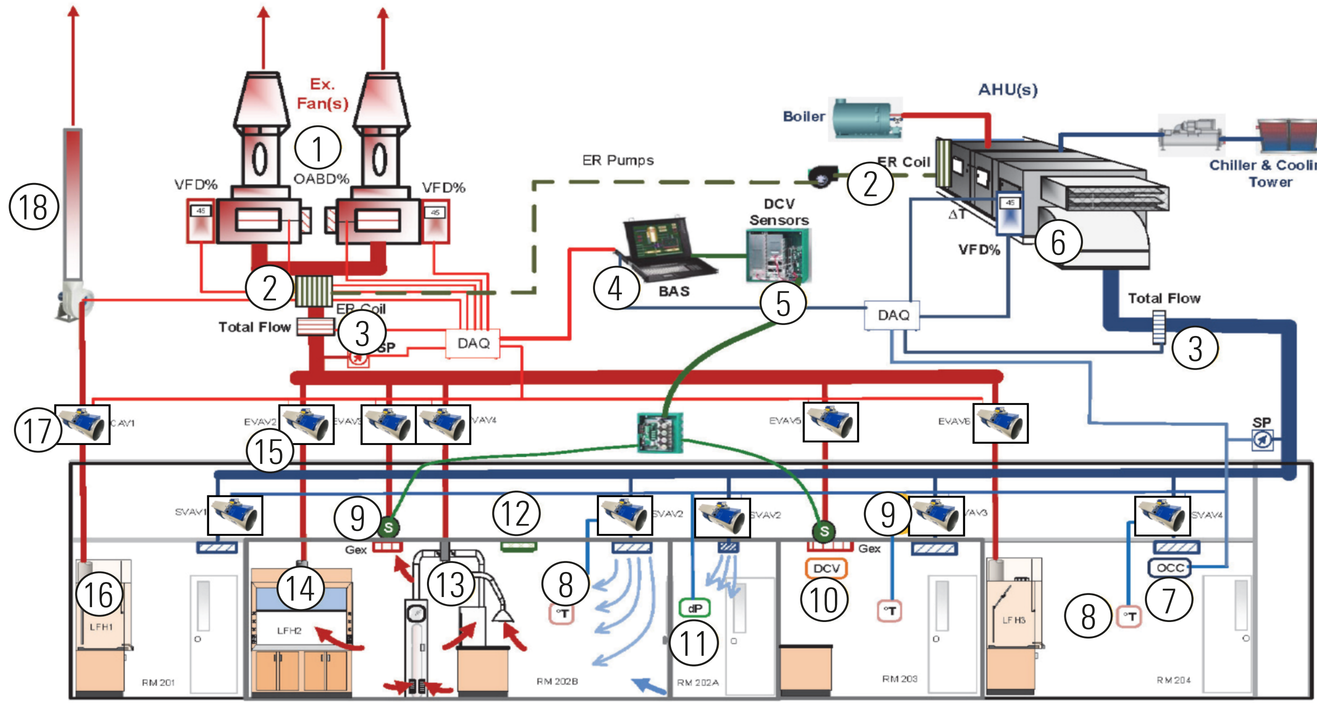
3. Convert to cfm

$$Q_{CFM} = 20.1 \times 60 = 1206 \text{ CFM}$$

4. Calculate mass flow rate

$$\dot{m} = 0.075 \times 1206 \approx 90.45 \text{ lbs per minute}$$

FIGURE 14: LACS SYSTEM MAP



Callouts	Feature	Description
1	Redundant fans with VFDs	Provides system reliability and optimized exhaust flow control with variable frequency drives.
2	Energy recovery systems	Recaptures energy from exhaust air; efficiency varies by system type.
3	Flow monitors	Sensors enhance flow control and pressure tracking, improving energy efficiency.
4	Building automation system	Monitors and controls HVAC functions and trends for operational efficiency.
5	Demand-controlled ventilation	Modulates airflow based on contaminant detection, optimizing air quality and energy use.
6	100% outdoor air AHU	Ensures clean air supply for critical spaces, avoiding recirculation.
7	Occupancy sensors	Adjust airflow based on laboratory occupancy.
8	Temperature sensors	Maintain room temperature via controlled air supply.
9	Air supply controls and diffusers	Correct air distribution to manage temperature and contaminants.
10	DCV for airborne contaminants	Adjusts ventilation to remove hazardous particles.
11	Anteroom with pressure monitoring	Provides additional isolation for laboratories handling hazardous materials.
12	Airborne contaminant filtration	Filters detect and remove hazardous chemicals from the air.
13	Exposure control devices (ECDs)	Localized exhaust systems capture hazardous fumes at the source.
14	VAV fume hoods	Adjusts airflow based on sash position to ensure containment.
15	VAV exhaust flow controller	Modulates exhaust flow in response to varying lab needs.
16	CV fume hoods	Maintains constant airflow for consistent containment.
17	CV exhaust flow controller	Ensures steady airflow through constant volume systems.
18	Exhaust stack	Design ensures correct discharge and plume dispersion of contaminated air.

ECOAIR VALVE CONTROL LOOP

The EcoAir Valve leverages the SSM to accurately measure the pressure differential across its Venturi Halo section, which is integral to the valve's control loop.

MEASUREMENT OF AIRFLOW INPUT:

The SSM within the EcoAir valve continuously monitors the differential pressure across the Venturi Halo section. As air flows through the constricted section, the Venturi effect induces an increase in velocity and a drop in pressure. The SSM captures this pressure differential with high accuracy and the EcoAir valve can calculate the real-time airflow rate with the Bernoulli's principle.

SIGNAL PROCESSING:

The pressure differential data the SSM captures converts into an electrical signal and relays to the EcoAir valve controller. The controller processes this data with advanced logic algorithms to determine the exact airflow rate through the valve. This process ensures that the airflow measurement is accurate and reflective of the real-time conditions within the duct system.

SETPOINT COMPARISON:

The EcoAir valve controller continuously compares the measured airflow rate, calculated from the SSM data, with the airflow setpoint. A room-level controller establishes the setpoint and communicates the target airflow to the device-level controller based on the specific HVAC system requirements. These requirements maintain the optimal environmental conditions such as temperature, humidity, and ventilation, within the controlled zone or room.

CONTROL SIGNAL ADJUSTMENT:

When deviation occurs between the actual airflow and the setpoint, the controller generates an adjustment signal for the valve actuator. The actuator then modifies the position of the EcoAir valve's damper blade to correct the airflow.

- If the actual airflow is lower than the setpoint: The controller signals the actuator to open the damper blade further and increases the airflow.
- If the actual airflow is higher than the setpoint: The controller directs the actuator to partially close the damper blade and reduces the airflow.

VALVE ACTUATION OUTPUT:

The actuator within the EcoAir Valve dynamically adjusts the position of the damper blade based on the control signals. This modulation precisely controls the airflow rate and maintains the optimal environmental conditions in the specific building zone or room.

FEEDBACK LOOP:

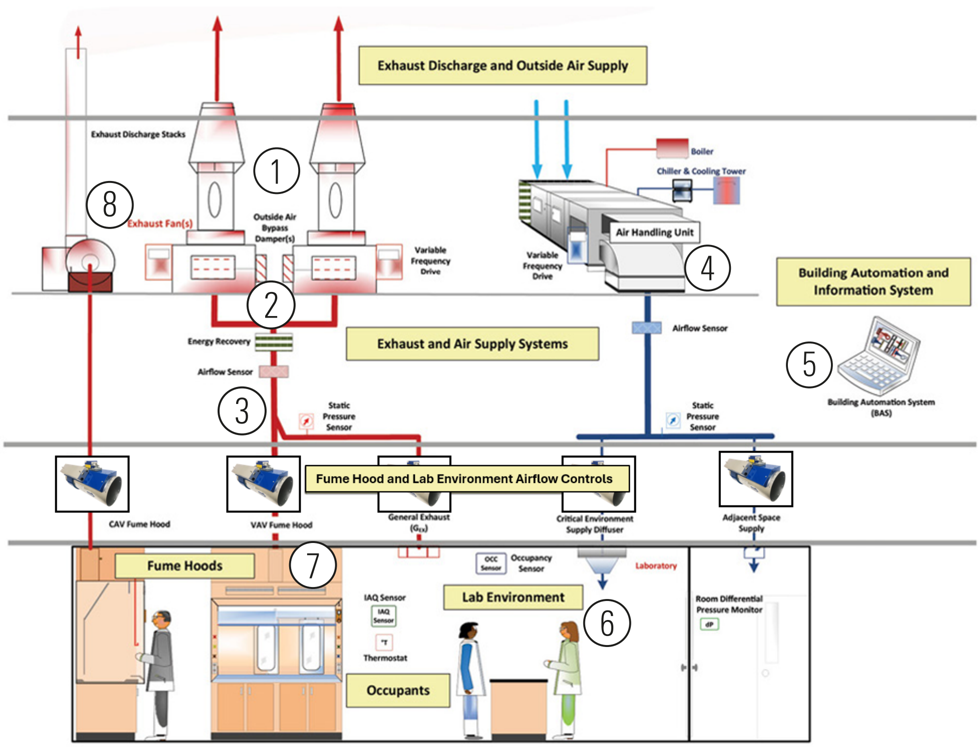
The operation of the EcoAir Valve forms a closed-loop system. The valve continuously monitors the actual airflow through the SSM and makes real-time adjustments to maintain the setpoint airflow. This feedback loop ensures that the airflow stays within specified parameters. It provides reliable and consistent control, especially in environments where precise airflow regulation is essential for safety and operational efficiency.

SUMMARY OF THE CONTROL LOOP:

- Input: Differential pressure measurement through the SSM.
- Processing: Conversion of the pressure differential into the airflow rate and comparison with the target setpoint.
- Control: Dynamic adjustment of the valve's damper blade position based on deviations from the setpoint.
- Output: Modulated airflow through the EcoAir valve.
- Feedback: Continuous real-time adjustments to maintain the desired airflow.

Incorporation of the SSM and a fast-acting actuator creates precise differential pressure measurement. The EcoAir Valve provides highly accurate control over airflow in HVAC systems. This precision is vital to ensure safe and stable environmental conditions, particularly in critical applications where consistent airflow and environmental stability are necessary for safety and compliance.

FIGURE 15: HVAC ECOSYSTEM



Callouts	Feature	Description
1	Redundant fans with VFDs	Provides system reliability and optimized exhaust flow control with variable frequency drives.
2	Energy recovery systems	Recaptures energy from exhaust air; efficiency varies by system type.
3	Flow monitors	Sensors enhance flow control and pressure tracking, improving energy efficiency.
4	100% outdoor air AHU	Ensures clean air supply for critical spaces, avoiding recirculation.
5	Building automation system	Monitors and controls HVAC functions and trends for operational efficiency.
6	Occupancy sensors	Adjust airflow based on laboratory occupancy.
7	VAV fume hoods	Adjusts airflow based on sash position to ensure containment.
8	Exhaust stack	Design ensures correct discharge and plume dispersion of contaminated air.

The EcoAir Valve, while a critical component in the HVAC system of a building, is only one part of a larger ecosystem that includes various other equipment and factors. It is essential to recognize that the performance of the EcoAir Valve can be influenced by both upstream and downstream elements within the system. For example, issues such as improper duct design, fluctuations in system pressure, or inefficiencies in other HVAC components can directly impact how effectively the EcoAir Valve functions.

UNDERSTANDING SYSTEM DYNAMICS

- **Upstream factors:** These could include the performance of the HVAC unit itself, such as the air handling unit (AHU) and the condition of the filters. If the AHU underperforms, or if the filters become clogged, the airflow and pressure in the EcoAir Valve are not optimal which affects its efficiency.
- **Downstream factors:** These involve elements like the ductwork layout, the presence of leaks, and the terminal units, such as diffusers and registers. Poorly designed ductwork or leakage can result in pressure drops or gains that the EcoAir Valve must compensate for which can potentially lead to inefficiencies.

HOLISTIC SYSTEM TESTING AND BALANCING

To ensure that the building is safe, comfortable, and energy-efficient, a holistic approach to system testing and balancing is crucial. This involves several key steps:

- Comprehensive testing: This includes testing all components of the HVAC system, not just the EcoAir Valve. With performance evaluation of both upstream and downstream equipment, you can identify any issues that might affect the overall system.
- System balancing: When testing is complete, adjustments are made to balance the system. This may involve EcoAir Valve K-factor changes in response to the actual conditions found in testing, fan speeds adjustments, or repair of leaks in the ductwork.
- Continuous monitoring: Implementation of a continuous monitoring HVAC system can help in optimal performance maintenance. Sensors and smart controls can provide real-time data on system performance and can make adjustments as necessary to maintain efficiency and comfort.
- Regular maintenance: Routine maintenance ensures that all components of the HVAC system, including the EcoAir Valve, are in good condition. This includes cleaning, parts replacement, and system updates based on seasonal changes or building occupancy patterns.

With adoption of comprehensive approach to system testing and balancing, facility managers can ensure that the EcoAir Valve and the entire HVAC system operate efficiently. This not only improves the environmental conditions within the building but also enhances energy conservation and reduces operational costs. This holistic perspective is essential to maintain a well-functioning HVAC system that meets the needs of building occupants and adheres to safety and efficiency standards. *The ASHRAE Laboratory Design Guide: Planning and Operations of Laboratory HVAC System* is mandatory minimum reading for any technician expecting to work with these systems.

FUME HOOD APPLICATION CONSIDERATIONS

Chemical fume hoods are essential to minimize exposure to hazardous substances in laboratories. ASHRAE 110 is a standard test method for the performance evaluation of laboratory fume hoods. It assesses how well a fume hood contains and exhausts hazardous fumes and ensures the safety of laboratory personnel. The test involves tracer gas, typically sulfur hexafluoride, to simulate a chemical release, and then measure the concentration of this gas at various points around the hood to detect any leaks. The key aspects of the test include face velocity measurements, smoke visualization tests, and tracer gas containment tests. This comprehensive evaluation helps to verify that fume hoods meet the required safety and performance standards.

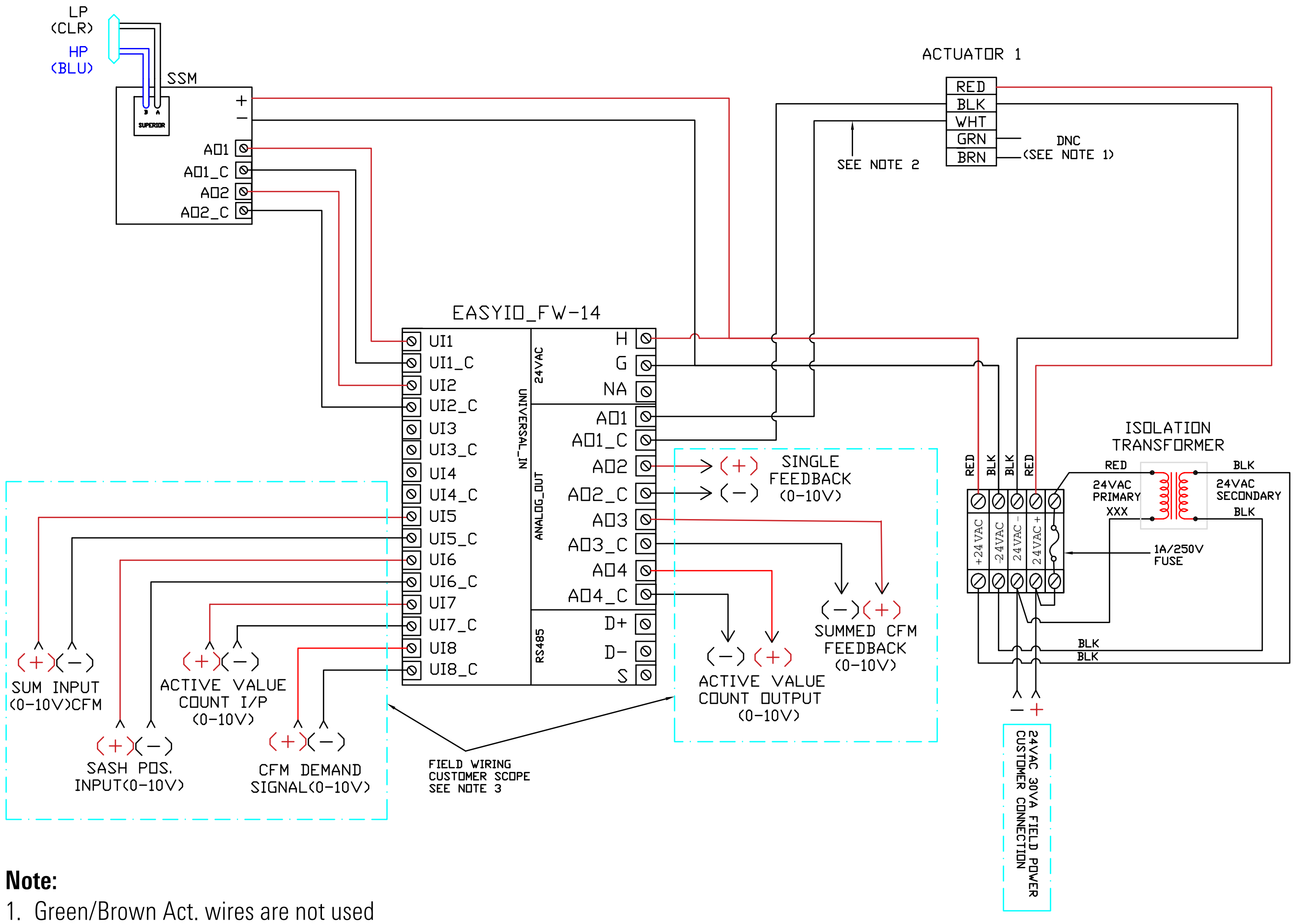
ASHRAE 110 outlines test methods for fume hood containment assessment but emphasizes that face velocity alone is not a direct indicator of chemical fume hood safety. It is important to understand that mismanagement of face velocity can lead to turbulence, which may compromise containment. The key safety considerations for HVAC systems that support these hoods include:

- Face velocity: Optimal face velocity, typically 60 fpm to 100 fpm, is critical for effective containment of hazardous fumes. Maintanence of consistent face velocity is essential, regardless of changes in filter load, sash position, or room conditions.
- Sash management: Correct sash management is crucial as it affects airflow dynamics. Smooth and controlled sash movement, as specified in ASHRAE 110-1995, ensures stable containment. For VAV fume hoods, the opening speed is 1.0 ft/s to 1.5 ft/s for accurate response time testing. Observation of appropriate sash height limits is necessary to maintain containment. Maximum heights are 28 in. for loading and 18 in. for working to avoid airflow obstruction.
- Exhaust system design: Correct exhaust design is critical to expel contaminated air safely, which also factors in fan placement, duct material, and safe dispersion. Redundancy in the exhaust system is essential to ensure continuous operation if equipment fails.
- Airflow monitoring and alarms: Continuous airflow monitoring ensures face velocity stays within safe limits. Alarm systems notify personnel of deviations and enable immediate corrective actions.
- Room air balance: Negative pressure maintainence in laboratories with fume hoods prevents contaminants leakage into other areas. Adequate air changes per hour ensure effective dilution and removal of airborne hazards.
- Temperature and humidity control: Stable temperature and humidity are essential for certain chemical processes. The HVAC system must manage these conditions without compromisation of fume hood performance.
- Maintenance and testing: Regular inspections and maintenance of HVAC components ensure continued safety and compliance. This includes checks for leaks, fan performance verification, and sensor recalibration. With maintenance of these safety aspects, HVAC systems can enhance the effectiveness of fume hoods and ensure a safe environment for laboratory personnel.

DEVICE LEVEL SINGLE WIRING

Note: For more information on the I/O wiring, K-Factor, and area values for the single, dual and triple device level wiring, refer to the the EcoAir.caf file on the License Portal.

FIGURE 16: ECOAIR WITH SINGLE WIRING



Note:

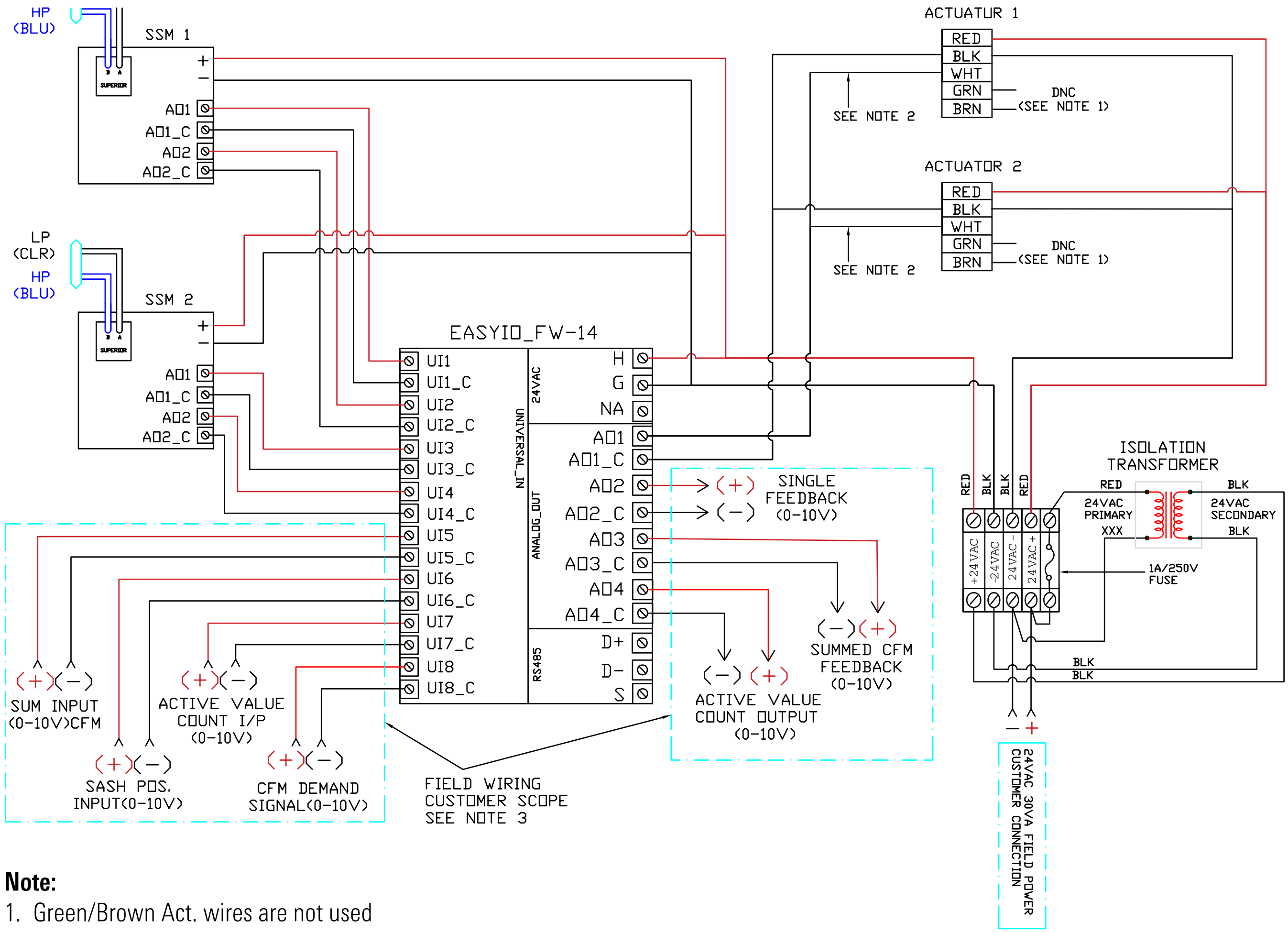
1. Green/Brown Act. wires are not used
2. WHT. Actuator control wire carries a 2-10V Signal from A01 output
3. Field wiring under border lines must be customer scope

TABLE 6: ECOAIR WITH SINGLE WIRING

Source	Function	SSM I/O	CCM I/O	Signal
SSM	Flow sensor range (A01)	AO-1	AI-1	0 VDC to 10 VDC
	Flow sensor press (A02)	AO-2	AI-2	0 VDC to 10 VDC
Actuator	Actuator command (IN)	IN	AO-1	0 VDC to 10 VDC
Flow command	CFM setpoint	n/a	AI-7	0 VDC to 10 VDC
Flow feedback	CFM feedback	n/a	CO-4	0 VDC to 10 VDC

DEVICE LEVEL DUAL WIRING

FIGURE 17: ECOAIR WITH CCM DUAL WIRING



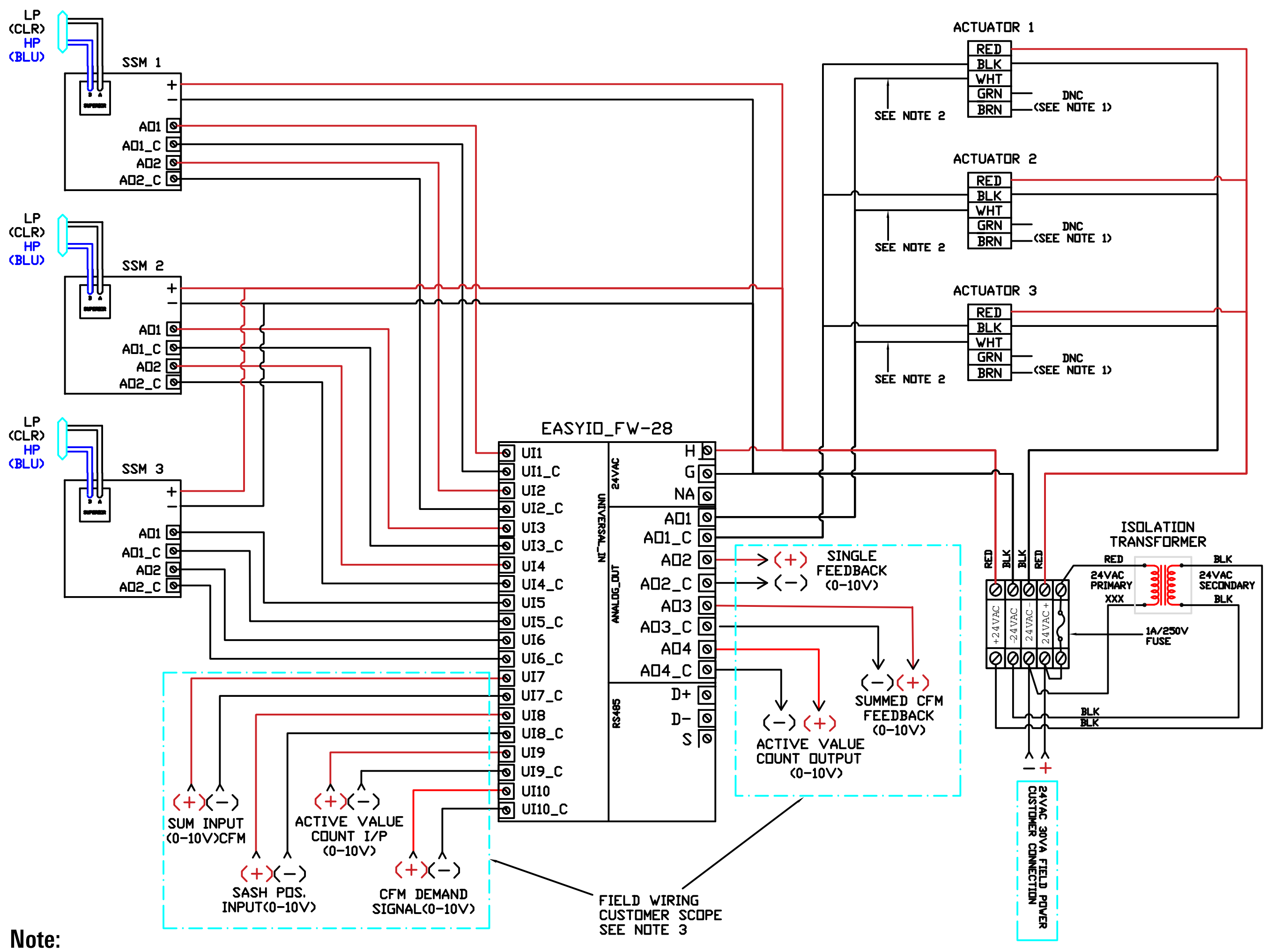
Note:

1. Green/Brown Act. wires are not used
2. WHT. Actuator control wire carries a 2-10V Signal from A01 output
3. Field wiring under border lines must be customer scope

TABLE 7: ECOAIR AND CCM DUAL WIRING

Source	Function	SSM I/O	CCM I/O	Signal
SSM 1	Flow sensor range (A01)	AO-1	AI-1	0 VDC to 10 VDC
	Flow sensor press (A02)	AO-2	AI-2	0 VDC to 10 VDC
Actuator 1	Actuator command (IN)	IN	AO-1	0 VDC to 10 VDC
SSM 2	Flow sensor range (A01)	AO-1	AI-3	0 VDC to 10 VDC
	Flow sensor press (A02)	AO-2	AI-4	0 VDC to 10 VDC
Actuator 2	Actuator command (IN)	IN	AO-1	0 VDC to 10 VDC
Flow command	CFM setpoint	n/a	AI-7	0 VDC to 10 VDC
Flow feedback	CFM feedback	n/a	CO-4	0 VDC to 10 VDC

FIGURE 18: ECOAIR WITH CCM TRIPLE WIRING



Note:

1. Green/Brown Act. wires are not used
2. WHT. Actuator control wire carries a 2-10V Signal from A01 output
3. Field wiring under border lines must be customer scope

TABLE 8: ECOAIR AND CCM TRIPLE WIRING

Source	Function	SSM I/O	CCM I/O	Signal
SSM 1	Flow sensor range (A01)	AO-1	AI-1	0 VDC to 10 VDC
	Flow sensor press (A02)	AO-2	AI-2	0 VDC to 10 VDC
Actuator 1	Actuator command (IN)	IN	AO-1	0 VDC to 10 VDC
SSM 2	Flow sensor range (A01)	AO-1	AI-3	0 VDC to 10 VDC
	Flow sensor press (A02)	AO-2	AI-4	0 VDC to 10 VDC
Actuator 2	Actuator command (IN)	IN	AO-1	0 VDC to 10 VDC
SSM 3	Flow sensor range (A01)	AO-1	AI-5	0 VDC to 10 VDC
	Flow sensor press (A02)	AO-2	AI-6	0 VDC to 10 VDC
Actuator 3	Actuator command (IN)	IN	AO-1	0 VDC to 10 VDC
Flow command	CFM setpoint	n/a	AI-7	0 VDC to 10 VDC
Flow feedback	CFM feedback	n/a	CO-4	0 VDC to 10 VDC

DIMENSIONS

TABLE 9: ECOAIR VALVE WEIGHTS AND DIMENSIONS

Unit Size		Weight SS316		Valve diameter		Valve lenght (A)		Valve height (B)		Collar width (C)		Collar height (D)	
		lb	kg	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
8 in.	1	25	11	7.88	200	23	584	13	330	n/a			
10 in.	1	30	14	9.74	247	26	660	16	406	n/a			
	2	60	27	n/a	n/a	30	762	16	406	22.63	575	11.44	291
	3	90	41	n/a	n/a	30	762	16	406	33.75	857	11.44	291
12 in.	1	40	18	11.68	297	26.8	681	18	457	n/a			
	2	80	36	n/a	n/a	30.8	782	20.5	521	26.75	679	13.5	343
	3	120	54	n/a	n/a	30.8	782	20.5	521	40	1016	13.5	343
14 in.	1	50	23	13.62	346	30	762	20	508	n/a			
	2	100	45	n/a	n/a	34	864	23.5	597	32.15	817	16	406
	3	150	68	n/a	n/a	34	864	23.5	597	48.3	1,227	16	406

LOCATION CONSIDERATIONS

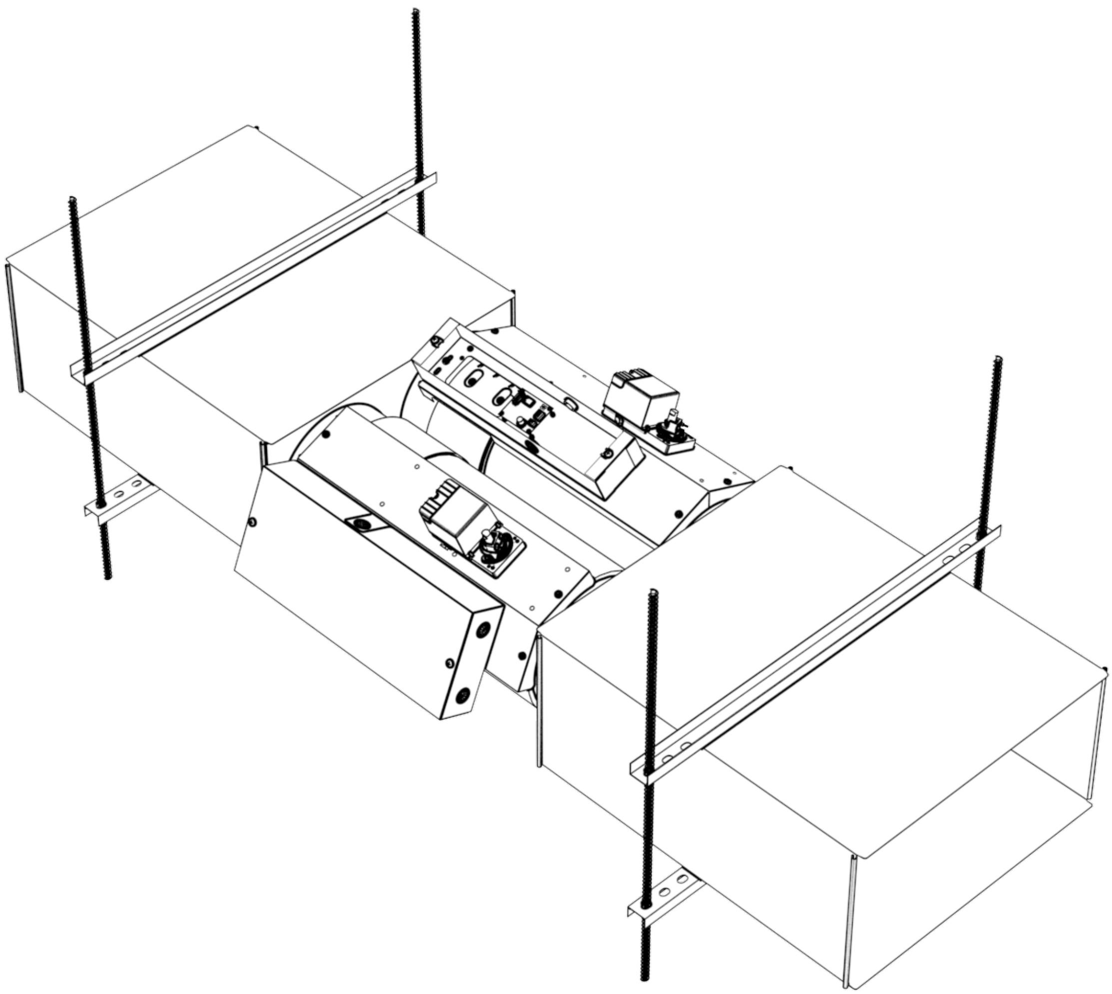
The EcoAir Valve offers flexible installation options. You can mount it in horizontal, vertical, or any other angled position. A common installation site is the ceiling space above work areas, The valve provides efficient use of space and maintains accessibility. As you install the valve, ensure that the operational components of the valve are unobstructed and do not obstruct other equipment in the area. Accessibility is crucial for the installation, particularly for the connection of electronics and any optional communication interfaces. One of the EcoAir Valve's advantages is that it does not require straight sections of ductwork upstream or downstream and simplifies installation in confined spaces.

However, it is essential to adhere to the airflow direction as indicated on the valve's label to ensure correct operation. To protect the electronic components and actuator, do not position these components directly beneath the valve body. This precaution helps prevent potential issues from condensation that could drip into the electronic housing and ensures longterm reliability and safety of the system. These installation considerations are critical to maximize the performance and lifespan of the EcoAir Valve while maintaining safety and compliance in HVAC applications.

MOUNTING A GANGED VALVE

Due to the large size and weight of ganged valves, use threaded rods and channel struts to support the installation. Consult local building codes for correct hardware, mounting, sealing and installation requirements.

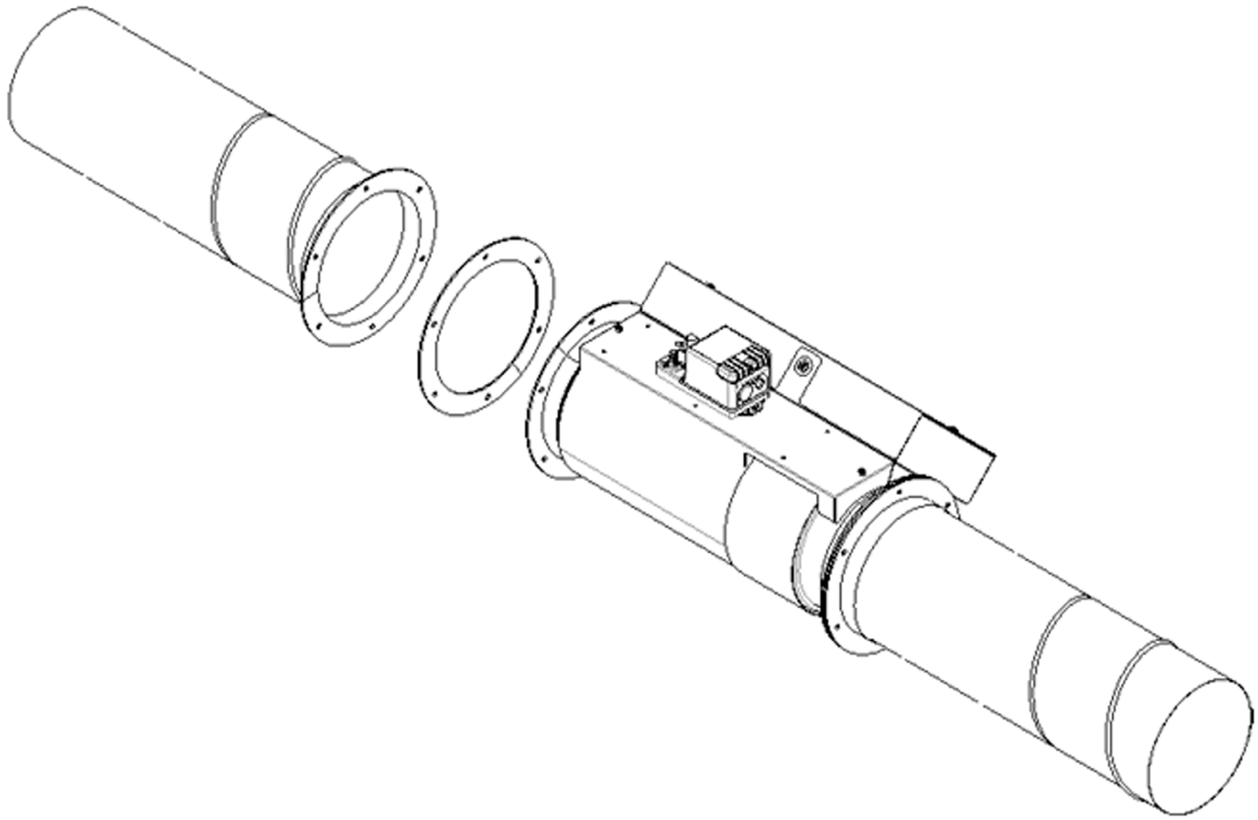
FIGURE 19: GANGED VALVE



MOUNTING A FLANGED VALVE

Flanged valves require a gasket between the duct and valve flanges with the addition of the flange fasteners. Ensure the metal straps support both sides of the valve weight and the duct work. For correct hardware, mounting, sealing and installation requirements, consult local building codes.

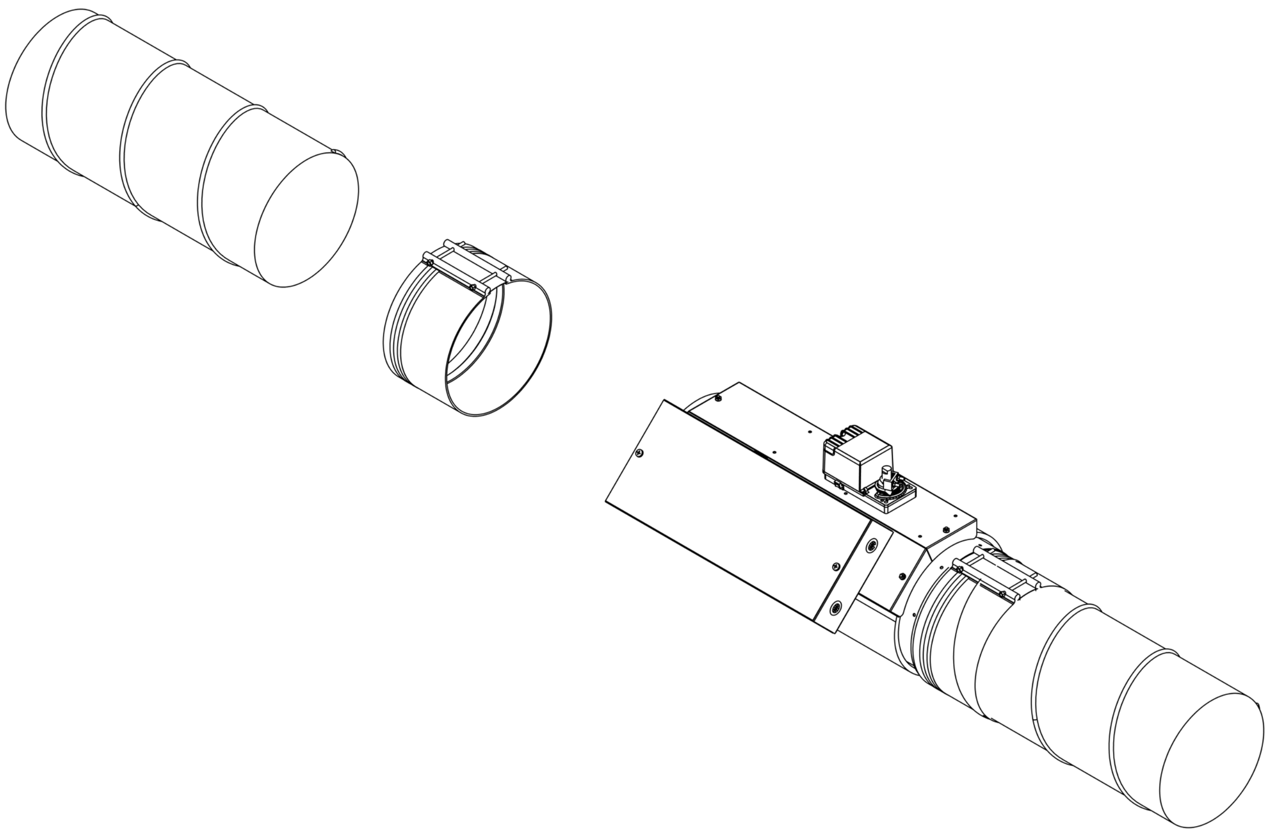
FIGURE 20: FLANGED VALVE



MOUNTING A QUICKSLEEVE VALVE

Quicksleeves are an optional accessory to speed up the installation of the valve. Each valve requires two quicksleeves, one on the inlet side and one on the outlet side of the valve. Due to the reduced diameter of the valve body, it is necessary to install the quicksleeves with the turned groove on the valve. This ensures that an air tight seal forms when the quicksleeve tightens around the valve. Ensure the metal straps support both sides of the valve weight and the duct work. For correct hardware, mounting, sealing and installation requirements, consult local building codes.

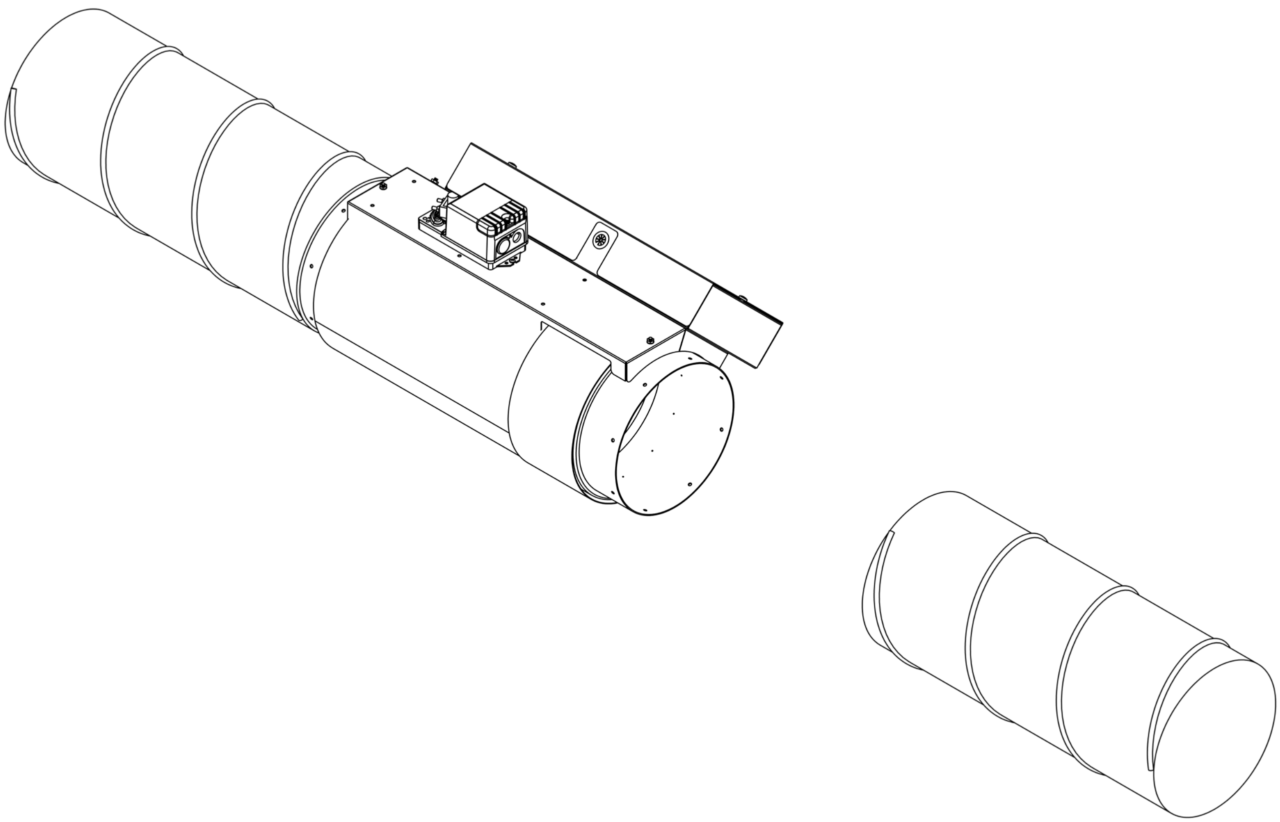
FIGURE 21: QUICKSLEEVE VALVE



MOUNTING A SLIP-ON VALVE

The outside diameter of the valve is undersized to fit inside standard duct sizes. Once the valve slips inside the duct, secure the valve with sheet metal screws. Apply a duct seal to ensure an air tight seal. Ensure the metal straps support both sides of the valve weight and the duct work. For correct hardware, mounting, sealing and installation requirements, consult local building codes.

FIGURE 22: SLIP-ON VALVE



START-UP SEQUENCE FOR THE ECOAIR VALVE

PRELIMINARY INSPECTION:

1. Check the correct installation of the EcoAir Valve, ductwork, and connections. Ensure that all components are accessible and installed in accordance with design specifications.
2. Check for damage or missing components in the EcoAir Valve panel.
3. Check that the pneumatic tubes are connected correctly to the pressure ports on the Venturi Halo.
4. Conduct a detailed point-to-point check of all electrical connections between the EcoAir Valve, actuator, controller, and other devices. Confirm that each wire connects correctly, and that all signal paths are clear and functional. This ensures reliable communication and control across the system.

POWER REQUIREMENTS AND CONNECTIONS:

1. Check that the power supply meets the EcoAir Valve's specifications, typically 24 VAC for the actuator.
2. Check that the power supplies are the correct size for the single or ganged valves. See Technical specifications for more information.
3. Check that the power wires are secure, with no loose or exposed wires that could cause electrical issues.

POWER ON:

1. Check the actuator DIP switch settings for command voltage, direct or reverse acting, and fail-safe modes to ensure they meet application requirements.
2. Power on the EcoAir Valve and observe its initial response. The actuator takes 100s to charge the fail safe capacitors initiates the first stroke sequence.
3. Check the actuator LED indicators to confirm correct operation.
4. Check the controller LED indicators to confirm correct operation.

POWER-OFF EVENT TEST:

Power off the system to simulate a power loss. Observe the valve's response and ensure it moves to the correct fail-safe position as configured. This test confirms the reliability of the fail-safe mechanisms.

START-UP COMPLETION:

Follow the appropriate steps to power up all other devices in the room in order to begin device and system commissioning in preparation for test and balance verification.

Important

Before you commission any lab system for the first time, read chapter 14 of ASHREA Laboratory Design Guide (LDG). The following instructions are for reference only and do not specifically apply to the specifications of your application. Consult your application sales engineer for all project requirements.

TYPICAL ROOM LEVEL SYSTEM CHECKOUT PROCEEDURE:

1. Command SAV valve to MIN COOLING design flow and verify flow.
2. Confirm that the GEX tracked the SAV setpoint offset to maintain room pressurization.
3. Confirm that the system maintains the VOC setpoint.
4. Command SAV valve to MAX COOLING design flow and verify flow.
5. Confirm that the GEX tracked the SAV setpoint offset to maintain room pressurization.
6. Confirm that the system maintains the VOC setpoint.
7. Command SAV valve to MIN HEATING design flow and verify flow
8. Confirm that the GEX tracked the SAV setpoint offset to maintain room pressurization.
9. Confirm that the system maintains the VOC setpoint.
10. Command SAV valve to MAX HEATING design flow and verify flow
11. Confirm that the GEX tracked the SAV setpoint offset to maintain room pressurization.
12. Confirm that the system maintains the VOC setpoint.
13. Modulate the fume hood sash to full open and verify that the room pressurization remains the same.
14. Confirm that the HEX reacted to the sash shift.
15. Confirm that the fume hood face velocity setpoint was maintained within 5%.
16. Modulate the fume hood sash to full closed and verify that the room pressurization remains the same.
17. Confirm that the fume hood face velocity setpoint was maintained within 5%.

START-UP SEQUENCE FOR THE ECOAIR VALVE

INSTRUMENTATION REQUIRMENTS FOR AIRFLOW MEASUREMENT

You need an instrument for airflow verification to commission the valve. Use a NIST traceable air flow measurement instrument from a reputable manufacturer. The air flow measurement instrument must be in calibration for accuracy and a reliable form of airflow measurement reading. A duct traverse is an essential method used to accurately measure airflow. It captures multiple velocity readings at specific points across the cross-sectional area of a duct. These readings enable calculation of the average air velocity, which is multiplied by the duct's area to derive the total airflow rate.

CONDUCTING A DUCT TRAVERSE:

1. Multiple readings for accuracy: To ensure reliable results, take at least 25 readings across the duct's cross-section. The more readings taken, the more accurate the airflow calculation.
2. Equal area distribution (Log-Tchebycheff Method): Instead of evenly spaced readings, use the Log-Tchebycheff method to divide the duct into equal-area segments, both in rectangular and round ducts. This ensures that velocity readings capture representative airflows across the various velocities present in different sections of the duct. For rectangular ducts, draw two perpendicular lines across the duct's cross-section, and take readings along these lines at specific locations that divide the area evenly. For round ducts, the cross-section divides into concentric circles, and take the readings along these circles, with equal representation from each area.
3. Optimal location for measurements: To minimize disturbances and ensure laminar airflow during measurement, conduct the traverse far from any upstream or downstream obstacles, ideally at least one duct diameter downstream of any disturbances, such as elbows, junctions, or fans, and at least half a diameter upstream of any other disturbance.
4. Compensation for non-standard conditions: If the duct's air conditions differ from standard, such as elevated temperature, humidity, or pressure, you may need a velocity correction factor. This factor accounts for variations in air density and ensures that the calculated airflow is accurate under actual operating conditions.

ECOAIR VALVE PATENTS

TABLE 10: PATENTS

Patents
US-12025335-B2
US-12038185-B2
US-2021172779-A1
US-2020370936-A1
US-2021018215-A1
US-2022184673-A1
EP-3740722-A1
US-D1014731-S
US-6994619-B2
US-5450999-A

TABLE 11: ECOAIR VALVE TECHNICAL SPECIFICATIONS

Electrical	Input power	24 VAC ± 20% 50 Hz/60 Hz
	Power requirements	Single: 30 VA
		Dual: 60 VA
		Triple: 90 VA
	CFM Command signal	0 VDC to 10 VDC with default scaling set to 1 V = 100 cfm
	CFM Feedback signal	0 VDC to 10 VDC with default scaling set to 1 V= 100 cfm
	Network	BACnet® MS/TP
Performance	Accuracy	± 5% or ± 10 cfm whichever is greater
	Operating pressure	0.01 in. W.G to 10 in. W.G. differential pressure across valve
	Failure modes	FA = Fail to close or open (optimal for critical applications)
	Operating temperature	0°F to 122°F (-17.78°C to 50°C)
	Storage temperature	-22°F to 122°F (-30°C to 50°C)
	Humidity	0% RH to 90% RH
Construction	Valve housing	SS316 18 gauge
	Shaft	SS316 5/8 in. (0.625 in.) round stock
	Shaft bearings	PTFE
	Seal	Neoprene
	Air fins	Formex®

Note: You must power the EcoAir Valve actuators directly from a customer-supplied 24 VAC power source. The valve does not receive power from an isolation transformer. Supply the power independently from the customer's electrical system and ensure a dedicated power connection to the actuator.

NORTH AMERICAN EMISSIONS COMPLIANCE

UNITED STATES

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case users will be required to correct the interference at their own expense.

CANADA

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations. Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

REPAIR INFORMATION

If you purchased a service agreement, contact your Titus representative for a replacement unit. If you do not have a service agreement, contact tu@titus-hvac.com.

PATENTS

Patents: https://jcipat.com

SOFTWARE TERMS

Use of the software that is in (or constitutes) this product, or access to the cloud, or hosted services applicable to this product, if any, is subject to applicable end-user license, open-source software information and other terms set forth at www.johnsoncontrols.com/techterms. Your use of this product constitutes an agreement to such terms.

PRODUCT WARRANTY

This product is covered by a limited warranty. Contact your representative for more details.

CONTACT INFORMATION

Contact your local Titus representative
Contact Support: Call (+1) 972-212-4800 or email tu@titus-hvac.com

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