X-VENTISO® by earthcore®

VMASS

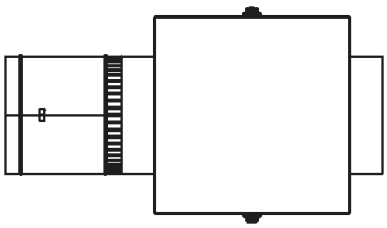
Variable Makeup Air System

Installation, Operation and Maintenance

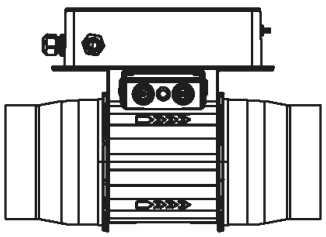
VMASS-400 Modular makeup air system, 6 in. duct
25 CFM continuous baseline, modulating to 400 CFM maximum
Closed-loop pressure control. Nothing to program.

Three components linked by duct: filter box with backdraft damper, fan with controller, and zero-clearance duct heater. One dedicated 20 A circuit powers the whole system.

INDOOR, DRY LOCATIONS ONLY. EVERY COMPONENT MUST STAY ACCESSIBLE FOR SERVICE.



Backdraft damper + filter box



Fan + controller



Duct heater, 2.0 kW

Plan views from VMASS-400-SPEC. Airflow left to right: outdoor air in, tempered air to the room.

1 Read First

Read this manual fully before installing, and leave it with the homeowner or building owner. Installation and service are for qualified personnel familiar with the codes that apply to the job.

DANGER: Disconnect all power to VMASS before installing or servicing any component. Unplug both the fan and the heater cords, and lock out the circuit if the receptacle is out of sight. The duct heater can be hot after the system shuts off.

WARNING: Bring in outdoor air only. Never connect the intake to a garage, attic, crawlspace, another dwelling unit, or any space that can hold exhaust, fumes or odors. Keep the intake hood clear of the flue, vent and exhaust terminations listed in Section 5.

WARNING: Never bypass or wire around the factory heater connection. The heater is enabled only by the VMASS controller, so it never heats without airflow. Never block the duct, the diffuser or the intake hood while the system is powered.

CAUTION: Follow all national, state and local codes and the instructions of the appliances in the space. Where they differ from this manual, the code governs. Codes are adopted and amended locally, and the authority having jurisdiction makes the final call on every installation.

THE THREE MOST COMMON INSTALL MISTAKES. CHECK THESE BEFORE YOU CLOSE UP.

1. **The enable leads left open.** VMASS ships with its orange and blue enable wires joined in a lever nut, so it runs as soon as it is plugged in. Remove the lever nut only to wire a switch or remote contact, and finish that connection: with orange and blue left open, VMASS sits inert, with no baseline and no response. See Section 10.
2. **The indoor pressure pickup in the wrong place.** A pickup next to a door, a window or the supply diffuser reads drafts, not room pressure, and the system chases false readings. Keep it in open wall in the room it serves. Keep the blue tubing free of kinks, and use rigid or metal tubing on runs over 20 ft. See Section 9.
3. **A component closed in without access.** The filter box, the fan and controller, and the heater (its cover comes off to set the temperature) all need a reachable access panel. The filter is serviced every time the HVAC filters are changed. See Sections 4 and 13.

Inspection is required. Have VMASS inspected every year by a qualified professional (Section 13), and service the filter every time the HVAC filters are changed. **2-year warranty**, valid with proper installation and use per this manual and documented inspections. **Skipping the inspections voids the warranty.**

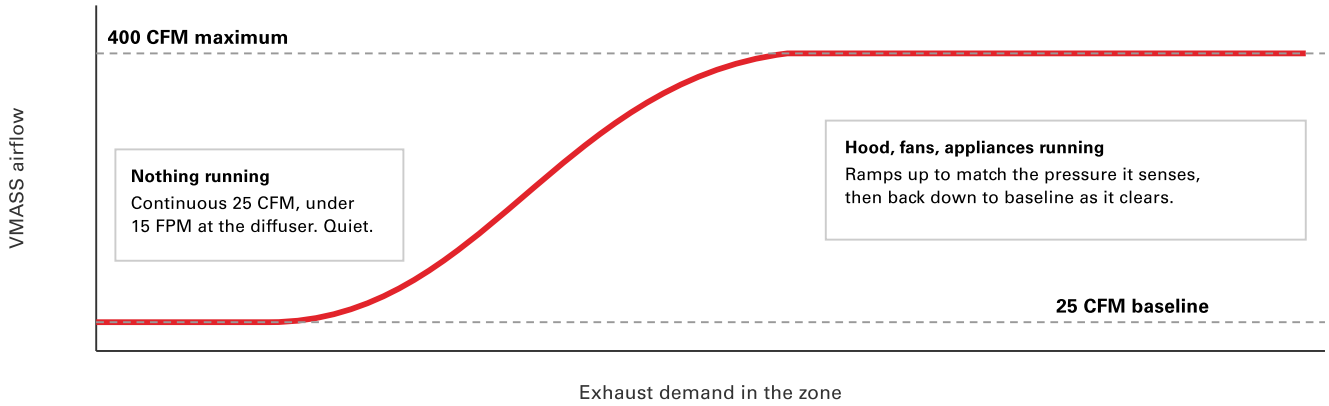
What this manual covers

1. Read First	2	9. Supply Diffuser and Indoor Pressure Pickup	12
2. How VMASS Works	3	10. Power and Connections	14
3. Components	4	11. Start-Up	15
4. Planning the Install	5	12. Operation	16
5. Outdoor Air Intake and Outdoor Pressure Probe	6	13. Maintenance	17
6. Mounting the Components	7	14. Troubleshooting	18
7. Cold-Climate Installation	9	15. Specifications, Checklist and Record	20
8. Ductwork	11		

2 How VMASS Works

Every exhaust device in a tight building removes air that has to come back from somewhere. A range hood, a bath fan, a dryer or a vented combustion appliance all pull the space negative. Without a planned path, replacement air comes in through the building envelope, or back down a flue.

VMASS supplies that replacement air. It measures the pressure difference between the room it serves and the outdoors, and adjusts its fan to hold that difference within a ±0.02 in. w.c. (5 Pa) band. The reference moves with real outdoor conditions (weather, elevation), so nothing has to be set for the site.



Exactly what the zone needs, only when it needs it. Delivered maximum depends on the duct run (Section 8).

What it responds to

VMASS does not need to know what caused the pressure change. It responds to the condition itself: one hood, several fans at once, a clothes dryer, stack effect. No wired link to any appliance is needed for it to respond.

One unit per zone, not per appliance

A zone is a connected air volume: the rooms that share air with no closed door between them. One VMASS serves one zone, however many exhaust devices are in it, as long as their combined peak demand stays within one unit's capacity. A zone whose combined demand can exceed one unit takes a second unit. Units never communicate with each other and don't need to. Each senses the same real condition and responds to it.

Tempered air

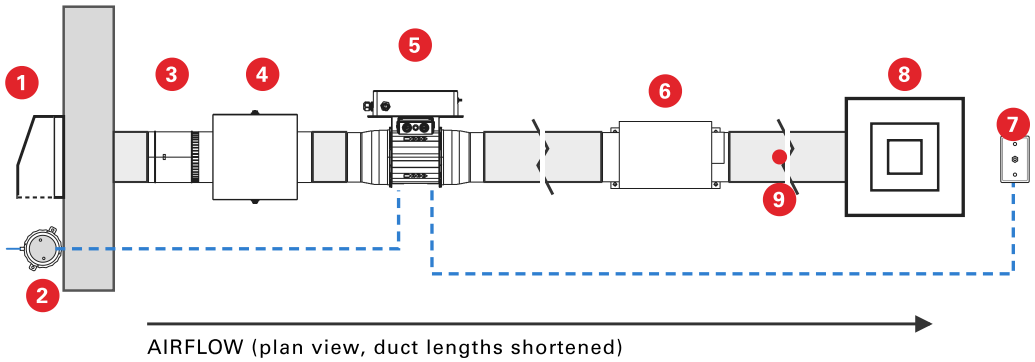
The 2.0 kW duct heater tempers incoming outdoor air before it reaches the room. Its supply temperature is set on a dial inside the heater, 61 to 90°F (Section 11). The controller enables the heater only while the fan runs.

What VMASS is not

VMASS is a makeup air system. It is not a whole-house ventilation system and is not intended to meet dwelling-unit ventilation requirements, which are designed separately.

Code basis. VMASS is designed to supply makeup air of the kind required for kitchen exhaust over 400 CFM (IRC Section M1503, IMC Section 505) and for protection against depressurization of vented appliances (for Canada, NBC Section 10.32, as adopted provincially). Where a code calls for makeup air to be interlocked with a specific exhaust device, confirm with the authority having jurisdiction how pressure-sensed operation is accepted, or use an enable connection from that device (Section 10).

3 Components



Plan view from VMASS-400-SPEC. Duct lengths shortened for the page; see Section 6 for the required straight lengths.

#	Component	Description
1	**Screened outdoor air hood**	6 in. wall hood with insect screen. Outdoor air enters here.
2	**Outdoor pressure probe**	Round housing with a metal face plate and two mounting ears. Air enters through a narrow gap at the bottom; the sensor port sits up inside, shielded from wind. Blue tubing runs to the controller port marked OUTDOOR.
3	**Backdraft damper**	Spring-closed, attached to the filter box inlet. Stops outdoor air from moving through the duct when the fan is off.
4	**Filter box**	Hinged, latched access door. Takes a **10 x 10 x 1 in. MERV 8** filter, disposable or washable.
5	**Fan + controller**	Factory assembled and wired. Variable speed inline fan with the VMASS controller mounted on it. Status display, two pressure ports, enable leads, heater connection, power cord.
6	**Duct heater, 2.0 kW**	Zero clearance to combustibles. Temperature set point dial (inside the cover), manual-reset high limit, duct temperature probe, Molex enable connection from the controller, NEMA 5-20P power cord.
7	**Indoor pressure pickup**	Standard wall plate with a built-in metal sensor port, in the zone served. Blue tubing runs to the controller port marked INDOOR.
8	**Supply diffuser**	Supplied by the installer (Section 9).
9	**Heater temperature probe**	Ships with the heater. Installed in the supply duct 36 in. downstream of the heater (Section 6).

In the box

- Filter box with backdraft damper, filter installed
- Fan + controller, factory assembled
- 2.0 kW duct heater with temperature probe
- Option: second heater XV-VMASS-HTR, with probe (cold climates; Section 7)
- Screened outdoor air hood
- Outdoor pressure probe and indoor wall plate pickup
- Blue pressure tubing, two 20 ft lengths (one per probe)
- Lever nut joining the orange and blue enable wires (installed)

Supplied by the installer

- 6 in. round duct, fittings, clamps, UL 181 tape or mastic
- Duct insulation where required (Section 8)
- Supply diffuser (Section 9)
- Dedicated 20 A, 120 V circuit with NEMA 5-20R receptacle
- Hangers, straps and fasteners
- Access panels
- Rigid or metal tubing for pressure runs over 20 ft
- Switch, dry contact or XV-INTG, if not using the lever nut
- Second heater only: a second dedicated 20 A circuit

4 Planning the Install

Zones first

Lay out the zones first: every area separated by a closed door is its own pressure zone. Assign one VMASS to each zone with exhaust or combustion appliances. Add a second unit in the same zone only when the combined exhaust that can run at once could exceed one unit's capacity. Call 800.642.2920 with the plans for help counting zones.

Where the components can go

The three components do not have to sit together. Duct links them, so each can go wherever there is room along the run, in the order in Section 6 (Section 7 in cold climates). Allow at least 36 in. of straight duct on each side of the heater (Section 6).

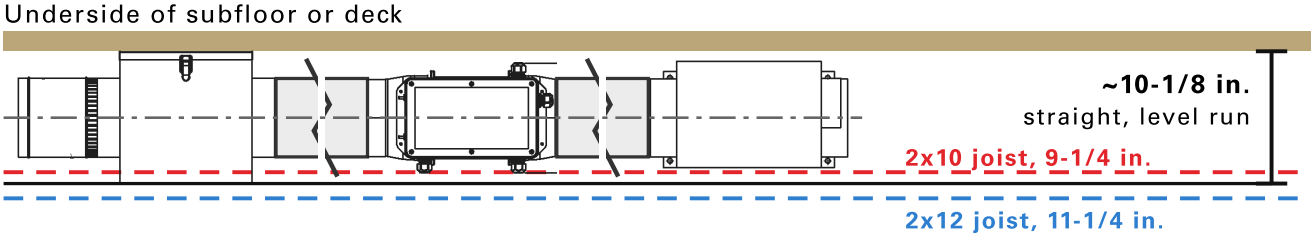
IMPORTANT: Keep the air around every component between **0°F and 120°F** (–18 and 49°C) year-round. Outdoor design temperature below **–13°F** (–25°C): see Section 7, Cold-Climate Installation.

Location	Allowed	Notes
Joist cavity	Yes	Check cavity depth below. Access panel at every component.
Attic	Sealed or conditioned only	**Never vented** (over 120°F in summer). Service access; insulate duct.
Crawlspace or basement	Yes, if dry	No standing water, flooding or condensation on the equipment.
Vertical, in a soffit or built chase	Yes	Not a standard stud wall: the components are deeper than a 2x4 or 2x6 wall. Access panel at every component.
Outdoors, garage, wet or corrosive locations	**No**	The controller is a NEMA 1 enclosure: indoor, dry locations only.

Will it fit? Component depth vs. framing

Component (from drawing VMASS-400-SPEC)	Length	Width	Depth	2x10 joist (9-1/4 in.)	2x12 or 11-7/8 in. I-joist
Backdraft damper + filter box	19-1/2 in.	11 in.	10-1/16 in.	**No**	Yes
Fan + controller	16-3/16 in.	11-1/2 in.	8-3/8 in.	Yes	Yes
Duct heater	15 in.	12-1/2 in.	8 in. on its side (12-1/2 in. upright)	Yes, on its side	Yes, on its side

Lengths include duct collars. Joist spacing of 16 in. on center (14-1/2 in. clear) accepts every component's width. In a joist cavity, lay the heater on its side, cover facing the access panel. A straight, level run then needs ~10-1/8 in. of depth: it fits 2x12 and 11-7/8 in. I-joists. In 2x10 framing, place the filter box below the framing or offset it with elbows (never within 36 in. of the heater). A vertical chase needs 10-1/2 in. clear depth plus room to open the filter door.



Views from VMASS-400-SPEC, drawn to scale, collars on one centerline, heater on its side. Duct between components shortened.

5 Outdoor Air Intake and Outdoor Pressure Probe

The intake hood decides what air comes into the building. Locate it first, then route the duct to it.

Intake hood location

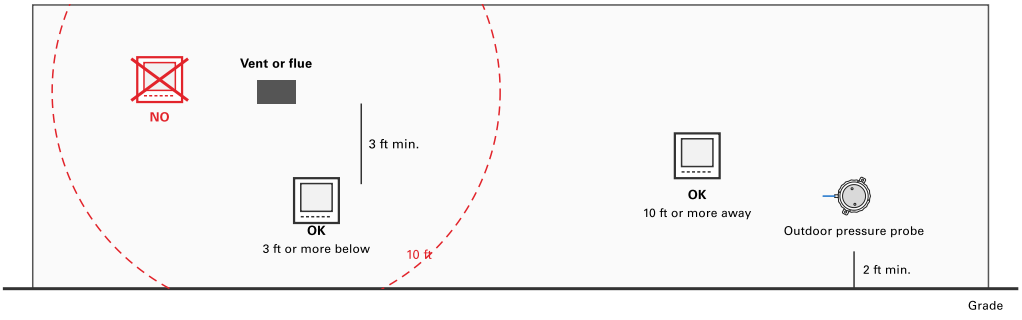
Rule	Requirement
Distance from contaminants	At least 10 ft from any hazardous or noxious contaminant source: chimneys, appliance vents, plumbing vents, streets, alleys, parking areas and driveways. *(IRC R303.5.1)*
Exception: below the source	Closer than 10 ft is allowed where the intake is at least 3 ft below the contaminant source. *(IRC R303.5.1, Exception 1)*
Appliance vents and dryers	Also meet the clearance the vent or chimney manufacturer, the appliance manufacturer and the code require from air intakes. Clothes dryer exhaust terminates per its own section of the code. Whichever is greater governs.
Height	Bottom of the hood at least **2 ft above grade, roof or deck**, or **12 in. above the design snow depth** (table below), whichever is higher.
Source	Outdoor air only. Never from a garage, attic, crawlspace or adjacent unit.
Keep clear	Away from landscaping, mulch beds, trash areas, pet areas and anything that can block or foul the screen.

Dwelling bath, toilet and kitchen exhaust is not hazardous under IRC R303.5.1; still keep the intake as far from it as the wall allows. Local codes govern.

Intake height in snow country

Ground snow load, Pg (psf)	10	20	30	40	50	60	70	80	100
Design snow depth (in.)	8	15	21	25	30	34	37	40	45
Hood bottom, minimum (in.)	**24**	**27**	**33**	**37**	**42**	**46**	**49**	**52**	**57**

Pg: from the building department (IRC Table R301.2(1)); between columns, use the next higher. Depth per ASCE 7 snow density (0.13 Pg + 14 pcf, max. 30), rounded up. Drifts run deeper against walls: when in doubt, go higher. Special snow areas (mountain sites): call 800.642.2920.



Exterior wall elevation, intake hood shown from the front.

Outdoor pressure probe

- Mount it on a **soffit (preferred, out of driving rain)** with the metal face plate facing down, or on an exterior wall. Air enters through the narrow gap around the face plate (drawing in Section 9). Keep it near the controller where practical: each probe comes with a 20 ft tube.
- Keep it out of the discharge of any exhaust hood, dryer vent, bath fan or condensing unit. Air blowing across the probe reads as a pressure change.
- Run the blue tubing inside through a sealed penetration to the controller port marked **OUTDOOR** (Section 10).
- Pitch the tubing so water cannot collect in a low loop. Never let it kink, crush or pass through a hot space.

6 Mounting the Components

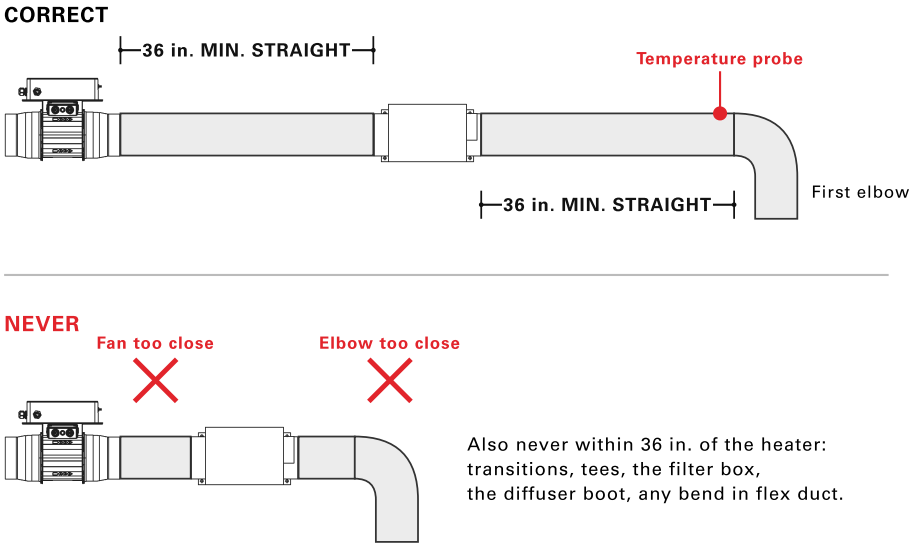
WARNING: Disconnect power before mounting or moving any component. Do not plug anything in until Section 11.

Order and direction

From the intake: **hood, backdraft damper + filter box, fan + controller, duct heater, diffuser.** Every component carries an airflow arrow. Point every arrow toward the room.

> **Outdoor design temperature below –13°F (–25°C)?** The heater goes ahead of the fan. Plan the run from **Section 7, Cold-Climate Installation**, before mounting anything.

1. **Backdraft damper + filter box.** Mount with the filter door facing the access panel and enough clear space to open the door and slide the filter out. The spring-closed damper works in any orientation, horizontal or vertical.
2. **Fan + controller.** The arrow cast into the fan housing must point toward the room. Mount using the fan's integrated brackets to framing or a solid backer. Keep the controller face (status display, pressure ports, leads) toward the access panel. Orientation: horizontal or vertical. Do not hang the fan from its duct.
3. **Duct heater.** Mount directly to the framing. The heater is rated for **zero clearance to combustibles**, so it can sit against wood framing. Place it so its **cover can be removed from the access panel**: the temperature dial and the high-limit reset are inside. It may be mounted upright or on its side, with airflow horizontal or vertical in either direction. Keep the control panel facing the access panel.
4. **Straight duct both sides of the heater.** Keep at least **36 in. of straight duct upstream and downstream** of the heater, clear of the fan, the filter box, any elbow, transition or diffuser. The heater needs even airflow across its coil. A fitting is anything that turns or reshapes the airflow: elbows, any bend in flex duct, transitions, tees, the filter box, the fan, the diffuser boot. Straight couplings are fine. If 36 in. will not fit, move the heater, never the rule. Call 800.642.2920.
5. **Heater temperature probe.** Insert the probe into the supply duct **36 in. downstream of the heater**, at the end of the straight run and before the first fitting, through a hole sized to the probe, and seal around it.



Plan views from VMASS-400-SPEC, drawn to scale. The fan's cast arrow points toward the heater.

Support

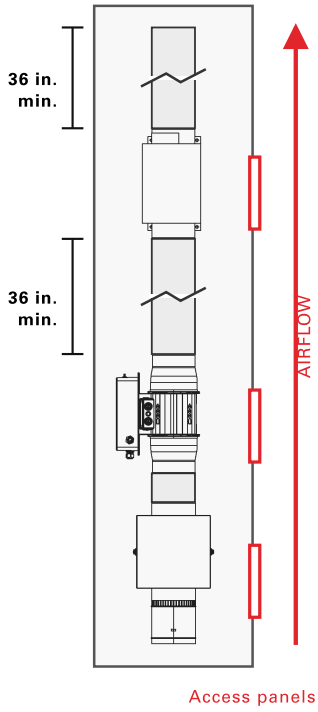
- Support each component on its own. Duct is never used to carry a component, and a component never carries the duct.
- Use metal strap, hanger brackets or screws into framing. Never rest a component on drywall, ceiling tile or insulation.
- Use the vibration isolation the fan brackets provide. Do not hard-mount the fan to a drywall surface that can drum.

Access

Every component needs an access panel or open approach. The filter is serviced as often as the HVAC filters, the heater cover comes off to set the temperature or reset the high limit, and the controller display is how status and alarms are read. Size panels so the filter slides out without removing anything else.

Vertical installs

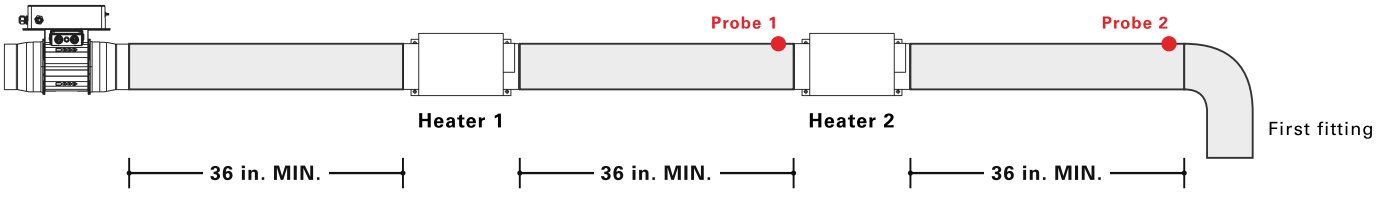
- Airflow can run up or down. Keep the same order (Section 7 in cold climates) and keep every arrow pointing toward the room.
- The 36 in. straight-duct rule applies vertically too. Plan the chase height for it: a full vertical stack with both straight runs is ~11 ft from filter inlet to the end of the heater's outlet run.
- The heater may be upright or on its side. Keep its cover facing the access panel.
- Every component still needs its own access panel.



Vertical chase, plan views from VMASS-400-SPEC turned to vertical. Straight runs shortened.

Second heater, XV-VMASS-HTR (option, cold climates)

- Standard two-heater run (outdoor design –13°F and above): **fan, 36 in., heater 1, 36 in., heater 2, 36 in., first fitting**. Plan ~11-1/4 ft from the fan outlet to the first fitting. Colder climates: Section 7.
- Each heater keeps its own temperature probe, 36 in. downstream of that heater. Probe 1 sits just upstream of heater 2.
- Heater 2 needs **its own dedicated 20 A circuit** (Section 10) and plugs into the controller's second heater lead. A heater sold separately ships with a 10 ft enable lead; place it within reach of the controller.
- Set the two dials per Section 11.

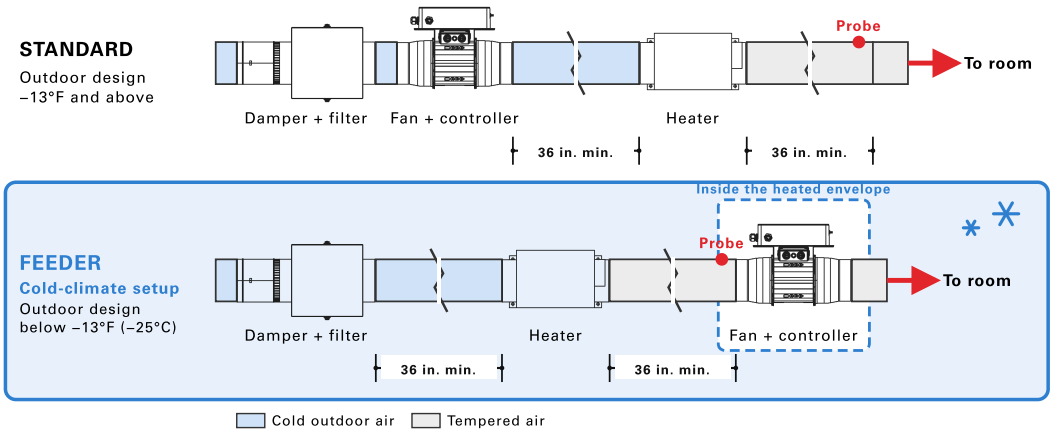


Two heaters, plan views from VMASS-400-SPEC, to scale. One 36 in. straight section between the heaters serves both.

7 Cold-Climate Installation

Use this section where the outdoor design temperature is below –13°F (–25°C). The fan is not built to move air that cold, so at least one heater goes ahead of it. Every setup delivers the same heat to the room. What changes is the air the fan itself has to move: only the heaters ahead of the fan protect it.

Feeder: the heater ahead of the fan



Plan views from VMASS-400-SPEC, drawn to scale. Duct breaks: lengths shortened. Collars on one centerline.

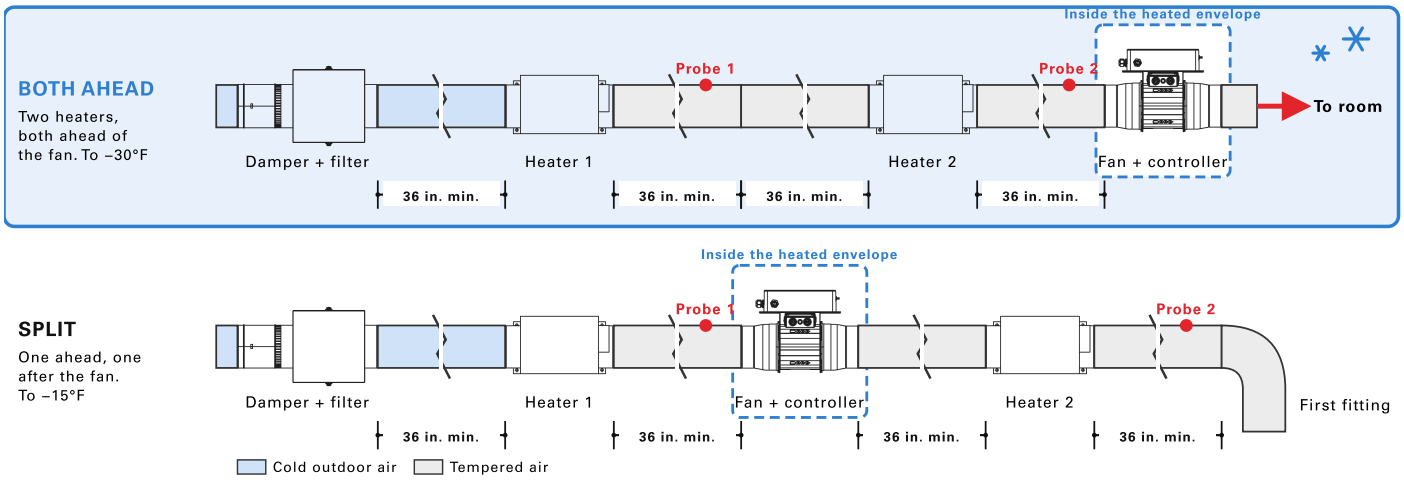
- **Order:** hood, backdraft damper + filter box, duct heater, fan + controller, diffuser. The filter box always comes first, so the heater stays clean.
- **36 in. of straight duct on each side of the heater**, the same rule as Section 6. The filter box and the fan both count as fittings.
- **Probe** at the end of the heater's downstream run, just before the fan.
- **Fan inside the heated building envelope**, so the air around it stays between 0°F and 120°F.

Air through the fan on a –30°F (–34°C) day

Setup	Heaters ahead of the fan	25 CFM (baseline)	50 CFM	200 CFM	400 CFM (max)	Rated to (outdoor design)
Standard, 1 or 2 heaters after the fan	0	**–30°F**	**–30°F**	**–30°F**	**–30°F**	**–13°F** (–25°C)
Feeder, 1 heater	1	**Dial setting**	**Dial setting**	**+2°F**	**–14°F**	**–15°F** (–26°C)
Split, 1 ahead + 1 after the fan	1	**Dial setting**	**Dial setting**	**+2°F**	**–14°F**	**–15°F** (–26°C)
Both heaters ahead of the fan	2	**Dial setting**	**Dial setting**	**33°F**	**+2°F**	**–30°F** (–34°C)

Dial setting: at that airflow the heater has more than enough capacity to hold its dial setting (61 to 90°F). **Blue** = air at 0°F or warmer reaches the fan. **Red** = colder than the fan is built for. VMASS runs at its 25 CFM baseline almost all the time and climbs only while exhaust runs, but every rating holds at the full 400 CFM: a large range hood on the coldest night is exactly when VMASS reaches it.

Two-heater setups



Plan views from VMASS-400-SPEC, drawn to scale. Duct breaks: lengths shortened. Collars on one centerline.

- **Ultra-cold climates (to –30°F): both heaters ahead of the fan.** This is the setup to specify with the second heater, XV-VMASS-HTR.
- **Split** only when there is no room for both heaters between the filter box and the fan. It protects the fan like one feeder heater, so it is rated to –15°F.
- Every heater keeps 36 in. of straight duct on each side and its own probe at the end of its downstream run. One 36 in. section between two heaters serves both.
- Heater 2 needs its own dedicated 20 A circuit (Section 10).
- **Dials:** heater 1 is the first heater in the airflow. Set it about 5°F below heater 2 (Section 11).
- Colder than –30°F (–34°C): call 800.642.2920 before installing.

Cold-climate checklist

Item	Why
Fan inside the heated envelope	Keeps the air around the fan and controller between 0°F and 120°F, even while VMASS is off or the power is out.
Outdoor air duct insulated, hood to first heater	Continuous vapor retarder on the outside (Section 8). Cold duct inside a warm building sweats.
Intake hood 12 in. above design snow depth	From the site's ground snow load (Section 5), never less than 2 ft above grade. Drifted snow blocks the intake and starves the system.
Outdoor probe sheltered	Soffit mount, face plate down (Section 5), out of drifting snow and ice.
High limit and dials checked at start-up	Each heater's dial set (Section 11) and its manual-reset high limit not tripped.

8 Ductwork

VMASS uses 6 in. round duct throughout. The duct run is the biggest factor in how much air the system can deliver at its maximum.

Keep it short and straight

- Keep the run from hood to diffuser as short and as straight as the layout allows. Every elbow, every foot of duct and every sag in flex duct reduces the maximum airflow available.
- Use rigid duct wherever practical. Where flex is used, pull it taut, support it so it never sags, and keep bends gradual.
- Never reduce below 6 in. anywhere in the run.

> At the 25 CFM baseline the duct run barely matters. At high demand it does: airflow at the top of the range depends on the total resistance of the duct, fittings, filter, hood and diffuser. Plan the run for the largest exhaust demand the zone will see.

Connect and seal

- Slide duct over each collar, fasten with at least three sheet metal screws or a draw band, and seal every joint with UL 181 listed tape or mastic.
- Do not screw into the filter box door, the heater element area or the controller.

Insulation

Duct location	What to do
Outdoor air duct inside conditioned space	Insulate the hood-to-heater section with a continuous vapor retarder on the outside. Cold outdoor air in an uninsulated duct sweats.
Any duct in an attic, crawlspace or other unconditioned space	Insulate to the R-value the local energy code requires for ducts in that location, with a sealed vapor retarder.
The fan, where its casing can sweat	Insulate the fan casing only. **Never wrap or seal the motor:** leave the motor and control area, every ventilation opening, the electrical housing, the controller face, the pressure ports and every lead uncovered. A motor that runs hot delivers less air.
Supply duct after the heater, inside conditioned space	Insulation recommended, to keep tempered air warm and quiet the run.

CAUTION: Insulation can touch the heater housing (zero clearance), but never cover the heater's cover side or label, its temperature probe, or the controller.

Penetrations

- Seal the duct where it passes through the exterior wall, and flash the hood per the hood and siding manufacturers.
- Where the duct passes through a fire-rated assembly, use a listed firestop system or fire damper as the code requires.
- Pitch the duct slightly down toward the intake hood where possible, so any water that gets past the hood drains outward.

9 Supply Diffuser and Indoor Pressure Pickup

Supply diffuser (installer supplied)

Any ceiling, wall or floor diffuser can be used if it is rated for the full 400 CFM at a sound level that suits the room. Select from the diffuser maker's published data, not by collar size alone.

- **Size for quiet.** For living spaces, choose a diffuser rated NC 25 or lower at 400 CFM. As a rule of thumb, that means a face velocity of 500 FPM or less at 400 CFM, which takes ~0.8 sq ft of free area.
- A diffuser with a larger neck than 6 in. is fine. Transition from 6 in. at the diffuser boot.
- **Where VMASS air enters the room, and the HVAC supply duct question:** see the next page.
- **Locate in the zone it serves.** Near the main exhaust or combustion appliance is common. Do not aim the discharge into a firebox opening, at a burner, at a pilot, or into a range hood's capture area.
- Keep the diffuser at least 6 ft from the indoor pressure pickup, and do not aim it at the pickup.

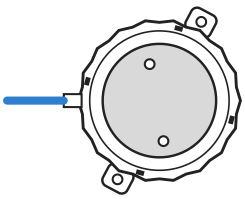
Indoor pressure pickup

The pickup tells the controller what the room is doing. It can go anywhere on a wall in the zone it serves. What matters is what is near it.

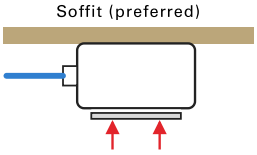
- **Keep it away from exterior doors, windows and operable openings**, and from interior doors that open into another zone. Opening them moves air past the pickup and causes false readings.
- Keep it out of the supply diffuser's air stream, and away from return grilles, exhaust grilles and range hoods.
- It can sit behind a wall-mounted TV with at least 4 in. of clearance around the plate.
- Mount on an interior wall where possible.
- **Custom finish?** Each probe is the end of a 1/4 in. tube. Any finish works as long as nothing blocks the opening inside, and the outdoor probe stays protected from wind gusts and moisture. Send the detail to 800.642.2920 for review.

Pressure tubing (both probes)

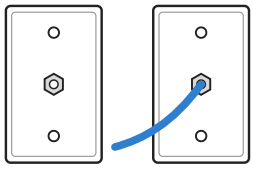
- Run each tube to the port marked for it on the controller: **outdoor probe to OUTDOOR (top), indoor pickup to INDOOR (bottom)**. Swapped tubes make the system run backward.
- Keep runs as short as the layout allows.
- Each probe gets one of the two 20 ft lengths supplied. **Runs over 20 ft: use rigid or metal tubing** (installer supplied), which won't kink, crush or sag.
- No kinks, pinches, tight bends or low loops that can trap water. Never staple through the tubing.
- Seal every wall or ceiling penetration around the tubing.



Outdoor probe, front
Tube exits the side fitting

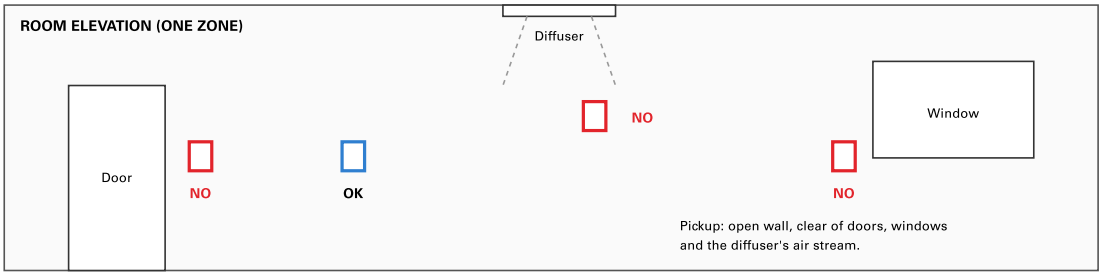


Soffit mount, side view
Face plate down; air enters the gap



Indoor pickup, front and back
Standard wall plate, metal port

Drawn from production units.



9 Supply Diffuser (continued): Where VMASS Air Enters the Room

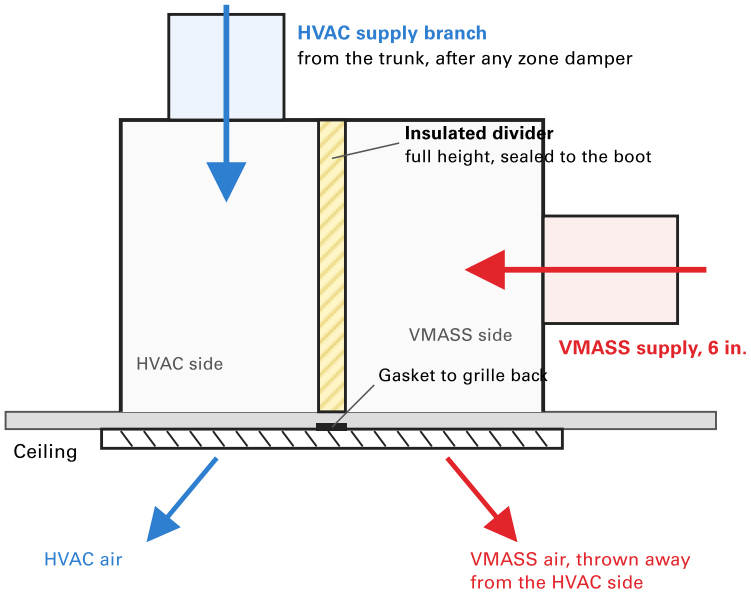
Recommended: VMASS supplies the zone through its own outlet. It does not have to be a visible diffuser. A toe-kick grille, a linear slot in a soffit, ceiling reveal or millwork, or one slot of a multi-slot linear diffuser with its own plenum all work, as long as the outlet is rated for 400 CFM at the sound level the room calls for.

CAUTION: In humid (A) IECC climate zones, do not connect VMASS into a cooled HVAC supply duct. When the air conditioner cycles off, humid outdoor air meets duct walls and register boots still cold from cooling, and they sweat every cycle. In dry (B) zones, a supply-duct connection is acceptable: connect at the register boot, with a backdraft damper in the branch between the trunk and the connection. Marine (C) zones: dedicated outlet unless the HVAC contractor confirms cooling-season outdoor dew points stay below 55°F. Confirm the county's zone in IECC Table R301.1.

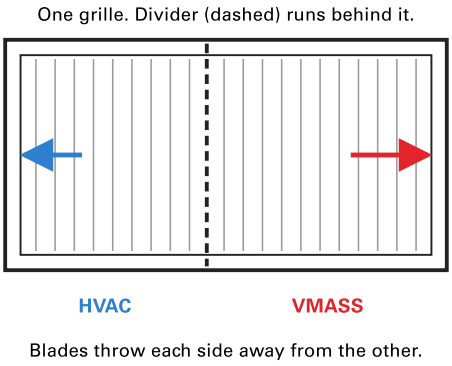
One grille, two plenums

For a single-register look in any climate, share the grille, not the duct. A divided register boot keeps VMASS air and HVAC air in separate compartments until they leave the grille face, so VMASS air never touches cooled duct.

SECTION THROUGH THE BOOT



LOOKING UP AT THE CEILING

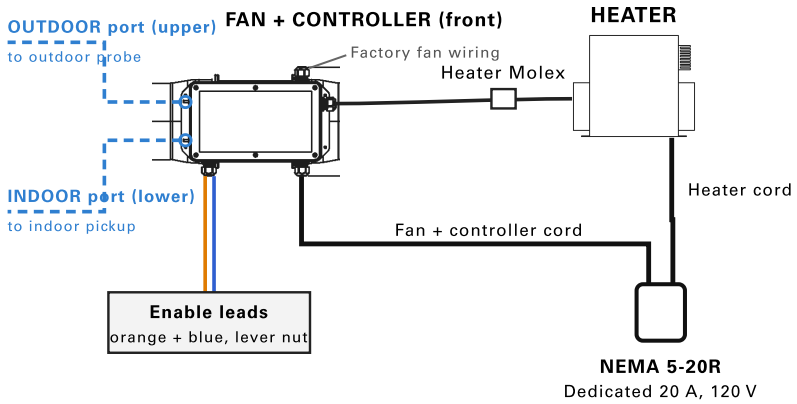


Divided register boot, typical. Proportions shown are illustrative; size each side as noted below.

1. **Boot:** a standard sheet-metal register boot sized for the combined grille, with a **full-height divider** from the top of the boot down to the grille.
2. **Divider:** insulated (it has cold supply air on one side and humid outdoor air on the other), sealed with mastic along every edge, and gasketed to the back of the grille so the two airstreams cannot mix behind the face.
3. **VMASS side:** 6 in. collar, with grille free area for 400 CFM at 500 FPM or less (~0.8 sq ft). **HVAC side:** per the HVAC design.
4. **Grille:** one grille across both sides. Set the blades so each side throws away from the other, with no shared blade at the divider line.
5. **Heater:** the boot is a fitting. Keep at least 36 in. of straight duct between the heater and the boot (Section 6).
6. **Linear slot version:** a multi-slot linear diffuser with a separate plenum per slot works the same way. Feed enough slots from VMASS for 400 CFM per the diffuser maker's data.
7. The HVAC contractor designs the boot and balances the HVAC side.

10 Power and Connections

Everything on VMASS plugs in. The fan and controller are factory wired, and the heater connects to the controller with one Molex lead. The only field wiring is the enable connection, if a switch or remote contact is used.



Front views from VMASS-400-SPEC. Ports and leads shown at their actual positions: power cord bottom right, enable leads bottom left, heater enable lead(s) right side. The top-right gland carries the factory wiring between fan and controller: never disconnect it.

Power

- **One dedicated 20 A, 120 V branch circuit** feeds the whole system, ending in a NEMA 5-20R duplex receptacle within reach of both cords. The fan and controller cord and the heater cord (NEMA 5-20P) plug into it. Nothing else shares the circuit.
- Locate the receptacle where it is reachable for service, and follow local code for GFCI or AFCI protection.
- Never use an extension cord, plug strip or adapter.

Heater connection

Plug the heater's Molex lead into the controller's heater lead (heater 1). With a second heater, plug it into the controller's second heater lead; a separately sold heater ships with a 10 ft lead. Plug heater 2's power cord into its own dedicated 20 A circuit. This is the heater enable: the controller turns the heater on only while the fan runs. It is plug-in only. No field wiring.

Enable leads: choose one

Method	How it runs	Use when
Lever nut (continuous)	As shipped: orange and blue wires joined in the lever nut. Runs the 25 CFM baseline at all times and responds to every pressure change.	Standard residential zones. Recommended.
Wall switch	Runs while the switch is on. Inert while off.	The owner wants manual control.
Dry contact from an appliance or system	Runs while the contact is closed: an X-VENTISO controller through XV-INTG, a home automation system, or any device that can close a dry contact. Through XV-INTG, VMASS also purges: it keeps supplying air for 20 seconds while the draft inducer or appliance shuts down.	The AHJ or the design calls for operation tied to a specific appliance, or for hospitality projects.

Enable wires: **orange and blue**, the same setup as X-VENTISO ignition leads. For a switch or remote contact, remove the lever nut and connect the orange and blue wires to the dry contact with 2-conductor, 18 AWG minimum, low-voltage wire. 18 AWG handles runs of 100 ft and more. Never apply voltage to them.

Building automation (optional)

For BACnet, order VMASS with the **XV-BACnet INTF** gateway, integrated at the factory before shipment. It connects to the building automation system by Ethernet. Available data: room pressure, fan speed and power status (read only), plus on/off. Operating settings cannot be changed through the BAS. For Modbus RTU, specify it when ordering. It is set up at the factory before shipment. Never open the controller.

11 Start-Up

There is nothing to program. Start-up confirms the installation and checks the heater setting.

1. **Before power:** every airflow arrow points toward the room; all duct joints fastened and sealed; filter installed and door latched; both tubes on the correct ports with no kinks; heater Molex connected; enable leads closed by the method chosen in Section 10.
2. **Power up.** Plug in the fan and controller cord, then the heater cord. VMASS starts almost immediately once the enable contact is closed. The controller status goes from Starting to Running (Section 14), with no alarm.
3. **Check the baseline.** With all exhaust off and doors and windows closed, the fan runs at its low baseline. At the diffuser, airflow is barely noticeable. That is correct.
4. **Check the response.** Turn on the largest exhaust device in the zone (range hood on high, for example). As the room pressure drops, VMASS ramps up and airflow at the diffuser rises clearly. There is no fixed ramp time: how fast and how far it ramps follows the pressure loss the exhaust creates. Turn the exhaust off: VMASS returns to baseline.
5. **Check the backdraft damper.** Switch the system off at the enable connection (or unplug the fan). The damper closes, and no outdoor air moves through the duct.
6. **Heater dial(s).** Each heater ships set to **75°F**. One heater: leave it unless the owner wants a different supply temperature. Two heaters: turn heater 1 down to 70°F (below). To change a setting, unplug the heater, remove its cover, and turn the blue dial on the control board (61 to 90°F). Replace the cover, then plug the heater back in.
7. **Close up.** Install access panels, fill in the owner quick reference (Section 12, including where the filter access panel is), leave this manual with the owner, and complete the record in Section 15.

DANGER: Line voltage is present inside the heater. Unplug the heater before removing its cover, and never adjust the dial or press the reset with power on.

Setting the heater dials

Each heater holds the temperature at its own probe. How much it can add depends on airflow: **temperature rise (°F) = watts × 3.412 ÷ (1.08 × CFM)**, or ~6,320 ÷ CFM for one 2.0 kW heater.

Airflow	Rise, 1 heater	Rise, 2 heaters	Coldest outdoor air still delivered at 75°F, 1 heater	Same, 2 heaters
25 CFM (baseline)	More than enough. The heater holds its dial setting.		Any	Any
100 CFM	63°F	126°F	12°F	Below –50°F
200 CFM	32°F	63°F	43°F	12°F
300 CFM	21°F	42°F	54°F	33°F
400 CFM	16°F	32°F	59°F	43°F

- **One heater:** the factory 75°F setting is the supply temperature at the diffuser. Change it only if the owner wants warmer or cooler air (61 to 90°F). For a different target, subtract the rise from it to find the coldest outdoor air it can hold.
- **Two heaters:** leave **heater 2** (the last one) at 75°F, or the supply temperature wanted. Set **heater 1 about 5°F lower**: 70°F with the factory setting, and never below 61°F. Heater 1 carries the load; heater 2 adds the last few degrees and takes over the rest when heater 1 reaches its limit. Never set heater 1 more than 16°F below heater 2, or the pair loses capacity at full airflow.
- Above the coldest temperatures in the table, supply air arrives cooler during heavy exhaust, then returns to the dial setting as airflow drops. If supply air feels cool, raise the setting(s) a few degrees, or add the second heater.

12 Operation

Once enabled, VMASS runs on its own. The owner does not have to do anything for it to work. Leave this page with the owner.

FOR THE OWNER: VMASS QUICK REFERENCE

What normal looks like

- The controller display reads **Running**.
- Airflow is quiet and barely noticeable most of the time.
- It gets louder when the range hood, dryer, bath fans or fireplace run, then settles back. That is VMASS doing its job.
- In winter the air is tempered. In summer the heater stays off. Both are normal.

Every time you change your HVAC filters

1. Unplug VMASS.
2. Open the filter box and replace the filter with a standard **10 x 10 x 1 in. MERV 8**, or rinse a washable filter and let it dry completely.
3. Match the airflow arrow on the filter, latch the door, and plug VMASS back in.

Once a year

Have VMASS inspected along with your HVAC service. It is required to keep the 2-year warranty.

Call your installer if

- The display shows an alarm. VMASS has shut down and the room has no makeup air.
- The display reads **Off** and nobody turned it off.
- The air feels cold in winter.
- You hear a new noise, rattle or whistle.
- You see water or condensation near the equipment, the duct or the outlet.

Never

- Open the heater cover or the controller. Line voltage is inside.
- Block the supply outlet, the wall pickup or the outdoor hood.
- Unplug VMASS while exhaust fans or fireplaces are in use.

Filled in by the installer

Installer	Zone served
Phone	Heater setting
Date installed	**Filter access panel is located**

13 Maintenance

DANGER: Unplug both cords before opening the filter box or touching any component. Let the heater cool.

When	Item	What to do
Every HVAC filter change	VMASS filter	**Disposable:** replace with a standard 10 x 10 x 1 in. MERV 8 filter, available wherever HVAC filters are sold. **Washable:** rinse clean, let it dry completely, reinstall. Never reinstall a wet filter. Match the airflow arrow on the filter. Latch the door. Never run VMASS without the filter or with the filter door open: the filter keeps dust off the heater coil and fingers away from the fan.
Every year (required)	Intake hood	Screen clear of debris, nests, lint and leaves. Hood sealed to the wall.
	Outdoor pressure probe	Clear, undamaged, not painted over or blocked.
	Pressure tubing	Both tubes on the correct ports, no kinks, cracks or water in the tubing.
	Backdraft damper	Opens freely and closes fully.
	Duct and heater	Joints sealed, insulation intact, no condensation. Heater probe in place, dial set.
	Operation	Repeat start-up steps 3 and 4 (Section 11). Status Running, no alarm. Record the visit below.

Service record

Date	Service	Findings / work done	Technician / company

Warranty: 2 years, valid with proper installation and use per this manual and documented inspections. Skipping the inspections voids the warranty.

14 Troubleshooting

Problem	Likely cause	Check
Nothing runs, controller dark	No power	Cord plugged in, breaker on, receptacle live.
Nothing runs, status reads Off	Enable leads open	Orange and blue wires joined in the lever nut, switch on, or the remote contact closed (Section 10). This is the most common call.
Runs high all the time	Pressure tubes swapped, kinked, disconnected or water in a tube. Indoor pickup near an open door, window or the diffuser. An exhaust device left running.	Tubes on the right ports and clear (Section 9). Move the pickup if it sits in a draft. Check every exhaust device in the zone.
Never ramps up	Tubing problem as above. Blocked intake screen or filter.	Tubing, screen, filter.
Less airflow than expected at high demand	Dirty filter, blocked screen, crushed or sagging flex, long run with many elbows, undersized diffuser.	Filter and screen first. Then duct run (Section 8) and diffuser (Section 9).
Cold air at the diffuser	Heater set low. Heater cord or Molex unplugged. Probe out of the duct. Heater high limit tripped by low airflow (dirty filter, blocked screen, crushed duct).	Setting, both heater connections, probe position (Section 6). Clear the airflow problem first. Then unplug the heater, remove the cover, and press the red button on the round high-limit switch. Replace the cover before restoring power.
Noisy at high airflow	Diffuser undersized, duct velocity, fan hard-mounted to a drumming surface.	Diffuser selection (Section 9), mounting (Section 6).
Whistle or rattle at the hood	Damper or screen obstructed. Loose hood.	Clear and resecure.
Condensation on duct	Outdoor air duct not insulated or vapor retarder broken.	Insulate and seal (Section 8).
Breaker trips	Another load on the circuit, or a fault.	Dedicated circuit only. If it continues, call 800.642.2920.

14 Troubleshooting (continued)

Normal status

The controller spells out its status on the display on its face. There are four normal statuses.

Status	What it means
Off	Powered, not enabled. The enable leads are open: orange and blue not joined, switch off, or the remote contact open (Section 10). VMASS moves no air.
Starting	Enabled. The controller is proving that all required conditions are met, without error, before it runs.
Running	Normal operation: baseline airflow, modulating with room pressure. This is what the owner should see nearly all the time.
Purging	Only when VMASS is tied to an appliance through XV-INTG. After the appliance or draft inducer is called off, VMASS keeps supplying air for **20 seconds** while it shuts down, then returns to Off.

Alarm codes

On an alarm, **VMASS shuts down** (no makeup air, no heat) and spells out the alarm on its display. Alarms are also readable through the optional BACnet gateway. VMASS uses three codes.

Code	Meaning	Likely cause	Check
No alarm	No alarms are active or logged.	Normal.	None.
1	Supply air pressure switch circuit open: the controller cannot prove airflow.	**Most often:** pressure tubing clogged, pinched, kinked or pulled off a port. Less often: blocked intake screen, dirty filter, crushed duct, fan not running.	**Check the tubing first**, end to end (Sections 9 and 10). Then the screen, filter and duct. If the alarm stays, call 800.642.2920.
3	Damper or pressure fault. A closed damper keeps air from moving, so the pressure reading is wrong.	**Most often:** pressure tubing clogged, pinched or kinked. Also: backdraft damper stuck closed or obstructed.	**Check the tubing and the damper.** The damper must open freely and close fully (Section 13). Then the screen and filter.
4	Room pressure sensor high limit exceeded.	**Most often:** pressure tubing clogged, pinched, kinked, holding water, or on the wrong port. Less often: pickup in a draft, or more exhaust in the zone than one unit can make up.	**Check the tubing first** (Sections 9 and 10). Then the pickup location and the exhaust running in the zone (Section 4).

Pressure tubing is the most common cause of every VMASS alarm. Look for a pinch behind a panel, a kink at a bend, debris in the outdoor probe, water in a low loop, or a tube pulled off a port. While VMASS is shut down, the zone has no makeup air. Find and fix the cause promptly.
Clearing an alarm: the alarm clears on its own once the cause is fixed, or by cycling power. Cycling power does not fix anything: if the cause is still there, VMASS goes straight back into alarm. Fix the cause first.

Never open the controller. It is factory sealed. For anything not covered here, call Technical Support at **800.642.2920** with the alarm code and a description of the install.

15 Specifications, Checklist and Record

VMASS-400	
Airflow	25 CFM baseline, modulating to 400 CFM maximum (depends on the duct run).
Control	Closed loop on indoor vs. outdoor pressure, ±0.02 in. w.c. (5 Pa). Not field programmable.
Duct	6 in. round, supply and intake
Filter	10 x 10 x 1 in. MERV 8, disposable or washable
Backdraft damper	6 in., spring closed, any orientation
Heater	2.0 kW, 120 V, 16.7 A. Set point 61 to 90°F, 75°F factory, dial inside the cover. Zero clearance to combustibles. Manual-reset high limit. Option: second heater XV-VMASS-HTR on its own 20 A circuit.
Power	120 V, 60 Hz, one dedicated 20 A circuit. Fan and controller 1.9 A; heater 16.7 A
Enable	Orange and blue wires, dry contact (lever nut, switch, remote contact, XV-INTG)
BAS (optional)	BACnet via factory-integrated XV-BACnet INTF. Read only, plus on/off.
Enclosure	NEMA 1 controller; fan IP44, UL Listed. Indoor, dry. Installation space 0 to 120°F (–18 to 49°C). Outdoor design temperature: standard order above –13°F (–25°C); colder to –30°F (–34°C) per Section 7.
Listing	Built from individually listed components. Controller: UL 378, ETL Listed, Intertek control no. 4007025. Fan: UL Listed. Heater: cETLus, UL 1996 / CSA C22.2 No. 155.
Warranty	2 years, with documented inspections

Installation checklist

Item	Done
One unit per zone; zone demand within capacity	☐
Intake hood: 10 ft from contaminants (or 3 ft below); 2 ft above grade or 12 in. above design snow depth	☐
Outdoor probe sheltered, tubing pitched, no kinks	☐
Component order and airflow arrows correct	☐
Each component supported on its own	☐
36 in. straight duct each side of each heater; probe at 36 in. downstream of each	☐
Duct joints fastened and sealed; insulation and vapor retarder	☐
Diffuser sized for 400 CFM, aimed clear of appliances	☐
Indoor pickup clear of doors, windows, diffuser	☐
Tubes on correct ports; rigid or metal over 20 ft	☐
Dedicated 20 A circuit, 5-20R receptacle (second heater: its own circuit)	☐
Heater Molex connected	☐
Enable leads closed (method: _____)	☐
Start-up steps 1 to 6 complete; heater dial(s) checked (75°F factory)	☐
Access to every component; manual left with owner	☐

Installation record

Installation address _____

Installer / company _____

Zone served _____

Date installed _____

Serial number _____

Heater dial setting _____

TECHNICAL SUPPORT 800.642.2920 x-ventiso.com