

Phoenix Controls Make-up Air Controllers, used with Phoenix Controls valves and drives, are designed to maintain proper pressurization of a particular space. Primary functions include:

- Summing the total exhaust flow from all exhaust sources
- Controlling a make-up air valve by using volumetric tracking of the exhaust (make-up air = exhaust – offset)
- Temperature override control for cooling
- Minimum ventilation control

Controllers are available in two- and six-input units for standalone applications or for integration into a facilities management system (FMS).

SPECIFICATIONS

Dimensions

See Figure 1 on page 4.

Operating Range

32-122 °F (0-50 °C) ambient

Analog Signals

0-10 Vdc scaled @ 200/500/1250 CFM/volt (340/850/2125 m³/hr/volt)

Available Signals

- Fume hood exhaust flow
- Fume hood sash position
- Fume hood user status
- Fume hood flow alarm
- Fume hood emergency exhaust alarm
- Make-up airflow
- Make-up airflow alarm
- General exhaust flow
- General exhaust flow alarm

Panel (MAC500)

- 16 gauge NEMA-1 (UL listed)
- Light gray baked enamel finish
- 0.875/1.125" (22/29 mm) diameter knockouts
- 1/8" bulkhead fitting for pneumatic thermostat option
- Power input: 100-120 Vac, 47-63 Hz or 215/230-240 Vac, 47-63 Hz (field-configurable)
- Power output: +15 Vdc, -15 Vdc, ±5% @ 1.5 amp for up to 3 hood inputs; 3.0 amp for 4, 5 and 6 hood inputs
- Weight: 19 lbs (8.3 kg)



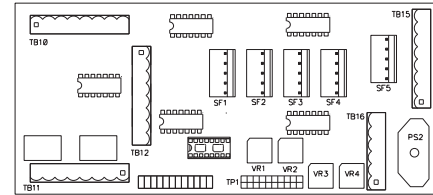
See wiring diagrams

FCC Compliance

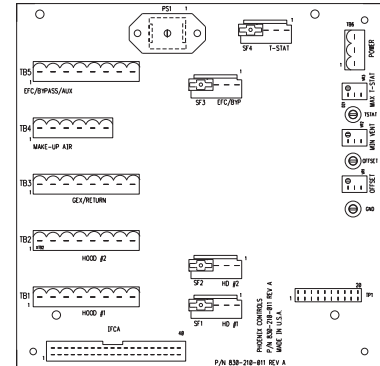
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

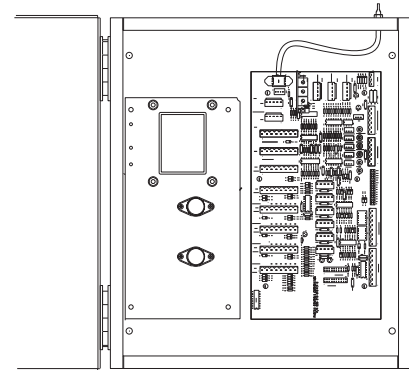
MAC300 (valve mounted)



MIX400



MAC500 (panel mounted, cover open)



If the Make-up Air Controller is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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FEATURES

FEATURES/OPTIONS	MAC3 Series	MAC5 Series	MIX400* Series	MIX500* Series	MIJ400* Series	MIJ500* Series
Maximum hood inputs	2	6	2	6	2	6
Make-up air output	1	1	1	1	1	1
General exhaust output	1	1	1	1	1	1
Generic exhaust or supply input	1	1		1		1
Dedicated constant volume input		1		1		1
Dedicated office supply input		1		1		1
Dedicated snorkel/canopy exhaust input		1		1		1
Adjustable room offset	✓	✓	✓	✓	✓	✓
Emergency exhaust override	✓	✓	✓	✓	✓	✓
Pneumatic and electronic thermal override control signals	✓	✓	✓	✓	✓	✓
Minimum ventilation control	✓	✓	✓	✓	✓	✓
Unoccupied ventilation setback		✓	✓	✓	✓	✓
Exhaust fan control	✓	✓	✓	✓	✓	✓
Common alarm contact	✓	✓				
Factory-mounted power supply		✓				
Interfaces with all DDC systems via individual hard-wired signals	✓	✓				
Interfaces with specific DDC systems* via 40-pin ribbon cable			✓	✓	✓	✓
Installation location	Analog valve	Panel	DDC panel	DDC panel	DDC panel	DDC panel
Pluggable terminal block wiring	✓	✓	✓	✓	✓	✓
Unity gain: supply and exhaust at same scale factors	✓	✓		✓		✓

*Contact factory for approved DDC partner list.

ORDERING GUIDE

MAC 5 2 2 - ETI - P15 - 1SE

PRODUCT FAMILY

MAC = Make-up air controller
MIJ = Make-up air controller for Johnson Controls (JCI); DDC integrated, excludes terminal block connectors
MIX = Make-up air controller for non-JCI applications; DDC integrated, includes terminal block connectors

SERIES

3 = Two inputs, valve mounted (MAC only)
 4 = Two inputs, DDC integrated (MIJ, MIX only)
 5 = Six inputs, panel mounted MAC or DDC integrated MIJ or MIX

OUTPUTS

1 = Supply make-up air control
 2 = Supply make-up air plus general exhaust/return

INPUTS

1 = One
 2 = Two
 3 = Three (Series 5 MAC, MIX, MIJ only)
 4 = Four (Series 5 MAC, MIX, MIJ only)
 5 = Five (Series 5 MAC, MIX, MIJ only)
 6 = Six (Series 5 MAC, MIX, MIJ only)

OPTIONS

When multiple options are selected, list alphabetically first, numerically second.

AOC = Additional override control external input (MAC 5 only)
ARC = Add ribbon cable (MAC 5 only)
EFC = Exhaust fan speed control
ETI = Electronic thermostat interface (scaling function module)
NEN = No enclosure (MAC 5 only)
PTI = Pneumatic thermostat interface (pneumatic to electric transducer and scaling function)
P08 = 0.8 amp power supply (MAC 5 only)
P15 = 1.5 amp power supply (MAC 5 only)
P30 = 3.0 amp power supply (MAC 5 only)
SMC = Scaled make-up command (Series 5 MAC, MIX, MIJ only)
SMF = Scaled make-up feedback (Series 5 MAC, MIX, MIJ only)
ZUG = Unity gain header added for same input to output scale factors
Z16 = Different PCB modified with 0.16 gain for 200 to 1250 (input to output) scale factors (MAC 5 only)

For the following scalable inputs, the number of available inputs must be equal to or greater than the number of the SE option selected. This option is used when any of the hood inputs into the make-up air controller are un-scaled; typically used with a variable speed drive provided by others.

1SE = One scalable input
2SE = Two scalable inputs
3SE = Three scalable inputs (Series 5 MAC, MIX, MIJ only)
4SE = Four scalable inputs (Series 5 MAC, MIX, MIJ only)
5SE = Five scalable inputs (Series 5 MAC, MIX, MIJ only)
6SE = Six scalable inputs (Series 5 MAC, MIX, MIJ only)

APPLICATIONS

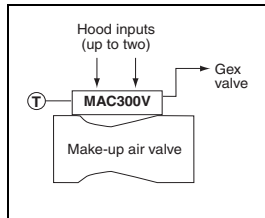
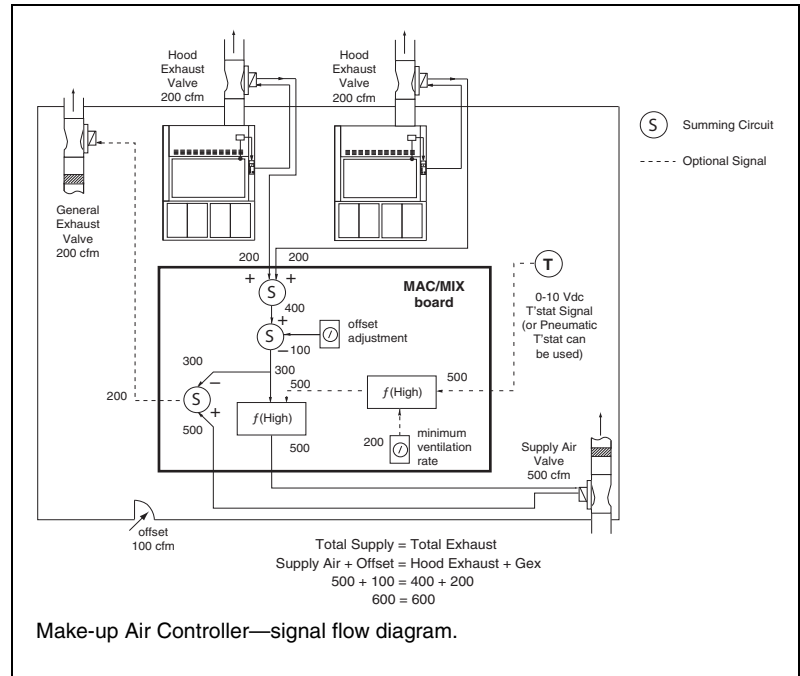
Room Pressurization is maintained at all times with the proper volumetric balance between the exhaust and supply air. All Phoenix Controls make-up air controllers provide this balance while offering:

- **Thermal override control**—Allows the supply air to increase in response to the thermostat. Pressurization is maintained by increasing the rooms' general exhaust.
- **Minimum ventilation control**—Maintains the proper air change rates by controlling total supply and total exhaust at minimum levels.

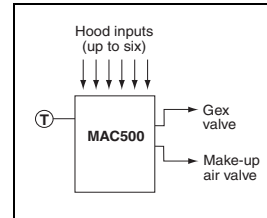
These types of Make-up Air Controllers are available:

1. MAC300V—Valve-mounted unit for laboratories with two hoods maximum
2. MAC500P—Panel-mounted unit for laboratories with six hoods maximum
3. MIX400*—Integrated unit for laboratories with two hoods maximum
4. MIX500*—Integrated unit for laboratories with six hoods maximum
5. MIJ400*—Integrated unit for laboratories with two hoods maximum
6. MIJ500*—Integrated unit for laboratories with six hoods maximum

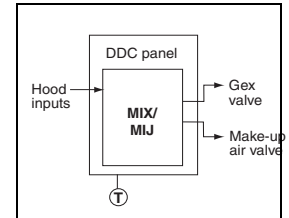
* Controllers are mounted in a DDC panel for easy FMS integration.



MAC300V: Valve-mounted controller



MAC500P: Panel-mounted controller



MIX400/500, MIJ400/500: Controller within DDC panel

INSTALLATION

Physical

MAC500

See Figure 1. Install the unit in an area where it will be protected from:

- Direct sunlight, rain, or moisture
- Corrosive gases or liquids
- Extreme temperatures
- Vibration, airborne dust, or metallic particles

MAC300

Factory-mounted on an analog air valve

MIX400/500 and MIJ400/500

Shipped to the DDC vendor for snap-in installation into its control panel

Electrical—Power and Grounding

MAC300 and MAC500

- **Controls electrician**—Complete all low-voltage wiring between the panels and control devices as specified in the room wiring diagrams. MAC series make-up air controllers have conduit knockouts pre-punched for your use. *Do not create new holes in the enclosure. This will void the product's warranty.*
- **Power electrician**—Complete all high-voltage wiring between the distribution panel and the MAC as specified in the wiring diagram inside the panel. Use a dedicated circuit for each make-up air controller.

MIX400/500 and MIJ400/500

Controls electrician:

1. Orient the MIX/MIJ board so that the power terminal is at the top (see Figure 2).
2. Mount the MIX/MIJ board into the FMS panel via the fastening standoffs.
3. Plug the 40-pin ribbon connector(s) into the MIX/MIJ board as specified in the submittal wiring diagrams.
4. Terminate the valve cables to the plug-in connectors.
5. Insert the plug-in connectors into the proper terminal blocks as specified in the submittal wiring diagrams.
6. Insert the three-pin power terminal from the FMS panel into the proper terminal block of the MIX/MIJ board.

Pneumatic (when applicable):

Connect the pneumatic thermostat signal tubing to the control board (MAC300, MIX400, MIX500, MIJ400 and MIJ500) or to the panel's barbed fitting (MAC500).

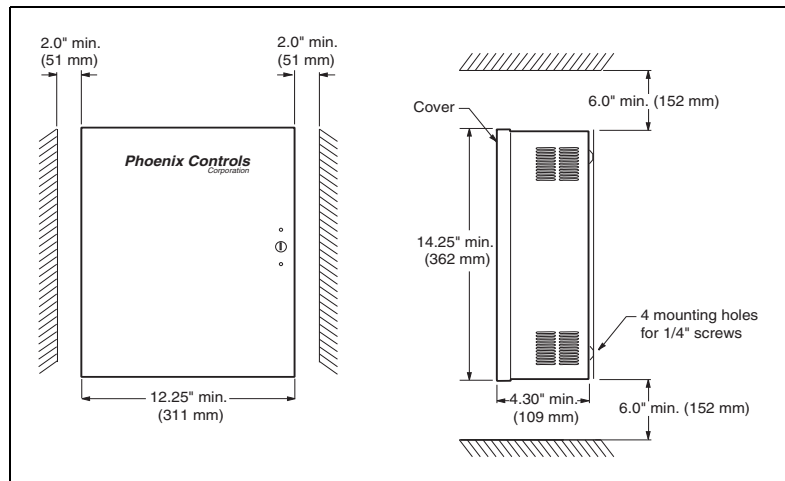


Figure 1. MAC500 dimensions.

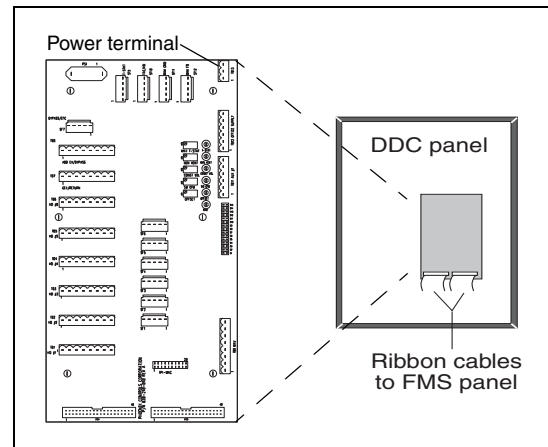
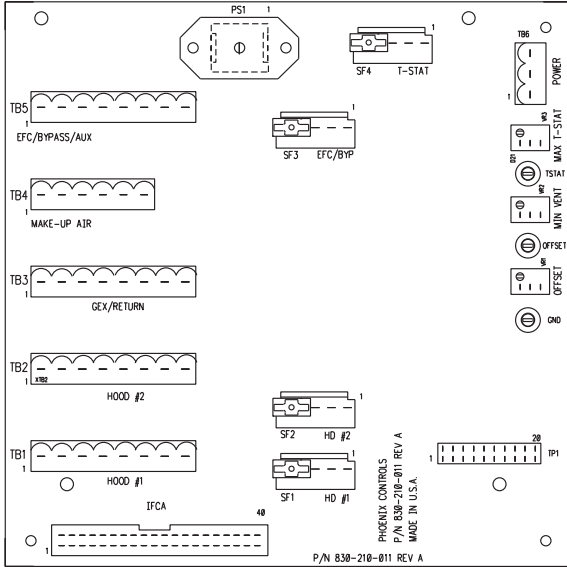


Figure 2. MIX500 in a FMS panel.

Board Control and Monitoring Points (MIX400 shown)



Test Point	Function
TP-1	Fume hood #1 flow feedback
TP-2	Fume hood #2 flow feedback
TP-3	Fume hood #3 flow feedback*
TP-4	Fume hood #4 flow feedback*
TP-5	Fume hood #5 flow feedback*
TP-6	Fume hood #6 flow feedback*
TP-7	General exhaust feedback
TP-8	Additional exhaust flow
TP-9	Additional exhaust feedback (supply scale)
TP-10	Total exhaust (supply scale)
TP-11	Additional supply flow
TP-12	Office supply feedback*
TP-13	Temperature override (supply scale)
TP-14	Offset (exhaust scale)
TP-15	Total make-up demand
TP-16	Supply feedback
TP-17	General exhaust min clamp
TP-18	-12 V
TP-19	+12 V
TP-20	Ground

* For MAC500P, MIX500 and MIJ500 only.

Wire Color	Pin Number	Signal
White	1	+15 Vdc
Orange	2	Ground
Black	3	-15 Vdc
Red	4	Command
Green	5	Feedback
Yellow	6	Alarm
Blue	7	User status/GEX minimum (if applicable)
Brown	8	Sash signal (if applicable)
Required color code and reference signals (Belden 9421 or equivalent)		

Note: Eight-conductor wire is Belden 9421 (22 AWG) or equivalent. (Tape back unused conductors.)

	TERMINAL BLOCKS		
	Hood Input	General Exhaust	Supply Air
MAC300	TB1, TB10	TB11	—
MIX400 MIJ400	TB1, TB2	TB3	TB4
MAC500	TB1-TB6	TB7	TB9
MIX500 MIJ500	TB1-TB6	TB7	TB9

POINTS AND WIRING (CONTINUED) (see submittal wiring diagram for project-specific details)

Spec Pin-out Points, MIX400/500 and MIJ400/500 Interface Connector IFC-A

Interface Connector IFC-A			Points available for hard-wire on:	
Pin Number	Interface Point Description	Point Type	MAC3xx	MAC5xx
1	Hood #1 Flow Feedback	AO	Yes	Yes
2	Hood #2 Flow Feedback	AO	Yes	Yes
3	Hood #1 Sash Position	AO	Yes	Yes
4	Signal Common	—	—	—
5	Hood #2 Sash Position	AO	Yes	Yes
6	Hood #1 Command/Emergency Override	AO	Yes	Yes
7	Hood #2 Command/Emergency Override	AO	Yes	Yes
8	Signal Common	—	—	—
9	Make-up Air Flow Feedback	AO	Yes	Yes
10	GEX/Return Flow Feedback	AO	Yes	Yes
11	Office Supply Flow Feedback	AO	Yes	Yes
12	Signal Common	—	—	—
13	Bypass/EFC Flow Feedback	AO	No	Yes
14	Ancillary Exhaust Flow Feedback	AO	No	Yes
15	Switched Volume Flow Quantity	AO	No	Yes
16	Signal Common	—	—	—
17	Constant Volume Preset Flow Quantity	AO	No	No
18	Offset Default Set Point	AO	No	No
19	Hot Deck Flow Feedback	AO	No	Yes
20	Signal Common	—	—	—
21	Hood #1 Alarm	AO (Tri-state)	Yes	Yes
22	Hood #2 Alarm	AO (Tri-state)	Yes	Yes
23	Hood #3 Alarm	AO (Tri-state)	No	Yes
24	Signal Common	—	—	—
25	Hood #1 User-status	AO	Yes	Yes
26	Hood #2 User-status	AO	Yes	Yes
27	Hood #3 User-status	AO	No	Yes
28	Signal Common	—	—	—
29	Make-up Air Alarm	AO	Yes	Yes
30	GEX/Return Alarm	AO	Yes	Yes
31	Office Supply Flow Alarm	AO	No	Yes
32	Hot Deck Flow Alarm	AO	No	Yes
33	Bypass Flow Alarm	AO	No	Yes
34	Ancillary Exhaust Flow Alarm	AO	No	Yes
35	Offset Polarity	AO/AI	No	No
36	Signal Common	—	—	—
37	Emergency Purge/Vent	AI	Yes	Yes
38	Raw or Pre-scaled Thermal Demand	AI	Yes	Yes
39	Room Offset Adjustment	AI	Yes	Yes
40	Open	—	—	—

POINTS AND WIRING (CONTINUED) (see submittal wiring diagram for project-specific details)

Spec Pin-out Points, MIX500 and MIJ500 Interface Connector IFC-B

Interface Connector IFC-B			Points available for hard-wire on:	
Pin Number	Interface Point Description	Point Type	MAC3xxV	MAC5xxP
1	Hood #3 Flow Feedback	AO	No	Yes
2	Hood #4 Flow Feedback	AO	No	Yes
3	Hood #5 Flow Feedback	AO	No	Yes
4	Signal Common	—	—	—
5	Hood #6 Flow Feedback	AO	No	Yes
6	Signal Common	—	—	—
7	Hood #3 Sash Position	AO	No	Yes
8	Open Note that this pin is connected to signal common on IFC-A. This variation between IFC-A and IFC-B can be used to communicate the connector's identity to the interfacing FMS controller. In essence, it is an electronic key that may be used for confirmation.	—	—	—
9	Hood #4 Sash Position	AO	No	Yes
10	Signal Common	—	—	—
11	Hood #5 Sash Position	AO	No	Yes
12	Signal Common	—	—	—
13	Hood #6 Sash Position	AO	No	Yes
14	Signal Common	—	—	—
15	Hood #3 Command/Emergency Override	AO	No	Yes
16	Signal Common	—	—	—
17	Hood #4 Command/Emergency Override	AO	No	Yes
18	Hood #5 Command/Emergency Override	AO	No	Yes
19	Hood #6 Command/Emergency Override	AO	No	Yes
20	Signal Common	—	—	—
21	Hood #4 Alarm	AO (Tri-state)	No	Yes
22	Hood #5 Alarm	AO (Tri-state)	No	Yes
23	Hood #6 Alarm	AO (Tri-state)	No	Yes
24	Signal Common	—	—	—
25	Hood #4 User-status	AO	No	Yes
26	Hood #5 User-status	AO	No	Yes
27	Hood #6 User-status	AO	No	Yes
28	Signal Common	—	—	—
29	Signal Common	—	—	—
30	Signal Common	—	—	—
31	Signal Common	—	—	—
32	Signal Common	—	—	—
33	Signal Common	—	—	—
34	Signal Common	—	—	—
35	Signal Common	—	—	—
36	Signal Common	—	—	—
37	Open	—	—	—
38	Open	—	—	—
39	Open	—	—	—
40	Open	—	—	—

MAINTENANCE

Phoenix Controls Make-up Air Controllers require no ongoing preventive maintenance. Once the engineer has completed the field setup, the units will provide years of continuous operation.

Replacement Part	Part Number
MAC300 board	800-210-013
MAC300 with PTI board	800-210-108
MAC500 board	800-210-182
MAC500 with PTI board	800-210-185
MIX400 or MIJ400 board	800-210-102
MIX400 or MIJ400 with PTI board	800-210-035
MIX500 or MIJ500 board (also with PTI)	800-210-161
Scaling Function Module	800-210-192

TROUBLESHOOTING

Problem	Possible Cause/Solution
1. The room is too hot or too cold.	A. The reheat coil is wide open or closed. <ul style="list-style-type: none">• Check discharge air temperature into room.• Check reheat operation. B. The thermostat is malfunctioning. Check set point and calibration. C. The air handler is malfunctioning. <ul style="list-style-type: none">• Air handler is shut down. Check operation.• Verify air handler unit discharge temperature. D. The valve is not operating correctly. Perform Lab Room Airflow Verification procedure.
2. Odors are outside the lab/room pressurization problem.	The airflow tracking is malfunctioning. <ul style="list-style-type: none">• Perform Lab Room Airflow Verification procedure.• Contact Phoenix Controls Product Support for assistance.