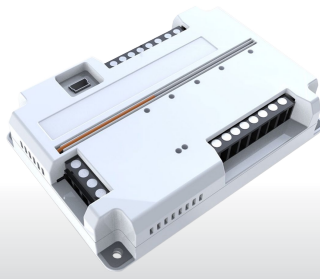


M9-MTB

HVAC Controller Installation



Description:

The Magnum HVAC Control Board (M9-MTB) has the ability to control fan coil units, PTAC units, heat pumps, up to two cool and three heat. The M9-MTB uses wireless communication to provide quick and easy implementation of the energy-saving HVAC controls. When the M9-MTB receives an "occupied" signal from any of Magnum's wireless sensors (including M9-RPW), the user immediately gains full control of the HVAC settings. When the M9-MTB receives an "unoccupied" signal, it sets the room back to the preset unoccupied temperature. When used with Magnum's Gateway, the thermostat can also be connected to BACNet HVAC control systems.

Technical Specifications:

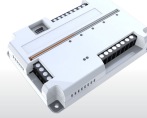
Part Numbers (Frequency Dependent)	M9-MTB (902 MHz - North America) M8-MTB (868 MHz - Europe and China) MJ-MTB (928 MHz - Japan)
Range	50 ft-150 ft typical
Input Voltage	24 VAC
Max Loads	24V (1.5 amp/circuit)
Temperature Monitor Range	32°F to 99.9° F (0°C to 37.7°C)
Temperature Set Point Range	60°F to 85°F(15.5°C to 29.5°C)
Operating Environment	14°F to 131°F (-10°C to 55°C) Non Condensing Humidity
Storage Environment	-4°F to 131°F (-20°C to 55°C) Non Condensing Humidity
Fan Control	Selectable: Auto Cycle, Low, Medium, High, Economy, Off
Memory	Stores up to 30 Device IDs
Accuracy	+ / - 1°F (0.5°C)
Heat / Cool Control	<ul style="list-style-type: none">• Compressor• Reversing Valve• Medium Fan• Auxiliary Heat• Low Fan• High Fan Relays
Dimensions	3" W x 4.25" L x 0.875" H (76.2 mm W x 107.95 mm L x 22.225 mm H)
Radio Certifications	TCM300U FCC (SZV-STM300U); IC (Canada 5713A-STM300U)

Features Include:

- Compatible with key card switch, occupancy sensor, window / door sensor and other wireless transmitters.
- Controllable via BAS or Venergy via eBox.
- Two Way Communication.

Equipment Needed for Installation:

- Narrow slot blade Screwdriver (for terminal blocks)
- Wire strippers



Equipment needed for Setup: (optional, MTB can be preconfigured)

- Computer capable of running the airConfig application
- USB communication FOB for EnOcean devices
- The airConfig application itself

Planning for Installation:

- The MTB switches low voltage signals typically found in HVAC systems. It does generate about 1.6 watts of heat, so installation in a tightly sealed space is to be avoided.
- The MTB uses radio to communicate with external devices. If using in a metal enclosure (like a fan coil), ensure the MTB is near openings in the metal to allow the radio signals to pass.
- The MTB **REQUIRES** the return air sensor (included) **TO BE CONNECTED** for **ALL** configurations. It is **NOT optional**. The MTB will not operate without it being connected and it should be located in a return air stream.
- Always use a qualified installer.
- Do not mount close to large contactors or other electromagnetic interference sources. These devices may impair the ability of the MTB to communicate.
- **Always turn off power prior to installation.**

Configuration:

The MTB is a very application flexible HVAC controller. It can be configured to control most existing common HVAC systems. It is intended to be used with a remote mounted user interface device using wireless communication. It may also be controlled via Venergy or most BAS systems via an Mx-eBox. The MTB is configured via Magnum's airConfig tool. This may be accomplished prior to installation if desired. The various parameters are explained in the following sections.

Magnum airConfig:

The airConfig tool is used to configure the MTB. The following will touch on many of the features available through the airConfig tool **Call or email support@magnumfirst.com for down load instructions.** There is helper function (the magic wand on the equipment tab) for the most common configurations to get started.

EQUIPMENT TAB:

Heating/Cooling:

This is set by the capabilities of the EQUIPMENT, not the user preference for controlling the space. The user preference is set in the user interfacing device (like the M9-RPW). If a mode is disabled here it cannot be overridden by any peripheral device.

Fan Coil:

Cycle Rate: This is the maximum call cycles permitted per hour. For a fan coil typical value is 12; max value is 24. These are enforced by the MTB.

4-pipe:

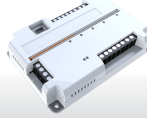
Heating and cooling are always assumed to be available, so no pipe sensor is required.

2-pipe:

- All 2-pipe versions require a pipe temperature sensor to measure the supply water temperature. Those that have valves use only the cooling output (Y1) to drive the water valve. This leaves the heating output available to control auxiliary heat, if so configured.
- All valved fan coils purge the loop periodically to have conditioned water in the call ready for the next call. If a potable system is in use, the water must be circulated periodically by code. There are two parameters which govern the purge: Purge frequency and purge duration. These are set in the Fan/Override/Purge tab.

Note: Acceptable water temperatures for heating and cooling are set in the "Setpoint" tab. More on that later.

- 2-pipe valveless uses just the fan to service calls. Constant fan is not available. Aux heat is also not available. A pipe temperature sensor is still required.
- Use the "Advanced" tab (discussed later) to choose the appropriate water valve behavior.



Magnum airConfig: (continued)

- Use the "Fan/Override" tab (discussed later) to configure the fan options.

HP (heat pump):

- Single stage compressor unless "2 stage CP" selected.
- Aux Heat: select if available.
- RV Latched: Some controllers need the reversing valve to maintain state between calls. This is known as latching the reversing valve. It wastes energy, so only use it when necessary.
- O/B Type: Select correct reversing valve based on the equipment. O-type energized in cooling, B-type energizes in heating.
- Use CP with Aux Heat: Depending on the type of Aux heat (electric, fossil fuel, etc.) and then the local preference, the compressor may be run along with the aux heat source. This is generally NOT recommended when the Aux heat source is fossil fuel.
- Compressor protection: selected.
- Use the "Fan/Override" tab to configure the fan options.

AC (may add aux heat):

- Compressor based cooling, up to 2 stages. If 2 stage aux heat is desired, so select; else select "aux heat" for single stage aux heat.
- Some controllers require a reversing valve input even though it's not a heat pump. If needed, select "use RV with AC", then select the desired RV action (O or B).
- Compressor Protection: selected.
- Setback Ramping, Setback Timer and Degrees per Hour: If Setback Ramping is selected, the step size and duration are programmable. If ramping is not selected, these parameters are not used.
- Cycle Rate: This is the maximum call cycles permitted per hour. Typical value is 6, max value is 8.
- Use the "Fan/Override" tab to configure the fan options.

Compressor protection:

- This enables a 3 minute delay between compressor cycles to allow pressures to equalize.
- Deadband is the difference between the heating and cooling setpoint. In the MTB, the cooling setpoint will always be the warmer of the two, unless deadband = 0. When a setpoint is selected (Setpoints tab) the MTB will compare to the current conditions and decide if it is a heating or cooling setpoint, then make the correct one active. It will use the deadband value to generate the inactive setpoint. Values from 0 to 4 are most common. For autochangeover, a 2 degree F difference is used to prevent mode oscillation when the deadband value is set to less than 2.

Setback Timer:

The number of minutes setback is delayed once no occupancy is detected in a space.

Setpoint Hold Timer:

This is the amount of time the user preferred setpoint is held once economy or checked out mode is achieved. After that, the default setpoint is applied.

Fan Purge Timer:

The duration the fan runs beyond the completion of a HVAC call.

Amana:

When selected, certain proprietary behaviors are enabled which are required to be interoperable with certain Amana brand equipment. Do NOT select for non-Amana equipment.

ADVANCED TAB:

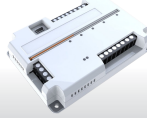
Water Valve Configuration is only used for fan coil equipment.

Wired Inputs:

The MTB has two channels of wired dry contact inputs available. If used, select the desired functionality of the input. No other options for these inputs are available.

Wired Temperature Sensors:

The MTB has two channels for type 2 thermistor inputs. Use the drop down selections to assign the function to the input.



Magnum airConfig: (continued)

Time/Repeater: Leave "Off".

De-Humidify: Leave NOT Enabled.

Status after power Failure: Choose desired state.

0-10V TAB:

The MTB has three channels of assignable 0-10V analog outputs. All are electrically referenced to the "C" terminal (AC common), which is typical of HVAC applications. For each channel select the desired function, then the desired output configuration.

EC Fan: Configures the selected channel to output a voltage that varies with the difference between setpoint and the space temperature. The voltage may be stepwise or linear depending on the fan configuration selected. Please see the "Fan configuration" in the "Fan/Override" tab for available options.

Note: Selecting any EC fan configuration **DISABLES** the fan relay output.

Proportional Cooling Valve / Proportional Heating Valve:

Configures the channel to output a voltage that's proportional to the difference between the supply air sensor value and the supply air setpoint. A supply air sensor is required. Should a sensor not exist, this output operates as either full open or fully closed.

Warning: Operating cooling with too warm a supply air setpoint can result in mold growth. When in doubt, use cooling air setpoints well below the dewpoint. Magnum First is not responsible nor liable for mold issues or related damage.

Damper Control:

Configures the selected channel to output a voltage to open or close the damper on the event of a call. This does not disable the fan relay output.

Damper Control for Economizer w/o Fault Relay:

Controls the selected channel to output a linear voltage to control a damper that is used to mix outside air with return air as an economizing function. A supply air and an outdoor air temperature sensor are required.

Damper Control for Economizer with Fault Relay:

Same as the previous "w/o the relay" except that, should the supply air setpoint not be able to be reached by modulating the damper voltage, a fault will be generated and the other channel defined as "Fault Relay" will be energized to drive an external relay.

Fault relay (requires MTB-AB1):

The MTB-AB1 is an external relay assembly that accepts a 0-10VDC input to drive a conventional relay. Terminals are provided for NC, C and NO relay contacts. The Option is always 0-10V output, regardless of the selection.

SCHEDULES TAB:

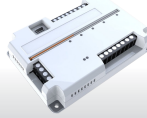
Time Synchronization:

Updates the internal time of day clock in the MTB to the time sent, usually the local computer time. For improved accuracy, care should be taken to ensure the computer actually operates using the correct time (prefer NIST or similar). Note that time zone offset is supported.

Daylight Savings Time:

When selected, the MTB will automatically set up / set back per the selected Zone schedule. There are 4 zones available which capture those in use worldwide.

Night-Time occupancy override allows for a daily interval of time to be established during which the MTB will not allow the oc-



Magnum airConfig: (continued)

cupancy state to change from occupied to unoccupied. This is most often used to prevent uncomfortable conditions during sleeping periods.

Schedules: The MTB supports user defined schedules of up to 10 events per day. The fan operation is selectable between “Auto” cycling and “Const(ant)” for each event. This is useful for office buildings where fresh air requirements require the use of constant fan during occupied periods. Should an occupant select a different setpoint other than the schedule (using a RPW or other learned setpoint control device), the selection will be honored until the next event occurs. At that point the schedule resumes.

SENSORS TAB:

A variety of wireless sensors are available to the MTB. Each is taught to the MTB by ID and EEP function. There is no other method to teach wireless devices to the MTB. The airConfig method is drag and drop, so wait until the device to be learned appears in the rightmost column, then select it and drag while holding the left mouse button. Some device can be learned to a variety of functions (like a door or window switch). Once in the “sensors to be learned” area, right click and select the desired function. A list of supported devices is available.

SETPOINTS TAB:

Comfort Setpoint:

When in the Occupied state, here set the range limits and the default comfort setpoint along with the setpoint (or limit value) to enable freeze protection.

Green Mode:

These are the heating and cooling limit values for when the MTB is in the deepest energy saving state. The space will stay between these values during this mode. This may also be known as the economy or checked out condition.

Unoccupied: The interim state between Occupied and Green modes. This is an energy saving mode that is intended to allow quick recovery to the Occupied state. When occupancy is no longer detected, the space is held between these limits after the delay expires. The Checkout period begins once the delay timer expires. Once the checkout timer expires the Green mode is active.

Window Open:

These parameters define the space temperature control limits after the window open delay period expires.

Supply Air:

These are the target values when a controlled temperature supply air source is required.

Pipe Sensor Activation Sensor / Heat Pump Outdoor Activation:

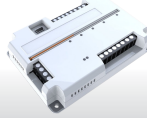
When the equipment is a fan coil, these are the limit values used to define whether adequate cooling or heating water exists in the pipe to perform the desired functions.

When the equipment is a heat pump with aux heat AND there's an outdoor sensor, the heating value is the temperature above which the compressor can also be used for heating; the cooling is the temperature below which the compressor will be disabled for heating calls, using only the aux heat. If there is no outdoor sensor, these parameters are ignored.

Differentials

This is how closely the space is held to setpoint (\pm the differential). Suggested values are 0.4°F to 0.8°F for comfort.

Setting: These are the states that control returns to after the listed action occurs.



Magnum airConfig: (continued)

FAN / OVERRIDE / PURGE TAB:

Definitions

- Fan PSC (permanent split capacitor) is a fan motor than is wired for specific speeds. By energizing a particular wire, that speed is selected. Some EC (electrically commutated) fans are preprogrammed to behave the same way. Let use the term "EC preconfigured" for those.
- Fan EC1-3 are EC fans that we want to operate as if they were multispeed fans. These are not preconfigured, so we use the "Fan speed Emulation" values to define the operating points. Those operating points are adjustable and are set using the Fan Speed Emulation values for speeds 1, 2 and 3.
- Fan ECM is a variable speed fan. The fan speed is proportional to the difference between the setpoint and the space temperature. The Fan Speed emulation values are not used.
- Fan Auto: The fan only cycles with the call
- Fan User: the fan cycles with the call, but the user can set a minimum fan speed (other than off).

Note: For external devices (like the M9-RPW) to have fan control, ONLY the User mode can be used. Other modes will lock out the external device fan control.

- Fan Constant: The fan runs all the time, even when there is no call.

Fan / Override / Purge Settings:

Based on the capabilities of the equipment, select the appropriate fan configuration using the above definitions.

Fan Mode: Select "Fan User" unless there's a good reason not to.

Fan Speed Emulation:

If one of the "EC preconfig" values was selected, set the emulated fan speed in % of full speed. If less than 3 are selected, set the necessary number of the values the same.

Compressor cycling:

Certain regions will freeze the evaporator when the compressor is in cooling use and the outdoor temperature is below freezing. If such a condition exists, the compressor can be duty cycled to allow the space air to keep the evaporator ice free. Use these parameters to set up the duty cycle. Most applications do not need this, so keep the "off delay" at "0" and the off minutes at "3". The "Off minutes" are enforced to a minimum value of "3".

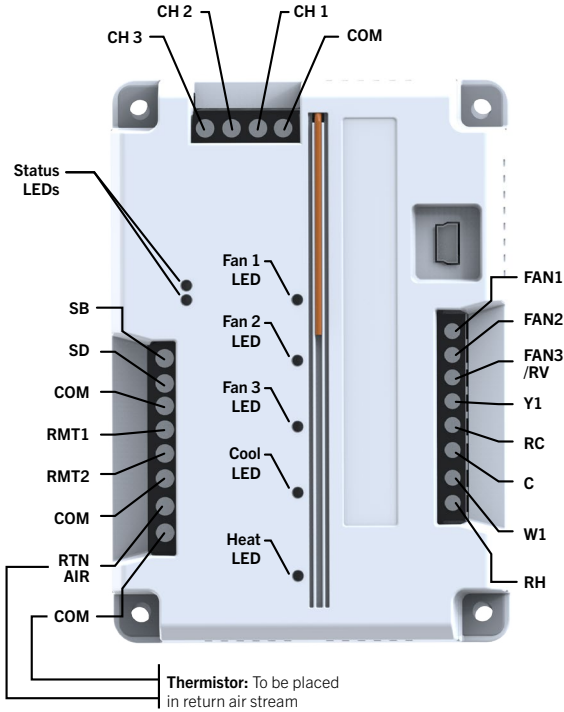
Fan Refresh:

During extended periods between HVAC calls, some areas will become stagnant. To prevent that, set the interval to how often the fan stirs the air and the duration to the length of time it runs. This only functions when there is no call. Each time there is a call, the interval timer restarts. Setting the "Refresh interval" to "0" disables this function.

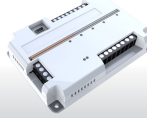
Purging: These parameters are only used with 2-pipe valved fan coils. Periodically the water temperature in the pipe is measured to ensure a heating or cooling call can proceed. The sampling is controlled by the Purge Frequency and the Purge duration. These timers run between calls. If the water temperature is outside the parameters set for the Pipe Sensor Activation (Setpoints tab), no call will be allowed. Typical values are 60 minutes for purge frequency and 180 seconds for purge duration.



Connection Overview:



*Additional Available MTB Wired Connections on next page

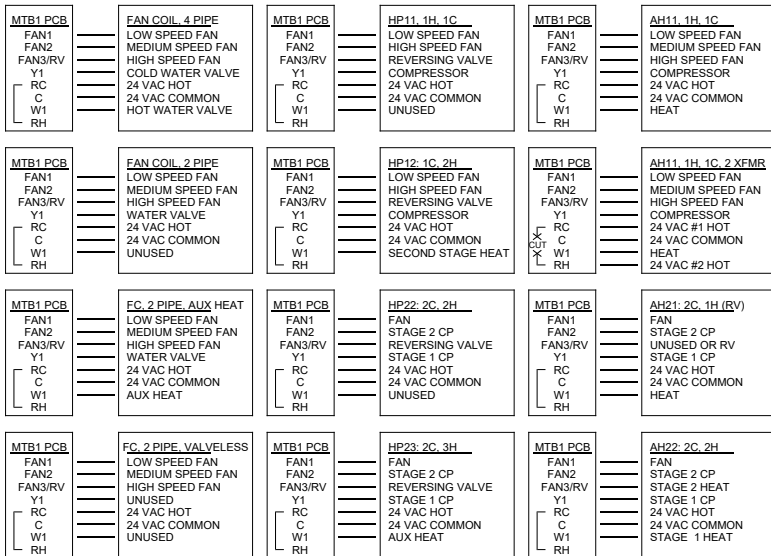


Additional Available MTB Wired Connections:

Name	Signal	Type	Connections	Allowable Usage (Must be so configured)
SB	NO, NC	Dry Contact	SB - COM	Wired Entry Door Switch Wired Motion Sensor
SD	NO, NC	Dry Contact	SD - COM	Wired Balcony Door Wired Window Sensor
RMT1	10K Thermistor, Type 2		RMT1 - COM	Pipe Temperature Sensor (Aquatat) Return Air Temperature Sensor Supply Air Temperature Sensor Outdoor Temperature Sensor
RMT2	10K Thermistor, Type 2		RMT2 - COM	Pipe Temperature Sensor (Aquatat) Return Air Temperature Sensor Supply Air Temperature Sensor Outdoor Temperature Sensor
RTN AIR	10K Thermistor, Type 2 (Provided)	Required	RTN AIR - COM	Required Return Air Temperature Sensor Required for Any and All Configurations Not Configurable
CH1	0-10V Assignable Output	Analog	CH1 - COM	Function and Polarity are Assignable Using AirConfig
CH2	0-10V Assignable Output	Analog	CH2 - COM	Function and Polarity are Assignable Using AirConfig
CH3	0-10V Assignable Output	Analog	CH3 - COM	Function and Polarity are Assignable Using AirConfig

Notes: All "COM" terminals are electrically connected to the "C" power connection.

24 VAC Connections for M9-MTB Controller



NOTE: THE RC-RH JUMPER IS ON THE MTB PC BOARD ITSELF AND IS NORMALLY POPULATED. TO ACCESS AND CUT THAT JUMPER, THE BOARD MUST BE REMOVED FROM THE CASE. USE FLUSH CUTTING PLIERS.

ALL 2-PIPE FAN COILS REQUIRE A PIPE TEMPERATURE SENSOR. SOME AC UNIT CONTROLLERS REQUIRE A REVERSING VALVE INPUT.

FC = FAN COIL, HP = HEAT PUMP, AC = COMPRESSOR BASED COOLING, AUX HEAT = ELEC STRIP OR FOSSIL FUEL UNUSED CONNECTIONS ARE TO REMAIN UNCONNECTED.