

Installation and Operations Guide

MS/TP Microset II

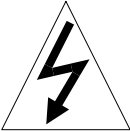
Important safety information and installation precautions

Read all instructions

Failure to follow all instructions may result in equipment damage or a hazardous condition. Read all instructions carefully before installing equipment.

Local codes and practices

Always install equipment in accordance with the National Electric Code and in a manner acceptable to the local authority having jurisdiction.



Electrostatic sensitivity

This product and its components may be susceptible to electrostatic discharge (ESD). Use appropriate ESD grounding techniques while handling the product. When possible, always handle the product by its non-electrical components.

High voltage safety test

Experienced electricians, at first contact, always assume that hazardous voltages may exist in any wiring system. A safety check using a known, reliable voltage measurement or detection device should be made immediately before starting work and when work resumes.

Lightning and high-voltage danger

Most electrical injuries involving low-voltage wiring result from sudden, unexpected high voltages on normally low-voltage wiring. Low-voltage wiring can carry hazardous high voltages under unsafe conditions. Never install or connect wiring or equipment during electrical storms. Improperly protected wiring can carry a fatal lightning surge for many miles. All outdoor wiring must be equipped with properly grounded and listed signal circuit protectors, which must be installed in compliance with local, applicable codes. Never install wiring or equipment while standing in water.



Wiring and equipment separations

All wiring and controllers must be installed to minimize the possibility of accidental contact with other potentially hazardous and disruptive power and lighting wiring. Never place 24VAC or communications wiring near other bare power wires, lightning rods, antennas, transformers, or steam or hot water pipes. Never place wire in any conduit, box, channel, duct or other enclosure containing power or lighting circuits of any type. Always provide adequate separation of communications wiring and other electrical wiring according to code. Keep wiring and controllers at least six feet from large inductive loads (power distribution panels, lighting ballasts, motors, etc.). Failure to follow these guidelines can introduce electrical interference and cause the system to operate erratically.

Warning

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the 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 is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

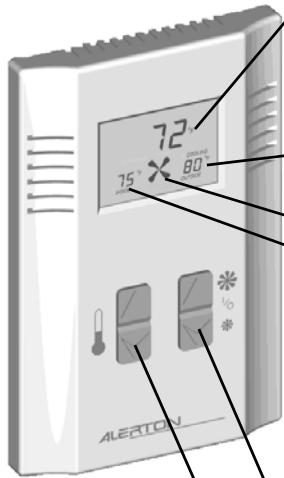
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Quick reference



ID	Display/control function	Description	Software remarks
1	Setpoint (°F or °C as appropriate) Override time remaining ON/OFF status Time of day (optional alternate) Value associated with data code (field service mode)	Displays unit setpoint, after-hours/housekeeping timer, ON/OFF status, or value of field service code, depending on mode of operation. Optionally, in modes M1-M6, the time of day can display alternately on a three-second cycle with any of the above.	Setpoint = AV-90. Housekeeping timer or after-hours timer = AV-98. ON/OFF mode = BV-65. Time of day is read directly from the MS/TP Microset II when BV-82 is ON. The MS/TP Microset II must be time-synced. BV-83 controls format (12- or 24-hour).
2	Outside air temperature (OAT) Outside humidity (optional alternate)	Displays OAT. Optionally, an outside humidity reading in %RH can display alternately on a three-second cycle with the OAT.	OAT = AV-103, which is written to in MS/TP Microset II. %RH = AV-107. If AV-107 is non-zero display will cycle.
3	Fan status	Displays occupant-selected fan status and speed in modes M4, M5, M8, and M9. In these modes, the occupant can use the right UP/DOWN buttons to increase and decrease the fan speed. In other modes, occupant adjustment is disallowed, but DDC can control the fan status and speed display.	Only one of the following BVs may be ON; otherwise, the Microset II indicates a high fan speed: BLANK = BVs 72-74 OFF. Low = BV-72 ON. Med = BV-73 ON. High = BV-74 ON.
4	Space temperature Space humidity (optional alternate for MS-2000H) Field service code (field service mode)	Displays space (room) temperature. With the Microset II with humidity sensor (MS-2100H-MSTP), the room %RH can display alternately on a three-second cycle with the room temperature.	Space temperature = AV-101. AI-0 is room temperature as read by the Microset II thermistor. Turn ON BV-75 to link AV-101 to AI-0. Turn OFF BV-75 if using DDC to write space temperature to ACV-101. Display will cycle between space temperature and humidity if BV-84 is ON. Space humidity = AV-102. No DDC required. AV-102 cannot store other values.
5	Right UP/DOWN buttons Fan speed control (M4, M5, M8) After-hours increment/decrement (M2, M5) ON/OFF control (M3, M6) Housekeeping timer ON/OFF (M7, M9) Adjust value (field service mode)	Button press causes only affected value on LCD to appear; all others disappear. Display remains in this state for three seconds after button release.	Button press affects BV-67 according to mode (see Table 5 on page 22). In fan modes, button press also affects BVs 72-74 (Table 8 on page 43).
6	Left UP/DOWN buttons Adjust setpoint Display unoccupied heating/cooling setpoints (M2, M5) Scroll through codes (field service mode)	Button press causes only affected value on LCD to appear; all others disappear. Display remains in this state for three seconds after button release.	

Quick reference (continued)

Mode IDs

M1—Office, no fan, occupied
M2—Office, no fan, unoccupied
M3—Office, no fan, ON/OFF
M4—Office, fan, occupied
M5—Office, fan, unoccupied
M6—Hotel, no fan, rented
M7—Hotel, no fan, vacant
M8—Hotel, fan, rented
M9—Hotel, fan, vacant

See Table 5 on page 22 for more information.

Field Service Codes

Code	Data point	Meaning
UC.	AV-95	Unoccupied cooling setpoint
UH.	AV-96	Unoccupied heating setpoint
CO.	AV-93	Cooling offset
HO.	AV-94	Heating offset
CS.	AV-99	Occupied cooling setpoint
HS.	AV-100	Occupied heating setpoint
AL.	AV-97	Override limit
rO	AV-108	Room temperature offset
hO	AV-109	Space humidity offset
HI.	AV-91	Setpoint high limit
LO.	AV-92	Setpoint low limit
SP.	AV-90	Occupant-selected space temperature setpoint

Introduction

The MS/TP Microset™ II is a wall-mounted BACnet MS/TP smart sensor that resides on an MS/TP network. It is designed for applications with multiple zones, such as a restaurant or a shopping mall; or split zone control sites, like an office setting where occupants share a single zone split into multiple working areas.

Features:

- Supports MS/TP communications
- Outside and room humidity display
- Outside temperature displayed at all times
- Space (room) temperature displayed at all times
- Space (room) humidity displayed at all times
- Fan speed display/adjustment (up to three speeds and OFF)
- Setpoint display/adjustment
- After-hours/housekeeping overrides
- Optional time of day display
- Heating or cooling mode display
- English or metric units

Specifications

Table 1 MS/TP Microset II specifications.

Part Number	MS-2100H-MSTP
Power	24 VAC @ 5 VA
MS/TP	MS/TP LAN operates up to 115 Kbps
Dimensions	4.6" (117 mm) H X 3.0" (76 mm) L X 0.7" (18 mm) D.
Humidity Sensor Accuracy Operating Temp. Repeatability	±5% RH, 10–90% RH @ 25°C. -40–185°F (-40–85°C). ±0.5% RH.
Ratings	EMC Directive 89/336/EEC (European CE Mark). FCC Part 15, Subpart J, Class B.

Mounting

The MS/TP Microset II is designed to be wall-mounted indoors, with dimensions ideal for mounting to a single-gang electrical box. See Fig. 3 on p. 10.

Mount in a clean, dry location away from windows, air ducts, and other places where environmental factors may affect temperature and humidity readings.

Note If you mount the MS/TP Microset II on the interior of an outside wall, thoroughly insulate so air behind the sensor doesn't affect the sensor reading.

To meet requirements of the Americans with Disabilities Act, mount no higher than 48" from the floor and with a minimum clear floor space of 30" X 48" (760 X 1220 mm). See Figure 1.

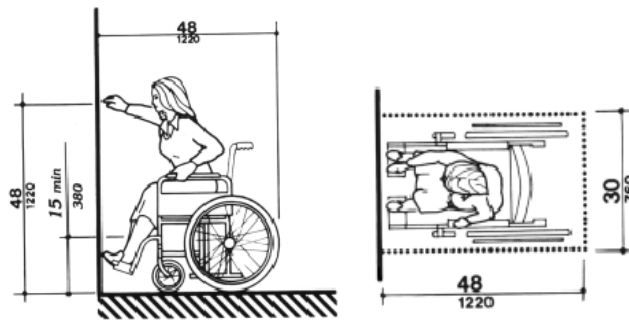


Figure 1 Mounting guidelines for compliance with Americans with Disabilities Act (ADA).

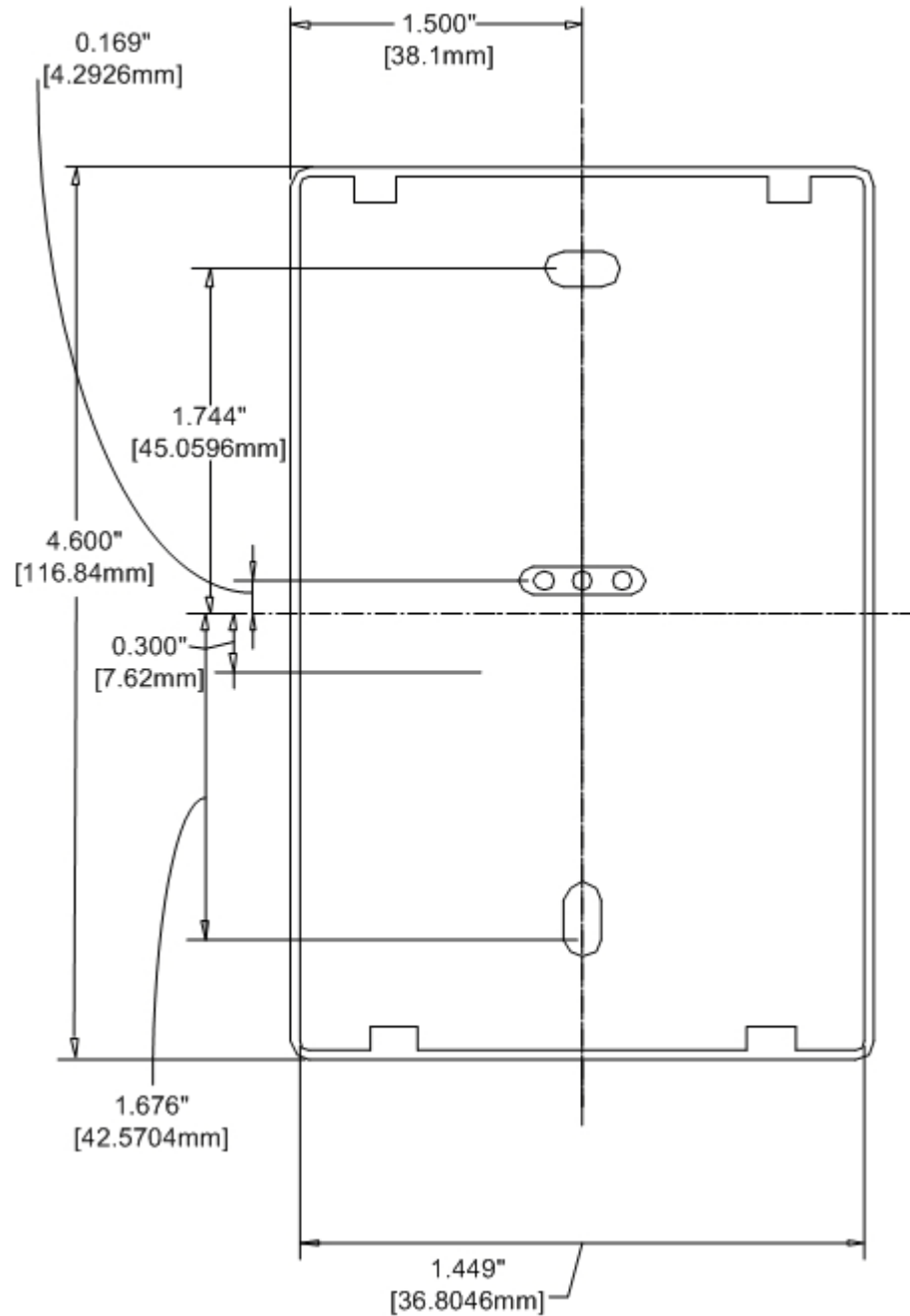


Figure 2 Backplate mounting dimensions.

The MS/TP Microset II ships with the backplate on backwards. This makes the backplate easier to remove during installation. Two screws attach the backplate to an electrical box, mud ring, or other mounting surface.

► **To secure the MS/TP Microset II to a mounting surface**

1. Remove the backplate from the MS/TP Microset II and the wiring pigtail.
2. Flip the backplate so the smooth side faces the mounting surface.
3. Rethread the wires through the center knockout on the backplate.

4. Use communications grade connectors to splice the MS/TP Microset II wires to the wire run of the MS/TP network. Alerton recommends using communications grade connectors for splicing into the MS/TP network. See “Wiring” on page 12 for details.
5. Secure the backplate to the mounting surface with the enclosed screws or your own.
6. Hold the MS/TP Microset II at an angle above the backplate and then slide it down.
7. The two tabs on the inside top edge of the MS/TP Microset II should fit into the tab slots on the backplate (see Figure 3).
8. Push the bottom of the MS/TP Microset II onto the backplate legs until they snap securely on the tab-stops (see Figure 3).

CAUTION Do not crimp or kink the pigtail wires. See “MS/TP LAN wiring” on page 14 for more wiring diagrams.

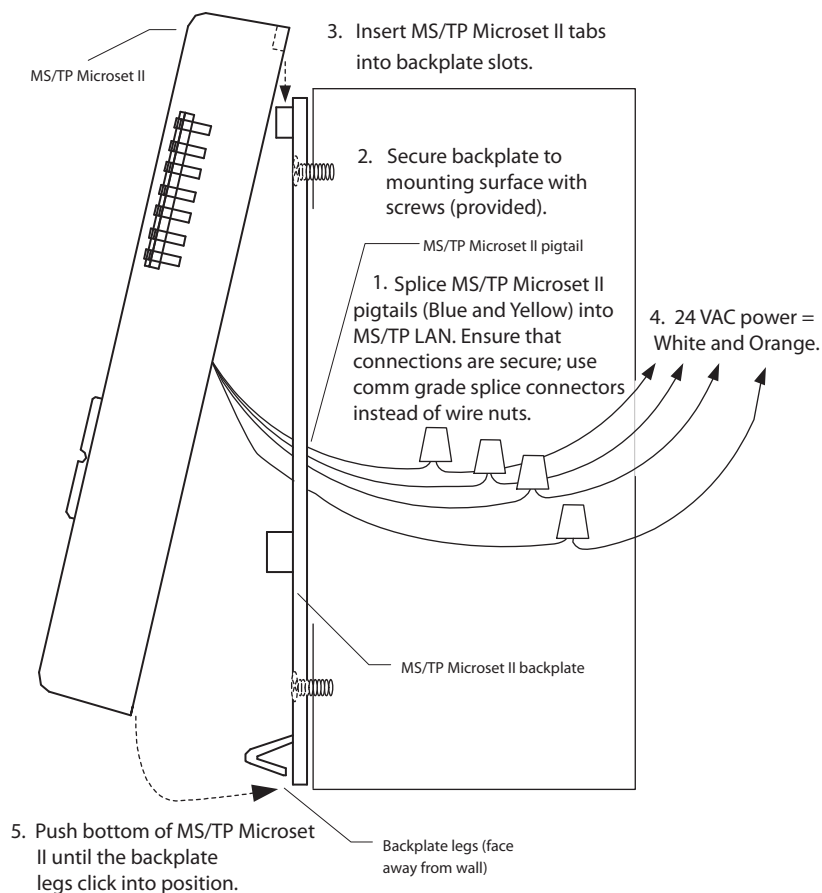


Figure 3 MS/TP Microset II mounting.

► **To remove the MS/TP Microset II from the backplate**

1. Insert a thin, flat-tipped screwdriver into the last vent slot on the bottom of the MS/TP Microset II. Position the screwdriver so that you can apply pressure to the backplate leg (see Figure 4, bottom view).
2. Firmly depress the backplate leg until it is clear of the tab-stop on the MS/TP Microset II.
3. Gently pull the freed corner of the MS/TP Microset II away from the wall.
4. Repeat steps 1–4 on the other side.
5. Push upward on the bottom of the MS/TP Microset II until it is completely free of the backplate.

Side view

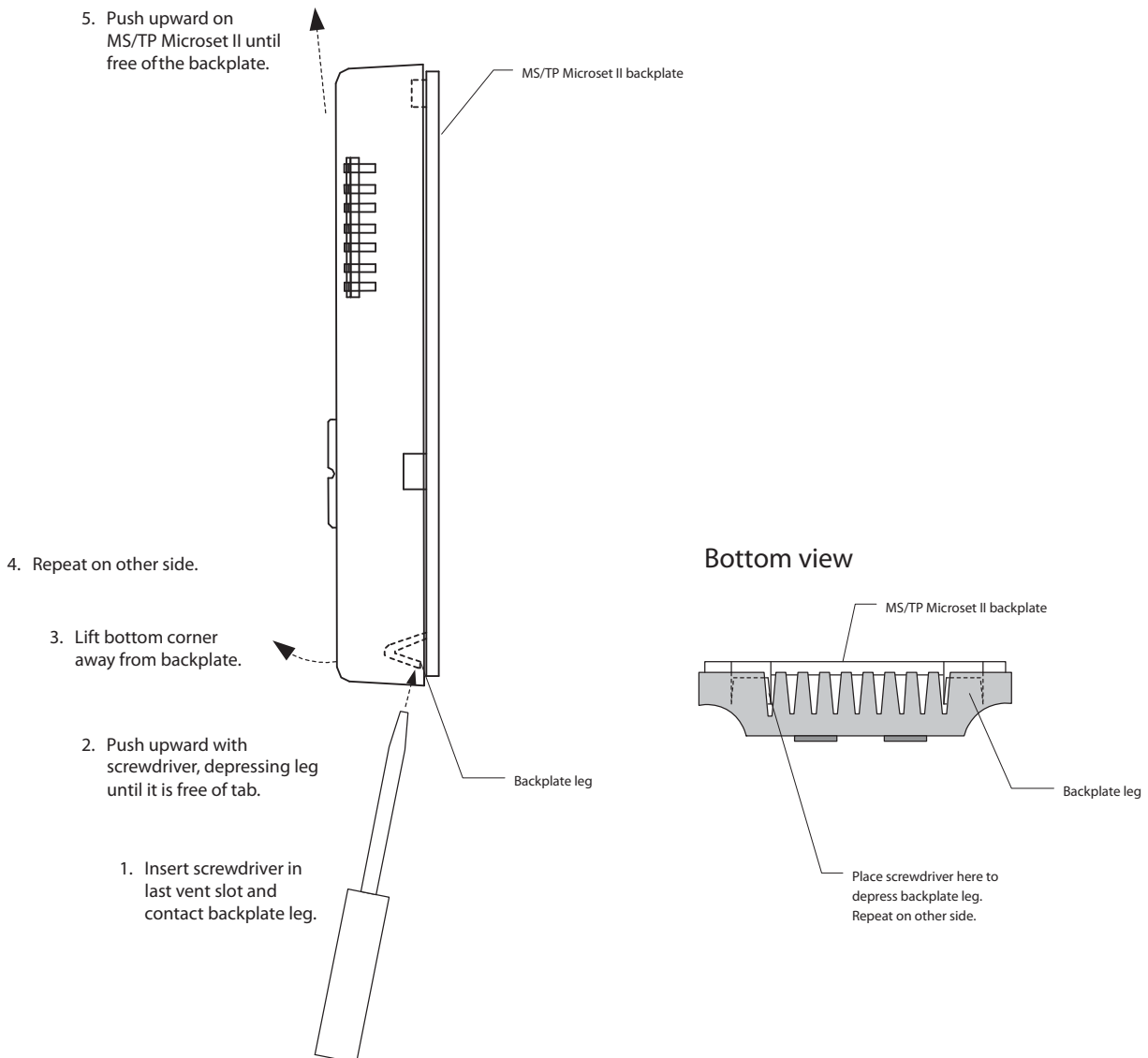


Figure 4 Removal of MS/TP Microset II from backplate.

Wiring

The MS/TP Microset II has a four-conductor connection to 24VAC power and BACnet MS/TP.

Table 2 MS/TP Microset II wire terminations.

Wire color	Use
Orange	24 VAC Hot
White	24 VAC GND (neutral). Must be connected to Earth ground, which acts as the MS/TP reference plane.
Blue	MS/TP +
Yellow	MS/TP -

Wire specifications

Note Do not run MS/TP Microset II wire in the same conduit or alongside building power cables. This can cause interference. If power cables must be crossed, cross at 90°.

Power supply guidelines and requirements

The MS/TP Microset II uses 24VAC power from a UL Listed Class 2 - 24VAC transformer (not provided). The MS/TP Microset II uses a half-wave rectifier to convert the AC power supply to onboard power. This enables multiple MS/TP Microset IIs to be powered from a single, grounded transformer.

CAUTION Half-wave devices and full-wave devices must not use the same AC transformer. If a MS/TP Microset II will share its power supply with another device, make sure that the other device utilizes a half-wave rectifier and that polarity of wiring is maintained. Failure to do so can result in equipment damage.

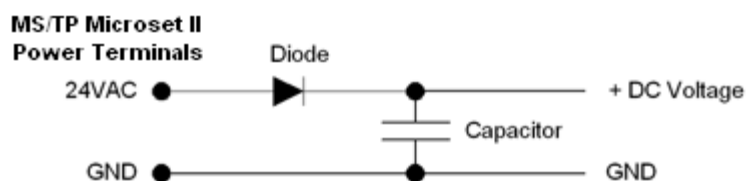


Figure 5 Internal MS/TP Microset II power wiring schematic, half-wave rectifier.

MS/TP Microset II power ratings

The MS/TP Microset II minimum current draw is 24 VAC @200ma leading to 5VA.

Power supply grounding and wiring

When connecting power to the MS/TP Microset II, ensure that one leg of the VAC secondary circuit connects to a known earth ground.

Supplying a high-quality ground connection to a MS/TP Microset II is one of the most important things you can do to ensure a trouble-free installation.

The 24VAC secondary leads are not interchangeable. Once a lead connects to the GND wire on the MS/TP Microset II, it is the grounded lead. Observe and maintain polarity for subsequent connections. The GND terminal provides a reference ground for the circuit board and communications wiring. Use 18 AWG cable for best results.

WARNING Ensure that all MS/TP Microset II power and communications cabling are grounded according to these instructions. Failure to follow these instructions may result in MS/TP Microset II operational and communication failures or equipment damage.

Power supply wire selection

If you are considering long power supply wiring runs, using the right wire size is critical. If the wire is too small, the resistance may be too high, resulting in a low voltage supply. This is known as *line loss*. The wire size is based on the length of the wire run and the current draw of the MS/TP Microset II. Use Figure 6 to determine wire size; obtain additional information from the transformer manufacturer.

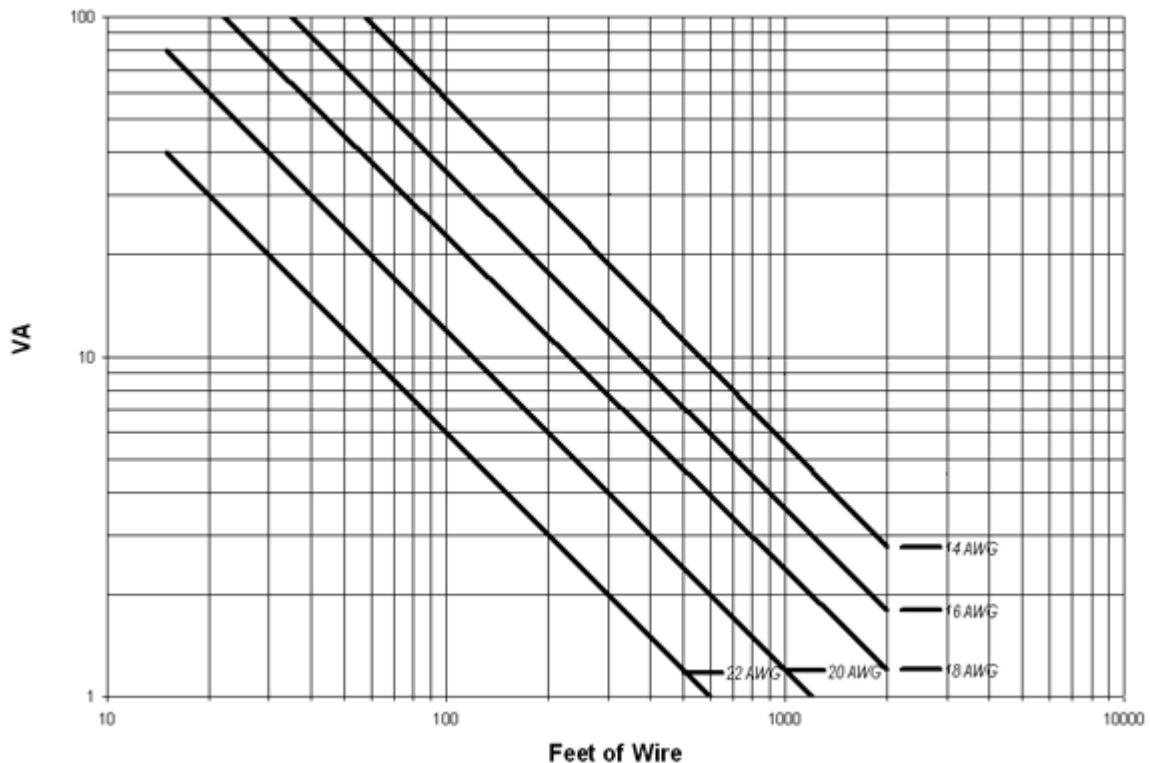


Figure 6 MS/TP Microset II wiring recommendations

MS/TP LAN wiring

The MS/TP Microset II communicates on the site-wide BACnet system over a twisted-pair MS/TP LAN, which uses the EIA-485 signaling standard. MS/TP Microset IIs are master devices on the MS/TP LAN.

Each MS/TP Microset II employs a high-quality EIA-485 transceiver and exerts $\frac{1}{4}$ unit load on the MS/TP LAN.

Table 3 MS/TP LAN facts

Transmission speed	9.6, 19.2, 38.4, 76.8, 115.2Kbps (configured at global controller).
Layout	Bus.
Cabling	BACnet specifies the following. Shielded, twisted-pair cabling with characteristic impedance between 100 and 130Ohms. Distributed capacitance between conductors must be less than 30 pF/foot (100 pF/m). Distributed capacitance between conductor and shield must be less than 60 pF/foot (200 pF/m). Foil or braided shield acceptable.
Segment length	4000 ft. (1071 m.) per segment using recommended wire.
Maximum devices overall	Depends on classification of devices as master or slave. Maximum number of master devices is 128. Maximum number of slave devices or devices overall (mixed master and slave) is 255. This includes VLCs, BACtalk global controllers (all are considered masters) and any other devices, regardless of their relative unit loads.
Maximum devices per segment	Depends on relative unit load of devices (see "Terminating MS/TP LAN cabling" on page 15).
Repeaters	Required when making runs longer than 4000 ft. Three repeaters maximum between any two devices.
Terminating resistors	Matched resistors required at each end of segment bus wired across (+) and (-). Use matched precision resistors rated $\frac{1}{4}W$ $\pm 1\%$ / 80 - 130 Ohms.
Shield grounding	Ground shield drain wire at single point earth (panel) ground, <i>not</i> MS/TP Microset II <i>ground</i> . Tape off shield drain wire at other end. Tie shield drain wire through at each MS/TP Microset II.

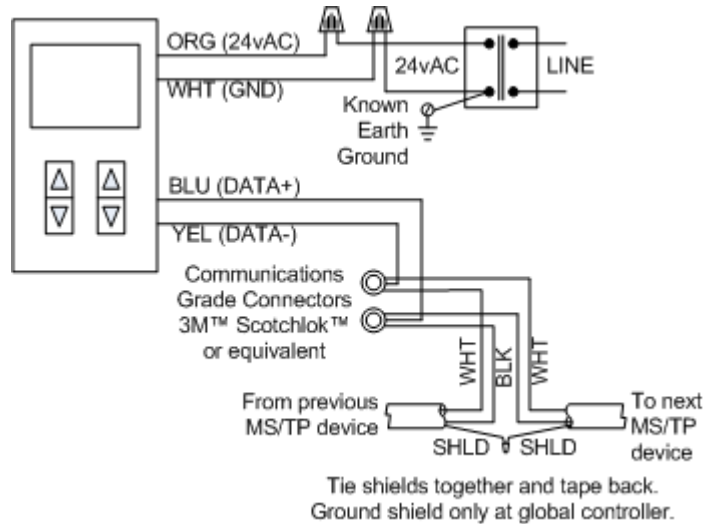


Figure 7 Recommended MS/TP Microset II wiring: option 1

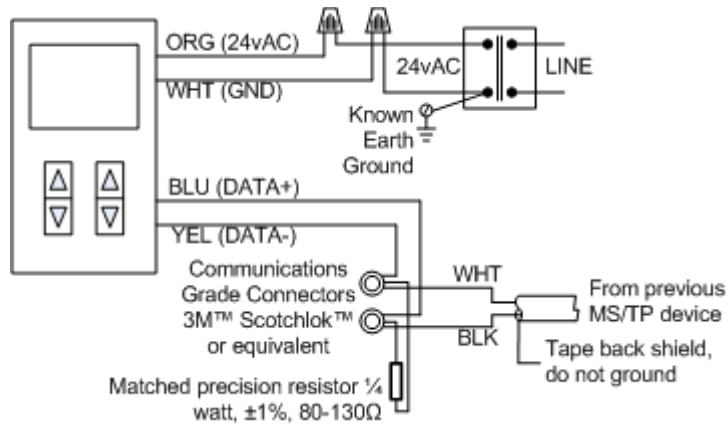


Figure 8 Recommended MS/TP Microset II wiring: option 2

Terminating MS/TP LAN cabling

Maintain polarity of the MS/TP wire run throughout the MS/TP LAN.

Note Do not run MS/TP Microset II wire in the same conduit or alongside power cables to avoid interference. If power cables must be crossed, cross at 90°.

IMPORTANT Always use communications grade connectors, such as 3M Scotchlok or equivalent, when splicing pigtails with MS/TP LAN cabling.

Grounding the MS/TP LAN shield

Proper shield grounding of the MS/TP cabling can help minimize the risk of communications problems and damage to equipment because of transient voltage spikes (for example, lightning strikes).

Follow these guidelines for grounding MS/TP cable shields:

- Each MS/TP segment must have a single point of shield ground, as close to the middle of the cabling run as possible (see Figure 9).
- Do not ground the MS/TP shield directly to a MS/TP Microset II wire.
- Never ground both ends of a shield because differences in potential between the grounds may induce current on the shield, causing interference.
- At connecting termination points, tie the shield through with a wire nut.
- At ungrounded, exposed shield points (the end of a segment), tape back the shield to the wire jacket or, for optimum transient shunting, use 100V gas discharge tubes or 120V MOVs between the shield and ground. See Figure 9.

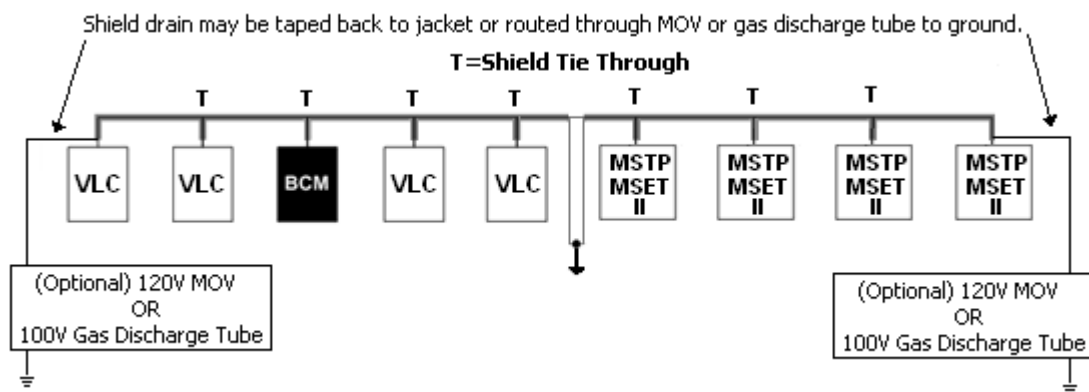


Figure 9 MS/TP shield drain termination and tie through

Terminating resistors

At the last device on each end of the MS/TP segment, matched terminating resistors wired across MS/TP+ and MS/TP- are required for signal integrity.

Optimum segment performance typically requires “tuning,” a process by which the value of the terminating resistors is selected based on the wave form of signals on the segment. View wave forms using an industrial scope meter. The goal is to have as square a wave form as possible with an amplitude greater than 200 mV. Resistors affect the wave form as follows:

- When the resistance value decreases, the amplitude of the wave form decreases and becomes more square.
- When the resistance value increases, the amplitude of the wave form increases and becomes less square.

Typically, precision resistors in the range 80-130 Ohms ($\pm 1\%$) yield acceptable results. Ideally, the value of the terminating resistors should match the rated characteristic impedance of the installed cable. For example, if the installed MS/TP cable has a listed characteristic impedance of 100 Ohm, install 100 Ohm matched precision resistors.

CAUTION Do not mismatch terminating resistors. Ensure that both resistors on a segment have the same value.

Operational overview

The MS/TP Microset II operates in one of nine modes. In each mode, the MS/TP Microset II displays data and has operational features unique to that mode. Operating modes are listed in Table 4 on page 21 and Table 5 on page 22.

Review the different MS/TP Microset II modes and determine which one is best for your application. Then set BVs 64, 65, 80, and 81 according to Table 5 on page 22.

BACtalk data displays can directly reference data points in the MS/TP Microset II reserved for MS/TP operations. This offers the system operator flexibility and ease of use—with a mouse click, the system operator can control MS/TP Microset II operations.

Hotel vs. office modes

BV-81 controls hotel and office mode (BV-81 ON = hotel). The primary difference between hotel and office mode is the function of the after-hours timer as compared to the function of the housekeeping timer. See “After-hours override operation” and “Housekeeping override operation” herein. Other operational details vary as well. See “Operating mode specifics” on page 21.

Fan-control vs. no-fan-control modes

BV-80 determines fan control mode (BV-80 ON = fan-control mode).

In fan-control modes, the occupant can select fan speed at the MS/TP Microset II. Fan-control modes are typically used in fan-coil, air conditioning, or unit ventilator applications.

In no-fan-control modes, the occupant is unable to select fan speed. However, if desired, DDC can cause fan symbology to display at the Microset II. No-fan-control modes are typically used in VAV or heat pump applications.

Cooling and heating setpoint calculation

The MS/TP Microset II calculates current heating and cooling setpoints (AV-99 and AV-100) using different logic in occupied and unoccupied modes (as read from BV-67). Using the current setpoints (AV-99 and AV-100) in your control DDC is most efficient because the MS/TP Microset II automatically calculates these setpoints according to the operating status of the MS/TP Microset II.

Occupied setpoint logic (BV-67 ON)

- Current cooling setpoint (AV-99) = Occupant-selected space temperature setpoint¹ (AV-90) + Cooling offset (AV-93) + Demand offset (AV-106)
- Current heating setpoint (AV-100) = Occupant-selected space temperature setpoint¹ (AV-90) – Heating offset (AV-94) – Demand offset (AV-106)

¹ The system's setpoint high limit (AV-91) and setpoint low limit (AV-92) limit this value.

Unoccupied setpoint logic (BV-67 OFF)

- Current cooling setpoint (AV-99) = Unoccupied cooling setpoint (AV-95)
- Current heating setpoint (AV-100) = Unoccupied heating setpoint (AV-96)

After-hours override operation

Unoccupied office modes (M2 and M5) offer an after-hours override feature, which enables the occupant to override a scheduled unoccupied status at the MS/TP Microset II.

In override, the unit calculates current setpoints (AV-99 and AV-100) using occupied setpoint logic (see “Cooling and heating setpoint calculation” on page 17). The occupant can increase or decrease the timer to the next half-hour increment. The occupant can also adjust the setpoint and fan speed (if applicable).

The after-hours timer (available in software as AV-98) automatically counts down whenever it is set to a non-zero value.

To disable this feature, set the after-hours timer limit (AV-97) to zero.

DDC can read override status from BV-66, which is ON if the after-hours timer is non-zero. When BV-64 (occupied/unoccupied command) is ON, the after-hours timer automatically resets to zero.

Housekeeping override operation

Vacant hotel modes (M7 and M9) offer a housekeeping override. This is similar to the after-hours override in that it causes occupied setpoint logic to be in effect. However, there are important differences: the occupant can only start and stop the timer (timer adjustment is not allowed); the override timer limit (AV-97) is read in minutes, not hours; and the occupant can't adjust setpoint or fan speed.

This feature can be disabled by setting the override timer limit (AV-97) to zero.

DDC can read override status from BV-66, which is ON if the housekeeping timer is non-zero. When BV-64 (occupied/unoccupied command) is ON, the housekeeping timer automatically resets to zero.

English and metric units

You can set the MS/TP Microset II to display English or metric units based on the selection in the DDC header file or you can toggle that status in software. The English or metric setting is referred to as the native units mode.

BV-69 can be set ON to reverse native units mode for the MS/TP Microset II display. Thus, if the MS/TP Microset II is set to English, and BV-69 is ON, the MS/TP Microset II displays units in appropriate metric equivalents. This enables the system to display units at the MS/TP Microset II according to occupant preference without a programmer having to write separate DDC sequences around each unit of measure.

Outside air temperature (OAT) display

For OAT read at another unit to display at the MS/TP Microset II, the OAT value must be written in BCM DDC to the Present Value of AV-103 in the MS/TP Microset II.

LCD backlight operation

The MS/TP Microset II requires 24VAC (white and orange wires) to operate. BV-79 controls backlight operation. If BV-79 is OFF, the backlight turns ON when any button is pressed and stays on for 20 seconds after there is no button activity. If BV-79 is ON, the backlight is ON continuously.

Testing the LCD backlight/ LCD/ and MS/TP status

You can test the LCD to ensure that it is functional.

► To test the LCD backlight

1. Turn ON the LCD backlight by turning ON BV-79.
Verify the backlight is ON.
2. Turn OFF the LCD backlight by turning OFF BV-79.
Verify the backlight is OFF.
3. Turn ON the LCD backlight again by turning ON BV-79.
Verify the backlight is ON.

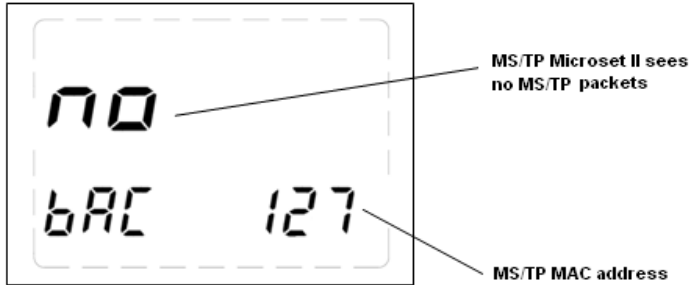
► To test the LCD and MS/TP status

1. Press and hold the left UP and right DOWN buttons simultaneously.
All LCD items should be visible.

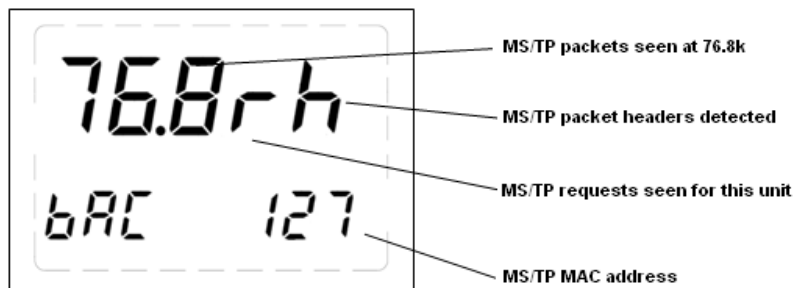
Note After 5 seconds the test ends and MS/TP communication status is displayed. The LCD returns to normal operations when the buttons are released.

Viewing communications status

- If the MS/TP Microset II sees no MS/TP packets, “no” displays.
- The MS/TP MAC address is displayed in the outside area.



- If it sees valid MS/TP requests, then “r” displays.
- If it sees valid MS/TP headers, then “h” displays.
- If it sees valid MS/TP headers or requests, then the baud rate displays in digits. For example, 9.6, 19.2, 38.4, 76.8, or 115.



Operating mode specifics

This topic provides LCD, button operation, for each of the operating modes. Use Table 4 to compare operating mode features.

Use Table 5 on page 22 to determine values to set for enabling each operating mode.

Table 4 Operating mode feature comparison.

Mode ID	Mode Name	Occupant Setpoint Adjustment	Occupant Fan Speed Control	Occupant ON/OFF Control	After-hours Override	Housekeeping Timer	Alternate Time of Day Disp.	View Unoccupied Setpoints
No fan control								
M1	Office, no fan, occupied	u					u	
M2	Office, no fan, unoccupied	◆ ^a			u		u	u
M3	Office, no fan, ON/OFF	u		u			u	
Fan control								
M4	Office, fan, occupied	◆ ^b	u				u	u
M5	Office, fan, unoccupied	u ^a	u ^a		u		u	
No fan control								
M6	Hotel, no fan, rented	u		u			u	
M7	Hotel, no fan, vacant					u		
Fan control								
M8	Hotel, fan, rented	◆ ^b	u				u	
M9	Hotel, fan, vacant					u		

a. Available only when after-hours override is active.

b. Available only when fan is running.

Enabling operating modes

Combinations of values for BVs 64, 65, 80, and 81 control operating modes. In each mode, BV-67 (a read-only point) reports occupied/unoccupied status. Use this data point in DDC as a flag to control occupied and unoccupied operating sequences.

Table 5 lists data point settings for the various operating modes and indicates the action of BV-67 in each mode. See Table 8 on page 43 for further detail.

Table 5 Data point settings for MS/TP Microset II operating modes, with BV-67 status.

Mode	Description	BV-64 Occupied	BV-65 ON/OFF	BV-80 Fan-control	BV-81 Hotel	BV-67 (read only) occupied/unoccupied status
M1	Office, no fan, occupied	ON	OFF	OFF	OFF	ON
M2	Office, no fan, unoccupied	OFF	OFF	OFF	OFF	OFF unless after-hours timer (AV-98) is non-zero.
M3	Office, no fan, ON/OFF	ON	ON	OFF	OFF	Right UP/DOWN buttons control BV-67 to match occupant selected ON/OFF status. UP turns BV-67 ON, DOWN turns it OFF.
M4	Office, fan, occupied	ON	ON ^a	ON	OFF	ON unless the fan is OFF (BVs 72-74 OFF), then BV-67 is OFF.
M5	Office, fan, unoccupied	OFF	ON ^a	ON	OFF	OFF unless after-hours timer (AV-98) is non-zero.
M6	Hotel, no fan, rented	ON	ON ^a	OFF	ON	Right UP/DOWN buttons control BV-67 to match occupant selected ON/OFF status. UP turns BV-67 ON, DOWN turns it OFF.
M7	Hotel, no fan, vacant	OFF	ON ^a	OFF	ON	OFF unless housekeeping timer (AV-98) is non-zero.
M8	Hotel, FC, Rented	ON	ON ^a	ON	ON	ON unless the fan is OFF (BVs 72-74 OFF), then BV-67 is OFF.
M9	Hotel, FC, Vacant	OFF	ON ^a	ON	ON	OFF unless housekeeping timer (AV-98) is non-zero.

a. The Microset turns BV-65 ON in these modes.

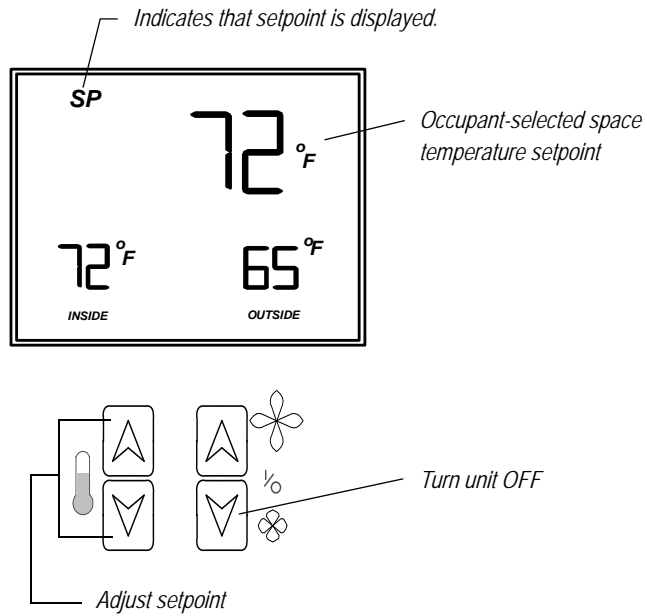
Office modes

Office modes are typically used in commercial use environments.

M1—Office, No Fan, Occupied

Set BV-64 ON and BV-65, BV-80, and BV-81 OFF. The LCD displays the occupant-selected space temperature setpoint (AV-90). The unit controls to occupied setpoints.

This mode's counterpart is M2, which is activated by setting BV-64 OFF.



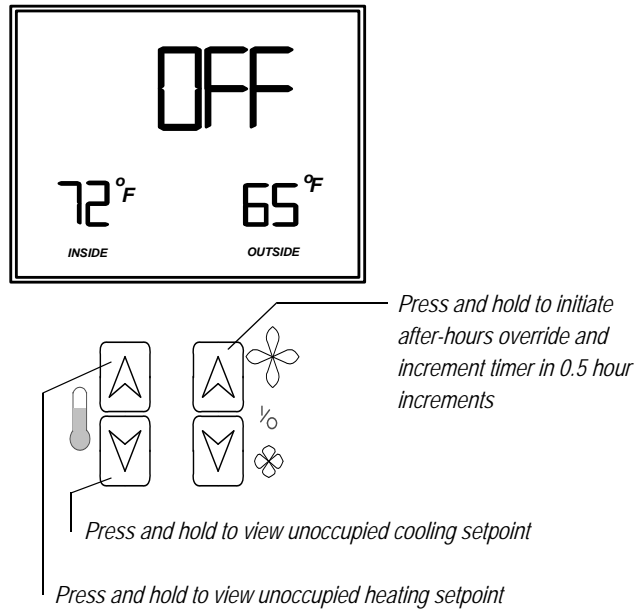
M2—Office, No Fan, Unoccupied

Set BVs 64, 65, 80, and 81 OFF. The LCD displays the word OFF. The unit controls to unoccupied setpoints.

The occupant can press the right UP button to initiate after-hours override. The occupant can press and hold the left UP button to view the unoccupied heating setpoint or press and hold the left DOWN button to view the unoccupied cooling setpoint.

If desired, after-hours operation can be disabled by writing a 0 value to the after-hours timer limit (AV-97).

This mode's counterpart is M1, which is activated by setting BV-64 ON.

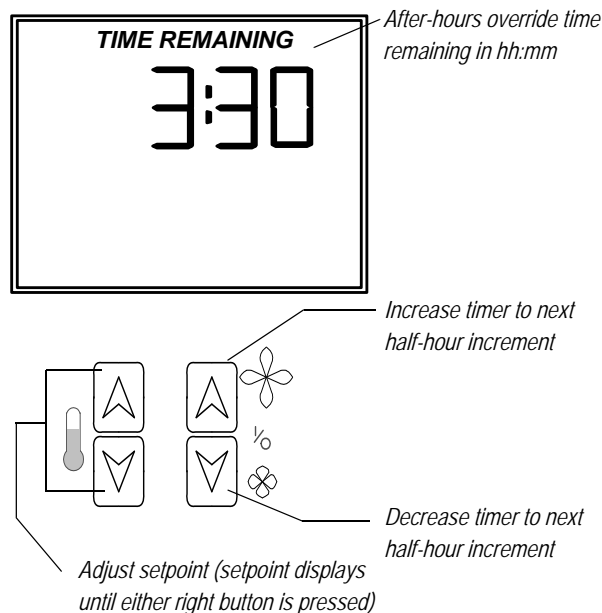


After-hours override operation

When after-hours override is in effect, the after-hours timer (AV-98) automatically decrements, and the LCD displays the current timer value. The unit controls to occupied setpoints while the after-hours timer is non-zero.

At any time, the occupant can use the right UP/DOWN buttons to increase or decrease the timer to the next half-hour increment up to the timer limit (AV-97).

The after-hours timer automatically resets to zero if the zone is set to occupied (BV-64 ON).

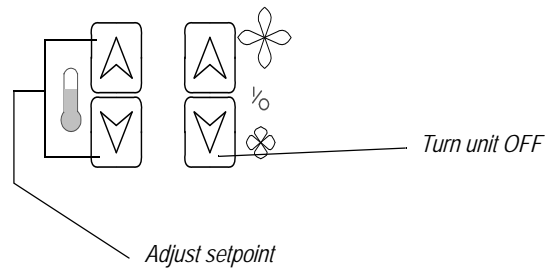
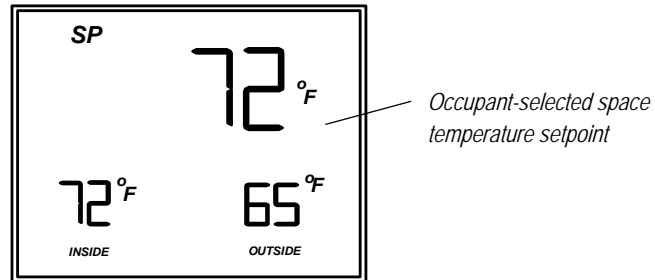


M3—Office, No Fan, Occupied, ON/OFF

Set BV-64 and BV-65 ON and BV-80 and BV-81 OFF. The occupant can use the right UP/DOWN buttons to set ON and OFF operation.

Operation when ON

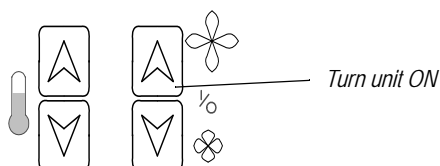
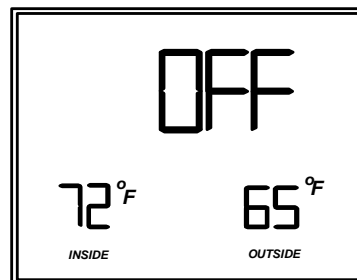
The LCD displays the occupant-selected space temperature setpoint (AV-90). The unit controls to occupied setpoints. The occupant can adjust the temperature setpoint with the left UP/DOWN buttons. The occupant can turn the unit OFF with the right DOWN button.



Operation when OFF

The LCD displays the word OFF. The unit controls to unoccupied setpoints.

The occupant can press the right UP button to turn the unit ON. The left buttons have no effect.



M4—Office, Fan, Occupied

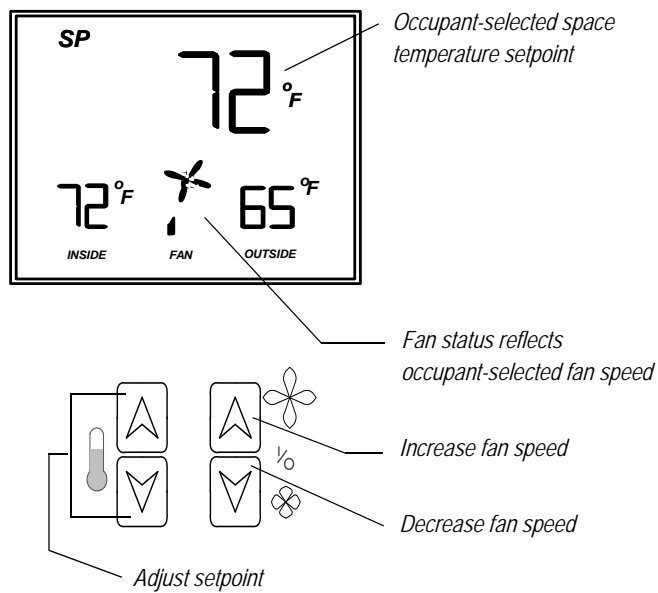
Set BVs 64 and 80 ON and BV-81 OFF. Operation depends on whether the fan is running or stopped.

This mode’s counterpart is M5, which is activated by setting BV-64 OFF.

Operation with fan ON

The LCD displays the occupant-selected space temperature setpoint (AV-90) and the fan speed. The unit controls to occupied setpoints.

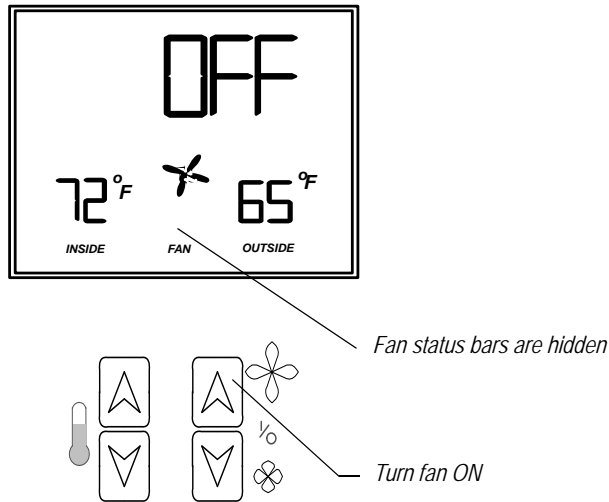
The occupant can adjust the setpoint with the left UP/DOWN buttons. The occupant can also use the right UP/DOWN buttons to change the fan speed or turn the fan OFF.



Operation with fan OFF

If the occupant presses the right DOWN button until the fan turns OFF, the fan symbol stops turning, the fan speed bars are not visible, and the word OFF appears on the LCD. The unit controls to unoccupied setpoints.

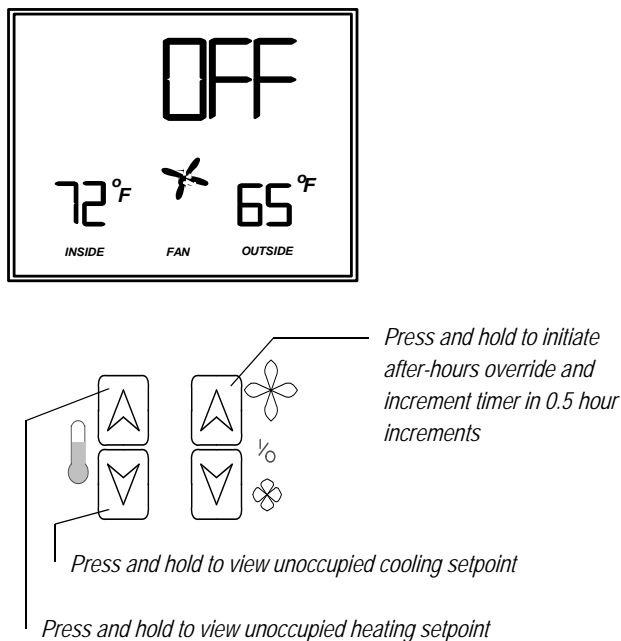
The occupant can press the right UP button to turn the unit ON.



M5–Office, Fan, Unoccupied

Set BV-64 and BV-81 OFF and BV-80 ON. The LCD displays the word OFF. The unit controls to unoccupied setpoints.

This mode’s counterpart is M4, which is activated by setting BV-64 ON.



After-hours override operation

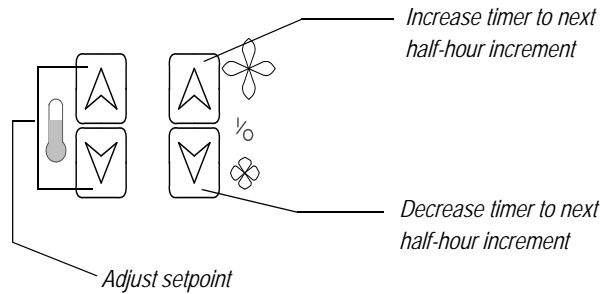
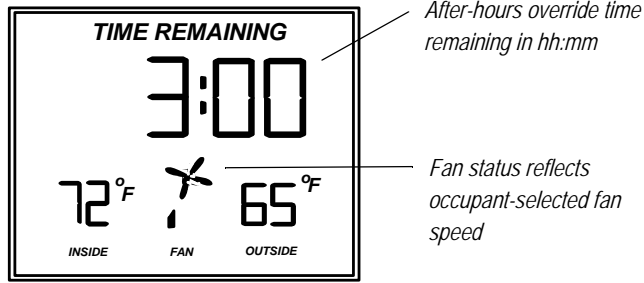
When after-hours override is in effect, the after-hours timer (AV-98) automatically decrements. The unit controls to occupied setpoints while the after-hours timer is non-zero.

The occupant can increase or decrease the timer to the next half-hour increment up to the timer limit (AV-97) with the right UP/DOWN buttons. The right

UP/DOWN buttons enable the occupant to adjust both the after-hours override time (after-hours adjustment mode) and the fan speed (fan speed mode). This function alternates after a three-second pause. Thus, after adjusting the after-hours override time, the occupant waits three-seconds to adjust fan speed.

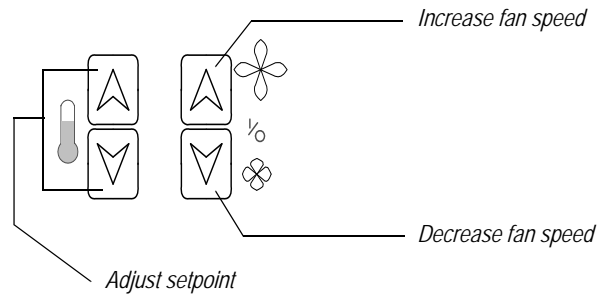
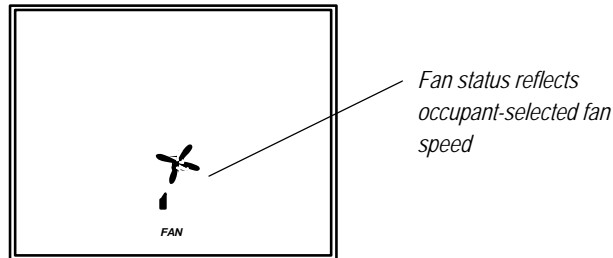
While the after-hours override is in effect, the occupant can press the left UP/DOWN buttons to adjust the setpoint (setpoint adjustment mode) at any time.

After-hours adjustment mode



Wait several seconds until TIME REMAINING disappears to enter fan speed mode

Fan speed mode

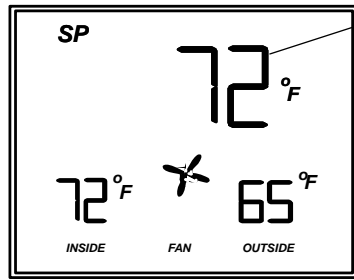


Wait several seconds and then press either right UP/DOWN button to enter after-hours adjustment mode

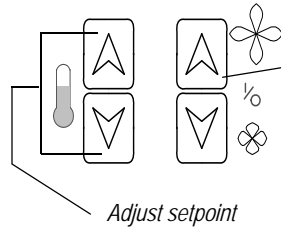
Setpoint adjustment mode

Pressing either left button when the unit is in after-hours override causes the setpoint to display. The occupant can use the left UP/DOWN buttons to adjust the

setpoint.



The setpoint remains displayed until a right button is pressed or the after-hours timer expires



Return to after-hours adjustment mode (either button)

Hotel modes

Hotel modes have a feature set typically used in the hospitality industry.

M6—Hotel, No Fan, Rented

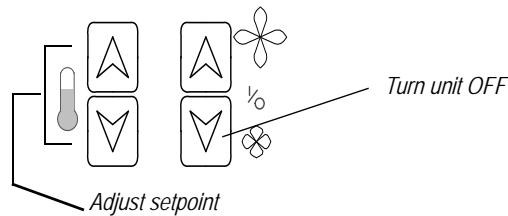
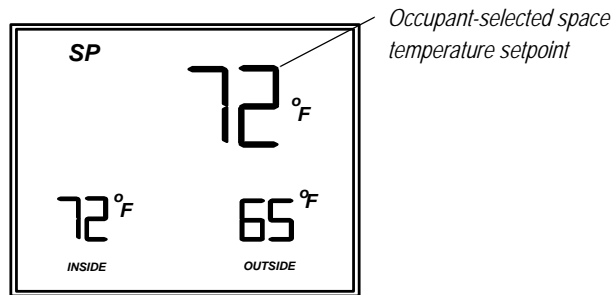
Set BV-64 and BV-81 ON and BV-80 OFF. Operation depends on whether the unit is ON or OFF.

This mode's counterpart is M7, which is activated by setting BV-64 OFF.

Operation when ON

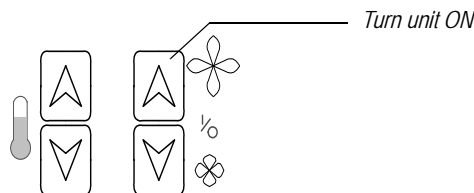
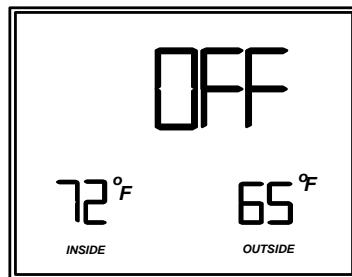
The LCD displays the occupant selected space temperature setpoint (AV-90). The unit controls to occupied heating and cooling setpoints.

The occupant can use the right DOWN button to turn the unit OFF. The occupant can also adjust the setpoint with the left UP/DOWN buttons.



Operation when OFF

The LCD displays the word OFF. The unit controls to unoccupied setpoints. The occupant can press the right UP button to turn the unit ON.

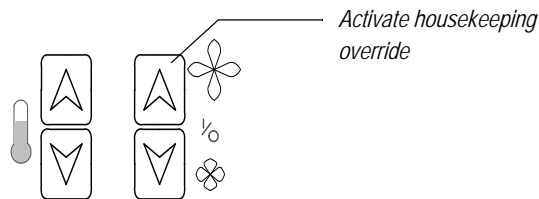
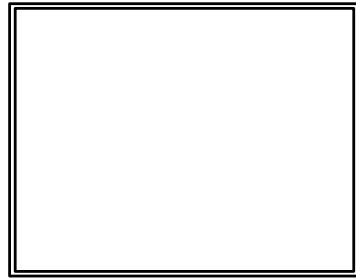


M7—Hotel, No Fan, Vacant

Set BV-81 ON and BV-64 and BV-80 OFF. The unit controls to unoccupied heating and cooling setpoints. The display is blank.

This mode’s counterpart is M6, which is activated by setting BV-64 ON.

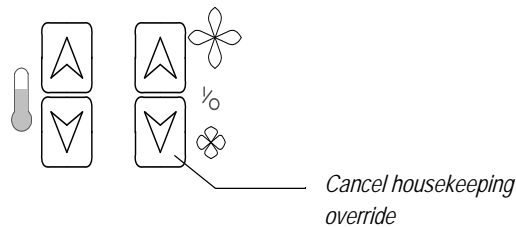
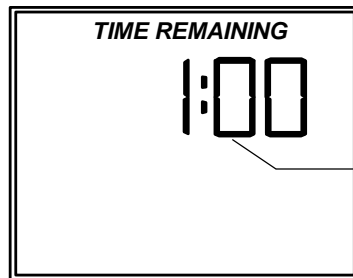
Vacant mode offers a temporary housekeeping override function. Housekeeping can press the right UP button to activate the override, which sets the timer to the override limit (AV-97).



Housekeeping override operation

The LCD displays the override time remaining. The unit controls to occupied setpoints while the override timer (AV-98) is non-zero.

Housekeeping can press the right DOWN button to cancel the override. The timer can't restart until it has timed down or been canceled. The setpoint is not adjustable.



M8—Hotel, Fan, Rented

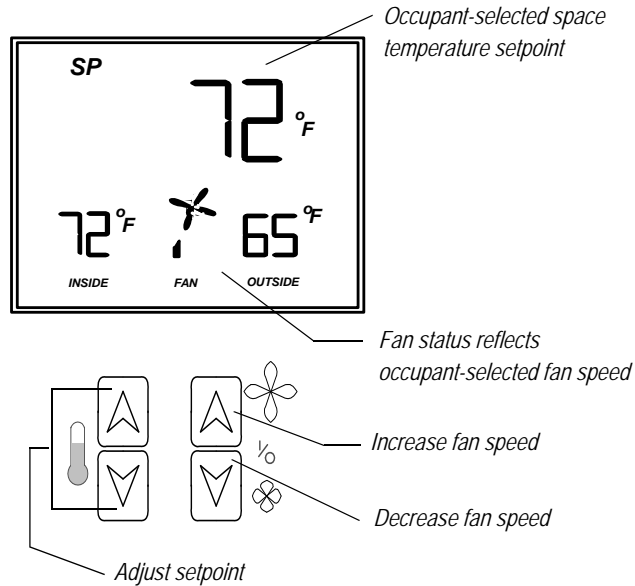
Set BVs 64, 80, and 81 ON. Operation depends on whether the fan is running or stopped.

This mode's counterpart is M9, which is activated by setting BV-64 OFF.

Operation with fan ON

The LCD displays the occupant-selected space temperature setpoint (AV-90) and the fan speed. The unit controls to occupied setpoints.

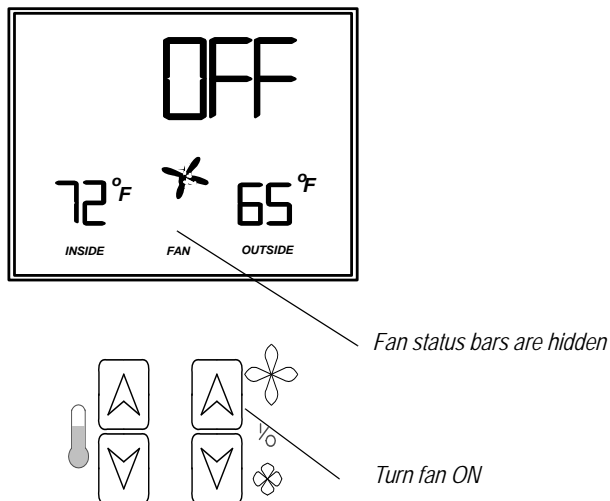
The occupant can adjust the setpoint with the left UP/DOWN buttons. The occupant can also use the right UP/DOWN buttons to change the fan speed or turn the fan OFF.



Operation with fan OFF

If the tenant presses the right DOWN button until the fan turns OFF, the fan symbol stops turning, the fan speed bars are not visible, and the word OFF appears on the LCD. The unit controls to unoccupied setpoints.

The occupant can press the right UP button to turn the unit ON.

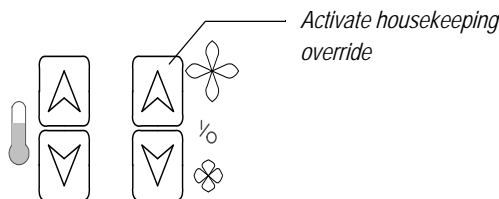
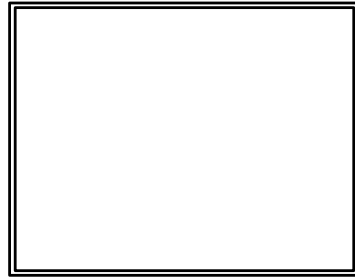


M9—Hotel, Fan, Vacant

Set BV-64 OFF and BV-80 and BV-81 ON. The display is blank. The unit controls to unoccupied heating and cooling setpoints.

This mode’s counterpart is M8, which is activated by setting BV-64 ON.

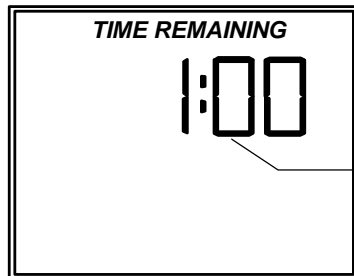
Vacant mode offers a temporary housekeeping override function. Housekeeping can press the right UP button to activate the override, which sets the timer to the override limit (AV-97).



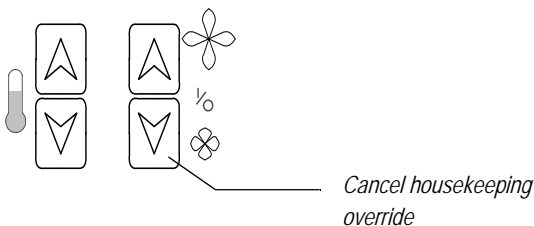
Housekeeping override operation

The LCD displays the override time remaining. The unit controls to occupied setpoints while the override timer (AV-98) is non-zero.

Housekeeping can press the right DOWN button to cancel the override. The timer can’t restart until it has timed down or been canceled. The setpoint is not adjustable.



Housekeeping override time remaining in hh:mm



Field service mode

Field service mode enables technicians to query and command key operating variables in the MS/TP Microset II. A technician presses a particular button sequence at the MS/TP Microset II to enter field service mode. In field service mode a technician uses the left buttons to scroll through data codes and the right buttons to change the value associated with a code.

The lower left of the LCD shows the two-digit data code and the main area displays the data value. A pre-defined list of data codes is available (see Table 6 on page 36).

Note Fixed codes appear with a period after them, which enables a technician to distinguish them quickly from custom codes.

The data range in field service mode is -3276 to 3276 . When a data value is less than -999.9 , the decimal point is automatically dropped.

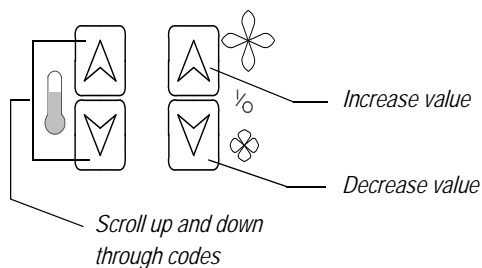
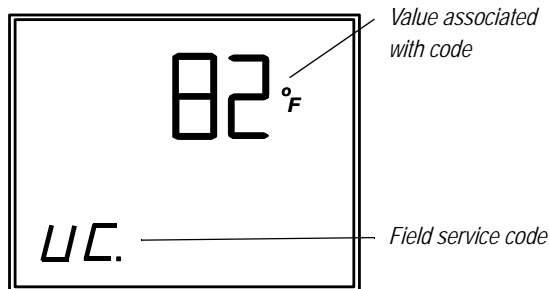
Set BV-68 ON (field service lockout) to deny access to field service mode.

Field service mode ends automatically if there is no button activity for 40 minutes.

► To start field service mode

1. Press and release the left UP button and right UP buttons simultaneously.
2. Repeat step 1.
3. Press the right UP button.
4. Use the left UP/DOWN buttons to set the lower right display item to the number 7.
5. Press the right UP button.

The MS/TP Microset II displays the field service code and its associated value.



► **To adjust values for codes in field service mode**

1. Press the left UP/DOWN button until the code you want to work with appears.
2. Field service codes appear in the order shown in Table 6. Pressing the left DOWN button scrolls down through this list.
3. Press the right UP/DOWN buttons to adjust the value associated with the code.
4. Press the left UP/DOWN button to accept your change and scroll to a different code.

► **To exit field service mode**

- Press the left and right UP buttons simultaneously or press the left and right DOWN buttons simultaneously.

Table 6 Field service mode fixed codes.

Code	Data point	Meaning
UC.	AV-95	Unoccupied cooling setpoint
UH.	AV-96	Unoccupied heating setpoint
CO.	AV-93	Cooling offset
HO.	AV-94	Heating offset
CS.	AV-99	Occupied cooling setpoint

Table 6 Field service mode fixed codes.

Code	Data point	Meaning
HS.	AV-100	Occupied heating setpoint
AL.	AV-97	Override limit
rO.	AV-108	Microset room temperature offset
hO.	AV-109	Space humidity offset
HI.	AV-91	Setpoint high limit
LO.	AV-92	Setpoint low limit
SP.	AV-90	Occupant-selected space temperature setpoint

Setting the MS/TP MAC address and BACnet device instance

Set the MS/TP MAC address and BACnet device instance on the LCD using the MAC/Device Instance field service mode. NOTE: There are no DIP switches on the MS/TP Microset II.

Table 7 MAC/Device Instance Mode (two-digit access code 9)

Display code	Data point	Description	Range
Ad.	n/a	MS/TP MAC address	0-127
D0.	n/a	BACnet device instance (unsigned integer in the 0-4,194, 303)	0-4,194
D1.	n/a	BACnet device instance	0-999 (or 0-303 if D0 is at 4,194)

► **To set the MS/TP MAC address and BACnet device instance**

1. Press and release the left UP button and right UP buttons simultaneously.
2. Repeat step 1.
3. Press the right UP button.
4. Use the left UP/DOWN buttons to set the lower right display item to the number 9.
5. Press the right UP button.

You may also set the BACnet device instance using the Envision for BACtalk front-end, like you can with VLCs. See the *VLC Installation and Operations Guide* (LTBT-TM-Gen4VLC-IOG) for more information.

BACnet object and property reference

This section shows the BACnet objects available in the MS/TP Microset II. The tables that follow list individual points and give details about the properties of each object listed.

MS/TP Microset II objects

Object (instance range)	Remarks
AI-(0)	AI-0 is the MS/TP Microset II internal sensor analog input object.
AV-(90–107)	RESERVED AVs for Alerton legacy Microset behavior.
AV-(0-47)	General use AVs.
BV-(0-47)	General use BVs. BV-40 supports the priority-array property. BV-40 is typically used by Alerton DDC applications to receive scheduled occupancy commands from a global controller. The priority array allows a BACnet user to override the occupancy command. When in Occupancy mode with an internal schedule enabled, internal schedule commands are written to BV-40 priority 16, therefore DDC applications that use BV-40 can easily use either internal or external scheduling.
BV-(99)	Disable unoccupied setpoint deadband
File (254)	Provides information about the ROC file.
Program 254	Firmware program. Entry into boot loader requires writing password to property ALERBP_DOWNLOAD_PASSWORD.
File 240	Legacy method of setting device instance. Has special security feature
File 254	File object used to do firmware download. Has special semantics.
File 260	AI-Linearization data. Only writable by halting associated program object.
Program 260	Allows access to AI-linearization data when halted. Halting requires writing password to property ALERBP_DOWNLOAD_PASSWORD.

Object properties

Device object properties

Property	Access	Notes
Object Identifier	R	
Object Name	R/W	
Object Type	R	
System Status	R	OPERATIONAL
Vendor Name	R	“Alerton”
Vendor Identifier	R	18
Model Name	R	VLC-MS-2100H-MSTP
Firmware Revision	R	(comes from boot loader) initially “RL 5.00 (build x)”
Application Software Version	R	“5.00 (build y)” or similar
Location	R/W	
Description	R/W	
Protocol Version	R	1
Protocol Revision	R	4

Property	Access	Notes
Protocol Services Supported	R	atomicReadFile, atomicWriteFile, readProperty, readPropertyMultiple, writeProperty, writePropertyMultiple, deviceCommunicationsControl, reinitializeDevice, i-Am, unconfirmedPrivateTransfer, timeSynchronization, who-Has, who-Is, utcTimeSynchronization
Protocol Object Types Supported	R	analog-input, analog-output, analog-value, binary-input, binary-output, binary-value, device, file, program, schedule
Object List	R	Too large to return in a single request, so returns “segmentation not supported”. Individual array entries can be read.
Max APDU Length Accepted	R	480
Segmentation Supported	R	no-segmentation
Local Time	R	Default = “00:00:00”. Changed using TimeSync or UTCTimeSync.
Local Date	R	Default = “Jan 1, 1900”. Changed using TimeSync or UTCTimeSync.
UTC Offset	R/W	Default = 0
APDU Timeout	R/W	Default = 6000, limited to 100..60000
Number of APDU Retries	R/W	Default = 3, limited to 0..16
Max Master	R	127
Max Info Frames	RW	Default = 3, limited to 1..60
Device Address Binding	R	Empty List

AI-object properties

Applies to AI-0 only since that is the only analog input object in the MS/TP Microset II.

Property	Access	Notes
Object Identifier	R	
Object Name	R/W	AI-0.
Object Type	R	
Present Value	R/W	Value handled as described in the sequence of operation
Description	R/W	
Status Flags	R	All false
Event State	R	NORMAL
Out Of Service	R	FALSE
Units	R	

AV-object properties

Property	Access	Notes
Object Identifier	R	
Object Name	R/W	“AV-nnn” by default.
Object Type	R	
Present Value	R/W	As described below
Description	R/W	
Status Flags	R	No flags set
Event State	R	Normal
Out Of Service	R	FALSE
Units	R	As described below

BV-object properties

Property	Access	Notes
Object Identifier	R	
Object Name	R/W	“BV-nnn” for most BVs by default.
Object Type	R	
Present Value	R/W	As described below
Description	R/W	
Status Flags	R	No flags set
Event State	R	NORMAL
Out Of Service	R	FALSE
Priority Array	R/W	BV-40 only
Relinquish Default	R/W	BV-40 only

BV and AV assignments

Each MS/TP Microset II has a number of pre-assigned data points—Binary and Analog Values (BVs and AVs). These data points are available from the MS/TP Microset II as BACnet objects; BACnet-compliant devices can access the properties of these objects. For a complete reference of objects and properties available in MS/TP Microset IIs, see the *Programmer's Guide and Reference for BACTalk Systems (LTBT-TM-PRGRMR)*.

Note Table 8 and Table 9 are concerned only with the Present Value property of the AV and BV objects. These are listed as Data Points.

Table 8 BV assignments for the MS/TP Microset II.

Data point	Read only	Description	ON action/status	OFF action/status
BV-64		Controls occupied/unoccupied, rented/vacant status (see Table 5 on page 22).	Sets MS/TP Microset II to occupied or rented operation.	Sets MS/TP Microset II to unoccupied or vacant operation.
BV-65		Enables and disables ON/OFF mode (see Table 5 on page 22).	Enable ON/OFF mode.	Disable ON/OFF mode.
BV-66	X	Override status. Activated in unoccupied/vacant modes when the user initiates override from the MS/TP Microset II.	ON when override timer (AV-98) is non-zero.	OFF when override timer (AV-98) is zero.
BV-67	X	Occupied status. Reflects value of BV-64 or BV-66 as appropriate. Also reflects user selection of ON/OFF mode when BV-64 is ON (see Table 5 on page 22). Use this as a flag in DDC to control equipment occupied/unoccupied operation.	Space is occupied. Current setpoints (AV-99, AV-100) calculated using occupied logic.	Space is unoccupied. Current setpoints (AV-99, AV-100) calculated using unoccupied logic.
BV-68		Field service mode and balance mode lockout.	Lockout field service mode and balance mode.	Allow field service mode and balance mode access.
BV-69		English/metric mode swap. See “English and metric units” on page 18.	Swap native units mode from English to Metric or vice versa.	Use units as determined by native units mode.
BV-70	X	MS/TP Microset II connection status.	MS/TP Microset II connection detected.	MS/TP Microset II not detected.
BV-71	X	Native units mode status.	English units.	Metric units.
BV-72 ^a		Fan low speed.	Enable fan low speed status indicator at Microset II.	
BV-73 ^a		Fan medium speed.	Enable fan medium speed indicator at Microset II.	
BV-74 ^a		Fan high speed.	Enable fan high speed indicator at MS/TP Microset II.	
BV-75		Link AV-101 to AI-0.	AI-0 is automatically transferred to AV-101.	

Table 8 BV assignments for the MS/TP Microset II. (continued)

Data point	Read only	Description	ON action/status	OFF action/status
BV-76		Reserved for future fan auto icon.	n/a	n/a
BV-77		Display/hide heating icon.	Display heating icon.	Hide heating icon.
BV-78		Display/hide cooling icon.	Display cooling icon.	Hide cooling icon.
BV-79		LCD backlight command. See “LCD backlight operation” on page 19.	LCD backlight ON continuously.	LCD backlight is ON only in response to button activity.
BV-80		Fan control mode (see Table 5 on page 22).	Fan control mode.	No-fan-control mode.
BV-81		Select office mode or hotel mode operation (see Table 5 on page 22).	Hotel mode.	Office mode.
BV-82		Space temperature and time displays alternate.	Enable alternate time of day display.	Disable alternate time of day display.
BV-83		Select 12- or 24-hour time format.	Display time in 24-hour format.	Display time in 12-hour format.
BV-84		Display/hide room humidity.	Display room humidity.	Hide room humidity.
BV-85		Backlight Disable. BV-85 has priority over BV-79. Regardless of BV-85’s state, the backlight turns ON during the first few seconds at startup when the display test and revision code are shown.	Disable backlight.	Factory default; backlight is enabled.
BV-99		Disable unoccupied setpoint deadband		

a. These BVs can be written to in DDC. They are also affected by the occupant selection of fan speed. Only one of these BVs can be ON at once; otherwise, the fan displays high fan status. When fan is OFF, these BVs are OFF.

Table 9 AV assignments for the MS/TP Microset II.

Data point	Read only	Description
AV-90		Occupant-selected space temperature setpoint. May be written to in DDC.
AV-91		Setpoint high limit. Value of AV-90 can’t exceed this value.
AV-92		Setpoint low limit. Value of AV-90 can’t be below this value.
AV-93		Cooling offset in degrees. Added to the value of AV-90 in calculation of AV-99. See “Cooling and heating setpoint calculation” on page 17.
AV-94		Heating offset in degrees. Subtracted from the value of AV-90 in calculation of AV-100. See “Cooling and heating setpoint calculation” on page 17.
AV-95		Unoccupied cooling setpoint.
AV-96		Unoccupied heating setpoint.

Table 9 AV assignments for the MS/TP Microset II. (continued)

Data point	Read only	Description
AV-97		Override timer limit. After-hours override timer limit is in hours—3.5 = 3 hours 30 minutes. Housekeeping timer limit is in minutes—3.5 = 3 minutes 30 seconds.
AV-98		After-hours/housekeeping override timer value. Resets to 0 when BV-64 is ON.
AV-99	X	Current cooling setpoint. Equal to AV-90 + AV-93 + AV-106 while occupied (BV-67 ON). Equal to AV-95 while unoccupied (BV-67 OFF).
AV-100	X	Current heating setpoint. Equal to AV-90 – AV-94 – AV-106 while occupied (BV-67 ON). Equal to AV-95 while unoccupied (BV-67 OFF).
AV-101 ^a		Space temperature to display. Range is 0–127°F (-18–53°C).
AV-102	X	Humidity, read directly from MS/TP Microset II humidity sensor.
AV-103		Outside air temperature (OAT) to display on MS/TP Microset II. Temperature range is -99–127°F (-73–53°C).
AV-106 ^b		Demand offset.
AV-107 ^c		Outside humidity (in %RH) to display on MS/TP Microset II.
AV-108		Microset room temperature offset.
AV-109		Microset space humidity offset.

a. The temperature read by the MS/TP Microset II is available as AI-0. BV-75 controls transfer of AI-0 to AV-101.

b. Typically, this is a demand offset value controlled by a BACtalk demand limiting program or by an global controller DDC demand limiting algorithm.

c. This value displays while AV-107 is non-zero. If another unit reads outside humidity, DDC writes this value to AV-107.