MS Series Multi-Stage Electronic Temperature Controls

The MS Series Controls are versatile, microprocessor-based, multifunction, programmable temperature controls. They are designed for single and multiple stage temperature control applications.

Depending on the model selected, the MS Series Controls can operate in the following modes:

- *Direct mode*

- *Reverse mode*

- *Deadband mode*

- *Independent Setpoint mode*

The MS Series Controls have large, easy-to-read, red Light-Emitting Diode (LED) displays. These compact controls are available in Panel Mount and DIN Rail Mount models. MS Series Controls use the A99B temperature sensors, which allow remote mounting of the display unit.

Figure 1: MS4 Panel Mount and DIN Rail Multi-Stage Electronic Temperature Controls

Features and Benefits	
❑ **Programmable Functions**	Allows adjustment of control settings to meet application needs
❑ **Alarm Management Functions**	Provides visible alarm codes on the display
❑ **Easily Readable LED Display**	Displays temperature and functions quickly and clearly
❑ **Programming Button Lockout**	Allows user to disable programming buttons and deter accidental or unauthorized changes
❑ **Accurate Sensors for Temperature**	Provides accurate control performance with up to 300 feet of wiring (an adjustable offset is provided for longer wiring)
❑ **Self-Test Procedure**	Checks control operation by cycling all outputs and testing all LEDs

Overview

IMPORTANT:	All MS Series Controls are designed for use **only** as operating controls. Where an operating control failure would result in personal injury or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Refer to a specific model's installation bulletin for the necessary information on installation, use, and servicing.

Table 1: Selected Applications

MS1	MS2	MS4	Application
✔	✔	✔	Cooling tower pump and/or fan control
✔	✔	✔	Rooftop heating or cooling units
✔	✔	✔	Boiler or pump control
✔	✔	✔	Space temperature control
	✔	✔	Compressor or chiller staging

Mode Selection

Mode Selection allows selection of one of several modes, depending on the model:

- Direct mode for cooling applications

- Reverse mode for heating applications

- Deadband mode for applications requiring cooling and heating with a common setpoint and a deadband

- Independent Setpoint mode for applications requiring cooling and heating with an independent setpoint for each

Stage Control Functions

Adjustable Setpoint Stops restrict setpoint adjustment to avoid extreme settings. The setpoint cannot be changed to a value outside of these stops.

Soft Start controls the rate at which temperature approaches the setpoint on power up, both initially and when the binary input is configured as a remote shutoff.

Anti-short Cycle Delay avoids situations where the equipment starts, stops, and restarts in a short period of time. This feature determines the minimum time between two subsequent On cycles of the equipment.

Binary Input Functions

The MS2 and MS4 controls are equipped with a binary input that can perform one of the following functions:

- **Shutoff and Alarm Signaling**: When the binary input is open for a time longer than the binary input time delay, all outputs are shut off and an alarm message is displayed. Restart does not use the soft start feature.

- **Setback**: When the binary input is open, the setpoints are shifted by a preset value in order to save energy.

- **Remote Shutoff**: When the binary input is open for a time longer than the binary input time delay, all outputs are shut off and an alarm message is displayed. Restart uses the soft start feature.

Dual Sensor Temperature Reset

This feature resets the Setpoint based on the difference between temperature reading from the Auxiliary Temperature Sensor (ATS) and the setpoint. This feature is available only on the MS4 Series and can only be used when the ATS is connected.

Alarm Management Functions

High and Low Temperature Alarms have setpoints relative to the main setpoint. If the temperature reaches or exceeds the alarm values, the display flashes a specific alarm message. On the MS1, an alarm output circuit is energized. The MS2 and MS4 controls have no alarm output. Alarms are disabled for 20 minutes after startup in addition to the alarm time delay.

Alarm Time Delay is used to avoid short-duration events triggering the alarm.

Alarm Differential can be set to keep the alarm from cycling rapidly on and off.

Sensor Failure is indicated by an alarm message on the display.

Alarm codes are displayed by the LEDs and are used to help troubleshoot errors. Alarm codes exist for these conditions:

- process sensor failure
- high temperature alarm
- low temperature alarm
- program failure
- binary input codes

Self-Test Procedure

The self-test procedure allows the user to verify that the LEDs and outputs of an MS control are operating correctly before the control is put into service.

Additional Features

Programming Button Lockout allows the programming buttons to be deactivated, which deters accidental or unauthorized modifications to the settings.

Sensor Offset allows programming an offset of the measured temperature for use with sensor leads longer than 300 ft.

Display Updating Time provides an adjustable refresh rate to avoid displaying short duration fluctuations.

Units of Measurement for temperature measurement can use either Fahrenheit or Celsius temperature scales.
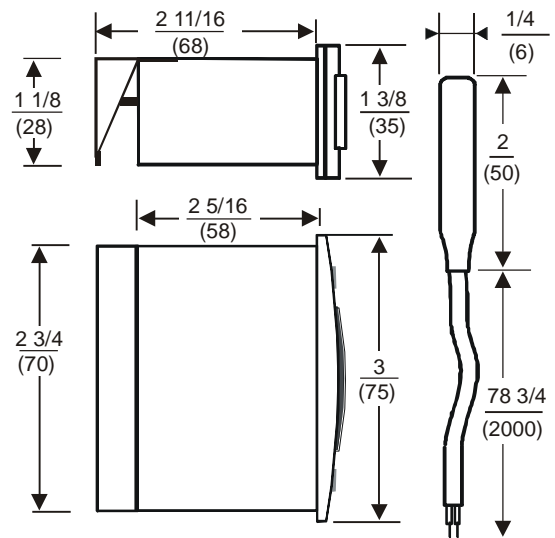
Dimensions

Figure 2: Panel Mount Control and A99 Sensor, in. (mm)
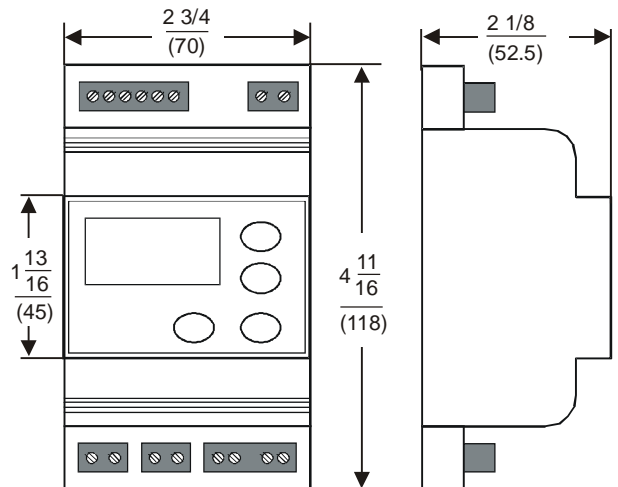

Figure 3: DIN Rail Mount Control, in. (mm)

Display

The display has two 7-segment LEDs and a minus (-) indication to display temperatures from -40 to 99°F (-40 to 70°C), with 1F° (C°) resolution. Three individual stage status LEDs display the relay status.

- LED ✶ indicates Relay Output 1 is energized.

- LED ✳ indicates Relay Output 2 is energized.

- LED ✸ indicates Relay Output 3 is energized.

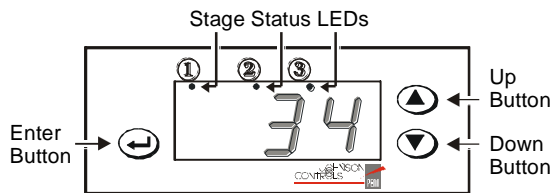The MS1 has one stage status LED. The MS2 has two stage status LEDs. The MS4 has three stage status LEDs.

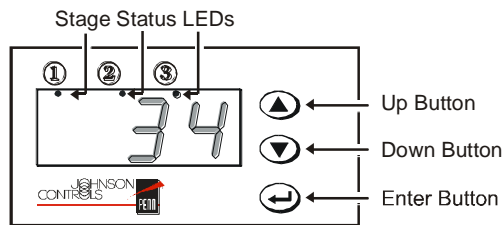**Figure 4: Panel Mount Front Panel and Display**

Figure 5: DIN Rail Mount Front Panel and Display

The MS1 has one stage status LED. The MS2 has two stage status LEDs. The MS4 has three stage status LEDs.

Modes of Operation

The MS1 Series Control performs temperature and alarm management for single-stage applications. It operates in either Direct or Reverse modes.

The MS2 Series Control performs temperature management for 2-stage applications. In addition to the MS1 modes, it has Deadband and Independent Setpoint modes for applications that require both cooling and heating.

The MS4 Series Control performs temperature management for 4-stage applications. It has the same mode selection as the MS2. It can automatically adjust the setpoint to save energy, based on readings from the auxiliary temperature sensor and the function settings.

Table 2: Modes of Operation

MS1	MS2	MS4	Modes of Operation
✔	✔	✔	Direct (Cooling)
✔	✔	✔	Reverse (Heating)
	✔	✔	Deadband (Cooling and Heating)
	✔	✔	Independent Setpoint (Cooling and Heating)

The illustrations on the following pages show the modes that each MS Series Control is capable of using.
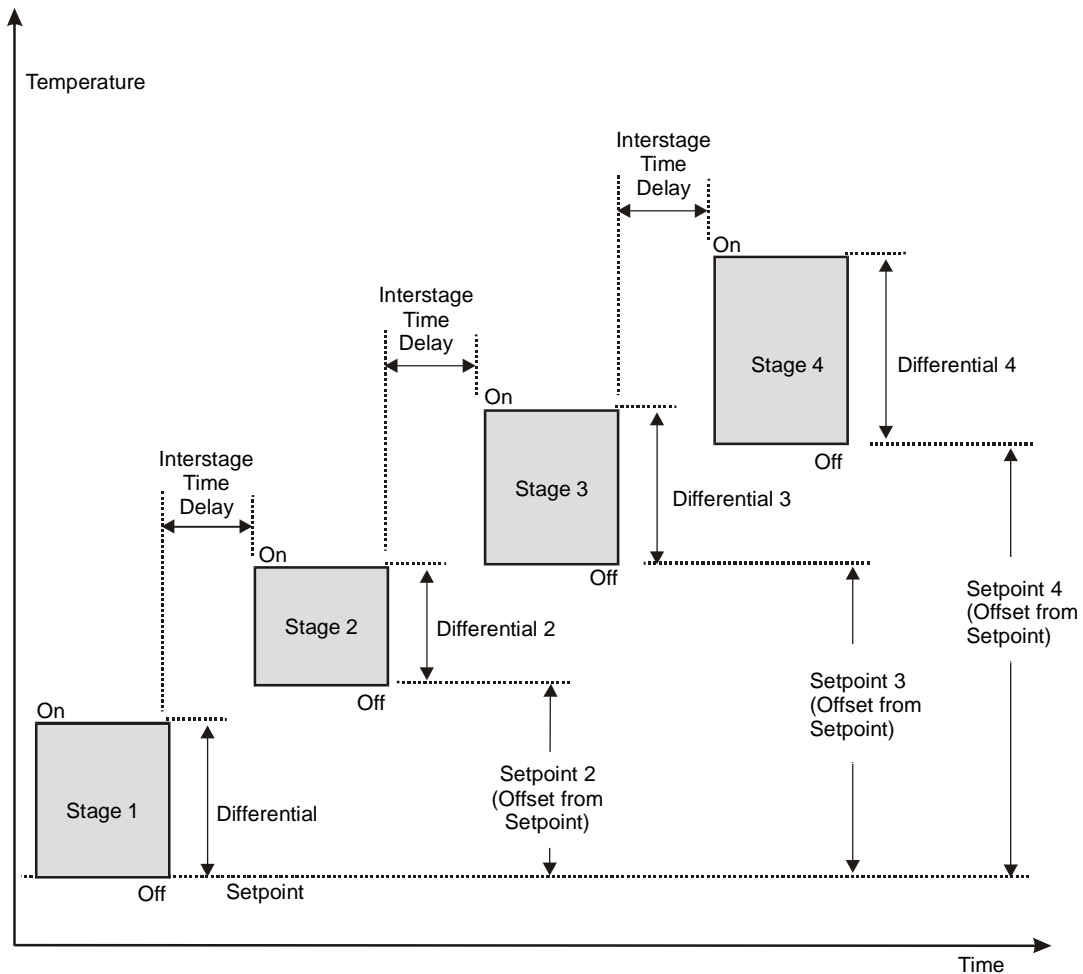
Direct Mode (Cooling)

Figure 6: Direct Mode

Direct mode is used for cooling applications. The MS1 has one stage. The MS2 has two stages. The MS4 has four stages. Where desirable, stages may overlap or have space between them.

Setpoint is the desired temperature.

Differential is the operational range of Stage 1.

Setpoint 2 is the offset from setpoint that activates Stage 2.

Differential 2 is the operational range of Stage 2.

Setpoint 3 is the offset from setpoint that activates Stage 3.

Differential 3 is the operational range of Stage 3.

Setpoint 4 is the offset from setpoint that activates Stage 4.

Interstage Time Delay is the minimum amount of time between two successive stages when multiple stages are called for in rapid sequence.
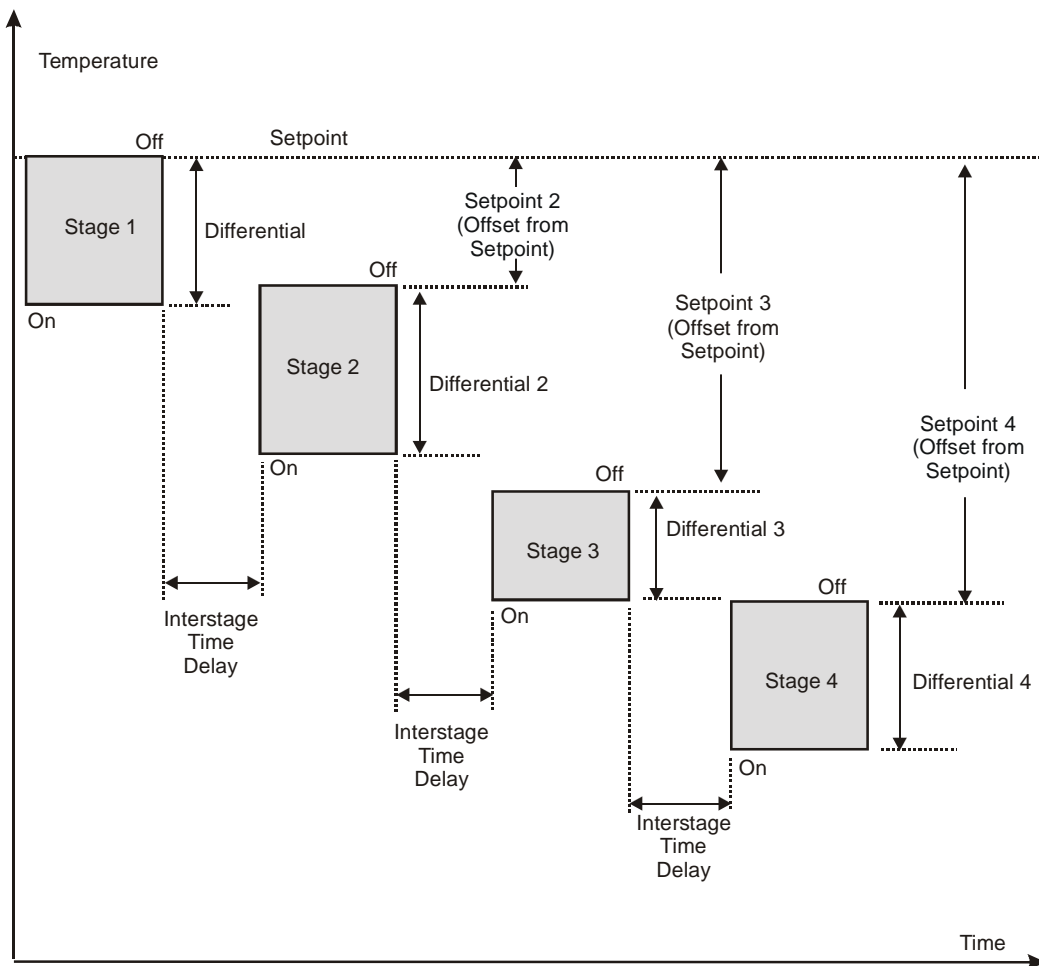
Reverse Mode (Heating)

Figure 7: Reverse Mode

Reverse mode is used for heating applications. The MS1 has one stage. The MS2 has two stages. The MS4 has four stages. Where desirable, stages may overlap or have space between them.

Setpoint is the desired temperature.

Differential is the operational range of Stage 1.

Setpoint 2 is the offset from setpoint that activates Stage 2.

Differential 2 is the operational range of Stage 2.

Setpoint 3 is the offset from setpoint that activates Stage 3.

Differential 3 is the operational range of Stage 3.

Setpoint 4 is the offset from setpoint that activates Stage 4.

Differential 4 is the operational range of Stage 4.

Interstage Time Delay is the minimum amount of time between two successive stages when multiple stages are called for in rapid sequence.
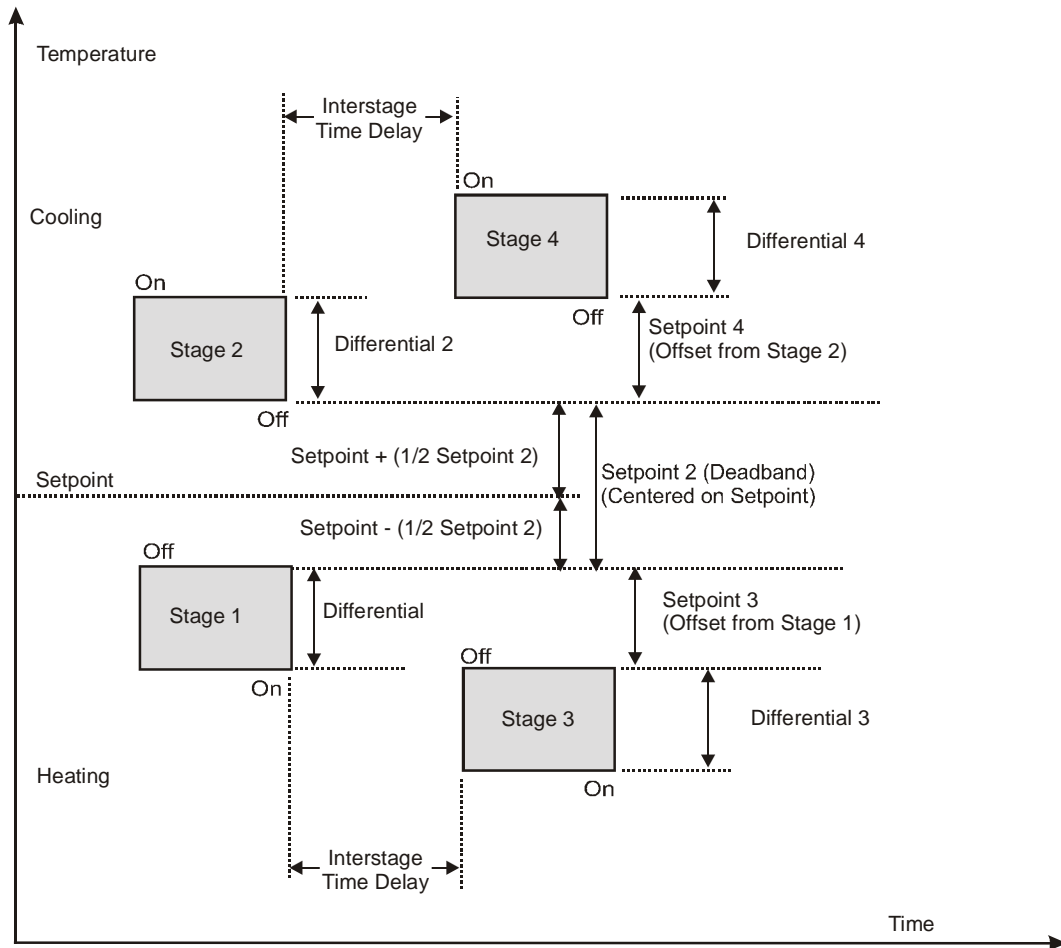
Deadband Mode

Figure 8: Deadband Mode

Deadband mode is used for applications requiring cooling and heating. The MS2 has two stages. The MS4 has four stages. Where desirable, stages may overlap or have space between them.

Setpoint is the desired temperature.

Differential is the operational range of Stage 1.

Setpoint 2 is width of the deadband, which is centered on setpoint.

Differential 2 is the operational range of Stage 2.

Setpoint 3 is the offset from the low end of the deadband that activates Stage 3.

Differential 3 is the operational range of Stage 3.

Setpoint 4 is the offset from the high end of the deadband that activates Stage 4.

Differential 4 is the operational range of Stage 4.

Interstage Time Delay is the minimum amount of time between two successive stages when multiple stages are called for in rapid sequence.
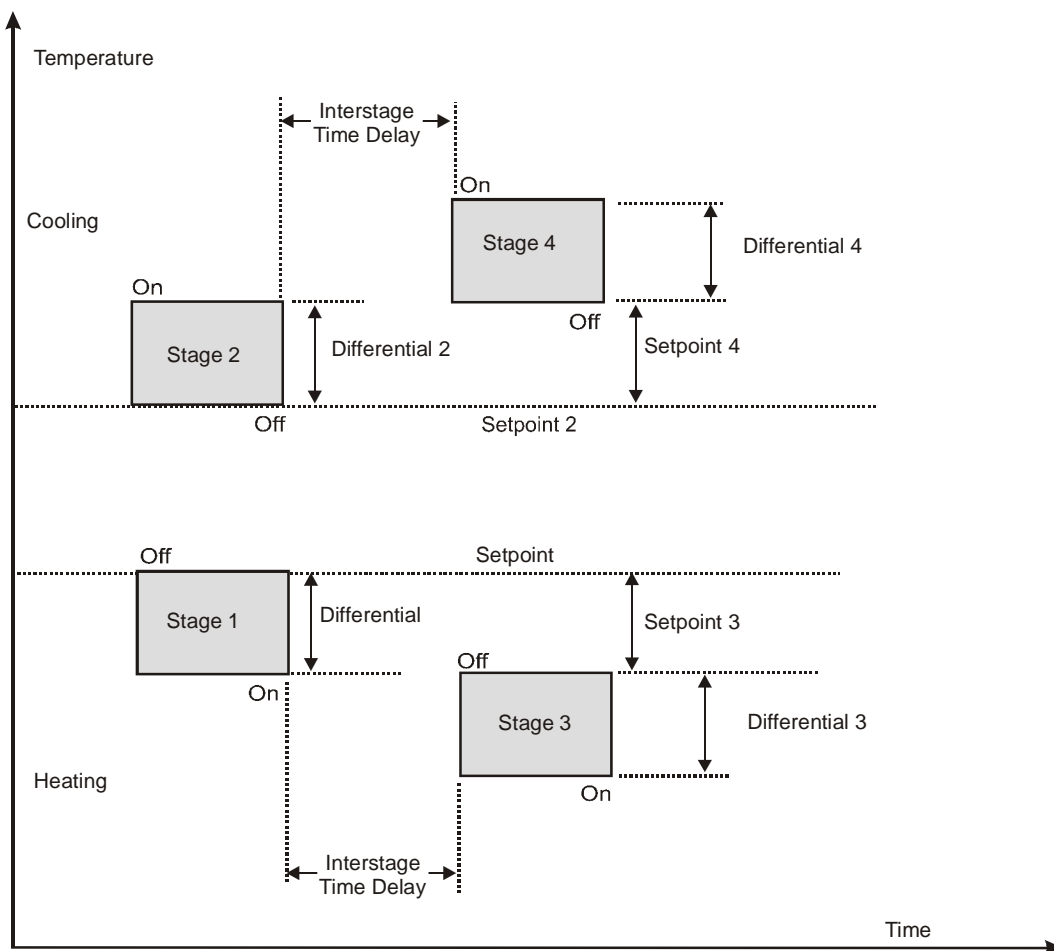
Independent Setpoint Mode

Figure 9: Independent Setpoint Mode

Independent Setpoint mode is used for applications requiring cooling and heating. The MS2 has two stages. The MS4 has four stages. Where desirable, stages may overlap or have space between them.

Setpoint is the desired heating temperature. It is the basis for the reverse stages.

Differential is the operational range of Stage 1.

Setpoint 2 the desired cooling temperature programmed by the user. It is the basis for the direct stages.

Differential 2 is the operational range of Stage 2.

Setpoint 3 is the offset from Setpoint that activates Stage 3.

Differential 3 is the operational range of Stage 3.

Setpoint 4 is the offset from Setpoint 2 that activates Stage 4.

Differential 4 is the operational range of Stage 4.

Interstage Time Delay is the minimum amount of time between two successive stages when multiple stages are called for in rapid sequence.

Function Definitions

The MS Series controls include a variety of temperature and alarm management functions, which are listed below. Not all of these functions are available on every model.

Refer to Table 3 for functions and setting ranges for specific models.

Temperature Management

Setpoint is the primary control point programmed by the user.

Setpoint 2, Setpoint 3, Setpoint 4 depend on the mode used. For information on function in each mode, see *Modes of Operation*.

Differentials (or hysteresis) establishes the difference between the value at which the output is switched Off and the value at which the output is switched On. For further information, see *Modes of Operation.*

Example: In Direct (cooling) mode, with the setpoint at 40°F, and the differential at 4F°, the compressor is switched On when the temperature goes above 44°F, and is turned Off when the temperature decreases to below 40°F.

High and Low Setpoint Stops are temperature settings (°F or °C) that define how high and low the primary **setpoint** may be adjusted. Setpoint stops deter unauthorized or accidental overadjustment of **setpoint**.

Anti-short Cycle Timer, Direct establishes the minimum time in minutes between two subsequent On cycles of Direct (cooling) stages.

Anti-short Cycle Timer, Reverse establishes the minimum time in minutes between two subsequent On cycles of reverse (heating) stages.
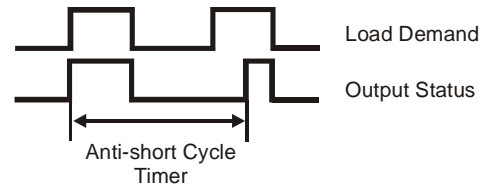

Figure 10: Anti-short Cycle Timer

Interstage Time Delay is the minimum amount of time between two successive stages when multiple stages are called for in rapid sequence.

Soft Start controls the rate at which the process temperature is allowed to approach the **setpoint** on power up, both initially and when the binary input is configured as remote shutoff. The setting is minutes/temperature units, such as minutes/F°.

Example:

Process temperature = 20°
Setpoint = 30°
Soft start = 2 minutes

Rate of Increase =
Soft start x (**setpoint** – sensor reading)

Process setpoint increases by 1° every two minutes, until the setpoint temperature is reached. To go from 20° to 30° takes 10 minutes.

Temperature Sensor Offset allows the user to compensate for temperature differences between actual and displayed temperature, such as those experienced when using long sensor leads or when the location of the sensor results in inaccurate readings.

Temperature Units allows the user to select either the Fahrenheit or Celsius temperature scale.

Display Refresh Rate establishes the time delay (seconds) between updates of the temperature display.

Heating Reset and **Cooling Reset** are used in Deadband mode. The reset is an automatic shift of the **setpoint**, based on the temperature at the Auxiliary Temperature Sensor (ATS).

Non-compensated Band establishes the temperature range (F° or C°) over which reset does not take place.

Alarm Management

High Temperature Alarm sets the temperature (°F or °C) relative to setpoint at which the control goes into a high temperature alarm condition.

Example: If setpoint is 40°F and **high temperature alarm** is 15F°, the alarm message will be displayed at or above 55°F.

Low Temperature Alarm sets the temperature (°F or °C) relative to setpoint at which the control goes into a low temperature alarm condition.

Example: If setpoint is 40°F and low temperature alarm is -10F°, an alarm message will be displayed at or below 30°F.

Alarm Differential establishes the difference (F° or C°) between the temperature at which the alarm is activated and the temperature at which the alarm is deactivated. On the MS1, alarm activation triggers an external alarm and displays an alarm message. On the MS2 and MS4, an alarm message is displayed.

Example (cooling):
Setpoint = 40°F
High Temperature Alarm = 15F°
Alarm Differential = 2F°

When the room temperature exceeds 40 + 15 = 55°F for a time greater than the **alarm time delay** setting, the alarm message is displayed; however, it will reset after the temperature drops below 40+15-2=53°F.

Alarm Time Delay establishes the time delay (minutes) between reaching an alarm condition (high or low temperature) and activating the alarm. This function reduces nuisance alarms caused by transient changes that temporarily exceed alarm setpoint temperatures. Conditions that would cause a temperature alarm are disregarded by the unit during the first 20 minutes after power up.

Binary Input

Binary Input Function allows the user to select how the binary input will activate the stage control contacts. The user can select to disengage this function or set one of three actions:

- **Shutoff and Alarm Signaling** - If the binary input contact is open for a time longer than that set through the **binary input time delay**, the stage control contacts are switched Off, and an alarm message (A1) is displayed. On the MS1, the alarm is also activated.

- **Setback** - If the binary input contact is open for a time longer than that set through the **binary input time delay**, the setpoints are shifted by **setback**. Reverse setpoints (heating) decrease. Direct setpoints (cooling) increase.

- **Remote Shutoff** of the outputs. - If the binary input contact is open for a time longer than that set through the **binary input time delay**, the stage control contacts are switched Off.

If a set of stage control contacts are used to control an external alarm, this function should be disabled.

Binary Input Time Delay establishes the time delay (minutes) between binary signal reaching the control and control's response to the binary signal.

Setback determines the value of the setpoint shift when the binary input is open and the **binary input function** is set at setback.

Temperature Reset

Heating reset, cooling reset, and Non-compensated Band (NCB) are used only with the MS4. Heating reset only affects the heating setpoint, and cooling reset only affects the cooling setpoint. These functions appear only when the Auxiliary Temperature Sensor (ATS) is connected.

Heating Reset

When the ATS reading is lower than the setpoint, and the difference exceeds the deadband, temperature reset will take place. The setpoint will be lowered. Degrees of reset are equal to:

[ATS – (setpoint – NCB)] / heating reset

Cooling Reset

When the Auxiliary Temperature Sensor (ATS) reading is higher than the setpoint, and the difference exceeds the deadband, temperature reset will take place. The setpoint will be raised. Degrees of reset are equal to:

[ATS – (setpoint + NCB)] / cooling reset

Non-compensated Band (NCB)

The temperature range over which reset does not take place.

Temperature Reset Examples

Heating Reset Example:
Setpoint = 70°
Auxiliary Temperature Sensor (ATS) = 42°
NCB = 20°
Heating Reset = 2°

Step 1
ATS–(setpoint–NCB) = differential
42 – (70 – 20) = -8

Step 2
differential/heating reset = reset
-8/2 = -4

Step 3
setpoint + reset
70 + (-4) = 66

Setpoint is reset to 66° to save energy.

Cooling Reset Example:
Setpoint = 70°
Auxiliary Temperature Sensor (ATS) = 92°
NCB = 10°
Cooling Reset = 2°

Step 1
ATS–(setpoint + NCB) = differential
92 – (70 + 10) = 12

Step 2
differential/cooling reset = reset
12/2 = 6

Step 3
setpoint + reset
70 + 6 = 76

Setpoint is reset to 76° to save energy.

Heating Reset
Only Affects Heating Stages

Cooling Reset
Only Affects Cooling Stages
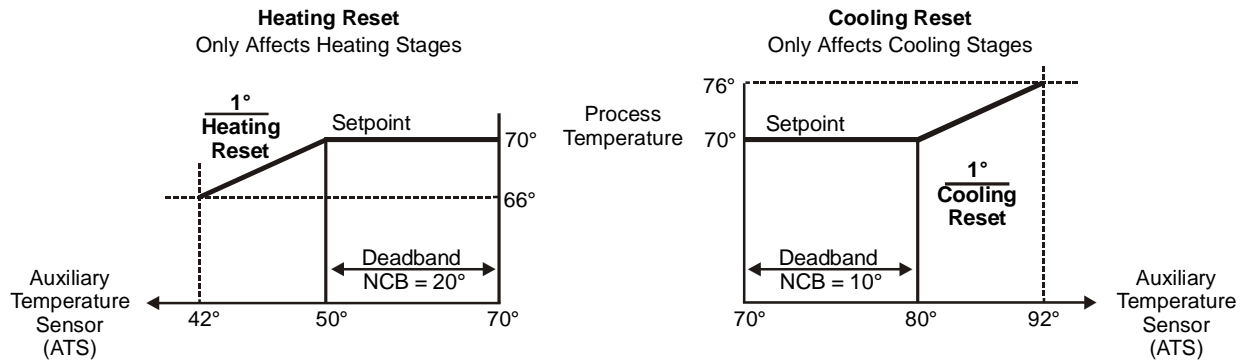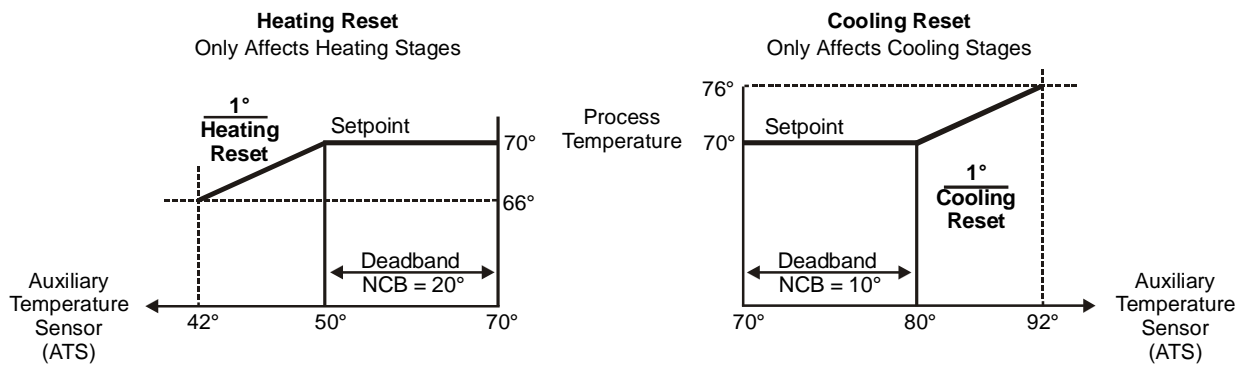
Figure 11: Temperature Reset Examples

Table 3: Functions and Settings

MS1	MS2	MS4	Setting	Setting Range
✓	✓	✓	**Mode Selection**	D = Direct (Cooling)
✓	✓	✓		R = Reverse (Heating)
	✓	✓		B = Deadband (Direct and Reverse)
	✓	✓		I = Independent Setpoint (Direct and Reverse)
✓	✓	✓	**Setpoint**	-40 to 99°F (-40 to 70°C)
✓	✓	✓	**Differential 1**	F°/1 to 9 C°
	✓	✓	**Setpoint 2**	D, R modes 1 to 40F° (1 to 40C°)
				B mode 2 to 40F° (2 to 40C°)
				I mode Low to High Setpoint Stop
	✓	✓	**Differential 2**	1 to 9F° (1 to 9C°)
		✓	**Setpoint 3**	1 to 40F° (1 to 40C°)
		✓	**Differential 3**	1 to 9F° (1 to 9C°)
		✓	**Setpoint 4**	1 to 40F° (1 to 40C°)
		✓	**Differential 4**	1 to 9F° (1 to 9C°)
✓	✓	✓	**Low Setpoint Stop**	-40° to High Setpoint Stop
✓	✓	✓	**High Setpoint Stop**	Low Setpoint Stop to 99°F (70°C)
	✓	✓	**Interstage Time Delay**	3 to 90 seconds
✓	✓	✓	**Anti-short Cycle Timer, Direct**	0 to 9 minutes
✓	✓	✓	**Anti-short Cycle Timer, Reverse**	0 to 9 minutes
✓	✓	✓	**Soft Start**	0 to 99 minutes/1F° (1C°)
		✓	**Heating Reset**	0 to 6F° (0 to 6C°)
		✓	**Cooling Reset**	0 to 6F° (0 to 6C°)
		✓	**Non-compensated Band**	0 to 20F° (0 to 20C°)
✓	✓	✓	**Sensor Offset**	-20 to +20F° (-20 to +20C°)
✓	✓	✓	**Units Used**	0 = °C 1 = °F
✓	✓	✓	**Display Refresh Rate**	1 to 99 seconds
✓	✓	✓	**High Temperature Alarm**	0 to 50F° (0 to 50C°) above Setpoint
✓	✓	✓	**Low Temperature Alarm**	-50 to 0F° (-50 to 0C°) below Setpoint
✓	✓	✓	**Alarm Differential**	1 to 9F° (1 to 9C°)
✓	✓	✓	**Alarm Time Delay**	0 to 99 minutes
	✓	✓	**Binary Input Function**	0 = No binary input 1 = Shutoff and alarm signaling 2 = Setback 3 = Remote shutoff
	✓	✓	**Setback**	0 to 20F° (0 to 20C°)
	✓	✓	**Binary input Time Delay**	0 to 99 minutes

*M*S1 – One Stage Electronic Temperature Control

The MS1 control is designed for 1-stage temperature and alarm control applications. This model uses the A99B Series temperature sensors.
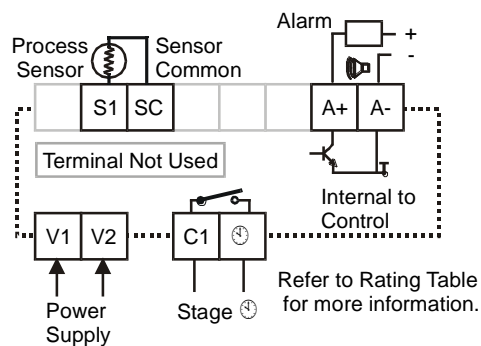

Figure 12: MS1 DIN Rail Mount Wiring

Table 4: Rating Table

Rating Category	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	-
Full Load Amperes	5.8	4.9	-
Locked Rotor Amperes	34.8	29.4	-
Inductive (non-motor) Amperes	8	8	8
Pilot Duty VA	275	450	-

Alarm circuit is 40 VDC, 100 mA maximum.
Alarm requires separate power source.
Power supply is 24 VAC.

Modes of Operation

- Direct (Cooling)
- Reverse (Heating)

Temperature Management Settings

- Setpoint
- Differential (Hysteresis)
- Low Setpoint Stop
- High Setpoint Stop
- Anti-short Cycle Timer
- Soft Start
- Temperature Sensor Offset
- Temperature Units Used
- Display Refresh Rate

Alarm Management Settings

- High Temperature Alarm
- Low Temperature Alarm
- Alarm Differential
- Alarm Time Delay

Table 5: Ordering Information

Product Code Number	Description
MS1DR24T-11C	MS1 DIN Rail Mount Control; A99BB-200C sensor included; shipping weight 0.75 lb (340 g)

MS2 – Two Stage Electronic Temperature Control

The MS2 control is designed for 2-stage temperature control applications. These models use the A99B Series temperature sensors.
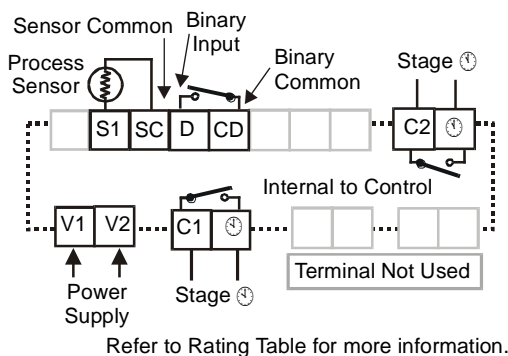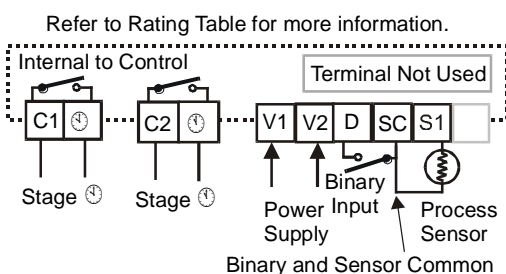

Refer to Rating Table for more information.

Figure 13: MS2 DIN Rail Mount Wiring

Refer to Rating Table for more information.

Figure 14: MS2 Panel Mount Wiring

Table 6: Rating Table

Rating Category	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	-
Full Load Amperes	5.8	4.9	-
Locked Rotor Amperes	34.8	29.4	-
Inductive (non-motor) Amperes	8	8	8
Pilot Duty VA	275	450	-

Power supply is 24 VAC.

Modes of Operation

- Direct (Cooling)
- Reverse (Heating)
- Deadband (Cooling and Heating)
- Independent Setpoint (Cooling and Heating)

Temperature Management Settings

- Multiple Setpoints
- Multiple Differentials (Hysteresis)
- Low Setpoint Stop
- High Setpoint Stop
- Interstage Time Delay
- Anti-short Cycle Timers
- Soft Start
- Temperature Sensor Offset
- Temperature Units Used
- Display Refresh Rate

Alarm Management Settings

- High Temperature Alarm
- Low Temperature Alarm
- Alarm Differential
- Alarm Time Delay

Binary Input Management Settings

- Binary Input Function Selection
- Binary Input Time Delay
- Setback

Table 7: Ordering Information

Product Code Number	Description
MS2DR24T-11C	MS2 DIN Rail Mount Control; A99BB-200C sensor included; shipping weight 0.79 lb (360 g)
MS2PM24T-11C	MS2 Panel Mount Control; A99BB-200C sensor included; shipping weight 0.53 lb (240 g)

MS4 – Four Stage Electronic Temperature Control

The MS4 control is designed for 4-stage temperature control applications. These controls use the Johnson Controls/PENN A99B temperature sensor.
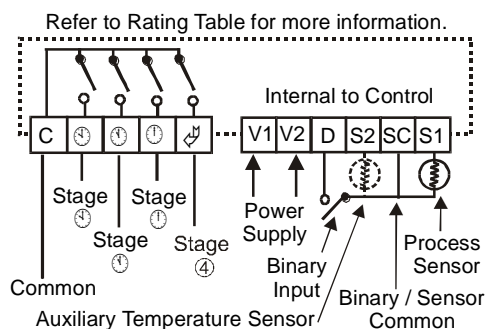

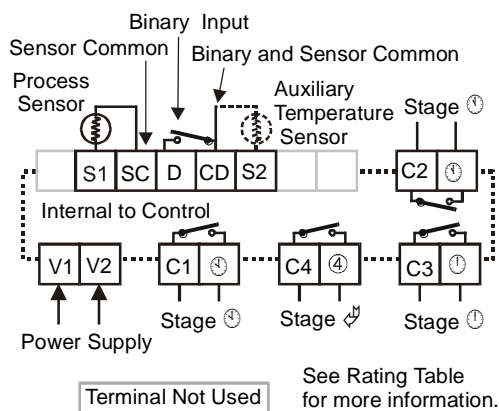**Figure 15: MS4 Panel Mount Wiring**

Figure 16: MS4 DIN Rail Mount Wiring

Table 8: Rating Table

Rating Category	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	-
Full Load Amperes	5.8	4.9	-
Locked Rotor Amperes	34.8	29.4	-
Inductive (non-motor) Amperes	8	8	8
Pilot Duty VA	275	450	-

Power supply is 24 VAC. Relay outputs must not exceed 20 amperes total connected load.

Modes of Operation

- Direct (Cooling)
- Reverse (Heating)
- Deadband (Cooling and Heating)
- Independent Setpoint (Cooling and Heating)

Temperature Management Settings

- Multiple Setpoints
- Multiple Differentials (Hysteresis)
- Low Setpoint Stop
- High Setpoint Stop
- Interstage Time Delay
- Anti-short Cycle Timers
- Soft Start
- Heating Reset
- Cooling Reset
- Non-compensated Band
- Temperature Sensor Offset
- Temperature Units Used
- Display Refresh Rate

Alarm Management Settings

- High Temperature Alarm
- Low Temperature Alarm
- Alarm Differential
- Alarm Time Delay

Binary Input Management Settings

- Binary Input Function Selection
- Binary Input Time Delay
- Setback

Table 9: Ordering Information

Product Code Number	Description
MS4DR24T-11C	MS4 DIN Rail Mount Control; includes one A99BB-200C sensor; shipping weight 1.17 lb (530 g)
MS4PM24T-11C	MS4 Panel Mount Control; includes one A99BB-200C sensor; shipping weight 0.90 lb (410 g)

Table 10: Replacement Sensor Ordering Information

Product Code Number	Operating Range	Cable
A99BB-200C		6-1/2 ft (2 m) PVC
A99BB-300C		9-3/4 ft (3 m) PVC
A99BB-500C	-40 to 212ºF (-40 to 100ºC)	16-3/8 ft (5 m) PVC
A99BB-600C		19-1/2 ft (6 m) PVC
A99BA-200C		6-1/2 ft (2 m) Shielded

Table 11: Electrical Ratings of Contacts

Rating Category	120 VAC	240 VAC	24 VDC
Horsepower	1/4	1/2	---
Full Load Amperes	5.8	4.9	---
Locked Rotor Amperes	34.8	29.4	---
Inductive (non-motor) Amperes	8	8	8
Pilot Duty VA	275	450	---

Relay outputs must not exceed 20 amperes total connected load. Open collector transistors on the MS1 alarm circuits have a maximum rating of 40 VDC, 100 mA. Alarm requires separate power source.

Specifications

Product	MS Series One-and Multi-Stage Electronic Temperature Controls
Power Requirements	3.7 VA @ 24 VAC, 50/60 Hz, Class 2 (20-30 VAC)
Accuracy	± 1.8F°(± 1C°)
Ambient Conditions	Operating: +14 to +140°F (-10 to +60°C); 0 to 95 % RH (non-condensing) Storage: -22 to +176°F (-30 to +80°C); 0 to 95 % RH (non-condensing)
Agency Listings	UL Recognized: File E194024, CCN XAPX2 Canadian UL Recognized: File E194024, CCN XAPX8 FCC Compliant per Class A Digital Device, Part 15 Canadian DOC Compliant per Class A, Radio Interference Regulations
Dimensions (H x W x D)	Panel Mount: 1.38 x 2.95 x 2.68 in. (35 x 75 x 68 mm) DIN Rail: 4.65 x 2.76 x 2.07 in. (118 x 70 x 52.5 mm)
Shipping Weight	See ordering information in Tables 5, 7, and 9.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls/Penn Refrigeration Application Engineering at (414) 274-5535. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.