

**System 350™
S350A Temperature, S351A Humidity,
and S352A Pressure Stage Modules**

The S350A, S351A, and S352A Stage Modules are intended to be used with System 350™ controls. Each of these stage modules plugs into the respective control module to add multiple-stage capability. These stage modules have Single-Pole, Double-Throw (SPDT) relay output with Light-Emitting Diode (LED) indication.

As are all System 350 products, the stage modules are housed in NEMA 1, high-impact thermoplastic enclosures. The modular design provides easy, plug-together connections for quick installation and future expandability.



Figure 1: System 350 Stage Module

Features and Benefits	
<input type="checkbox"/> Modular Design	Permits system to be configured to equipment, with convenient, future expansion made easy
<input type="checkbox"/> Plug-together Connectors and 35 mm DIN Rail Mounting	Eliminates wiring between modules and reduces installation costs
<input type="checkbox"/> Selectable Mode of Operation	Provides independent relay energization, either above or below setpoint, for cooling/heating (S350A), dehumidification/humidification (S351A), or direct acting/reverse acting (S352A)
<input type="checkbox"/> Adjustable Differential	Enables user to match the range of temperature, humidity, or pressure stage modules to specific application requirements
<input type="checkbox"/> Adjustable Offset	Allows multiple stage sequencing of 1-30F° (0.5-17C°) (S350A), 2-30% RH (S351A), or 2-50 psi (S352AA-2)

Application

The S350A, S351A, and S352A Stage Modules receive power, setpoint, and sensor input from the respective System 350 control modules. When connected, the individual modules act as a multistage control system.

The maximum number of stages that can be used in a system varies with the control module type (temperature, humidity, or pressure) and stage module design.

Refer to Table 1 or Table 2 to determine the maximum number of stages that may be used with each control module. When mixing stage module designs, always use the lower number.

Note: When using an external transformer, the Y65 Series or other 40 VA Class 2 transformers are recommended.

Table 1: Maximum Number of Add-on Modules when Powered by a Y350R Power Module

Control Module	Stage Module		Display Module	
	No.	Model Numbers	No.	Model Number
A350A A350B A350E	9	S350As or S350Cs	1	D350
	6	S350As or S350Cs with 1 S350P		
	4	S350As or S350Cs with 2 S350Ps		
A350P	4	S350As or S350Cs	1	D350
	2	S350As or S350Cs with 1 S350P		
A350R A350S	9	S350As or S350Cs	2	D350s
	6	S350As or S350Cs with 1 S350P		
	4	S350As or S350Cs with 2 S350Ps		
W351A	5	S351As	1	D351
W351P	4	S351As	1	D351
P352AB	5	S352As	1	D352A
P352PN	4	S352As	1	D352A

Table 2: Maximum Number of Add-on Modules when Powered by an External Transformer

Control Module	Stage Module		Display Module	
	No.	Model Numbers	No.	Model Number
A350A A350B A350E	9	S350As or S350Cs	1	D350
	8	S350As or S350Cs with 1 S350P		
	7	S350As or S350Cs with 2 S350Ps		
A350P	9	S350As or S350Cs	1	D350
	8	S350As or S350Cs with 1 S350P		
	7	S350As or S350Cs with 2 S350Ps		
A350R A350S	9	S350As or S350Cs	2	D350s
	8	S350As or S350Cs with 1 S350P		
	7	S350As or S350Cs with 2 S350Ps		
W351A	9	S351As	1	D351
W351P	9	S351As	1	D351
P352AB	9	S352As	1	D352A
P352PN	9	S352As	1	D352A

Notes: This bulletin only refers to the S350A, S351A, and S352A Stage Modules.

For information on the S350C refer to the *System 350™ S350C Temperature Slave Stage Module Product/Technical Bulletin (LIT-930084)*.

For information on the S350P refer to the *System 350™ S350P Proportional Plus Integral Temperature Stage Module Product/Technical Bulletin (LIT-930086)*.

For information on the D350, D351 and D352 refer to the *System 350™ D350 Display Modules Product/Technical Bulletin (LIT-930070)*.

Operation

The S350A, S351A, and S352A Stage Modules provide SPDT relay output. A front panel LED lights to indicate when the relay is energized.

IMPORTANT: The System 350 Stage Modules are intended to control equipment under normal operating conditions. Where failure or malfunction of the System 350 Stage Modules could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory systems) intended to warn of or protect against failure or malfunction of the System 350 Stage Modules must be incorporated into and maintained as part of the control system.

Offset Adjustment

The offset adjustment determines the amount of offset from the control module setpoint at which the stage module relay de-energizes.

Differential Adjustment

Differential is defined as the difference in degrees, % RH, or psi between energization and de-energization of the stage module's relay.

Operation Mode Selection

The S350A, S351A, and S352A utilize jumpers (at jumper terminal J2) to select the operation mode. (See *Adjustments* section and Figures 3, 4, and 5.)

With the jumpers positioned horizontally, the stage module is set for Cooling (S350A), Dehumidification (S351A), or Direct Acting (DA) (S352A) operation. In this mode the relay and LED indicator de-energize when the sensed temperature, humidity, or pressure drops to the setpoint *plus* offset value.

With the jumpers positioned vertically, the stage module is set for Heating (S350A), Humidification (S351A), or Reverse Acting (RA) (S352A) operation. In this mode, the relay and LED indicator de-energize when the sensed temperature, humidity, or pressure rises to the setpoint *minus* offset value.

Note: The S350A, S351A, and S352A Stage Modules are configured with the jumpers in the horizontal position at the factory.

Refer to Figures 6, 7, and 8 for examples of S350A, S351A, and S352A applications.

Dimensions

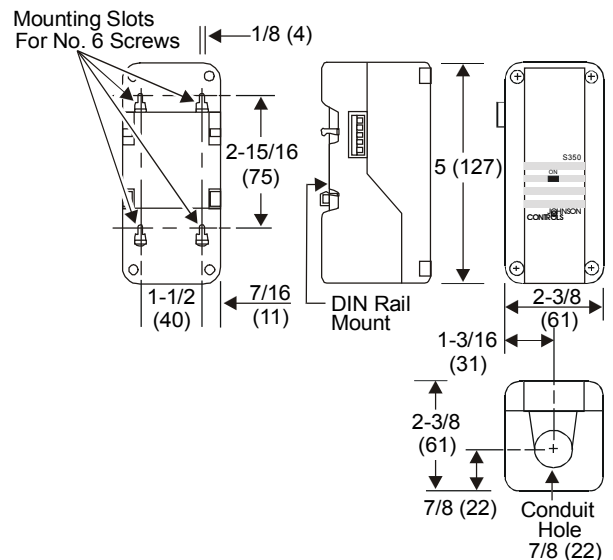


Figure 2: System 350 Stage Module Dimensions, in. (mm)


Mounting

Each System 350 Stage Module is housed in a compact NEMA 1 plastic enclosure designed for standard 35 mm DIN rail mounting. Four key-slot mounting holes on the back of the control case are provided for surface mounting. (See Figure 2.) The modules are not position sensitive, but should be mounted for convenient access to wiring and adjustments.

Note: When mounting any System 350 module to rigid conduit, attach the hub to the conduit before securing the hub to the control enclosure.

Adjustments

Refer to the following steps for adjusting stage module settings. (See Figures 3, 4, and 5.)



WARNING: Risk of Electrical Shock.
Disconnect power supply to avoid possible electrical shock or equipment damage. More than one disconnect may be required to completely de-energize equipment.

1. Ensure all power to system is off.
Each stage module may be receiving separate power sources. Make sure all power sources to each stage module are off.
 2. Remove the stage module cover by loosening the four captive cover screws.
 3. **Set the mode of operation** by positioning the jumpers (at jumper terminal J2) for Cooling, Dehumidification, or Direct Acting mode. Position the jumpers vertically for Heating, Humidification, or Reverse Acting mode.
- Note: The S350A, S351A, and S352A Stage Modules are configured with the jumpers in the horizontal position at the factory.

4. **Adjust the differential** using the potentiometer marked DIFF to the desired setting (the difference in degrees, % RH, or psi between energization and de-energization of the stage module's relay).
5. **Adjust the offset** using the potentiometer marked OFFSET to the number of degrees, % RH, or psi from the System 350 control's setpoint at which the stage relay de-energizes (above setpoint with Cooling, Dehumidification, or Direct Acting mode selected, or below setpoint with Heating, Humidification, or Reverse Acting mode selected).
6. Replace the cover on the stage module and fasten in place with screws.
7. Restore power to system.

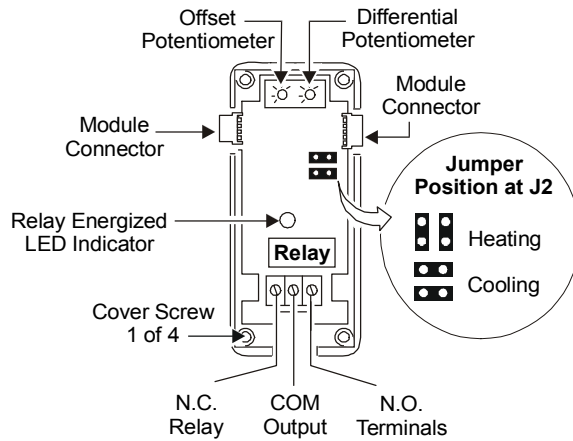


Figure 3: Interior View of S350A Stage Module

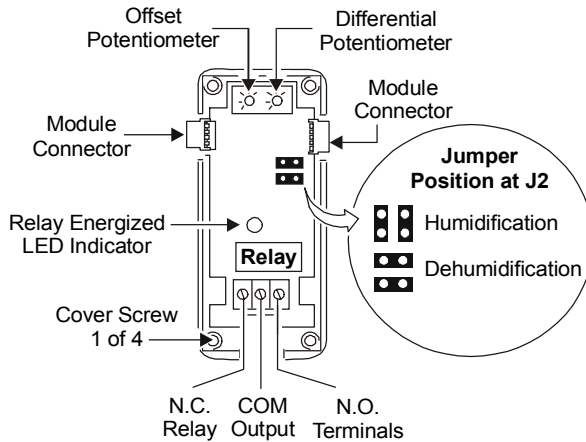


Figure 4: Interior View of S351A Stage Module

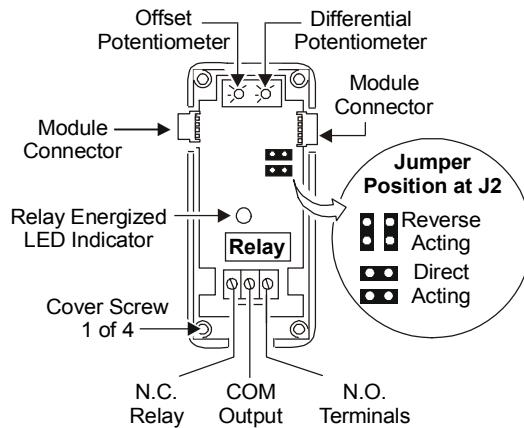


Figure 5: Interior View of S352A Stage Module

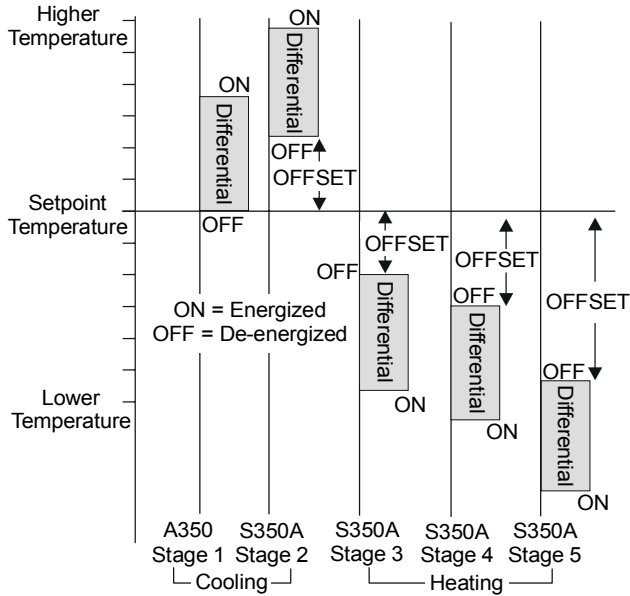


Figure 6: Example of a Heating/Cooling Application Using One A350 and Four S350As

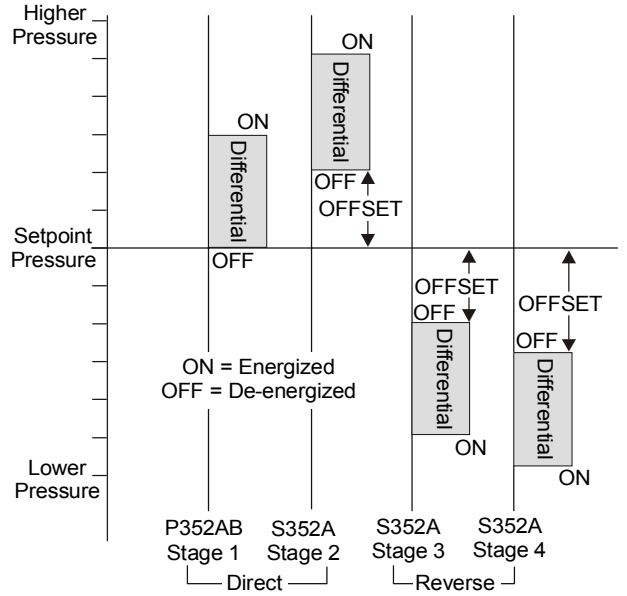


Figure 8: Example of a Reverse Acting/Direct Acting Application Using One P352AB and Three S352As

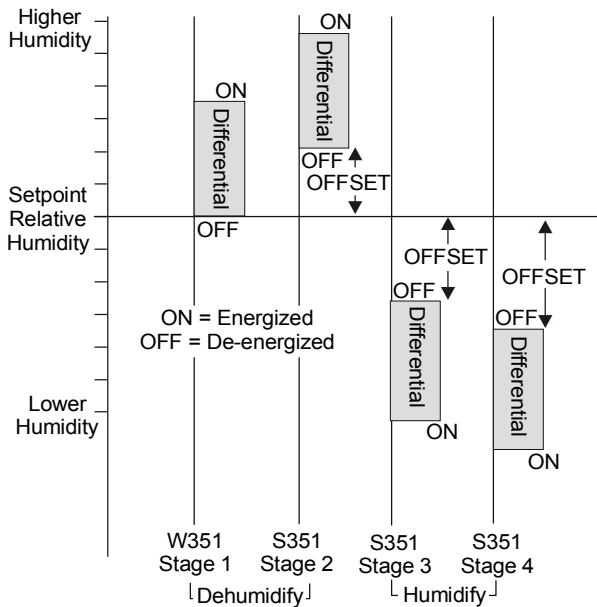


Figure 7: Example of a Humidification/Dehumidification Application Using One W351 and Three S351As

Wiring

Refer to the following guidelines and wiring diagrams for proper wiring and terminal designations (See Figures 9, 10, and 11.)

Note: For information on connecting to an external transformer refer to the applicable control bulletin.

WARNING: Risk of Electrical Shock. Disconnect power to avoid possible electrical shock or equipment damage. More than one disconnect may be required to completely de-energize equipment.

IMPORTANT: Make all wiring connections in accordance with the National Electrical Code and all local regulations. Use copper conductors only. Do not exceed the control's electrical ratings.

The stage modules plug into the control and other add-on modules via 5-pin connectors located on either side of each module. Wiring is made at the Normally Open (N.O.)/Normally Closed (N.C.) relay terminal strip. (See Figures 3, 4, and 5.)

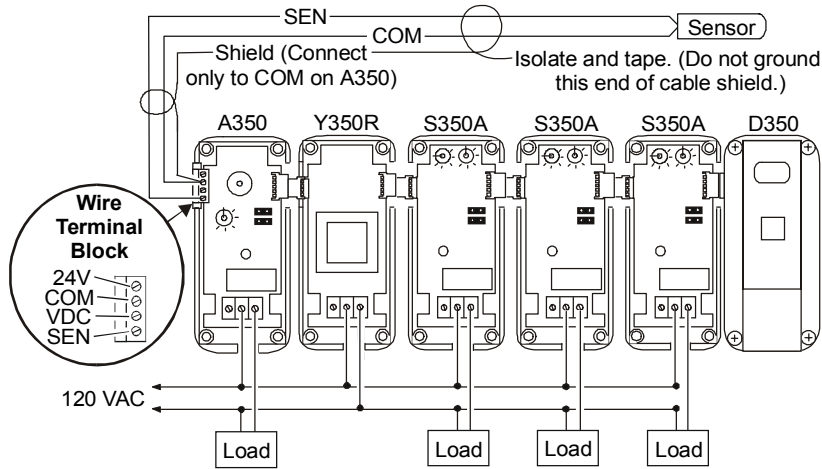


Figure 9: Typical Multistage Temperature Control System Using 120 VAC Power Supply

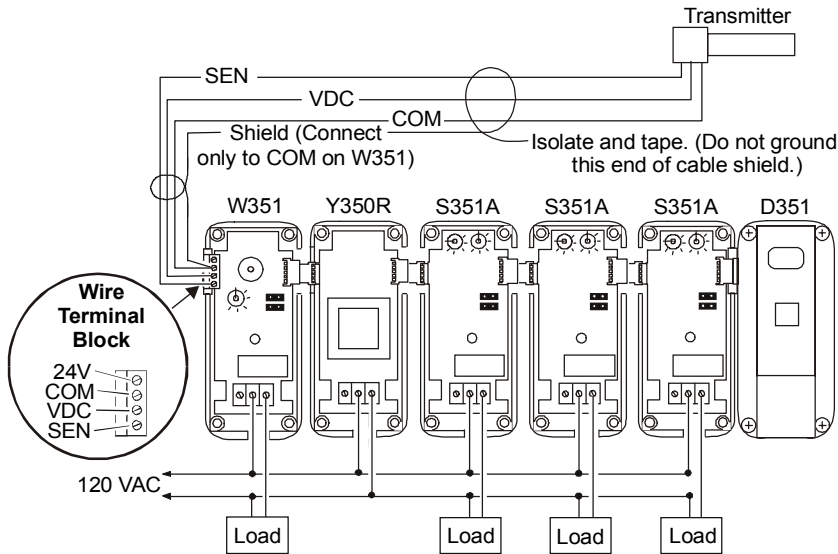


Figure 10: Typical Multistage Humidity Control System Using 120 VAC Power Supply

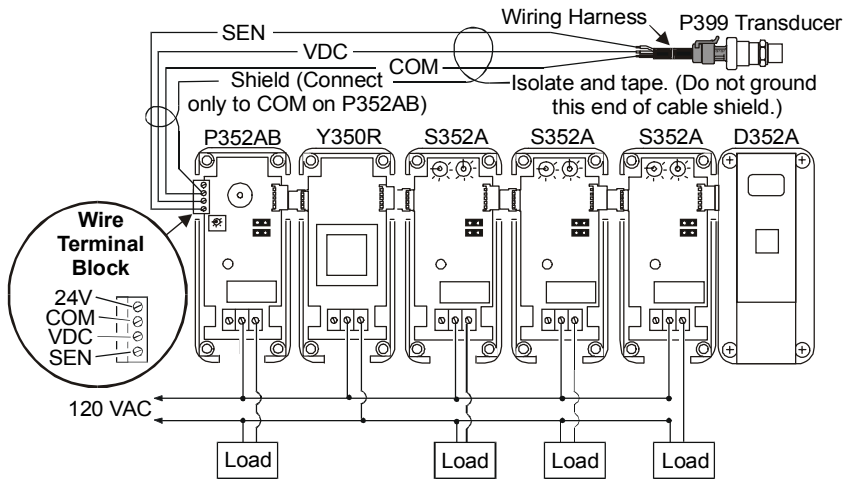


Figure 11: Typical Multistage Pressure Control System Using 120 VAC Power Supply

Checkout Procedure

Before applying power, make sure installation and wiring connections are according to job specifications. After necessary adjustments and electrical connections have been made, put the system in operation and observe at least three complete operating cycles before leaving the installation.

Troubleshooting

If the control system does not function properly, first verify that the control, power, and display modules are all operating correctly (refer to the respective literature). Then inspect the stage modules for proper operation.

Check that the proper operating mode (Cooling/Heating, Dehumidification/Humidification, or Direct Acting/Reverse Acting) has been selected on each stage module. (See *Adjustments* section and Figures 3, 4, and 5.) Then perform the following procedures to determine the problem.

1. Verify the system has power.
2. Note the offset and differential settings on the stage module.
3. Turn the setpoint dial on the control module to minimum.
4. Increase the setpoint by slowly adjusting the setpoint dial until the stage relay LEDs turn On and Off as shown in Tables 3, 4, or 5.

Table 3: S350A Relay Troubleshooting

Operation Mode	LED	N.O. Relay Status	Setpoint Dial Setting
Cooling	On	Closed	(T _S)* - offset - differential
Cooling	Off	Open	(T _S) - offset
Heating	On	Closed	(T _S) + offset + differential
Heating	Off	Open	(T _S) + offset

*(T_S) = sensed temperature

Table 4: S351A Relay Troubleshooting

Operation Mode	LED	N.O. Relay Status	Setpoint Dial Setting
Dehumidify	On	Closed	(RH _T)* - offset - differential
Dehumidify	Off	Open	(RH _T) - offset
Humidify	On	Closed	(RH _T) + offset + differential
Humidify	Off	Open	(RH _T) + offset

*(RH_T) = actual relative humidity at transducer

Table 5: S352A Relay Troubleshooting

Operation Mode	LED	N.O. Relay Status	Setpoint Dial Setting
Direct	On	Closed	(psi _T)* - offset - differential
Direct	Off	Open	(psi _T) - offset
Reverse	On	Closed	(psi _T) + offset + differential
Reverse	Off	Open	(psi _T) + offset

*(psi_T) = actual pressure at transducer

5. If the relays do not perform as indicated in Tables 3, 4, or 5, adjust the stage module's differential and offset potentiometers to minimum and repeat Steps 1 through 3.
6. If the relays still do not turn on and off, replace the defective stage modules.

Note: There is the unlikely possibility that a defect in one stage module could cause defective symptoms in all modules. Plug each stage into the control individually and check the performance of each as explained above.

Repairs and Replacement

Do not make field repairs or perform calibration. Sensors and replacement controls are available through your local Johnson Controls representative.

Ordering Information

Table 6: Ordering Information

Item	Product Code Number	Description
S350A Temperature Stage Module	S350AA-1C	Temperature Stage Module with Fahrenheit Scale
	S350AB-1C	Temperature Stage Module with Celsius Scale
S351A Humidity Stage Module	S351AA-1C	Humidity Stage Module with percent RH Scale
S352A Pressure Stage Module	S352AA-2C	Pressure Stage Module with psi Scale

Specifications

Product	S350AA: Temperature Stage Module with Fahrenheit Scale S350AB: Temperature Stage Module with Celsius Scale S351AA: Humidity Stage Module with Percent RH Scale S352AA-2: Pressure Stage Module with psi Scale
Input Voltage	S350AA: Provided by the A350 S351AB: Provided by the W351 S352AA-2: Provided by the P352AB
Power Consumption	1.0 VA maximum
Output Relay Electrical Ratings	SPDT Enclosed Relays 10 Ampere Non-inductive, 125 VA Pilot Duty, 24/240 VAC 1/2 hp 120/240 VAC
Differential Adjustment Range	S350AA: 1 to 30F° S350AB: 0.5 to 17C° S351AA: 2 to 10% RH S352AA-2: 2 to 50 psi
Offset Range	S350AA: 1 to 30F° S350AB: 0.6 to 16.7C° S351AA: 2 to 30% RH S352AA-2: 2 to 50 psi
Ambient Temperature	Operating: -30 to 150°F (-34 to 66°C) Shipping: -40 to 185°F (-40 to 85°C)
Ambient Humidity	0 to 95% RH (Non-condensing)
Material	Case, Cover: NEMA 1 High Impact Thermoplastic
Mounting	Wall or DIN Rail
Agency Listing	UL Listed, CCN XAPX, File E27734 UL Listed for Canada, CCN XAPX7, File E27734

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



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