

P266 Series Single-Phase Condenser Fan Speed Control

Product Bulletin

P266xxx-x

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The P266 Series Single-Phase Condenser Fan Speed Control is a cost-effective, weather-resistant, durable motor speed control. The P266 Series controls are designed for approved single-phase, Permanent Split-Capacitor (PSC) motors commonly used in a wide variety of refrigeration and air conditioning condenser fan applications.

The P266 Series controls are designed to replace the Johnson Controls® P66 Series and P215 Series fan speed controls, providing additional features and flexibility, greater energy efficiency, and longer motor life in a compact, rugged, weather-resistant package.

P266 Series controls are available for 208 through 575 VAC 50/60 Hz range applications. P266 Series controls have current ratings from 4 to 12 A, depending on the voltage and model.

Some P266 Series controls provide optional control of up to three auxiliary (fixed-speed) fans or fan stages. In addition, some models provide two additional high-voltage triacs that allow you to split the source power to the main and auxiliary windings, and connect a low-speed capacitor to increase efficiency at low-speed operation.



Figure 1: P266 Series Single-Phase Condenser Fan Speed Control

Table 1: Features and Benefits

Features	Benefits
One or Two Durable, Accurate, Stainless Steel, Remote-Mount Pressure Transducers	Resist damage from physical shock, vibration, pressure pulsation, and extreme environmental conditions; eliminate capillary tube breaks and greatly reduce refrigerant loss potential; provide 1% total error band; and are applicable to single and multi-circuit condenser applications.
Available in 208/240 VAC (8 or 12 A), 380/460 VAC (4 A), or 460/575 VAC (4 A)	Provides efficient PSC motor speed control for a wide range of condenser fan applications.
Wide, Adjustable Pressure Throttling Range	Enables application flexibility and allows you to tune condenser operation to specific pressure ranges and ambient environments.
Optional Auxiliary Fan Control	Provides control of up to three fixed-speed fans or fan stages in conjunction with the speed controlled fan or fan stage.
Optional Low-Speed Capacitor Mode	Enables cooler, quieter, and more efficient fan motor operation at low speeds.
NEMA3R, (IP54) Enclosure with Integral Metal Heat-Sink and Stand-Off Mounting Feet	Provides a rugged weather-resistant fan control with good heat dissipation and a sturdy mounting base.

Application

IMPORTANT: Use this P266 Series Single-Phase Condenser Fan Speed Control only as an operating control. Where failure or malfunction of the P266 Series Fan Speed Control could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the P266 Series Fan Speed Control.



CAUTION: Risk of Property Damage

Use only single-phase Permanent Split Capacitor (PSC) motors approved by the manufacturer for speed control applications with the P266 Series control. Failure to use a single-phase PSC motor may damage the motor and other property.

The P266 Series Single-Phase Condenser Fan Speed Control, in conjunction with a P266 Series Electronic Pressure Transducer, is a pressure-actuated, digital electronic motor speed control designed for approved single-phase, PSC motors used in a wide variety of Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) applications.

The P266 Series Fan Speed Control regulates supply voltage to the fan motor in response to the condenser refrigerant pressure and maintains the appropriate fan speed (air movement) through the condenser regardless of the ambient temperature or air delivery variations.

The P266 Series control is housed in a NEMA 3R (IP54) rainproof enclosure for outdoor applications.

The P266 Series control is an energy efficient and effective alternative to On/Off fan-cycling controls, multiple-speed motors, temperature fan-speed controls, modulating air-damper systems, condenser flood-back systems, and other condenser pressure control methods.

P266 Series Fan Speed Control applications include:

- computer room air conditioning
- commercial refrigeration
- commercial air conditioning

P266 Series Fan Speed Control Operation

The P266 Series control regulates fan motor speed by limiting the supply voltage to the motor based on the sensed condenser pressure. In a typical P266 Series control application, as the condenser pressure rises, the P266 Series control increases the supply voltage to the fan motor, which increases fan speed and air movement across the condenser coil. The increased air movement removes condenser heat faster, which maintains the condenser pressure within the defined range.

P266 Series Setup Values and Modes

The P266 Series control ships with up to ten factory default setup values and modes. These settings can be adjusted in the field (if required) to meet your specific condenser application requirements.

The P266 Series control's adjustable settings include:

- **Start Voltage** establishes the initial minimum voltage delivered by the P266 Series control to the fan motor to idle the fan motor at the minimum speed.
- **Start Pressure** establishes the pressure setpoint (psi or bar) at which the P266 Series control outputs the Start Voltage and runs the fan motor at minimum speed.
- **End Voltage** establishes the voltage output that is maintained by the P266 Series control when the sensed pressure is equal to or greater than the End Pressure. The End Voltage to the motor can be set to either 95% or 97% of the total input voltage to the P266 Series control.
- **End Pressure** establishes the pressure setpoint (bar or psi) at which the P266 Series control outputs the End Voltage and runs the fan motor at maximum speed.

Figure 2 show the relationship between Start Voltage, Start Pressure, End Voltage, and End Pressure.

Low Pressure Mode (LPM) determines whether the fan motor is powered On (at the start voltage and typically idling at minimum speed) or is Off when the condenser pressure is below Start Pressure. See Figure 2.

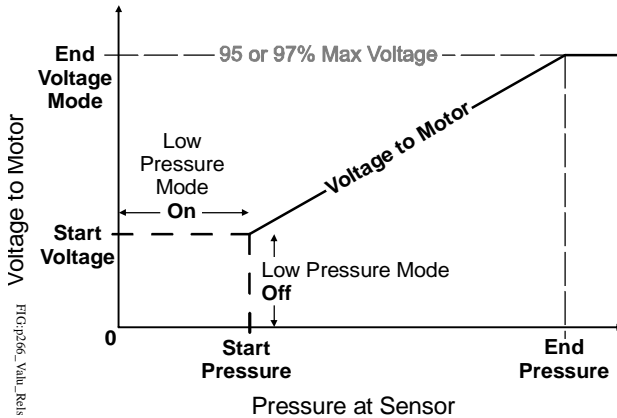


Figure 2: Relationship between Some P266 Series Fan Speed Control Values and Modes

Split Winding Mode enables the M2 Triac on the P266 Series control, which allows you to split the motor's main windings from the auxiliary windings (and the M1 Triac) and power the main windings with the M2 Triac. Split winding operation increases fan motor efficiency.

Note: Split Winding Mode is available for **only** 240 VAC single-phase PSC motors that have split winding wire leads. Refer to the motor manufacturer's installation instructions to determine if your fan motor may be wired to enable the Split Winding Mode.

Copeland Digital Scroll™ Compressor Mode allows you to use the P266 Series control on a system that uses a digital scroll compressor. Failure to enable the digital scroll compressor mode when using a digital scroll compressor may cause your condenser fan to oscillate.

Low-Speed Capacitor Mode allows you (on some P266 Series models) to connect a low-speed capacitor to the control's M3 triac and the fan motor's auxiliary windings and power the M3 triac, which provides additional power to the motor at low speed. In many fan motor speed applications, the addition of the low-speed capacitor circuit can provide more efficient, quiet and cooler motor operation at low speeds.

Changeover Voltage determines the voltage at which the P266 Series control connects and disconnects power to the M3 triac, low-speed capacitor, and auxiliary motor windings (Figure 3).

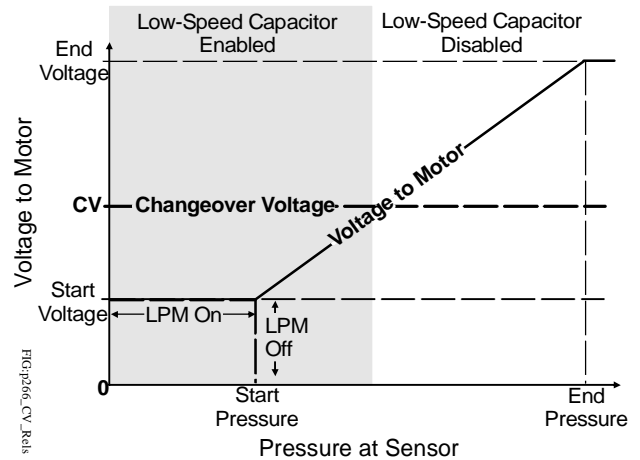


Figure 3: Low-Speed Capacitor Operation

Auxiliary Fan Stage Mode allows you to set up the P266 Series control to cycle (On/Off) up to three additional (fixed-speed) fan motors or fan stages in conjunction with the variable speed fan controlled by the P266 Series control. Three low-voltage circuits can be wired to control the auxiliary fan motor/stage starters.

Figure 4 shows a P266 Series control application with one auxiliary fan operating in conjunction with the speed-controlled fan. When the condenser load exceeds the output capacity of the speed-controlled fan, the P266 Series control powers On the auxiliary fan and shifts the speed-controlled (P266) fan to a new start pressure.

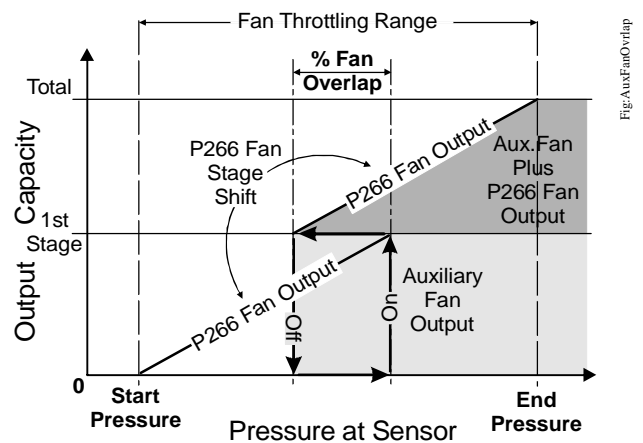


Figure 4: Graph Showing a Speed-Controlled (P266) Fan Operating with One Auxiliary (On/Off) Fan Stage over the Entire Pressure Range

Auxiliary Fan Overlap determines the pressure range overlap (as a percentage of the total pressure range) between the fan stages set up on the P266 Series control. The fan overlap value is equal for all auxiliary fan stages set up on the control.

Increasing the Auxiliary Fan Overlap value decreases the (On/Off) cycling rate of the auxiliary fans and increases the pressure differential between auxiliary fan stages (which increases the pressure range of each auxiliary fan stage).

Test Voltage Mode

Test Voltage mode is a special setup, testing, and tuning feature that allows you to wire a P266 Series control and fan motor in the field, and test operate the fan motor at different start voltage values without connecting a pressure transducer. You can also set up and test low-speed capacitor operation in the Test Voltage mode. When your fan motor is operating as desired, you can save the test settings, connect the transducer, and operate your application at the saved settings.

Ordering Information

The four basic types of P266 Series controls are based on the supply voltage rating and whether the control has an onboard, low-voltage power supply transformer.

P266A type controls are 208 to 240 VAC range controls without onboard, low-voltage transformers.

| **P266B** type controls are 460 to 575 VAC range controls without onboard, low-voltage transformers.

| **P266C** type controls are 380 to 460 VAC controls without onboard, low-voltage transformers.

P266E type controls are 208 to 240 VAC range controls with an onboard, low-voltage transformers.

Table 2 provides product code numbers, descriptions, and details for the currently available P266 Series Fan Speed Control models.

Table 3 provides product code numbers and descriptions for the currently available P266 Series Electronic Pressure Transducers.

Repair Information

If a P266 Series Single-Phase Condenser Fan Speed Control fails to operate within its specifications, replace the unit. For a replacement P266 Series control, contact the nearest Johnson Controls representative.

Table 2: P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details (Part 1 of 3)

Product Code Number	Description	Transducer Model Included in Kit	Voltage (in VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits ¹
P266AAA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	3	0
P266ABA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	3	3
P266ACA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	1	0
P266ADA-100C ²	P266 Fan Speed Control (only)	N/A	208/240	8	1	3
P266BGA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	2	0
P266BHA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	2	3
P266BCA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	1	0
P266BDA-100C ²	P266 Fan Speed Control (only)	N/A	460/575	4	1	3
P266CHA-100C ²	P266 Fan Speed Control (only)	N/A	380/460	4	2	3
P266ABA-1K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	8	3	3

Table 2: P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details (Part 2 of 3)

Product Code Number	Description	Transducer Model Included in Kit	Voltage (in VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits ¹
P266ABA-3K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	208/240	8	3	3
P266ABA-2K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6.6 ft) cables	P266SNR-1C 0–35 bar (0–508 psi)	208/240	8	3	3
P266ABA-4K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6.6 ft) cables	P266SNR-2C 0–52 bar (0–754 psi)	208/240	8	3	3
P266BHA-1K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	460/575	4	2	3
P266BHA-3K ²	P266 Fan Speed Control with one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	460/575	4	2	3
P266BHA-2K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6.6 ft) cables	P266SNR-1C 0–35 bar (0–508 psi)	460/575	4	2	3
P266BHA-4K ²	P266 Fan Speed Control with two P266 Pressure Transducers and two 2 m (6.6 ft) cables	P266SNR-2C 0–52 bar (0–754 psi)	460/575	4	2	3
P266EAA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	8	3	0
P266EAA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	208/240	8	3	0
P266EBA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	8	3	3
P266EBA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	208/240	8	3	3
P266ECA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	8	1	0
P266ECA-3K	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	208/240	8	1	0

Table 2: P266 Series Fan Speed Control Model and Kit Product Code Numbers, Descriptions, and Details (Part 3 of 3)

Product Code Number	Description	Transducer Model Included in Kit	Voltage (in VAC)	Maximum Output Amperes	High VAC Triacs	Available Auxiliary Fan Control Circuits ¹
P266EDA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	8	1	3
P266EDA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	208/240	8	1	3
P266EEA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	12	1	0
P266EEA-3K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-2C 0–52 bar (0–754 psi)	208/240	12	1	0
P266EFA-1K ²	P266 Fan Speed Control with Internal Transformer and one P266 Pressure Transducer and one 2 m (6.6 ft) cable	P266SNR-1C 0–35 bar (0–508 psi)	208/240	12	1	3

1. 24 VAC Class 2 at 1/4 A.
2. Factory default settings: Start Voltage is set to 40% of the supply line-voltage. End Voltage is set to 95% of the supply line-voltage. Start Pressure is set to 44% of the P266 transducer's total pressure range. End Pressure is set to 51% of the P266 transducer's total pressure range.

P266 Series Electronic Pressure Transducers

P266 Series controls are designed to reference either one or two Johnson Controls P266 Series Electronic Pressure Transducers to monitor condenser pressure.

P266 Series transducers are specialized versions of the P499 Series Electronic Pressure Transducers designed for use with P266 Series Fan Speed Controls. See Table 3 for the available P266 Series transducer models.

Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* for detailed information on installing P266 Series transducers.

Note: On P266 Series control applications that use two P266 Series transducers, the P266 Series control always references the transducer that is sensing the higher pressure.

IMPORTANT: When two P266 Series transducers are connected to a P266 Series control, the transducers must be the same model (product code number). Failure to connect the same P266 Series transducer models to the P266 Series control can result in erratic control behavior.

Table 3: P266 Series SNR Electronic Pressure Transducers

Product Code Number	Description
P266SNR-1C	Electronic Pressure Transducer: 0 to 35 bar (0 to 508 psi) total range with a 1/4 in. SAE Female Flare connection and a 2 meter (6.6 ft) cable.
P266SNR-2C	Electronic Pressure Transducer: 0 to 52 bar (0 to 754 psi) total range with a 1/4 in. SAE Female Flare connection and a 2 meter (6.6 ft) cable.

Technical Specifications

P266xxx-x Series Single Phase Condenser Fan Speed Controls

Input Supply Power	208/240 VAC 50/60 Hz, 380/460 VAC 50/60 Hz, or 460/575 VAC 50/60 Hz, depending on the model (Refer to the label inside the P266 Series control housing cover for rated voltage range and model-specific wiring diagram.)
Short Circuit Current Rating	Suitable For Use On A Circuit Capable Of Delivering Not More Than 5,000 rms Symmetrical Amperes, 600 Volts Maximum When Protected By Class H Fuses.
Low-Voltage Power Supply	P266A, P266B, and P266C Types: External 24 VAC Class 2, 20 VA Supply Transformer P266E Types: Low-voltage power for P266 Series control is provided by an onboard transformer. Note: When auxiliary fan starters are connected to P266E type controls, you must provide an external Safety Extra-Low Voltage (SELV) AC supply to power the fan starters.
Ambient Operating Conditions	Temperature: -40 to 60°C (-40 to 140°F) Humidity: Up to 95% RH non-condensing; Maximum Dew Point 29°C (85°F)
Ambient Shipping and Storage Conditions	Temperature: -40 to 85°C (-40 to 185°F) Humidity: Up to 95% RH non-condensing; Maximum Dew Point 29°C (85°F)
Low-Voltage Connections	1/4 in. Quick-Connect terminals, 30 m (100 ft) maximum wiring runs
Input Transducer	P266SNR-x Pressure Transducer: 5 VDC for 0.5 to 4.5 VDC ratiometric analog signal
Enclosure Type	NEMA 3R, IP54
Case Construction	Aluminum Die Casting
Cover Construction	UV Stabilized Polycarbonate
Dimensions (HxWxD)	159 x 177 x 70 mm (6-1/4 x 7 x 2-3/4 in.)
Weight	Heaviest Model Weight: 1.0 kg (2.2 lb) Approximate Shipping Weight: 1.2 kg (2.6 lb)
Compliance	Europe: Mark: CE Compliant; CENELEC EN 60947-1 & 4-2; RoHS Directive (2002/95/EC); WEEE Directive (2002/96/EC) Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC North America: cULus, File E244421; FCC Compliant to CFR47, Part 15, Subpart B, Class A Industry Canada (IC) Compliant to Canadian ICES-003, Class A limits Australia: C-Tick Compliant (N1813)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls Application Engineering at (414) 524-5535. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

United States Federal Communication Commission (FCC) Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this 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/her own expense.

Canadian Compliance Statement

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.



Building Efficiency

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