EC Motor

Application

The EVO/ECM-SNV allows industry standard $0V_{to}+10V$ automation signals to adjust PWM controlled EC Motors. The device is designed and packaged to provide a solution for rooftop machinery and other severe environment applications.

The SNV provides remote adjustment of the motor output from $0\%^{pwm}{}_{to}100\%^{pwm}$ of the motor's programmed control range. A signal lamp continuously flashes out the $\%^{pwm}$. Instruments are not required to read the output. The signal lamp also indicates the EVO/ECM-SNV is powered, the microcontroller is running and indicates the control signal in tenths of a Volt.

Signal Lamp

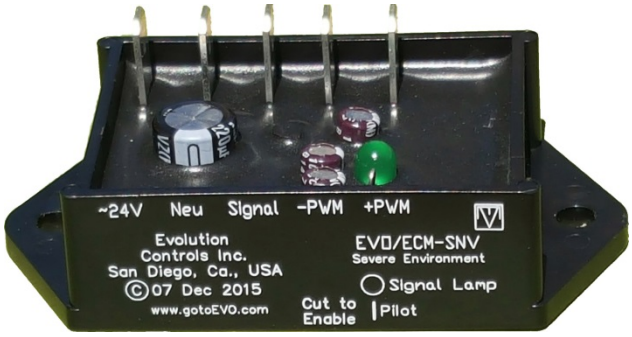
The green lamp continuously indicates the $\%^{pwm}$ motor control signal. After a pause, the lamp flashes out the tens digit, then the units digit of a number between $0\%^{pwm}$ and $100\%^{pwm}$. Long flashes represent the tens digit, and short flashes represent the units digit. For example, a flow index of 23 flashes two longs, then three shorts. Two extra-long flashes indicate a $0\%^{pwm}$. An extra-long flash and ten short flashes indicate a $100\%^{pwm}$ motor control signal. The lamp flashes the signal that was present when the flash sequence started.

Options

Pilot Pulse	Cut jumper, then cycle power to enable pilot pulse
Signal	$0V_{to}+10V = 0\%^{pwm}$ to $100\%^{pwm}$ $+2V_{to}+10V$ 0V[1] $-4mA_{to}+20mA$[1], [2]

Ordering

Please use EVO/ECM-SNV as your part number. Or include EVO/ECM-SNV in your part description.



Specifications

Power[3]	NEC Class II or equal ~24V ± 20% 50/60 Hz 0.5W, 1.0VA + 0.25W, 0.35VA/Motor 1.5W, 2.5VA with 4 Motors
Control Signal	$0V_{to}+10V = 0\%_{to}100\%^{pwm}$ 20kΩ impedance, (0.5 mA@ +10V)
PWM Output	+18V ±2V @ 30mA Up to 4 2.7kΩ motor loads
Thermal Stability	PWM >0.01%/°F
Operating Environment	0°F to 150°F / -20°C to 65°C 10-95% rh
Low Temperature Environment	*The control operates below 0°F/-20°C with reduced control accuracy* -40°F to 150°F / -40°C to 65°C
Connections	¼" Push On Tabs
Flammability	UL 94-V0 or better All components, case and potting

[1] Requires $20\%^{pwm}$ start point in motor profile
[2] Requires 511Ω dropping resistor

[3] VA required varies with ~24V power system design. Add 20% to published VA for most applications.

Application

Signal

$0V_{to}+10V$

The EVO/ECM-SNV features a standard $0V_{to}+10V$ control.

$+2V_{to}+10V$

For $+2V_{to}+10V$ operation, set the motor start threshold to 20%^{pwm} and the motor stop threshold to 10%^{pwm}.

+4mA to +20mA

For $+4mA_{to}+20mA$ operation, set the motor start threshold to 20%^{pwm} and the motor stop threshold to 01%^{pwm}. Then, connect a 511Ω 1% resistor between the SNV signal connection and the SNV neutral connection.

Start/Stop

Best practice keeps line power on the motor except when the service switch is off. Normal on/off is achieved with low voltage controls.

Use the EVO/ECM-SNV-S1 to control motors with a dedicated control circuit (GO) to start/stop the motor.

Most motors with only PWM for control can be started and stopped by setting motor start and stop thresholds. Best practice sets the motor start threshold to 20%^{pwm} and the motor stop threshold to 10%^{pwm}. This causes the system to behave as an industry standard $+2V_{to}+10V$ control.

Pilot Pulse

Pilot Pulse (*Autoswitch*) provides a 49^{us} pulse at minimum and maximum signal so the motor knows the EVO/ECM-SNV is connected. Many motors may be programmed to respond to loss of the pilot pulse by defaulting to a local program or emergency motor speed.

Equipment manufacturers may offer a standard equipment configuration where motor taps are used for standard applications. And pilot pulse detection switches the motor to be controlled by the pilot pulse capable controller for automation and other special applications.

Testing

Check all wiring before powering the EVO/ECM-SNV. Make sure the power connection is ~24V, and be sure the signal, PWM and common connections are proper.

Power the machine where the EVO/ECM-SNV is installed, and test for proper operation.

Observe that the motor is off or at minimum speed when the $0V_{to}+10V$ signal is at 0V. Some motors are configured to be off when the signal is at or near 0V. Others are set up to run at minimum speed when the signal is at 0V.

Observe the motor runs at full speed when the $0V_{to}+10V$ signal is at +10V.

Troubleshooting

If the EVO/ECM-SNV does not properly operate the motor, isolate the problem to the EVO/ECM-SNV, the Motor, or the wiring.

Observe the signal lamp. If it is lit, the EVO/ECM-SNV is powered. If it is flashing, the EVO/ECM-SNV is powered and the micro-controller is running.

Use a DC voltmeter to measure the Signal voltage. Touch the Black(-) lead to the Neu connection and the Red (+) lead to the Signal connection. Read the lamp. The flashes should indicate the signal voltage in tenths of a Volt. For example, a signal of +3.7V produces 3 long flashes and 7 short flashes.

Disconnect the -PWM and +PWM wires going to the connected motors. Use a multimeter set to measure continuity. Check each wire of the motor connections, -PWM and +PWM, for continuity to ground. These wires should not conduct to ground. The PWM control line ground path is provided when connected to the EVO/ECM-SNV Common connection. Make sure to observe polarity when re-connecting the PWM wires. A wrong polarity connection does not damage the EVO/ECM-SNV or the motor, but polarity must be correct to operate the motor.

Use a DC voltmeter to measure the PWM voltage. The voltmeter will integrate the pulse signal, providing an approximation of the %^{pwm}. Touch the Black(-) lead to the -PWM connection and the Red (+) lead to the +PWM connection.

The voltage should be between +1.6V and +21V depending on the 0V to +10V signal. If the input signal is 0V, the PWM voltage will be +2V ±0.2V. If the input signal is +10V, the voltage will be +21V ±2V. Vary the 0V to +10V signal and observe that the PWM voltage changes.

Determine if Signal from the signal source controller is causing the problem by removing the signal connection at the EVO/ECM-SNV and attaching a +9V battery between Neu and Signal. The motor should run at about 90%. If this works, make sure the Signal Source controller signal is referenced to common. And be sure no other connections are made to the EVO/ECM-SNV Neu or the Neu wire leading to the signal source controller.

Wiring

Power the EVO/ECM-SNV with a ~24V NEC Class II[USA] power limited transformer[4]. Observe all code requirements and follow all safety practices regarding low voltage power supplies and circuits to insure a safe, reliable installation. Or power from a code compliant automation (Signal Source) controller's ~24V output.

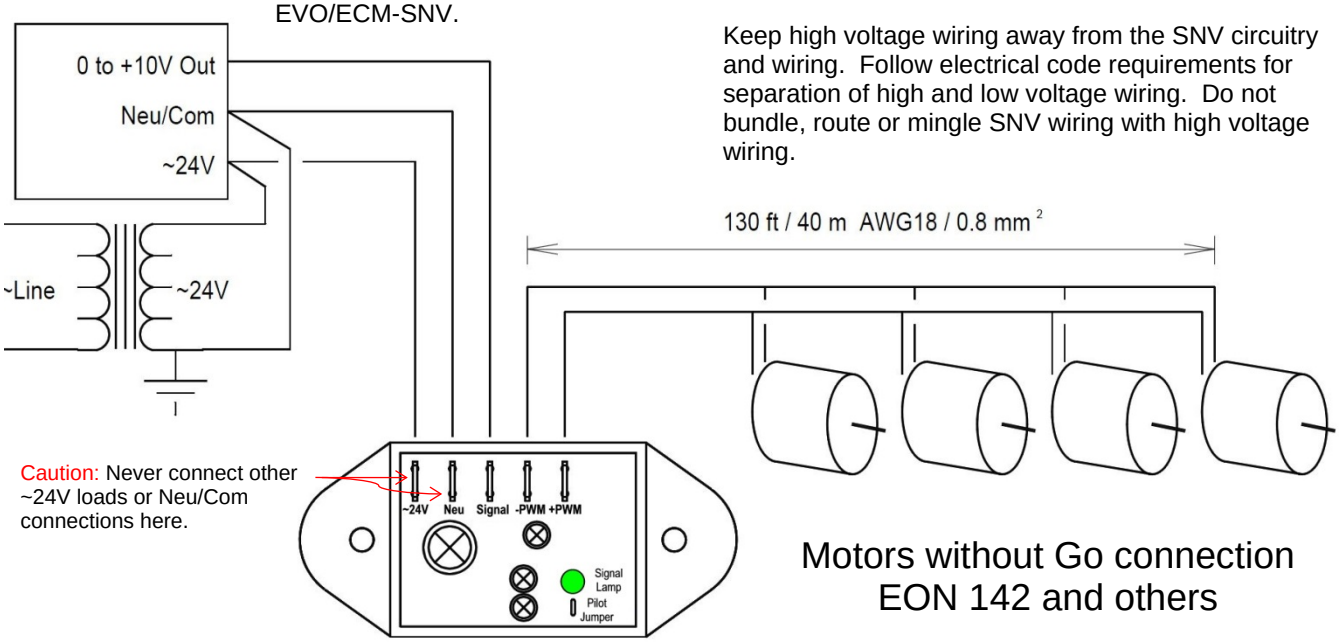
Some applications may require an isolated power supply or alternative earthing scheme. Follow applicable code requirements and carefully observe all safety practices concerning earthing and safety requirements for low voltage circuits.

Best practice wiring powers the Signal Source Controller directly from the ~24V transformer, then connects power and signal from the Signal Source Controller to the EVO/ECM-SNV.

Earth one lead of the ~24V side of the power transformer[5]. Connect the earthed lead to the Signal Source Controller neutral connection.

Connect the other (hot) lead of the ~24V side of the power transformer to the Signal Source Controller ~24V connection. Never connect other ~24V loads to the EVO/ECM-SNV. Never make other Neu connections at the EVO/ECM-SNV.

Best practice uses an AWG 22/0.35 mm² twisted triplet cable[6] between the Signal Source Controller and the EVO/ECM-SNV.



Motors without Go connection
EON 142 and others

For connections over 9[ft]/3[m], best practice uses AWG 19/0.75 mm² twisted triplet shielded cable[7]. Connect the shield to the Signal Source Neu/Com connection. Do not connect the far end (SNV) of the shield. Cut it flush and tape to insulate.

Use the remaining conductor of the twisted triplet cable to connect the Signal Source Controller $0V_{to}$ +10V Out to the EVO/ECM-SNV Signal connection.

Use one conductor of the twisted pair to connect the Signal Source Controller Neutral/Common to the EVO/ECM-SNV Neutral. Also connect the shield here, If the twisted pair cable is shielded. Do not connect the far end of the shield. Cut it flush and tape to insulate.

Use the remaining conductor of the twisted pair to connect the Signal Source Controller 0 to +10V Out to the EVO/ECM-SNV Signal connection.

The input presents a 21KΩ load to the signal source. Include this resistance when calculating a dropping resistor for 4-20 mA operation. A 511Ω 1% resistor[8] provides a 500Ω dropping resistance. Connect the resistor between the SNV NEU and Signal connections.

Connect the SNV -PWM connection to the motor PWM (-) / common wire. Connect the SNV +PWM connection to the motor PWM (+) wire. Connect up to 4 motors in parallel.

Keep high voltage wiring away from the SNV circuitry and wiring. Follow electrical code requirements for separation of high and low voltage wiring. Do not bundle, route or mingle SNV wiring with high voltage wiring.

[4] See NEC[USA] 725.41
[5] NEC[USA] 250.20.a.
[6] West Penn 25231B or equal
[7] West Penn 25303B or equal
[8] www.Mouser.com pn. 271-511-RC

Connections

Use non locking type ¼ inch quick connects. Cover each quick connect tab with dielectric grease. Flood each wire with dielectric grease. Treat each quick connect with dielectric grease.

Crimp each quick connect onto the wire(s) using the crimp instructions below.

Use compression type wire caps to connect wiring. Wire caps have better integrity than butt splices because the wires are twisted together and crimped, not depending on the integrity of two connections required with butt splices.

Treat each wire with dielectric grease. Fill the crimp cap with enough dielectric grease to flood the metal parts of the wires and crimp sleeve when the splice is finished. Coat the wires with dielectric grease. Twist the wires together then fit them into the wire cap.

Crimp Instructions

Use a heel and anvil type crimper. Notice some types of wire caps will improperly form when the crimper heel is on or near the crimp sleeve seam. For best results, place the heel on the opposite side of the crimp sleeve ring and make sure the heel is centered on the crimp sleeve.

Mounting

Mount with clearance for the ~24V power wires, automation wires and motor control wires. Mount in a location where the control will not be immersed in water, and where condensation or other moisture will drain from the device. Where convenient, mount where natural or forced air ventilation can cool the device.

Use washer faced screws to mount the device. Do not use flat head, oval head or other countersink type screws. They will spread the mounting holes and crack the case.