EC Motor

Application

The EVO/ECM-SNV-S1 allows industry standard 0V to +10V automation signals to adjust up to 4 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% to 100% 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, and the microcontroller is running.

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 100% PWM motor control signal. The lamp flashes the signal that was present when the flash sequence started. When the control is powered, but the motor is signaled off, the signal lamp displays a “heartbeat” flash every 3 seconds.

Options

PWM2 Cut “PWM2” jumper, to enable PWM2 in place of the GO/motor signal. PWM1 controls up to 2 motors. PWM2 is used with motors that do not need GO/motor to connect up to 2 more motors.

Signal Cut “+2V to +10V” jumper to change from 0 to +10V signal to +2V to +10V signal.

Specifications

| Power1 | NEC Class II or equal
| ~24V ±20% 50/60 Hz |
| 0.5W, 1.0VA + 0.25W, 0.35VA/motor circuit |
| 1.5W, 2.5VA with 4 Single circuit motors or 2 dual circuit motors. |
| Control | Signal |
| 0V to +10V = 0%-100% PWM |
| +2V to +10V = 0%-100% PWM |
| 20kΩ impedance, (500 µA@ +10V) |
| PWM1 | GO/PWM2 |
| +18V ±2V @ 15 mA |
| +18V ±2V @ 15 mA |
| Output | Up to four 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 |

Ordering

Please use EVO/ECM-SNV-S1 as your part number. Or include EVO/ECM-SNV-S1 in your part description.

1 VA required varies with ~24V power system design. Add 20% to published VA for most applications.
Application

Motor Control Circuits

The EVO/ECM-SNV-S1 will control single control circuit motors or dual control circuit motors. Single control circuit motors only need a PWM signal. While Dual control circuit motors require a PWM signal to control motor speed and a GO\textsubscript{motor} signal to turn the motor On/Off. The SNV can control up to 4 control circuits. Therefore, the SNV will control up to 4 single control circuit motors or up to 2 dual control circuit motors.

Options

Options are selected by cutting jumpers.

Caution: Cut Jumpers cannot be restored.

Be careful to make sure options are fully understood before cutting jumpers.

Without cutting jumpers, the EVO/ECM-SNV-S1 Is configured for a 0\textsubscript{to}+10V signal and a GO\textsubscript{motor} signal on the GO\textsubscript{/PWM}, connection. This configuration provides 0\textsubscript{to}+10V control for up to two single control circuit motors or up to two dual control circuit motors.

Signal

0\textsubscript{to}+10V

The default control signal is 0\textsubscript{to}+10V to control PWM to 0\textsubscript{to}100\%. Note: \textit{Signal} x 10 = \%\textsubscript{PWM}.

+2V\textsubscript{to}+10V

Select the optional +2V\textsubscript{to}+10V control signal by cutting the Signal jumper. +2V\textsubscript{to}+10V controls PWM from 0\textsubscript{to}100\%. Note: \textit{(Signal - 2)} x 12.5 = \%\textsubscript{PWM}.

When the input signal = < +2V, PWM stays at 0\%\textsubscript{PWM}. Signal < +1V turns GO\textsubscript{motor} off. Signal >+2V turns GO\textsubscript{motor} on.

GO\textsubscript{/PWM}

To control more than 2 single control circuit motors, cut the PWM\textsubscript{2} jumper. This changes the GO\textsubscript{/PWM\textsubscript{2}} connection function from GO\textsubscript{motor} to PWM. Two additional single control circuit motors may be connected to this connection.

On/off

For Single Control Circuit Motors

0\textsubscript{to}+10V

See the motor manufacturer’s recommendations to on/off with 0-100\%\textsubscript{PWM}. Most EC Motor manufacturers recommend ~line power on the motor except when the service switch is off. And they recommend on/off control using the PWM signal. Some recommend on/off operation at very low PWM thresholds. In this case, never set the stop threshold < 2\%\textsubscript{PWM} or the pilot pulse may prevent the motor from stopping.

+2V\textsubscript{to}+10V

Caution: Do not cut the +2V\textsubscript{to}+10V jumper.

Most single control circuit motors can be configured to start when the signal reaches the selected \%\textsubscript{PWM}, and to stop when the signal falls below the selected \%\textsubscript{PWM}. (The stop \%\textsubscript{PWM} is always < the start \%\textsubscript{PWM}).

For +2V\textsubscript{to}+10V operation, configure the motor start to 20\%\textsubscript{PWM} and the motor stop to 10\%\textsubscript{PWM}.

+4mA\textsubscript{to}+20mA

For +4mA\textsubscript{to}+20mA operation, configure the motor start threshold to 20\%\textsubscript{PWM} and the motor stop threshold to 10\%\textsubscript{PWM}. Then, connect a 511Ω 1\% resistor at the SNV between the signal connection and the neutral connection. (+20mA flowing through the 511Ω paralleled with the 20KΩ input resistance produces +10V at the Signal terminal).

For Dual Circuit Motors

Best practice keeps ~line power on the motor except when the service switch is off. Routine on/off is achieved by switching the GO signal (the 2\textsuperscript{nd} circuit).

Pilot Pulse

Pilot Pulse (Autoswitch) provides a 49\textmu s 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.
Severe Environment

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. Reference Wiring, followed by diagrams starting on the next page.

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<sub>j</sub>+10V signal is at 0V. Some motors are set up 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.

For +2V<sub>j</sub>+10V applications, test that the motor is off when the signal decreases below +1V. And the motor starts when the signal increases above +2V.

Observe the motor runs at full speed when the 0V<sub>j</sub>+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 flashing, the EVO/ECM-SNV is powered, and the micro-controller is running. With the signal jumper cut (+2V<sub>j</sub>+10V option), the signal lamp displays a short “heartbeat” flash every 3 seconds, indicating the EVO/ECM-SNV is powered, the processor is running, but the motor is not being called to run.

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 signal lamp.

For 0V<sub>j</sub>+10V configuration, 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. This also indicates 37% PWM.

For +2V<sub>j</sub>+10V (jumper cut), the flashes should indicate the signal voltage minus 2; then multiply by 12.5. Example: a +6V signal indicates 50% PWM. To convert flashes to the expected signal, divide flashes by 12.5; then add 2.

Disconnect the mCom, PWM<sub>1</sub> and GO/PWM<sub>2</sub> wires going to the connected motors. Use a multimeter set to measure continuity. Check each wire of the motor connections, mCom, +PWM; and GO/PWM<sub>2</sub> 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 %<sub>PWM</sub>. Touch the Black(-) to the -PWM connection and the Red (+) to the +PWM connection.

The voltage should be between +1.6V and +21V depending on the 0V<sub>j</sub>+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<sub>j</sub>+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<sup>2</sup>. 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<sup>3</sup>. 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 Neutral connections at the EVO/ECM-SNV.

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<sup>2</sup> See NEC<sub>USA</sub> 725.41

<sup>3</sup> NEC<sub>USA</sub> 250.20.a.
Severe Environment

Best practice uses an AWG 22/0.35 mm² three twisted triplet cable⁴ between the Signal Source Controller and the EVO/ECM-SNV.

For connections over 9⁷⁄₃⁸₂ m, best practice uses AWG 19/0.75 mm² twisted triplet shielded cable⁵. 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 to connect the Signal Source Controller 0V+→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% resistor⁶ provides a 500Ω dropping resistance. Connect the resistor between the SNV Neu and Signal connections.

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

Keep high voltage wiring away from 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.

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⁴ West Penn 25231B or equal

⁵ West Penn 25303B or equal

⁶ www.Mouser.com  pn. 271-511-RC
Severe Environment

Dual Circuit Motors
Control Signal On/Off
Cut +2V, +10V Jumper

Caution: Never connect other ~24V loads or make other Neu/Com connections here.

Motors with GO connection
ECM 2.3 EON and others

Single Circuit Motors
0V, +10V Signal
Caution: Do Not Cut Jumpers

Motor profile may start motor at low start & stop %\text{PWM}.
Never set stop %\text{PWM} below 2%\text{PWM}.
See motor maker information for other means to start & stop the motor.

Motors without GO connection
EON 42 and others

Connect 511Ω resistor here.
**Single Circuit Motors**

**+2V<sub>o</sub>+10V Signal**

*Caution: Do Not Cut Jumpers*

- Motor profile may start motor at low start & stop %<sub>PWM</sub>. Never set stop %<sub>PWM</sub> below 2%<sub>PWM</sub>. See motor maker information for other means to start & stop the motor.

- For +2V<sub>o</sub>+10V operation: Set motor profile to start motor At 20%<sub>PWM</sub> and stop motor At 10%<sub>PWM</sub>

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4 Single Circuit Motors

**0V+10V Signal**

*Cut GO/PWM<sub>2</sub> Jumper only*

- Motor profile may start motor at low start & stop %<sub>PWM</sub>. Never set stop %<sub>PWM</sub> below 2%<sub>PWM</sub>. See motor maker information for other means to start & stop the motor.

- For +2V<sub>o</sub>+10V operation: Set motor profile to start motor At 20%<sub>PWM</sub> and stop motor At 10%<sub>PWM</sub>
Connect Multiple Motors
Use AMP 61765-1 & Insulate

EVO/SNV-CAB ??
(?? = Length in Feet)

Cables > 12'
Use an EVO/SNV-CAB 01. Extend the cable as needed using Amp 2-521192-2 25mil insulated Faston tabs and West Penn 25234B or equal AWG 18 cable.

Evolution Controls Inc.
Connections

Use non locking type ⅛ 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 cramped, 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.

Box Height:
0.725 in
18.4 mm