Micropump, Inc.
1402 NE 136th Avenue
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www.micropump.com

Frequently Asked Questions Regarding EagleDrive

ESD

The microprocessor and BLDC controller have 2000V human body ratings, and at least 200V machine model ratings. Care should be taken when handling open-frame versions, or when handling the leads of the housed EagleDrive

CE Compliance

EMSN AND EELN drives have passed emissions testing and meet requirements for Class A equipment based on the following standards:

- AS/NZS 61000-6-4:2012 Class A
- EN 61000-6-4:2007+a1:2011 Class A
- FCC 15.107:2017 Class A
- FCC 15.109(g): 2017 Class A
- ICES-003:2016 Class A

The individual emissions testing include the following:

- Radiated Emissions
- Conducted Emissions
- Electrostatic Discharge (ESD)
- Radiated Immunity
- Magnetic Field Immunity

Conducted Immunity and Electrical Fast Transients were out of scope per EN 61000-6-2:2005 because drive cable length are less than 3 meters.

Voltage Dips and Interruptions were out of scope because it only applies to AC powered devices.

EMSN drive has passed Low Voltage Directive testing based on the following standards:

- Annex I of Machinery Safety Directive 2006/42/EC
- EN 809:1998/A1:2009

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Mains input

24 +/- 12Vdc (nominal), voltage ripple must be maintained below 5% peak-to-peak, from SELV Class2 or Limited Power Source, *Micropump always recommends external overcurrent protection*
Internal hardware-phase-current-limit (MODEL MS ~2A, MODEL EL ~3A), hardware-current-limit decreases motor speed to hold at current limit until rotation stops (stall), in locked-rotor condition maximum stall current is ~1.2A.
If locked rotor operation occurs at full load current in greater than 70°C ambient temperature conditions can result in winding temperatures greater than UL 1004 limits. To reduce risk of exceeding winding temperature limits we recommend always monitoring the tachometer signal and commanding stop if the pump shows a locked rotor condition lasting more than one minute.

Control input

-0.3 to 5.1Vdc control input, motor set to zero rpm -0.3 to +0.2V, motor set to 100% above +5.0V as read with 10-bit ADC channel on microprocessor
Input impedance ~6 kohm, input is not clamped and must remain below 5.1V max at all times
Internal 100k pull down on input provided positive stop should lead be disconnected
Input Voltage vs RPM is proportional within a given mains voltage (i.e. % of 5.0V = % of maximum motor speed at defined mains input), as controlled by 8-bit microprocessor signal, operating open-loop-speed with motor max output current limited

PWM input

% Positive duty cycle within 3% to 97% at 20-100Hz frequency results in motor speed proportional to the input.
Input impedance ~6 kohm, input is not clamped and must remain within -0.3 to 1.5v (Lo) and +3.5 to 5.1V (Hi) or the motor will be irreparably damaged.
Internal 100k pull down on input provided to hold low should lead be disconnected
PWM vs RPM is proportional within a given mains voltage (i.e. % of Positive Duty Cycle = % of maximum motor speed at defined mains input), as controlled by 8-bit microprocessor signal, operating open-loop-speed with motor max output current limited

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Direction Input

An internal 10Kohm pull up to the drive's 5V supply ensures the motor runs forward direction when this lead is not connected or floating. To select reverse rotation the external circuit will need to sink ~0.5mA current. This lead is often connected using a relay to the Mains Ground – activating the relay selects reverse rotation.

Tacho output

2 PPR (standard) TTL-compliant square wave pulses, common emitter transistor output, 5.25V max collector voltage
V_{high} = 5 +/-0.25Vdc
V_{low} = 0.09 +/- 0.09Vdc
100 ohm impedance low state, 1.1 kohm output impedance hi state

Fault outputs

Active low microprocessor outputs, driven with 5.6kohm pull-up resistors to the internal 5V, should be monitored with a high impedance device (Rload > 100kohms)
V_{high} = 5 +/-0.25Vdc
V_{low} = 0.09 +/- 0.09Vdc
1 kohm impedance low state, 6.6 kohm output impedance hi state

Fault signals are V_{low} when:

- Supply under voltage, decreasing below approximately 8 V, ~0.5V hysteresis
- Over temperature, temperature increasing above 170°C, 15°C max hysteresis
- Logic fault, error conditions on the Hall sensors (i.e. pump not installed correctly)
- Internal component failure (internal short or open connection as follows)
  - Short from any of the motor phase connections to ground
  - Short from any of the motor phase connections to the mains supply
  - Short across motor phase windings,
  - Open condition in the internal motor phase connection

Fault 1=0, Fault 2=1: Low load Current. This can occur at any RPM below 800.

Thermal Shutdown

The internal microprocessor located on the motor circuit board senses temperature and is monitored via firmware. Standard Firmware will disable the drive when the temperature on chip exceeds 136°C or falls below -40°C, the pump will automatically resume operation when the temp falls below 127°C or exceeds -32°C.

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Connections

Open-frame connector mates with:
Molex Micro Fit 3.0 per Product Specification PS-43045
Tyco Electronics Micro MATE-N-LOK per Product Specification 108-1836
Contact plating: 15µin or 30 µin gold on contact area (100 µin matte tin on solder tails)

Housed version PVC jacketed cable with SR-PVC insulated lead wires, 22 AWG (7/30) per UL STYLE 2517, 105°C, 300V
Refer to IOM for connection table

Key Electronic Components

COMPONENT TYPE	MANUFACTURER	MFG P/N
SOLID TANTALUM CAP	AVX	TPSC686K016R0200
ELECTROLYTIC CAP	PANASONIC	EEHZC1H101P
ZENER DIODE	VISHAY	BZT52B3V3-E3-18
SCHOTTKY DIODE	DIODES INC	BAS70-04-7-F
ZENER DIODE	PANASONIC	DZ2J047M0L
TVS DIODE	LITTLEFUSE	SMAJ40A
BLDC CONTROLLER	ALLEGRO	A3931KJP-T
MOSFET	IRC	IRF7351PBF
HALL SENSOR	MELEXIS	US2881LUA
RECTIFIER	VISHAY	SS8P6C-M3/86A
TRANSISTOR	ZETEX	FCX1053ATA
MICROCONTROLLER	FREESCALE	MC9S08QD4MSC
OP AMP	TI	OPA322AIDBVR

Equivalent alternate devices as approved by Micropump may be substituted for the specific examples above.
Remaining components are MLCC SMT capacitors and Thick-Film SMT resistors.

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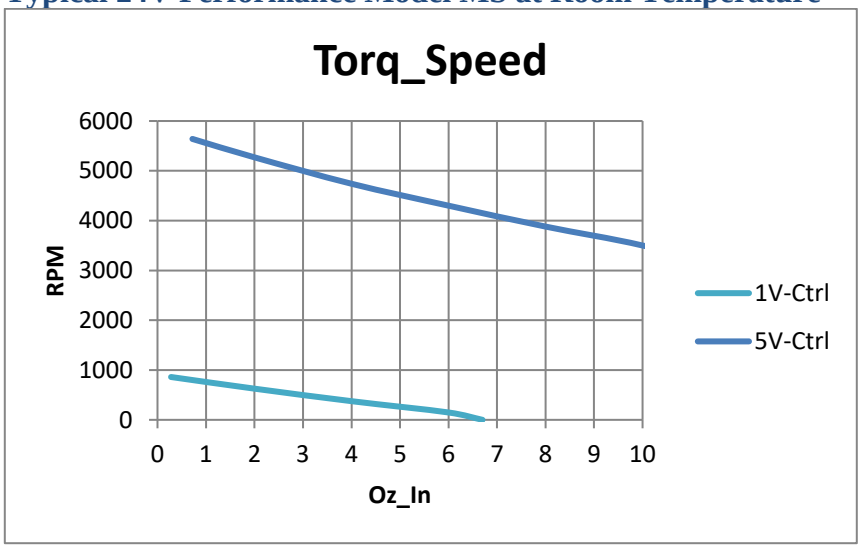
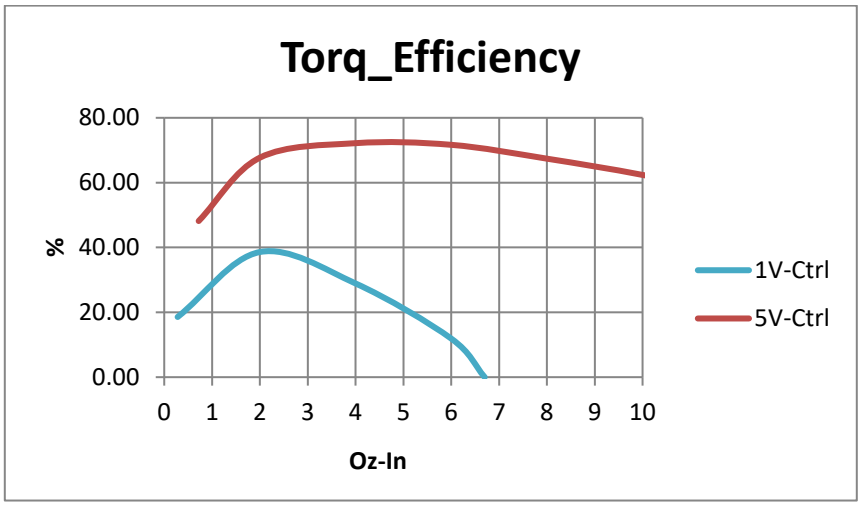
Typical 24V Performance Model MS at Room Temperature





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Typical 24V Performance Model EL at Room Temperature