

# MICROPUMP®

## EAGLEDRIVE™

### INSTALLATION, OPERATION AND WARRANTY INFORMATION

#### EagleDrive™ MS



Without Enclosure

#### EagleDrive™ EL



Without Enclosure

## **PUBLISHED BY**

MICROPUMP INC.

A Unit of IDEX Corporation

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The products manufactured by Micropump Incorporated are warranted to be free from defects in workmanship and material at the time of shipment from the place of manufacture. Micropump will repair or replace, at its option, any part or component which fails to conform to this warranty for a period of one year. Micropump's obligation under this warranty is limited to the repairs or replacement of defective equipment returned to Micropump on an F.O.B. destination and freight-prepaid basis. All normal wear and tear is excepted, and product is subject to examination at Micropump to verify that the parts or components were defective at the time of sale.

For the purposes of the limited warranties, the "Stator/Controller Assembly" means only the stator and the printed circuit board and electronic components contained in the controller housing, plus the connecting control and power cables. The "Power Supply Assembly" means only the printed circuit board and the electronic or mechanical components located inside or on the power supply enclosure and the "Pump head Assembly" means all other parts of the product, including but not limited to, the rotor.

No warranty of any kind is made or shall be imposed with respect to any pump or parts (1) that have not been properly installed and tested in operation, (2) that have been subject to misuse, negligence, acts of God or the elements, or any other form of casualty, or (3) that have been repaired or altered outside Micropump's facility in a way, so as, in our judgment, to affect performance or reliability.

The parties agree that the buyer's sole and exclusive remedy against Micropump shall be for repair or replacement of defective parts under the conditions stated above. The buyer agrees that no other remedy (including but not limited to incidental or consequential damages for lost profits, lost sales, loss of use, injury to person or property, or any other incidental or consequential loss) shall be available to them.

This warranty shall not apply to prototype pumps, experimental pumps, or brush-type electric motors. Warranty of equipment or accessories from outside sources, purchased by Micropump and incorporated into Micropump's product is subject to the manufacturer's standard warranty, unless specifically agreed otherwise between Micropump and buyer. A copy of the warranty on the aforementioned equipment is available on request.

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## Your Micropump Product...

represents years of fluid handling experience and we feel it is the finest product available of its type.

The product you have purchased was designed and constructed for use within designated limits and conditions. Staying within performance limits and following the guidelines given in this manual will result in excellent performance and maximum life.

Should you have a question or a problem, technical assistance is available worldwide. Micropump products are designed for easy field servicing with service kits and technical support available for all products.

### The Purpose of this Guide...

is to provide information to enable suitably qualified technicians and fitters to install, operate and maintain the Micropump EagleDrive and common pump/motor combinations.

### Use the Guide...

when you have purchased a motor or pump/motor combination. This guide contains specific information for installation, operation, and maintenance of the EagleDrive and references some of the most common pump/motor combinations. This guide should be read in conjunction with the instructions provided with your specific pump. General information is given on installation within a system, but reference should always be made to instructions provided with ancillary equipment when installing the unit.

## Abbreviations

The following abbreviations are used in this guide:

°C	Degrees Celsius	°F	Degrees Fahrenheit
EMC	Electromagnetic Compliance	DC	Direct Current
LVD	Low Voltage Directive		
IOM	Installation, Operation and Maintenance Manual		
Max	Maximum	Min	Minimum
RPM	Revolutions Per Minute	SELV	Safety Electric Low Voltage
V	Volt(s)	W	Watt(s)

## Safety

The following are used throughout this guide to indicate procedure that, if not followed correctly, may result in injury to personnel or damage to equipment.



**Warnings are used to alert the reader to a procedure or practice, which if not followed correctly, could result in personal injury.**



**Warning - Hot Surface is used to alert the reader to a procedure or practice, which if not followed correctly, could result in personal injury due to contact with a hot surface.**



**Cautions are used to alert the reader to a procedure or practice, which if not followed correctly, could result in damage to the pump, motor, or ancillary equipment.**



**Notes are used to highlight important information that may assist the reader in carrying out a procedure or in understanding the text.**

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## Limits of Use

The EagleDrive motor is intended for use with pumps handling fluids in a variety of pump-ing systems. These fluids may be innocuous or hazardous, depending on the specific application. You should contact your local Micropump distributor or contact Micropump directly about special limitations of your pump/motor unit with regard to your specific system.

To achieve optimum performance and safe operation Micropump products must be operated with the limits given in the Technical Specification. Operation outside these limits is not recommended and may result in damage to the pump, motor, and/or ancillary equipment.



**Temperature.** Operating beyond the maximum operating temperature given in the Technical Specification is not recommended and may result in damage to the product and compromise safety by creating high surface temperature.



**Mechanical Danger.** The product must be installed in a location that exposes it to a low risk of external damage.



**Hot Surfaces.** Under some operating conditions, surface temperatures can exceed 90°C (195°F.) Do not touch products while operating. Do not touch within 30 minutes of system shutdown to allow surfaces to reach safe handling temperature.



**Flooding and Water Immersion.** The products covered by this guide are not designed to operate immersed in water. Refer to the Technical Specification for the environmental rating.



**Corrosive Liquids.** Corrosive liquids may eventually produce leak paths around the sealing surfaces of the product. The product should be inspected for leaks on a regular basis.



**Condensation.** When pumping cold liquids ensure that condensation does not present a safety hazard. Condensation on the external surfaces of the magnet cup may result in a short-circuit in the motor controller.

## Installation in Explosive and Fire Danger Zones

Micropump offers products designed and tested for installation in explosive or fire danger zones. Contact your local Micropump distributor or contact Micropump directly to determine if your EagleDrive product combination can be certified for this use.

In Addition to the warnings provided throughout this manual, the following must be considered in any explosion or fire danger zone installation:



**Ensure the pump head, motor, and any mounting adapter are suitable for area classification.**



**Ensure that pumping liquid temperature, and motor housing temperature are maintained within acceptable range as specified by Micropump Certification of ATEX Conformity.**

## Description

The EagleDrive is a brushless DC motor with integrated controller specially designed to be electromagnetically coupled to a variety of Micropump pump heads. When properly assembled to the pump head with sealing o-ring, this comprises a sealed unit where the driven magnet is within a magnet cup that separates the pumped fluid from the atmosphere.

The enclosed versions are within a thermoplastic housing. The motor is capable of rotating in both directions and has several speed control input options. A tachometer signal, with a 0-5 V square-wave output provides speed feedback. The tachometer output has 2 pulses per revolution. The output frequency is multiplied by 30 to obtain RPM. The main input power is 12-36 VDC from a class 2 (SELV) source.

There are two EagleDrive models, the MS and EL. Both models operate from 12-36 VDC, with speed control input, 0-5V square wave tachometer feedback, and FWD/REV capabilities. Instructions for utilizing other speed input signals are provided in this manual.

Both EagleDrive models can be controlled using one of these options:

1. Externally applied 0-5 VDC supply
2. Externally applied 4-20 mA signal (conditioned with external resistor)
3. Manually-adjusted speed control (through use of external potentiometer)

## Function

The driven magnet is connected to the pumping parts and is sealed in the magnet cup. This magnet forms the rotor of the brushless DC motor and is driven by the rotating magnetic field in the stator. Rotation of the pumping elements produces flow.

The control signal controls pump speed. Internal feedback monitors the rotational speed of the pump and regulates the speed in relation to the control voltage. The controller increases current to regulate speed against increasing back pressure (within the operating limits of the pump and motor).

## Unpacking and Storage



**Inspect the magnet cup before assembly with the motor. Replace or repair if there are signs of damage.**

Before installing the product ensure all transit packaging has been removed. Remove the blanks from any inlet and outlet ports. If the pump is to be stored prior to installation, re-pack the pump in its original packing, refit the blanks to the ports and store in a dry, covered environment.

Protect the pump head from damage during unpacking and installation. Impacts to the magnet cup can cause internal damage or result in rub between the magnet cup and driven magnet upon assembly with the motor.

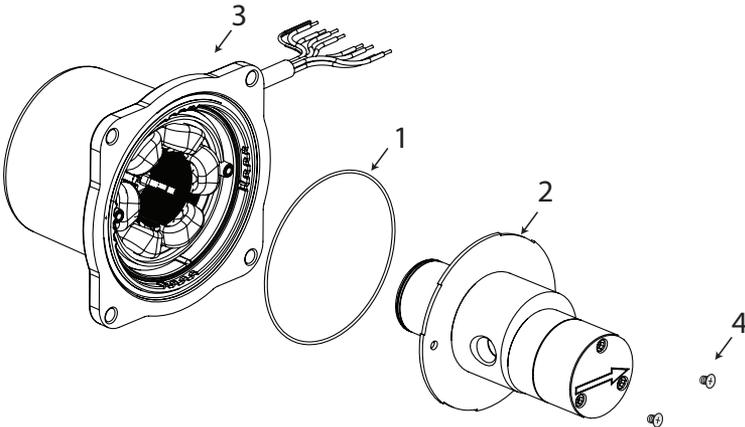
## Assembly



**Loose bolts may result in pump/motor misalignment. Tighten bolts appropriately. Pump/motor misalignment may result in weakening the sealing of the enclosure.**

If the pump head housing assembly and EagleDrive motor are supplied separately they will need to be assembled prior to the installation.

Insert the drive housing seal (1) into the groove in the face of the housing (3). Align the pump assembly flange (2) so that it fits into the matching recesses and rotate clockwise to engage the housing. Secure using the two screws (4) supplied with the EagleDrive. Torque screws to 0.8 N-m (7 in-lbs).



## Space Requirements

Refer to the Technical Specification for overall dimensions and weights of the EagleDrive and some of the most common pump/motor combinations.

## Location



Pump head or adaptor cannot support the weight of the motor. Ensure the motor is adequately supported by the foundation and/or mounting bracket.



The foundation must be capable of supporting the combined weight of the pump and motor and provide a rigid support.

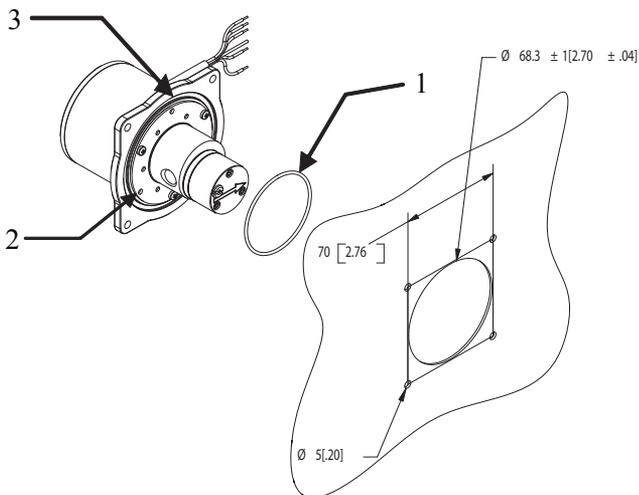
The product should be located with the inlet below or even with the liquid level of the fluid supply. The product can be mounted in any position. Ensure that there is adequate space for operation, inspection and maintenance.

## Bulkhead Mounting (EL Model)

If mounting the pump/EagleDrive assembly through a bulkhead, insert the bulkhead o-ring (1) into the groove in the face of the housing (3). Position the adaptor flange (2) through the bulkhead hole so that it does not interfere with the sealing of the bulkhead hole. Secure the pump/EagleDrive assembly using four screws, nuts, and washers as needed. Tighten screws evenly and in an alternating pattern.



O-Ring 2-040 described below is necessary to ensure bulkhead is sealed.



## EagleDrive Electrical Connection



Electrical installation must be carried out by qualified personnel who are conversant with local electricity installation regulations.



Before starting any electrical installation work ensure that the main electrical supply is adequately isolated.



Ensure that the pump motor is earthed. The pump may be electrically isolated from the motor depending on the mounting configuration. Some installations may need an earthing connection on the pump head.



Pumping flammable fluids without a proper earthing connection may cause spontaneous ignition.



Ensure that all electrical connections use a common earth ground to avoid hazardous ground loops.

### Power In

The main input power is 12 to 36 VDC from a Class 2 (SELV) source applied across the power in and common ground leads. This voltage must be maintained within the specified limits as the motor is loaded to its maximum current of 2A (Model - MS) or 3A (Model - EL.)



Ensure that the voltage of the supply is correct for the motor being connected, and that the source is Class 2 or a Limited Power Source.



Ensure that only power supplies having SELV specification are connected to the EagleDrive.



Ensure that the power supply voltage ripple is maintained below 5% peak to peak.



Ensure that all associated equipment has a form of overcurrent protection. If a fuse is used see table below for recommendations.

EAGLEDRIIVE MODEL	RECOMMENDED FUSE
MS	LITTLEFUSE 0313002 HXP
EL	LITTLEFUSE 0313003 HXP

## EagleDrive Electrical Connection (Continued)

### Control Signal In

#### 0 to 5 VDC Speed Control

When the lead is connected to a supply within the range the motor speed is proportional to the input. The applied voltage must be within -0.3 to +5.1 VDC or the motor will be irreparably damaged.

### Common Ground

The input voltage, control inputs, fault flags, and the tachometer output all use a common ground. It is possible that ground potential differences between the power supply, control voltage source and the frequency counter (if used) will be forced to the same ground reference when connected to the EagleDrive. Ensure only one earth ground is used to avoid ground loops.

### Isolated Ground

The motor common (black) wire is isolated from the motor housing. There is an internal connection between the cable shield (bare wire) with the common (black) wire. If the black lead is connected to the shield, EMC will not be affected. This can be done at the customer input end of the cable.

### Using The Tachometer Output

The tachometer output can be monitored using a frequency counter. The tachometer output is 0-5V square wave pulse that occurs twice per pump drive revolution. To convert the tachometer output to rpm, multiply the output frequency (Hz) by 30.



**Inadvertent connection of the tachometer output (green) wire to ground or the supply voltage can cause damage to the drive. If the tachometer is not used, trim and insulate the green lead.**

### Forward/Reverse Operation

The direction of fluid flow can be changed by connecting the orange wire to ground.

For FORWARD flow, make NO CONNECTION to the orange wire. For REVERSE flow, connect the orange wire to GROUND.



**DO NOT reverse the direction of rotation of the drive until the drive has come to a complete stop. Reversing the direction while the drive is still turning may damage the motor.**



Inadvertent grounding of the forward/reverse (orange) wire will cause the drive to operate in reverse. If reverse operation is not required, trim and insulate the orange lead.



Motor/Pump performance will be different between FWD and REV operating modes.

## Fault Signal Out

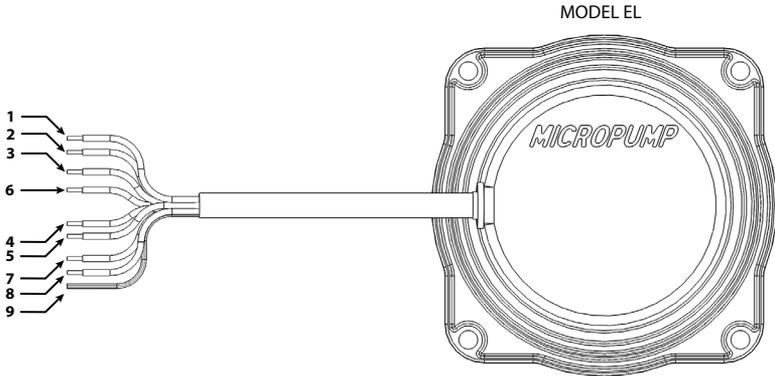
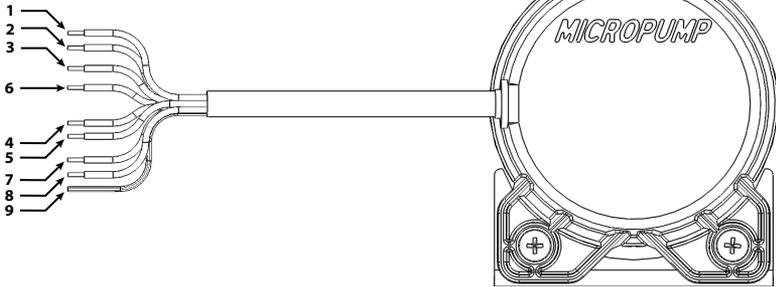
The two fault signals provide diagnostic feedback to the user's control system. These use the common ground to provide HI or LOW signals. When both Fault Signals indicate HI, the EagleDrive is operating normally (no faults detected). Signals are driven with 5.6kohm pull-up resistors to the internal 5V and should be monitored with a high impedance device ( $R_{load} > 100\text{kohms}$ ).



**Do not short Fault Signals to ground or EagleDrive will not operate properly.**

Fault Signal 1	Fault Signal 2	Fault Description	Drive Condition	Reason for Fault	Remedy
Lead 8 Brown	Lead 7 Blue				
0	0	Under Voltage	Disabled	Voltage supply less than 8.5V	Ensure proper supply voltage, check power and ground connections
0	0	Over Temperature	Operating	Internal component temperature greater than 170° C	Reduce load or increase cooling
0	0	Logic Fault	Disabled	Drive cannot locate the magnets inside the pump	Ensure pump is correctly attached to EagleDrive
1	0	Internal Short	Disabled	Drive components have failed	Reset EagleDrive by disconnecting and restoring power supply connection, if problem persists, contact Micropump for a replacement.
0	1	Low Load Current	Operating	Drive components have failed	Reset EagleDrive by disconnecting and restoring power supply connection, if problem persists, contact Micropump for a replacement.
1	1	None	Operating	No Fault	

## EagleDrive Lead Wire Assignments



Lead	Function	Color	
1	Power In	Red	+12 to +36 VDC, Class 2 (SELV), Reverse-polarity protected
2	Common	Black	Isolated from motor housing
3	Control Signal In	Yellow	0-5 VDC
4	Tachometer Out	Green	5 V square wave-2 pulses per revolution
5	FWD/REV	Orange	Forward (float and insulate), Reverse (ground)
qww	Not Connected	Violet	None
7	Error Out	Blue	Fault Signal 2
8	Error Out	Brown	Fault Signal 1
9	Shield	-	Connected to Common



The 0-5 VDC Control Signal In must be within -0.3 to +5.1 VDC or the motor will be irreparably damaged.

## Operation



**Starting or running the pump with the discharge valve closed may result in overpressure in the discharge pipe.**



**Extended periods of dry running may result in permanent damage to the pump and may cause surface temperature to exceed the operating temperature of the pump. Ensure that the pump head temperature does not exceed the flash point temperature of the fluid or area. Shut down pump for a no fluid condition. Shut down the pump for a no flow condition.**



**Ensure the pump head temperature does not exceed the flash point temperature of the fluid or area.**

### Start-up Procedure

Before starting the pump ensure that any valves in the inlet or discharge lines are open and that any inlet filters are clean and free from obstruction.

1. Set the external control signal input to minimum value (0 VDC.)
2. Set the power supply (12 VDC to 36 VDC) to ON. With the control input set to 0V, the pump will show a nominal 25mA to 100mA current draw and will not turn.
3. Adjust the control signal input to the required level. Current demand will rise and fall as the pump load and speed varies.

Once started the pump should prime if it has not already been filled with fluid. If the pump fails to prime, stop the pump and fill the pump head with liquid.

### Post Start-up Checks

Once the pump has started, carry out the following checks:

1. Check that the pump and motor operate smoothly and are free from vibration.
2. Check the inlet and discharge fittings are free from leaks.



**Flow rate should always be adjusted by controlling motor speed. Ensure that overpressure does not occur in the discharge pipe. NEVER throttle flow by an inlet valve.**

### Shut-down Procedure

Switch off the EagleDrive by first setting the external control signal input to the minimum value, then switch off the power supply. Check that the unit runs down in a steady manner. Close the inlet and discharge valves. Drain the pump if it is to be shut-down for long periods or installed in areas where the liquid may freeze. Refer to the Maintenance section for instruction on draining.



**Do not operate EagleDrives in two-wire mode (with control input connected to mains voltage). Contact your local Micropump distributor or contact Micropump directly about a special pump/motor unit with regard to your specific system needs.**

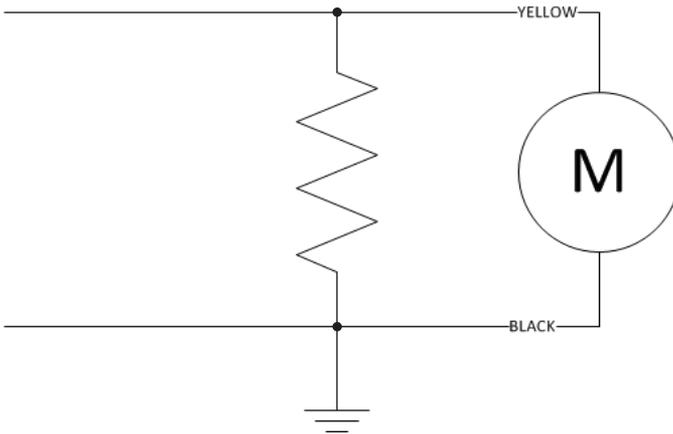
## 4-20mA Control Input



To maintain protection of internal drive controller, your external resistor should be fitted with appropriate insulation.

### 4-20mA Control

Install a 250 Ohm resistor across the yellow Speed Input and black Common lead wires. Applying current across this resistor will result in a commanded proportional speed from the Eagle Drive.



Recommended Resistor
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VISHAY P/N PTF65250R00AYBF
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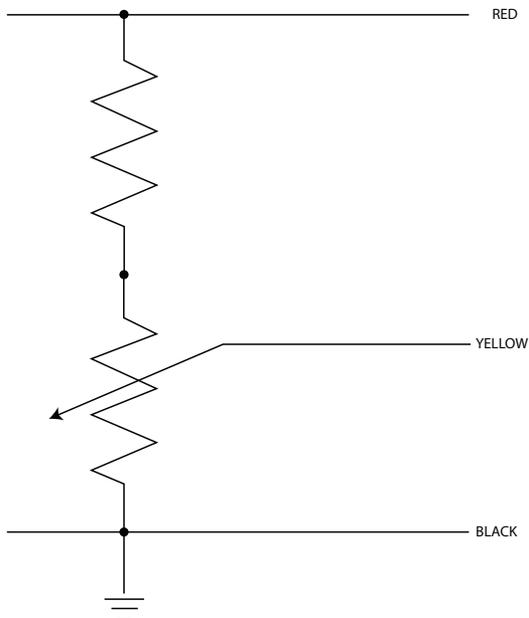
## Manual Control Configuration



To maintain protection of internal drive controller, your external potentiometer should be fitted with appropriate insulation.

### Manual Control

Install a resistor (sized according to your voltage supply input) across the red Power In and black Common lead wires. The potentiometer wiper is connected to the yellow Speed Input lead wire. To increase speed, rotate the potentiometer to increase voltage to the control line. To decrease speed, rotate the potentiometer to decrease voltage to the control line.



### Recommended Parts (24 VDC Mains)

Resistor (38 KOHM)	VISHAY CMF5038K300FHEB
Potentiometer (10 KOHM)	VISHAY P16NP103KAB15

## Magnet Decoupling

The EagleDrive pump/motor combinations do not decouple. If pump load becomes excessive, current limiting in the controller prevents motor overload. Additional protection is provided by a thermal sensor which shuts down the drive if the internal temperature exceeds a preset value.

## Maintenance



Excessive wear to the pump can result in driven magnet rub on the magnet cup. This can generate high surface temperatures or degrade the capability of the pressure boundary. Remove the pump from service and replace or repair if pump performance degrades significantly or the pump becomes noisy.



Ensure that heavy deposits of dust are not allowed to accumulate. Clean the pump periodically.



The pump cannot be drained completely, a certain amount of liquid will remain in the magnet cup area. Ensure that the pump is either flushed with a suitable flushing agent or precautions are taken against the effect of any remaining liquid during servicing. When the pump has been handling flammable, toxic or hazardous fluid, the pump internals must be properly decontaminated by suitably qualified personnel. The Material Safety Data Sheet for the pumped liquid must be referred to for correct procedures and precautions to be followed when handling the liquid.

Micro pump EagleDrive motors are designed to be maintenance free and require no adjustments. To ensure the motor or pump/motor assembly retains optimum performance maintain the fluid circuit to keep filters clean and prevent abrasive solids from passing through the pump.



A program that includes periodic monitoring of your Micro pump product is recommended to provide timely detection and assessment of any problem.

## Fault Isolation

If the EagleDrive does not meet its design performance or fails to operate correctly, refer to the following tables for assistance in identifying the cause and remedy:



**Execution of troubleshooting steps, determination of root cause and corrective actions should be performed by a skilled maintenance person.**

MOTOR WILL NOT OPERATE	
Cause	Remedy
No power to motor.	Ensure proper voltage has been applied to motor power leads. Check leads to ensure no short circuits are present.
Control Input lead is shorted.	Clear and isolate Control Input lead from Tachometer Out lead. Clear and isolate Control Input lead from Common lead.
No Control Input applied.	Ensure proper control input is applied to control Input lead: for 0-5V ensure line is not shorted. If manual control EagleDrive, adjust potentiometer to increase control voltage. Ensure control power supply common is connected to the common lead.
Thermal Limit is active.	Turn off motor and wait for temperature to cool. NOTE: If power voltage and control signals are present, motor will automatically restart when temperature is reached. Reduce motor load conditions and/or improve cooling of motor housing if persistent limit occurs.
Motor has been damaged.	Contact your Micropump Distributor or contact Micropump directly for replacement product.
CYCLIC NOISE OR VIBRATIONS	
Cause	Remedy
Loose motor mounting bolts.	Tighten motor mounting bolts.
Foundation not rigid.	Relocate motor.
Pump loose on motor.	Tighten pump mounting bolts.
Pump is worn.	Replace or repair pump.
Tachometer Out lead is shorted to FWD/REV lead.	Clear and isolate Tachometer Out lead from FWD/REV lead.
NO TACHOMETER SIGNAL	
Cause	Remedy
No power to motor.	Ensure proper voltage has been applied to motor power leads. Check leads to ensure no short circuits are present.
Improper wiring.	Check that the Tachometer Out lead is connected to the positive input of the frequency counter. Check that the common lead of the frequency counter is connected to the motor Common lead. Check leads to ensure no short circuits are present.
Motor is stopped.	Ensure proper voltage has been applied to motor power leads Ensure proper control input is applied to Control Input lead. Ensure control power supply common is connected to the Common lead.
MOTOR RUNS IN THE WRONG DIRECTION	
Cause	Remedy
FWD/REV lead is shorted to Common lead.	Clear and isolate FWD/REV lead from Common lead or shield. Check leads to ensure no short circuits are present.

## Technical Specification

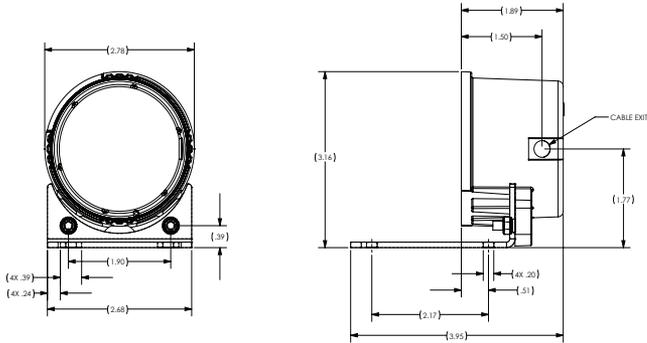


All Dimensions in mm.[inch]



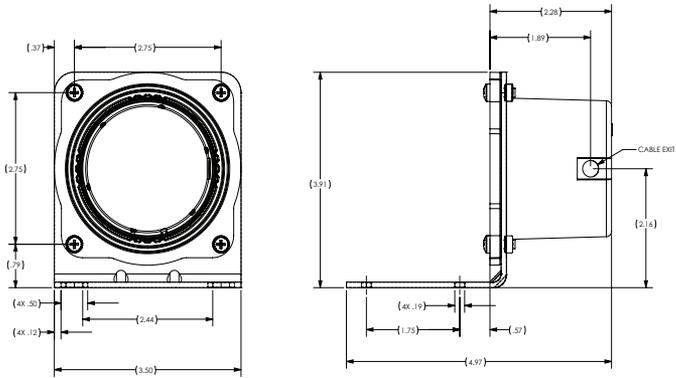
Not all possible configurations are shown. Contact your local Micropump distributor or contact Micropump directly for additional versions.

## Model MS



EagleDrive	
Model	MS
Product Code	DEMSE
Speed Range	250 to 10000 rpm
Typical No-Load Speed (24 VDC Input / 5 VDC Control / 25°C Ambient)	6000 rpm
Speed @ Rated Torque	3500 rpm @ 70 mNm (10 oz-in)
Input Voltage Range	10 to 38 VDC
Max Full-Load Current @ Nominal Voltage (25°C Ambient)	2A @ 24 VDC
Speed Control	0 to 5 VDC
Tachometer Out	0 to 5 VDC square wave - 2 pulse per revolution
Thermal Shutdown	135°C
Thermal Restart	120°C
Storage Temperature	-40 to +135°C
Maximum Ambient Operating Temperature	85°C at max load
Reversible	Yes
Weight	0.3 kg

## Model EL



EagleDrive	
Model	EL
Product Code	DEELE
Speed Range	250 to 9000 rpm
Typical No-Load Speed (24 VDC Input / 5 VDC Control / 25°C Ambient)	5500 rpm
Speed @ Rated Torque	3500 rpm @ 140 mNm (20 oz-in)
Input Voltage Range	10 to 38 VDC
Max Full-Load Current @ Nominal Voltage (25°C Ambient)	2.9A @ 24 VDC
Speed Control	0 to 5 VDC
Tachometer Out	0 to 5 VDC square wave - 2 pulse per revolution
Thermal Shutdown	135°C
Thermal Restart	120°C
Storage Temperature	-40 to +135°C
Maximum Ambient Operating Temperature	85°C at max load
Reversible	Yes
Weight	0.5 kg

## EagleDrive Pump Configurations

### EagleDrive™ MS

#### GA Series



#### GJ Series



#### CA Series



### EagleDrive™ EL

#### GB Series



#### GJ Series



**Notes**

**To purchase pumps, parts or receive further information contact your local Micropump distributor or contact Micropump directly.**

**Micropump, Inc.**

A Unit of IDEX Corporation  
1402 NE 136th Avenue  
Vancouver, WA 98684 USA  
Tel: +1 (360) 253-2008  
Fax: +1 (360) 253-2401  
E-mail: [info.micropump@idexcorp.com](mailto:info.micropump@idexcorp.com)  
Web: [www.micropump.com](http://www.micropump.com)

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