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Every effort has been made to ensure that the information contained in this manual is accurate prior to printing. However, the products described in this manual are subject to continuous development and improvement and Micropump shall not be liable for any errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this manual.

INTRODUCTION**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 pump life.

Should you have a question or a problem, technical assistance is available through a global network of distributors, factory engineers, and field sales personnel. 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 to install, operate and maintain the Micropump range of gear pumps and gear pump/motor combinations.

How to Use the Guide

You have purchased a motor or pump/motor combination. This guide contains specific information for the Model 380 motor. When installing or operating pump/motor combinations the instructions given in this guide should be read in conjunction with the instructions provided with the pump.

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List of Abbreviations

The following abbreviations are used in this guide:

Avg	Average
°C	degrees Celsius
DC	Direct Current
EMI	Electro-Magnetic Interference
IOM	Instruction, Operation, Warranty and Maintenance Manual
Max	Maximum
Min	Minimum
NdFeB	Neodymium Iron Boron
RPM	Revolutions Per Minute
Typ	Typical
V	Volt(s)
W	Watt(s)

GENERAL

Safety

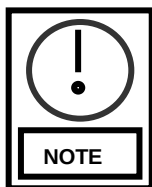
The following safety definitions are used throughout this guide to indicate procedures that, if not followed correctly, may result in injury to personnel or damage to equipment.



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



Cautions are used to alert the reader to a procedure or practice, which if not followed correctly, could result in damage to the pump and/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**

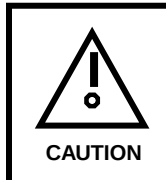
To achieve optimum performance and safe operation Micropump pumps and motors must be operated within the limits given for each Model in their respective Technical Specification tables. Operation outside these limits is not recommended and may result in damage to the pump and/or ancillary equipment.



Temperature. In some operating conditions, the surface temperature can reach up to 94°C (201°F). This temperature is high enough to potentially cause injury. Do not touch motor while operating. Also, do not touch motor within 30 minutes of shutdown to allow the motor housing to reach a safe temperature.



Temperature. Operating the motor beyond the maximum operating temperature given in the technical specification is not recommended and may result in damage to the motor.



Dust and Airborne Contamination. Motor performance is not affected providing the installation instructions given are followed. Reference should always be made to the installation and operating instructions for the motor under such conditions.



Corrosive Liquids. Corrosive fluid that comes in contact with the motor could result in damage to the motor. In case of exposure, clean motor and inspect for damage to the housing. If the internal electronic enclosure is exposed, replace the motor. Otherwise, clean and reinstall the drive.



Flooding and Water Immersion. The motor covered by this guide is not designed to operate immersed in water. Refer to the technical specification for the environmental rating.

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High Humidity. 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 motor seizure.

Unpacking and Storage

Before installing the motor or motor/pump assembly ensure all transit packaging has been removed. Remove the caps or plugs from the inlet and outlet ports. If the motor or motor/gear pump assembly is to be stored prior to installation, re-pack the motor or motor/pump assembly in its original packing, refit the caps or plugs to the ports and store in a dry, covered environment.



Micropump pumps are tested with water and cannot be drained completely. Ensure that the pump is either flushed with a suitable flushing agent or precautions are taken against the effect of any residual water having a detrimental affect on the fluid being pumped or the system components.

TECHNICAL SPECIFICATION -- Model 380 Motor

Typical No-Load Speed (at 25°C, 24V and 5V control)	5000 RPM			
Maximum Full-Load Current Draw (@25°C)	3.4 Amperes			
Input voltage	Min = 20	Typ = 24	Max = 30	Volts
Control Voltage	0-5***Volts DC			
Control Voltage Gain	Min = 950	Avg = 1000	Max = 1050	RPM/Volt
Storage Temperature	Min = 0		Max = 90	°C
Operating Temperature	Min = 0		Max = 40*	°C
Thermal Shutdown**	Min = 86	Avg = 90	Max = 94	°C
Restart Temperature** (After Thermal Shutdown)	Min = 76	Avg = 80	Max = 84	°C
Thermal resistance to ambient air	3°C /W			

*If the motor is run at less than full load, the motor can be operated in a higher temperature ambient. Please contact your Micropump distributor if you plan to operate the motor in an ambient temperature above 40°C.

**The thermal shutdown refers to the temperature of the motor flange at which the internal thermal protection will shut down the motor. The motor will restart automatically when the flange has cooled to below the listed restart temperature

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***To run the motor in two-wire mode, the control (white) wire can be connected to the positive supply (red) wire. The motor will run at its maximum speed. The speed control will not be damaged if the applied voltage is within +/-30VDC of the common (black) wire, though maximum speed is achieved at +5VDC or higher, and the motor will stop if 0VDC or lower is applied.

DESCRIPTION

A Model 380 is an outside rotor, Brushless DC Motor. The motor is enclosed in a clear-anodized, aluminum covering. Depending on the specific model purchased, there may be an attached magnet hub, a pump adapter, and/or a pump. The motors rotate in one direction and have a 0-5 volt speed control input. There is a tachometer signal with a 0-5 volt square-wave output for speed feedback. The tachometer output has 2 pulses per revolution, and the output frequency can be multiplied by 30 to obtain RPM. The main power is 24VDC.

Function

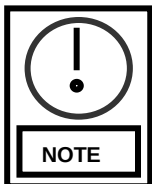
The output shaft drives a magnet hub which drives a magnet in the pump. The driven magnet is connected to the pumping parts and is sealed in the magnet cup. The magnets align pole-to-pole and rotate at the same speed until the coupling torque is exceeded. Rotation of the pumping elements produces liquid flow. Magnet hubs are supplied by Micropump, and included with the motor assembly.

Magnet Decoupling

Magnetic decoupling occurs when the load on the pump exceeds the coupling torque between the magnets. The magnets are forced out of pole-to-pole alignment and are decoupled. When decoupling occurs, the driving magnet speed increases to motor no-load speed while the driven magnet and pumping parts remain motionless. To recouple the magnets, the motor must be stopped to allow the magnets to re-align. The motor can then be restarted. The magnet couplings used with the Model 380 motor will typically be sized so that the motor stalls before the magnets decouple. However, some dynamic conditions (i.e. sudden changes in load) can cause the magnets to decouple, despite the limited motor torque.



The motor is not designed to run in a stall condition continually. In a stall condition, the motor thermal protection may not protect the internal electronics from overheating. Do not run motor continuously in a stalled condition.



Decoupling is an inherent feature of magnetic couplings and DOES NOT indicate a pump failure. Decoupling should only occur when the magnet decoupling torque has been exceeded. Decoupling can be a safety feature, preventing inadvertent pump/motor overloads.

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**ASSEMBLY**

If the pumphead and drive are supplied separately, they will need to be assembled prior to installation. Please refer to the weights/dimensions drawings in this manual. If you have questions about assembling your pump to your drive, please contact your Micropump distributor.

INSTALLATION

Pump Installation. Refer to the pump manual for pump installation details.

Motor Installation.

- Ensure that there is adequate space for operation, inspection and maintenance.
- Secure the pump/motor to the foundation using suitable mounting bolts. The mounting bolts should hold the drive and pump securely.
- If the mounting surface is hotter than 40°C (104°F), the motor may not be able to operate at full load without tripping the thermal protection.
- The foundation must be capable of supporting the combined weight of the pump and motor and provide a rigid support.
- There is a o-ring groove designed to fit a size AS-568A No. 2-038 o-ring in the face of the motor flange.

Installation in Explosive and Fire Danger Zones.

Ensure the motor is suitable for area classification. The Model 380 is designed to meet IP55 and NEMA 4 requirements. This drive is not explosion-proof.

Space Requirements. Refer to the illustrations on pages 14-16 for overall dimension and weight of the motor. Refer to the pump manual for the specific space requirements of the pump.

Mounting Plates and Adapters

This section is intended to cover installation of Micropump supplied pumps with the Model 380 motor. If you have purchased a pump/motor combination this will be assembled ready for installation.

If you have purchased a motor without a pump, the pump will have been supplied with a plastic or metal adapter that mounts to the square aluminum flange. The adapter allows the pump to be securely mounted to the motor. If you have the incorrect adapter for your pump, the pump and motor will not mount together. Please contact your Micropump distributor for assistance.

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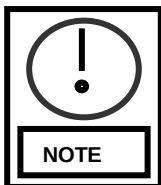
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Motor mounting screws are not supplied when a pump only is purchased.

Electrical Connection. Refer to the figures on page 14-15 for connection details. The Model 380 drive does not incorporate any fusing. A 5 Amp, fast-acting fuse between the power supply and the motor is recommended. There is an internal 1000uF capacitor with an ESR of 0.2 Ohms between the positive supply lead (red wire) and the motor common (black wire). This can cause an inrush current whose exact nature will vary with your power supply. The gradient of the inrush can be reduced by adding a low value resistor (up to 1.0 ohm) in series with the positive supply lead. However, this will limit the maximum power output of your motor (to 35 watts, in the case of a 1.0 ohm resistor). The resistor wattage should be appropriate for the application. If you need help selecting a fuse and/or series resistor, please contact your Micropump distributor.

The input voltage, the 0-5 VDC control input and the tachometer output all use a common ground. Any potential difference between the grounds of the power supply, control voltage source, and the customer supplied frequency counter (if used) will be forced to the same ground reference when connected to the Model 380 drive. While not typical, in some cases undesirable currents can flow through these devices' ground wires if more than one device is connected to earth ground. Ensure only one earth ground is used.

Voltage is not normally applied to the tachometer, but in case of misconnection, the tachometer can withstand an applied voltage in the range of +/-30VDC with respect to the motor common (black) wire. Also, the speed control (white) wire can also withstand an applied voltage in the range of +/-30VDC with respect to the motor common (black) wire. When the speed control wire is connected to more than 5 volts, the motor will run at its maximum speed. When the speed control wire is connected to less than zero volts, the motor will stop.

To maintain EMI compliance, connect the shield (bare wire) to the motor common (black wire) when wiring the motor.

Note that the motor common (black wire) is isolated from the motor housing. There is an internal 220nF, 63V capacitor between the motor housing and motor common. If an earth ground is required for the motor housing, the grounding wire can be bolted to the motor mounting flange. There is a thin layer of clear anodize covering the motor, so some care should be taken to ensure a proper ground connection (if required).



This motor is not protected against a reverse-polarity connection, where the common (black) wire is connected to the positive of the power supply, and the supply (red) wire is connected to the negative of the power supply. If power is applied in reverse-polarity, the motor will be irreparably damaged.

EMI Compliance

The Model 380 motor has been tested and found to be in compliance with EN-55014.

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**UL Recognized**

The Model 380 motor is recognized per UL 1004.



Electrical installation must be carried out by qualified personnel familiar with local electrical installation regulations.



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



When using the Model 380 drive, it must be connected to a class II power supply. A class II power supply is defined as being limited to supplying no more than 100 volt-amperes.



The pump is generally electrically isolated from the motor. Some installations may need an earthing connection on the pumphead. If an earthing connection is required for the pump, the connection should be made using one of the mounting screws fastening the pump to the motor adaptor. (Refer to your assembly instructions.)



Pumping flammable fluids without a proper earthing connection may cause spontaneous ignition. The Model 380 motor is not designed for use in explosive atmospheres.

OPERATION

Start-up Procedure. Before starting the pump/motor assembly, ensure that any valves in the inlet or discharge lines are open and that any inlet filters are clean and free from obstruction. Refer to the pump IOM for its operational instructions.

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Starting or running the pump with the discharge valve closed may result in overloading of the drive motor and overpressure in the discharge pipe.

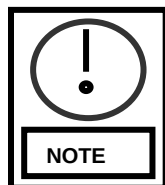


Operating the motor without an attached pump will expose rotating parts that can cause injury to personnel. Never touch the rotating components.

1. Set the external control voltage to minimum (0VDC).
2. Turn on the 24VDC power supply. With the control voltage set to 0VDC, the motor should not turn. In this idle state the motor will draw a nominal 60-80 mA current.
3. Adjust the control voltage 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 pumphead with liquid.

Post Start-up Checks. Once the pump has started perform the following checks:



A program which includes periodic monitoring of your Micropump pump is recommended in order to provide timely detection and assessment of any problems.



Flow rate should always be adjusted by a diverter valve fitted in the discharge line or the motor speed. NEVER throttle the flow of a positive displacement pump by the inlet valve.

- Check that the pump and motor operate smoothly and are free from excessive vibration or cyclic noise.
- Check the inlet and discharge fittings are free from leaks.

Shut-down Procedure. To shut down the Model 380 drive, first, turn off the control voltage. Check that the unit runs down in a steady manner. When the unit has stopped, disconnect the 24VDC power. 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.

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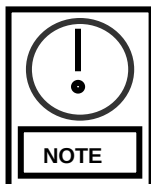
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If a low impedance path (i.e. a solenoid valve) is connected in parallel with the motor power leads and the 24VDC power is shut off before the motor stops, potentially damaging regenerative currents can flow out of the motor leads. Ensure motor stops before disconnecting power.

Using the Tachometer Output. The tachometer output can be monitored using any frequency counter. The tachometer output is 0-5V square wave that has two cycles per drive revolution. The frequency range is 0-160Hz. To convert the tachometer output to RPM, multiply the frequency by 30. The tachometer can be used as a speed feedback in a control system, or as a means of automatically sensing a decouple condition. Please contact your distributor if you need assistance.

How to Recognize Magnet Decoupling. Magnet decoupling occurs when the load on the pump exceeds the coupling torque between the magnets. The magnets are forced out of pole-to-pole alignment and are decoupled. When decoupling occurs, the driving magnet speed increases to motor no-load speed while the driven magnet and pumping parts remain motionless. An automatic system can detect decoupling by monitoring the tachometer line and either flow or pressure. If the tachometer line is sensing that the motor is turning but there is no flow, or pressure is much lower than expected, then a decouple is likely to have occurred. Depending on the complexity of the control system, a warning can be issued or an automatic re-coupling routine can be performed.



Decoupling is an inherent feature of magnetic couplings and DOES NOT indicate a pump failure. Decoupling should only occur when the magnet decoupling torque has been exceeded. Decoupling can be a safety feature, preventing inadvertent pump/motor overloads.

Causes of Magnet Decoupling. Magnetically driven pumps can operate very quietly. It is not always possible to detect, without disassembly of the pump, when the magnet coupling and pumping parts are operating incorrectly. It is therefore important to be able to recognize possible causes of magnet de-coupling:

- Blockage or restriction in the discharge side of the system
- Discharge pressure exceeds decouple point
- Fluid viscosity too high
- Foreign particles jamming pumping parts
- Binding or stuck pumping parts - this may occur between pumping cycles as a result of dried residue of the fluid being pumped. Drain and flush the pump to remove the residue.
- Sudden changes in pump load (including water -hammer or fluid-line pressure surges)

Magnet Recoupling. Before recoupling ensure that the cause of the decoupling has been identified and rectified. To recouple the magnets, the motor must be stopped (to allow the magnets to re-align) and then restarted.

MAINTENANCE, SERVICING AND FAULT ISOLATION

Maintenance

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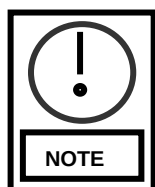
The Model 380 motor is designed to be maintenance free.

Servicing

The Model 380 motor requires no service for the life of the drive.

Troubleshooting

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



A program which includes periodic monitoring of your Micropump pump, is recommended in order to provide timely detection and assessment of any problems.

MOTOR WILL NOT OPERATE	
CAUSE	REMEDY
No power to the motor.	Ensure that the proper voltage has been applied to the motor power leads (red and black wires).
No control voltage applied.	Ensure that the appropriate control voltage has been applied to the control lead (white wire). Also, ensure that the control power supply common has been connected to the motor common (black wire).
Thermal limit has activated.	NOTE: The motor will restart automatically when it has cooled down to below 76°C (169°F), provided power and control voltage are still applied. Reduce the motor load by lowering outlet pressure or reducing flow (by reducing motor speed). Improve heat sinking by mounting the motor to a cool, metal surface. Improve heat dissipation by blowing air over the motor.
Motor damaged	Improper operation (including exceeding the maximum power voltage) or reverse connection of the power leads (black wire connected to +24VDC and red wire connected to ground) can permanently damage the motor. A damaged motor cannot be repaired, it must be replaced.

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MOTOR RUNS, BUT PUMP DOES NOT PRODUCE FLOW OR PRESSURE	
CAUSE	REMEDY
Suction valve closed. Discharge valve closed.	Open suction valve. Open discharge valve.
Feed piping blocked. Outlet piping blocked.	Check piping for blockage.
Magnets have de-coupled.	Shut off the motor. Allow the motor to come to a complete stop. Ensure the inlet and outlet valves are open. Restart the motor.
Driving hub is loose on the motor shaft.	Shut down the motor. Remove the pump from the motor. Tighten the driving-hub set-screw (observe driving-hub set-height -- refer to the outline dimensions on pages 14-16). Reassemble pump and motor (refer to the assembly instructions).

NO TACHOMETER SIGNAL	
CAUSE	REMEDY
No power to the motor.	Ensure that the proper voltage has been applied to the motor power leads (red and black wires).
Wiring incorrect.	Check that the tachometer lead (green wire) connects to the positive input of the frequency counter. Check that the motor common (black wire) connects to the negative or common input of the frequency counter.
Motor is stopped.	Ensure that the appropriate control voltage has been applied to the control lead (white wire). Also, ensure that the control power supply common has been connected to the motor common (black wire). Note that if the motor is commanded to stop, there will be no tachometer signal.

CYCLIC NOISE OR EXCESSIVE VIBRATION	
CAUSE	REMEDY
Loose mounting bolts.	Tighten mounting bolts.
Foundation not rigid.	Relocate motor.
Pump loose on motor.	Tighten bolts attaching motor to pump.
Magnet hub loose on shaft or not set to proper location on shaft	Remove pump from motor. Set hub to proper height on shaft. Tighten set-screw to 14 lb-in.

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**STANDARD LIMITED WARRANTY**

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 from date of original invoice, but not to exceed 18 months from the date of shipment. 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 Pumphead 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) which 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) which have been repaired or altered outside of 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 the 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 it.

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.

The adjustment or replacement of defective parts made under this warranty will not extend the original warranty period.

THE WARRANTY DESCRIBED ABOVE IS THE EXCLUSIVE MICROPUMP WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY WARRANTY PREVIOUSLY ISSUED. WE NEITHER ASSUME NOR AUTHORIZE ANY PERSON TO ASSUME FOR US ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OR USE OF OUR EQUIPMENT.

MICROPUMP, INC.**A Unit of IDEX Corporation**

PO Box 8975, Vancouver, WA 98668-8975, USA

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Fax: (360) 253-2401

email: info@micropump.comWebsite: www.micropump.com**MICROPUMP LIMITED****A Subsidiary of Micropump, Inc.**

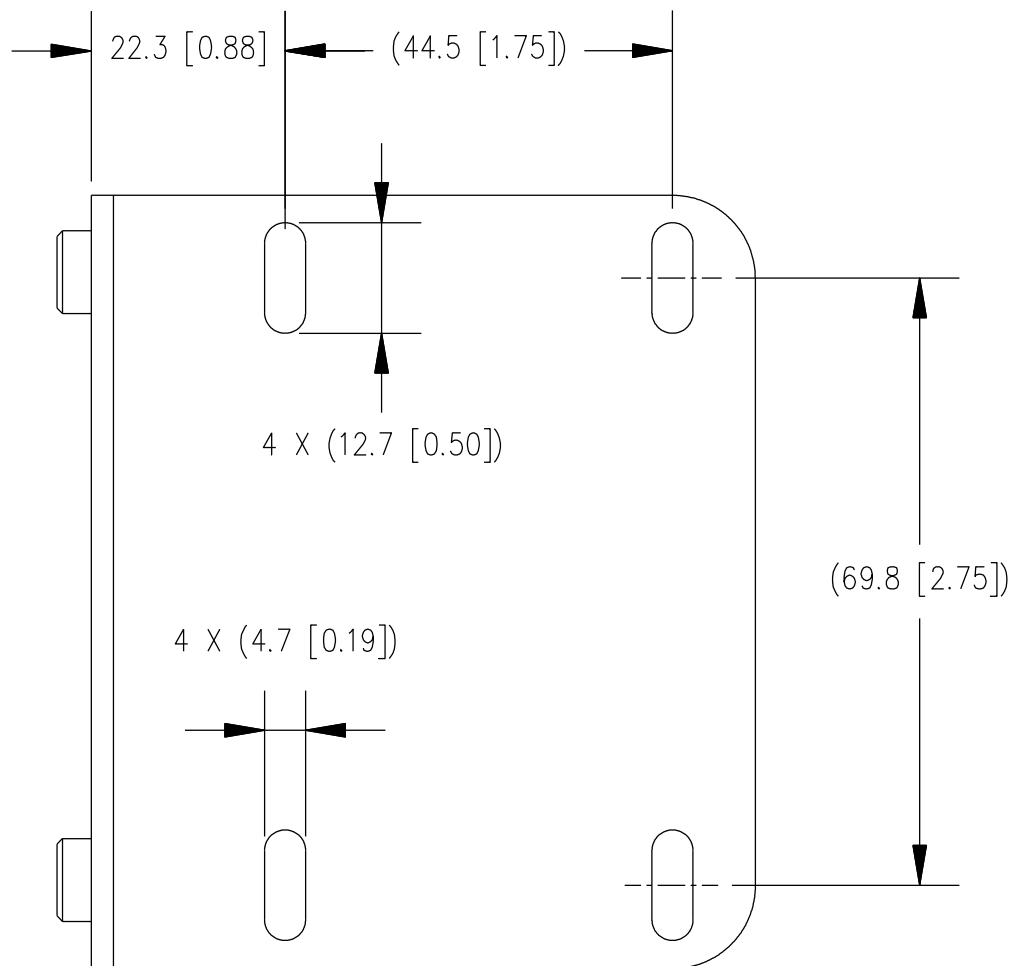
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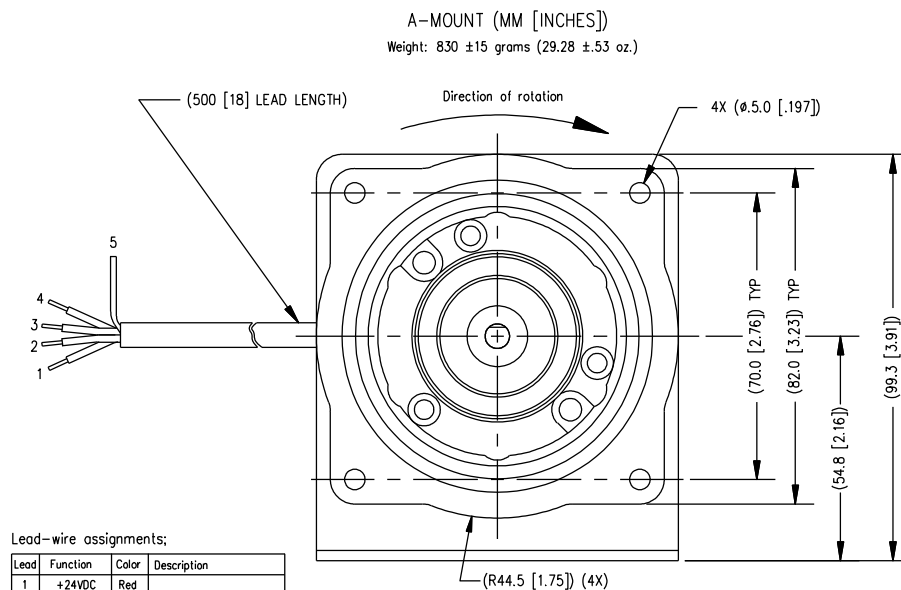
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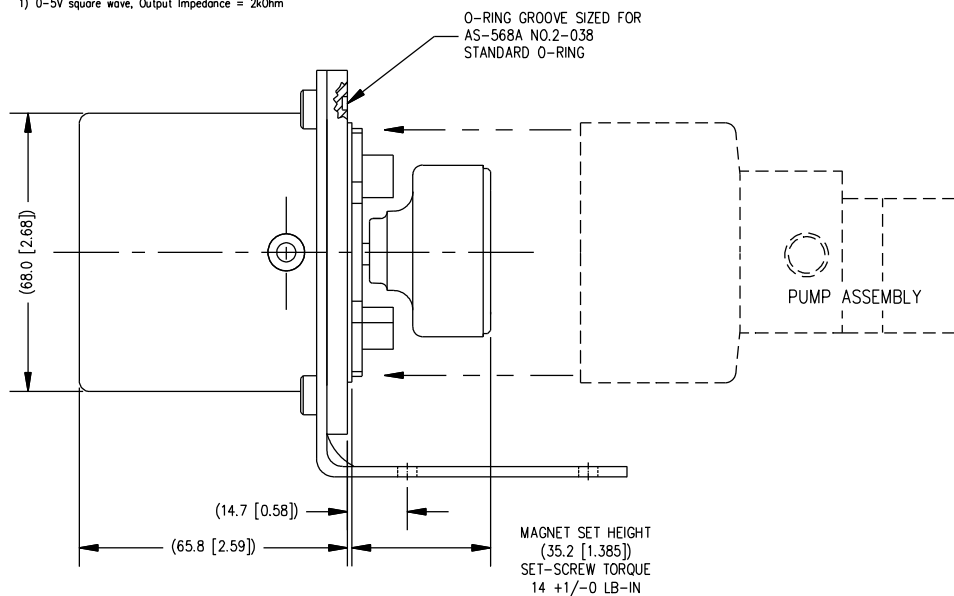
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1) 0-5V square wave, Output Impedance = 2kOhm



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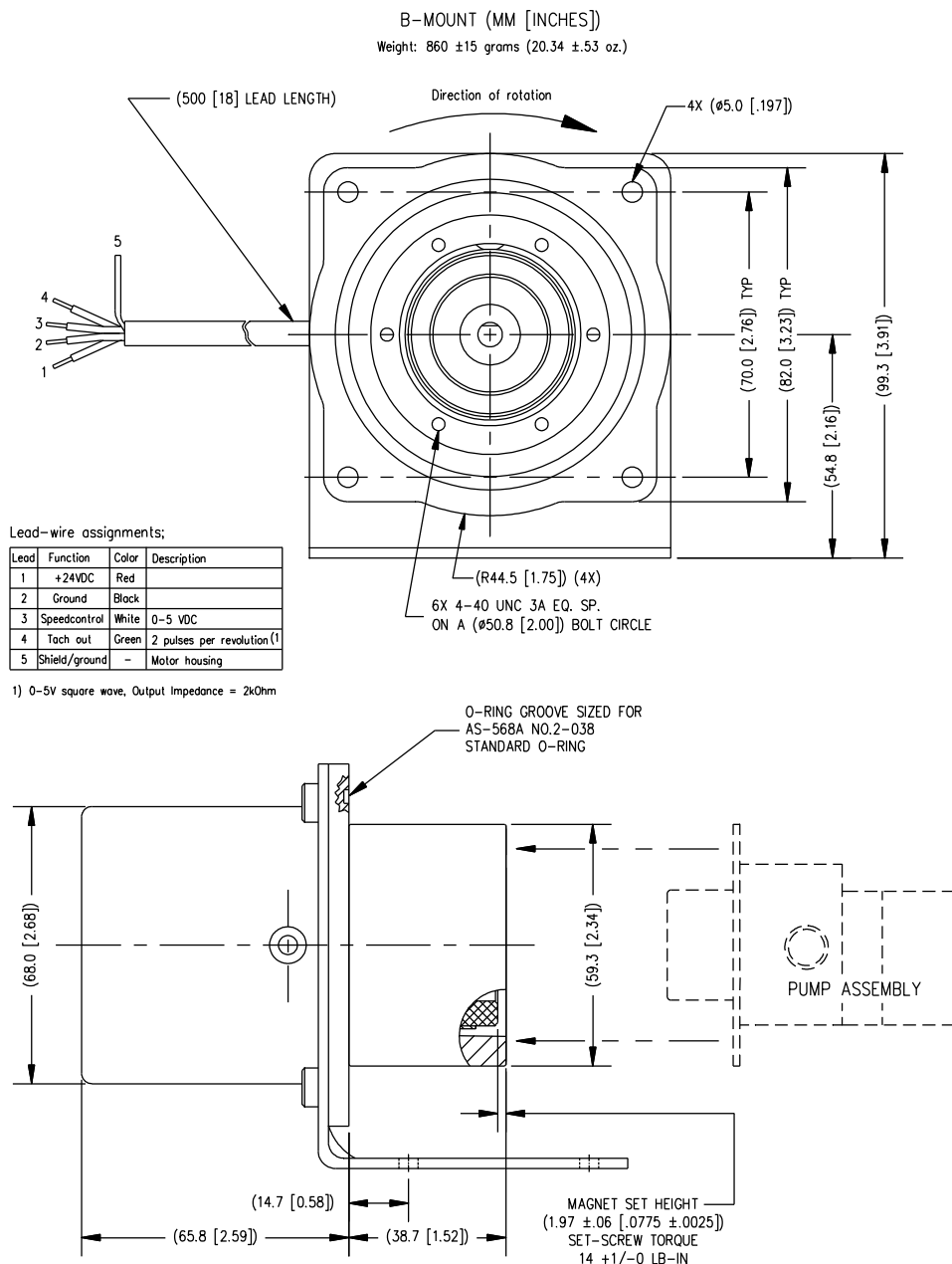
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EC DECLARATION OF INCORPORATION**(In accordance with Annex II B of the Machinery Directive 89/392/EEC)**

I, the undersigned Scott Hollister, of
MICROPUMP INC.

A Unit of IDEX Corporation

1402 NE 136th Avenue

Vancouver, WA 98684-0818

U.S.A.



Declare that the pumps described in this document comply with the following EU directives:

EN809, EN 292 Part 1, EN 292 Part 2

and within the limits specified for the machinery, is in conformity with the essential health and safety requirements of the Machinery Directive 89/392/EEC and subsequent amending directives.

The machinery described in this certificate must not be put into service until the machinery in which it is incorporated has been declared in conformity with the provisions of the Machinery Directive and its amendments.

MANUFACTURER:**IMPORTER IN COUNTRY OF USE:**

(Signature)

(Signature)

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