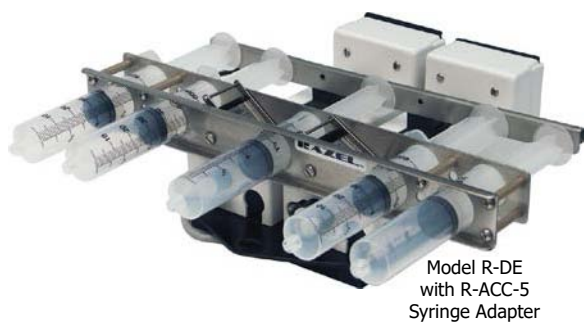


# RAZEL R-E SYRINGE PUMPS

## USER'S MANUAL



**DOC-190**  
**Rev. 2.0**

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## CHAPTER 1 | FEATURES & MODELS

- FLOW RATES - .10cc/HR. TO 24cc/MIN
- SYRINGES – PLASTIC OR GLASS, 50cc TO MICROLITER
- ACCURACY – WITHIN 99.5%
- SAFETY – STERILE HOLDER, CLUTCH FOR MOTOR
- CONSTRUCTION – STAINLESS STEEL & ALUMINUM FRAME

**Model R-E** (115 Volts/60 Hz) or (230Volts/50 Hz) *Specify Country*) Single speed with stock synchronous motor and stop switch that disconnects power when the plunger reaches the end of the syringe. Color specifies speed (see data sheet). \*

**Model R-DE** (115 Volts/60 Hz) or (230Volts/50 Hz) *Specify Country*) Two Pumps mounted on a common Base with stock synchronous motors and stop switches that disconnects power when the plunger reaches the end of the syringe.\*

**Model R-ES Remote Operate** (115 Volts/60 Hz) or (230Volts/50 Hz) *Specify Country*) Optically isolated remote operation by DC ground, TTL logic "0" or switch closure.

**R-MOT-115/60 Hz** Synchronous motor color specifies speed (see data sheet). \*

**R-MOT-230/50 Hz** Synchronous motor color specifies speed (see data sheet). \*

**R-MOT-Non-Stock** Non-Stock synchronous motor. \*

**R-ACC-Micro Syringe Insert** Adapter for 1cc micro syringe.

**R-ACC-5 Syringe Adapter** Adapter to drive five 50ml syringes.

**R-ACC-5 5/10ml Syringe Adapter** Adapter to drive 5/10ml syringes.

*This can also be converted back to a 50ml adapter.*

\* The speed determines the infusion rate for various syringes - see data sheets for the values.



**FLOW RATES Model R-E**

**RAZEL**  
SCIENTIFIC INSTRUMENTS

**MOTOR SPEEDS & INFUSION RATES**  
for pump models:  
R-E | R-ES | R-DE

Calculated using BD Multifit™ glass syringes:

- 1 cc = 0.176 cm<sup>2</sup>
- 2 cc = 0.626 cm<sup>2</sup>
- 5 cc = 1.084 cm<sup>2</sup>
- 10 cc = 1.692 cm<sup>2</sup>
- 20 cc = 3.017 cm<sup>2</sup>
- 30 cc = 4.047 cm<sup>2</sup>
- 50 cc = 6.173 cm<sup>2</sup>

\* = Available in 115V 60Hz only

calibrated in cc/min								
MOTOR CODE	RPM	1cc	2cc	5cc	10cc	20cc	30cc	50cc
GREY	20	0.688	2.446	4.236	6.612	11.789	15.814	24.122
WHT/RED*	15	0.516	1.835	3.177	4.959	8.842	11.861	18.091
BLACK	10	0.344	1.223	2.118	3.306	5.895	7.907	12.061
RED	5	0.172	0.612	1.059	1.653	2.947	3.954	6.030
PINK	3.33	0.115	0.407	0.705	1.101	1.963	2.633	4.016
GREEN	2	0.069	0.245	0.424	0.661	1.179	1.581	2.412
WHT/GRN	1.5	0.052	0.183	0.318	0.496	0.884	1.186	1.809
WHITE	1	0.034	0.122	0.212	0.331	0.589	0.791	1.206
WHT/BRN	0.5	0.017	0.061	0.106	0.165	0.295	0.395	0.603

calibrated in cc/hr								
MOTOR CODE	RPM	1cc	2cc	5cc	10cc	20cc	30cc	50cc
WHITE	1	2.063	7.338	12.708	19.835	35.368	47.442	72.365
WHT/BRN	0.5	1.032	3.669	6.354	9.917	17.684	23.721	36.182
BROWN	0.333	0.687	2.444	4.232	6.605	11.777	15.798	24.097
BLUE	0.2	0.413	1.468	2.542	3.967	7.074	9.488	14.473
ORANGE	0.1	0.206	0.734	1.271	1.983	3.537	4.744	7.236
WHT/ORG*	0.083	0.171	0.609	1.055	1.646	2.948	3.938	6.006
WHT/YEL	0.05	0.103	0.367	0.635	0.992	1.768	2.372	3.618
WHT/YEL/BLK*	0.042	0.087	0.308	0.534	0.833	1.485	1.993	3.039
YELLOW	0.033	0.068	0.242	0.419	0.655	1.167	1.566	2.388
WHT/PUR	0.022	0.045	0.162	0.280	0.436	0.778	1.044	1.592
PURPLE	0.008	0.017	0.059	0.102	0.159	0.283	0.380	0.579

To calculate the flow rate using a different syringe, use this formula:

$$\text{flow rate (mL/min)} = 0.19538 \times \text{RPM} \times \text{syringe cross-sectional area (cm}^2\text{)}$$

**SPECIFICATIONS**

**Accuracy:** 99.5% accuracy, 99.5% repeatability.

**Pressure limits:** Accurate flow up to 10 psi or 540 mm/hg with a 50-60cc syringe; 14 psi or 800 mm/hg with a 30-35cc syringe; 20 psi or 1000 mm/hg with 20cc syringe; 40 psi or 2000 mm/hg with 10cc syringe.

**Electrical:** 3 wire grounded plug, 30 watts @ 115 volts 50-60 hertz. Less than 25 microamperes current leakage.

**Physical:** Weight - 7 pounds. Size- 4" high x 7" wide x 10" long.



## CHAPTER 2 | SET-UP PROCEDURES & SYRINGE INFORMATION

### SYRINGE PLACEMENT

Ensure the hub of the syringe barrel is positioned adjacent to the syringe clamp when loading the infusion pump. If a gap exists between the hub and the clamp, accurate flow rates cannot be assured, as the entire syringe (both barrel and plunger) may move forward. Verify the plunger moves and the barrel is fixed by turning the front knob of the pump.

### GLASS SYRINGES

Extra precaution is needed when using glass syringes with a ground glass plunger. These syringes exhibit almost no sliding friction and thus can cause an uncontrolled infusion in the following two ways:

1. The weight of the plunger may be sufficient to push the fluid out of the syringe if the syringe is held with the plunger above.
2. The weight of the fluid in the tubing may be sufficient to siphon the fluid out of the syringe if the catheter infusion site is below the syringe elevation.

To test for these two conditions, connect the syringe to the tubing and hold vertically with the plunger above the barrel at the height of the pump. If no motion occurs, the syringe can then be placed in the pump.

To reduce the danger of an uncontrolled infusion:

1. Lower the relative height of the infusion pump in relation to the infusion site. With the pump below the infusion site, the instrument will pump the fluid to the higher elevation.
2. Use a smaller bore catheter which will reduce the weight of the fluid in the tubing and impart some friction upon the flowing fluid.
3. Position the pump so that the syringe is vertical (plunger below), thus the weight of the syringe plunger will be acting against the weight of the fluid.
4. Use a syringe with a rubber seal on the plunger, ie. an O-ring sealed or plastic syringe.

### SMALL SYRINGES

The automatic shut-off switch stops an infusion if the pump reaches the end of the syringe. In addition, the green ON/OFF switch light will turn off.

The automatic shut-off switch uses an internal micro-switch that detects when the slide assembly reaches a certain point. This point is adjustable so that the pump can accommodate various sizes and brands of syringes.

### LEAKING SYRINGE

Prevent fluids from dripping into the pump and electrical switch. If leaking occurs, the pump can be placed on its end, (syringe pointing up) or turn the pump on its side. This will prevent the fluid from flowing on the screw mechanism and the electrical switch. The pump should be wiped dry, and can be cleaned with alcohol and a clean absorbent cloth.

## DEVICE

This syringe pump is to be used in research and experimentation in a laboratory environment. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

## ENVIRONMENTAL CONDITIONS

Designed for indoor use with: a temperature of 10°C to 35°C ; a relative humidity of not more than 75%; an air pressure of 75 kPa to 106 kPa.

## ELECTRICAL SUPPLY

Safety and accuracy maintained when voltage is within  $\pm 10\%$  of rating Input 115 VAC, 60 HZ, 0.2 Amps or Input 230 VAC, 50HZ, 0.1 Amps (export model).

The Earth (ground) terminal should be plugged into appropriate receptacle Fuse #3AG, 0.5 Amp, time delay (slow blow) or #2AG, 0.5 Amp, time delay.

## SYMBOLS





Nomenclature

cc or ml cubic centimeters or milliliters (volume)

cc/HR cubic centimeters per hour (infusion rate)

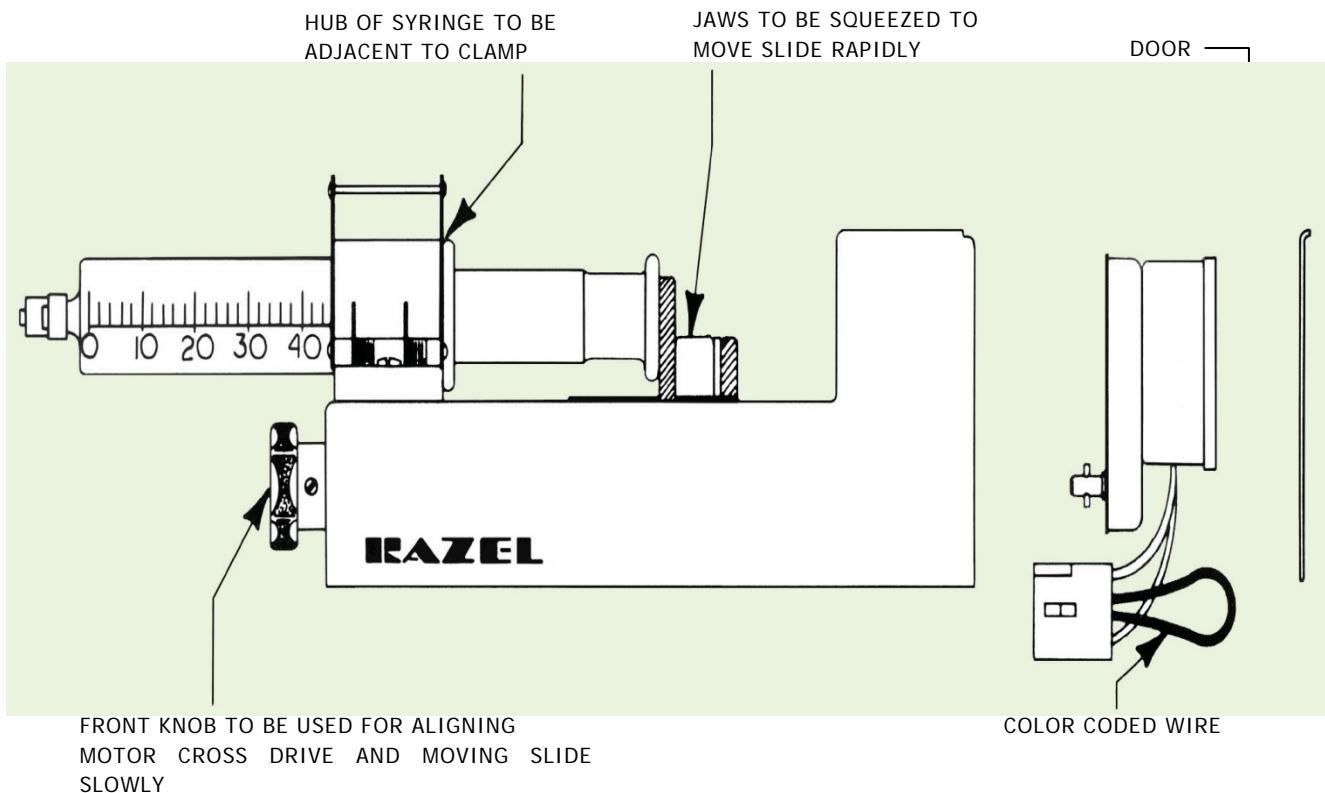
ml/HR milliliters per hour (same as cc/HR)

### Labels

	Symbol imprinted on switch to indicate on
	Symbol imprinted on switch to indicate off
	Symbol stamped adjacent to grounding screw
VAC	Voltage, alternating current
HZ	Hertz, cycles per second, electrical
AMPS	Ampere, unit of electrical current
	Caution, refer to instructions (documents provided with pump)
UL	The UL listing label affixed to the product pertain to the 115 volt pumps Be advised that UL coverage does not extend to the 230 volt pumps
CE	European approval for laboratory
EMC	European approval for Electro Magnetic Compatibility

## CHAPTER 3 | OPERATING INSTRUCTIONS

1. With electric plug removed from the outlet, open sliding door, and check by color code to determine if correct motor is installed. If needed, remove existing motor by pulling the small nylon electrical connector and the motor body.
2. Replace with appropriate motor, rotating the front knob to seat the cross-drive. Push the electric connector in securely and replace sliding door.
3. Move slide to rear (to motor section) by squeezing the jaws. Insert syringe by lifting the clamp cover and placing into clamp. Now slide can be moved toward the end of the syringe. Fine adjustments may be made by turning knob so that the slide makes contact with the rear of the syringe.
4. Push start button and pump with operate. Note, that the lighted switch will be illuminated. To stop operation, press switch again.



### SHUT OFF SWITCH

This option uses a microswitch that trips when the slide assembly passes the trip point. This trip point is adjustable so that the pump can accommodate various sizes and brands of syringes. The motor will cease operation and the lighted power switch will go out providing a visual indication that the infusion is complete.

Adjust the trip point of the adjustment screw to the left of the front knob.

Model R-E: Insert an empty syringe with the plunger at the 1ml mark. Move the slide assembly to the rear of the plunger. With the pump on, rotate the adjustment screw CCW (counter clockwise) until the power light goes out. If it is desirable to completely empty the syringe, rotate the adjustment screw clockwise until the syringe plunger is at the 0ml mark and the power switches off. (each ½ turn of the adjustment screw, 180°, will allow the plunger to push .025 inches further).

## CALIBRATION OF FLOW RATES

The following is a list of cross-sectional areas of various syringes from different manufacturers. These sizes have some importance when using a syringe type pump, because the accuracy of the flow rate is determined by the cubic centimeters of fluid per unit length of syringe.

<b>MULTIFIT, glass</b>	
Syringe size	Cross-section
1ml	0.176 cm <sup>2</sup>
2ml	0.626 cm <sup>2</sup>
5ml	1.084 cm <sup>2</sup>
10ml	1.692 cm
20ml	3.017 cm <sup>2</sup>
30ml	4.047 cm <sup>2</sup>
50ml	6.173 cm <sup>2</sup>

<b>HAMILTON, glass</b>	
Syringe size	Cross-section
.05ml	0.008 cm <sup>2</sup>
.10ml	0.017 cm <sup>2</sup>
.25ml	0.042 cm <sup>2</sup>
.50ml	0.083 cm <sup>2</sup>
1ml	0.167 cm <sup>2</sup>
2.5ml	0.417 cm <sup>2</sup>
5ml	0.833 cm <sup>2</sup>
10ml	1.667 cm <sup>2</sup>

<b>UNIMETRICS, glass</b>	
Syringe size	Cross-section
.05ml	0.008 cm <sup>2</sup>
.10ml	0.017 cm <sup>2</sup>
.25ml	0.042 cm <sup>2</sup>
.50ml	0.083 cm <sup>2</sup>
1ml	0.167 cm <sup>2</sup>

<b>MONOJECT, plastic</b>	
Syringe size	Cross-section
1ml	0.173 cm <sup>2</sup>
3ml	0.622 cm <sup>2</sup>
6ml	1.263 cm <sup>2</sup>
12ml	1.977 cm <sup>2</sup>
20ml	3.308 cm <sup>2</sup>
35ml	4.474 cm <sup>2</sup>
60ml	5.545 cm <sup>2</sup>

<b>B-D PLASTIPAK, plastic</b>	
Syringe size	Cross-section
1ml	0.173 cm <sup>2</sup>
2.5ml	0.578 cm <sup>2</sup>
5ml	1.129 cm <sup>2</sup>
10ml	1.635 cm <sup>2</sup>
20ml	2.850 cm <sup>2</sup>
30ml	3.662 cm <sup>2</sup>
60ml	5.556 cm <sup>2</sup>

<b>TERUMO, plastic</b>	
Syringe size	Cross-section
3ml	0.629 cm <sup>2</sup>
5ml	1.327 cm <sup>2</sup>
10ml	1.961 cm <sup>2</sup>
20ml	3.189 cm <sup>2</sup>
30ml	4.191 cm <sup>2</sup>
60ml	6.651 cm <sup>2</sup>

MULTIFIT is the trademark of Becton, Dickinson & Co., Rutherford, NJ.

HAMILTON is the trademark of Hamilton Company, Reno, NV.

UNIMETRICS is the trademark of Unimetrics Corp., Anaheim, CA.

MONOJECT is the trademark of Sherwood Medical Industries, St. Louis, MO.

PLASTIPAK is the trademark of Becton, Dickinson & Co, Rutherford, NJ.

TERUMO is the trademark of Terumo Corporation, Piscataway, NJ.



RAZEL SCIENTIFIC INSTRUMENTS calibrates both the Model R-E and the Model R-99 E syringe pump with the B-D Multifit syringe. The Model R-E pump comes with a chart listing flow rates with 14 different syringes. Other Razel pumps are calibrated with plastic syringes or by drug concentration.

**EXAMPLE:**

The flow rate for a Model R-E pump can be calculated from:

FLOW RATES in ml/hr = 11.7228 cm/hr. x Motor RPM x Syringe Cross-section in cm<sup>2</sup> (Flow Rate in cm/min = .19538 x RPM x syringe cross-section)

A Model R-E pump equipped with a .333 RPM (brown) motor, and a 30ml Multifit syringe will infuse at a flow rate (.19538 x .333 x 4.047) .263 ml/mn (agrees with instruction sheet) or multiply by 60 mn/hr. to obtain 15.798 ml/hr. (to agree with "Flow Rates" on the Model R-E specification sheet.)

The flow rate for an R-99 E pump can be calculated from:

FLOW RATES in ml/hr. = .23446 cm/hr. x Number on Rate Selector Switch x Syringe Cross-section in cm<sup>2</sup>

The Model R-99 E pump is calibrated for Multifit syringes. Assume a flow rate of 50 ml/hr. is desired with a 50ml Multifit syringe. The built-in flow rate chart will list #34...49.2ml/hr. and #35...50.7ml/hr. If a 50ml B-D Plastipak syringe is substituted, the flow rate at setting #35 will be 50.7ml/hr. x .90 = 45.6ml/hr. To attain the correct flow divide #35 by .90 to obtain the Rate Selector Switch setting at #39.

Or using the Flow Rate formula,

50ml/hr. = .23446 x NR x 5.556 cm<sup>2</sup> The NR on the Flow Rate Switch calculates to #38.

*While it is our intent to precisely determine each syringe size, Razel Scientific Instruments, Inc. cannot be responsible for the accuracy of the enclosed information.*

## CHAPTER 4 | MAINTENANCE INFORMATION

**CLEANING:** Use water and a mild detergent and/or alcohol. The white housing is an ABS plastic.

**LUBRICATION:** A drop of oil on the bearings and silicon spray on the lead screw is recommended annually.

**CHANGING MOTOR:** With the electric plug removed from the outlet, open the door motor cover by sliding up. Remove the motor by pulling the electrical connector from its mate. The motor is held in position by 2 pins. Replacing the motor is accomplished by reversing the procedure. The front knob is used for aligning the slot in the lead screw with cross drive pin on the motor shaft.

**POWER SWITCH:** Removal of the power switch Double-Pole Single-Throw (DPST) is accomplished by using a thin screwdriver or a chisel under the bevel edge of the switch. Pry up.

**DISASSEMBLY:** Removal of the syringe clamp (A-1004) and the plastic housing (A-1011) is accomplished by unfastening all the visible screws and the knob. Pumps have nut inserts under the syringe clamp, thus a screwdriver is the only tool required. Optional pumps require a 5/16" nut driver to prevent the nut from rotating when turning the screws. With the removal of the plastic housing, the slide assembly (A-1008) can be removed for replacement. Lead screw (A-1002) replacement requires pushing out the rear bronze bearing.

**ELECTRICAL:** All electrical wiring can be checked with an ohmmeter when the power line is unplugged from the power source. If replacement of the power cord is required, this can only be accomplished at the Razel factory, or an authorized service facility with the proper tools. The replacement cord is to be U.L. listed (230v cords to have other approvals) and meet all the specifications (outer diameter, wire size, color coding, temperature, and insulation) of the original.

**MECHANICAL:** If the syringe is not emptying, check if the I. V. tubing has a kink or if the syringe is bound. Check the pressure capability of the slide assembly (A1008), by either using a pressure gauge (6 psi) or by sealing a 50ml syringe with 50ml of air. Operate the pump until the air is compressed to 36ml. If the pump is not capable of pushing the syringe to this pressure, the motor, the lead screw and the slide assembly should be inspected for wear.

## MOTOR CHANGING PROCEDURE

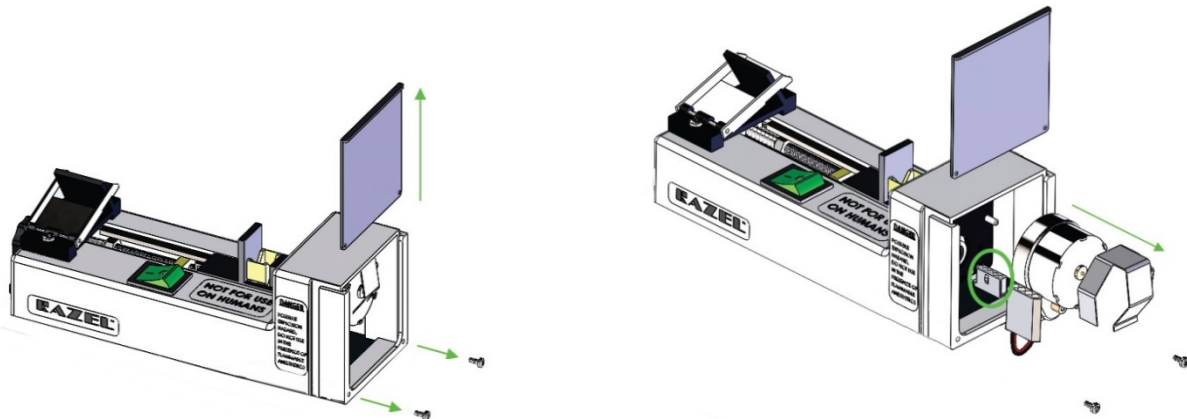
**Note:** Procedures are the same for all Razel syringe pumps.

Selection of the required motors should be determined prior to purchase of instruments, but extra motors can be ordered at any time. If the optional syringe adapter is to be used with the Model R-DE, two synchronous motors of the same speed have to be used.

## REMOVING THE MOTOR

Remove the screws on the back of the pump and slide the motor compartment door up to remove it, as seen in Figure 1 below.

*Figure 1 – Accessing the Motor*



Slide the motor straight out, unplug the Molex connector, and remove the retaining clip from the motor. Set the retaining clip aside as this will be used when installing the new motor.

## INSTALLING THE MOTOR

Insert the new motor in the pump by aligning the motor tabs and shaft with the mounting pins and drive slot of the pump, see Figure 3 below.

*Figure 3 – Motor Installation*

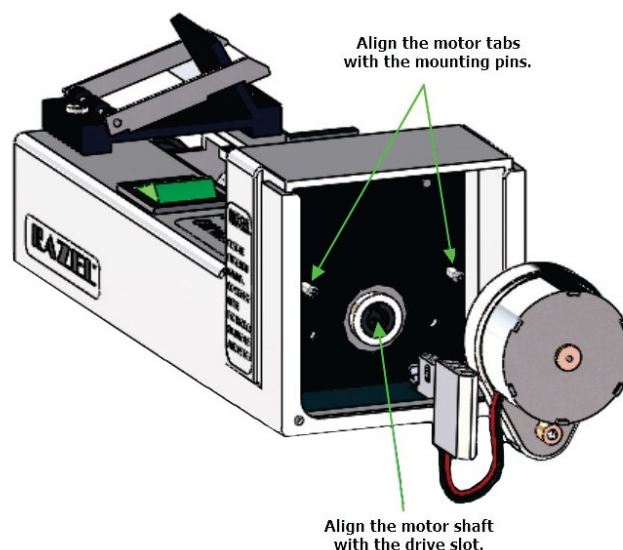
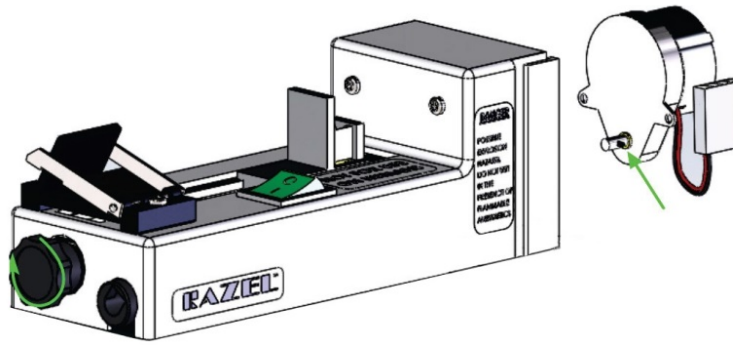


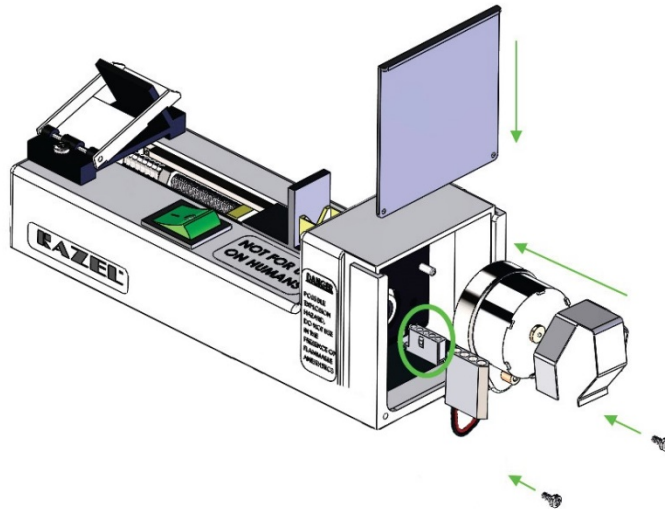
Figure 4 – Pump and Motor Alignment



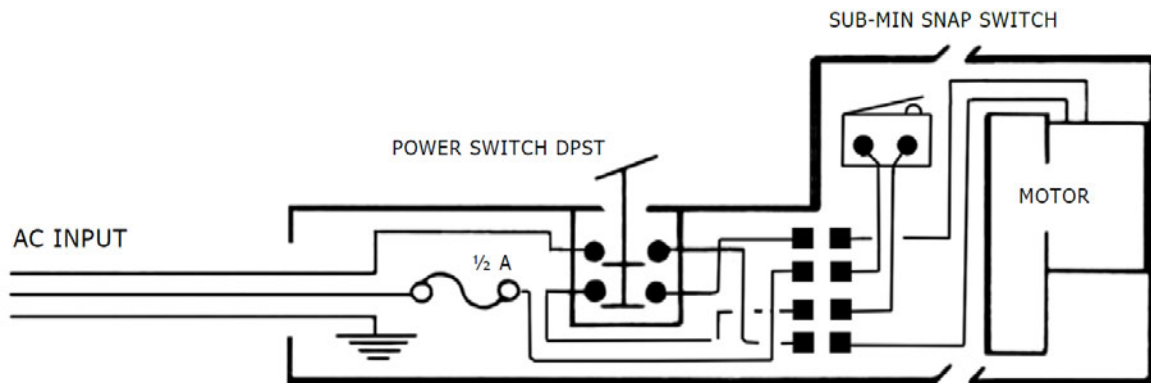
In order to install the new motor in the pump, the drive slot must be in the same orientation as the motor's shaft. Use the manual adjustment knob on the front of the pump to turn the drive slot so it aligns with the motor shaft as seen in Figure 4 above.

Connect the new motor to the pump via the Molex connector, reinstall the retaining clip on the motor, and reinstall the motor compartment door and screws as seen below in Figure 5 below.

Figure 5 - Reinstallation



**ELECTRICAL WIRING**



## APPENDIX A | WARRANTY INFORMATION

### Limited Warranty

Razel Scientific Instruments Division of MED Associates, Inc. (Razel) warrants the products bearing its name and trademark against all defects in material, workmanship, and performance to the original using purchaser for a period of one (1) year from the date of shipment by Razel. Razel warrants that its products will meet the electronic and mechanical specifications stated in Razel's catalog, although the specifications in the catalog are subject to change without notice. Razel at its option will repair or replace a product which is found to be defected during the warranty period. Defective merchandise must be received at RAZEL SCIENTIFIC INSTRUMENTS, Georgia Regional Industrial Park, 166 Industrial Road, Fairfax, VT, USA 05454 no more than thirteen (13) months from the date of original shipment by MED. All shipments must include a Return Authorization Number (RMA #), obtainable from Razel, and must be sent freight prepaid by the sender. Razel holds the right to charge a 25% restocking fee on items purchased and returned due to any circumstances other than malfunction.

**LIMITATIONS OF WARRANTY:** This warranty is nontransferable. This warranty does not apply to any defects or damages resulting from alteration, modification, neglect, misuse, usage of an improper power sources, damage in transportation, abuse, or any cause other than normal use of the equipment. This warranty does not apply to products resold by Razel that are manufactured by other companies. No warranty or claim is made by Razel, regarding the efficacy of any product for any particular application. This warranty gives you specific legal rights, and you may also have other rights, which vary, from state to state.

Except for the Limited Warranty stated above, Razel disclaims any and all other warranties, express or implied, oral or written, including any implied warranties or merchantability or fitness for a particular purpose. Some states do not allow limitations on implied warranties, so the above limitation may not apply to you.

In no event, shall Razel be liable for any damages whatsoever arising out of the use of its products, including without limitation any direct, incidental or consequential damages, any damages for loss of profits, business interruption, loss of information of any pecuniary loss, even if Razel has been advised of the possibility of such damages. Some states do not allow the exclusion of limitation of liability for incidental or consequential damages, so the above limitation may not apply to you.

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