R-100E(-S) SYRINGE PUMP

OPERATORS MANUAL

TABLE OF CONTENTS

CHAPTER 1
Background

The Razel R-100E and R-100E-S (see TTL Operation) Pump ensures safe, accurate infusion using several unique features. The R-100E allows the user to specify a syringe brand and capacity, as well as the desired infusion rate. The pump settings are clearly displayed on an LCD for easy viewing. For added safety the R-100E Pump utilizes an automatic shut-off when the end of the syringe is reached. Razel strongly encourages you to thoroughly read this manual prior to operating the pump.

The R-100EB option includes a FORWARD/REVERSE switch on the front panel, which allows the user to push fluid from the syringe, or draw fluid into the syringe.

Specifications

Pressure Limits: Accurate flow up to 5 psi or 270 mm/Hg with a 50–60 cc syringe; 7 psi or 400 mm/Hg with a 30-35 cc syringe; 10 psi or 500 mm/Hg with 20 cc syringe; 20 psi or 1000 mm/Hg with 10 cc syringe.

CHAPTER 2
Pump Interface
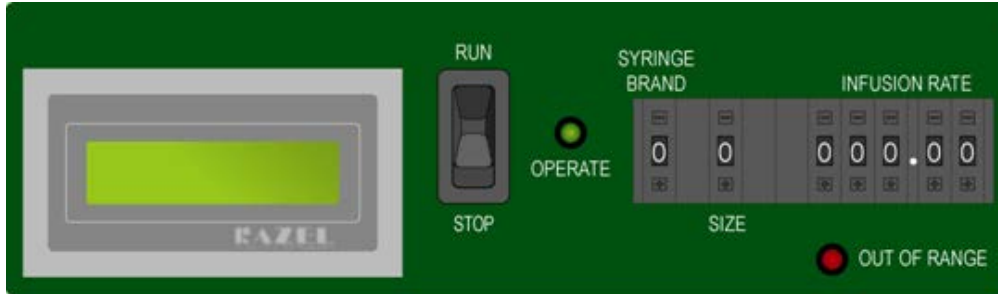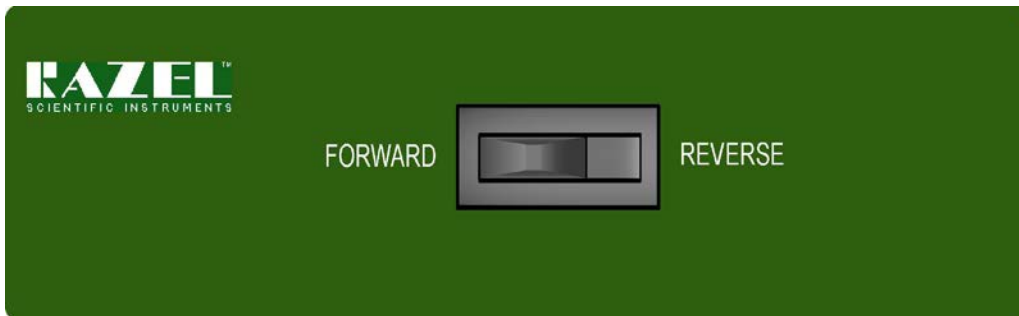
Figure 1 - R-100E Control Panel

Figure 2 - Back of the R-100E

Figure 3 – Front of the R-100E with B Option (FORWARD/REVERSE)

NOTE: The Razel R-100E is operated using 24 – 28 VDC.

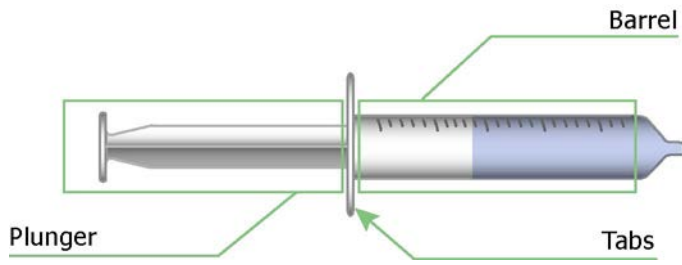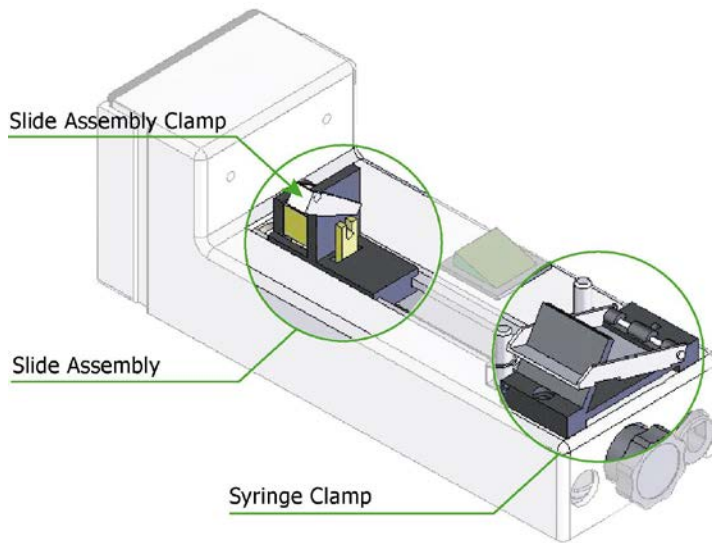*Figure 4 - Syringe Components*

Figure 5 - Pump Mechanism Components

RUN/STOP Switch

When the switch is in the **RUN** (or "up") position:

1. The Pump operates at the set rate;
2. The SYRINGE BRAND, SIZE or INFUSION RATE pushbutton switches are disabled. Changes made to these settings while the pump is in RUN mode will not be recognized;
3. The green OPERATE light will be steady on if operating.
4. **B Option Only:** The green OPERATE light will be flashing if operating in REVERSE mode.
5. **B Option Only:** The direction of the pump can be changed using the FORWARD/REVERSE switch;

When the switch is in the **STOP** (or "down") position:

1. The SYRINGE BRAND, SIZE and INFUSION RATE pushbutton switches are enabled. These setting may be adjusted when in STOP mode;
2. The green OPERATE light is off.
3. **B Option Only:** The direction of the pump can be selected using the FORWARD/REVERSE switch;

SYRINGE BRAND / SIZE and INFUSION RATE Switches

These switches are used to select the desired syringe type and infusion rate. The function of these switches is described in detail in Chapter 5.

Automatic Shut-Off Switch

The automatic shut-off switch stops an infusion if the pump reaches the end of the syringe. In addition, the red OUT OF RANGE light will flash and if the audible alarm is enable, it will sound (Chapter 6).

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.

To adjust the automatic shut-off switch, insert an empty syringe with the plunger at the desired shut-off position. Move the slide assembly to the rear of the plunger (Figure 6A). With the pump turned on, rotate the adjustment screw (Figure 6B) until the OUT OF RANGE light comes on and the audible alarm beeps. Each clockwise ½ turn of the adjustment screw will cause the switch to activate .025 inches further, and each counterclockwise ½ turn of the adjustment screw will cause the switch to activate .025 inches sooner. When the automatic shut-off switch is activated the LCD display will read **LIMIT Switch ON Pump OFF**. In order to clear this message and resume pump operation squeeze the tabs on the slide assembly (Figure 7) and move it back until the switch is deactivated.

Figure 6 - Automatic Shut-Off Switch Adjustment
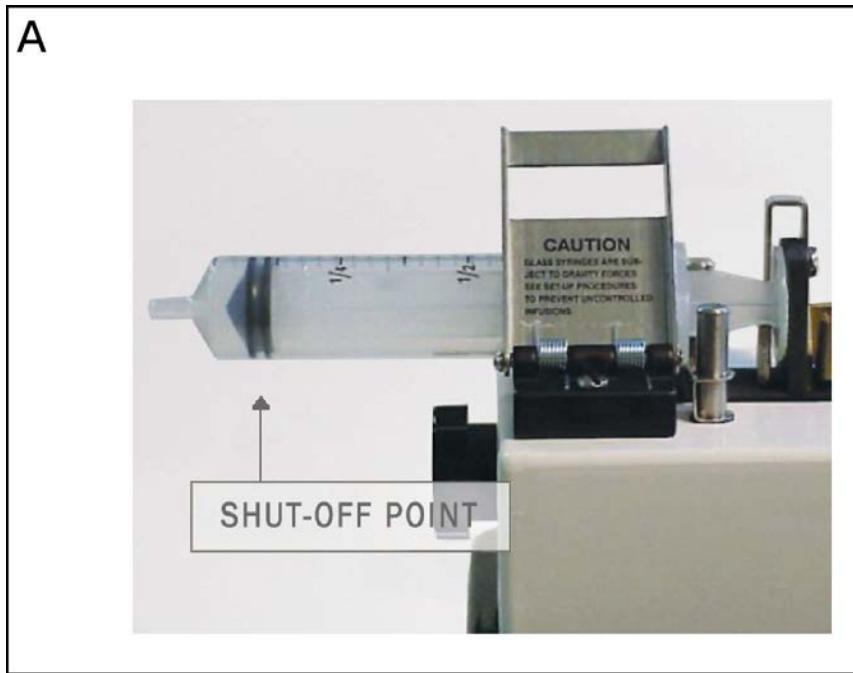
Operate Light

- If the pump is operating, the OPERATE Light is on.

- The OPERATE Light is off when the infusion is complete and when the pump is off.

- **B Option Only:** If the pump is operating in REVERSE mode, the OPERATE light is flashing.

Out Of Range Light

- If the selected INFUSION RATE is out of range, the OUT OF RANGE Light is on.

- If the Automatic Shut-Off Switch has been activated, the OUT OF RANGE Light is flashing.

- If the INFUSION RATE switches are set to "000.00", the OUT OF RANGE Light is on.

- The OUT OF RANGE Light is off when the pump is operating correctly and when the pump is powered off.

FORWARD/REVERSE Switch (B Option Only)

When the switch is in the **FORWARD** position:

1. The pump pushes fluid from the syringe;
2. The green OPERATE Light is on when the pump is switched to RUN.

When the switch is in the **REVERSE** position:

1. The pump draws fluid into the syringe;
2. The green OPERATE Light is flashing when the pump is switched to RUN.

CHAPTER 3
Syringe Placement

Care should be exercised that the syringe is positioned correctly when loading the infusion pump. Accurate flow rates cannot be assured if the syringe is not properly loaded. It is also important that the slide is making contact with the syringe plunger. Complete the following steps to properly load the syringe:

A.   Move the slide assembly to rear (toward motor section) by squeezing the jaws.

Figure 7 - Moving the Slide Assembly to the Rear of the Pump
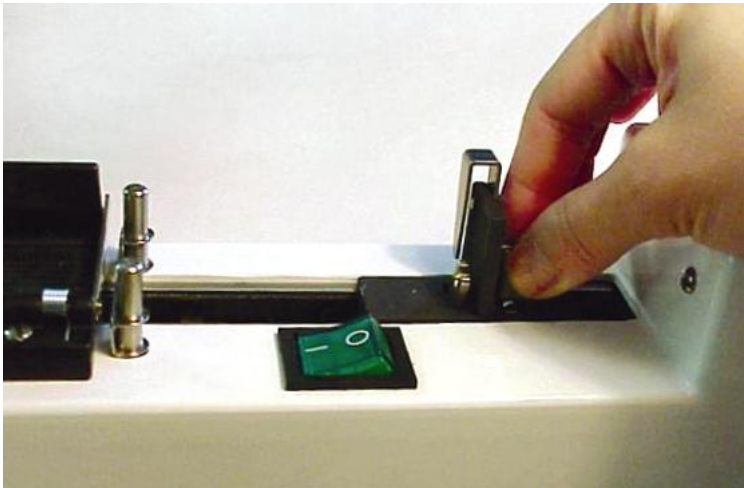
B.   Insert syringe by lifting clamp cover and placing the syringe barrel into the clamp.

Figure 8 - Open Syringe Clamp
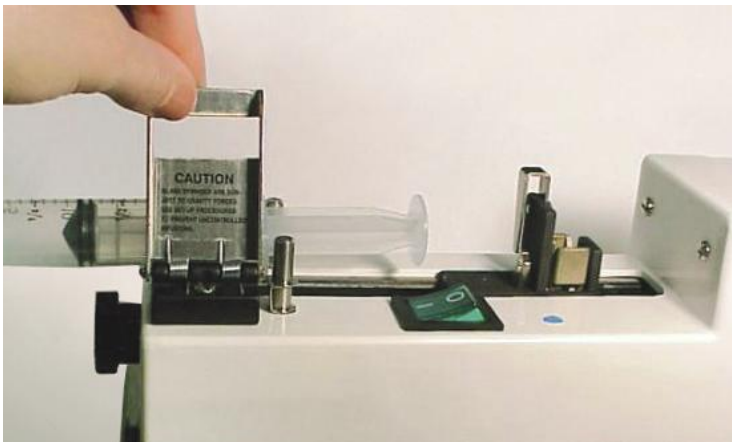
C. Be sure that the syringe tabs are properly inserted between the syringe clamp and the retaining posts, as shown in Figure 9.

Figure 9 - Properly Aligned Syringe Tabs
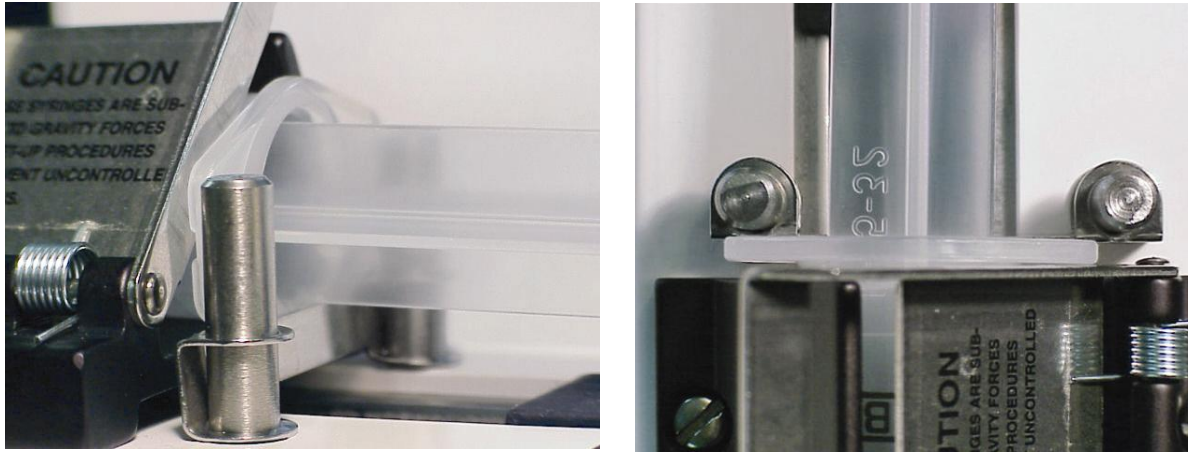
D. Ensure that the syringe is loaded with the syringe tabs positioned horizontally, so that they do not impede the travel of the slide assembly, as shown in Figure 10.

Figure 10 - Tabs Positioned Horizontally
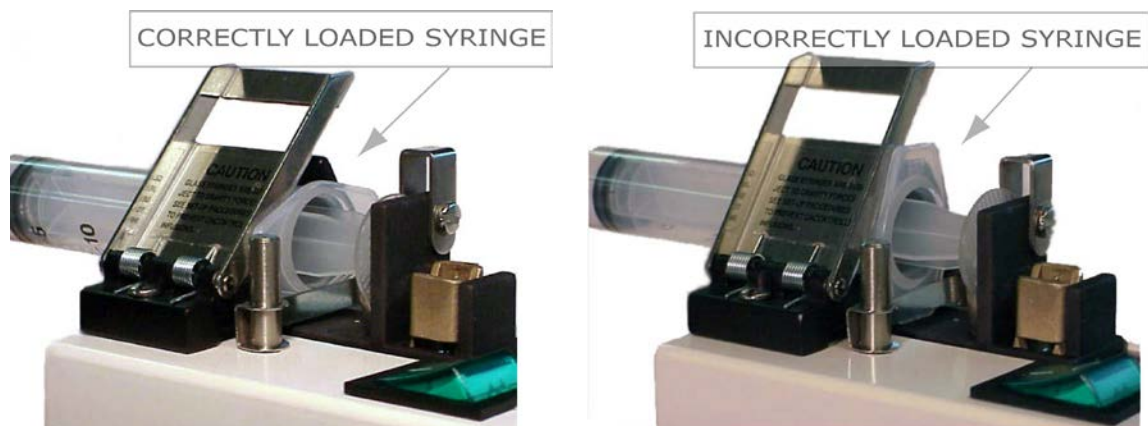
E.   Move the slide assembly to the end of the syringe and insert the plunger into the slide assembly clamp as shown.

Figure 11 - Plunger Positioned in the Slide Assembly Clamp
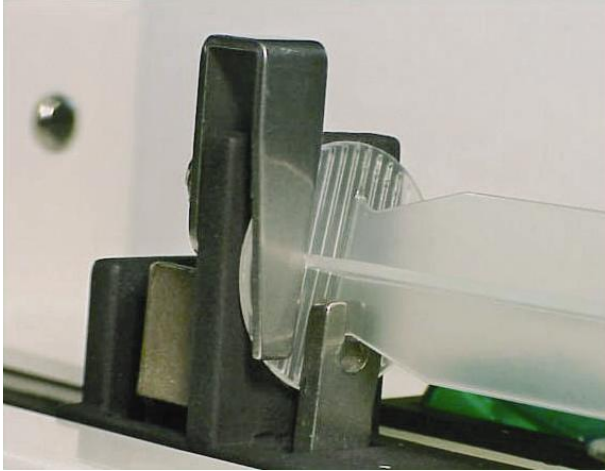
F.   Run the pump until the slide assembly makes contact with the plunger and the syringe tabs are in contact with the syringe clamp.

CHAPTER 4
Specialty Syringes

Glass Syringes

Extra caution 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 the syringe.

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 height of the syringe.

To test for these two conditions, it is suggested that the syringe be connected to the tubing and held vertically at the height of the pump. If no motion occurs, the syringe can then be placed in the pump.

The following may 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 increase the friction on the flowing fluid.

3. Use a syringe with a rubber seal on the plunger, i.e. an O-ring sealed or plastic syringe.

Small Syringes

Syringes of less than 5 ml capacity can be held more securely in the syringe clamp if the R-ACC Micro Syringe Adapter is used. This insert slides into the standard syringe clamp and can hold two micro syringes.

CHAPTER 5
Operating Instructions

Figure 12 - Control Panel
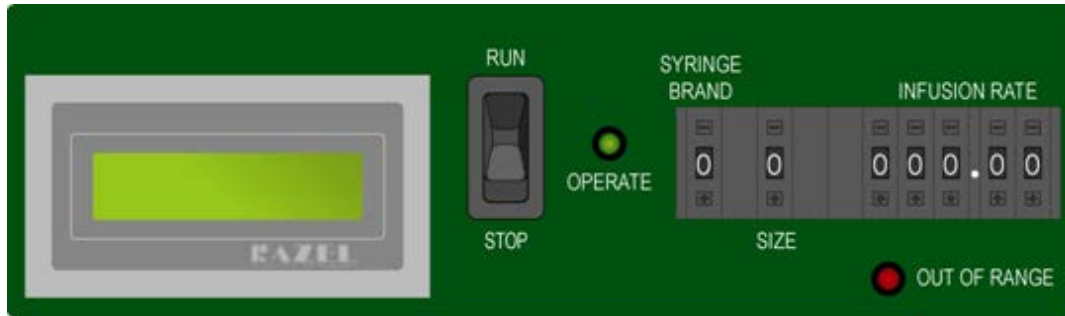
1. Apply power to the R-100 Pump by plugging in the A/C power adapter to the "+28 VDC" Connector.   Be sure that the RUN/STOP switch is in the STOP position. Using the green ON/OFF rocker switch, turn the pump on.   Changes to the pushbutton settings will not be recognized if the switch is in the RUN position.

2. Set the SYRINGE BRAND pushbutton switch by selecting the number that corresponds to the brand. Refer to Table 1.

Figure 13 - SYRINGE BRAND Pushbutton Switch

Table 1 – Syringe Brand

SYRINGE BRAND Pushbutton Setting	Corresponding Syringe Brand	Upper Left of LCD Display will read:
0	Unknown Brand	Select Units
1	BD Plastipak	BD PLASTIC
2	Monoject	MONOJECT
3	Terumo	TERUMO
4	BD Glass	BD GLASS
5	Unimetrics	UNIMET
6	Hamilton (μl)	HAMLTON μl
7	Hamilton (ml)	HAMLTON ml
8	Popper & Sons	P & S
9	Alarm Setting	ALARM

The Brand Name selected is displayed in the upper left corner of the LCD display. If the brand of the syringe being used is not on the chart above, set the SYRINGE BRAND pushbutton to zero. With the SYRINGE BRAND pushbutton set to zero, the SIZE pushbutton switch changes the units of the infusion rate; see Table 2. Once the desired unit has been selected proceed to Step 4.

Table 2 – Infusion Rate Unit Selection

SYRINGE BRAND Pushbutton Setting	SIZE Pushbutton Setting									
	0	1	2	3	4	5	6	7	8	9
0	mm/minute	mm/hour	cm/hour	in/hour	R-99EJM	RPM/100	Hertz	Hertz	Hertz	Hertz

3. Once a selection has been made for SYRINGE BRAND, set the SIZE pushbutton switch using Table 3. The sizes displayed in **black** will be infused in cc/hour, the sizes displayed in red will be infused in μl/minute and the sizes displayed in blue will be infused in μl/hour. The SIZE is displayed in the upper right corner of the LCD display and the infusion units are displayed in the lower right corner of the LCD display.
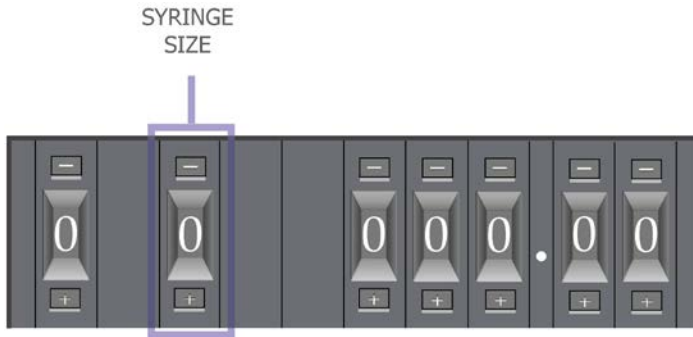
Figure 14 - SIZE Pushbutton Switch

Table 3- Syringe Size

SYRINGE SIZE CHART												
SYRINGE BRAND	SYRINGE BRAND Pushbutton Setting	SIZE Pushbutton Setting*										
		0	1	2	3	4	5	6	7	8	9
BD Plastipak	1	1 ml	1 ml	2.5 ml	2.5 ml	5 ml	10 ml	20 ml	30 ml	50 ml	60 ml
Monoject	2	1 ml	1 ml	3 ml	3 ml	6 ml	12 ml	20 ml	35 ml	60 ml	60 ml
Terumo	3	3 ml	3 ml	5 ml	10 ml	20 ml	30 ml	60 ml	60 ml	60 ml	60 ml
BD Glass	4	1 ml	1 ml	2 ml	2 ml	5 ml	10 ml	20 ml	30 ml	50ml	50 ml
Unimetrics	5	50 μl	50 μl	100 μl	100 μl	250 μl	250 μl	500 μl	500 μl	1 ml	1 ml
Hamilton (μl)	6	10 μl	25 μl	50 μl	50 μl	100 μl	100 μl	250μl	250 μl	500 μl	500 μl
Hamilton (ml)	7	1 ml	1 ml	2.5 ml	2.5 ml	5 ml	5 ml	10 ml	25 ml	25 ml	25 ml
Popper & Sons	8	1 ml	1 ml	2 ml	2 ml	3 ml	5 ml	10 ml	20 ml	30 ml	50 ml

- Sizes displayed in **black** will be infused in cc/hour.
  Sizes displayed in red will be infused in μl/minute.
  Sizes displayed in blue will be infused in μl/hour.

4. Set the desired INFUSION RATE using the pushbutton switches. The INFUSION RATE is displayed on the bottom left corner of the LCD display, and the unit of the INFUSION RATE is displayed on the lower right of the LCD display (see Figure 15). Verify that all settings are correct.

*Figure 15 - INFUSION RATE Pushbutton Switches*

5. **B Option Only**

   Select FORWARD or REVERSE mode using the FORWARD/REVERSE switch on the front of the pump (Figure 3). In FORWARD mode fluid is pumped out of the syringe and in REVERSE mode fluid is drawn into the syringe. It is important to note that the FORWARD/REVERSE switch remains active when the pump is switched to RUN so that the direction can be changed during an infusion. When the pump is operating the green OPERATE light will come on (solid green in FORWARD, flashing green in REVERSE)

   NOTE: The automatic shutoff switch is active only when the pump is operating in FORWARD mode.

6. Verify that the desired pump settings are correct using the LCD display and make any necessary changes.

Figure 16 - Viewing the LCD Display
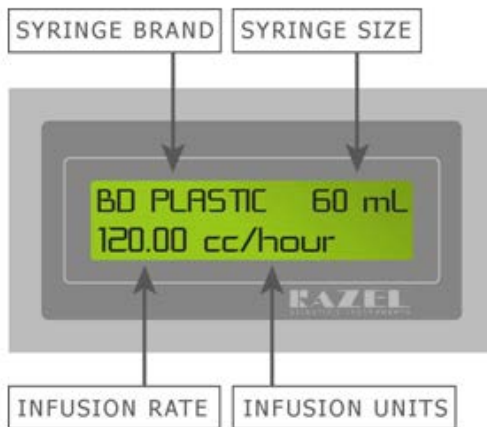
7. Switch RUN/STOP switch to RUN. The pump will infuse at the set rate and the green OPERATE light will come on.

8. If the INFUSION RATE selected is out of range, the red OUT OF RANGE light will come on and the pump will not operate. If "000.00" is selected on the INFUSION RATE pushbutton switch the Pump will not operate.

9. Changes made to any of the pushbutton switches while the pump is in RUN mode are not recognized. Changes will not be recognized until the pump is switched to STOP. If the OUT OF RANGE light is on and the pump settings cannot be changed, be sure that the RUN/STOP switch is set to STOP.

10. When the end of the syringe is reached the automatic shut off switch will stop the infusion, the red OUT OF RANGE light will flash and if the Audible Alarm is enabled, it will sound (see Chapter 6).

TTL Operation (R-100E-S Only)

Follow Steps 1 – 6 above to select the desired pump settings. The **RUN/STOP** switch needs to be set to **STOP** for TTL operation. Connect the TTL cable to the **TTL** port, located on the back of the pump (see Figure 2). The wire connections for the TTL cable are as follows:

TTL Cable Wire Connections

Red Wire	Black Wire
Operate (+ 5V Inactive, 0V Active)	Ground

When the TTL signal is activated, the pump will infuse at the set rate, in the selected direction (**FORWARD** or **REVERSE; B option only!**) and the green **OPERATE** light will come on (solid green in **FORWARD**, flashing green in **REVERSE**).

If the **INFUSION RATE** selected is out of range, the red **OUT OF RANGE** light will come on and the pump will not operate. If "000.00" is selected on the **INFUSION RATE** pushbutton switch the pump will not operate.

CHAPTER 6
Audible Alarm Setting

The Audible Alarm sounds when the automatic shut-off switch is activated. The volume level (low and high) and interval between alarm beeps (0.5-39 seconds) are user-defined. For the remainder of this section the pushbuttons switches will be referred to as follows:

Figure 17 - Switch Numbering
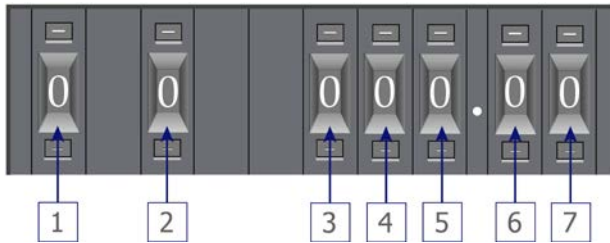
View Current Settings

To view the current alarm settings on the LCD Display, Switch 1 should be set to **9** and Switch 3 should be set to **0**.

Figure 18 - Viewing Current Alarm Settings

Set Alarm Defaults

To make changes to the alarm settings, the following procedure should be followed:

1. Set **Switch 1** to **9** and **Switch 3** to **1**, as shown below.

Figure 19 - Changing Audible Alarm Settings

2. Use Switch 2 to select alarm volume or alarm off. A setting of 0 will turn the alarm off, a setting of 1 will turn the alarm on at the low volume level and a setting of any value above 1 (2 – 9) will turn the alarm on at the high volume level, refer to Table 4.

Table 4– Switch 2 Settings

Switch 2	Function	LCD Display
0	Alarm Off	SET ALARM OFF
1	Alarm On Low	SET ALARM LOW
2	Alarm On High	SET ALARM HIGH
3	Alarm On High	SET ALARM HIGH
4	Alarm On High	SET ALARM HIGH
5	Alarm On High	SET ALARM HIGH
6	Alarm On High	SET ALARM HIGH
7	Alarm On High	SET ALARM HIGH
8	Alarm On High	SET ALARM HIGH
9	Alarm On High	SET ALARM HIGH

3. Use Switches 6 and 7 to set the interval between Audible Alarm occurrences. This interval can be 0.5 – 39 seconds. If it is desired that the Audible Alarm sound every 30 seconds, Switch 6 should be set to 3 and Switch 7 should be set to 0. The LCD will display this value as **DELAY = 30 sec**. Setting Switches 6 and 7 to "00" will produce an interval of 0.5 seconds.

Figure 20 - Alarm Display

4. Be sure that the Audible Alarm settings are correct and set Switch 3 to 2 to save the changes. **ALARM SAVED** will be displayed on the LCD. If changes need to be made to the alarm settings once ALARM SAVED has appeared on the LCD, Switch 1 must be switched from 9 to any other setting, then back to 9 again.

Figure 21 - Alarm Saved