INTRODUCTION

The DR-2000 is a time-activated water-resistant peristaltic pump for industrial applications. Up to 24 events may be programmed with variable run times for each event from one second to 20 minutes. The DR-2000 operates a 7-day clock in which events can be programmed to occur every day or only on particular days throughout the week. A back up battery keeps the clock running in the event of an interruption in the electrical power.

The DR-2000 is available for use with 115VAC, 230VAC or with a D-cell battery pack. Batteries are not included.

Battery life dependent on quality and age of batteries used.

PREFACE

This manual describes how to install, setup, operate and maintain the DR-2000. Material in this manual is subject to change without notice. Manual revisions will be made on an as needed basis. Special circumstances involving important design, operation or application information will be released via Equipment Technical Bulletins.

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SAFETY

These symbols on the unit mean:

Direct Current

Alternating Current

SPECIFICATIONS

OPERATING CONDITIONS

Ambient Operating Temperature

35 to 104ºF (5 to 40ºC)

Electrical Power

Options available: 115VAC 50/60 Hz +/- 10%

230VAC 50/60 Hz +/- 10%

4 D-cell battery powered

Altitude

<2000 meters

Humidity

0 to 100% relative humidity (non-condensing) throughout temperature range.

Ratings

Pollution Degree: 2

Installation Category II

Intended for indoor use only.

TIMING CAPABILITY

Up to 24 different times. Daily, weekly, or mixed schedule; variable run time 1 second to 19 minutes and 59 seconds.

DIMENSIONS

115 VAC/230 VAC Version:

<table>
<thead>
<tr>
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<th>Height</th>
<th>Width*</th>
<th>Depth**</th>
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D-Cell Battery Powered Version:

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<th>Depth**</th>
</tr>
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<tr>
<td>Centimeters</td>
<td>14.2</td>
<td>21.3</td>
<td>12.2</td>
</tr>
</tbody>
</table>

*Width includes feet
**Depth with SnapHead pump cartridge in place.

Weight

- 115VAC/230VAC version: 1.85 lbs/0.84 kg
- D-Cell Battery Powered version: 1.57 lbs/0.72 kg*

*D-Cell Battery Powered version without batteries

COMPONENTS

Enclosure
Molded ABS plastic, water-resistant, flame-resistant

Pump
Peristaltic, self-priming and self-checking, 6 Volts DC

Speed & Displacement

- **Battery-Powered Units**: 5.5 oz per min (153 ml per min)*
- **Line-Powered Units**: 7.5 oz per min (222 ml per min)*

*With Silicone tubing. Results may vary depending on voltage, chemical viscosity, temperature and other factors. Always perform your own test with your unit to confirm actual pump speed.

Maximum Duty Cycle

- At temperatures up to 85°F/29°C: 4 hours of pump down-time required for every 20 minutes of continuous run.
- At temperatures over 85°F/29°C: 12 hours down-time for every 20 minutes of continuous run time.

Hydraulic Performance

- **Maximum Vacuum**: 8 in of mercury
- **Maximum Pressure**: 20 psi

Tubing Material
Silicone
Viton

Coin Battery
3 Volt Lithium BR2032 or CR2032

Regulatory

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<tr>
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For confirmation of regulatory compliance, see rating label on your DR-2000.

INSTALLATION

Refer installation and service to qualified personnel only.
Installation must comply with all applicable plumbing and electrical codes.

MOUNTING

The DR-2000 should be mounted so the LCD screen can be viewed easily. It should be located close enough to both the injection point and liquid supply to ensure unobstructed delivery.

1. Align the metal mounting bracket and mount on a smooth surface using screws.
2. Place the DR-2000 over the mounting bracket and slide it down tight.
3. If desired, a screw can be placed in one of the feet to hold the unit in place.

The DR-2000 can also be mounted using the three plastic feet. If mounting on an uneven surface, be careful not to over-tighten or snap the feet off.

INSTALLING SUPPLY LINES

1. Cut the desired length of 1/4-inch (6mm) chemical feed line and attach it to the nut of the left side (suction side) of the pump squeeze tube.

2. For the chemical uptake side, a standpipe is provided. Cut the bottom of the chemical feed line tubing at a 45-degree angle and press it into the standpipe. Insert the chemical feed line 0.5 inches (12 mm) above the bottom of the standpipe. Both the 45-degree cut and the 0.5 inch (12 mm) distance above the bottom of the standpipe will help avoid the formation of a seal with the bottom of the chemical drum and ensure an unobstructed chemical uptake.
3. Cut and connect the desired length of chemical feed line for the chemical delivery to the right side of the pump squeeze tube. Run the delivery tube to the desired injection point. Avoid uphill runs greater than 10 feet (3 meters).

**POWER SUPPLY**

**115VAC Power Cord Version**
This unit comes with a standard power cord. No ground connection is required.

![Figure 6. Plugging DR-2000 into Outlet.](image)

**230VAC Power Cord Version**
This unit comes pre-wired for 230 VAC with flying leads (no plug). Qualified service personnel should wire it into a 230VAC power source.

![Figure 7. Inserting D-Cell Batteries](image)

**D-Cell Battery Powered Version**
This unit comes with a battery pack for 4 D-Cell batteries (batteries not included). The D-Cell battery holder is housed in the battery compartment.

**Installing the Batteries**
1. Remove the 4 screws holding the battery-housing top in place (the battery pack bezel).
2. Lift off the top and remove the battery holder, being careful not to damage the gasket.
3. Insert 4 D-cell batteries as indicated.
4. Replace the battery holder and battery-housing top.
5. Refit and tighten the 4 screws, being careful not to damage the gasket.

**Battery Life**
It is important to know that there is significant difference in quality between commercially available D-cell batteries. “Heavy-duty” and “Copper Top” brand batteries tend to last the shortest length of time, while the Duracell Ultra M3 and Energizer Max batteries can last up to ten times longer. We recommend that you ONLY use these high-quality alkaline batteries.

![NOTE] There is a 3-volt lithium battery on the main PCB that serves as an emergency backup power supply. This battery provides backup power to retain the clock settings during power loss. It provides enough power to retain time and event date but will not run the DR-2000 operator. The circuit breaker must be marked as the disconnecting device for the DR-2000. If the equipment is used in a manner not specified by the manufacturer, the protection provided may be impaired.

**NOTE**
It is not necessary to remove the front of the pump control box. The batteries are in the battery compartment. They can be changed without opening the pump side of the DR-2000.

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**Figure 4. Cutting Chemical Feed Tubing, Inserting into Standpipe**

**Figure 5. Chemical Feed Tubing (uptake side) with Standpipe in Chemical Drum**

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pump. The life of this battery will depend on the amount of time that power is lost during the lifetime of the pump and the average ambient temperature. Because of the extremely low power demands of the DR-2000 it may never be necessary to change this battery. If this battery does go dead, the clock will revert to the default time of 12:00 AM of Day 1 and all programmed events will be erased after a power loss. A replacement battery can be purchased commercially. See the Periodic Maintenance section for more information.

**OPTIONAL LOW LEVEL ALARM KIT**

An optional low level (sonic) alarm and low level alarm lance are available (see Spare Parts list).

The low level alarm lance is inserted into the chemical drum and the sonic alarm is installed on the left side of the pump housing. Both are wired into the appropriate connectors on the main PCB. The lance detects when the chemical drum is empty and the sonic alarm issues an audible alarm.

**SETUP & PROGRAMMING**

During normal operation, the DR-2000 is in Run Mode. In Run Mode, the screen will display the current time and day of the week, and the colon will blink once per second.

The DR-2000 is programmed using the 5 buttons and screen in the front of the unit.

**ENTERING PROGRAM MODE**

To begin programming, you must first enter into Program Mode. To do this, hold down the Program button for 8 seconds. The colon will blink fast and irregularly while the Program button is pressed.

The screen will flash and the colon will stop blinking to indicate that you have successfully entered Program Mode. The screen display will not change. It will continue to show the current time and day of the week.

**SETTING THE CLOCK**

Once you enter Program Mode, your first option is to set the clock. Use the Hours button and the Minutes button to change the time of day. The clock will display “P” for PM settings. Use the day button to change the day of the week. We recommend that you program Monday as day 1.

**PROGRAMMING WHEN AN EVENT WILL OCCUR**

1. Press the Event button once. You will see the following screen. This screen indicates which event you are entering.

Example:

![Event Screen](image)

The screen above indicates that you are entering event number 1.

2. Press the Event button again. This screen shows the day and time this event will begin.

3. Change the time that the event will occur using the Hours and Minutes buttons.

4. Change the day of the week that this event will occur using the day button. When scrolling through the day menus you will see that you are able to select from the following options:
• Select each day individually, as days 1 through 7.
• Select all the days of the week, 1 through 7 appear together.
• Select week day only, 1 through 5 appear together
• Select weekend days only, 6 and 7 appear together

Example:

1
1:45
P

The screen above indicates that the event will occur at 1:45 PM every Monday (only Mondays).

Example:

1 2 3 4 5 6 7
8:30

The screen above indicates that the event will occur all days at 8:30 AM (everyday).

**PROGRAMMING HOW LONG AN EVENT WILL BE**

Once you have programmed when the event will occur, press the Event button again. The screen will display the day of the event and the duration of the event in Minutes and Seconds. Min:Sec will appear in the bottom of the screen. The maximum run time is 19 minutes and 59 seconds. Set the duration of the event using the Minutes button and the Seconds button. We recommend you allow an interval of 20 minutes between events.

Example:

2:15
MIN:SEC

The above screen indicates that the event will have a duration of 2 minutes and 15 seconds.

Once you have finished programming the first event, press the Event button again to move to next event. You can program up to 24 events this way.

**CLEARING UNWANTED EVENTS**

As a rule, it is a good idea to clear events that you do not plan to use. This eliminates the occurrence of any unwanted events. To clear unwanted events:

1. Go to the event screen of the first event you want to clear.
2. Press and hold the Hours and Minutes buttons.
3. While still pressing the Hours and Minutes buttons, press and hold the Event button. The unit will scroll through all higher-numbered events and clear them (by setting the duration to “000”).

The unit will stop clearing after event 24.

**Example of Clearing Unwanted Events**

Let’s say you’ve programmed events 1 through 5 and are not planning to use events 6 through 24. It is advisable to be sure that there are no events programmed for 6 through 24. To do this:

1. Go to the event 6 screen.
2. Press the Hours, Minutes and then Event buttons and hold them down. The unit will scroll from event 6 through 24, setting all values to “000”. This process will stop when it returns to event 1. You now have events 1 through 5 as you programmed them and events 6 through 24 cleared.

**RETURNING TO RUN MODE**

When you have finished programming, you can return to Run Mode by pressing the Program button once. The colon will again flash normally (once per second). If you leave the DR-2000 in Program Mode and unattended for 2 1/2 minutes, it will switch back into Run Mode automatically.

You can be sure you are in Run Mode by pressing the Prime button and priming the pump. The Prime button will not prime the pump if you are not in Run Mode.

**PRIMING**

1. Ensure that you are in Run Mode.
2. Press the Prime button to operate the pump.

**ORDERING INFORMATION**

**SPARE PARTS**

Main PCB 1202397
Power PCB 115 VAC 1202396
Power PCB 230 VAC 1202678
D-cell Battery Holder 1202596
Pump Motor Gearbox 6 VDC 057755
SnapHead Pump Cartridge 1/4 inch w/Silicone Tube 058210
SnapHead Pump Cartridge 1/4 inch w/Viton Tube 1203790
SnapHead Pump Cartridge 6 mm w/Silicone Tube 1202707
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<td>Install Kit (non-European versions)</td>
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**MAINTENANCE**

- Safety glasses and protective clothing should be worn while servicing the DR-2000.
- Refer installation and service to qualified personnel only.

**PERIODIC MAINTENANCE**

**Pump & Squeeze Tube Replacement Schedule**

Since every installation is different (chemicals, tube runs, operating frequency, and so on), an exact tube replacement schedule cannot be specified. With use, the tube slowly evolves from round to oval and the amount of chemical pumped decreases. By regularly checking the amount of chemical pumped, you can determine general tube life. It is recommended that you closely monitor the time it takes the original tube to reach the end of its flex life, and then establish a replacement schedule. Replacing tubes at regularly scheduled intervals ensures more accurate product use and reduces service calls. In general, short feed lines of a large diameter will improve pump tube life.

**REPLACING PUMP CARTRIDGES**

**To Remove**

1. Turn off power to the unit to ensure that the pump does not run during maintenance.

2. Turn snap pins to the left or right to remove the pump head.

3. Remove the supply and feed lines from the old pump squeeze tubing and connect them to the new pump squeeze tubing.

**To Install**

1. Align and engage the pump drive spline with the motor gear by rotating the roller assembly.

2. Turn the snap pins so that the arrow is pointed either straight up or down. Then push in until you hear a distinct click.

**Replacing Pump Squeeze Tubing**

- Splash danger! Because the squeeze tube contains chemical product and is flexible, extra caution should be taken while changing the squeeze tube to insure that the chemical does not splash in the eyes or on the hands or clothing of the service person.

- Always wear protective eyewear, gloves and protective clothing when changing the squeeze tube.

1. Remove the cartridge as described above.

2. Loosen but do not remove the small screw at the bottom of the rear cover and lift the cover from the cartridge.

3. Pull the roller assembly out of the pump cartridge to release the pump squeeze tubing.

4. Pull the tube inserts out of the pump cartridge.

5. Remove the squeeze tube.

6. Replace it with a new squeeze tube.

7. When using Viton or Silicone, coat the inside of the cartridge with a liberal amount of Vaseline (petroleum jelly) lubricant. Never use Dow Corning lubricant with a Silicone tube, as it will cause it to fail prematurely.

8. Press the two tube inserts into the cartridge so that the tie wrap "buckles" face toward the center of the pump. Remember, the tube must not be twisted during the assembly.

9. Replace the roller assembly.

10. Replace the rear cover and screw.

11. Push the black snap pins back into position, with the arrow pointing up or down.
How to Replace Pump Motor

To Remove
1. Ensure that power is off.
2. Remove the 4 screws holding the front plate (bezel) in place.
3. Remove the front plate.
4. Remove the pump cartridge from the motor assembly, leaving the chemical lines attached.
5. Remove the electrical connections at the back of the motor.
6. Compress the two flex ears on the back of the motor until the motor slides out through the hole in the front plate.

To Replace
1. Locate the alignment tip of the motor housing so it is in the down position.
2. Slide the pump motor housing into the front plate hole. The holding ears will expand to hold the pump motor in place. Verify that both ears popped out and are locked in place.
3. Reinstall the electrical connections at the back of the motor.
4. Install the pump cartridge.
5. Prime the pump to verify proper pump rotation (clockwise). If the direction is wrong, switch the motor wires.
6. Remount the front plate (bezel) and retighten the screws, being careful not to damage the gasket.

How to Replace the Main PCB
1. Disconnect power to the unit.
2. Remove the 4 screws holding the front plate of the DR-2000 control box in place. Remove the front plate (bezel), being careful not to damage the gasket.
3. Detach the power wire connection from the main PCB.
4. Detach the power cord.
5. Remove the screws holding the power PCB in place.
6. Gently lift out the power PCB.
7. Align the new power PCB and replace the screws. Be sure to tighten the screws into position.
8. Reattach the power cord to the terminal block.
9. Reattach the power wire connection from the main PCB.
10. Remount the front plate (bezel) and retighten the screws, being careful not to damage the gasket.

How to Replace the Power PCB
1. Disconnect power to the unit.
2. Remove the 4 screws holding the front plate of the DR-2000 control box in place. Remove the front plate (bezel), being careful not to damage the gasket.
3. Detach the power wire connection from the main PCB.
4. Detach the power cord.
5. Remove the screws holding the power PCB in place.
6. Gently lift out the power PCB.
7. Align the new power PCB and replace the screws. Be sure to tighten the screws into position.
8. Reattach the power cord to the terminal block.
9. Reattach the power wire connection from the main PCB.
10. Remount the front plate (bezel) and retighten the screws, being careful not to damage the gasket.

How to Replace Coin Battery
1. Ensure that power is off.
2. Remove the 4 screws holding the front plate of the DR-2000 control box in place. Remove the front plate (bezel), being careful not to damage the gasket.
3. Locate the coin battery on the PCB.
4. Slip the coin battery out and replace it with a new one (3 Volt lithium BR2032 or CR2032).
5. Remount the front plate (bezel) and retighten the screws, being careful not to damage the gasket.

Cleaning the Unit
Wipe pump housing clean with a dry rag.

When the lithium backup battery is removed, all programmed events will be erased and the clock will revert to its default setting of 12:00 AM, Monday.
TROUBLESHOOTING

Pump Runs Continuously
If the pump runs without being activated, replace the main PCB.

Pump is Running Backwards
Check that the polarity of the wires from the main PCB to the motor is correct.

Pump Runs Too Slowly
1. Check that the squeeze tube or pump cartridge is not jammed.
2. Check the chemical uptake line for kinks.
3. Verify that the chemical uptake line is not forming a seal against the side or bottom of the chemical drum (See: INSTALLING SUPPLY LINES in INSTALLATION section).
4. If the liquid being pumped is very viscous the pump may labor in order to move it. Using a less viscous chemical, pumping shorter distances, setting longer run times, and assuring that the squeeze tube is in good condition will help address this issue.

For 115 VAC and 230 VAC Versions:
1. Verify that the correct line power is installed and adequate power is arriving to the unit.
2. Check for 6.0 volts DC or greater at the motor connection wires with the motor disconnected and the pump prime button activated. If this voltage is present, replace the motor gearbox. If the problem persists after the motor gearbox has been replaced, replace the power PCB. If the voltage is absent replace the main PCB.

For D-cell Battery Power Version
1. Check for 6.0 volts DC or greater coming from the battery holder. If voltage is absent replace the batteries. If voltage is present, proceed with step 2.
2. Check for 4.5 volts DC or greater at the motor connection wires with the motor disconnected and the pump Prime button activated. If this voltage is present, replace the motor gearbox. If the voltage is absent, replace the main PCB.

Pump Will Not Run
1. Check that the squeeze tube or pump cartridge is not jammed.
2. Check the chemical uptake line for kinks.
3. Verify that the chemical uptake line is not forming a seal against the side or bottom of the chemical drum (See: INSTALLING SUPPLY LINES in INSTALLATION section).
4. Check to see that the motor connection wires are properly connected from the main PCB to the motor gearbox.
5. Press the Program button once to assure that you are in Run Mode. If you are in Run Mode the colon should blink once per second. You must be in Run Mode for programmed events to occur.
6. Push the Prime button and try to prime the pump. If the pump does prime, check that events are properly programmed.

For 115 VAC and 230 VAC Versions
1. Verify that the power is connected.
2. Check for 6 to 11 volts in the wire harness from the power PCB to the main PCB. If the voltage is absent replace the power PCB.
3. Check for 6 volts DC or greater at the motor connection wires with the motor disconnected and the pump prime button activated. If this voltage is present, replace the motor gearbox. If the voltage is absent, replace the main PCB.

For D-cell Battery Power Version
1. Make sure that the batteries are properly aligned.
2. Make sure that the polarity of the wires running from battery pack to the main PCB is correct.
3. Check for 4.5 volts DC or greater coming from the battery holder. If voltage is absent, replace the batteries. If voltage is present, proceed with step 2.
4. Check for 4.5 volts DC or greater at the motor connection wires with the motor disconnected and the pump Prime button activated. If this voltage is present, replace the motor gearbox. If the voltage is absent, replace the main PCB.

Clock Resets to 12:00 AM and Events are Erased When Unplugged or Power is Lost
Replace backup battery.

Pump Will Not Operate When Programmed Interval Occurs
Check event programming. If setup is correct, and the prime switch activates the pump, replace the main PCB.

Pump Will Not Pull Liquid from the Supply Container
1. If there is too much vacuum created, the pump will not be able to move the chemical. This is easily recognized when the squeeze tubing collapses. If this happens:
   a) Check that the squeeze tube or pump cartridge is not jammed.
   b) Check the chemical uptake lines for kinks.
   c) Ensure that the chemical uptake line is not forming a seal against the side or bottom of the chemical drum (See INSTALLING SUPPLY LINES in INSTALLATION section).
   d) Using a less viscous chemical, pumping shorter distances, setting longer run times and ensuring that the squeeze tube is in good condition will help address the issue.
2. Check to see that there is not an air leak somewhere along the chemical supply line.

**PRODUCT REPAIR**

If an item is in need of repair, please call or write to obtain a Return Authorization (RA) number. When calling, ask for the Repair Department. They provide RA numbers. Then, please write the number on the outside of the box before sending. It is very helpful to our Repair Department to include a note explaining the nature of the problem. Failure to obtain an authorization number before returning an item may delay repair of the equipment.
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