

**kangaroo<sup>®</sup> 224**

**FEEDING PUMP**

service manual

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# 1. general information

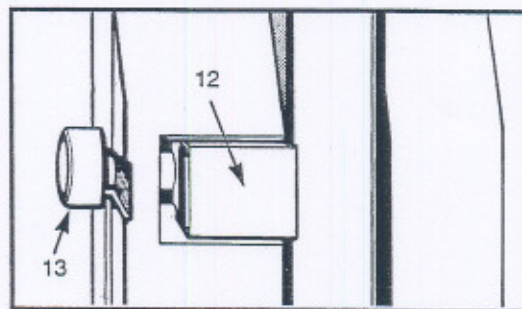
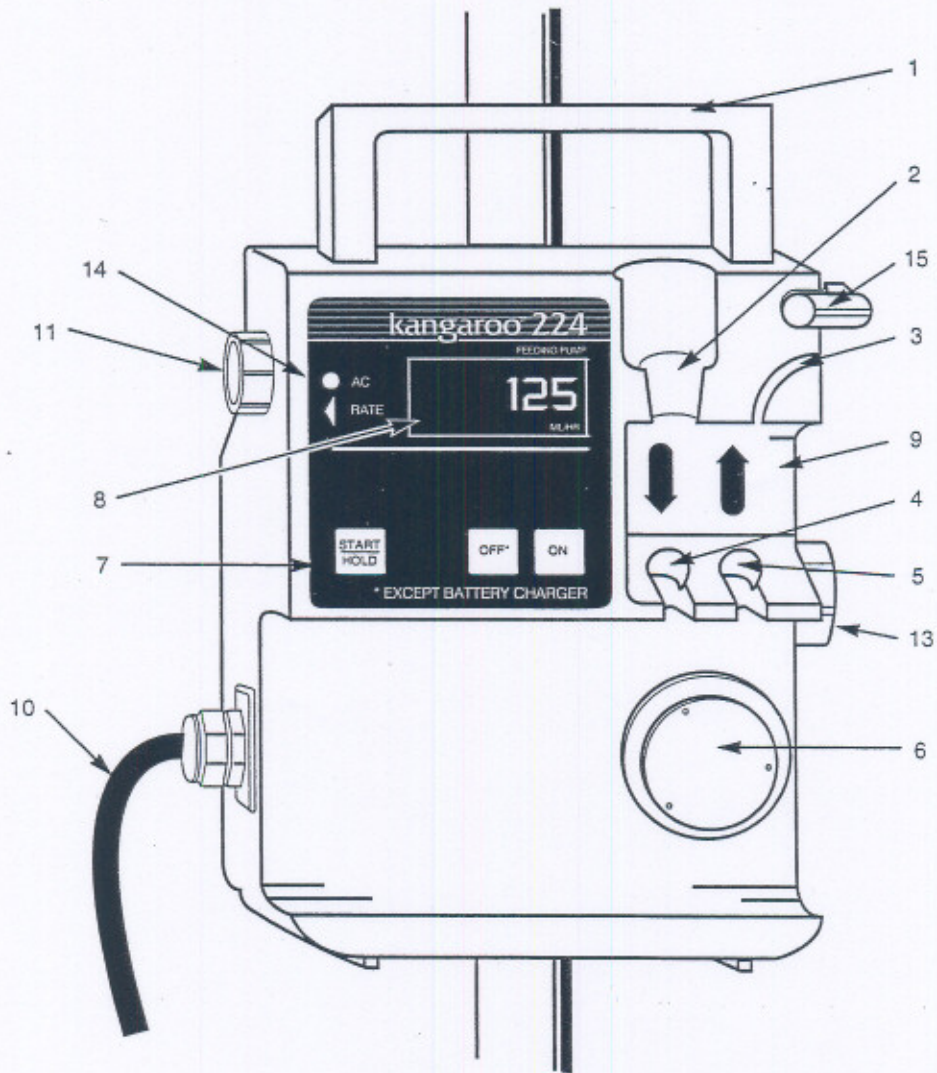
## product description

The Sherwood Medical Kangaroo® Feeding Pump is a rotary peristaltic pump designed to regulate the flow rate of enteral feedings. Among the features provided by this pump are:

- Portable operation—built in battery
- Wide flow rate range 5-300 ml/hr in 5 ml/hr increments
- Small and lightweight for easy transport
- Touch panel operation
- Shut off and activation of audible and visible alarms when:
  - Feeding container is empty
  - Feeding tube becomes occluded
  - Drop sensors blocked
  - Battery low (alarms 15 minutes before pump shut off)
  - Unit is left on "HOLD" longer than 2½ minutes
  - Pump set is improperly loaded
  - Self diagnosed problem which requires technical servicing
  - Pump motor malfunction
- Automatic systems check after pump has been turned ON
- Large LED display
- Low occlusion pressure. Pump will not overcome back pressure greater than approximately 12 psi (82.7 kPa)
- Integral pole clamp
- Use of safety interlock pump sets to safeguard against the risk of overinfusion due to misloading of pump set onto pump
- Pump running indicator lights
- DC motor with intermittent operation
- Memory of flow rate setting for 24 hours after pump shut off.

**WARNING:** This Kangaroo Pump requires the use of a Kangaroo Pump Set. The pump will not operate if sets other than Kangaroo Pump Sets are loaded onto the pump.

- |  |                           |
|--|---------------------------|
| 1 Handle   | 9 Direction for Use Label |
| 2 Upper Drip Chamber Guide (including drop sensor) | 10 Power Cord             |
| 3 Tubing Guide                                     | 11 Rate Control Knob      |
| 4 Lower Drip Chamber Guide                         | 12 Pole Clamp             |
| 5 Retainer Lock                                    | 13 Pole Clamp Knob        |
| 6 Rotor Assembly                                   | 14 A.C. Light             |
| 7 Touch Panel                                      | 15 Tubing Guide Latch     |
| 8 LED Display and Pump Running Indicator Lights    |                           |





## 2. operating procedures

### touch panel

#### AC Light

On whenever pump is plugged in

#### RATE Control Knob

Increases or decreases flow rate desired

#### ON

Powers the pump

#### OFF

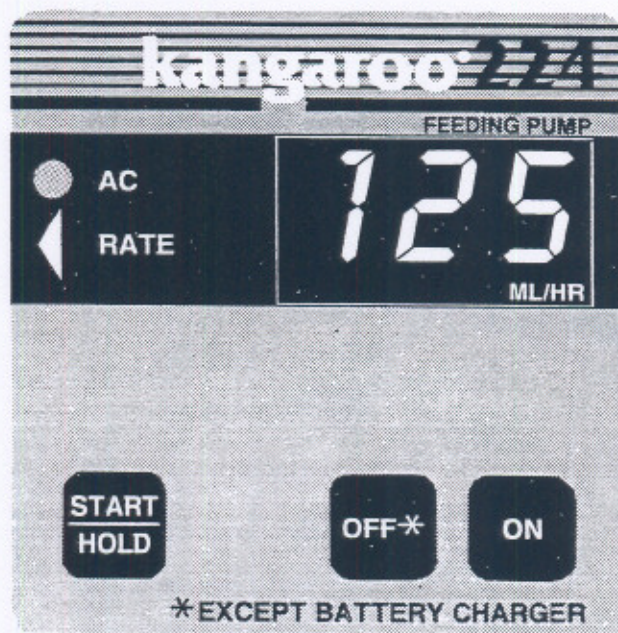
Shuts pump off

#### START/HOLD

Starts pump rotor to deliver feeding formula to patient and alternately puts unit on HOLD. HOLD is used to stop fluid flow to: (1) correct alarm condition—alarm is silenced (2) change the flow rate (3) change pump set. When on HOLD, the display flashes on and off.

NOTE: IF THE PUMP HAS BEEN PLACED ON HOLD AND NOT RESTARTED WITHIN 2.5 MINUTES, AN ALARM WILL SOUND.

Battery will charge with pump plugged into wall outlet, even when OFF button has been pressed.



### normal operations

Insert hospital grade plug into AC wall outlet.

### battery operation

Unplugging the pump from the AC line outlet will automatically put the pump on battery power. A new battery, when fully charged, will operate the instrument for more than 24 hours at 125 milliliters per hour. Approximately 15 minutes prior to battery discharge, a low battery alarm will occur, (see alarm section). When complete discharge occurs, the pump will automatically turn itself off.

NOTE: AS THE BATTERIES GET OLDER, THE TIME FROM LOW BATTERY ALARM TO COMPLETE DISCHARGE MAY BE LESS THAN 15 MINUTES.



The battery will charge continuously during AC line operation.

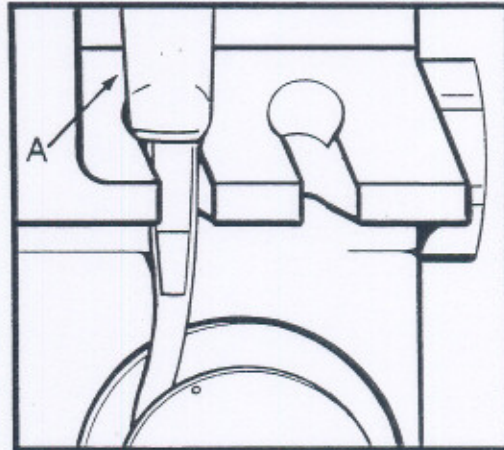
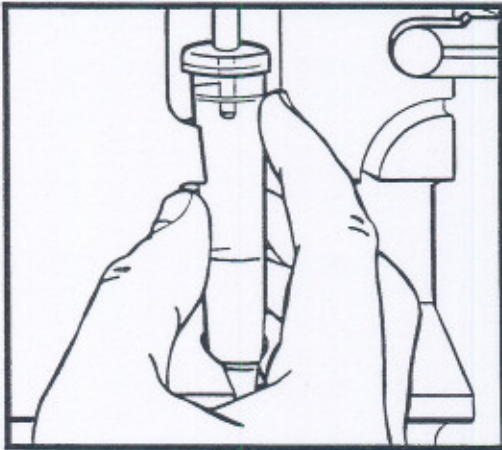
To recharge battery, insert hospital grade plug into AC wall outlet. Battery will automatically begin charging. The recharge time for a fully discharged battery is approximately 15 hours.

The battery will charge whenever the pump is plugged into a wall outlet, even when the OFF button has been pressed.

## beginning administration

Below are general instructions for inserting all Sherwood Medical Pump Sets into the Kangaroo 224 Feeding Pump.

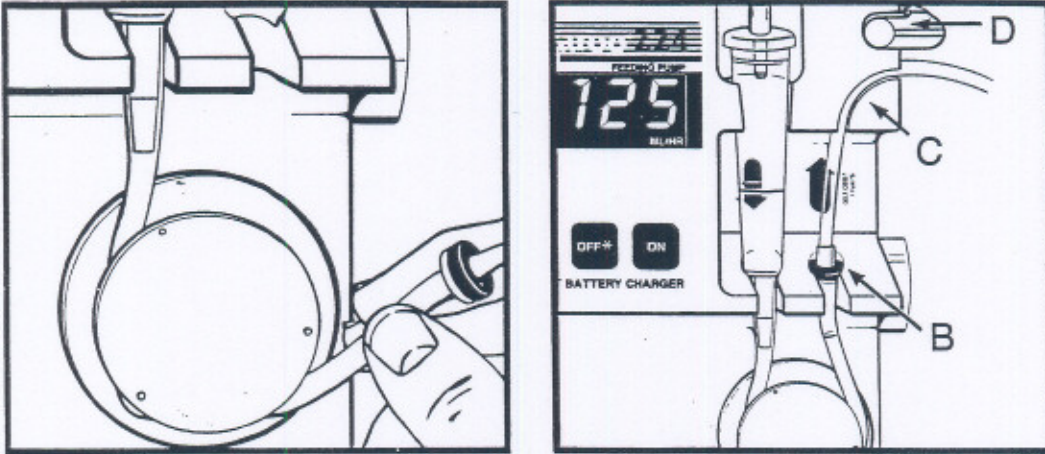
1. Press ON.
2. Wait while pump performs system check.
3. When display reads 0, set desired rate in ml/hr by turning RATE Control Knob on side of pump.



4. Slide drip chamber into upper drip chamber guide.
5. Seat and secure drip chamber in lower drip chamber guide (A).
6. Remove distal connector protective cover.
7. Slowly open clamp and fill entire line with fluid.  
NOTE: AVOID FILLING THE DRIP CHAMBER MORE THAN HALF FULL.  
Close clamp.
8. Attach distal connector to feeding tube.



## 2. operating procedures (cont.)



9. Grasp silicone tubing and gently stretch around rollers. Insert retainer into retainer lock (B). Thread tubing over tubing guide (C). Secure latch over tubing (D).

**VERIFY THAT THE PUMP SET IS PROPERLY LOADED IN THE PUMP BEFORE PROCEEDING. AN IMPROPERLY LOADED PUMP SET COULD RESULT IN UNCONTROLLED FLOW AND POSSIBLE PATIENT INJURY.**

10. Open control clamp.
11. Press START/HOLD.
12. Proceed with feeding.

### alarms

The Sherwood Medical Kangaroo 224 Feeding Pump has been designed to provide audible and visible alarms under several conditions where proper performance cannot be maintained. When an alarm occurs, press the START/HOLD button on the pump and perform the necessary procedures to correct the alarm condition.

**NOTE: THE VISIBLE ALARM IS IN THE FORM OF A MESSAGE SHOWN ON THE DISPLAY.**

#### **No Set (no SET)**

The feeding set is not installed or is installed improperly. See Operating Procedure for installation instructions.

#### **Flow Error (FLO Err)**

- A. The feeding container is empty.

To correct this situation, if more feeding is required, refill the container with the desired amount of formula and follow the steps in the Operating Procedures of this manual.

- B. The feeding container, the feeding set tubing, or the feeding tube itself has become occluded beyond the pump's capability to pump. Alarm will activate at approximately 12 psi (82.7 kPa).

To correct this condition, determine where in the system the occlusion has occurred. Correct occlusion condition. Press START/HOLD switch. Continue with feeding.



**Low Battery (Lo bAt)**

This alarm is activated when the battery begins to run down and flow rate accuracy can no longer be maintained.

The low battery alarm occurs approximately 15 minutes before complete discharge. When complete discharge occurs, the pump automatically turns itself off.

To correct this condition, plug the pump into an AC wall outlet. When the pump is connected to a wall outlet, it will continue to operate and charge the battery at the same time. Once the low battery alarm has sounded, it will take approximately 15 hours to fully recharge.

**Hold Error (HLd Err)**

If the pump is left in the hold mode for approximately 2½ minutes "HOLD ERROR" will alarm.

**System Error (Sys Err)**

A. Rotor is not turning while pump is in start mode.

NOTE: DOTS WILL FLASH ACROSS TOP OF LED DISPLAY WHILE PUMP IS RUNNING.

B. Rotor is turning, but is not detected by rotor sensors.

Do not try to repair pump. Return pump for technical service.

NOTE: FOR ALL ALARM CONDITIONS, PRESSING THE START/HOLD BUTTON WILL SILENCE THE AUDIBLE ALARM. THE VISIBLE DISPLAY WILL CONTINUE TO FLASH UNTIL THE START/HOLD BUTTON IS PRESSED AGAIN.



## 3. maintenance

### routine maintenance

Routine maintenance consists primarily of preventing and cleaning spillage on the housing, rotor and rollers.

**CAUTION:** DO NOT IMMERSE PUMP OR POWER CORD IN WATER OR OTHER CLEANING SOLUTION; CLEAN USING A DAMP (NOT WET) CLOTH OR SPONGE. FAILURE TO FOLLOW THE CLEANING PROCEDURES DESCRIBED HEREIN COULD RESULT IN HAZARDS TO USERS. As with any A.C. powered electrical device, care must be taken to prevent liquid from entering the pump or the power cord receptacle to avoid electrical shock hazard, fire hazard, or damage to electrical components.

Should any of the following events occur, DO NOT USE the pump until it has been properly cleaned and serviced by personnel trained in servicing Kangaroo pumps:

- wetting of the pump's power cord or leakage into the pump interior during cleaning.
- spillage of large amounts of formula onto the pump exterior or any spillage on the power cord.

### general cleaning directions

Cleaning of Kangaroo 224 pumps must be performed as follows:

**CAUTION:** Disconnect pump from A.C. power source before cleaning. Upon completion of cleaning, do not connect to A.C. power source until pump and power cord are thoroughly dry.

- A mild detergent should be used for general cleaning. If necessary, the pump may be cleaned with a 10:1 water and hypochlorite mixture. However, repeated cleaning with this solution can damage the plastic pump case. Isopropyl alcohol applied with a damp (**not wet**) cotton swab may be used for cleaning difficult to reach areas such as the drop sensor and inside the A.C. receptacle. However, it should be used sparingly because repeat cleaning may damage the case.
- DO NOT USE strong cleaners such as Spray-Nine, PhisoHex, Hibiclens, or Vesta-Syde because damage to the pump case housing can result.

### directions for cleaning pump housing

- Refer to General Cleaning Directions before starting.
- Clean outside surface with a damp (**not wet**) cloth or sponge and keep pump in upright position as much as possible.
- Avoid excess moisture near handle hinges.
- Avoid excess moisture near pole clamp area.
- When cleaning around buzzer opening on back of pump housing, do not let cleaning solution get inside pump.



## **directions for cleaning pump power cord**

- Refer to General Cleaning Directions before starting.
- Unless soiling is observed, the power cord should not be cleaned.
- If cleaning of the power cord is necessary, wipe the exterior surfaces of the wall plug of the power cord with a cloth dampened with isopropyl alcohol.

**CAUTION:** Avoid exposing power cord to excess moisture, as this can lead to an electrical shock or fire hazard.

## **directions for cleaning drop detector**

- Refer to General Cleaning Directions before starting.
- Clean the drop sensors in the upper drip chamber guide with a cotton swab dampened with isopropyl alcohol.
- Be sure sensor areas are clear.

## **directions for cleaning rotor assembly**

- Refer to General Cleaning Directions before starting.
- Loosen rotor set screw with a 5/64" allen wrench and gently pull rotor forward off shaft. After removing rotor, avoid getting any moisture in the rotor shaft opening.
- Clean rollers thoroughly with warm soapy water, or isopropyl alcohol if necessary.
- Be sure all parts of rotor are completely dry before putting it back onto shaft.
- To replace rotor, align set screw on hub of rotor with the flattened section of the output shaft.
- Push rotor into place and tighten set screw (Do not over tighten).

## **preventive maintenance**

This pump must be periodically serviced to assure proper functioning and safety. The recommended service interval is 6 months, but in no case less than once each twelve (12) months per JCAHO. Servicing must be performed by personnel trained in servicing Kangaroo pumps and be done at the user's biomedical engineering department, an outside service, or by Sherwood Factory Service. To arrange for Sherwood Factory Service, call 1-800-448-0190.



## 3. maintenance (cont.)

### calibration

#### Flow Error Alarm

For optimum performance of the infrared emitter/detector pair, the voltage at the node of C22 and R40 should be between 0.99 and 1.01 VDC, without a drip chamber in place.

**CAUTION:** Always disconnect the pump from the A.C. power source before opening the pump housing.

This adjustment may be made with R42 while shading the emitter/detector pair from ambient light and shorting the drain of Q6 to ground.

#### Low Battery Alarm

The low battery alarm is designed to commence when the battery voltage drops between 6.8 and 7.2 VDC. The pump automatically shuts itself off when the battery voltage drops between 5.3 and 5.6 VDC.

### additional tests

#### Motor Speed Verification

Motor speed can be verified by measuring the time elapsed from when the motor starts turning, stops, and then starts turning again.

**NOTE:** Ignore the very first start/stop cycle as this cycle is intentionally longer than subsequent cycles.

Motor cycle time is as follows:

Rate (ml/hr)	Time (seconds)
295	4.54 to 4.84
35	12.77 to 13.56

#### No Set Alarm

With no feeding set installed, the pump should alarm and display the "no set" message when start/hold is pressed.

#### Flow Error Alarm

The pump should alarm and display "FLO Err" when no drops have been detected for approximately two motor cycles (i.e., set is empty or flow is restricted).



## KANGAROO® 224 FEEDING PUMP RECOMMENDED PERFORMANCE TEST

SERIAL NUMBER: \_\_\_\_\_ DATE: \_\_\_\_\_  
 EQUIPMENT \_\_\_\_\_  
 CONTROL NO.: \_\_\_\_\_ TECHNICIAN: \_\_\_\_\_

**1. EXTERIOR CLEANING/INSPECTION:**

- a. Power cord not damaged.
- b. Rotor rollers turn freely.
- c. Clean case, rotor, and drop sensor windows.
- d. Check rotor shaft for straightness.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**2. TOUCH PANEL:**

- a. "ON" Button (display flashes "888" w/dots at top)
- b. "OFF" Button
- c. "START/HOLD" Button

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**3. VISUAL INDICATORS:**

- a. A.C. Light
- b. Rate Control Knob/Display (5-300)
- c. No Set Error
- d. Flow Error

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**4. AUDIBLE ALARM**

**5. SPEED VERIFICATION TEST:**

- a. Fill the feeding set with water and connect it to the pump. (Refer to pages 4 and 5 of the operating manual.)
- b. Press and release the ON button. Set the delivery rate at 295 ml/hr.
- c. Press and release the START/HOLD button.  
Observe that the rotor will turn approximately one revolution, then stop.
- d. When the rotor begins to turn for the second time, start the stopwatch.
- e. The rotor will turn for a time, then it will stop. When the rotor begins to turn again, stop the stopwatch.
- f. The results displayed on the stopwatch must be 4.54 to 4.84 seconds.
- g. Time one complete rotor revolution (from start to stop) and verify that it is no more than 4 seconds.
- h. Press and release the START/HOLD button.
- i. Repeat steps C through E with a delivery rate of 35 ml/hr. The time must be 12.77 to 13.56 seconds.
- j. This concludes the motor speed/accuracy test.

\_\_\_\_\_ sec.  
 \_\_\_\_\_ sec.  
 \_\_\_\_\_ sec.

**6. DROP SENSOR TEST:**

- a. Repeat steps 5a-5c.
- b. After pump has run for a few seconds, press and release START/HOLD button to put pump in hold mode.
- c. Close roller clamp.
- d. Restart pump by pressing START/HOLD button.
- e. Flow error alarm should sound within 15 seconds.

**7. ELECTRICAL SAFETY TESTS:**

- a. Chassis to Ground Resistance (0.15 ohms or less)
- b. Leakage Current (less than 100 microamps)
- c. Test unit with power on and off.
  - 1. Normal
  - 2. Open Ground
  - 3. Open Ground Reverse Polarity

	_____ ohms
	_____ uA
ON	OFF
_____ uA	_____ uA
_____ uA	_____ uA
_____ uA	_____ uA

**8. OPERATIONAL TEST:**

- a. Operate pump at 150 ml/hr for a minimum of 30 minutes with feeding set in place.

**It is recommended that this performance test be conducted once per year.**



## 4. circuit description

### MCU introduction

The heart of the feeding pump is an 8-bit microcomputer unit (MCU). This CMOS single chip MCU contains a cpu, clock oscillator, 4KBytes of PROM, 192 Bytes of RAM, 31 parallel I/O pins, two timers and a serial communication interface (SCI).

A 2MHZ crystal oscillator connected between pins 38 and 39 provides the required clock frequency for the MCU.

### power supply

AC power is converted to DC through a transformer, rectifier and a filter capacitor. The rectified voltage (Vrec) is used to indicate the presence of AC to MCU. To prevent possible damage to the MCU, the Vrec is connected to the MCU through the optoisolator (U5). Presence of Vrec forces pin 22 of MCU low and the low on this pin will instruct the MCU to ignore LO BATT and BAT DEAD signals and to resume normal operation even with dead batteries.

The Vrec is used to power the pump and to charge the battery. The battery charging circuit is an LM317 configured to provide a nominal 120mA constant current. The battery itself is a six cell Nicad battery providing 7.2V and 1200 m Amp-hour capacity. This provides for 24 hour operation at a delivery rate of 125 ml/hr. Diodes CR5-CR7 serve to isolate the Vrec and the battery circuits from one another.

### power-on circuit

The ON button is connected to the interrupt line of the MCU. When pressed, it turns on FET Q13 which applies power to the MCU via 5V regulator, LM2931. It also causes the MCU to execute the interrupt routine. This routine initializes the MCU, which includes bringing pin 16 high. The high on pin 16 will turn the Q10 switch on and pull the gate of the Q13 switch to the ground. This will allow the Vrec and/or battery voltages to be applied to the main circuit voltage regulator (VR3) and to the motor power switch (Q11).

### keyboard

Each of the buttons on the front panel display are connected to pins 26 – 28 (PC2 – PC0) and 30 – 33 (PD1 – PD4). The MCU scans these inputs, checking for a low condition. When a button is pushed and a low condition occurs, the MCU executes the appropriate instruction.

### display & LED indicators

Port A (PA0 – PA7) of the MCU is used to control each of the three 7-segment LED displays. An octal line driver interfaces port A and the LED displays. Individual 7-segment displays are multiplexed and controlled by pins PBO – PB2. Each segment is turned on in succession every 2 msec.



## 4. circuit description (cont.)

The AC indicator is powered by the Vreg. The LM317L provides constant current to the LED and prevents the LED intensity from varying.

### battery monitoring circuits

Each pump has 2 battery monitoring circuits connected to pins 24 (PC4) and 21 (PC7). LO BATT will cause a low level signal when the battery voltage reaches  $7.0 \pm .2V$ , and will sound the alarm. When this occurs, the pump will display the LOW BATT message. If the pump is not connected to the AC power within 15 minutes, the pump will stop operating. The 15 minute time limit eliminates the possibility of incorrect pump operation due to insufficient battery voltage. When the battery voltage reaches  $5.45 \pm .15V$ , the BATT DEAD circuit will cause a low level signal on pin 21 (PC7). When this occurs, the pump immediately disables itself. This is a back up to the LO BATT circuit.

### reset circuit

In order to prevent inappropriate operation due to the microprocessor failure, an automatic reset circuit is included. Under normal operating conditions, a steady stream of 4msec positive synchronizing pulses are present on pin 34 (PD5) which is programmed as an output. These pulses continuously reset the timer (U3), allowing it to hold the reset line (pin 1) high. If for any reason the resulting square wave is absent, the timer (U3) will produce one time negative 20 msec reset pulse which puts the system into a new start mode. This disables the pump, preventing unpredictable operation in the event of the MCU failure. If the condition is not corrected, the reset circuitry will produce 20 msec restart pulses every 200 msec.

### drop detector

The drop detection circuit consists of an Infrared Emitting Diode (IED) and phototransistor sensor pair. When a drop falls between the IED and sensor a momentary low pulse occurs on pin 23 (PC5). The software is programmed to "look" for the presence of at least 1 drop every 2 revolutions of the rotor. If this does not occur, a Flow Error will result. Pin 35, the output line (IED driver) turns the drop circuitry on whenever the motor is turning and the rate is greater than 95 ml/hr. For rates less than or equal to 95 ml/hr the drop circuit is turned on all the time except for the initial Hold/Start state. If the Q6 switch shorts out or this output line becomes internally shorted to the positive voltage, the drop sensor will be enabled permanently. This would only result in unnecessary power drainage. If pin 23 (PC5) input line becomes permanently shorted to the positive voltage, and the motor is running, the drop signals will not be sensed and an error message will be displayed, causing the feeding to terminate. However, if this line is shorted to the ground inadvertent continuous flow signal is sensed and the MCU terminates the feeding because of the flow error. If Q6 switch is open, or pin 35 (PD6) output line is internally shorted to the ground, the drop sensor will be disabled and no drop will be sensed, resulting in an error message and no feeding will occur.



## motor

This pump uses a DC motor with a 100:1 gear ratio. It is operated at 5.0 VDC. The rate of delivery is controlled in the software by varying the pause between revolutions. Each revolution will take a maximum of 4 seconds. A slower rate results in longer pauses. Rotor rotation is determined with 3 equally spaced magnets mounted on the rotor which are detected by a sensor in the pump. The motor is controlled by the MCU, from pin 17 (PB5). If a malfunction occurs in the motor control circuit causing the motor to run continuously, the fail-safe circuit, which prevents the motor from running continuously in the event of any component failures, will be activated. When the motor stops, Q14 will be shorted to ground, bypassing the motor power, which in turn will pull CR8 to ground, which will discharge C17. This prevents the fail-safe from opening the fuse during normal operation. However, if the motor tries to run continuously (more than 22 seconds steady), which corresponds to longer than two revolution time periods in the highest rate setting (300ml/hr) and 3½ revolution time periods in the lowest rate setting (1ml/hr), C17 would charge sufficiently (approximately 3.9V). This will trigger Q9, dumping the accumulated charge on C17 to the gate of the SCR (Q8). The SCR will become activated, short to the ground, and will pull an infinite amount of current from the battery and/or transformer. This will blow the fuse and permanently cut the power to the system.

## audio alarm

Pin 19 (PB7), an output line, controls the operation of the beeper used to signal various error conditions. LOW BATT, HOLD ERROR, FLOW ERROR, NO SET and SYSTEM ERROR will sound the alarm.

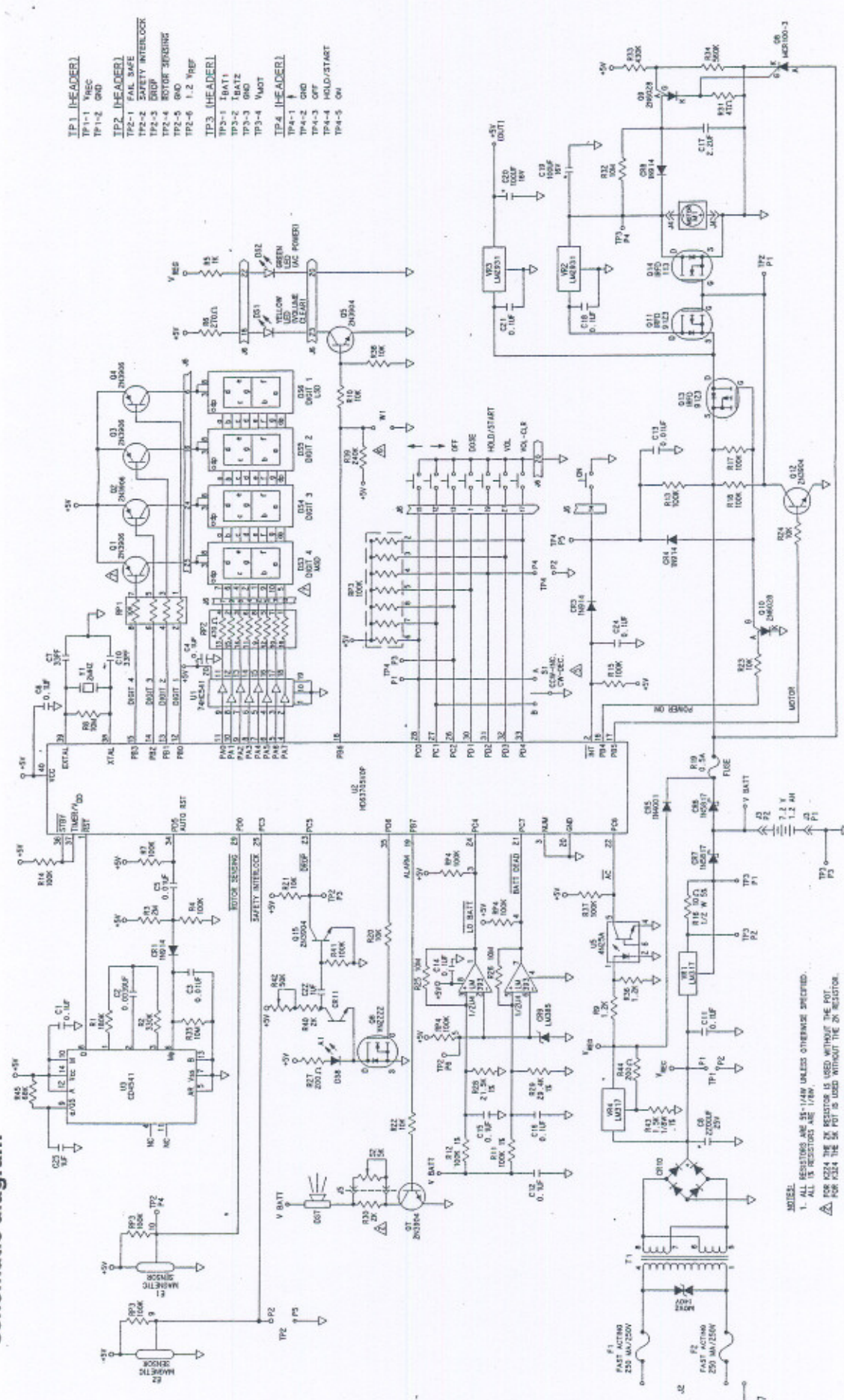


## **5. printed circuit board**

**schematic diagram**



# schematic diagram



- TP1 - HEADER  
 TP1-1 \*REC  
 TP1-2 GND
- TP2 - HEADER  
 TP2-1 \*FIL SAFE  
 TP2-2 \*SAFETY INTERLOCK  
 TP2-3 \*STOP  
 TP2-4 \*MOTOR STOPPING  
 TP2-5 \*RND  
 TP2-6 1.2 \*REF
- TP3 - HEADER  
 TP3-1 \*OAT1  
 TP3-2 \*OAT2  
 TP3-3 \*OAT  
 TP3-4 \*V.MOT
- TP4 - HEADER  
 TP4-1 \*  
 TP4-2 \*GND  
 TP4-3 \*OFF  
 TP4-4 \*HOLD/START  
 TP4-5 \*ON

- NOTES:  
 1. ALL RESISTORS ARE 1/4W UNLESS OTHERWISE SPECIFIED.  
 2. ALL CAPACITORS ARE 50V UNLESS OTHERWISE SPECIFIED.  
 3. FOR K224 THE IC MUST BE USED WITHOUT THE POT.  
 4. FOR K324 THE IC MUST BE USED WITHOUT THE ON-RESISTOR.  
 5. 20 PPM 11 HAS NO CONNECTION.  
 6. R4 100K SP HAS TWO UNUSED PULLUP PINS 2 & 6.  
 7. ENCODED ROTARY SW. USED ONLY ON MODEL K224.  
 8. ON VOLUME CLEAR CIRCUIT ONLY R20 AND W1 ARE USED FOR THE K224 MODEL PUMP.  
 9. FOR A K324 MODEL, ONLY R10, R30, C5, W5 & D31 ARE USED.  
 10. FOR A K324 MODEL, 01 & D33 ARE USED. FOR A K224 MODEL, 01 & D33 ARE NOT USED.



## **5. printed circuit board (cont.)**

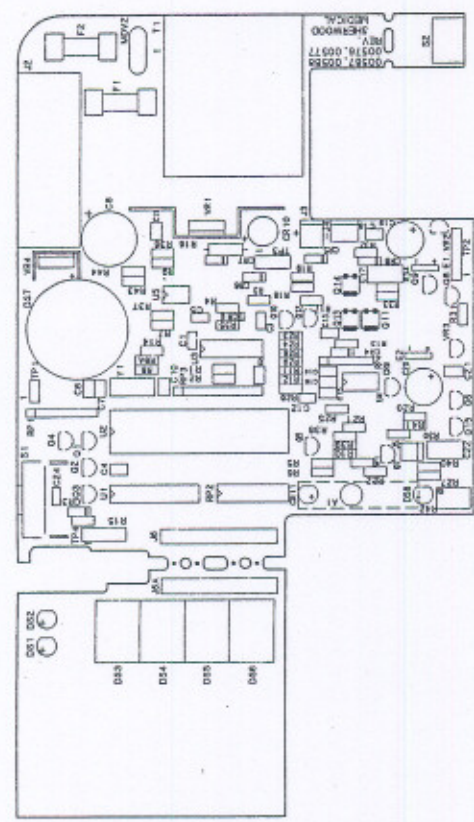
### **assembly diagram**

NOTE: An assembly diagram for each of the three versions of the K324/224 PCB is included in this section. The PCB assembly number and revision letter can be found on the PCB itself, and the three different versions are as follows: 00559/00567, 00587/00588 Rev. A through K, and 00587/00588 Rev. L.

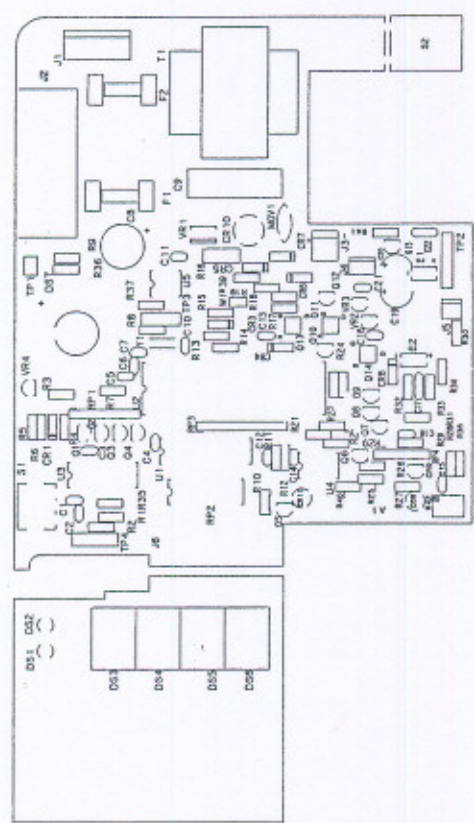


# assembly diagram

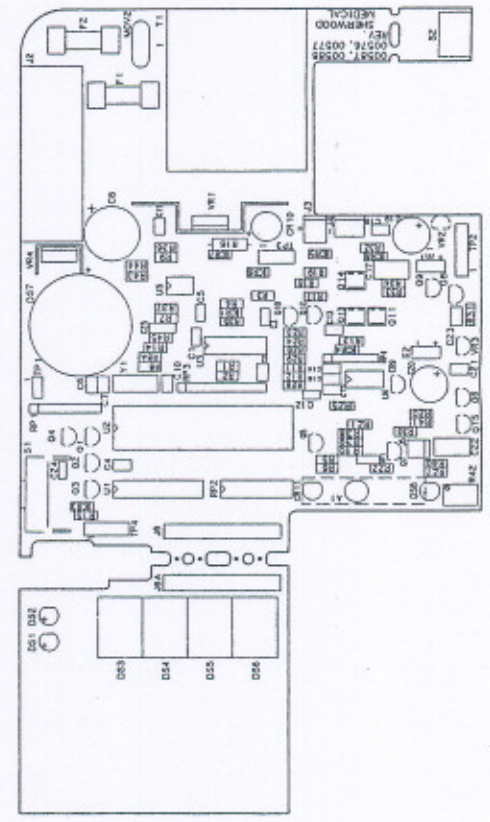
assembly diagram  
00587 / 00588  
Rev. A through K



assembly diagram  
00589 / 00567



assembly diagram  
00587 / 00588  
Rev. L





## 5. printed circuit board (cont.)

parts list



parts list

CUSTOMER ORDER NO.	DESCRIPTION	QTY	DESIGNATION
7774-101096	TRANSFORMER	1	T1
7774-101633	TRANSFORMER*	1	T1
7774-202365	OCTAL TRI STATE BUFFER	1	U1
7774-800069	MICROPROCESSOR SPEC.	1	U2
7774-202324	PROGRAMMABLE TIMER	1	U3
7774-201425	COMPARATOR LM393N	1	U4
7774-105535	QUARTZ CRYSTAL ASSEMBLY	1	Y1
7774-202332	ADJ. VOLT REG.	2	VR1, VR4
7774-201755	VOLT REG. LM2931	2	VR2, VR3
7774-300466	TRANSISTOR PNP 2N3906	3	Q2, Q3, Q4
7774-300383	TRANSISTOR NPN 2N3904	3	Q7, Q12, Q15
7774-300607	TRANSISTOR MOSFET VN2222LL	1	Q6
7774-300912	SCR MCR100-3	1	Q8
7774-300888	PROG. UNIJUNCTION TRANS.	2	Q9, Q10
7774-300441	TRANSISTOR MOSFET IRF D 9123	2	Q11, Q13
7774-300670	TRANSISTOR HEXFET	1	Q14
7774-300078	SILICONE DIODE 1N914	4	CR1, CR3, CR4, CR8
7774-300110	DIODE 1 AMP RECTIFIER	1	CR5
7774-300730	SCHOTTKY DIODE	2	CR6, CR7
7774-300847	DIODE VOLT. REF. 1.2 LM 385	1	CR9
7774-300581	BRIDGE RECTIFIER 1.5A	1	CR10
7774-040187	10 OHMS 1/2W 5% RESISTOR	1	R16
7774-400522	47 OHMS 1/4W 5% RESISTOR	1	R31
7774-404284	200 OHMS 1/4W 5% RESISTOR	2	R27, R44
7774-801190	40 PIN DIP SOCKET	1	U2
7774-040104	120 OHM 1/4W 5% RESISTOR*	1	R5
7774-040575	10K OHMS 1/4W 5% RESISTOR	5	R20, 21, 22, 23, 24
7774-400068	100K OHMS 1/4W 5% RESISTOR	9	R4, 7, 13, 14, 15, 17, 18, 37, 41
7774-040260	180K OHMS 1/4W 5% RESISTOR	1	R1
7774-040427	330K OHMS 1/4W 5% RESISTOR	1	R2
7774-040328	430K OHMS 1/4W 5% RESISTOR	1	R33
7774-404292	560K OHMS 1/4W 5% RESISTOR	1	R34
7774-401520	2M OHMS 1/4W 5% RESISTOR	1	R3
7774-040120	10M OHMS 1/4W 5% RESISTOR	5	R8, 25, 26, 32, 35
7774-040658	21.5K OHMS 1/4W 1% RESISTOR	1	R28
7774-040633	29.4K OHMS 1/4W 1% RESISTOR	1	R29
7774-401967	100K OHMS 1/4W 1% RESISTOR	2	R11, R12
7774-404474	10K OHMS SIP RESISTOR PACK (4)	1	RP1
7774-040609	470 OHMS DIP RESISTOR PACK (8)	1	RP2
7774-040625	100K OHMS SIP RESISTOR PACK (9)	1	RP3
7774-040617	100K OHMS SIP RESISTOR PACK (5)	1	RP4
7774-501410	33PF MONOLYTHIC CAPACITOR	2	CP, C10
7774-501758	.0039 MF CERAMIC CAPACITOR	1	C2
7774-050053	.01 MF MONOLYTHIC CAPACITOR	3	C3, C5, C13
7774-501204	.1 MF CERAMIC CAPACITOR	11	C1, 4, 6, 11, 12, 14, 15, 16, 18, 21, 24
7774-050152	.1 MF POLYPROPYLENE CAPACITOR*	1	C9

\*used only on PCB Assembly #00567

CUSTOMER ORDER NO.	DESCRIPTION	QTY	DESIGNATION
7774-501709	2.2 MF CERAMIC CAPACITOR	1	C17
7774-050186	100 MF SOLID TANTALUM CAPACITOR	2	C19, C20
7774-501063	2200 MF ELECTROLYTIC CAPACITOR	1	C8
7774-600519	GREEN DIF. LED	1	DS2
7774-060052	DISPLAY	3	DS4, DS5, DS6
7774-105667	PIEZO-ALARMS BUZZER ASSEMBLY	1	DS7
7774-701010	RATE SWITCH	1	S1
7774-403484	50K OHM 25 TURN POTENTIOMETER	1	R42
7774-801471	3 PIN HEADER 1/8" CTRS.	1	J4
7774-300920	PHOTOTRANSISTOR	1	CR11
7774-080274	2 PIN HEADER .156" CTRS.	1	J3
7774-080134	6 PIN HEADER 1/8" CTRS.	1	TP2
7774-903038	25 PIN STAGGERED JUMPER	1	J6
7774-202399	SOLID STATE SWITCH	2	E1, E2
7774-300839	VARISTOR*	1	MOV1
7774-101740	SUB MINIATURE FUSE .5 AMP	1	R19
7774-101807	5x20MM 1/4 AMP FUSE	2	F1, F2
7774-101682	FUSE CLIP	4	F1, F2
7774-040013	2K OHMS 1/4W 5% RESISTOR	2	R30, R40
7774-080266	AC RECEPTACLE	1	J2
7774-030865	VARISTOR	1	MOV2
7774-300931	SENSOR HOLDER	1	A1
7774-501238	1 MF CERAMIC CAPACITOR	2	C22, C25
7774-050050	PHOTO DIODE INFRARED LED	1	DS8
7774-130459	PLASTIC RIVET	2	J2
7774-101864	HEAT SINK	1	VR1
7774-300995	NO. 6-32 KEP NUT	2	VR1, VR4
7774-300649	NO. 6-32 PAN HEAD SCREW	2	VR1, VR4
7774-080233	2 PIN HEADER 1/8" CTRS.	1	TP1, W1
7774-309202	SENSOR BRACKET	1	E2
7774-403799	1.2K OHMS 1/4W 5% RESISTOR	2	R9, R36
7774-201474	VOLTAGE REGULATOR*	1	VR4
7774-800838	5 PIN HEADER	1	TP4
7774-080282	4 PIN HEADER	1	TP3
7774-202415	OPTO COUPLER/ISOLATOR	1	U5
7774-406123	240K OHM 1/4W 5% RESISTOR	1	R39
7774-500271	LONG TIE STRAP	1	
7774-090315	CONNECTING TUBE (SPACER)	.052	A1
7774-309145	LOCATOR-SENSOR. YOKE	1	A1
7774-304534	NO. 4-40 x 1 1/4 MACH. SCREW	2	T1 (not on PCB ass'y 00567)
7774-101872	HEAT SINK	1	VR4
7774-400704	1.5 K OHM 1/4W .1% RESISTOR	1	R43
7774-404151	1 K OHM 1/4W 5% RESISTOR	1	R5
7774-304831	PEM FASTENER	2	T1 (not on PCB ass'y 00567)
7774-405042	68 K OHMS 1/4W 5% RESISTOR	1	R45
7774-080241	4 PIN LOCK-IN HEADER*	1	J1
7774-802420	4 PIN CRIMP HOUSING*	1	J1

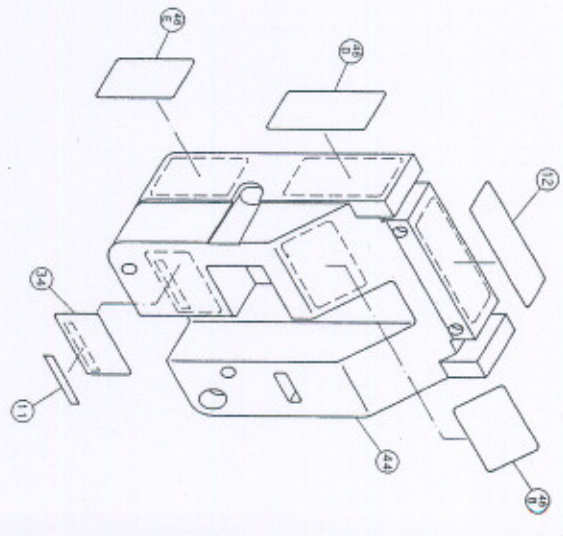
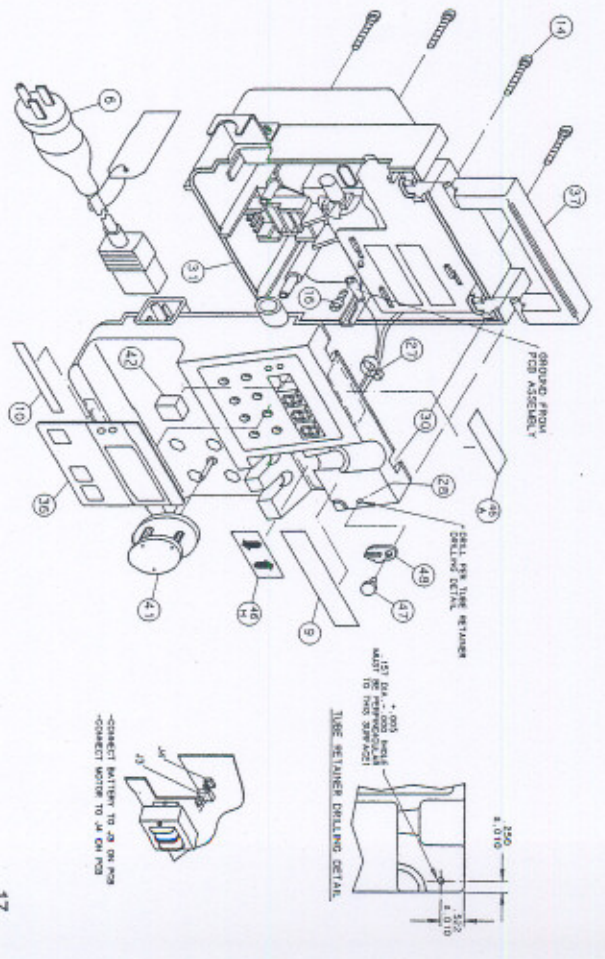
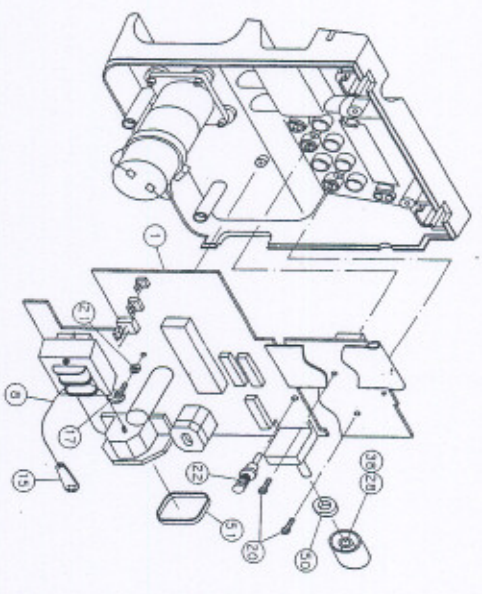
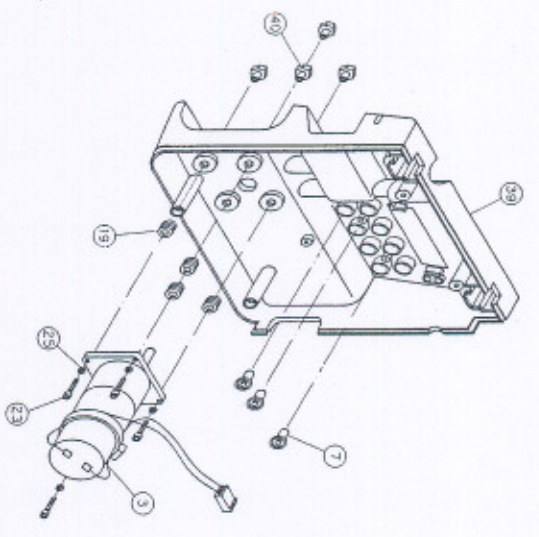
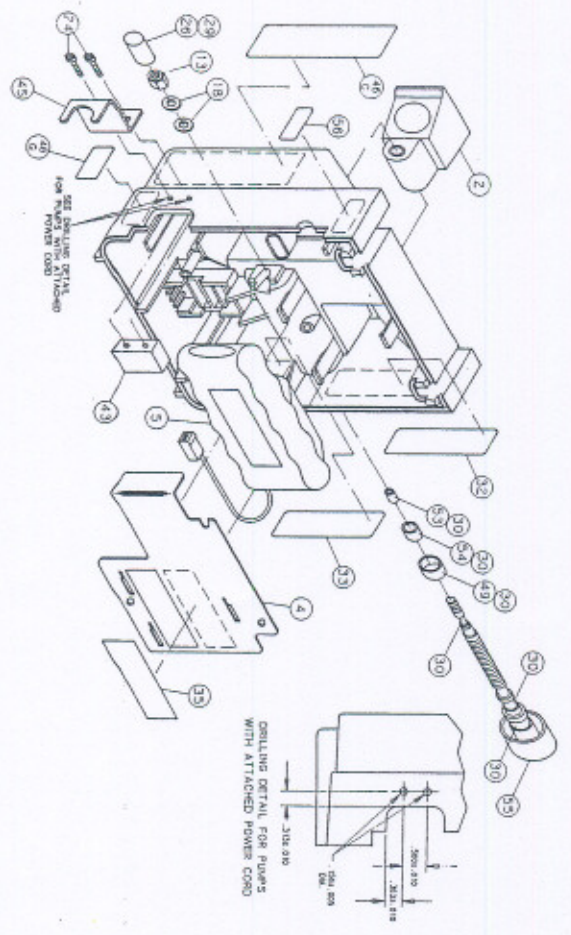


## **6. final assembly**

**parts breakdown diagram**



parts breakdown diagram





## **6. final assembly (cont.)**

**parts list**



parts list

F140190 Rubber bumper (goes with 2)

ITEM	CUSTOMER ORDER NO.	COMPONENT DESCRIPTION	QTY
1	7774-005875	K324 PCB ASSEMBLY	1
2	7774-104819	K324/224 POLE CLAMP ASSEMBLY	1
3	7774-104850	K324/224 MOTOR ASSEMBLY	1
4	7774-104876	K324 VOLUME CONTROL ASSEMBLY	1
5	7774-104884	K324/224 BATTERY RETAINER ASSEMBLY	1
6	7774-104892	K324/224 BATTERY ASSEMBLY	1
7	7774-105352	POWER CORD ASSEMBLY	1
8	7774-070077	ELASTOMER SWITCH	8
9	7774-902196	8", 18 AWG GREEN WIRE	1
10	7774-148220	CHARGE REQUIREMENT LABEL	1
11	7774-161363	FRENCH DANGER LABEL (1)	1
12	7774-178003	MYLAR OVERLABEL	1
13	7774-119403	K324/224 WRITE-ON LABEL	1
14	7774-301506	1/4"-20 LOCKNUT	1
15	7774-301696	#8-32 x 1" MACHINE SCREW	4
16	7774-302926	#10 LOCKWASHER TERMINAL	1
17	7774-302934	#8-32 x 3/8" MACHINE SCREW	1
18	7774-303213	#4-10 x 1/4" SELF-TAPPING SCREW	1
19	7774-303510	PLAIN WASHER	2
20	7774-130442	RUBBER GROMMET	4
21	7774-130426	#4 x 1/4" THREAD-FORMING SCREW	2
22	7774-130434	NYLON WASHER	1
23	7774-130475	PCB SUPPORT SPACER	1
24	7774-130483	#3-48 x 7/16" CAP SCREW	4
25	7774-304690	#6-32 x 1/2" MACHINE SCREW (2)	2
26	7774-304708	#3 SPRING LOCKWASHER	4
27	7774-402262	VOLUME CONTROL KNOB	1
28	7774-402270	VOLUME CONTROL KNOB CAP	1
29	7774-402346	BLACK VINYL CAP (1)	1
30	7774-500016	4" MINIATURE CABLE TIE	2
31	NOT AVAILABLE	LOCTITE 405	AR

\*part of item no. 47  
1 Canadian version pumps only  
2 pumps with attached power cords only

ITEM	CUSTOMER ORDER NO.	COMPONENT DESCRIPTION	QTY
32	NOT AVAILABLE	LOCTITE 422 SUPER BONDER (1)	AR
33	NOT AVAILABLE	NON-CURING SEALANT	AR
34	NOT AVAILABLE	RTV SEALANT	AR
35	7774-180371	1/2 AMP FUSE REPLACE LABEL	1
36	7774-180389	1/4 AMP FUSE REPLACE LABEL	1
37	7774-805720	K324 SERIAL NO. LABEL	1
38	7774-804806	K324/224 BATTERY POLARITY LABEL (1)	1
39	7774-807429	K324 POLYESTER OVERLAY	1
40	7774-308865	K324 FRONT CASE	1
41	7774-308907	K324/224 CASE HANDLE	1
42	7774-309004	K324/224 MOTOR MOUNT NUT	4
43	7774-309194	K324/224 ASSEMBLED ROTOR	1
44	7774-309392	POWER PLUG RETAINER SUPPORT (2)	1
45	7774-309533	K324 BACK CASE	1
46	7774-309517	POWER PLUG RETAINER (2)	1
47	7774-309558	K324 DOMESTIC OUTSIDE LABELS	1
47A	7774-119429	ANESTHETICS LABEL	*
47B	7774-119437	K324/224 CAUTION LABEL	*
47C	7774-119502	K324 DIRECTIONS LABEL (#1)	*
47D	7774-119510	K324 DIRECTIONS LABEL (#2)	*
47E	7774-119528	K324 DIRECTIONS LABEL (#3)	*
47F	7774-119494	K324 VOLUME CONTROL LABEL	*
47G	7774-804384	K324 ALARMS LABEL	*
47H	7774-119478	POWER REQUIREMENT LABEL	*
47J	7774-119411	K324/224 ARROWS LABEL	*
48	7774-309608	STUD TUBE RETAINER	1
49	7774-309616	MOLDED TUBE RETAINER	1
50	7774-309640	POLE CLAMP SEAL	1
51	7774-309731	AC RECEPTACLE GASKET	1
53	7774-309970	K324/224 LEFT SEAL - POLE CLAMP	1
54	7774-309988	K324/224 RIGHT SEAL - POLE CLAMP	1
55	7774-310085	K324/224 MACHINED KNOB W/CLAMP SCREW	1

\*part of item no. 47  
1 Canadian version pumps only  
2 pumps with attached power cords only

7.51



## 7. specifications

### **Type Infusion Device**

Volumetric

### **Pumping Mechanism**

Rotary Peristaltic

### **Pump Set Required**

Sherwood Medical Kangaroo Feeding Pump Administration Sets.

### **Operating Range**

5-300 ml/hr in 5 ml/hr increments

### **Accuracy**

±10% of selected flow rate

### **Occlusion Pressure**

12 psi (82.7 kPa) Nominal

### **Alarms**

- Flow Error
- Low Battery
- Hold Error
- No Set
- System Error

### **Battery**

- Rechargeable
- Automatically charges when pump is plugged into wall outlet. Recharge time for fully discharged battery is approximately 15 hours.
- A new battery, when fully charged, will operate for approximately 24 hours at 125 milliliters per hour.

### **Dimensions**

Approximately 7¼" High x 5½" Wide x 4¼" Deep

### **Weight**

Approximately 3.625 lbs.

### **Case Material**

ABS Plastic-FIRE RESISTANT

### **Power Requirements**

120V, 60 Hz, 1 Amp



## 8. troubleshooting guide

Listed below are some of the probable causes of alarm conditions and their corrections.

Symptom	Probable Cause	Corrections
Flow Error Alarm ( <b>FLO Err</b> )	Feeding container is empty.	Refill feeding container. If bag has been in use for 24 hours, replace.
	Feeding tube or feeding set tubing is occluded.	Locate point of occlusion and correct. Note: occlusion may occur upstream or downstream from pump. <ul style="list-style-type: none"> <li>• Feeding Container</li> <li>• Feeding Pump Set (control clamp closed)</li> <li>• Feeding Tube-patency of feeding tube should be checked.</li> </ul>
	Drip chamber is improperly placed in pump.	Check to make sure drip chamber is properly "locked" in position in drip chamber guide.
	Drip chamber walls are coated with feeding formula.	Check to make sure formula is not preventing detectors from proper operation. If formula cannot be removed from inside walls of chamber via chamber manipulation, replace set.
	Sensors in upper drip chamber guide are blocked.	Check to make sure detectors are free of dried formula. Remove any deposits by using a cotton swab dampened with warm soapy water.
Low Battery Alarm ( <b>Lo bAt</b> )	Battery has been run down below point of maintaining accuracy of pump.	Plug pump power cord into wall outlet.
Hold Error Alarm ( <b>HLd Err</b> )	Pump has been left in the hold mode for over 2½ minutes.	Press START/HOLD to silence alarm, then press START/HOLD again to restart pump.
No Set ( <b>no SET</b> )	Pump set has been improperly placed onto pump.	Check to make sure only Kangaroo Pump Set has been placed onto the pump. Check to make sure that retainer clip on pump set has been properly positioned into retainer lock on pump.
System Error Alarm ( <b>SYS Err</b> )	Rotor is not turning while pump is running.	Return pump for technical service.
	Rotor is turning but is not detected by rotor sensors.	Return pump for technical service.



## 9. factory service/ordering information

If the pump malfunctions, please contact your Sherwood Medical Representative or call Customer Service for instructions.

Outside of New York state  
800-448-0190

In New York state  
call collect 315-788-5246

In New York City  
212-671-1809

If a pump requires factory service, carefully pack the pump. Ship the return via parcel post to:

Sherwood Medical Co.  
98.6 Faichney Drive  
Watertown, NY 13601



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