

ThermoFisher
S C I E N T I F I C

The world leader in serving science

Cellwasher Service Training

**Cellwasher 2 Plus and Centra W
Cellwasher**

Cellwasher 2 Plus and CentraW Family Products

- IEC CentraW = Sorvall Cellwash 2+ (Sold as Hellmer in early-mid 90's)
Model, Brand



Cellwasher 2 Plus and CentraW Definition

IEC CentraW/Sorvall Cellwasher 2+ Is **NOT** a Centrifuge It is an AUTOMATIC CELL WASHING SYSTEM

It is used to automatically perform the washing phase of the anti-globulin procedure in tests using up to six drops of blood sample.

The cell washer will accommodate either twelve 12x 75 mm tubes, or twelve 10 x 75 mm tubes.

It is registered as a device in accordance with FDA regulations governing the distribution and use of such products.

Cellwasher 2 Plus and CentraW Definition

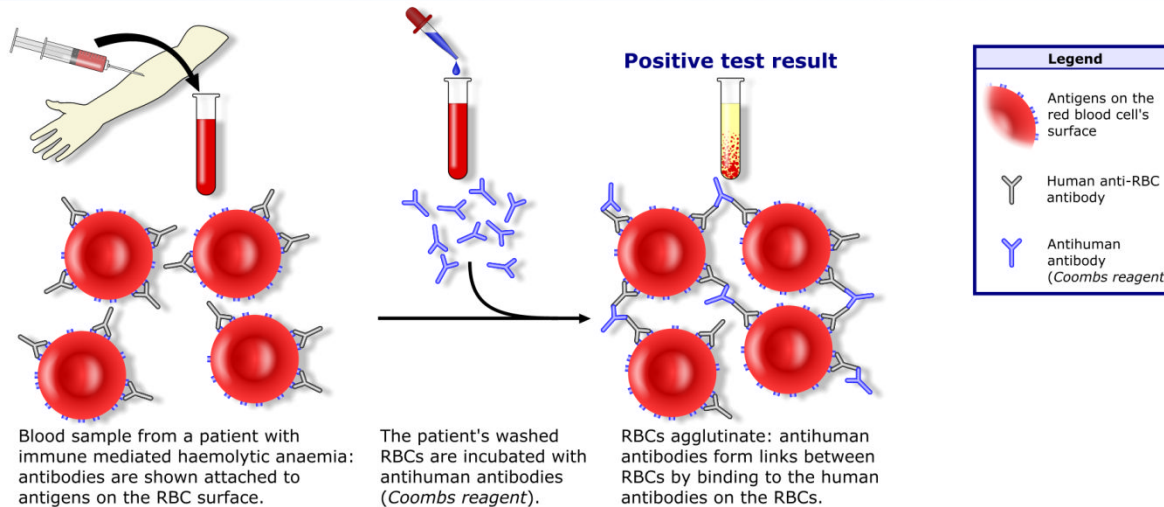
- Features
 - Brushless 2 Speed AC Motor
 - Built-in Peristaltic Pump
 - Built-in Drain
 - 120/220V AC 50/60Hz (PEM Configuration)
 - Low Saline Detector
 - Dispense Saline Calibration

Cellwasher 2 Plus and CentraW Vocabulary

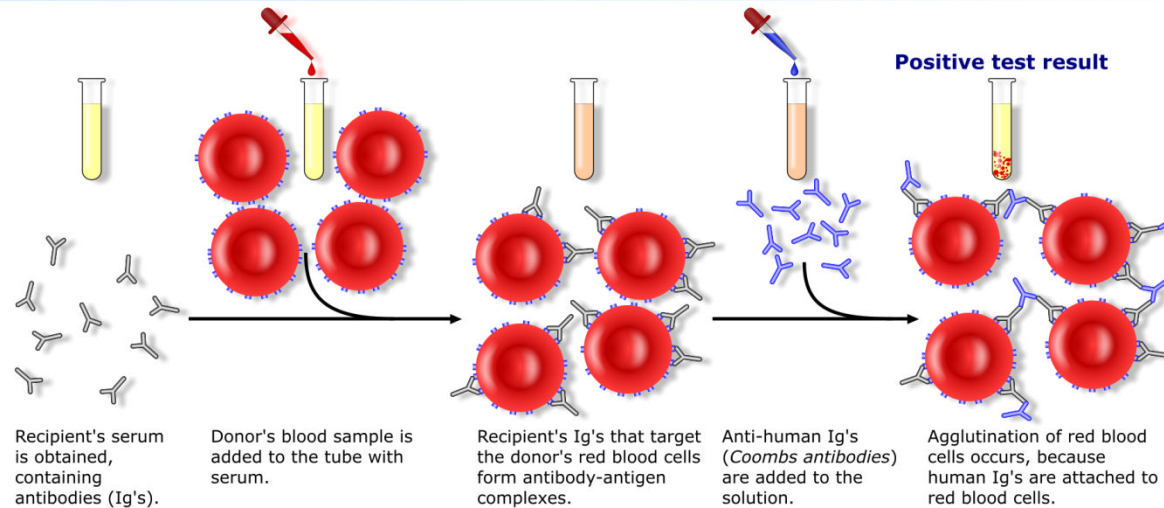
- **Wash Cycle** - The process of filling tubes with saline, spinning to concentrate sample, decanting the saline leaving a “button” of sample in the tube bottom. In multiple cycles after decant an agitation step is included.
- **Decant** – Holding the tubes at a slight negative angle and spinning at slow speed to push saline up the sides and out of the tubes.
- **Agitate** - A process of quickly stepping the motor/rotor to shake and brake up the “button” or cell pellet to re-suspend the sample for the next wash cycle.
- **Saline** – Liquid with salt content to match the human body. Generally consisting of water and various concentrations of salt.
- **Antiglobulin Test** – A test used to determine blood type, to detect Rh antibodies and screen for autoimmune hemolytic anemia's or to diagnose certain blood disorders

Cellwasher 2 Plus and CentraW Vocabulary

Direct Coombs test / Direct antiglobulin test



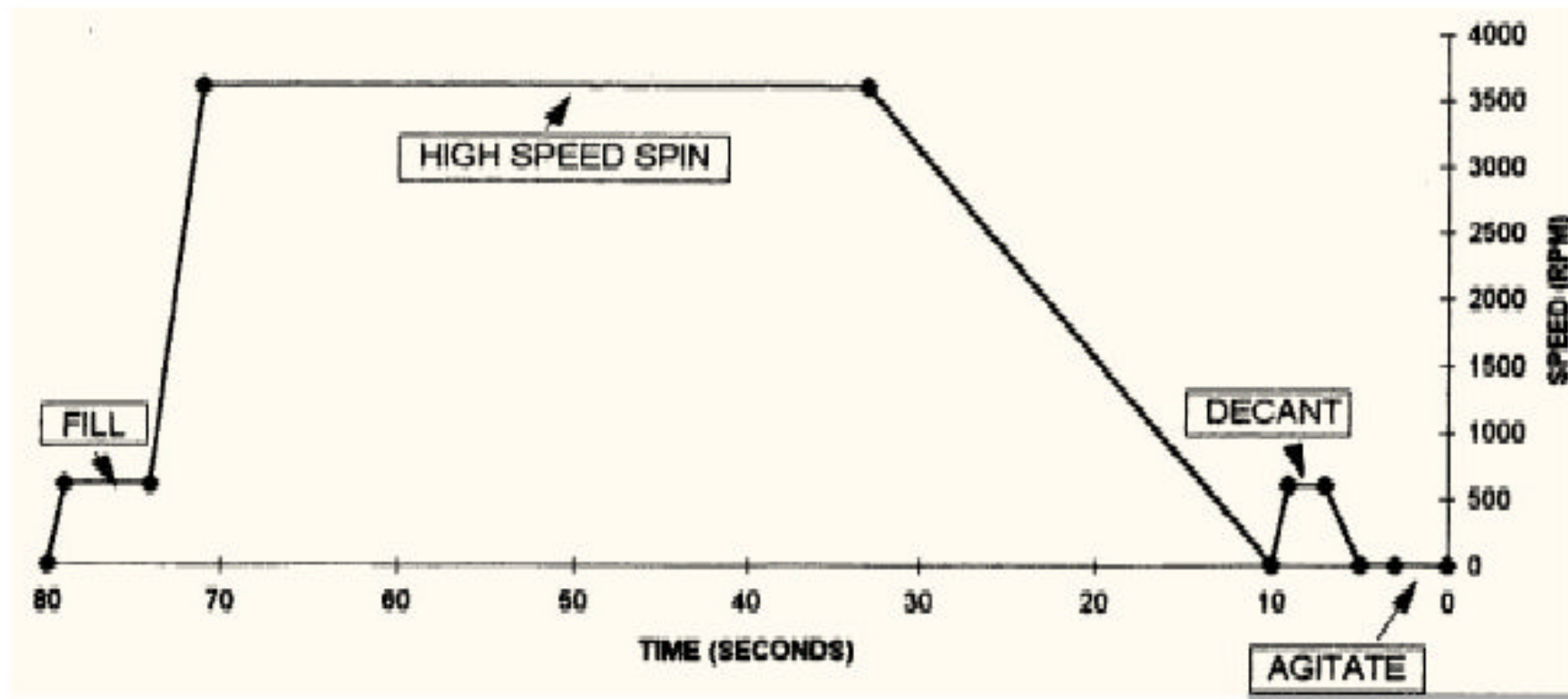
Indirect Coombs test / Indirect antiglobulin test



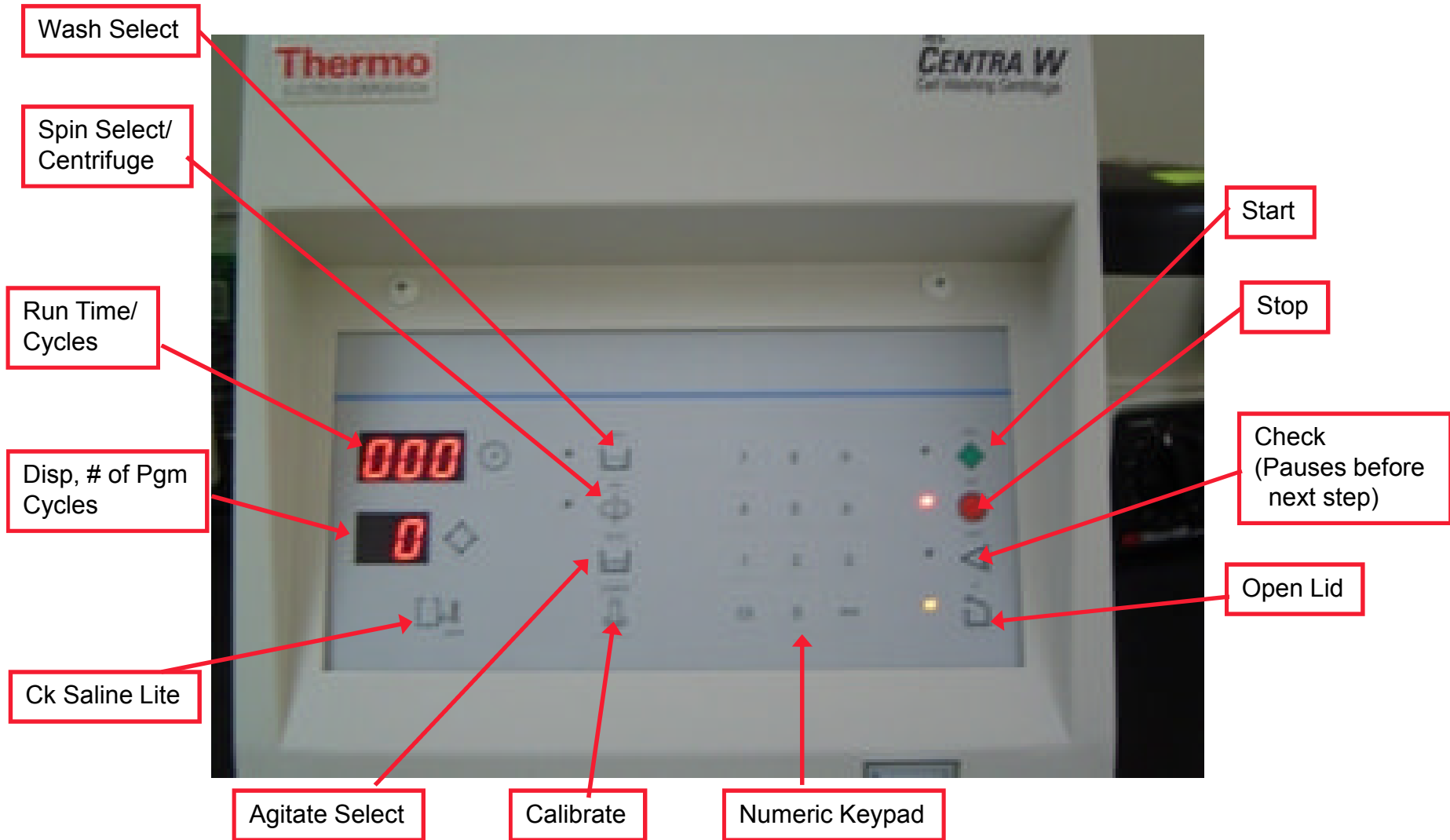
Operation

- The cell washer can run up to four 80second wash cycles. The system automatically eliminates the “agitate” step from a single, or, the final wash cycle so that the clean pellet is well defined at the completion of the run.
- Each wash cycle consists of four steps
 1. **FILL-Low Speed** Saline wash solution is drawn from the reservoir by the peristaltic pump up through the flow control valve, the flow switch and the cover saline dispensing nozzle. The nozzle feeds the saline into the inlet porthole in the rotor distributor where the filler tubes feed the saline into the test tubes.
 2. **SPIN-High Speed** The system rapidly accelerates to full speed to pellet the red blood cells. Dynamic braking at the end of this step provides rapid deceleration to prevent resuspension or dislodging of the cell button.
 3. **DECANT-Low Speed** The rotor holds the tubes at a slight negative angle and spent saline is expelled from the test tubes by low centrifugal force. This action retains virtually all cells in the tubes while removing almost all residual saline. Decanted waste solution is directed, by the splash guard in the cover, into the drain-hole in the chamber and into the drain tubing which carries the waste out of the cell washer and into a waste container or drain.
 4. **AGITATE** (except in a single or final wash cycle) This phase is included on all but the final, or a single, wash cycle. By a rapid “stepping” motion of the rotor, cell pellets are disrupted (broken up) for resuspension of the cells during subsequent wash cycles.

Operation



Cellwasher 2 Plus and CentraW Membrane Panel

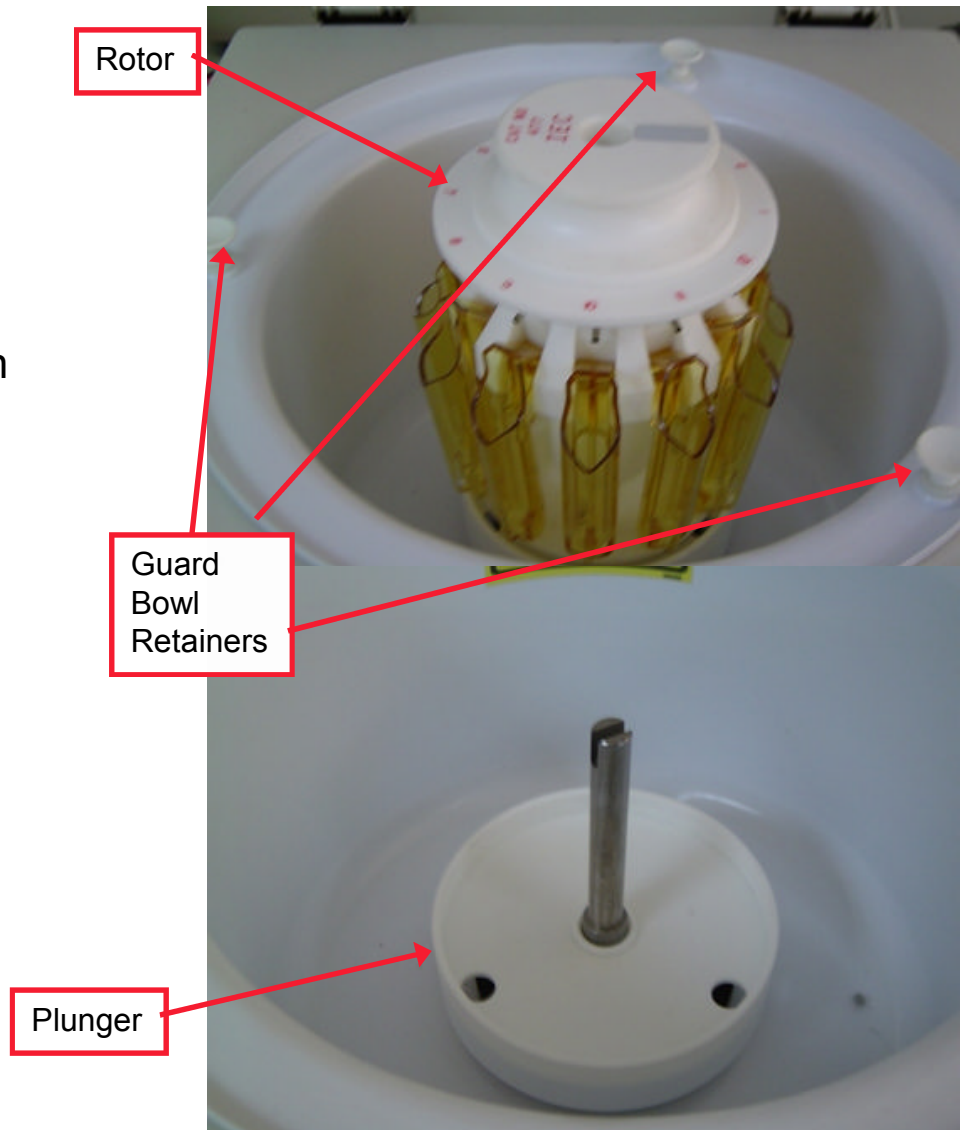


Component Access

Cabinet Removal

1. Open the cover, **remove the rotor and plunger, remove the guard bowl**, and unplug the unit (do not close cover).
2. Remove the four Phillips head screws at the rear of the cell washer, and the two on the front control panel.
3. Slide the cover and cabinet assembly forward and up for removal.

(The wiring harness to the latch assembly and the tubing from the cover to the flow switch must both be disconnected before complete removal is possible (reach in between the cabinet and inner splash guard to gain access to the latch harness)).

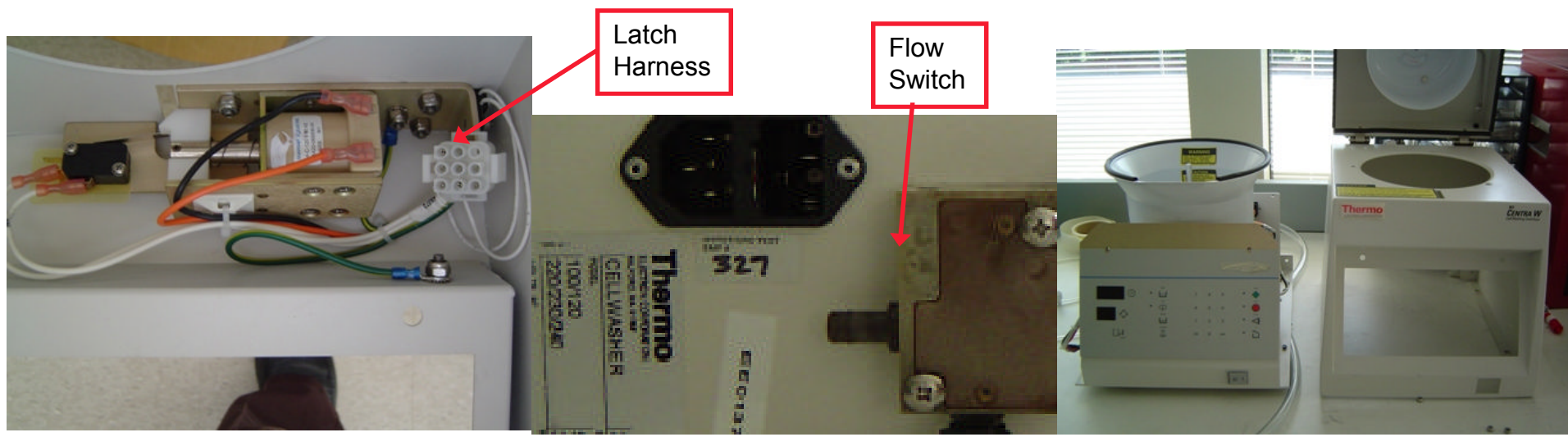


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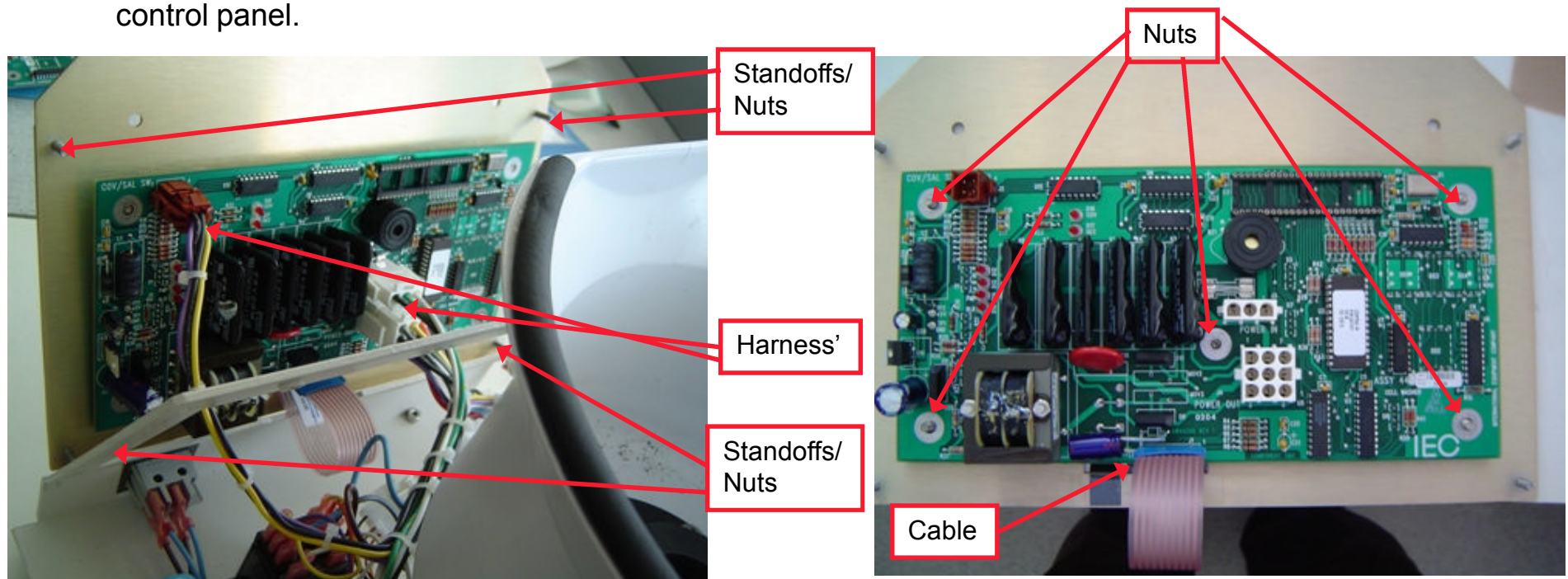


Component Access

Control Panel Removal

1. Remove Cabinet Assembly
2. Disconnect the three wiring harness connectors to the PCB.
3. Remove the four nuts (in corners) securing the control panel assembly.

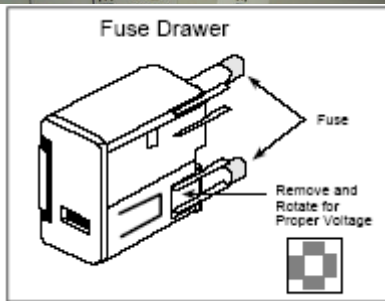
To separate the PCB from the control panel, disconnect the ribbon cable between the PCB and control panel. Remove the five nuts (one in each corner and one in center) securing the PCB to the control panel.



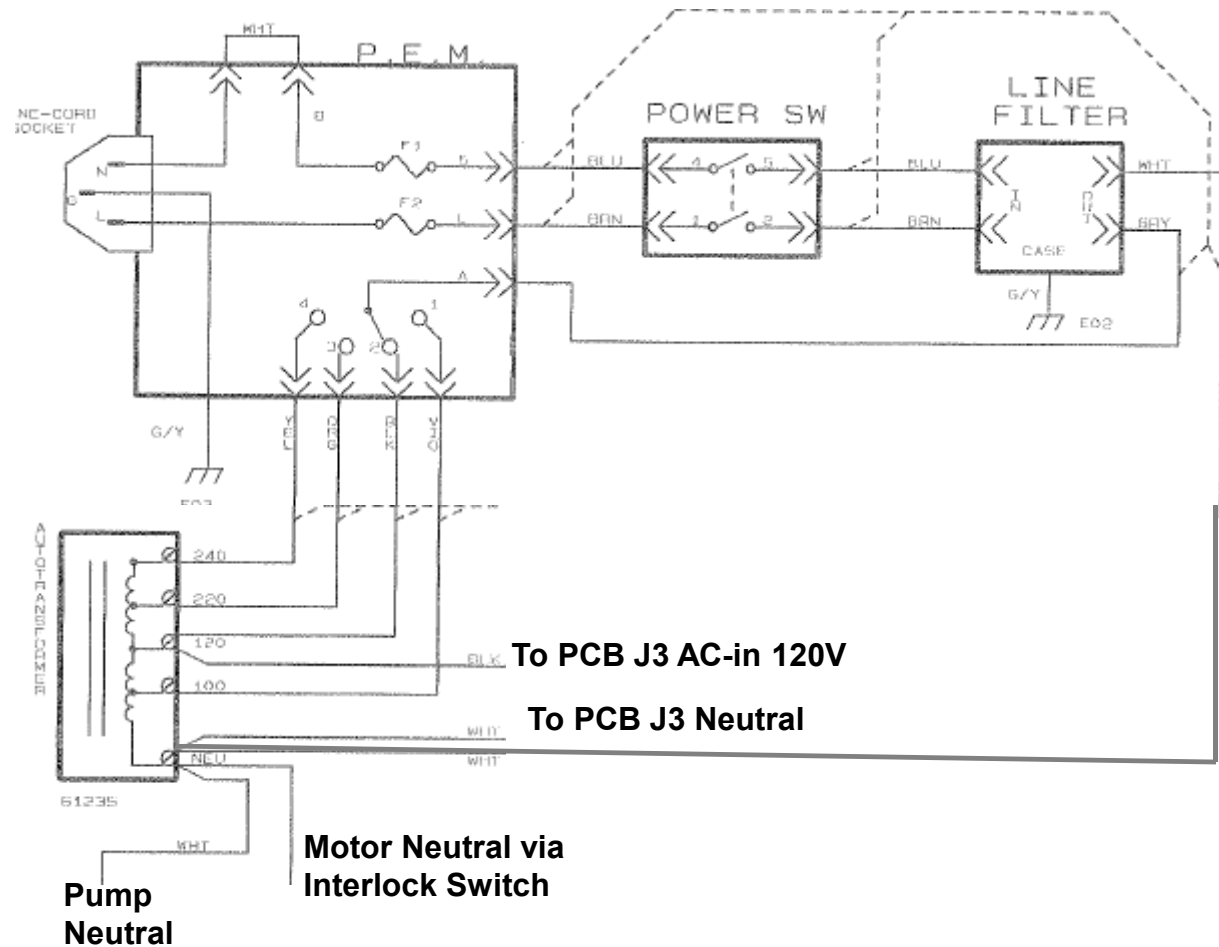
Power Distribution

AC Power Distribution

- Line Voltage comes into PEM (Power Entry Module) (Check voltage config)
- Routed to Pwr Sw > Line Filter
- Line Filter routed to Xfmr
- Xfmr to PCB (Hot)
- Xfmr to Pump, Mtr



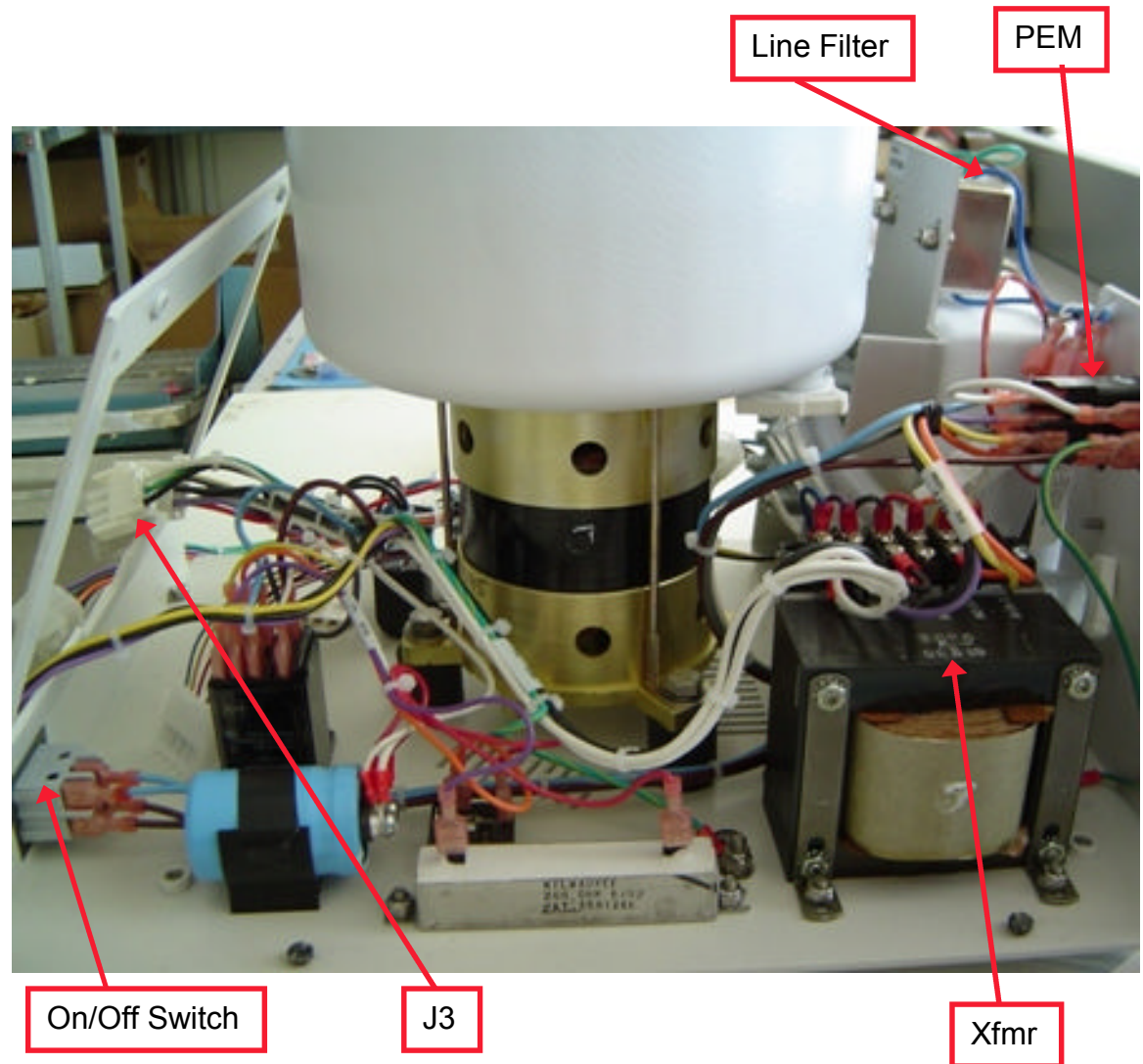
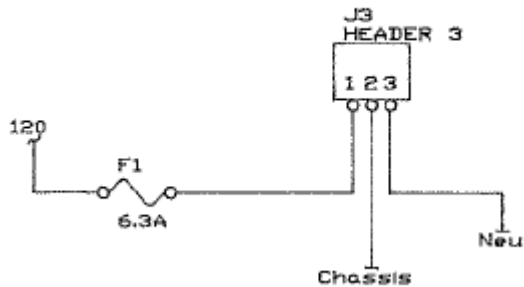
FUSE DRAWER



Power Problems AC

AC Power

1. Check PEM fuses.
2. Remove Cabinet
3. Measure the voltage at xfmr white wires (out) if bad trace back to pwr sw, line filter, xfmr, PEM
4. If good check J3 1&3 (blk-white)
5. If bad, check fuse on PCB



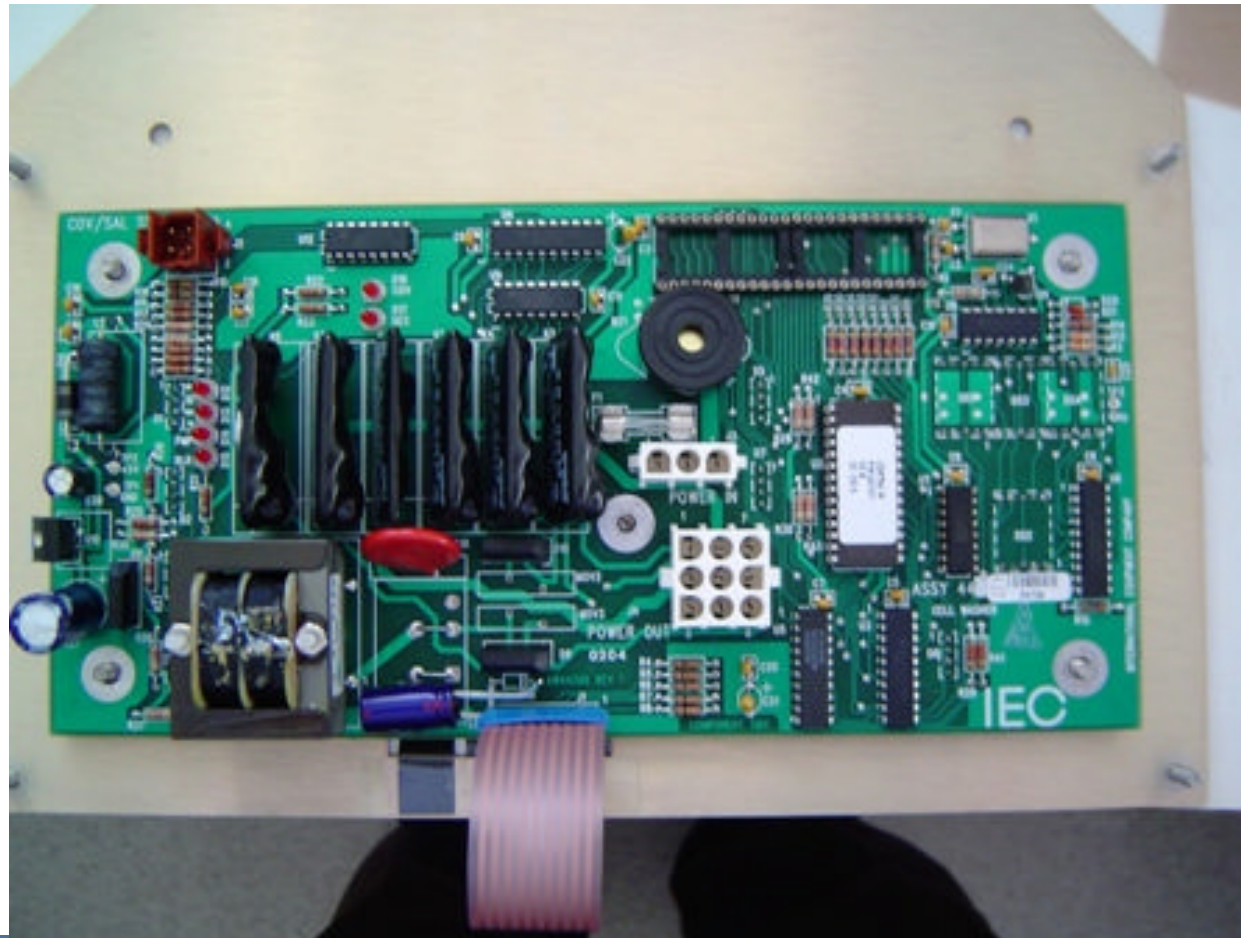
Power Problems CB/Fuse

Fuse Blows

- If a fuse blows immediately when the unit is plugged in and turned on the short may be in the main power line, (power entry module, xfmr, or line filter) or in the circuit board.
 1. Remove the front control panel. Follow AC distribution notes on previous slide
- If F1 blows when the COVER OPEN button is pressed, the short may be in the interlock assembly.
 1. Remove the cabinet and check the latch solenoid.
- If a fuse blows when the RUN button is pressed, then the short may be in the motor, pump or decant coil. (Verify at what cycle step the fuse blows)
 1. Remove the cabinet.
 2. If fuse blows during Fill, check pump and motor
 3. If fuse blows during Spin, check motor
 4. If fuse blows during Decant, check decant coil
 5. If fuse blows during brake step, check brake

PCB

The CentraW or Cellwasher 2 Plus contains only 1 PCB. Contained on the PCB is the processor, logic, display, latch, motor, and pump drive systems.



PCB Logic DC Power

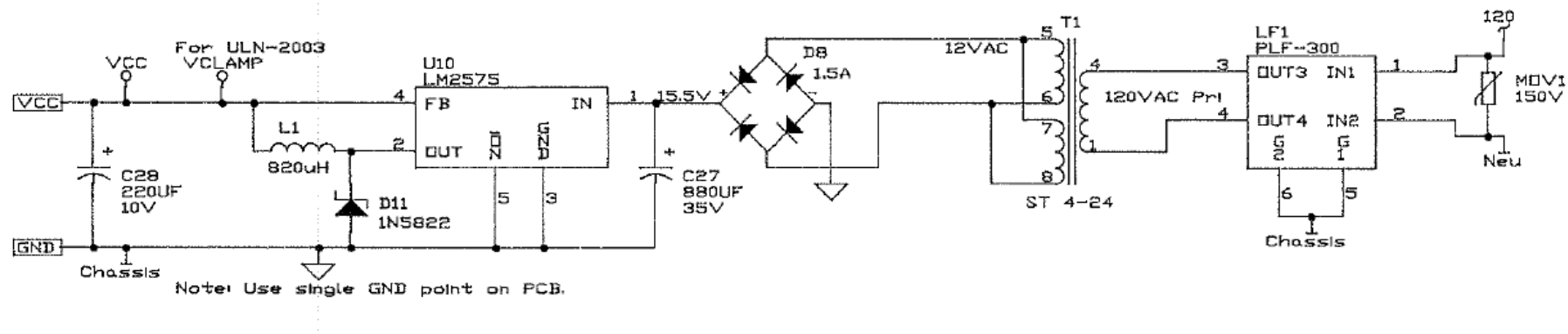
Generates the Logic DC Voltage

120V AC into PCB Line Filter

Line Filter to transformer T1, 12VAC is tapped off.

Rectified across D8 = 15.5VDC.

15.5V to U10 = regulated 5VDC for logic.



Note: If and LED or Display on Control Panel are on PCB Logic Power circuit is functional.

PCB TP's

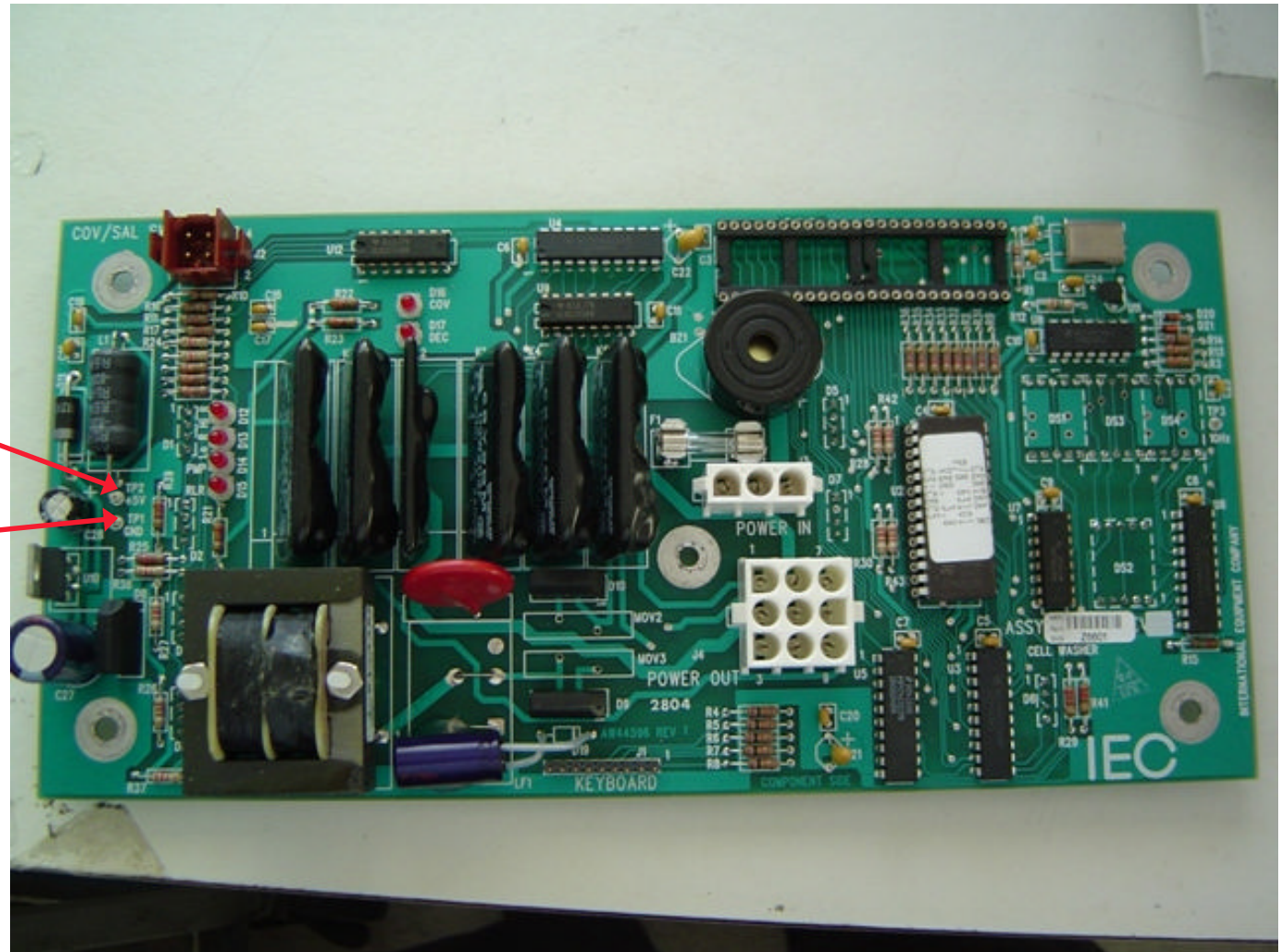
Test Points

TP1 Gnd

TP2 VCC (+5Vdc)

TP2
5Vdc

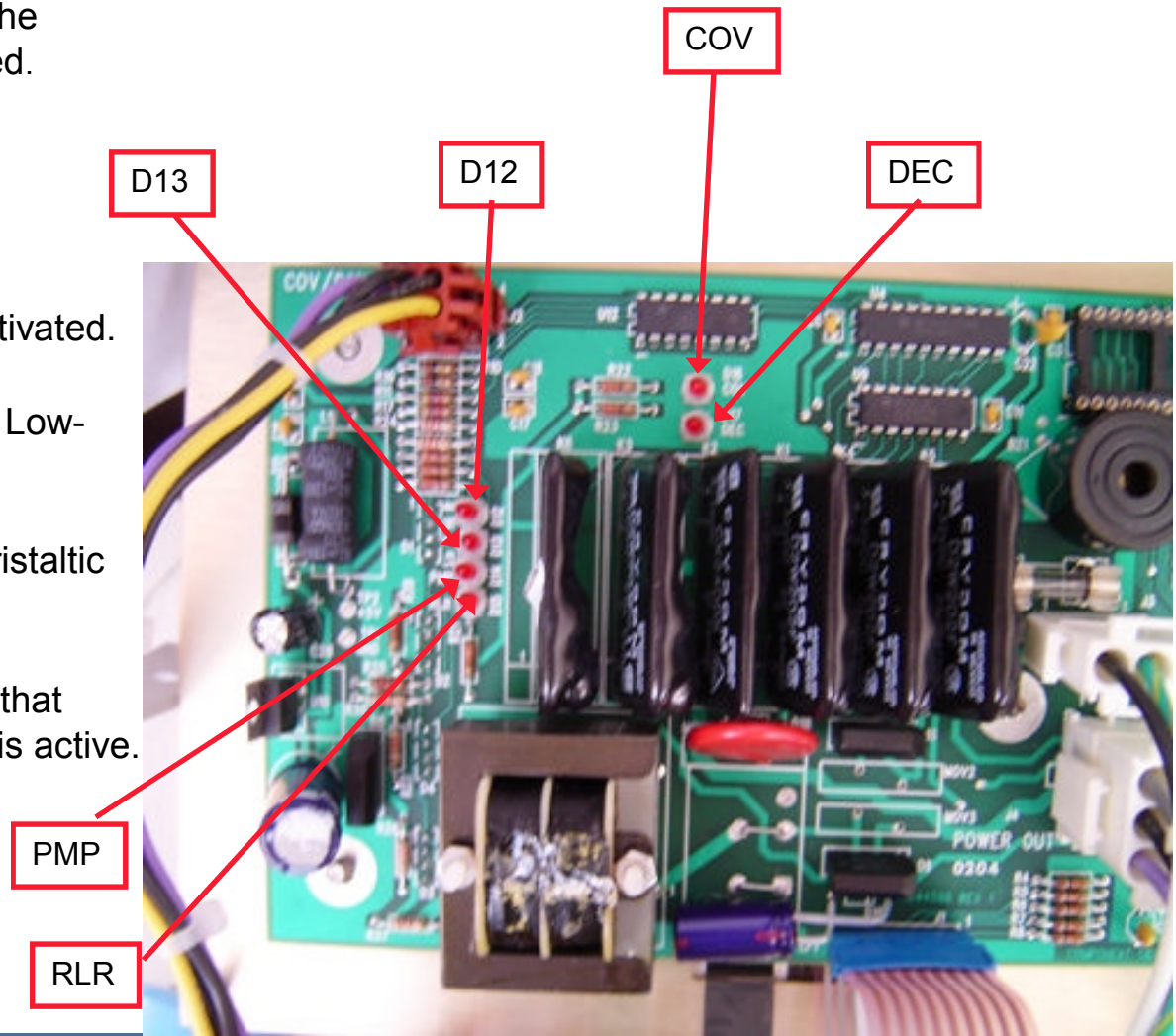
TP1
Gnd



PCB LED's

LED's

- COV: This red LED indicates when the cover solenoid drive circuit is activated.
- DEC: This red LED Indicates the decant coil circuit is activated.
- D12: This red LED indicates that the Hi-Speed motor drive circuit is activated.
- D13: This red LED indicates that the Low-speed motor drive circuit is activated.
- PMP: This red LED indicates the peristaltic pump circuit is activated.
- RLR: This red LED is on when relay that drives Hi-speed reverse and braking is active.



PCB Logic/Display Function

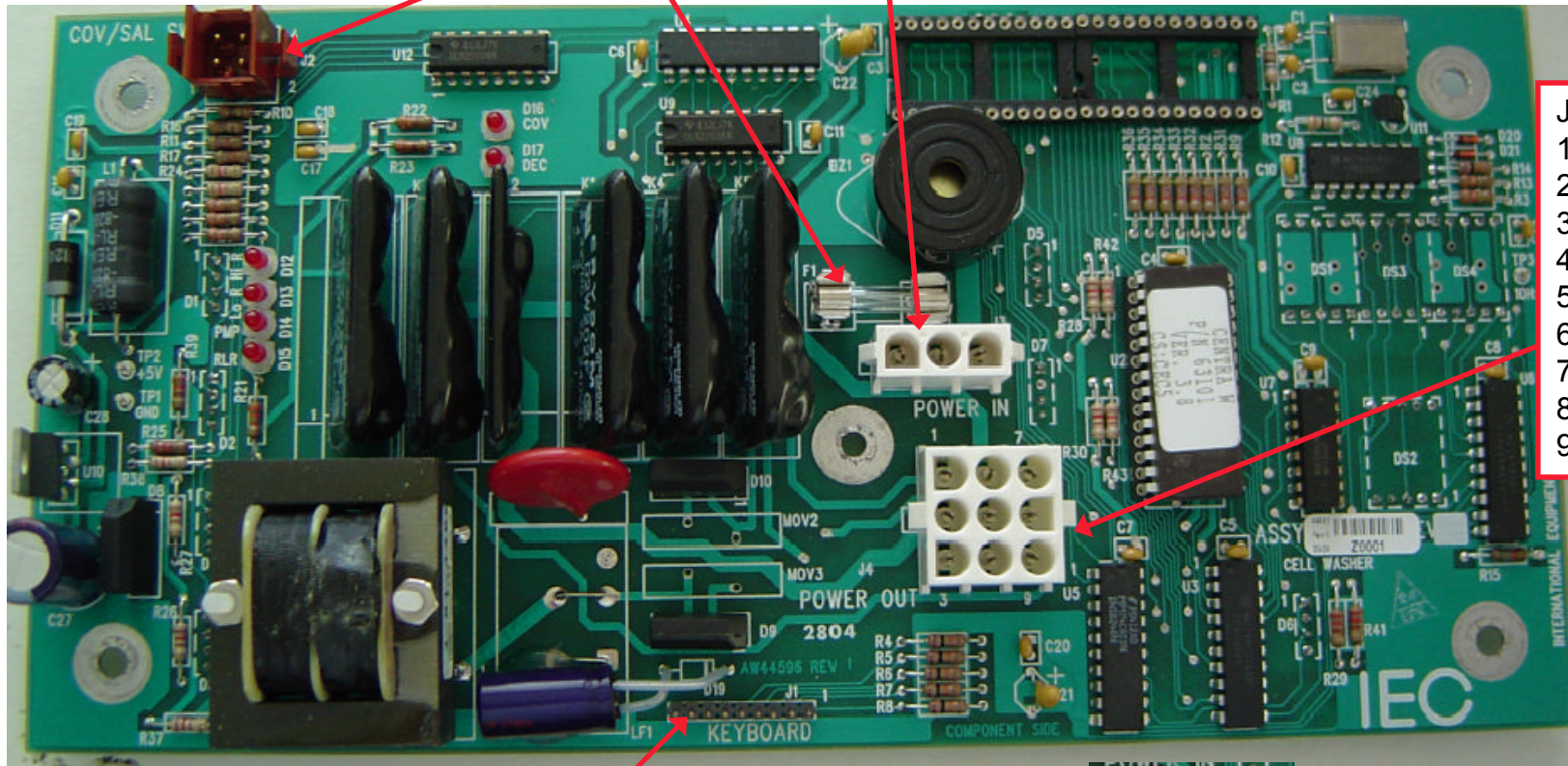
- The microcontroller on the circuit board consists of the controlling microprocessor.
 - The Multi microcontroller is an embedded system design.
 - The non volatile RAM in an extended memory map, allows the recall of programmed parameters, even after power line interruption.
- The membrane keyboard and user interface displays
 - Under full microprocessor supervision.
- System Controls
 - Motor Control (including Brake)
 - Pump
 - Cover Solenoid
 - Decant Solenoid
 - Low Saline Indicator (Flow monitoring)

PCB, I/O's

J2, 1,4 CVR (Proximity Sensor)
J2, 2,3 Saline Switch

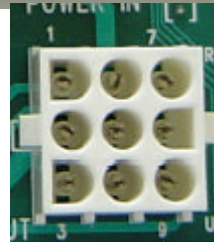
F1

J3, AC in



- J4 Power Out
- 1= Mtr Hi-Spd
- 2= Mtr Low Spd
- 3= Decant Coil
- 4= Pump
- 5= Cvr Sol
- 6= Neut>Rly/Brk
- 7= Cvr Sol
- 8= Rly/Brk
- 9= Decant Coil

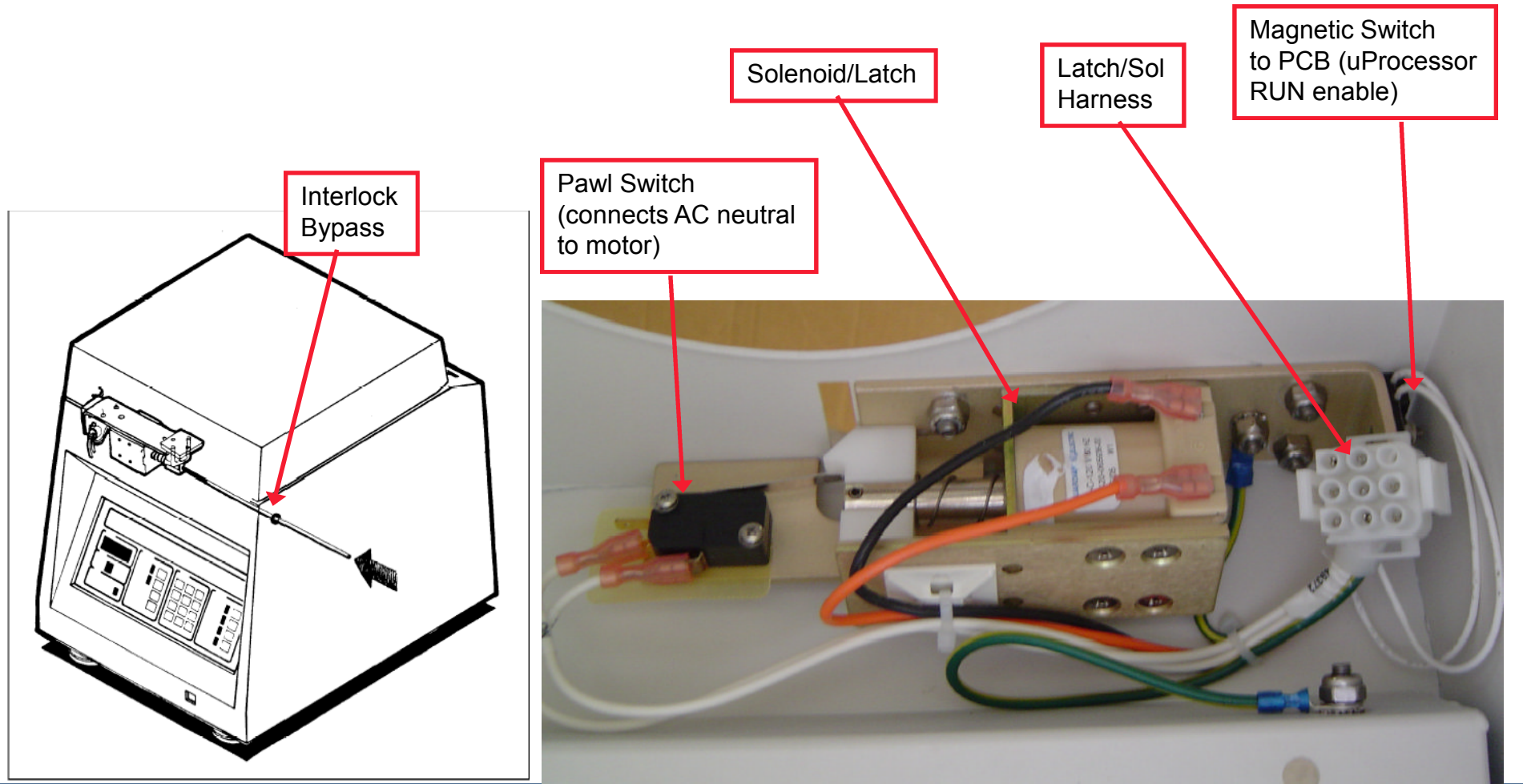
J1, Membrane Panel



1	4	7
2	5	8
3	6	9

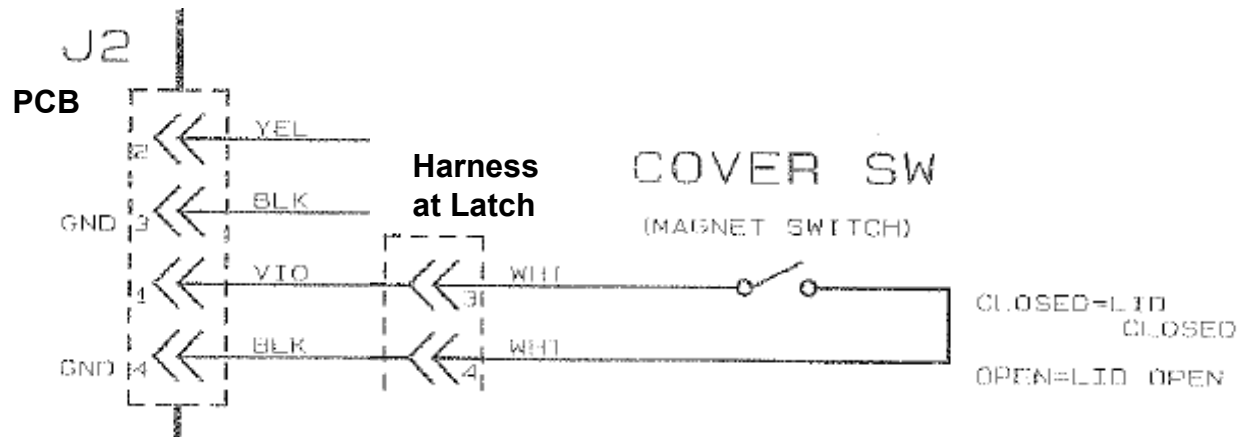
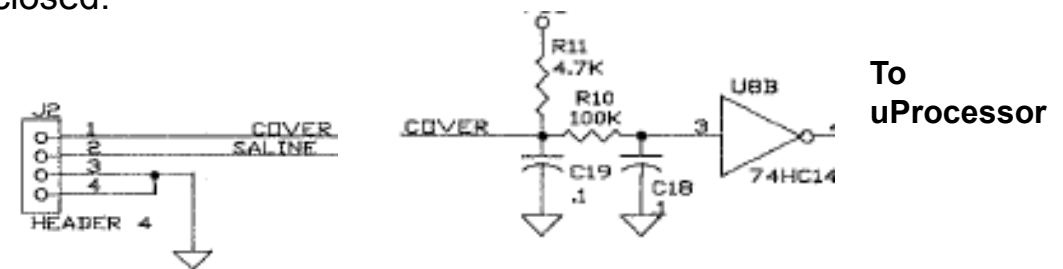
Interlock Component ID

Latch is located inside the Cabinet



Interlock Magnetic Switch

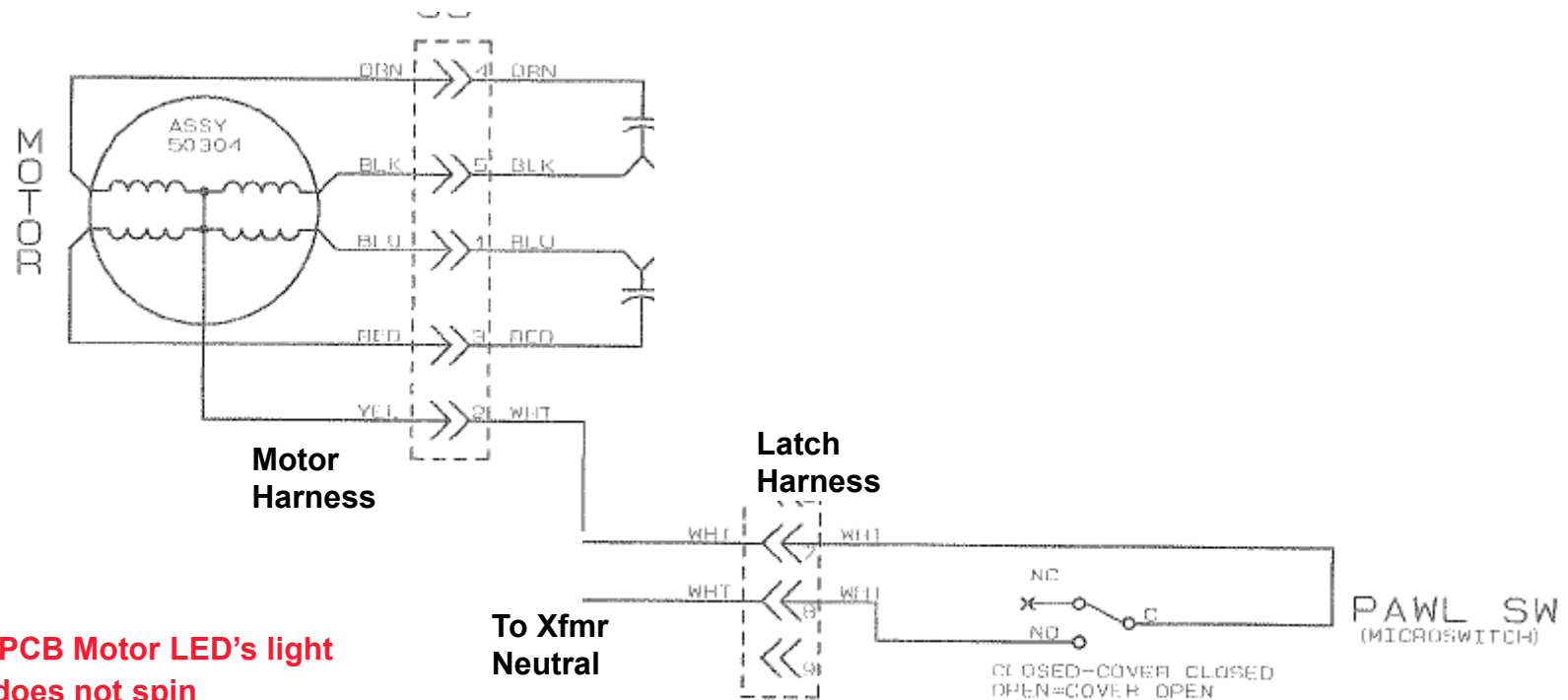
- Testing the Switch
 1. Remove the cabinet.
 2. Connect a DVM on latch harness pin 3 & 4
Open when lid = open,
Minimal resistance when latches = closed.
No power required



* Suspect if unit does not run and no PCB Motor LED's light

Interlock Pawl Switch Troubleshooting

- Testing the Switch
 1. Remove the Cabinet.
 2. Connect a DVM on latch harness pin 7 & 8Open when lid = open,
Minimal resistance when latches = closed.



* Suspect if PCB Motor LED's light
and Motor does not spin

Interlock Solenoid Troubleshooting

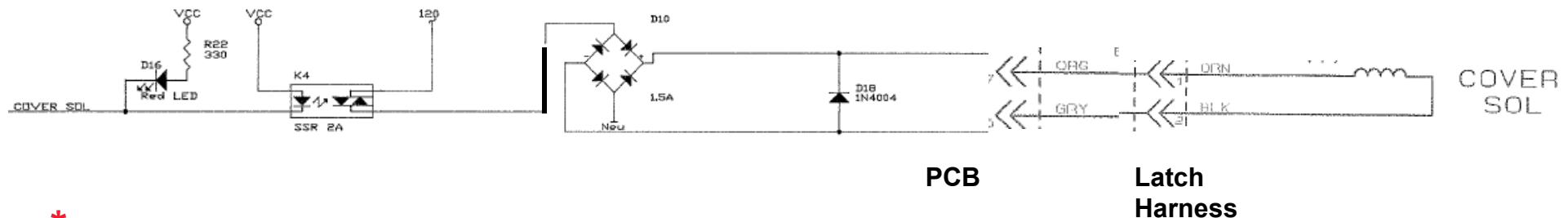
- Testing the Solenoid Resistance

1. Remove the Cabinet
2. Connect a DVM on latch harness pin 1 & 2
Measurement should be approximately 125 ohms.

- Testing the Solenoid Voltage

1. Remove the Cabinet
2. Re-connect the latch harness (The harness can be connected by placing the cabinet on its side with the control panel opening towards the base. Feed the harness through the control panel opening to reach the latch assembly for connection.)
3. Connect a DVM on latch harness pin 1 & 2 (Use peak hold if available)
3. Press the Cover Open button.

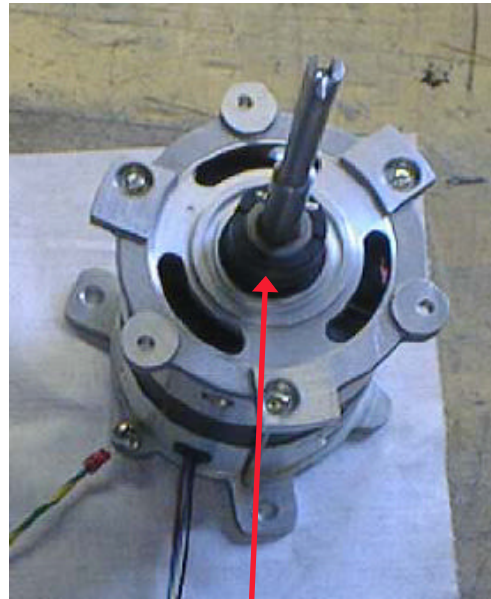
Expected value 109Vdc If voltage present, replace the defective latch, if voltage not present, replace the PCB.



* Check SOL LED on PCB if it does not light suspect PCB

Motor/Drive Overview

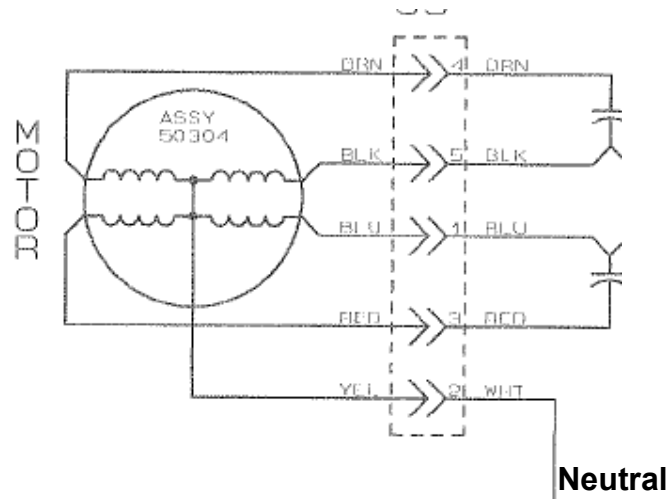
- The Drive Motor is a 2 speed (dual winding) brushless AC motor
- The bearings are permanently lubricated
- Motor top is sealed to prevent liquid seepage.



Motor Shaft Seal

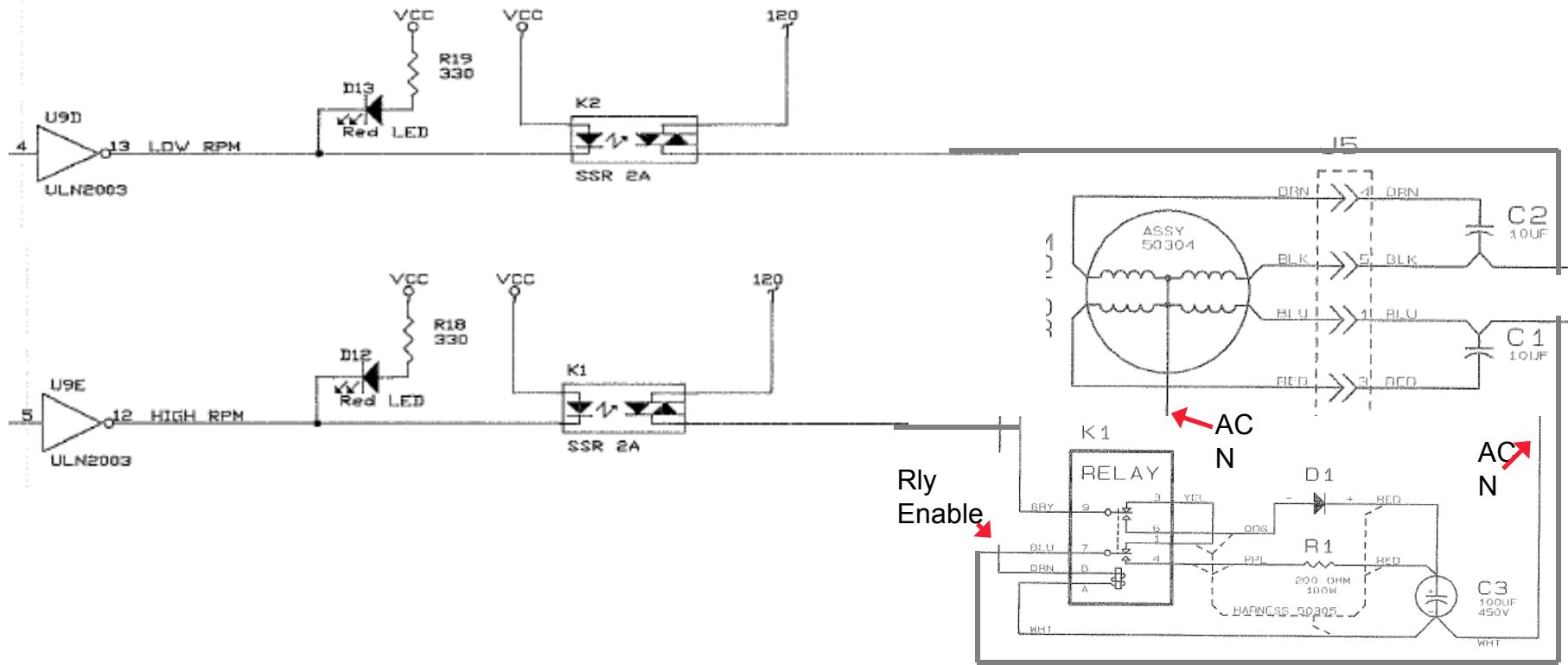


Motor / Bowl Assy (spare part less tubing)



Motor/Drive Control

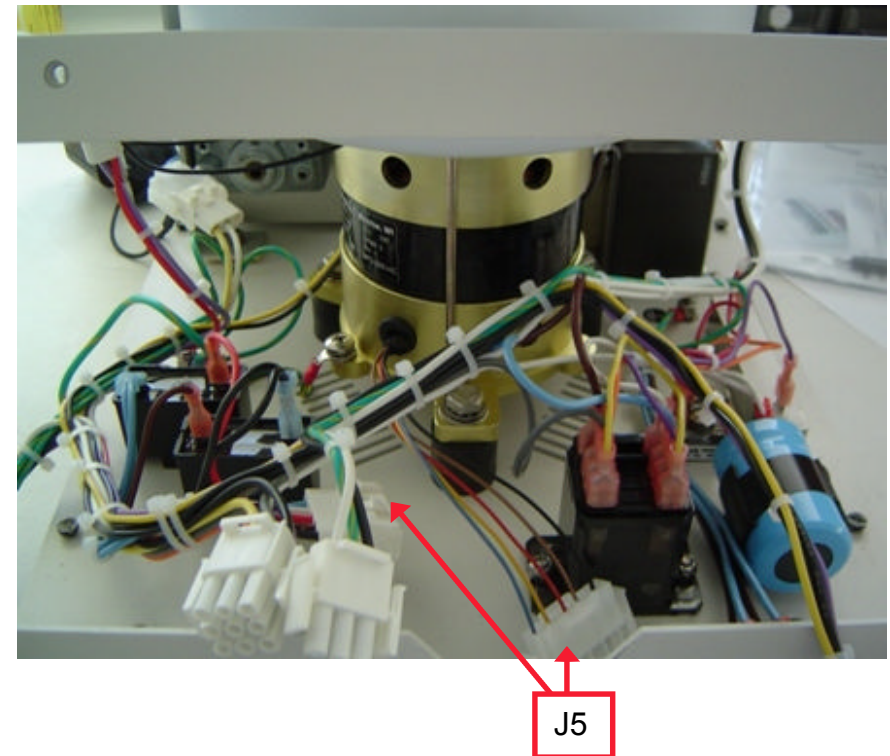
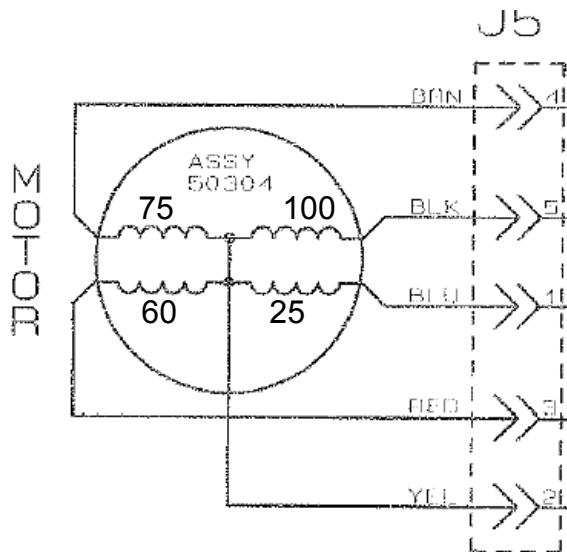
- Hi-speed Winding for Spin, Brake
- Low-speed Winding for Fill, Decant and Pre-Brake
 - Processor/Program Control
 - Only one set powered at a time



Motor Resistance

- To measure the resistance of the motor, use the following procedure:

1. Remove the Cabinet
2. Remove connector J5 at Motor harness
3. Measure the resistance of the motor between the following pins:
 - 1 & 2 (BLU & YEL) 25 ± 5
 - 1 & 3 (BLU & RED) 85 ± 10
 - 2 & 5 (YEL & BLK) 100 ± 10
 - 3 & 4 (RED & BRN) 135 ± 10
 - 4 & 5 (BRN & BLK) 190 ± 20

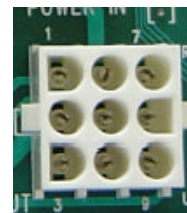


Motor Voltage

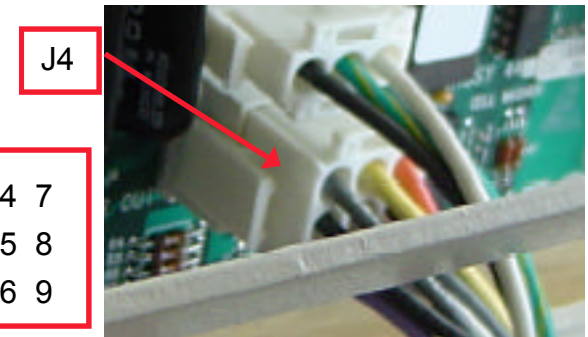
- To measure the voltage to the motor, use the following procedure:
 1. Remove the Cabinet
 2. Re-connect the Latch harness (The harness can be connected by placing the cabinet on its side with the control panel opening towards the base. Feed the harness through the control panel opening to reach the latch assembly for connection.)
 3. Verify that the Run signal is present. D12 and D13 LEDs on the PCB, should cycle ON when Start button is pushed. (D13 during Fill, D12 during Spin.)
 4. Insert multimeter leads into the back of the J4 connector, pin 2&6 (blk and white)
 5. Select 1 wash cycle, verify rotor installed, press Start.
120 VAC should be present for the first step (FILL) of the wash cycle (approximately six seconds).
 6. Turn power off and move the probes to pin 1&6 (blue and white)
 7. Turn the unit back on, select one WASH cycle and press the START key.
120 VAC should be present for the second step (SPIN) of the wash cycle (after an approximate six second delay).

If voltage is present, and the motor does not run, check the motor.

If voltage is not present, replace the board.

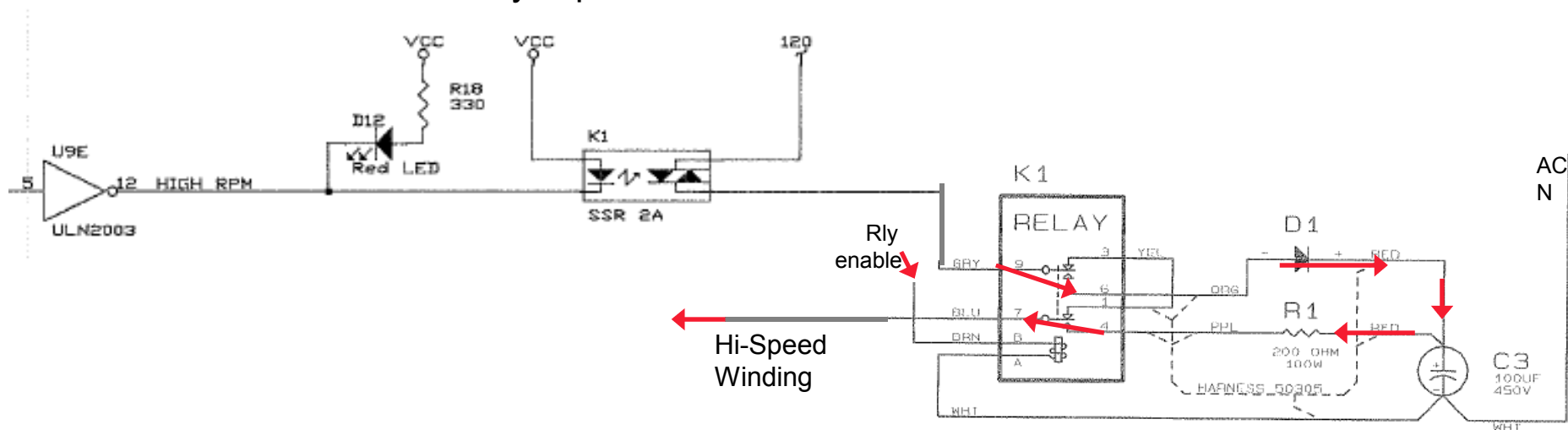


1	4	7
2	5	8
3	6	9



Motor Braking

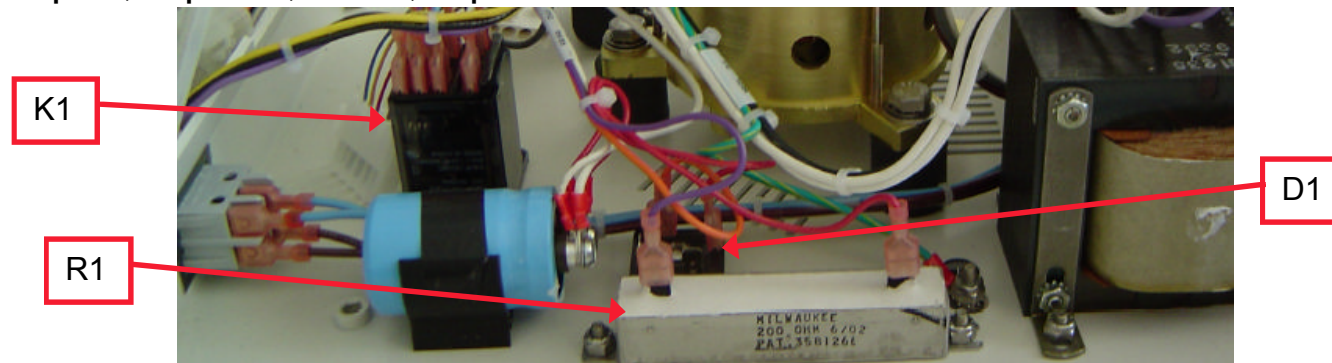
- The electric Brake system in the CentraW and Cellwasher 2 Plus consists of 2 separate steps:
 1. The PC board, first, powers the low speed winding to bring the speed down.
 2. Then a DC voltage is applied to the high speed winding to stop the motor.
- The brake is used after the third (DECANT) step of each WASH cycle and during the agitate step. It is also used in the SPIN MODE at the end of a spin, and any time the STOP key is pressed.



Motor Brake

To verify the function of the Brake, use the following procedure:

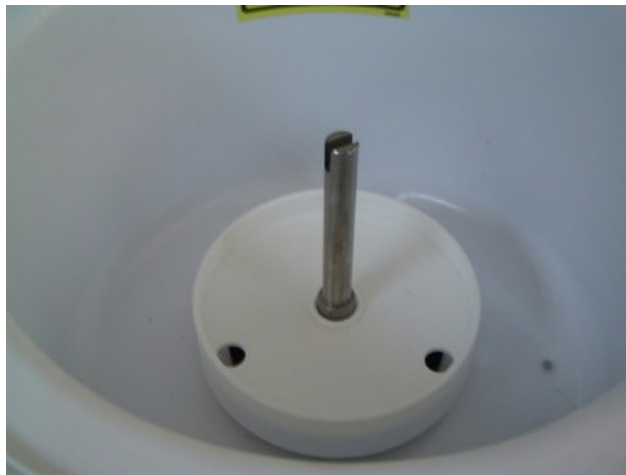
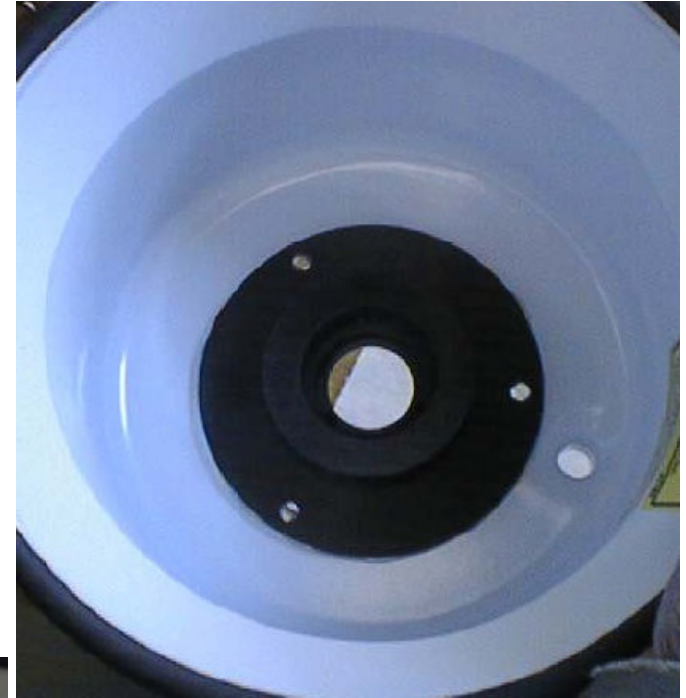
1. Remove the cabinet.
2. Re-connect the Latch harness (The harness can be connected by placing the cabinet on its side with the control panel opening towards the base. Feed the harness through the control panel opening to reach the latch assembly for connection.)
3. Connect multimeter leads onto R1 (red wire) and gnd.
4. Plug the unit in, select a SPIN of five seconds, and press the START key.
At the end of the spin, listen for the relay K1 to click, approximately 126 VDC should be present. If the relay does not click, repeat and verify RTR LED on PCB lights at the end of the cycle. If LED does not light, replace the PCB.
5. Connect multimeter leads onto the back of the J4 connector, pin 1&6 (gray and white). **At the end of the spin, approximately 120 VAC should be present and D13 on PCB should light. If LED does not light, replace PCB.**
6. If 120 VAC present, relay clicks, and 126 VDC not present, check resistance of R1 to be 200 ohms. If open, replace, If OK, replace diode D1.



Decant

- The decant function of the Cell Washer involves three elements. The rotor, solenoid plunger and solenoid coil.

The solenoid plunger (located beneath the rotor) has a metal band on it which, when the solenoid coil is energized, is pushed upward, locking the bottom tabs of the tube holders at a negative angle. Then, when the rotor is spun at low speed, the saline is forced up the sides of the tubes and out.



Mag ring

Decant

There are several factors which can prevent proper decanting.

1. Saline build up in the solenoid plunger well and/or on the motor shaft
2. Corroded or dirty solenoid plunger.
3. Broken tube holder tabs on rotor.
4. Defective solenoid coil.
5. PC board.

The #1 cause of Decant problems is cleanliness

If there are any signs of salt build-up on the rotor and or plunger, soak in warm water and a mild detergent (paying particular attention to the inside of the plunger and the metal band). Rinse thoroughly under warm water. Take a damp cloth and wipe any saline residue from the well that the plunger sits in.

If there are any signs of salt build-up on the motor shaft, clean it with warm water and a mild detergent. If the shaft is corroded or rusted, stuff the plunger well with a cloth, use steel wool or an Emory cloth to clean the shaft smooth and coat with a thin layer of petroleum jelly.

Decant



Shaft & Well

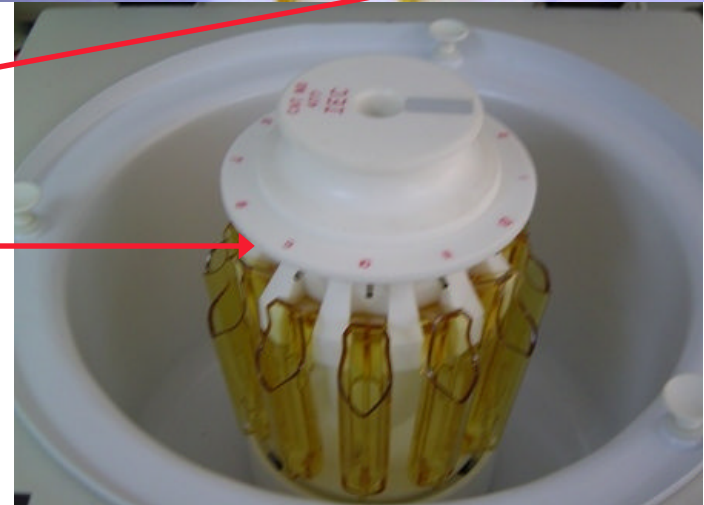


Tube holder & Tab



Rotor Decant Position

Plunger & Ring



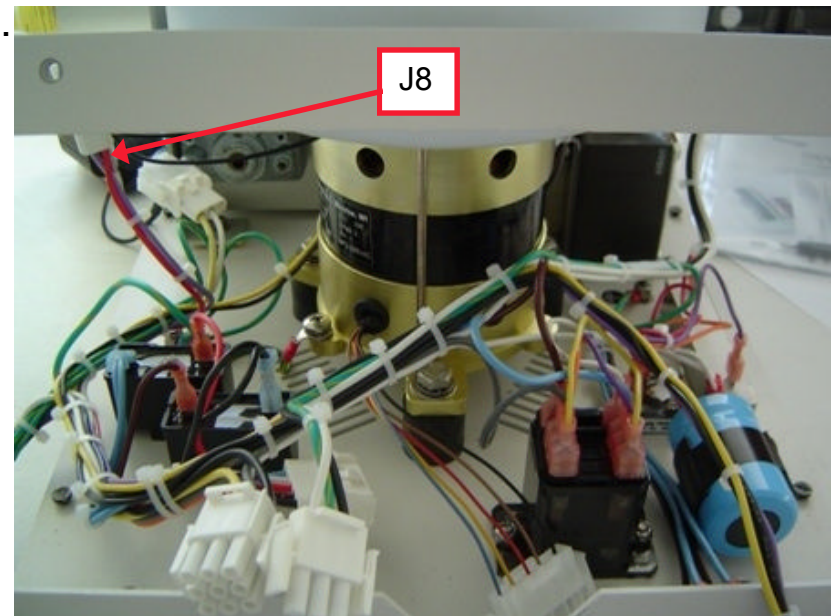
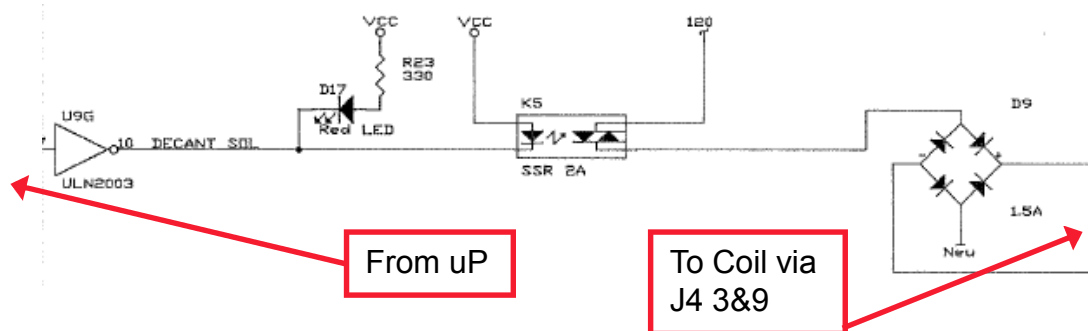
Decant Coil/PCB

To verify the Decant coil and PCB, use the following procedure:

1. Remove the cabinet.
2. Disconnect the solenoid coil at connector J8.
3. Connect DVM between the 2 black leads, coil resistance should be 645 ohms

To check power to the Decant coil

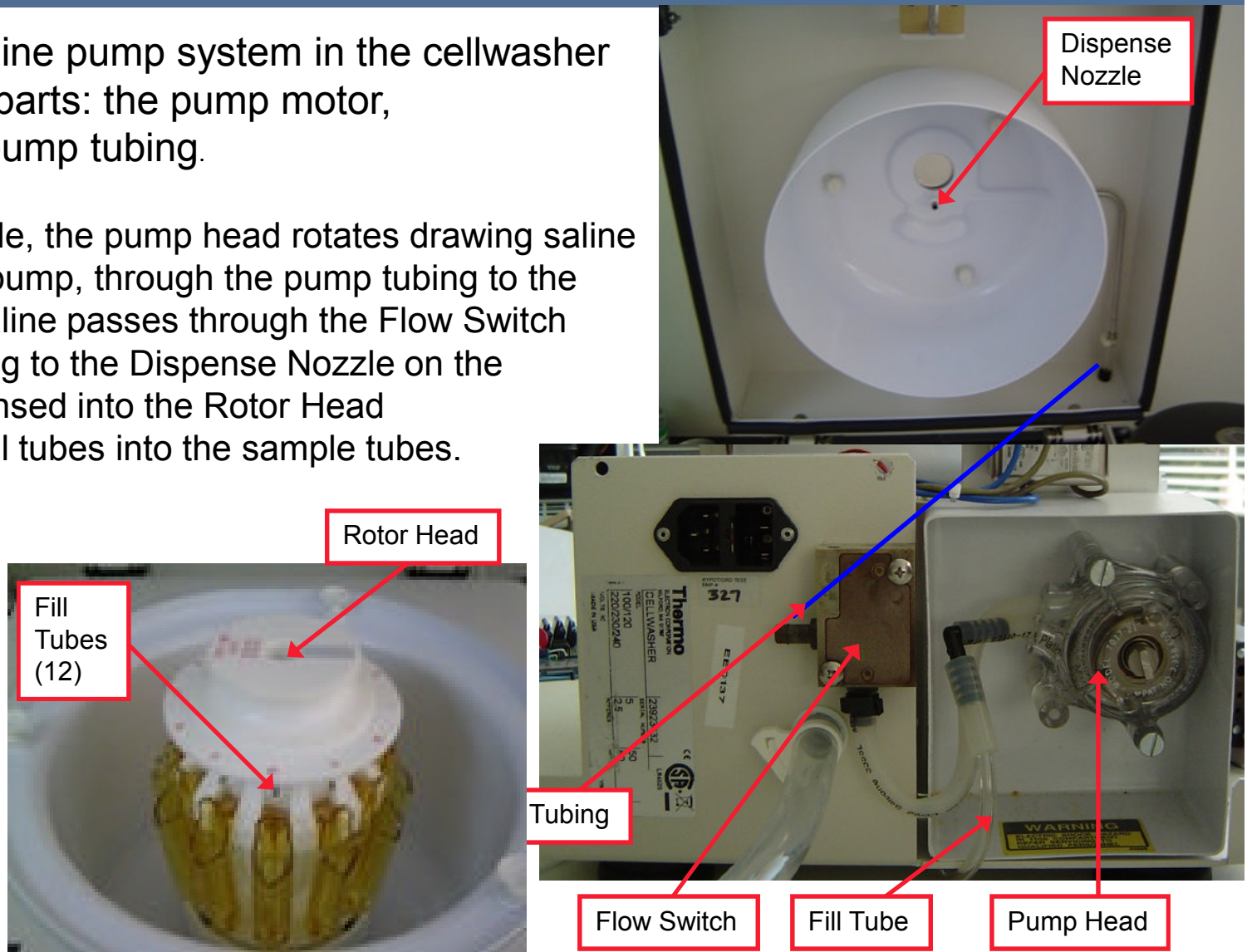
1. Re-connect the Latch harness (The harness can be connected by placing the cabinet on its side with the control panel opening towards the base. Feed the harness through the control panel opening to reach the latch assembly for connection.)
2. Place probes in the back of the J8 connector shell.
3. Power up, select 1 Wash cycle
4. At Decant (3rd step) voltage to the coil should be appx 140 VDC (SOL LED on). If voltage present check coil resistance and cleanliness, if voltage not present, replace the PCB.



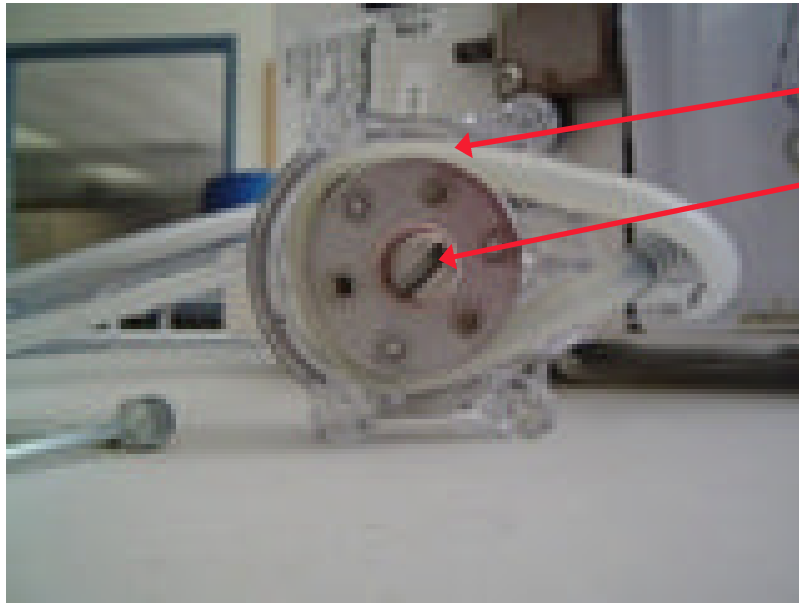
Peristaltic Pump

The peristaltic saline pump system in the cellwasher consists of three parts: the pump motor, pump head and pump tubing.

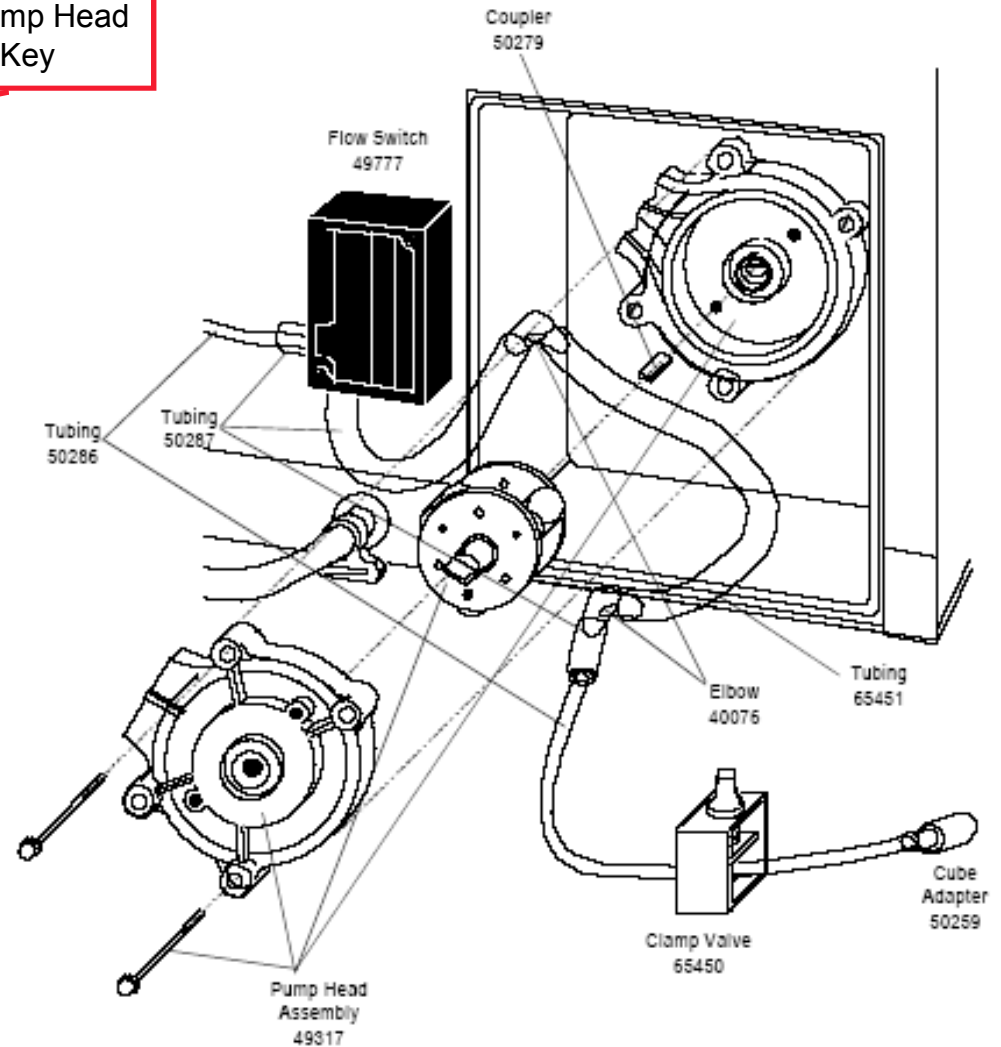
During the FILL cycle, the pump head rotates drawing saline into and out of the pump, through the pump tubing to the flow Switch. The Saline passes through the Flow Switch through the fill tubing to the Dispense Nozzle on the lid where it is dispensed into the Rotor Head and out the Rotor fill tubes into the sample tubes.



Peristaltic Pump



Pump Head & Key



Check for kinks in pump head tubing.

Manually turn pump. The pump should turn freely.

Use kit 500190 S

Refer to Users or Service Manual for instructions on replacing tubing.

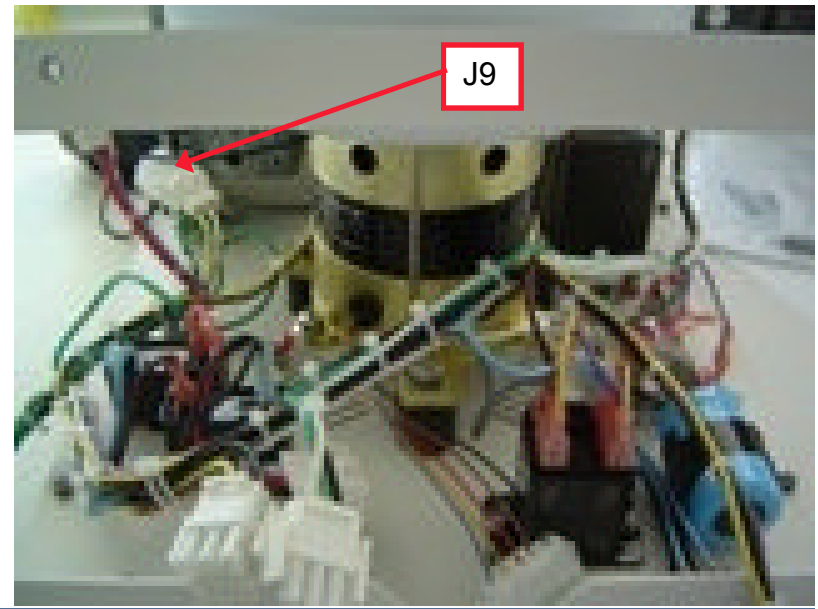
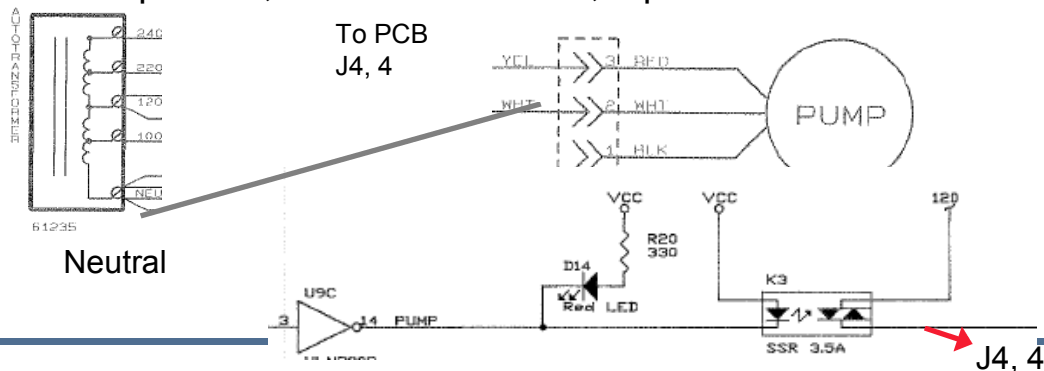
Peristaltic Pump/PCB

To verify the Peristaltic and PCB, use the following procedure:

1. Remove the cabinet.
2. Remove connector J9 at the pump motor.
3. Connect DVM between the red and white leads (pins 2&3), the resistance should be 4 ohms

To check power to the Pump Motor

1. Re-connect the Latch harness (The harness can be connected by placing the cabinet on its side with the control panel opening towards the base. Feed the harness through the control panel opening to reach the latch assembly for connection.)
2. Place probes in the back of the J9 connector shell. (pins 2&3, red and white)
3. Power up, select 1 Wash cycle
4. At FILL (1st step) voltage to the pump should be 120 VAC (PMP LED on). If voltage not present, check connections, replace the PCB.



Flow Switch

The flow switch is used to sense when the saline supply has been depleted. The switch is normally closed and is open when saline is present. When saline is not present the switch closes and stops a run during the fill mode.

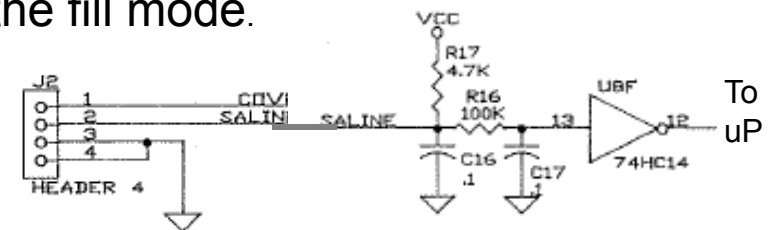
To Test The Switch, No Flow:

1. Remove the Cabinet
2. Disconnect J2 on PCB
3. Measure the resistance across pins 2&3 (yellow and black)

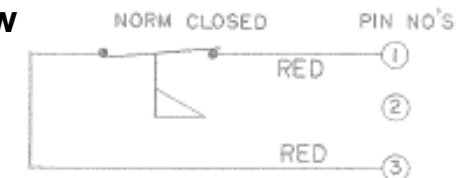
The resistance should read shorted (minimal resistance) with no saline flow

To Test The Switch, Saline Flow:

1. Re-connect the Latch harness (The harness can be connected by placing the cabinet on its side with the control panel opening towards the base. Feed the harness through the control panel opening to reach the latch assembly for connection.)
2. Place probes in the back of the J2 connector shell Yellow and black (pin 2 and 3) disconnected,
3. Power up, select 1 Wash cycle
4. At FILL (1st step) the resistance should show open circuit.



WIRING DIAGRAM
NO FLOW CONDITION



Warning /Error Messages

The only display on the panel indicating any warning is the Low Saline LED.
If illuminated check the saline level. pump or flow switch [Peristaltic Pump](#)

- No Power, Display Blank.
 1. New Install- Check PEM voltage config [Power Distribution](#)
 2. Check C/B, PCB [Power Distribution](#)
- Does Not Spin.
 1. No power to Motor, defective Motor [Check Motor.](#)
 2. Lid Pawl Switch defective [Check Lid Switch's](#)
- Does not Fill
 1. Pump defective or tubing clogged [Check Pump,](#)
- Latch Does Not Open.
 1. No power to or defective Latch [Check Interlock](#)
- No or Poor Decant.
 1. Decant Coil shorted or no power [Decant Coil](#)
 2. Rotor /Plunger/Motor dirty [Decant](#)