

Overview

- Microprocessor controlled Stepper Motor



- Programmable control of highly accurate and predictable motion.
 - Pulsation minimized
 - Pressure compensation controllable
 - Power and speed optimized for flowrate requirements.
 - Noise minimized through motor drive control.
- Power Supply is less critical in determining motor speed.
- Low tolerance on motor-to-motor variations.

General Specifications

Power requirements		
Voltage	48 or 24 volts DC motor drive	24 max volts DC Digital and Analog
		On board conversion for: 12 volt DC analog 5 volt DC digital
Current	1.5 amp motor drive	250 mA Digital and Analog

Motor Drive	Series III (“A”)	MOSFET driven H Bridge
	Series II (“B”)	ASIC Motor Drive
Digital Control	80C51 Micro	I/O interface to: GAL, Digital, Logic, & Analog I/O
Communication	RS232 Serial Communication 9600 BAUD 8,1,0	I/O lines for: <ul style="list-style-type: none"> • Pump Stop • Pump Prime • Prime LED Indicator • Serial Controlled TTL output
Front Panel (connector)	Pump Control Functions	4 position 7 segment LED display

Additional Control Functions:

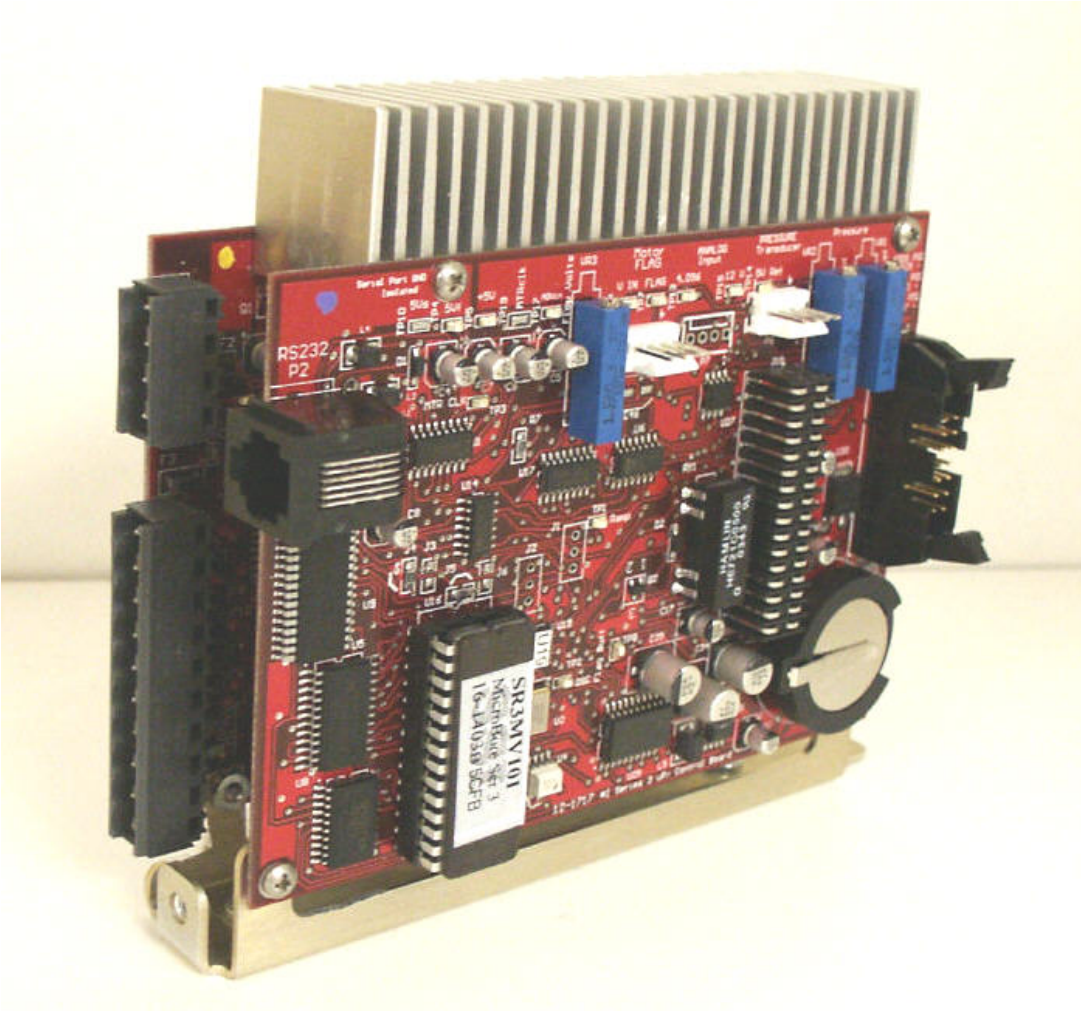
Power-Up Functions for Series II & III

Keys to Hold Down	Routine Enabled	Display
UP ARROW & DOWN ARROW	Test Serial Port	
UP ARROW & PRIME	Test Refill Switch	“----“ or “_ _ _ “
UP ARROW & RUN/STOP	Display Software Version	
PRIME & RUN/STOP	Motor Stall Detector	“On” or “OFF”
RUN/STOP & DOWN ARROW	Display Checksum	
UP ARROW	Reset to Factory Settings	
RUN/STOP	Select Head Type	SXX or PXX
PRIME	Set Pressure Compensation	(pressure / 100)

Circuit Board Layout

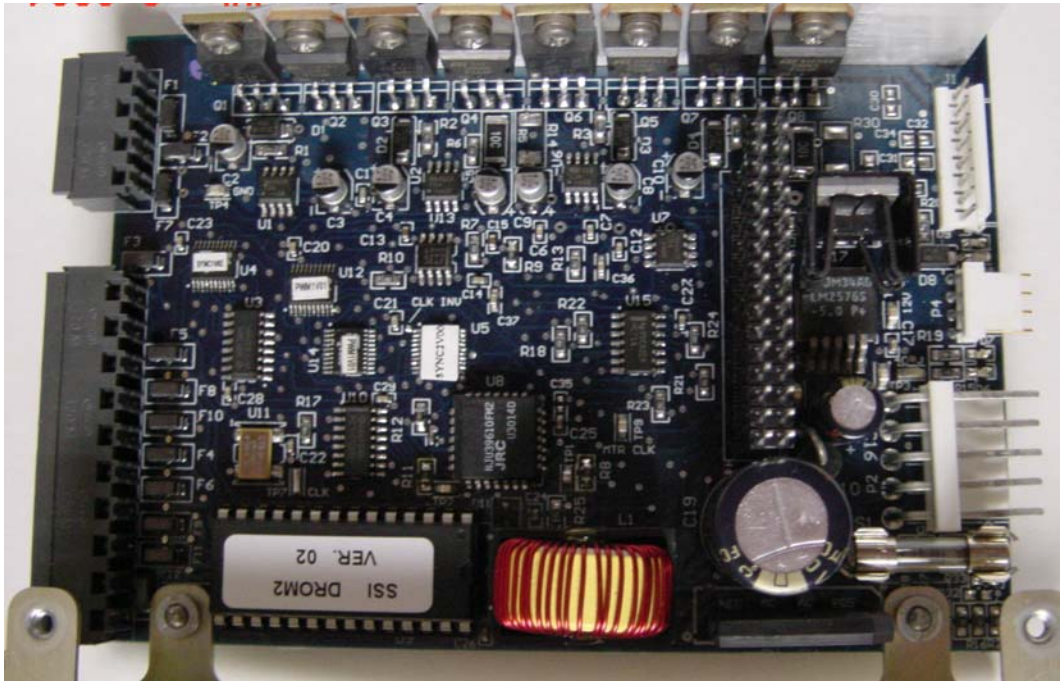
Series III

- Three board set for high-end control and monitoring

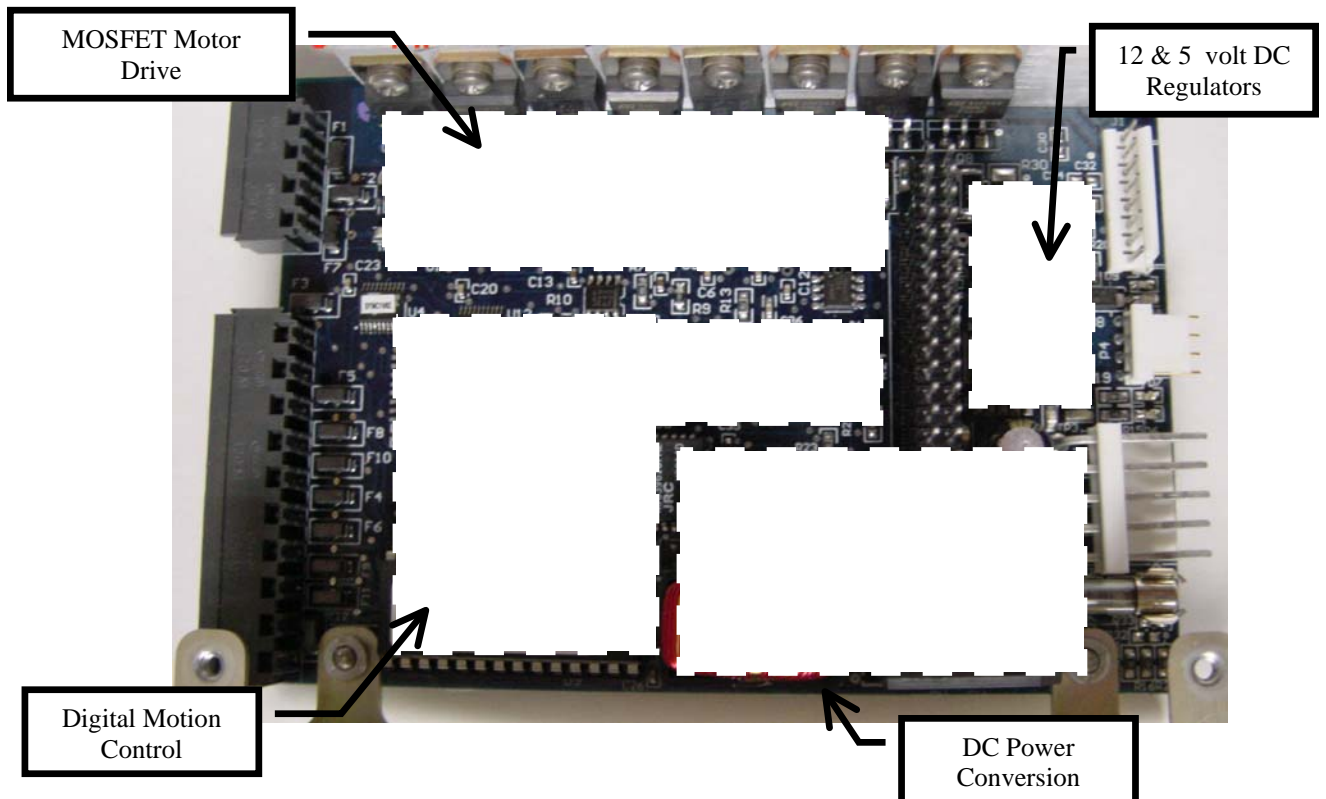


- **Motor Drive**

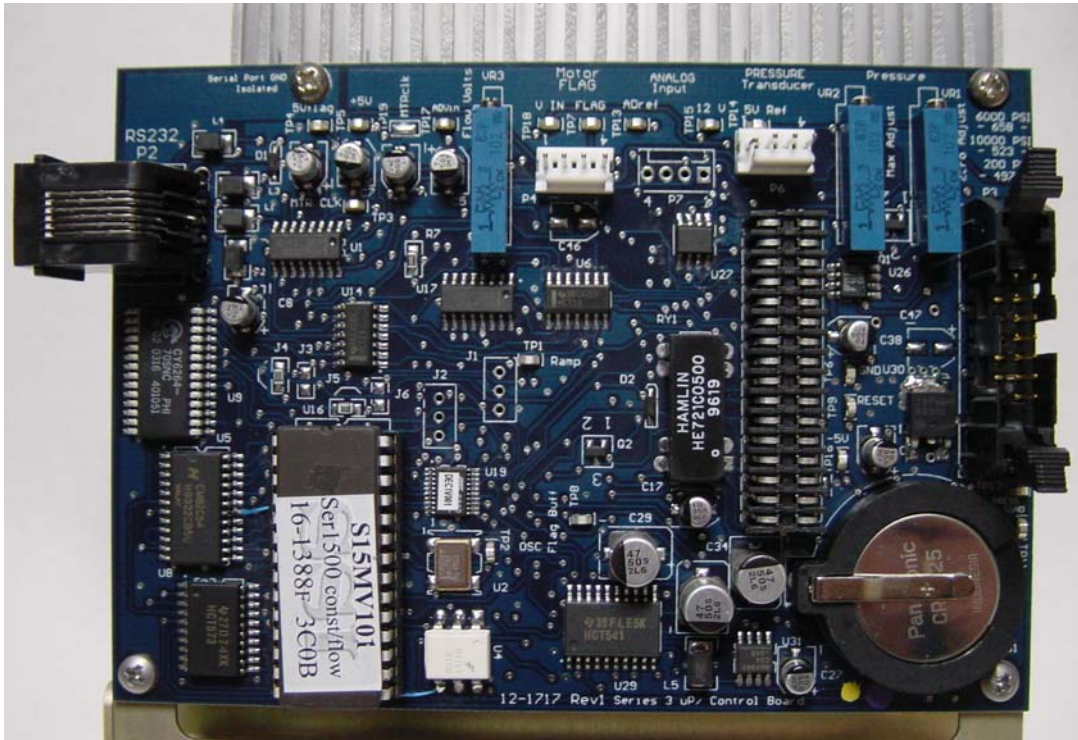
- MOSFET Driven H Bridge dedicated motor drive circuit board.



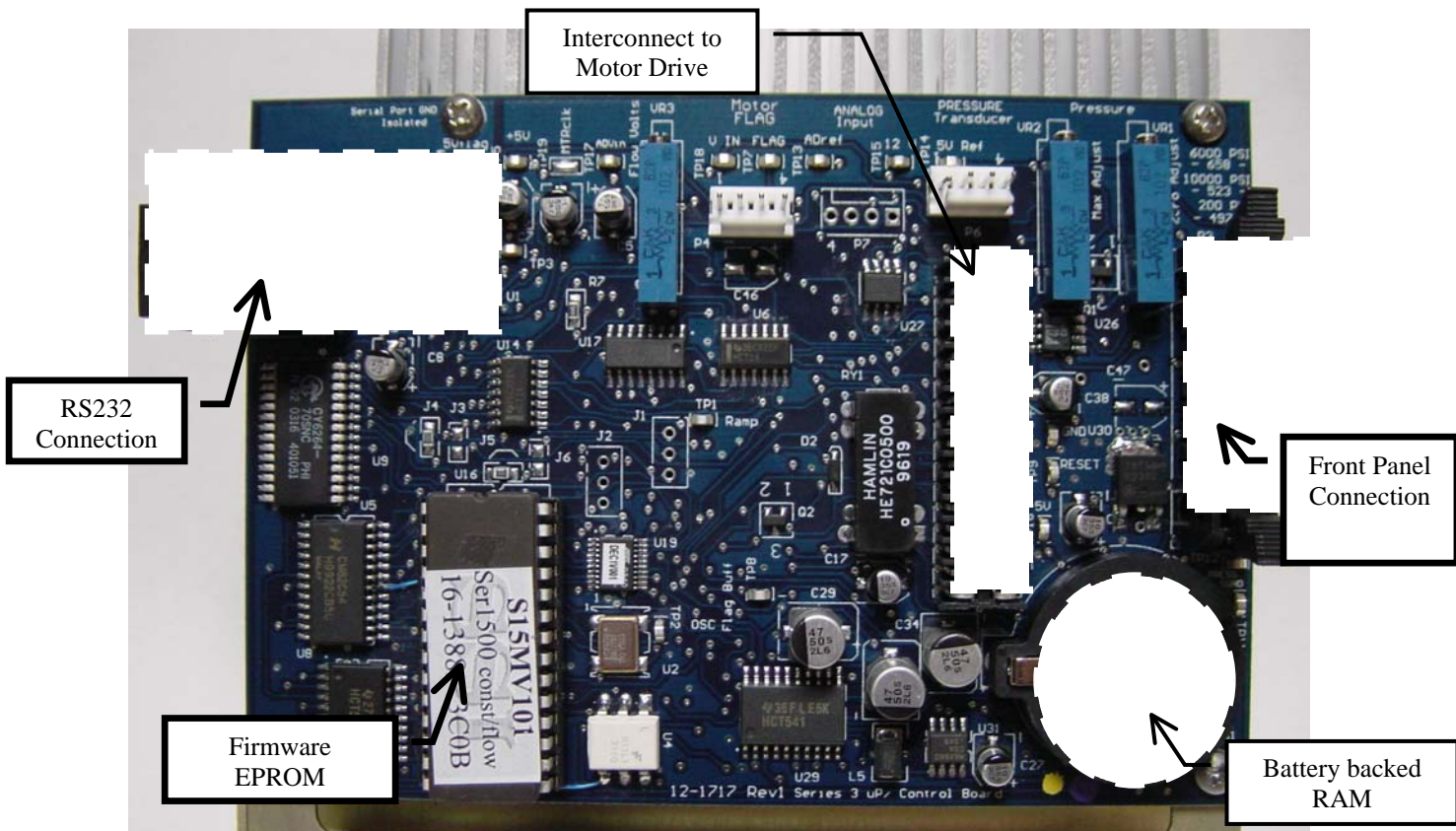
- **Motor Drive Board Layout**



- Microprocessor Control
- Digital Control Circuit Board

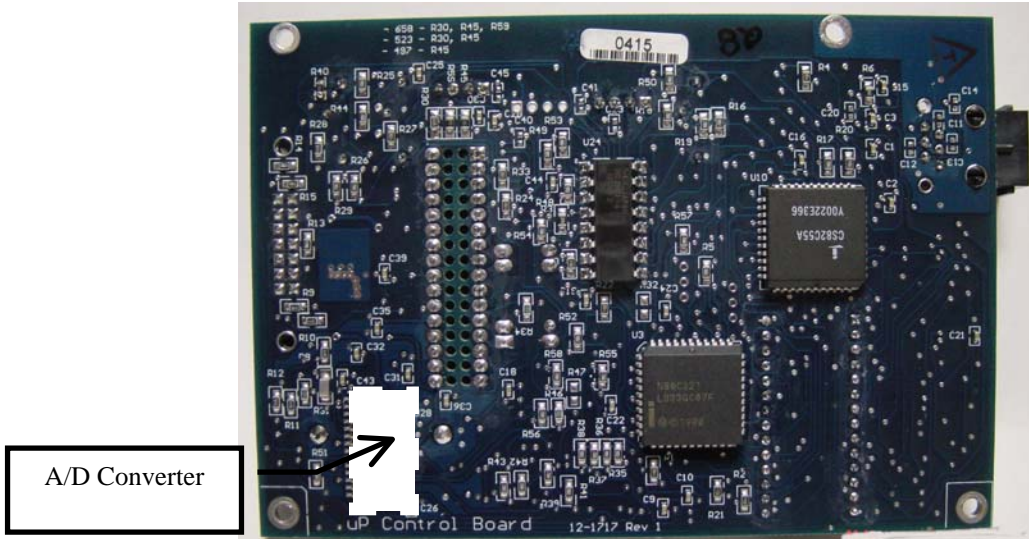


- Control Circuit Board Layout

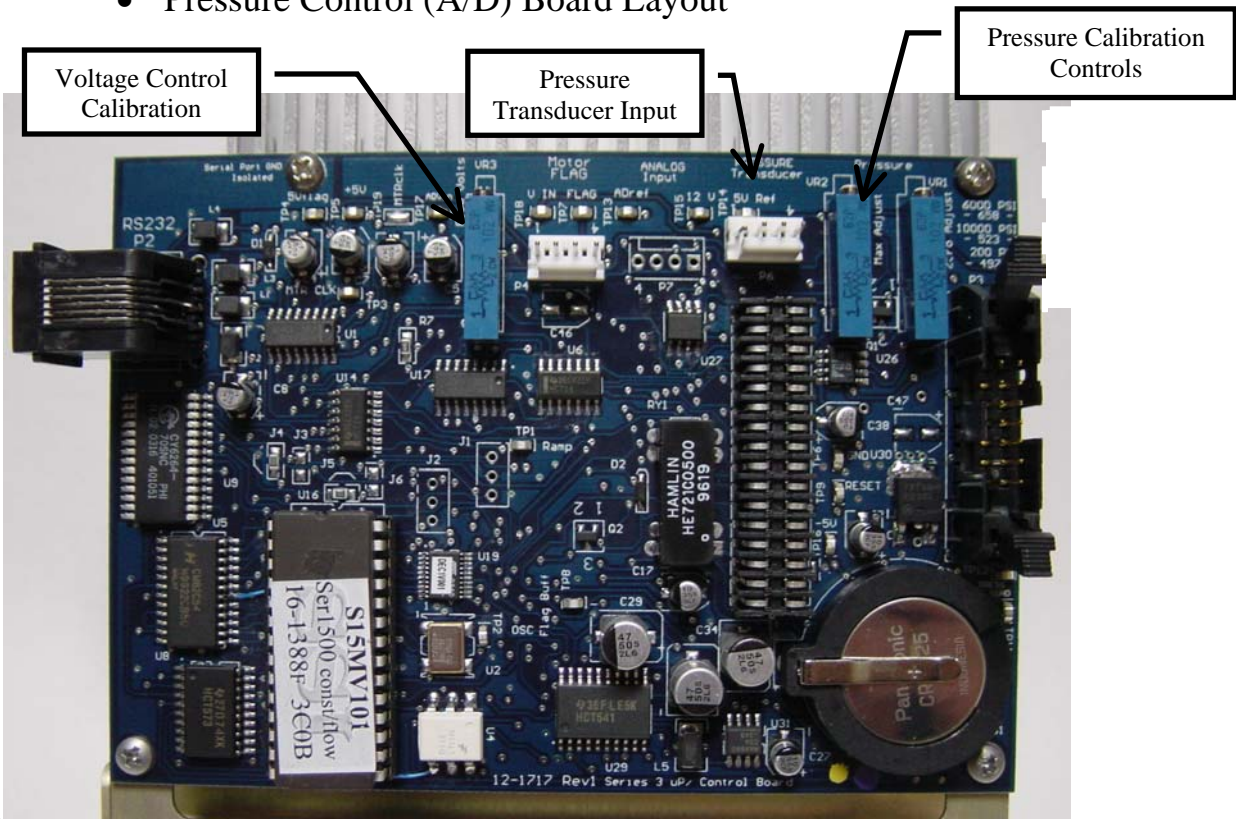


- Remaining areas are microprocessor and additional I/O inputs

- **Analog to Digital Converter**
- Input for pressure transducer voltage

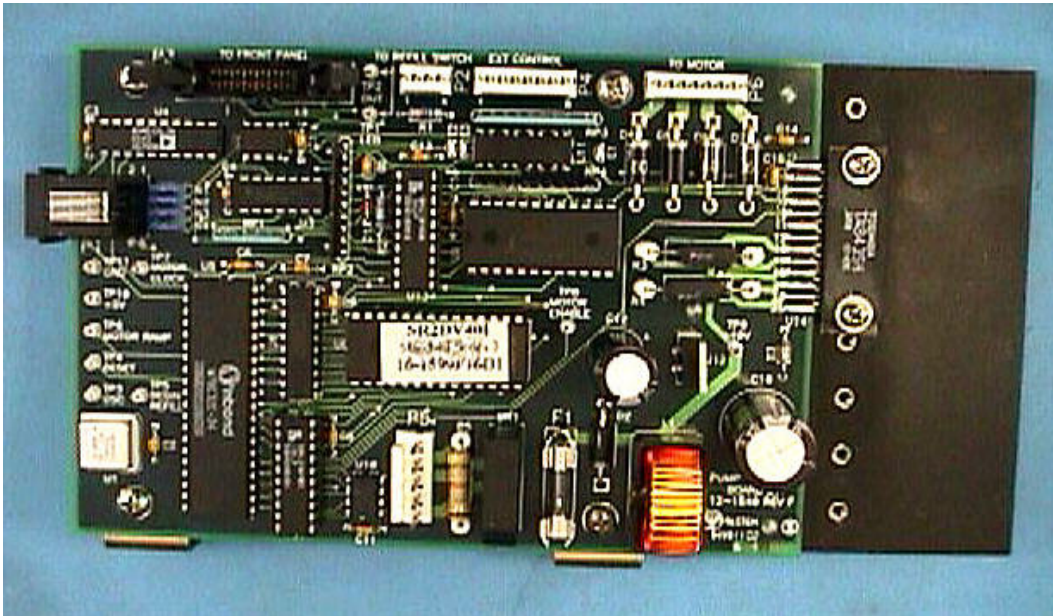


- **Pressure Control (A/D) Board Layout**



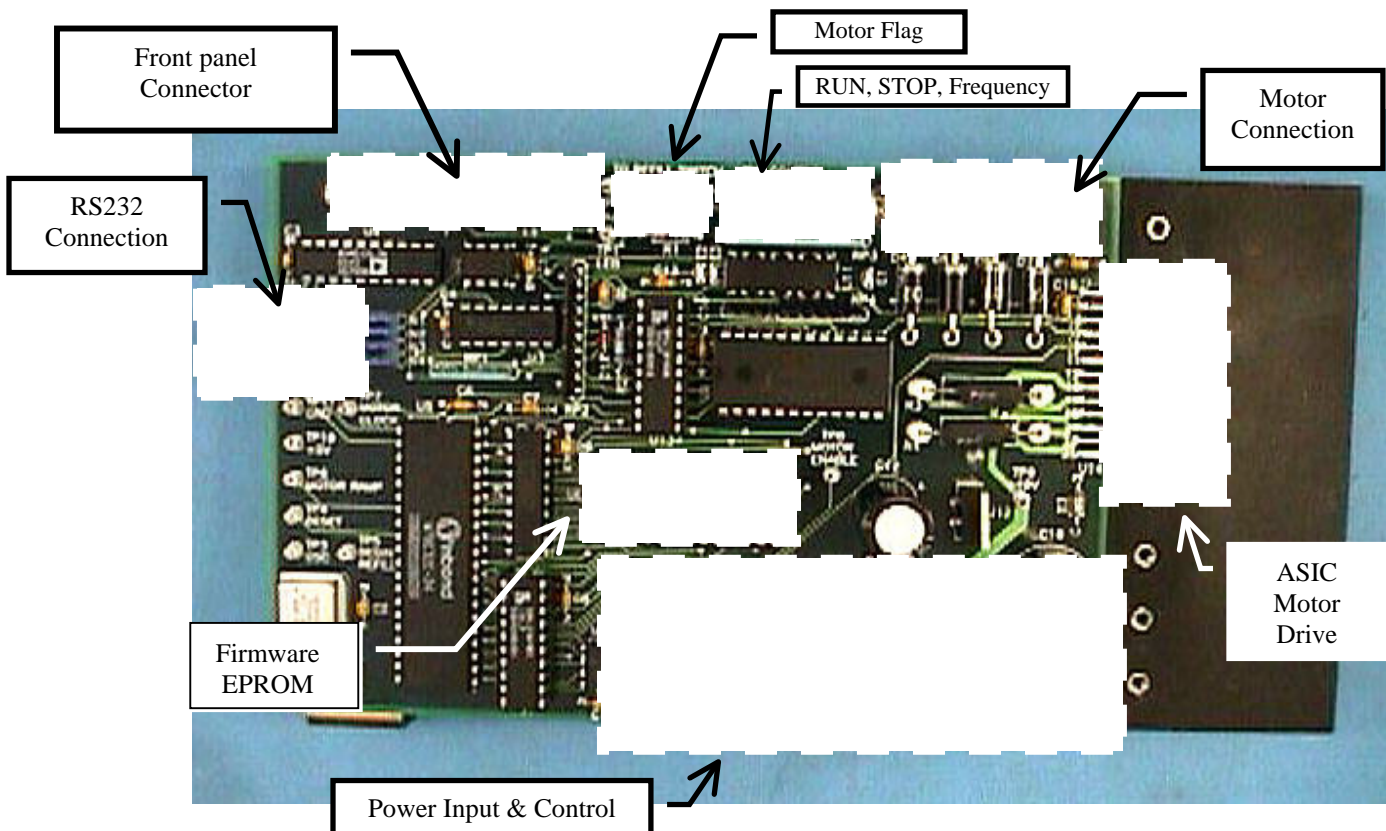
Series I Pump Board

- Single board for basic control needs



• Motor Drive and Microprocessor Control Layout

- ASIC Motor Drive.
- Microprocessor control & additional I/O ports.



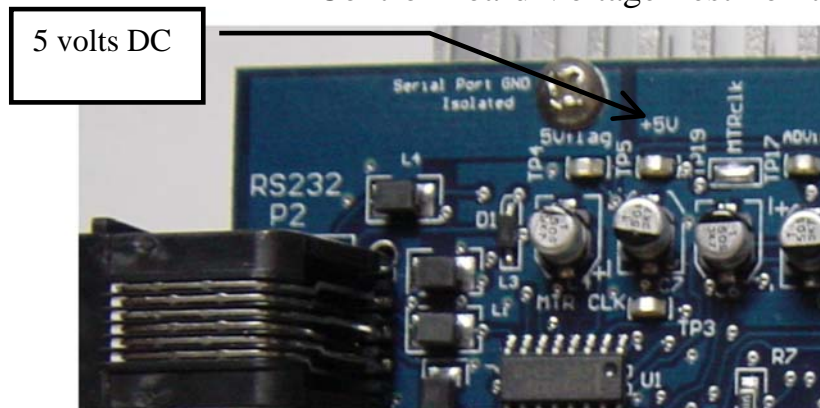
Troubleshooting

- All Boards are “Run-In” for a minimum of 8 hours (usually overnight).
- All products are 100% tested in-house.
- SSI’s field failure rate is extremely low.

Basics

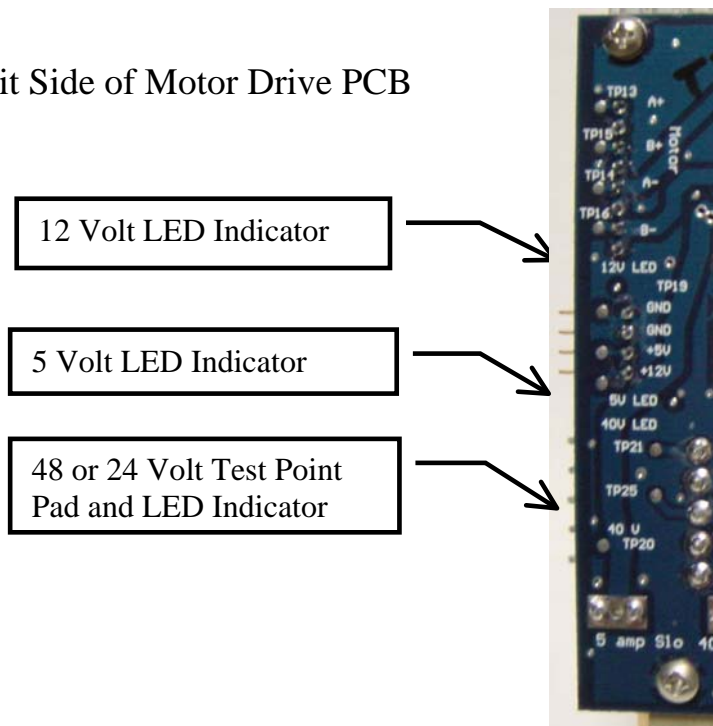
- **DC Voltage Checks**
 - 5 volts, 12 volts, and 36 volt
- **Series III**

Control Board Voltage Test Points



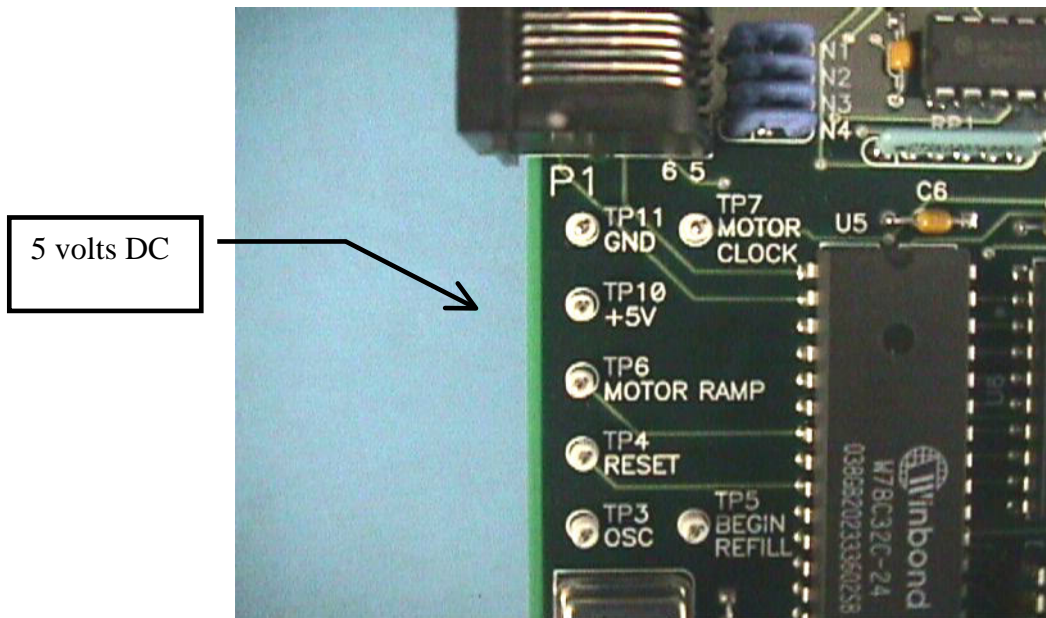
Motor Drive Board Voltage Test Points

Circuit Side of Motor Drive PCB

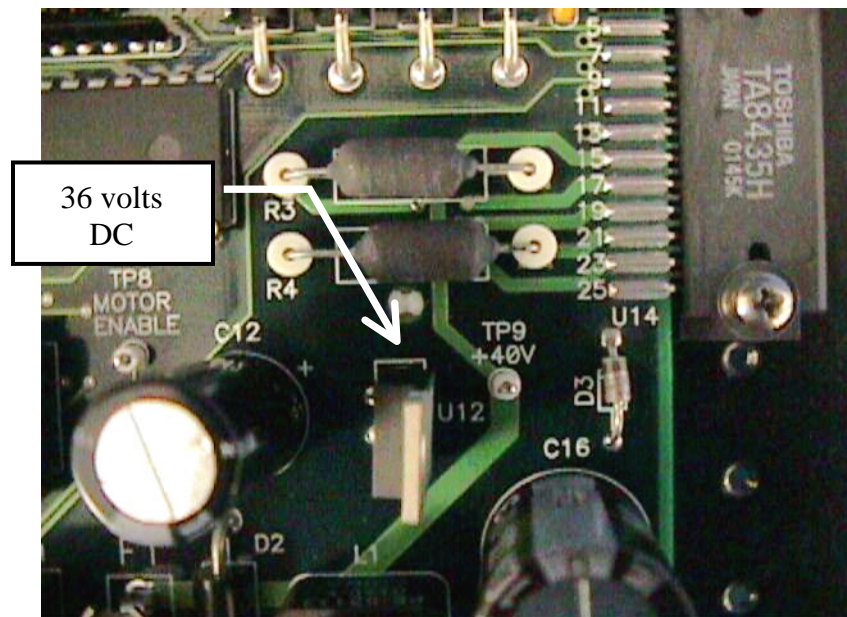


- **Series I PCB**

Digital Supply Voltage Test Points



Motor Drive Voltage Test Point

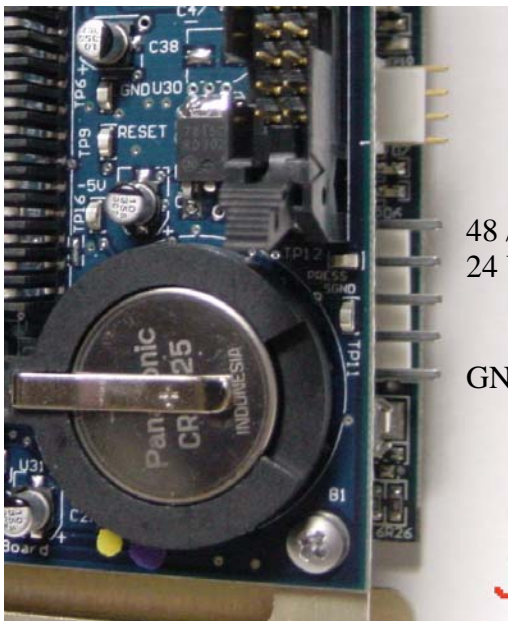
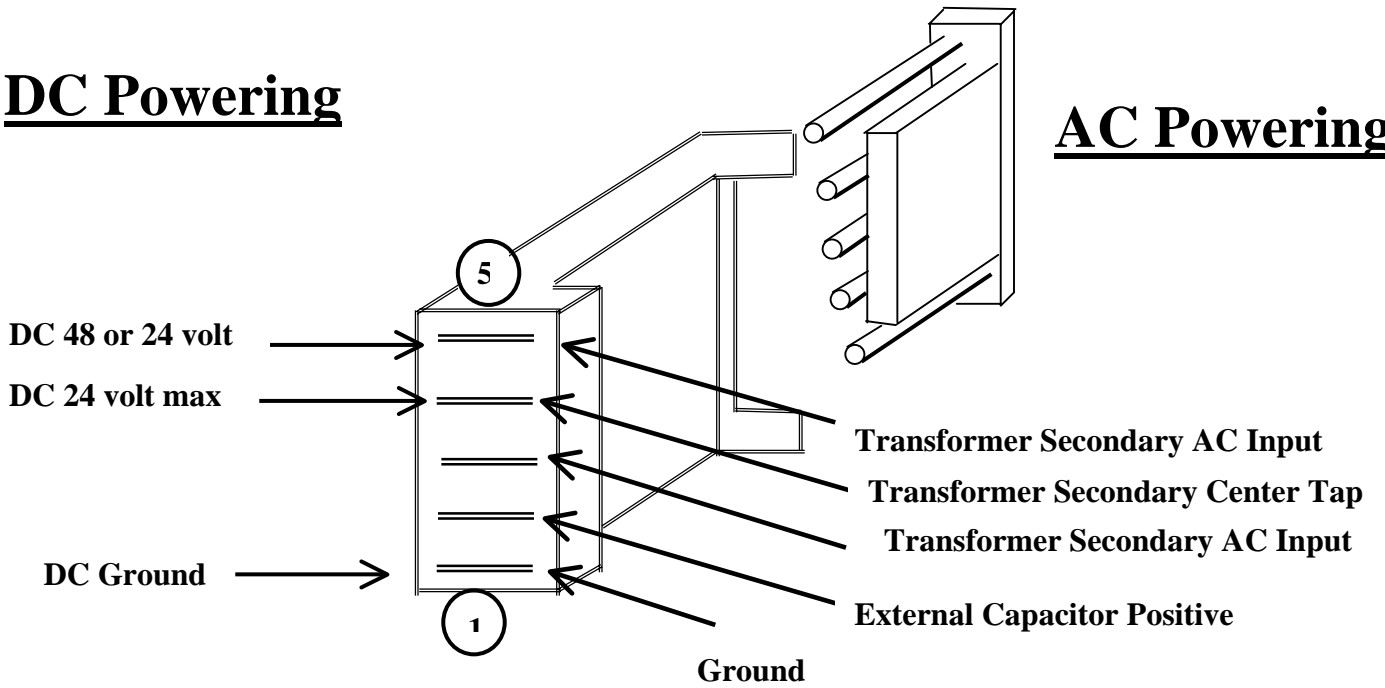


- Power connector for Series I or III Pump Boards

*****NOTE *****
Series I Pump board has a maximum input voltage of 40 Volts DC on the high voltage drive side of the connector.

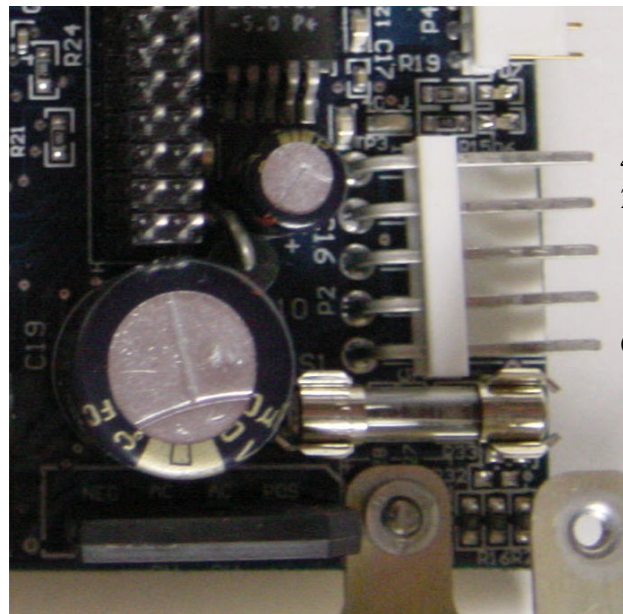
DC Powering

AC Powering



48 / 24 VDC
 24 VDC max

GND



48 / 24 VDC
 24 VDC max

GND

Failure modes

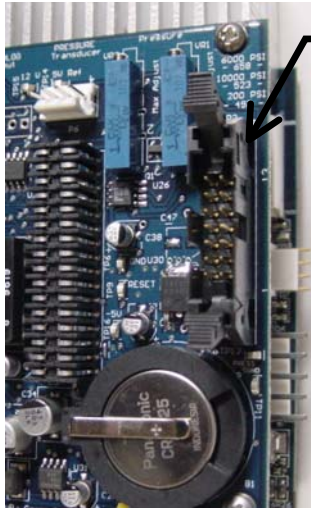
**** Warning ****

Do not unplug the Motor Connector from the circuit board while the power is on, or has just been turned off. Turn off the power and wait 5 seconds for the voltage present in the capacitors to dissipate.
Failure to follow this procedure will damage the motor drive power handling devices.

- **Pump Not Responding to PC Control.**
 - Check RS232 connector
 - Check for 24 / 48 and 5 Volts on the PCB.
 - If 24 / 48 volts isn't present, check the Power Supply connections.
 - If voltage is present at the plug and 5 volts isn't at the test points, replace the circuit board.
 - Replace PCB Series II or Control board on Series III
- **If Pump will not retain initial settings** such as in High or Low Pressure Limits or Head size.
 - Replace the battery for the battery backed RAM on the 2 board set "Series III".
- **Motor noise, motor stall, or missing steps at low speed.**
 - This is an indicator of:
 - Pressure has built up excessively in the flow path.
 - An over-tightened drive belt.
 - A defective component in the Motor Drive circuits.
- **Motor Drive Diagnosis.**
 - If the front panel and/or serial communication works, but the motor won't run, replace the 5 x 20 mm fuse on the circuit board.
 - At low speed the motor may be able to step with only one MOSFET damaged. Run the motor at PRIME or any faster rate, if it stalls it's probably a damaged MOSFET. Replace the circuit board.

- **Flowrate problems**
 - All pumps are tested at the factory for flowrate accuracy. Assume that the pump flowed correctly prior to a service call.
 - By nature this is not an electronic problem. Try changing the pressure compensation setting to adjust for your solvents compressibility.
 - Check the fluid path for obstructions that may alter the pressure or flow.
- **Pressure not functioning correctly**
 - Transducer damaged.
 - Usually this will result in a constant maximum pressure reading.
 - Pressure settings that are incorrect can be recalibrated.
 - If in doubt about recalibrating this board, replace the board and Transducer/Pulse Damper with a Factory matched set.
 - Most SSI Pumps maintain a 100 PSI pressure fault window on the upper pressure fault setting. This is maintained so that minor pressure variations from backpressure devices, pulsation, or system setups will not inadvertently trigger the upper pressure fault. If absolute accuracy is needed on the upper pressure fault setting, set the upper pressure fault to 100 PSI less than the systems maximum desired pressure.
 - Damaged PCB.
 - This is a rare case and would require some outside source to damage the unit. Contact SSI customer service for details.

- **Front Panel connection and operation**



Series III
Front
Panel
Connector

Series I
Front Panel Connector



- The 4-digit display shows the pump flow rate (mL/min), or system pressure (PSI), or the set upper or lower pressure limit (PSI) when operating. Choice of display is selected with the MODE key.

Operation Keys

- RUN/ STOP: When pressed, this key alternately starts and stops the pump.
 - Δ When pressed, this key increases the flow rate.
 - ∇ When pressed, this key decreases the flow rate.
- PRIME: When pressed the pump runs at the maximum flow
- MODE : (Series III/Pump "A" only) Steps through the available controls and readings
 - ML/MIN
 - When lit, the digital display shows flow rate in mL/min.
 - PSI
 - When lit, the digital display shows system pressure in PSI.
 - HI PRESS
 - When lit, the display shows the user-set upper pressure limit in PSI.
 - LO PRESS
 - When lit, the display shows the user-set lower pressure limit in PSI.
- **Additional LED indicators**
 - PUMP RUN
 - Lights to indicate that the pump is running.
 - FAULT
 - Lights when a fault occurs and stops the pump.

- **Fault Conditions and Causes**

- If the pump runs for a short time and then stops, or if it stops unexpectedly:
 - Test for High or Low Pressure Faults or a Stall Fault.
 - Using the Display Panel, run the pump and when the pump stops:
 - The red Fault Light flashes indicating an error has occurred.

Series III

- On a **High Pressure Fault** the High Pressure LED will light along with the Fault Light, and the pressure will be displayed.
- On a **Low Pressure Fault** the High Pressure LED will light along with the Fault Light, and the pressure will be displayed.

Series II or III

- On a Stall Fault only the Fault light is activated, this indicates a motor fault from a lack of power, or overpressure condition.

- **Power-Up Functions for Series I & III**

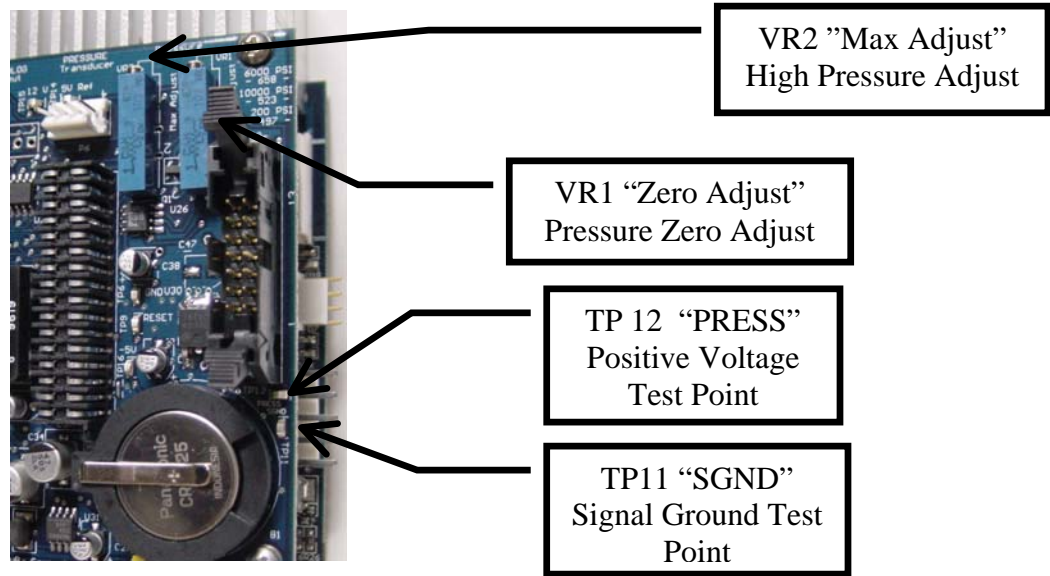
- Additional functions can be accessed by holding specific buttons when the power is cycled on a pump.

Keys to Hold Down	Routine Enabled	Display
UP ARROW & DOWN ARROW	Test Serial Port	
UP ARROW & PRIME	Test Refill Switch	“----“ or “_--“
UP ARROW & RUN/STOP PRIME & RUN/STOP	Display Software Version Motor Stall Detector	“On” or “OFF”
RUN/STOP & DOWN ARROW UP ARROW	Display Checksum Reset to Factory Settings	
RUN/STOP PRIME	Select Head Type Set Pressure Compensation	SXX or PXX (pressure / 100)

- Serial Port Loop Back test require a RJ11 connector with Pins 3 & 4 and Pins 2 & 5 connected together.
- Test Refill Switch will indicate the flag is passed when rotated by hand.
 - This will test the stall fault and fast refill are functioning correctly.
 - Malfunctions are indicated when the display doesn’t change.
 - Check that the flag is in the correct connector location.
- Motor Stall Detector turns off the Stall Fault triggered by missing the flag on the CAM shaft.
- Reset can be used to determine if a reset to factory settings can correct a problem.

PRESSURE TRANSDUCER CALIBRATION PROCEDURE

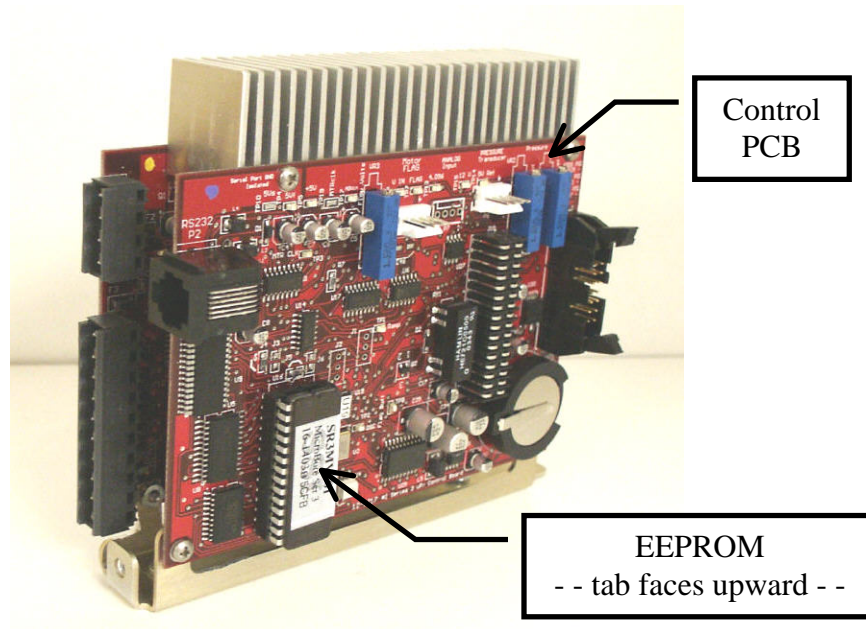
- Pressure Transducers and component tolerances variations require the circuit board to be matched to the transducer.
- SSI will match replacement Boards to a Transducer/Pulse Damper as a replacement part.
- In the event a simple adjustment could correct a problem quickly at a customer sight, the controls for matching the transducer to a circuit board are included here.
- Connect a voltmeter to the pressure board with the black lead on TP11 and the red lead on TP12.



- Apply power to the pump and verify that the lower pressure limit is 0 PSI and the upper pressure limit is 6000 PSI. If they are not at these values, change them.
- With the pump stopped, the prime-purge valve open, and the pump at atmospheric pressure, adjust the "Zero Adjust" VR1 trimpot until the voltmeter reads approximately 0.000 volts.
 - This can be adjusted to zero just by using the front panel readout, but it is less accurate.
- Close the valve and run the pump at 1.00 mL/min. Turn the VR2 "Max Adjust" trimpot counterclockwise if the pressure readout on the pump approaches 5000 PSI. This will prevent an overpressure fault from stopping the pump. Stop the pump when the test gauge reads approximately 5200 PSI.
 - Another possibility is to use an inline pressure regulator of known fixed pressure value.
 - Run the pump at 1 ml/min and when pressure has stabilized adjust the trimpot to that known, fixed value.
- Recheck the zero pressure value and the high pressure value, correct as necessary.

Changing the EPROM/Firmware on an SSI Series III style Pump:

- Turn off and unplug the pump.
- Open chassis by removing the 10 screws on the sides of the cover.
- The EPROM is on the Control PCB.



- Using an IC remover or suitable device, remove the EPROM.
- Insert the new EPROM noting that the tab on the EPROM matches the tab on the PCB silkscreen for the IC socket.

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- **NOTE:** The Head type must be checked or reset after changing the EPROM.
 - Hold the **RUN/STOP** button while powering the pump.
 - Use the **UP** or **DOWN** arrow keys to set the Head Type

Max Flowrate	Pump Display	Notes
100 ml/min heads	S50 or P50	(Stainless Steel or PEEK respectively)
24 ml/min heads	S12 or P12	(Stainless Steel or PEEK respectively)
12 ml/min heads	S6 or P6	(Stainless Steel or PEEK respectively)

Troubleshooting:

- If the MODE light is lit but the MODE button does not work. The RAM needs to be cleared. Remove the Battery (see above), wait 1 minute, and turn the pump on. This will reset the RAM. Turn the power off, reinstall the battery and the MODE will be enabled.
- If the front panel is unresponsive and unlit the EPROM is probably in backwards or improperly seated. Check that the tab on the EPROM matches the tab on the PCB silkscreen for the IC socket.
- If all lights are lit and the pump is unresponsive, the EPROM may be improperly aligned in the socket.
- Below is a list of built in functions for SSI's pumps, which are activated by holding specific front panel keys down while turning on the pump.
 - Not all pumps have all these functions. Please call SSI for additional information.

Power-Up Functions for Series III and Dual Piston Pumps

Keys to Hold Down	Routine Enabled	Display
UP ARROW & DOWN ARROW	Test Serial Port	
UP ARROW & PRIME	Test Refill Switch	
UP ARROW & RUN/STOP	Display Software Version	
PRIME & RUN/STOP	Motor Stall Detector	"On" or "OFF"
RUN/STOP & DOWN ARROW	Display Checksum	
DOWN ARROW	Select Voltage or Frequency Input	"U" or "F"
UP ARROW	Reset to Factory Settings	
RUN/STOP	Select Head Type	SXX or PXX
PRIME	Set Pressure Compensation	(pressure / 100)

For Constant Pressure Pump ONLY

PRIME & DOWN ARROW	Set ramp speed factor	(% of factory setting – 10% to 500%)
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For Series I500 and Prep Pumps ONLY

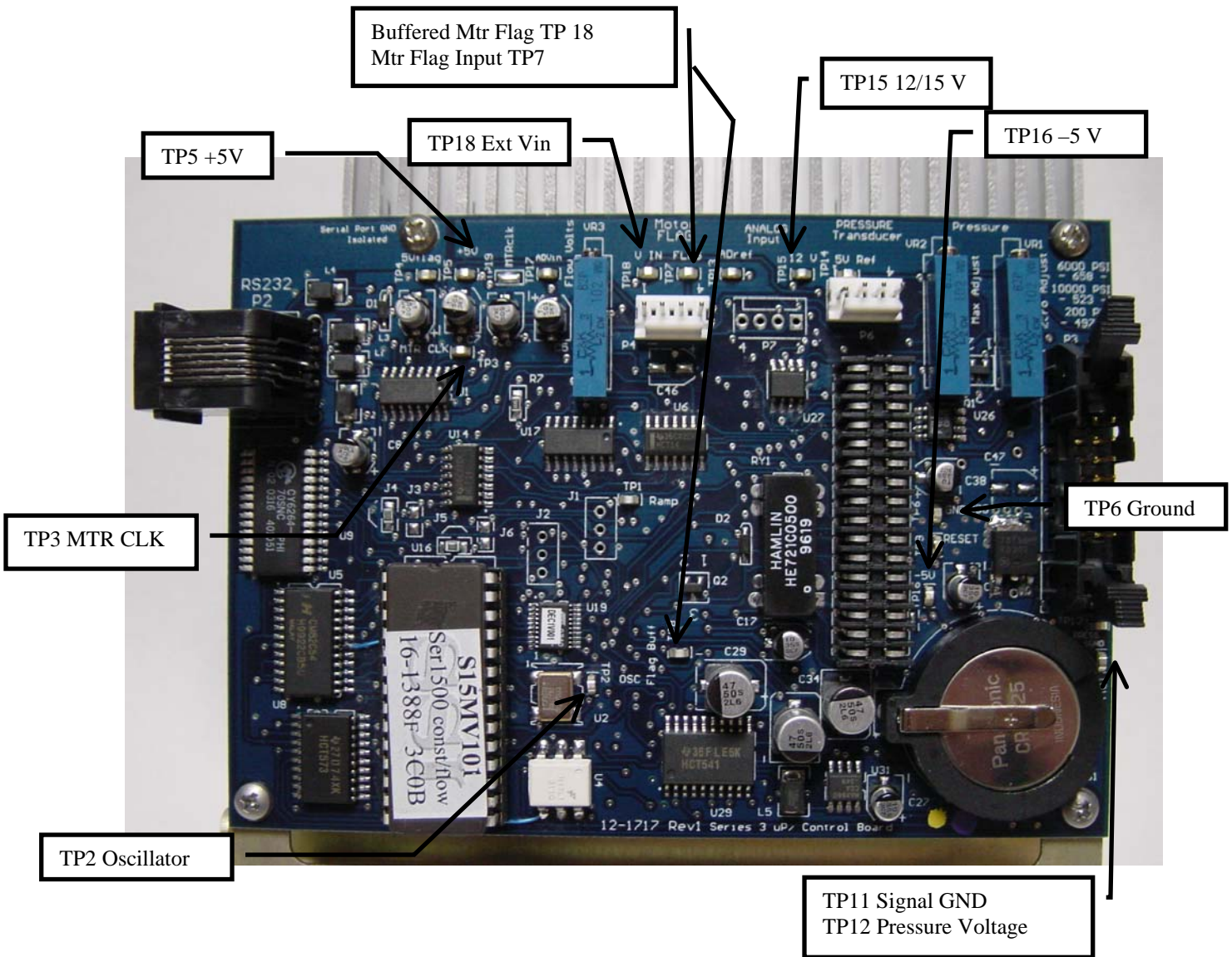
PRIME & DOWN ARROW	Pressure Limiting for Pulse Damper (Limits any Pressure above 6100 to 6100 PSI)	▲ Pdin --- Maximum Pressure set to 6100 PSI ▼ noPd -- Maximum Pressure set to 6100 PSI
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For Series IX (Ser III PCB) ONLY

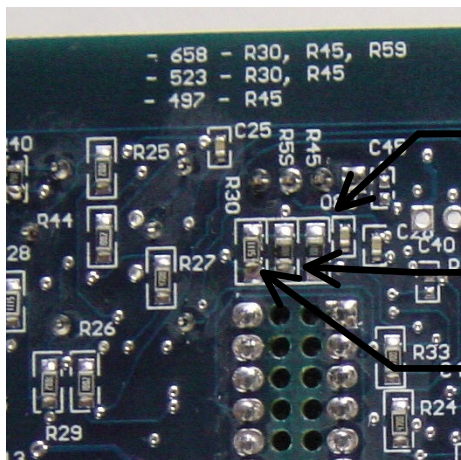
PRIME & DOWN ARROW	Pressure Transducer Option Setting	▲ Pres --- Pressure Reading & MODE button
enabled	(Sets Pressure and Mode Button)	▼ noPr -- Pressure Reading & MODE button
disabled		

Series III Control PCB Board Level Information

Test Points

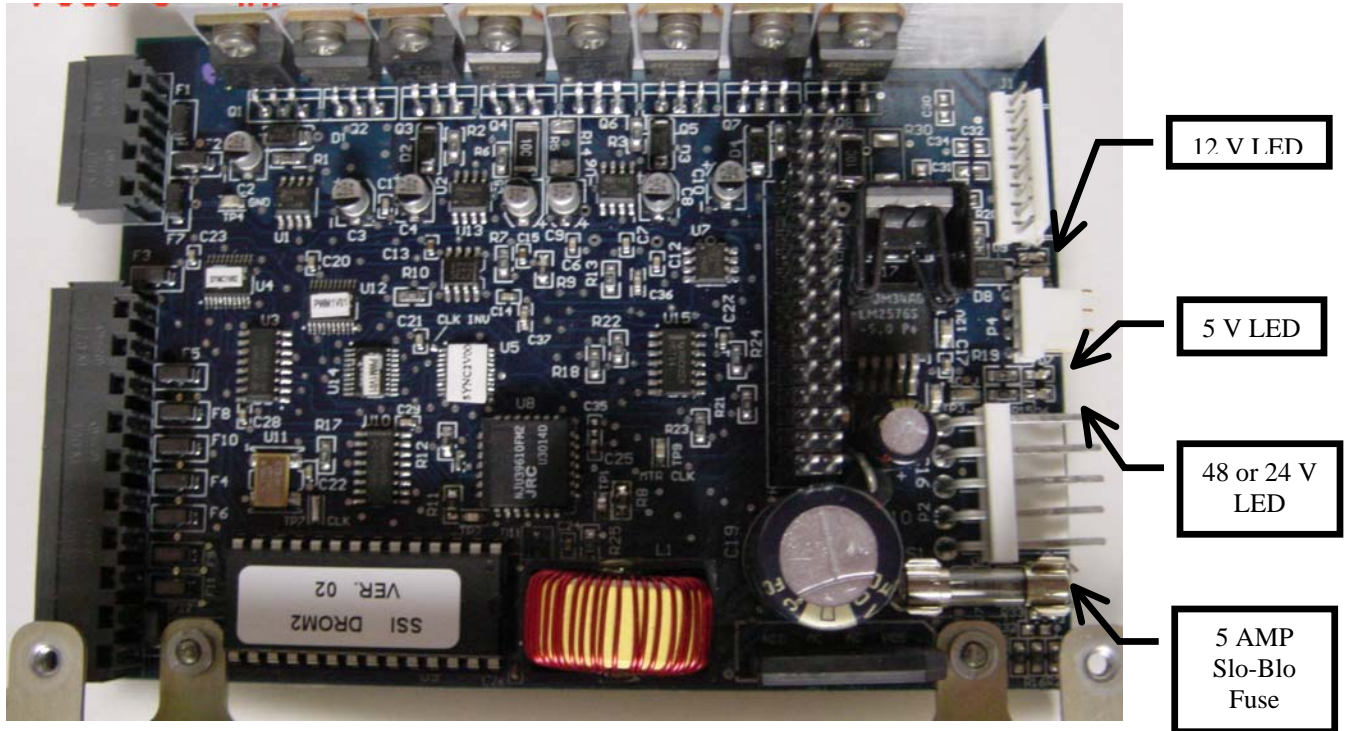


Resistor Selection for Pressure Transducer Scaling

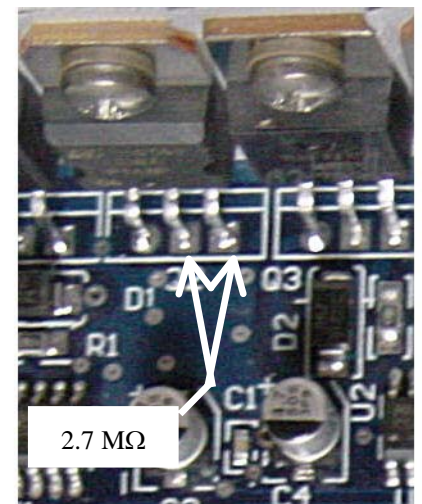
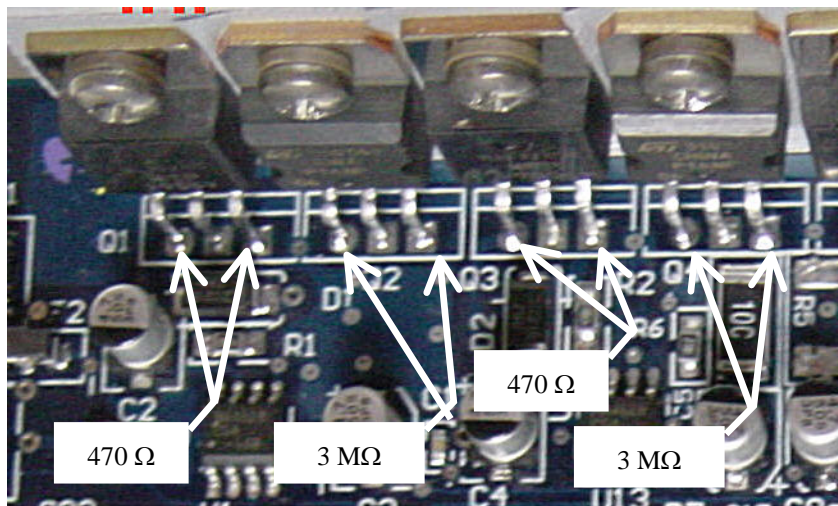


- For Transducers Scaled to **6000 PSI** upper limits (6142 max reading) use all three resistors, R45, R59, R30.
- For Transducers Scaled to **10,000 PSI** or **2500 PSI** upper limits (9999 max or 2512 PSI max reading) and use just two resistors, R45, R30.
- For Transducers Scaled to **200 PSI** upper limits (204 max reading) use just resistor, R45.

Series III Motor Drive PCB Board Level Information



MOSFET Tests



- Ever other resistor should have 470 Ω across leads 1 & 3
- The remaining MOSFETs should have around 3 M Ω across leads 1 & 3.
- All MOSFETs should have about 2.7 M Ω across leads 1 & 2.