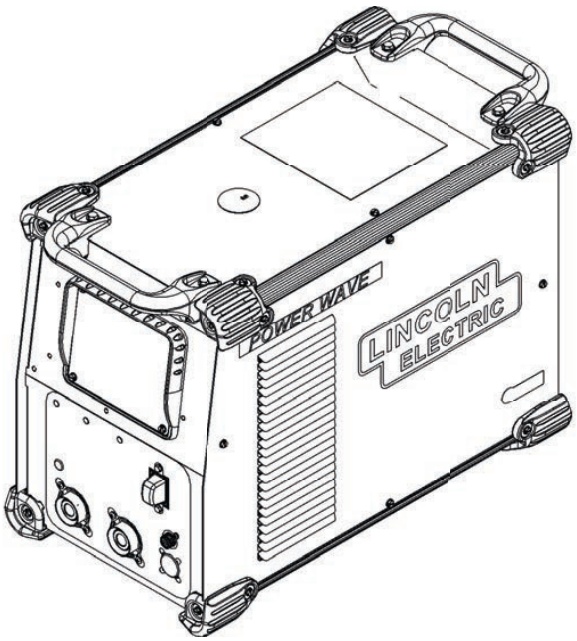
LINCOLN ELECTRIC

Power Wave® R350

For use with machines having Code Numbers:

Power Wave R350: 11745, 12482

SERVICE MANUAL



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THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

SAFETY DEPENDS ON YOU

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. **DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.** And, most importantly, think before you act and be careful.

⚠ WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life.

⚠ CAUTION

This statement appears where the information must be followed to avoid minor personal injury or damage to this equipment.

KEEP YOUR HEAD OUT OF THE FUMES.

DON'T get too close to the arc. Use corrective lenses if necessary to stay a reasonable distance away from the arc.

READ and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

USE ENOUGH VENTILATION or exhaust at the arc, or both, to keep the fumes and gases from your breathing zone and the general area.

IN A LARGE ROOM OR OUTDOORS, natural ventilation may be adequate if you keep your head out of the fumes (See below).

USE NATURAL DRAFTS or fans to keep the fumes away from your face.

If you develop unusual symptoms, see your supervisor. Perhaps the welding atmosphere and ventilation system should be checked.

WEAR CORRECT EYE, EAR & BODY PROTECTION

PROTECT your eyes and face with welding helmet properly fitted and with proper grade of filter plate (See ANSI Z49.1).

PROTECT your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.

PROTECT others from splatter, flash, and glare with protective screens or barriers.

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

Also, wear safety glasses in work area **AT ALL TIMES.**

SPECIAL SITUATIONS

DO NOT WELD OR CUT containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

DO NOT WELD OR CUT painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.

Additional precautionary measures

PROTECT compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.

BE SURE cylinders are never grounded or part of an electrical circuit.

REMOVE all potential fire hazards from welding area.

ALWAYS HAVE FIRE FIGHTING EQUIPMENT READY FOR IMMEDIATE USE AND KNOW HOW TO USE IT.

SECTION A: WARNINGS

CALIFORNIA PROPOSITION 65 WARNINGS

Diesel Engines

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Gasoline Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

ARC WELDING CAN BE HAZARDOUS. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE POWERED EQUIPMENT.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

- 2.d.1. Route the electrode and work cables together - Secure them with tape when possible.
- 2.d.2. Never coil the electrode lead around your body.
- 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
- 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
- 2.d.5. Do not work next to welding power source.

ELECTRIC SHOCK CAN KILL.

3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS CAN BURN.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES CAN BE DANGEROUS.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

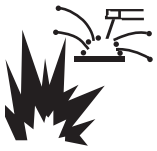
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER MAY EXPLODE IF DAMAGED.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.

FOR ELECTRICALLY POWERED EQUIPMENT.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

Refer to http://www.lincolnelectric.com/safety for additional safety information.

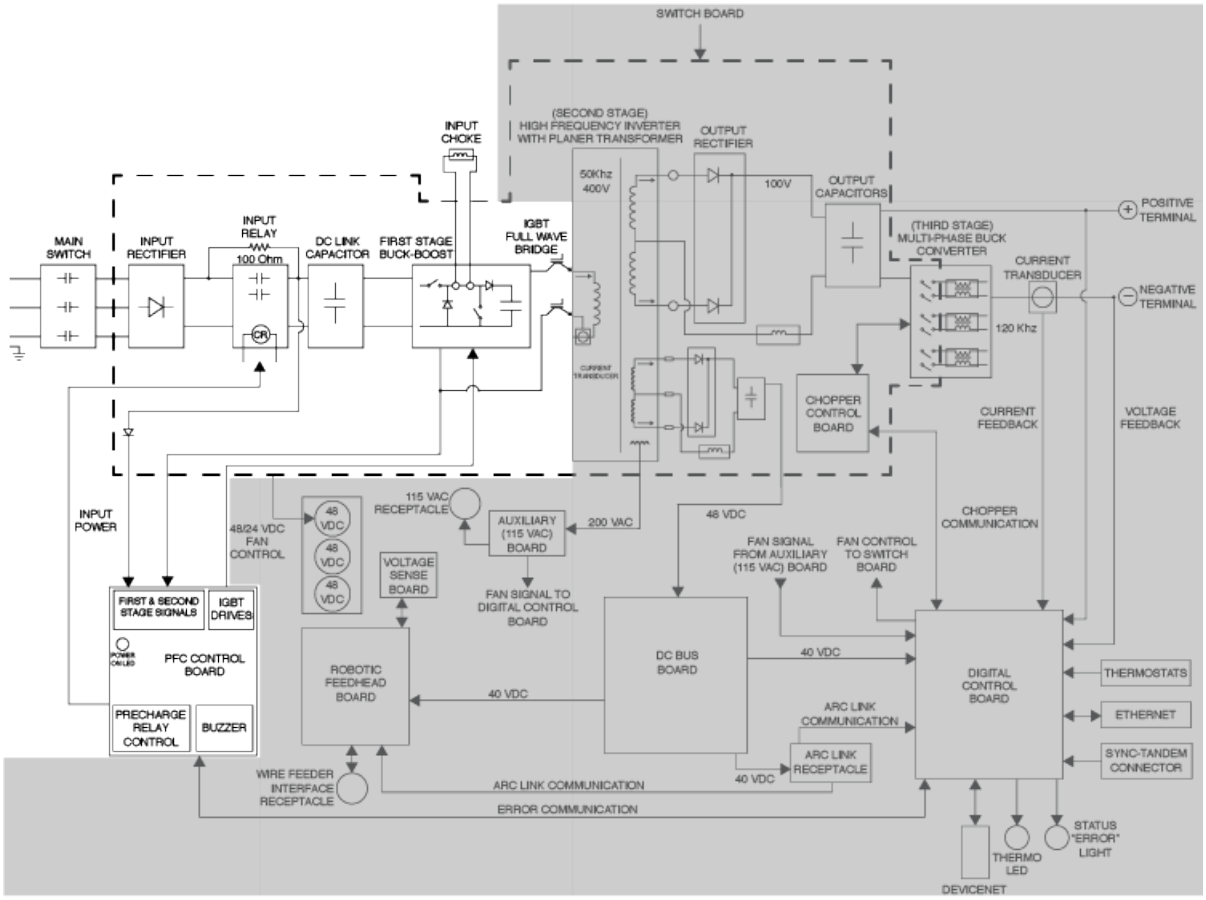
Power Wave® R350

Service Manual

Last update: 2017/09/01

Theory of Operation

Figure E.1 – Main input switch, input rectifier, soft start / input relay, DC link capacitor, buck-boost and power factor correction control board



Main Input Switch, Input Rectifier, Soft Start / Input Relay, DC Link Capacitor, Buck-Boost And Power Factor Correction Control Board

The Power Wave R350 can be connected to a variety of both three-phase or single phase input voltages. The Power Wave R350 automatically adjusts to operate with different AC input voltages. No reconnect switch settings are required. The initial input power is applied through a line switch located on the lower front panel of the machine. This AC input voltage is applied to an input rectifier where it is rectified to a DC voltage. The DC voltage is then applied to a soft-start circuit consisting of a 100 ohm resistor and a DC relay. The rectified input power is also connected, through a blocking diode, to the power factor correction board.

Initially the DC relay is not activated and the incoming DC voltage is applied to the DC link capacitor via the 100 ohm resistor. This resistor functions as a current limiting device allowing the DC link capacitor to charge slowly. The PFC board uses the incoming DC voltage to create three separate 15 VDC supplies. These auxiliary voltages are used to power the circuitry for the control circuits as well as the +15 volts for the buck-boost IGBTs and the soft start relay.

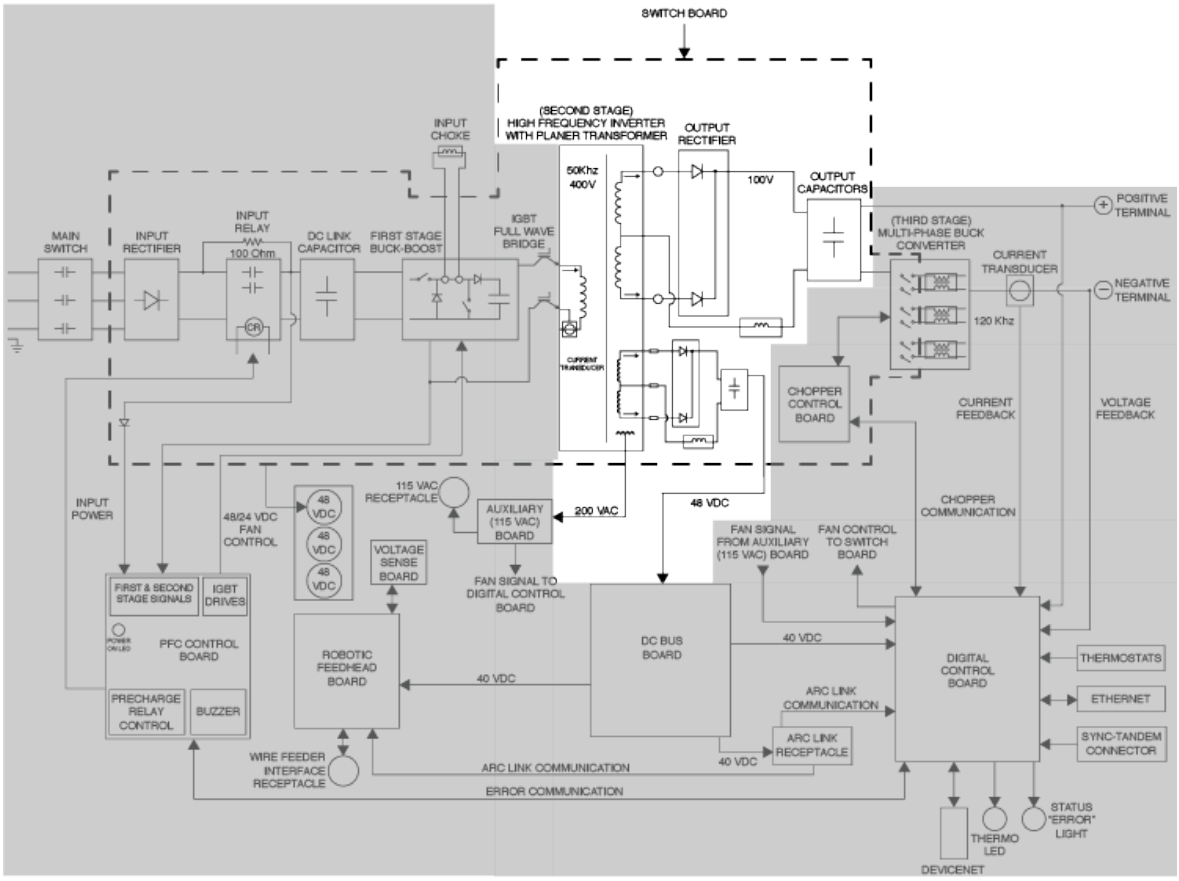
Under normal operating conditions the PFC board activates the soft start relay 50ms after input power is applied to the machine. The 100 ohm resistor will be “shorted out” by the relay’s contacts and the full input potential will be applied to the DC link capacitor. The DC link capacitor also functions as a voltage clamp for the buck-boost circuit.

The buck-boost circuit, located on the switch board, consists of a buck converter followed by a boost converter. The boost switch is active when the input voltage is at 230 VAC input or less. Under this condition the Buck switch is held on the entire time. The buck switch is active when the input voltage is at 325 VAC or more. Under this condition the boost switch is not active for most of the time. The buck-boost circuit operates at 25kHz. The buck-boost circuit’s output is a 400 volt regulated bus.

The output of the buck boost circuit is filtered and applied to an IGBT controlled full wave bridge inverter that is located on the switch board. The resultant 400 volt output is coupled to the primary winding of a planar transformer that is also located on the switch board. The full wave bridge operates at 60kHz. switching frequency with a 99% on time.

The PFC board controls the “firing” of the buck boost circuit and the IGBT full wave bridge circuit. This permits the PFC board to monitor and control the wave shape of the applied input current to provide an optimal power factor correction for the Power Wave R350.

Figure E.2 – Planar transformer, output rectification and filtering



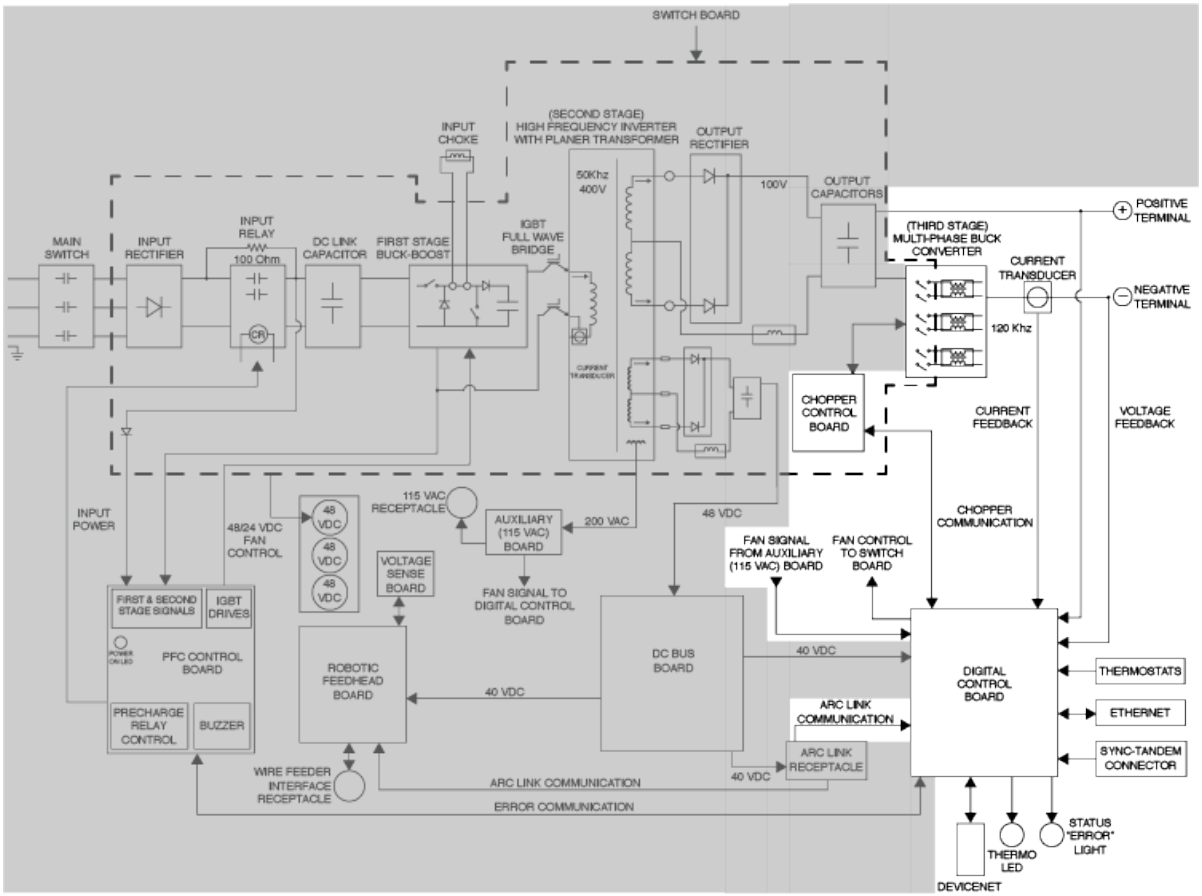
Planar Transformer, Output Rectification And Filtering

The planar transformer has three secondary windings. The 100 volt weld winding is center tapped and rectified. The 48 volt auxiliary winding is also center tapped and rectified. The third secondary winding supplies 200 VAC to the auxiliary (115 VAC) board. The term “Planar” refers to the design and construction of the transformer. The windings are created on printed circuit boards and stacked up to create a transformer.

The primary and secondary connections are oriented at opposite ends of the transformer. This type of assembly provides for tighter magnetic coupling between the primary and secondary windings resulting in lower leakage inductance, higher efficiency, cooler operation and reduced size.

The 100 volt output of the weld winding is rectified and filtered by three capacitors and an inductor. This filtered DC voltage is applied to the multi-phase output chopper circuit.
The 48 volt output from the planar transformer’s auxiliary winding is also rectified and filtered and is used to provide power for the fans and the DC bus board.

Figure E.3 – Multi-phase chopper, chopper control board, current transducer and digital control board



Multi-Phase Chopper, Chopper Control Board, Current Transducer And Digital Control Board

The multi-phase chopper is used to control the welding voltage and current output. It receives the 100 volt DC from the planar transformer and produces a regulated output for welding purposes. It contains six chopper phases in parallel that turn on 60 degrees out of phase, two are complimentary. Each conducts 180 degrees out of phase through the same output choke assembly.

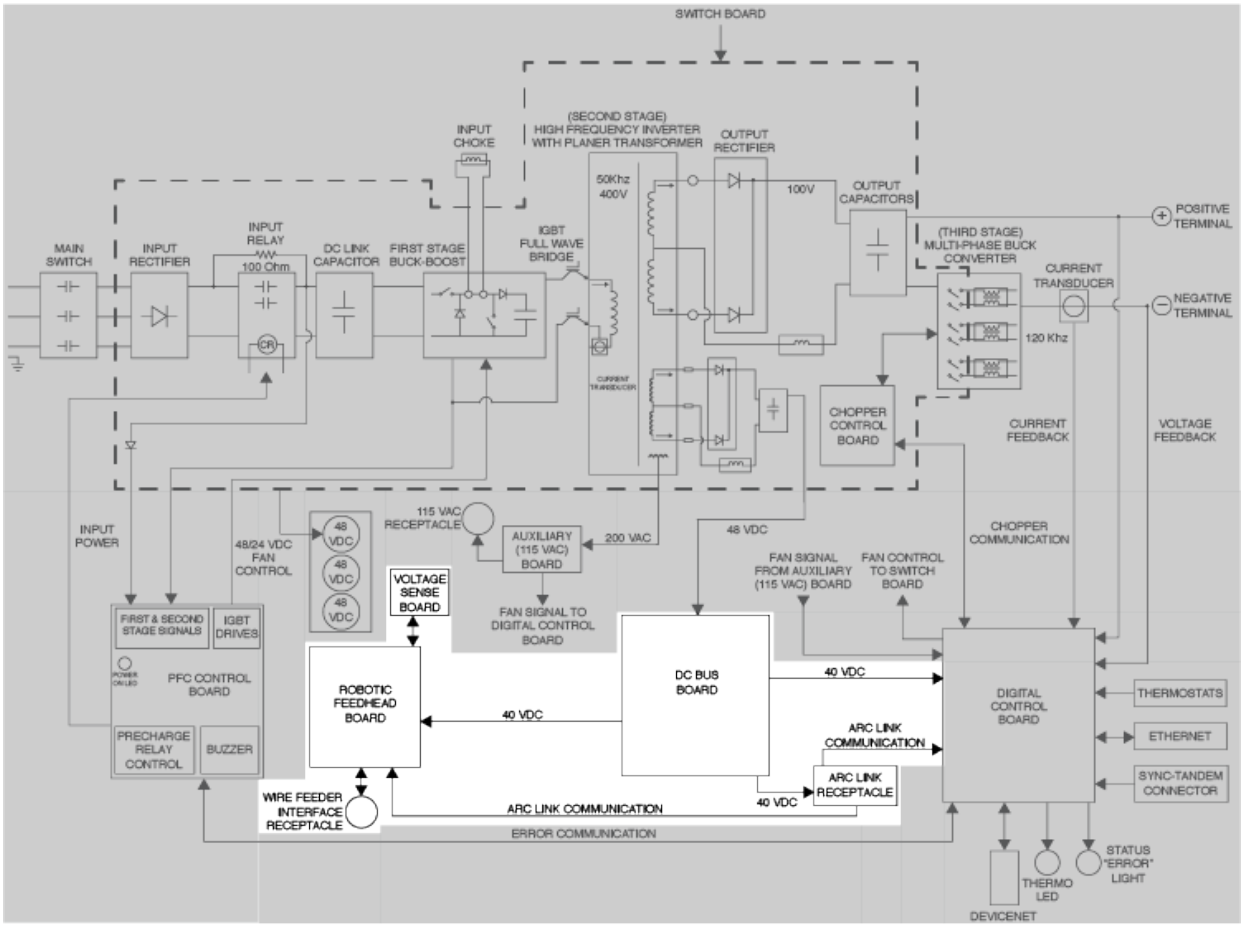
The chopper control board, located on the switch board, receives welding output commands from the control board. The chopper control board then determines the on-time of the six chopper IGBTs to meet the requirements set forth from the control board.

The control board receives commands and feedback information, via Arc-Link communication, from the Arc Link receptacle and the chopper control board. It also receives output current and voltage information from the current transducer and via leads 202 and 206 from the output terminals.

The current transducer monitors the output current and converts that information into a low voltage signal that is sent to the control board (500 Amps = 4.0 VDC). The control board uses this current feedback information along with the output voltage feedback to monitor and control the output of the machine. The control board also houses the software welding tables.

In addition, the control board monitors the thermostat circuitry, the shutdown circuitry and controls the two speed fans.

Figure E.4 – DC bus board and robotic feedhead board



DC Bus Board And Robotic Feedhead Board

The DC bus board receives 48 VDC supply voltage from the planar transformer circuitry. This voltage is regulated to 40 VDC and is applied to the ArcLink receptacle for wire feeder operation. 40 VDC is also applied to the control board and the robotic feedhead board.

The robotic feedhead board receives 40 VDC from the DC bus board. It also receives and sends information via the ArcLink digital communication network. The robotic feedhead board powers and monitors the wire drive motor, the tachometer circuitry on the wire drive and the gas solenoid via the wire feeder receptacle.

Thermal Protection

Two normally closed (NC) thermostats protect the machine from excessive operating temperatures. One is connected to the control board. It is located on top of the secondary heat sink. The other thermostat is located and integrated into the switch board and is monitored by the power factor correction board. Excessive temperatures may be caused by a lack of cooling air or by operating the machine beyond its duty cycle or output rating. If excessive operating temperatures should occur, the thermostats will prevent output from the machine. The yellow thermal light, located on the front of the machine, will be illuminated. The thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fans are operating normally, the power switch may be left on and the reset should occur within a 15-minute period. If the fans are not turning or the intake air louvers are obstructed, the power must be removed from the machine and the fan condition or air obstruction corrected.

Protective Circuits

Protective circuits are designed into the Power Wave R350 to sense trouble and shut down the machine before damage occurs to the machine's internal components. Error Codes will be flashed out by the light on the control board and will help identify the reason for the shutdown. They should all be steady green. See the ***Troubleshooting & Repair Section*** for more information regarding Error Codes. Fault codes can also be seen by using the diagnostic software.

Over Current Protection

If the average weld current exceeds 375 amps the machine's output will be disabled.

Troubleshooting & Repair

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM). Look under the column labeled "PROBLEM" (SYMPTOMS). This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into four main categories: Output Problems, Welding Problems, Ethernet Problems and Wire Feed Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)", lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this section. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the referred to test points, components, terminal strips, etc., can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

• Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

⚠ CAUTION

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

PC board can be damaged by static electricity.

• Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

ATTENTION
Static-Sensitive Devices
Handle only at Static-Safe Workstations

Reusable Container
Do Not Destroy

• If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

• Tools which come in contact with the PC board must be conductive, anti-static or static-dissipative.

• Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

• If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

• If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.

a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks and terminal strips.

b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.

6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

Troubleshooting guide

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
OUTPUT PROBLEMS		
Major physical or electrical damage is evident.	1. Contact your local authorized Lincoln Electric Service Facility.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
The input fuses repeatedly fail or the input circuit breakers keep tripping.	1. Make sure the fuses or breakers are properly sized. 2. The welding procedure may be drawing too much input current or the duty cycle may be too high. Reduce the welding current and/or reduce the duty cycle. 3. Check for error codes. See ***Status LED Troubleshooting*** in this section.	1. Perform the ***Input Rectifier Test Procedure***. 2. Perform the ***Switch Board Test Procedure***. 3. Perform the ***Power Factor Correction (PFC) Control Board Test Procedure***.
The machine will not power up. No lights or displays. The machine appears to be off.	1. Make sure the proper input voltage is being applied to the machine (check fuses or breakers). 2. Make sure the input supply disconnect has been turned ON. 3. Make certain the input power switch is in the ON position. 4. Check for error codes. See ***Status LED Troubleshooting*** in this section.	1. Check the input switch for proper operation. Also check the associated leads for loose or faulty connections. See the Wiring Diagram. 2. Perform the ***DC Bus Board Test Procedure***. 3. Perform the ***Input Rectifier Test Procedure***. 4. Perform the ***Power Factor Correction (PFC) Control Board Test Procedure***.
⚠ CAUTION		
If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.		

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
OUTPUT PROBLEMS		
The Power Wave R350 does not have welding output.	1. Make sure the input voltage is correct. 2. If the symptom is accompanied by an error code, see ***Status LED Troubleshooting*** in this section. 3. There may be an external "short" in the external output circuitry. Remove all loads from the output terminals and restart the machine. 4. If the thermal LED is illuminated the unit may be overheated. Adjust the welding load and/or duty cycle to coincide with the output limits of the Power Wave R350. Also see the symptom "The thermal LED is illuminated" in this section.	1. Perform the ***Input Rectifier Test Procedure***. 2. Perform the ***Switch Board Test Procedure***. 3. Perform the ***Planar Transformer Resistance Test Procedure***. 4. Perform the ***Digital Control Board Test Procedure***. 5. Perform the ***Robotic Feedhead Board Test Procedure***. 6. Perform the ***Output Rectifier Test Procedure***. 7. Perform the ***DC Bus Board Test Procedure***.
⚠ CAUTION		
If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.		

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
OUTPUT PROBLEMS		
The thermal LED is illuminated. The machine regularly overheats. There is no welding output.	1. The welding application may be exceeding the recommended duty cycle and/or current limits of the machine. 2. Dirt and dust may have clogged the cooling inside the machine. See the Maintenance section of the Operators manual. 3. The air intake and exhaust louvers may be blocked due to inadequate clearance around the machine. 4. Make sure the fans are functioning correctly. The fans should run in a low speed setting when the machine is at idle and a high speed when welding output is activated. The fans should also run if a thermostat has tripped.	1. Check the thermostats and associated wiring for loose or faulty connections. See Wiring Diagram. 2. Check the DC voltages being applied to the fans at lead 351 (-) to lead 353 (+). At the low speed setting the voltage should be 24 VDC. At the high speed setting the voltage should be 48 VDC. See Wiring Diagram.
The 'Real Time Clock' no longer functions.	1. The digital control board battery may be faulty.	1. Replace the battery if necessary (type BS2032).
The Power Wave R350 will not produce full output.	1. The input voltage may be too low. See the check for error codes. See ***Status LED Troubleshooting*** in this section. 2. Make certain the input voltage is correct for the machine.	1. Perform the ***Current Transducer Test Procedure***. 2. Perform the Power Wave Verification And Calibration Procedures, See SVM251. 3. The control board may be faulty. Perform the ***Digital Control Board Test Procedure***.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
WELDING PROBLEMS		
General degradation of the welding performance.	1. Check for proper wire feeding. Make certain that the actual wire feed speed is the same as the preset. 2. Verify that the correct wire drive and gear ratio have been selected. 3. Check the welding cables for loose or faulty connections. 4. Check for adequate gas shielding. 5. Make sure the welding process is correct for wire feed and voltage settings.	1. Perform the Power Wave Verification And Calibration Procedures, see SVM251.
The wire burns back to the tip at the end of the weld.	1. Reduce the burnback time. 2. Reduce the workpoint.	1. N/A.
During a weld the machine shuts down.	1. The secondary current limit has been exceeded and the machine shuts down to protect itself. Adjust the procedure to reduce the load and lower the output current draw.	1. A non-recoverable internal fault will interrupt the welding output. This condition will also result in a status light blinking. Check for error codes. See ***Status LED Troubleshooting*** in this section.
The arc is excessively long and erratic.	1. In the wire feeder, make certain the correct wire drive and gear ratio have been selected for the welding process being used. 2. Make sure the shielding gas is correct for the welding process being used. Also make sure the flow rate is correct.	1. Perform the Power Wave Verification And Calibration Procedures, see SVM251.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
ETHERNET PROBLEMS		
The system will not connect.	1. Make sure that the correct patch cable or cross cable is being used. 2. Make sure the software is not blocking the connection. See the on line diagnostic utility. 3. Verify that the cables are fully inserted into the bulk head connector. 4. Verify that the network device connected to the Power Wave is either a 10-baseT device or a 10/100-base-T device.	1. Use Weld Manager (included on the Power Wave Utilities and Service Navigator CD's or available at www.powerwavesoftware.com to verify the correct IP address information has been entered. 2. Verify that no duplicate IP addresses exist on the network.
The Ethernet connection drops out while welding.	1. Make sure all of the connections are tight and secure.	1. Make certain that the network cable is not located next to any heavy current carrying conductors. This would include input power cables and welding output cables.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Observe Safety Guidelines detailed in the beginning of this manual.		**TROUBLESHOOTING GUIDE**
PROBLEMS (SYMPTOMS)	**POSSIBLE AREAS OF MISADJUSTMENT(S)**	**RECOMMENDED COURSE OF ACTION**
WIRE FEED PROBLEMS		
There is no 115 VAC auxiliary output.	1. Check circuit breaker CB1, reset if necessary. 2. Check for loose or faulty connections between the 115 VAC receptacles and the auxiliary (115 VAC) board. See Wiring Diagram.	1. Perform the ***Auxiliary (115 VAC) Board Test Procedure***.
There is no wire feed.	1. Make certain the robotic wire drive is connected properly to the Power Wave R350 machine. 2. Check leads and connections at the wire feeder receptacle.	1. Perform the ***Robotic Feedhead Board Test Procedure***.
The wire feed speed is erratic and no control.	1. Make certain the robotic wire drive is connected properly to the Power Wave R350 machine. 2. Check leads and connections at the wire feeder receptacle.	1. Perform the ***Robotic Feedhead Board Test Procedure***.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

Not all of the Power Wave R350 errors will be displayed on the user interface (if it is installed). There are two status lights that display error codes. If a problem occurs it is important to note the condition of the status lights. **Therefore, prior to cycling power to the system, check the power source status light for error sequences as noted below**.

There is one externally mounted status lights located on the case front of the machine. This status light corresponds to the digital control board's status. A second status light is internal and is located on the input control board and can be seen by looking through the left case side louvers.

There is an audible beeper associated with this input control board's status light. So the error codes on the input board can be detected through either the status light or the status beeper.

Included in this section is information about the Status Lights and some basic troubleshooting charts for both machine and weld performance.

The status lights for the digital control board are dual-color LED's. Normal operation for each is steady green, whereas the status light on the input control board is one color. Normal operation is for the status light to be off (and the buzzer to be off).

Error conditions are indicated in the following chart.

Observe Safety Guidelines detailed in the beginning of this manual.	**STATUS LED**	
LIGHT CONDITION	**MEANING**	
	POSSIBLE DIGITAL CONTROL BOARD STATUS LIGHT	**INPUT CONTROL BOARD**
STEADY GREEN	System OK. Power source is operational and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.	NOT APPLICABLE.
BLINKING GREEN	Occurs during power up or a system reset, and indicates the Power Wave R350 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on or if the system configuration is changed during operation.	NOT APPLICABLE.
FAST BLINKING GREEN	Indicates auto-mapping has failed.	NOT APPLICABLE.
ALTERNATING GREEN AND RED	Non-recoverable system fault. If the status lights are flashing any combination of red and green, errors are present. **Read the error code(s) before the machine is turned off.**	NOT APPLICABLE.
	Error Code interpretation through the status light is detailed in this service manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the status light.	
	Error codes can also be retrieved with the **Diagnostics Utility** (referred to on the **Service Navigator** DVD or available at www.powerwavesoftware.com). This is the preferred method, since it can access historical information contained in the error logs.	
	To clear the active error(s), turn power source off and back on to reset.	
STEADY RED	NOT APPLICABLE.	NOT APPLICABLE.
BLINKING RED	NOT APPLICABLE.	ERROR CODE INTERPRETATION - INDIVIDUAL CODE DIGITS ARE

		FLASHED IN RED WITH A LONG PAUSE BETWEEN DIGITS. THESE ERROR CODES ARE THREE DIGIT CODES THAT ALL START WITH A NUMBER THREE.
STATUS LED OFF	NOT APPLICABLE.	SYSTEM OK.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

ERROR CODES FOR THE POWER WAVE R350

The following is a list of possible error codes for the Power Wave R350.

DIGITAL CONTROL BOARD ("STATUS" LIGHT)		
ERROR CODE #		**INDICATION**
36	THERMAL ERROR	Indicates over temperature. Usually accompanied by thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
54	SECONDARY (OUTPUT) OVER CURRENT ERROR	The long term average secondary (weld) current limit has been exceeded. **NOTE:** The long term average secondary current limit is 325 amps.
56	CHOPPER COMMUNICATION ERROR	Indicates communication link between digital control board and chopper has errors. If cycling the input power on the machine does not clear the error, contact the Lincoln Electric service department at 1-888-935-3877.
58	PRIMARY FAULT ERROR	Review error code from input board status light or status beeper. Most likely caused by an over power condition which caused an under voltage on the primary bus. If cycling the input power on the machine does not clear the error, contact the Lincoln Electric service department at 1-888-935-3877.
OTHER		Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the power source control board. If cycling the input power on the machine does not clear the error, contact the Lincoln Electric service department at 1-888-935-3877.

POWER FACTOR CORRECTION (PFC) CONTROL BOARD		
ERROR CODE #		**INDICATION**
331	PEAK INPUT CURRENT LIMIT	Input current limit has been exceeded. Typically indicates short term power overload. If problem persists, contact the Lincoln Electric service department at 1-888-935-3877.
333	UNDER-VOLTAGE LOCKOUT	+15 VDC supply on power factor correction (PFC) control board too low. Verify input voltage is within the acceptable range. If problem persists, contact the Lincoln Electric service department at 1-888-935-3877.
336	THERMAL FAULT	Thermostat on primary module tripped. Typically caused by bottom fan not working.
337	PRE-CHARGE TIMEOUT	Problem with start-up sequence. If problem persists, contact the Lincoln Electric service department at 1-888-935-3877.
346	TRANSFORMER PRIMARY OVER CURRENT	Transformer current too high. Typically indicates short term power overload. If problem persists, contact the Lincoln Electric service department at 1-888-935-3877.
OTHER		Contact the Lincoln Electric service department at 1-888-935-3877.

WIRE DRIVE MODULE		
ERROR CODE #		**INDICATION**
81	MOTOR OVERLOAD	Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).
82	MOTOR OVERCURRENT	Absolute maximum motor current level has been exceeded. This is a short term average to protect drive circuitry.
83	SHUTDOWN #1	The shutdown inputs on the Power Wave R350 have been disabled. The presence of these errors indicates the robotic feedhead board may contain the wrong operating software.
84	SHUTDOWN #2	

Test Procedures

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Case Covers.

MATERIALS NEEDED

5/16” Nutdriver
7/16” Nutdriver

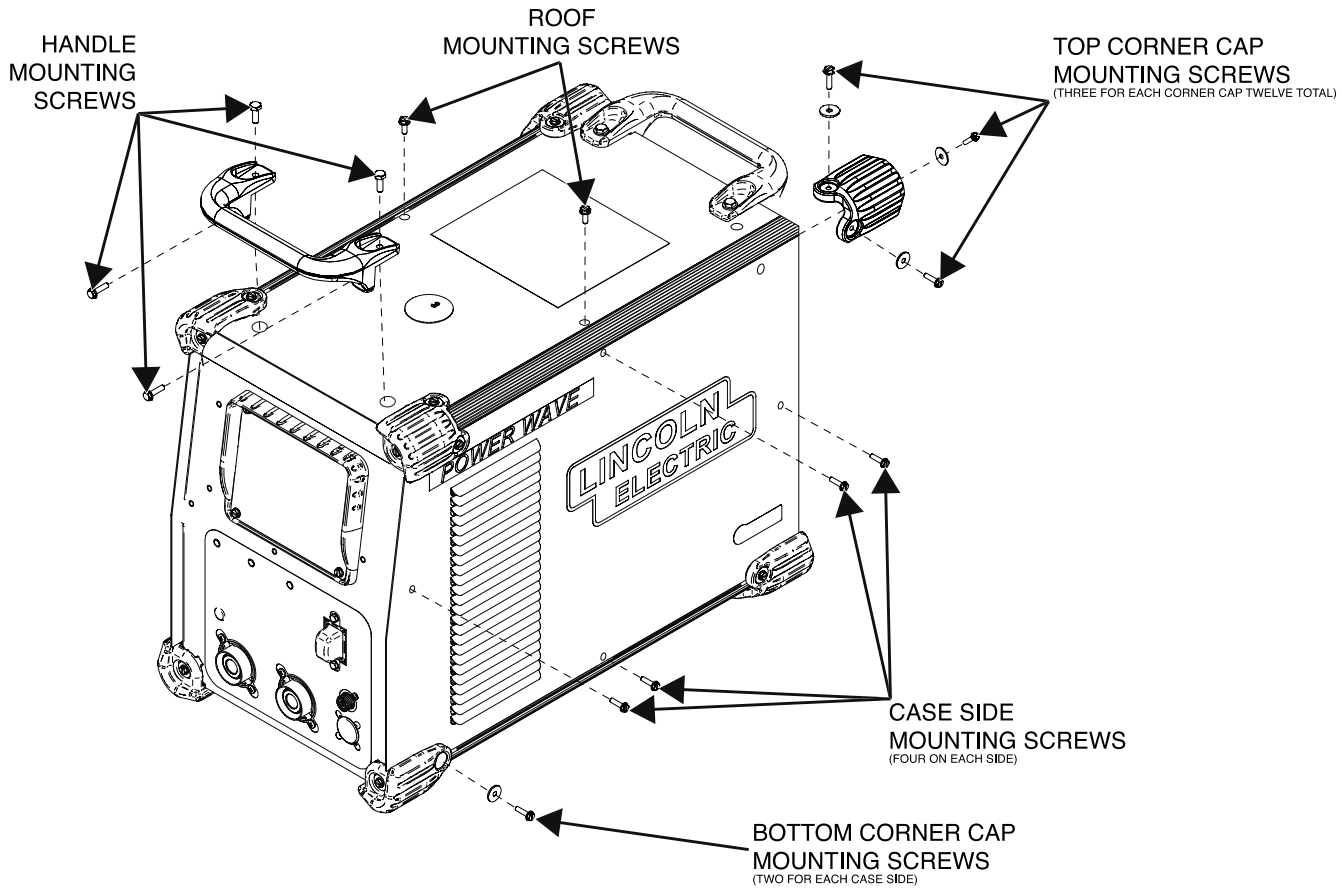
REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Using the 5/16” nutdriver, remove the three screws and flat washers securing each of the four (top) corner end caps (twelve screws and flat washers total) to the machine. See ***Figure F.1***. Note washer placement for reassembly.
3. Using a 5/16” nutdriver, remove the two screws and flat washers from the bottom corner end caps that secure each case side to the machine (four screws and flat washers total). See ***Figure F.1***. Note washer placement for reassembly.
4. Using a 5/16” nutdriver, remove the four screws securing the left case side to the machine. See ***Figure F.1***.
5. The left case side can now be removed.
6. Using a 5/16” nutdriver, remove the four screws securing the right case side to the machine. See ***Figure F.1***.
7. The right case side can now be removed.
8. Using a 7/16” nutdriver, remove the four screws and washers securing each handle to the machine (eight screws and washers total). See ***Figure F.1***.
9. Using a 5/16” nutdriver, remove the two screws securing the roof to the machine. See ***Figure F.1***.
10. Perform any tests /replacement procedures.

REPLACEMENT PROCEDURE

1. Carefully position the roof onto the machine.
2. Using a 5/16” nutdriver, attach the two screws securing the roof to the machine.
3. Carefully position each handle onto the machine.
4. Using a 7/16” nutdriver, attach the four screws and washers securing each handle to the machine (eight screws and washers total).
5. Carefully position the right case side onto the machine.
6. Using a 5/16” nutdriver, attach the four screws securing the right case side to the machine.
7. Carefully position the left case side onto the machine.
8. Using a 5/16” nutdriver, remove the four screws securing the left case side to the machine.
9. Using the 5/16” nutdriver, attach the two screws and flat washers to the bottom corner end caps that secure each case side to the machine (four screws and flat washers total).
10. Carefully position the four (top) corner end caps onto the machine.
11. Using the 5/16” nutdriver, attach the three screws and flat washers securing each of the four (top) corner end caps (twelve screws and flat washers total) to the machine.

Figure F.1 – Case cover mounting screw locations



CAPACITOR DISCHARGE PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will help determine if the Capacitors are discharged.

MATERIALS NEEDED

Resistor (25-1000 ohms and 25 watts minimum) Lincoln Part #S01404-114 Works Well For This Purpose
Electrically Insulated Gloves
Electrically Insulated Pliers
Jumper Leads
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. The DC link capacitor is located on the switch board. See ***Figure F.2***. See Wiring Diagram.
4. Using a volt/ohmmeter, check the voltage across the terminals of the DC link capacitor. See ***Figure F.3***. See Wiring Diagram.
5. If any voltage is present, using the high wattage resistor (25-1000 ohms @ 25 watts minimum), electrically insulated gloves and pliers, discharge the capacitor by holding the resistor terminals on the capacitor terminals for 10 seconds. See ***Figure F.3***. See Wiring Diagram.
   NOTE: DO NOT TOUCH THE CAPACITOR TERMINALS WITH YOUR BARE HANDS. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
6. Using a volt/ohmmeter, recheck the voltage across the capacitor terminals. See ***Figure F.3***. See Wiring Diagram. The voltage should be zero.
7. If any voltage remains, repeat the discharge procedure.
   NOTE: Any voltage present after discharge has been performed, is an abnormal condition and may indicate a switch board problem.
8. Using a volt/ohmmeter, carefully check for DC voltage at B48 - B49 on the switch board. See ***Figure F.3***. See Wiring Diagram.
9. If voltage is present, wait for voltage to decay before proceeding.

Figure F.2 – Switch board location

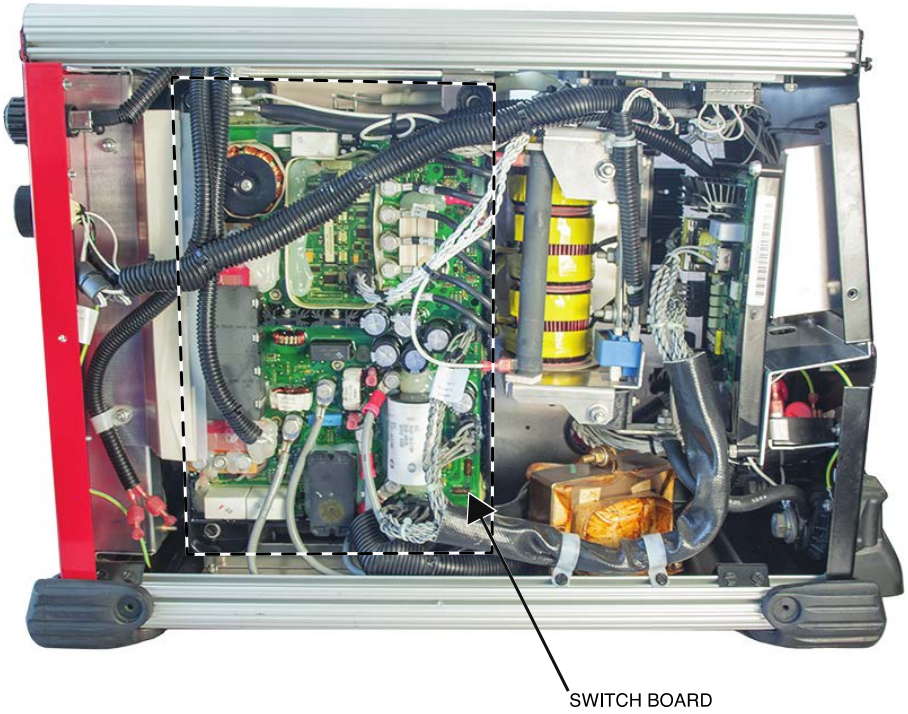
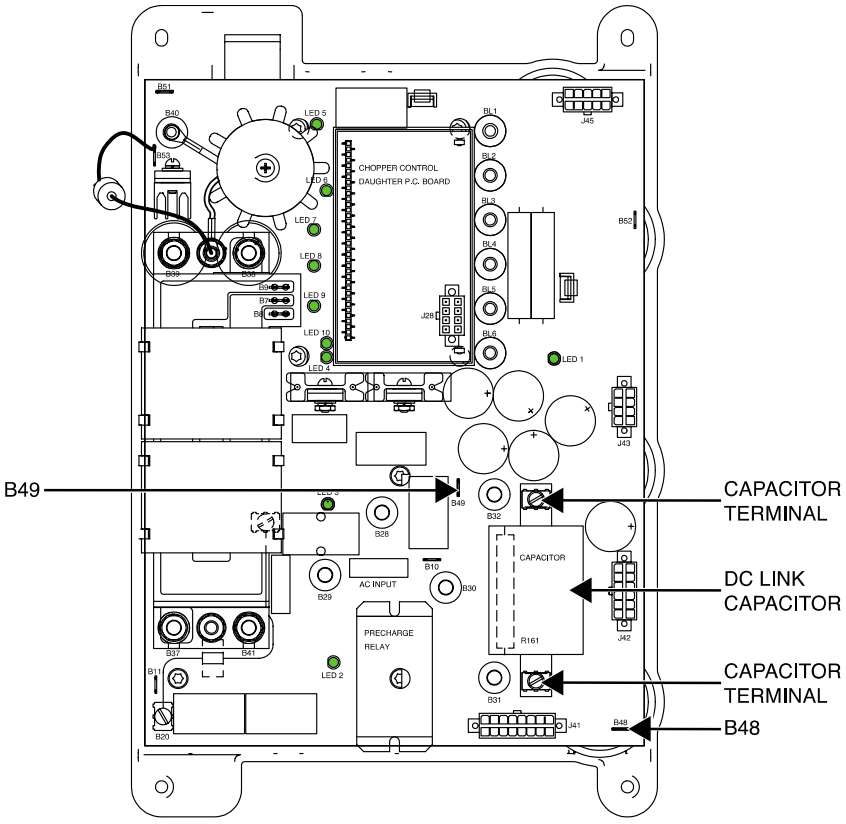


Figure F.3 – Capacitor discharge test point locations



POWER FACTOR CORRECTION (PFC) CONTROL BOARD TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Power Factor Correction (PFC) Control Board is functioning properly. There are very high voltages present on the PFC Control Board. This test will be limited to LED and audio error codes and also resistance checks with the input power removed from the machine.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the PFC control board. See ***Figure F.4***. See Wiring Diagram.
5. Apply the correct input power to the Power Wave R350 machine.
6. Locate LED 2 on the PFC control board. See ***Figure F.5***. See Wiring Diagram.
7. LED 2 should be illuminated and green during proper operation of the PFC control board. See ***Table F.1***.
8. Locate LED 1 and the audio buzzer on the PFC control board. See ***Figure F.5***.
9. If there is a problem with the PFC control board, LED 1 and the buzzer will provide an error code. See ***Figure F.5*** for error codes. LED 2 will also be OFF or blinking.
10. If further testing is required remove the input power to the machine and perform the resistance tests in ***Table F.2***. See ***Figures F.4***, ***F.5***, ***F.6*** and ***F.7*** for test point locations. See Wiring Diagram. To access some of the test points the PFC control board may have to be removed from its mounting studs. See the ***Power Factor Correction (PFC) Control Board Removal Procedure***.
11. When testing is complete connect all previously disconnected plugs.
12. Perform the ***Case Cover Replacement Procedure***.

Table F.1 – PFC control board LED codes and indications

LED #	COLOR	FUNCTION
2	GREEN	15 VDC POWER SUPPLY FUNCTION PROPERLY WHEN ILLUMINATED.
1	RED	ERROR CODE (LED WILL FLASH ERROR AND BUZZER WILL SOUND). SEE BELOW FOR DETAILS.
• PAUSE BEFORE REPEATING THE CODE: 3.5 SECONDS. • PAUSE BETWEEN DIGITS OF THE CODE: 1.5 SECONDS. • PAUSE BETWEEN SOUNDS/FLASHES INDICATING A SPECIFIC DIGIT: 0.5 SECONDS.		
ERROR CODE		
ERROR	**EXPLANATION**	
331	PEAK INPUT CURRENT LIMIT.	
334	START UP CURRENT CHECK FAILURE.	
335	START UP VOLTAGE CHECK FAILURE.	
336	THERMAL FAULT (NO FIRST STAGE FAN).	
337	PRECHARGE TIMEOUT.	
346	TRANSFORMER PRIMARY OVERCURRENT.	

Table F.2 – PFC control board resistance tests

DESCRIPTION	METER TEST POINTS AND POLARITY	EXPECTED READINGS	CONDITIONS
AUXILIARY POWER INPUT CIRCUIT	PLUG J27 PIN 3 (-) TO PLUG J27 PIN 4 (+)	VERY HIGH RESISTANCE. GREATER THAN 50,000 OHMS.	INPUT POWER REMOVED. REMOVE PLUG J27 FROM THE PFC BOARD. TYPICAL FAILURE IS A SHORT.
AUXILIARY POWER DIODE CIRCUIT ON SWITCH BOARD	TERMINAL B48 (-) ON THE SWITCH BOARD TO PLUG J27 PIN 4 (+)	VERY HIGH RESISTANCE. GREATER THAN 50,000 OHMS.	INPUT POWER REMOVED. TYPICAL FAILURE IS A SHORT. IF SHORTED PERFORM THE ***SWITCH BOARD REMOVAL AND REPLACEMENT PROCEDURE***.
AUXILIARY POWER DIODE CIRCUIT ON SWITCH BOARD	TERMINAL B12 (-) ON THE SWITCH BOARD TO PLUG J27 PIN 4 (+)	VERY HIGH RESISTANCE. GREATER THAN 50,000 OHMS.	INPUT POWER REMOVED. TYPICAL FAILURE IS A SHORT. IF SHORTED PERFORM THE ***SWITCH BOARD REMOVAL AND REPLACEMENT PROCEDURE***.
PRE-CHARGE RELAY DRIVE CIRCUIT	PLUG J23 PIN 3 (-) TO PLUG J23 PIN 4 (+)	VERY HIGH RESISTANCE. GREATER THAN 30,000 OHMS.	INPUT POWER REMOVED. REMOVE PLUG J41 FROM THE SWITCH BOARD. TYPICAL FAILURE IS A SHORT.
FULL BRIDGE GATE	PLUG J23 PIN 6 (+)	HIGH RESISTANCE.	INPUT POWER REMOVED.

DRIVE CIRCUIT	TO PLUG J23 PIN 5 (-)	GREATER THAN 5,000 OHMS.	REMOVE PLUG J41 FROM THE SWITCH BOARD. TYPICAL FAILURE IS A SHORT.
MAIN BUCK GATE DRIVE CIRCUIT	PLUG J23 PIN 11 (-) TO PLUG J23 PIN 12 (+)	RESISTANCE SHOULD BE GREATER THAN 500 OHMS.	INPUT POWER REMOVED. REMOVE PLUG J41 FROM THE SWITCH BOARD. TYPICAL FAILURE IS A SHORT.
AUXILIARY BUCK GATE DRIVE	PLUG J23 PIN 2 (-) TO PLUG J23 PIN 1 (+)	RESISTANCE SHOULD BE GREATER THAN 500 OHMS.	INPUT POWER REMOVED. REMOVE PLUG J41 FROM THE SWITCH BOARD. TYPICAL FAILURE IS A SHORT.
MAIN BOOST GATE DRIVE	PLUG J23 PIN 8 (-) TO PLUG J23 PIN 7 (+)	RESISTANCE SHOULD BE GREATER THAN 500 OHMS.	INPUT POWER REMOVED. REMOVE PLUG J43 FROM THE SWITCH BOARD. TYPICAL FAILURE IS A SHORT.
AUXILIARY BOOST GATE CIRCUIT	PLUG J23 PIN 9 (-) TO PLUG J23 PIN 10 (+)	RESISTANCE SHOULD BE GREATER THAN 500 OHMS.	INPUT POWER REMOVED. REMOVE PLUG J43 FROM THE SWITCH BOARD. TYPICAL FAILURE IS A SHORT.

Figure F.4 – Power factor correction (PFC) control board location

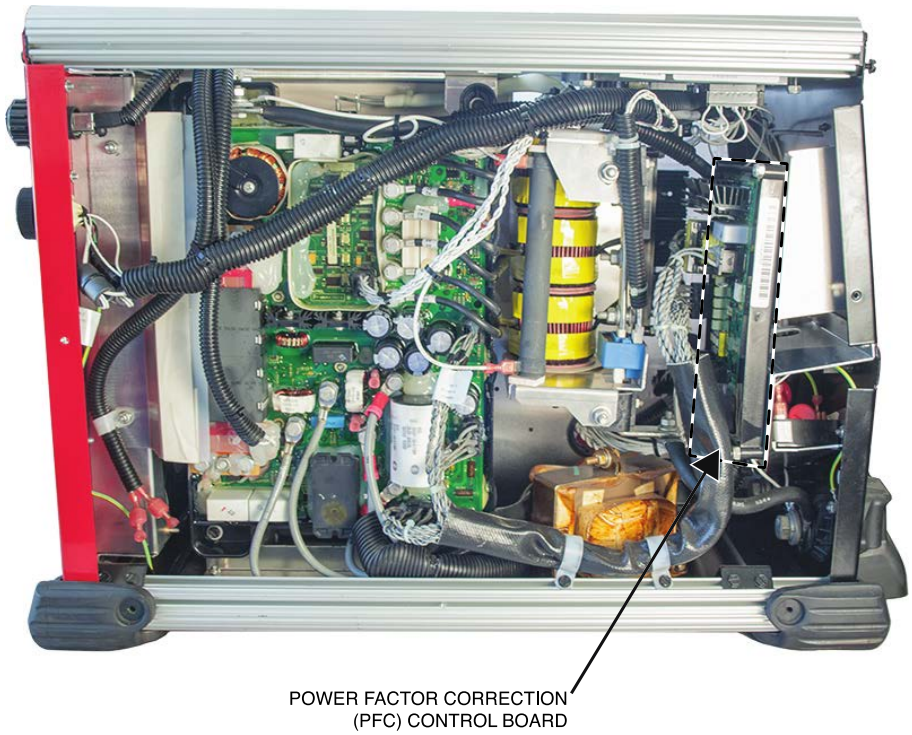


Figure F.5 – Power factor correction (PFC) control board plug and LED locations

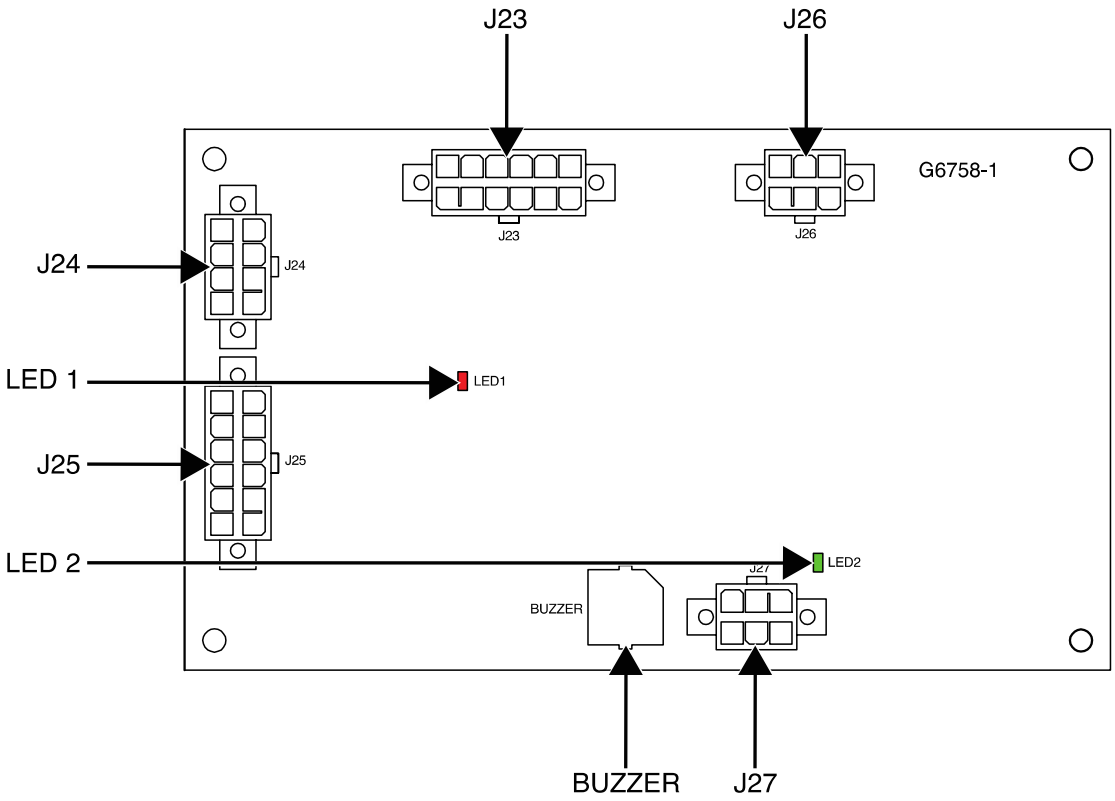


Figure F.6 – Power factor correction (PFC) control board lead locations

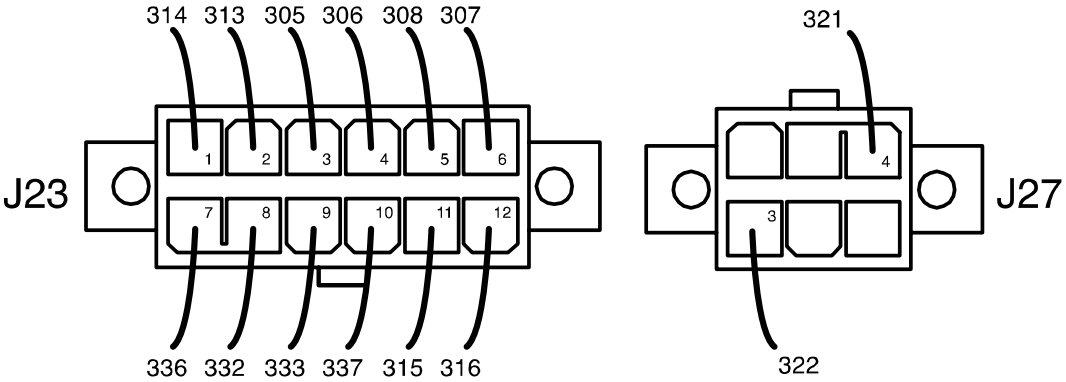
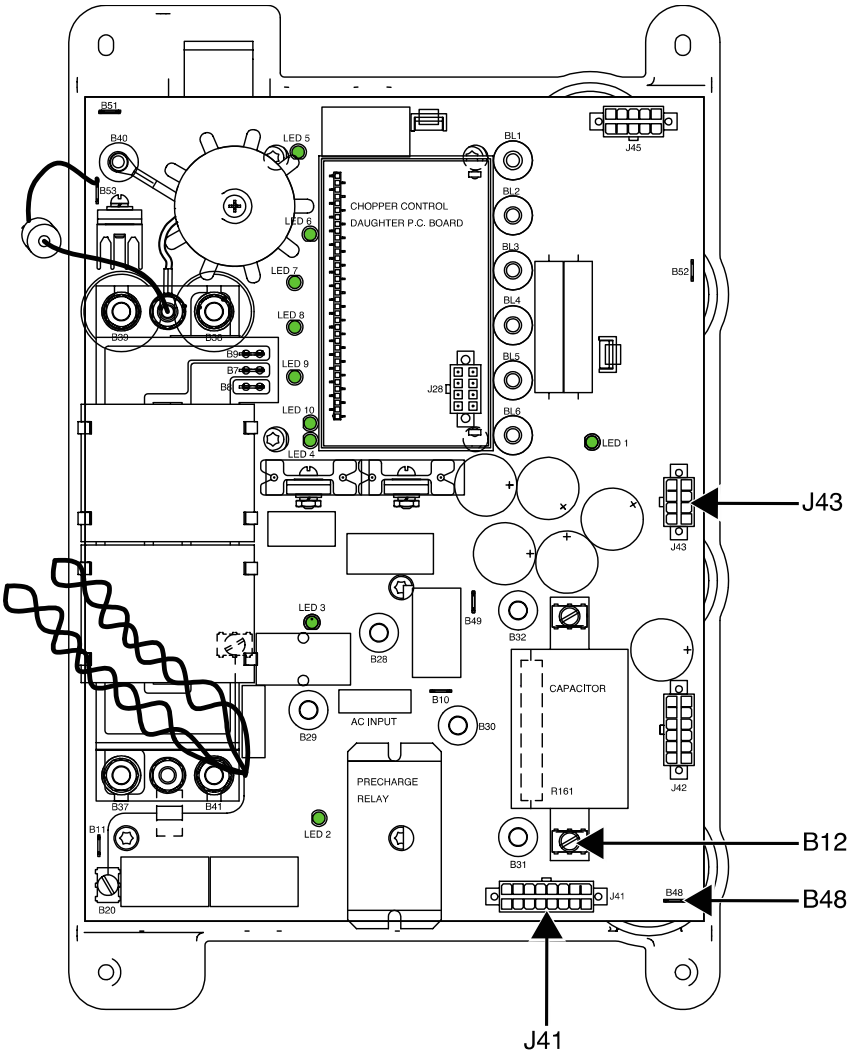


Figure F.7 – Switch board plug and terminal locations



DIGITAL CONTROL BOARD TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Digital Control Board is receiving the correct input voltage and if the board is functioning properly. The test will not test all of the circuits on the board.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the digital control board. See ***Figure F.8***.
5. Locate Plugs J4, J5, J7, J8, J9 and J12 on the digital control board. See ***Figure F.9***. See Wiring Diagram.
6. Carefully apply the correct input voltage to the Power Wave R350 machine.
7. Check for the correct operation of the LED lights on the digital control board. See ***Table F.3***. See ***Figure F.9***.
8. Using a volt/ohmmeter, perform the voltage tests in ***Table F.4***. See ***Figures F.9*** and ***F.10***.
9. Carefully remove input power from the Power Wave R350 machine.
10. Using a volt/ohmmeter, perform the resistance checks in ***Table F.5***. See ***Figures F.9*** and ***F.10***.
11. If the correct input voltage is being applied to the digital control board and the correct output voltages are not being generated, the digital control board may be faulty.
12. If faulty, perform the ***Digital Control Board Removal And Replacement Procedure***.
13. Perform the ***Case Cover Replacement Procedure***.

Table F.3 – Digital control board LED descriptions and functions

LED #	COLOR	FUNCTION
1	GREEN	STATUS IS OK
2	RED	ERROR CODE (BLINKING) (SEE ERROR CODES IN ***TROUBLESHOOTING GUIDE***)
3	GREEN	OUTPUT ENABLED
4	GREEN	SINGLE PHASE INPUT
5	GREEN	ELECTRODE SENSE
6	GREEN	WORK SENSE
7	GREEN	ETHERNET LINK / ACTIVITY STATUS
8	GREEN	ETHERNET SPEED STATUS
9	GREEN	INPUT SUPPLY STATUS (30 VDC TO 55 VDC)
10	GREEN	DEVICENET EXTERNAL 24 VDC PRESENT

Table F.4 – Digital control board voltage tests

DESCRIPTION	TEST POINT (+)	TEST POINT (-)	EXPECTED READING	CONDITIONS
INPUT SUPPLY FROM PFC BOARD	PLUG J4 PIN 1 (LEAD 358)	PLUG J4 PIN 2 (LEAD 356)	40 VDC	INPUT POWER APPLIED TO MACHINE.
POWER FROM DIGITAL CONTROL BOARD TO CHOPPER BOARD	PLUG J12 PIN 3 (LEAD 341)	PLUG J12 PIN 12 (LEAD 342)	5 VDC	INPUT POWER APPLIED TO MACHINE.
FAN CONTROL BOARD	PLUG J7 PIN 6 (LEAD 355)	PLUG J7 PIN 16 (LEAD 350)	10 VDC	INPUT POWER APPLIED AND FAN RUNNING.
POWER SUPPLY TO CURRENT TRANSDUCER	PLUG J8 PIN 2 (LEAD 212)	PLUG J8 PIN 6 (LEAD 216)	+15 VDC	INPUT POWER APPLIED TO MACHINE.
POWER SUPPLY TO CURRENT TRANSDUCER	PLUG J8 PIN 3 (LEAD 213)	PLUG J8 PIN 6 (LEAD 216)	-15 VDC	INPUT POWER APPLIED TO MACHINE.
SUPPLY TO OPTIONAL INVERTER BOARD	PLUG J4 PIN 8 (LEAD 416)	PLUG J8 PIN 7 (LEAD 417)	15 VDC	INPUT POWER APPLIED TO MACHINE.

Table F.5 – Digital control board resistance tests

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READING	CONDITIONS
CONNECTIONS TO OUTPUT TERMINALS	PLUG J9 PIN 3 (LEAD 202)	NEGATIVE OUTPUT TERMINAL	ZERO OHMS	INPUT POWER APPLIED TO MACHINE.
CONNECTIONS TO OUTPUT TERMINALS	PLUG J9 PIN 1 (LEAD 206)	POSITIVE OUTPUT TERMINAL	ZERO OHMS	INPUT POWER APPLIED TO MACHINE.
CONNECTIONS TO NORMALLY CLOSED THERMOSTATS	PLUG J5 PIN 2 (LEAD 410)	PLUG J5 PIN 3 (LEAD 409)	ZERO OHMS	INPUT POWER APPLIED TO MACHINE.

Figure F.8 – Digital control board location

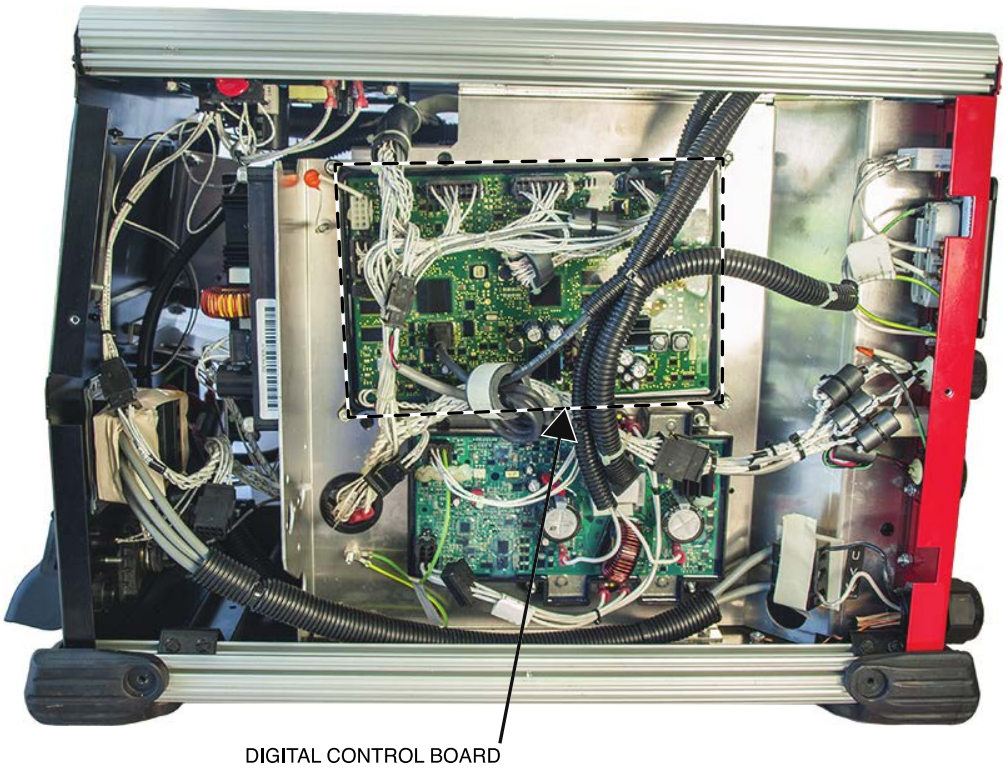


Figure F.9 – Digital control board plug and LED locations

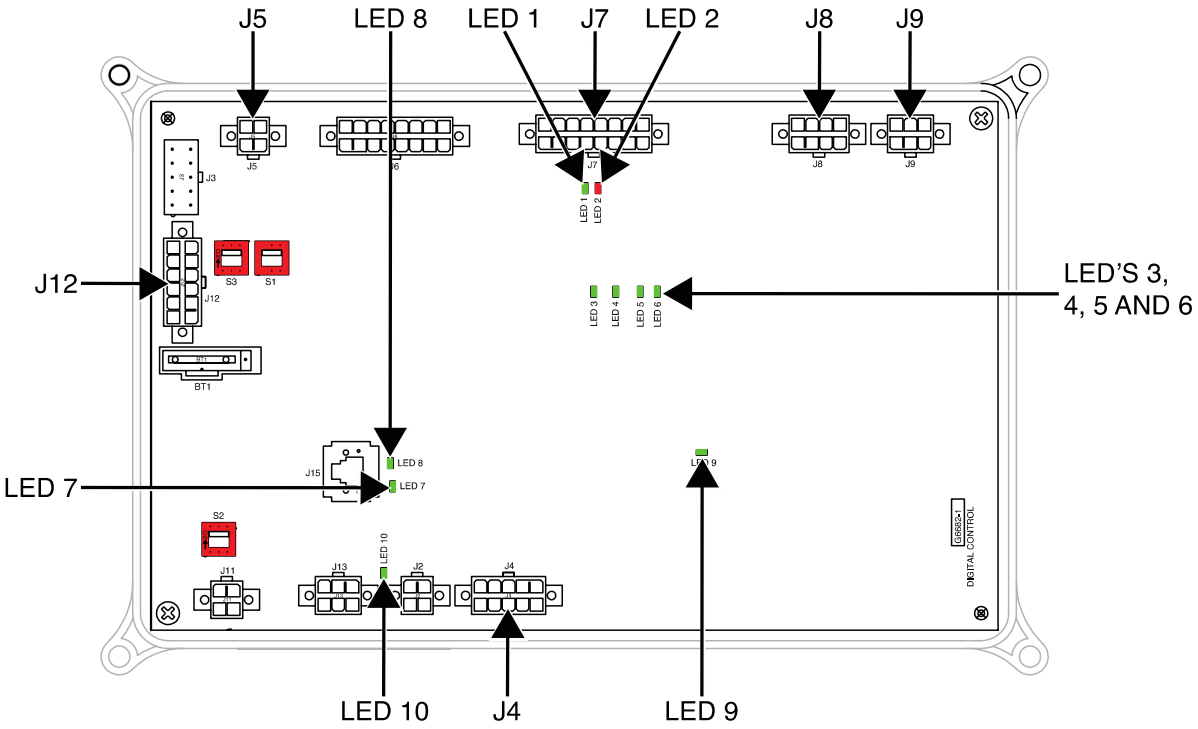
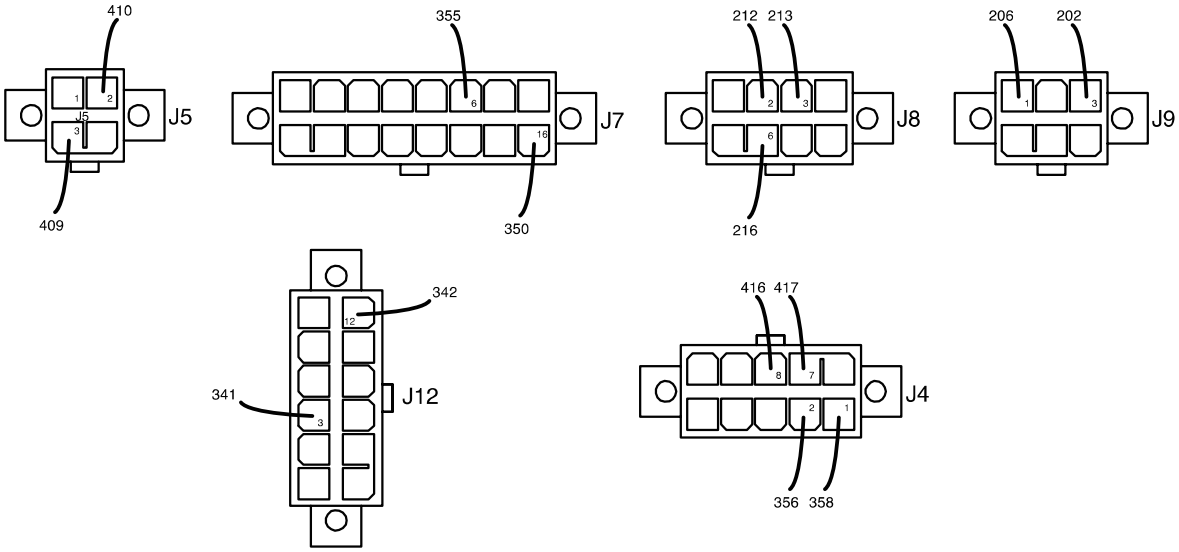


Figure F.10 – Digital control board lead locations



SWITCH BOARD TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the Switch Board is receiving the correct voltages and also if the Switch Board is functioning properly. The Switch Board has many functions and components. Testing of the Planar Transformer, the Input Rectifier and the Output Diodes are addressed with individual testing procedures. See the Troubleshooting and Repair Section Table of Contents.

MATERIALS NEEDED

7/16" Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the switch board on the left side of the machine. See ***Figure F.11***.
5. Carefully apply the correct input power to the Power Wave R350. Check the LEDs per ***Table F.6***. See ***Figure F.12*** for LED locations.
6. If the LEDs are not indicating a properly functioning switch board (per ***Table F.6***) proceed with the following steps.
7. Using a volt/ohmmeter, check the voltages per ***Table F.7***. See ***Figures F.13*** and ***F.14***, for test point locations. See Wiring Diagram.
8. Using a volt/ohmmeter, check the switch board resistances per ***Table F.8***. See ***Figures F.13*** and ***F.14***, for test point locations. See Wiring Diagram.
9. If any of the test results are not correct, perform the ***Switch Board Removal And Replacement Procedure***.
10. Connect all previously disconnected plugs and leads.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.6 – Switch board LEDs

DESCRIPTION	INDICATES	LIGHT	CONDITIONS
LED 1	+48 VDC SUPPLY	ON	POWER APPLIED TO POWER WAVE R350
LED 4	+15 VDC SUPPLY	ON	POWER APPLIED TO POWER WAVE R350
LED 3	BOOST CIRCUIT ACTIVE	ON*	* WHEN HIGH INPUT VOLTAGE IS APPLIED (460 AND HIGHER) LED 3 MAY BE VERY DIM OR OFF.
LED 2	BUCK CIRCUIT ACTIVE	ON**	** BRILLIANCE MAY VARY WITH LOAD.
LED'S 5 THRU 10	CHOPPER IGBTS ACTIVATED	ON***	*** BRILLIANCE WILL VARY WITH LOAD AND OUTPUT.
LED'S 5 THRU 10 – THESE SIX LEDS ARE USED TO INDICATE A TURN-ON OF A CHOPPER PHASE. INTENSITY OF EACH LED IS RELATED TO THE ON-TIME OF EACH OF THE IGBT'S. LED 4 - +15 VDC POWER SUPPLY FOR SECONDARY CONTORLS. LED 1 - +48 VDC AUXILIARY POWER SUPPLY INDICATOR. LED 3 – BOOST IGBT DRIVE. LED 2 – BUCK IGBT DRIVE.			

Table F.7 – Switch board voltage tests

DESCRIPTION	TEST POINT	EXPECTED READING	CONDITIONS
PRE-CHARGE RELAY COIL COLTAGE	PLUG J41 PIN 6 (-) TO PLUG J41 PIN 5 (+)	15 VDC	CORRECT INPUT POWER APPLIED TO MACHINE AND PRE-CHARGE COMPLETED. IF NOT CORRECT, PERFORM THE ***POWER FACTOR CORRECTION (PFC) CONTROL BOARD TEST PROCEDURE***. SEE WIRING DIAGRAM.
400 VDC FROM BUCK/BOOST AND DC LINK CAPACITOR	TERMINAL B48 (+) TO TERMINAL B49 (-)	400 VDC	CORRECT INPUT POWER APPLIED TO MACHINE AND PRE-CHARGE COMPLETED. IF NOT CORRECT, PERFORM THE ***INPUT RECIFIER TEST PROCEDURE***.
48 VAC FROM PLANAR TRANSFORMER WINDING	TERMINAL B7 TO B9 ALSO TERMINAL B7 TO B8	50 VAC	CORRECT INPUT POWER APPLIED TO MACHINE AND PRE-CHARGE COMPLETED. IF NOT CORRECT, PERFORM THE ***PLANAR TRANSFORMER RESISTANCE TEST PROCEDURE***.
100 VAC FROM PLANAR TRANSFORMER WINDING	TERMINAL B38 TO TERMINAL B40	100 VAC	CORRECT INPUT POWER APPLIED TO MACHINE AND PRE-CHARGE COMPLETED. IF NOT CORRECT, PERFORM THE ***PLANAR TRANSFORMER RESISTANCE TEST PROCEDURE***.
100 VDC FROM OUTPUT RECTIFIER	TERMINAL B52 (-) TO TERMINAL B51 (+)	100 VDC	CORRECT INPUT POWER APPLIED TO MACHINE AND PRE-CHARGE COMPLETED. IF NOT CORRECT, PERFORM THE ***OUTPUT RECTIFIER TEST PROCEDURE***.

Table F.8 – Switch board voltage tests

DESCRIPTION	TEST POINT	EXPECTED READING	CONDITIONS
100 OHM PRE-CHARGE RESISTOR	TERMINAL B10 (+) TO TERMINAL B12 (-)	100 OHM	MACHINE "OFF" NO INPUT POWER APPLIED.
PRE-CHARGE RELAY COIL RESISTANCE	PLUG J41* PIPN 5 (+) TO PLUG J41* PIN 6 (-) * TEST AT RECEPTACLE ON THE SWITCH BOARD	15,000 TO 30,000 OHMS DEPENDANT ON METER BEING USED. TWO DIODES ARE IN THE CIRCUIT PATH TO THE RELAY COIL.	MACHINE "OFF" NO INPUT POWER APPLIED. PLUG J41 REMOVED FROM THE SWITCH BOARD.
"BUCK" CONVERTER IGBTs	TERMINAL B12 (+) TO TERMINAL B28 (-)	HIGH RESISTANCE. GREATER THAN 100,000 OHMS. TYPICAL FAILURE IS A "SHORT".	MACHINE "OFF" NO INPUT POWER APPLIED. THE INPUT CHOKE DISCONNECTED FROM THE SWITCH BOARD TERMINAL B28.
"BUCK" CONVERTER DIODE	TERMINAL B28 (+) TO TERMINAL B49 (-)	HIGH RESISTANCE. GREATER THAN 100,000 OHMS. TYPICAL FAILURE IS A "SHORT".	MACHINE "OFF" NO INPUT POWER APPLIED. THE INPUT CHOKE DISCONNECTED FROM THE SWITCH BOARD TERMINAL B28.
"BOOST" CONVERTER IGBTs	TERMINAL B29 (+) TO TERMINAL B49 (-)	HIGH RESISTANCE. GREATER THAN 100,000 OHMS. TYPICAL FAILURE IS A "SHORT".	MACHINE "OFF" NO INPUT POWER APPLIED. THE INPUT CHOKE DISCONNECTED FROM THE SWITCH BOARD TERMINAL B28.
"BOOST" CONVERTER DIODE	TERMINAL B48 (+) TO TERMINAL B29 (-)	HIGH RESISTANCE. GREATER THAN 100,000 OHMS. TYPICAL FAILURE IS A "SHORT".	MACHINE "OFF" NO INPUT POWER APPLIED. THE INPUT CHOKE DISCONNECTED FROM THE SWITCH BOARD TERMINAL B28.
FULL BRIDGE HIGH SIDE IGBTs	TERMINAL B48 (+) TO TERMINAL B37 (-) ALSO TERMINAL B48 (+) TO TERMINAL B41 (-)	HIGH RESISTANCE. GREATER THAN 100,000 OHMS. TYPICAL FAILURE IS A "SHORT".	MACHINE "OFF" NO INPUT POWER APPLIED. THE PLANAR TRANSFORMER ELECTRICALLY ISOLATED FROM THE SWITCH BOARD AT TERMINALS B37 AND B41.
FULL BRIDGE LOW SIDE IGBTs	TERMINAL B37 (+) TO TERMINAL B49 (-) ALSO	HIGH RESISTANCE. GREATER THAN 100,000 OHMS. TYPICAL FAILURE IS A "SHORT".	MACHINE "OFF" NO INPUT POWER APPLIED. THE PLANAR TRANSFORMER ELECTRICALLY ISOLATED FROM THE SWITCH

	TERMINAL B41 (+) TO TERMINAL B49 (-)		BOARD AT TERMINALS B37 AND B41.

Figure F.11 – Switch board location

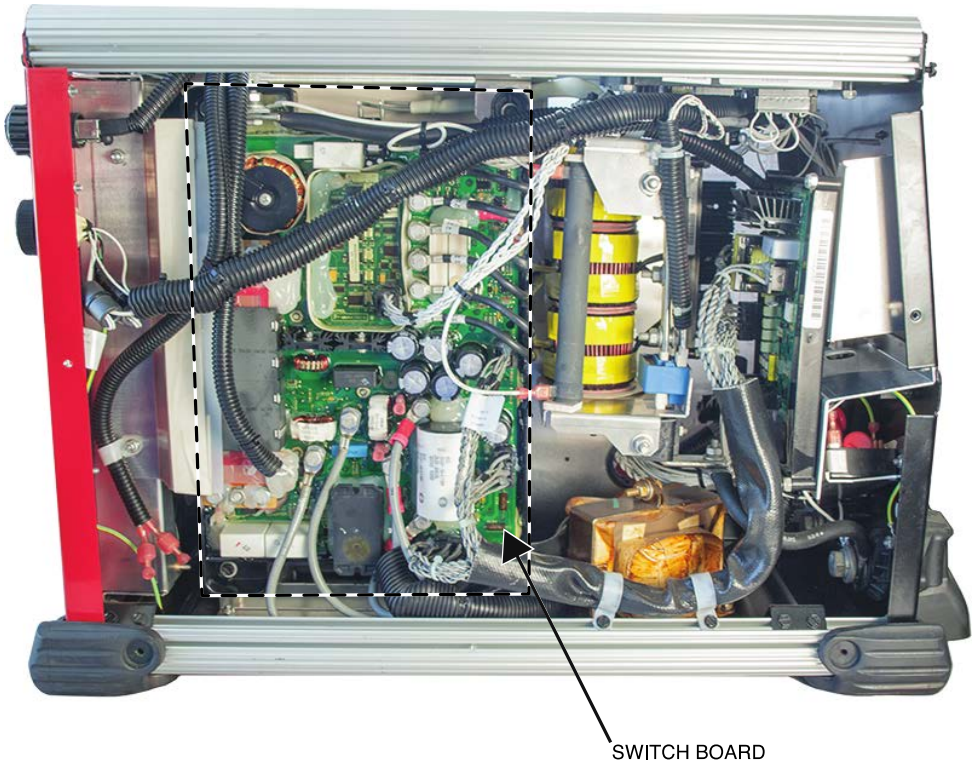


Figure F.12 – Switch board LED locations

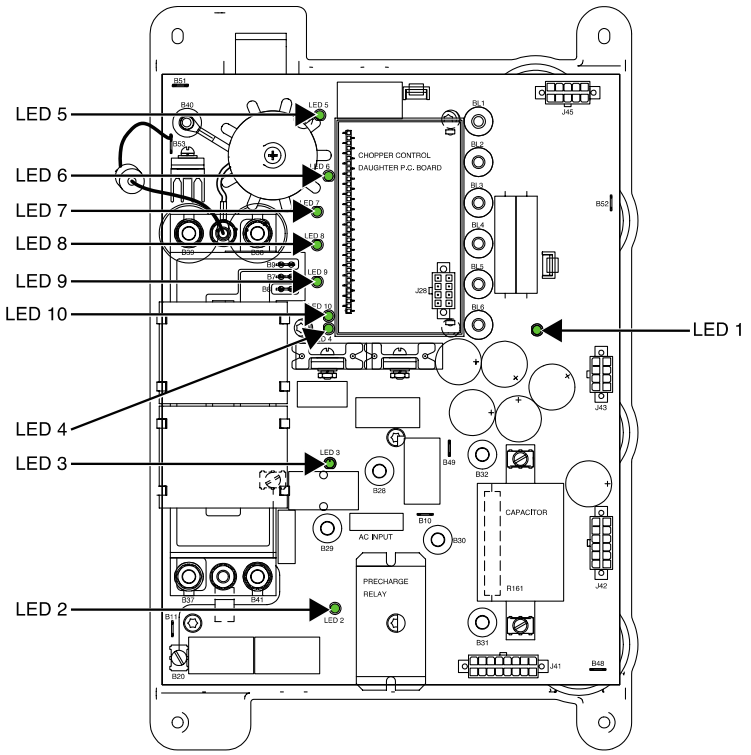


Figure F.13 – Switch board plug and terminal locations

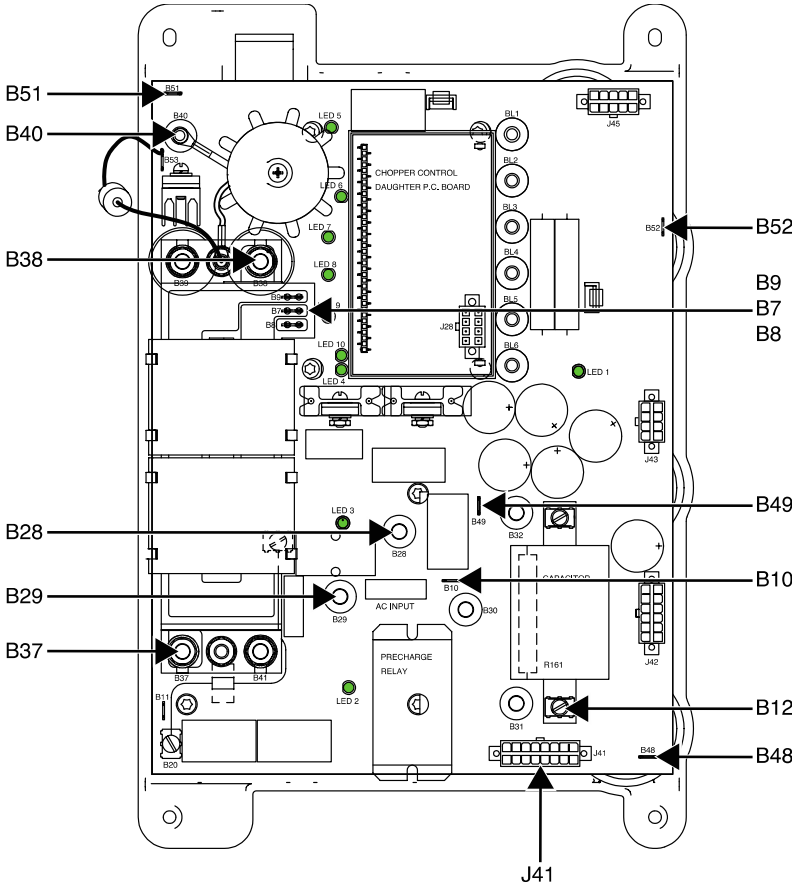
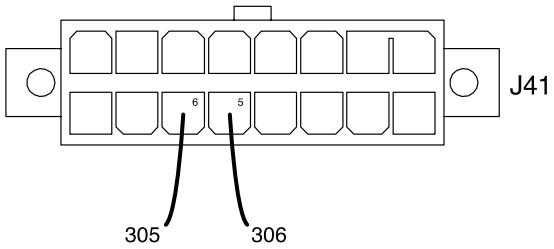


Figure F.14 – Switch board plug J41 lead locations



INPUT RECTIFIER TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Input Rectifier has “shorted” or “open” diodes.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

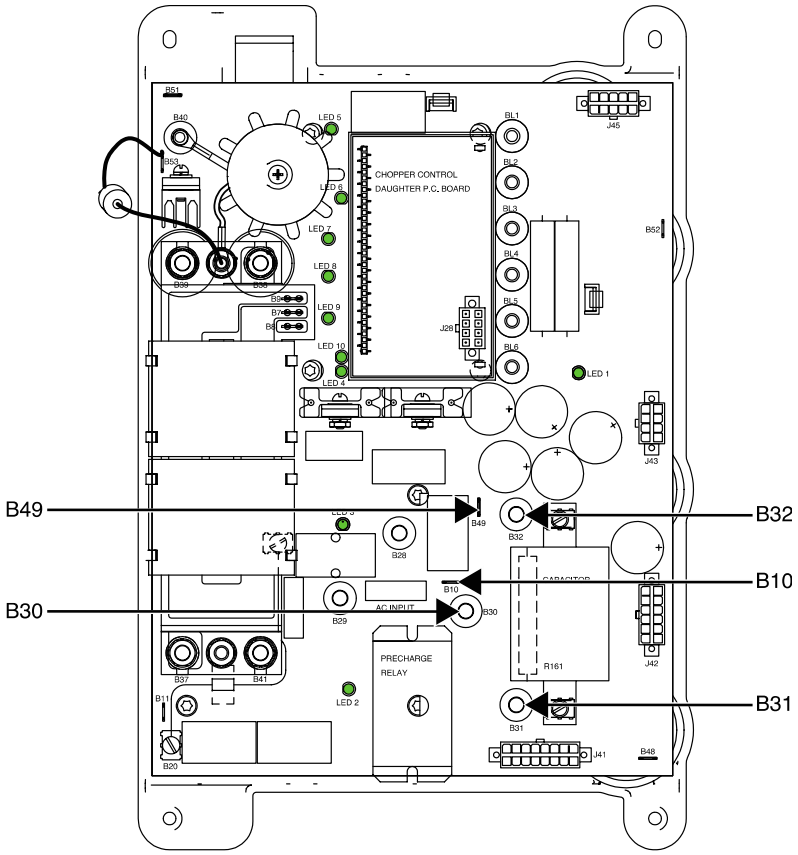
1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. The input rectifier is located on the switch board. See Wiring Diagram.

5. Using a volt/ohmmeter set to diode test mode, perform the tests detailed in ***Table F.9***. See ***Figure F.15***. See Wiring Diagram.
6. If the input rectifier tests fail, the switch board may be faulty.
7. If faulty, perform the ***Switch Board Removal And Replacement Procedure***.
8. Perform the ***Case Cover Replacement Procedure***.

Table F.9 – Input rectifier diode tests

TEST POINT (RED)	TEST POINT (BLACK)	EXPECTED READING
TERMINAL B32	TERMINAL B10	0.3V – 1.0V
TERMINAL B31	TERMINAL B10	0.3V – 1.0V
TERMINAL B30	TERMINAL B10	0.3V – 1.0V
TERMINAL B49	TERMINAL B32	0.3V – 1.0V
TERMINAL B49	TERMINAL B31	0.3V – 1.0V
TERMINAL B49	TERMINAL B30	0.3V – 1.0V

Figure F.15 – Input rectifier test point locations



PLANAR TRANSFORMER RESISTANCE TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Planar Transformer Windings are good and not shorted to each other or to ground.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.

3. Perform the ***Capacitor Discharge Procedure***.
4. The planar transformer is located on the switch board. See ***Figure F.16***. See Wiring Diagram.
5. Using the ohmmeter, check the resistances per ***Table F.10***. See ***Figures F.16*** and ***F.17***. See Wiring Diagram.
6. If the resistances are correct per ***Table F.10*** then the planar transformer is OK.
7. If any of the tests fail, the switch board may be faulty.
8. If faulty, perform the ***Switch Board Removal And Replacement Procedure***.
9. Perform the ***Case Cover Replacement Procedure***.

Table F.10 – Planar transformer resistance tests

TEST POINT	EXPECTED READING	COMMENTS
TERMINAL B37 TO TERMINAL B41	ZERO OHMS	CONTINUITY OF PRIMARY WINDING.
TERMINAL B39 TO TERMINAL B40	ZERO OHMS	CONTINUITY OF 1/2 OF SECONDARY WINDING.
TERMINAL B40 TO TERMINAL B38	ZERO OHMS	CONTINUITY OF 1/2 OF SECONDARY WINDING.
TERMINAL B8 TO TERMINAL B7	ZERO OHMS	CONTINUITY OF 1/2 OF 48V WINDING.
TERMINAL B7 TO TERMINAL B9	ZERO OHMS	CONTINUITY OF 1/2 OF 48V WINDING.
TERMINAL B37 TO TERMINAL B40	INFINITY	ISOLATION BETWEEN PRIMARY AND SECONDARY WINDING.
TERMINAL B37 TO TERMINAL B7	INFINITY	ISOLATION BETWEEN PRIMARY AND 48V WINDING.
TERMINAL B40 TO TERMINAL B7	INFINITY	ISOLATION BETWEEN SECONDARY AND 48V WINDINGS.
ALL TEST POINTS TO CHASSIS GROUND	INFINITY	ISOLATION FROM ALL WINDINGS TO CHASSIS GROUND.

Figure F.16 – Switch board location

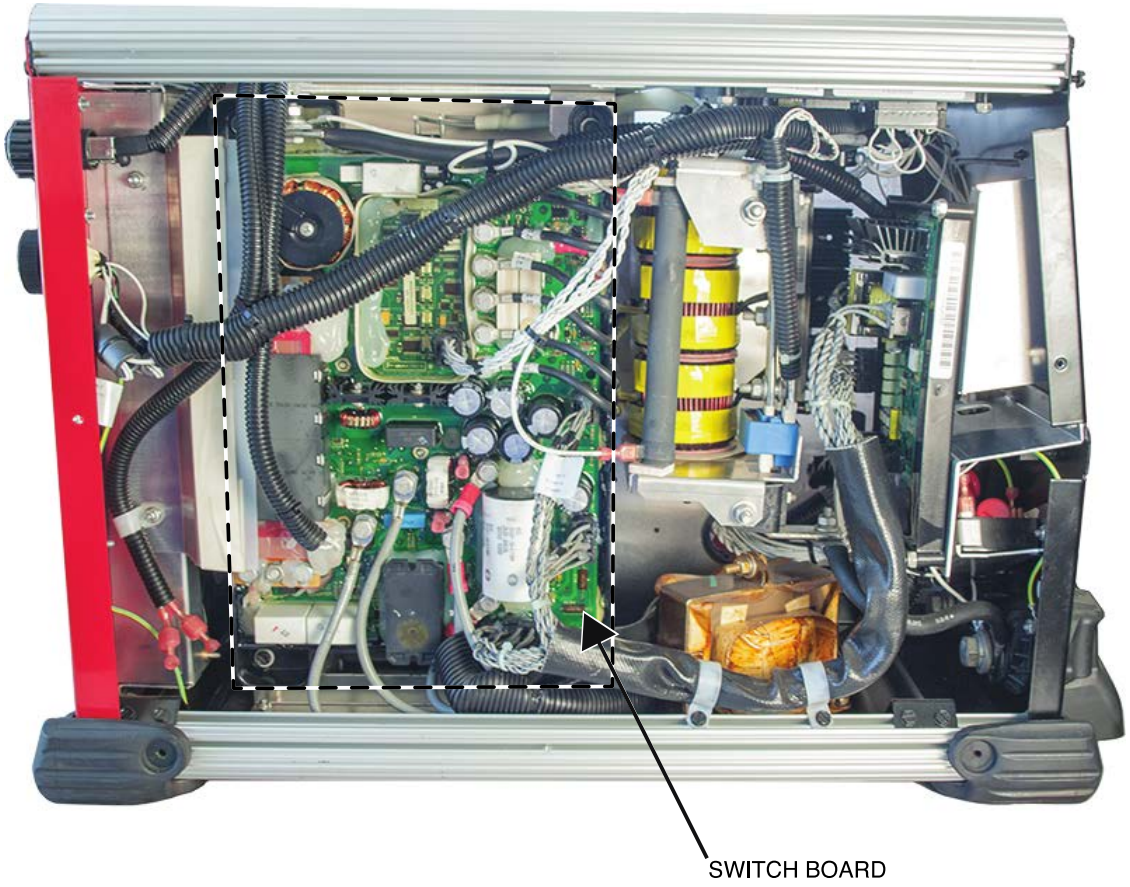
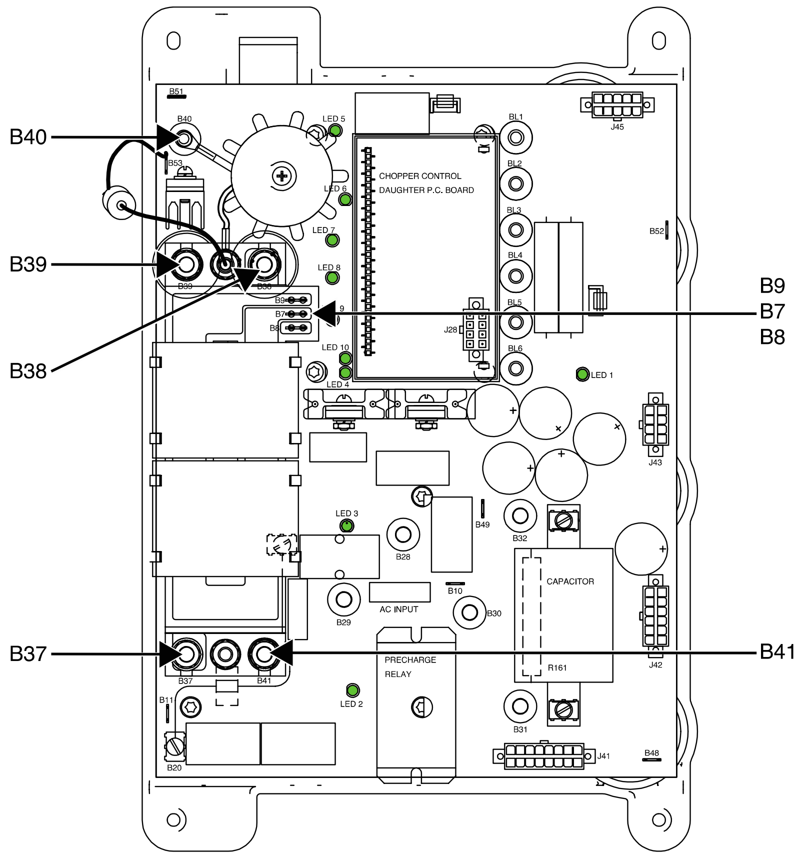


Figure F.17 – Planar transformer test point locations


B40
B39
B38
B37
B9
B7
B8
B41
CHOPPER CONTROL
DAUGHTER P.C. BOARD
CAPACITOR
PRECHARGE
RELAY
AC INPUT

OUTPUT RECTIFIER TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Output Rectifier is “open” or “shorted”.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate test points B51, B38 and B39 on the switch board. See ***Figure F.18***. See Wiring Diagram.
5. Label and disconnect lead 207 from the 200 ohm 100 watt output resistor. See Wiring Diagram.
6. Using the ohmmeter, check the resistances from B51 to B38/B39. Polarity of the ohmmeter is important. See ***Figure F.19***. See Wiring Diagram.
7. With the positive meter probe on B51 and the negative meter probe on B38/B39 the resistance reading should be very high. See Wiring Diagram.
8. With the positive meter probe on B38/B39 and the negative probe on B51 the resistance reading should be very low. Thus a forward diode drop. See Wiring Diagram.
9. If the meter readings indicate a very low resistance in both directions, the output rectifier may be shorted.
10. If the meter readings indicate a very high resistance in both directions, the output rectifier may be open.
11. If the output rectifier is faulty, the entire switch board must be replaced.
12. If faulty, perform the ***Switch Board Removal And Replacement Procedure***.
13. Connect the previously removed lead 207 to the 200 ohm 100 watt output resistor. See Wiring Diagram.
14. Perform the ***Case Cover Replacement Procedure***.

Figure F.18 – Switch board location

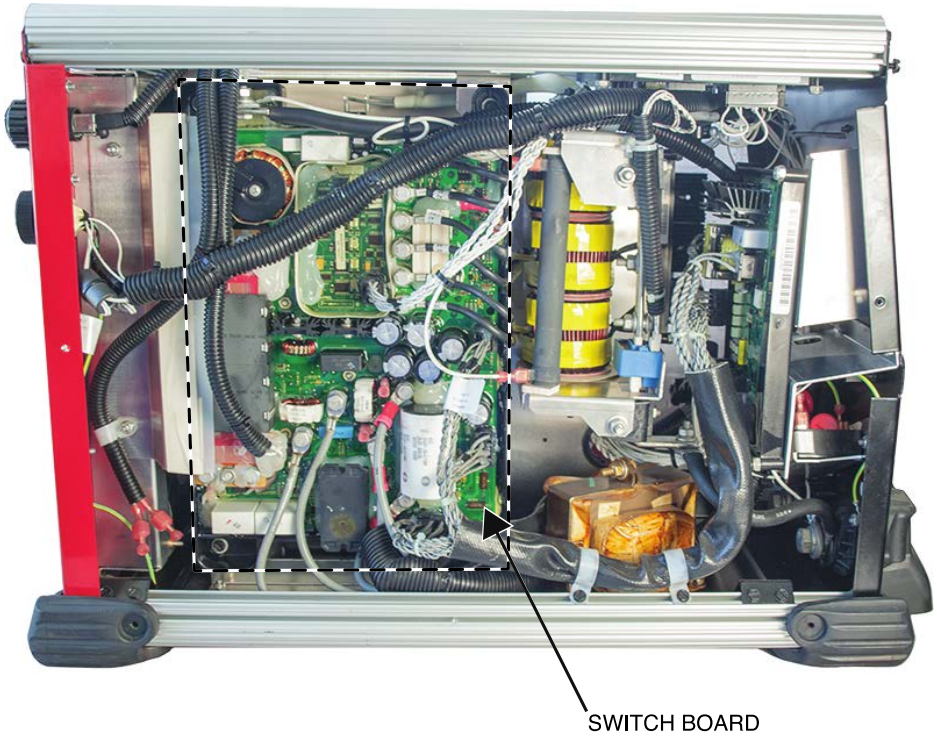
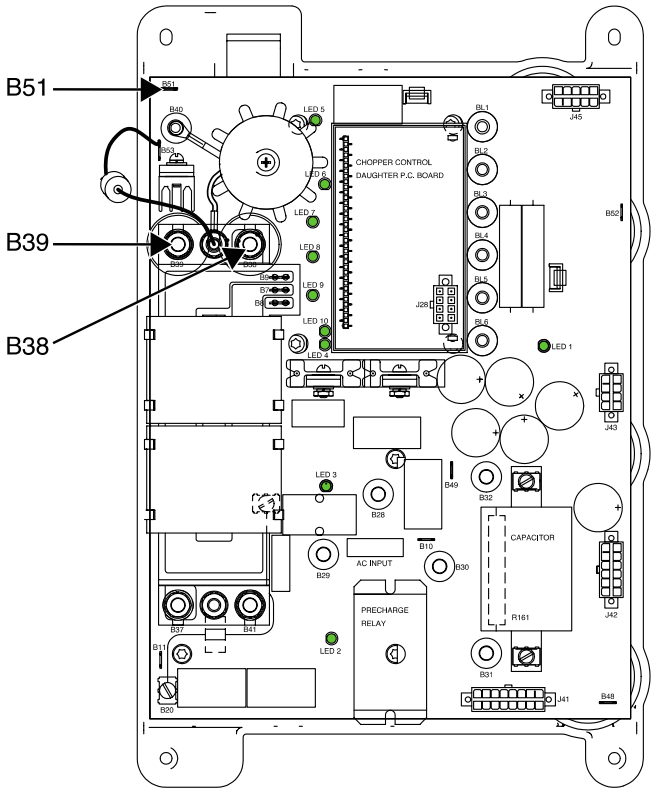


Figure F.19 – Switch board terminal locations



CURRENT TRANSDUCER TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Current Transducer and associated wiring are functioning properly.

MATERIALS NEEDED

Laptop Computer
Diagnostic Utilities Software
Ethernet Cross Connect Cable (LE Co. #M19969-7)
Resistive Load Bank (Optional 50 ft. 4/0 Weld Cable)
Calibrated Ammeter
Volt/Ohmmeter
Wiring Diagram

NOTE: The Diagnostic Utility Software is on the Utilities Disc that was shipped with the machine. It can also be accessed from the Lincoln Service Navigator or downloaded from the "web" at www.Powerwavemanager.com.

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the digital control board. See ***Figure F.20***.
5. Locate the current transducer. See Wiring Diagram.
6. Carefully apply the correct input power to the Power Wave R350.
7. Using a volt/ohmmeter, check for the correct DC supply voltage to the current transducer. See ***Figures F.21*** and ***F.22*** for Plug J8. See Wiring Diagram.
   A. Pin 2 (lead 212+) to Pin 6 (lead 216-) should read +15 VDC.
   B. Pin 3 (lead 213-) to pin 6 (lead 216+) should read -15 VDC.
   NOTE: Do not attempt to check the voltages at the current transducer connector. The terminals are small and delicate and may be damaged if probed with meter leads.
8. If the DC supply voltages are not present, the digital control board may be faulty. If the supply voltages are correct, proceed to Step 9.

For Steps 9 through 15 refer to the information in the Diagnostic Utility found on the Lincoln Service Navigator or at *www.Powerwavemanager.com*.

9. Using the Ethernet cross connect cable, connect a laptop computer to the Power Wave R350 via the Ethernet port located at the top rear of the machine. See ***Figure F.23***.
10. Connect a load bank (or 50 ft. weld cable) to the positive and negative output terminals on the Power Wave R350. See Wiring Diagram.
11. Using the "Diagnostic Utility Software":
    A. Establish Communication with the Power Wave R350.
    B. Select the "Calibrate" tab.
    C. Select the "50 amp" current set point.
    D. Select "Turn Output On".
    E. Use an external calibrated ammeter that is not affected by inverter noise to read the actual current.
12. Check the current transducer's feedback voltage at the digital control board plug J8 per ***Table F.11***. Pin 1 (lead 211+) to pin 6 (lead 216-). See ***Figure F.22***, for pin locations. See Wiring Diagram.
13. Repeat the test at several other current levels. If the transducer feedback voltage is correct for the actual current, the current transducer is functioning properly. If there is no feedback voltage, check the wiring from the digital control board to the current transducer. See Wiring Diagram.
14. If the supply voltages are correct but the current transducer feedback voltages are incorrect, the current transducer or wiring from the current transducer to the digital control board may be defective. See Wiring Diagram.
15. Click on "Turn Output Off".
16. Disconnect the laptop computer.
17. If any of the tests fail, perform the ***Current Transducer Removal And Replacement Procedure***.
18. Remove the input power to the Power Wave R350 machine
19. Perform the ***Case Cover Replacement Procedure***.

Table F.11 – Current transducer voltage tests

OUTPUT CURRENT (ACTUAL)	TRANSDUCER FEEDBACK VOLTAGE
500	4.0
450	3.6
400	3.2
350	2.8
300	2.4
250	2.0
200	1.6
150	1.2
100	0.8
50	0.4

Figure F.20 – Digital control board location

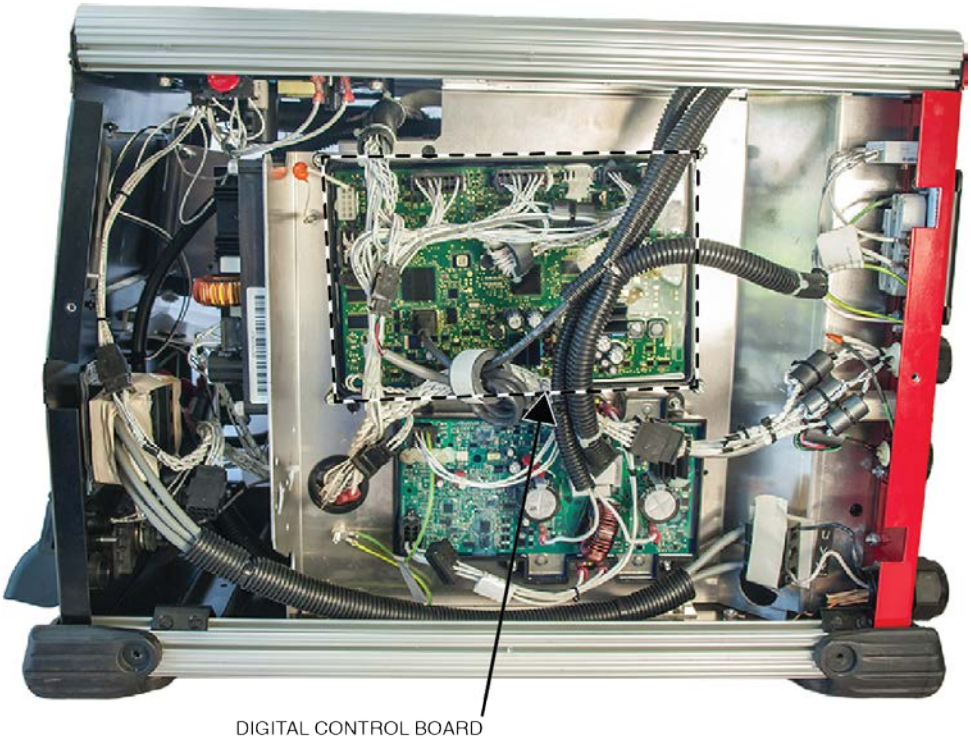


Figure F.21 – Digital control board plug J8 location

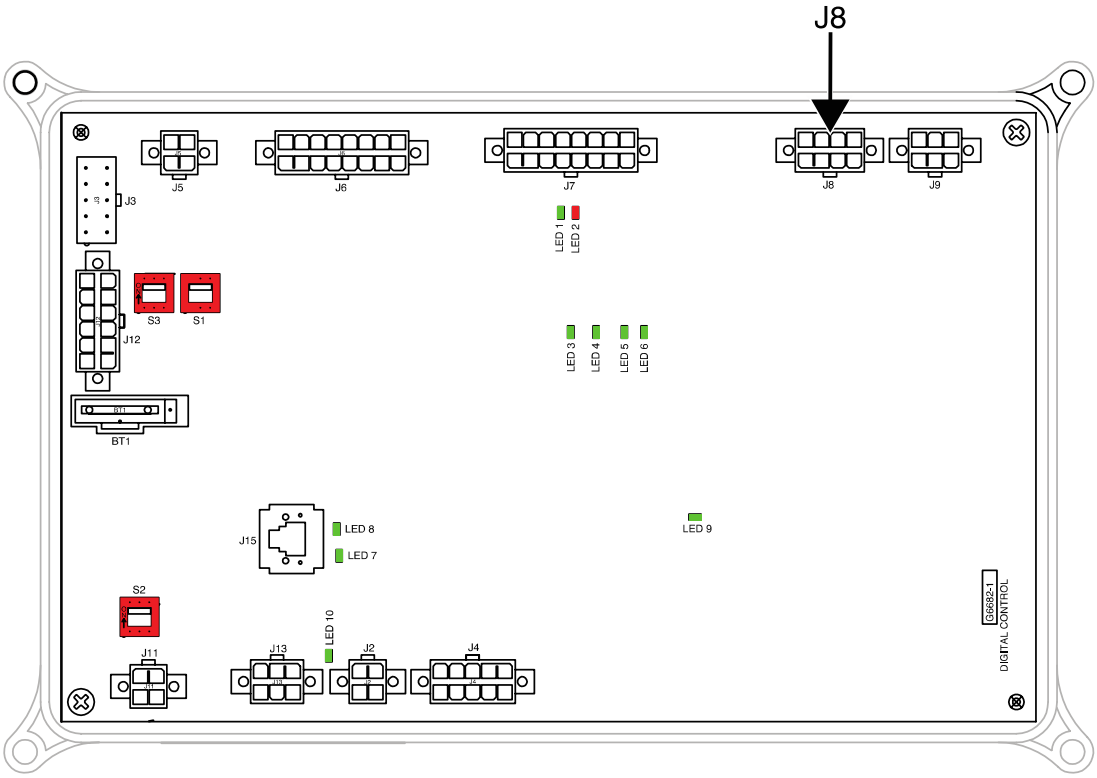


Figure F.22 – Digital control board lead locations

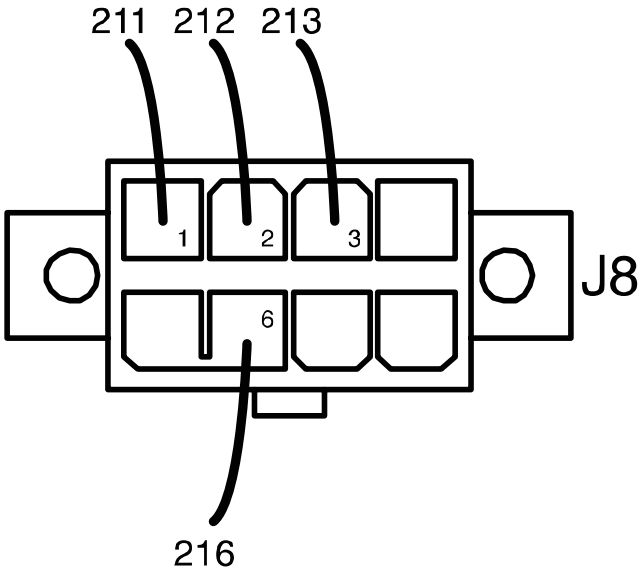


Figure F.23 – Ethernet receptacle location

DC BUS BOARD TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the DC Bus Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the DC bus board. See ***Figure F.24***.
5. Carefully apply the correct input voltage to the Power Wave R350 machine.
6. Locate LED 1 on the DC bus board. See ***Figure F.25***. If LED 1 is bright red and steady, the DC bus board is OK. If the LED 1 is dim or not steady, remove the input power and disconnect Plug J47. See ***Figure F.25***. When power is reapplied, if the LED 1 is bright and steady, check leads 356 - 358 for a heavy load or short on leads 51 - 52. See Wiring Diagram.
7. If LED 1 is NOT ON proceed to the next steps.
8. Carefully check to ensure that the correct input voltage (48 VDC) is being applied to the DC bus board. Plug J46 Pin 1 (lead 65+) to Plug J46 Pin 3 (lead 66-). See ***Figures F.25*** and ***F.26***. See Wiring Diagram.
9. If the correct input voltage (48 VDC) is not present, check the circuit breaker and associated wiring between the DC bus board and the switch board. See Wiring Diagram.
10. If the correct input voltage is being applied to the DC bus board, check for the correct output voltages.
11. Check for the presence of 40 VDC at Plug J47 Pin1 (Lead 51-) to Plug J47 Pin 8 (Lead 52+). See ***Figures F.25*** and ***F.26***. See Wiring Diagram.
12. Check for the presence of 40 VDC at Plug J47 Pin5 (Lead 356-) to Plug J47 Pin4 (Lead 358+). See ***Figures F.25*** and ***F.26***. See Wiring Diagram.
13. If the correct input voltage is being applied to the DC bus board and the output voltages are not correct or missing, the DC bus board may be faulty.
14. If faulty, perform the ***DC Bus Board Removal And Replacement Procedure***.

15. Remove the input power to the Power Wave R350 machine.
16. Perform the ***Case Cover Replacement Procedure***.

Figure F.24 – DC Bus board location

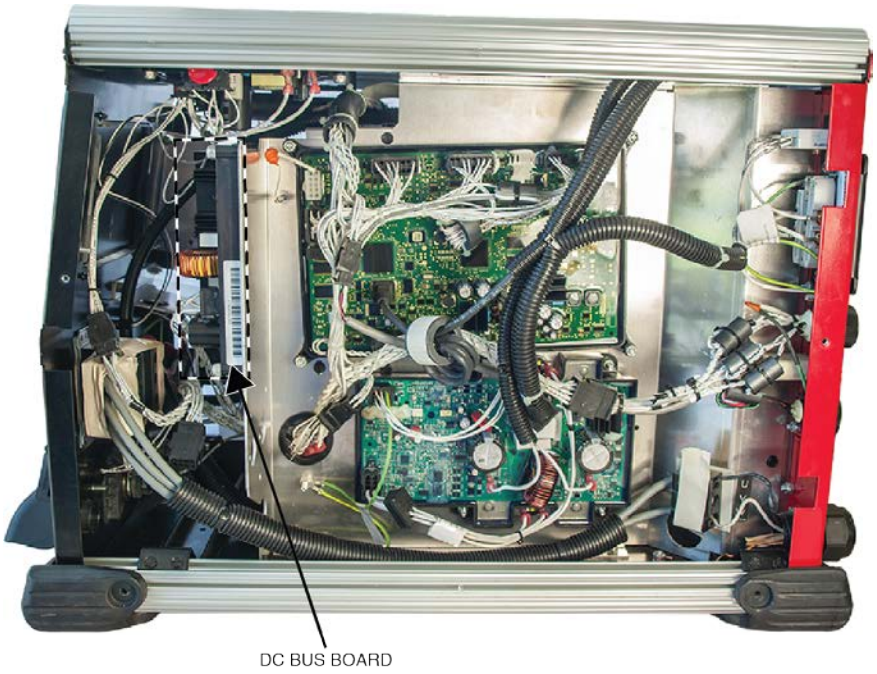


Figure F.25 – DC bus board plug and LED locations

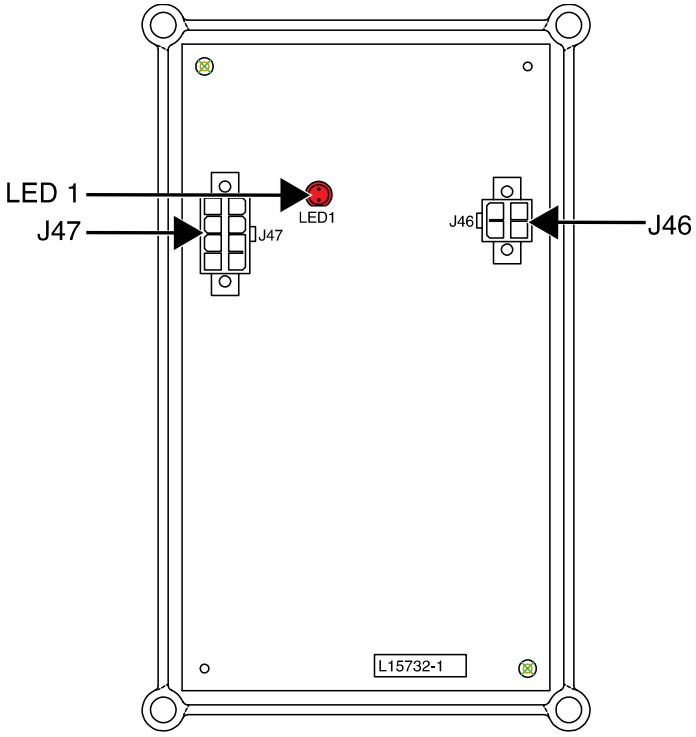
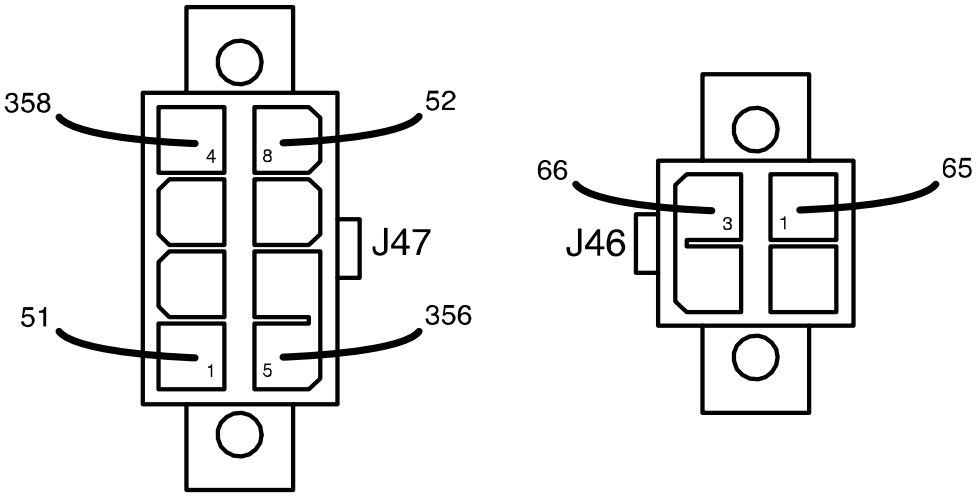


Figure F.26 – DC bus board plug and LED locations



AUXILIARY (115 VAC) BOARD TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Auxiliary (115 VAC) Board is functioning properly.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the auxiliary (115 VAC) board. See ***Figure F.27***. See Wiring Diagram.
5. Carefully apply the correct input voltage to the Power Wave R350 machine.
6. Check for the correct operation of the LED lights on the auxiliary (115 VAC) board. See ***Tables F.12*** and ***F.13***. See ***Figure F.28***.
7. Using a volt/ohmmeter, perform the voltage and resistance tests in ***Table F.14***. See ***Figures F.28*** and ***F.29***.
8. If any of the tests fail, the auxiliary (115 VAC) board may be faulty.
9. If faulty, perform the ***Auxiliary (115 VAC) Board Removal And Replacement Procedure***.
10. Carefully remove input power from the Power Wave R350 machine.
11. Perform the ***Case Cover Replacement Procedure***.

Table F.12 – Auxiliary (115 VAC) board LED indications

LED #	COLOR	FUNCTION
1	RED	ERROR CODE (LED WILL FLASH ERROR) SEE ***TABLE F.13*** FOR DETAILS
2	GREEN	RECEPTACLE OUTPUT IS ON (115 VAC).
3	GREEN	INPUT POWER PRESENT. POWER SUPPLY ON.

Table F.13 – Auxiliary (115 VAC) board LED error codes

ERROR	EXPLANATION
1	GROUND FAULT.
2	THERMAL FAULT.
3	15V CONTROL UNDERVOLTAGE.
4	200V BUS UNDERVOLTAGE.
5	OUTPUT OVER CURRENT.
6	OUTPUT OVER VOLTAGE.

Table F.14 – Auxiliary (115 VAC) board voltage and resistance tests

TEST DESCRIPTION	TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING	CONDITIONS / COMMENTS
INPUT FROM PLANAR TRANSFORMER	TERMINAL B5 (LEAD 317)	TERMINAL B6 (LEAD 318)	200 VAC @ 50 KHz.	VOLTAGE READING MAY VARY WITH METERS
15 VDC SUPPLY	PLUG J62 PIN 2 (LEAD 416)	PLUG J62 PIN 4 (LEAD 417)	15 VDC	MACHINE ON
15 VDC SUPPLY	PLUG J62 PIN 5 (LEAD 418)	PLUG J62 PIN 4 (LEAD 417)	15 VDC	MACHINE ON AND OUTPUT OFF
115 VAC OUTPUT FROM BOARD	PLUG J63 PIN 3 (LEAD 32)	PLUG J63 PIN 1 (LEAD 33)	115 VAC	MACHINE ON
UPPER THERMOSTAT RESISTANCE	PLUG J61 PIN 1 (LEAD 411)	PLUG J61 PIN 6 (LEAD 412)	LESS THAN ONE OHM	MACHINE OFF
LOWER THERMOSTAT RESISTANCE TEST	PLUG J61 PIN 2 (LEAD 413)	PLUG J61 PIN 7 (LEAD 414)	LESS THAN ONE OHM	MACHINE OFF

Figure F.27 – Auxiliary (115 VAC) Board location

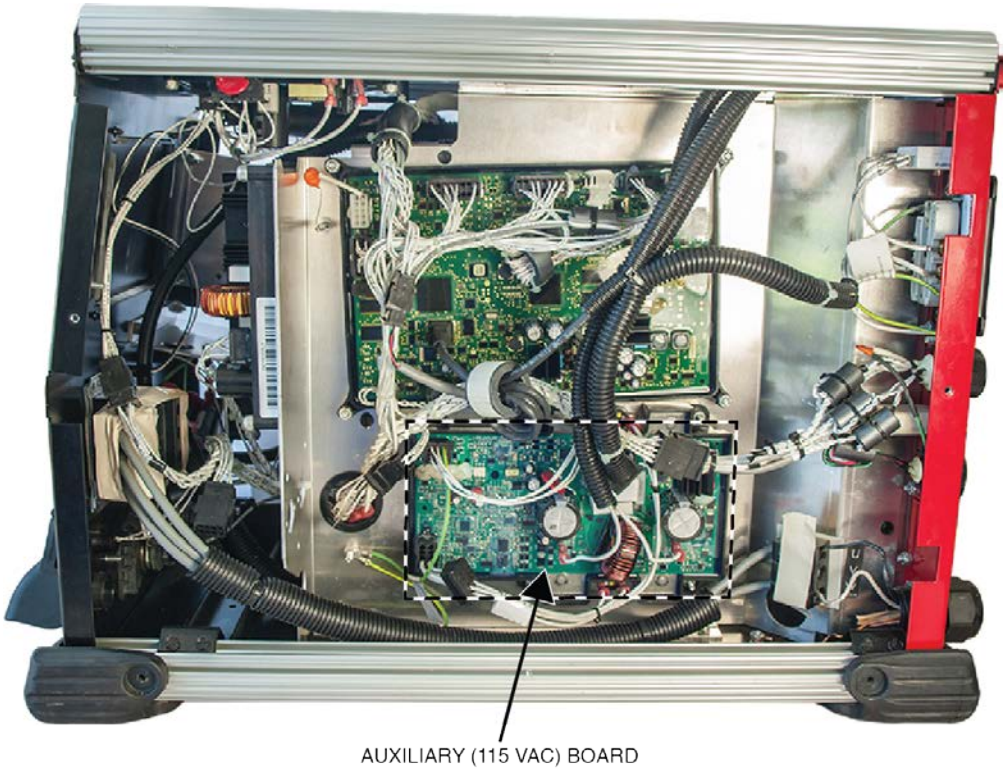


Figure F.28 – Auxiliary (115 VAC) Board plug and LED locations

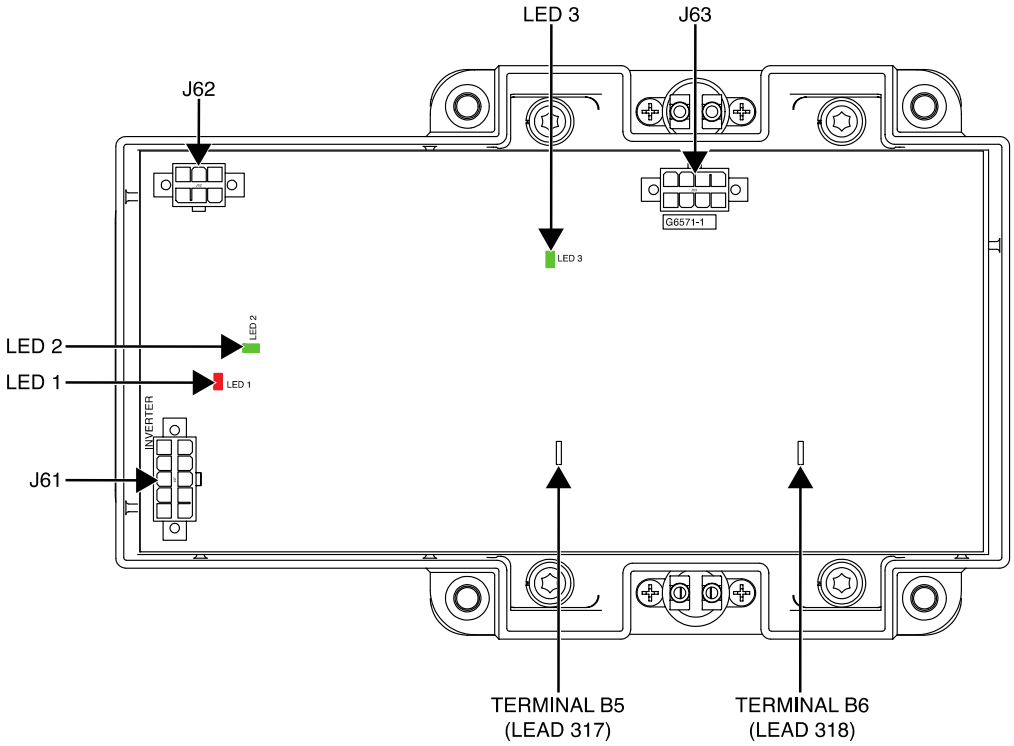
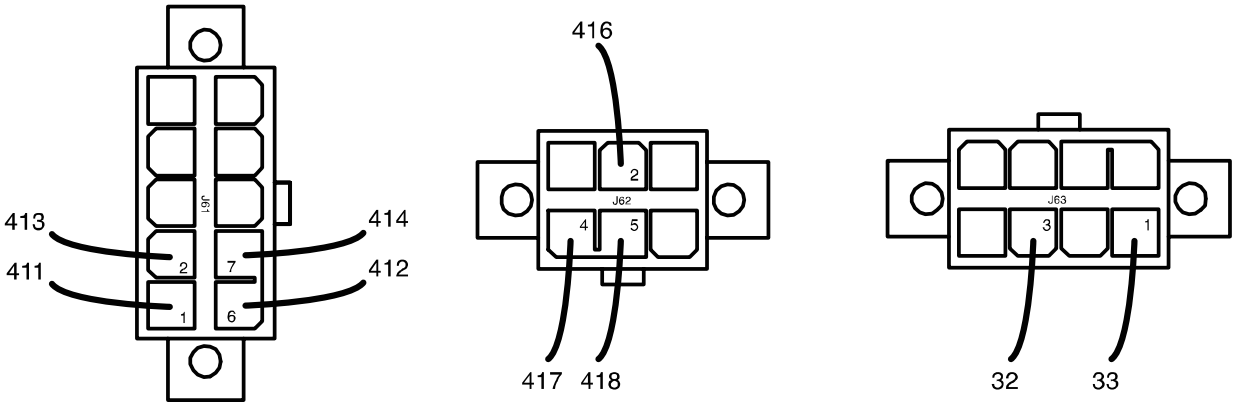


Figure F.29 – Auxiliary (115 VAC) Board lead locations



ROBOTIC FEEDHEAD BOARD TEST PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the Robotic Feedhead Board is functioning properly.

MATERIALS NEEDED

5/16” Nutdriver
Volt/Ohmmeter
Wiring Diagram

TEST PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Locate the robotic feedhead board. See ***Figure F.30***. See Wiring Diagram.
5. Using a 5/16” nutdriver, remove the four screws securing the robotic feedhead board mounting plate to the machine. See ***Figure F.30***.
6. Carefully maneuver the mounting plate to gain access to the plugs on the robotic feedhead board.
7. Carefully apply the correct input voltage to the Power Wave R350 machine.
8. Check for the correct operation of the LEDs on the robotic feedhead board. See ***Table F.15***. See ***Figure F.31***.
9. Using a volt/ohmmeter, perform the voltage tests in ***Table F.16***. See ***Figures F.31*** and ***F.32***.
10. If any of the tests fail, the robotic feedhead board may be faulty.
11. If faulty, perform the ***Robotic Feedhead Board Removal And Replacement Procedure***.
12. Carefully remove input power from the Power Wave R350 machine.
13. Perform the ***Case Cover Replacement Procedure***.

Table F.15 – Robotic feedhead board LED indications

LED #	COLOR	FUNCTION
1	GREEN	ARC LINK STATUS “OK”
2	RED	ARC LINK STATUS “ERROR”
3	GREEN	PSOC STATUS
4	GREEN	PSOC STATUS

Table F.16 – Robotic feedhead board voltage tests

TEST DESCRIPTION	TEST POINT (POS)	TEST POINT (NEG)	EXPECTED READING	CONDITIONS / COMMENTS
INPUT POWER TO FEEDHEAD BOARD	PLUG J82 PIN 4 (LEAD 52D)	PLUG J82 PIN 3 (LEAD 51D)	40 VDC	INPUT POWER APPLIED TO MACHINE.
ARCLINK	PLUG J82 PIN 1 (LEAD 53D)	PLUG J82 PIN 2 (LEAD 54D)	2.0 VDC	INPUT POWER APPLIED TO MACHINE.
WIREFEED MOTOR BLOCKING DIODE	PLUG J83 PIN 5 (LEAD 886)	PLUG J83 PIN 6 (LEAD 880)	0.35 VDC (DIODE DROP)	INPUT POWER APPLIED TO THE MACHINE AND WIREFEED ACTIVATED.
POWER FROM FEEDHEAD BOARD TO VOLTAGE SENSE BOARD	PLUG J85 PIN 14 (LEAD 511)	PLUG J82 PIN 3 (LEAD 51D)	15 VDC	INPUT POWER APPLIED TO MACHINE.
POWER FROM FEEDHEAD BOARD TO VOLTAGE SENSE BOARD	PLUG J85 PIN 13 (LEAD 512)	PLUG J82 PIN 3 (LEAD 51D)	13.5 VDC	INPUT POWER APPLIED TO MACHINE.
SOLENOID SUPPLY	PLUG J83 PIN 3 (LEAD 521)	PLUG J82 PIN 3 (LEAD 51D)	40 VDC	INPUT POWER APPLIED TO MACHINE.
TACH SUPPLY	PLUG J84 PIN 1 (LEAD W)	PLUG J84 PIN 4 (LEAD B/W)	15 VDC	INPUT POWER APPLIED TO MACHINE.
TACH 1A DIFF SIGNAL	PLUG J84 PIN 2 (LEAD R)	PLUG J84 PIN 4 (LEAD B/W)	3.6 VDC	INPUT POWER APPLIED TO MACHINE.
TACH 1B DIFF SIGNAL	PLUG J84 PIN 3 (LEAD B/R)	PLUG J84 PIN 4 (LEAD B/W)	1.4 VDC	INPUT POWER APPLIED TO MACHINE.
TACH 2A DIFF	PLUG J84 PIN 5	PLUG J84 PIN 4	3.6 VDC	INPUT POWER

SIGNAL	(LEAD B/G)	(LEAD B/W)		APPLIED TO MACHINE.
TACH 2B DIFF SIGNAL	PLUG J84 PIN 6 (LEAD G)	PLUG J84 PIN 4 (LEAD B/W)	1.4 VDC	INPUT POWER APPLIED TO MACHINE.
TACH SIGNAL INPUT	PLUG J84 PIN 7 (LEAD 847)	PLUG J84 PIN 4 (LEAD B/W)	1.4 VDC	INPUT POWER APPLIED TO MACHINE.
MOTOR SUPPLY	PLUG J83 PIN 1 (LEAD 539)	PLUG J83 PIN 2 (LEAD 541)	2.6 VDC TO 27.0 VDC (DEPENDENT ON WIRE SPEED)	INPUT POWER APPLIED TO MACHINE AND WIREFEED ACTIVATED.

Figure F.30 – Robotic feedhead board location

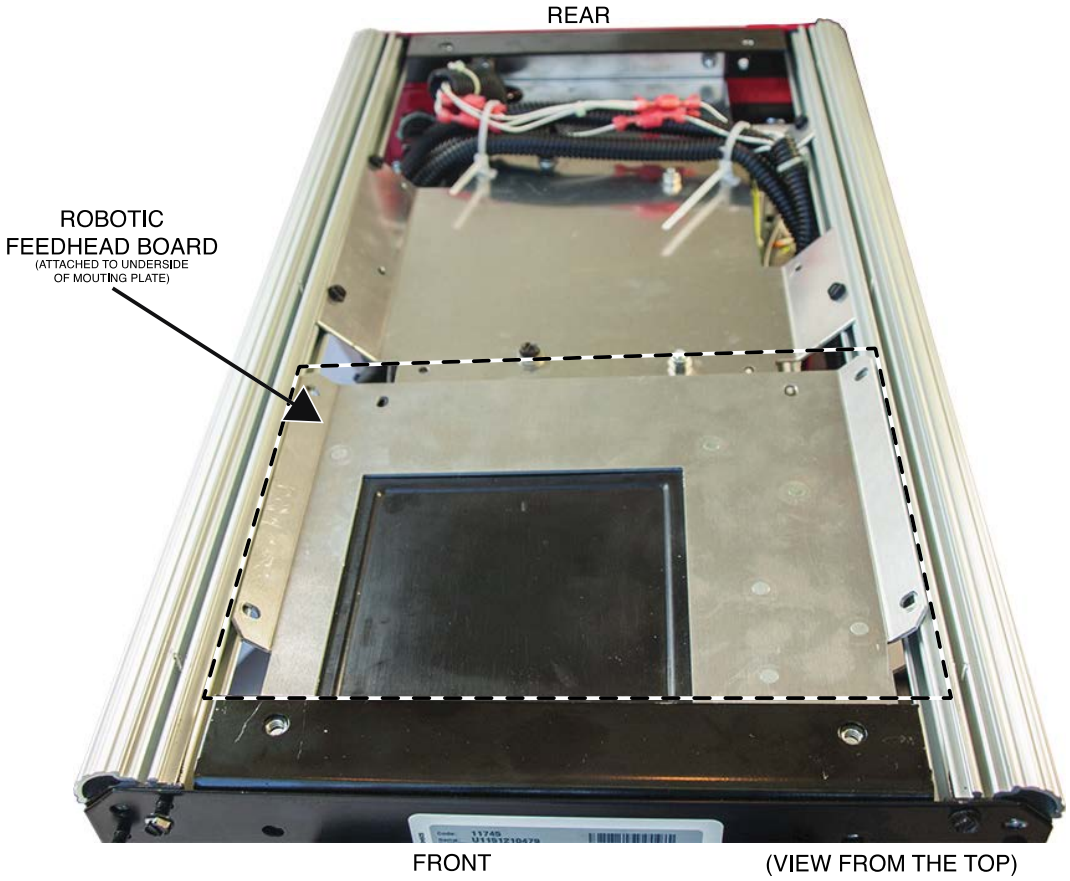


Figure F.31 – Robotic feedhead board plug and LED locations

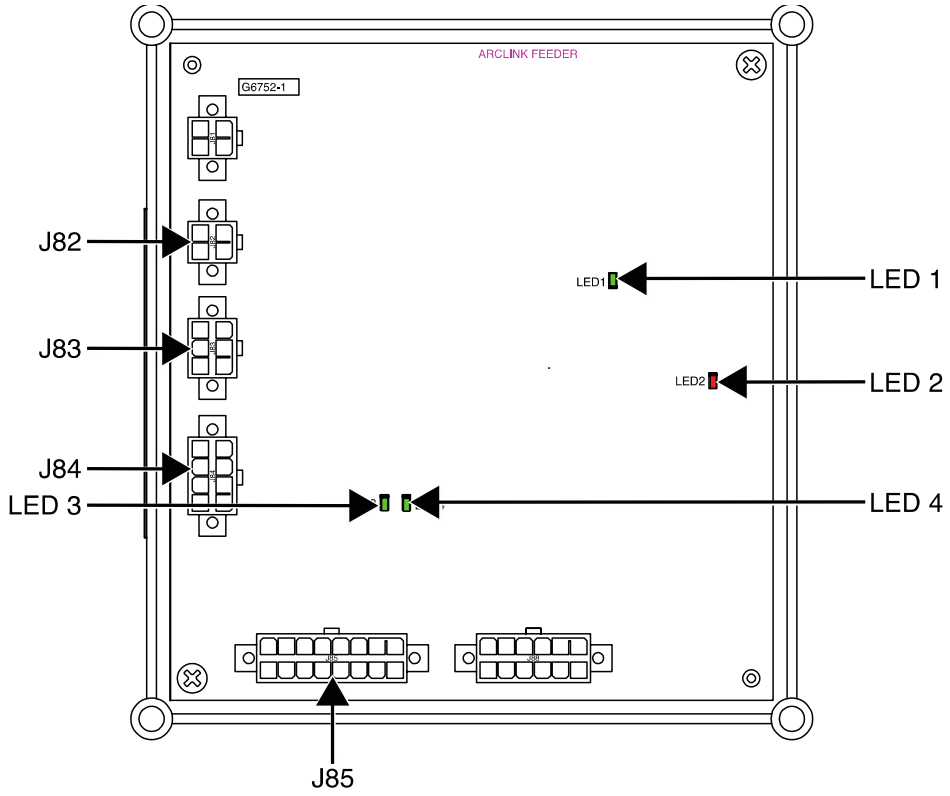
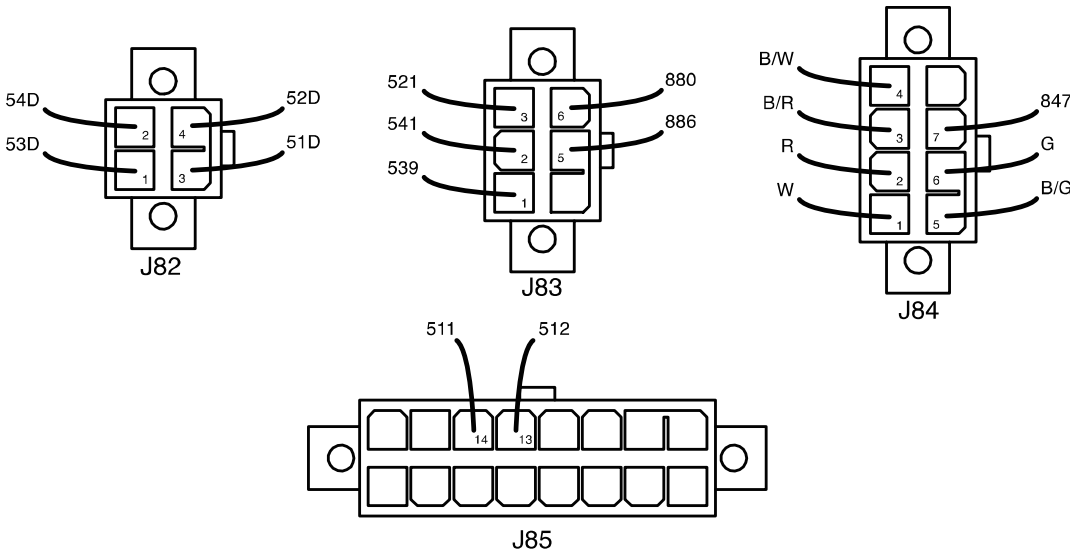


Figure F.32 – Robotic feedhead board lead locations



Removal And Replacement Procedures

POWER FACTOR CORRECTION (PFC) CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Power Factor Correction (PFC) Control Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 3/8” nutdriver, remove the three nuts securing the power factor correction (PFC) control board to the machine. See ***Figure F.33***.
5. Carefully slide the power factor correction (PFC) control board off of the mounting studs.
6. Label and disconnect plugs J23, J24, J25, J26 and J27 from the power factor correction (PFC) control board. See ***Figure F.34***. See Wiring Diagram.
7. The power factor correction (PFC) control board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Connect plugs J23, J24, J25, J26 and J27 to the new power factor correction (PFC) control board. See Wiring Diagram.
2. Carefully position the power factor correction (PFC) control board onto the mounting posts.
3. Using a 3/8” nutdriver, attach the three nuts securing the power factor correction control board to the machine.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.33 – Power factor correction (PFC) control board mounting nut locations

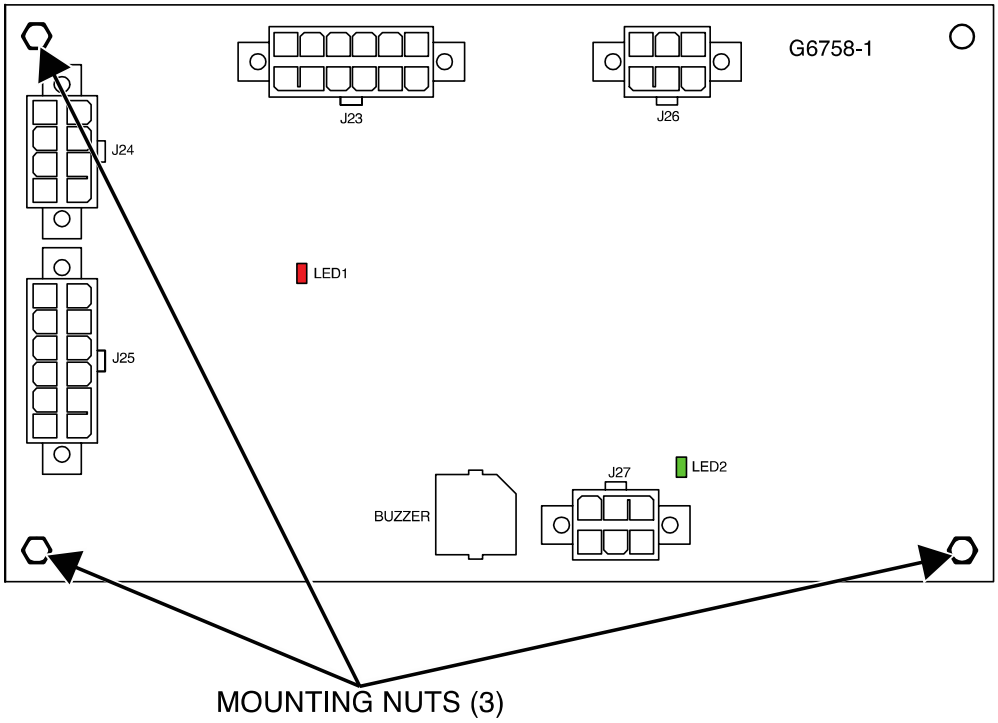
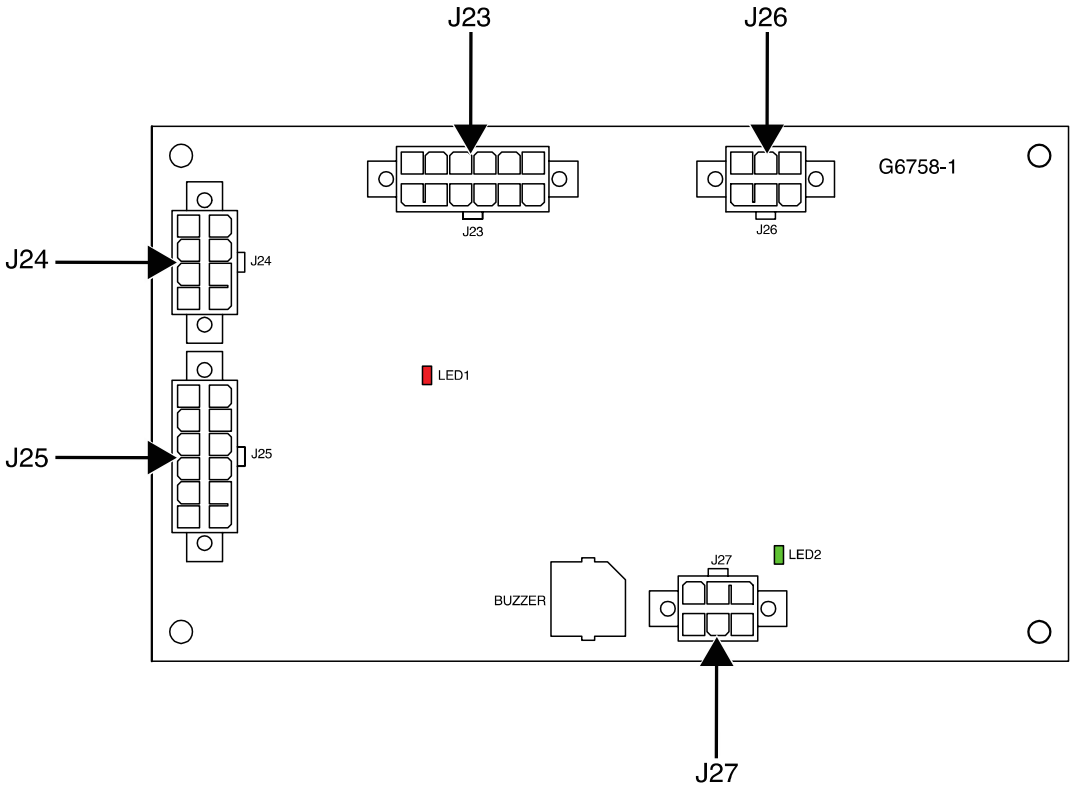


Figure F.34 – Power factor correction (PFC) control board plug locations



DIGITAL CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Digital Control Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect the Ethernet cable from terminal J15 on the digital control board. See ***Figure F.35***. See Wiring Diagram.
5. Label and disconnect plugs J4, J11, J12, J5, J6, J7, J8 and J9 from the digital control board. See ***Figure F.35***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the four nuts securing the digital control board to the machine. See ***Figure F.36***.
7. Carefully slide the digital control board off of the mounting studs
8. The digital control board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new digital control board onto the mounting studs.
2. Using a 3/8” nutdriver, attach the four nuts securing the digital control board to the machine.
3. Connect plugs J4, J11, J12, J5, J6, J7, J8 and J9 to the digital control board. See Wiring Diagram.
4. Connect the Ethernet cable to terminal J15 on the digital control board. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.35 – Digital control board plug locations

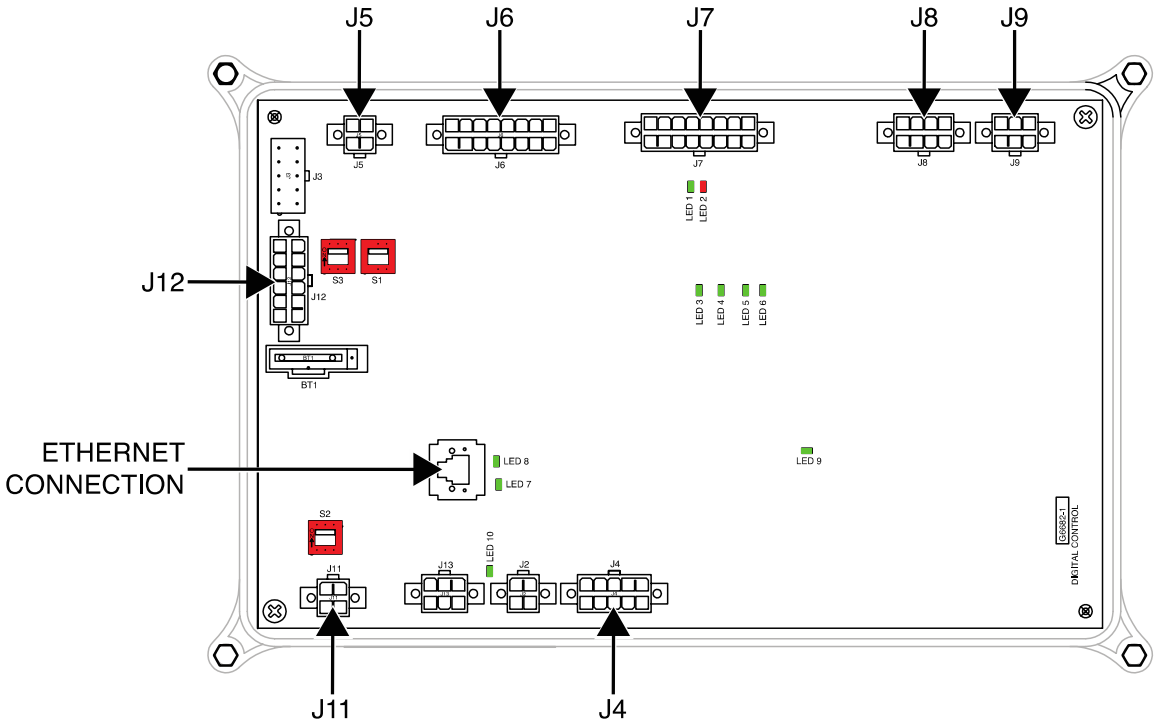
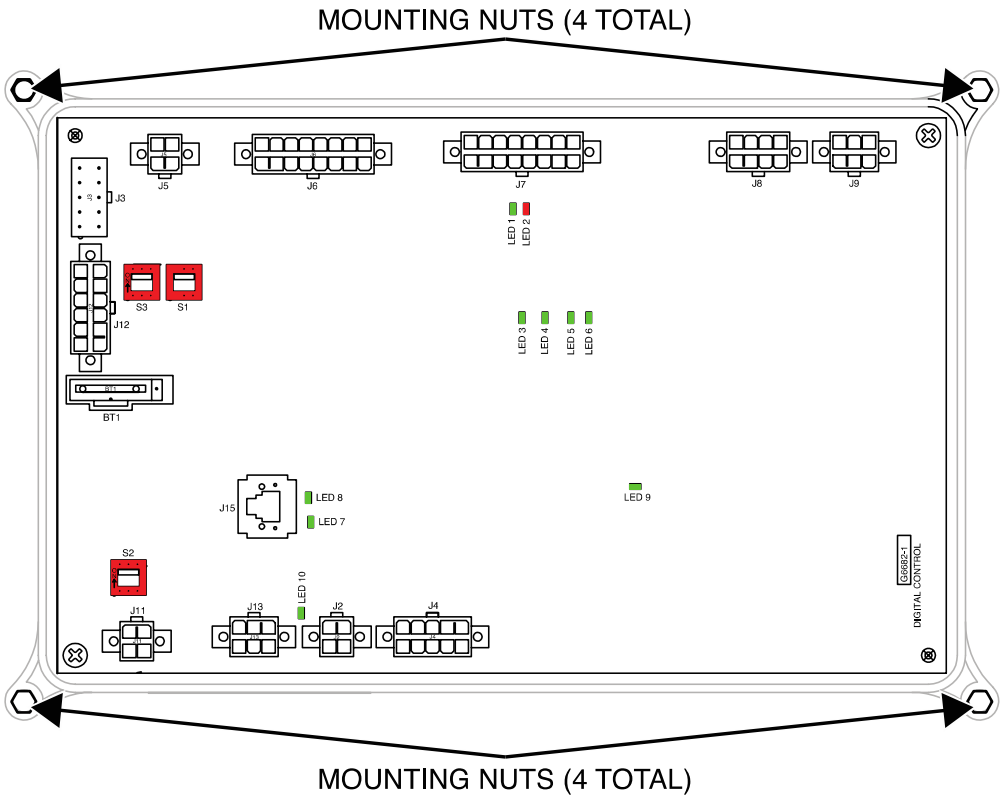


Figure F.36 – Digital control board mounting nut locations



SWITCH BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Switch Board.

MATERIALS NEEDED

7/16” Nutdriver
Two 7/16” Open-End Wrenches
5/16” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J41, J42, J43, J45 and J28 from the switch board. See ***Figure F.37***. See Wiring Diagram.
5. Using a 7/16” nutdriver, label and disconnect the six output choke leads from switch board terminals BL1, BL2, BL3, BL4, BL5 and BL6. See ***Figure F.37***. See Wiring Diagram.
6. Using two 7/16” open-end wrenches, label and disconnect the positive output cable from the switch board. See ***Figure F.37***. See Wiring Diagram. Note washer placement for reassembly.
7. Using a 7/16” nutdriver, label and disconnect the two input choke leads from switch board terminals B28 and B29. See ***Figure F.37***. See Wiring Diagram.
8. Using a 7/16” nutdriver, label and disconnect the three input power leads from switch board terminals B30 (lead 2A), B31 (lead 1A) and B32 (lead 3A). See ***Figure F.37***. See Wiring Diagram.
9. Label and disconnect leads 410 and 409 from the switch board heat sink thermostat. See ***Figure F.37***. See Wiring Diagram.
10. Using a 5/16” nutdriver, remove the four screws and washers securing the switch board to the chassis frame. See ***Figure F.38***.
    NOTE: It may be necessary to remove the air baffle to access the rear mounting screws.
11. The switch board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new switch board onto the mounting studs.
2. Using a 5/16” nutdriver, attach the four screws and washers securing the switch board to the chassis frame.
   NOTE: Attach air baffle if previously removed.
3. Connect leads 410 and 409 to the switch board heat sink thermostat. See Wiring Diagram.
4. Using a 7/16” nutdriver, connect the three input power leads to switch board terminals B30 (lead 2A), B31 (lead 1A) and B32 (lead 3A). See Wiring Diagram.
5. Using a 7/16” nutdriver, connect the two input choke leads from switch board terminals B28 and B29. See Wiring Diagram.
6. Using two 7/16” open-end wrenches, connect the positive output cable to the switch board. See Wiring Diagram.
7. Using a 7/16” nutdriver, connect the six output choke leads to switch board terminals BL1, BL2, BL3, BL4, BL5 and BL6. See Wiring Diagram.
8. Connect plugs J41, J42, J43, J45 and J28 to the switch board. See Wiring Diagram.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

Figure F.37 – Switch board plug and terminal locations

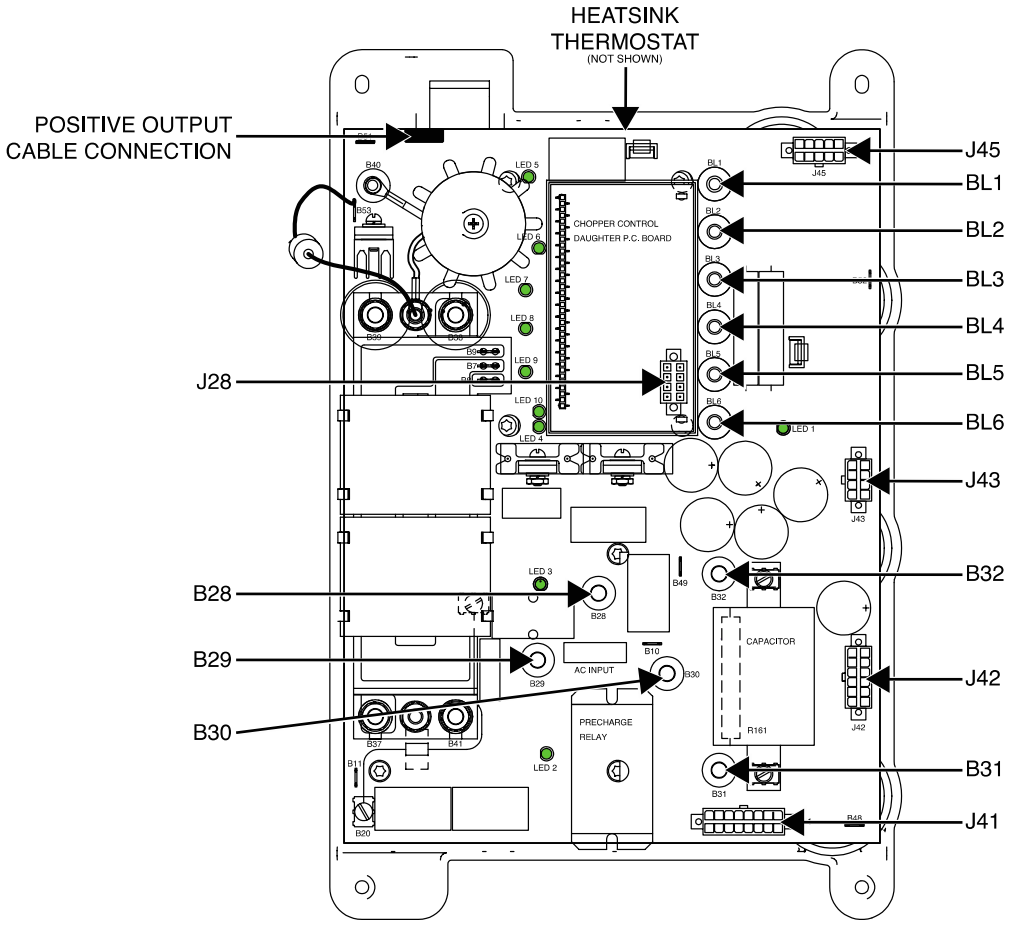
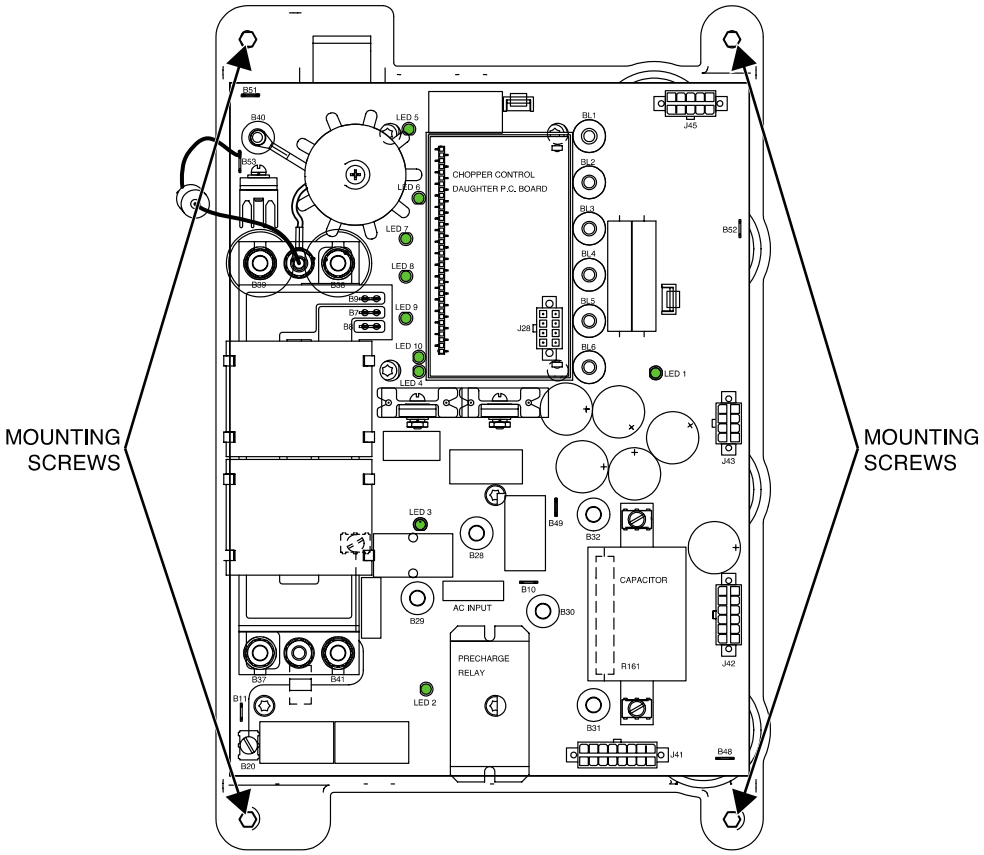


Figure F.38 – Switch board mounting screw locations



CURRENT TRANSDUCER REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Current Transducer.

MATERIALS NEEDED

Two 7/16” Open-End Wrenches
Slotted Screwdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect the small plug from the top of the current transducer. See ***Figure F.39***. See Wiring Diagram.
5. Using two 7/16” open-end wrenches, remove the bolt and washers securing the negative output cable to the bus bar. See ***Figure F.39***. See Wiring Diagram. Label lead for reassembly. Note washer placement for reassembly.
6. Using two 7/16” open-end wrenches, remove the bolts and washers securing the three pairs of leads to the bus bar. See ***Figure F.40***. See Wiring Diagram. Label leads for reassembly. Note washer placement for reassembly.
7. Using two 7/16” open-end wrenches, remove the bolt and washers securing the bus bar to the bottom choke bracket. See ***Figure F.40***.
8. Using two 7/16” open-end wrenches, remove the bolt and washers securing the bus bar to the top choke bracket. See ***Figure F.40***.
9. Carefully slide the bus bar out of the bottom choke bracket.
10. Using a slotted screwdriver, remove the screw securing the current transducer to the bottom choke bracket. See ***Figure F.41***.
11. The current transducer can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new current transducer into the machine.
2. Using a slotted screwdriver, attach the screw securing the current transducer to the bottom choke bracket.
3. Carefully slide the bus bar into the position through the bottom choke bracket and current transducer.
4. Using two 7/16” open-end wrenches, attach the bolt and washers securing the bus bar to the top choke bracket.
5. Using two 7/16” open-end wrenches, attach the bolt and washers securing the bus bar to the bottom choke bracket.
6. Using two 7/16” open-end wrenches, attach the bolts and washers securing the three pairs of leads to the bus bar. See Wiring Diagram.
7. Using two 7/16” open-end wrenches, attach the bolt and washers securing the negative output cable to the bus bar. See Wiring Diagram.
8. Connect the small plug to the top of the current transducer. See Wiring Diagram.
9. Perform the ***Case Cover Replacement Procedure***.
10. Perform the ***Retest After Repair Procedure***.

Figure F.39 – Current transducer plug location

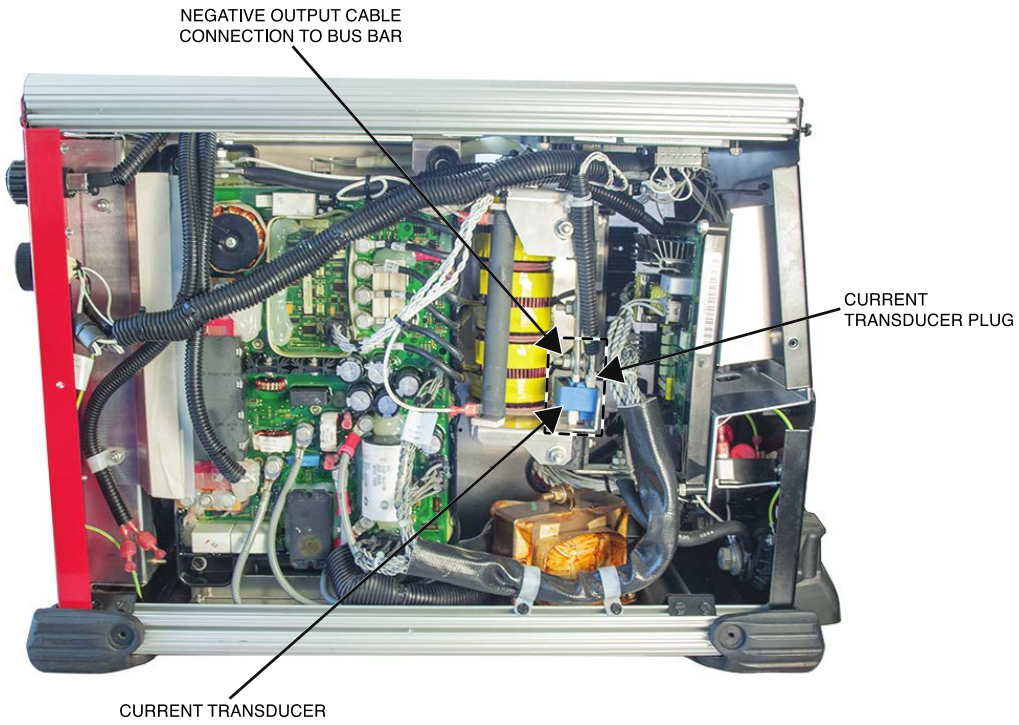


Figure F.40 – Current transducer removal

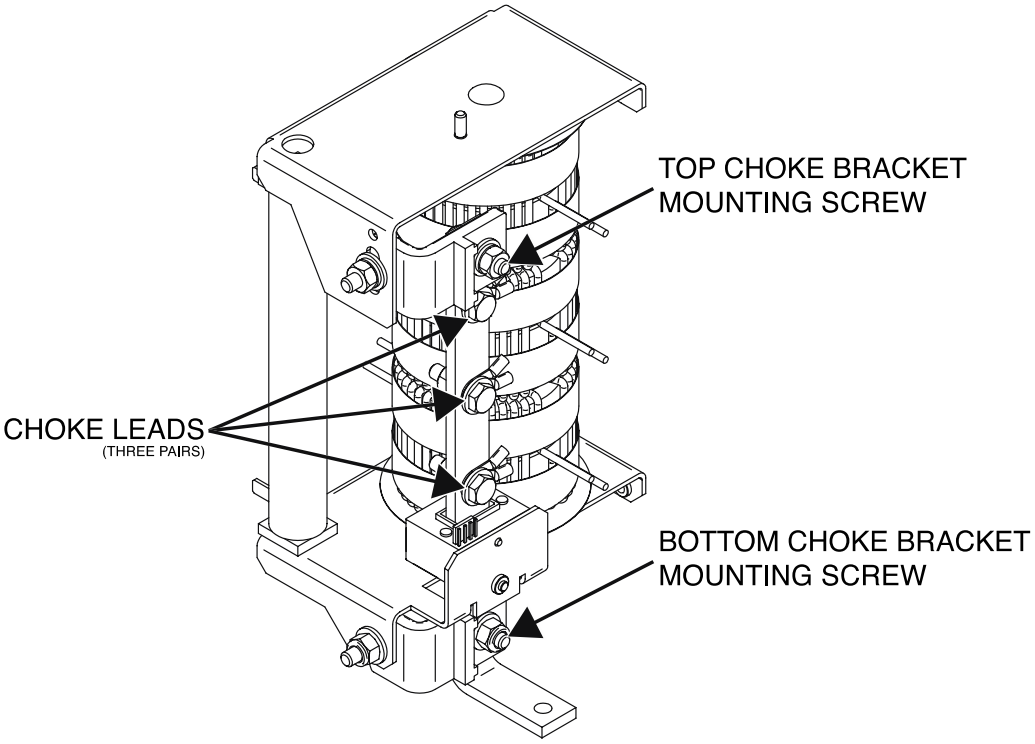
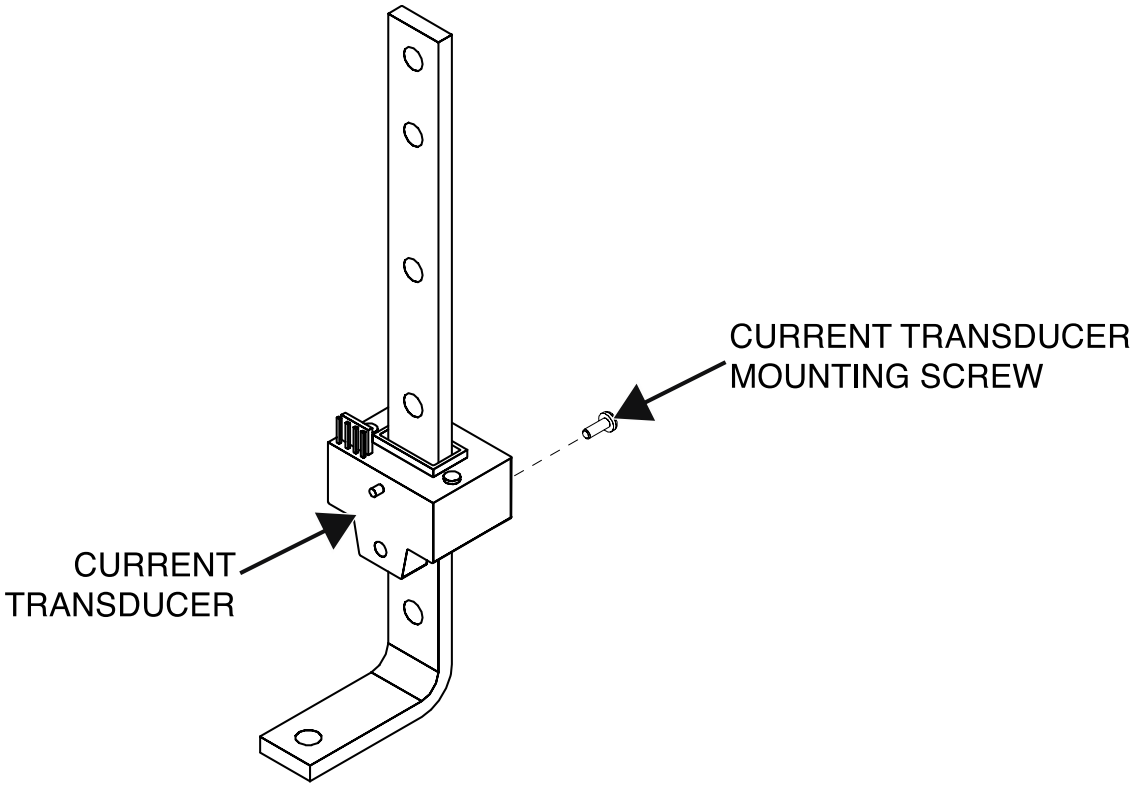


Figure F.41 – Current transducer mounting screw location



DC BUS BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the DC Bus Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J46 and J47 from the DC bus board. See ***Figure F.42***. See Wiring Diagram.
5. Using a 3/8” nutdriver, remove the four nuts securing the DC bus board to the vertical divider. See ***Figure F.43***.
6. Carefully remove the DC bus board form the mounting studs.
7. The DC bus board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new DC bus board onto the mounting studs.
2. Using a 3/8” nutdriver, attach the four nuts securing the DC bus board to the vertical divider.
3. Connect plugs J46 and J47 to the DC bus board. See Wiring Diagram.
4. Perform the ***Case Cover Replacement Procedure***.
5. Perform the ***Retest After Repair Procedure***.

Figure F.42 – DC bus board plug locations

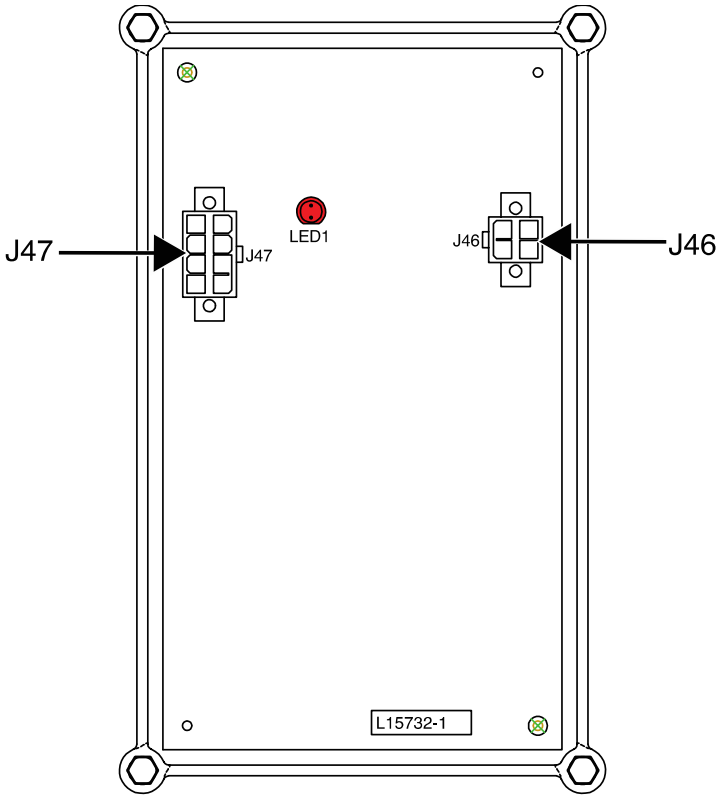
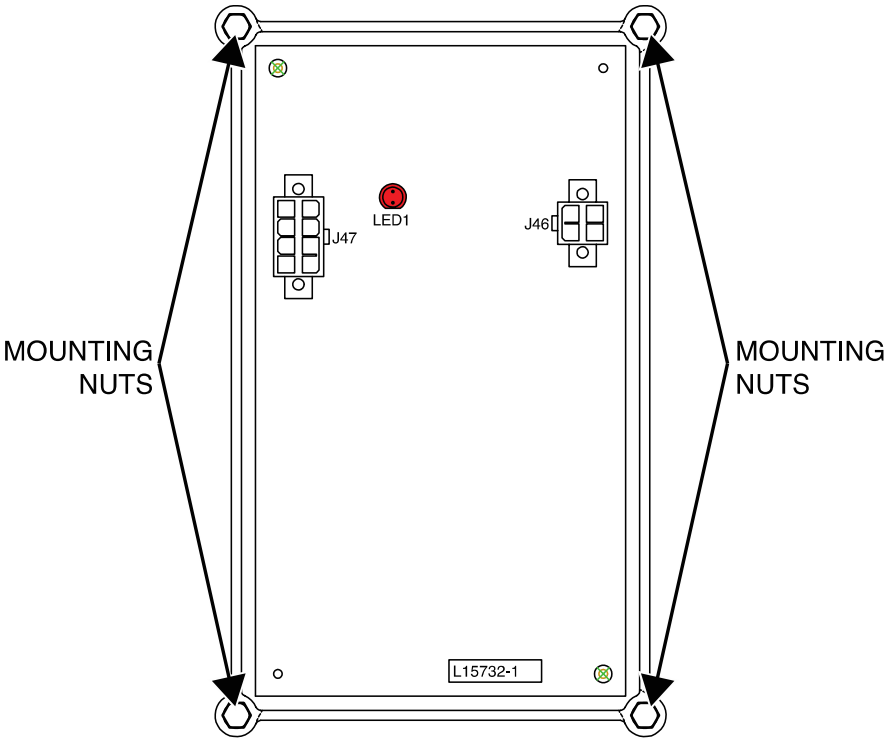


Figure F.43 – DC bus board mounting screw locations



AUXILIARY (115 VAC) BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Auxiliary (115 VAC) Board.

MATERIALS NEEDED

3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Label and disconnect plugs J61, J62 and J63 from the auxiliary (115 VAC) board. See ***Figure F.44***. See Wiring Diagram.
5. Label and disconnect leads from terminals B5 and B6 of the auxiliary (115 VAC) board. See ***Figure F.44***. See Wiring Diagram.
6. Using a 3/8” nutdriver, remove the four nuts securing the auxiliary (115 VAC) board to the center panel of the machine. See ***Figure F.45***.
7. The auxiliary (115 VAC) board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new auxiliary (115 VAC) board onto the center panel.
2. Using a 3/8” nutdriver, attach the four nuts securing the auxiliary (115 VAC) board to the center panel.
3. Connect the previously removed leads to terminals B5 and B6 of the auxiliary (115 VAC) board. See Wiring Diagram.
4. Connect plugs J61, J62 and J63 to the auxiliary (115 VAC) board. See Wiring Diagram.
5. Perform the ***Case Cover Replacement Procedure***.
6. Perform the ***Retest After Repair Procedure***.

Figure F.44 – Auxiliary (115 VAC) board plug locations

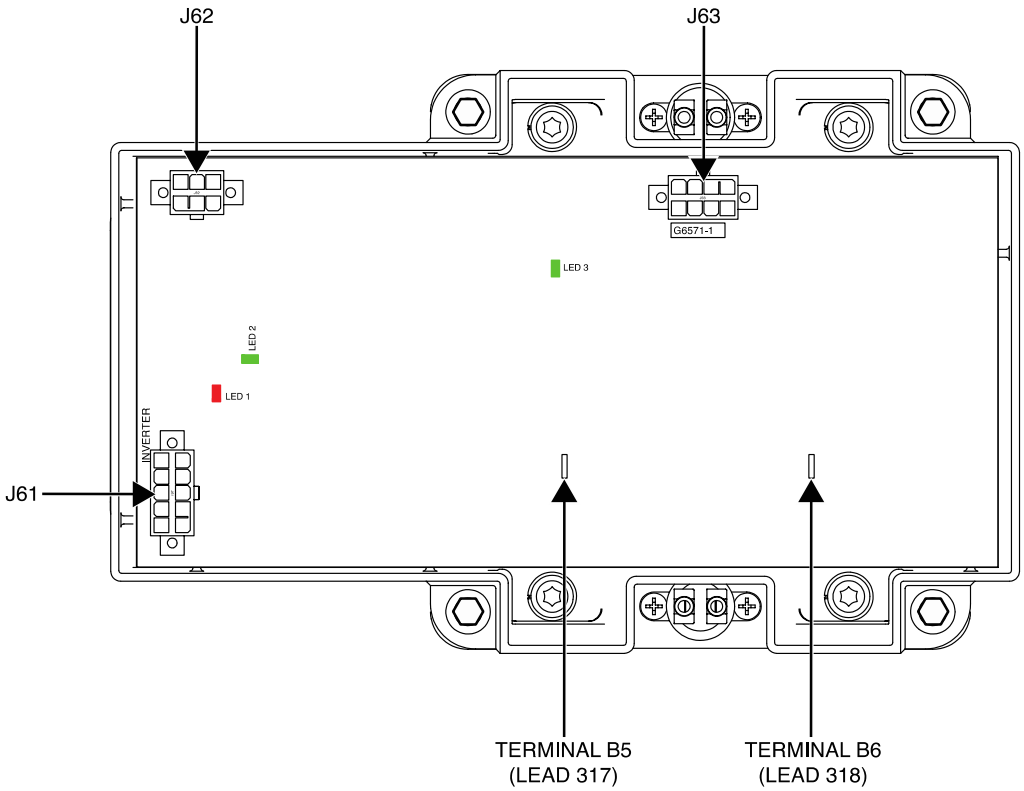
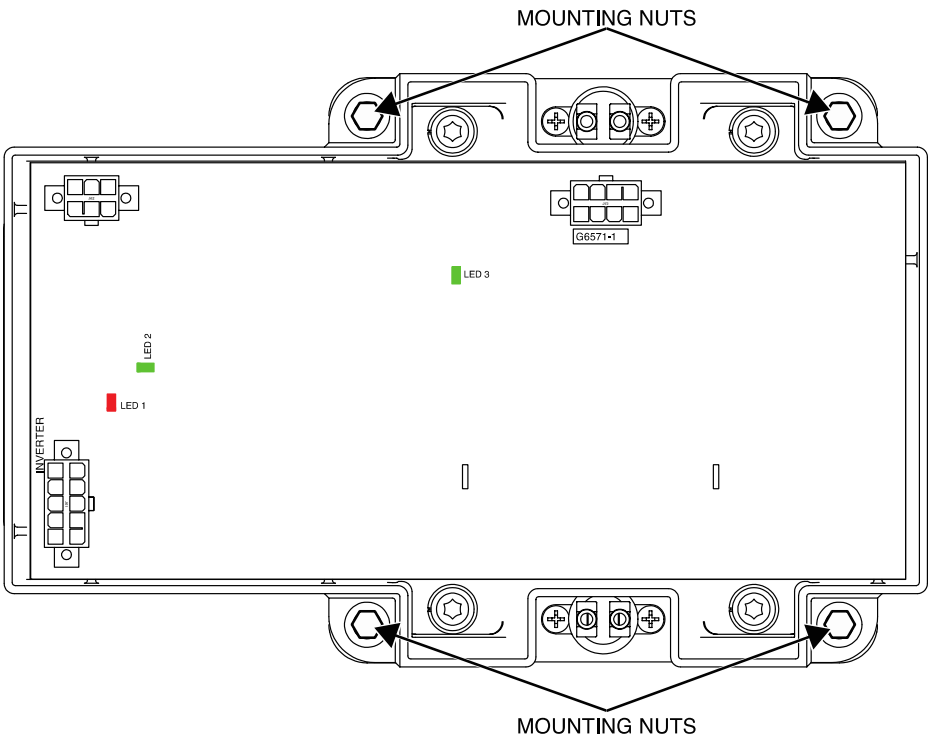


Figure F.45 – Auxiliary (115 VAC) board mounting nut locations



ROBOTIC FEEDHEAD BOARD REMOVAL AND REPLACEMENT PROCEDURE

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Robotic Feedhead Board.

MATERIALS NEEDED

5/16” Nutdriver
3/8” Nutdriver
Wiring Diagram

REMOVAL PROCEDURE

1. Carefully remove input power from the Power Wave R350 machine.
2. Perform the ***Case Cover Removal Procedure***.
3. Perform the ***Capacitor Discharge Procedure***.
4. Using a 5/16” nutdriver, remove the four screws securing the robotic feedhead board mounting plate to the machine. See ***Figure F.46***.
5. Carefully maneuver the mounting plate to gain access to the plugs on the robotic feedhead board.
6. Label and disconnect plugs J82, J83, J84 and J85 from the robotic feedhead board. See ***Figure F.47***. See Wiring Diagram.
7. Using a 3/8” nutdriver, remove the four mounting nuts securing the board to the mounting plate. See ***Figure F.48***.
8. The robotic feedhead board can now be removed and replaced.

REPLACEMENT PROCEDURE

1. Carefully position the new robotic feedhead board onto the mounting plate.
2. Using a 3/8” nutdriver, attach the four mounting nuts securing the board to the mounting plate.
3. Connect plugs J82, J83, J84 and J85 to the robotic feedhead board. See Wiring Diagram.
4. Carefully position the mounting plate onto the machine.
5. Using a 5/16” nutdriver, attach the four screws securing the robotic feedhead board mounting plate to the machine.
6. Perform the ***Case Cover Replacement Procedure***.
7. Perform the ***Retest After Repair Procedure***.

Figure F.46 – Robotic feedhead board mounting plate location

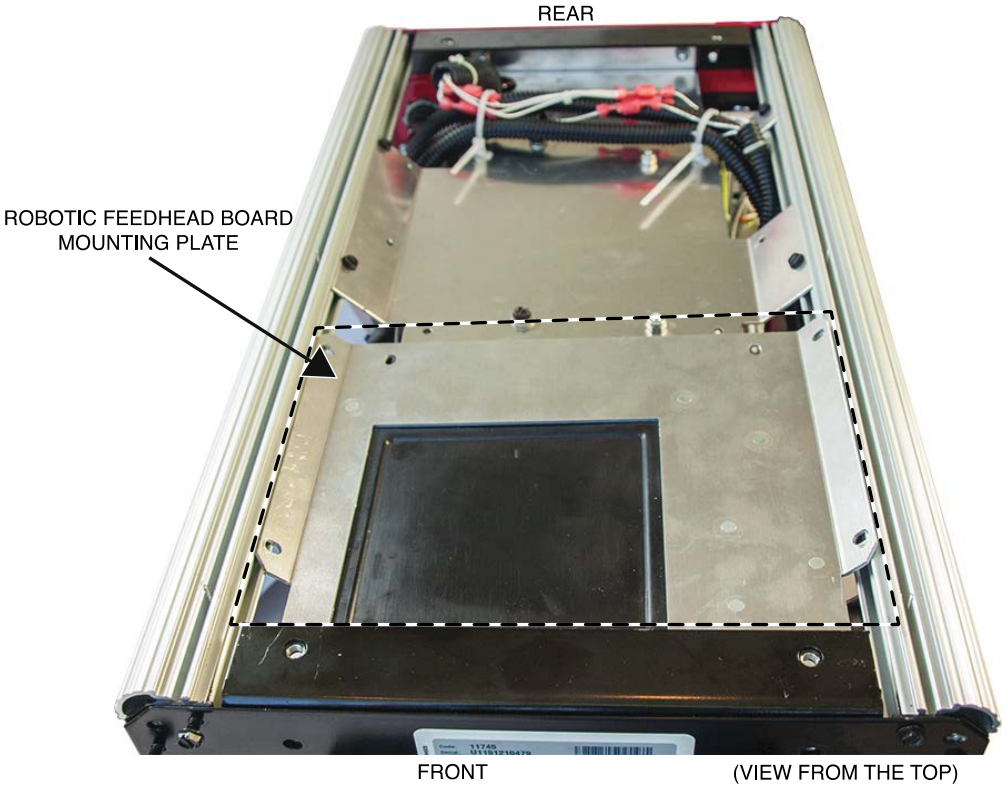


Figure F.47 – Robotic feedhead board plug locations

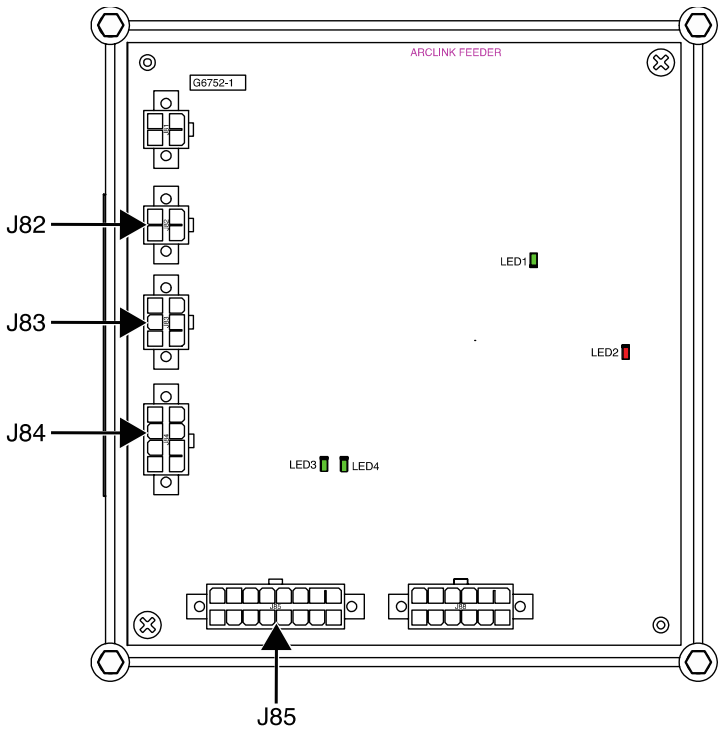
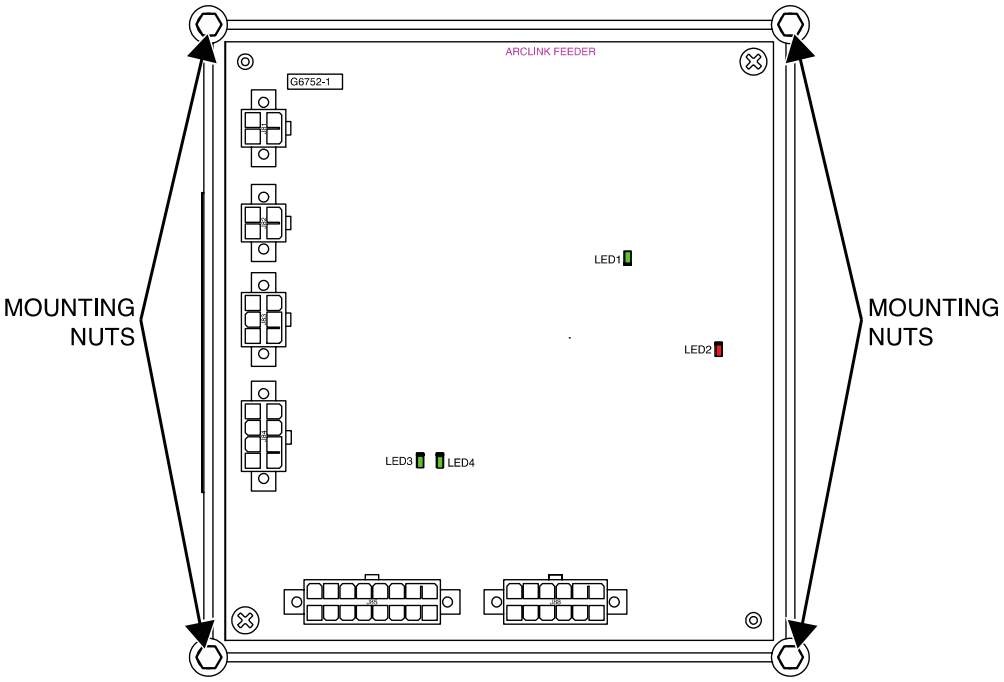


Figure F.48 – Robotic feedhead board mounting nut locations



RETEST AFTER REPAIR

Retest a machine:

• If it is rejected under test for any reason that requires you to remove any part which could affect the machine's electrical characteristics.

OR

• If you repair or replace any electrical components.

PROCEDURE

1. Be certain the machine is properly connected for the input voltage being applied.
2. Turn the power switch ON and see that the machine goes through the Start-up routine and the status light is steady green.
3. Turn the power switch OFF and connect a resistive load across the output studs and a computer to the Ethernet.
4. Perform the Power Wave Verification And Calibration Procedures, see SVM251.