LINCOLN ELECTRIC

GENUINE LINCOLN PARTS™

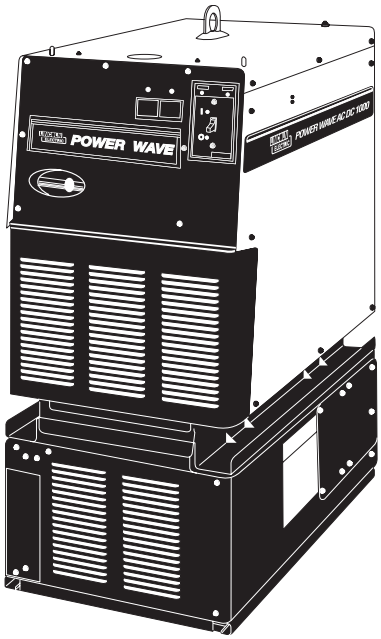
NOTE: This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

POWER WAVE® AC/DC 1000®, PF10A®, PF10S® SYSTEM

For use with machines having Code Numbers:

PW AC/DC 1000®	**11124, 11226**
PF10A®	**11139**
PF10S® Head	**11063, 11064, 11127**

SERVICE MANUAL



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THE LINCOLN ELECTRIC COMPANY
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⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

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

The Above For Diesel Engines

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

The Above For Gasoline Engines

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.

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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 with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) 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. In confined spaces or in some circumstances, outdoors, a respirator may 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 material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

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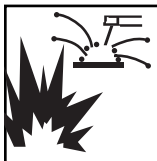

WELDING and CUTTING SPARKS can cause fire or explosion.

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 adjcent 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 1235 Jefferson Davis Highway, Arlington, VA 22202.

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.

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PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d.Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

Electromagnetic Compatibility (EMC)

Conformance
Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2004/108/EC. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

Introduction
All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

Installation and Use
The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

Assessment of Area
Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

a) other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;

b) radio and television transmitters and receivers;

c) computer and other control equipment;

d) safety critical equipment, e.g., guarding of industrial equipment;

e) the health of the people around, e.g., the use of pacemakers and hearing aids;

f) equipment used for calibration or measurement

g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;

h) the time of day that welding or other activities are to be carried out.

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Electromagnetic Compatibility (EMC)

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of Reducing Emissions

Mains Supply
Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

Maintenance of the Welding Equipment
The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturers instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables
The welding cables should be kept as short as possible and should be positioned close together, running at or close to floor level.

Equipotential Bonding
Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of the Workpiece
Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding
Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding installation may be considered for special applications. [1]

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[1] Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

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Section A

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TECHNICAL SPECIFICATIONS - POWER WAVE® AC/DC 1000® (K2344-1, K2344-2)

INPUT AT RATED OUTPUT - THREE PHASE ONLY

INPUT VOLTS 3 PHASE 50/60 Hz	INPUT CURRENT AMPS K2344-1	INPUT CURRENT AMPS K2344-2	OUTPUT CONDITIONS	IDLE POWER WATTS	POWER FACTOR @ RATED OUTPUT	EFFICIENCY @ RATED OUTPUT
380	---	82	1000A@44V. 100% Duty Cycle	225	.95	86%
400	---	79				
460	68	69				
500	62	62				
575	54	55				

OUTPUT

OPEN CIRCUIT VOLTAGE	AUXILIARY POWER (CIRCUIT BREAKER PROTECTED)	PROCESS CURRENT RANGES (AC or DC)
25 to 100 V_{RMS}	40 VDC AT 10 AMPS 115 VAC AT 10 AMPS	SAW-DC+ SAW-DC- SAW-AC } Output Range 200-1000 Average Amps

RECOMMENDED INPUT WIRE AND FUSE SIZES[1]

3 PHASE INPUT VOLTAGE 50/60Hz	TYPE 90°C COPPER WIRE[3] IN CONDUIT AWG (mm2)	COPPER GROUNDING CONDUCTOR AWG (mm2)	TIME-DELAY FUSE OR BREAKER[2] AMPS
380	3(25)	8 (10)	100
400	3(25)	8 (10)	90
460	4(25)	8 (10)	90
500	4(25)	8 (10)	80
575	6(16)	10 (6)	70

PHYSICAL DIMENSIONS

MODEL	CONFORMITY MARK	HEIGHT	WIDTH	DEPTH	WEIGHT
K2344-1	CSA C/UL	43.5 in 1105 mm	19.2 in 488 mm	33 in 838 mm	600 lbs. 272 kg.
K2344-2 *	CE EN 60974-1 CSA C/UL	43.5 in 1105 mm	19.2 in 488 mm	33 in 838 mm	650 lbs. 296 kg.

TEMPERATURE RANGES

Operating Temperature Range	storage temperature range
32°F to 104°F(0°C to 40°C)	-40°F to 185°F(-40°C to 85°C)

Insulation Class: Class F(155°C)

1 Wire and Fuse Sizes based upon the U.S. National Electric Code and maximum output for 40°C (104°) ambient.

2 Also called “inverse time” or “thermal/magnetic” circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of current increases.

3 Failure to use proper type of copper wire will cause fire hazards.

* An external filter will be required to meet CE and C-Tick conducted emission requirements. It will meet CE and C-Tick requirements with the use of an optional external filter. (K2444-1 CE and C-Tick Filter Kit)

WELDING PROCESSES

Process	Electrode Diameter Range	Output Range (Amperes	Wire Feed Speed Range
SAW	5/64 – 7/32" (2 – 5.6 mm)	200 - 1000	21 - 300 ipm (.53 – 7.62 m/minute)

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TECHNICAL SPECIFICATIONS: POWER FEED® 10A CONTROLLER

SPEC.# TYPE	142:1 SPEED RATIO			95:1 SPEED RATIO		
POWER FEED® 10A Controller with POWER FEED® 10SF	Speed	Wire Size		Speed	Wire Size	
		Solid	Cored		Solid	Cored
K2362-1	10-200 IPM (0.25 -5.08 m/min.)	7/32 in. (5.6 mm)	5/32 in. (4.0 mm)	10-300 ipm (0.25 -7.62 m/min.)	1/8 in. (3.2 mm)	5/32 in. (4.0 mm)

INPUT VOLTAGE & CURRENT			PHYSICAL SIZE				TEMPERATURE RATING	
Model	Voltage	Input Amps*	Dimensions			Weight	Operating	Storage
			Height	Width	Depth			
K2362-1	40VDC	1.0	15.0in. (381 mm)	13.0 in (259 mm)	4.0 in. (102 mm)	25 Lbs (11.3 Kg.)	4°F to 104°F (-20°C to 40°C)	-40°F to 185°F (-40°C to 85°C)

* When not driving a motor.

WELDING PROCESSES			
Process	Electrode Diameter Range	Output Range (Amperes)	Wire Feed Speed Range
SAW	5/64 in. – 7/32 in (2.0 – 5.6 mm)	1000 Amps	10 - 300 ipm (0.254- 7.62 m/minute)

TECHNICAL SPECIFICATIONS: POWER FEED® 10S

SPEC.	TYPE	142:1 SPEED RATIO			95:1 SPEED RATIO			57:1 SPEED RATIO		
			Wire Size			Wire Size			Wire Size	
		Speed	Solid	Cored	Speed	Solid	Cored	Speed	Solid	Cored
K2312-1	Power Feed 10S	10-200	7/32	5/32	10-300	1/8	5/32	10-450	1/16	3/32

WIRE FEEDERS - INPUT VOLTAGE AND CURRENT	
Voltage	**Input Amperes**
32V DC	7 Amps (max.)

PHYSICAL DIMENSIONS				
Model	**Height**	**Width**	**Depth**	**Weight**
K2312-1	12.0 in. (305 mm)	14.0 in. (355 mm)	10.0 in. (254 mm)	35.0 lbs. (15.9 kg)
K2370-1	12.0 in. (305 mm)	14.0 in. (355 mm)	10.0 in. (254 mm)	80.0 lbs. (36.3 kg)
K2311-1	8.0 in. (203 mm)	6.0 in. (152 mm)	5.0 in. (127 mm)	

TEMPERATURE RANGES	
Operating Temperature Range	**Storage Temperature Range**
-4°F to 104°F (-20°C to 40°C)	-40°F to 185°F (-40°C to 85°C)

WELDING PROCESSES			
Process	**Electrode Diameter Range**	**Output Range (Amperes)**	**Wire Feed Speed Range**
SAW	5/64 in. – 7/32 in (2.0 – 5.6 mm)	200 - 1000 Amps	21 - 300 ipm (0.53 - 7.62 m/minute)

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SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

⚠ WARNING

ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.
- Do not touch electrically hot parts.
- Always connect the POWER WAVE® grounding lug (located inside the reconnect input access door) to a proper safety (Earth) ground.

LOCATION AND MOUNTING

Place the welder where clean cooling air can freely circulate in through the rear louvers and out through the case sides and front. Dirt, dust, or any foreign material that can be drawn into the welder should be kept at a minimum. Do not use air filters on the air intake because the air flow will be restricted. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdowns.

⚠ CAUTION

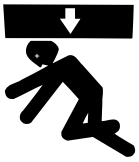
DO NOT MOUNT OVER COMBUSTIBLE SURFACES.
Where there is a combustible surface directly under stationary or fixed electrical equipment, the surface shall be covered with a steel plate at least .06”(1.6mm) thick, which shall extend not more than 5.90”(150mm) beyond the equipment on all sides.

STACKING

POWER WAVE® AC/DC 1000® machine cannot be stacked.

LIFTING

⚠ WARNING



FALLING EQUIPMENT CAN CAUSE INJURY.

- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.
- Do not lift machine if lift bail is damaged.
- Do not operate machine while suspended from lift bail.

Lift the machine by the lift bail only. The lift bail is designed to lift the power source only. Do not attempt to lift the POWER WAVE® AC/DC 1000® with accessories attached to it.

ENVIRONMENTAL LIMITATIONS

Do not use the POWER WAVE® AC/DC 1000® in an outdoor environment. The POWER WAVE® AC/DC 1000® power source should not be subjected to falling water, nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

ELECTROMAGNETIC COMPATIBILITY (EMC)

The EMC classification ot the POWER WAVE® AC/DC 1000® is Industrial, Scientific and Medical (ISM) group 2, class A. The POWER WAVE® AC/DC 1000® is for industrial use only.

Locate the POWER WAVE® away from radio controlled machinery.

⚠ CAUTION

The normal operation of the POWER WAVE® AC/DC 1000® may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

INPUT AND GROUND CONNECTIONS

MACHINE GROUNDING

The frame of the welder must be grounded. A ground terminal marked with the symbol shown is located inside the reconnect / input access door for this purpose. See your local and national electrical codes for proper grounding methods.

INPUT CONNECTION

WARNING

ELECTRIC SHOCK can kill.

- Only a qualified electrician should connect the input leads to the POWER WAVE®. Connections should be made in accordance with all local and National Electrical Codes and the connection diagram located on the inside of the reconnect / input access door of the machine. Failure to do so may result in bodily injury or death.

Use a three-phase supply line. A 1.75 inch (45 mm) diameter access hole for the input supply is located on the case back. Connect L1, L2, L3 and ground according to the Input Supply Connection Diagram.

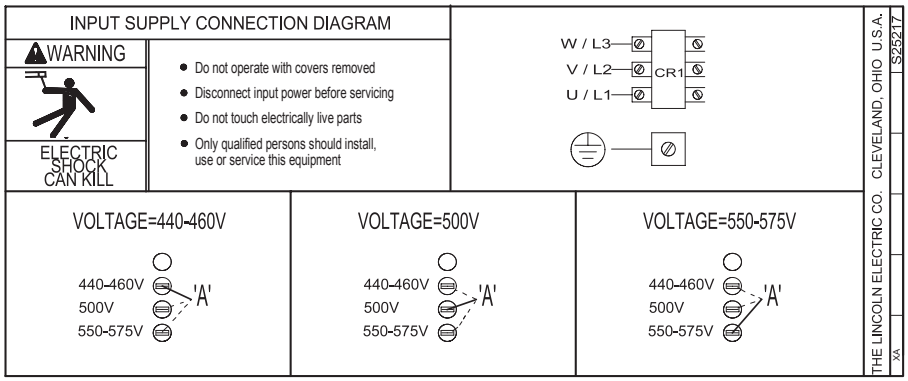
INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

Refer to Specifications page for recommended fuse and wire sizes. Fuse the input circuit with the recommended super lag fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" circuit breakers). Choose input and grounding wire size according to local or national electrical codes. Using fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents, even if the machine is not being used at high currents.

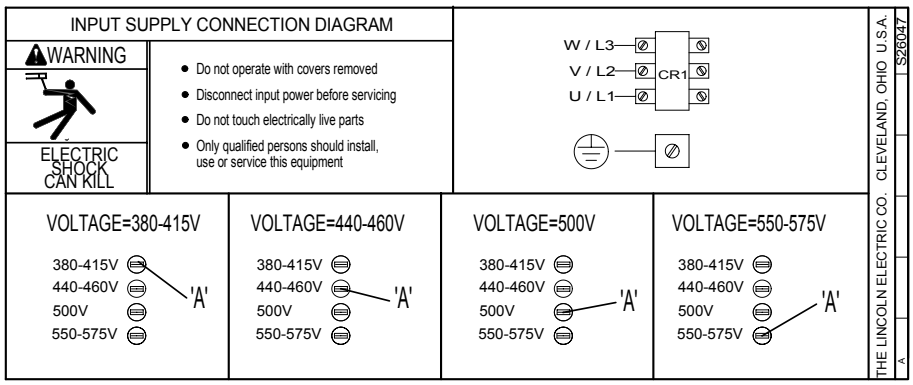
INPUT VOLTAGE SELECTION

Welders are shipped connected for the highest input voltage listed on the rating plate. To move this connection to a different input voltage, see the diagram located on the inside of the input access door, or the Reconnect Diagram K2344-1 and K2344-2 shown below. If the Auxiliary lead (indicated as 'A') is placed in the wrong position, there are two possible results. If the lead is placed in a position higher than the applied line voltage, the welder may not come on at all. If the Auxiliary lead is placed in a position lower than the applied line voltage, the welder will not come on, and the two circuit breakers in the reconnect area will open. If this occurs, turn off the input voltage, properly connect the auxiliary lead, reset the breakers, and try again.

RECONNECT DIAGRAM FOR K2344-1 POWER WAVE® AC/DC 1000®



RECONNECT DIAGRAM FOR K2344-2 POWER WAVE® AC/DC 1000® ("CE – READY")



POWER WAVE® AC/DC 1000®

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SYSTEM CONNECTION

SYSTEM OVERVIEW

The POWER WAVE® AC/DC 1000® power source is designed to be a part of a modular welding system typically controlled by a **POWER FEED® 10A Controller** or customer supplied **Programmable Logic Controller (PLC)**. Each welding arc may be driven by a single power source or by a number of power sources connected in parallel. The actual number of power sources per arc will vary depending on the application. When only one power source is required for an arc group, it must be configured as a Master. When multiple parallel machines are required, one is designated as the Master and the rest as Slaves. The Master controls the AC switching for the arc group, and the Slaves respond accordingly.

When employed in a multi-arc AC system it is beneficial to synchronize the arcs to each other. The Master for each arc can be configured to follow a dedicated external synchronization signal to determine its frequency and balance. The optional POWER WAVE® System Interface provides the means to synchronize the AC wave shapes of up to four different arcs to a common carrier frequency. This frequency can range from 10 hertz to 300 hertz, with the most practical range being 10 to 100 hertz. It can also control the phase angle between arcs to reduce the effects of welding related issues such as "Arc Blow".

The arc to arc phase relationship is determined by the timing of each arc's "sync" signal relative to the "sync" signal of ARC 1.

In a typical multi-arc system, each arc is controlled by its own POWER FEED® 10A Controller. The basic characteristics of the individual arcs such as WFS, amplitude, and offset are set locally by each arc's dedicated controller. The frequency, balance, and phase shift parameters of each arc are controlled by the POWER FEED® 10A Controller for ARC 1, which must be connected to its Master through the POWER WAVE® System Interface (see multi-arc Connection Diagrams on the next few pages).

A PLC interface is an alternate method of control for larger systems. The PLC is typically connected via DeviceNet directly to the POWER WAVE® System Interface, and the Master power source of each arc group in the system.

The following list of Recommended and Optional equipment is included as a reference for the following connection diagrams. The connection diagrams describe the layout of three typical systems. Each diagram has a step by step Installation Checklist. Additionally, a dedicated diagram has been provided detailing the parallel connection of machines for extra output capacity which can be applied to the system diagrams as required.

PRODUCT SUMMARY

The POWER FEED® 10S series of Automatic Wire Drives are designed for hard automation, submerged arc welding. The heavy-duty gearbox and feed plate have many years of proven reliability while a new permanent magnet motor has been added.

The POWER FEED® 10S wire drives consist of a high torque motor and gearbox assembly with a heavy-duty feed plate housing knurled drive rolls for positive, accurate wire feeding of heavy welding wire. The POWER FEED® 10S has many axes of rotation for ease of fixturing and locating.

RECOMMENDED PROCESSES

- The POWER FEED® 10S series of wire drives are best suited for submerged arc welding.

PROCESS LIMITATIONS

- MIG welding
- Robotic applications

EQUIPMENT LIMITATIONS

The POWER FEED® 10S series of wire drives cannot be used with the NA3, NA-4, or NA-5 series of Lincoln Automatics.

COMMON EQUIPMENT PACKAGES

Basic Package:

K2344-1	POWER WAVE® 1000 AC/DC
K2362-1	PF-10A Controller
K2312-1	PF-10SF Wire Drive

Basic Package with optional kits:

K2311-1	PF-10SM Motor Retrofit Kit
K2370-1	PF-10S Wire Drive (includes Cross Seam Adjuster and Automatic Flux Hopper with hardware to connect to TC-3 Travel Carriage)
K2282-1	System Interface (Phase Generator)

RECOMMENDED EQUIPMENT

System Identifier	Part No.	Description	Single Arc[4]	Tandem Arc[4]	Triple Arc[3,4]
Power Source	K2344-1 -or- K2344-2	POWER WAVE® AC/DC 1000® Power Source	1 [1]	2 [1]	3 [1]
Weld Cables	K2163-xx -or- K1842-xx	Welding Power Cables Power Source to contact Nozzle, and Power Source to Work K2163 Series cables sold in pairs. K1842 Series cables sold individually. See Price Book for details and bulk cable availability.	Refer to "Output Cable Guidelines" for recommended size and quantity		
Head	K2370-1 -or- K2312-1	**POWER FEED® 10S** Head for 3/32 to 7/32 in. solid wire (includes hopper, wire straightener, cross seam adjuster, head mounting hardware, and 2 - 5ft 4/0 weld cables). **POWER FEED® 10S** Head for 3/32 to 7/32 in. solid wire (fixture builder's head, with wire straightener - insulators not included).	1[2]	2[2]	3[2]
Torch	K231-xxx	**Submerged Arc Contact Nozzle Assembly**	1	2	3
Power Source to Head Control Cable	K1785-xx	**Feeder Control Cable (14 pin).**	1[2]	2[2]	3[2]
User Interface	K2362-1	**POWER FEED® 10A Controller**	1[2,4]	2[2,4]	---
ArcLink Digital Communication Cable	K1543-xx [5]	**ArcLink Control Cables (5 pin).** Single Arc: (1) PF-10A Controller to the power source Tandem Arc: (1) Lead Arc to System Interface (2)System Interface to Lead Arc PF-10A Controller (3) Trail Arc to Trail Arc PF-10A Controller Triple Arc: (1) Lead Arc to System Interface	1	3	1
PLC (w/ User Interface)	Customer Supplied	**Programmable Logic Controller** (DeviceNet compatible)	---	---	1[4]
DeviceNet Cables and Accessories	Automation Department or Customer Supplied	**DeviceNet Cables, Tees, and Terminators (5 pin)** sealed "mini style") form a trunk style network connecting PLC to each power source and the System Interface. For additional information refer to the "DeviceNet Cable Planning and Installation Manual" (Allen Bradley publication DN-6.7.2).	---	---	Cables, Tees, and Terminators as required per Triple Arc Connection Diagram [4]
System Interface	K2282-1	**POWER WAVE® System Interface** provides the means to synchronize the AC wave shapes of up to four different arcs to a common carrier frequency, and control the phase angle between them to reduce the effects of "Arc Blow".	---	1[2]	1[2]
System Interface to Power Source Control Cable	K1795-xx [5]	**Control Cable (22 pin)** connects between each power source and the System Interface.	---	2[2]	3[2]

Notes:

1. "Recommended Quantity" assumes one power source per arc. Multiple power sources may be used to increase the output capacity per arc (see "Connection Diagram - Parallel Machines").
2. Control Cable connections only required at the Master of each parallel power source arc grouping.
3. Can be expanded to 4 or more arcs (Note: The System Interface can currently only synchronize up to four AC arc groupings).
4. The triple arc system is an economical breakpoint for a PLC Interface. It does not preclude the use of a PLC for single or tandem arc systems, nor PF-10A's from being used to control multiple arc systems with greater than two arcs.
5. Cables can be connected end to end to extend length.

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OPTIONAL EQUIPMENT

System Identifier	Part No.	Description
Ethernet Network Equipment	Customer Supplied	**Ethernet Switch, Cables, etc.** required for arcs > 1000A, or for use of **POWER WAVE® Submerged Arc Utilities** software package.
Personal Computer	Customer Supplied	**IBM Compatible PC** (Windows NT SP6, Windows 2000, Windows XP, or greater) required for use with **POWER WAVE® Submerged Arc Utilities** software package.
Travel Carriage	K325-x	**TC-3 Self-Propelled Travel Carriage** for traversing standard carriage beam (per G1458)
Travel Carriage (High Capacity)	K325-HCx	**TC-3 Self-Propelled High Capacity Travel Carriage** for traversing standard carriage beam (per G1458)
Controller Mounting Bracket User Interface	K2462-1	**PF-10A Mounting Bracket** mounts PF-10A Controller to left side of TC-3 carriage. Brackets can be cascaded to accommodate more than one controller. Note: Bracket uses mounting holes reserved for K299 Wire Reel Assembly (see Wire Reel Mounting options for additional information).
Horizontal Adjuster	K96	**Horizontal Lift Adjuster** provides 2" (51mm) crank adjustment of horizontal head position.
Vertical Adjuster	K29	**Vertical Lift Adjuster** provides 4" (102mm) crank adjustment of vertical head position. Also provides 3.37" (95mm) in-and-out horizontal adjustment with movable stops for repeatability.
Wire Reel Mounting (single)	K299	**Wire Reel Assembly** accommodates one 50-60 lb (22.7-27.2 kg) coil, includes mounting spindle and braking system. Mounts to left side of TC-3 Std. or High Capacity Travel Carriage (K325-x). Cannot be mounted to TC-3 when K2462-1 PF-10A Mounting Bracket is used (use K390 instead).
Wire Reel Mounting (dual)	K390	**Electrode Reels and Mountings** for mounting up to two 50-60 lb (22.7-27.2 kg) coils, includes mounting spindle and braking system. Mounts to top of TC-3 High Capacity Travel Carriage (K325-HCx). Does not interfere with K2462-1 PF-10A Mounting Bracket.
Mounting for Dual Head	K387	**Tandem Arc Framework** includes hex style framework and mounting hardware to attach two PF-10S or PF-10SF heads directly to a high capacity TC-3 carriage, or user supplied fixture or gantry.
Flux Hopper	K219	**Flux Hopper** with electric flux valve for Submerged Arc welding.
Flux Hopper	K389	**Flux Hopper** with electric flux valve, for K387 tandem mounting. Mounts directly to hex crossbar.

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SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

⚠ WARNING

ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.
- Do not touch electrically hot parts.

⚠ WARNING

ELECTRIC SHOCK can kill.

- Caution: parts may be at welding voltage.

⚠ CAUTION

NON-STANDARD SAFETY INFORMATION

The PF-10S series of wire drives may be at welding voltage potential when the output of the power source is active.

INPUT AND GROUND CONNECTIONS

Only a qualified electrician should connect the POWER FEED® 10S. Installation should be made in accordance with the appropriate National Electrical Code, all local codes and the information in this manual.

LOCATION AND MOUNTING

- The POWER FEED® 10S will operate in harsh environments.

HIGH FREQUENCY PROTECTION

Locate the POWER FEED® 10S away from radio controlled machinery.

STEP BY STEP INSTALLATION CHECKLIST

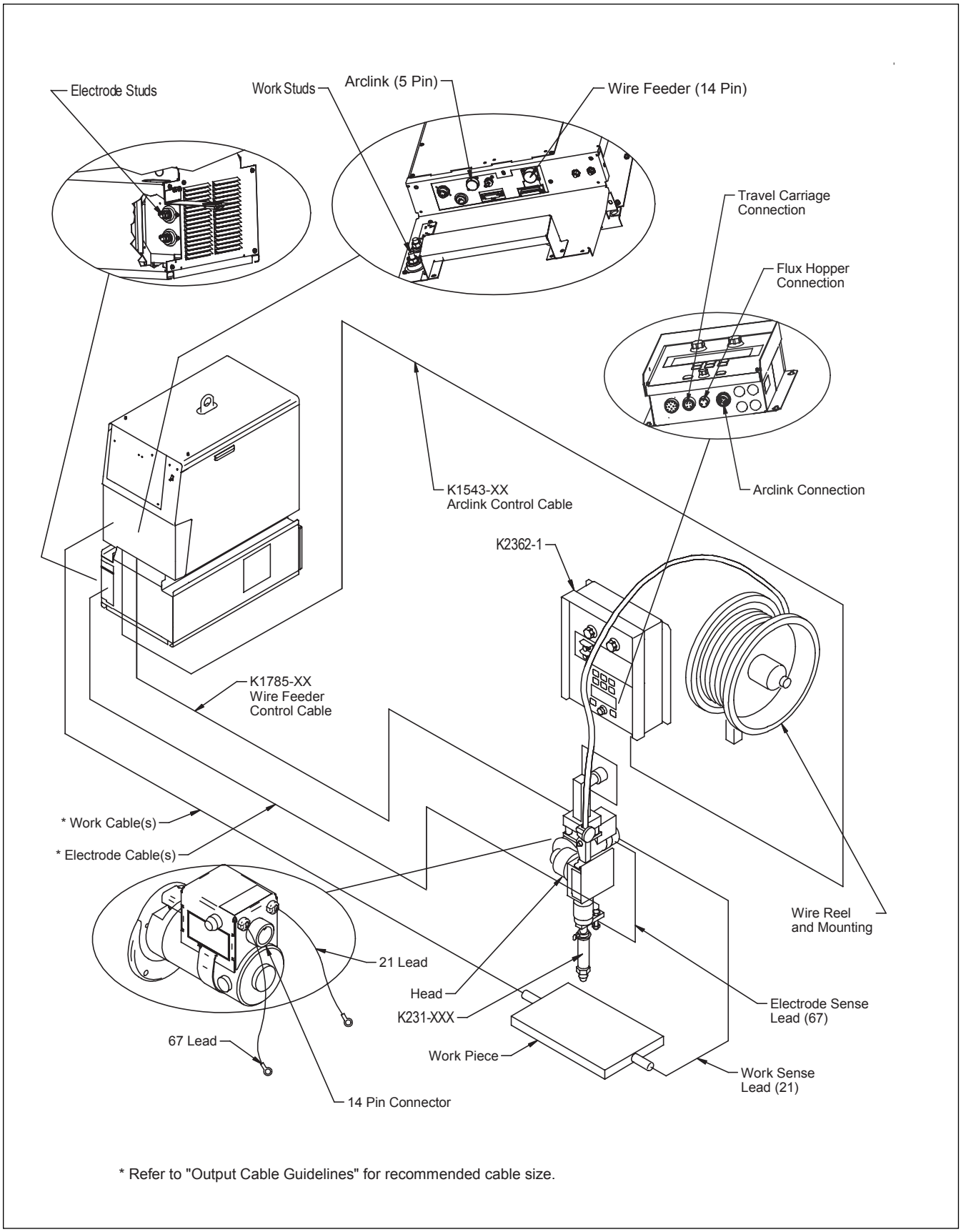
SINGLE ARC SYSTEM CHECKLIST –
(PF-10A CONTROLLED, 1 POWER SOURCE)
(See ***Figure A.1*** Connection Diagram "Typical Single Arc System")

- Place POWER WAVE® in suitable operating location.
- Mount PF10A Controller.
- Install PF10S Wire Drive and other accessories in their operating location.
- Connect K1785-xx Wire Feeder Control Cable (14 pin) between the POWER WAVE® and Wire Drive.(1)
- Connect K1543-xx ArcLink Control Cable (5 pin) between POWER WAVE® and PF10A.(1)
- Configure / Install sense leads.
- Connect / Install welding cables per recommended "Output Cable Guidelines."
- Open all POWER WAVE® front panel and configure DIP switch settings per "Internal Controls" section.
- Connect input power to POWER WAVE® per recommended guidelines.
- Turn on POWER WAVE®, and verify all system Status Lights are solid green.

NOTES:

(1) ArcLink and Wire Feeder control cable connections are only required at the Master power source of each arc grouping. For additional information see the ***Extra Capacity Parallel Connection Checklist.***

FIGURE A.1
CONNECTION DIAGRAM - TYPICAL SINGLE ARC SYSTEM (POWER FEED® 10A CONTROLLER)



* Refer to "Output Cable Guidelines" for recommended cable size.

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POWER WAVE® AC/DC 1000®AMP SUB-ARC SYSTEM CONNECTIONS

(See ***Figure A.1*** and A.2)

1- Work cable connection

3- 14 pin wire feeder control cable

4- 5 pin Arclink control cable to user interface

7- Electrode cable connection

MOUNTING DIMENSIONS

The PF-10S can be mounted by using the four 3/8-16 tapped holes or the two 0.562 through holes. See mounting hole locations (Figure A.3).

FIGURE A.2

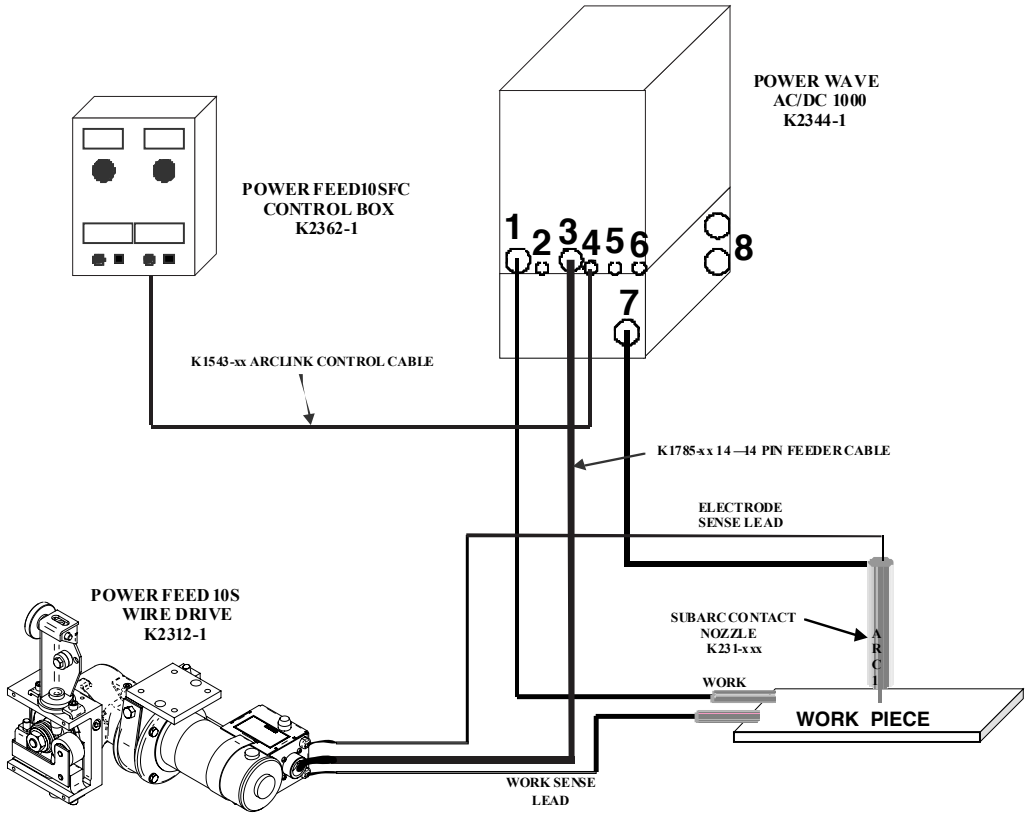


FIGURE A.3

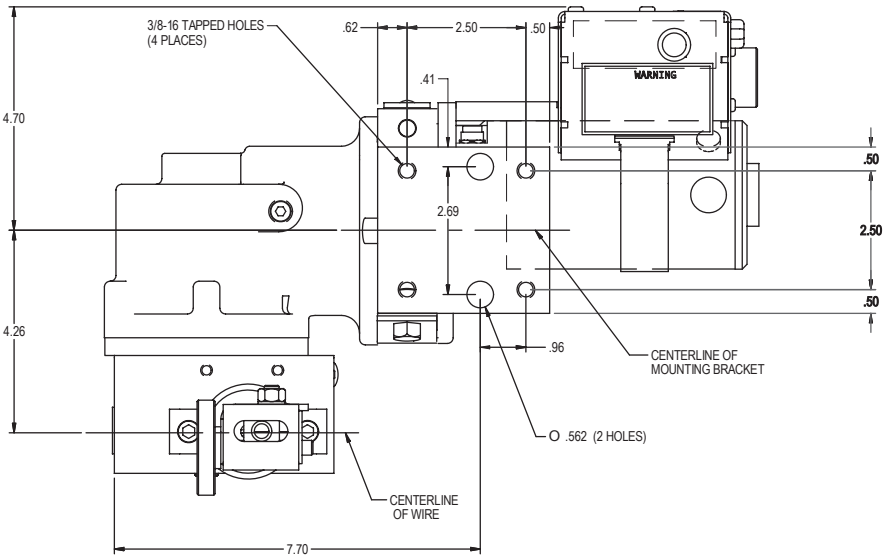
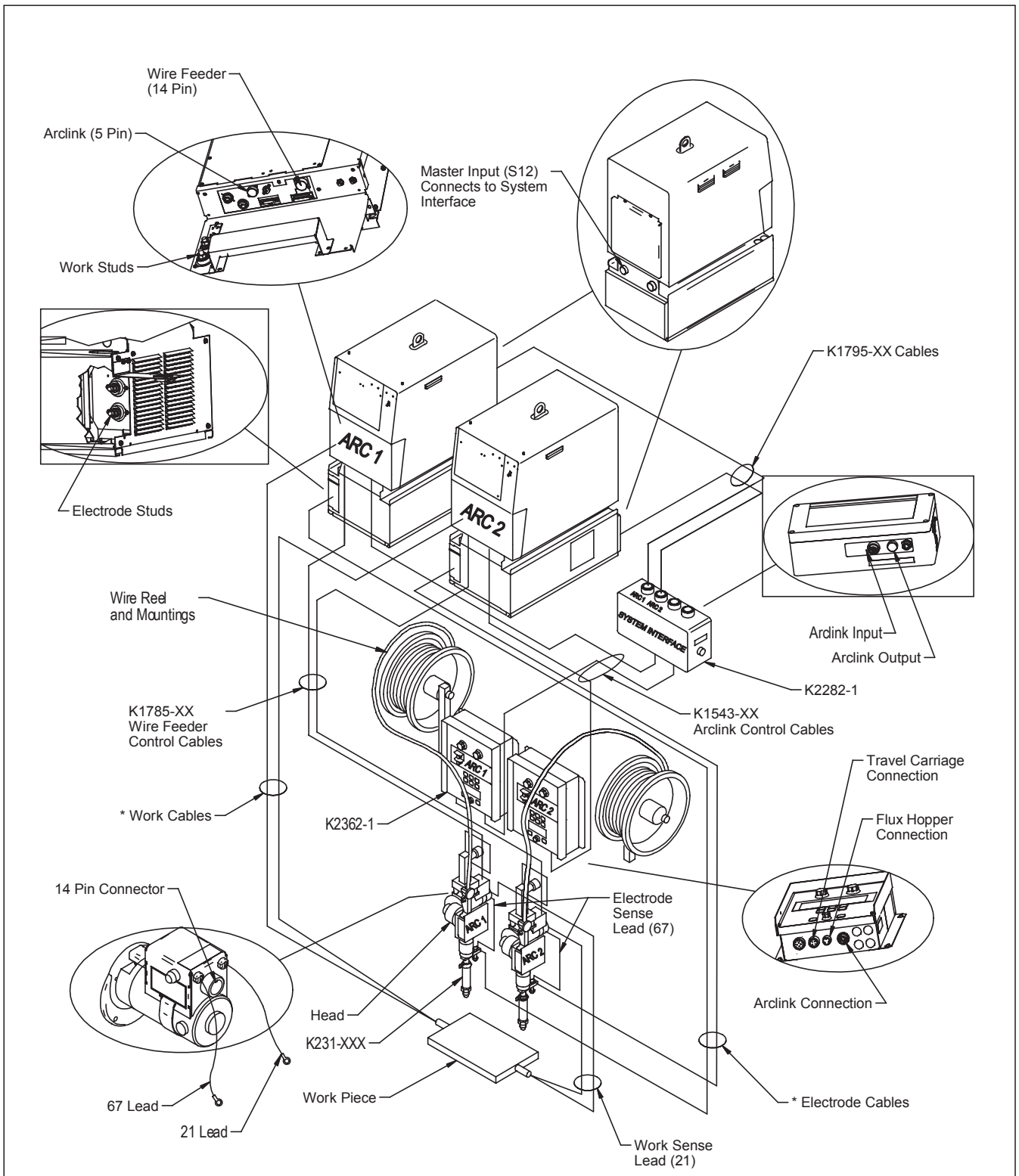


FIGURE A.4
CONNECTION DIAGRAM - TYPICAL TANDEM ARC SYSTEM (POWER FEED® 10A CONTROLLER)



* Refer to "Output Cable guidelines" for recommended cable size.

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STEP BY STEP INSTALLATION CHECKLIST

TANDEM ARC SYSTEM CHECKLIST –
(PF-10A CONTROLLED, 1 POWER SOURCE PER ARC) (See ***Figure A.4*** "Typical Tandem Arc System")

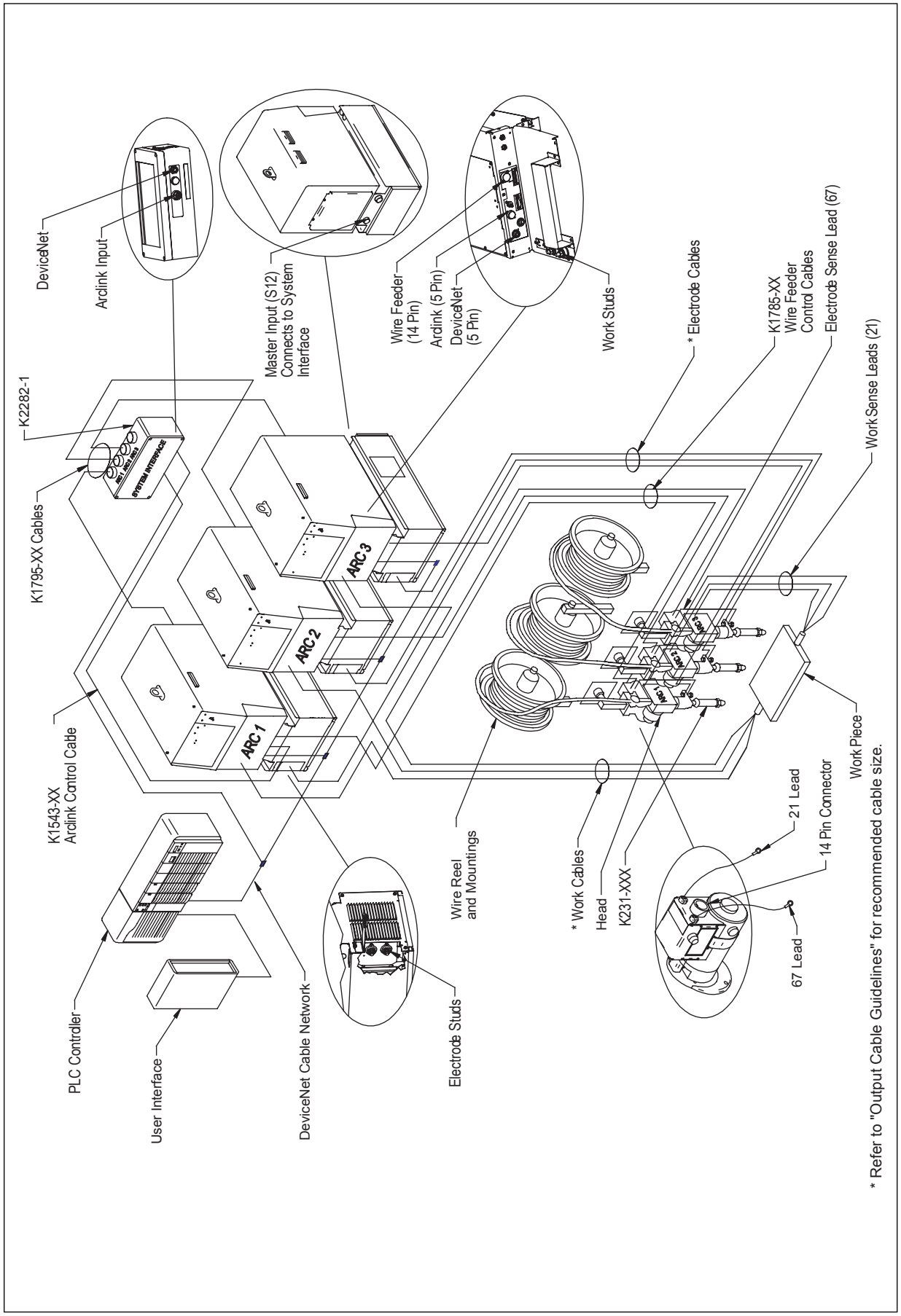
- Place POWER WAVE®s in suitable operating location.
- Mount PF10A Controllers.
- Install PF10S Wire Drives and other accessories in their operating location.
- Mount POWER WAVE® System Interface.
- Connect K1785-xx Wire Feeder Control Cable (14 pin) between each POWER WAVE® and Wire Drive.(1)
- Connect K1543-xx ArcLink Control Cables (5 pin) from POWER WAVE® #1 to the System Interface input, and from the System Interface output to the PF10A Controller for ARC #1.(1)
- Connect K1543-xx ArcLink Control Cable (5 pin) between POWER WAVE® #2 and the PF10A Controller for ARC #2.(1)
- Connect K1795-xx System Control Cables (22 pin) between each POWER WAVE® and the System Interface. (2)
- Configure / Install sense leads.
- Connect / Install welding cables per recommended "Output Cable Guidelines."
- Open all POWER WAVE® front panels and configure DIP switch settings per "Internal Controls" section.
- Connect input power to POWER WAVE®s per recommended guidelines.
- Turn on POWER WAVE®s, and verify all system Status Lights are solid green.

NOTES:

(1) ArcLink and Wire Feeder control cable connections are only required at the Master power source of each arc grouping. For additional information see the ***"Extra Capacity Parallel Connection Checklist."***

(2) The "ARC" (formerly "PHASE") connections from the System Interface are only required for the Master power source of each arc grouping. For additional information see the ***"Extra Capacity Parallel Connection Checklist."***

FIGURE A.5
CONNECTION DIAGRAM - TYPICAL TRIPLE ARC SYSTEM (DEVICENET PLC CONTROLLER)



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STEP BY STEP INSTALLATION CHECKLIST

TRIPLE ARC SYSTEM CHECKLIST – (DEVICENET PLC CONTROLLED, 1 POWER SOURCE PER ARC) (See ***Figure A.5*** "Typical Triple Arc System")

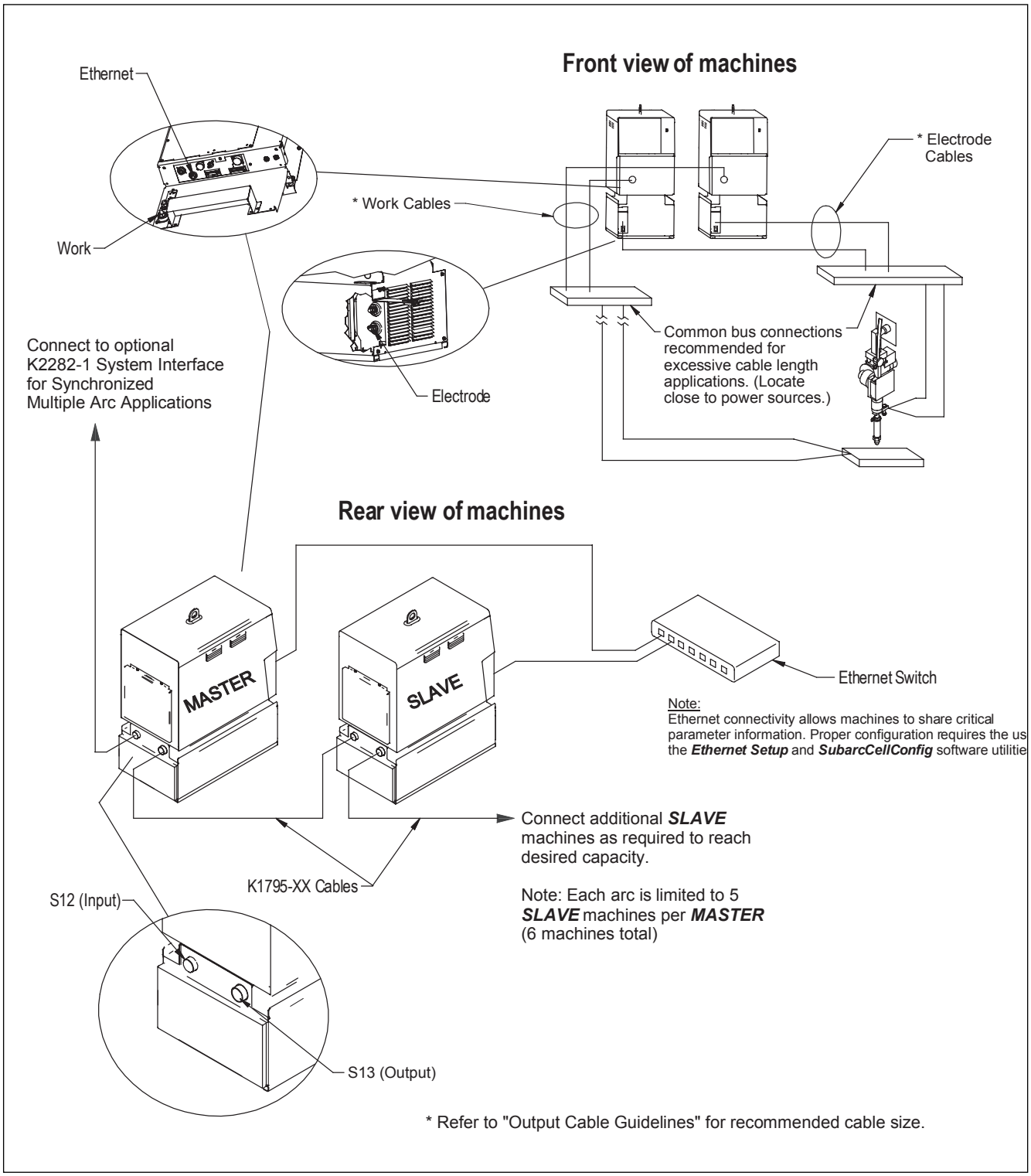
- Place POWER WAVE®s in suitable operating location.
- Mount DeviceNet PLC Controller and User Interface.
- Install PF10S Wire Drives and other accessories in their operating location.
- Mount POWER WAVE® System Interface.
- Connect K1785-xx Wire Feeder Control Cable (14 pin) between each POWER WAVE® and Wire Drive.(1)
- Connect K1543-xx ArcLink Control Cable (5 pin) from ARC #1 power source to the System Interface input.(1)
- Connect K1795-xx System Control Cables (22 pin) between each POWER WAVE® and the appropriate System Interface "ARC" (formerly "PHASE") outputs. (2)
- Connect the System Interface and each power source to the PLC via the DeviceNet network.(1)
- Configure / Install sense leads.
- Connect / Install welding cables per recommended "Output Cable Guidelines."
- Open all POWER WAVE® front panels and configure DIP switch settings (including the DeviceNet MAC ID and Baud Rate settings) per "Internal Controls" section.
- Connect input power to POWER WAVE®s per recommended guidelines.
- Turn on POWER WAVE®s, and verify all system Status Lights are solid green.

NOTES:

(1) ArcLink, DeviceNet and Wire Feeder control cable connections are only required at the Master power source of each arc grouping. For additional information see the ***"Extra Capacity Parallel Connection Checklist."***

(2) The "ARC" (formerly "PHASE") connections from the System Interface are only required for the Master power source of each arc grouping. For additional information see the ***"Extra Capacity Parallel Connection Checklist."***

FIGURE A.6 – CONNECTION DIAGRAM - PARALLEL MACHINES
(Example depicts a single arc grouping, and may be repeated for each arc in the system)



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STEP BY STEP INSTALLATION CHECKLIST

EXTRA CAPACITY PARALLEL CONNECTION

(See ***Figure A.6*** "Parallel Machines")

- Follow all steps of Single, Tandem, or Triple Arc checklists.
- Be sure input power is disconnected prior to following the remaining steps.
- Control Cable Connections:

  PF-10S Connections:

  - Each PF-10S must be connected to the Master power source of its associated arc.

  PF-10A Controlled Systems:

  - Each PF-10A Controller must be connected to the Master power source of its arc via a K1543-xx ArcLink Control Cable (5 pin), but should not be connected to the Slave(s).
  - In a multi-arc system, the System Interface must also be connected to the ARC #1 Master power source via a K1543-xx ArcLink Control Cable (5 pin).

  DeviceNet PLC Controlled Systems:

  - Only the Master power source of each arc should be connected to the PLC Controller via the DeviceNet network.
  - In a multi-arc system, the System Interface must connected to the PLC via the DeviceNet network. It must also be connected to the ARC #1 Master power source via a K1543-xx ArcLink Control Cable (5 pin).

- Connect K1795-xx System Control Cables (22 pin) between the Master and Slaves of each arc grouping per the Parallel Machines Connection Diagram.
- Connect / Install welding cables per the recommended "Output Cable Guidelines" and the "Parallel Machines Connection Diagram" for each arc grouping.
- Configure / Install sense leads (the sense lead configuration of all machines in a given parallel arc grouping must be the same).
- Open POWER WAVE® front panels and configure DIP switch settings per "Internal Controls" section.
- POWER WAVE® to LAN (Local Area Network). See "Connection Between Power Source and Ethernet Network."
- Connect input power to POWER WAVE®s per recommended guidelines.
- Turn on POWER WAVE®s.
- Configure network settings using **Ethernet Setup** software utility (follow instructions provided).
- Run the **Submerged Arc Cell Configuration** software utility to configure the Master / Slave relationships of each arc grouping (follow instructions provided).

ELECTRODE AND WORK CONNECTIONS

GENERAL GUIDELINES

The unique switching structure of the POWER WAVE® AC/DC 1000® allows it to produce DC positive, DC negative or AC output waveforms without repositioning the work and electrode leads. Additionally, no DIP switch changes are required to switch between the different polarities. All of this is controlled internally by the POWER WAVE® AC/DC 1000®, and based exclusively on the weld mode selection.

The following recommendations apply to all output polarities and weld modes:

- **Select the appropriate size cables (per Table A.1 "Output Cable Guidelines") below.** Excessive voltage drops caused by undersized welding cables and poor connections often result in unsatisfactory welding performance. Always use the largest welding cables (electrode and work) that are practical, and be sure all connections are clean and tight.

NOTE: Excessive heat in the weld circuit indicates undersized cables and/or bad connections.

- **Route all cables directly to the work and wire feeder, avoid excessive lengths and do not coil excess cable.** Route the electrode and work cables in close proximity to one another to minimize the loop area and therefore the inductance of the weld circuit affects AC welding.

- **Always weld in a direction away from the work (ground) connection.**

TABLE A.1 - OUTPUT CABLE GUIDELINES

Total Cable Length ft (m) Electrode & Work Combined	Duty Cycle	Number of Parallel Cables	Cable Size Copper
0 (0) to 250 (76.2)	80%	2	4/0 (120 mm²)
0 (0) to 250 (76.2)	100%	3	3/0 (95 mm²)

ELECTRODE CONNECTIONS

Connect an electrode cable of sufficient size and length (Per Table A.1) to the "electrode" stud on the power source (located behind the cover plate on the lower left side). For convenience, the cable can be routed down through the two holes in the left cable tray before being connected to the output terminals. Connect the other end of the electrode cable to the wire drive feed plate on the wire feeder. Be sure the connection to the feed plate makes tight metal-to-metal electrical contact.

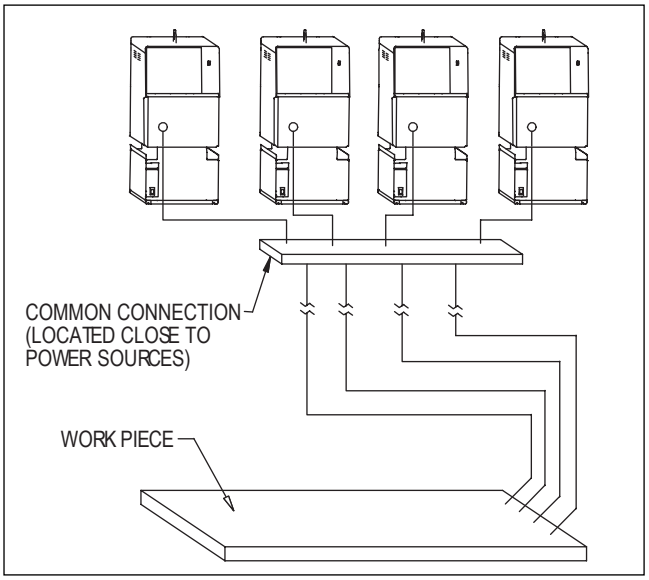
For parallel applications with excessive electrode cable lengths, a common bus connection should be used. The common electrode connection serves to minimize voltage drops associated with resistive losses in the electrode path. It should be made of copper, and located as close as possible to the power sources. (***See Figure A.6*** "Connection Diagram – Parallel Machines")

WORK CONNECTIONS

Connect a work lead of sufficient size and length (Per Table A.1) between the "work" stud (located beneath the spring loaded output cover on the top, front of the machine) and the work piece. For convenience, the work lead can be routed along the left cable tray, and out the back of the machine. Be sure the connection to the work makes tight metal-to-metal electrical contact.

For parallel and/or multiple arc applications with excessive ground path lengths, a common work connection bus should be used. The common work connection serves to minimize voltage drops associated with resistive losses in the ground paths. It should be made out of copper, and located as close as possible to the power sources (See Figure A.7 “Common Connection Diagram”).

FIGURE A.7
COMMON CONNECTION DIAGRAM



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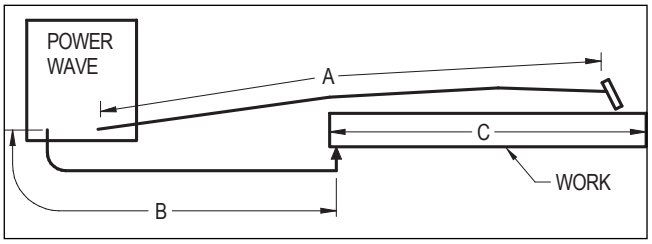
CABLE INDUCTANCE, AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (see Figure A.8 below). To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

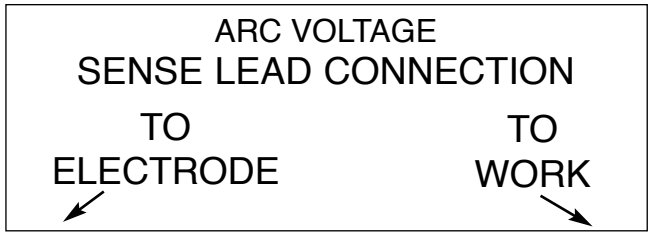
FIGURE A.8
WELDING LOOP LENGTH



REMOTE SENSE LEAD SPECIFICATIONS

The POWER FEED® 10S has sense lead connections at the Connection Box mounted to the motor. These sense leads are critical to the accuracy of the POWER WAVE® welding process. Ring terminals are provided at the ends of the leads. These leads must be extended to the Work piece and the Electrode respectively. The lead marked "TO WORK" should be extended and connected to the work piece, while the lead marked "TO ELECTRODE" should be extended and connected to the nozzle. These connections should be made as close to the welding arc as possible. Use at least a 12 AWG wire with a proper sized ring terminal. Use a screw with a lock washer and nut to make the connection, then insulate the connection with electrical tape. Proper care should be taken to protect the sense leads from becoming disconnected or damaged. The loss of a sense lead connection can adversely affect welding performance.

FIGURE A.9



There are several different sense lead configurations that can be used depending on the application. The ELECTRODE sense lead (67) and the WORK sense lead (21) are built into the wire drive control cable. The system has multiple sense lead configurations available.

REMOTE SENSE LEAD CONNECTIONS

VOLTAGE SENSING OVERVIEW

The best arc performance occurs when the POWER WAVE® AC/DC 1000® has accurate data about the arc conditions. Depending upon the process, inductance within the electrode and work cables can influence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. To counteract this negative effect, remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board.

There are several different sense lead configurations that can be used depending on the application. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

⚠ CAUTION

If the remote voltage sensing is enabled but the sense leads are missing, improperly connected, or if the electrode polarity switch is improperly configured extremely high welding outputs may occur.

ELECTRODE VOLTAGE SENSING

The remote ELECTRODE sense lead (67) is built into the wire feeder control cable (K1785) and accessible at the wire drive. It should always connected to the wire drive feed plate when a wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured through software.

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WORK VOLTAGE SENSING

For most applications the use of a remote work voltage sense lead is recommended. The POWER WAVE® AC/DC 1000® is shipped from the factory with the remote work voltage sense lead enabled. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see the section entitled ***"Voltage Sensing Considerations for Multiple Arc Systems"***. The remote WORK sense lead (21) can be accessed at one of two locations. Either at the wire drive via the wire feeder control cable (K1785), or at the four-pin WORK sense lead connector located under the spring loaded output cover. Whenever possible, use the WORK sense lead that is built into wire feeder control cable (K1785) since it is closely coupled with the ELECTRODE sense lead and will tend to be more immune to electrical noise. If it is not possible to sense the WORK voltage near the feeder, the four-pin WORK sense lead connector at the power source should be used (a plug and pigtail assembly is provided for this purpose).

⚠ CAUTION

Never connect the WORK sense lead at two different locations.

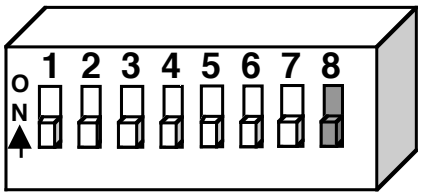
⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.

Some simplified applications may perform adequately by sensing the work voltage directly at the WORK STUD without the use of a remote work voltage sense lead. If a remote work voltage sense lead is not used, it must be disabled as follows:

1. **Turn off power to the power source at the disconnect switch.**
2. Remove the front cover from the power source.
   a. Locate the 8 segment DIP switch on the control board and look for switch 8 of the DIP switch.
   b. Using a pencil or other small object, **slide the switch to the OFF position if the work sense lead is NOT connected.** Conversely, **slide the switch to the ON position** if the **work sense lead is present.**
   c. Replace the cover and screws. The PC board will read the switch at power up, and configure the work voltage sense lead appropriately.



Voltage Sensing for "Slave" machines

If "Slave" machines are configured to use remote voltage sensing they receive these signals directly from the "Master" machine. The K1795 control cable used for parallel connection of machines contains both the ELECTRODE sense lead (67) and the WORK sense lead (21). No other external sense lead connections are required for "Slave" machines.

NOTE: All of the machines of a given arc group (both Master and Slaves) must have their work voltage sensing configured identically. All must either use a remote lead or sense directly from the stud. For additional information see the "Work Voltage Sensing" section of this document.

VOLTAGE SENSING CONSIDERATIONS FOR MULTIPLE ARC SYSTEMS

Special care must be taken when more than one arc is welding simultaneously on a single part. Multiple arc applications do not necessarily dictate the use of remote work voltage sense leads, but they are strongly recommended.

If Sense Leads ARE NOT Used:

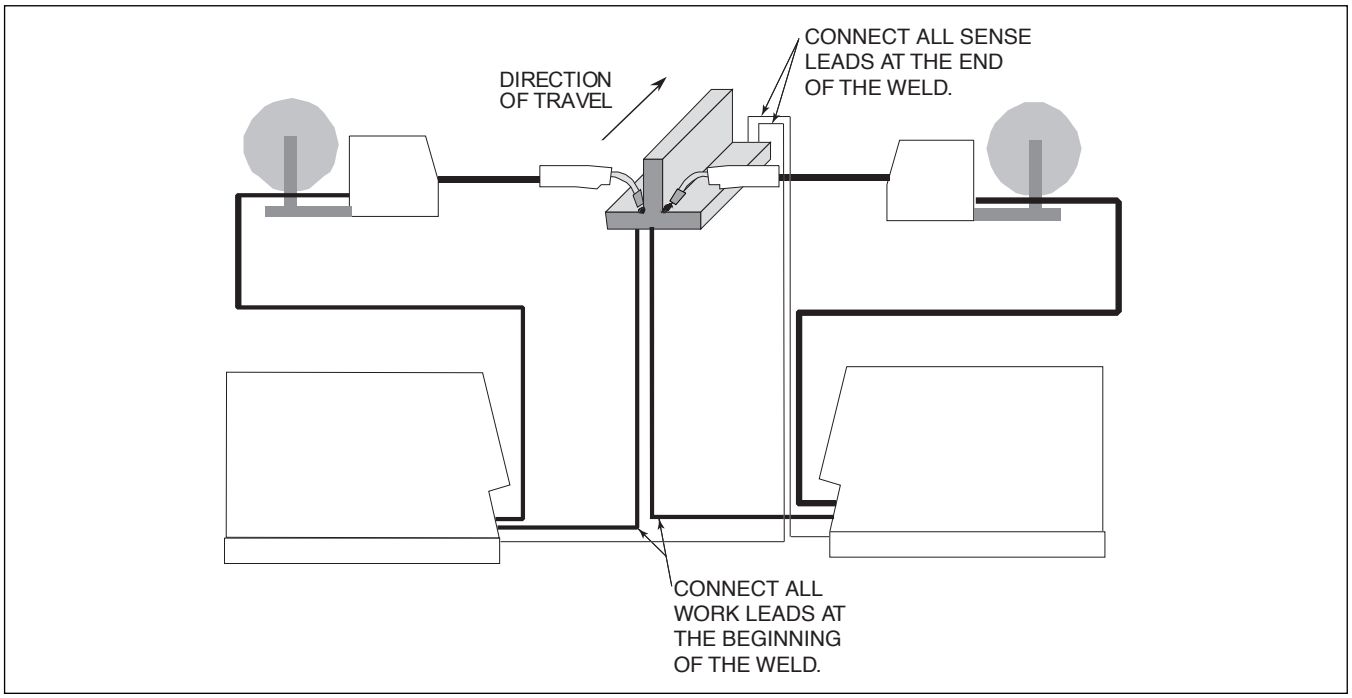
- **Avoid common current paths.** Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

If Sense Leads ARE Used:

- **Position the sense leads out of the path of the weld current.** Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

- **For longitudinal applications,** connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads. (See Figure A.10)

FIGURE A.10



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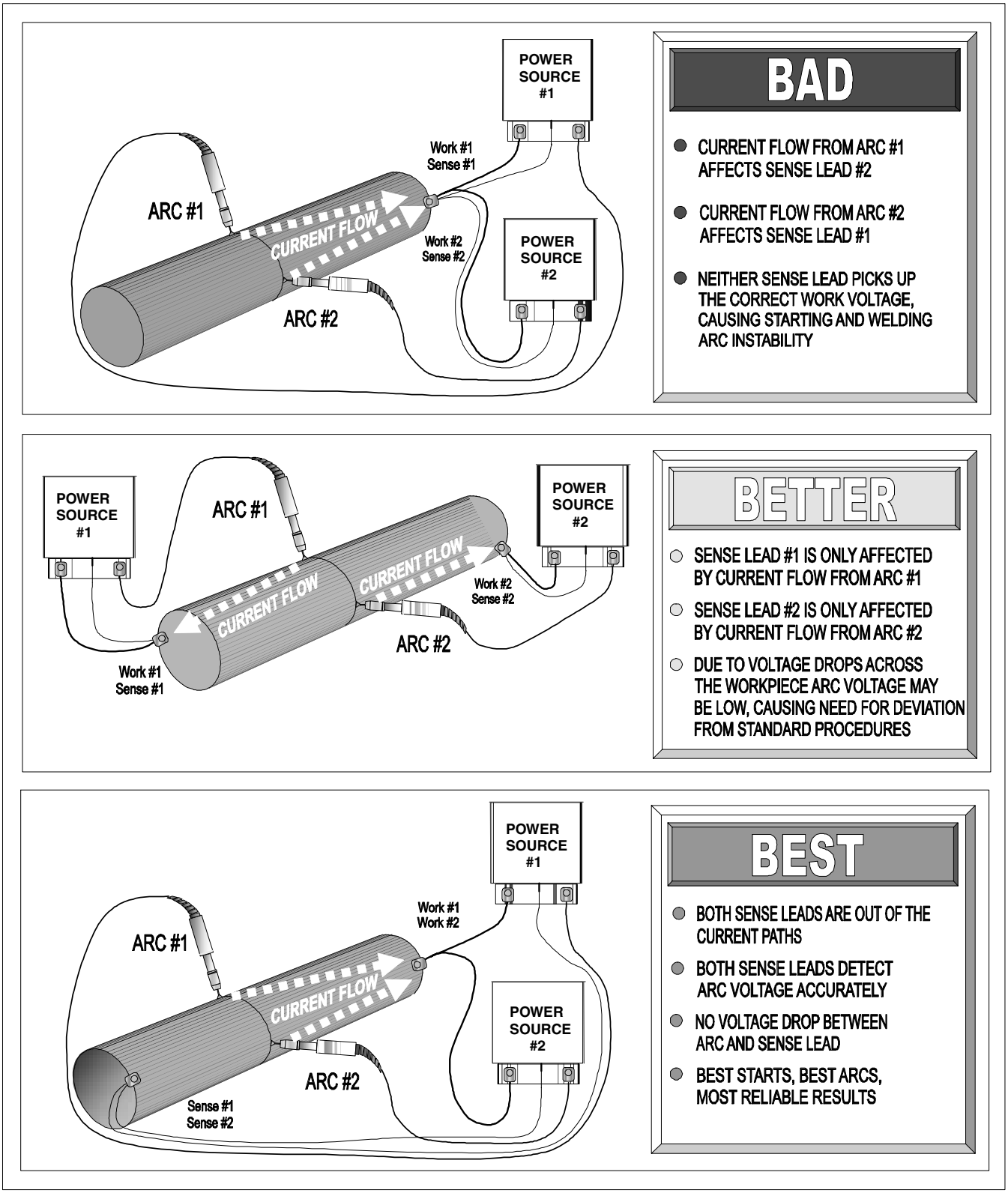
- **For circumferential applications,** connect all work leads on one side of the weld joint, and all of the work voltage sense leads on the opposite side, such that they are out of the current path.

FIGURE A.11



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CONTROL CABLE CONNECTIONS

GENERAL GUIDELINES

Genuine Lincoln control cables should be used at all times (except where noted otherwise). Lincoln cables are specifically designed for the communication and power needs of the POWER WAVE® / POWER FEED® systems. Most are designed to be connected end to end for ease of extension. However, it is recommended that the total length not exceed 100 feet (30.5 m). The use of non-standard cables, especially in lengths greater than 25 feet, can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems). Always use the shortest length of control cable possible, and DO NOT coil excess cable.

Regarding cable placement, best results will be obtained when control cables are routed separate from the weld cables. This minimizes the possibility of interference between the high currents flowing through the weld cables, and the low level signals in the control cables. These recommendations apply to all communication cables including optional DeviceNet and Ethernet connections.

COMMON EQUIPMENT CONNECTIONS

Connection Between Power Source and POWER FEED® 10S Series Wire feeder (K1785 - Control Cable). The 14-pin wire feeder control cable connects the power source to the wire drive. If there is more than one power source per arc, it connects from the wire drive to the power source designated as the Master. It contains all of the necessary signals to drive the motor and monitor the arc, including the motor power, tachometer, and arc voltage feedback signals. The wire feeder connection on the POWER WAVE® AC/DC 1000® is located under the spring loaded output cover on the case front. The control cable is keyed and polarized to prevent improper connection. For convenience, the control cables can be routed along the right channel of the POWER WAVE®, out the back, and to the wire feeder. Control cables SHOULD NOT be routed through the same (left) channel as the welding cables.

Connection Between Power Source and POWER FEED® 10A Controller (K1543 – ArcLink Control Cable). Single and tandem arc systems are typically controlled by a POWER FEED® 10A Controller (K2362-1). In a tandem, or multi-arc system, each arc requires its own dedicated POWER FEED® 10A (PF-10A).

The 5-pin ArcLink control cable connects the power source to the PF-10A. If there is more than one power source per arc, it connects from the PF-10A to the power source designated as the Master for that arc. The control cable consists of two power leads, one twisted pair for digital communication, and one lead for voltage sensing. The ArcLink connection on the POWER WAVE® AC/DC 1000® is located under the spring loaded output cover on the case front. The control cable is keyed and polarized to prevent improper connection. For convenience, the control cables can be routed along the right channel of the POWER WAVE®, out the back, and to the PF-10A. Control cables SHOULD NOT be routed through the same (left) channel as the welding cables.

In multiple arc systems equipped with a POWER WAVE® System Interface (K2282-1), and controlled by PF-10A controllers, the system interface must be connected to the ArcLink network of the ARC1 Master power source. See ***Figure A.4*** "Tandem Arc Connection Diagram" for detailed information.

Connections Between Power Source and Optional DeviceNet Programmable Logic Controller(PLC). It is sometimes more practical and cost effective to use a custom PLC interface to control a multi-arc system (See ***Figure A.5*** "DeviceNet Configuration" for interface information). The POWER WAVE® AC/DC 1000® is equipped with a 5-pin DeviceNet mini style receptacle for this purpose. The receptacle is located under the spring loaded output cover on the case front. The DeviceNet cable is keyed and polarized to prevent improper connection. For convenience, it can be routed along the right channel of the POWER WAVE®, and out the back. DeviceNet cables SHOULD NOT be routed through the same (left) channel as the welding cables.

In a typical system, a DeviceNet connection is made between the master power source of each arc, and the PLC interface. When a POWER WAVE® System Interface (K2282-1) is used to synchronize the arcs, it must also be connected to the DeviceNet network. For best results, route DeviceNet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. DeviceNet cables must be sourced locally by the customer. For additional guidelines refer to the "DeviceNet Cable Planning and Installation Manual" (Allen Bradley publication DN-6.7.2).

Connections Between Multiple Power Sources Run in Parallel (K1795 - Control Cable). To increase the output capacity for a given arc, the output studs of multiple POWER WAVE® AC/DC 1000® machines can be connected in parallel. The parallel machines utilize a master/slave control scheme to distribute the load and coordinate AC switching. The 22 pin parallel control cable contains all of the necessary signals to keep the machine outputs synchronized, including polarity, ready, kill, and arc voltage feedback signals. The cable connects between the Master/Slave I/O connectors (S12 & S13) located on the rear of the POWER WAVE® AC/DC 1000®. The input connector (S12) is located on the lower left side of the case back (as viewed from the rear), and the output connector (S13) is located on the lower right side. The output connector (S13) on the master connects to the input connector (S12) on the slave. If needed the output connector on the slave machine can be used to connect to the input connector of another slave machine in a daisy chain fashion. This connection scheme can be repeated as required until the desired output capacity is achieved. The system is currently limited to a maximum of 5 slaves per master, or a total of 6 machines per arc.

NOTE: In addition to the parallel control cable, parallel connected machines also require an Ethernet connection to share critical weld parameter information. For more information refer to the "Connection Between a Power Source and Ethernet Network" section of this document.

Connection Between Power Source and Ethernet Network. Ethernet connections are required for systems with parallel connected power sources (more than one power source per arc), or to utilize the tools provided in the POWER WAVE® Submerged Arc Utilities software package. To facilitate this, the POWER WAVE® AC/DC 1000® is equipped with an RJ-45 Ethernet connector, which is located under the spring loaded output cover. External Ethernet equipment (cables, switches, etc.) must be supplied by the customer. It is critical that all Ethernet cables external to either a conduit or an enclosure are solid conductor, shielded cat 5 cable, with a drain. The drain should be grounded at the source. The use of cat 5+, cat 5E, cat 6 or stranded cable is not recommended. For best results, route Ethernet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. For additional guidelines refer to ISO/IEC 11801. Failure to follow these recommendations can result in an Ethernet connection failure during welding.

NOTE: See ***Ethernet Configuration*** section for additional information.

Connections Between a Power Source and System Interface (K1795 - Control Cable). When multiple arcs need to be synchronized, a POWER WAVE® System Interface (K2282-1) is required. The system interface provides a dedicated synchronization signal for frequency and balance to each of the four ARC (a.k.a. PHASE) receptacles. The synchronization signals for ARC1 through ARC4 can be phase shifted with respect to one another to reduce the effects of "arc blow" and other welding related issues. The individual synchronization signals are relayed to the master machine of their corresponding arc via a 22 pin control cable. The control cable(s) connect between the individual ARC receptacles on the system interface, and the Master/Slave input connector on the master of each corresponding arc group. The Master/Slave input connector (S12) is located on the lower left side of the case back (as viewed from the rear) of the POWER WAVE® AC/DC 1000®.

NOTE: In addition to the 22-pin arc synchronization cables, the system interface also requires a connection to the system controller either via ArcLink for POWER FEED® 10A controlled systems (see ***"Connection Between Power Source and POWER FEED® 10A Controller")***, or via DeviceNet for PLC controlled systems (see ***"Connection Between a Power Source and Optional DeviceNet PLC Controller"***).

Connections Between a Power Source and Local PC (RS-232 – Null Modem Cable). For diagnostic and set up purposes it is sometimes necessary to connect the power source directly to a PC (personal computer). The POWER WAVE® AC/DC 1000® is equipped with an RS-232 DB-25 style serial connector for this purpose. It is located under the spring loaded output cover on the case front. RS-232 cables must be supplied by the user (Radio Shack part # 26-269; Note: USB port adapter - part #26-183 - is also required for PC's equipped with USB instead of a serial port). For best results, route the RS-232 cable away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field.

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EXTERNAL I/O CONNECTOR

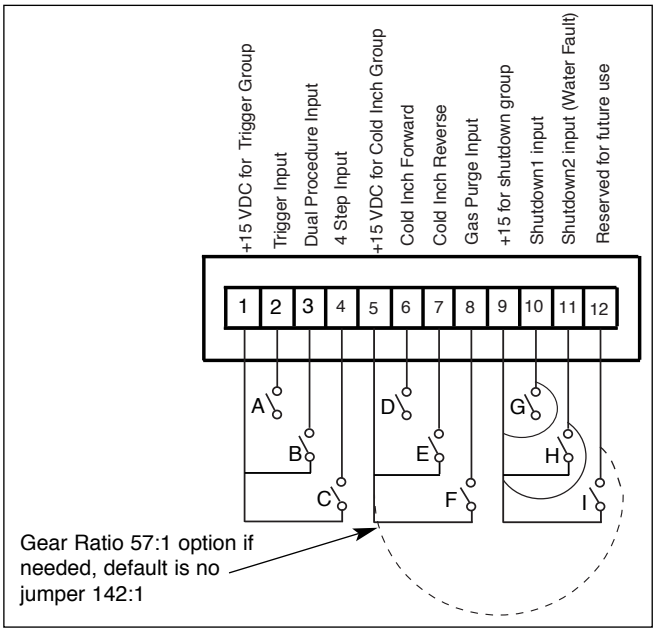
The POWER WAVE® AC/DC 1000® is equipped with a terminal strip for making simple input signal connections. The terminal strip is located underneath the spring-loaded cover, and divided into three groups: Trigger group, Cold Inch Group and Shutdown Group. When the POWER WAVE® AC/DC 1000® is controlled via DeviceNet, the Trigger and Cold Inch Groups can interfere with the welding sequence and should not be used.

All inputs use "normally open" logic except the shutdown group. The shutdown inputs use "normally closed" logic, and are always enabled. Shutdown2 is typically used for signaling low flow in the water cooler. Unused shutdowns must be tied to the +15V supply for the shutdown group. Machines are shipped from the factory with jumpers installed on both shutdown inputs. (See Figure A.12)

NOTES:

1. Activating the Trigger or Cold Inch group inputs on a system without a user interface or other means of configuring the Weld Sequencer will result in default values for Weld Mode, WFS and Work point settings.
2. Trigger and Cold Inch group inputs may be redefined as "Weld Profile Selections" by Production Monitoring software (see Production Monitoring Literature for details)
3. On later machines, pin 12 has been redefined as a gear ratio selection input. See ***"Setting the Wire Drive Gear Ratio"*** for further information.

FIGURE A.12



RECEPTACLE SPECIFICATION

TABLE A.2 - OUTPUT ARCLINK RECEPTACLE S1 (5 PIN – MS STYLE)

PIN	Lead #	Function
A	53	Arclink L
B	54	Arclink H
C	67A	Electrode Voltage Sense
D	52	Ground(0v)
E	51	+40vdc

TABLE A.3 - VOLTAGE SENSE RECEPTACLE S2 (4 PIN – CIRCULAR PLASTIC)

PIN	Lead #	Function
3	21A	Work Voltage Sense

TABLE A.4 - RS232 CONNECTOR S3 (DB-25 STYLE)

PIN	Lead #	Function
2	253	RS232 Receive
3	254	RS232 Transmit
4	#	S3 Pin5
5	#	S3 Pin4
6	##	S3 Pin20
20	##	S3 Pin6
7	251	RS232 Common

TABLE A.5 - DEVICENET CONNECTOR S5 (5 PIN - "MINI" STYLE)

PIN	Lead #	Function
2	894	+24vdc DeviceNet
3	893	Common DeviceNet
4	892	DeviceNet H
5	891	DeviceNet L

TABLE A.6 - WIRE DRIVE INTERFACE RECEPTACLE S6 (14 PIN – MS STYLE)

Pin	Function
A	Motor "+"
B	Motor "-"
C	+40 VDC for solenoid
D	Solenoid input
E	Tach 2A differential signal
F	Single Tach Input
G	+15 VDC Tach
H	Tach common
I	Work voltage sense lead 21
J	Electrode voltage sense lead 67
K	Tach 1A differential signal
L	Tach 1B differential signal
M	Tach 2B differential signal
N	Electrode voltage sense lead 67

TABLE A.7 - EXTERNAL I/O S7 (12 PIN – TERMINAL BLOCK)

PIN	Lead #	Function
1	851	+15vdc for Trigger group
2	852	Trigger input
3	853	Dual procedure input
4	854	4 step input
5	855	+15vdc for cold inch group
6	856	cold inch forward
7	857	cold inch reverse
8	858	gas purge input
9	859	+15vdc for shutdown group
10	860	shutdown1 input
11	861	shutdown2 input
12	862	input B

TABLE A.8 - ETHERNET CONNECTOR S9 (8 PIN – RJ-45 STYLE CONNECTOR / CAT 5 CABLE)

PIN	Function
1	Transmit +
2	Transmit -
3	Receive +
4	---
5	---
6	Receive -
7	---
8	---

TABLE A.9 - MASTER / SLAVE I/O AND SYSTEM INTERFACE OUTPUT RECEPTACLES (22 PIN – MS BAYONET STYLE)

Pin	Master / Slave Input (S12)	Master / Slave Output (S13)	Optional System Interface (ARC1, ARC2, ARC3, ARC4)
A	Reserved for future use	Reserved for future use	---
B	Reserved for future use	Reserved for future use	---
C	Sync In	Reserved for future use	Sync Out
D	Sync In	Reserved for future use	Sync Out
E	Ready In	Ready In	---
F	Ready In	Ready In	---
G	Polarity Out	Polarity Out	---
H	Polarity Out	Polarity Out	---
I	Ground	---	---
J	Reserved for future use	Reserved for future use	---
K	Reserved for future use	Reserved for future use	---
L	+40v (COM)	Reserved for future use	---
M	+40v ("+")	Reserved for future use	---
N	Reserved for future use	Reserved for future use	---
P	Reserved for future use	Reserved for future use	---
R	Reserved for future use	Reserved for future use	---
S	Reserved for future use	Reserved for future use	---
T	Drain (ethernet)	Drain (ethernet)	---
U	Kill Out	Kill Out	---
V	Kill Out	Kill Out	---
W	Work voltage sensing (21)	Work voltage sensing (21)	---
X	Electrode Voltage Sensing (67)	Electrode Voltage Sensing (67)	---

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WIRE DRIVE GEAR RATIO SETTING

Changing the wire feeder gear ratio requires a gear change and a P.C. board DIP switch change. As shipped from the factory, the low speed (high torque) gear is configured. To change the gear ratio see the Wire Feeder's Instruction Manual. The High/Medium/Low DIP switch code on Wire Drive P.C. board can be set as follows: (See ***Table A.11*** for High/Medium/Low gear ratios).

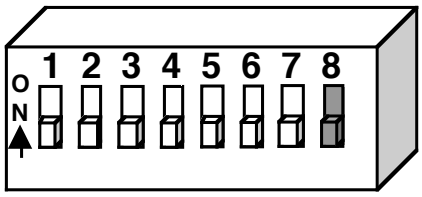
⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.

⚠ WARNING

1. **Turn off power to the power source at the disconnect switch.**
2. Remove the front cover from the power source.
3. The wire feed head board is on the right side of the power source. Locate the 8-segment DIP switch and look for the position 8 of the DIP switch.
4. Using a pencil or other small object, **slide the switch to the OFF position,** when the **low speed gear** is installed. Conversely, **slide the switch to the ON position,** when the **high speed gear** is installed.



5. Replace the cover and screws. The PC board will "read" the switch at power up, automatically adjusting all control parameters for the speed range selected.

CHANGING WIRE DRIVE CONFIGURATION

The POWER FEED®-10S Wire Drives can be reconfigured to fit in any hard automation application.

The POWER FEED®-10S Wire Drives can be reconfigured in such a way that the wire feed direction is reversed. If this is the case, the motor leads must be reversed so the wire will feed correctly. Follow these instructions to reverse the motor polarity. ***(See Figure A.13)***

1. Remove all power from the POWER FEED®-10S Wire Drive.
2. Disconnect the Control Cable from the POWER FEED®-10S Wire Drive Connection Box.
3. Loosen the fastener from the Band Strap to the Connection Box, which secures the assembly to the Motor housing, and expose the leads inside of the Connection Box.
4. Locate the Motor leads. These leads will go from the Motor to the Control Cable connector on the inside of the Connection Box.
5. Carefully disconnect the Motor leads from the harness by pulling the quick-connect terminals apart.
6. Reverse the motor leads and reconnect the quick-connect terminals ***(see Wiring Diagram)***.
7. Carefully replace the wire harness back into the Connection Box and place back onto the Motor housing locating over the Motor lead grommet. Ensure that the tachometer leads are completely covered by the Channel that snaps into the Connection Box. The Connection Box assembly should be pushed all the way up to the Motor-to-Gearbox Adapter Plate.
8. Before securing the Connection Box to the Motor housing with the Band Strap, ensure that none of the harness leads are being pinched underneath the edges of the Connection Box and Channel.
9. Place the Band Strap into the "T" slot on the side of the Connection Box and wrap it around the Motor housing.
10. Replace the fastener between the Band Strap and the Connection Box. Tighten so that the Connection Box cannot move on the Motor housing.

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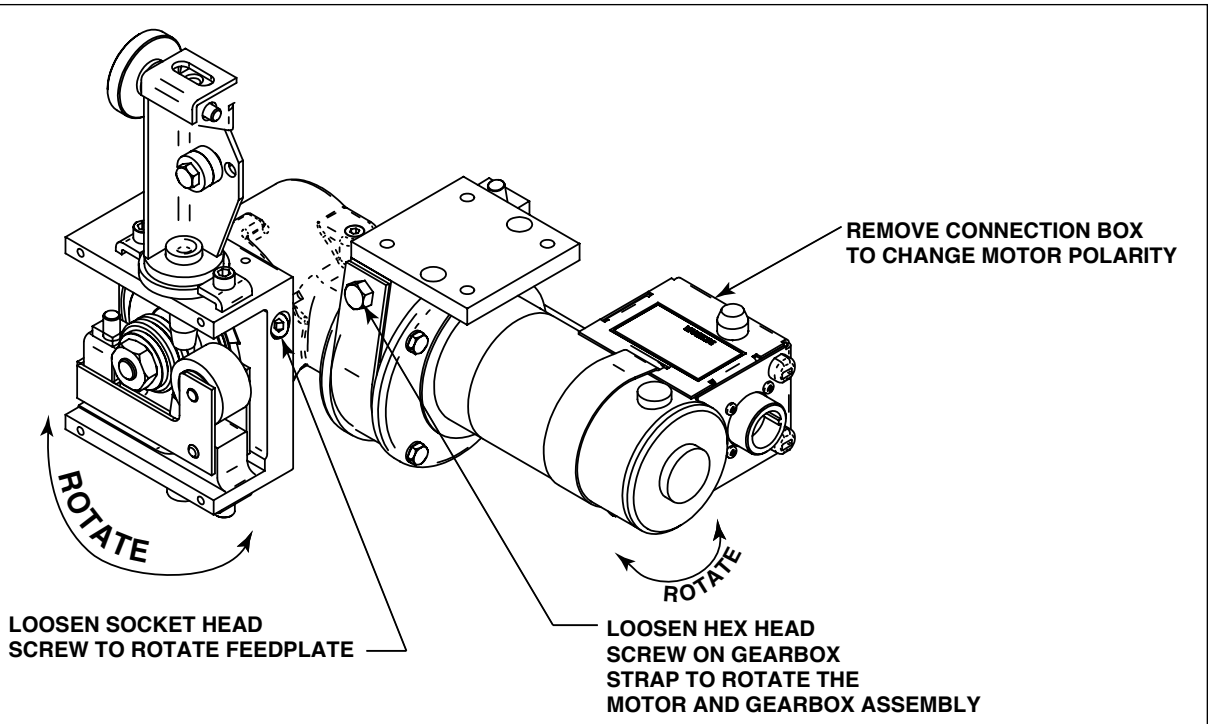
FIGURE A.13



GEAR RATIO CONVERSION KITS (SEE INSTRUCTIONS INCLUDED WITH CONVERSION KIT)
L12243 142 & 95-1 Ratio
L12243-1 57-1 Ratio

1. Remove the 2 hex head screws and the 2 slot head screws holding the Motor to the Wire Drive Gearbox assembly.
2. Remove existing Adapter Plate and Motor Assembly.
3. Take the two long screws removed in step 1 and screw one into each of the tapped holes located on the face of fiber input helical gear. Insert the screws through the full thickness of the gear, and using a screwdriver wedged between the screws to prevent rotation, remove the hex nut that holds the gear to the shaft. Remove plain washer.
4. Pull the gear from the shaft using the screws as a pulling device.
5. Be certain woodruff key is properly located on the shaft. Screw the adapter plate and motor assembly mounting screws into the new fiber input helical gear from the stenciled side and place the gear on the shaft. Replace plain washer, tighten the hex nut, and remove the adapter plate and motor assembly mounting screws from the gear.
6. Support the pinion properly and, with the proper size punch, drive the roll pin that holds the pinion out of the shaft. Pull the pinion off. Remove the Ring Magnet from the pinion gear and snap it onto the new pinion gear. Before installing the new pinion gear with the Ring Magnet onto the motor shaft, ensure that the flat washer is located at the bottom of the shaft. Install the new pinion and replace the roll pin.
7. Cover the teeth of the motor pinion and the input gear with a non-fluid molydisulfide type grease such as Non-Fluid Oil Corporation's A-29 Special/MS Lubricant. This grease can be scooped from the cavity of the gear case.
8. Reassemble the motor on the gearbox; make sure the gears mesh properly and the adapter plate locating bead is in its cavity. Replace and tighten the four screws removed in step 1.
9. **See the Feed Head Board *(Table A.11)* for how to configure the Feed Head Board. DIP switches for the new gear ratio are located inside the power source.**

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ETHERNET CONFIGURATION

Ethernet capability is provided for data monitoring, or to enable parallel machine operation. To utilize these features the network settings of each POWER WAVE® AC/DC 1000® must be properly configured. This is accomplished through the use of the **Ethernet Setup** software utility. Follow the instructions provided with the utility to properly configure the Ethernet address.

When used in a system with parallel machines, the **Submerged Arc Cell Configuration** software utility must be used to map the master/slave relationships within and between the different arc groups. This utility allows the user to configure the system by selecting from a list of master and slave machines (as determined by their individual dip switch settings).

NOTE: Each machine must be configured as either a Master or Slave via the dip switches on the Ethernet PC Board. Furthermore, Master machines must be configured for either internal synchronization (stand alone applications), or external synchronization (multiple arc applications utilizing a POWER WAVE® System Interface). See the **"*Internal Controls*"** section of this document.

DEVICENET CONFIGURATION

For systems controlled via DeviceNet, The MAC ID and baud rate must be properly configured (see the ***Internal Controls*** section of this document). Other information regarding basic system integration of the POWER WAVE® AC/DC 1000® with a DeviceNet PLC is provided in the DeviceNet Interface Specification (part of the POWER WAVE® Submerged Arc Utilities software package available from the Lincoln Electric Company).

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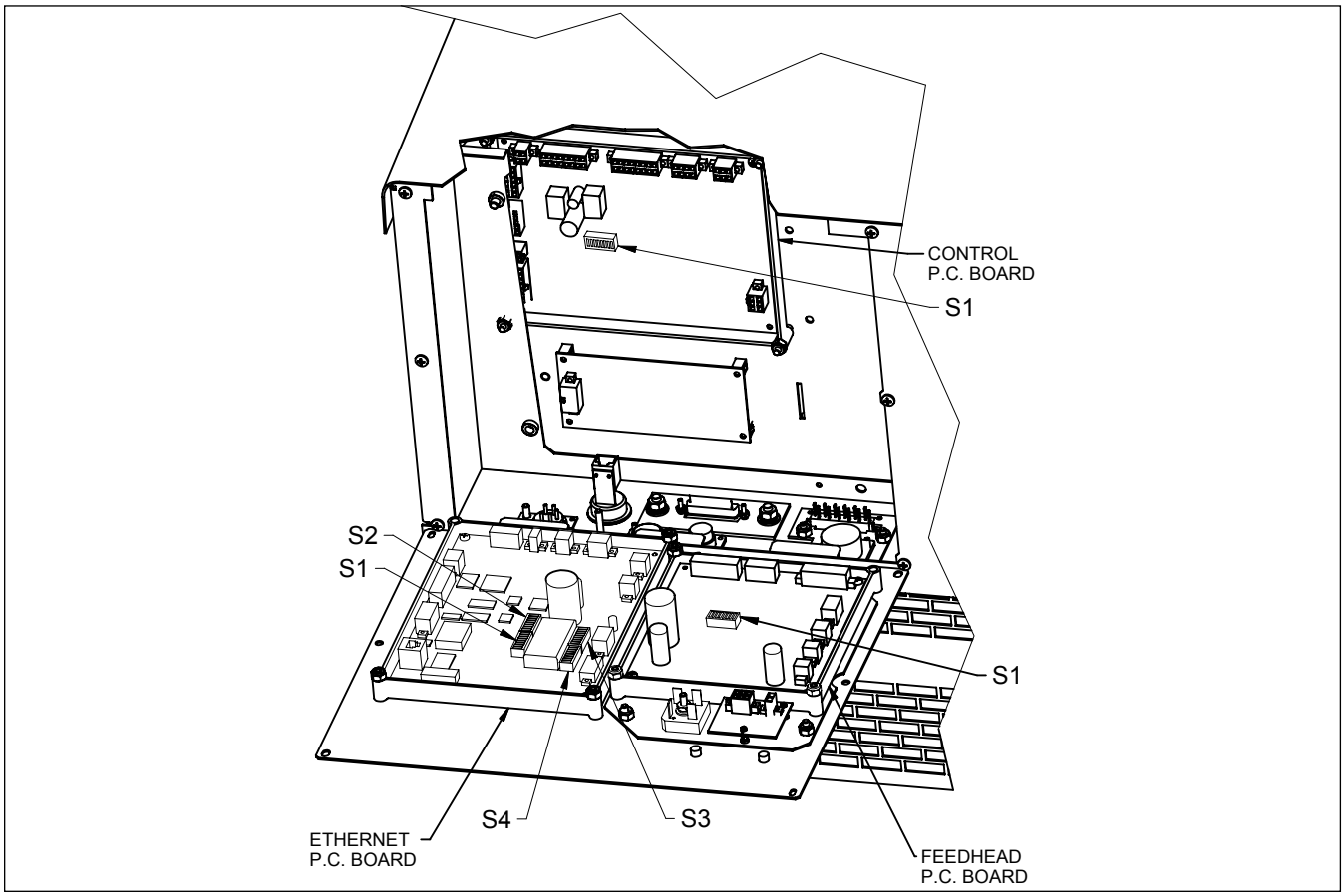
INTERNAL CONTROLS

FIGURE A.14



INTERNAL CONTROLS DESCRIPTION

The P.C. Boards located behind the POWER WAVE® AC/DC 1000® front access panel are equipped with DIP switches for custom configuration. (From the factory the DIP switches are set for single arc applications with a PF10A control box and a PF10S welding head.) To access the DIP switches to customize:

⚠ WARNING

ELECTRIC SHOCK can kill.

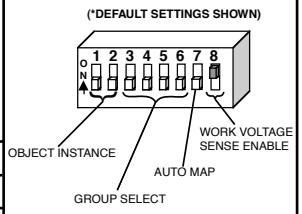
- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.

1. Turn off power at the disconnect switch.
2. Remove the screws securing the front access panel.
3. Open the access panel, allowing the weight of the panel to be carried by the hinge tab at the bottom. Make sure the weight of the access panel is supported by the hinge tabs, not the wiring harness.
4. Adjust the DIP switches as necessary (see ***Tables A.10-A.16 and Figure A.15***).
5. Replace the panel and screws, and restore power.

CONTROL BOARD DIP SWITCH (S1):

BANK S1

TABLE A.10

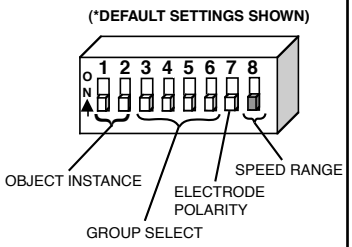
Switch		Description	Comments	
1		Object Instance LSB* (see table A.14)	Arclink configuration	
2		Object Instance MSB** (see table A.14)		
3		Equipment Group 1 Select (default OFF)		
4		Equipment Group 2 Select (default OFF)		
5		Equipment Group 3 Select (default OFF)		
6		Equipment Group 4 Select (default OFF)		
7	off	Arclink Object Auto mapping enabled (default)	Default setting	
	on	Arclink Object Auto mapping disabled	Requires manual configuration	
8	off	Work sense lead not connected	Used for configuring work sense lead (See section A)	
	on	Work sense lead connected (default)		

*LSB - Least Significant Bit **MSB - Most Significant Bit

FEED HEAD BOARD DIP SWITCH (S1):

BANK S1

TABLE A.11

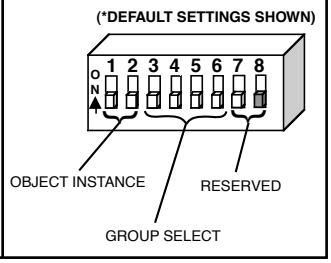
Switch		Description	Comments	
1		Object Instance LSB (see table A.14)	ArcLink Configuration	
2		Object Instance MSB (see table A.14)		
3		Equipment Group 1 Select (default OFF)		
4		Equipment Group 2 Select (default OFF)		
5		Equipment Group 3 Select (default OFF)		
6		Equipment Group 4 Select (default OFF)		
7	off	Electrode polarity positive (default)	Must be OFF for POWER WAVE® AC/DC 1000®	
	on	Electrode polarity negative		
8	off[1]	Low speed gear 142:1 (default)	Gear ratio configuration.	
	on[1]	High speed gear 95:1		
	off[2]	High speed gear 57:1	} These two options available in S25564-11 and later software.	
	on[2]	Reserved (presently configured for 57:1)		

Notes: 1. No jumper installed on External I/O connector (pin 5 to pin 12).
2. Jumper installed on External I/O connector (pin 5 to pin 12).

ETHERNET BOARD DIP SWITCHES (S1, S2):

Bank S1 – ArcLink Set-up

TABLE A.12

Switch	Description	Comments	
1	Object Instance LSB (see table A.13)	Used for Arclink Configuration	
2	Object Instance MSB (see table A.13)		
3	Equipment Group 1 Select (default OFF)		
4	Equipment Group 2 Select (default OFF)		
5	Equipment Group 3 Select (default OFF)		
6	Equipment Group 4 Select (default OFF)		
7	Reserved for future use (default OFF)		
8	Reserved for future use (default OFF)		

Bank S2 – DeviceNet Set-up

TABLE A.13

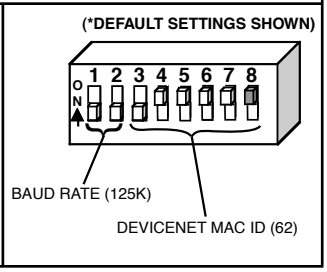
Switch	Description	Comments	
1	DeviceNet Baud Rate see Table A.14	Used for DeviceNet Configuration	
2			
3	DeviceNet Mac ID see Table A.15		
4			
5			
6			
7			
8			

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TABLE A.14 - OBJECT INSTANCE

Switch 2	Switch 1	Instance
off	off	0(default)
off	on	1
on	off	2
on	on	3

TABLE A.15 - DEVICENET BAUD RATE

Switch 1	Switch 2	Baud Rate
off	off	125K (default)
on	off	250K
off	on	500K
on	on	Programmable value.

FIGURE A.15 – ETHERNET BOARD DIP SWITCHES (S3, S4):

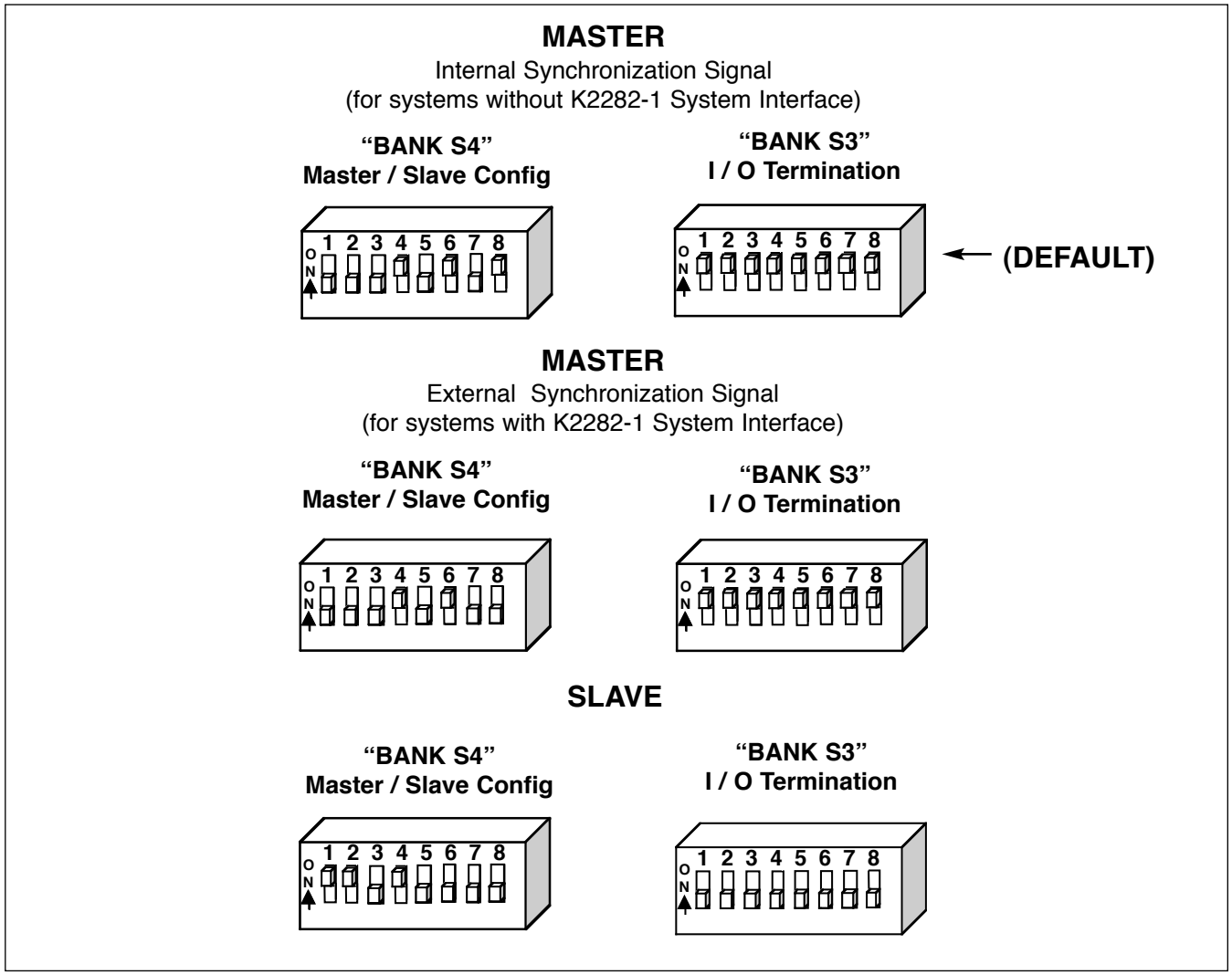

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TABLE A.16 - DEVICENET MAC ID

Mac I.D.	Switch 8	Switch7	Switch6	Switch5	Switch4	Switch 3	
0	0	0	0	0	0	0	Software Selectable
1	0	0	0	0	0	1	
2	0	0	0	0	1	0	
3	0	0	0	0	1	1	
4	0	0	0	1	0	0	
5	0	0	0	1	0	1	
6	0	0	0	1	1	0	
7	0	0	0	1	1	1	
8	0	0	1	0	0	0	
9	0	0	1	0	0	1	
10	0	0	1	0	1	0	
11	0	0	1	0	1	1	
12	0	0	1	1	0	0	
13	0	0	1	1	0	1	
14	0	0	1	1	1	0	
15	0	0	1	1	1	1	
16	0	1	0	0	0	0	
17	0	1	0	0	0	1	
18	0	1	0	0	1	0	
19	0	1	0	0	1	1	
20	0	1	0	1	0	0	
21	0	1	0	1	0	1	
22	0	1	0	1	1	0	
23	0	1	0	1	1	1	
24	0	1	1	0	0	0	
25	0	1	1	0	0	1	
26	0	1	1	0	1	0	
27	0	1	1	0	1	1	
28	0	1	1	1	0	0	
29	0	1	1	1	0	1	
30	0	1	1	1	1	0	
31	0	1	1	1	1	1	
32	1	0	0	0	0	0	
33	1	0	0	0	0	1	
34	1	0	0	0	1	0	
35	1	0	0	0	1	1	
36	1	0	0	1	0	0	
37	1	0	0	1	0	1	
38	1	0	0	1	1	0	
39	1	0	0	1	1	1	
40	1	0	1	0	0	0	
41	1	0	1	0	0	1	
42	1	0	1	0	1	0	
43	1	0	1	0	1	1	
44	1	0	1	1	0	0	
45	1	0	1	1	0	1	
46	1	0	1	1	1	0	
47	1	0	1	1	1	1	
48	1	1	0	0	0	0	
49	1	1	0	0	0	1	
50	1	1	0	0	1	0	
51	1	1	0	0	1	1	
52	1	1	0	1	0	0	
53	1	1	0	1	0	1	
54	1	1	0	1	1	0	
55	1	1	0	1	1	1	
56	1	1	1	0	0	0	
57	1	1	1	0	0	1	
58	1	1	1	0	1	0	
59	1	1	1	0	1	1	
60	1	1	1	1	0	0	
61	1	1	1	1	0	1	
62	1	1	1	1	1	0	Default Setting

Section B-1

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SAFETY PRECAUTIONS

Read this entire section of operating instructions before operating the machine.

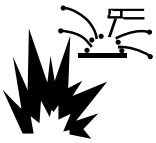
⚠ WARNING

ELECTRIC SHOCK can kill.

- Unless using cold feed feature, when feeding with gun trigger, the electrode and drive mechanism are always electrically energized and could remain energized several seconds after the welding ceases.
- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.

FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust to remove fumes from breathing zone.



WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not weld on containers that have held combustibles.

ARC RAYS can burn.

- Wear eye, ear, and body protection.

Observe additional guidelines detailed in the beginning of this manual.

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GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

INPUT POWER	SMAW
ON	GMAW
OFF	FCAW
HIGH TEMPERATURE	GTAW
MACHINE STATUS	U_0 OPEN CIRCUIT VOLTAGE
CIRCUIT BREAKER	U_1 INPUT VOLTAGE
WIRE FEEDER	U_2 OUTPUT VOLTAGE
POSITIVE OUTPUT	I_1 INPUT CURRENT
NEGATIVE OUTPUT	I_2 OUTPUT CURRENT
3 PHASE INVERTER	PROTECTIVE GROUND
INPUT POWER	
THREE PHASE	WARNING OR CAUTION
DIRECT CURRENT	

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PRODUCT DESCRIPTION
POWER WAVE® AC/DC 1000®

The POWER WAVE® AC/DC 1000® is a high performance digititally controlled inverter welding power source. It is capable of producing a variable frequency and amplitude AC output, DC positive output, or DC negative output without the need for external reconnection. It utilizes complex, high-speed waveform control to support a variety of constant current and constant voltage welding modes in each of its output configurations.

The POWER WAVE® AC/DC 1000® power source is designed to be a part of a modular welding system. Each welding arc may be driven by a single machine, or by a number of machines in parallel. In multiple arc applications, the phase angle and frequency of different machines can be synchronized with the use of an external System Interface to improve performance and reduce the effects of arc bow.

The POWER WAVE® AC/DC 1000® is primarily designed to interface with compatible ArcLink equipment. However, it can also communicate with other industrial machines and monitoring equipment via DeviceNet, or Ethernet. The result is a highly integrated and flexible welding cell.

If the duty cycle is exceeded, a thermostat will shut off the output until the machine cools to a reasonable operating temperature.

RECOMMENDED PROCESSES

The POWER WAVE® AC/DC 1000® is designed for submerged arc welding (SAW). Due to its modular design the POWER WAVE® AC/DC can operate on either single arc or multiple arc applications. Each machine is factory preprogrammed with multiple welding procedures to support all types of submerged arc welding. The POWER WAVE® AC/DC 1000® carries an output rating of 1000 amps, 44 volts (at 100% duty cycle). If higher currents are required machines can be easily paralleled.

PROCESS LIMITATIONS

The POWER WAVE® AC/DC 1000® is suitable for MIG Welding and Robotic applications.

Do not use Power AC/DC 1000® for pipe thawing.

EQUIPMENT LIMITATIONS

The POWER WAVE® AC/DC 1000® is not to be used in outdoor environments.

Operating Temperature Range is 32°F to 104°F (0°C to +40°C).

Only the ArcLink POWER FEED® 10S series wire feeders and POWER FEED® 10A controller may be used in a standard system. Other Lincoln or non-Lincoln wire feeders can only be used in custom interfaces.

The Power Wave AC/DC will support a maximum average output current of 1000 Amps at 100% Duty Cycle.

PF10A will be discussed later in this manual.

COMMON EQUIPMENT PACKAGES

Basic Package

K2344-1 or K2344-2	POWER WAVE® AC/DC 1000®
K2370-1 Feeder	POWER FEED® 10S Head Wire
K-2362-1	POWER FEED® 10A Controller/User Interface
K-1543-xx	Control Cable (5 pin - 5 pin) - power source to controller.
K-1785-xx	Control Cable (14 pin - 14 pin) - power source to wire feeder.

Optional Kits

K2282-1	System Interface - for Synchronizing multiple arc applications.
K1795-xx	Control Cable (22 pin - 22 pin) - for paralleling / multiple arc applications.
K2312-1	POWER FEED® 10SF wire feeder (for fixture builders).
K2311-1	POWER FEED® 10SM Motor Conversion Kit (to convert existing NA-3/NA-4/NA-5 wire feeder gear boxes).
K2444-1	CE, C-Tick Filter Kit.

RECOMMENDED EQUIPMENT

(See ***Installation Section***)

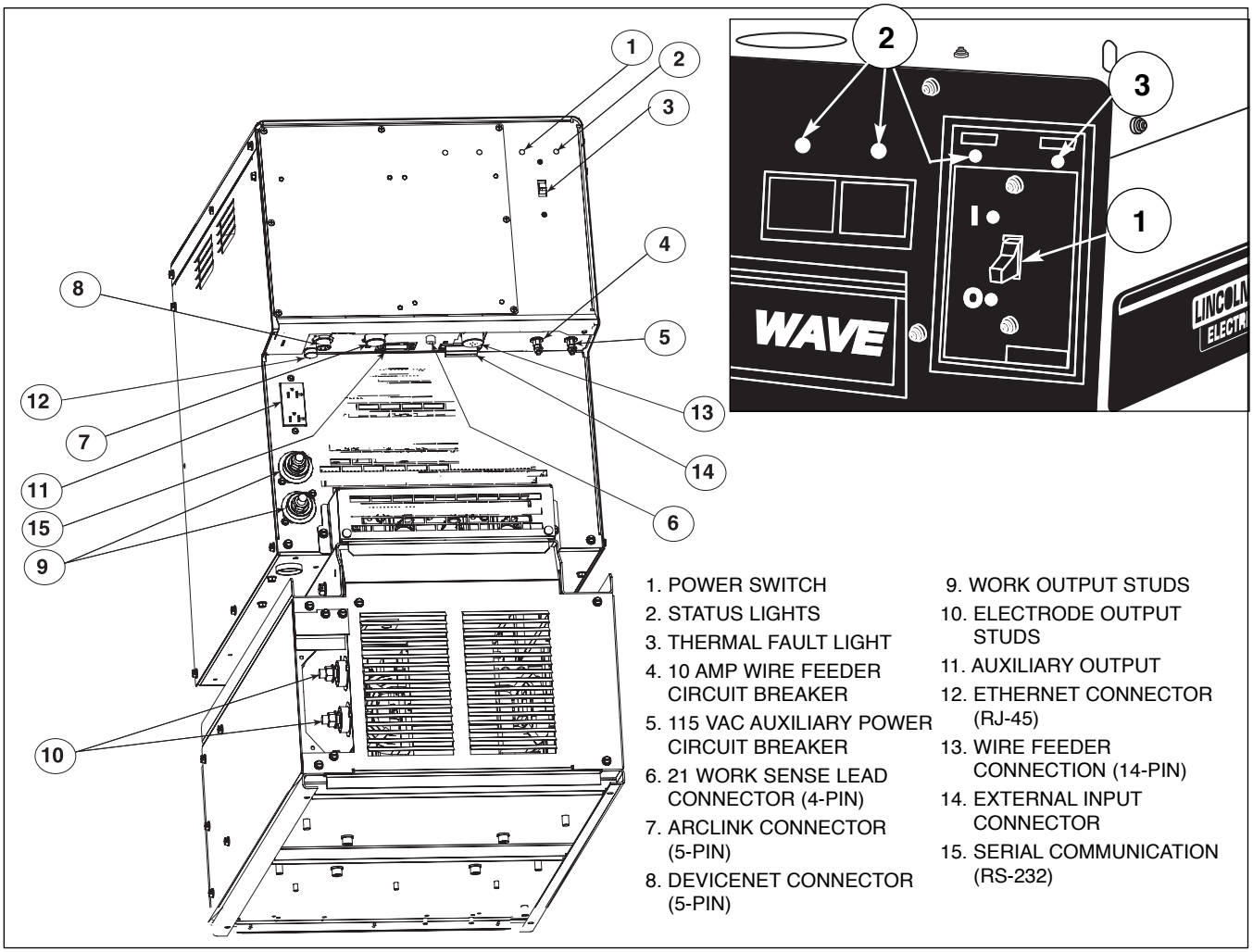
CASE FRONT CONTROL DESCRIPTIONS

1. **Power Switch:** Controls input power to the POWER WAVE®
2. **Status Lights:** A two color light that indicates system errors. Normal operation is a steady green light. Error conditions are indicated in the ***Troubleshooting Section*.**

NOTE: The PowerWaves' status light will flash green, for up to 15 seconds when the machine is first turned on. This is a normal situation as the machine goes through a self test at power up.

3. **Thermal Fault Light:** A yellow light that comes on when an over temperature situation occurs. Output is disabled until the machine cools down. When cool, the light goes out and output is enabled.
4. **10 Amp Wire Feeder Circuit Breaker:** Protects 40 volt DC wire feeder power supply.
5. **115 VAC Auxiliary Power Circuit Breaker:** Protects case front receptacle auxiliary supply. (10 amps)
6. **21 Work Sense Lead Connector(4-Pin)**
7. **Arclink Connector (5-Pin)**
8. **DeviceNet Connector (5-Pin)**
9. **Work Output Studs**
10. **Electrode Output Studs**
11. **Auxiliary Output**
12. **Ethernet Connector (RJ-45)**
13. **Wire Feeder Connection (14-Pin):** Connects the control cable between the power source and wire feeder.
14. **External Input Connector**
15. **Serial Communication (RS-232)**

FIGURE B.1 – CASE FRONT



1. POWER SWITCH
2. STATUS LIGHTS
3. THERMAL FAULT LIGHT
4. 10 AMP WIRE FEEDER CIRCUIT BREAKER
5. 115 VAC AUXILIARY POWER CIRCUIT BREAKER
6. 21 WORK SENSE LEAD CONNECTOR (4-PIN)
7. ARCLINK CONNECTOR (5-PIN)
8. DEVICENET CONNECTOR (5-PIN)
9. WORK OUTPUT STUDS
10. ELECTRODE OUTPUT STUDS
11. AUXILIARY OUTPUT
12. ETHERNET CONNECTOR (RJ-45)
13. WIRE FEEDER CONNECTION (14-PIN)
14. EXTERNAL INPUT CONNECTOR
15. SERIAL COMMUNICATION (RS-232)

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CASE REAR COMPONENTS DESCRIPTION

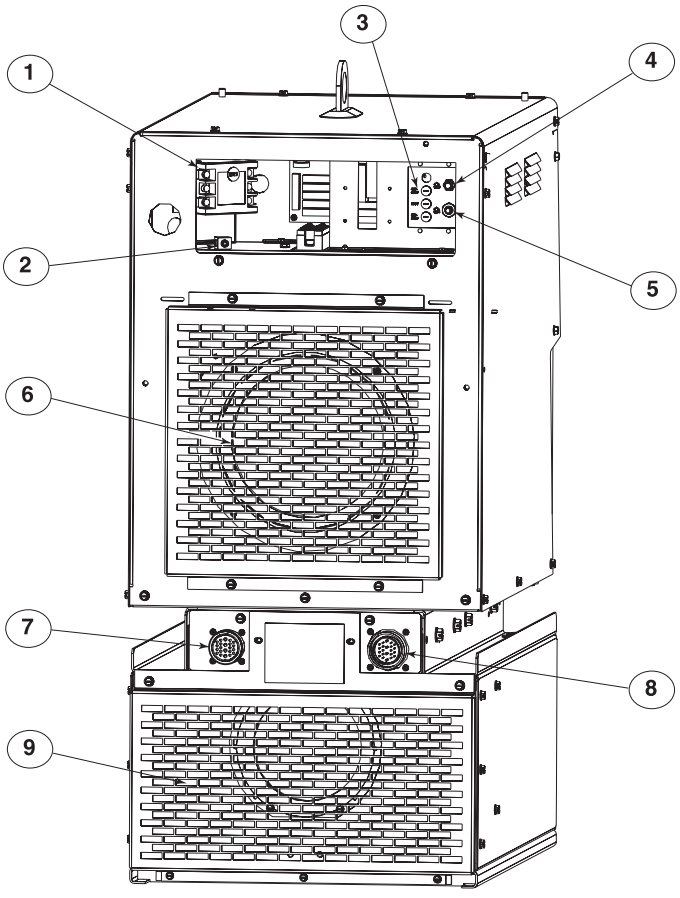
1. **Input Contactor:** Connection point for incoming 3 Phase power (see ***Recommended Input Wire and Fuse Size*** chart in this document).
2. **Case Ground:** The frame of the welder must be grounded to earth at this terminal. See your local and national electrical codes for proper grounding methods.
3. **Auxiliary Reconnect:** Select proper tap based on input voltage.
4. **CB3**: Primary side protection for auxiliary transformer (T2).
5. **CB4:** Primary side protection for auxiliary transformer (T1).
6. **Impeller Fan Technology™** provides superior cooling.
7. **Master/Slave Input (S12):** Input connection for paralleling machines, or multi-arc synchronization.
8. **Master/Slave Output (S13):** Output connection for paralleling machines.
9. **AC Switch Assembly W/Impeller Fan**
10. **Optional CE Filter Assembly (not shown):** CE compliance filter connects in series with input connection. Available for K2344-2 only.

POWER-UP SEQUENCE

When power is applied to the POWER WAVE® AC/DC 1000®, the status lights will flash green, for up to 15 seconds. This is normal and indicates POWER WAVE® AC/DC 1000® is performing a self test, and mapping (identifying) each component in the local ArcLink system. The status lights will also flash green as a result of a system reset or configuration change during operation. When the status lights become steady green the system is ready for normal operation.

If the status lights do not become steady green consult the ***Troubleshooting Section*** of this manual for further instruction.

FIGURE B.2 – CASE BACK



1. INPUT CONTACTOR
2. CASE GROUND
3. AUXILIARY RECONNECT
4. CB3
5. CB4
6. IMPELLER FAN TECHNOLOGY™
7. MASTER/SLAVE INPUT (S12)
8. MASTER/SLAVE OUTPUT (S13)
9. AC SWITCH ASSEMBLY W/IMPELLER FAN
10. OPTIONAL CE FILTER ASSEMBLY (NOT SHOWN)

POWER WAVE® AC/DC 1000®

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DUTY CYCLE

The POWER WAVE® AC/DC is capable of welding at a 100% duty cycle (continuous welding).

COMMON WELDING PROCEDURES

Making a Weld

The serviceability of a product or structure utilizing the welding programs is and must be the sole responsibility of the builder/user. Many variables beyond the control of The Lincoln Electric Company affect the results obtained in applying these programs. These variables include, but are not limited to, welding procedure, plate chemistry and temperature, weldment design, fabrication methods and service requirements. The available range of a welding program may not be suitable for all applications, and the build/user is and must be solely responsible for welding program selection.

The steps for operating the POWER WAVE® AC/DC 1000® will vary depending upon the user interface of the welding system. The flexibility of the POWER WAVE® AC/DC 1000® lets the user customize operation for the best performance.

First, consider the desired welding procedures and the part to be welded. Choose an electrode material, diameter, and flux.

Second, find the program in the welding software that best matches the desired welding process. The standard software shipped with the POWER WAVE® AC/DC 1000® encompasses a wide range of common processes and will meet most needs. If a special welding program is desired, contact your local Lincoln Electric sales representative.

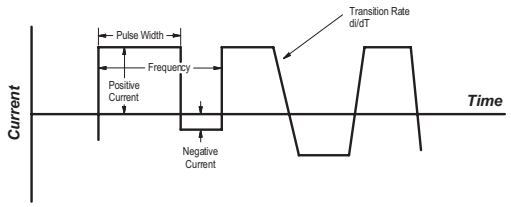
To make a weld, the POWER WAVE® AC/DC 1000® needs to know the desired welding parameters. Waveform Control Technology ™ allows full customization of Strike, Run-in, Crater and other parameters for exacting performance.

OVERVIEW OF THE AC/DC SUBMERGED ARC PROCESS

The POWER WAVE® AC/DC 1000® combines the advantages of AC and DC Submerged Arc Welding (SAW) into a single power source. The limiting factor of AC-SAW welding has always been the time it takes to transition from positive to negative polarity. This lag through the zero crossing can cause arc instability, penetration, and deposition problems in certain applications. The POWER WAVE® AC/DC 1000® utilizes the speed of an inverter based power source, and the flexibility of Waveform Control Technology™ to address this issue. By adjusting the Frequency, Wave Balance and Offset of the AC waveform the operator can now control the balance (relationship) between the penetration of DC positive and the deposition of DC negative while taking full advantage of the reduction in arc blow associated with AC.

FIGURE B.3
AC/DC SUBMERGED ARC PROCESS

Output waveform variations made possible by ***Waveform Control Technology™***



Depending on the process, different parts of the output waveform and wire feed speed may be modulated at varying rates to achieve a smooth and stable arc.

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MULTIPLE ARC SYSTEM CONSIDERATIONS

Large scale SAW applications often employ multiple arcs to increase deposition rates. In multiple arc systems, magnetic forces created by like and opposing weld currents of adjacent arcs can result in arc interaction that can physically push or pull the arc columns together. To counteract this effect, the phase relationship between adjacent arcs can be adjusted to alternate and equalize the duration of magnetic push and pull forces. This is accomplished by the use of an optional K2282-1 POWER WAVE® System Interface, which not only synchronizes the arcs, but also enables adjustment of the phase relationship between them. Ideally, the net result is a cancellation of the interacting forces.

FIGURE B.4 – MULTIPLE ARC SYSTEMS

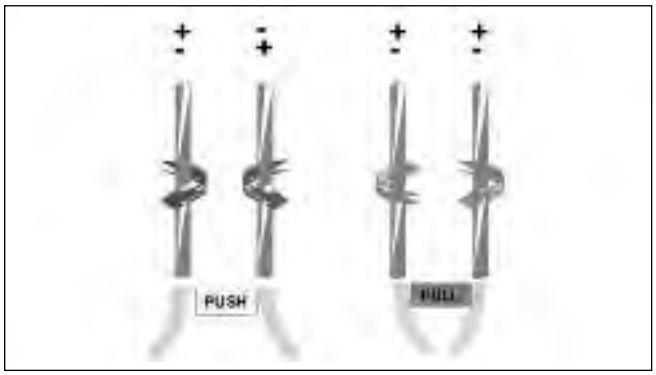
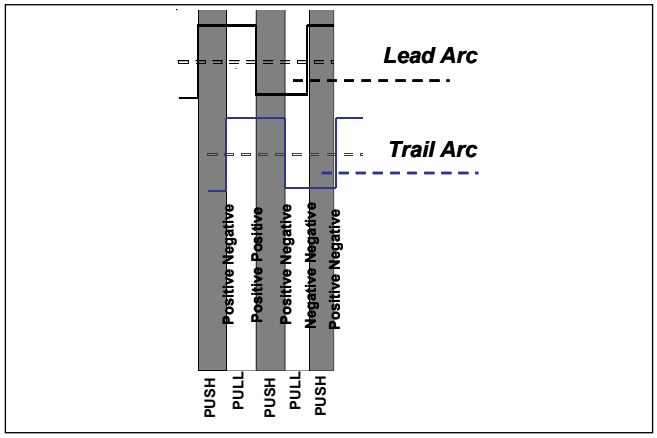


FIGURE B.5 – ARC INTERACTION



⚠ WARNING

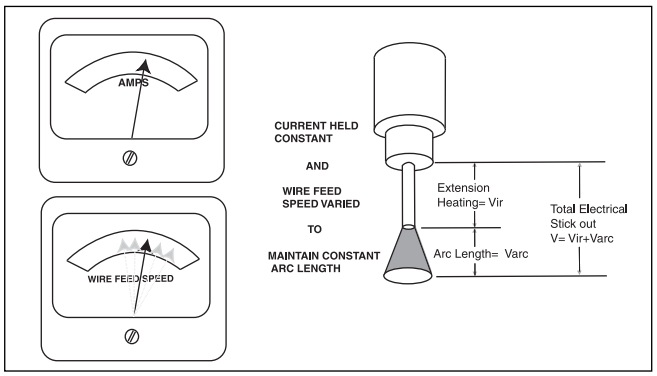
Never simultaneously touch electrically "hot" parts in the electrode circuits of two different welders. The electrode to electrode no load voltage of multiple arc systems with opposite polarities can be double the no load voltage of each arc. Consult the Safety information located at the front of the Instruction Manual for additional information.

BASIC MODES OF OPERATION

CONSTANT CURRENT (CC)

- Operator presets Current and desired Voltage.
- The Power Source:
  - Goal is to maintain a constant arc length.
  - Drives a constant Current.
  - Synergically Controls WFS to Maintain Voltage at the desired Set point.
- Arc Length is proportional to Voltage.
- Traditionally used for larger diameter wires and slower travel speeds.

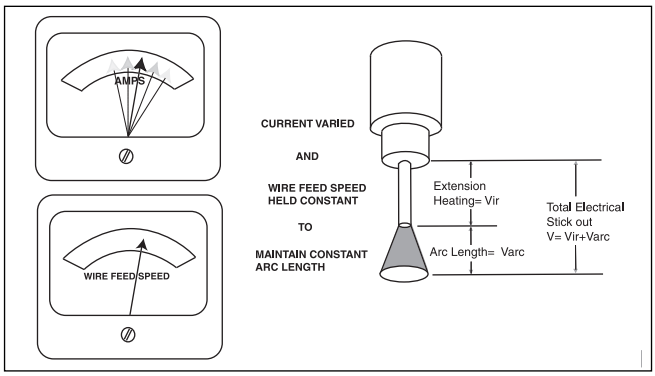
FIGURE B.6 – CONSTANT CURRENT (CC)



CONSTANT VOLTAGE (CV)

- Operator presets Wire Feed Speed and desired Voltage
- The Power Source:
  - Goal is to maintain a constant arc length.
  - Commands constant wire feed speed
  - Synergically Controls Current to Maintain Voltage at the desired Set point
- Arc Length is proportional to Voltage
- Traditionally used for smaller diameter wires and faster travel speeds.

FIGURE B.7 – CONSTANT VOLTAGE (CV)



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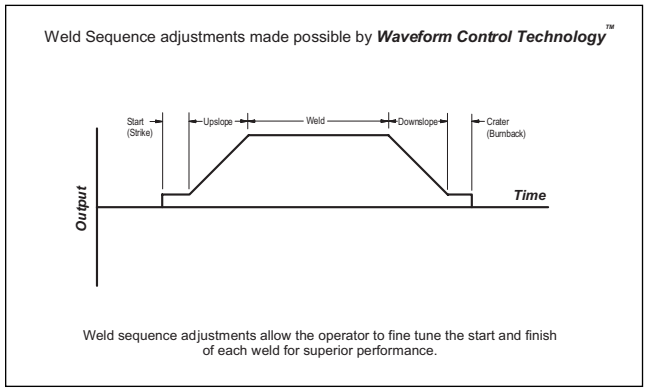
WELD SEQUENCE

The weld sequence defines the weld procedure from beginning to end. The POWER WAVE® AC/DC 1000® not only provides adjustment of basic welding parameters, but also allows the operator to fine tune the start and finish of each weld for superior performance.

All adjustments are made through the user interface. Because of the different configuration options, your system may **not have all of the following adjustments.** Regardless of availability, all controls are described below.

FIGURE B.8 – WELD SEQUENCE



START OPTIONS

The Strike, Start, and Upslope parameters are used at the beginning of the weld sequence to establish a stable arc and provide a smooth transition to the welding parameters.

- **Strike** settings are valid from the beginning of the sequence (Trigger) until the arc is established. They control Run-in (speed at which the wire approaches the workpiece), and provide the power to establish the arc.
  - Typically output levels are increased and WFS is reduced during the Strike portion of the weld sequence
- **Start** values allow the arc to become stabilized once it is established.
  - Extended Start times or improperly set parameters can result in poor starting
- **Upslope** determines the amount of time it takes to ramp from the Start parameters to the Weld parameters. The transition is linear and may be up or down depending on the relationship between the Start and Weld settings.

END OPTIONS

The **Downslope, Crater,** and **Burnback** parameters are used to define the end of the weld sequence.

- **Downslope** determines the amount of time it takes to ramp from the Weld parameters to the Crater parameters. The transition is linear and may be up or down depending on the relationship between the Weld and Crater settings.
- **Crater** parameters are typically used to fill the crater at the end of the weld, and include both time and output settings.
- **Burnback** defines the amount of time the output remains on after the wire has stopped. This feature is used to prevent the wire from sticking in the weld puddle, and condition the end of the wire for the next weld. A Burnback time of 0.4 sec is sufficient in most applications. The output level for Burnback is generally set to the same level as the last active weld sequence state (either Weld or Crater).

RE-STRIKE TIMER

If the arc goes out for any reason (short circuit or open circuit), the POWER WAVE® AC/DC 1000® will enter a Re-strike state. During this state the system will automatically manipulate the WFS and output in an attempt to re-establish the arc. The Re-strike timer determines how long the system will attempt to re-establish the arc before it shuts down.

- Used to protect the welding system and/or work piece being welded.
- A Re-strike time of 1 to 2 sec is sufficient in most applications.

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WELD PROCESS ADJUSTMENTS

Depending on the weld mode, there are a number of adjustments that can be made, including but not limited to Current, Voltage and WFS. These adjustments apply to either AC or DC processes, and control the basic parameters of the weld.

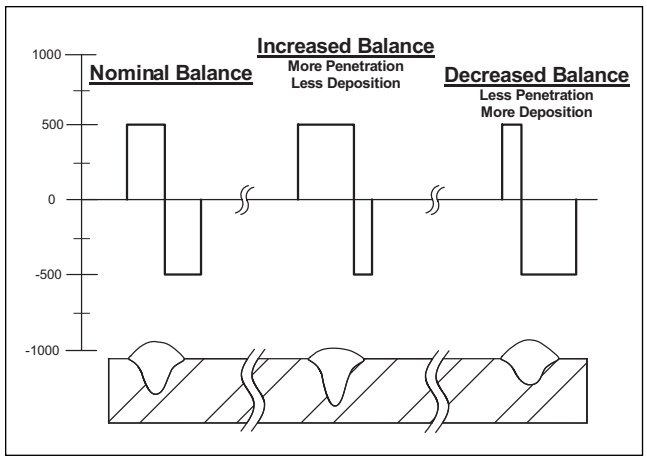
AC ADJUSTMENTS

In addition to the basic weld parameters, there are a number of unique adjustments related to the AC waveform of the POWER WAVE® AC/DC 1000®. These adjustments enable the operator to balance the relationship between penetration and deposition to tailor the output for specific applications.

WAVE BALANCE

- Refers to amount of time the waveform spends in DC+ portion of the cycle.
- Use Wave Balance to control the penetration and deposition of a given process.

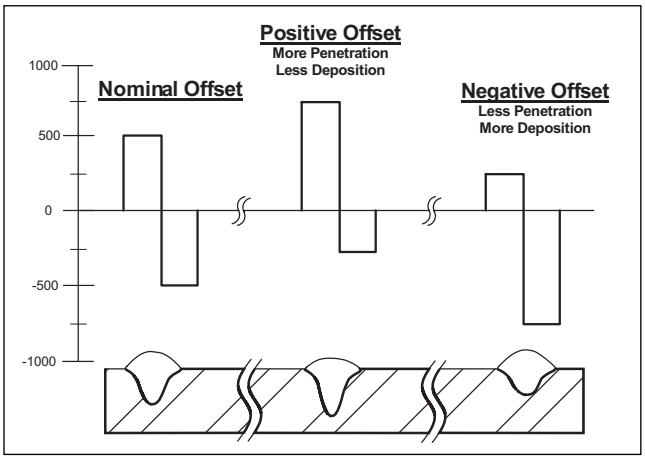
FIGURE B.9 – WAVE BALANCE



DC OFFSET

- Refers to +/- shift of the current waveform with respect to the zero crossing.
- Use Offset to control the penetration and deposition of a given process.

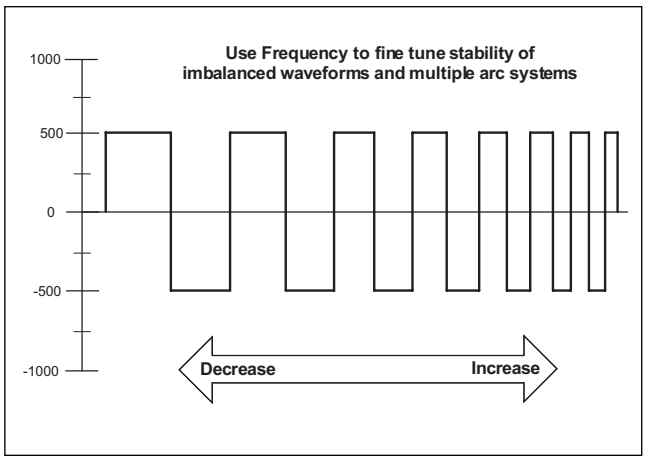
FIGURE B.10 – DC OFFSET



FREQUENCY

- POWER WAVE® AC/DC 1000® can produce Output Frequencies from 10 - 100Hz
- Use Frequency to fine tune stability
- Higher frequencies in multiple arc setups can help reduce arc interaction

FIGURE B.11 – FREQUENCY



MULTIPLE ARC AC ADJUSTMENTS FOR SYSTEMS EQUIPPED WITH K2282-1 SYSTEM INTERFACE

Phase

The **phase relationship** between the arcs helps to minimize the magnetic interaction between adjacent arcs. It is essentially a time offset between the waveforms of different arcs, and is set in terms of an angle from 0 to 360°, representing no offset to a full period offset. The offset of each arc is set independently with respect to the lead arc of the system (ARC 1).

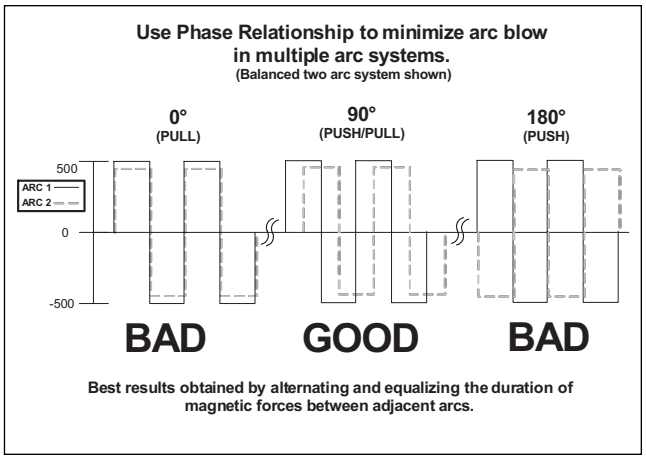
Recommendations:

- For balanced waveforms a phase relationship of 90° should be maintained between adjacent arcs.

	ARC 1	ARC2	ARC3	ARC 4
2 Arc System	0°	90°	X	X
3 Arc System	0°	90°	180°	X
4 Arc System	0°	90°	180°	270°

- For unbalanced waveforms:
  - Avoid switching at same time
  - Break up long periods of unchanged polarity relative to adjacent arcs

FIGURE B.12 – PHASE RELATIONSHIP



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PRODUCT DESCRIPTION PF10A

General Physical Description

The POWER FEED® 10A Controller is a user interface. The control is used to set all welding parameters and control any travel mechanisms. High-speed digital cables connect the control, wire drive, and the POWER WAVE® power source together.

The POWER FEED® 10A Controller is a self-contained control box designed to control the entire weld cell at one location. The control uses bright digital displays, encoders, and heavy-duty pushbuttons designed for every-day industrial use.

The Mode Select Panel utilizes alphanumeric displays for advanced text messaging providing the end user with an intuitive interface allowing for easy set up and real-time control of all welding parameters.

A six button Memory Panel has been included which provides easy storage and recall of stored welding parameters.

The Switch Panel can be removed from the control box and turned into a Pendant for remote control near the arc.

General Functional Description

- The POWER FEED® 10A Controller is one of the most versatile user interfaces ever created. Easy to use features make it a snap to adjust the arc for specific preferences.

- The new Mode Select Panel brightly displays essential welding information. Use the Mode Select Panel to quickly adjust weld settings, arc starting parameters, arc end parameters and set-up information.

- The Memory Panel allows for up to six weld schedules to be stored and quickly recalled. The Memory Panel along with the Mode Select Panel allows for multiple levels of limits and lockouts.

- Digital communications to the power source provide the most accurate and reliable operation possible.

- The POWER FEED® 10A Controller is one of the first user interfaces with an infrared red (IR) port. Transferring weld settings from one user interface to another is accomplished with a common Palm computer.

- When the POWER FEED® 10A Controller is coupled to a POWER WAVE® welding power source, the result is a welding system with the best arc performance on the market.

RECOMMENDED PROCESSES

- The POWER FEED® 10A Controller is best suited for submerged arc welding.

- SAW

PROCESS LIMITATIONS

- MIG processes

The Mode Select Panel does not support "Spot" welding.

NOTE: Not all weld modes or processes described in this manual are available on all POWER WAVE® power sources.

EQUIPMENT LIMITATIONS

- The POWER FEED® 10A Controller does not operate with the POWER WAVE® 450.

- The POWER FEED® 10A Controller does not operate with any analog-based power sources (CV-xxx machines, DC-xxx machines, etc.)

COMMON BASIC EQUIPMENT PACKAGES

Basic Packages:

POWER WAVE® 1000 AC/DC

POWER FEED®-10SF Wire Drive

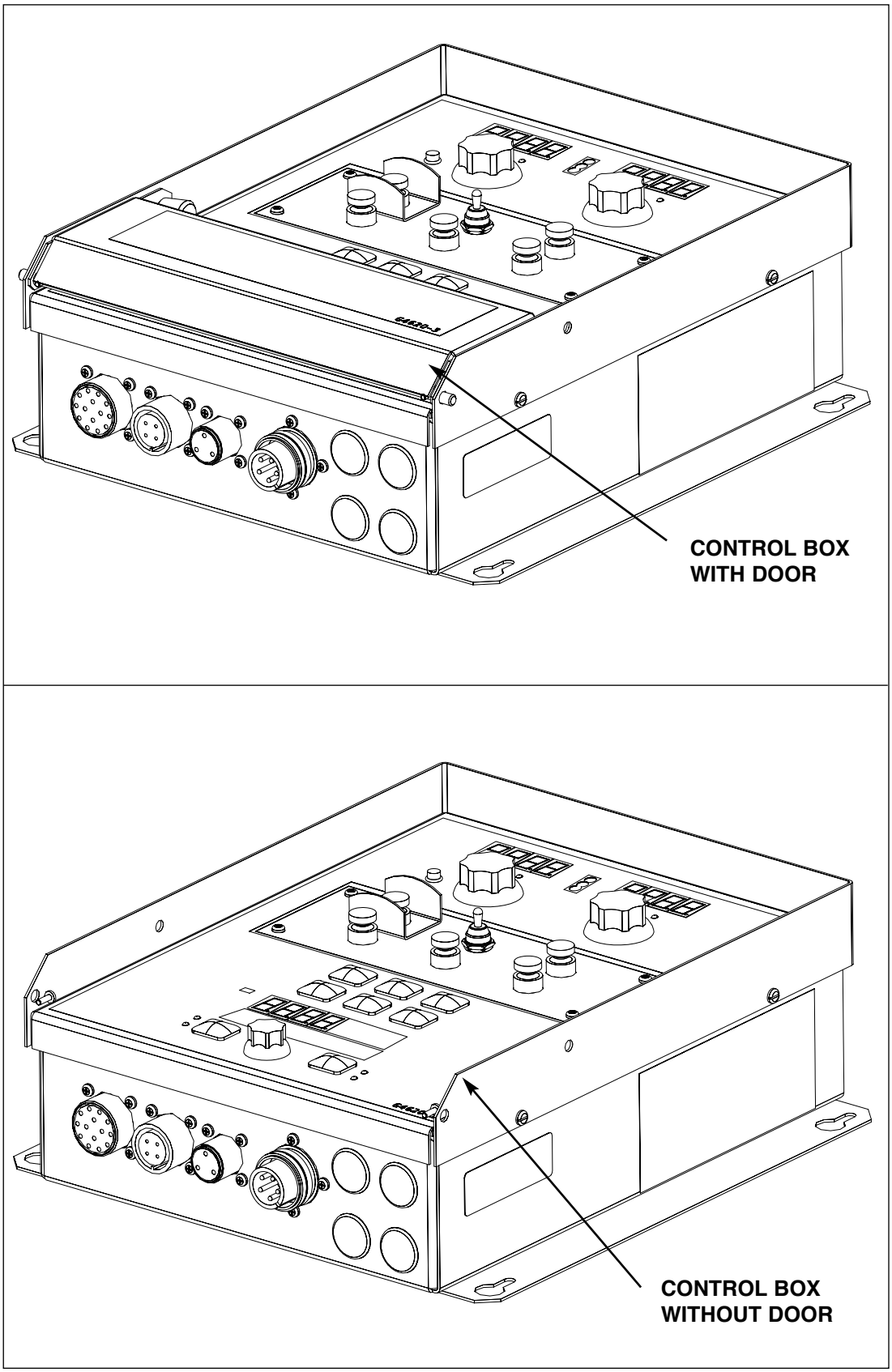
Basic Optional Kits:

POWER FEED®-10SM Motor Conversion Kit (Converts Lincoln NA style wire drives)

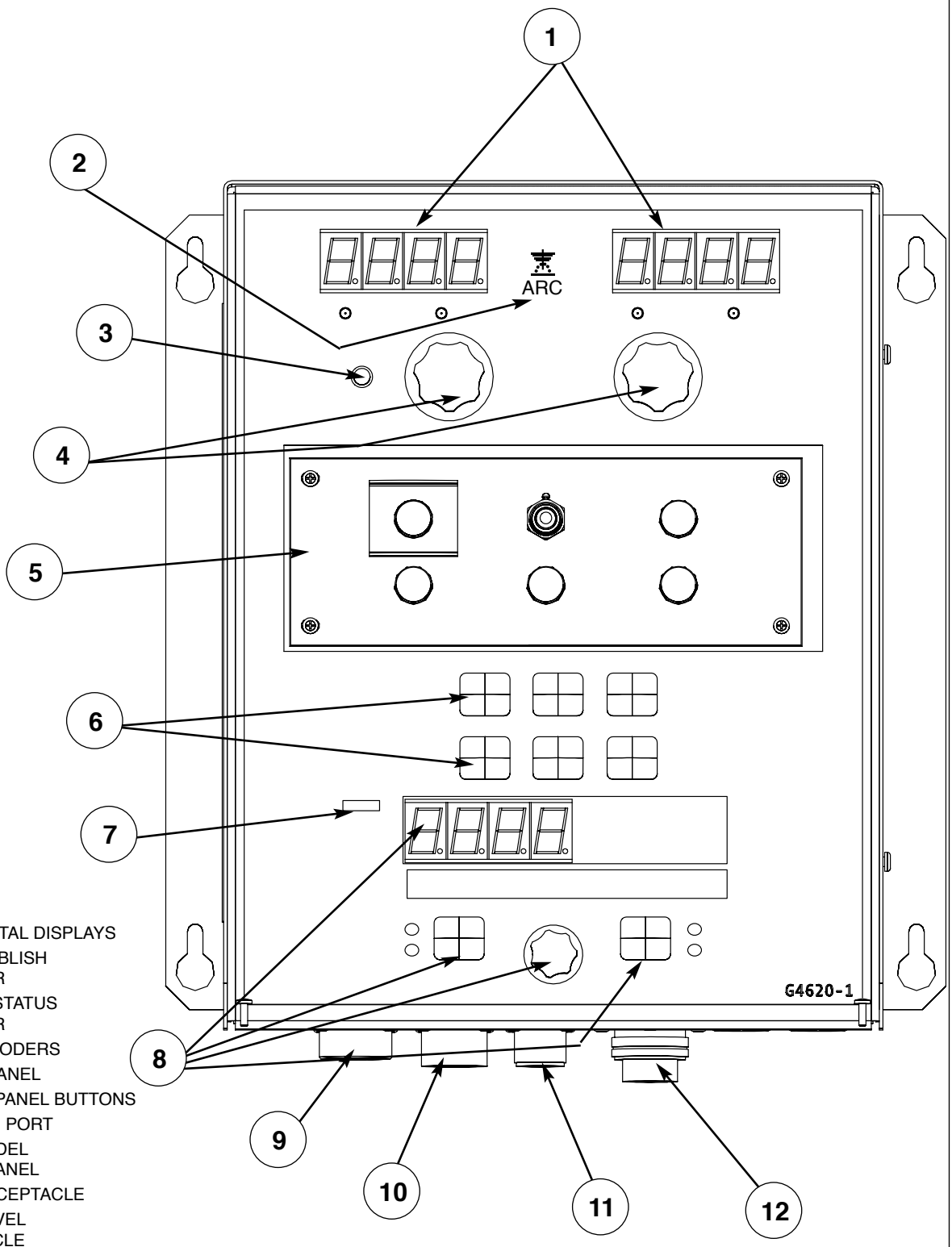
POWER FEED®-10S Wire Drive (connects to Lincoln TC-3 Travel Carriage)

System Interface (Phase Generator)

FIGURE B.13
LOCATING FRONT PANEL CONTROLS AND INPUT, OUPUT CONNECTIONS



B.14 – CASE FRONT CONTROLS FRONT VIEW



1. DUAL DIGITAL DISPLAYS
2. ARC ESTABLISH INDICATOR
3. ARCLINK STATUS INDICATOR
4. DUAL ENCODERS
5. SWITCH PANEL
6. MEMORY PANEL BUTTONS
7. INFRARED PORT
8. WELD MODEL SELECT PANEL
9. 14-PIN RECEPTACLE
10. 4-PIN TRAVEL RECEPTACLE
11. 3-PIN FLUX RECEPTACLE
12. 5-PIN INPUT RECEPTACLE

SEE OPERATIONS SECTION B FOR DETAILS AND DESCRIPTION OF EACH FUNCTION

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SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- Only qualified personnel should perform this installation.
- Turn off the input power to the power source at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on this equipment.
- Do not touch electrically hot parts.

WIRE FEEDER SETUP

Do not wear gloves when inserting wire into the feed mechanism or when hands are near moving parts.

Use the Cold Inch up / Inch down features to insert wire into the feed mechanism.

INPUT AND GROUND CONNECTIONS

Only a qualified electrician should connect the POWER FEED® 10A Controller. Installation should be made in accordance with the appropriate National Electrical Code, the local codes and the information in this manual.

Wire drive surfaces are at welding voltage potential when the output of the power source is active.

LOCATION AND MOUNTING

The POWER FEED® 10A Controller will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation. The POWER FEED® 10A Controller must be located where there is little risk of impacts to the Controller.

HIGH FREQUENCY PROTECTION

Locate the POWER FEED® 10A Controller away from radio controlled machinery. The normal operation of the POWER FEED® 10A Controller may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

AUXILIARY EQUIPMENT INPUT POWER CONNECTION

The POWER FEED® 10A Controller has the ability to control auxiliary equipment such as flux hoppers and travel motors using solid state relays. There are three relays in the POWER FEED® 10A Controller, controlled by two independent coil drivers. The coils of CR1 and CR2 are in parallel, therefore, they must turn ON and OFF at the same time. The CR1 and CR2 relays are designated for driving travel motors to control motion. CR3 is driven separately, and is designated to control flux hopper operation.

POWER FEED® 10A Controller Relay Ratings:

Coil: 12Vdc, resistance = 86 ohms at 25° C
N.C. Contacts: 3A @ 277VAC
N.O. Contacts: 30A @ 277VAC

The POWER FEED® 10A Controller **does not provide the input power to operate auxiliary equipment,** therefore a separate power supply must be provided by the end user. The POWER FEED® 10A Controller has been shipped standard with all of the wiring and connectivity to connect to the Lincoln K325 TC-3 Travel Carriage (4-pin cable connector) and the Lincoln K219 Automatic Flux Hopper (3-pin cable connector). The CR2 Relay is wired to the 4-pin travel connector, and the CR3 Relay is wired to the 3-pin flux connector, both located on the bottom of the POWER FEED® 10A Controller. 115VAC, 50/60Hz power is required for the Lincoln auxiliary equipment.

If either of these is to be used with the POWER FEED® 10A Controller, **the end-user must provide the 115VAC input power to the terminal strip located inside the POWER FEED® 10A Controller.** Access to the terminal strip may be obtained via the 4 access holes in the bottom of the POWER FEED® 10A Controller. These access holes are shipped with plug buttons installed.

⚠ WARNING

Although input power to POWER FEED® 10A Controller is turned off, the customer installed auxiliary input may be energized! Ensure that all input power to the POWER FEED® 10A Controller is turned off before opening the cover.

Auxiliary Input Power Connection Instructions:

1. Remove two Phillips Head screws on right side of front panel of hinged door to access terminal strip.

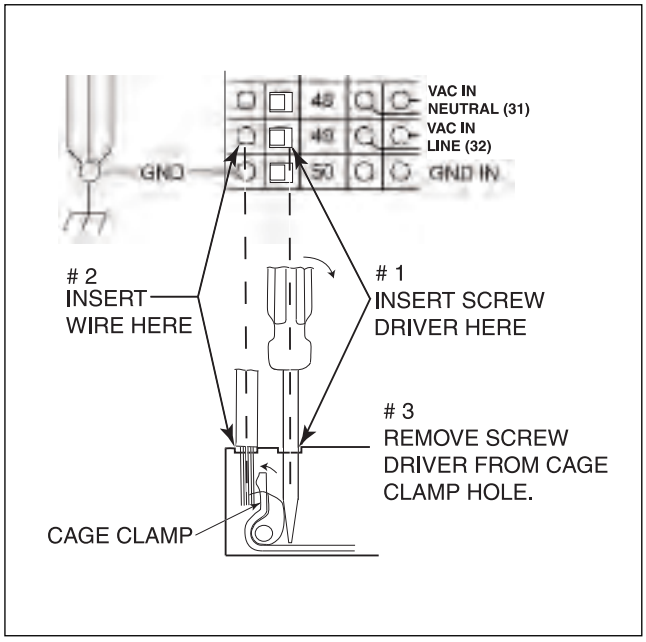
2. Remove a plug button and install a box connector to provide strain relief for the input power leads.

3. Use the appropriate size leads, at least 14 AWG – 2 wire with ground.

4. Using a flat-head screwdriver with a blade dimension of 0.137"(3.5mm) x 0.020"(.51mm), insert the screwdriver into the square hole next to the mounting hole to be used on the terminal strip. The screwdriver should be inserted until it bottoms out. This opens the screwless cage clamping style wire insertion port. The insulation on the leads should be stripped at least 0.25"(6.4mm). With the cage clamp opened insert the wire into the round port until it bottoms out. While holding the lead securely, remove the screwdriver from the terminal block. This closes the cage clamp onto the lead holding it securely. Any open port on blocks #48, #49, and #50 may be used.

5. The 4-terminal blocks, numbered #48, #49, and #50 are to be used to bring in auxiliary power. Terminal block #50 is used for the input ground connection. This terminal block is color-coded green and yellow for easy identification. Terminal blocks #48 and #49 are to be used to connect the input power circuit. (See figure B.15)

FIGURE B.15 – TERMINAL BLOCKS



Terminal blocks 48 and 49 are shipped connected to CR2 and CR3 (532 and 531 leads) and these relays are connected to the 3-pin and 4-pin connectors located on the bottom of the POWER FEED® 10A Controller. CR1 is available for a separate customer connection, but it will turn ON and OFF with CR2. Therefore, if Lincoln auxiliary equipment is to be used, connecting 115VAC to the terminal strip is all that is required to power the devices.

NOTE: The contacts of CR1 are not connected to terminals #48 and #49 when shipped. Applying power the #48 and #49 terminals will not transfer voltage to the CR1 relay. Connect leads from the #48 terminal to the #4 terminal and from the #49 terminal to the #3 terminal to supply power to the common contacts of the relay.

Once input power is applied to the terminal strip, this voltage is always on terminal strip blocks #3, #4 (if connected), #11, #17, and #18. These are the inputs to the solid-state relay contacts. Input voltage is also present on terminal strip blocks #7, #8 (if connected), #15, #21, and #22 due to the N.C. contacts on the relays. When the CR1 relay is energized, input power is transferred to terminal strip blocks #5 and #6 (if connected). When the CR2 relay is energized, input power is transferred to terminal strip block #13. When the CR3 relay is energized, input power is transferred to terminal strip blocks #19 and #20. CR1 and CR2 will be turned ON and OFF at the same time.

INTERFACING TO THE POWER FEED® 10A CONTROLLER

The POWER FEED® 10A Controller is a versatile controller. The Switch Panel can be removed and made into a hand-held pendant. Most circuits can be accessed through the screwless terminal strip. The auxiliary relays can control standard Lincoln equipment, or they can be used to control any other auxiliary equipment (see ***relay rating information*** above). Custom controls or PLC interfacing to control starting, stopping, motion, etc, can be accomplished with ease.

Converting Switch Panel to a remote pendant:

1. Remove all input power to the POWER FEED® 10A Controller including any auxiliary power supplies.

2. Remove the fasteners from the Switch Panel and disconnect the Switch Panel from the wire harness.

3. Jumper the wire harness connector (J2) to the mating 10-pin connector (P2P) that is floating inside the control box (See ***PF10A Wiring Diagram***) in Section G.

4. Replace the Switch Panel on the POWER FEED® 10A Controller with the blank panel included with the pendant box.

5. Connect the Switch Panel to the mating 10-pin connector inside the pendant box.

6. Fasten the Switch Panel to the pendant box.

7. Connect the 14-pin/9-pin pendant cable to the mating cable connector on the bottom of the POWER FEED® 10A Controller and the mating cable connector on the pendant.

8. The remote pendant is now ready to be used.

Interfacing to the Switch Panel Controls:

The Switch Panel circuits can be accessed on the screwless terminal strip. Easy access to these circuits enables the POWER FEED® 10A Controller to interface with custom controls or PLC's. These circuits must see a contact closure to function properly.

1. Remove all input power to the POWER FEED® 10A Controller including any auxiliary power supplies.

2. Remove the fasteners from the Switch Panel and disconnect the Switch Panel from the wire harness. The Switch Panel should be stored in a secure place in the event that it is needed in the future.

⚠ WARNING

The Switch Panel should not be left in the POWER FEED® 10A Controller if the switches are not connected. This could cause a safety concern due to the fact that the switches will not stop the welding sequence, etc.

3. Jumper the wire harness connector (J2) to the mating 10-pin connector (P2P) that is floating inside the control box (See ***PF10A Wiring Diagram***) in Section G.

4. Replace the Switch Panel on the POWER FEED® 10A Controller with the blank panel included with the pendant box.

5. Remove the wire duct cover to gain access to the leads on the right side of the terminal strip.

6. Remove the leads going to the Pendant 14-pin connector from the right side of terminal strip blocks #39, #40, #41, #42, #43, #44, #45, #46, & #47.
   NOTE: see ***Auxiliary Input Power Connection Instructions*** on how to remove/install wires to the screwless terminal strip

7. Remove one of the plug buttons located on the bottom of the POWER FEED® 10A Controller control box and install some type of strain relief for the interfacing leads.

8. Connect the interfacing leads to the Switch Panel circuits on the terminal strip (see ***PF10A Wiring Diagram*** for terminal strip designations) in Section G. The supply for START, STOP, and INCH UP comes from SWITCH GROUP #1 SUPPLY on block #39. The supply for TRAVEL AUTO, TRAVEL ON, FLUX FILL, and INCH DOWN comes from SWITCH GROUP #2 SUPPLY on block #43.

9. To activate any of the Switch Panel circuits, a contact closure must be established between the supply and the particular circuit it is referenced to – for instance, to start the weld sequence, a contact closure must be established momentarily between terminal strip blocks #39 (SUPPLY) and #40 (START). See ***FIGURE B.16***.

10. The leads from the 14-pin connector that were removed from the terminal strip can be taped and secured in the wire duct located next to the terminal strip.

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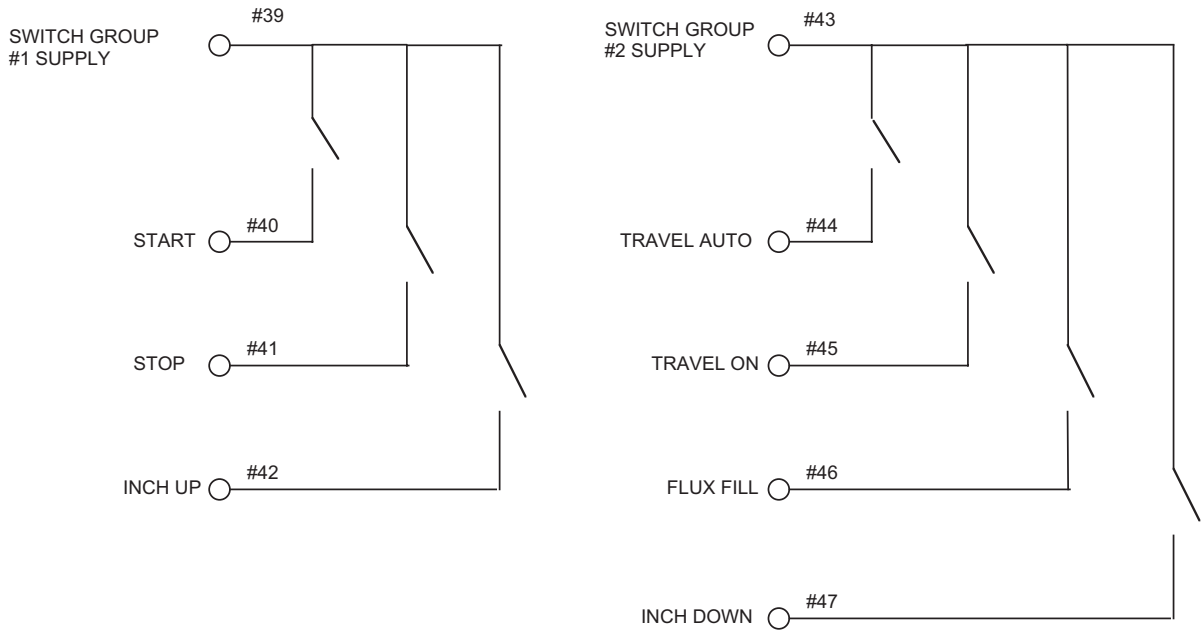
FIGURE B.16 – SWITCH GROUP



NOTE: TRAVEL AUTO and TRAVEL ON should not be closed at the same time. Either one OR the other should be closed at any time, and must remain closed to keep particular Travel Mode active. If neither switch is closed at any time, travel will be turned OFF, regardless of the welding state. Inching and Flux switches will activate their particular function when the switch is closed, and will cease when opened. The START and STOP switches are MOMENTARY and only need to be closed for a short period of time to start or stop the weld sequence.

CONTROLLING NON-LINCOLN AUXILIARY EQUIPMENT:

Custom motion control and/or other auxiliary equipment can be powered using the terminal strip and relays. To use non-Lincoln motion control and/or flux hoppers, follow instructions below.

1. Remove all input power to the POWER FEED® 10A Controller including any auxiliary power supplies.

2. Remove the wire duct cover to gain access to the leads on the right side of the terminal strip.

3. Remove one of the plug buttons located on the bottom of the POWER FEED® 10A Controller control box and install some type of strain relief for the auxiliary control leads.

4. Remove the leads going from the terminal strip to the corresponding connectors, i.e. terminal strip blocks #11, #13, and #16 for the 4-pin TC-3 Travel Carriage or terminal strip blocks #19, #20, and #23 for the 3-pin Automatic Flux Hopper.

5. These loose leads can be taped and secured in the wire duct.

6. Any custom or non-Lincoln equipment can be powered by the normally open contacts from relays CR1, CR2, or CR3. The normally open contacts for CR1 are located on terminal strip blocks #5 and #6. The normally open contacts for CR2 are located on terminal strip blocks #12 and #13. The normally open contacts for CR3 are located on terminal strip blocks #19 and #20. CR1 and CR2 are BOTH turned ON when the weld sequence starts and are BOTH turned OFF when the weld sequence stops as long as the TRAVEL MODE Switch is in the AUTO position.

7. The input supply voltage to power these devices is provided by the end user. As shipped, the PF-10A has the auxiliary supply blocks (terminal strip blocks #48 and #49) connected to the CR2 relay and CR3 relay inputs, respectively. When the end user connects a supply to the AUX blocks #48 and #49, this voltage will be jumpered to the CR2 and CR3 relay inputs on terminal strip blocks #11, #17, and #18. Note – the CR1 relay is not connected to the AUX terminal strip blocks; the customer must connect power to this relay if it is to be used. See relay ratings listed earlier.

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8. Connect input supply voltage per the ***Auxiliary Input Power Connection Instructions*** listed earlier.

9. The relays could also be used to provide contact closure for any interfacing signals out using the normally open contacts. An external auxiliary supply voltage would not be necessary to use the relays as hard contact closure out signals.

NOTE: The CR1 relay as shipped does not have AUX leads connected to it. This relay has two normally open contacts that close at the start of the weld cycle and open at the end of the weld cycle. These hard contact closures could be used as a signal out when interfacing to PLC's or custom controls.

Shutdown Inputs:

The POWER FEED® 10A Controller has two shutdown inputs available on the terminal strip. These are independent, normally closed inputs that can be used for limit switches, PLC inputs, etc, in order to shut down the welding operation for any reason. Shutdown #1 is located on terminal strip blocks #24 and #25. Shutdown #2 is located on terminal strip blocks #26 and #27.

1. Remove all input power to the POWER FEED® 10A Controller including any auxiliary power supplies.

2. Remove the wire duct cover to gain access to the leads on the right side of the terminal strip.

3. Remove one of the plug buttons located on the bottom of the POWER FEED® 10A Controller control box and install some type of strain relief for the auxiliary control leads.

4. Connect the external shutdown circuit to either of the shutdown terminal blocks, #24 & #25, and/or #26 & #27. A normally closed circuit must be connected – the POWER FEED® 10A Controller will recognize an open circuit as a shutdown command.

5. Remove the shorting jumpers imbedded in the center of the terminal strip with a small screwdriver for the shutdown circuits to be used.

When a shutdown input is received, all welding will stop and an error message will be displayed on the POWER FEED® 10A Controller. The shutdown circuit must be closed before resetting Controller. To reset the system, the Mode Select Panel display will prompt the user to press the left Mode Select Panel Pushbutton.

Stop Input:

The POWER FEED® 10A Controller has a Stop Input available on the terminal strip. The Stop Input will work just like pressing the STOP Pushbutton. This circuit is in parallel with the STOP Pushbutton located on the Switch Panel. Unlike the Shutdown Inputs, which completely shutdown all welding and auxiliary equipment, the STOP Input will allow all welding and auxiliary motion to continue based on the END OPTIONS configurations in the POWER FEED® 10A Controller.

1. Remove all input power to the POWER FEED® 10A Controller including any auxiliary power supplies.

2. Remove the wire duct cover to gain access to the leads on the right side of the terminal strip.

3. Remove one of the plug buttons located on the bottom of the POWER FEED® 10A Controller control box and install some type of strain relief for the auxiliary control leads.

4. Connect the external Stop Input circuit to terminal blocks #28 and #29.

The Stop Input is not necessary if the POWER FEED® 10A Controller is configured for Remote Interfacing, mentioned earlier, due to the fact that the Stop circuit can be accessed, in this configuration, on terminal strip blocks #39 and #41. The Stop Input was intended to be used when the Switch Panel is still included in the system, either on the Controller, or in the Pendant.

NOTE: the STOP circuit only needs a momentary closure to be recognized by the POWER FEED® 10A Controller.

Refer to ***Figure B.16*** in this Section for Connection Diagram. More complete information is in the ***PF10A Wiring Diagram*** in Section G.

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REMOTE SENSE LEAD SPECIFICATIONS

Welding with Multiple Arcs

Special care must be taken when more than one arc is welding simultaneously on a single part. Arc blow and arc interference may occur or be magnified. Each power source requires a work lead from the work stud to the welding fixture. Do not combine all of the work leads into one lead. Perform welding in the direction away from the work leads. Connect all of the work sense leads from each power source to the work piece at the end of the weld, such that they are out of the path of the weld current.

For the best results when pulse welding, set the wire size and wire feed speed the same for all the arcs. When these parameters are identical, the pulsing frequency will be the same, helping to stabilize the arcs.

Refer to ***Figures A.2 thru A.11*** in the Installation Section for Remote Sense Lead Specification Diagrams.

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SAFETY PRECAUTIONS-PF10A

⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts or electrodes with your skin or wet clothing.
- Insulate yourself from the work and ground.
- Always wear dry insulating gloves.
- Do not use welder if your clothing, gloves or work area is damp or if working on, under or inside workpiece.
- Do not operate with panels removed.
- Disconnect input power before servicing.

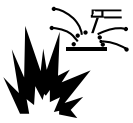
Only Qualified persons should install, use or service this equipment. Read and FOLLOW THE MANUFACTURER'S INSTUCTIONS, EMPLOYER'S SAFTEY PRACTICES AND MATERIAL SAFTEY DATA SHEETS (MSDS) FOR CONSUMABLES.

READ THIS WARNING, PROTECT YOURSELF & OTHERS.

FUMES AND GASES can be dangerous.

- Keep your head out of fumes.
- Use ventilation or exhaust at the arc, or both, to keep fumes and gases from your breathing zone and general area.

WELDING SPARKS can cause fire or explosion.



- Do not weld near flammable material.
- Do not weld on containers which have held flammable material.

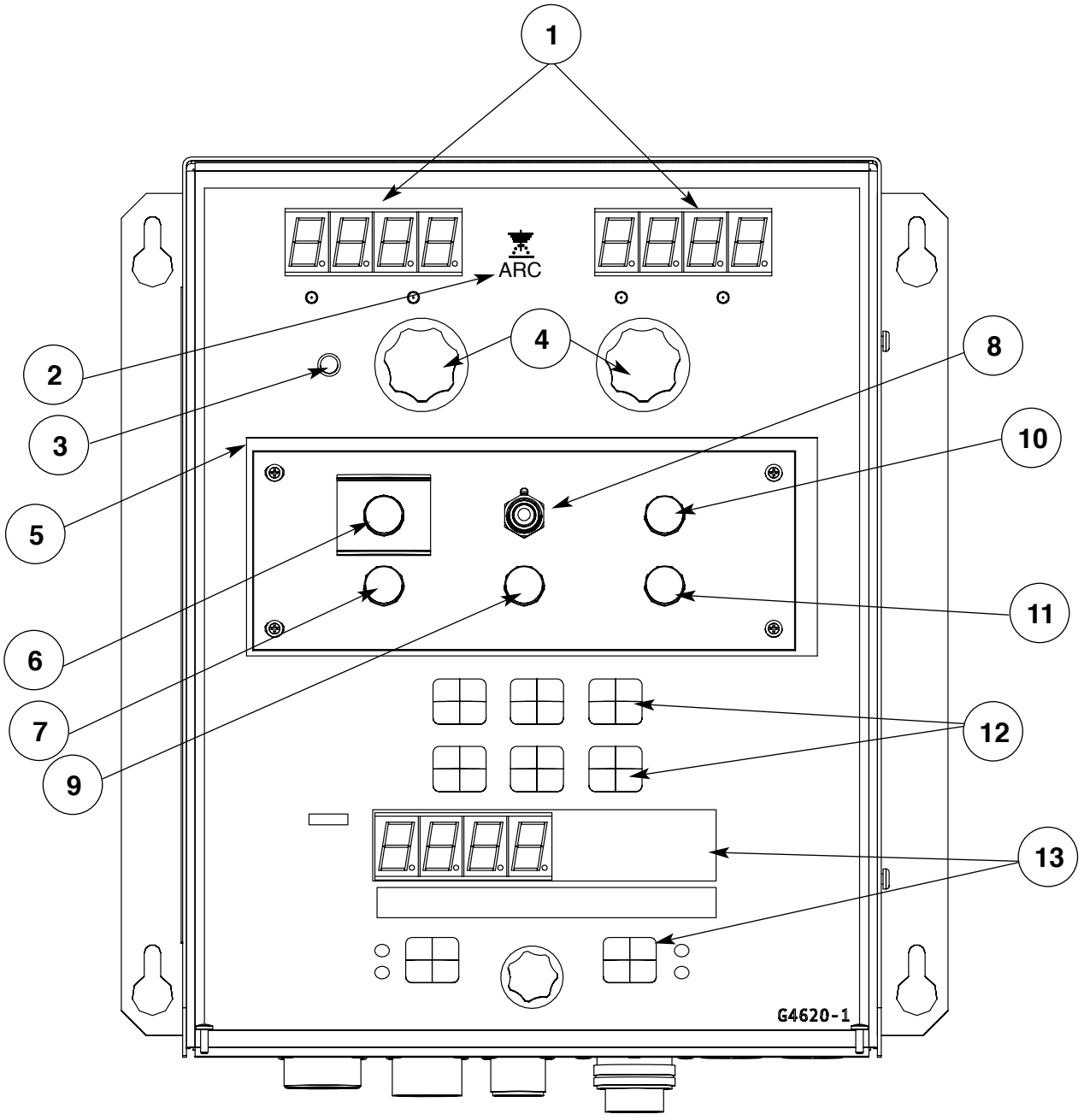
ARC RAYS can burn.

- Wear eye, ear, and body protection.

DESIGN FEATURES

- Mode Select Panel for easy control of all weld parameters.
- Memory Panel for easy storage and recall of weld schedules.
- Weld parameter limit setting and lockout capabilities.
- Digital communications for accurate and reliable performance.
- Infrared red (IR) port for transferring weld settings.
- PC boards are potted in epoxy for the ultimate in outdoor protection.
- Connectors are filled with environmental protective grease.
- Designed for the POWER WAVE® series of products for the best arc in the industry.
- Wire feed speed accuracy calibrated to within 2%.
- Digital display of voltage and wire feed speed.
- Tachometer controlled wire drive motor.
- Flux Fill Switch.
- Bright, high intensity digital read-outs.
- Industrial Push Button Switches
- Switch panel can be removed and converted into a remote pendant.

FIGURE B.17 – CASE FRONT CONTROLS



1. DUAL DIGITAL DISPLAYS
2. ARC ESTABLISH INDICATOR
3. STATUS LED
4. DUAL ENCODERS
5. SWITCH PANEL
6. START
7. STOP
8. TRAVEL MODE
9. FLUX FILL
10. INCH UP
11. INCH DOWN
12. MEMORY PANEL
13. MODE SELECT PANEL

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CASE FRONT CONTROL DESCRIPTIONS

1. **DUAL DIGITAL DISPLAYS –** Bright 7-segment displays showing welding parameter settings and actual levels while welding.
2. **ARC ESTABLISH INDICATOR –** Illuminates when a "true" arc has been established.
3. **Status LED -** The status LED indicates system status. Normal operation is a steady green light.

NOTE: During normal power-up, the LED may flash red and/or green as the equipment performs self tests.

LED condition	Definition
Steady green	System okay. The power source and wire feeder are communicating normally.
Blinking green	Occurs during a reset and indicates the power source is identifying each component in the system. This is normal for the first 10 seconds after power-up, or if the system configuration is changed during operation.
Alternating green and red	Non-recoverable system fault. If the power source or wire feeder status LED is flashing any combination of red and green, errors are present in the system. Read the error code before the machine is turned off.
	Instructions for reading the error code are detailed in the 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.
	To clear the error, turn the power source OFF, and then back ON to reset. See troubleshooting section.
Steady red	Non recoverable hardware fault. Generally indicates a problem with the cables connecting the wire feeder to the power source.
Blinking red	Not applicable.

4. **DUAL ENCODERS –** Accurately adjust weld parameters as pre-set values, or on-the-fly values while welding.
5. **SWITCH PANEL** – Heavy-duty pushbutton switches that control inching of the wire, starting and stopping of welding, travel and flux control. The Switch Panel can be removed and turned into a remote pendant.
6. **START** – Activates the weld cycle.
7. **STOP** – Deactivates the weld cycle.
8. **TRAVEL MODE:**

   ON – Activates travel.

   OFF – Disables travel.

   AUTO – Activates travel when the START button is pressed. Disables travel when the STOP button is pressed.
9. **FLUX FILL** – Activates the flux hopper.
10. **INCH UP** – Cold feeds the wire upwards, away from the work.
11. **INCH DOWN** – Cold feeds the wire downward, toward the work. NOTE: The POWER FEED® 10A uses a Touch Sense circuit that disables the cold feeding of the wire when the wire comes in contact with the work. When the wire touches the work, the flux hopper will open distributing flux around the wire. The flux hopper will close once the INCH DOWN Pushbutton is released.
12. **MEMORY PANEL** – Enables the storage and recall of up to 6 weld schedules. Enables weld parameter limit setting.
13. **MODE SELECT PANEL** – The main user interface for weld mode selection, welding parameter adjustment, and multiple levels of user lockouts. Bright 7-segment display and alphanumeric displays enable text messaging for user friendly parameter setup.

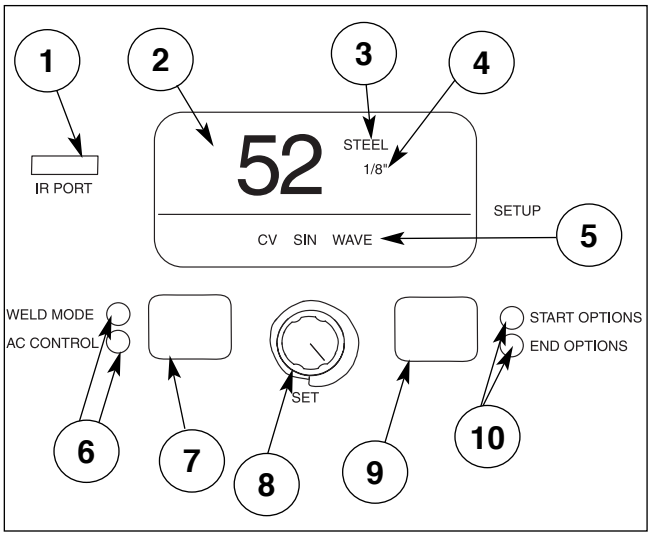
POWER-UP SEQUENCE

When power is first applied to the machine, a lamp test is performed. All discrete LED's are turned on, all 7-segment displays will show a pattern of "8." and all alphanumeric displays will show a hatch pattern where every-other pixel is illuminated. The lamp test will last for two seconds, after which all displays are turned off. The 16-character alphanumeric display will show "Initializing…" while waiting for the Weld Sequencer to configure. The Mode Select Panel alphanumeric displays will then display the name of the weld table loaded in the attached power source while the user interface prepares the machine for operation. After all initialization is complete, the Mode Select Panel will display the weld mode information for the mode number that was selected when the machine was last powered down.

COLD INCH WIRE FEED SPEED SETTING

While pressing either the Inch Up Pushbutton or the Inch Down Pushbutton, the preset wire feed speed will be displayed on the Dual Display panel. This value can be changed while inching wire by turning the WFS Encoder and will be stored in memory.

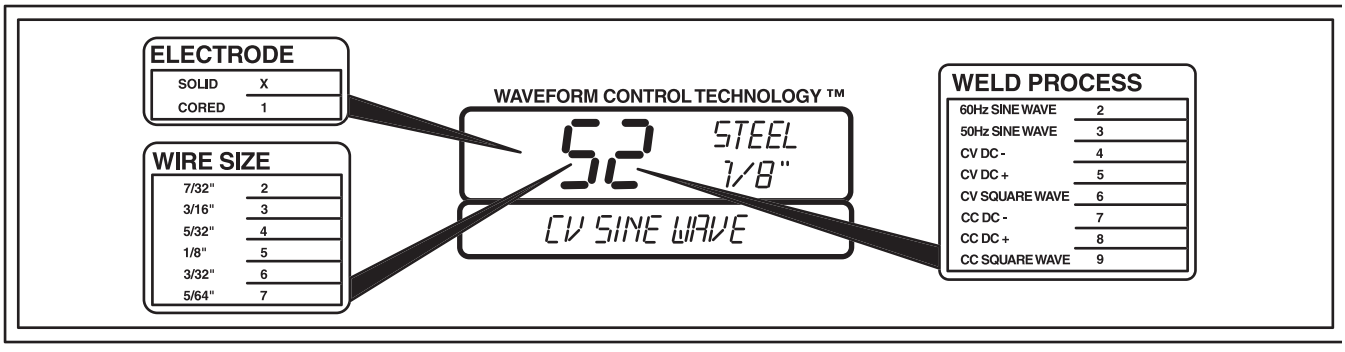
FIGURE B.18 – CHANGING WELD MODES



MODE SELECT PANEL 4 (MSP4)

ITEM	DESCRIPTION
1	IR (Infrared) Port.
2	Weld Mode Number.
3	Weld Wire Type.
4	Wire Size.
5	Weld Mode Description.
6	Weld Mode/AC Control LED's.
7	Selection Pushbutton Weld Mode or AC Control.
8	"Set" (Adjustment) Dial / Knob
9	Selection Pushbutton Start and End Option
10	Start/End Options LED's.

FIGURE B.19 – WELDING MODE SELECTION



*This table is located on the inside of front panel door. This Chart will let the operator select the proper Electrode, Wire size and Weld process for welding.

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GENERAL SETUP MODE OPTIONS

The Setup Mode can be used to set more general welding configurations such as travel options or display configurations and can be used to access diagnostic tools.

The POWER FEED® 10A Controller can be configured to display the wire feed speed in inches per minute or meters per minute, and\or display wire feed speed or Amps in any weld mode. To access the wire feed speed units in the Setup Mode, enter into the Setup Mode by pressing both Mode Select Panel Pushbuttons simultaneously. The SETUP LED will illuminate. Turn the Mode Select Panel Knob until WFS UNITS is listed.

P.1	English
WFS Units	

SETUP

- Press the right Mode Select Button.
- Turn the Knob to toggle between English and Metric.

To set the display to read Wire Feed Speed or Amps, turn the Mode Select Knob until ARC DISPLAY MODE is listed.

P.2	Amps
Arc Display Mode	

SETUP

- Press the right Mode Select Button.
- Turn the Knob to toggle between Amps or WFS.

The POWER FEED® 10A Controller can start and stop travel based on the START and STOP Pushbuttons, or based on the arc being established or extinguished. To access the Travel Options in the Setup Mode, enter into the Setup Mode by pressing both Mode Select Panel Pushbuttons simultaneously. The SETUP LED will illuminate. Turn the Mode Select Panel Knob until TRAVEL OPTIONS is listed.

P.12	Travel Options
	Yes

SETUP

Pressing the right Mode Select Panel Pushbutton will enter into the Travel Options. Turning the Mode Select Panel Knob will toggle between TRAVEL STARTS and TRAVEL STOPS. Pressing the right Mode Select Panel Pushbutton, will allow the travel to be set to start on the START BUTTON or on the ARC STRIKE, and to stop on the STOP BUTTON or on the ARC OUT.

P.12	Start Button
Travel Starts	

SETUP

P.12	Arc Out
Travel Ends	

SETUP

- Pressing the left Mode Select Panel Pushbutton will exit the parameter setting section, returning to the previous section. Continuing to press the left Mode Select Panel Pushbutton will return to the Setup Mode user preferences and welding parameters list.
- Diagnostic tools SHOW TEST MODES and VIEW DIAGS can be accessed in the Mode Select Panel Setup Mode also, but these tools should only be accessed by properly trained personnel.

TABLE B.1 – TEST MODES & SETUP MODES (USER PREFERENCES)

P0	Exit menu				
P1	WFS Units - Metric or English				
P2	Arc Display Mode - WFS or Amps				
P11	Setup Timers - Upslope, Downslope, Restrike (if a customer experiences arc outages, have them set a restrike time)				
P12	Travel Carriage Options				
P14	Rset Wire? - For Production Monitoring				
P15	Touch Sense Disable - This allows touch sense during cold inch forward to be active or inactive				
P99	Show Test Modes? - Include test modes from weld table to be displayed and selected. //DIAGNOSTICS (View Only)********** Must exit this menu after selecting SHOW TEST MODE. For mode 221, 222, these test modes will now be available in the REGULAR WELD FILES SELECTION. **NOTE:** Cycling input power removes test modes 221 & 230 from mode selection list.				
221	DC+ CC Test	CC TEST 20-1250A	AMPS	20 ~ 1250A	
222	CV Test	CV TEST 10-35V	AMPS	100 ~ 350 A	
223	DC-CC Test	AC-NEG CC TEST	AMPS	25 ~ 1250 A	
224	Sq Wave CC Test	CC SQUARE WAVE	AMPS	25 ~ 1050 A	
225	50 Hz Sine Test	AC-NEG CC TEST	AMPS	25 ~ 1250 A	(available but do not use)
230	CC Square Wave	ARC OBJECT	AMPS	300 ~ 700 A	(available but do not use)
P100	View Diagnostics				
P101	View Event Logs				
P102	View Fatal Logs				
P103	View Software Version				
P104	View Hardware Version				
P105	View Welding Software (Weld Table)				
P106	View Ethernet IP Address				
P107	View Power Source (ArcLink or LincNet)				

Additions or deletions of these modes are dependent on power source or PF10A software versions!
See IM Manual for PF10A (IM849) for more details & updates.

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CHANGE WELD MODES (MSP4 left button)

DESCRIPTION OF WELD MODES

NOTE: Some features may or may not appear depending on the application or software.

AC Control of: (MSP4 Panel Left Button)		
Frequency Balance Offset		Utilizes MSP4 Panel Set Knob
ARC 2 Phase ARC 2 Balance ARC 3 Phase ARC 3 Balance ARC 4 Phase ARC 4 Balance	Multiple Arc Only Applications	
Start Options: (MSP4 Panel Right Button) then utilizes MSP4 panel knob & display		
ARC Delay Time Strike WFS Strike Volts Start UFS/AMPS Start Volts		Utilizes Dual Display Knobs
Start Time	Utilizes MSP4 Panel Display & Center Knob	
End Options: (MSP4 Panel Right Button) then:		
Crater WFS/AMPS Crater Volts	Utilizes Dual Display Panel Knobs	
Crater Time Burnback Time	Utilizes MSP4 Panel Center Knob	
General Setup Mode Options: (Utilizing MSP4 Panel) same time pushing left & right button (left button to exit):		
WFS unit in English Arc display in AMPS versus WFS Travel options - starting & stopping	Right Button & Center Knob	
Diagnostic modes	See list of features in Troubleshooting Section to energize output in welding	
Infrared (IR) control	See next few pages	
Lock/out security	See List of Lockouts (Utilized by IR [Infrared] [MSP4 Panel])- see next few pages	
Memory panel six locations	Save and recall features via Memory Panel	
Limit setting	Utilizes MSP4 Panel	

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TABLE B.2 – WELD SEQUENCE PARAMETER LIST

PARAMETER	UNITS	RANGE	DEFAULT VALUE	WHERE IS IT SET?
Arc Delay Time	seconds	0-5.0	OFF	MSP4 - START OPTIONS
Strike WFS	IPM	from weld table*	weld mode dependant	Left Dual Display
Strike Volts	volts	from weld table*	weld mode dependant	Right Dual Display
Restrike Time	seconds	0-10.0	OFF	MSP4 - SETUP Menu
Start WFS/Amps	IPM/amperes	from weld table*	weld mode dependant	Left Dual Display
Start Volts	volts	from weld table*	weld mode dependant	Right Dual Display
Start Time	seconds	0-0.5	0.1	MSP4 - START OPTIONS
Start Arc Force	amperes	from weld table*	weld mode dependant	MSP4 - SETUP Menu
Upslope Time	seconds	0-10.0	OFF	MSP4 - SETUP Menu
Weld WFS/Amps	IPM/amperes	from weld table*	weld mode dependant	Left Dual Display
Weld Volts	volts	from weld table*	weld mode dependant	Right Dual Display
Weld Arc Force	amperes	from weld table*	weld mode dependant	MSP4 - SETUP Menu
Frequency (AC)	hertz	10-100	weld mode dependant	AC CONTROL
Balance (AC)	percent	25-75	weld mode dependant	AC CONTROL
Offset (AC)	percent	-50.0 - +50.0	0.0	AC CONTROL
Arc 2 Phase (if applicable)	degrees	0-359	90	AC CONTROL
Arc 2 Balance (if applicable)	percent	25-75	50	AC CONTROL
Arc 3 Phase (if applicable)	degrees	0-359	180	AC CONTROL
Arc 3 Balance (if applicable)	percent	25-75	50	AC CONTROL
Arc 4 Phase (if applicable)	degrees	0-359	270	AC CONTROL
Arc 4 Balance (if applicable)	percent	25-75	50	AC CONTROL
Downslope Time	seconds	0-10.0	OFF	MSP4 - SETUP Menu
Crater WFS/Amps	IPM/amperes	from weld table*	weld mode dependant	Left Dual Display
Crater Volts	volts	from weld table*	weld mode dependant	Right Dual Display
Crater Time	seconds	0-10.0	OFF	END OPTIONS
Crater Arc Force	amperes	from weld table*	weld mode dependant	MSP4 - SETUP Menu
Burnback Time	seconds	0-2.0	0.2	END OPTIONS

* Range depends on the Machine Power Source, Literature and Tables supplied with each unit.

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INFRARED (IR) CONTROL

The Mode Select Panel interface includes an infrared transceiver. This allows wireless machine configuration using a Palm OS based handheld computer. A proprietary Palm OS application, ALPalm, has been developed for this purpose.

LOCKOUT/SECURITY

The POWER FEED® 10A can be optionally configured to prevent the operator from changing selected POWER FEED® 10A panel controls. By default, the welder will be able to change the weld mode, all relevant wave controls and all relevant start and end options.

Here is a list of Lockout levels:

PANEL	LOCKOUT LEVEL
Mode Select	All Mode Select options unlocked (default). All Mode Select options locked. START OPTIONS and END OPTIONS locked. WELD MODE selection locked, only wave controls are unlocked (useful when Memory) Panel is used to recall weld modes. AC CONTROL locked. START OPTIONS, END OPTIONS, and wave options locked. START OPTIONS, END OPTIONS, and WELD MODE Locked.
Memory Panel	All memories enabled (default). All memories disabled. Memories 2-6 disabled. Memories 3-6 disabled. Memories 4-6 disabled. Memories 5-6 disabled. Memory 6 disabled.
Encoder Panel	Both knobs unlocked (default). Both knobs locked. Right knob locked. Left knob locked.

NOTE: When an option is locked, its value can still be monitored. For example, if start and end options are locked, the welder can still press the right Mode Select Panel Pushbutton and see the value set for Start Time. If the welder attempts to change its value, a message will briefly appear on the Mode Select Panel indicating "MSP Option is LOCKED!".

Presently, lockout features are only available through a PC application or the IR Port. See Power Wave Manager software that is available from www.powerwavesoftware.com

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OPTIONAL KITS AND ACCESSORIES

K2282-1 POWER WAVE® System Interface
The optional POWER WAVE® System Interface provides the means to synchronize the AC wave shapes of up to four different arcs to a common carrier frequency. This frequency can range from 10 hertz to 300 hertz, with the most practical range being 10 to 100 hertz. It can also control the phase relationship between arcs to reduce the effects of welding related issues such as "Arc Blow".

K2444-1 CE – C-Tick Filter Kit
This external filter kit is available for the **K2344-2** POWER WAVE® AC/DC 1000®, and mounts directly to the reconnect area on the rear of the machine. The filter is necessary to meet CE conducted emission requirements.

SOFTWARE TOOLS
S26122 CD Part Number(Obsolete)

The POWER WAVE® AC/DC 1000® was shipped with a CD including software tools and other documents related to the integration, configuration, and operation of the system. The **POWER WAVE® Submerged Arc Utilities** CD is obsolete and Power Wave Manager software available from www.powerwavesoftware.com should be used.

Name	Purpose
Ethernet Setup	Setup Ethernet address information, and apply security settings.
Command Center	AC/DC system tool to observe and log welding operation, verify welding configuration, and facilitate quality analysis.
Submerged Arc Cell Configuration	Used to configure and verify a multi-arc or parallel connected power source (more than one POWER WAVE® per arc) systems.
Production Monitoring	Allows user to setup Production Monitoring options on the POWER WAVE® including Email notification, Shift Timers, Wire Package Tracking. Also provides means to retrieve statistical welding data, generate machine reports, and update the POWER WAVE® Firmware and Welding Software.
Diagnostics Utility	Utility to diagnose POWER WAVE® problems, read system information, calibrate output voltage and current, test sense leads, and diagnose feed head issues. Can also setup and verify DeviceNet operation.
Power Wave Manager software (Palm Application)	Palm based utility used to configure, backup and restore various POWER FEED® 10A Controller settings (can be used to copy settings from one PF-10A to another). Also provides means to retrieve version information and setup Ethernet address of the local Power Wave system (only those components directly connected to the PF-10A via ArcLink).

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GENERAL OPTIONS / ACCESSORIES

K2311-1 **POWER FEED® 10SM** – Converts NA style wire drives into POWER FEED®-10S Wire Drives

K2370-1 **POWER FEED® 10S Wire Drive** – POWER FEED®-10S with hardware to connect to a TC-3 Travel Carriage.

K2282-1 **System Interface** – Includes phase generator for multiple arcs.

K1543-xx **ArcLink Cables** – ArcLink cable of length "xx".

K1842-110 **Weld Power Cable** – Lug to Lug, 4/0 Cable of length 110 ft.

K2163-xx **Weld Power Cable** – Lug to Lug, 4/0 Cable of length "xx"

K1795-xx **POWER WAVE® to System Interface Cable**

K1785-xx **Wire Drive Cable**

K231-x **Contact Nozzle Assembly**

K226R **Contact Jaw Assembly**

K148 **Positive Contact Assembly**

K149 **Linc-Fill Attachments**

K386 **Narrow Gap Deep Groove Nozzle**

K285 **Concentric Flux Cone Assembly**

K225 **Twinarc Contact Assemblies**

K129 **Tiny Twinarc Assemblies**

K281 **Tiny Twinarc Solid Wire Straightener**

K325 **TC-3 Travel Carrriage**

K299 **Wire Reel Assembly for 50-60lbs Coils**

K162-1 **Spindle Kit – 2in. hub**

K29 **Vertical Lift Adjuster**

K96 **Horizontal Adjuster**

K278 **SpreadArc Oscillator**

K310 **Flux Screen – Air Driven Vibrator**

K58 **Magnetic Separator**

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K2311-1 MOTOR CONVERSION KIT (FOR 142:1 NA STYLE WIRE DRIVES)

This convertion kit converts old NA style wire drives.

1. Remove the 2 hex head screws and the 2 slot head screws holding the Motor to the Wire Drive Gearbox assembly.
2. Remove existing Adapter Plate and Motor Assembly.
3. The Conversion Kit Motor is shipped configured for a 142:1 gear ratio. The existing gearbox must be configured for a 142:1 gear ratio for the Conversion Kit to assemble correctly. If both assemblies are not configured for the same gear ratio, this must be done before continuing. (See Gear Ratio Conversion Kit instructions or in same kit 57:1 ratio & 95:1 ratio.)
4. Cover the teeth of the new Motor pinion gear with a non-fluid molydisulfide type grease such as Non-Fluid Oil Corporation's A-29 Special/MS Lubricant. This grease can be scooped from the cavity of the gear case First Chamber.
5. Reassemble the new Adapter Plate and Motor Assembly on the Wire Drive Gearbox; making sure the gears mesh properly and the Adapter Plate locating bead is in its cavity. Replace and tighten the 4 screws removed in step 1.

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SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

- Only Qualified personnel should perform this maintenance.
- Turn the input power OFF at the disconnect switch or fuse box before working on this equipment.
- Do not touch electrically hot parts.

ROUTINE MAINTENANCE POWER WAVE® AC/DC 1000®

Routine maintenance consists of periodically blowing out the machine, using a low-pressure airstream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine.

PERIODIC MAINTENANCE POWER WAVE® AC/DC 1000®

Calibration of the POWER WAVE® AC/DC 1000® is critical to its operation. Generally speaking the calibration will not need adjustment. However, neglected or improperly calibrated machines may not yield satisfactory weld performance. To ensure optimal performance, the calibration of output Voltage and Current should be checked yearly.

CALIBRATION SPECIFICATION POWER WAVE® AC/DC 1000®

Output Voltage and Current are calibrated at the factory. Generally speaking the machine calibration will not need adjustment. However, if the weld performance changes, or the yearly calibration check reveals a problem, use the calibration section of the Diagnostics Utility to make the appropriate adjustments.

The calibration procedure itself requires the use of a grid (Resistive Load Bank), and certified actual meters for voltage and current. The accuracy of the calibration will be directly affected by the accuracy of the measuring equipment you use. The **Diagnostics Utility** includes detailed instructions, and is available on the **POWER WAVE® Submerged Arc Utilities** and **Service Navigator** CD's. If not calibrating properly, see the troubleshooting section.

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SAFETY PRECAUTIONS-PF10A

⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically live parts such as output terminals or internal wiring.
- When inching with buttons, electrode and drive mechanism are "hot" to work and ground and could remain energized several seconds after the button is released.

- Turn OFF input power at welding power source before installation or changing drive roll and/or guide tubes.
- Welding power source must be connected to system ground per the National Electrical Code or any applicable local codes.
- Only qualified personnel should perform maintenance work.

See additional warning information throughout this service manual.

ROUTINE MAINTENANCE PF10A

- Check weld cables, control cables and gas hoses for cuts.
- Clean and tighten all weld terminals.
- Inspect and clean drive rolls and inner wire guide and replace if worn.

PERIODIC MAINTENANCE PF10A

- Blow out or vacuum the inside of the feeder.
- Every six months check the motor brushes. Replace them if they are less than 1/4"(6.4mm) long.
- Every year inspect the gearbox and coat the gear teeth with a moly-disulfide filled grease. DO NOT use graphite grease.

CALIBRATION SPECIFICATION PF10A

All calibration is factory set on the POWER FEED® 10A Controller.

To verify the wire feed speed:

- Press the INCH DOWN switch and adjust the wire feed speed to 100 in/min (2.54m/min).
- Measure the actual wire feed speed with a calibrated wire feed speed tachometer.

The measured wire feed speed should be within ±2% of the set value.

If not see the troubleshooting section of this manual. If a wire feed speed tachometer is not available, turn off the "run in" features. Set cold feed to a value – make sure wire is cut flush with contact tip. Feed wire for 6 seconds. Stop feeding, measure the fed wire from end of wire to contact tip (wire that was feed out in 6 seconds). What you measure in inches add a zero (0) to the right of measured value. This will give you your IPM value. See example.

Example:

Measured length = 34 inches
34" = 34"0 = 340 IPM
60 sec. in 1 minute

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ROUTINE MAINTENANCE PF10S

- Check weld cables, control cables and gas hoses for cuts.
- Clean and tighten all weld terminals.
- Inspect and clean drive rolls and inner wire guide and replace if worn.

PERIODIC MAINTENANCE PF10S

- Every six months check the motor brushes. Replace them if they are less than 1/4" long.
- Every year inspect the gearbox and coat the gear teeth with a moly-disulfide filled grease. DO NOT use graphite grease.

CALIBRATION SPECIFICATION PF10S

All calibration is factory set on the POWER FEED® 10S.

To verify the wire feed speed:

- Press the INCH DOWN switch and adjust the wire feed speed to 100 in/min (2.54m/min).
- Measure the actual wire feed speed with a calibrated wire feed speed tachometer (K283 type).
- The measured wire feed speed should be within ±2% of the set value.

If a wire feed speed tachometer is not available, turn off the “run in” features found in users preferences of PF10A. Set cold feed to a value – make sure wire is cut flush with contact tip. Feed wire for 6 seconds. Stop feeding, measure the fed wire from end of wire to contact tip (wire that was fed out in 6 seconds). What you measure in inches add a zero (0) to the right of measured value. This will give you your IPM value. See example.

Example:

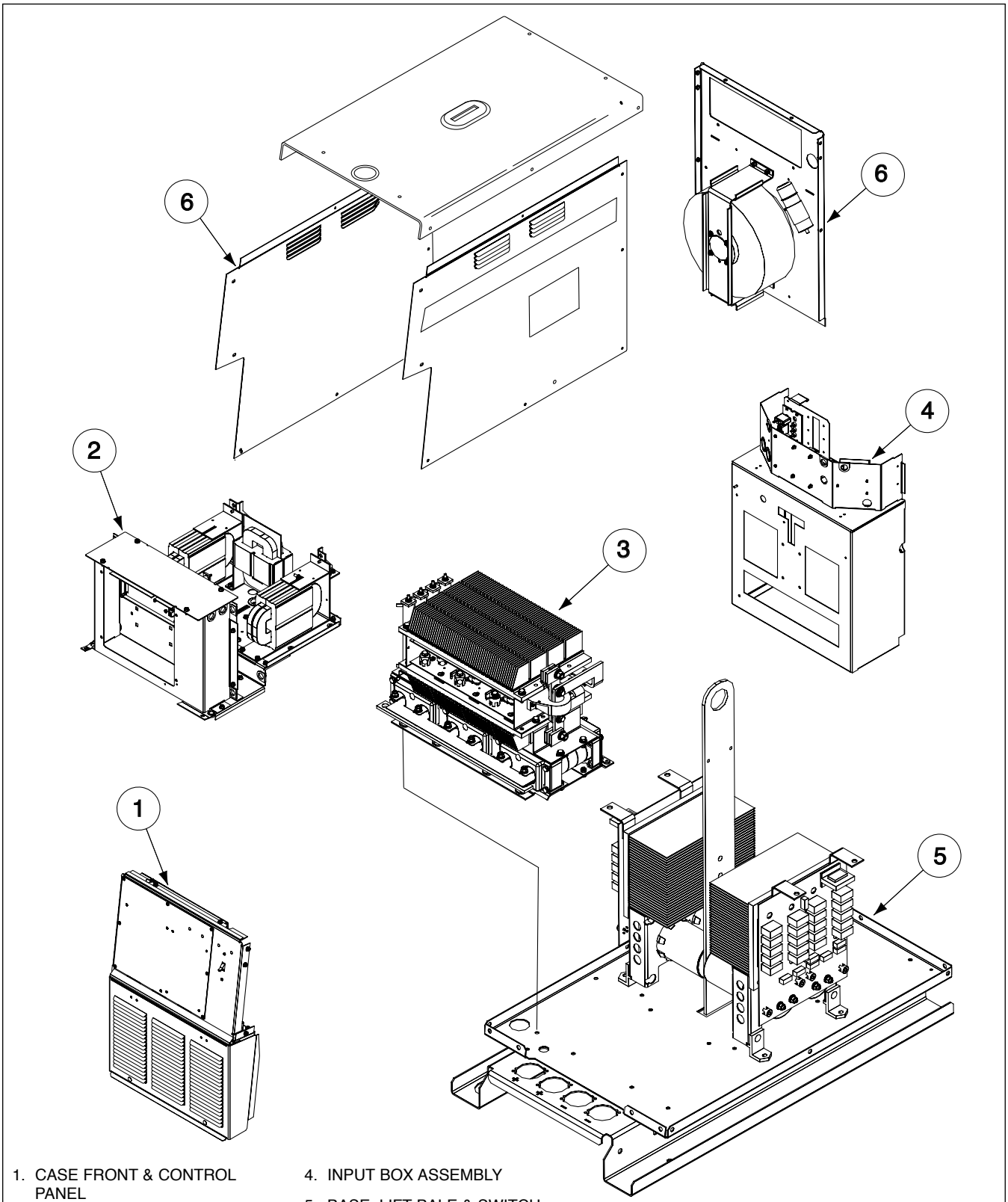
Measured length = 34 inches
34” = 34”0 = 340 IPM
60 sec. in 1 minute

Electronic software check of WFS can be accomplished via Diagnostic Utility Software see ***Feedhead Board Check*** in Section F. Also see Section F of ***Feedhead Board*** for reason WFS is not correct.

SENSE LEAD FUSE

There should never be any current flowing through the sense leads! There is a fuse located in the sense lead circuit that is mounted in the wire drive Connection Box which protects the sense lead circuit from weld current due to incorrect configuration. If this fuse ever opens, check the sense lead configuration to ensure proper connections. The fuse must be replaced with a comparable fuse with a rating of less than 1 amp before welding. The fuse being open or missing would have the same effect on the welding as having a disconnected sense lead.

FIGURE D.1 – MAIN ASSEMBLY (EXPLODED VIEW) POWERWAVE AC/DC 1000®



1. CASE FRONT & CONTROL PANEL
2. CONTROL BOX & HORIZONTAL DIVIDER
3. MAIN TRANSFORMER & OUTPUT RECTIFIER
4. INPUT BOX ASSEMBLY
5. BASE, LIFT BALE & SWITCH BOARD HEATSINK ASSEMBLY
6. COVER & FAN ASSEMBLY

NOTE: For more details of these parts see the exploded views of the parts page. Parts page section can be found in the table of contents of this manual.

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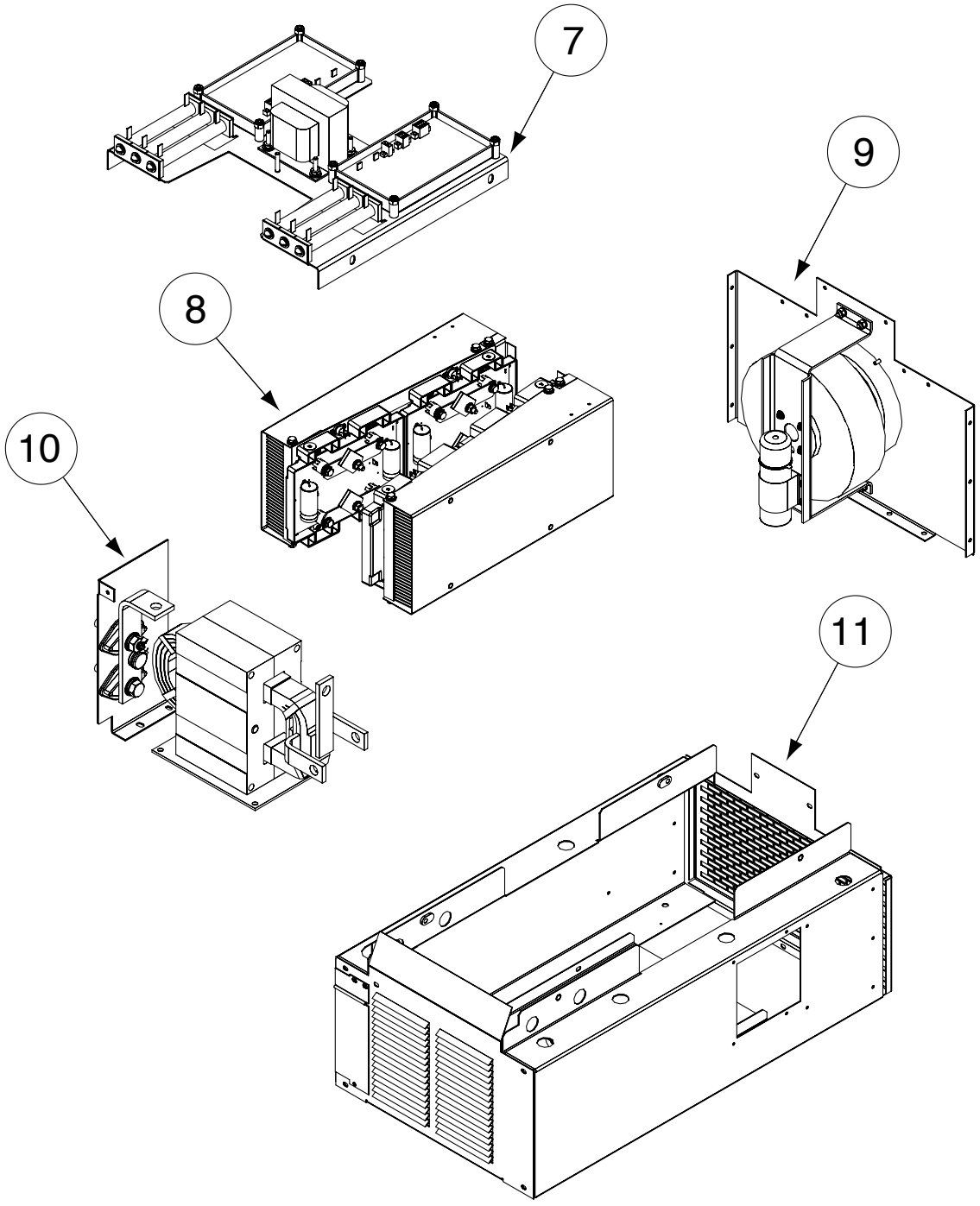
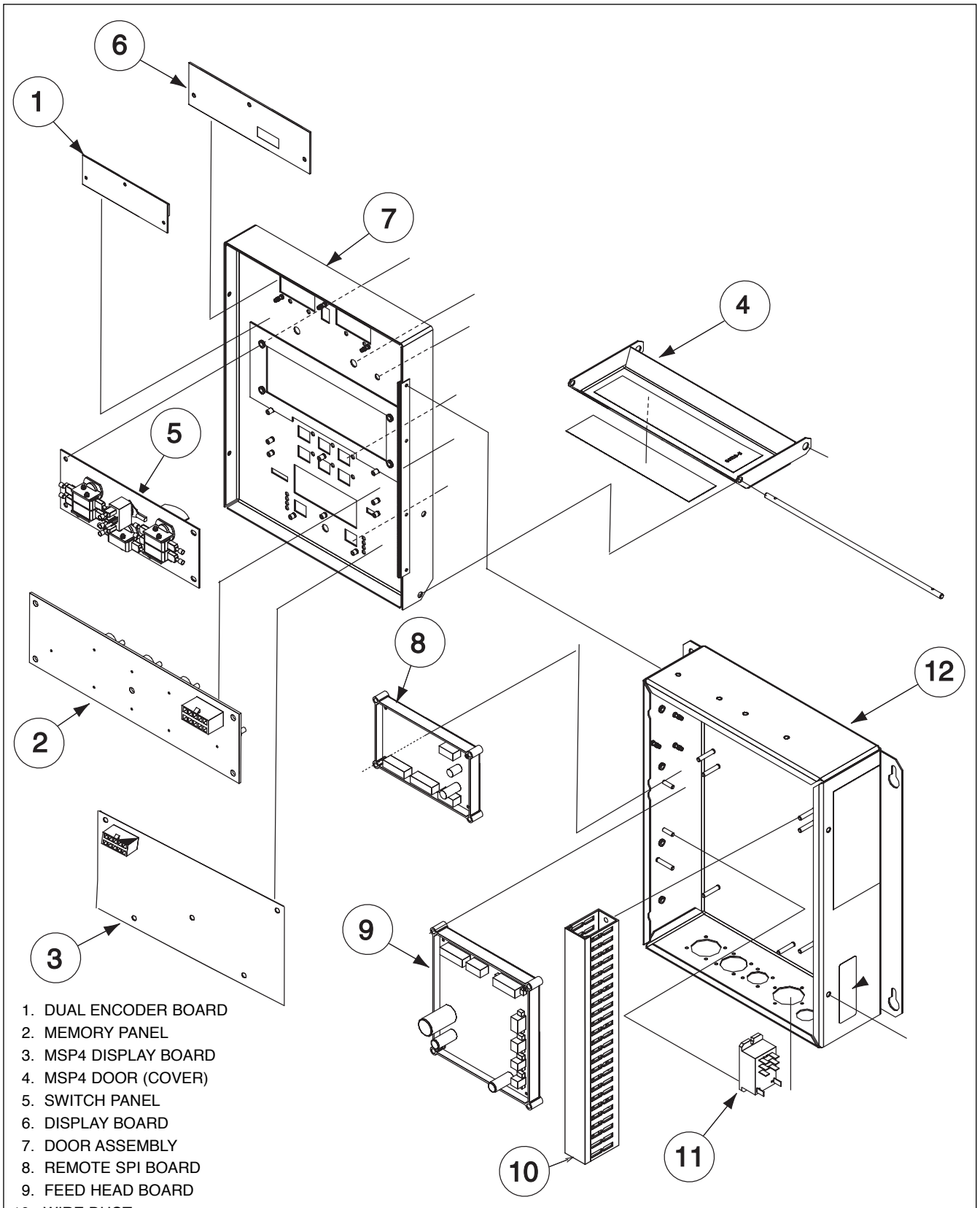
FIGURE D.2 – AC SWITCH SUB-ASSEMBLIES POWERWAVE AC/DC 1000®



7. AC SWITCH MAIN SNUBBER ASSEMBLY
8. AC SWITCH CHOPPER & SHROUD ASSEMBLY LEFT & RIGHT
9. AC SWITCH IMPELLER (FAN) & INPUT RING
10. AC SWITCH OUTPUT STUD & CHOKE ASSEMBLY.
11. AC SWITCH SLIDE COVER ASSEMBLY

NOTE: For more details of these parts see the exploded views of the parts page. Parts page section can be found in the table of contents of this manual.

FIGURE D.3 – PF10A ASSEMBLY (EXPLODED VIEW) INSIDE VIEW OF DOOR



1. DUAL ENCODER BOARD
2. MEMORY PANEL
3. MSP4 DISPLAY BOARD
4. MSP4 DOOR (COVER)
5. SWITCH PANEL
6. DISPLAY BOARD
7. DOOR ASSEMBLY
8. REMOTE SPI BOARD
9. FEED HEAD BOARD
10. WIRE DUCT
11. RELAY 3 EACH
12. CONTROL BOARD WELDER ASSEMBLY

NOTE: For more details of these parts see the exploded views of the parts page. Parts page section can be found in the table of contents of this manual.

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FIGURE D.4 – LOCATION OF COMPONENTS

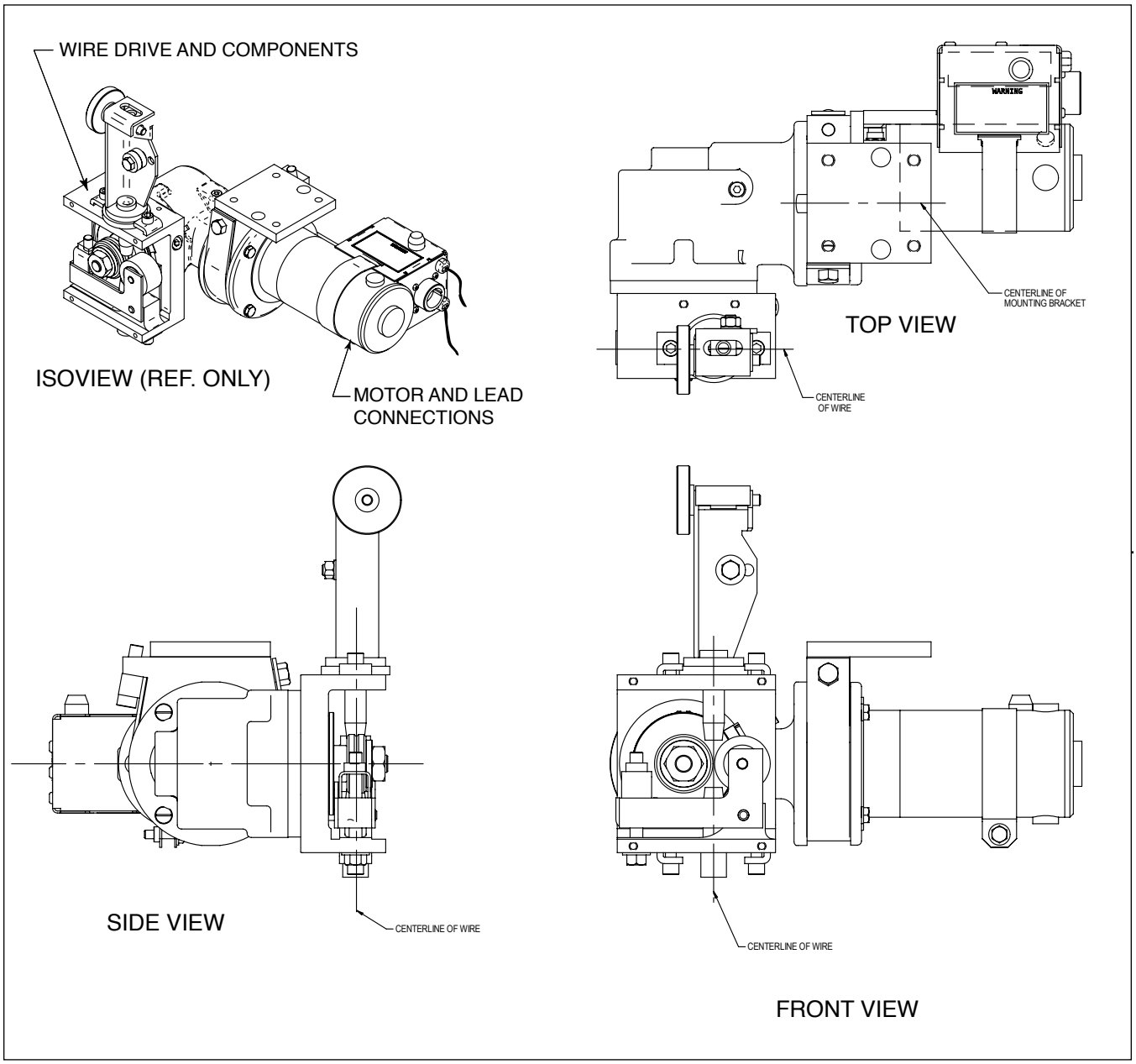

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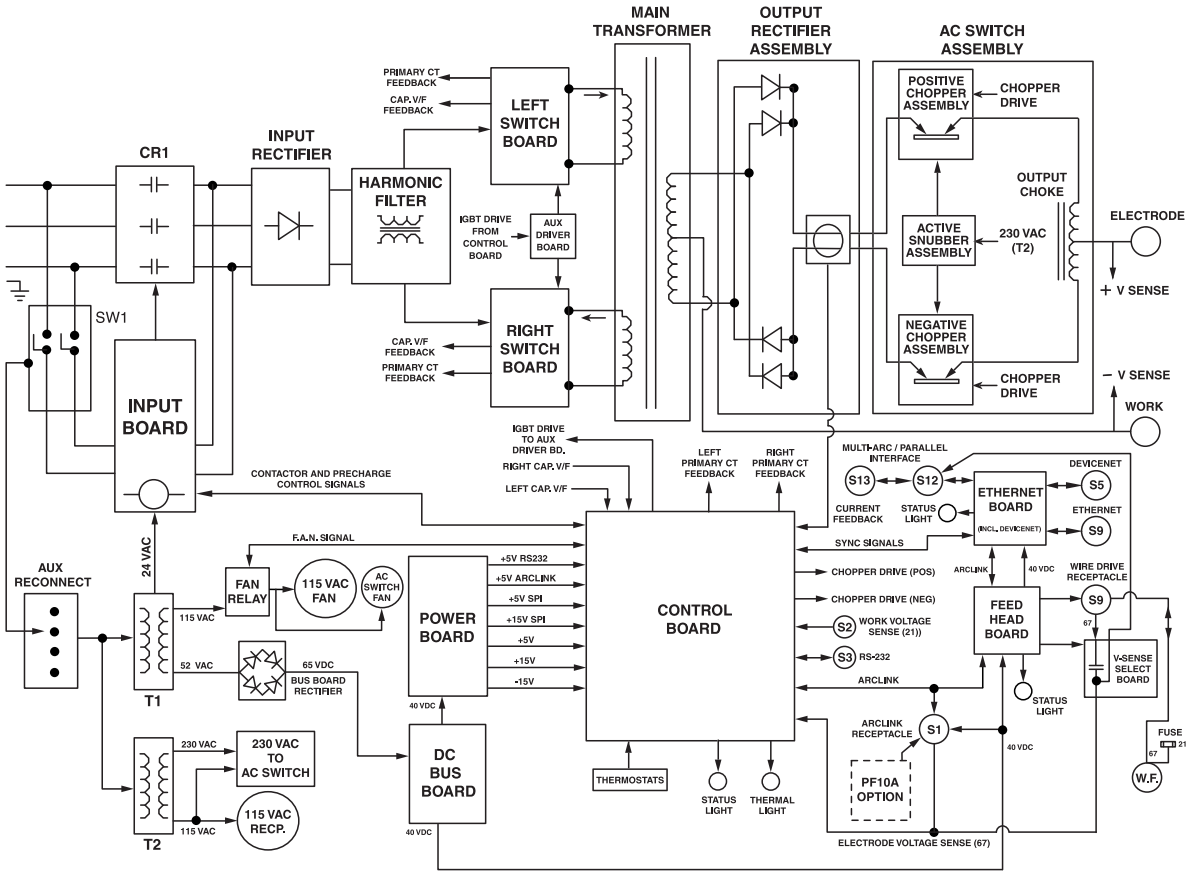
FIGURE E.1 – POWER WAVE® AC/DC 1000® BLOCK LOGIC DIAGRAM



GENERAL DESCRIPTION

The POWER WAVE® AC/DC 1000® is a high performance, digitally controlled welding power source utilizing inverter technology. The POWER WAVE® is capable of producing a variable frequency, balance and/or amplitude AC output in either a sine wave or square wave pattern in a weld environment application. The output of the POWER WAVE® AC/DC 1000® is capable of being DC positive output or DC negative without the need for external reconnection. It utilizes complex, high-speed waveform control to support a variety of constant currents and constant voltage welding modes in each of its output configurations.

The POWER WAVE® AC/DC 1000® power source is a relatively lightweight, compact unit designed to be a part of a modular welding system. Each welding arc may be driven by a single machine or by a number of machines in parallel. In multiple arc applications of up to four arcs, (five arcs in special applications) the phase angle and frequency of different machines can be synchronized with the use of an external "System Interface" to improve performance and reduce the effects of arc blow. A System Interface setup requires a software program for multiple arcs that is packaged and shipped with the unit literature. This software is also available by referring to our website at www.lincolnelectric.com. Simply go to "Products," then CLICK on "PowerWave Software" and CLICK on "Setup Software."

The POWER WAVE® AC/DC 1000® is primarily designed to interface with compatible ArcLink equipment such as the PF10A Interface Controllers. However, the POWER WAVE® AC/DC 1000® can also communicate with other industrial machines and monitoring equipment via DeviceNet or Ethernet. The result of this interface is a highly integrated and flexible welding cell.

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FIGURE E.2 – SOFTWARE TOOLS
(S26122 CD part number - Obsolete)

The POWER WAVE® AC/DC 1000® was shipped with a CD including software tools and other documents related to the integration, configuration, and operation of the system. The POWER WAVE® Submerged Arc Utilities CD is obsolete and Power Wave Manager software available from www.powerwavesoftware.com should be used. **NOTE:** *the software is not required to run a single arc weld system but is required for calibration, Production Monitoring, Diagnostics, etc...*

NAME	PURPOSE
Ethernet Setup	Used to setup Ethernet address information and security settings.(older version)
Command Center	AC/DC system tool used to observe and log welding operation, to verify welding configuration and to facilitate quality analysis.
Submerged Arc Weld Configuration	Used to configure and verify multi-arc or parallel connected power source (more than one POWER WAVE® per arc) systems.
Production Monitoring	Allows user to setup Production Monitoring options on the POWER WAVE® including Email notification, Shift Timers and Wire Package Tracking. Also provides a means to retrieve statistical welding data, to generate machine reports and to update the POWER WAVE® Firmware and Welding Software.
Power Wave Manager	Utility used to diagnose POWER WAVE® problems, read system information, calibrate output voltage and current, test sense leads and diagnose feed head issues. Can also setup and verify DeviceNet operation.
Power Wave Manager (Palm Application)	Palm-based utility used to configure, backup and restore varous Power Feed 10A Controller settings (can be used to copy settings from one PF-10A to another). Also provides a means to retrieve version information and and setup the Ethernet address of the local POWER WAVE® system *(only those components directly connected to the PF-10A via ArcLink)*.

MACHINE OVERVIEW

The POWER WAVE® AC/DC 1000® machine is divided into two distinct sub-assemblies: the Power Source and the AC-Switch. Both sub-assemblies are combined to create the final machine assembly. (These sub-assemblies are not sold separately.)

- The ***Power Source sub-assembly*** is the "upper portion" of the machine. *The main function of the Power Source sub-assembly is to create a DC output wave shape suited for your specific welding process.*

- The ***AC-Switch sub-assembly*** is the "lower portion" of the machine and is designed to *convert the DC output wave shape of the Power Source sub-assembly into an AC, +DC or -DC output. Basically, the AC-Switch subassembly functions as an electronic polarity switch*. The AC/Switch is designed with a removable "slide assembly," which contains all of the electrical components of the machine for simplified serviceability.

RECOMMENDED PROCESSES

The POWER WAVE® AC/DC 1000® is designed for submerged arc welding (SAW) constant current (C.C.) or constant voltage (C.V.) - - it is not designed for open-arc processes. Due to its modular design, the POWER WAVE® AC/DC 1000® can operate on either single arc or multiple arc applications up to 5 arcs. Each machine is factory-programmed with multiple welding procedures to support all types of submerged arc welding applications with steel, stainless steel or cored wires. The POWER WAVE® AC/DC 1000® carries an output rating of 1000 amps, 44 volts (at 100% duty cycle). If higher currents are required, these machines can be easily paralleled to accomplish this need.

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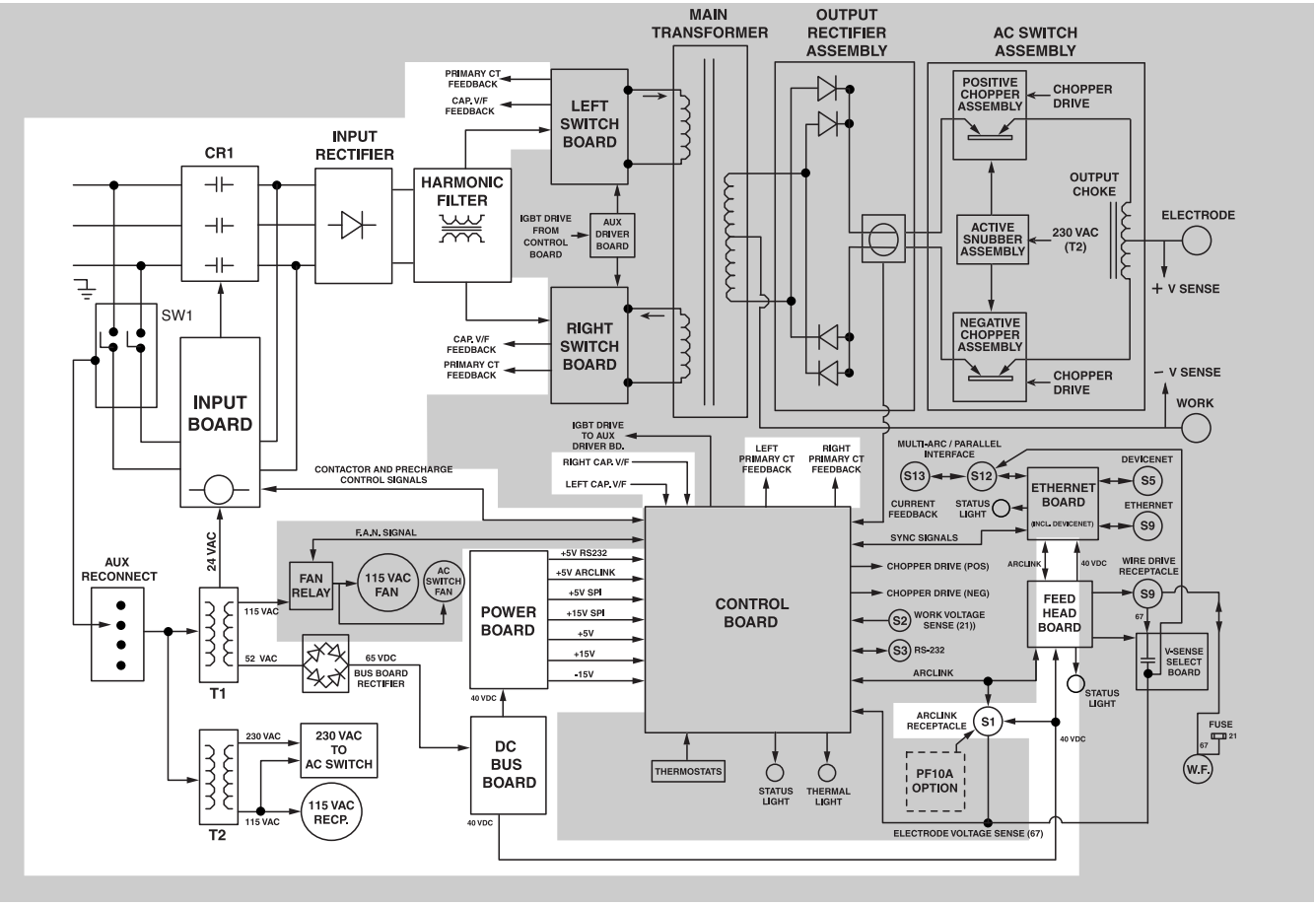
FIGURE E.3 – INPUT SECTION AND PRECHARGE



INPUT VOLTAGE AND PRECHARGE

The POWER WAVE® AC/DC 1000® can be connected for a variety of only three-phase input voltages of 300 volts and higher. Refer to ***Figure A.2.*** See the Power Source Operator's Manual for details of reconnection procedure.

When the initial input power is applied to the POWER WAVE® AC/DC 1000® through a line switch located on the front of the machine. Two phases of the three-phase input power are applied to the Input Board and to both auxiliary transformers. The various secondary voltages developed by transformer T1 are applied to the:

- Input Board
- fan motors (via a control relay)
- Bus Board rectifier.

The 65VDC produced from the Bus Board rectifier is used by the Bus Board to provide various DC voltages for the Power Board, Feed Head Board the Ethernet Board and the ArcLink receptacle. The 115/230VAC developed on the secondary of auxiliary transformer T2 is applied to the 115VAC receptacle and to the AC switch (bottom section) transformer for circuit power.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

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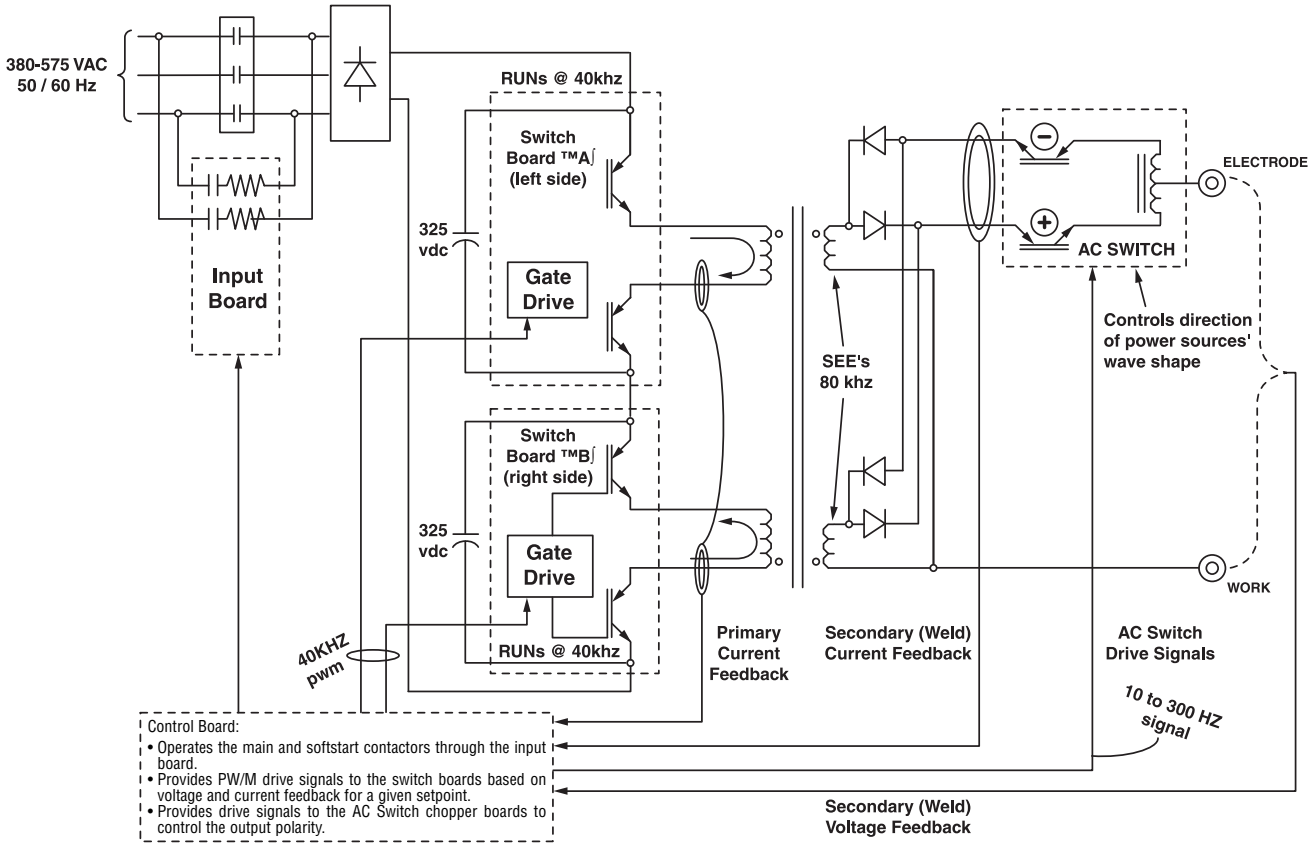
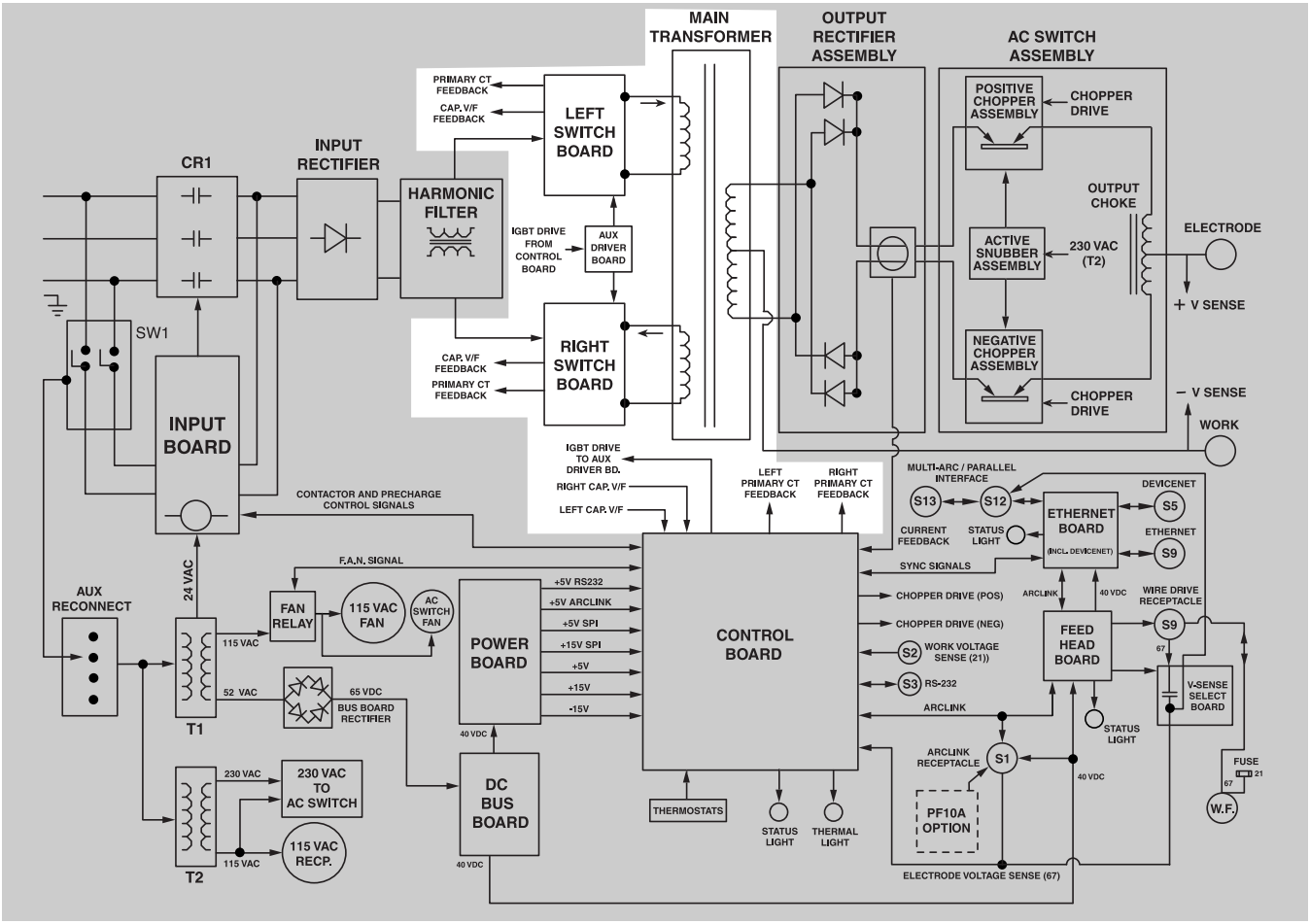
FIGURE E.4 – SIMPLIFIED FUNCTIONAL DIAGRAM



The two phases that are connected to the Input Board, through the input line switch SW1, are connected to the input rectifier at the load side of the CR1 contactor. During the precharge or "soft start" sequence, these two phases are current-limited by the Input Board. The AC input voltage is rectified, and the resultant DC voltage is applied through the harmonic filter to the input capacitors located on the right and left switch boards. The Control Board monitors the voltage across the capacitors via a V/F (voltage to frequency) inverter.

When the capacitors have charged to an acceptable level, the Control Board signals the Input Board to energize the main input contactor CR1, making all three phases of input power available (without current limiting) to the input capacitors. At this point, the POWER WAVE® AC/DC 1000® is in the "Run Mode" of operation. If the capacitors become undervoltaged, overvoltaged or unbalanced, the Control Board will signal the Input Board to de-energize the main input contactor (CR1), thus disabling the POWER WAVE® AC/DC 1000®. Refer to ***Figure E.3.*** The Input Board not only provides "soft start" features and control of the 24VAC to CR1 contactor coil, but it also sends a single phase input detect signal to the control board to limit the output to 500 amps.

FIGURE E.5 – SWITCH BOARDS AND MAIN TRANSFORMER



SWITCH BOARDS AND MAIN TRANSFORMER

There are two switch boards in the POWER WAVE® AC/DC 1000® machine. Each board contains two input capacitors and two insulated gate bipolar transistor (IGBT) switching circuits. Refer to ***Figure E.4.*** (We do not show parallel circuits for simplicity.) See wiring diagram and machine diagram for details. These two circuits on each switch board are connected in parallel. This paralleled board arrangement (left switch board) is permanently connected in series with an identical paralleled switch board arrangement on the right side. There are no reconnect switches in this power source configuration; reconnect involves only an auxiliary transformer tap configuration.

When the switch board input capacitors are fully charged (Run Mode), they act as power supplies for the switch board IGBT switching circuits. The insulated gate bipolar transistors switch the DC power from the input capacitors "on and off," thus supplying pulsed DC current (effectively AC) to the main transformer primary windings. See ***IGBT OPERATION DISCUSSION AND DIAGRAMS*** in this section. This pulsed DC is varied (via signals from the Control Board) to produce optimum wave forms and power for correct welding characteristics for its mode. This control takes place in the primary stage of the transformer.

Each switch board IGBT circuit feeds current to a separate, oppositely wound primary winding in the Main Transformer. See main coaxial transformer design in this section. The reverse directions of current flow through the main transformer primaries, and the offset timing of the IGBT switch boards, induce an AC square wave output signal at the secondary winding of the main transformer. Current transformers located near the switch boards monitor the primary currents. If the primary currents become abnormally high, the Control Board will shut off the IGBTs, thus disabling the machine's output. The DC current flow through each primary winding is clamped back to each respective input capacitor when the IGBTs are turned off. This action is needed due to the inductance of the transformer primary windings. The firing of the two switch boards occurs during halves of a 25 microsecond interval, creating a constant 40 KHz output per primary half. Gate signals come from the auxiliary driver board but are generated originally on the Control Board.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

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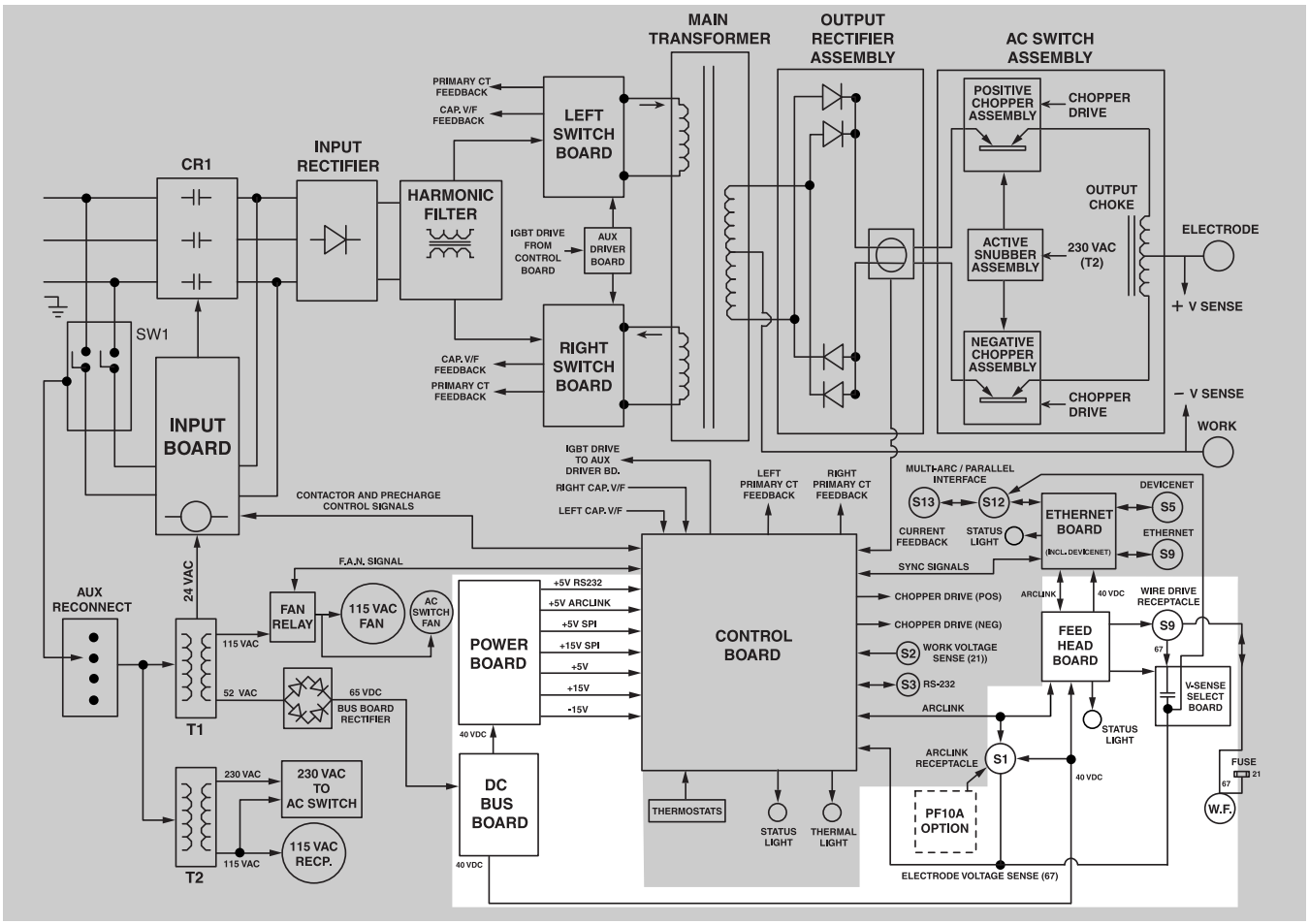
FIGURE E.6 – WIRE DRIVE MODULE



DC BUS BOARD, POWER BOARD, FEED HEAD BOARD, AND VOLTAGE SENSE BOARD

The DC Bus Board receives approximately 65VDC from the Bus Board rectifier. The DC Bus Board regulates that 65VDC to a +40VDC supply. This regulated 40VDC is applied to the Feed Head Board, the Power Board the EtherNet Board (via the Feed Head Board and the Arclink receptacle for PF10A use.

The switching power supplies on the Power Board supply a variety of regulated DC voltages to the Control Board. The Control Board uses these regulated voltages to power the many circuits and communication functions incorporated within the Control Board.

The Feed Head Board uses the POWER WAVE® AC/DC 1000®'s 40VDC supply to drive a remote wire feed motor in a forward or reverse direction via isolation diode, which is mounted off-board. The Feed Head Board receives and sends commands for both feeding the wire and for determining at which speed the wire is fed. This is accomplished using Arclink communication.

The Feed Head Board also receives confirming feedback of the actual speed in which the wire is fed. Wire speed feedback is processed via a digital tachometer feedback from a 14-pin amphenol on the motor assembly. The Feed Head Board controls the Voltage Sense Board (positive voltage sense circuit). The Feed Head Board also supplies 40VDC to the Ethernet Board to facilitate Arclink communication

There are no on-board troubleshooting lights for the Feed Head Board, but it does have a green/red Status Light on the front of the POWER WAVE® AC/DC 1000® for this use.

An external terminal strip is available that provides I/O access directly to the Feed Head Board. This provides input for the following functions: trigger, dual procedure, 4-step mode, shutdown, cold inch, gas purge and 57:1 gear ratio selection.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

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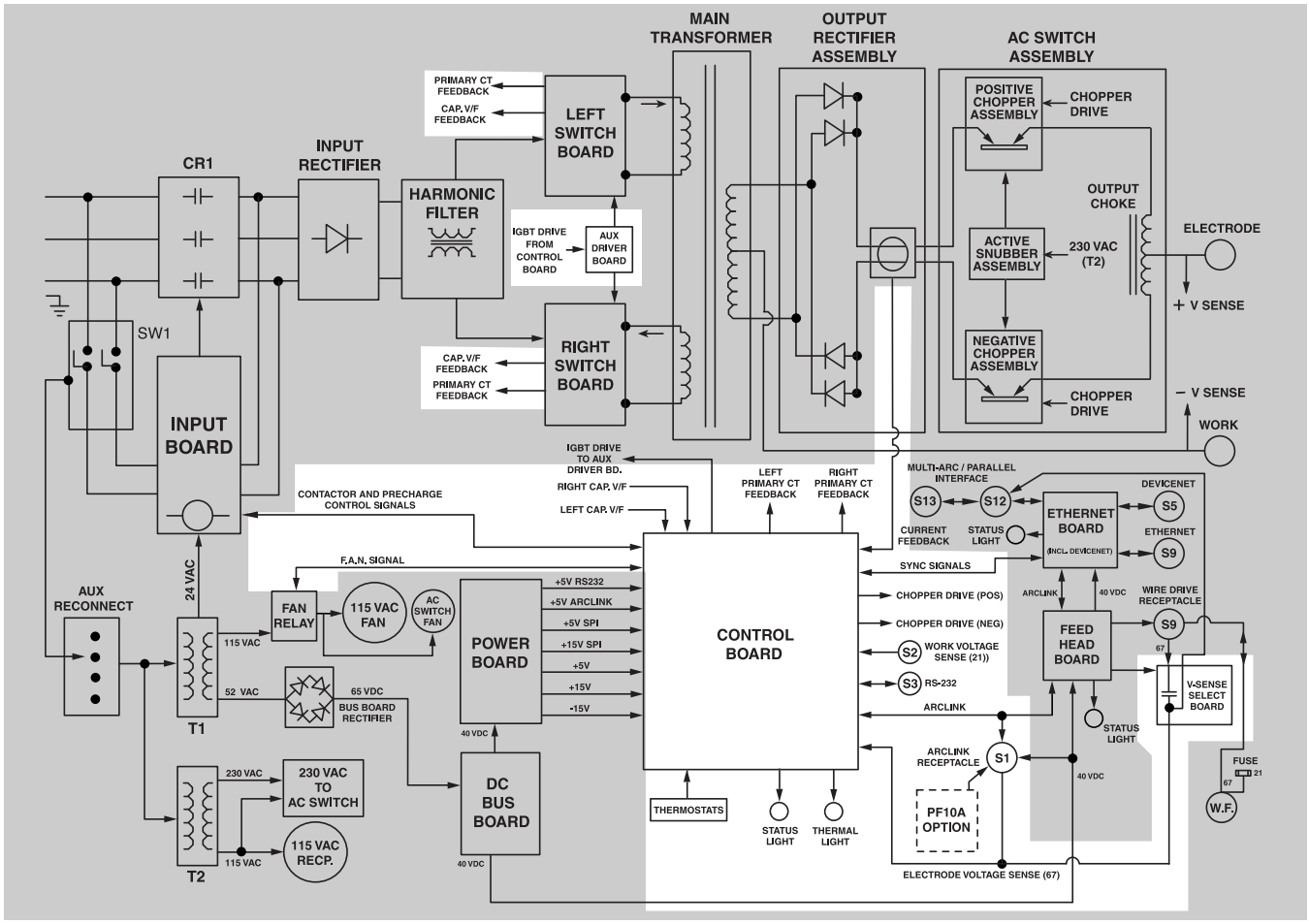
FIGURE E.7 – COMMON CONTROLS / HARDWARE PLATFORM



CONTROL BOARD

The Control Board performs the primary interfacing functions to establish and maintain output control of the POWER WAVE® AC/DC 1000® machine. The function generator and weld files exist within the Control Board hardware and software. Digital user command signals and feedback information is received and processed at the Control Board. Software within the Control Board processes the command and feedback information and sends the appropriate pulse width modulation (PWM) signals (see ***PULSE WIDTH MODULATION*** at the end of this section) to an auxiliary drive board (booster) then to the switch board IGBTs. In this manner, the digitally controlled high-speed welding waveform is created.

The Control Board also sends command signals to the AC switch (lower section) regarding when to operate for AC, DC-, DC+ demands, and it determines the source of voltage feed back. This is accomplished primarily by "weld mode type" selection.

In addition, the Control Board performs the following functions:

- monitors the thermostats
- monitors and balances the main capacitors on the IGBT switch boards (upper section)
- monitors the main transformer primary currents (toroid sense)
- monitors input filter capacitor voltages by a Voltage to Frequency (V to F) converter circuit. "Normal" for a 460VAC input is about 2600 Hz. indicating approximately 325VDC on the capacitors.

Depending on the fault condition, the Control Board will activate the thermal light and/or the status light, and will disable or reduce the machine output accordingly. In some conditions, the input contactor will be de-energized and the control board will generate error codes.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

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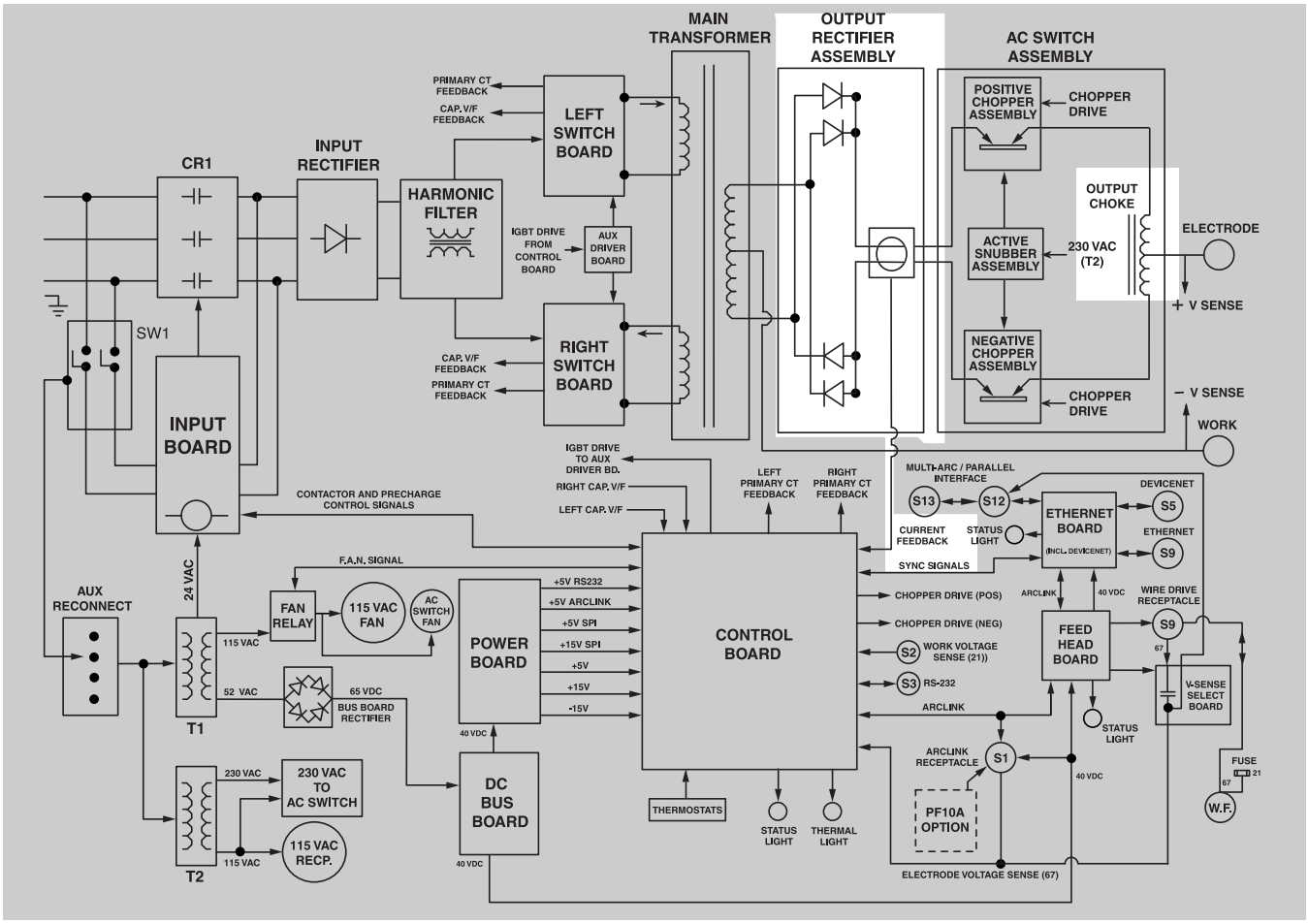
FIGURE E.8 – OUTPUT RECTIFIER

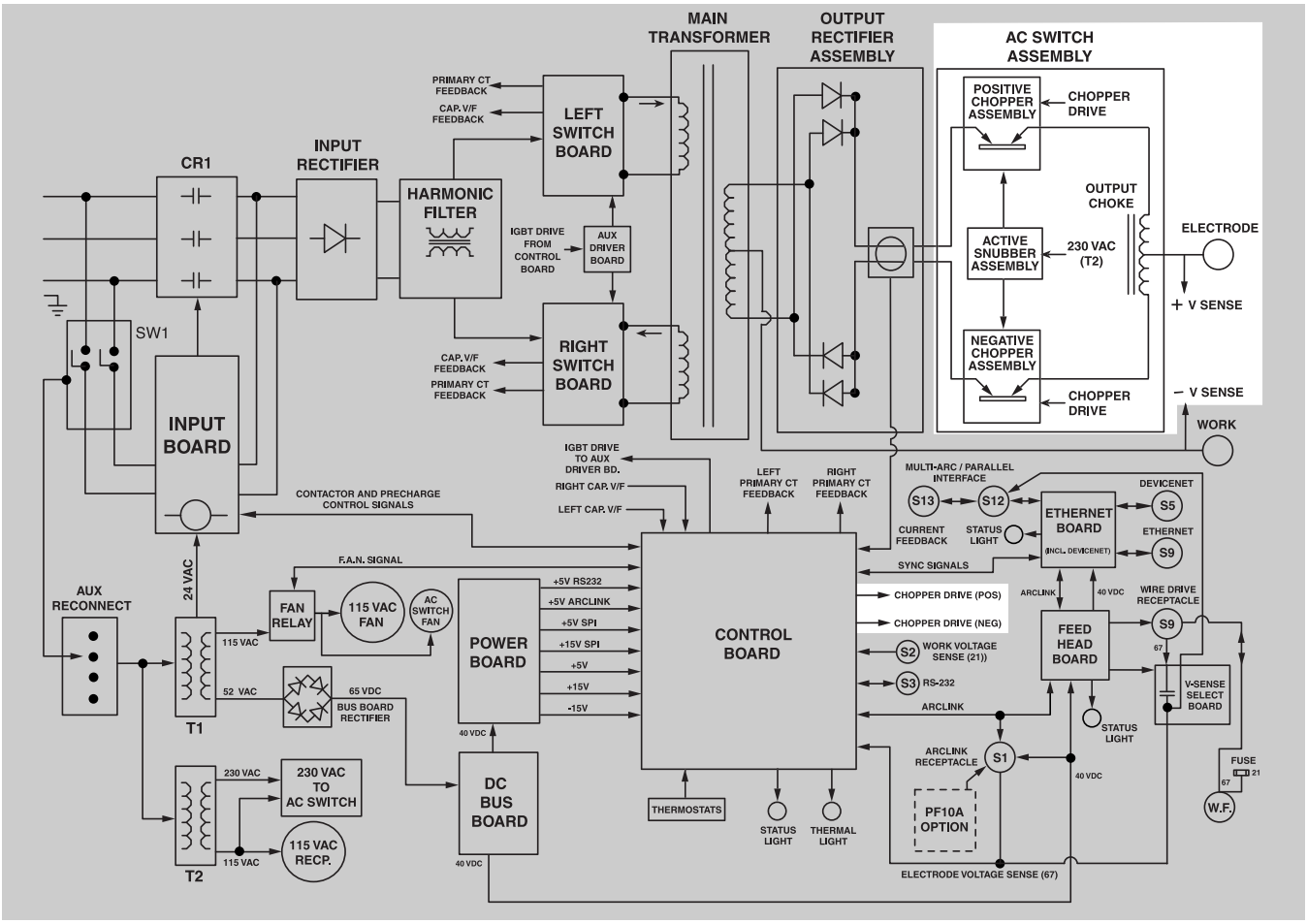


OUTPUT RECTIFIER

The Output Rectifier receives the AC output from the main transformer secondary winding (resultant @ 80 Khz.) and rectifies it to a DC voltage level. The DC weld current is sent through the Current Transducer for control board current feed back. One transducer is used for the regulation of both negative and positive DC welding current. An effort is made to route current in same direction for positive or negative welding currents. This gives the Control Board ability to always sense positive going current for feed back. This developed DC output after the output rectifier and transducer is sent to the AC/DC switch section (via four covered studs across the middle front section in between upper (power source)/lower (AC/DC switch) section.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

FIGURE E.9 – AC/DC SWITCH



AC/DC SWITCH

Essentially, the AC/DC switch is a high-speed electronic polarity switch. The AC switch uses pairs of chopper boards as switches to select either positive or negative output — thus creating DC+, DC- or AC weld output. The power source *(upper section)* always provides the DC wave shape output to the AC switch section via four covered studs across the middlefront section, between the upper (Power Source) and lower (AC/DC Switch) sections.

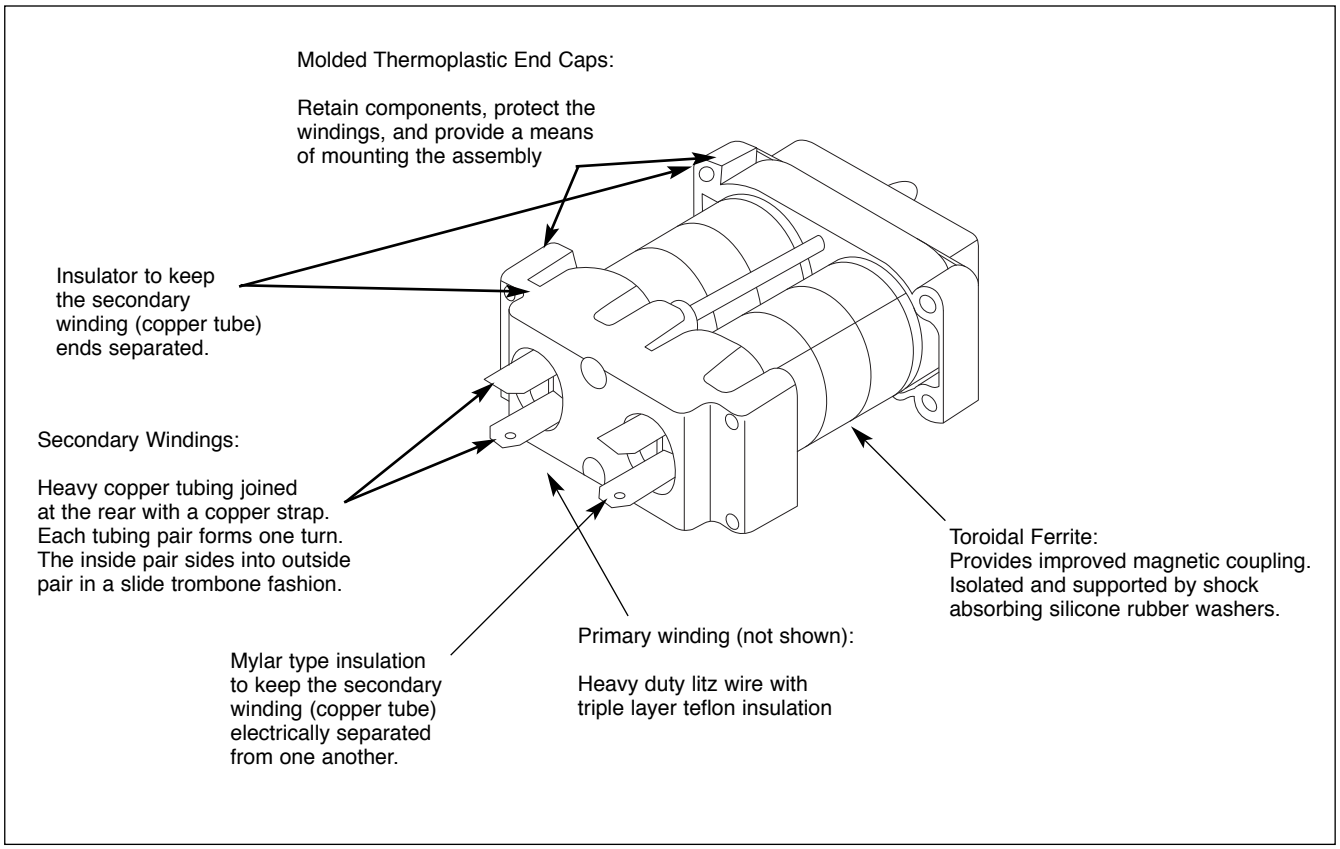
There are four chopper boards per machine, two for each polarity. All choppers are thermostatically protected. There is one positive and one negative chopper board per left or right heat sink. (This ensures that the thermal load is evenly distributed in DC applications.) Timing of the chopper gate drive comes from the power source control board. Power for the chopper board electronic drives comes from snubber boards in the AC Switch Assembly. Active snubber's maintain an acceptable voltage on the chopper capacitors. A pre-charge of 275VDC is also done via these snubber boards (lower section) and T2 transformer. Active operation is typically from 325 to 350 volts DC.

CHOKE

The weld output choke is a center-tap type, because of the output requirements for AC, DC+, and DC-. This mandates that the choke center tap to be in the electrode stud circuit. DC positive chopper power is applied to one input side of the choke at the proper time. DC negative chopper power is applied to the opposite input side of the choke at its proper time. This technique yields AC, DC- or DC+ output to the weld. The output choke has a smoothing effect in DC mode. In AC mode the choke keeps the arc lit during AC zero crossings.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

FIGURE E.10 – COAXIAL TRANSFORMER



MAIN COAXIAL TRANSFORMER

The POWER WAVE® AC/DC 1000® utilizes newer coaxial-type main transformers. They utilize the same principle as standard transformers, but are constructed in a different manner. Part of this difference is that the secondary conductors are oriented in a tubular fashion (not in a traditional winding). One tube pair is equal to one turn of secondary winding. (See Figure E.10.)

The primary windings are wound through the center of the tubular secondary windings (tubes). This coaxial design provides the following benefits for the POWER WAVE® AC/DC 1000®:

- reduction of magnetic losses
- boost in machine efficiency
- cooler operating temperatures
- opportunity for the physical unit to be smaller in size.

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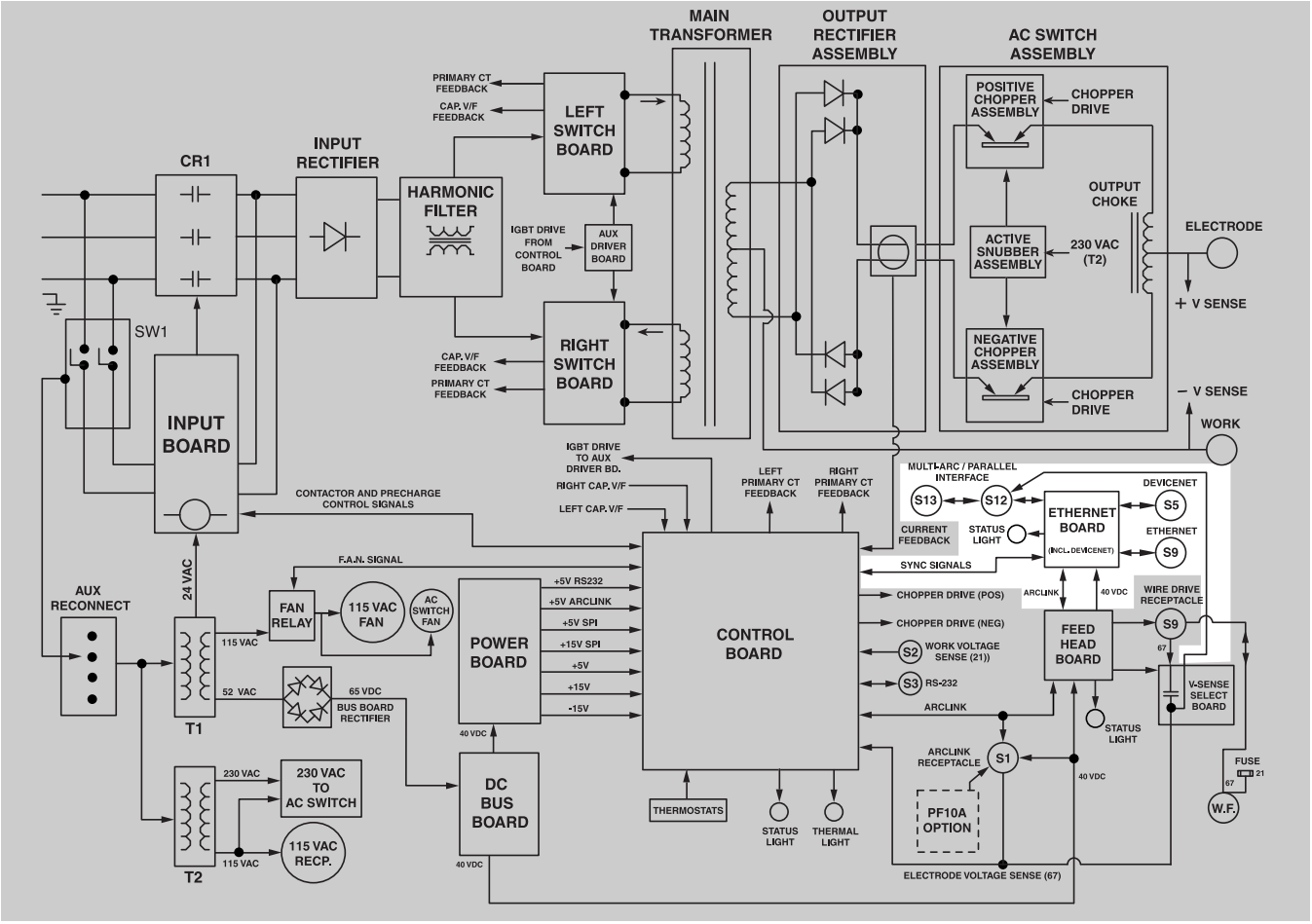
FIGURE E.11 – ETHERNET BOARD



ETHERNET BOARD

The POWER WAVE® AC/DC 1000® uses three digital communication platforms — Arclink, DeviceNet and Ethernet. Platform selection is dependent on whether the unit is used in the welding machine's internal or external environment.

- Internally, the POWER WAVE® always communicates using Arclink and external Arclink equipment.
- Externally, the POWER WAVE® can use industry standard DeviceNet or Ethernet or protocol or Arclink with apprppriate external equipment.

The Ethernet Board makes the translation between ArcLink and either of the external communication platforms possible. The Ethernet Board also synchronizes AC welding arcs forr machines in parallel nd /or multi-arc system configurations. Dip switch settings are very important for any application. Various LEDs are utilized on this board to help repair people identify trouble shooting strategies. Status lights located on the front of the AC/DC 1000® power source are also used to help in troubleshooting scenarios *(see **Machine Diagram** for details).*

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion.

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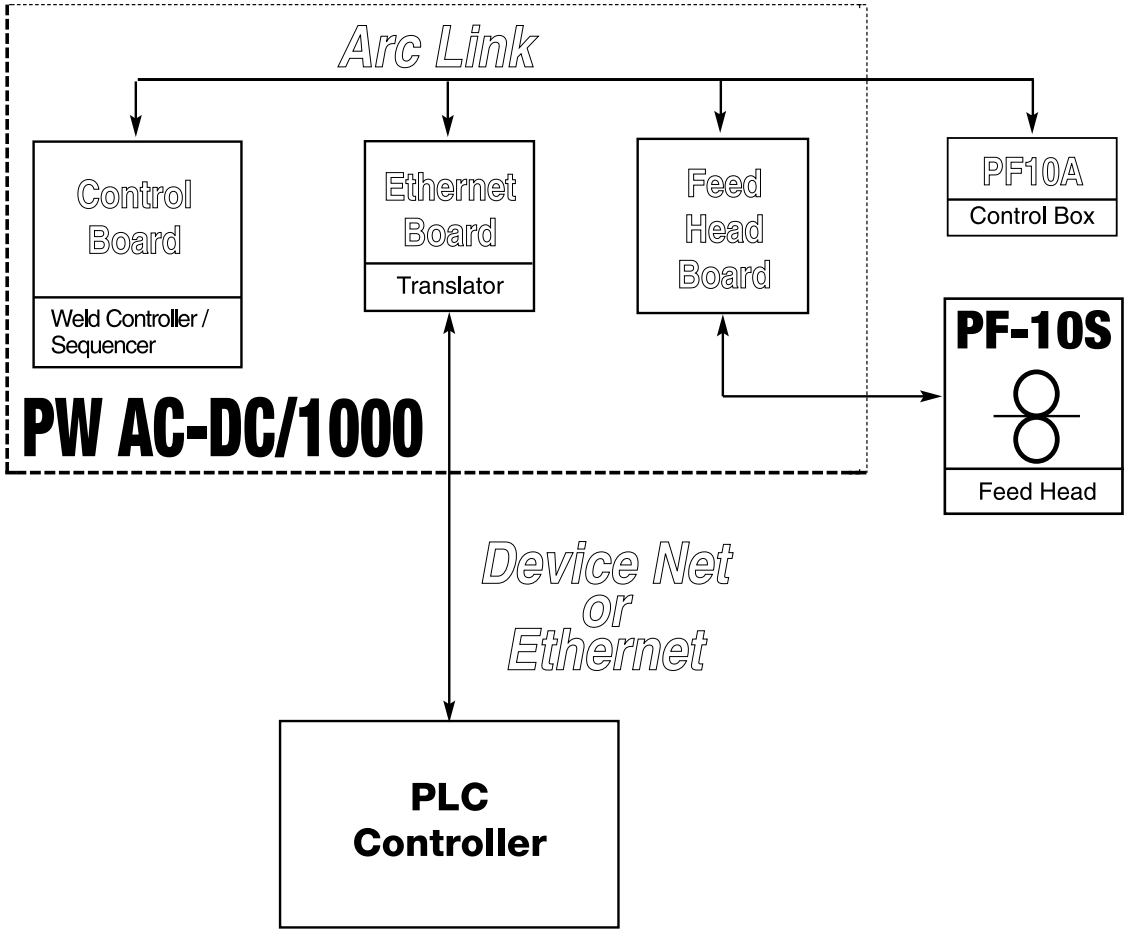
FIGURE E.12 – POWER WAVE® COMMUNICATIONS



PF10A INTERFACE

The POWER FEED® 10A controller is the main User Interface for the POWER WAVE® AC/DC 1000®. The following elements are controlled from the PF10A:

- all weld parameters
- timers
- start / stop commands
- motion control (travel) multi-procedures
- memory configuration
- diagnostics
- touch sense
- remote interface
- security of procedure settings.

The POWER FEED® 10A controller is also designed to interface with Programmable Logic Controllers (PLCs) or custom controls.

It should be noted that the PF10A does not directly drive the feeder motor. All commands are communicated digitally to the power source via Arclink communications. The feed motor is driven by the Feed Head Board inside the POWER WAVE® AC/DC 1000®. Flux hopper, travel and flow switch input is directly driven by the PF10A. An external 115VAC must be provided for travel or flux hopper equipment. If flow switches or Emergency stop switches are not used, then jumpers must be left in the circuit to bypass this shut down feature. *(See appropriate wiring or machine diagrams.)*

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THERMAL PROTECTION

Seven normally closed (N.C.) thermostats protect the machine and the AC/DC switch from excessive operating temperatures. These thermostats are wired in series and are connected to the control board. One of the thermostats is located on the heat sink of the DC bus board mounting and one each is located on the left and right switch boards. One of the thermostats is also located on each chopper board in the AC/DC switch area.

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. If this condition occurs, the yellow terminal light, located on the front of the machine, will be illuminated. The thermostats are self-resetting once the machine cools to a sufficient level.

If the thermostat shutdown is caused by excessive output or duty cycle (and if the fans are operating normally), the power switch may be left on and the reset should occur within a 15-minute period. However, if the fans are not turning or if the intake air louvers are obstructed, the power must be removed from the machine — and the fan condition or air obstruction must be corrected. It should be noted that the cooling fans run only when necessary. The F.A.N. (Fan As Needed) system is controlled by the Control Board via a solid state relay. Two fans are contained in the POWER WAVE® AC/DC 1000®. One fan is designed for the top power source section, and another is designed for the AC/DC switch section.

PROTECTIVE CIRCUITS

Protective circuits are designed into the POWER WAVE® AC/DC 1000® to sense trouble and shut down the machine before damage occurs to the machine's internal components. See the ***Error Code*** section (in the troubleshooting section of this manual) to help better understand this important feature.

OVER CURRENT PROTECTION

Both average and peak currents are monitored throughout the weld process. If either parameter is exceeded for the maximum allowable time, the weld will stop and the PF-10 a will indicate a "secondary overcurrent" and a need to be 'RESET' An error code will also be indicated by the Status LED on the Power Wave, and an event will be logged in the system. These events can be seen by using the Diagnostic Utility that is included with the machine. (See the Error Code information in the ***Troubleshooting Section***).

UNDER/OVER VOLTAGE PROTECTION

A protective circuit is designed into the Control Board to monitor the voltage across the input capacitors. In the event that a capacitor voltage is too high, too low, or becomes unbalanced side-to-side, the protection circuit will automatically de-energize the CR1 input contactor. If this event occurs, the welding machine output will be disabled, and the "soft start" mode will be repeated.

The protection circuit will prevent output if any of the following circumstances occur:

1. ***Capacitor Imbalance.*** (Capacitor voltage between Switch Boards must be within 100VDC).
2. ***Voltage across a capacitor exceeds 467 VDC volts max.*** (This could be a result of high input line surges or improper input voltage connections.)
3. ***Voltage across a capacitor is under 200 volts.*** (This would be due to improper input voltage connections.)
4. ***Internal component damage.***

INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBT are semiconductors well suited for high frequency switching and high current applications.

Examples A in Figure E.13 shows an IGBT in passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction, the circuit will not supply current to components connected to the source. The circuit is turned OFF like a light switch.

Example B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to the circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

FIGURE E.13 – IGBT

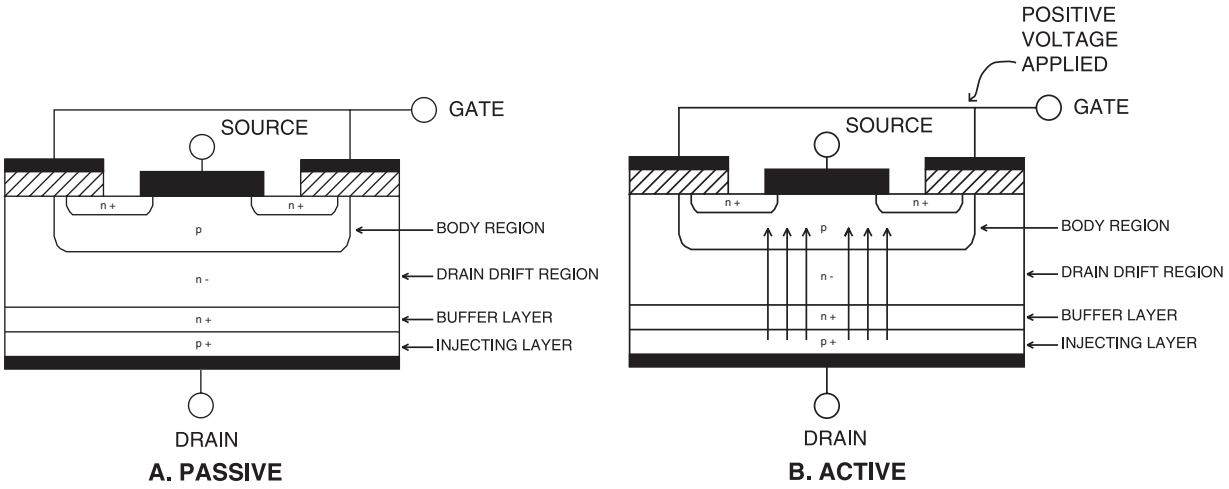
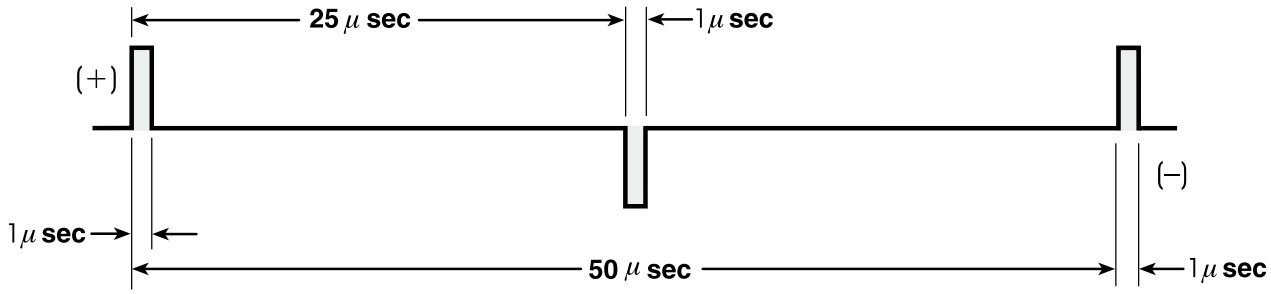
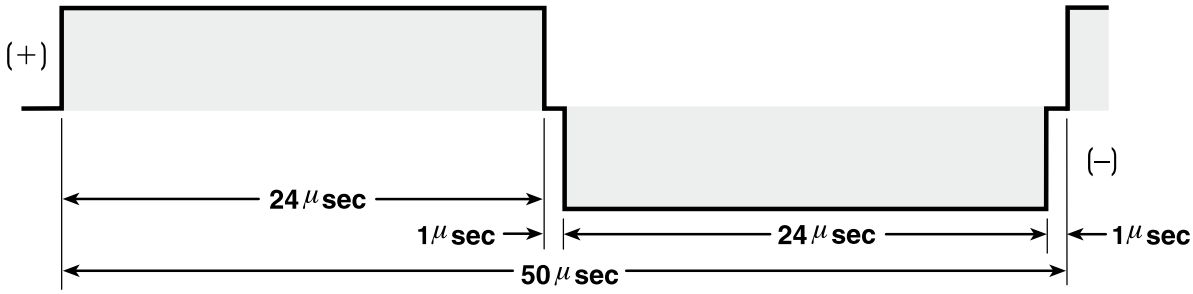


FIGURE E.14 – TYPICAL IGBT OUTPUTS



MINIMUM OUTPUT



MAXIMUM OUTPUT

PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION (PWM) is used to describe how much time is devoted to conduction in the positive and negative portions of the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing above shows the minimum output signal possible over a 25 microsecond time period.

The shaded portion of the signal represents one IGBT group[1], conducting for 1 microsecond. The negative portion is the other IGBT group. The dwell time (off time) is 24 microseconds (both IGBT groups off). Since only 2 microseconds of the 25 microsecond time period are devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

By holding the gate signals on for 12 microseconds each and allowing only 2 microseconds of dwell or off time (one microsecond during each half cycle) during the 25 microsecond cycle, the output is maximized. The darkened area under the minimumm output curve can be compared to the area under the maximum output curve. The more darkened area, the more power is present.

[1]An IGBT group consists of the sets of IGBT modules grouped onto one switch board.

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TROUBLESHOOTING AND REPAIR

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How To Use Troubleshooting Guide

⚠ WARNING

Service and Repair should only be performed by 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 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 three main categories: Output Problems, Function Problems and LED Function 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 wrap-around 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 chapter. 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.

IMPORTANT TROUBLESHOOTING TIPS:

The most common problem in multiple machine installations is proper routing of the Weld cables, control cables and remote sense leads. See the information in Section A of this manual or in the Operator's Manual (IM848).

When trying to troubleshoot an AC/DC 1000® that is in a multi arc, tandem and/or parallel weld cell set up,it would be an advantage to use a known good welder, wire feed head, or PF10A controller to help isolate the problem with the system. If replacing a component eliminates the problem, the weld cell can be re-started and the defective unit can possibly be repaired outside of the working weld cell. This can help to minimize down time.

Note: It is good practice to record the dip switch arrangement before any changes are made. If the machine is to be returned to the same location, the proper re-setting the switches will help facilitate the installation. When working on welders that have been in a multi-arc or parallel set-up, the dip switches on the control board & ethernet board will have to be re-configured to the factory "default" settings for Single arc applications. The dip switch information can be found in Section A of this manual or in the Operator's Manual (IM-848)under the heading "Internal Controls".

Once the welder is set for a single arc application, troubleshooting can be done with a single PF10A controller and , PF10S feed head or with the diagnostic software that is packaged with the POWER WAVE® AC/DC 1000®.

⚠ CAUTION

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

TROUBLESHOOTING AND REPAIR

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major physical or electrical damage is evident when the sheet metal covers are removed.		Contact the Lincoln Electric Service Department at 1-888-935-3877.
The input fuses repeatedly fail or the input circuit breakers keep tripping.	1. Input fuses or breakers may be improperly sized. 2. The reconnect panel may not be configured properly for the applied voltage.	1. Check the reconnect panel connections and associated wiring. See the Wiring Diagram and Input information in Section A for the proper input voltage. Check the input voltage and make sure it is correct.
The input fuses fail or input breakers trip after the CR-1 contactor closes.	1. Input fuses or breakers may be improperly sized. 2. The reconnect panel may not be configured properly for the applied voltage. 3. A component in the input circuitry has failed.	1. Check the re-connect panel connections and associated wiring. See the wiring diagram and Input information in Section A. 2. Perform the ***Input Rectifier Test.*** If the Input Rectifier is defective, perform tests 3 and 4. 3. Perform the ***IGBT Switch Board Test.*** 4. Perform the ***Input Board Test.***

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine is dead - - no lights - - no output - - the machine appears to have no power.	1. Make sure the input power switch SW1 is in the ON position.	1. Check the input power switch SW1 for proper operation. Also check the associated leads for loose or faulty connections. See the ***Wiring Diagram*** or ***Machine Diagram*** for the welder in Section G***.***
	2. Check the main input fuses or breakers and make sure all three phases are present.	2. Replace or reset input fuses or breaker.
	3. Check the CB4 breaker (located in the reconnect area). Reset if tripped.	3. If CB-4 opens repeatedly, perform the ***Auxiliary Transformer Test.***
		4. The power board rectifier may be faulty. Check the rectifier and associated wiring. See the ***Wiring Diagram or Machine Diagram*** for the welder in Section G.
		5. Perform the ***DC Bus Board Test and Power Board Test.***
		6. Perform the ***Control Board Check.*** The Control Board may be faulty.
The Auxiliary Receptacle is “dead”. No 120VAC present.	1. Check CB-2 on the case front. Reset if necessary.	1. Check the receptacle and associated wiring. See the ***Wiring Diagram*** or ***Machine Diagram*** in Section G.
	2. Check CB-3 and CB-4 in the reconnect area. Reset if necessary.	2. Perform the ***Auxiliary Transformer tes***t for T-2.
	3. Make sure all three input phases are present.	

⚠ CAUTION

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

TROUBLESHOOTING AND REPAIR

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The POWER WAVE® AC/DC 1000® does not have welding output. The main input contactor (CR1) is not activating. **NOTE:** This problem will normally be accompanied by an error code. Error codes are displayed as a series of red and green flashes of the status light. See ***Status Light Section*** of this document for additional information. View the displays on the PF10A or if there is no PF-10A controller connected, use the Power Wave Manager software. The Power Wave Manager software is available at www.powerwavesoftware.com.	1. The input voltage may be too high or too low or Reconnect panel may be incorrectly connected. 2. May be a thermal shutdown. Check to see if the Thermal LED is ON. 3. The primary current limit has been exceeded. (CR1 drops out when the output is initiated.) 4. The power source (upper section) has failed. If nothing is evident from a visual inspection, perform tests as shown. **Note**: Error codes as indicated by the Status Light or Diagnostic utilities may help determine which tests to do first.	1. Make certain that the input voltage is proper, according to the Rating Plate located on the rear of the machine. See ***Installation Section*** of this manual. 2. See "***Thermal LED is ON"*** In this section. 3. Possible short in output circuit. Turn machine off. Remove all leads from the output of the machine. 4. Perform the ***Input Contactor test***. 5. Perform the ***Input Board Test***. 6. Perform the ***Auxiliary Transformer test*** for T-1. 7. Preform the ***Input Rectifier test.*** 8. Perform the ***IGBT Switch Board Test.*** 9. Perform the ***DC Bus Board Test and Power Board Test.*** 10. Perform the ***Control Board Check.*** The Control Board may be faulty. 11. Perform ***Output Rectifier Test.***

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Thermal LED is ON. The machine regularly “overheats.”	1. The welding application may be exceeding the recommended duty cycle and/or limits of the machine. 2. Dirt and dust may have clogged the cooling channels inside the machine. Refer to the ***Maintenance Section*** of this manual. 3. Air intake and exhaust louvers may be blocked due to inadequate clearance around the machine. Check the upper section of the machine and AC/DC switch lower section intakes. 4. Make sure the fans are functioning correctly. Machines are equipped with F.A.N. (fan as needed) circuitry. The fans run whenever the output is enabled and will continue running for a period of time (approximately 5 minutes) after the output is disabled. 5. Check for excessive load on the 40VDC supply. There may be a feeder problem and/or a short in the internal feeder cable. The DC Bus Board has a thermostat which, if open wil cause the Thermal LED to light.	1. One of the thermostats may be faulty. Also check associated wiring for loose or faulty connections. See the Wiring Diagram or the Machine Diagram in Section G. There are a total of 7 thermostats in the system. 2. Temporarily jumper out the thermostat circuit at the Control Board. See the ***Machine Diagram*** in this manual to jump this circuit function for test only. If the machine does not reset, the Control Board is defective. If it does reset, perform the ***Thermostat test***. 3. Temporarily jump around the fan relay contacts to test fan relay function. See the ***Machine Diagram*** in this manual to test the fan relay function. **CAUTION: 120VAC is used to run the fan.**

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The machine often “noodle welds” when running a particular process.	1. The machine may be single phased. 2. Too much resistance in the ‘weld circuit’. 3. Incorrect voltage or current feedback.	1. Single phasing of input can cause output current to be limited. Check for single phase of input current during a weld for all 3 input phases. 2. Perform the ***Weld Cable*** Check. 3. Perform the ***Sense Lead Routing Check.*** 4. Perform the ***Current Transducer Test.*** 5 The Control Board may be faulty.
The POWER WAVE® AC/DC 1000® will not produce full output.	1. The input voltage may be too low, limiting the output capability of the machine. 2. During the weld make sure all three phases of the input power are being applied to the machine. 3. Excessive Weld Cable reactance, (AC welding). 4. Software on Control Board may be corrupt. 5. Incorrect feedback. 5. Perform ***Calibration Check***.	1. Make certain the input voltage is correct for the reconnect panel configuration. 2. Single phasing of input can cause output current to be limited. Input currents should be +/- 5amps. 3. Be sure that the cables are not coiled. Perform the ***Weld Cable*** test. 4. Perform the ***Control Board*** Check. The Control Board may be faulty or require flashing with correct software. 5. Perform the ***Current Transducer Test.*** 6. Perform the ***DC Bus Bd. & Power Board Test.*** 7. Perform the ***Output Rectifier Test.*** 8. Perform ***AC/DC Switch Test.***

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELD AND ARC QUALITY PROBLEMS		
General degradation of weld performance.	1. Wire feed problem.	1. Check for proper wire speed and consistent feeding. See the wire feed issues in this troubleshooting guide.
	2. Cabling problems.	2. Check for poor connections, excessive loops in the weld cables. **NOTE:** The presence of heat in external welding circuits indicates poor connections or undersized weld cables.
	3. Verify weld mode is correct for process.	3. Select the correct weld mode for the application.
	4. Machine calibration.	4. Check the calibration using the Power Wave Manager software available at www.powerwavesoftware.com. 5. Perform ***Sense Lead Routing Check.*** 6. Perform ***Weld Cable Check*** and ***Control Cable/ Ethernet Cable*** Check. See ***Machine Diagram*** in Section G. 7. Perform ***Choke Test.*** 8. Perform ***Current Transducer Test*** and ***Sense Lead Routing Check.***

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELD AND ARC QUALITY PROBLEMS		
Wire burns back to tip when the arc is initiated.	1. Voltage sense lead problem.	1. Check sense lead connections. Check DIP Switch settings for sense lead configuration and arc polarity. Make sure the Electrode and Work connections are not reversed.
	2. Wire feed problem.	2. Check for proper wire speed and consistent feeding. See the wire feed issues in this troubleshooting guide.
	3. Check the fuse in the PF-10S head. Replace if open.	3. If the fuse blows repeatedly, check to be sure the feed head is completely isolated from work and earth ground.
		4. Perform ***Choke Test.***
		5. ***Perform Current Transducer Test , Voltage Sense bd. Test. & Sense Lead Routing Check.***
Wire burns back to tip at the end of the weld.	1. Burnback Time too long.	1. Reduce burnback time and/or work point settings.
	2. Power source output is staying energized after STOP button is pressed.	2. Check 'Crater' time and work point settings.

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELD AND ARC QUALITY PROBLEMS		
Cannot weld AC. (May weld OK in one DC polarity).	1. Improper Ethernet I/O Configuration. 2. AC Switch problem. Check the S14 Amphenol to make sure it is intact and properly connected (right lower side access door of AC switch). Look for any possible electrical damage on the snubber boards and on the four chopper boards that are mounted to the two heat sink assemblies.	1. Verify Ethernet board DIP Switch settings. NOTE: An IT network person or PLC programmer may have to be consulted if using multiple machines or if networking is involved. 2. .Perform an ***Ethernet Board Check.*** 3. Check the voltages into and out of the Auxiliary transformer in the AC/DC Switch,(lower section).See the ***Machine Schematic*** in Section G. 4. Perform ***AC/DC Switch Test.***
Machine shuts down during a weld. Note: The Power Wave Manager software can be used to check the 'event log' to determine cause of shut-down.	1. Secondary over-current occurred. 2. Restrike time (if set) may have been exceeded.	1. Adjust parameters to minimize momentary shorting of the arc. 2. Check for single phase input, (loss of L2) which will reduce the secondary current limit. Check input fuses or current in all three phases for balance (+/- 5amps). 3. Either turn off or lengthen re-strike time. Then adjust parameters to eliminate arc outages. 4. Perform ***Sense Lead Routing and Weld Cable*** test.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The feeder does not power up – no display, no cold feed.	1. The POWER WAVE® power source is OFF. Turn ON the POWER WAVE® source. 2. The circuit breaker for the wire feeder on the power source has tripped. Reset the circuit breakers. 3. The control cable may be loose or damaged. Tighten, repair or try a known good cable.	1. If no Status LED's are lit on the POWER WAVE®, check the Power Switch. 2. Perform the ***DC Bus Board Test and Power Board Test.***
Inconsistent wire feeding or wire not feeding, but drive rolls are turning.	1. Check the wire feed path for: Proper tension on drive rolls. Condition of Contact tip and wire guides. Worn or dirty drive rolls. Excessive loading on wire Loose or defective cable from feed head. 2. Possible defective tachometer or wire feed motor.	1. Adjust or replace items as necessary. 2. Perform the ***Tachometer Test.*** 3. Perform the ***Feed Motor Test.***
Wire feed speed consistently operates at the wrong value.	1. Wrong gear ratio setting or incorrect pinion gear on the motor. Standard ratio from factory is 142:1. • 142:1 ratio pinion gear has 21 teeth (approx. .9" dia) and provides 10 to 200 IPM. • 95:1 ratio pinion gear has 14 teeth (approx. .64" dia) and provides10 to 300 IPM. • 57:1 ratio pinion gear has 10 teeth (approx. .43" dia.)and provides 40 to 500 IPM.	1. Check the DIP switches on the Feed Head Board for proper setting. See Table A.11. 2. Perform ***Feed Head Board Check.*** 3. Perform the ***Feed Motor Test.***

⚠ CAUTION

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

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TROUBLESHOOTING AND REPAIR

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Cannot obtain desired weld speed minimum or maximum settings.	1. Wrong gear ratio. Standard ratio from factory is 142 to 1 speed = 10 to 200 IPM. • 142:1 ratio pinion gear has 21 teeth (approx. .9" dia) and provides 10 to 200 IPM. • 95:1 ratio pinion gear has 14 teeth (approx. .64" dia) and provides10 to 300 IPM. • 57:1 ratio pinion gear has 10 teeth (approx. .43" dia.)and provides 40 to 500 IPM. 2. Try a CV (constant voltage) process instead of a CC (constant current) process. In CV, the arc voltage will not affect the wire speed. 3. Check the actual speed with a K283 Wire Speed Meter or refer to the ***Feed Motor test***.	1. Must set DIP Switch on feed head board for correct gear ratios. See Operator's Manual for details. 2. If CV works OK perform the Current ***Transducer Test and Sense Lead Routing Check.*** 3. If the actual speed does not agree with the set speed and gear ratio and DIP switches are correct, Perform ***Tachometer Test.*** 4. Perform ***Feed Head Board Check.***

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Variable or “hunting” arc.	1. Contact tip worn or incorrect size. 2. Worn work cable or poor work connection. Verify that all work and electrode connections are tight and that the cables are in good condition. Clean/replace as necessary. 3. Machine may be out of calibration. 4. Wrong tension on the drive roll. 5. Drive roll is worn. Replace with new set.	1. Replace contact tip. 2. Perform the ***Sense Lead Routing Check, Voltage Sense Bd. Test.*** 3. Use the Power Wave Manager software to calibrate the machine.
PF10S 0.6 amp fuse blows repeatedly.	Check to ensure that the PF10S welding head is properly isolated (not grounded).	1. Make sure that only one source of 21 work sensing lead is present. Also for 67 electrode lead, one source of arc voltage sensing is present. 2. Check for continuity from head to ground. Welding head fixture must be isolated from the frame (ground). This includes wire reel and support. 3. Test the feeder cable by trying a different cable that is currently functioning properly.

⚠ CAUTION

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

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELD AND ARC QUALITY PROBLEMS		
Drive rolls turn, but wire will not feed or wire feeding is rough or uneven.	1. Wire jammed or kinked on route through wire drive. Remove wire from wire drive, then feed in new wire. Note any obstructions. 2. Incorrect drives rolls and/or guide tubes, or incorrect pressure setting. Ensure drive rolls and/or guide tubes are stamped with wire diameter being used. Replace if necessary. Check for proper pressure setting. 3. Worn drive rolls. Replace or reverse if split type. 4. Partially flashed or melted contact tip.	1. Temporarily attempt to run a small reel of wire to determine if the problem is resolved. Possible wire drag from original wire reel. Make sure that motor leads are isolated from case of the motor (electrode circuit).
Variable or “hunting” arc.	1. Contact tip worn or incorrect size. Replace contact tip. 2. Worn or undersize work cables or poor connections to work. Inspect and repair or replace as necessary. 3. Loose electrode connections. The following connections must be tight: electrode cable to wire drive and power source; work cable to power source and work; and contact tip to nozzle. 4. Rusty electrode. Replace electrode.	1. ***Perform Current Transducer Test, Sense Lead Routing Check and Voltage Sense Board Test.*** 2. Perform ***Choke Test.*** 3. Temporarily bypass the work lead and work clamping system with a larger or double size of the old work lead. Connect directly to the work piece at a section of the piece that has been ground down clean. Try a small reel of wire to eliminate a grounding wire reel or reel stand. 4. Perform the ***Feed Motor Test.***

⚠ CAUTION

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

TROUBLESHOOTING AND REPAIR

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
Device does not go on-line (used with PLC – Programmable Logic Controller).	1. 24v bus power.	1. Verify that LED 2 (on DeviceNet Board) is on when the DeviceNet network is powered. This can be done with the POWER WAVE® turned on or off.
	2. Baud rate.	2. Verify that the baud rate setting is the same as the DeviceNet Master. The baud rate is set via DIP Switch on the Ethernet PC Board. The current value of the baud rate setting can be viewed on the DeviceNet tab of the Diagnostics Utility Software (found on CD shipped with your welding machine). You may need to contact an IT person in your company.
	3. MAC ID.	3. Verify that the DeviceNet MAC ID is correct. The MAC ID is set via DIP Switch on the Ethernet PC Board. The current value of the MAC ID can be viewed on the DeviceNet tab of the Diagnostics Utility Software.
	4. Termination.	4. Verify that the DeviceNet bus is terminated correctly or go to the website of Allen Bradley (DN.6.72 publication). Also refer to ***Wiring Diagram*** or the ***Machine Diagram*** in Section G.
	5. Wiring.	5. Verify that the wiring of all multiport taps and field attachable ends (see weld set up for multiple head welding with a PLC diagram).

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⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
Device does not go on-line (used with PLC – Programmable Logic Controller) *(continued).*	6. EDS Files (you may need to contact an I.T. person in your company for assistance or PLC – Programmable Logic Controller) person.	6. Verify that the correct EDS (Electronic Data Sheet) files are being used if they are needed. The DeviceNet tab of the Diagnostics Utility Software displays the current Product Code and Vendor Revision of the POWER WAVE®. (The Diagnostic software was shipped with your welding machine and can also be found at www.LincolnElectric.com). 7. See the LED pattern per the ***Machine Diagram*** for the Ethernet Board in the Power Source in Section G. 8. Perform a ***Control Cable*** or ***Ethernet Cable Check*** (see Power Source ***Machine Diagram*** in Section G.
The DeviceNet goes off-line during welding.	1. Interface / Noise. 2. Termination. 3. Shielding.	1. Verify that DeviceNet cables are not running next to (in close proximity with) current-carrying conductors. This includes the welding cables, input cables, etc. 2. Verify that the DeviceNet bus is terminated correctly. See the Enhanced Machine Diagram for connector information or go to the website of Allen Bradley publication DN.6.7.2. 3. Verify that the cable shielding is correctly grounded at the bus power supply. The shield should be tied into the bus ground at only one point. (use CAT 5 or better Allen Bradley cable).

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
The DeviceNet goes off-line during welding *(continued).*	4. Power Supply.	4. Verify that the DeviceNet bus power supply can supply sufficient current for the devices on the network.
	5. Expected Packet Rate.	5. Verify that 1000/(Expected Packet Rate) ≤ (scans per second). The DeviceNet tab of the Diagnostics Utility Software displays these values. For additional help, you may need to contact your company's IT person or PLC weld program person.
		6. Perform ***Control Cable Test.*** See ***Machine Diagram*** or ***Wiring Diagram*** to check for shorts and opens on the DeviceNet cable .
Output will not come on.	1. DeviceNet trigger not asserted.	1. From the DeviceNet tab of the Diagnostics Utility Software, select Monitor. The Monitor window will be displayed. Verify under the "Produced Assembly" that "Trigger" is highlighted.
	2. Touch Sense command.	2. From the DeviceNet tab of the Diagnostics Utility Software, select Monitor. The Monitor window will be displayed. Verify under the "Produced Assembly" that Touch Sense" is NOT highlighted.
	3. Passive Mode.	3. The DeviceNet tab of the Diagnostics Utility Software displays the POWER WAVE®'s passive mode status. If the status needs to be changed, select Configure, and make the necessary modification.
	4. Welding Cables.	4. Verify that welding cables are connected properly.

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DEVICENET-PLC CONTROLLED SYSTEM		
Output will not come on *(continued)*.	5. Output disabled.	5. From the DeviceNet tab of the Diagnostics Utility Software, select Monitor. The Monitor window will be displayed. Verify under the "Produced Assembly" that "Disable Output" is NOT highlighted.
	6. Other modules faulted (example: Ethernet Board or Wire Feed Module Board on system interface box). See Weld Setup Diagram.	6. Verify no other modules are faulted (all system Status Lights should be steady green). Use Diagnostics Utility Software to display any current or recent faults in the system. Check system interface box (if applicable) multiple arc set-ups. Check that the Board Status Lights and Board LEDs are correct.
	7. DIP Switches.	7. Check the DIP Switches on all the boards in the system, this includes the System Interface. See ***Welder Diagrams*** in Section G.or Operator's Manual for the Power Source.
	8. Control Cables.	8. Verify that the control cables going to the System Interface box are wired correctly. See ***"Weld Set-up Machine Diagram"*** Section A (A-11 thru A-17).

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
Bad Weld Starting.	1. Wire Feed problem.	1. Verify that the Feeders drive roll tension is not too low allowing the wire to slip in the rolls. Verify that wire can be pulled easily through the wire conduit. Verify Contact tip is not blocked.
	2. Strike Wire Feed Speed.	2. Verify that the Strike Wire Feed Speed is set correctly. (Typically set to 20-30 IPM for 3/16 wire; 30-40 IPM for 5/32 wire; 40-50 IPM for 1/8 wire; and 50-60 IPM for 3/32 wire.)
	3. Incorrect Weld Schedule.	3. Verify that the correct weld schedule is selected.
	4. Voltage Sense Leads.	4. Verify that the voltage sense leads are properly connected and configured as described in the instruction manual.
	5. Analog Scans Between Updates.	5. The DeviceNet tab of the Diagnostics utility displays the POWER WAVE®'s "Analog Scans Between Updates" and "I/O Scans/Sec." Verify that the "Analog Scans Between Updates" is _ of "I/O Scans/Sec" value.
	6. Analog Hysteresis.	6. From the DeviceNet tab of the Diagnostics Utility, select Configure. Verify in "Analog Input Channels" that the Hysteresis settings are all "0."
	7. Limit Error.	7. Verify all analog input values are within limits.
	8. Flux Hopper.	8. Verify Flux Hopper is being turned on before the output.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
Bad Weld Starting *(continued)*.	9. System Interface is not configured.	9. Verify that the System Interface has been configured correctly. Using Command Center (software) or a PF10A verify that the Weld mode, Frequency, Balance, Phase, and DC offset is correct for each Arc.
	10. Arc Interface.	10. For multiple arc systems, verify that arcs are setup correctly in-relation to each other. See Weld Setup Machine Diagram, the Operator's Manual or "How to make a Submerged Arc weld" literature that comes with welder literature package.
	11. Control cables.	11. Verify that the control cables going to the System Interface box are wired correctly. See ***Weld Set-up Machine Diagram*** Section A (A-11 thru A-17).
		12. Perform a ***Control Cable/Ethernet Cable*** Check See the ***Machine Diagram*** for the Power Source in Section G.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
Analog Inputs do not respond or do not respond quickly.	1. Analog Scans Between Updates.	1. The DeviceNet tab of the Diagnostics Utility Software displays the POWER WAVE®'s "Analog Scans Between Updates" and "I/O Scans/Sec." Verify that "Analog Scans Between Updates" is _ of "I/O Scans/Sec" value.
	2. Analog In Active Selections.	2. From the DeviceNet tab of the Diagnostics Utility Software, select Configure. Verify in "Analog Input Channels" that the required channels are set active.
	3. Analog Hysteresis.	3. From the DeviceNet tab of the Diagnostics Utility Software, select Configure. Verify in "Analog Input Channels" that the Hysteresis settings are all "0."
	4. Passive Mode.	4. The DeviceNet tab of the Diagnostics Utility displays the POWER WAVE®'s passive mode status. If the status needs to be changed, select Configure, and make the necessary modification.
	5. DIP Switches.	5. Check the DIP Switch on all the boards in the system, this includes the System Interface. See ***Machine Diagram*** in Section G.or the Operator's Manual for the Power Source.
		6. Perform ***Control Cable/Ethernet Cable Check*** See the ***Machine Diagram*** in Section G.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET-PLC CONTROLLED SYSTEM		
Bad Weld Ending.	1. Burnback Disabled.	1. The DeviceNet tab of the Diagnostics Utility Software select Monitor. The Monitor window will be displayed. Verify under the “State Enabled” that “Burnback” is present.
	2. Burnback Time.	2. Using **Command Center Software,** verify that Burnback Time for the active schedule in the main window has a value other than “0.”
	3. Analog Scans Between Updates.	3. The DeviceNet tab of the Diagnostics Utility Software displays the POWER WAVE®’s ”Analog Scans Between Updates” and “I/O Scans/Sec.” Verify that” Analog Scans Between Updates” is _ of “I/O Scans/Sec” value.
	4. Limit Error reported at the end of a weld.	4. Verify all welding settings for Burnback and Crater states.
	5. Welding Set Points.	5. Verify Burnback set points for work point, trim, and wave values.
	6. Analog Hysteresis.	6. From the DeviceNet tab of the Diagnostics Utility Software, select Configure. Verify in “Analog Input Channels” that the Hysteresis settings are all “0.”
	7. DIP Switches.	7. Check the DIP Switch on all the boards in the system, this includes the System Interface. See **Machine Diagrams** in Section G.or Operator’s Manual for the Power Source.

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET - PLC CONTROLLED SYSTEM		
Bad Weld Ending (cont.).	8. System Interface is not configured.	8. Verify that the System Interface has been configured correctly. Using Command Center (software) or a PF10A verify that the Weld mode, Frequency, Balance, Phase, and DC offset is correct for each Arc.
	9. Arc Interface.	9. For multiple arc systems, verify that arcs are setup correctly in-relation to each other. See ***Weld Setup Machine Diagram*** Section A (A-11 thru A-17). or "How to make a Submerged Arc weld" literature that comes with welder literature package.
	10. Control Cable.	10. Verify that the control cables going to the System Interface box are wired correctly. See ***Weld Set-up Machine Diagram*** Section A (A-11 thru A-17).
Bad Welding.	1. Analog Scans Between Updates.	1. The DeviceNet tab of the Diagnostics Utility displays the POWER WAVE®'s "Analog Scans Between Updates" and "I/O Scans/Sec." Verify that "Analog Scans Between Updates" is of "I/O Scans/Sec" value.
	2. Voltage Sense Leads.	2. Verify that voltage sense leads are properly connected and configured as described in the instruction manual.
	3. Analog Hysteresis.	3. From the DeviceNet tab of the Diagnostics Utility Software, select Configure. Verify in "Analog Input Channels" that the Hysteresis settings are all "0".

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
DEVICENET - PLC CONTROLLED SYSTEM		
Bad Welding *(continued)*.	4. Limit Errors.	4. Verify welding set point values are within limits.
	5. Welding set points.	5. Verify welding set points for work point, trim and wave values. Perform a weld procedure that does work properly or see how to make a sub arc Welding Guide C5. 50 to get started.
	6. DIP Switches.	6. Check the DIP Switch on all the boards in the system, this includes the System Interface. See the ***Machine Diagram*** in Section G or the Operator's Manual.
	7. System Interface is not configured.	7. Verify that the System Interface has been configured correctly. Using Command Center (software) or a PF10A verify that the Weld mode, Frequency, Balance, Phase, and DC offset is correct for each Arc.
	8. Arc Interface.	8. For multiple arc systems, verify that arcs are setup correctly in-relation to each other. See the ***Machine Diagram*** in Section G. the Operator's Manual or "How to make a Submerged Arc weld" literature that comes with welder literature package.
	9. Control Cable.	9. Verify that the control cables going to the System Interface box are wired correctly. See ***Weld Set-up Machine Diagram.*** Section A (A-11 thru A-17).
		10. Perform ***Control Cable or Ethernet Check.***

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ETHERNET PROBLEMS		
Cannot Connect.	1. Physical connection.	1 Verify that the correct patch cable or cross over cable is being used (refer to local IT department for assistance). • Verify that cables are fully inserted into bulk head connector. • LED 10 will be lit when the board is connected to another network device.
	2. IP address information.	2. Use Power Wave Manager software to verify that the correct IP address information is entered. Power Wave Manager can be found at www.powerwavesoftware.com.
	3. Ethernet speed.	3. Verify that the PC has the correct IP address information has been entered (refer to local IT department for assistance). • Verify that another device on the network is not already using the IP address entered into the Power Wave Manager software. 4. Verify that the network device connected to the POWER WAVE® is either a 10-baseT device or a 10/100-baseT device.
Connection Drops while welding.	1. Cable Location.	Verify that Network cable is not located next to current-carrying conductors. This would include input power cables and welding output cables.

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USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

The POWER WAVE® AC/DC 1000® is equipped with three externally mounted Status Lights, one for the power source, and each module contained in the power source. A 4th Status Light if equipped with a PF10A. More Status Lights if using multiple weld heads with PF10A's and or AC/DC 1000® welders. 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.**

Included in this section is information about the power source, Wire Drive Module, PF10A and Communication Module Status LED's, and some basic troubleshooting charts for both machine and performance.

The Status Lights are dual-color LED's that indicate system errors. Error conditions are indicated in the following chart.

TROUBLESHOOTING THE POWER WAVE® AC/DC 1000® USING THE EXTERNAL STATUS LED'S

Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.
Blinking Green	Occurs during power up or a system reset, and indicates the PowerWave AC/DC 1000® is mapping (identifying) each component in the system. Normal for first 1-10 seconds after the power is turned on, or if the system configuration is changed during operation.
Fast Blinking Green (excluding system interface box, slow flash is normal in this case)	Indicates Auto-mapping has failed. Verify that all DIP switches are correct, and that all circuit boards are on line and functioning properly. May want to test boards in a system known to be functioning properly.
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.
	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 (included on the POWER WAVE® Submerged Arc Utilities and Service Navigator CD's). 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. If machine welds properly, possible status LED connected backwards.
Blinking Red	Not applicable.

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TROUBLESHOOTING & REPAIR

Observe Safety Guidelines detailed in the beginning of this manual.

ERROR CODES

The following is a partial list of possible error codes for the POWER WAVE® AC/DC 1000®. These error codes may appear on the Status Lights of the welding machine or, if equipped, on the PF10A controller displays. Diagnostic software supplied with your POWER WAVE® AC/DC 1000® will also list these codes.

POWER SOURCE – WELD CONTROLLER

ERROR CODE #	INDICATION
31 Primary (input) over current error.	Excessive Primary current present. May be related to a switch board or output rectifier failure. Try disconnecting the weld lead from output studs and reset the machine. Energize the output to determine if the error message goes away. If it does, there is a short circuit in the weld circuit. If not, possible shorted or open output diode. The power source has exceeded input current limits. Adjust the welding procedure to reduce the current draw. The welding procedure may exceed the capacity of the power source. See the Power Source troubleshooting. Use the Diagnostic Software to analyze the error.
32 Capacitor: "A" under voltage (left side facing machine). 33 Capacitor "B" under voltage (right side facing machine).	Low voltage on the main capacitors. May be caused by improper input configuration, or an open/short circuit in the primary side of the machine. Check V/F converter signal (on the Switch Board) to the Control Board. See ***Machine Diagram*** for details. A 1v to 8 Hz ratio will produce a 2.6Khz signal at 460 VAC input. (325VDC x 8Hz = 2600). See the Power Source troubleshooting. Use the Diagnostic Software to analyze the error.
34 Capacitor "A" over voltage (left side facing the machine). 35 Capacitor "B" over voltage (Right side facing the machine).	May be caused by improper input configuration, excessive line voltage or an improper capacitor balance. (See Error 43). Check V/F converter signal (on the Switch Board) to the Control Board See the ***Machine Diagram*** for details. A 1V to 8Hz ratio will produce a 2.6Khz signal at 460AVAC input. (325VDC x 8Hz = 2600).
36 Thermal Error	Indicates over temperature. It should be accompanied with a Thermal LED being lit. See the Troubleshooting guide. Make sure the process does not exceed the machine's rating.
37 Soft Start Error	Capacitor pre-charge failed. Usually in conjunction with Errors 32 thru 35. If tests for those errors are OK, check the Input Contactor (CR-1). See the ***Machine Diagram***. Perform the ***Input Board*** test.

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POWER SOURCE – WELD CONTROLLER	
ERROR CODE #	**INDICATION**
43 Capacitor Delta Error	The maximum voltage difference between the main capacitors has been exceeded. May be accompanied by Errors 32 thru 35. If so, perform test indicated by those errors. May be caused by an open or short in the primary or secondary circuit(s). Perform ***Output Rectifier*** test.
44 Main CPU problem	Verify that the earth ground connection to the power source is correct. Possible high frequency interference from TIG or plasma unit in the vicinity.
46 Secondary (output) overcurrent error	Absolute maximum current has been exceeded. This is a short term average designed to protect the inverter switching circuitry. Usually associated with shorting of the electrode to work. Make sure that weld procedures are correct or use a known good procedure.
49 Single Phase Error	Indicates the loss of one phase (L2). This will reduce the long term and short term average current limits of the machine.
53 Voltage Sense Loss	Verify correct sense lead connection. Perform ***Sense Lead Routing*** and ***Voltage Sense Board*** tests.
54 Secondary (output) Overcurrent Error	The long-term secondary current limit has been exceeded. **This error will cause immediate shutdown of weld output.**
Other error codes	Error codes of three or four digits are defined as “fatal errors”. They generally indicate internal errors on the Control Board in the power source. The errors can frequently be cleared by cycling the Power Switch Off and On. The errors can be identified through the Diagnostic Software (Error Lookup tab) or on-line at *powerwavesoftware.com* .

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ERROR CODES

The following is a partial list of possible error codes for the POWER WAVE® AC/DC 1000®. These error codes may appear on the Status Lights of the welding machine or, if equipped, on the PF10A controller displays. Diagnostic software supplied with your POWER WAVE® AC/DC 1000® will also list these codes.

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 the problem continues, consider utilizing a higher gear ratio. • The wire drive motor has overheated. Check that the electrode slides easily through any conduit or wire guides. • Check for proper tension setting of drive rolls. • Check that the spindle brake is not too tight. • Verify high quality electrode is being used. Wait for error to reset and the motor to cool (approximately one minute).
82 Motor Overcurrent (short term)	Absolute maximum motor current level has been exceeded. This is a short term average to protect drive circuitry. Make sure that wire tension is not too tight. • The wire drive motor may be defective or is in a “locked rotor” state due to a defect in the gearbox. Check that the motor can turn freely when idle arm is open.
83 Shutdown #1	The normally closed circuit of Shutdown #1 has been interrupted. Check the connection between pins 9 and 10 on the external I/O connector (S7). The customer may have installed an “E stop” (Emergency Stop), water flow sensor, weld gas pressure sensor. To determine if any of these sensors are causing an error message, perform a test by temporarily bypassing the sensor at the PF10A terminal strip input section or at S7 connector.
84 Shutdown #2	The normally closed circuit of Shutdown #2 has been interrupted. Check the connection between pins 9 and 11 on the external I/O connector (S7). The customer may have installed an “E stop” software, water flow software, weld gas pressure software. To determine if any of these sensors are causing an error message, perform a test by temporarily bypassing the sensor at the PF10A terminal strip input section or at S7 connector.
Other	Error codes of three or four digits are defined as “fatal errors”. They generally indicate internal errors on the Control Board in the power source. The errors can frequently be cleared by cycling the Power Switch Off and On. The errors can be identified through the Diagnostic Software (Error Lookup tab) or on-line at *powerwavesoftware.com* .

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ERROR CODES

The following is a partial list of possible error codes for the POWER WAVE® AC/DC 1000®. These error codes may appear on the Status Lights of the welding machine or, if equipped, on the PF10A controller displays. Diagnostic software supplied with your POWER WAVE® AC/DC 1000® will also list these codes.

COMMUNICATION MODULE

(For additional help regarding possible networking issues, consider contacting an IT person within your company)

ERROR CODE #	INDICATION
118 DeviceNet connection error	Lost connection with DeviceNet Master.
119 DeviceNet de-allocation error	The DeviceNet Master de-allocated the connection.
133 Write ArcLink action failure	May be caused by activating Cold Inch while welding through DeviceNet.
145 Duplicate MAC ID error	Check MAC ID assignments on DeviceNet Setup DIP Switch Bank (S2).
146 DeviceNet Bus off	Check condition of on board DeviceNet Status indicators.
147 DeviceNet polled I/O error	Problem changing attribute over polled I/O.
149 DeviceNet I/O data error	Received DeviceNet I/O data with wrong number of bytes.
169 Ethernet Connection Time out 171 Ethernet Socket Time out 172 Ethernet Watch Dog Time out	Loss of communication with PC Application. Check Ethernet Board LEDs per the ***Machine Diagram.***
194 Ethernet Send Problem 195 Ethernet Problem 197 Ethernet Problem 198 Ethernet Client Time Out 216 Ethernet Problem 224 Ethernet Problem 226 Ethernet Problem	Communication problems between the Master and slave machines. Make sure that LED10 on the Ethernet Board is lit. See that the Ethernet cables are not routed near the welding leads or input power cables. Make sure that some other external device is not flooding the network with traffic.
Err 263	The power source does not have any welding programs loaded. See the power source Instruction Manual for load welding programs.
Other	Error codes of three or four digits are defined as “fatal errors”. They generally indicate internal errors on the Control Board in the power source. The errors can frequently be cleared by cycling the Power Switch Off and On. The errors can be identified through the Diagnostic Software (Error Lookup tab) or on-line at *powerwavesoftware.com* .

⚠ CAUTION

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

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed only by 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.

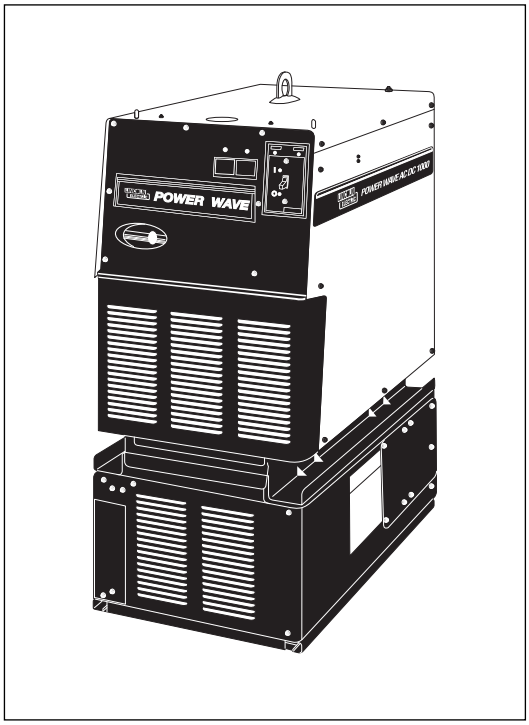
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Input Filter Capacitor is located left and right of the power source section.

This safety procedure should be performed before any internal maintenance or repair procedures are attempted on the POWER WAVE® AC/DC 1000®.

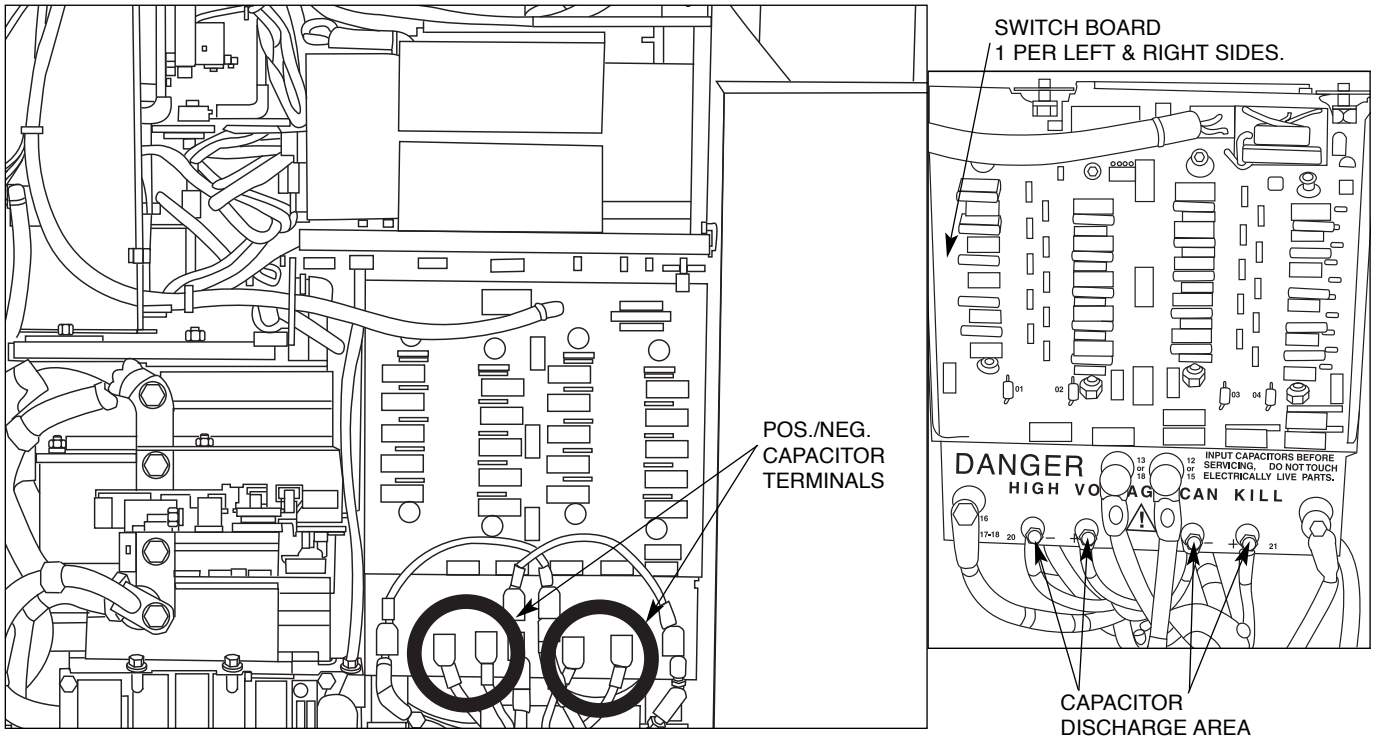


MATERIALS NEEDED

Volt-ohmmeter
25-1000 ohms @ 25 watts (minimum) resistor
Electrically insulated gloves and pliers
25 ohm 25 watt resistor S10404-57

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE *(Continued)*

FIGURE F.1 – CAPACITOR DISCHARGE PROCEDURE (RIGHT SIDE CASE)



TEST PROCEDURE

1. Remove input power to the POWER WAVE® AC/DC 1000®
2. Remove the left and right case sides.
3. Be careful not to make contact with the capacitor terminals that are located in the bottom center of the left and right side switch boards. See Figure F.1
4. Carefully check for a DC voltage at the capacitor terminals on both boards. Note the polarity is marked on the PC board.
5. If any voltage is present, proceed to Step #6. If no voltage is present, the capacitors are discharged.

NOTE: Normally the capacitors discharge in about two minutes after input power is removed.

6. Using the high wattage resistor (25-1000 ohms @ 25 watts (minimum), electrically insulated gloves and pliers, connect the resistor across the two capacitor terminals. Hold the resistor in place for 10 seconds. **DO NOT TOUCH THE CAPACITOR TERMINALS WITH YOUR BARE HANDS. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.**
7. Repeat procedure for the other capacitor; 2 capacitors per board; 4 per machine. Left & right side of welder.
8. Recheck the voltage across all capacitor terminals. The voltage should be zero. If any voltage remains, repeat the discharge procedure.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

INPUT BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

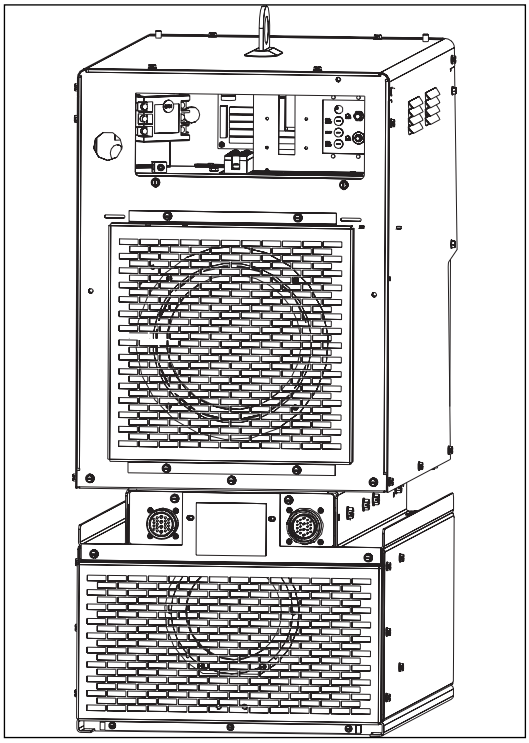
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Input Board is located in the upper rear of the power source section.

This test will help determine if the Input Board is receiving proper signals from the Control Board and activating the “soft start” function.



Rear View of Power Source

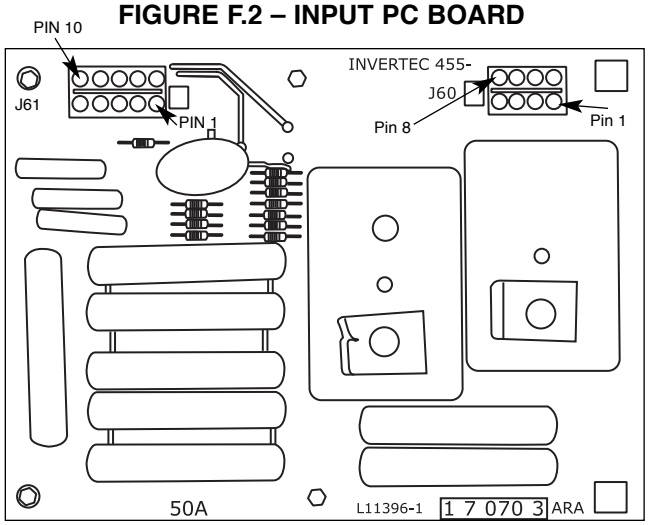
MATERIALS NEEDED

Volt-ohmmeter
Wiring Diagram

TROUBLESHOOTING AND REPAIR

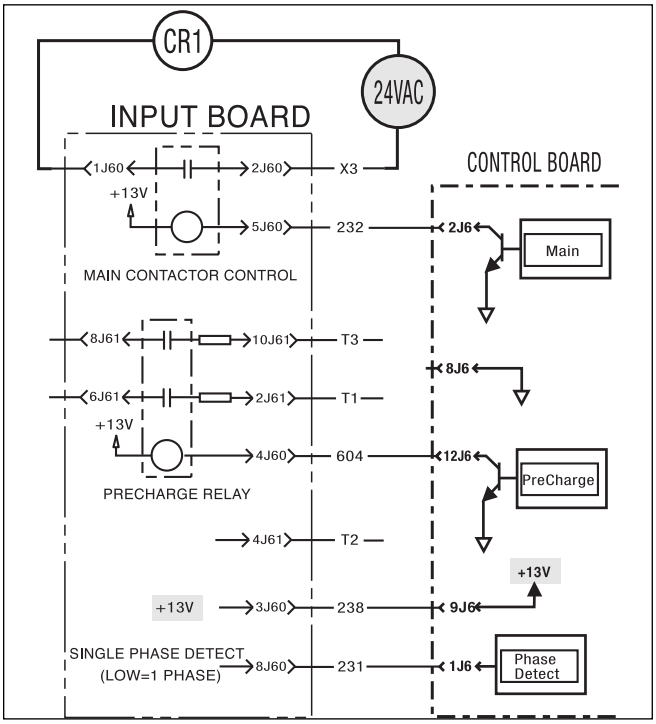
INPUT BOARD TEST *(Continued)*

FIGURE F.2 – INPUT PC BOARD



Molex pins are marked for pin location reference use.

FIGURE F.3 – INPUT PC BOARD SCHEMATIC



NOTE: This test is performed when the **input power** is applied in the area of this board. Use extreme caution when performing this test.

TEST PROCEDURE

1. During 10-15 seconds from power up:
   - Measure 13-15 VDC from 3J60 to 4J60 (as shown above in Figure F.3).
   - The Pre-Charge relay should be engaged on this Input Board.
2. 15 seconds after power up:
   - Measure 13-15VDC from 3J60 to 5J60 (as seen above in Figure F.3).
   - Main Contactor should be engaged – if the above test measure occurs and the contactor does not pull in the CRI contact coil or contactor may be defective. Turn off & disconnect input power to welder. Test the CRI coil with a separate (Bench top type 24V AC supply). Another area of potential trouble is wiring to ***Control Board*** (perform the ***Control Board Test***).

Return to Section TOC
Return to Master TOC

INPUT RECTIFIER TEST

⚠ WARNING

Service and repair should be performed only by 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.

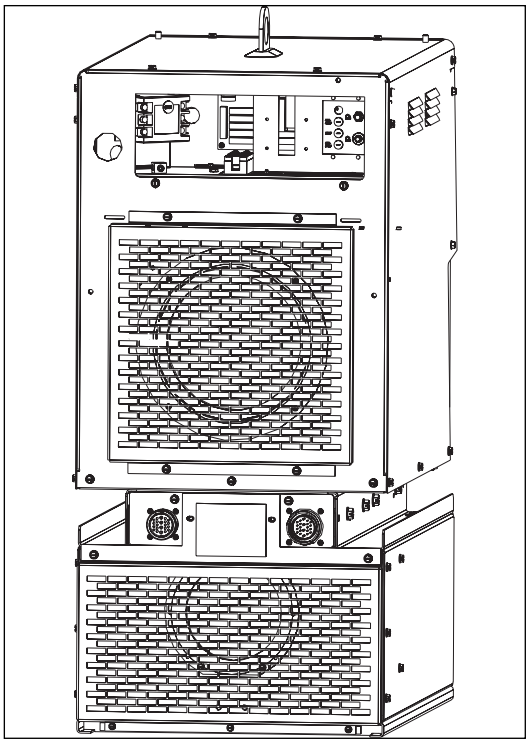
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Input Rectifier is located in the upper rear top (reconnect area) of the power source section.

This test will help determine if the Input Rectifier is converting 3 Phase 60Hz to full wave rectified DC.



Rear View of Power Source

MATERIALS NEEDED

Volt-ohmmeter
Wiring Diagram

INPUT RECTIFIER TEST

FIGURE F.4 – INPUT RECTIFIER

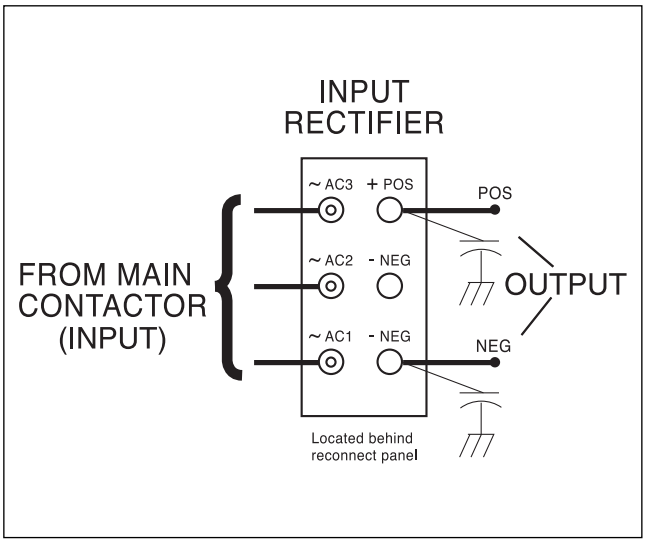
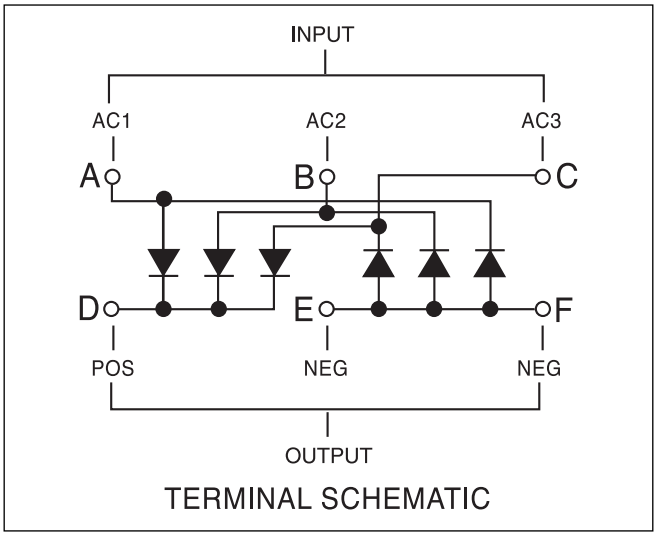


FIGURE F.5
INPUT RECTIFIER TERMINAL SCHEMATIC



TEST PROCEDURE (simplified)

1. Disconnect Input Power.
2. Perform ***Input Filter Capacitor Discharge Procedure*** at the beginning of this section.
3. Check the **input** to the **output** with a diode test or continuity test of known good volt-ohmmeter. For all 6 diodes (see Figure F.5).
4. Typical failure mode: SHORT CIRCUIT.
5. Failure of this component is typically the result of another problem (Perform the ***IGBT Switch Board Test***).

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

IGBT SWITCH BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

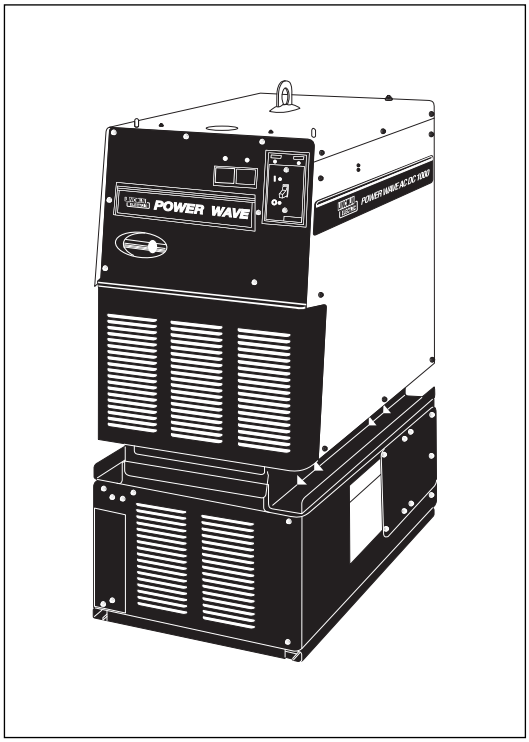
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The ***Switch Board*** is located at the left and right sides of the power source section.

This test will help determine if the ***Switch Boards*** are shorted and reporting capacitor frequency converted voltages to the Control Board.



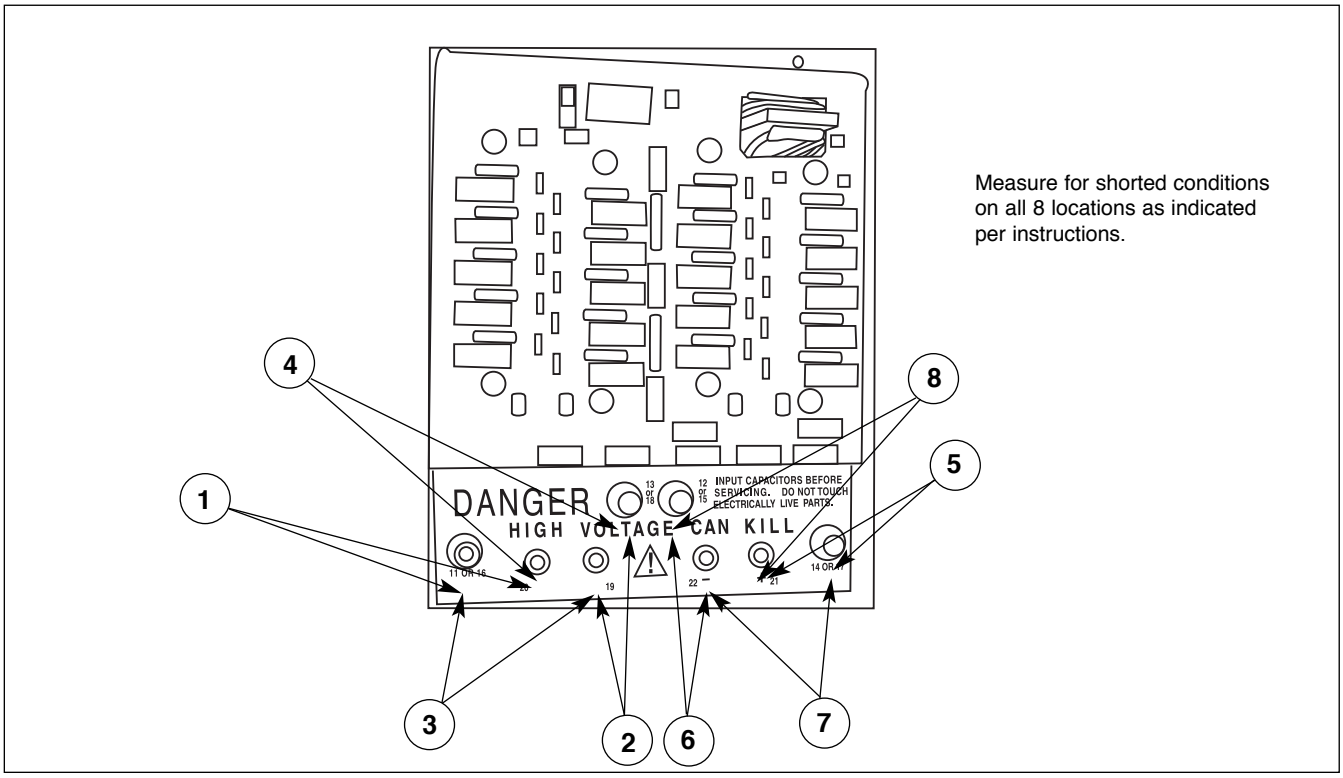
MATERIALS NEEDED

Digital volt-ohmmeter
Wiring Diagram
Digital volt-ohmmeter with a frequency counter

TROUBLESHOOTING AND REPAIR

IGBT SWITCH BOARD TEST *(Continued)*

FIGURE F.6 – SWITCH PC BOARD (G4664 SERIES)



TEST PROCEDURE 1

⚠ CAUTION

High DC Voltage on Switch Boards.

1. Disconnect the input power, and discharge the main Capacitors (there are two per board/four each per machine). Use a 25 ohm/25 watt resistor. ***(See Capacitor Discharge Procedure.)***
2. Check the points indicated (see Figure F.6) for a short circuit condition, (100Ω or less). A good reading will be greater that 1kΩ.

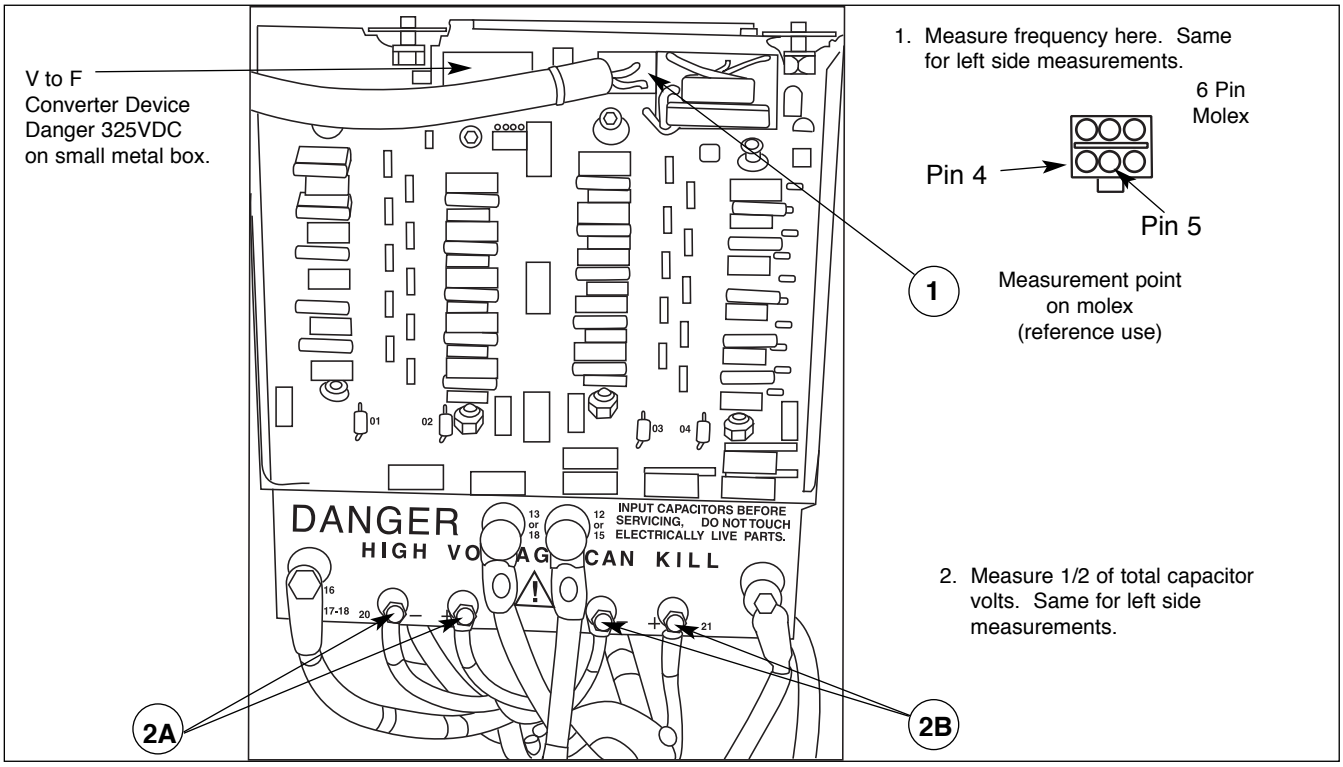
   NOTE: If using an analog meter, use a 1K scale or higher

   - Polarity is not important.
   - If the board fails the test, remove and retest to eliminate wiring issues
   - Boards can be replaced individually, but must be identical hardware revision (same board numbers and dash numbers).
   - Be sure to note Capacitor polarity during installation (when applicable).
   - Thermal pad MUST be completely removed. Mineral Spirits may help remove old thermal pads when replacing switch boards.
   - Check capacitors for any venting at vent plugs. Check capacitors per machine diagram values.
   - Look for any obvious electrical damage to components on either side of IGBT switch board.

Normal Board Resistances when connected in welder: typically 700 to 800 ohms NOT connected in welder: typically 300 to 400 ohms.

IGBT SWITCH BOARD TEST *(Continued)*

FIGURE F.7 – RIGHT SIDE SWITCH PC BOARD (G4664 SERIES)



TEST PROCEDURE 2

⚠ CAUTION

High DC Voltage on Switch Boards and around areas being tested. See Figure F.7.

Active Switch Board Testing: Voltage to Frequency Converter

1. Measure at switch board frequency feed back.
   - Left Side: 4J40 to 5J40 lead 404 to 405
   - Right Side: 4J50 to 5J50 lead 504 to 505
2. Capacitor voltage measured at test point 2A, 2B. Add both measured values together to get total capacitor volts for one side. Compared to frequency obtained in previous step. Typically, each volt converts to 8Hz of frequency

Example:

Cap V_1 right side = 162.5VDC

Cap V_2 right side = 162.5VDC

Cap V total = 325V = 2600 Hz frequency to control box frequency

- 100V = 800Hz
- 200V = 1600Hz
- 300V = 2400Hz

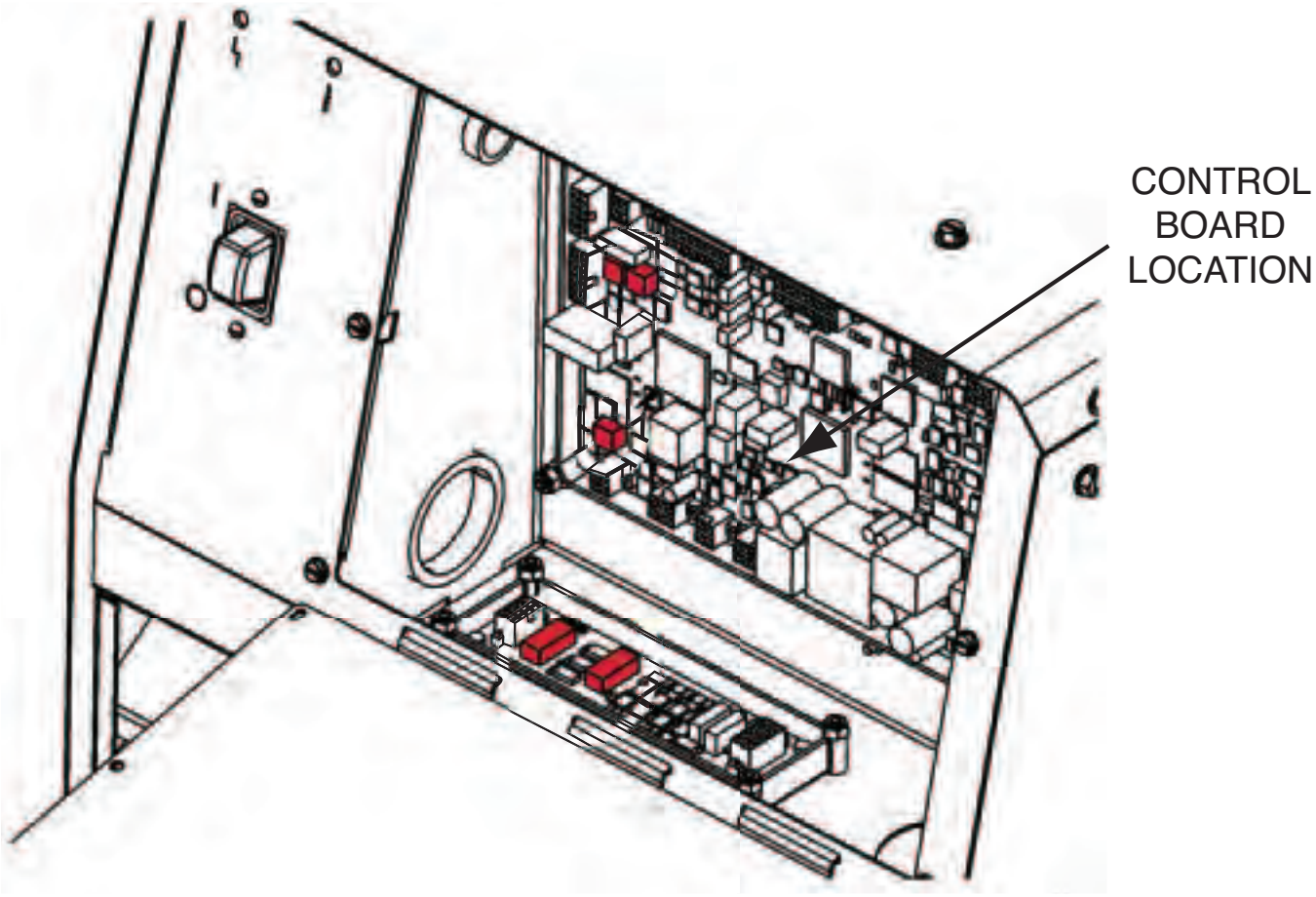
Typical Values = 8Hz/volt (325VDC @ 2600Hz)

Note: The Calibration screen in the Power Wave Manager software also reports the interpreted Capacitor Voltage for each side. It is best to verify actual with this diagnostic reading.

Return to Section TOC
Return to Master TOC

IGBT SWITCH BOARD TEST *(Continued)*

FIGURE F.8 – CONTROL BOARD LOCATION



PRIMARY CURRENT TRANSFORMER(S) TEST

Current Transformers (CT) Test Description

The two primary current transformers (CT1 and CT2) monitor the primary currents in the primary windings of the main transformer. See the wiring diagram. The output of the CTs is sent to the control board for processing. If the primary current feedback signals (output of the CTs) are not balanced the control board will adjust the pulse width modulation (PWM) signal sent to the switch boards to keep the IGBTs balanced. Also, if either switch board is supplying too much current to the main transformer the control board will remove the PWM signal and the inverter will be shut off to protect the switch board(s).

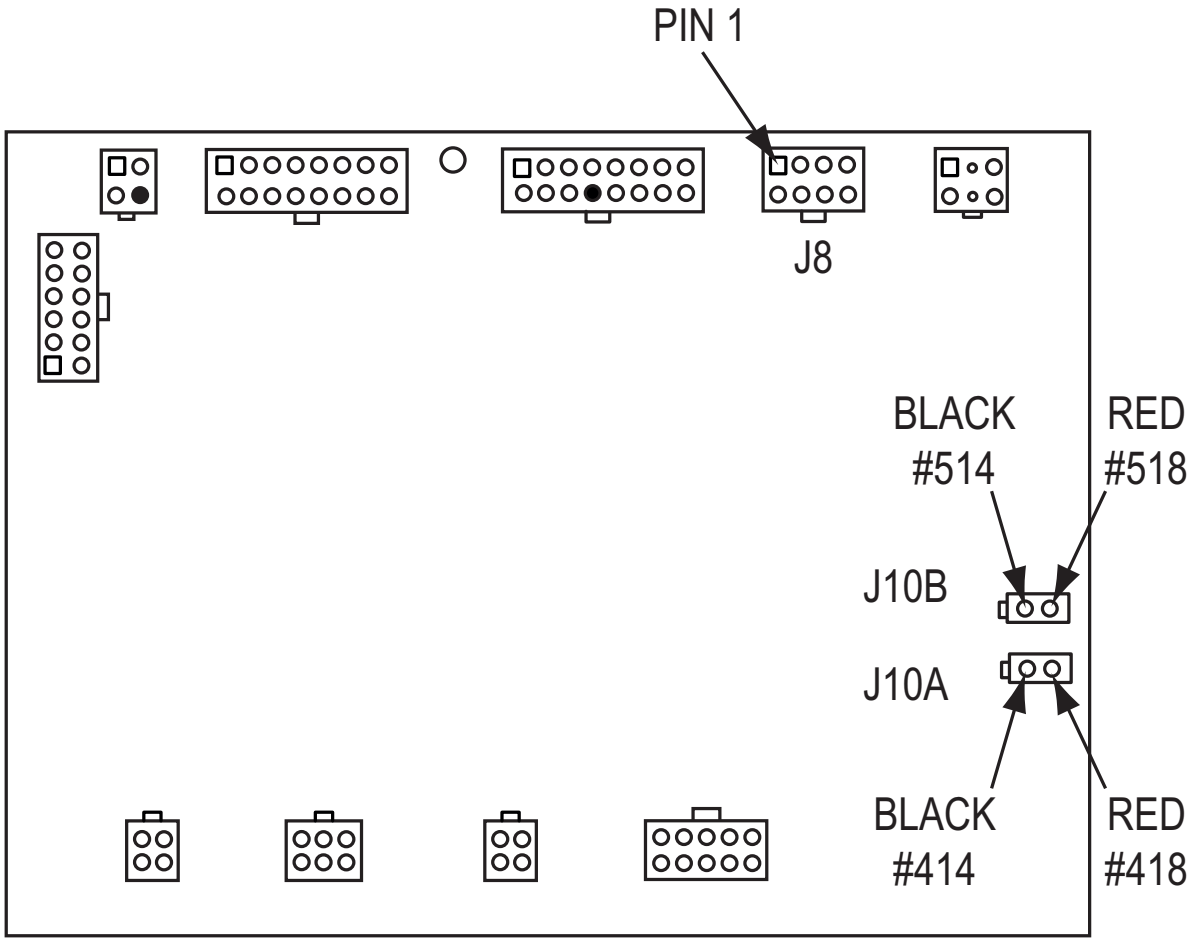
The best way to test a current transformer is by measuring the inductance. The measurement should always be made inside the machine by disconnecting the CT leads from the control board. Special care should be taken to not disturb the CT location or wiring harness as failures are often the result of stress applied to the device. Polarity is also very important. Always check the wiring diagram to make certain the CT leads are connected properly.

MATERIALS NEEDED

Volt-Ohmmeter with inductance measuring capabilities (Amprobe Model 37XR-A)
Wiring Diagram
Phillips Screwdriver

IGBT SWITCH BOARD TEST *(Continued)*

FIGURE F.9 – PLUGS J10A, J10B AND LEADS ON CONTROL BOARD



PROCEDURE

1. Remove the input power to the Power Wave AC/DC 1000 machine.
2. Using the Phillips head screwdriver, remove the control box cover and locate the control board. See ***Figure F.8***.
3. Locate and remove plugs J10A and J10B from the control board. See Figure F.9.
4. Using the Volt-Ohmmeter with inductance measuring capabilities, check the left side switch board CT inductance by checking from the red lead (#518) to the black lead (#514) at plug J10B. Normal inductance is approximately 370mH +/- 20%.
5. Using the Volt-Ohmmeter with inductance measuring capabilities, check the right side switch board CT inductance by checking from the red lead (#418) to the black lead (#414) at plug J10A. Normal inductance is approximately 370mH +/- 20%.
6. If the inductance reading is not correct replace the faulty CT.
7. When testing is complete replace plug J10A and J10B into the correct receptacles. See Figure F.9.
8. Replace the control box cover.

TROUBLESHOOTING AND REPAIR

AUXILIARY DRIVER PC BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

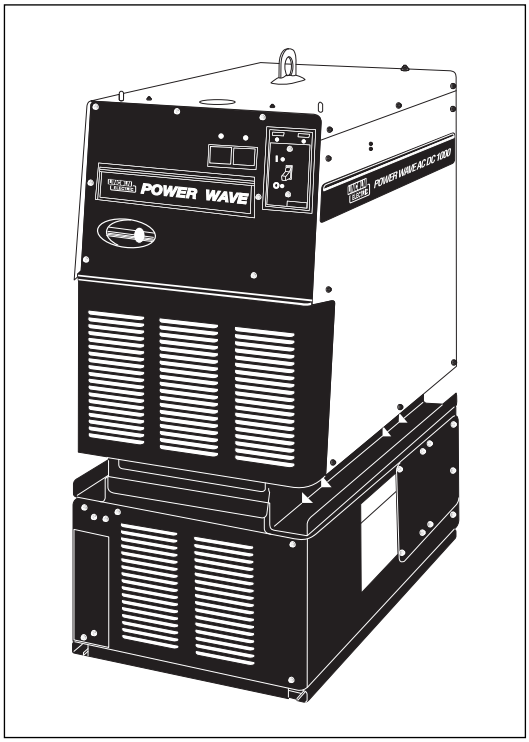
NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The ***Auxiliary Driver PC Board*** is located at the inside rear of the control box of the power source.

The ***Auxiliary Driver PC Board*** provides additional drive capacity for faster switching and it provides gate drive to 20 individual IGBT's on the switch box. This test will help determine if the gate drive output from the Control PC Board is properly boosted to the ***Switch Boards.***

.



MATERIALS NEEDED

Volt-ohmmeter with a frequency counter
Wiring Diagram

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

AUXILIARY DRIVER PC BOARD TEST *(Continued)*

FIGURE F.10
SWITCH PC BOARD (G4664 SERIES)

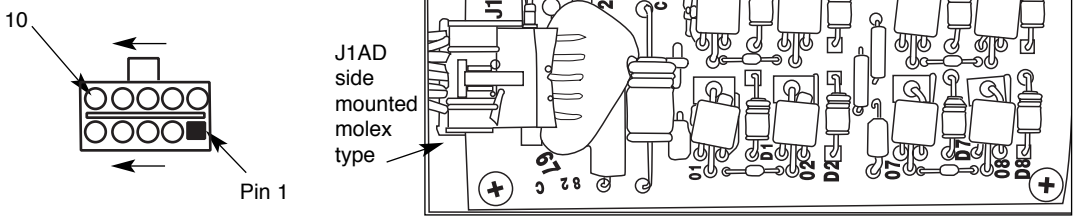
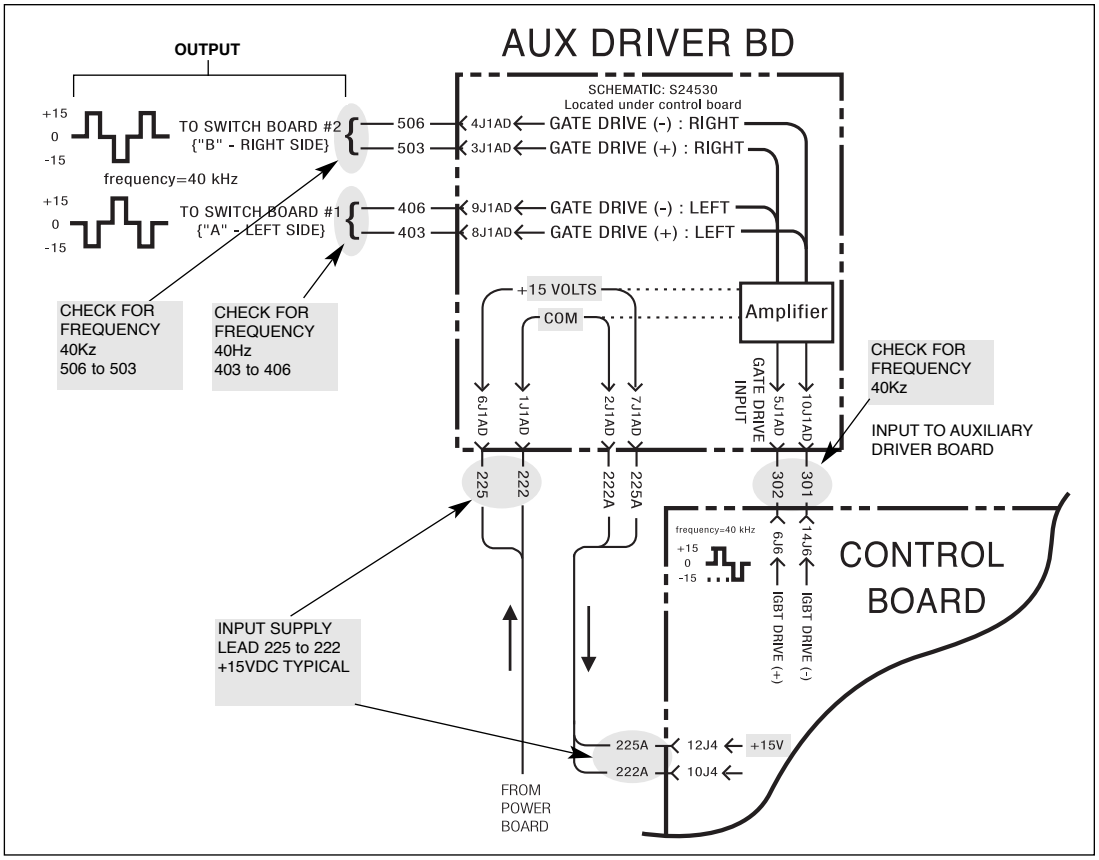


FIGURE F.11 – AUXILIARY DRIVER BOARD/CONTROL BOARD SCHEMATIC



TEST PROCEDURE

Before performing this test, keep the following in mind:

1. The Auxiliary Driver PC Board splits a single bipolar input into two high capacity outputs.
   - Each output is bipolar (±15VDC), with 180° phase shift.

     Positive half cycle fires the Switch Board.

.

1. Look for 40 KHZ signals with "**output on**" and supply to board per diagram (Figure F.11). The ***Control Board*** has to have an output command sent to it via ARCLINK communication using a PF10A or PLC or the Power Wave Manager software (calibration screen) to activate weld output.
2. Use a digital FLUKE type meter that has the ability to measure kHZ (frequency).
3. If this test shows to be good (or bad), check the ***Machine Diagram*** for associated wiring or other boards potentially causing problems - control board, power board, switch board.

OUTPUT RECTIFIER TEST (G4496 SERIES)

⚠ WARNING

Service and repair should be performed only by 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.

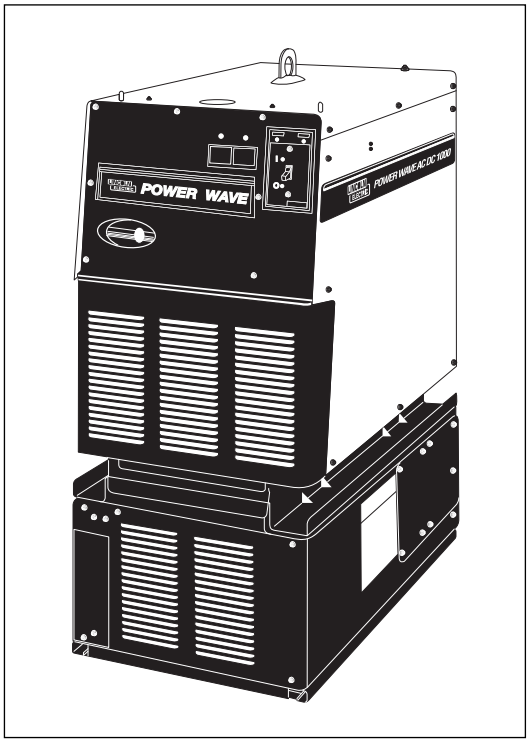
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Output Rectifier is located in front of the power source behind the exhaust sheet metal opening.

The Output Rectifier converts the 80kHZ transformer output to DC for welding. It consists of two 'full wave' rectifiers (one for each polarity), interleaved on two heat sinks.



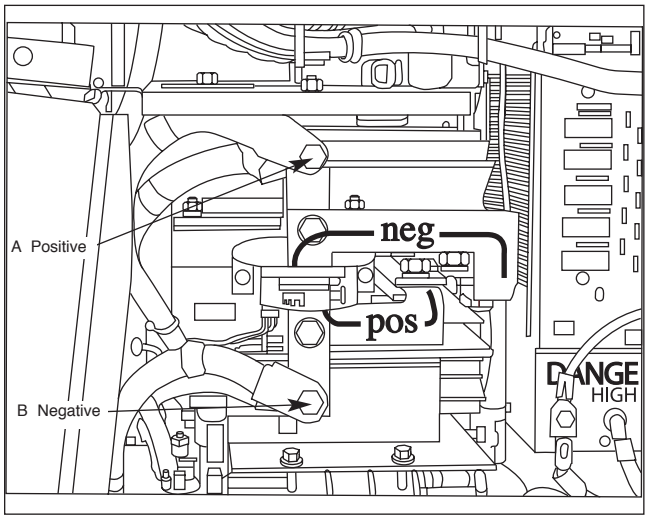
MATERIALS NEEDED

Volt-ohmmeter
Wiring Diagram

Return to Master TOC
Return to Master TOC
Return to Master TOC
Return to Master TOC

OUTPUT RECTIFIER TEST

FIGURE F.12
ANODE, CATHODE & JUNCTION TERMINALS



TEST PROCEDURE 1

Test for shorts with bridge still inside the machine

1. Perform ***Input Filter Capacitor Discharge Procedure***
2. Disconnect load resistors (left side) of bridge rectifier (four, 200 ohm 100 watt resistors).
3. Check from the points indicated to the WORK stud for a short circuit condition (typically less than 30 ohms). Polarity is not important. See Figure F.12.
   - If the rectifier fails this test, disconnect and retest per TEST PROCEDURE 2 (below) to eliminate possible wiring issues.

   NOTE: Boards are "matched" and as a result, the entire rectifier assembly must be replaced if either board is defective.

TEST PROCEDURE 2

To be performed with the Rectifier Assembly removed from the machine or completely disconnected

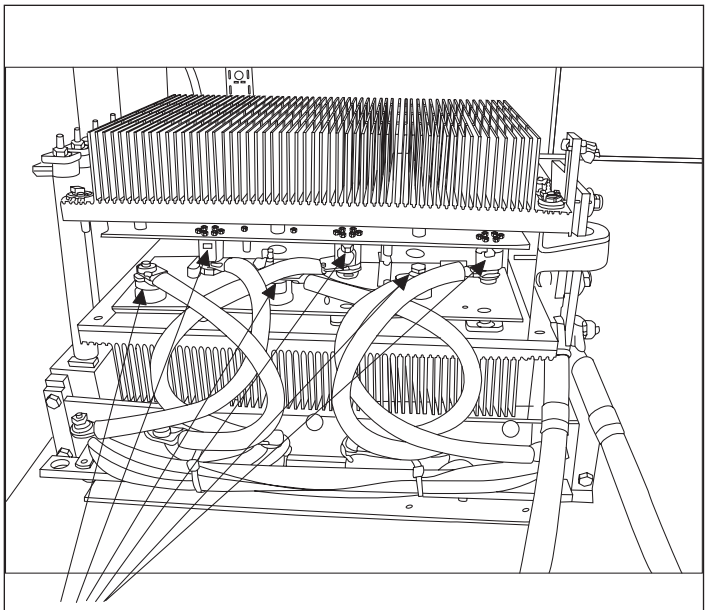
1 Perform the ***Input Filter Capacitor Discharge Procedure***.

2. Disconnect the six transformer secondary leads and the leads from the Positive and Negative copper bars. See **the *Output Diode and Main Transformer Removal*** procedure.
3. Test the rectifier per the table in Figure F.13.

   If all tests are OK the short measured in Step 1 (above) is due to a wiring problem. If any tests are incorrect, the Rectifier Assembly must be replaced.

   NOTE: Boards are "matched" and as a result, the entire rectifier assembly must be replaced if either board is defective.

FIGURE F.14
RECTIFIER ASSEMBLY (FRONT VIEW)



Transformer Connections (6).

FIGURE F.13 – RECTIFER RESISTANCE CHECK

+ PROBE (RED)	- PROBE (BLACK)	RESULT
A THRU F	POSITIVE BUS BAR	0.3V - 0.7V
POSITIVE BUS BAR	A THRU F	OPEN
NEGATIVE BUS BAR	A THRU F	0.3V - 0.7V
A THRU F	NEGATIVE BUS BAR	OPEN
EACH TRANSFORMER CONNECTION POINT (6)	EVERY OTHER TRANSFORMER CONNECTION POINT	> 1 MEG OHM

Return to Section TOC
Return to Master TOC

AC/DC SWITCH PC BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

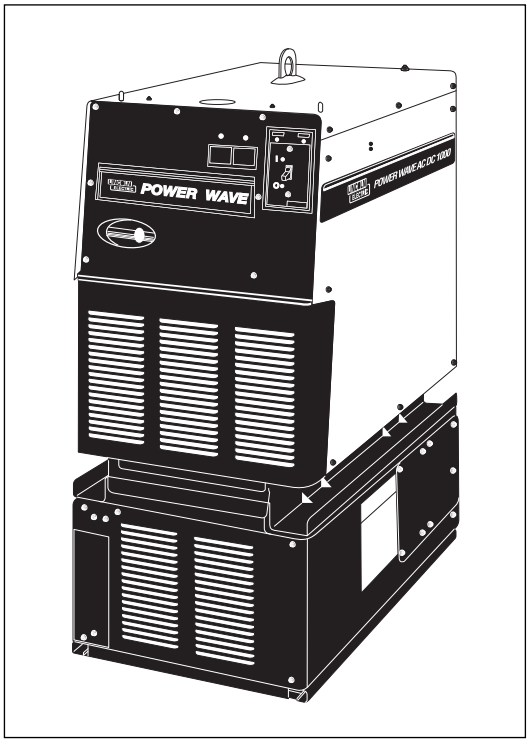
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The AC/DC Switch PC Boards are located in the AC Switch (lower section) slide out drawer.

The AC/DC Switch PC Boards control the power to the Electrode Studs to create AC, DC+ or DC- output.



MATERIALS NEEDED

Volt-ohmmeter
Wiring Diagram

Return to Section TOC Return to Master TOC

AC SWITCH PC BOARD TEST (G4619 CHOPPER SERIES)

Inside a Welding Machine and in a Weld Cell Environment - TESTING

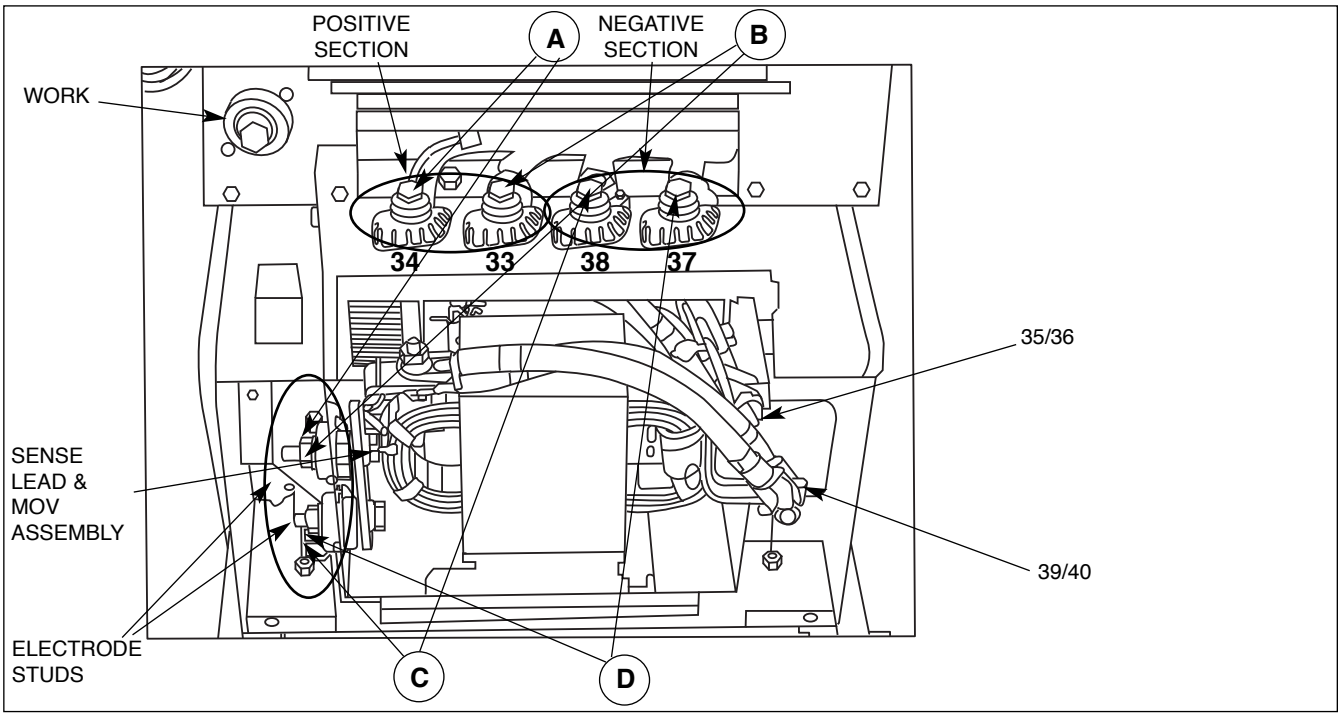
OUTPUT STATUS			PROBABLE CAUSE	COURSE OF ACTION
DC+	DC-	AC		
Y	N	Halfwave (+)	***Positive Switch Shorted.*** Negative output is shunted directly back to the power source. Negative current may register on the display, but does not appear at the output.	Check positive chopper boards for evidence of a short circuit at leads 33/34 to 35/36. Visually inspect chopper and snubber boards for evidence of catastrophic failure (see ***Figure F.15*** for assistance in locating test points) if check is OK, check the Negative Switch Boards.
			Negative Switch Open. Typically caused by loss of gate drive, auxiliary supply, snubber PCB or catastrophic switch failure.	Verify gate drives and auxiliary supply. Verify proper Dip Switch settings on Ethernet PCB. (Use ***Machine Diagram*** for reference). Visually inspect chopper and snubber boards for evidence of catastrophic failure.
N	Y	Halfwave (-)	**Negative Switch Shorted**. Positive output is shunted directly back to the power source. Positive current may register on the display, but does not appear at the output.	Check negative chopper boards for short circuit at leads 37/38 to 39/40. Visually inspect chopper and snubber boards for evidence of catastrophic failure (see ***Figure F.15***). If check is OK, check the Positive Switch Boards.
			Positive Switch Open. Typically caused by loss of gate drive, auxiliary supply, snubber PCB or catastrophic switch failure.	Verify gate drives and auxiliary supply. Verify proper Dipswitch settings on Ethernet PCB. (use ***Machine Diagram*** for reference). Visually inspect chopper and snubber boards for evidence of catastrophic failure.
N	N	N	**No Output From Power Source.**	Check for power source output from leads 37/38 and 33/34 to the WORK STUD (typically 100V). See ***Figure F.15***. If voltage is present, proceed to next step.
			Positive AND Negative Switch Open. Typically caused by loss of auxiliary power, or disconnected gate leads (S11) connection.	Verify gate drives and auxiliary supply. Verify proper Dipswitch settings on Ethernet PCB. Visually inspect chopper and snubber boards for evidence of catastrophic failure(see ***Figure F.17A*** for assistance in locating test points).
			Positive AND Negative Switch Shorted. Typically the result of a catastrophic failure.	Check all chopper boards for short circuit at leads 37/38 to 39/40 and 33/34 to 35/36. Visually inspect chopper and snubber boards for evidence of catastrophic failure (See ***Figure F.17A*** for assistance in locating test points).

NOTE: If all checks are good and problem persists, check for possible open choke leads or for an open in the weld circuit.

AC/DC SWITCH ASSEMBLY TEST (G4619 CHOPPER SERIES) *(Continued)*

Short Circuit Test with Switch Boards in the AC Switch Assembly

FIGURE F.15 – AC SWITCH PC BOARD (G4619 CHOPPER SERIES)



Removal Note: Be sure to disconnect the sense lead and MOV assembly when sliding out AC switch to access Chopper assemblies. Also, disconnect the four Amphenols behind the access door on right side of AC/DC Switch. See the *AC/DC Switch Removal Procedure.*

TEST PROCEDURE #1

1. Disconnect the external welding cable from both welding output studs.
2. With an analog ohmmeter, check from points A, B, C, and D to the Electrode Stud. (see Figure F.15). A low reading (typically less than 30 ohms) indicates a shorted Chopper Board. A normal reading is a high resistance (>100Kohm) in one polarity and 'Open' in the other polarity.

   If any test points show 'open' in both directions, check resistances to 35/36 and 39/40. Normal readings indicate an open choke or broken connection.

If a reading indicates a 'short', remove the AC/DC Switch and retest to eliminate wiring issues (see ***AC/DC Switch Removal Procedure).***

Replacement of an AC Switch Board is a fairly complicated procedure. It is recommended that the entire AC/DC Switch assembly be replaced if a board is shorted.

Removal Note: Be sure to disconnect the sense lead and MOV assembly when sliding out AC switch to access Chopper assemblies. Also, disconnect the four Amphenols behind the access door on right side of AC/DC Switch. See the *AC/DC Switch Removal Procedure.*

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AC/DC SWITCH ASSEMBLY TEST (G4619 CHOPPER SERIES) *(Continued)*

TEST PROCEDURE #2 (simplified)

Actions performed with AC/DC Switch removed from the machine

1. Perform the input capacitor discharge procedure in this section.
2. Disconnect the external welding cables from both output studs.
3. Follow AC Switch Assembly Removal procedure.
4. Check continuity at the points A, B, C, D as indicated for a shorted condition (typically less than 30 ohms).

   Meter lead polarity is not important.

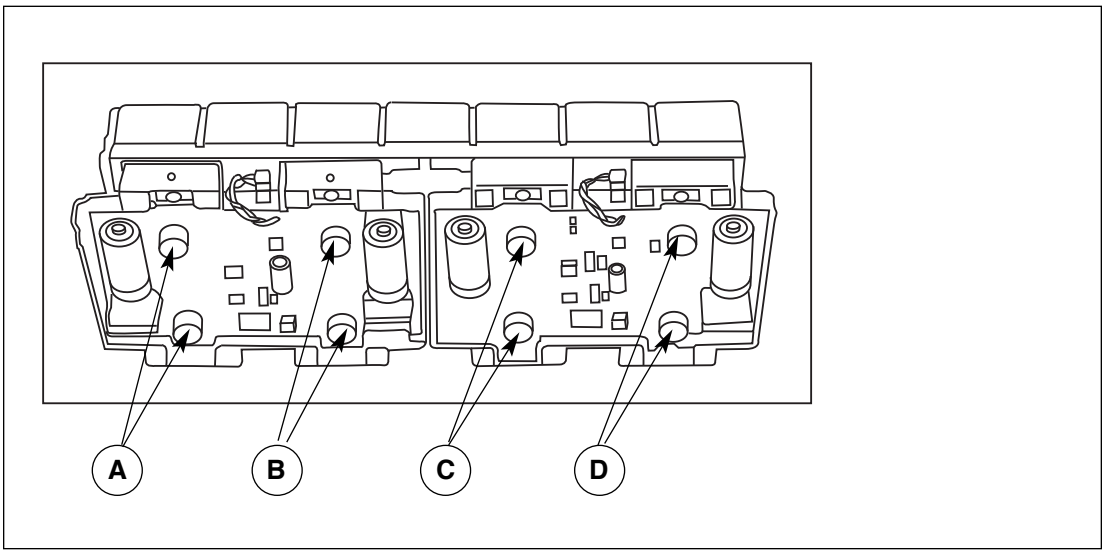
If the boards fail the test, remove cables and retest to eliminate wiring issues. See ***Figure F.17B.***

Boards are “potted” to heatsink and must be replaced as an assembly (two boards per assembly; hardware revision is not critical).

Replacement of an AC Switch Board is a fairly complicated procedure. It is recommended that the entire AC/DC Switch assembly be replaced if a board is shorted.

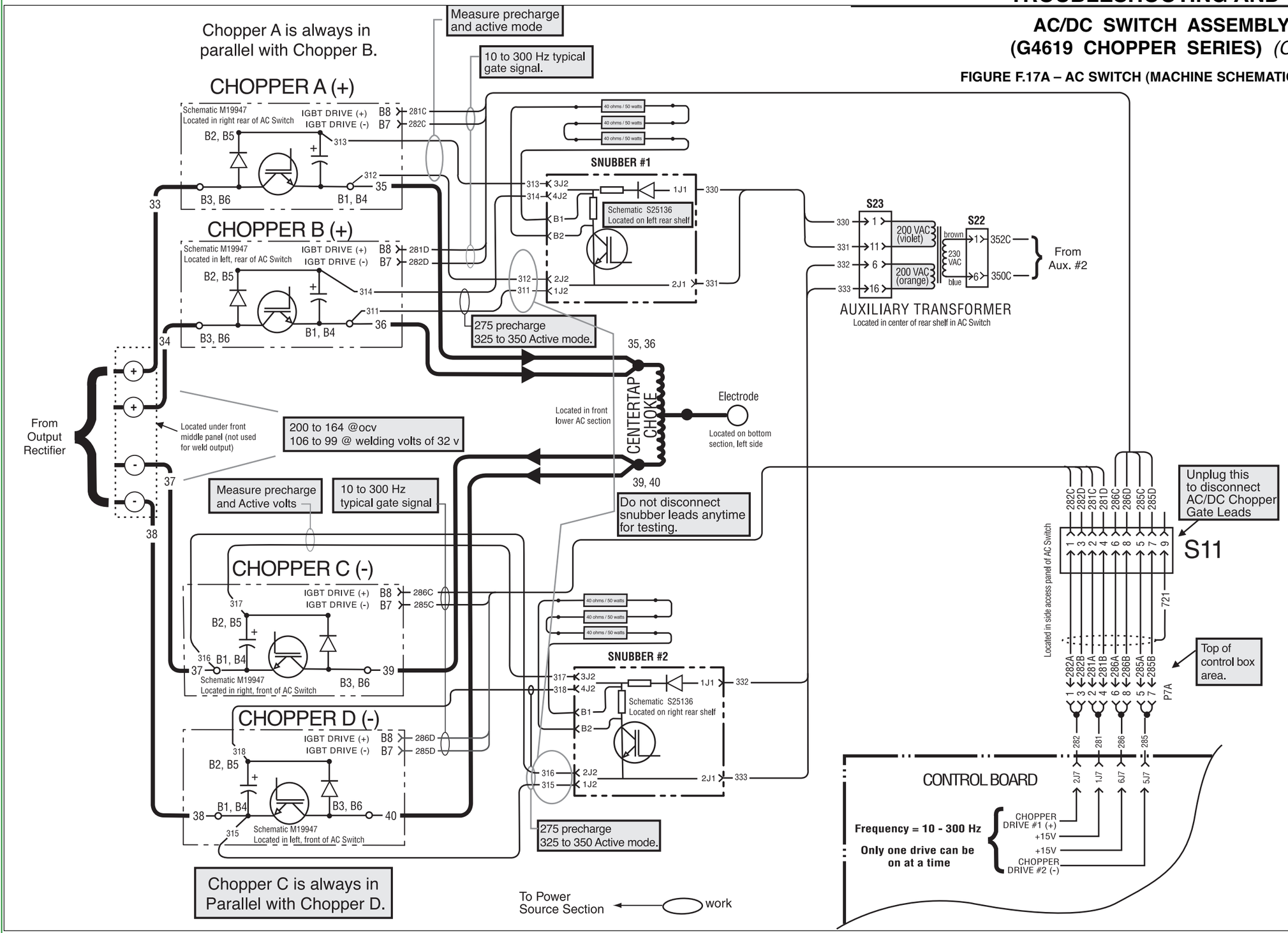
Continuity Test Outside the Welding Machine

FIGURE F.16 – AC SWITCH PC BOARD (G4619 CHOPPER SERIES)



AC/DC SWITCH ASSEMBLY TEST (G4619 CHOPPER SERIES) *(Continued)*

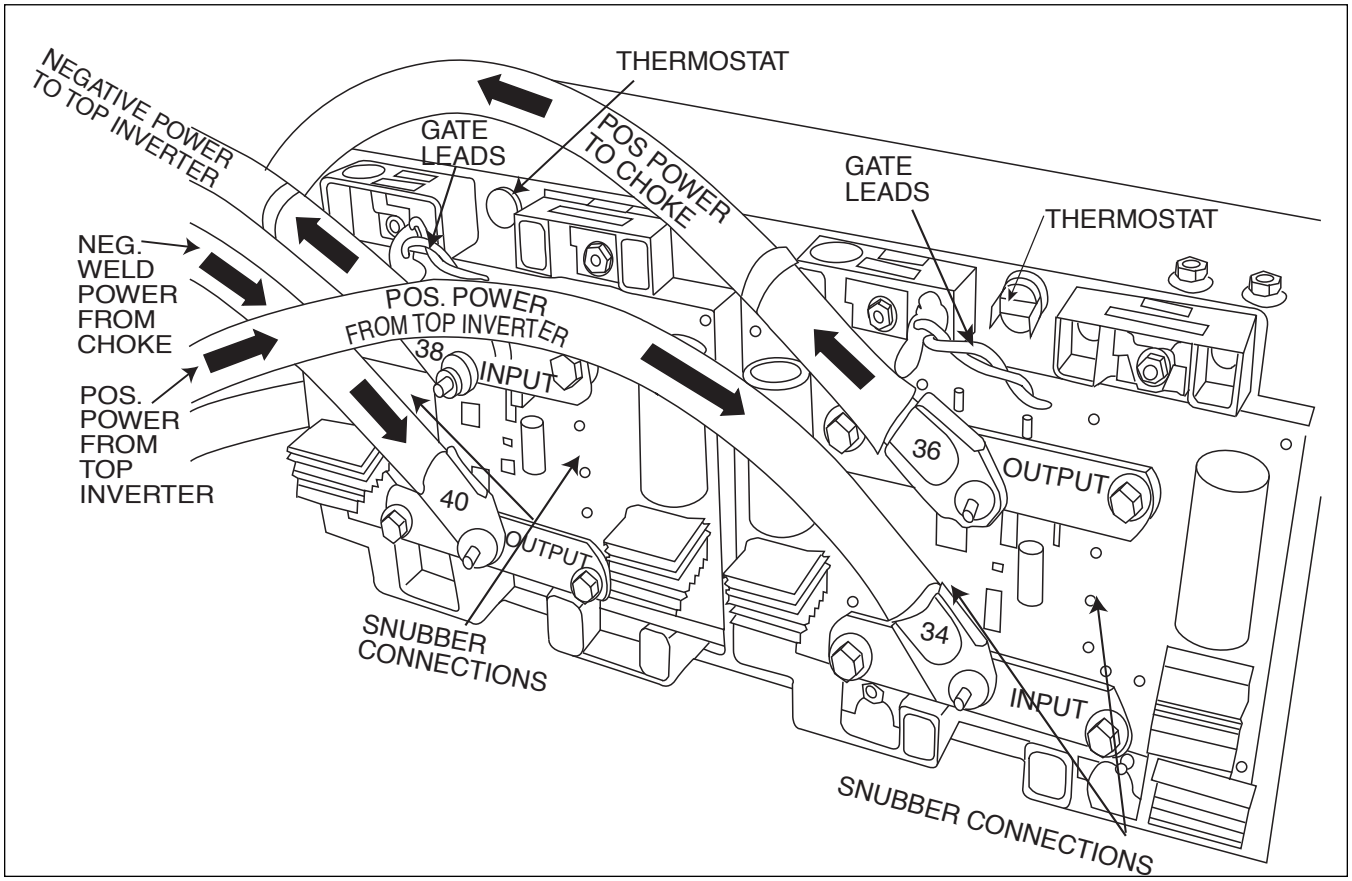
FIGURE F.17A – AC SWITCH (MACHINE SCHEMATIC - POWER SECTION)



This reference print is from G4967 Page G-22 Section G.

AC/DC SWITCH ASSEMBLY TEST (G4619 CHOPPER SERIES)

FIGURE F.17B – AC SWITCH



One of two AC Switch Chopper Assemblies (left side shown)

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POWER BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

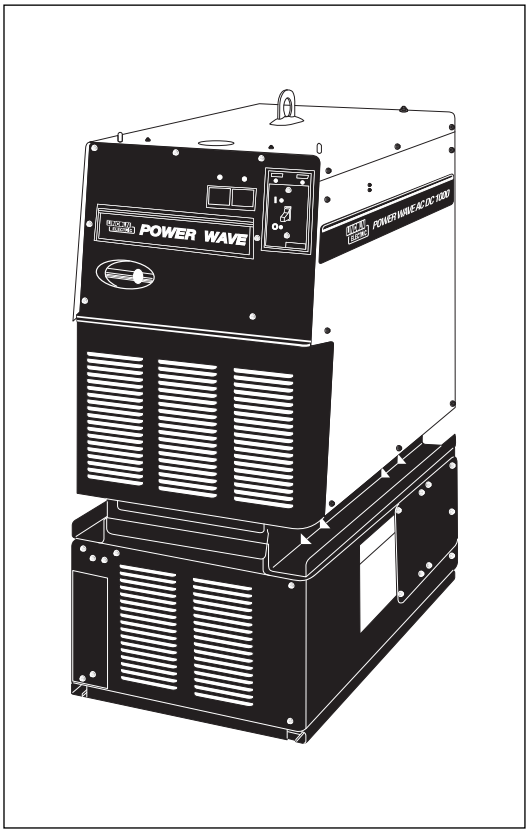
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Power Board is located on the top outside rear of the Control Box of the Power Source.

This test will help determine if the Power Board is receiving the correct voltages and also if the Power Board is regulating and producing the correct DC voltages.



MATERIALS NEEDED

Volt-ohmmeter
Wiring Diagram

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POWER BOARD TEST *(Continued)*

TEST PROCEDURE

1. Remove input power to the POWER WAVE® AC/DC 1000®
2. Remove the case top and sides.
3. Perform the ***Input Filter Capacitor Discharge Procedure.***
4. Locate the Power Board and plugs J42 and J43. Do not remove plugs or leads from the Power Board. Refer to ***Figure F.18***.
5. Carefully apply input power to the POWER WAVE® AC/DC 1000®.
6. Turn on the POWER WAVE® AC/DC 1000®. Carefully test for the correct voltages at the Power board according to F.18 diagram.

⚠ WARNING

ELECTRIC SHOCK can kill.

High Voltage is present when input power is applied to the machine.

7. If the 40 VDC voltage is low or not present at plug J41, perform the ***DC Bus PC Board Test.*** See the Wiring Diagram.
8. If any of the DC voltages are low or not present at plugs J42 and/or J43, the Power Board may be faulty. It is also possible that other boards may be loading down Power Board supplies. Unplugging J-4 and J-11 from the Control Board from the Power Board may make supplies read normal. If so, Control Bord or Feed Head Board may be defective.

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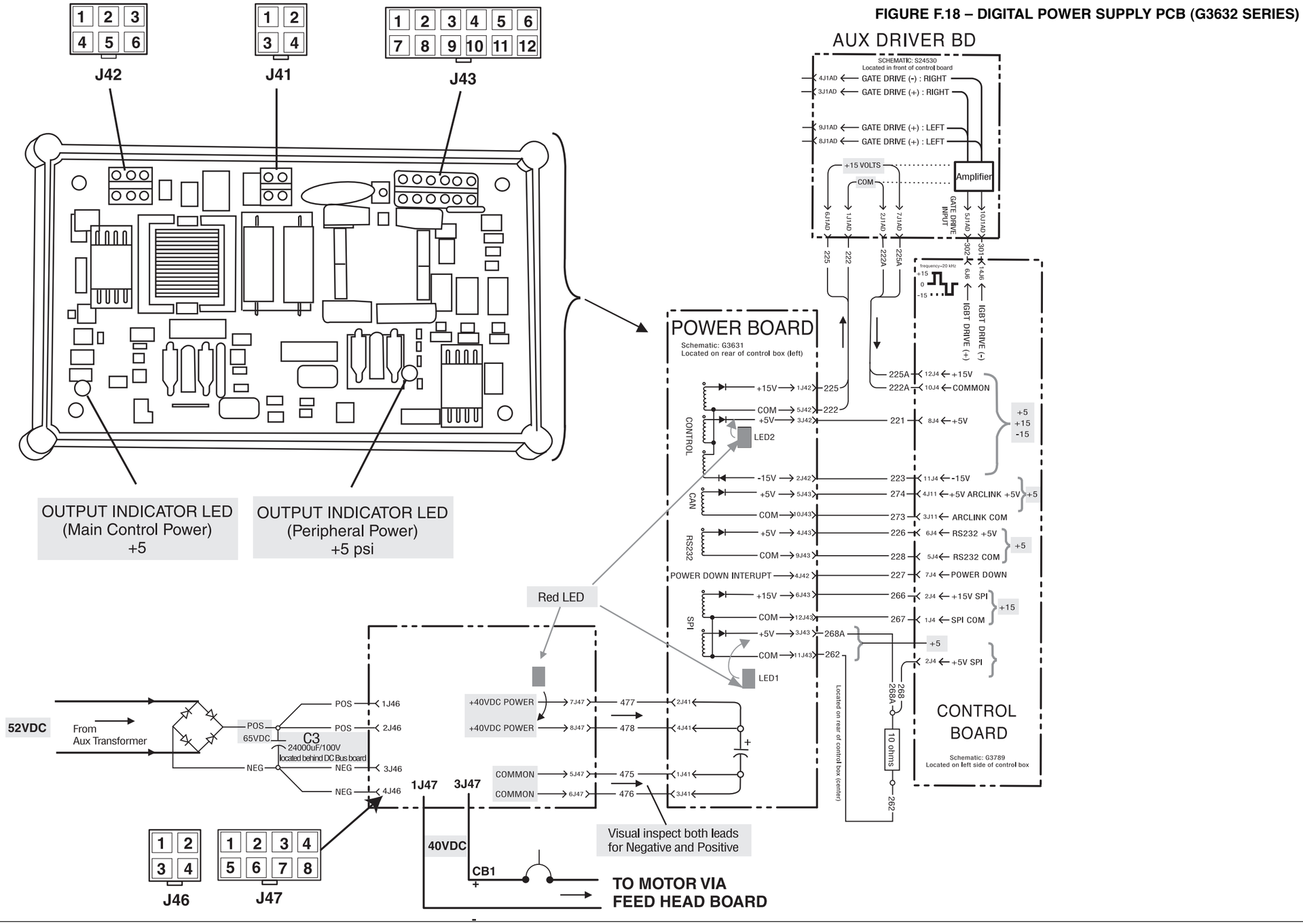
Return to Section TOC
Return to Master TOC

POWER BOARD TEST

FIGURE F.18 – DIGITAL POWER SUPPLY PCB (G3632 SERIES)



A version of this print can be found in Section G.

DC BUS BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

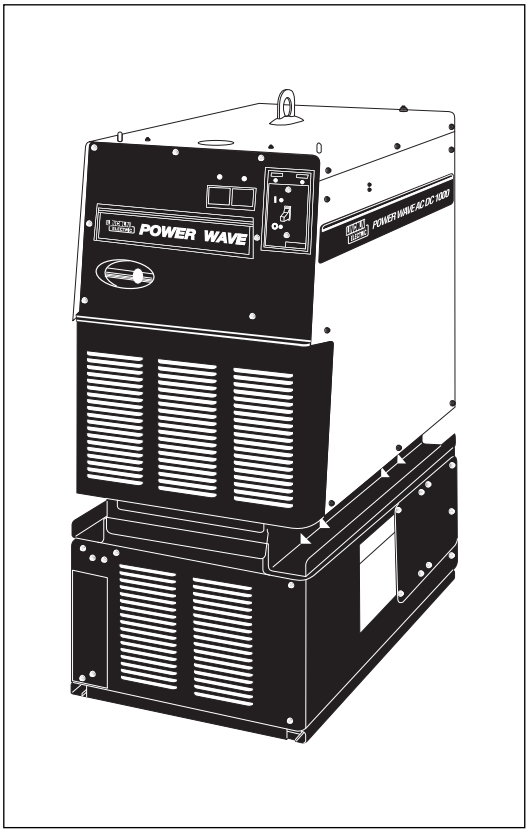
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The DC BUS Board is located on the top outside rear of the Control Box of the Power Source.

This test will help determine if the Bus Board is receiving the correct voltages and if it is regulating and producing the correct DC voltages.



MATERIALS NEEDED

Volt-ohmmeter
Wiring Diagram

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DC BUS BOARD TEST (*Continued*)

TEST PROCEDURE

1. Perform the ***Input Filter Capacitor Discharge Procedure.***

2. Locate the DC Bus Board connectors J46 and J47. See ***Figure F.18*** and the ***Machine Diagram***.

3. Turn Power Switch ON and measure and the input voltage to the Bus Board at J46, Pin1(+) to Pin 3(-). Typical reading is 65 VDC.

   If not correct, check the Power Board Rectifier and the AC input to the rectifier from Auxiliary Transformer T1.

4. Measure the voltage at J47. Pin 7(+) to Pin 5(-) and from Pin 8(+) to Pin 6(-). Both readings should be 40VDC (+/-2).

   If readings are low, unplug J41 from the Power Board. If still low, the Bus Board is defective. If the readings return to normal, the Power Board, Control Board or Feed Head Board may be defective and loading down the supply.

5. Measure the voltage at J47, Pin 3(+) to Pin 1(-).The reading should be 40VDC(+/-2).

   This supplies the Arc Link Receptacle and the Feed Head Board through the 10 amp Circuit Breaker (CB1).

CURRENT TRANSDUCER TEST

⚠ WARNING

Service and repair should be performed only by 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.

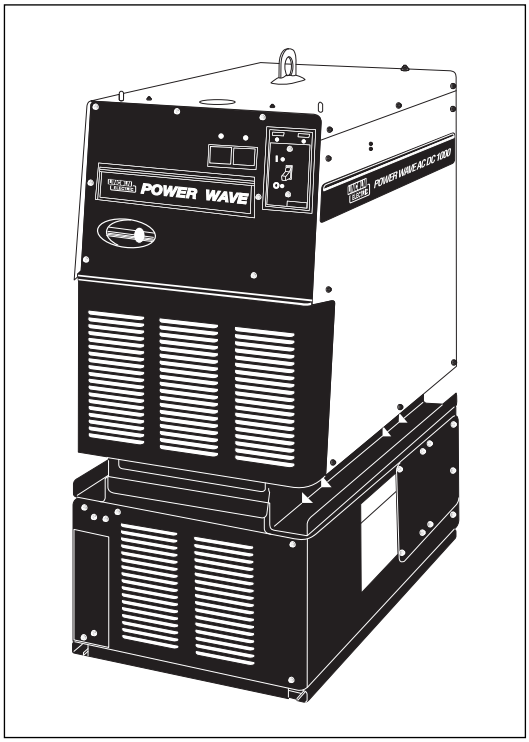
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The POWER WAVE® Current Transducer is located at the right front of the Power Source section and is part of the Output Rectifier assembly.

This test will help determine if the POWER WAVE® current transducer and associated wiring is functioning correctly.



MATERIALS NEEDED

Volt-ohmmeter

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CURRENT TRANSDUCER TEST *(Continued)*

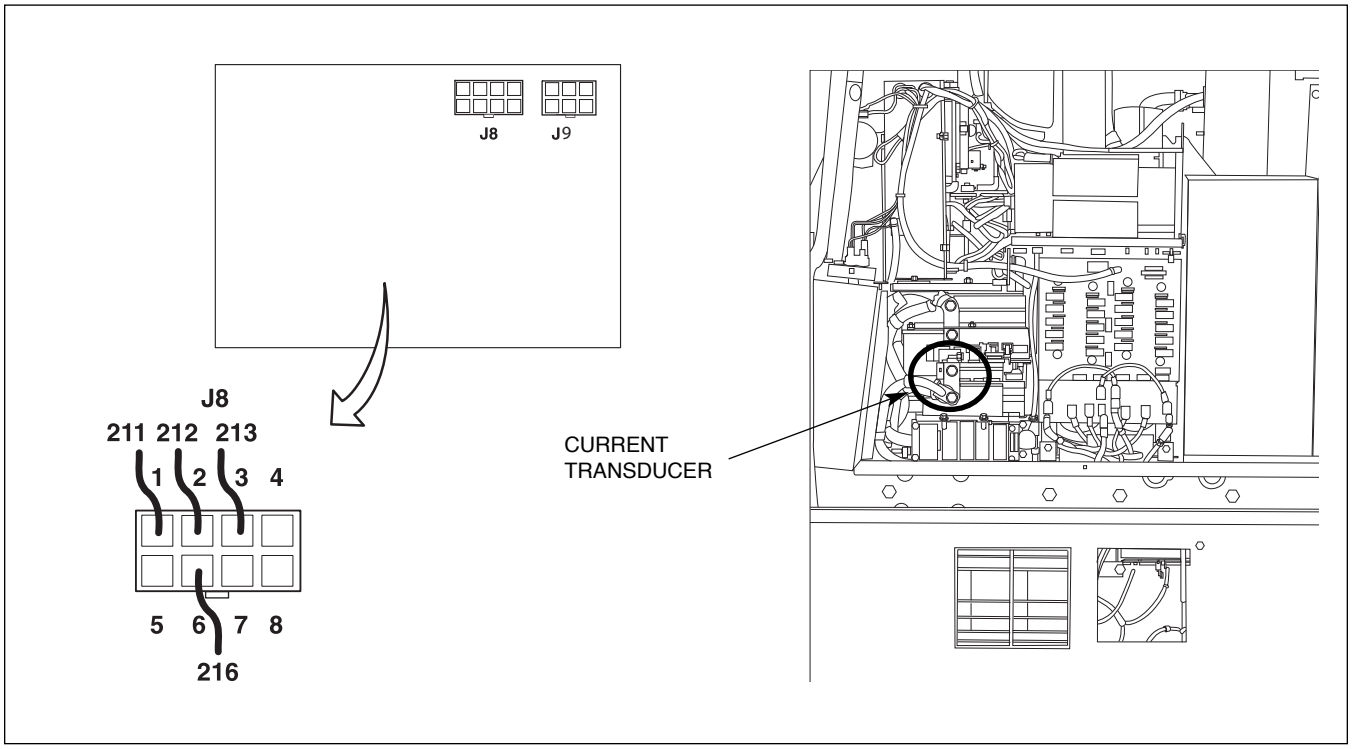
TEST PROCEDURE

1. Remove input power to the POWER WAVE® AC/DC 1000®.
2. Remove the right case side and the control box cover of the Power Source.
3. Locate the POWER WAVE® current transducer leads at Control Board plug J8. See Figure F.21.
4. Carefully apply input power to the POWER WAVE® AC/DC 1000®.

⚠ WARNING

ELECTRIC SHOCK can kill. High Voltage is present when input power is applied to the machine.

FIGURE F.21 – CURRENT TRANSDUCER TEST



5. Check the DC supply to the Current Transducer at the following points:
   A. +15 VDC from J8 Pin 2 (+) to J8 Pin 6 (-)
   B. - 15 VDC from J8 Pin 3 (-) to J8 Pin 6(+)
   C. + 30 VDC from J8 Pin 2 (+) to J8 Pin 3 (-)

   If voltage readings are low, check the wiring from J8 to the Current Transducer connector P91.
   If voltages are not present, perform the ***Control Board test*** and the ***Power Board test.***

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.

CURRENT TRANSDUCER TEST *(Continued)*

7. Use the "Power Wave Manager software" or a PF10A test mode 221 and control cable. See how to ***Energize Output for Load Bank Testing.***

9. With the POWER WAVE® AC/DC 1000® triggered, check the feedback voltage from the current transducer. The current feedback voltage can be read at plug J8 on the Control Board.

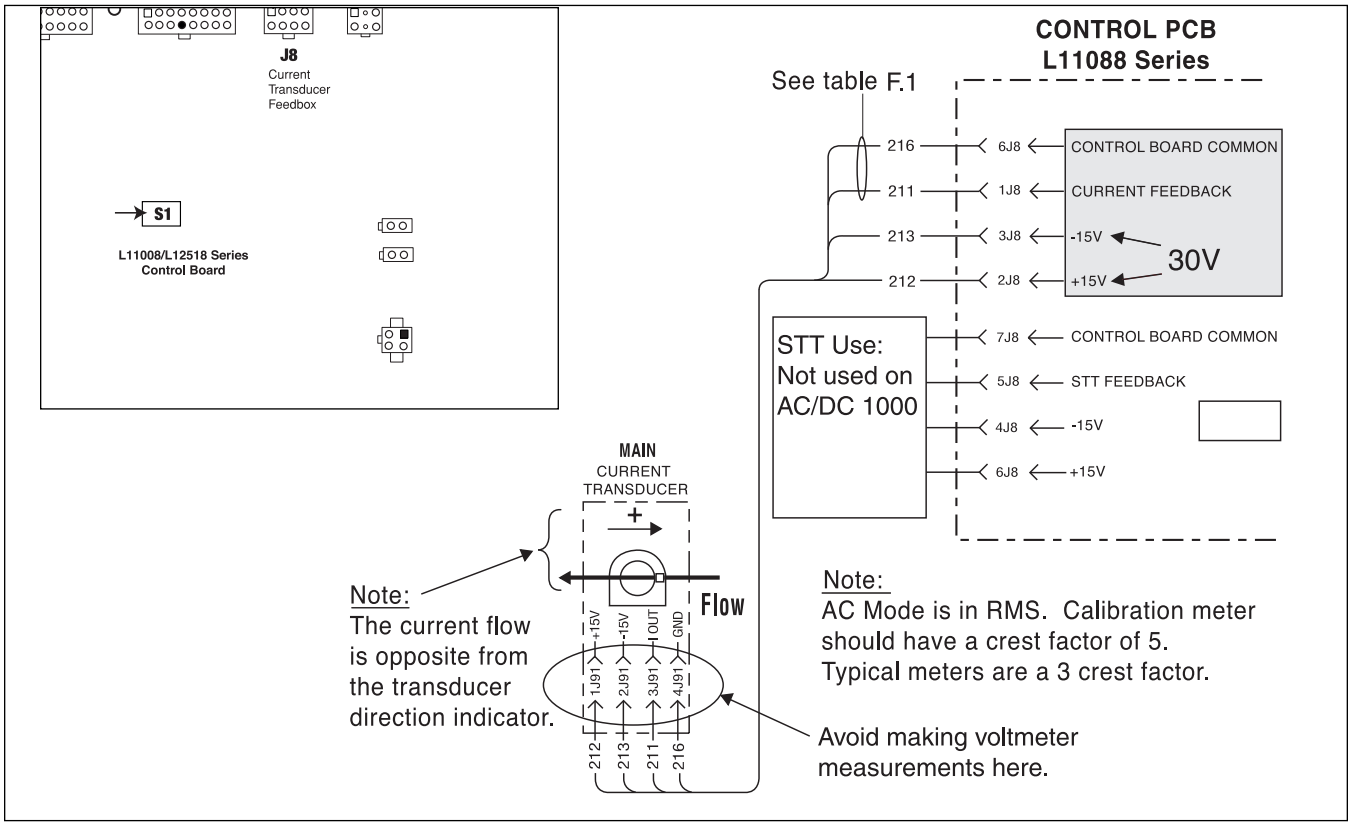
Pin 1 (lead 211 +) to pin 6 (lead 216 -) should read 8mv/amp of output current. See table F.1 for feedback voltage at various outputs.

If supply voltages are correct but feedback voltages incorrect, the Current Transducer or wiring to the Control Board may be defective.

TABLE F.1 - CURRENT FEEDBACK AT VARIOUS OUTPUT LOADS

OUTPUT LOAD CURRENT	EXPECTED TRANSDUCER FEEDBACK VOLTAGE
1000	8.0
750	6.0
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.22 - CURRENT TRANSDUCER - (S15804-2 & -5 SERIES)



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VOLTAGE SENSE LEAD CHECK

⚠ WARNING

Service and repair should be performed only by 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.

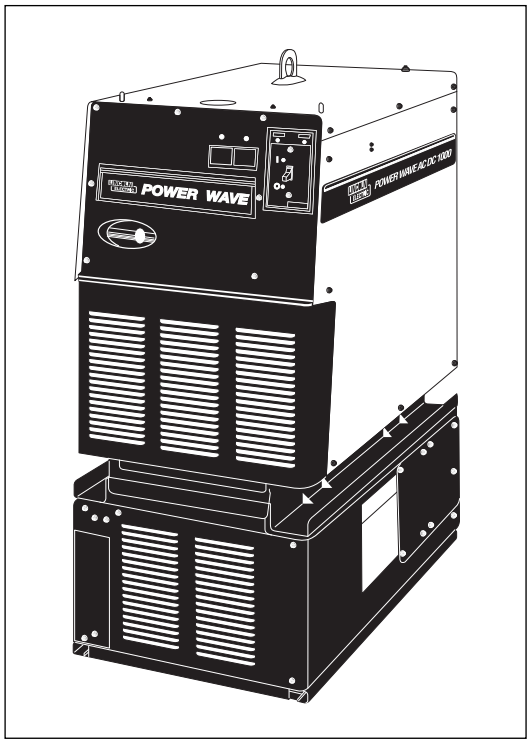
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Voltage Sense Leads are used to provide the most accurate information to the Control board. All of the POWER WAVE® AC/DC weld modes use voltage sensing. The mode determines the best sensing location.

This test will help determine where the sensing information is being lost.



MATERIALS NEEDED

Volt/ohmmeter
Wiring Diagram

VOLTAGE SENSE LEAD CHECK *(Continued)*

TROUBLESHOOTING

The sense lead matrix design is such that loss of one sense lead will give a reading on the PF-10A of approximately 1/2 of the voltage at the output studs.

The loss of both sense leads will give a reading of 0 volts even though there is voltage present at the output studs.

1. Visually check the condition of remote sensing leads if used.
2. Check the fuse in the connection box on the wire feed motor.
3. Check the continuity of the #21 (Pin i) and #67 (Pin J) leads in the K1785 Control Cable from the head to the Power Source.
4. Check Continuity of #21 lead from the Wirefeeder Receptacle in the Power source(Pin i) to the Control Board receptacle J9, Pin 6.

   If open, check integrity of connections at the Wirefeeder Receptacle, the Remote Sense Lead receptacle and choke L4. See the ***Wiring Diagram*** or the ***Machine Diagram.***

Any suspect connections in the #21 circuit can be bypassed to confirm diagnosis.

5. Check continuity of the #67 lead from the Wirefeeder Receptacle to the Voltage Sense Board receptacle J1 Pin 3. If OK, perform the ***Voltage Sense Board test.***

   A jumper from J2/Pin 1 to J1/Pin 3 at the Voltage Sense Board can be used as a temporary bypass of that board. With that jumper in place there should be continuity from the Control Board (J9/Pin4) to the Wirefeeder Receptacle. If not, use ***Figure F.23*** or the ***Wiring Diagram*** to locate the broken connection.

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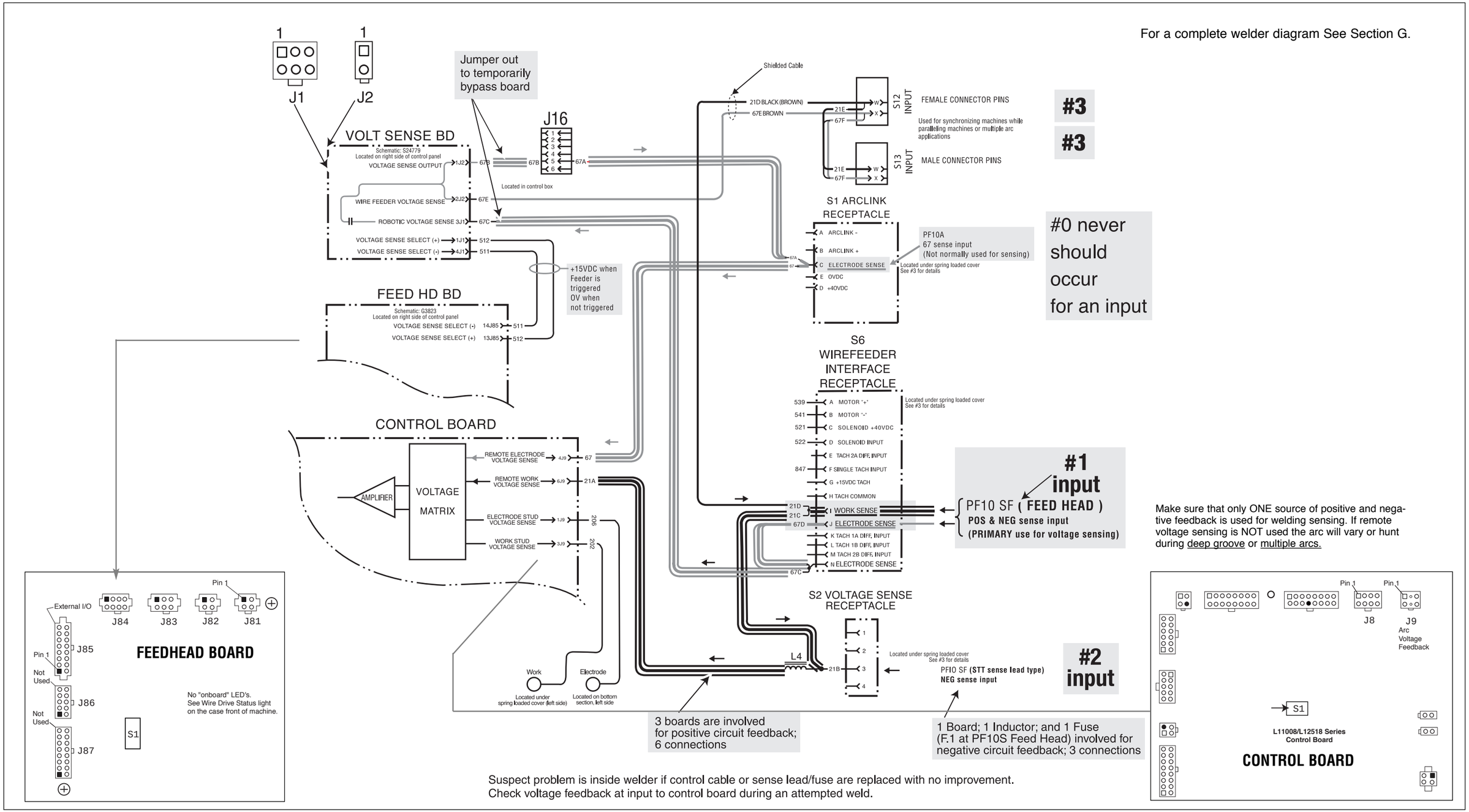
VOLTAGE SENSE LEAD CHECK

Figure F.23 – ARC VOLTAGE FEEDBACK (MACHINE SCHEMATIC)



THERMOSTAT TEST – THERMAL PROTECTION

⚠ WARNING

Service and repair should be performed only by 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.

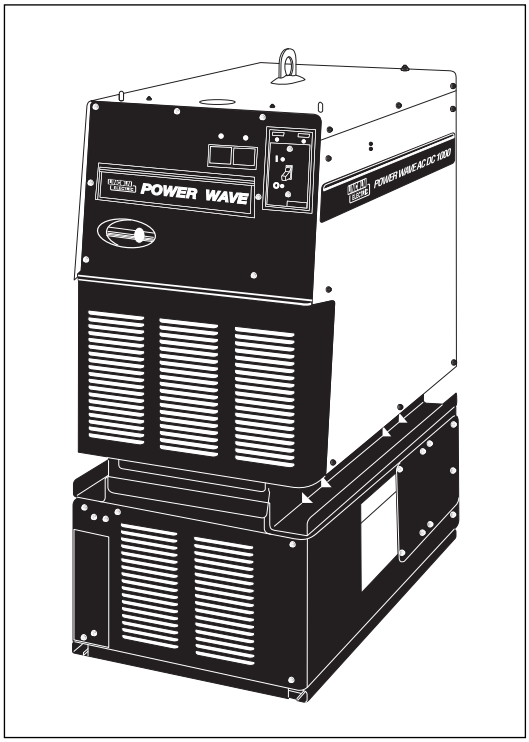
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Thermostats are located in various locations within the welding machine. See ***Machine Diagram*** for specific locations.

This test will determine if a thermostat is intermittently opening or is fully open.



MATERIALS NEEDED

Small, gauge (#18) short jumper wire
(Wire should be approximately 4 inches in length)

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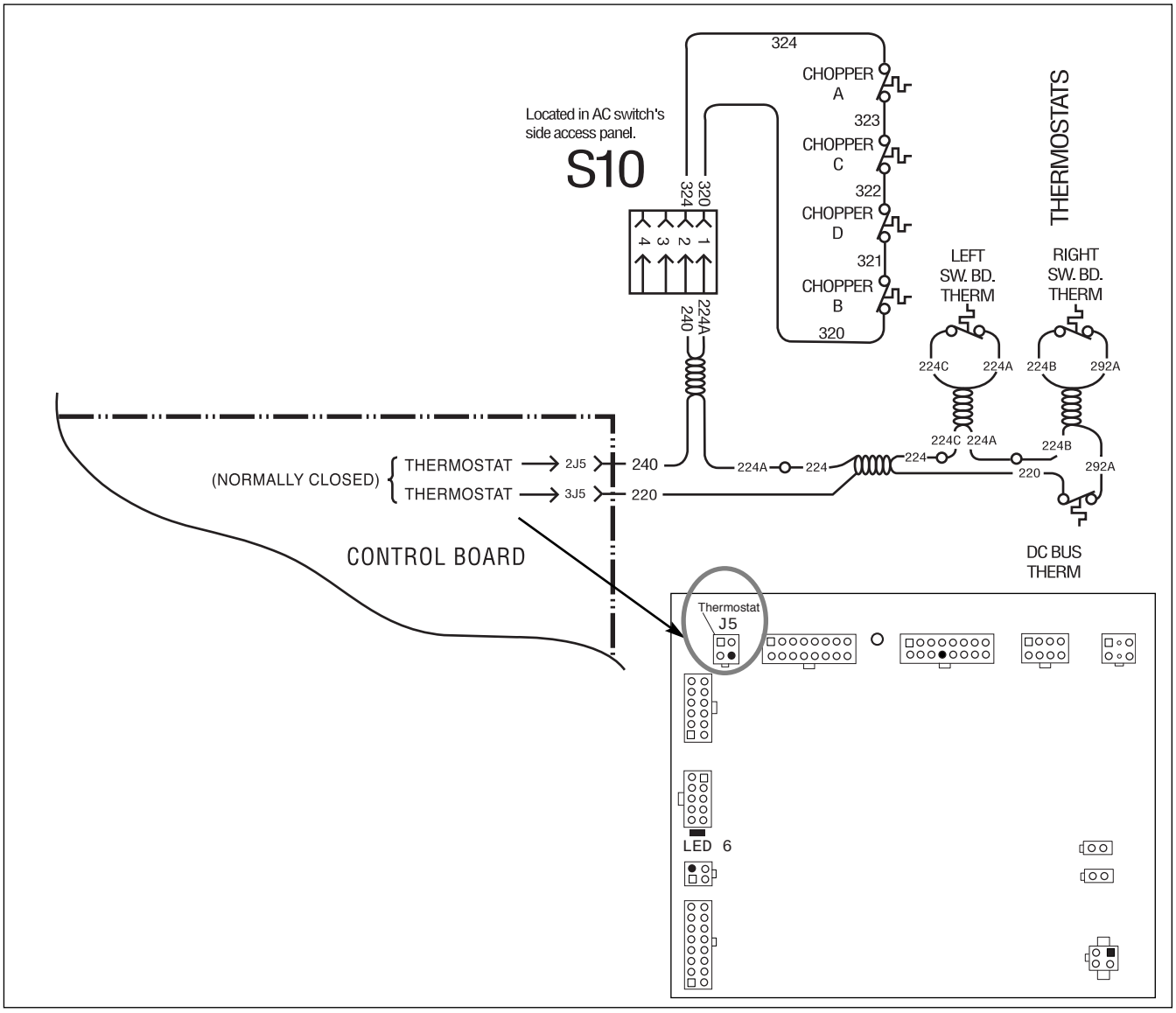
THERMOSTAT TEST – THERMAL PROTECTION *(Continued)*

FIGURE F.24 – THERMOSTAT CIRCUIT



SIMPLIFIED TEST PROCEDURE

NOTE: Never run the POWER WAVE® AC/DC 1000® under load when any of the thermostats are bypassed. This is only a means of isolating the inoperative or open thermostat.

1. Temporarily bypass thermostat circuits with a shorting jumper as follows:
   - All thermostats at the Control Board (2J5 to 3J5)
   - AC Switch Thermostats only (S10, Pins 1 & 2)
   - Switch Board Thermostats only (224 to 292A)
   - DC Bus Board thermostat only (220 to 292A) Located on DC Bus Board heat sink

All thermostats are normally closed so moving the jumper as indicated and watching the Thermal LED should help determine which thermostat or associated wiring is defective.

TACHOMETER TEST

⚠ WARNING

Service and repair should be performed only by 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.

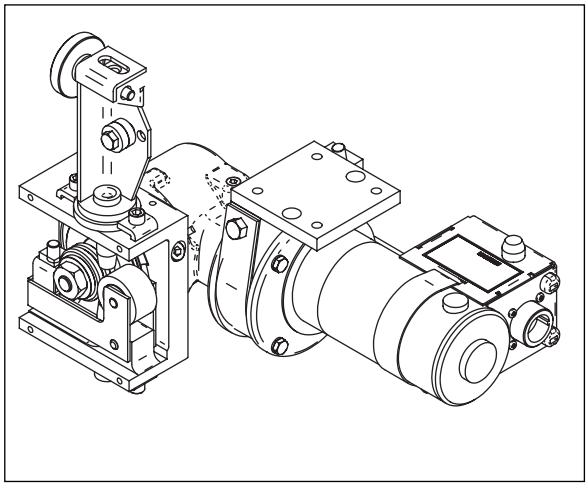
NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Tachometer is located in the connection box on the side of the PF10S Wire Feed Head Motor.

The Tach Interface Board converts a 15v pulsing signal to a 5v differential square wave signal which is sent to the Feed Head Board to regulate wire feed speed.

This test will help determine if the tachometer feedback circuit is working correctly.

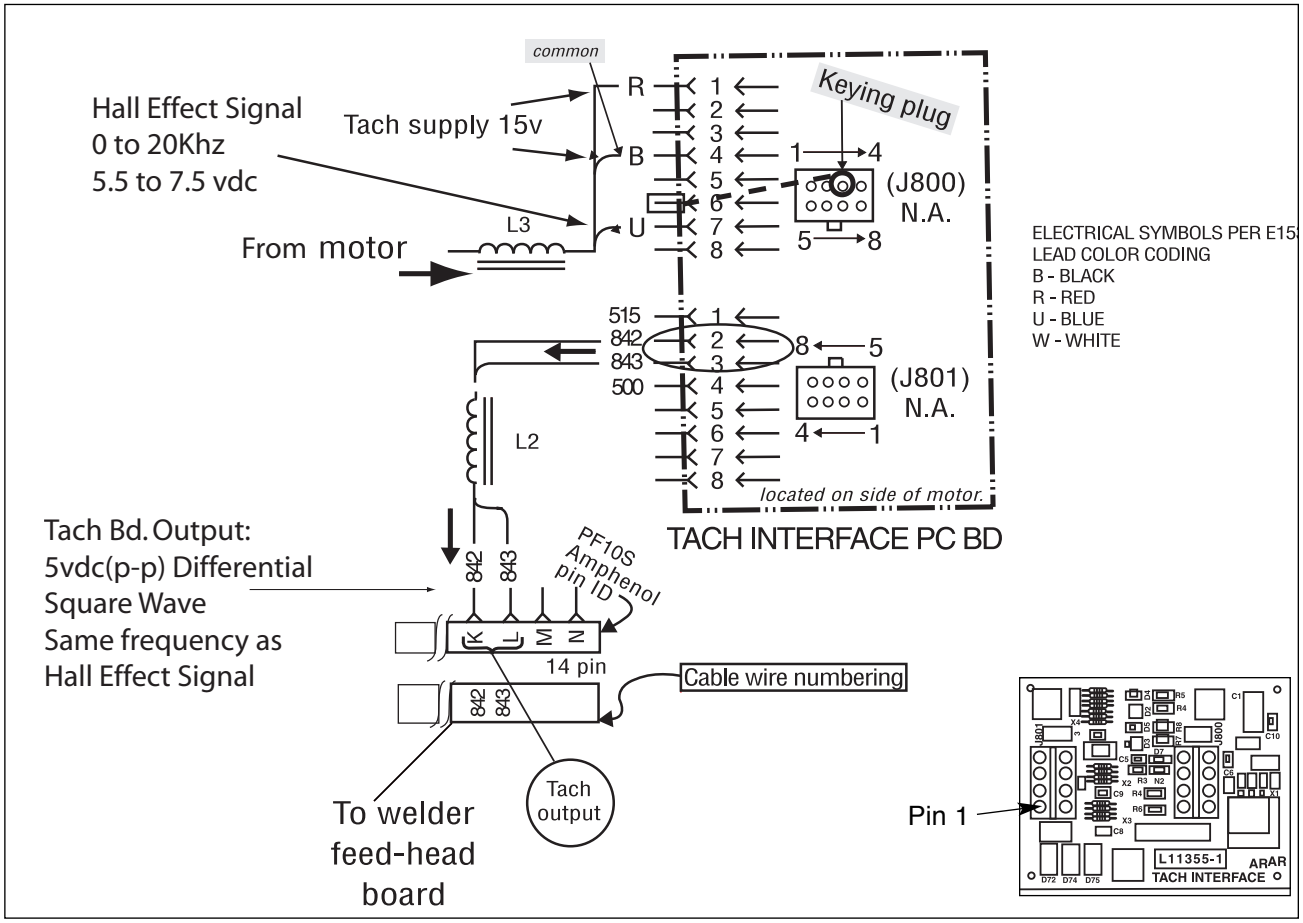


MATERIALS NEEDED

Voltmeter (with a frequency counter)

TACHOMETER TEST *(Continued)*

FIGURE F.25 – TACHOMETER SCHEMATIC DIAGRAM



TEST PROCEDURE

1. Remove the Connection Box from the Wire Feed Motor.
2. Check Tachometer signals into the Tach Interface Board from the Hall Effect Switch.

   Red to Black = 15VDC

   Blue to Black = 5.5/7.5VDC.

   Frequency = 0 to 2Khz (depending on speed)

   Approximate readings with a 142:1 gearbox.

   10 ipm = 99 Hz

   100 ipm = 975 Hz

   200 ipm = 1950 Hz
3. If supply voltage is correct but output of the Hall Effect Switch frequency is incorrect, check adjustment of switch.
   - Loosen the lock nut on Hall Effect Switch.
   - Gently “bottom out” the device and then back out 1/4 to 1/2 turn to provide about .015” clearance.
   - Re-tighten the lock nut without allowing the switch to turn.
   - Re-check Frequency per Step 2. If still wrong, replace the Hall Effect Switch
4. Check the output of the Tach Interface Board at leads 842 & 843 with a frequency meter or an oscilloscope.

   5 VDC (peak to peak) square wave .

   Frequency should match Hall Effect Switch.

Note: A voltmeter cannot be used for this test because the average voltage of a square wave signal is zero volts.

FEED MOTOR TEST

⚠ WARNING

Service and repair should be performed only by 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.

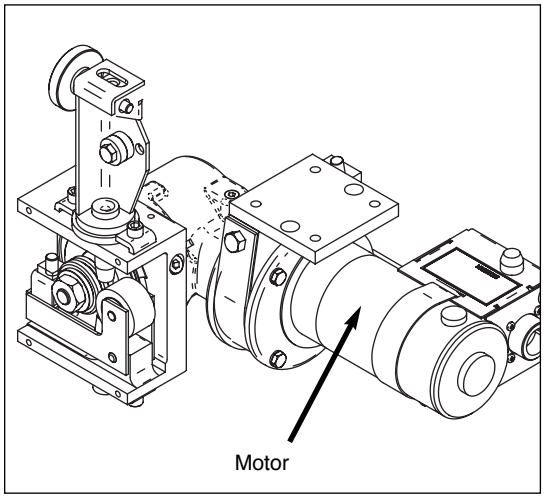
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Feed Motor is located on the PF10S weld head.

This test will help determine if the wire drive motor is working properly and is receiving correct voltages from the Feed Head Board in the PowerWave AC/DC 1000®.



MATERIALS NEEDED

Voltmeter (with a frequency counter)

NOTE: The Power Wave Manager software can be used to check Set and Actual speed and motor voltage and current.

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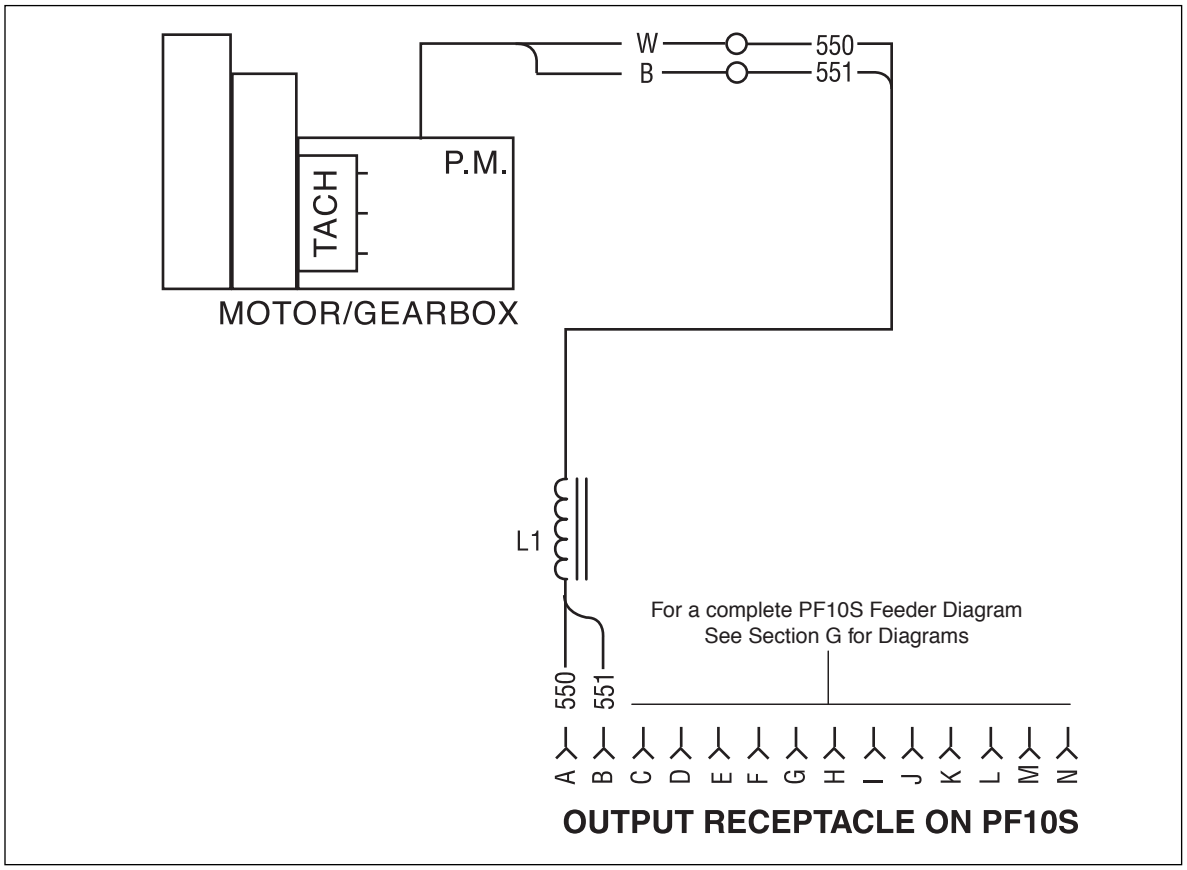
FEED MOTOR TEST

FIGURE F.26 – MOTOR WIRING DIAGRAM



FEED MOTOR TEST

1. Check the resistance of the motor armature at Pins A & B of the amphenol on the Connection Box
   - Normal resistance is approximately 5 ohms
   - Resistance from either pin to the motor frame should be >1 Megohm.
2. Check the accuracy of the wire feed speed using a K283 Tachometer or by feeding wire for a set time and measuring the length of the wire.

   Example: Set for 100 ipm and feed wire for 6 sec. It should feed 10 inches of wire. Use the Cold Inch Switch for this test.

NOTE: Dip switches and jumpers must be properly set for the gear ratio being used. See the Operator's Manual or ***Section A*** of this manual for information.

The following test can also be done using an external power supply of 32 VDC.

If the motor speed is erratic check for worn brushes or signs of arcing on the commutator that may indicate a shorted or grounded armature.

3. Check the maximum speed of the Feed Head
   - 142:1 ratio = 200-225 ipm
   - 95:1 ratio = 300-350 ipm
   - 57:1 ratio = 450-500 ipm

MOTOR OVERLOAD: Typical motor current is about 2 amps. The Feed Head Board will tolerate currents of approximately 9 amps for up to 20 seconds or 20 amps for 1/2 second. If these levels are exceeded the Feed Head Board will shut off the arc and an error code will be displayed indicating a motor problem. See the error code information in this section.

Return to Section TOC
Return to Master TOC

CHOKE TEST

⚠ WARNING

Service and repair should be performed only by 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.

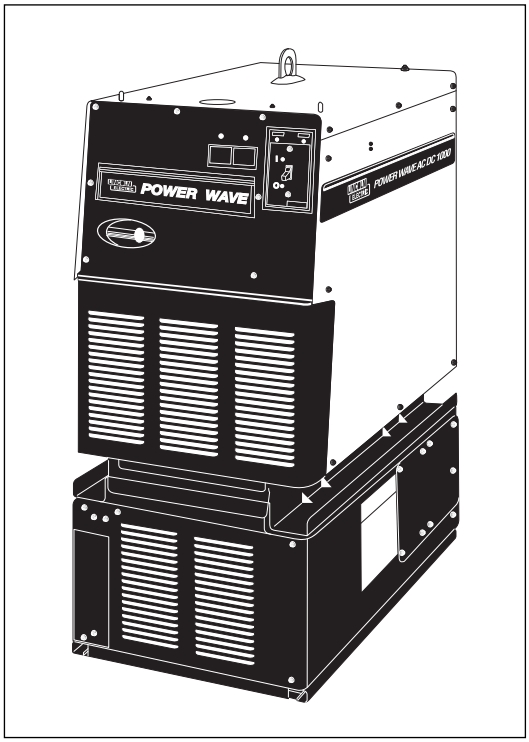
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Weld Choke is located down and in front of the AC/DC switch area.

This test will help determine if the Choke is shorted to ground or is open.

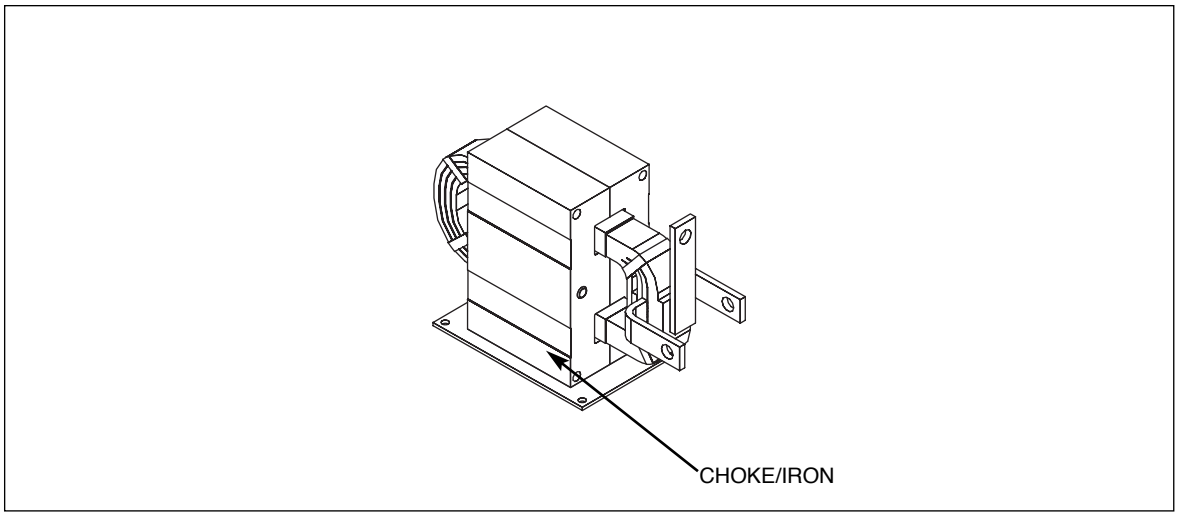


MATERIALS NEEDED

Digital volt/ohmmeter

CHOKE TEST *(Continued)*

FIGURE F.27 – CHOKE ASSEMBLY



TEST 12: CHOKE TEST

1. Using an Ohmmeter, make sure that the choke windings are not grounded to the lamination (> 1megohm).

No windings or terminal connections should look burned or over-heated. AC welding may cause choke to buzz slightly.

AUXILIARY TRANSFORMER NO. 1 TEST

⚠ WARNING

Service and repair should be performed only by 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.

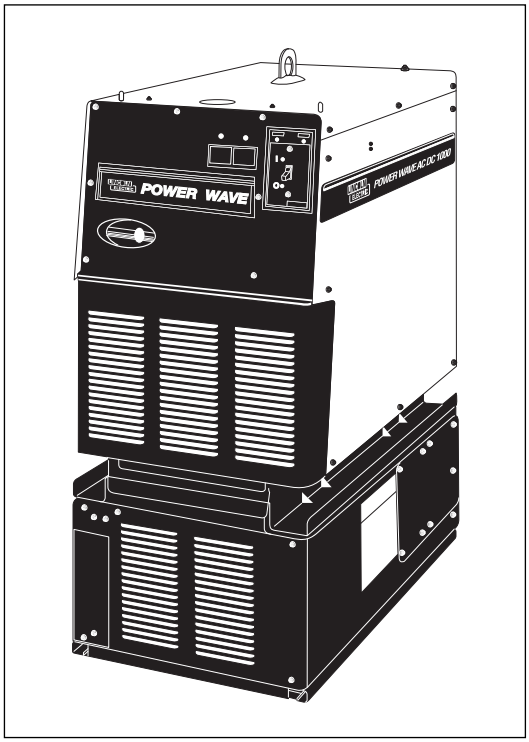
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Auxiliary Transformer is located in the top roof section of the power source on the left side.

This test will determine if the correct voltage is being applied to the primary of Auxiliary Transformer No. 1 and also if the correct voltages are being induced on the secondary windings of the auxiliary transformer.



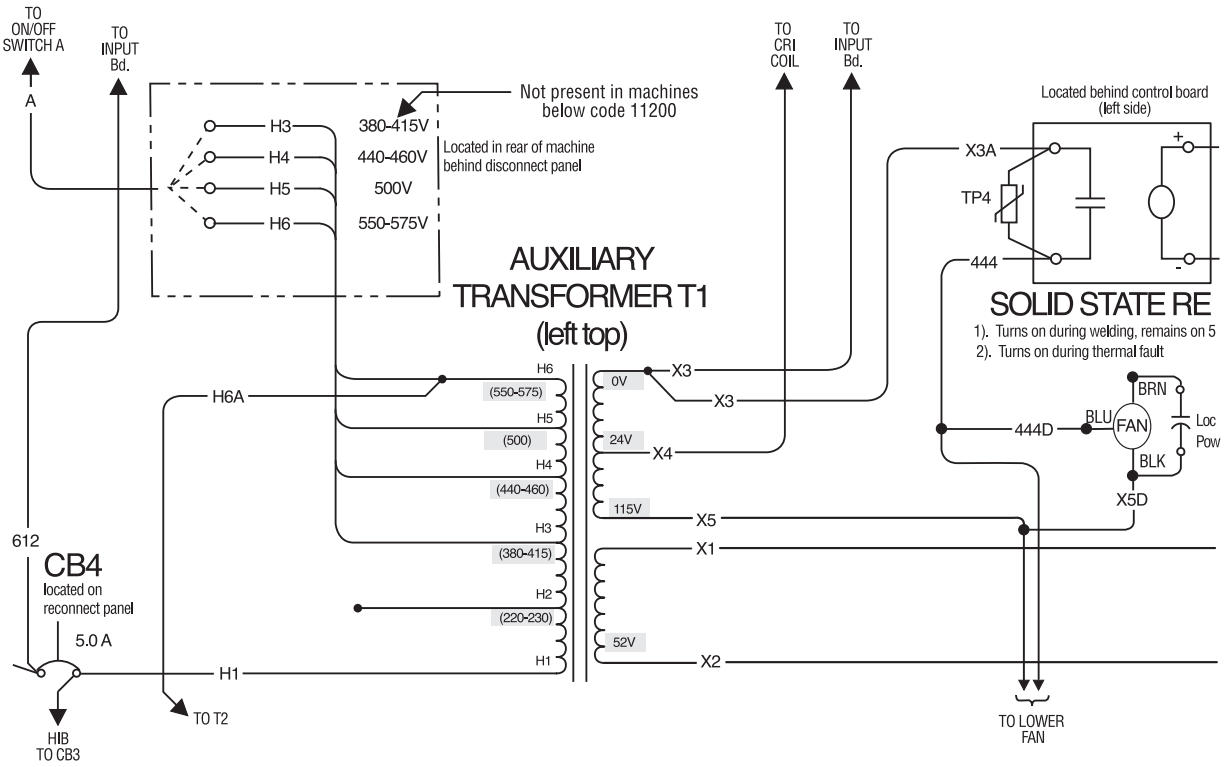
MATERIALS NEEDED

Volt-ohmmeter (Multimeter)
Wiring Diagram

Return to Section TOC
Return to Master TOC

AUXILIARY TRANSFORMER NO. 1 TEST *(Continued)*

FIGURE F.28 – AUXILIARY TRANSFORMER #1 SCHEMATIC



For a complete welder diagram that this above circuit is from see Machine Schematic in ***Section G***.

TEST PROCEDURE

⚠ WARNING

ELECTRIC SHOCK can kill.

High voltage is present at primary of the Auxiliary Transformer.

1. Remove the main input power to the POWER WAVE® AC/DC 1000® machine.
2. Remove the case top and sides.
3. Perform the ***Input Filter Capacitor Discharge procedure***.
4. Locate secondary leads X1 and X2 at Power Board Rectifier Bridge (upper left section behind control box area).

   Refer to Figure F.28
5. Locate secondary leads X3 common and X5.
6. Locate secondary lead X4 (at main contactor) and X3. See Diagram above for other points of measurement.
7. Carefully apply the correct input voltage to the POWER WAVE® AC/DC 1000®.
8. Check for the correct secondary voltages per ***Table F.2***.

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AUXILIARY TRANSFORMER NO. 1 TEST *(Continued)*

TABLE F.2 – SECONDARY VOLTAGES FOR AUXILIARY T1

LEAD IDENTIFICATION	EXPECTED VOLTAGE
X1 to X2	52 VAC
X3 to X5	115 VAC
X3 to X4	24 VAC

TEST PROCEDURE (continued)

NOTE: The secondary voltages will vary in proportion to the input line voltage.

9. If the correct secondary voltages are present, the T1 Auxiliary Transformer is functioning properly. If any of the secondary voltages are missing or low, check to make certain the primary is configured correctly for the input voltage applied.

10. If the correct input voltage is applied to the primary, and the secondary voltage(s) are not correct, the T1 transformer may be faulty.

11. If the volts on the transformer test are good, turn off the power, then disconnect the main input power. Measure isolation between all windings. See ***Figure F.28.*** Resistance reading between windings should be >1 megohm to ground. If the test fails, disconnect and check the suspected winding and test again for isolation and grounds. If fails test replace T1.

12. Replace any cables ties and insulation removed earlier.

AUXILIARY TRANSFORMER NO. 2 TEST

⚠ WARNING

Service and repair should be performed only by 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.

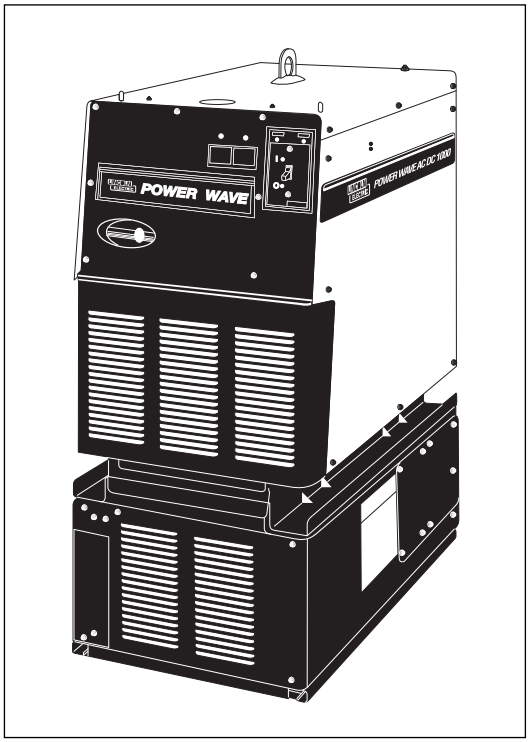
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Auxiliary Transformer is located in the top roof section of the power source on the right side.

This test will determine if the correct voltage is being applied to the primary of Auxiliary Transformer No. 2 and also if the correct voltages are being produced on the secondary windings of the transformer.



MATERIALS NEEDED

Volt-ohmmeter (Multimeter)
Wiring Diagram

Return to Section TOC
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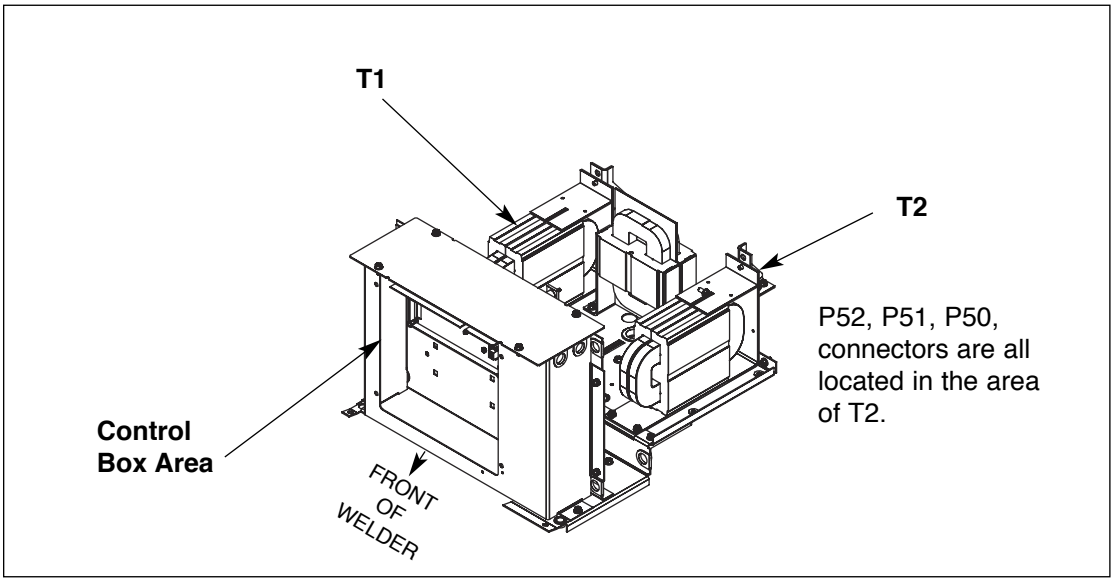
AUXILIARY TRANSFORMER NO. 2 TEST *(Continued)*

FIGURE F.29 – POWER AUXILIARY TRANSFORMER SECTION



TEST PROCEDURE

1. Remove the main input power to the POWER WAVE® AC/DC 1000® machine.
2. Remove any load that may be connected to the 115 VAC receptacle.
3. Remove the case top.
4. Locate plugs P52, P51, and P50 at the Auxiliary Transformer No. 2 . Refer to ***Figure F.30.***
5. Carefully apply the correct input power.

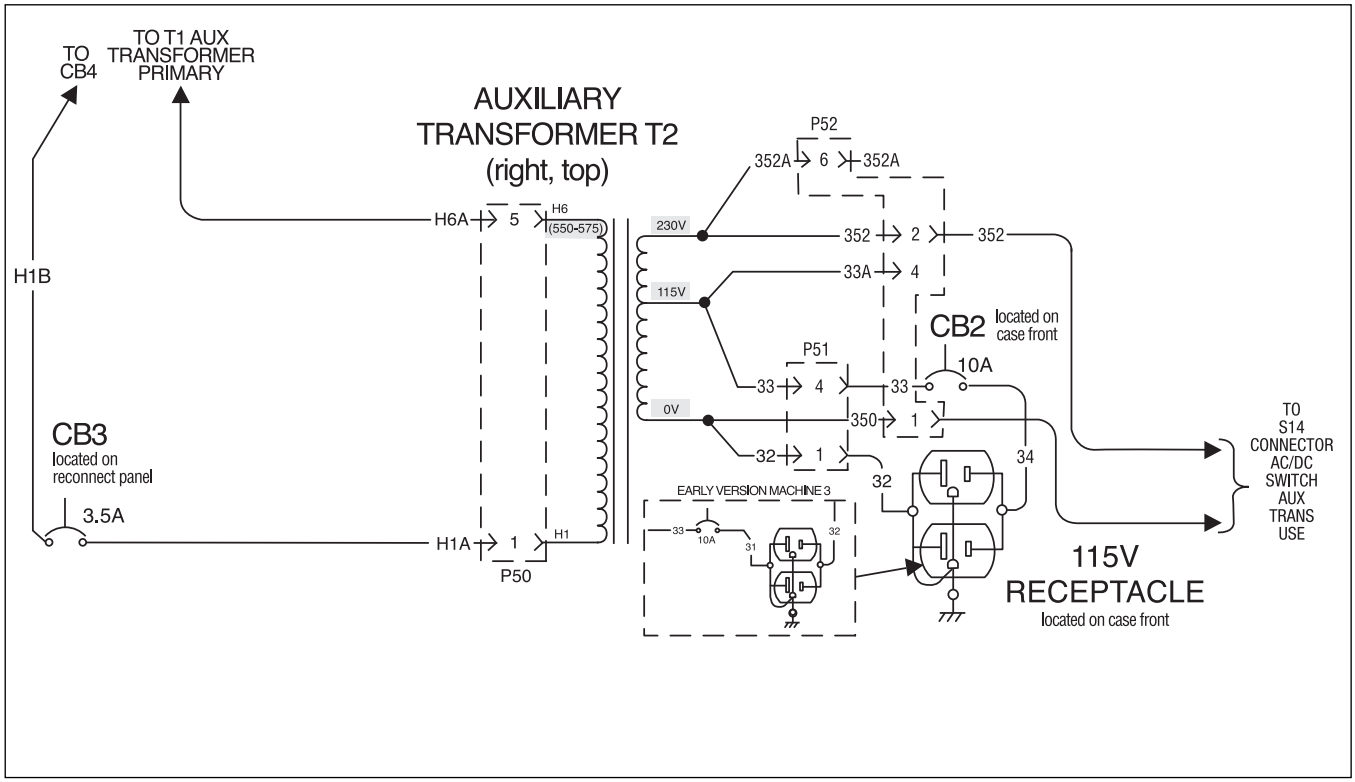
⚠ WARNING

ELECTRIC SHOCK can kill. High voltage is present at both plugs.

6. Check for 115 VAC at plug P52 per diagram ***Figure F.30***. Check for 230 VAC at plug P52.
7. If 115 VAC and 230 VAC are present, Auxiliary Transformer No. 2 is good.
8. If 115VAC and/or the 230 VAC is not present, check the associated leads and plugs for loose or faulty connections per diagram in ***Figure F.30.***
9. Carefully test for the correct AC input voltage applied to the primary windings at plug P50. See the diagram in ***Figure F.30.***
10. If the correct AC input voltage is applied to the primary of the Auxiliary Transformer No. 2 and the secondary voltages are NOT correct, the transformer may be faulty.
11. If the volts on the transformer test are good, turn off the power, then disconnect the main input power. Measure isolation between all windings. (See ***Figure F.30***). Resistance reading should be >1 megohm to ground between windings. If the test fails, disconnect and check the suspected winding and test again for isolation and grounds. If fails test replace T2.
12. Replace any cables ties and insulation removed earlier.

AUXILIARY TRANSFORMER NO. 2 TEST *(Continued)*

FIGURE F.30 – AUXILIARY TRANSFORMER T2 SCHEMATIC



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CALIBRATION CHECK

(Using a PF10A control unit and POWER WAVE® AC/DC power source)

⚠ WARNING

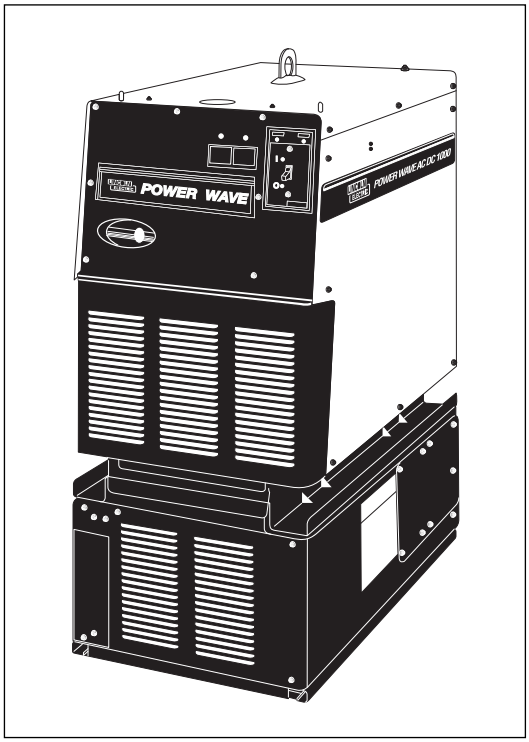
Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe 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.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

Single unit with a PF10A control box and a PF10S feed head located in the customer's weld cell setup.



MATERIALS NEEDED

This check will require:

- Grid Load (Load Bank)
- Calibrated ammeter (see Meter NOTE)
- Calibrated voltmeter (see Meter NOTE)
- 2, #4/0, 20 ft. Weld Cables.

TROUBLESHOOTING AND REPAIR

CALIBRATION CHECK *(Continued)*

Calibration accuracy is directly related to the quality of the external metering equipment. Using DC output is recommended for field calibration of the machines. Set the PF10A to test Mode 221 for DC+ and 223 for DC-. The nature of the control system guarantees if the DC values are correct, the AC values must also be correct. Test AC output on a load bank with mode 224, once calibrate check has been done in both DC polarities.

When calibrating in AC mode, the frequency, wave shape, balance and offset can adversely affect the accuracy of the typical external meter. Not recommended. A **True RMS** meter with **a crest factor of at least 6** is required for AC Calibration.

NOTE: Calibration test should be done at a 300 amp/30 volt load. Loads over 40 volts can result metering errors!

Calibration inaccuracies due to external metering can and will effect weld performance in the field. Lincoln strongly recommends calibration be performed in both DC polarities only. Test for frequency can be done in the AC test mode 224. Frequency is variable from 10 to 100 Hz.

Meter Note:

Due to the fact that this inverter supply runs at a 80 kHZ, some DC meters will not read correctly. Some meter recommendations are shown below.
All meters should be calibrated and traceable to a National Standard.

Fluke 170 series (Model 179) Voltmeter only

Voltage: +/- 50mV (slight dither - overall good performance)

Current: (across 750A/50mV shunt): +2A error, steady readout

Comments: inexpensive, good choice for infrequent use when a grid load and calibrated shunt are available.

Megger Model DCM204R

Voltage: **+.4V** error, steady

Current: +2A error, steady

Comments: A bit pricey, but it is a high quality True RMS meter with a crest factor of 6. Should give good accuracy even on unbalanced AC. Do not measure current with voltage leads attached to circuit.

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CALIBRATION CHECK

(Without Power Wave Manager Software)

TEST MODES

There are several "Test Modes" included in the weld software of the PF-10A. They are specifically for calibration and may not be used for welding. Likewise, calibration checks should not be attempted in the other weld modes.

The test modes can be accessed through the MSP-4 panel in the 'User Preferences'. See the PF-10A Operator's Manual. The recommended test modes for calibration are:

Mode 221 for DC+ , Constant Current

Mode 223 for DC - , Constant Current

PROCEDURE

1. Using two 20', #4/0 cables, connect a Resistive Load to the output studs of the POWER WAVE® AC/DC.

   Shorter leads may cause 'squealing' in the weld current circuit.

   Cables should not be coiled to minimize the inductance in the circuit.

2. Set the load bank for about a 600amp load.
3. Connect test meters to machine output.
4. Turn on the Power Source, remove the wire from the Feed Head and select Test Mode 221.
5. Activate the output using the START switch on the PF-10A and using the Volts Control along with the load bank adjustment, set the output for a reading of 600 amps at 42volts on the PF-10A displays.

NOTE: With paralleled machines, the current should divide equally between the two machines. If there is a question about the accuracy, it would be better to test them individually. Remember to set the Ethernet Board Dip Switches as required.

6. Compare the readings on the PF-10A to the calibrated test meters. If there is a significant error, use the Diagnostic Utilities Calibration Procedure to re-calibrate the system.
7. De-activate the output, select mode 223 and re-test as above without changing the load settings. The current should match the reading in Step 6 with-in +/-2%.

NOTE: Cycling input power to the welding machine will clear all test modes from PF10A lower display.

Calibration Fundamentals

If a calibration adjustment of your POWER WAVE® welding machine is required, the calibration procedure needs to be run from the Power Wave Manager Software. (See "***Calibration Procedure***" in this manual to do this.)

AC parameters can be checked using Test Mode 224 but due to the wide range of external conditions that can affect AC welding, calibration in this mode **should not be attempted.**

Some factors other than a defect in the machine, that can affect measured AC output are:

- inadequate metering
- excessive output lead lengths
- coiled output leads
- output leads are not routed side by side. (They must be together or VERY far apart to avoid changing AC arc characteristics)

A common problem when checking Voltage Calibration is that the test meters are not monitoring the same point as the POWER WAVE®. POWER WAVE® test modes **always sense at the PW1000 output studs** so that is where the test voltmeter should be connected.

CALIBRATION PROCEDURE USING POWER WAVE MANAGER SOFTWARE

(Found at www.powerwavesoftware.com)

MATERIALS NEEDED:

Power Wave Manager software

Laptop or other suitable computer

Computer connection cables

Resistive load bank

Calibrated test meters (***see Meter Note***)

FIGURE F.32 – POWER WAVE MANAGER (CALIBRATION SCREEN)

Calibration of the POWER WAVE® AC/DC 1000® should be done after the following situations:

Calibration check indicates voltage or current inaccuracy.

Replacement of Control Board or Current Transducer.

Calibration is performed using the ***Calibration*** page in the Power Wave Manager software. See Figure F.32.

CAUTION: READ COMPLETE INSTRUCTIONS BEFORE PROCEEDING WITH ACTUAL CALIBRATION. If questions arise, contact the Lincoln Electric Service department for assistance.

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Return to Section TOC
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TROUBLESHOOTING AND REPAIR

CALIBRATION PROCEDURE *(Continued)*

CALIBRATION SCREEN REVIEW & RECOMMENDATIONS

Calibration Tab

⚠ WARNING

Machine output can be turned "on" with this screen.

Feedback Information

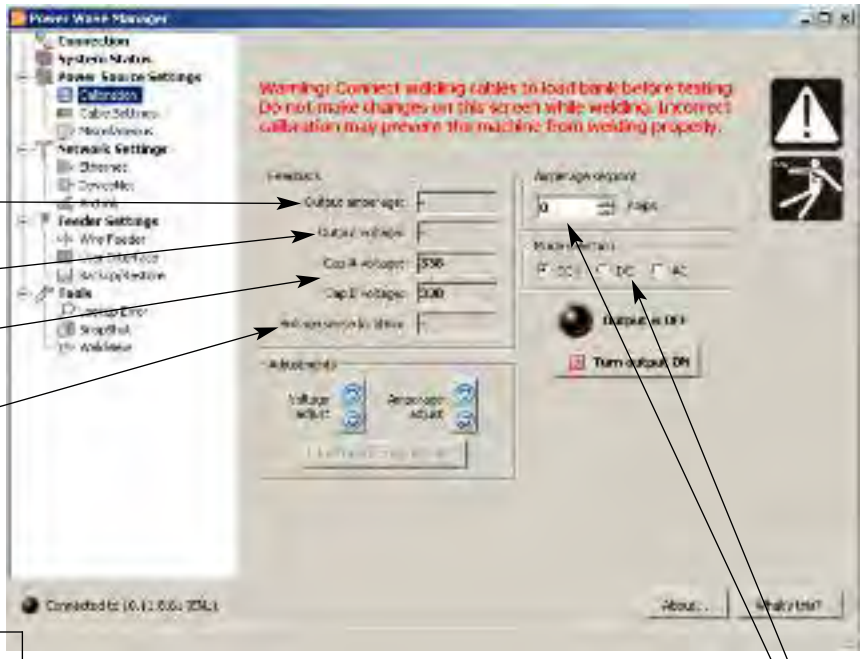
- Output Current – Value of Current Sensor Device (transducer).
- Output Voltage – Value of Voltage Sensoring point.
- Capacitor Group A and B Voltage values
- Voltage Sense Location – should be sensing at studs for calibration

Current Set Point for:

350A machine set to 300A
450A machine set to 300A
650A machine set to 300A

1000A machine set to 500A

FIGURE F.33 – POWER WAVE MANAGER (CALIBRATION SCREEN)

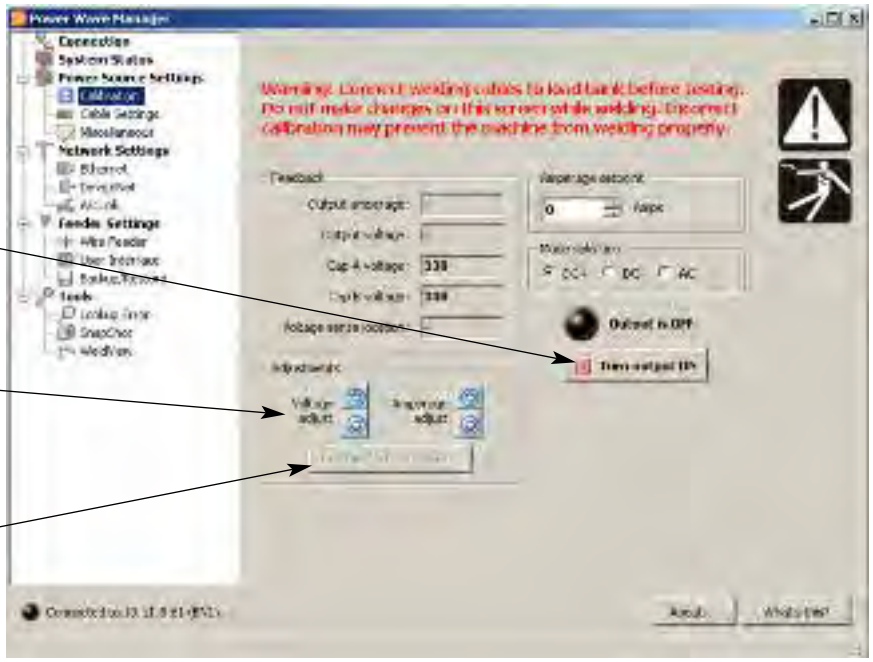


AC/DC Control

AC/DC Specific Calibration

- DC+
- DC-
- AC 60 Hz

FIGURE F.34 – POWER WAVE MANAGER (CALIBRATION SCREEN)



Calibration Tab

TURN OUTPUT ON

- Enables output for calibration
- Light will flash Red when output is "ON"

CALIBRATION ADJUSTMENT

- System will automatically adjust output levels as changes are made

Restore Factory Defaults

- Restore Factory Defaults is not applicable to Power Wave® AC/DC 1000®.

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Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

CALIBRATION PROCEDURE *(Continued)*

FIGURE F.35 – POWER WAVE MANAGER (CALIBRATION SCREEN)

Calibration Tab Note:

- Incorrect Calibration can cause welding problems. It is a good practice to run snapshot from the Tools section before making any adjustments.

Recommended Procedure

- Adjust resistance load bank for 500 amps at approximately 35 volts
- Select DC+.
- Select Current Set Point of 500 amps
- Turn output “ON” button.
- Use software adjustments to trim the feedback values to match actual values. (test meters).
- Wait for values to stabilize
- When complete Turn output “OFF”.

NOTE: Make sure the test meter leads are connected to the output studs of the POWER WAVE®. Calibration is performed in DC+ only. Machine output may be checked in DC- and AC but should not be calibrated with those modes.

Quick Current Procedure Calibration

- Use at least a 10 ft #4/0 weld cable connected between the POWER WAVE® AC/DC 1000® output studs.
- Turn output “ON”
- Use software adjustment to trim the Current Feedback values to match the actual values. (test meters)
- Wait for values to stabilize
- When completed Turn output “OFF”
- Remove shorting cable from output studs.

Voltage calibration requires use of a grid load as described.

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INPUT CONTACTOR TEST

⚠ WARNING

Service and repair should be performed only by 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.

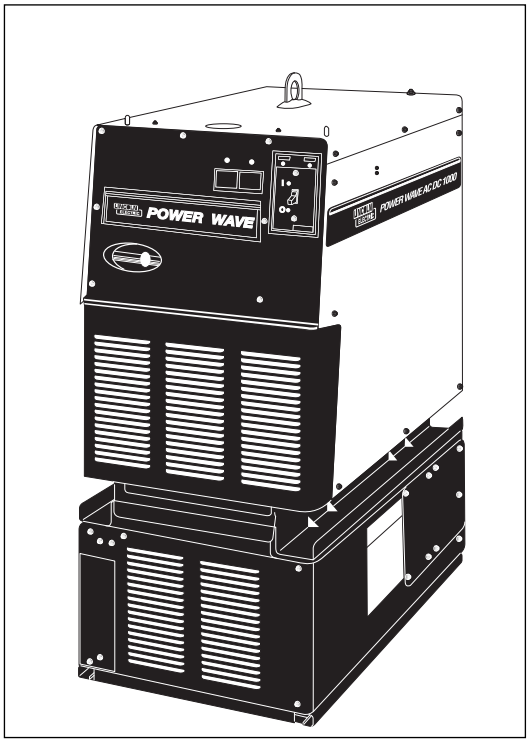
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Input Contactor is located in reconnect area, which is at the rear of the top section of the power source.

This test will help determine if the input contactor is functional and if the contacts are functioning correctly.



MATERIALS NEEDED

Volt-ohmmeter
External 24 VAC supply

INPUT CONTACTOR TEST *(Continued)*

FIGURE F.37 – INPUT CONTACTOR COIL

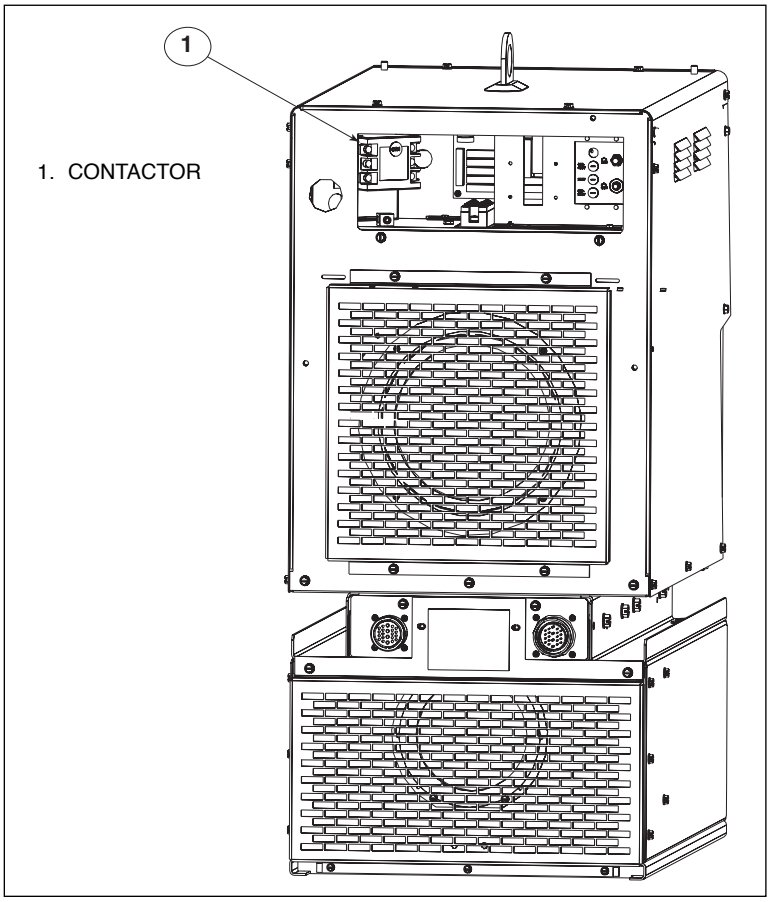


FIGURE F.38 – INPUT CONTACTOR

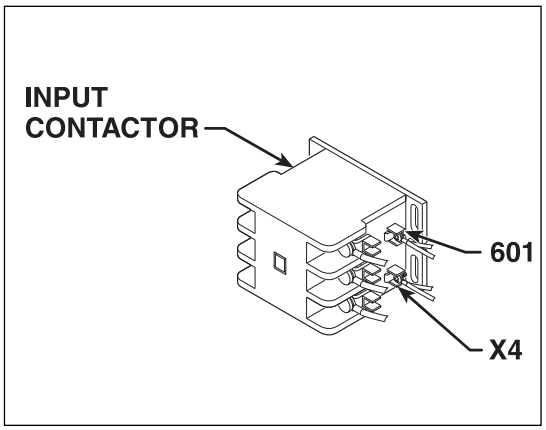
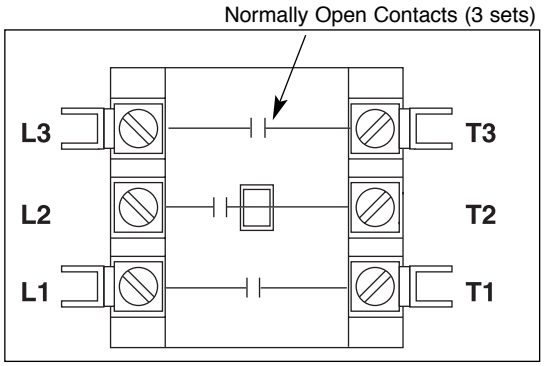


FIGURE F.39 – Contactor Test Points



TEST PROCEDURE

1. Remove input power to the POWER WAVE® AC/DC 1000®.
2. Remove the input access panel and case top.
3. Locate, mark, and remove the two leads (601, X4) that are connected to the Input Contactor coil. Refer to Figure F.38.
4. Using the external 24 VAC supply, apply 24 VAC to the terminals of the Input Contactor coil. If the contactor does NOT activate, the Input Contactor is faulty. Replace.
5. With the Input Contactor activated, check the continuity across the three sets of closed contacts. (Zero ohms or very low resistance is normal.) Refer to Figure F.39. If the resistance is high, the Input Contactor is faulty. Replace the Input Contactor.

6a. When the contactor is NOT activated, the resistance should be infinite or very high across the open contacts. If the resistance is low, the Input Contactor is faulty. See Figure F.39 for reference.

6b. Take off contact cover to inspect moving contacts and stationary contacts for heating effects (discoloration of contacts). Loose connection and arcing under high currents can cause this. Replace the complete contactor if necessary (no parts are available for the contactor itself).

6c. Replace contactor cover.

7. Reconnect the two leads (601, X4) to the Input Contactor Coil.
8. Install the Input Access Door and case.

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FEED HEAD BOARD TEST

⚠ WARNING

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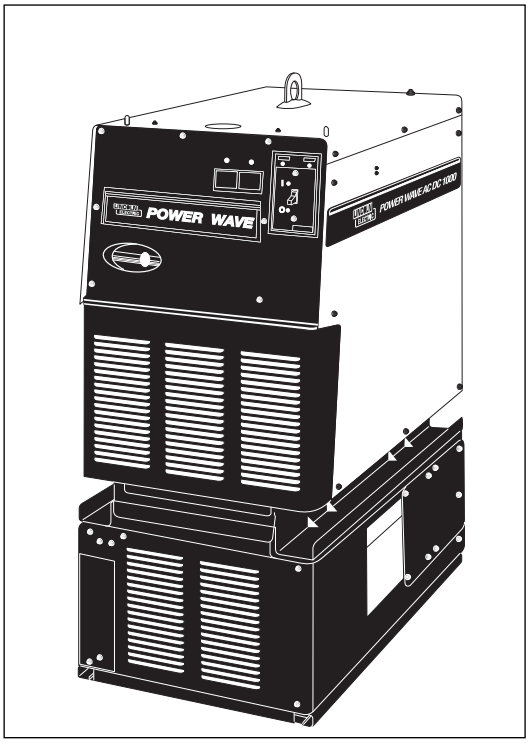
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Feed Head Board is primarily responsible for driving the wire feed motor at the proper speed and in the proper direction. It also communicates with the Control, Ethernet and Voltage Sense Boards

This test will help determine if the Feed Head Board is functioning properly.



MATERIALS NEEDED

Volt-ohmmeter

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FEED HEAD BOARD CHECK

Testing of the Feed Head Board for control of wire feed speed, stability and accuracy must be done with the power source connected to a PF10S Feed Head with a PF10A Interface. If not being tested at the installation site, it is preferable to duplicate that set-up as closely as possible.

There are no troubleshooting LED's on the Feed Head Board, but there is a Status LED on the front of the POWER WAVE® that will indicate Error Codes relating to the wire feed system. The Status Light table in this section can be used to identify the feed head issues.

TEST PROCEDURE

1. Wire does not feed at all (weld mode or cold inch), Status LED is steady Green and PF-10A displays 'set speed'.

   A. Check for DC volts (0 to 32 V) at J83, Pin1(+) to pin2(-) when Cold Inch switch is pressed.

      If voltage is present, check connections and the wire feed cable.

      Perform the ***Feed Motor test.***

   B. If no voltage, check the D-6 diode and connections to J83, Pin5 and Pin6.

      Possible defective Feed Head Board

2. Motor runs steady and can be controlled but speed is incorrect.

   A. Make sure DIP switches are set correctly for the gear ratio being used. (For 57:1 ratio make sure that there is a jumper from pin 5 to pin 12 of the External I/O Connector).

3. Motor runs but speed cannot be controlled.

   A. Perform the ***Tachometer Test***.

   B. Check connections from the Feed Head to the Board.

      Possible defective Feed Head Board.

4. Motor speed is erratic.

   A. If using a Constant Current weld mode, check weld procedures. (motor speed reacts to arc voltage changes and may even change direction with momentary shorts.)

      Perform ***Sense Lead Routing and Weld Cable Check***.

      Perform ***Feed Motor test***.

      Note: The Power Wave Manager software (Wire Feeder screen) can be used to check the motor parameters.

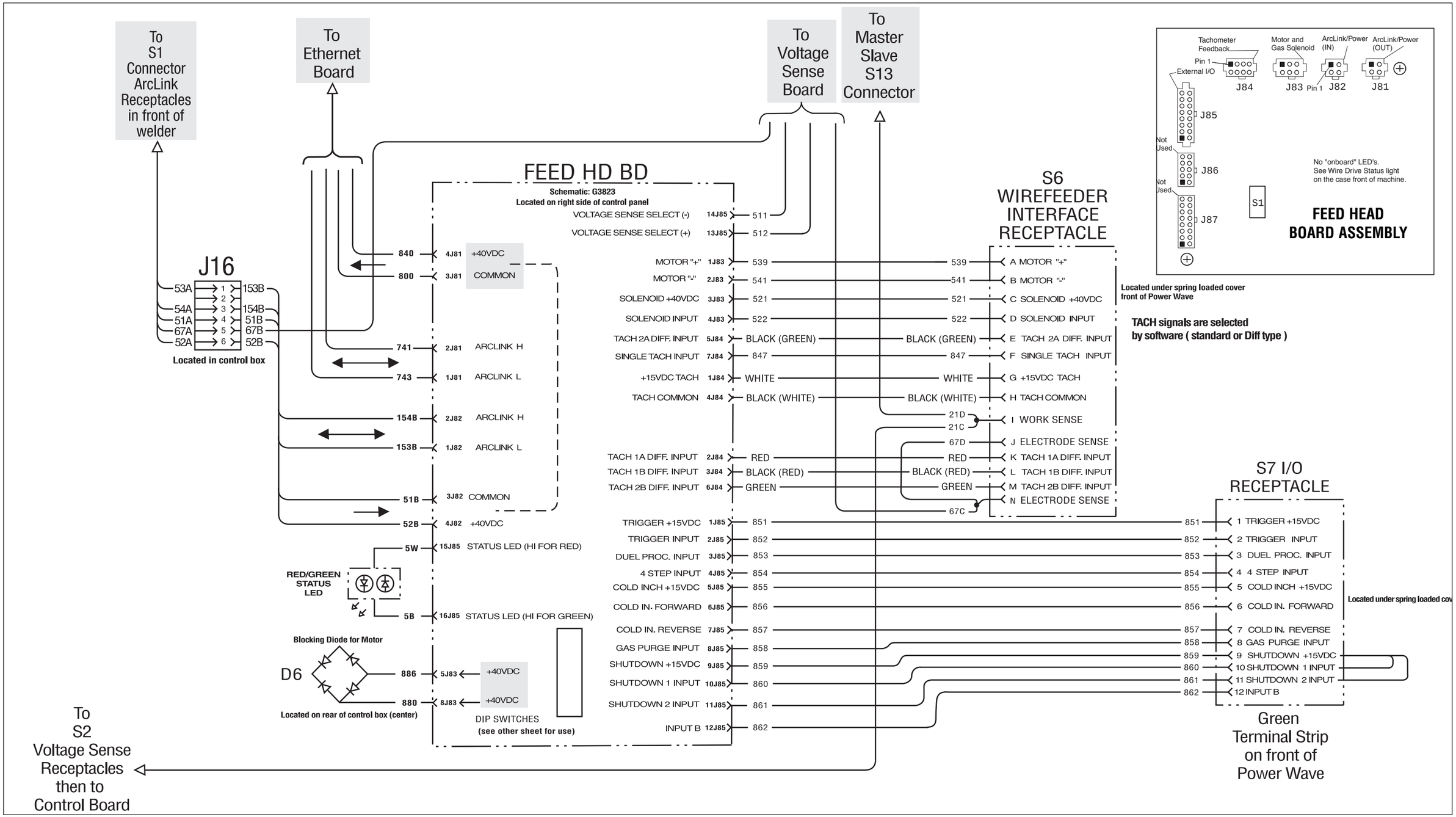
   B. Make sure the proper gear ratio is being used for the electrode size. Too low a ratio may cause excessive motor currents.

      Possible defective Feed Head Board

5. Make sure that the proper operating software is flashed into the Feed Head Board. The wrong software can cause the board to function improperly. The Software Version can be checked using the Power Wave Manager software or from the PF-10A MSP4 panel.

FEED HEAD BOARD CHECK *(Continued)*

FIGURE F.40 – FEED HEAD BOARD



Return to Section TOC
Return to Master TOC

CONTROL BOARD CHECK

⚠ WARNING

Service and repair should be performed only by 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.

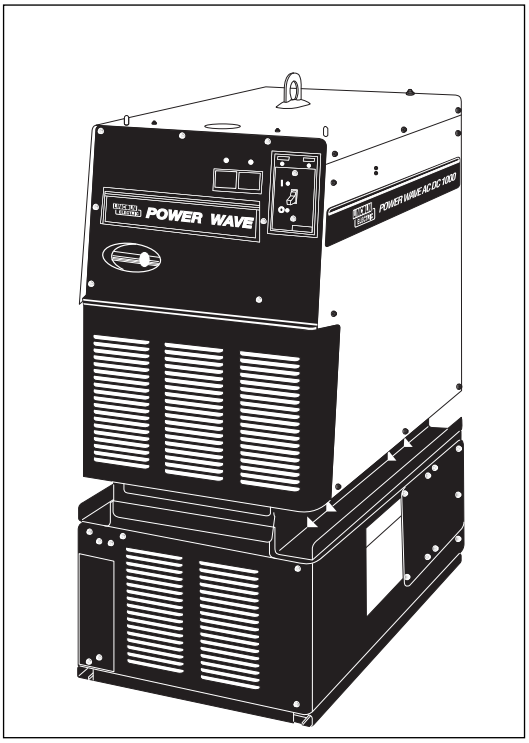
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Control Board performs te primary interfacing functions to control to establish and maintain control of the PW AC/DC 1000® output. It also monitors and/or controls most other areas of the system via the arclink communications connections.

This test will help determine if the Control Board is functioning properly.



MATERIALS NEEDED

Volt-ohmmeter

Return to Section TOC
Return to Master TOC

CONTROL BOARD CHECK

Since the functions of the Control Board are primarily software related, there are not very many tests to be performed that will help in diagnosing a problem with the board itself. Elimination of problems in the areas where loss of function is taking place will help decide by process of elimination if the Control Board is the defective component. As a result, the troubleshooting chart will typically recommend other areas to be tested before the Control Board.

If the Control Board does seem to be the most likely solution, perform the checks outlined below, and then try downloading the latest software into the machine. If a solution is still not evident, use the Diagnostic facility to take a “snapshot” that can then be sent to the Lincoln Service Department via e-mail for assistance in determining where the problem. Contact the Lincoln Service Department at 1-888-935-3877.

TEST PROCEDURE

1. Check the LED’s on the Control Board. Compare the pattern to Page 3 of the ***Machine Schematic***.

   Normal operation will show 8 Green LED’s ON and both Red LED’s OFF.

   Green LED’s 1 through 8 indicate the presence of the various DC supplies to the Board.

   LED 7 (red) will only be ON in the event of a Primary Overcurrent. Cycle the Power Switch to reset LED 7.

   LED’s 9 (green) & 10 (red) will mimic the Status LED on the front panel in the event of an error. If the Status LED is OFF, these will still indicate the error code.

2. If any of the Green LED’s 1 through 8 are not lit or are dimmer than the others:

   Turn the power off and disconnect all of the Control Board Molex connectors except J4 and turn the power back on. If the LED(s) in question stay the same:

   Check the DC voltage levels in connector J4. See the ***Machine Schematic*** for correct readings.

   If voltages are correct, replace the Control Board. If not, replace the Power Board.

3. If LED’s 9 & 10 are flashing an error code and all other LED’s are correct:

   Check the Error Code list in this section to determine where the problem may be.

   If the Error Code is not listed, contact the Lincoln Service Department for determination.

4. Check the DIP switches. In a single machine setup, switches 1 through 7 should be OFF. Switch 8 should be ON if a remote sense lead is attached.

   Incorrect DIP switch settings on the Ethernet Board can result in Error Codes. Check in Section A for proper settings.

NOTE: If any switches need to be changed because the machine was removed from a multi machine application be sure to write down their position before changing them so they can be properly reset when the machine is returned to it’s position.

Return to Section TOC
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ETHERNET BOARD CHECK

⚠ WARNING

Service and repair should be performed only by 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.

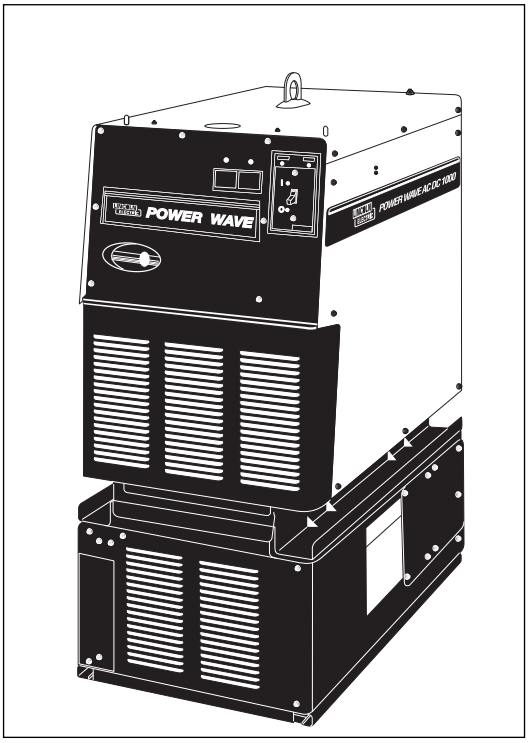
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Ethernet Board makes the translation between Arclink and either Arclink, Devicenet or Ethernet protocols that may be used in any external equipment.

This test will help determine if the Ethernet Board is functioning properly.



MATERIALS NEEDED

Volt-ohmmeter

Return to Section TOC
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ETHERNET BOARD CHECK

The Ethernet Board contains 4 DIP Switch packages that are used for setting up multiple machine applications. Incorrect switch settings can appear as a malfunctioning board. The information for the various applications is found in Section A of this manual or in the Operator's Manual for the POWER WAVE® AC/DC 1000®. If any of these switches need to be changed for troubleshooting, the positions as received should be recorded so they can be reset before being reinstalled into it's system.

From the factory, the Ethernet Board is set for "Dynamic IP address". If the machine is to be connected into a customer's network, the customer must assign a fixed IP address. The software CD (S26122) provides this information.The IP address needs to be recorded so it can be reset if the Ethernet Board has to be replaced. An incorrect IP address can cause the machine to not function properly when reconnected into it's network. The IP address can be found using the Diagnostic Software or through the MSP4 panel of the PF-10A.

Troubleshooting is done primarily with the LED's on the Ethernet Board. ***Figure F.43*** and Table F.3 show the location and function of the LED's. Tables F.4 and F.5 show possible variations of the Arclink and Devicenet Status LED's.

TEST PROCEDURE

1. Check for 40VDC supply from Feed Head Board at J72 pins 3(-) & 4(+). See ***Figure F.41*** or ***Machine Diagram.***
2. Check the +5VDC SPI supply at J77 pins 1(+) & 10(-).See ***Figure F.41*** or the ***Machine Diagram.***
3. Check LED's for fault indication per Tables F.3 and F.4.
4. Figures F.45 through F.47 refer to the DIP switch settings. If changed for troubleshooting, they may need to be reset before machine is reinstalled into it's application.

Table F.3 ArcLink Status LED's

Green	Red	INDICATION
OFF	OFF	Offline: Check power, or configuration
ON	OFF	Online and operational
FLASH	OFF	System Mapping
*OFF	FLASH	Non-= recoverable system fault: • Error code numbers flash red with long pause between digits • Green flash between codes

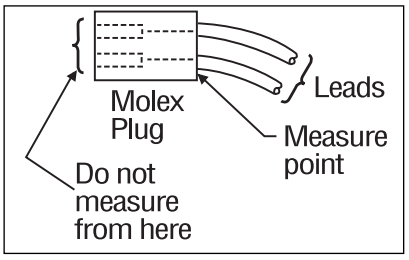
Table F.4 DeviceNet Status LEDs

Green	Red	INDICATION
OFF	OFF	Offline: Check power, or configuration
ON	OFF	Online and operational
FLASH	OFF	Online, but not connected/allocated *(Not connected to Device Net system)*
OFF	FLASH	Minor fault or connection time-out (will clear itself)
OFF	ON	Unrecoverable fault *(Check Dip Switch and baud rate setting)*

Caution: Do not probe into Molex pins that go to the board side connections of Molex. Pin damage occurs to small terminals.

TIP: Measure or probe on the lead side of Molex (harness side). See Figure F.42.

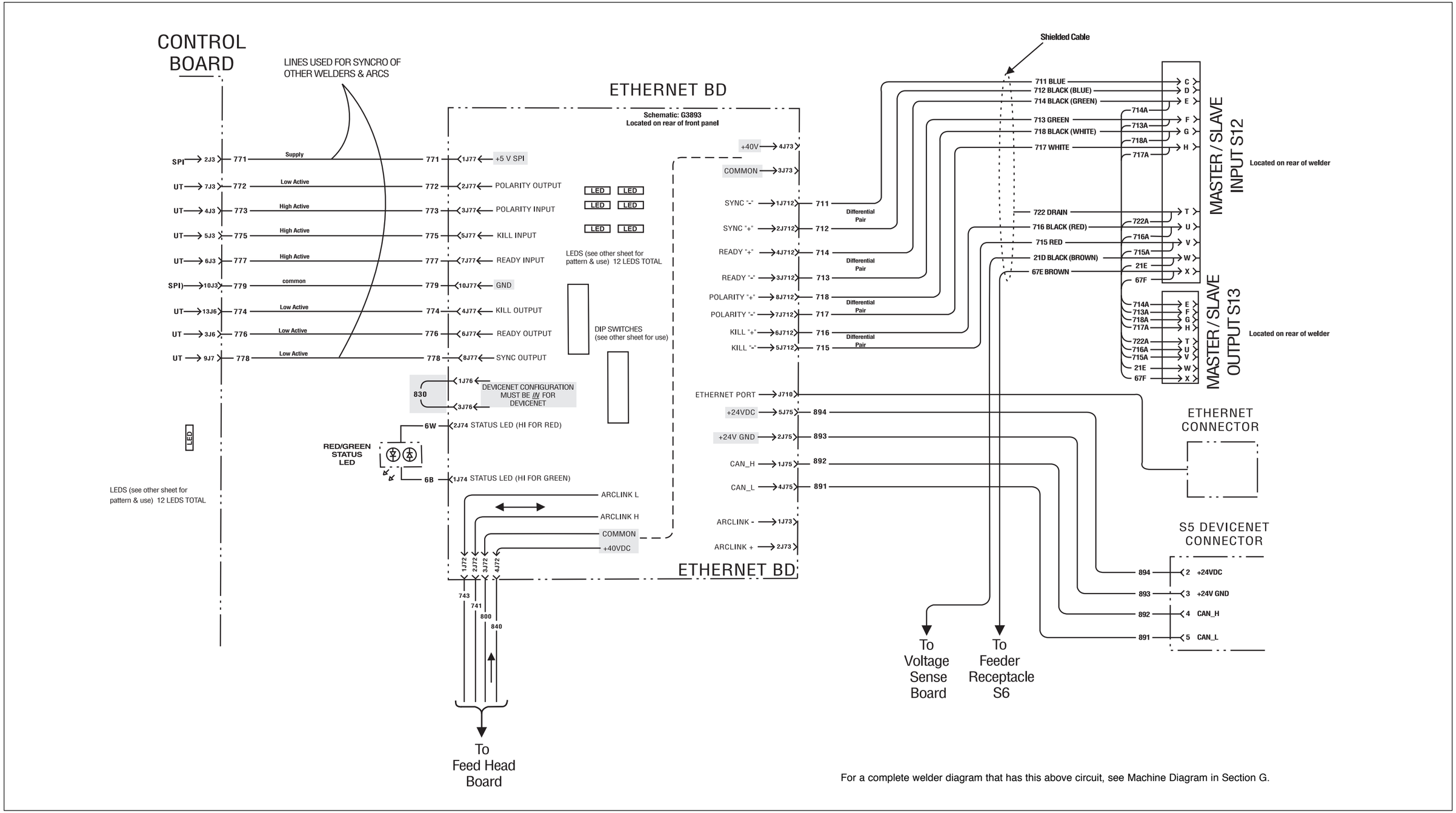
FIGURE F.42 – MOLEX PLUG



TROUBLESHOOTING AND REPAIR

ETHERNET BOARD CHECK *(Continued)*

FIGURE F.41 – INPUT/OUTPUT DIAGRAM



For a complete welder diagram that has this above circuit, see Machine Diagram in Section G.

Return to Section TOC
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TROUBLESHOOTING AND REPAIR

ETHERNET BOARD CHECK *(Continued)*

FIGURE F.43 – ETHERNET GATEWAY PCB STATUS LED's

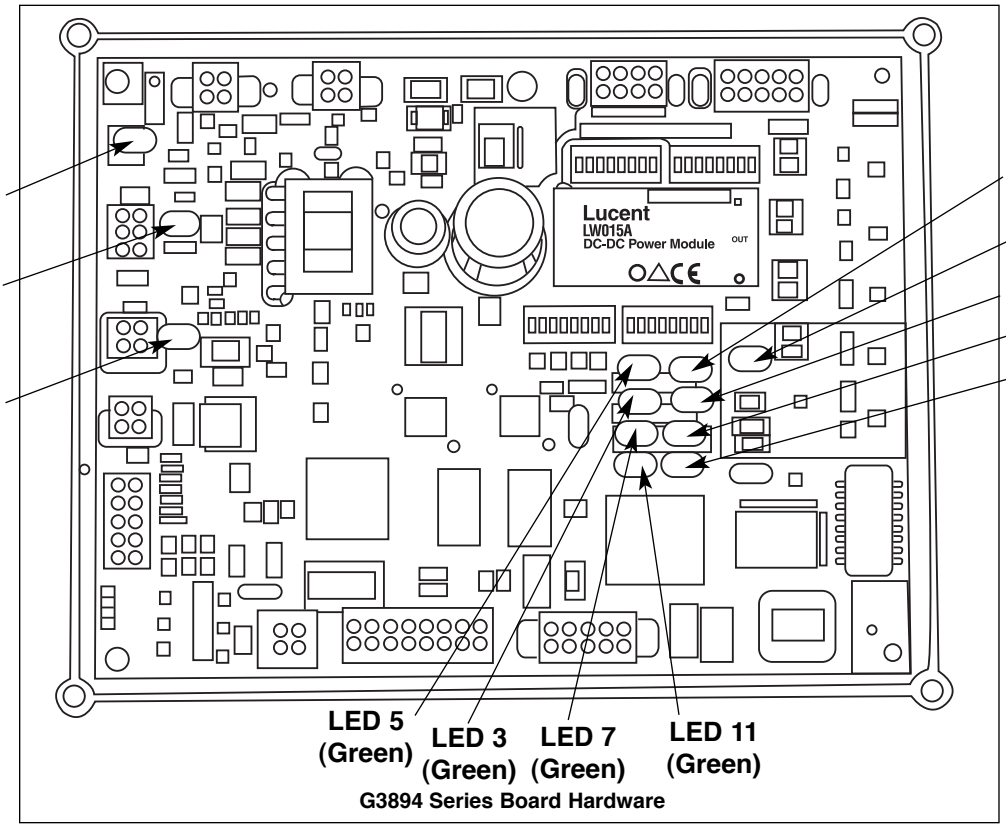

Table F.5 L11046 Ethernet Gateway PC Board Status LED's

LED#	COLOR	NORMAL STATUS	FUNCTION
1	Green	ON	Indicates Isolated Module Section Supply is ON *(+5 on board generated supply)*
2	Green	ON	Indicates DeviceNet Supply is ON *(+5 on board generated supply)*
3	Green	ON	ArcLink Status Indicators Main system Salve ArcLink Connection Solid Green only when functional (*See **Table F.4** for ArcLink status LEDs*) *(Same codes as power source when flashing).*
4	Red	OFF	OK
5	Green	OFF	Module Status Indicators
6	RED	OFF	
7	Green	ON	DeviceNet Status Indicators. *(See Ethernet board flashing error code **Table F.4**)*
8	RED	OFF	
9	Green	ON	Indicates Isolated ArcLink Section Supply is ON (+5 on board generated supply)
10	Green	ON	10Base-T Link Status ON indicates functional Ethernet link has been established. Ethernet board functioning properly *(not, if out)*
11	Green	ON	Receiver Polarity ON indicates proper Ethernet signal polarity *(Good connection)*
12	Green	ON	Indicates I/O +5V Supply is ON. This is used by differential I/O pair 4 circuitry, J712 pins 1 and 2. *(Use for synchronization signal to other welders).*
9 Green LED's total			

Return to Section TOC
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TROUBLESHOOTING AND REPAIR

ETHERNET BOARD CHECK *(Continued)*

FIGURE F.44 – ETHERNET PC BOARD SET-UP

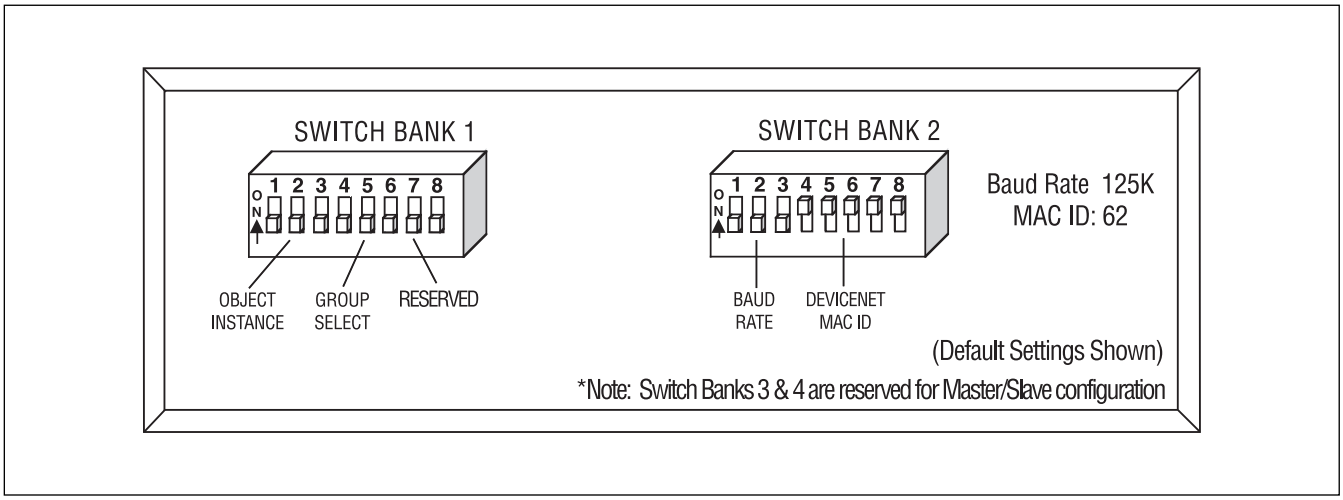
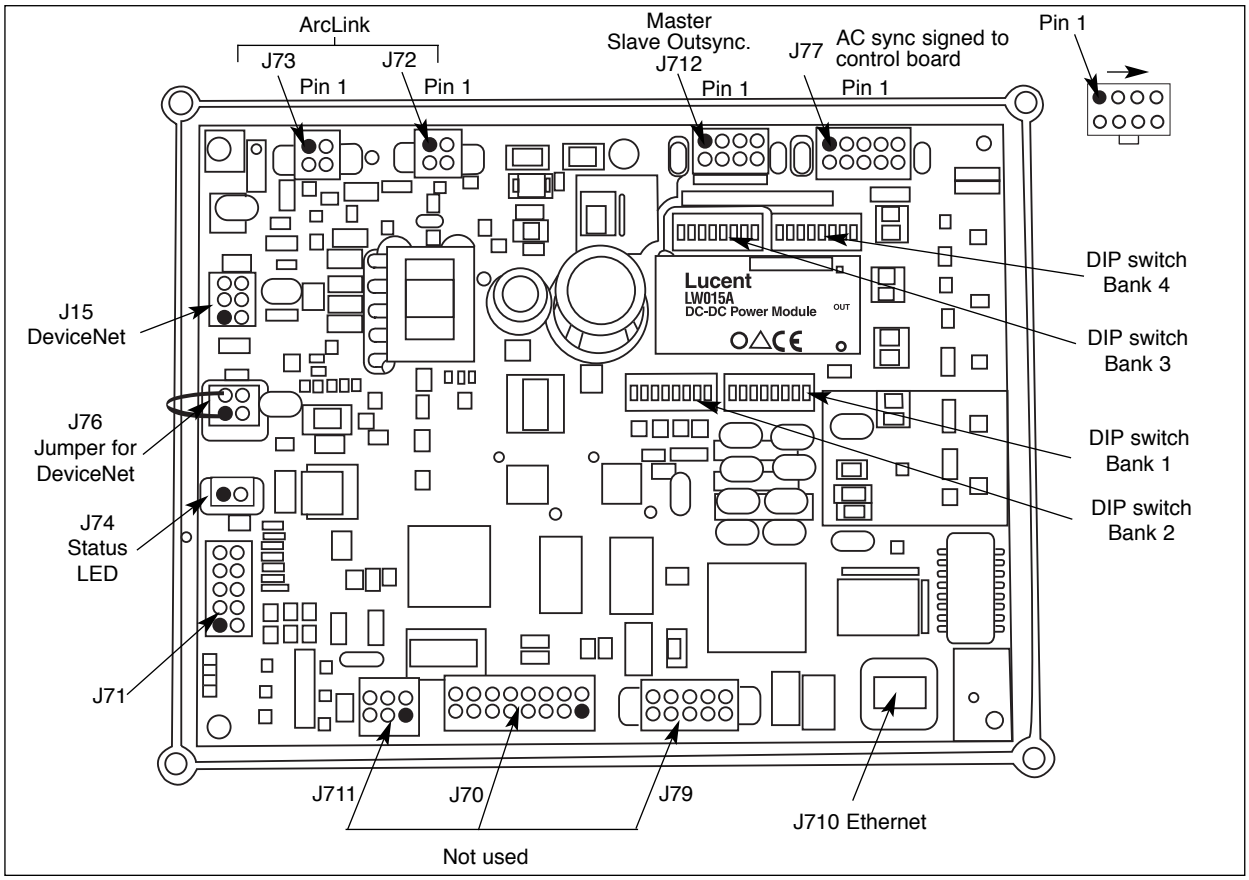


FIGURE F.45 – G3894 SERIES PCB HARDWARE



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ETHERNET BOARD CHECK

FIGURE F.46 – ETHERNET PC BOARD SET-UP

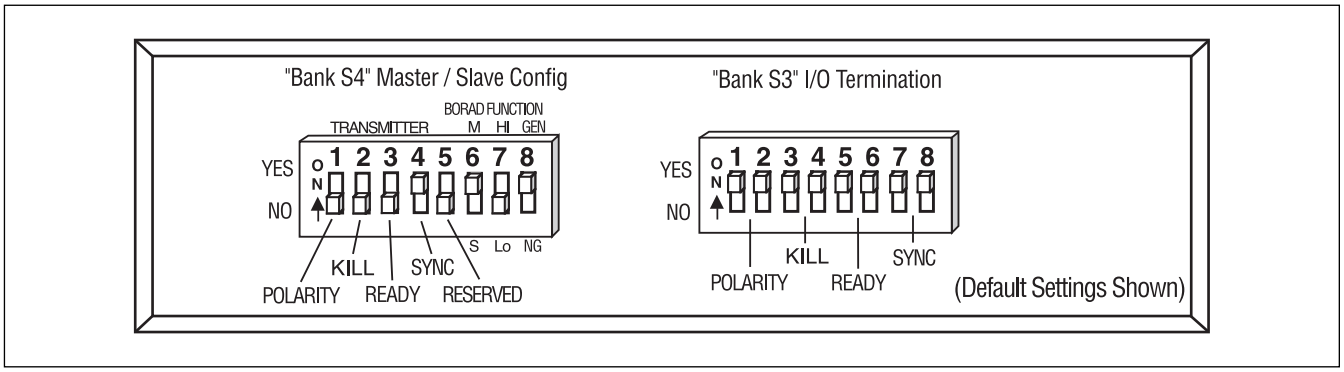
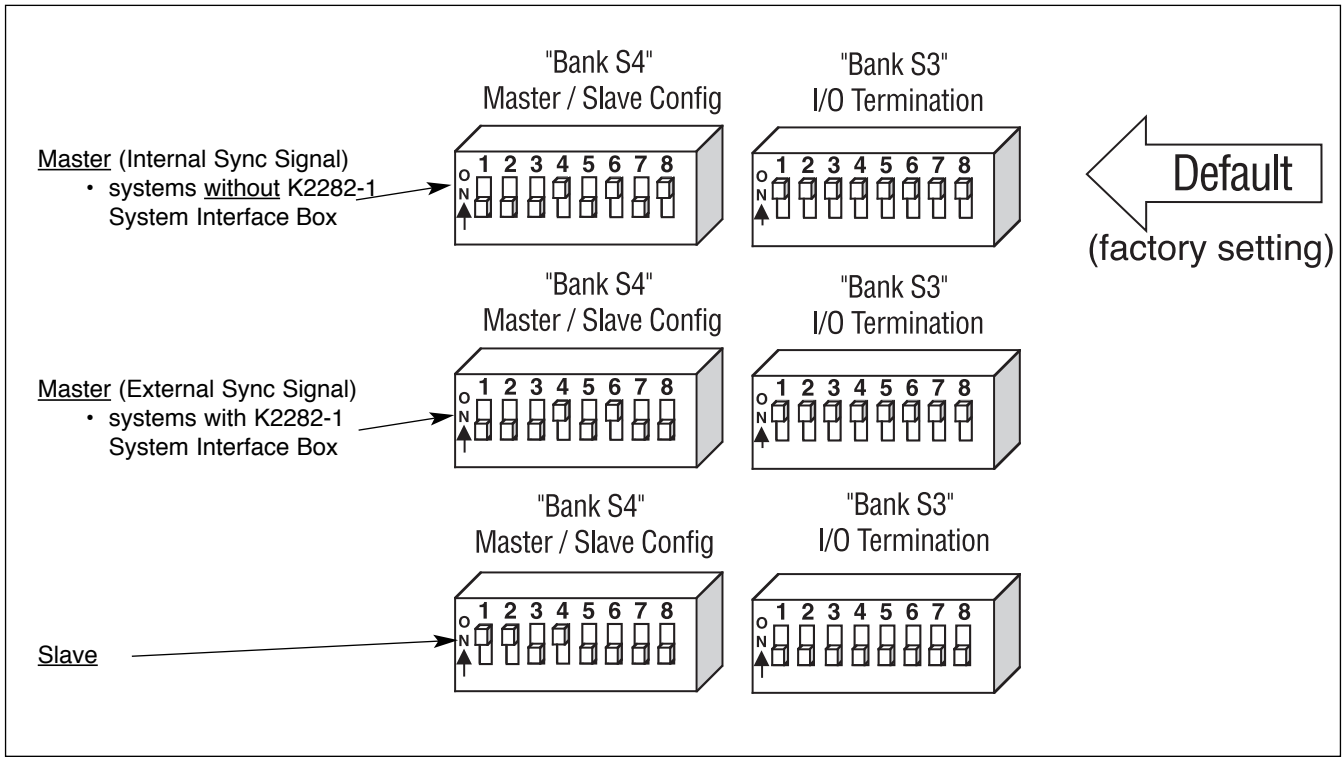


FIGURE F.47 – ETHERNET PC BOARD SET-UP



ETHERNET PC BOARD SET-UP

Software Configuration

I Check Power Source IM manual in Installation section for latest updates.

1. Ethernet Setup
   - Must be used to configure IP address

     Available on POWER WAVE® Submerged Arc Utilities CD provided with Power Source literature (Lincoln Part # S26122).

2. Submerged Arc Cell Configuration
   - Used for parallel machine configuration.
   - Available on POWER WAVE® Submerged Arc Utilities CD provided with Power Source literature (Lincoln Part# S26122).

VOLTAGE SENSE BOARD TEST

⚠ WARNING

Service and repair should be performed only by 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.

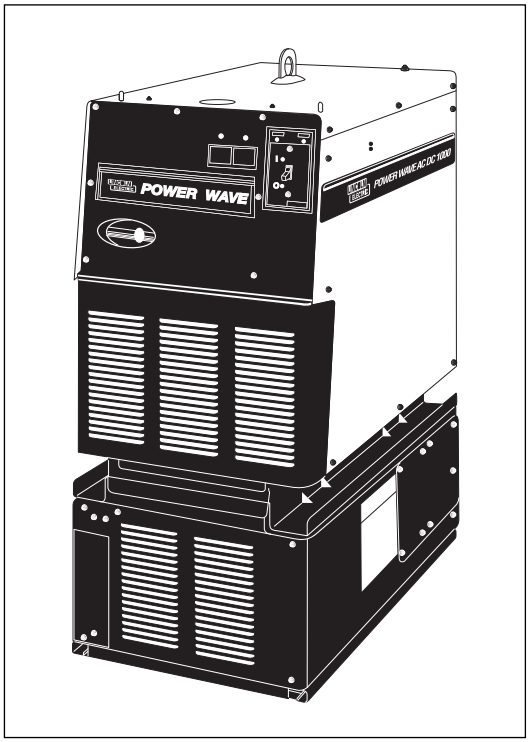
If for any reason you do not understand the test procedures or are unable to perform the test / repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

NOTE: The procedures and tests described in this manual are written with the understanding that the repair technician fully understands the process of locating and accessing (within the welding machine) the specific board or device involved in each procedure or test.

TEST DESCRIPTION

The Voltage Sense Board is a small board located near the Feed Head Board, inside POWER WAVE® AC/DC 1000 power source on the front right drop down door section.

This test will determine if the Voltage Sense Board is functioning properly.



MATERIALS NEEDED

Digital volt/ohm meter
18 gauge 4 inch jumper wire
1000 ohm 1/4 watt resistor

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VOLTAGE SENSE BOARD TEST *(Continued)*

Voltage Sense Board Test with a PF10A Interface

General Note: Disconnect external (slave or parallel connections). Remove the drive roll or lift idler rolls to keep from feeding wire during test. Leave weld wire in welding head or jumper from the Electrode Cable to the gear box during this test to maintain contact from the weld cable to the #67 lead in the connection box.

⚠ CAUTION

Disable flux hopper and travel sequence. Typically, both of these are powered by an external 115VAC supply through the PF10A controller. See Machine Diagram of PF10A. (May be as simple as unplugging the 115VAC to these units.)

⚠ CAUTION

PF10S wire feed head, wire reel and welder are energized with DCV during this testing.

1. Connect a DC voltmeter from J1, pin 3 of the Voltage Sense Board to the Work stud. Press the Start switch of the PF-10 A and observe the meter. See ***Figure F.49.***

NOTE: If POWER WAVE® will not stay energized, make sure the "restrike" timer is turned OFF. See the PF-10A Operator's Manual.

Meter should read OCV.

If reading is 0 volts:

check connections and the wire feed cable. See PF-10S Diagram.

Check connections inside the POWER WAVE® from the Wire Feed Receptacle to the Voltage Sense Board.

2. Measure Voltage from J2, pin 1 at the Voltage Sense Bd. to the Work Stud.

Should read OCV.

If not, the Voltage Sense Board is either not activating or is defective.

3. The Voltage Sense Board can be temporarily bypassed by putting a jumper from lead 67B (J2,pin1) to lead 67C (J1, pin 3). If the welding is normal, this indicates that the sense lead connections are OK and the problem is either the voltage sense Board or the activating signal.

If bypassing the Voltage Sense Board allows for normal operation, check the activation signal from the Feed Head Board at J1, pins 1(+) and4(-). Polarity is important.

Reading should be 15VDC when the Start Switch is pressed.

If 15 Volts is present, the Voltage Sense board is defective.

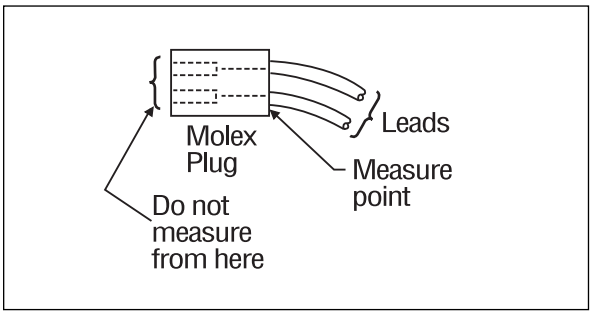
If 15 volts is not present, check the Feed Head Board and wiring.

⚠ CAUTION

Do not probe into Molex pins in the Board side of the Molex connector. Pin damage can occur to small terminals.

TIP: Measure or probe on the lead side of Molex (harness side). See Figure F.48.

FIGURE F.48 – MOLEX PLUGS



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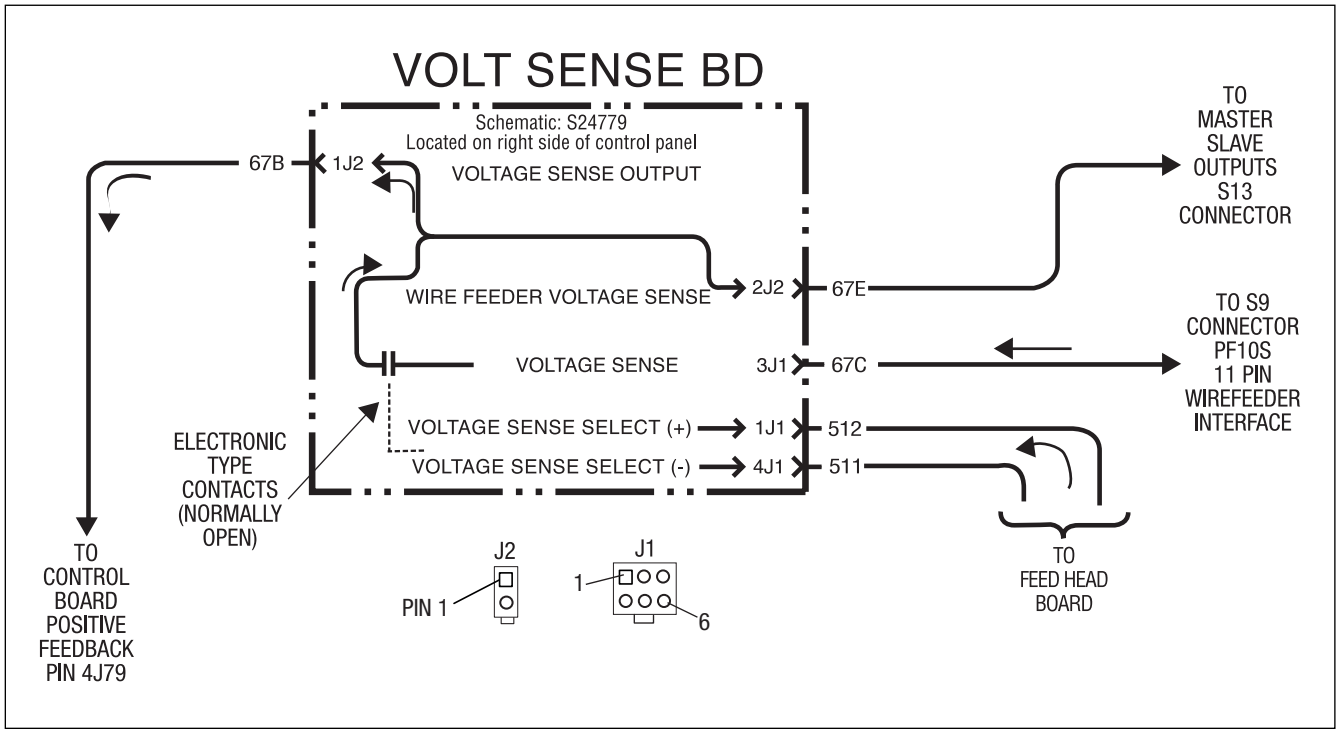
Return to Master TOC

VOLTAGE SENSE BOARD TEST

FIGURE F.49 – VOLTAGE SENSE BOARD



SENSE LEAD ROUTING AND WELD CABLE CHECK

SENSE LEAD ROUTING

Does the Welding Cell Require External Sense Leads?

- The preferred method is to use the Electrode Sense Leads from the wire drive PF10S at the Weld Head Connection (factory settings require this connection).
- If the distance from the Feed Head to the work piece is relatively short, connect Work Sense Lead from the wire drive PF10S to the work piece, (not to the WORK cable.
- External Work Sense Leed: If using the work sense lead from the head is not practical, use remote 21 work sensing lead from the front of the Power Source. Disconnect and insulate the work sense lead (#21) from the PF10S.
- Sensing at the studs will require voltage drop compensation of welding leads (requiring a higher weld voltage setting).
- Check the fuse on the PF10S to make sure it is functioning properly (not open). See 3 column troubleshooting chart if open.

WELD CABLE CHECK

- Cables should be sized to carry load. See weld cable recommendation table.
- Run Electrode & Work together if possible.
- Avoid Parallel Runs with Control Cables & Sense leads.
- Reduce inductive losses by avoiding routing through steel/iron rings.
- Do not coil cables.
- If AC welding is not acceptable, but DC welds can be accomplished, make sure Electrode & Work weld leads are routed together or very far apart. The distance between Work & Electrode leads during AC welding can affect AC weld output.
- Tighten all weld current connections.
- Check during operation for excessive voltage drop and/or hot connections.

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Return to Master TOC
Return to Section TOC
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TROUBLESHOOTING AND REPAIR

WELD CABLE CHECK *(Continued)*

RECOMMENDED ELECTRODE AND WORK CABLE SIZES FOR ARC WELDING

Tabulated below are copper cable sizes recommended for different currents and duty cycles. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable drop. Literature should correspond to these values.

RECOMMENDED CABLE SIZES* (RUBBER COVERED COPPER – RATED 75° C)**

	Percent	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES				
	Duty					
Amperes	Cycle	0 to 50 Ft.	50 to 100 Ft.	100 to 150 Ft.	150 to 200 Ft.	200 to 250 Ft.
100	20	8	5	3	2	1
125	30	6	5	3	2	1
150	40	6	5	3	2	1
180	20	5	4	3	2	1
180	30	4	4	3	2	1
200	50	3	3	2	1	1/0
200	60	2	2	2	1	1/0
200	100	2	2	2	1	1/0
225	20	4 or 5	3	2	1	1/0
225	40 & 30	3	3	2	1	1/0
250	30	3	3	2	1	1/0
250	40	2	2	1	1	1/0
250	60	1	1	1	1	1/0
250	100	1	1	1	1	1/0
300	60	1	1	1	1/0	2/0
325	100	2/0	2/0	2/0	2/0	3/0
350	60	1/0	1/1	2/0	2/0	3/0
400	60	2/0	2/0	2/0	3/0	4/0
400	100	3/0	3/0	3/0	3/0	4/0
500	60	2/0	2/0	3/0	3/0	4/0
600	60	3/0	3/0	3/0	4/0	2-3/0
600	80	2-1/0	2-1/0	2-1/0	2-2/0	2-3/0
600	100	2-1/0	2-1/0	2-1/0	2-2/0	2-3/0
650	60	3/0	3/0	4/0	2-2/0	2-3/0
650	80	2-1/0	2-1/0	2-1/0	2-2/0	3-3/0
700	100	2-2/0	2-3/0	2-3/0	2-3/0	2-4/0
800	80	3-1/0	3-1/0	3-1/0	2-3/0	2-4/0
800	100	2-3/0	2-3/0	2-3/0	2-3/0	2-4/0
1000	80	2-4/0	2-4/0	2-4/0	2-4/0	4-2/0
1000	100	3-3/0	3-3/0	3-3/0	3-3/0	3-3/0
1200	80	3-4/0	3-4/0	3-4/0	3-4/0	3-4/0
1200	100	4-4/0	4-4/0	4-4/0	4-4/0	4-4/0
1500	80	4-4/0	4-4/0	4-4/0	4-4/0	4-4/0
1500	100	5-4/0	5-4/0	5-4/0	5-4/0	5-4/0

**Tabled values are for operation at ambient temperatures of 40° C and below. Applications above 40°C may require cables larger than recommended, or cables rated higher than 75° C.

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Return to Master TOC
Return to Section TOC
Return to Master TOC

CONTROL CABLE, ETHERNET CABLE CHECK

ARCLINK CONTROL CABLES

Unique cable system optimizes performance

- Special construction
- End to end connectivity. Cables can be combined for lengths up to 100 ft.

ETHERNET CABLES

- Must be shielded CAT-5 cables

General Guidelines

- Do Not coil excess cable
- Route control and communication cables from Work and Electrode cables if possible
- Wireless routers are OK in this equipment & environment.

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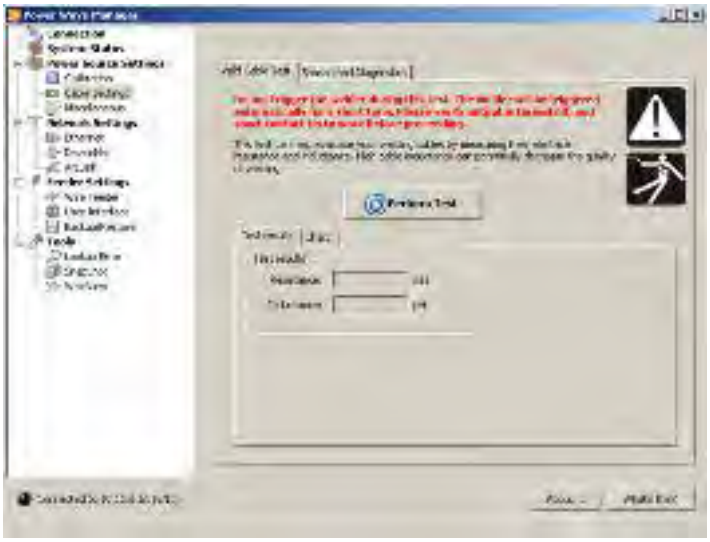
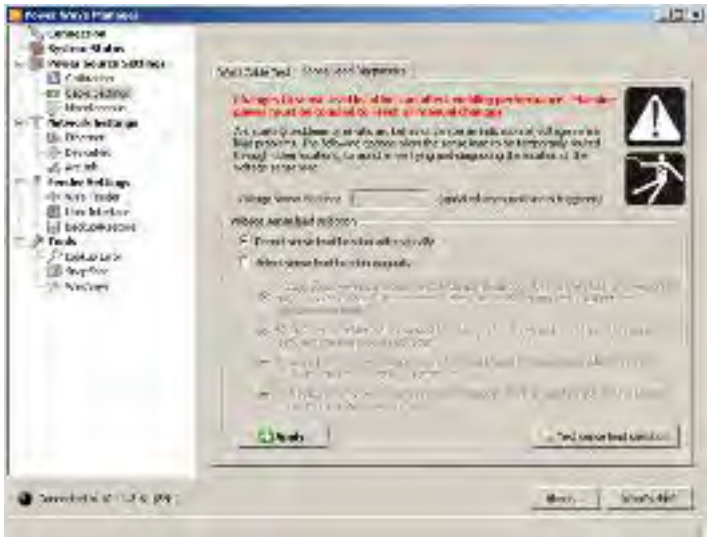
Return to Master TOC
Return to Section TOC
Return to Master TOC

TROUBLESHOOTING AND REPAIR

WELD CABLE TEST

FIGURE F.50 – WELD CABLE TEST
(VIA POWER WAVE MANAGER SOFTWARE METHOD)





Cable Settings and Tests screens while in the Power Wave Manager software

⚠ WARNING

- Machine output will be activated from Power Wave Manager software.

Weld Cable Evaluation

- Resistance
- Inductance
- Best used for comparing similar welding cells

Recommended Procedure

- Short piece of weld wire must be fed through the nozzle to the electrode tip.
- Run test (follow prompts)
- Test file is downloaded or write down the numbers
- 50 msec burst of energy (typically: 600 amps)

TIP: If the cell is welding properly, perform a Cable Circuit Test. If the welding machine malfunctions later in time, perform the Cable Test again. Compare those results to the previous test output (when the cell was working properly).

If the output numbers are the same or very close, then the problem is not in the weld CURRENT circuit. However, do not rule out the possibility of the WIRE REEL or the WELDING HEAD being intermittently grounded.

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Return to Master TOC

PF10A CHECKS

PF10A Checks:

PF-10A power and communication is from the POWER WAVE® AC/DC 1000® by way of the ArcLink cable. All normal open function switches & push buttons are shown on the ***PF-10A Machine Diagram*** in Section G for this unit.

Other information that can be found on the diagram are:

- PC board use & function
- Relay voltages & resistances
- wire routing
- terminal strip jumper required in lieu of flow switch.

NOTE: The PF10A requires that any external equipment (flux hopper, travel circuit etc...) needs a 120VAC supply connected to the PF10A terminal strip.

SYSTEM INTERFACE CHECKS

System Interface Checks (when used):

This interface helps eliminate the effect of arc blow (electronic scott connection). See the ***Machine Diagram*** in section G:

- for LED information on the unit (status light)
- Dip switch arrangements of PC board
- Wiring & measurements valves
- Board LED indications function
- Error codes

NOTE: The ethernet board that is in the unit has different software than other ethernet boards. Other boards will not work. Must order the correct board for this unit (order via software number) on side of board.

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SELECTING VOLTAGE SENSE LEADS ELECTRONICALLY

(Location determined via *Power Wave Manager software* method)

⚠ WARNING

FIGURE F.51 – LEAD SENSE CONFIGURATION

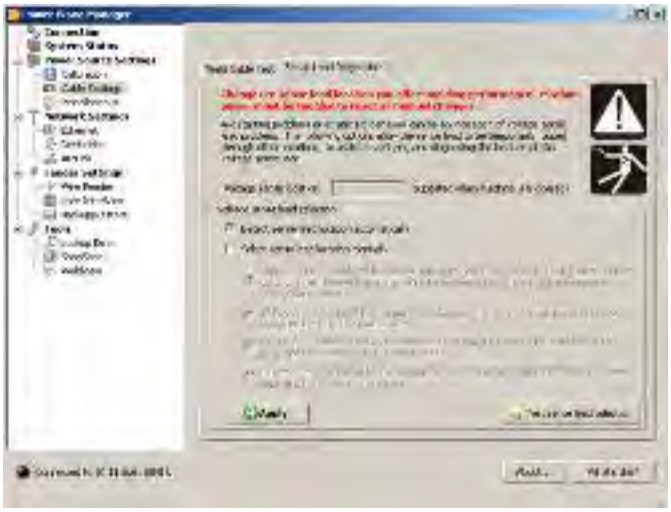
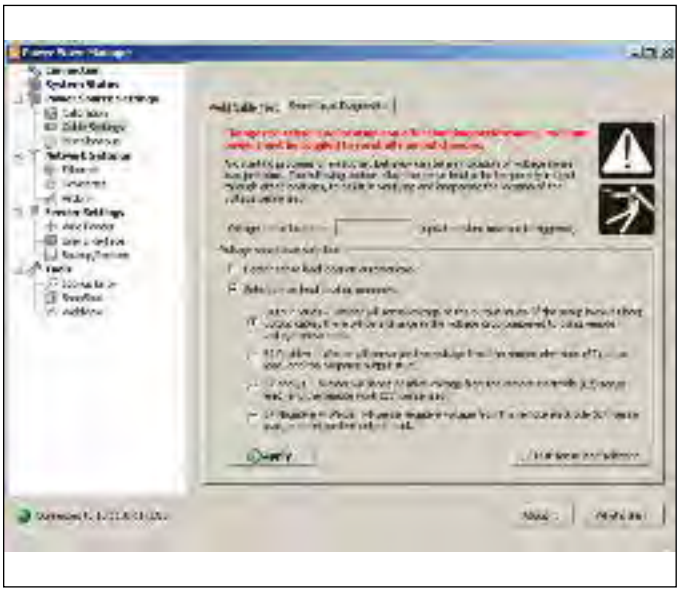


FIGURE F.52 – WARNING



WARNING

Changing voltage sense lead location can affect welding performance. Power must be toggled to reset all manual changes.

Changing the location of the sense leads can help diagnose the condition of the sense leads that are normally used in the application. If changing the sense lead location improves the welding, perform the ***Voltage Sense Board test.*** See the ***Machine Diagram*** or the diagram provided in the "Voltage Sense Board Test" to help find an open sense lead.

When the welder input power is cycled, all sense lead settings will be reset back to factory default settings for the selected weld mode.

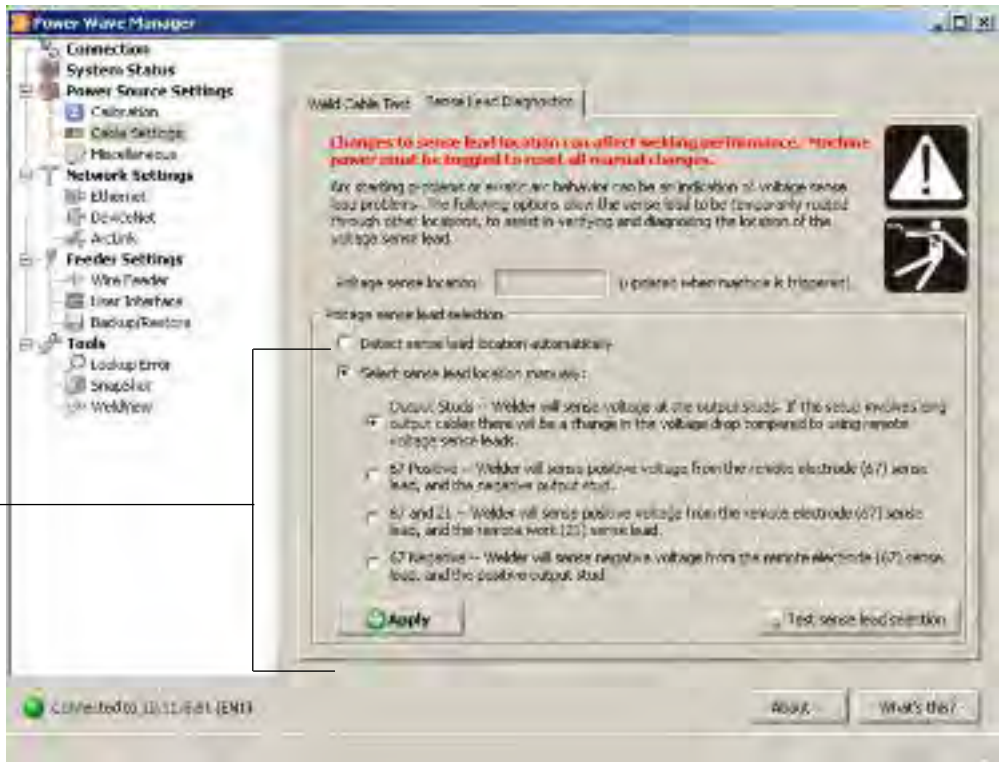
(Continued on next page)

SELECTING VOLTAGE SENSE LEAD LOCATIONS ELECTRONICALLY
(Continued)

⚠ WARNING

DIAGNOSTICS

FIGURE F.53 – SENSE LEAD CONFIGURATION



Troubleshooting information also.

Select "Cable Settings" screen while in the Power Wave Manager software

Voltage Sense Lead Manual Selection

⚠ WARNING

- Read all warnings before proceeding

• Voltage Sense Location

- Changing the voltage sense location can aid in solving welding problems

• Change Location

- Enable Manual Selection ⊙

Select: ⊙ Output Studs
◯ 67 and 21
◯ 67 positive
◯ 67 negative

Select **Apply**

Try a weld to see if performance has improved. If not, see the 3 column chart on troubleshooting in the beginning of this section to help identify welding problems.

When the welder input power is cycled, all sense lead settings will be reset back to factory default settings for the selected weld mode.

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HOW TO PERFORM A "SNAPSHOT" FILE

(OF INTERNAL SOFTWARE SEQUENCING OF THE CONTROL BOARD)
and associated ArcLink equipment

⚠ WARNING

What is it: Snapshot files are an internal binary file of ArcLink network equipment to gather information of the system. Snapshot analyzer is required to view the file. Which is not available to the field.

Purpose: Snapshot files can be sent (or e-mailed) to Lincoln Electric Technical Support to help diagnose equipment weld problems or connectivity.

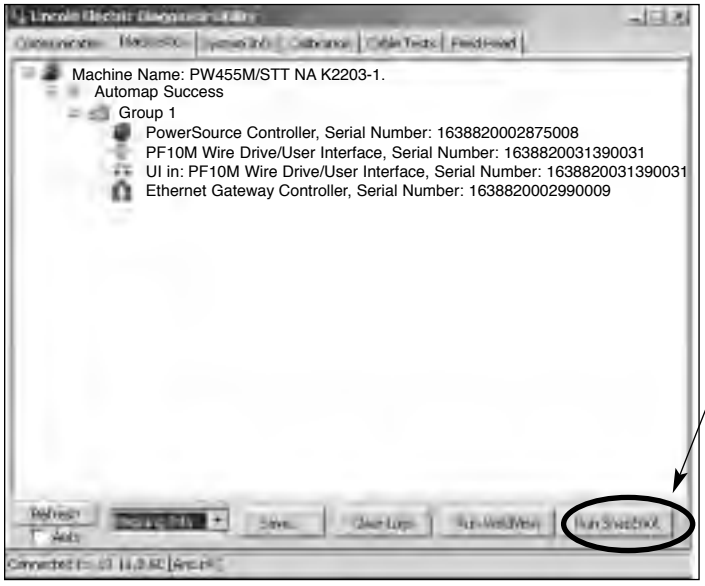
Operation:

- When launched from the Diagnostic Utilities Software application, the user will be prompted for a directory that the file will be saved to (select your desk top so that you can find it easy later). See Figure F.54.
- The application will then automatically connect to the machine and collect the data.
- When completed, the file will be saved to the specified directory and the SnapShot application will close itself and bring up the Diagnostic application again.
- **Diagnostic application is also used to clear the logs (errors) out of a machine.**
- Clear the logs using the Clear Logs button. Duplicate the welders problem. Take another snapshot of the latest problem. Make sure to send both files in the email to Lincoln via our web site www.lincolnelectric.com.

FIGURE F.55 – POWERWAVE SNAPSHOT

*Snapshot can take several minutes to retrieve this data.

FIGURE F.54 – DIAGNOSTICS (ARCLINK OPERATION)



Diagnostics Tab

- Run SnapShot
  - Launches SnapShot Application

Follow the prompts while in snap shot.

*Snapshot can take several minutes to retrieve this data.

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ENERGIZE OUTPUT FOR LOAD BANK TESTING

ENERGIZE OUTPUT with NO WELDING into a load bank
There are TWO METHODS - - Power Wave Manager software and PF10A Method

Power Wave Manager software Method	PF10A Method
Power Wave Manager software can be found at www.powerwavesoftware.com choose 'Calibration" screen to turn ON/OFF output. Different Sense Lead locations, polarities can be selected from the "Cable Settings" screen. Power Wave Manager software Modes: DC+ selects mode **200 automatically** DC- selects mode **213 automatically** AC uses mode **219** (50 Hz. Square-wave) and is not accessible with the PF-10A. **NOTE:** Power Wave Manager software may not turn on the Voltage Sense Board for its testing. See ***Voltage Sense Board Test***.	For accessing the test modes, see ***User Preference*** section in the PF10A manual. Once a test mode is selected per list below, press the **"START"** push button on the front of PF10A. TO TURN **"OFF"** OUTPUT: press the **"STOP"** button. **NOTE:** drive rolls do not turn while in test modes. **Test modes can not be used for welding.** Cycling power of welder will remove test modes from the display (they will have to be reloaded per PF10A manual). All test modes use voltage sensing at the welder output studs. **LOAD BANK TEST MODES VIA PF10A** **Mode 221**= DC+ CC Test 20-1250A (controlled Current) **Mode 223**= DC - CC Test 25-1250A (controlled Current) **Mode 222**= CV Test Mode, stud-sensing, 10-35V - 100 to 350A (constant voltage control at 10 to 1 ratio) **Mode 224**= Square-wave CC Test 25-1250A Variable frequency is from 10 HZ to 100 HZ via lower display All MODES: adjustments are locked out, except for current control or as noted below: • All CC test modes when a load bank is adjusted, output CURRENT is held constant (volts varies) • CV test modes when a load bank is adjusted, output VOLTAGE is held constant (current varies) Test modes and their abilities can vary from software versions to software versions of the PF10A.

For meter and oscilloscope recommendations see ***Calibration Check*** in this section.

SCOPE TRACES and TESTS AFTER REPAIR

SCOPE TRACES

This welder produces large amounts of Switch Board and Chopper Board noise on the output that will show up on some oscilloscopes rendering it unusable. Trying to get a wave shape comparable to a given standard is not practical.

Scope traces are not provided nor are they necessary to test or troubleshoot this welder. See "Troubleshooting" section or "Calibration Check".

To view the output current and voltage wave shape of this equipment, utilize the **"Power Wave Manager"** software. The software can be found at www.powerwavesoftware.com.

Keep in mind that if the welder is out of calibration, this viewed wave shape would correspondingly be out of calibration.

Power Wave Manager Note: This software shows positive wave forms only. If running negative polarity outputs, positive readings will show on the software. No AC wave shapes are possible. As of 9-6-05, no software is developed to view AC wave forms at customer levels.

TEST AFTER REPAIR

During this test the input circuit and input cord will develop typical input power voltage levels of 575VAC or 460VAC. Use **CAUTION** when working in this area and on this machine. It will be similar to working with this welder when the normal input voltages are applied.

ENSURE THAT THE MAIN INPUT POWER IS TURNED OFF TO THE SUPPLY CORD AND ELECTRICALLY INSULATED FROM PHASE TO PHASE.

Turn welder main power switch ON. Apply a 115 VAC supply to the 115VAC receptacle on the front of the power source. The unit will power up in a normal fashion. A computer with the diagnostic utility or a PF10 A will be able to operate the unit at this time. (PF10A and PF 10S can also be checked out functionally with this set up when connected to the welder).

WELDING OR LOADING OF THE OUTPUT SHOULD NOT BE DONE BECAUSE OF LOW AMPERAGE CAPACITY OF THE 115 VAC BREAKERS ON THE WELDER!

If circuit breakers on front of this receptacle or the input area do trip - - *power down the unit*. Perform the capacitor discharge procedure. Check wiring in the input areas up to the switch boards. Perform related test on the input circuits. See *Machine Diagram* to assist with which circuits to follow and boards to check. Follow the test procedures provided in this manual on suspected circuits or boards.

If circuit breakers **DO NOT** trip, turn on output with NO load on output of welder. Breaker should not trip. If breakers **do** trip, output diodes maybe shorted or open. Perform related test on the output circuits. See *Machine Diagram* to assist with which circuits to follow and/or boards or components to check. Look for shorts or opens across the output or to ground.

If breakers do **NOT** trip when the output is turned on:

1. Turn off power source via ON/OFF input power switch (on front of welder).
2. Remove 115VAC input TEST power from the front receptacle, after de-energizing its 115 VAC source.

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SCOPE TRACES and TESTS AFTER REPAIR *(Continued)*

(continued from previous page)

3. Connect input power in its normal fashion with rated fuses per IM manual input wiring data. Welder can be turned on for normal load testing. Test the welder output in all modes DC-, DC+, AC test modes. See ***Energizing Output with Load Bank*** Load the welder's output to maximum rated output per the Input Data Sheet in the front section of this manual or welders IM manual. A PF10A Control Box can be added to check its functionality also. It would be best to test with a PF10S Feed Head in the set up. See Installation Section A for a single arc arrangement.

   The PF10S can also be tested if connected to the PW AC/DC 1000®. The Power Wave Manager software can be used to activate the feeder & output. Select the "Wire Feeder" screen in the Power Wave Manager software to test motor feeding ability.

   How It Works :

   The reason 115VAC can be used to test the welder function is the fact that it is backfeeding voltage via the 115 auxiliary transformer. This makes the auxiliary transformer a step-up type transformer. The 460 primary taps of this transformer will produce 460 VAC. This **WILL** supply 460 volts to the input rectifier and input cord so that normal charging of the main capacitors takes place.

   The rest of the system, Control Board, Power board, and feeder are also powered. **USE CAUTION** when this test is being done. When powered down, you should perform the ***Input Filter Capacitor Discharge*** procedure because the switch board capacitors do get fully charged to 325VDC.

OUTPUT TEST:

Measure continuity from each output stud to the frame. It will typically read in the Meg ohms but must be at least 500Kohms. If less than 500K check for output circuit insulation break down to frame. See the ***Machine Diagram*** for which circuits to follow and components to check.

If no continuity issues are found to the frame from either output stud, obtain an insulated jumper wire and a 1 amp *Slow Blow* fuse (FDR type) in-line with jumper. The fuse should not blow if contact is made with either output stud to frame when the output of the welder is energized . **CAUTION: use an insulated jumper and gloves when doing this test.**

If the fuse blows, there is a short to frame from the output circuit. See ***Machine Diagram*** to assist with which output circuits to check for an insulation breakdown. Typically only a small spark will be seen when touching jumper/fuse circuit to case. A slight spark with the jumper/fuse circuit NOT blowing the fuse typically indicates the welder is functioning normally and there are no ground loops with either of the output stud circuits. The slight spark indicates noise leakage potential from the output of the welder to the case.

Conditions of the welder (clean, dirty, dry, wet, etc.) can affect this type of test. Conditions during this test should be dry and clean. If the fuse consistently blows, a direct shorting of a test lead to the frame should not show current flow from any weld stud to the case with a properly functioning machine. If it does, there is an output circuit short to case. See above recommendations to check output circuit using the ***Machine Diagram*** to follow the circuit.

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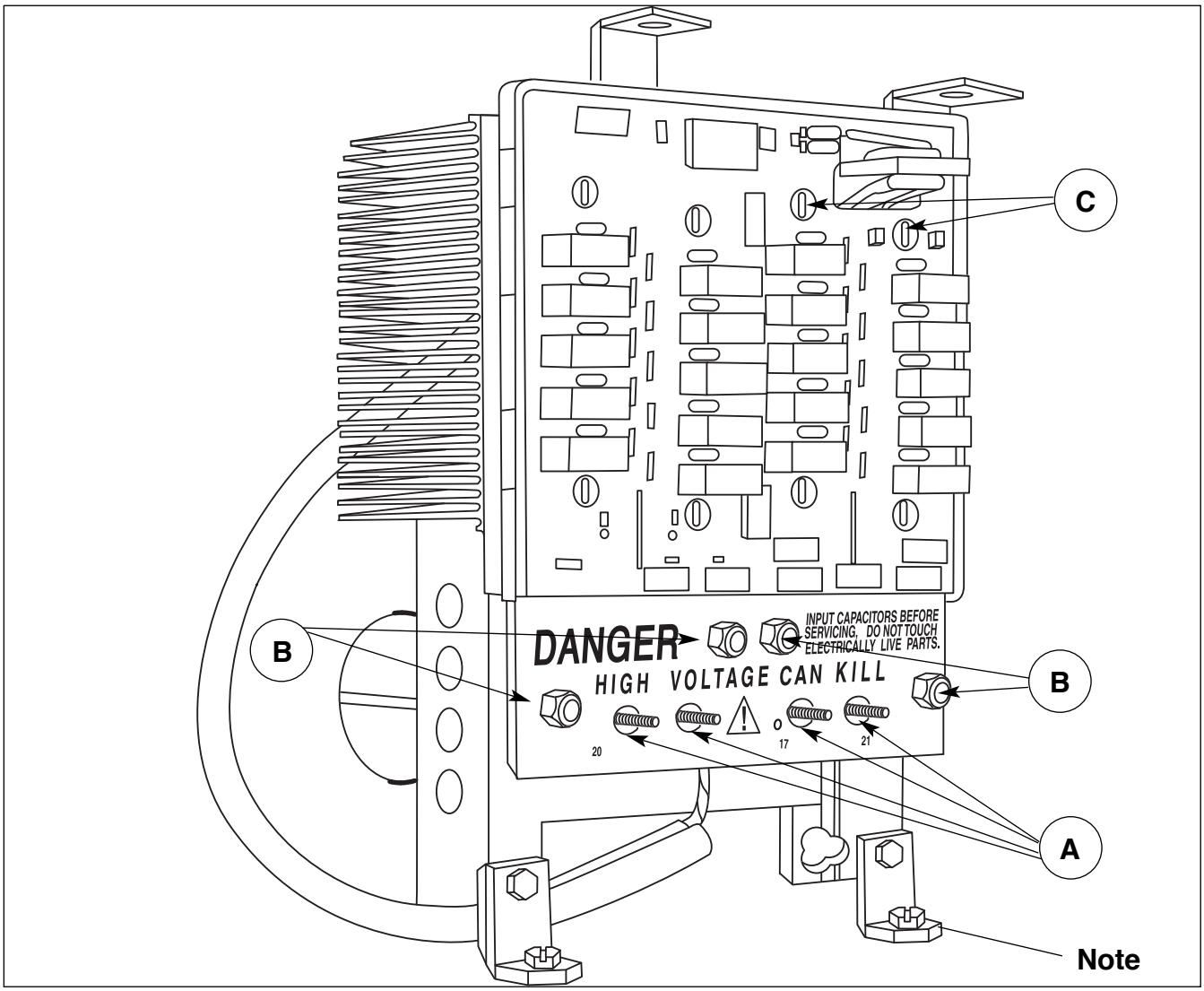
SWITCH PC BOARD ASSEMBLY REMOVAL

FIGURE F.56 – SWITCH PC ASSEMBLY BOARD



⚠ WARNING

You will be working near the input high volt capacitors. Follow discharge procedures of capacitors before working on this unit.

A. Main Capacitor terminals: remove the leads and nut (not the threaded studs, 4 places).

B. IGBT terminals: Remove the leads.

C. Remove IGBT cap screws in order to remove the Switch Board from the heat-sink (eight places).

Replacement:

D. Torque specification: Main Transformers 50-60 in lbs (input leads harmonic filter 25-30 in lb.)

E. Follow torque specifications that are on the instruction sheet that comes with the replacement board.

S25191-1 modules are typically 40-48 in lbs.

Capacitor screws are typically 50-60 in lb.

NOTE: To replace a complete Switch Assembly, remove four bracket screws (two on top/two on bottom). Use mineral spirits to help remove thermal pad material if needed from heat sink surface.

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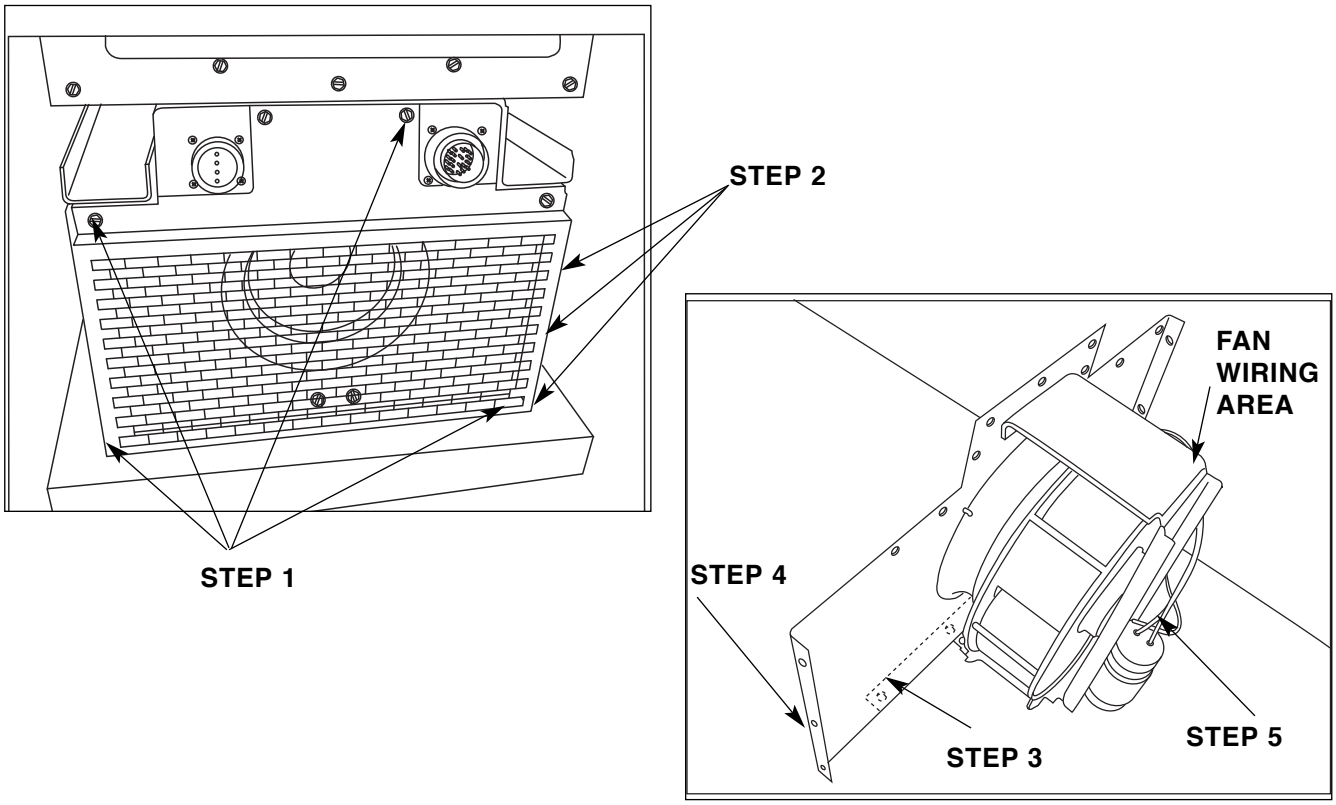
AC/DC SWITCH LOWER FAN REMOVAL

FIGURE F.57– AC/DC SWITCH LOWER FAN



NOTE: Make sure the welder is on a secure table or on the floor. Make sure wires do not get *pinched* during this process. **MAKE SURE WELDER DOES NOT *TIP***. Support welder by its lift bale hook.

AC/DC switch must be in place and secure before performing fan removal.

STEP 1: Remove all lower rear sheet metal screws that hold the rear fan assembly and finger guard in place (14).

STEP 2: Remove the rear side fan screws from the fan bracket to free the fan bracket from the AC switch sides (three per side). Leave the 4 screws holding the inner AC switch baffle support of welder (2 per side). Located approximately 7" in from the rear.

STEP 3: On the backside of the base, remove the fan mounting screws in the base (six).

STEP 4: FIRST, remove the rear fan panel lower edge from lower base. THEN, pull the fan assembly out. Disconnect the fan leads before completely removing the fan (left side).

STEP 5: Remove the four fan screws from the fan bracket to free the fan from the support bracket.

NOTE: Some early versions did not have the outside screws in STEP 3. Cutting out the fan support baffle to get access to the mounting screw will be required. A new bracket and screws will have to be ordered and remounted for replacement.

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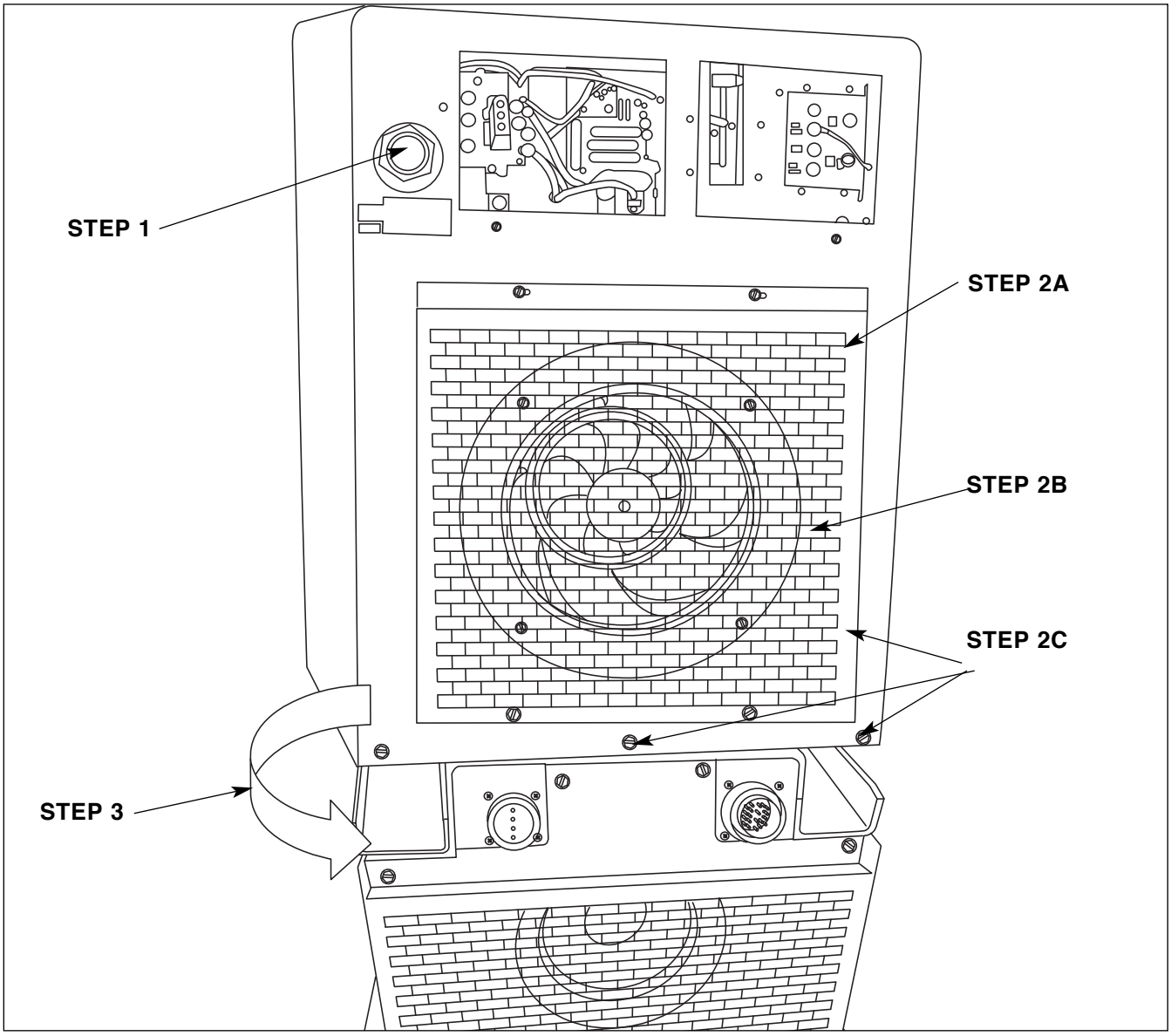
AC/DC SWITCH UPPER FAN REMOVAL

FIGURE F.58 – AC/DC SWITCH UPPER FAN



STEP 1: After disconnecting the input power, disconnect the input leads from the 1CR contactor.

Insure than all other sheet metal other than what is being removed is in place and secure.

STEP 2:

(A) Remove the fan guard brick-work sheet metal.

(B) Remove fan shroud (four screws).

(C) Remove the rear case panel screws and rear screws from side panels.

STEP 3: Swing the rear panel to the right to expose the fan motor screws, which are used to remove the power source fan motor from its bracket.

NOTE: Have some one hold the rear panel while the fan is being replaced.

⚠ WARNING

You will be working near the input high volt capacitors. Follow discharge procedures of capacitors before working on this unit.

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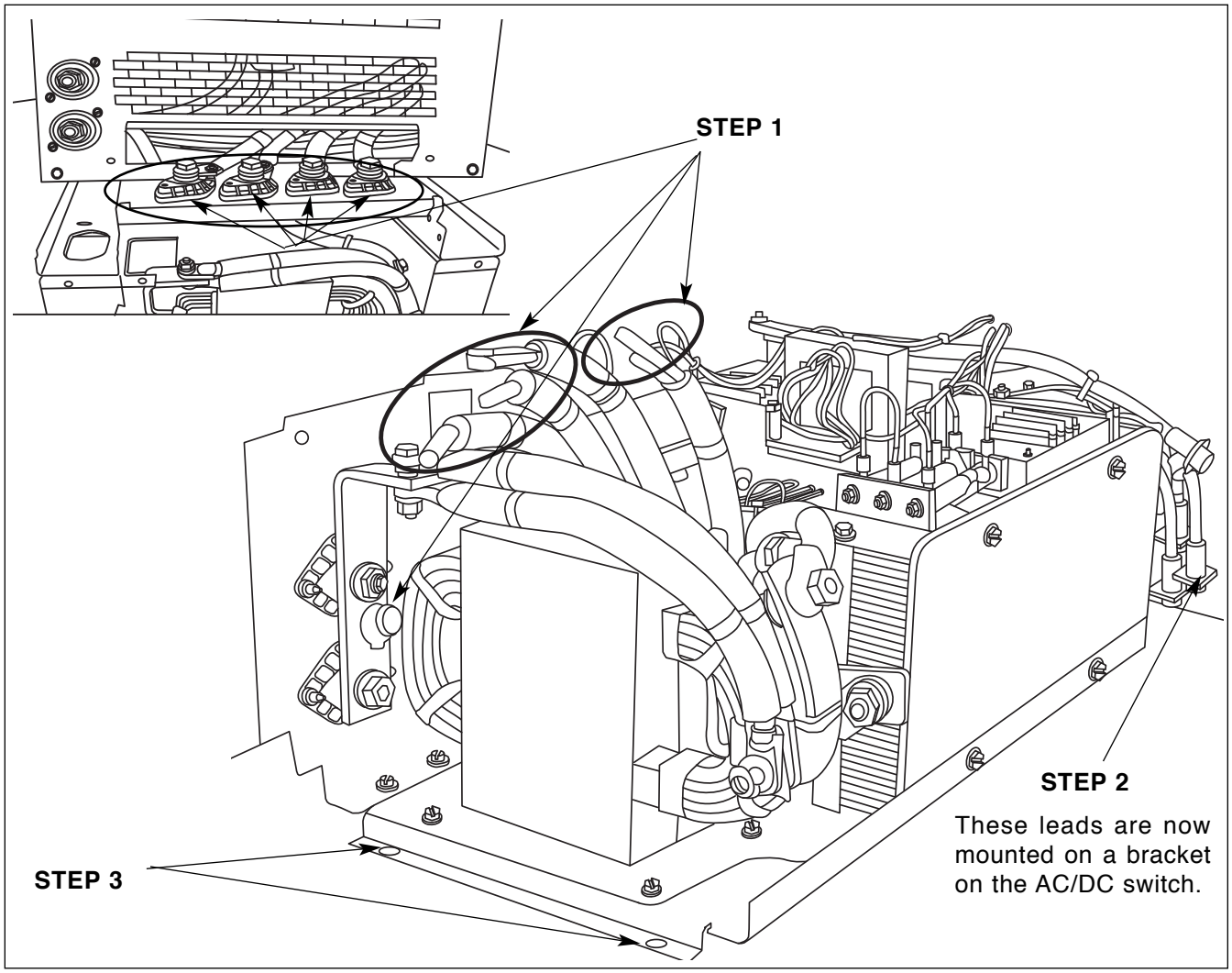
AC SWITCH ASSEMBLY REMOVAL

FIGURE F.59 – AC SWITCH ASSEMBLY



STEP 1:

A. Disconnect four heavy lead connections from **bottom** of the four feed-through studs across the front middle area of the welder.

B. Remove the sense leads.

STEP 2: Remove right rear access door. Disconnect all Amphenols coming from the top inverter section (four total) from the AC/DC switch section.

STEP 3: Remove two self-tapping screws. Slide the AC Switch Assembly unit forward to remove it from its housing.

REPLACEMENT NOTE:

When sliding the AC/DC switch back into its case, make sure all rear Amphenols (from upper section) are clear from being damaged.

Also make sure the sense leads removed from the electrode stud are reconnected to the stud.

⚠ WARNING

You will be working near the input high volt capacitors. Follow discharge procedures of capacitors before working on this unit.

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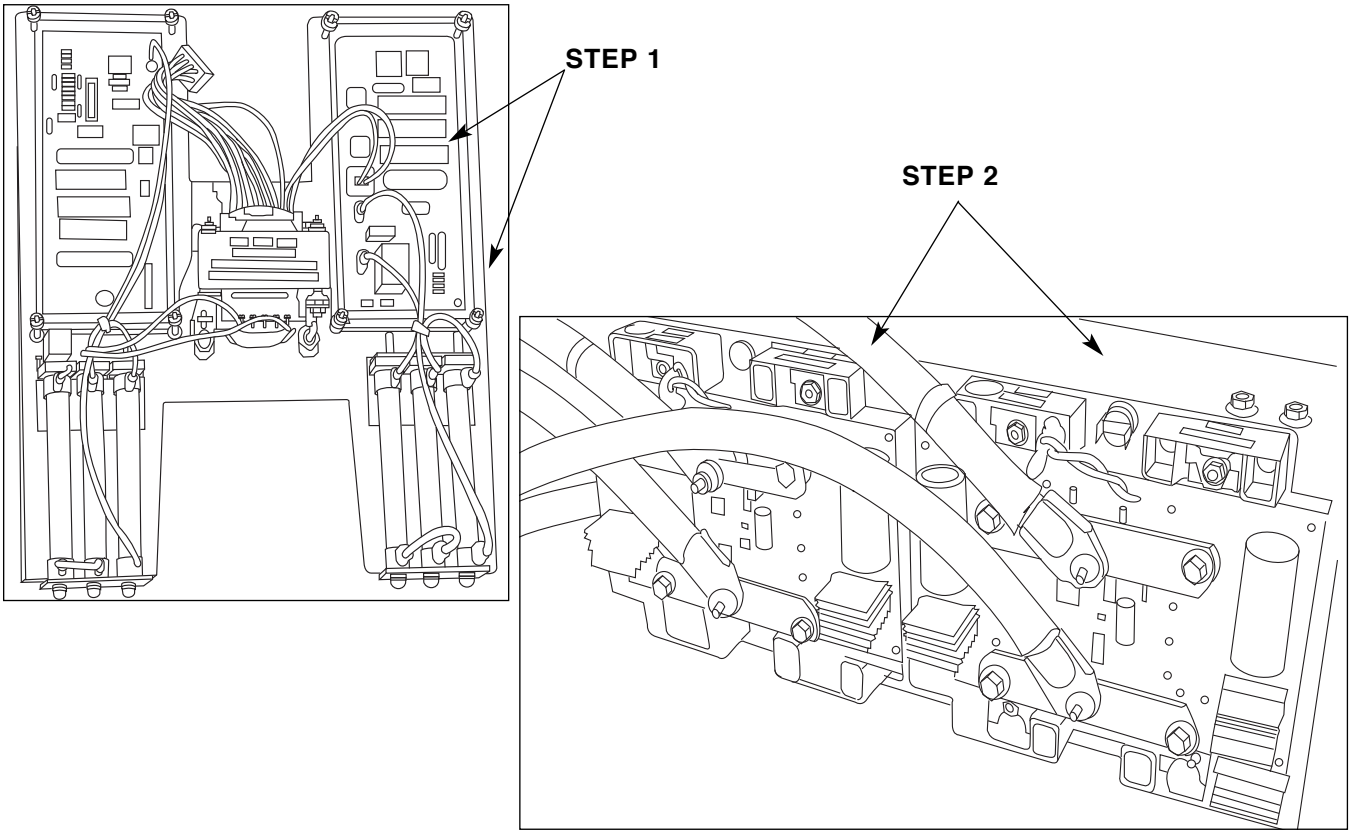
AC SWITCH CHOPPER BOARD ASSEMBLY REMOVAL

FIGURE F.60 – AC SWITCH CHOPPER BOARD



NOTE: This process can only be accomplished by first doing the AC Switch Assembly removal.

STEP 1: Remove sheet metal screws securing top snubber assembly to AC switch -- typically four screws. Disconnect all wires accordingly to move top snubber assembly to the side.

NOTE: Removal of heavy lead connections will be more easily accomplished if the Chopper Assembly is loose or slightly out of its mounting position. This will allow a tilting action of the chopper, thus providing clearance to the connections.

STEP 2: Remove weld cable leads from the Chopper Board (note numbering). Then remove self tapping screws (four each) from module assembly to get the assembly off the base bracket (out side edge).

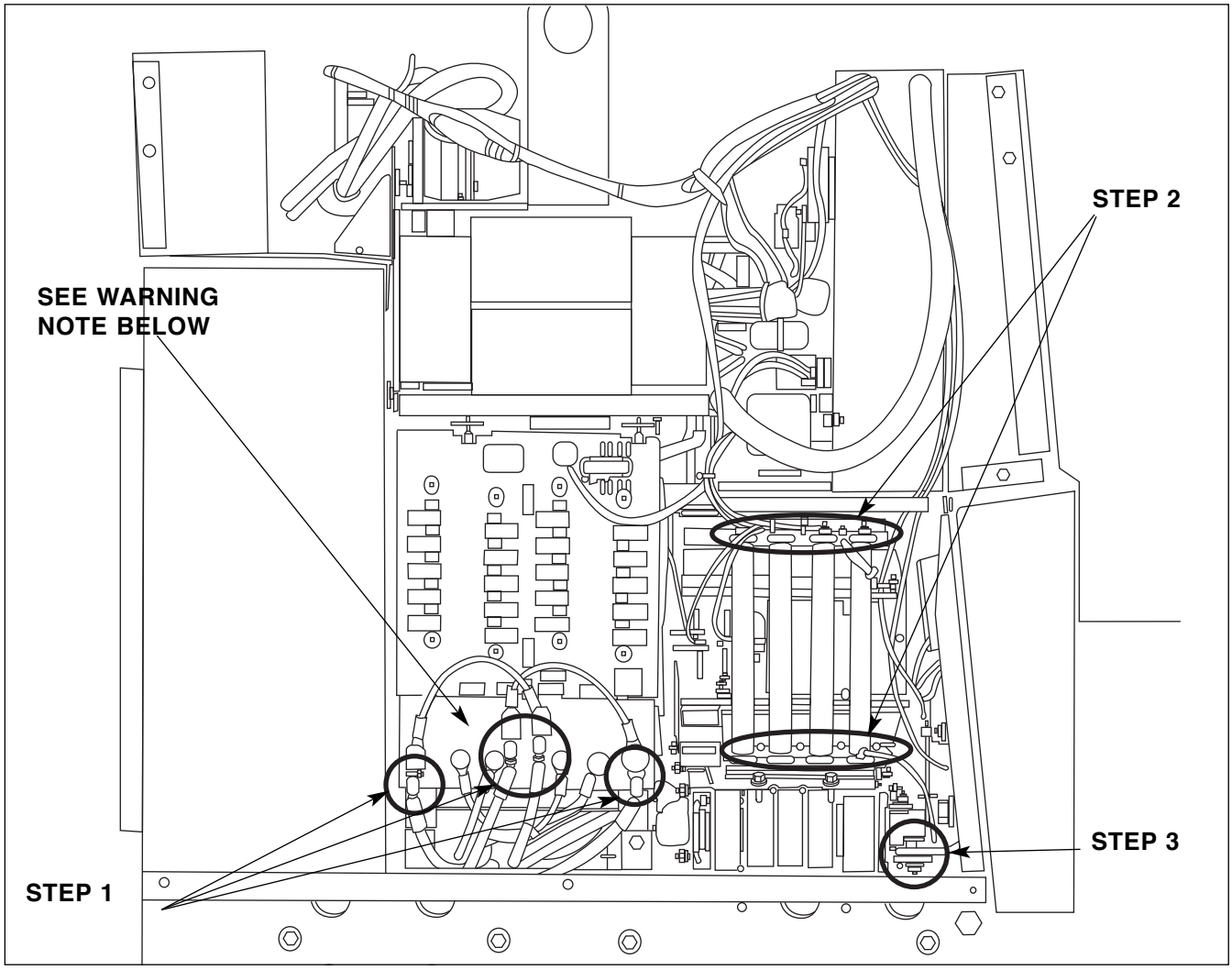
NOTE: See Machine Diagram for help with the left or right chopper lead numbering. Also reference print L12279-1 and 2 plus torque specifications in this manual. Torques are typically 50 to 60 in lbs.

Right side is a mirror image of this assembly also. Right side assembly is different part number (different lead numbers also).

NOTE: Chopper Boards can not be changed individually, they are physically attached (bonded) to their heat sink.

OUTPUT DIODE ASSEMBLY AND MAIN TRANSFORMER REMOVAL

FIGURE F.61– OUTPUT DIODE ASSEMBLY AND MAIN TRANSFORMER



Left Side View

WARNING

You will be working near the input high volt capacitors. Follow discharge procedures of capacitors before working on this unit.

STEP 1: Disconnect the primary leads of the main transformer from the switch board (four places). Perform the same action for the right side switch board (four places).

STEP 2: Disconnect resistor leads Figure F.61.

STEP 3: Remove the work lead bolt and nut connecting main transformer lead to work stud copper tab (access hole is provided in the base) Figure F.61.

Continued on next page.

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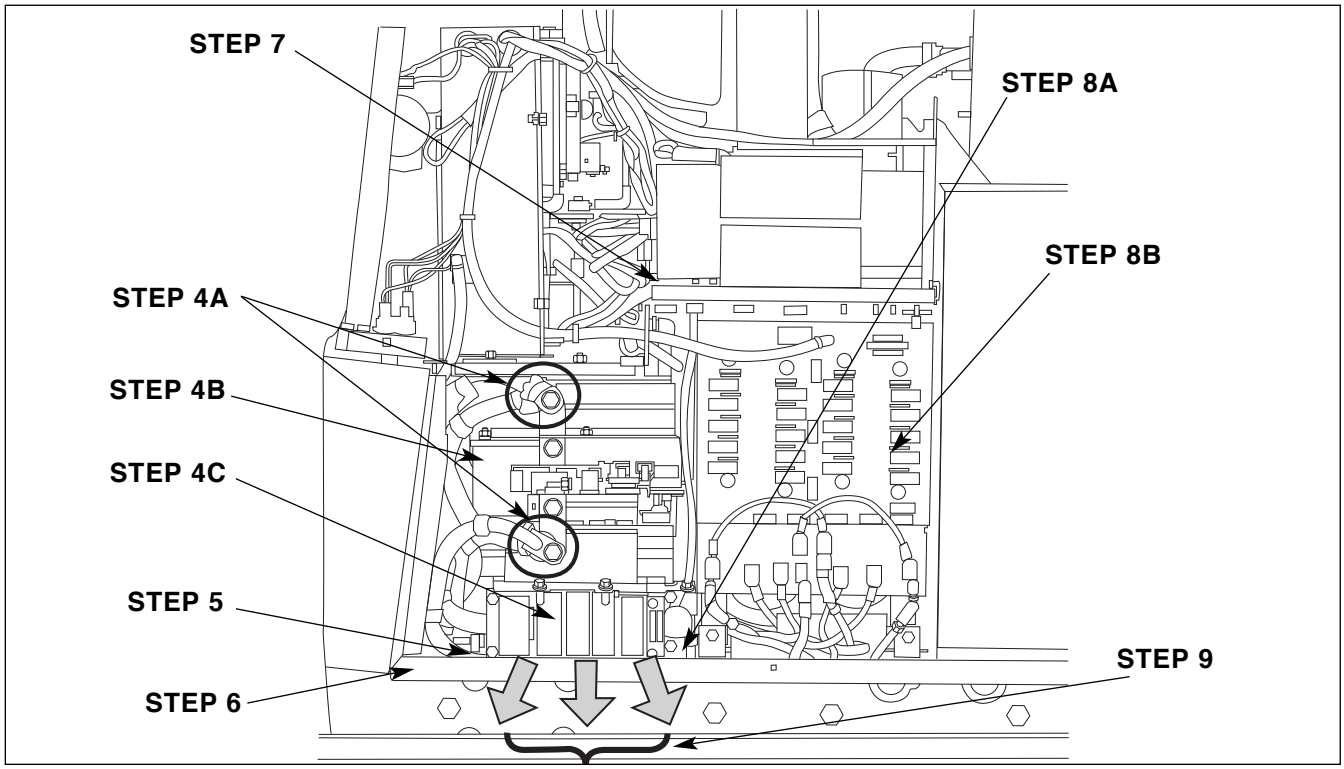
OUTPUT DIODE ASSEMBLY AND MAIN TRANSFORMER REMOVAL

FIGURE F.62 – OUTPUT DIODE ASSEMBLY AND MAIN TRANSFORMER



Right Side View

STEP 4:

(A) Disconnect the heavy flex leads and unplug the hall device harness.

(B) Output Diode Bridge location.

(C) Main Transformer location.

STEP 5: Under the base, remove four self-tapping screws holding the front plate of the main transformer to the base.

STEP 6: Remove self-tapping screws holding the lower front panel (four across width of welder).

STEP 7: Remove self-tapping screws holding the middle shelf (four across width of welder).

STEP 8:

(A) Shift the loose front assembly slightly forward. This will give clearance to remove the four self-tapping screws in the base, which hold the rear plate of the main transformer to the base. Use of a long socket extension is expected. On later models some of these self tapping screws are installed from under the base. If necessary, remove the AC/DC Switch to gain access to the screw heads.

(B) Switch PC Board location.

STEP 9: Lift the slightly loose front assembly. Pull the transformer and bridge together out from the right side.

REASSEMBLE NOTES:

Lead 17 and 18 of main transformer go through the right side toroid for right switch board.

Lead 13 and 14 of main transformer go into the left side toroid for left switch board.

⚠ CAUTION

When replacing the assembly, DO NOT pinch or gouge any leads.

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OUTPUT DIODE BRIDGE BOARD REMOVAL

FIGURE F.63 – FRONT VIEW

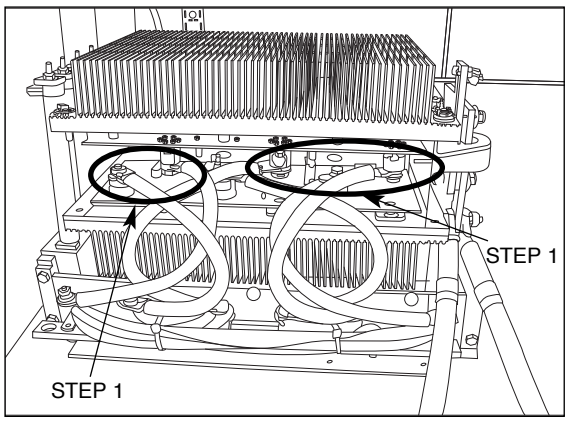
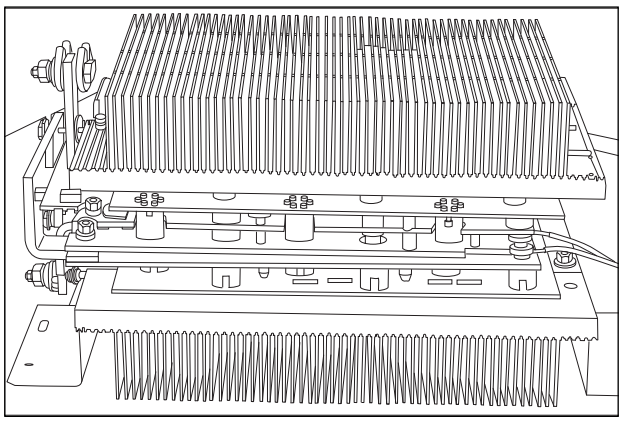


FIGURE F.64 – REAR VIEW



NOTE: Removal of the Output Diode Bridge and Main Transformer assembly must be performed first.

STEP 1: Disconnect the front Diode leads from Main Transformer at Diode Bridge end. See provided reference print Figure F.63 or in Section G for this and reassemble of the lead mounting. (G4502)

STEP 2: Remove the screws and nuts from the left and right metal mounting brackets from Main Transformer. Lift Output Diode Assembly from the Main Transformer.

STEP 3: See ***Current Transducer Removal*** to disassemble the transducer from the diode assembly. Do only STEPS 1 through 4 for the transducer removal.

NOTE: Output Diode Heat Sink Assembly is at the chassis (case) ground level.

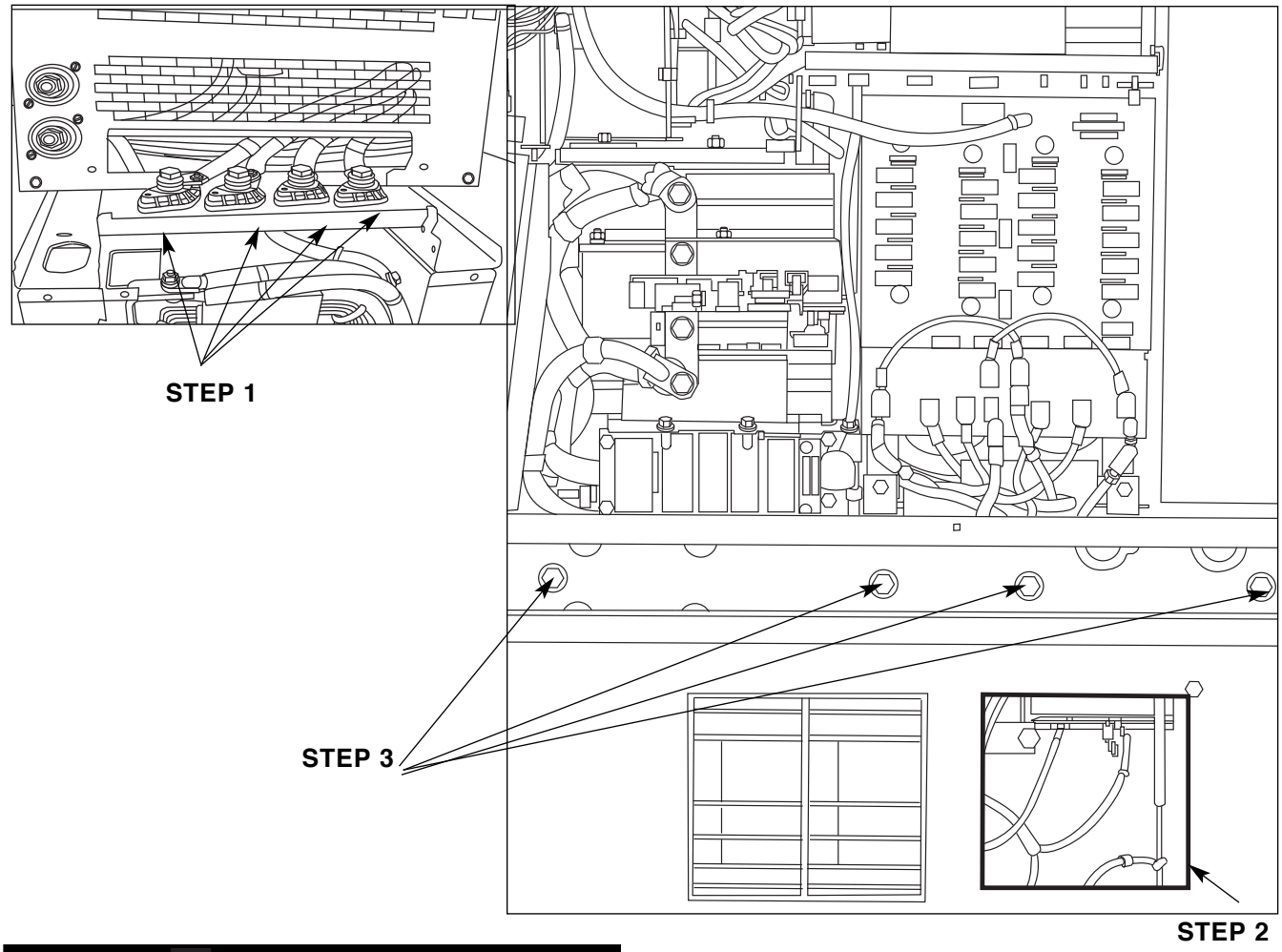
- Output Diodes Assembly Boards must be matching devices, top and bottom boards. They are changed as factory assembled parts.

  Transformer leads to Output Bridge torque is typically 45 in lbs.

UPPER SECTION SEPARATION FROM THE AC/DC (LOWER) SECTION

FIGURE F.65 – SEPARATION OF THE UPPER POWER INVERTER SECTION FROM THE AC/DC (LOWER SECTION)

NOTE: AC/DC switch can be removed easily. See its removal procedure (EZ slide out feature).



⚠ WARNING

You will be working near the input high volt capacitors. Follow discharge procedures of capacitors before working on this unit.

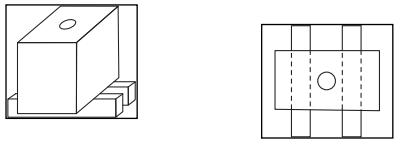
STEP 1: Disconnect the heavy leads from the underside of the feed-through connectors.

STEP 2: Gain access to the Amphenols inside the trap door and unplug them (lower right side).

STEP 3: Remove the eight self-tapping screws from the left and right sides (four per side).

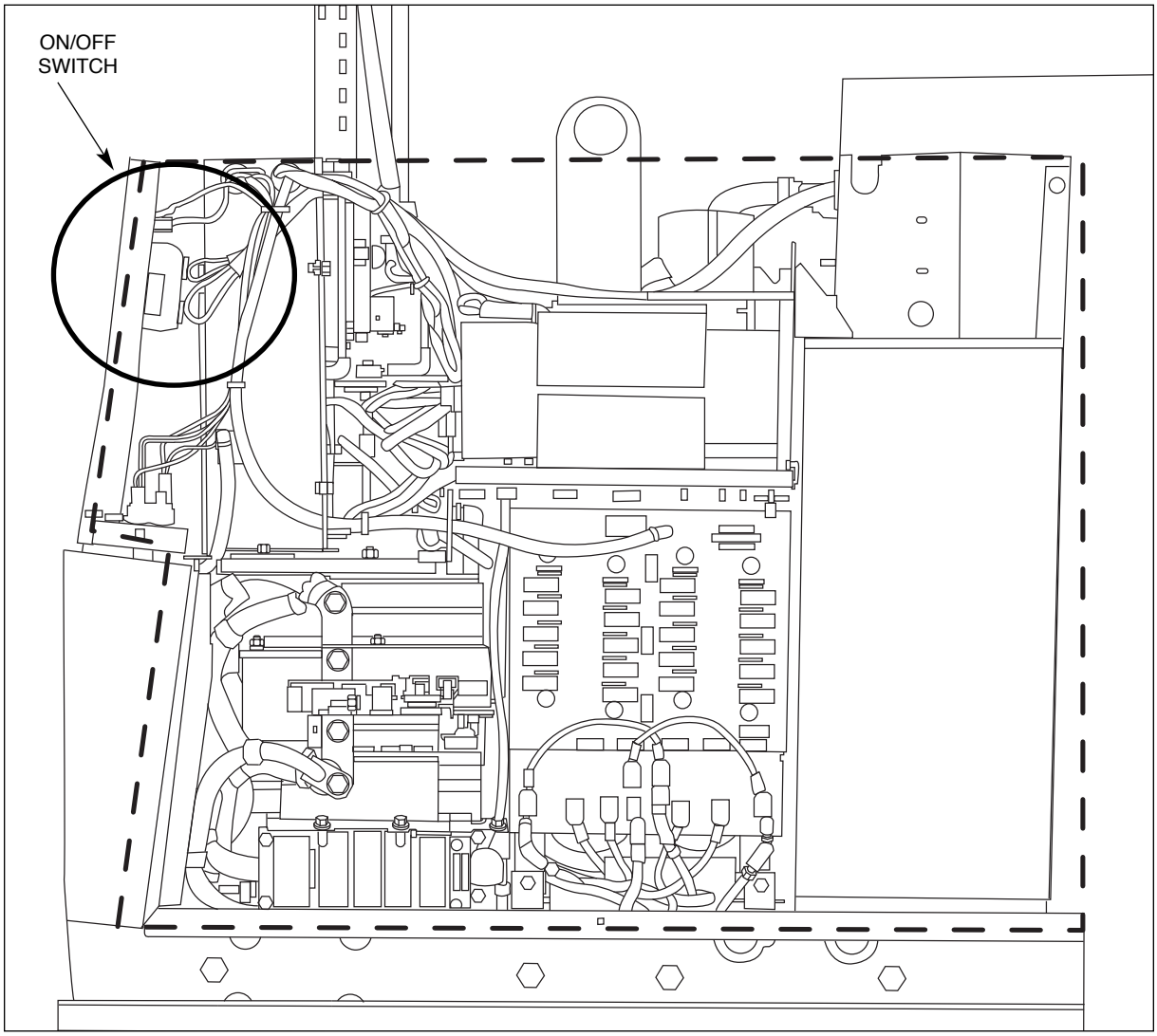
This will allow the top inverter power section to be lifted from the AC switch (lower section) assembly framing. (DO NOT set the unit down on the exposed leads). See NOTE.

NOTE: Use two 3-foot long wooden boards (4" x 4") as support for the welder; per the illustration. Be careful not to crush leads & amphenols on wood supports.



MAIN ON/OFF SWITCH REMOVAL

FIGURE F.66 – MAIN ON/OFF SWITCH



⚠ WARNING

You will be working near the input high volt capacitors. Follow discharge procedures of capacitors before working on this unit.

NOTE: Make sure all the input power is disconnected.

Access to the Main On/Off Switch is accomplished by removing the upper right side panel.

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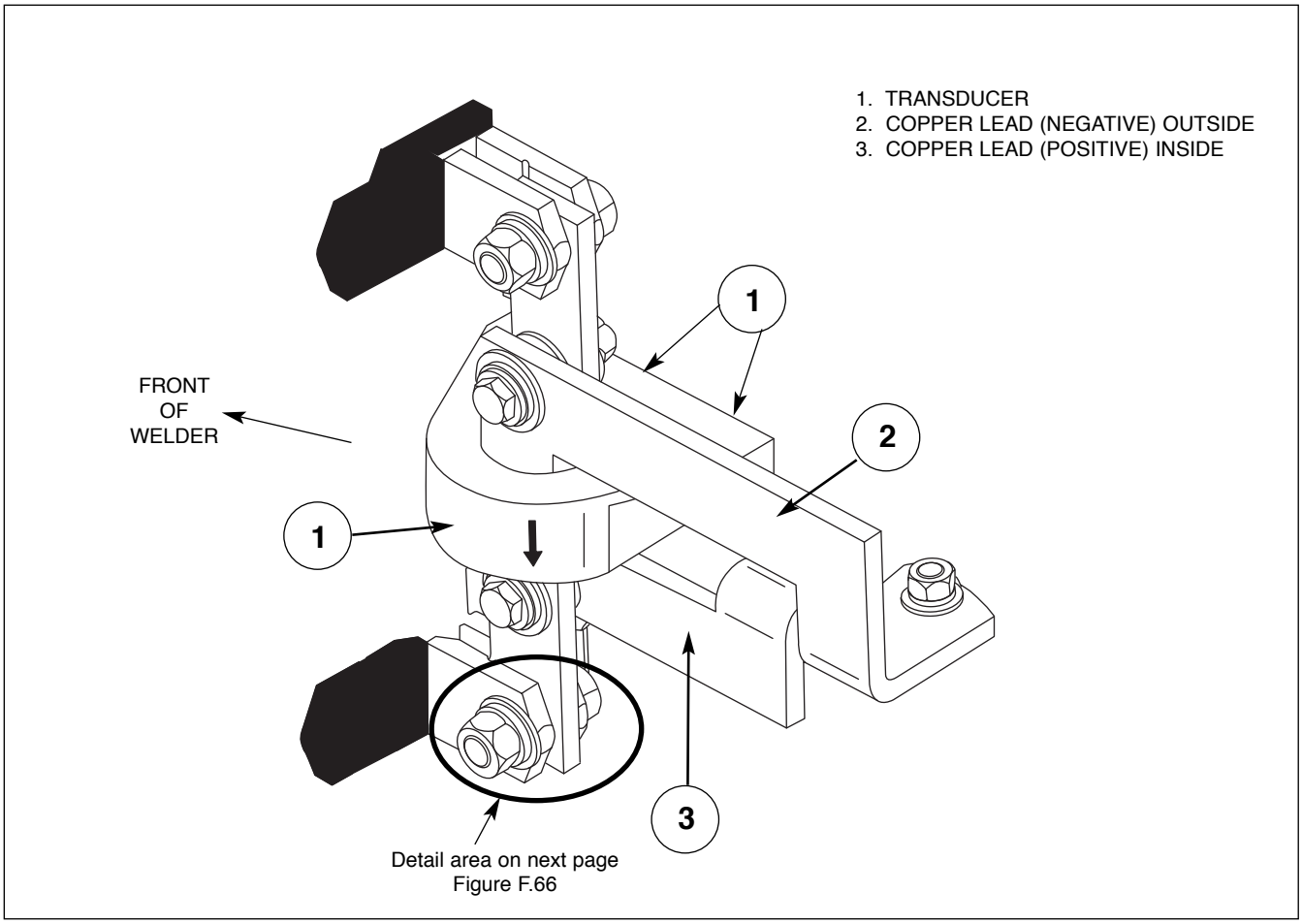
CURRENT TRANSDUCER REMOVAL

FIGURE F.67 – REFERENCE DRAWING



Remove both the copper bars and transducer together as a single unit. See Figure F.67.

STEP 1: Unplug the transducer. Then, remove the transducer mounting screws.

STEP 2: Disconnect the weld flex leads from the top inside copper bar. Leads 33-34 (positive).

STEP 3: Disconnect the weld flex leads from the bottom outside copper bar. Leads 37-38 (negative).

STEP 4: Disconnect both copper bars that are through the current transducer at the rear of the Output Rectifier area (be careful not to stress the output rectifier's copper bars.)

STEP 5: With the copper bars and transducer removed from the welder, disassemble bolts, nuts and insulators so that the transducer can be slipped over the copper bars.

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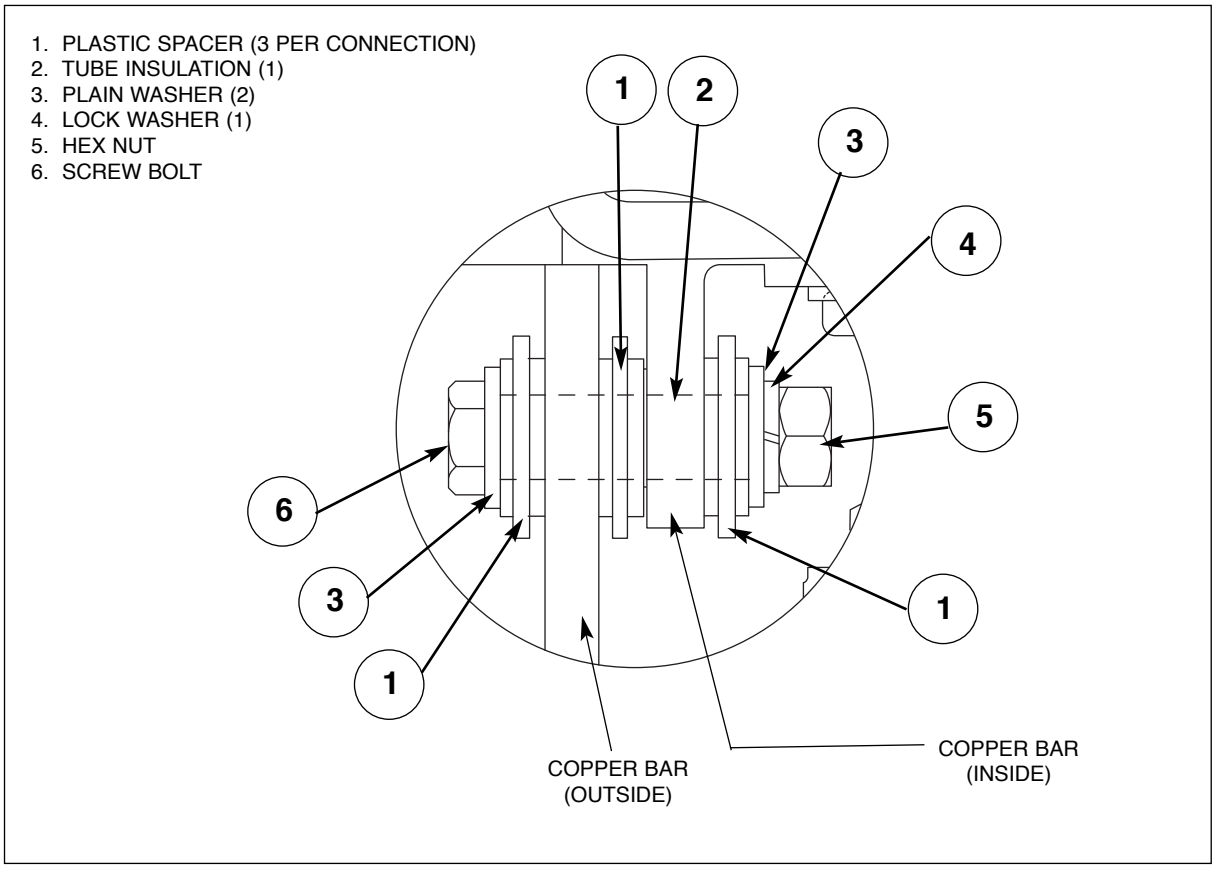
CURRENT TRANSDUCER REMOVAL: INSULATION WASHER DETAIL

FIGURE F.68 – DETAIL OF INSULATION WASHERS



Assemble in reverse order with the "transducer indicator arrow" pointing down when in the installed position. After installing the copper bars back through the transducer, ensure that the copper bars are insulated from each other BEFORE reconnecting them to the Output Rectifier.

See the detail of insulator arrangement.

NOTE: The inside copper bar fits up to the inner rectifier connections.

Assembly Hint: Loosely assemble nuts, bolts, and insulator that hold the copper bars at the transducer area BEFORE connecting coppers bars at Output Rectifier. Once tight at the rectifier, tighten the insulator nuts and bolts at the transducer. Be careful not to crack the insulators (torque specifications are 44 in. lbs.).

Reconnect the mounting screws and electrical harness on the transducer and other electrical connections to copper bars of assembly.

Return to Section TOC
Return to Master TOC

Section G-1

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- ELECTRICAL DIAGRAMS -

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Return to Master TOC
Return to Master TOC

PC BOARD ASSEMBLY - SWITCH BOARD (G4664-2)

G4664-2 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: REMOVED ITEM SH1 (PART ALREADY LISTED IN BILL OF MATERIAL)

NOTES:

N.A. **CAUTION**: THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.

N.B. PC BOARD AND MODULE MOUNTING HOLES TO BE FREE OF ENCAPSULANT MATERIAL FOR A CENTERED 0.50" MIN. DIA. AND 0.55" MAX. DIA. (8 HOLES). MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS. TO BE CENTERED WITHIN 0,100" (DO NOT GET ON MATING SURFACES).

N.C. MOLEX CAVITIES AND AREA AROUND LOCKING TAB TO BE FREE OF ENCAPSULANT MATERIAL. MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS.

N.D. FEMALE EYELET TO BE AGAINST THE OPPOSITE COMPONENT SIDE AS SHOWN. EYELET MUST NOT SPIN AFTER CLINCHING.

N.E. SOLDER EYELET SO THAT SOLDER COVERS ENTIRE EYELET AND ALL AROUND EYELET ON OPPOSITE COMPONENT SIDE ONLY. NO ICICLES OR SOLDER BLOBS PERMITTED.

N.F. BAR MUST BE FREE OF ENCAPSULATION MATERIAL ON BOTH SURFACES AROUND MOUNTING HOLES AND ENTIRE LENGTH OF MOUNTING SURFACES. ENCAPSULATION MATERIAL MUST NOT EXTEND BEYOND THE MOUNTING SURFACE PLANE (4 PLACES).

N.G. DO NOT COAT THE TOP SURFACES OR THREADS WITH ENCAPSULANT MATERIAL (4 TERMINALS). MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS.

N.H. ELECTRONIC MODULES TO BE ASSEMBLED, SOLDERED, AND SEALED TO PC BOARD PER E3875.

N.J. THESE SURFACES MUST BE MAINTAINED CO-PLANAR WITHIN .010" THROUGH ENTIRE SOLDERING AND SEALING PROCESS (4 PLACES).

N.K. INSPECT POWER TERMINAL PER E1880.

N.L. **ITEM 2** ELECTRONIC MODULES ON THE P.C. BOARD ASSEMBLY SHALL BE MATCHED WITHIN TWO SORT CODES FOR BOTH V_{CE} (1ST PAIR OF DIGITS OF 4 DIGIT SORT CODE) AND V_{GE} (2ND PAIR OF DIGITS OF 4 DIGIT SORT CODE).

e.g. M16100-61 X XX XXX.....

VENDOR CODE — VCE (SAT) — VGE (TH)

N.M. DO NOT COAT WITH ENCAPSULATION MATERIAL. TOP AND BOTTOM, FOR 0.80" MIN, DIA, AND 0.85" MAX. DIA. MASK PER APPROPRIATE MANUFACTURING WORK INSTRUCTIONS. TO BE CENTERED WITHIN 0,100" (DO NOT GET ON THE MATING SURFACES).

N.N. ENCAPSULATE COMPONENT SIDE OF P.C. BOARD TO A THICKNESS OF .30 +.12/-.00 IN AREA SHOWN.

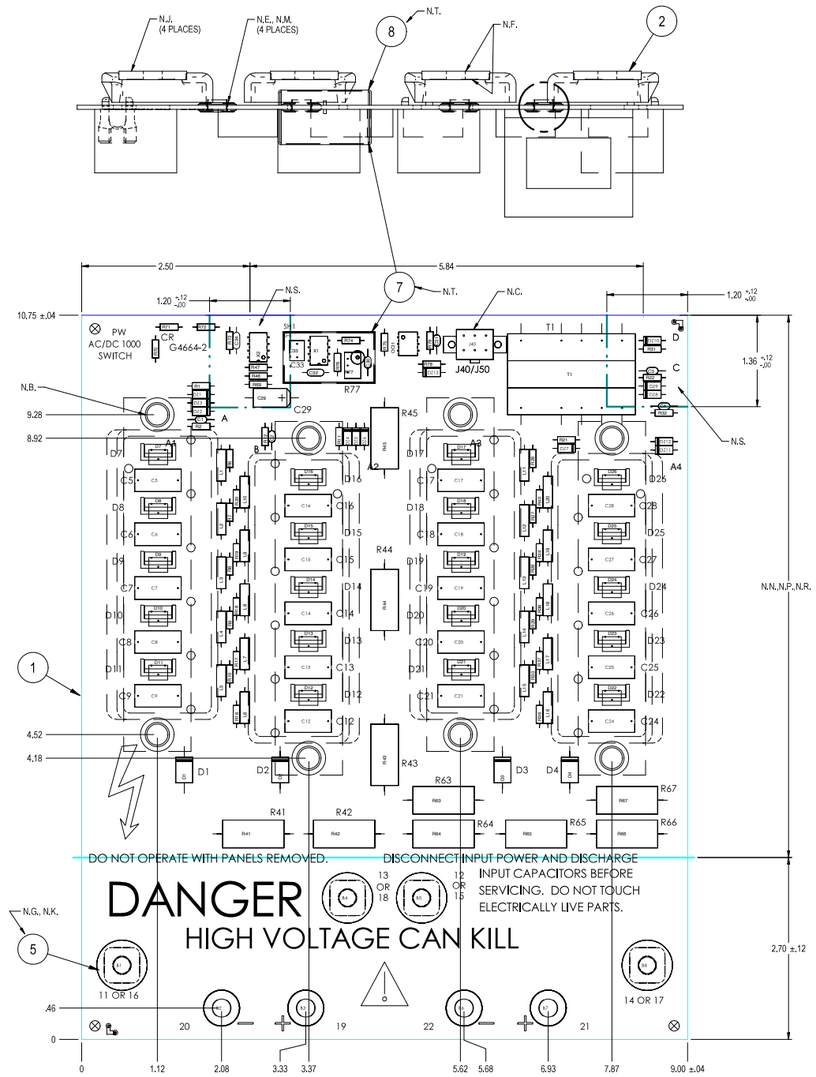
N.P. ENCAPSULATE OPPOSITE COMPONENT SIDE OF P.C. BOARD TO A THICKNESS OF .25 +.12/-.00.

N.R. ENCAPSULATION MATERIAL MUST EXTEND BEYOND EDGES OF P.C. BOARD -.12 +.12/-.00.

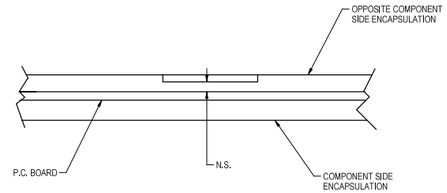
N.S. ENCAPSULATE OPPOSITE COMPONENT SIDE OF P.C. BOARD IN AREAS SHOWN TO A MAXIMUM THICKNESS OF .20.

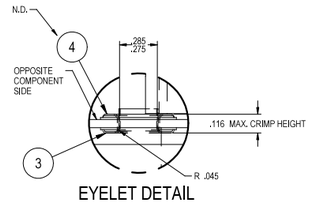
N.T. **ITEM 8** MOUNTS AND SOLDERS TO SAME HOLES AS **ITEM 7. ITEM 8** IS MOUNTED ON NON-COMPONENT SIDE OF P.C. BOARD.

N.U. ADD **ITEM 9** HEATSINK TO THESE DIODES (20 REQUIRED)
DIODES MUST HAVE SAME SORT CODE (WITHIN 50 MILLIVOLTS).



P.C. BOARD BLANK INFORMATION
BUY BLANK COMPLETE AS G4664-C
(4 LAYER BOARD PER E3867)
COPPER WEIGHT: OUTER LAYERS 4.0 oz./sq. ft.
INNER LAYERS 2.0 oz./sq.ft.
MAKES 2 BOARDS PER PANEL (SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION)
PANEL SIZE PER E1911





EYELET DETAIL

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	SEE ABOVE	PC BOARD BLANK
4	4	T9147-11	CONNECTOR, EYELET,POWER, FEMALE
6	430g	E2527	EPOXY ENCAPSULATING RESIN
7	1	S24869-1	PC BOARD SHIELD
8	1	S24869-2	PC BOARD SHIELD
N.U. 9	20	S20590-2	HEATSINK,STAND-UP, FOR TO-220
10	20	S25253-1	HEATSINK MOUNTING CLIP

REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW

N.A.,N.H.,N.L. REFERENCES	QTY	PART NUMBER	DESCRIPTION
A1, A2, A3, A4	4	M16100-61	ELECTRONIC-MODULE,5-T12704-105 IGBT'S
B1, B4, B5, B8	4	S23006	CONNECTOR,TERMINAL,POWER
B2, B3, B6, B7	4	T9147-15	CONNECTOR,EYELET,POWER,MALE
C1, C2, C3, C4, C31	5	S16668-6	CAPACITOR,CEMO,4700pF,50V,10%
N.U. C5, C6, C7, C8, C9, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C24, C25, C26, C27, C28	20	S20500-17	CAPACITOR,PPMF,0.1MF,630V,5%,BOX
C29	1	S13490-93	CAPACITOR,TAEL,27,35V,10%
C30	1	S16668-5	CAPACITOR,CEMO,.022,50V,20%
C32, C34	2	S16668-11	CAPACITOR,CEMO,0.1, 50V,10%
C33	1	S20500-14	CAPACITOR,PPMF,.022,100V,BOX,5%
D1, D2, D3, D4	4	T12705-59	DIODE,AXLDS,3A,600V,UFR
D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25, D26	20	T12705-32	DIODE,TO220,15A,600V,FR,MUR1560
DZ1, DZ4, DZ7, DZ10	4	T12702-40	ZENER DIODE,1W,6.2V,5%,1N4735A
DZ2, DZ3, DZ5, DZ6, DZ8, DZ9, DZ11, DZ12	8	T12702-29	ZENER DIODE,1W,15V,5%,1N4744A
DZ13	1	T12702-4	ZENER DIODE,1W,20V,5%,1N4747A
J40	1	S24020-6	CONNECTOR,MOLEX,MINI,PCB,6-PIN,TIN
L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16, L17, L18, L19, L20	20	T12218-15	CHOKE,RF,FERRITE BEAD,180 OHM
OC1	1	S15000-22	OPTOCOUPLER,PHOTO-Q,70V,CNY17-3/VDE
R1, R6, R7, R8, R9, R10, R11, R16, R17, R18, R19, R20, R21, R26, R27, R28, R29, R30, R31, R36, R37, R38, R39, R40, R69	25	S19400-10R0	RESISTOR,MF,1/4W,10.0,1%
R2, R12, R22, R32	4	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
R41, R42, R43, R44, R45, R63, R64, R65, R66, R67	10	T14648-9	RESISTOR,WW,5W,2.5K,5%,SQ
R46, R74	2	S19400-1002	RESISTOR,MF,1/4W,10.0K,1%
R47, R75	2	S19400-2001	RESISTOR,MF,1/4W,2.00K,1%
R70, R71, R72	3	S19400-1003	RESISTOR,MF,1/4W,100K,1%
R73	1	S19400-6191	RESISTOR,MF,1/4W,6.19K,1%
R76	1	S19400-6811	RESISTOR,MF,1/4W,6.81K,1%
R77	1	S16296-5	TRIMMER,MT,1/2W,10K, 10%,LINEAR
R78	1	S19400-1000	RESISTOR,MF,1/4W,100,1%
R79	1	S19400-2213	RESISTOR,MF,1/4W,221K,1%
T1	1	S13000-46	TRANSFORMER,PCB;
X1	1	M13552-3	IC,CONVERTER,V/F,654
X2	1	S15128-10	VOLTAGE REF,ADJ, PRECISION,431I

CAPACITORS = MFD/VOLTS
RESISTORS = OHMS

MAKE PER E1911
POT PER E1911-E
TEST PER E4107-SW

SCHEMATIC REFERENCE: L12291-2C0

MANUFACTURE AS:

G 4 6 6 4 - 2 C 0

PART NUMBER IDENTIFICATION CODE

INCLUDE:
(1) L12498 MOUNTING BRACKET
(8) S25347-2 THERMAL INTERFACE PADS
(1) S25191-1PRINT INSTRUCTIONS
(1) S25844PRINT INSTRUCTIONS
(1) S26109PRINT INSTRUCTIONS

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± .5 OF A DEGREE
MATERIAL TOLERANCE (+/-) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE	
DRAWN BY: RAS	G4662-1	
ENGINEER: T. SPEAR	SCALE:	1:1
APPROVED: -		

EQUIPMENT TYPE: POWERWAVE AC/DC 1000
SUBJECT: SWITCH P.C BOARD ASSEMBLY
MATERIAL DISPOSITION: NA | APPROVAL DATE: 08/03/2006 | PROJECT NUMBER: CRM22115-FY

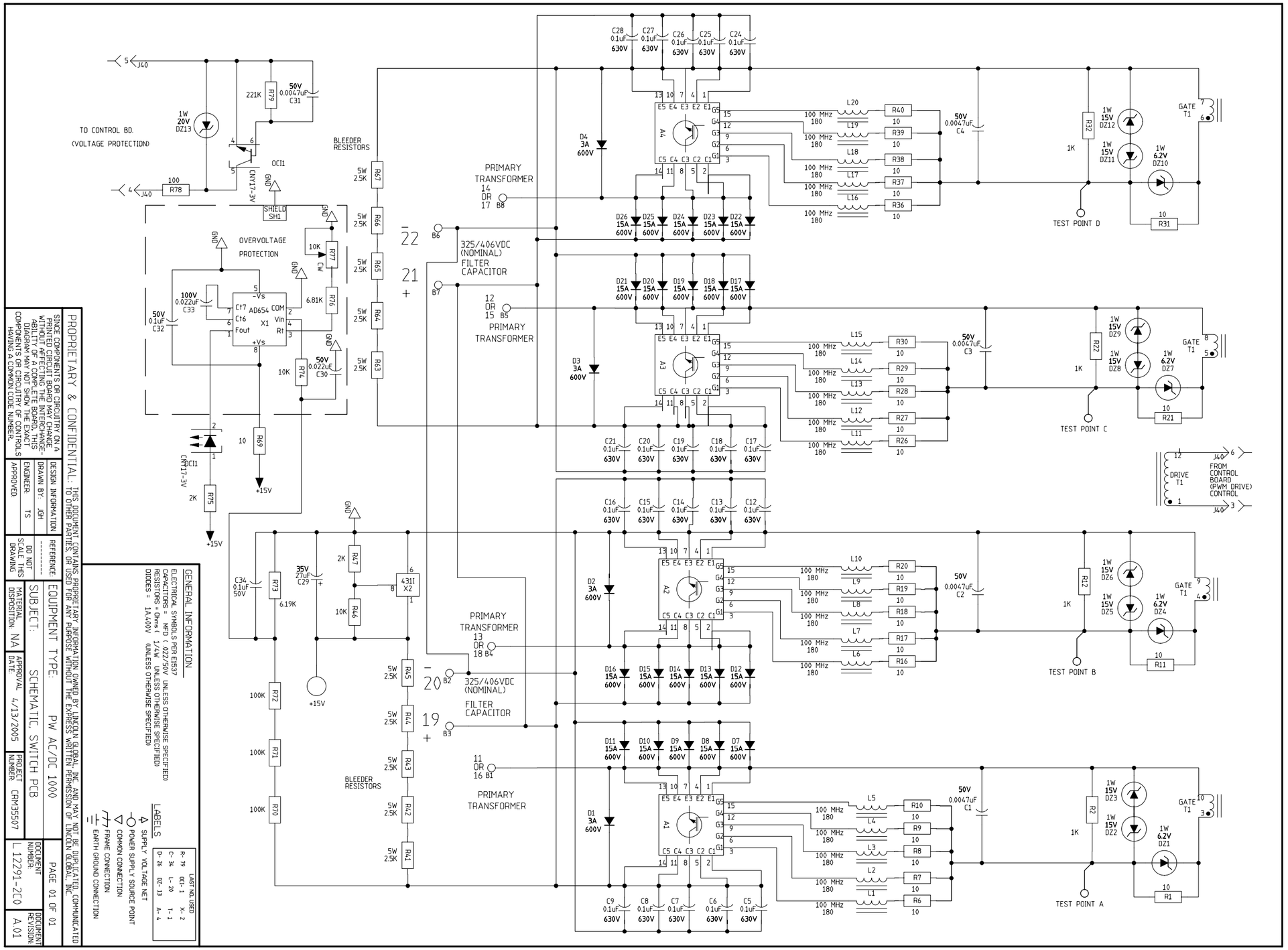
PAGE 1 OF 1
DOCUMENT NUMBER: G4664-2
DOCUMENT REVISION: D

SIZE B PAPER

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

Return to Section TOC
Return to Master TOC



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

LINCOLN ELECTRIC

PC BOARD ASSEMBLY - SWITCH BOARD & HEATSINK (G4962)

G4962 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: RELEASED A,04 FROM X.

NOTES :

N.A. APPLY THERMAL PAD (ITEM 10) AND MOUNT SWITCH BOARD PER E3875. TIGHTEN MODULES PER N.B.

N.B. TIGHTEN IN THE FOLLOWING MANNER (8 PLACES) :
TIGHTEN ALL UNTIL SNUG.
TIGHTEN ALL TO 24-28 IN.-LBS.
TIGHTEN ALL TO 40-48 IN.-LBS.

N.C. CLEAN CAPACITOR TERMINAL SURFACES PER E1388. APPLY A VERY THIN COATING OF ITEM⑥TO TERMINAL SURFACES. DO NOT APPLY COMPOUND TO SET SCREW THREADS OR THREADED AREA OF TERMINALS. HAND TIGHTEN SET SCREWS.

N.D. MOUNT CAPACITOR BRACKETS INTO HEAT SINK BEFORE INSERTING CAPACITOR INTO CAPACITOR BRACKET.

N.E. TIGHTEN UNTIL LOCKWASHER MAKES CONTACT WITH ITEM③EYELET.

N.F. MOUNT CAPACITORS WITH VENT IN THIS LOCATION.

N.G. **CAUTION : THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.**

N.L. LONGER END OF CAPACITOR BRACKET TO BE ORIENTED IN THIS DIRECTION.

N.N. MOUNT ITEM ⑧INSULATION BETWEEN ITEM ⑫ HEATSINK MTG. BRACKET AND ITEM ① HEATSINK. FOLD INSULATION TO COVER BOLT HEAD AND SECURE WITH ITEM ⑨TAPE BEFORE MOUNTING ITEM ③ SWITCH PC BOARD.

N.P. SEE FINAL ASSEMBLY FOR THERMOSTAT REQUIREMENTS.

N.R. MATCH "+" TERMINAL OF CAPACITORS TO "+" EYELET ON P.C. BOARD.

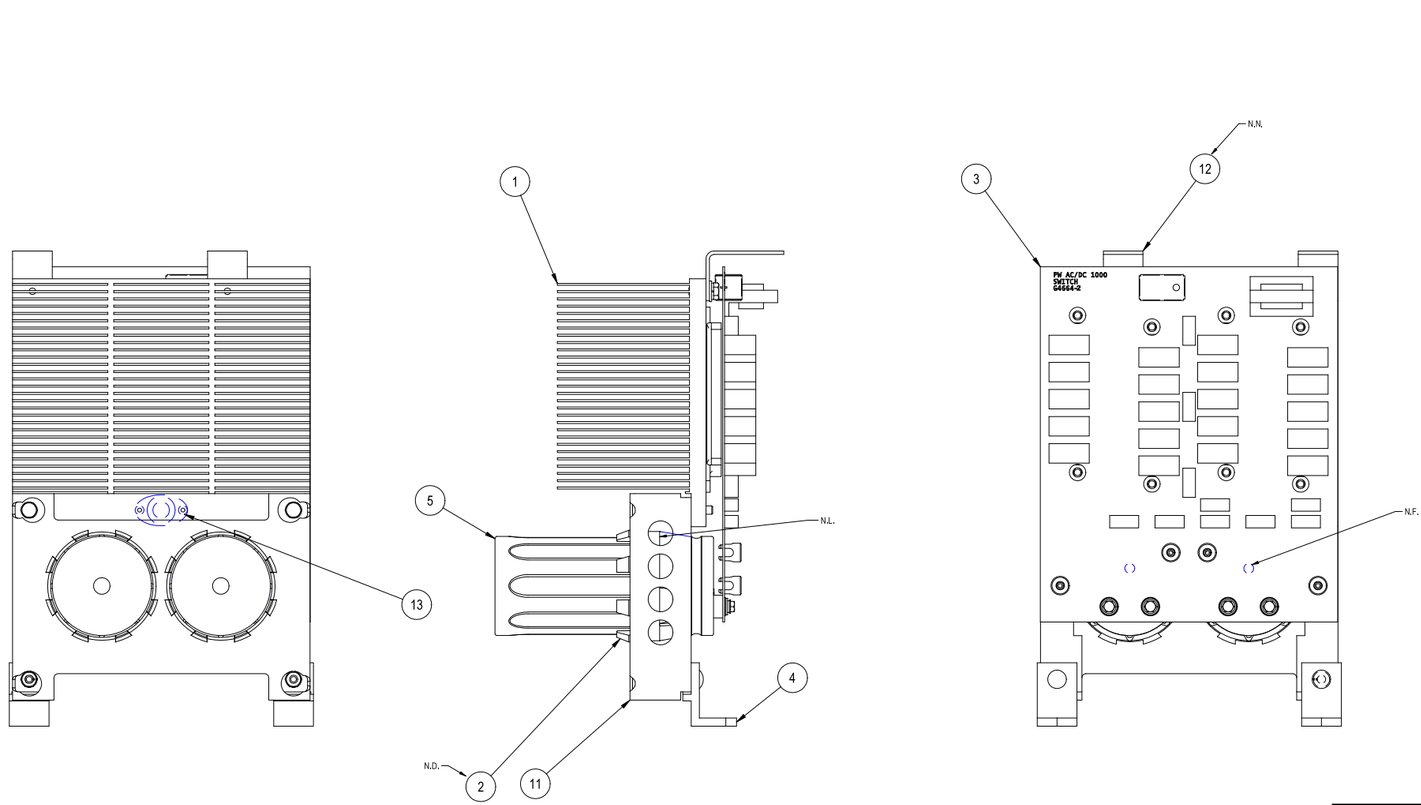
MANUFACTURING TEST :
GROUND TEST PER E3875

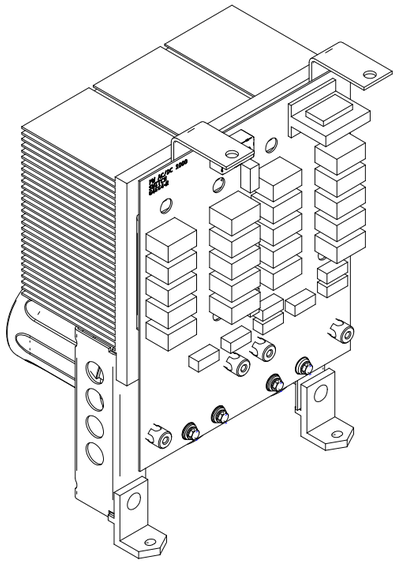
WARNING

ELECTRIC SHOCK can kill
- Turn the input power OFF at the disconnect switch and discharge input capacitors before working inside the equipment.
- Only qualified personnel should perform installation maintenance and troubleshooting work.

	ITEM	PART NO.	DESCRIPTION	QTY
	1	G5200	HEAT SINK	1
	2	M16737	CAPACITOR BRACKET	2
N.G.		G4664-2	SWITCH PC BOARD ASSEMBLY	1
N.C.	3	T9447-9	SOCKET HEAD CAP SCREW	8
N.B.		E106A-2	LOCKWASHER	8
	4	S22168	HEATSINK HOLDER	2
		T11827-44	CARRIAGE BOLT, 1/4-20X.50	2
		E106A-2	LOCK WASHER	2
		CF000017	1/4-20HN	2
	5	S13490-219	CAPACITOR	2
		M5 SCREW	SUPPLIED WITH CAPACITOR	4
N.L.		PLAIN WASHER	SUPPLIED WITH CAPACITOR	4
		LOCK WASHER	SUPPLIED WITH CAPACITOR	4
	★6	E2529	ELECTRICAL JOINT COMPOUND	.01 oz.
N.N.	★8	S24445	INSULATION	2
N.N.	★9	E1586-1.00 WIDE	TAPE	0.33 FT.
N.A.	★10	S25347-2	THERMAL INTERFACE PAD	4
	11	L12498	SWITCHBOARD BRACKET	1
		CF000013	1/4-20X.625HHCS	2
		S9262-98	PLAIN WASHER	2
		E106A-2	LOCK WASHER	2
	12	S25849	HEATSINK MOUNTING BRACKET	2
		CF000013	1/4-20X.625HHCS	2
		S9262-98	PLAIN WASHER	2
		E106A-2	LOCK WASHER	2
	13	S24360	THERMOSTAT ASSEMBLY	1
		S8025-62	SELF TAPPING SCREW	2
		E2529	THERMAL JOINT COMPOUND	.05 OZ.

★ THESE ITEMS NOT SHOWN





FOR PARTS ORDERS:

INCLUDE PRINT OF S25844 INSTRUCTIONS.

EN-170

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± .5 OF A DEGREE
MATERIAL TOLERANCE (T) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION		REFERENCE:	G4636
DRAWN BY:	RAS	SCALE:	1:2
ENGINEER:	TS		
APPROVED:	-		

EQUIPMENT TYPE: POWERWAVE AC/DC 1000
SUBJECT: SWITCHBOARD & HEATSINK ASSEMBLY
MATERIAL DISPOSITION: UF
APPROVAL DATE: 03/31/2005
PROJECT NUMBER: CRM36954

PAGE 1 OF 1
DOCUMENT NUMBER: G4962
DOCUMENT REVISION: A
SOLID EDGE

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

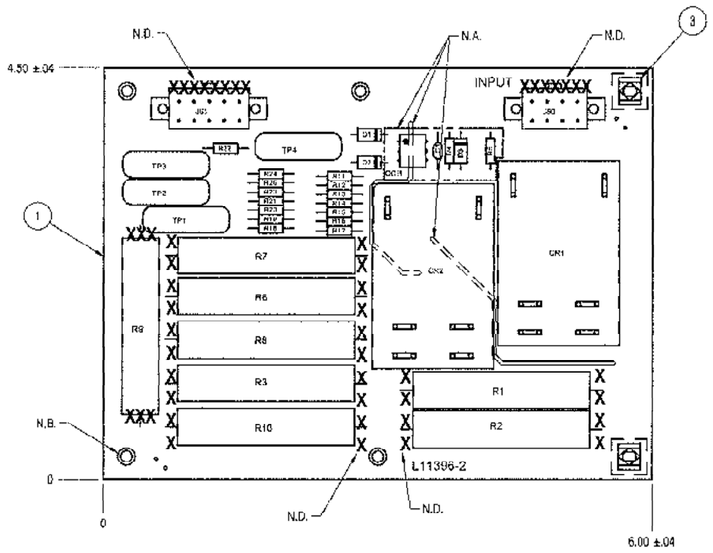
Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

L11396-2 | ENGINEERING CONTROLLED | CHANGE DETAIL: NEW
MANUFACTURER: No

	REFERENCES	QTY	PART NO.	DESCRIPTION
	C1	1	S16688-5	.022/50
	CR1, CR2	2	S14293-13	DPST RELAY
	D1, D3	2	T12199-1	1N4004
	D2	1	T12705-58	DIODE,1.0A,1500V
N.C.	J60	1	S24020-8	HEADER,VERTICAL
N.C.	J61	1	S24020-10	HEADER,VERTICAL
	OC1	1	S15000-22	OPTO ISOLATOR
	R1, R2, R3, R6, R7, R8, R9, R10	8	S24376-3	100/10W
	R4	1	S19400-2673	267K 1/4W
	R5	1	S19400-4750	475 1/4W
	R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25	15	S19400-3011	3.01K 1/4W
	TP1, TP2, TP3, TP4	4	T13640-23	MOV,250J,660V

P.C. BOARD BLANK INFORMATION
BUY COMPLETE AS L11396-B
(2 LAYER BOARD PER E3281)
(MAKES 8 BOARDS PER PANEL, SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION)



ITEM	REQ'D	PART NO.	IDENTIFICATION
1	1	SEE BLANK INFO.	P.C. BD. BLANK
2	1.0 OZ.	E2851	SEALANT
3	2	S14020-7	PLASTIC EXPANSION NUT

CAPACITORS = MFD / VOLTS

RESISTORS = OHMS/WATTS

N.A. THIS AREA TO BE COVERED ON BOTH SIDES OF BOARD WITH ITEM 2 PRIOR TO ENCAPSULATION. MATERIAL MUST BE APPLIED THRU SLOTS FROM BOTTOM SIDE TO COMPLETELY FILL TO UNDERSIDE OF DEVICE ON COMPONENT SIDE.

N.B. P.C. BOARD HOLES TO BE FREE OF ENCAPSULATION MATERIAL.

N.C. DO NOT COAT WITH ENCAPSULATION MATERIAL.

N.D. APPLY ITEM 2 AS SHOWN, ALL EXPOSED LEADS MUST BE COVERED. MATERIAL MUST BE APPLIED PRIOR TO ENCAPSULATION.

N.E. APPLY ITEM 2 ON NON-COMPONENT SIDE OF BOARD PRIOR TO ENCAPSULATION. ALL EXPOSED PINS MUST BE COVERED.

MAKE PER E1911
ENCAPSULATE WITH E1844
TEST PER E3647-I
SCHEMATIC REFERENCE: M19528-2B0

MANUFACTURED AS:

L11396-2B0

IDENTIFICATION CODE

ALL COMPONENTS AND MATERIALS USED IN THIS ASSEMBLY ARE TO BE RoHS COMPLIANT PER E4253.

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E9096
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .005
ON ALL ANGLES IS ± 3.0° A DEGREE
MATERIAL TOLERANCE (+/-) TO AGREE WITH PUBLISHED STANDARDS
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	
DRAWN BY:	FEI
ENGINEER:	
APPROVED:	
REFERENCE:	L11396-1
SCALE:	1:1
EQUIPMENT TYPE:	INVERTER WELDERS
SUBJECT:	INPUT P.C. BOARD ASSEMBLY
MATERIAL DESCRIPTION:	NA
APPROVAL DATE:	8/3/2006
PROJECT NUMBER:	CRM38146-A
PAGE	1 OF 1
DOCUMENT NUMBER:	L11396-2
DOCUMENT REVISION:	A

SOLID EDGE

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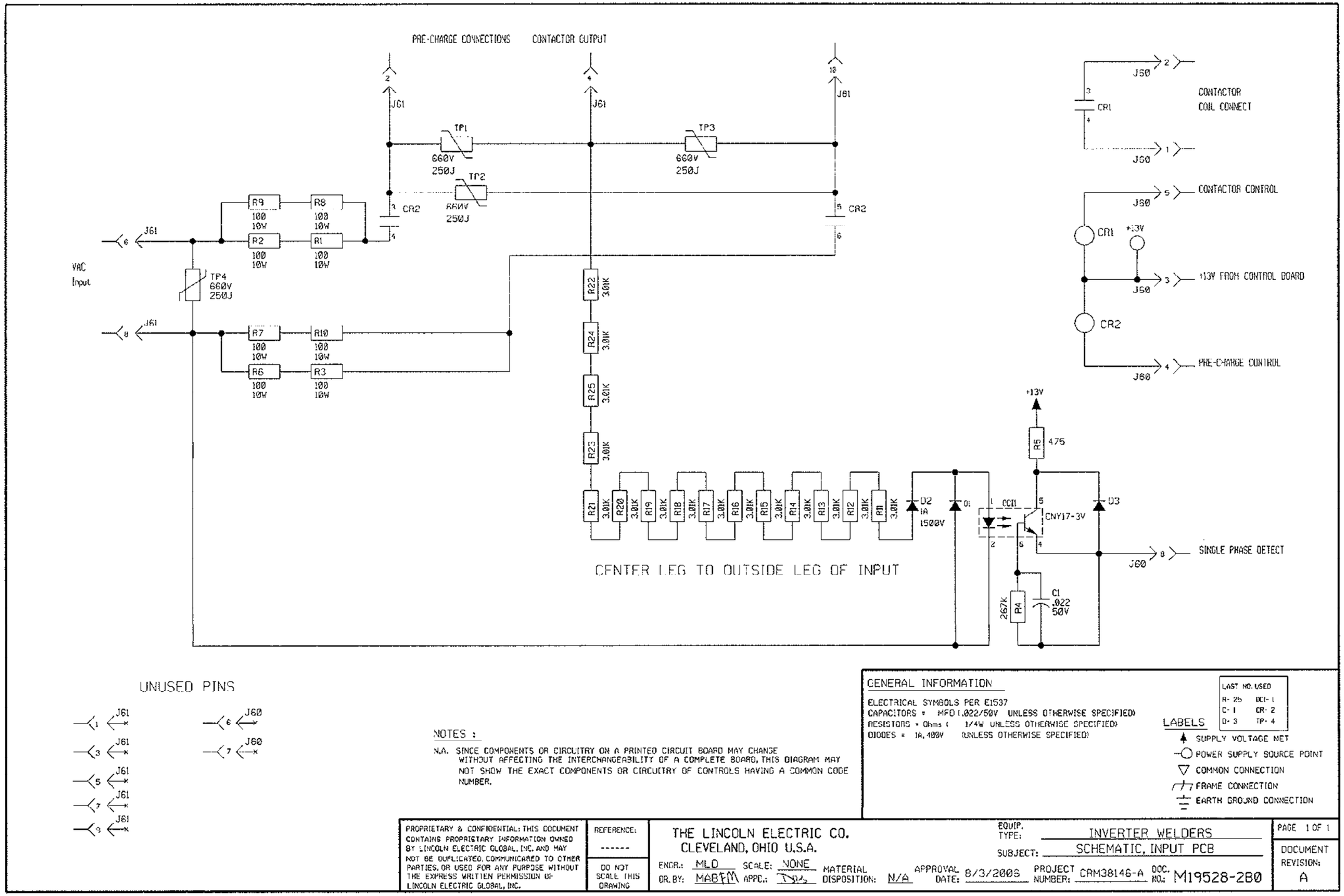
LINCOLN ELECTRIC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC



UNUSED PINS

J61 1, J61 3, J61 5, J61 7, J61 9, J60 6, J60 7

NOTES :

N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED	
R- 25	DI- 1
C- 1	CR- 2
D- 3	TP- 4

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

REFERENCE: ------

DO NOT SCALE THIS DRAWING

THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.

ENGR.: MLD SCALE: NONE MATERIAL DISPOSITION: N/A APPROVAL DATE: 8/3/2006
DR. BY: MABFM APPR.: TJS

EQUIP. TYPE: INVERTER WELDERS
SUBJECT: SCHEMATIC, INPUT PCB
PROJECT NUMBER: CRM38146-A
DOC. NO.: M19528-2B0

PAGE 1 OF 1
DOCUMENT REVISION: A

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

LINCOLN ELECTRIC

L11745	ENGINEERING CONTROLLED MANUFACTURER: No	CHANGE DETAIL: REVISED NOTE N.B. REMOVED NOTE N.D.

ITEM	PART NO.	DESCRIPTION	QTY
1	M19559	HEAT SINK	1
2	L11078-1	40V DC BUS P.C. BD. ASSEMBLY	1
	S25930-1	TORZ BUTTON HEAD SCREW	2
	S9262-23	PLAIN WASHER	2
	CF000017	1/4-20HN	2
	E2529	JOINT COMPOUND	.004 OZ.
* 3	E1777-2	RETAINING COMPOUND (LOCTITE 242)	2 cc
4	T13359-12	THERMOSTAT	1
	S8025-80	SELF TAPPING SCREW	2
	E2529	ELECTRICAL JOINT COMPOUND	.001 .OZ

* THESE ITEMS NOT SHOWN

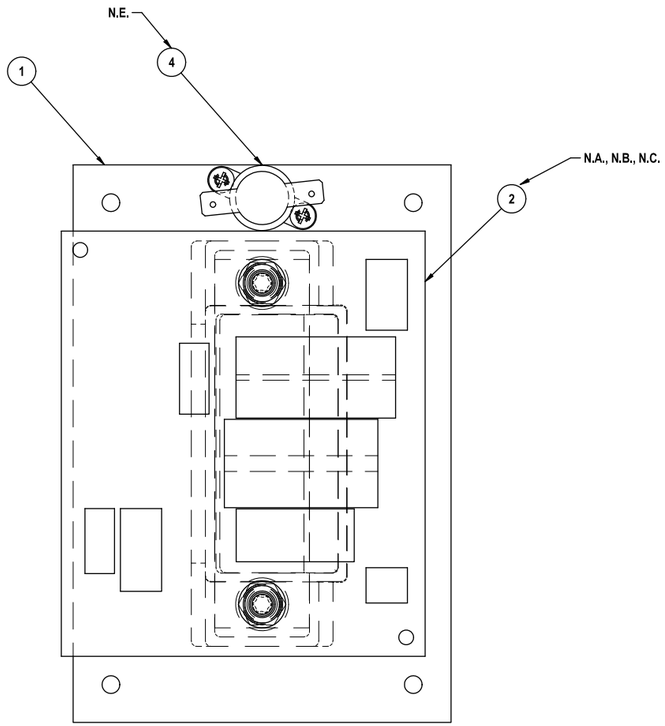
NOTES:

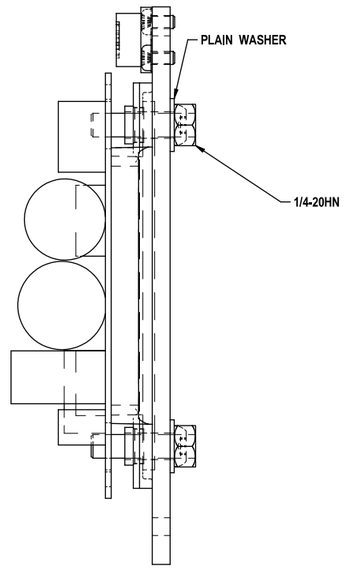
N.A. ASSEMBLE ITEM 2 WITH HEADERS LOCATED AS SHOWN.

N.B. MOUNT THE DC BUS & TIGHTEN THE MODULES PER E3875.

N.C. APPLY A SMALL DROP OF ITEM 3 TO THE FIRST 2-3 THREADS OF THE SOCKET HEAD CAP SCREW.

N.E. APPLY FILM OF COMPOUND TO MOUNTING SURFACE OF ITEM 4 THERMOSTAT.
MOUNT WITH TERMINALS POSITIONED AS SHOWN.





CAUTION: THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.

FOR PARTS ORDERS ONLY

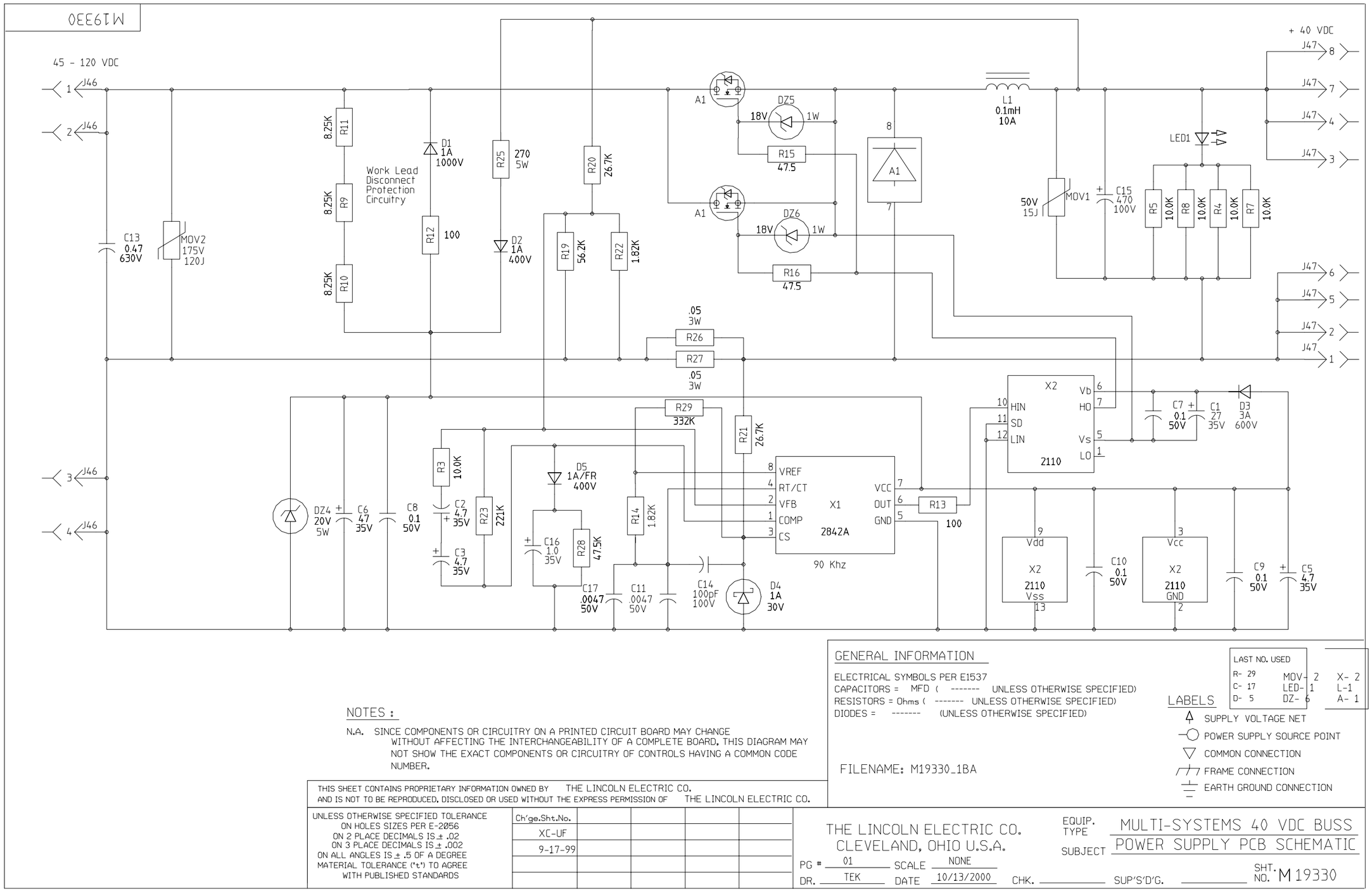
INCLUDE S25251 INSULATION

MANUFACTURING TOLERANCE PER EZ 56 UNLESS OTHERWISE SPECIFIED TOLERANCE ON 2 PLACE DECIMALS IS .2 ON PLACE DECIMALS IS .2 ON ALL ANGLES IS .5 OF A DEGREE MATERIAL TOLERANCE WILL TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	DESIGN INFORMATION DRAWN BY: kjustice ENGINEER: APPROVED: -	SCALE: 1:1 IF PRINTED A2 SIZE UNITS: INCH	EQUIPMENT TYPE: INVERTER WELDERS SUBJECT: EXCITER BOARD MODULE ASSEMBLY MATERIAL DISPOSITION: UF APPROVAL DATE: 3/17/2005 PROJECT NUMBER: CRM36772 REFERENCE: G3780	PAGE 1 OF 1	DOCUMENT NUMBER: L11745	DOCUMENT REVISION: C

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

Return to Section TOC
Return to Master TOC



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (------- UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (------- UNLESS OTHERWISE SPECIFIED)
DIODES = ------- (UNLESS OTHERWISE SPECIFIED)

FILENAME: M19330_1BA

LAST NO. USED			
R- 29	MOV- 2	X- 2
C- 17	LED- 1	L-1
D- 5	DZ- 6	A- 1

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

NOTES :

N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

UNLESS OTHERWISE SPECIFIED TOLERANCE
ON HOLES SIZES PER E-2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± .5 OF A DEGREE
MATERIAL TOLERANCE ('t') TO AGREE WITH PUBLISHED STANDARDS

Ch'ge.Sht.No.					
XC-UF					
9-17-99					

THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.

EQUIP. TYPE: MULTI-SYSTEMS 40 VDC BUSS
SUBJECT: POWER SUPPLY PCB SCHEMATIC

PG # 01 SCALE NONE
DR. TEK DATE 10/13/2000 CHK. _____ SUP'S'D'G. _____ SHT. NO. M 19330

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - AUXILIARY DRIVER BOARD (L11067)

L11067-1

ENGINEERING CONTROLLED
MANUFACTURER No

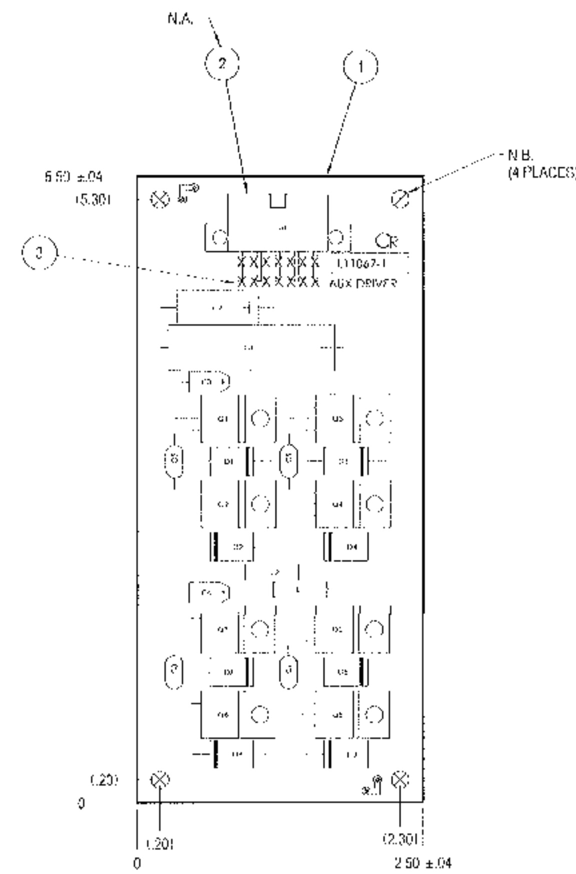
CHANGE DETAIL: RELEASED FROM X A.03

P.C. BOARD BLANK REFERENCE INFORMATION
MAKE FROM S19399
(MAKES 14 BOARDS PER PANEL. SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION)
BLANK PART NUMBER: L11067-C

ITEM	REQ'D	PART No.	DESCRIPTION
1	1	SEE BLANK	P. C. BOARD BLANK
2	1	S24016-10	HEADER (J1)
3	1 OZ	E2861	SEALANT

FOR ITEMS BELOW, REFER TO ELECTRONIC COMPONENTS DATABASE FOR COMPONENT SPECIFICATIONS

C1	1	S13490-71	CAPACITOR, ALEL, 100, 50V, +75/-10%
C2	1	S13490-66	CAPACITOR, TAEL, 47, 35V 10%
C3, C4	2	S13490-25	CAPACITOR, TAEL, 4.7, 35V 10%
C5, C6, C7, C8	4	S16668-11	CAPACITOR, CEMO, 0.1, 50V, 10%
D1, D2, D3, D4, D5, D6, D7, D8	8	T12705-37	DIODE, AXLDS, 3A, 40V, SCHOTTKY
L1, L2	2	T12218-15	CHOKE, RF, FERRITE BEAD, 180 OHM
Q1, Q3, Q5, Q7	4	T12704-41	TRANSISTOR, N, T220, 8A, 150V, MJE15030
Q2, Q4, Q6, Q8	4	T12704-49	TRANSISTOR, P, T220, 8A, 150V, MJE15031



UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

MANUFACTURED AS:
L11067-1C0
PART NUMBER IDENTIFICATION CODE

MAKE PER E1911
ENCAPSULATE WITH E1844,3 TIMES
TEST PER E3926-AD

NOTES:
N.A. DO NOT COAT WITH ENCAPSULATION MATERIAL.
N.B. AFTER ENCAPSULATION, DRILL HOLES (BOTH SIDES).

PROPRIETARY & CONFIDENTIAL: THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OWNED BY LINCOLN GLOBAL, INC. AND MAY NOT BE DUPLICATED, COMMUNICATED TO OTHER PARTIES OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS WRITTEN PERMISSION OF LINCOLN GLOBAL, INC.

UNLESS OTHERWISE SPECIFIED TOLERANCE
MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± .5 OF A DEGREE
MATERIAL TOLERANCE ("t") TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION
DRAWN BY: T.P.
ENGINEER: TK
APPROVED: TK

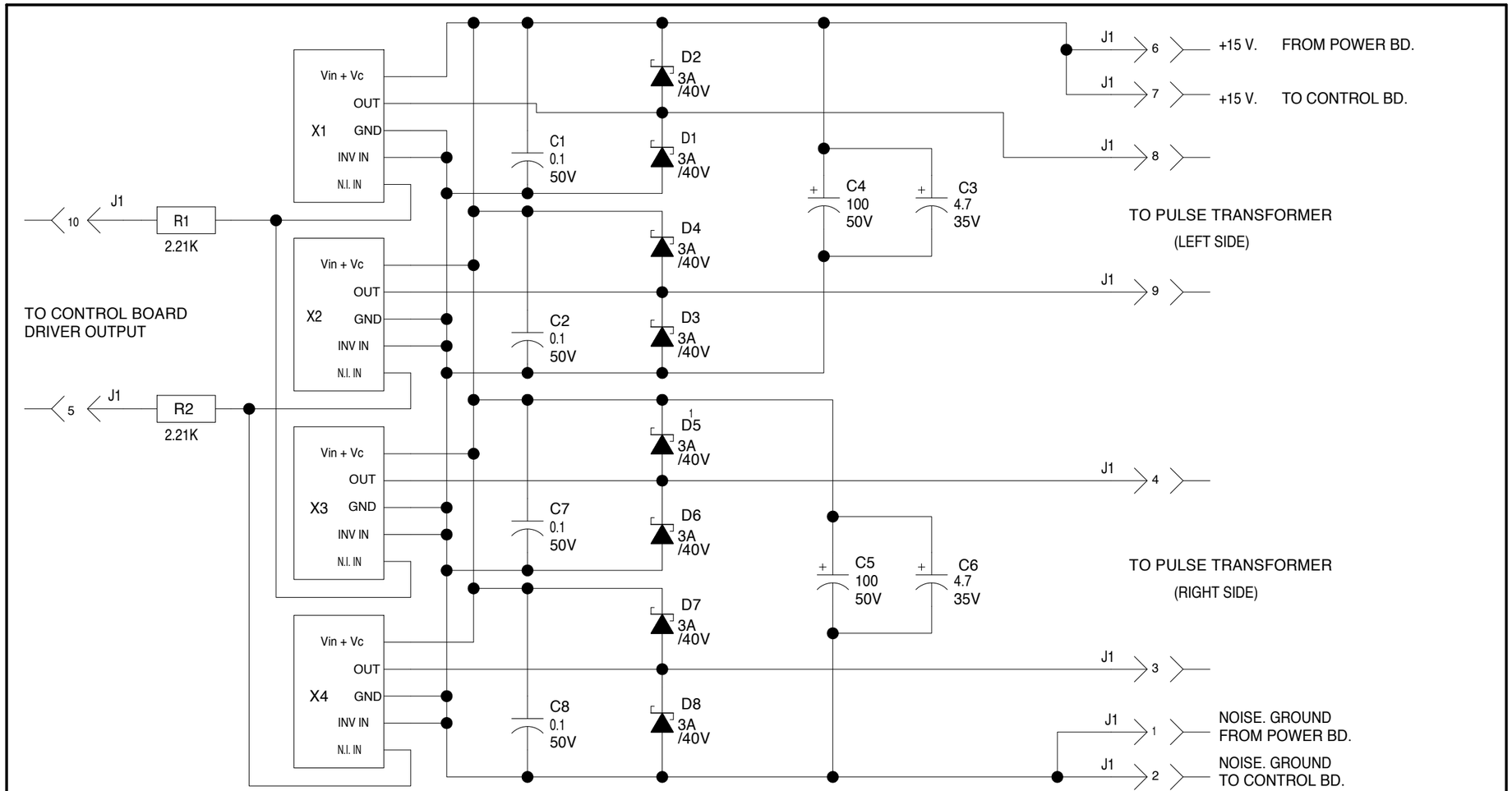
REFERENCE: Reference
SCALE: 1:1

EQUIPMENT TYPE: INVERTER WELDERS
SUBJECT: AUXILIARY DRIVER P.C.BD. ASSEMBLY
MATERIAL DISPOSITION: NA
APPROVAL DATE: 12/3/02
PROJECT NUMBER: CRM34209

PAGE 1 OF 1
DOCUMENT NUMBER: L11067-1
DOCUMENT REVISION: A

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

SCHEMATIC - AUXILIARY DRIVER BOARD (S24530)



NOTES :

N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD. THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LABELS

SUPPLY VOLTAGE NET
POWER SUPPLY SOURCE POINT
COMMON CONNECTION
FRAME CONNECTION
EARTH GROUND CONNECTION

file name S24530-1AB

UNLESS OTHERWISE SPECIFIED TOLERANCE
ON HOLES SIZES PER E-2056
ON 2 PLACE DECIMALS IS ± .O2
ON 3 PLACE DECIMALS IS ± .OO2
ON ALL ANGLES IS ± .5 OF A DEGREE
MATERIAL TOLERANCE ("t") TO AGREE WITH PUBLISHED STANDARDS

THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.

SCALE NONE

DR. LJB APP.DATE 12-20-02 CHK. TK SUP'S'D'G.

EQUIP. TYPE AUX_DRIVER P.C. BOARD

SUBJECT SUB: SCHEMATIC

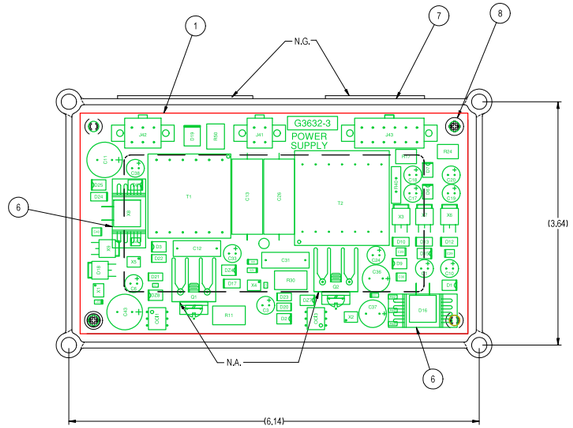
SHT. NO. S 24530

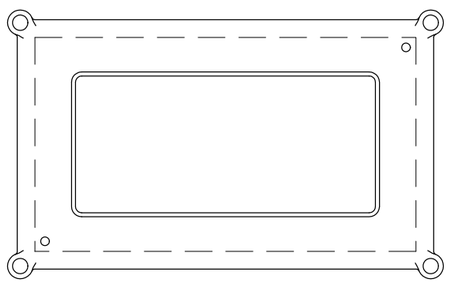
REV. A

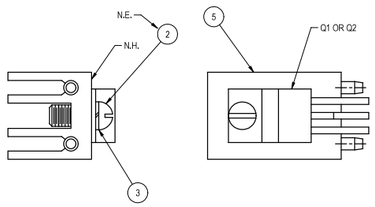
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - DIGITAL POWER BOARD (G3632)

G3632-3 | ENGINEERING CONTROLLED MANUFACTURER: Yes | CHANGE DETAIL: REVISED IDENTIFICATION CODE, BLANK PART NIMBER, SCHEMATIC REFERFENCE AND UPDATED GRAPHICS







HEATSINK MOUNTING DETAIL

ITEM (USED WITH)	QTY	PART NUMBER	DESCRIPTION
1	1	G3632-F	PC BOARD BLANK
N.A. 2 (Q1, Q2)	2	CF000003	6-32 X..375 ROUND HEAD MACHINE SCREW
N.A. 3 (Q1, Q2)	2	E106A-13	# 6 LOCK WASHER
4 (Q1, Q2)	AS REQ	E1868	THERMO JOINT COMPOUND
N.A. 5 (Q1, Q2)	2	S18104-5	HEAT SINK,ALUMINUM,EXTRUDED,FOR 1 TO-220,1.0
6 (D16, X8)	2	S25128-1SMT	SMD HEAT SINK FOR D2PAK TO-263
7	1	M19436-3	POTTING TRAY
8	2	S8025-80	SELF TAPPING SCREW
9	115g	E2527	EPOXY ENCAPSULTION RESIN
10	AS REQ	E2861	ELECTRICAL INSULATION COMPOUND

REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW

REFERENCES	QTY	PART NUMBER	DESCRIPTION
C1, C3, C6, C10, C17, C18, C19, C20, C24, C33, C38	11	S13490-197	CAPACITOR,ALEL,82,35V,20%,LOW-ESR
C2, C5, C7, C9, C14, C21, C22, C25, C34, C39, C44, C53	12	S25020-3SMT	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
C4, C8	2	S25020-4SMT	CAPACITOR,SMD,CERAMIC,820pF,50V,5%,COG,S0805
C11, C43	2	S13490-198	CAPACITOR,ALEL,1000,35V,20%,LOW-ESR
C12, C31	2	S20500-5	CAPACITOR,PPMF,,0015,2000V,BOX
C13, C26	2	T11577-62	CAPACITOR,PEMF,1.0,200V,10%
C16, C42	2	S25200-5SMT	CAPACITOR,SMD,CERAMIC,2700pF,50V,5%,X7R,S0805
C23, C29, C30, C40, C47	5	S25024-2SMT	CAPACITOR,SMD,TANTALUM,1.0MF,35V,10%,S3528
C28, C32	2	S25020-18SMT	CAPACITOR,SMD,CERAMIC,10pF,100V,5%,COG,S0805
C36, C37	2	S13490-202	CAPACITOR,ALEL,470MF,10V,20%
C45, C46, C52	3	S25020-13SMT	CAPACITOR,SMD,CERAMIC,150pF,100V,5%,COG,S0805
D1, D2, D3, D6, D7, D8, D9, D15, D25	9	S25040-11SMT	DIODE,SMD,1A,600V,S403A,ULTRA-FAST RECOVERY
D10, D12, D13, D17, D24	5	S25040-2SMT	DIODE,SMD,1A,400V,DO-214BA/AC
D16	1	S25040-13SMT	DIODE,SMD,DUAL,16A,200V,D2PAK,CC,ULTRA-FAST RECOVERY
D18	1	S25040-3SMT	DIODE,SMD,DUAL,6A,200V,DPAK,CC,ULTRA-FAST RECOVERY
D19	1	S25040-8SMT	DIODE,SMD,3A,600V,D0-214AB,ULTRA-FAST RECOVERY
D20, D21, D22, D23	4	S25049-2SMT	DIODE,SMD,SCHOTTKY,1A,30V,SMA
DZ2, DZ3	2	S25046-5SMT	ZENER DIODE,SMD,0.5W,27V,5%,SOD-123
DZ4	1	S25044-12SMT	ZENER DIODE,SMD,3W,3.3V,5%, SMB
DZ7, DZ8	2	S25044-5SMT	ZENER DIODE,SMD,3W,18V,5%, SMB
N.B. J41	1	S24020-4	CONNECTOR,MOLEX,MINI,PCB,4-PIN,TIN
N.B. J42	1	S24020-6	CONNECTOR,MOLEX,MINI,PCB,6-PIN,TIN
N.B. J43	1	S24020-12	CONNECTOR,MOLEX,MINI,PCB,12-PIN,TIN
LED1, LED2	2	S25080-1SMT	LED,SMD,RED,CLEAR,S1206
OC1, OC3	2	S15000-10	OPTOCOUPLER,PHOTO-Q,70V,CNY17-3
N.A. Q1, Q2	2	T12704-93	TRANSISTOR,NMF,T220,21A,200V,BUZ30A
R1	1	S25001-1502SMT	RESISTOR,SMD,15K,1/4W,1206,1%,TR
R2, R4, R13, R22, R27	5	S25001-1002SMT	RESISTOR,SMD,10K,1/4W,1206,1%,TR
R3	1	S25001-6191SMT	RESISTOR,SMD,6.19K,1/4W,1206,1%,TR
R5, R10, R29	3	S25001-1003SMT	RESISTOR,SMD,100K,1/4W,1206,1%,TR
R6, R7, R57, R58	4	S25002-47R5SMT	RESISTOR,SMD,47.5OHMS,1/3W,MF,1%,S1210
R8	1	S25001-4750SMT	RESISTOR,SMD,475OHMS,1/4W,1206,1%,TR
R9, R60, R61	3	S25000-10R0SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0OHMS,1%,S0805
R11, R30	2	S25005-1SMT	RESISTOR,SMD,METAL STRIP,3W,0.05OHMS,1%
R12, R28, R45	3	S25001-5621SMT	RESISTOR,SMD,5.62K,1/4W,1206,1%,TR
R14, R20	2	S25001-1821SMT	RESISTOR,SMD,1.82K,1/4W,1206,1%,TR
R15, R16	2	S25001-33R2SMT	RESISTOR,SMD,33.2OHMS,1/4W,1206,1%,TR
R17, R24	2	S25084-2SMT	THERMISTOR,SMD,PTC,0.35,/1.4OHMS,2.0A
R18, R49	2	S25001-4322SMT	RESISTOR,SMD,43.2K,1/4W,1206,1%,TR
R19, R23	2	S25002-2491SMT	RESISTOR,SMD,2.49K,1/3W,MF,1%,S1210
R21	1	S25001-4753SMT	RESISTOR,SMD,475K,1/4W,1206,1%,TR
R25, R44, R62, R63, R64	5	S25002-1500SMT	RESISTOR,SMD,150OHMS,1/3W,MF,1%,S1210
R31	1	S25001-7502SMT	RESISTOR,SMD,75.0K,1/4W,1206,1%,TR
R32, R43	2	S25001-15R0SMT	RESISTOR,SMD,15.0OHMS,1/4W,1206,1%,TR
R33	1	S25001-2490SMT	RESISTOR,SMD,249OHMS,1/4W,1206,1%,TR
R35, R36	2	S25002-30R1SMT	RESISTOR,SMD,30.1OHMS,1/3W,MF,1%,S1210
R37, R46, R48	3	S25002-1211SMT	RESISTOR,SMD,1.21K,1/3W,MF,1%,S1210
R38, R39	2	S25001-5622SMT	RESISTOR,SMD,56.2K,1/4W,1206,1%,TR
R40	1	S18380-15	THERMISTOR,PTC,0.01/0.03OHMS,4.0A
R41, R53	2	S25001-3320SMT	RESISTOR,SMD,332OHMS,1/4W,1206,1%,TR
R42, R51	2	S25001-4422SMT	RESISTOR,SMD,44.2K,1/4W,1206,1%,TR
R50	1	S25084-1SMT	THERMISTOR,SMD,PTC,0.06/.25OHMS,1.5A
R52	1	S25001-2213SMT	RESISTOR,SMD,221K,1/4W,1206,1%,TR
T1	1	S20375-13	TRANSFORMER,PCB,PWM,FLYBACK
T2	1	S20375-10	TRANSFORMER,PCB,PWM,FLYBACK
X1, X2	2	S15128-10SMT	IC,SMD,VOLTAGE REF,ADJ, PRECISION,431,SOIC-8
X3	1	S25068-9SMT	IC,SMD,VOLTAGE REGULATOR,FIXED,3-TERMINAL,0.5A,+15V
X4, X5	2	S25071-2SMT	IC,SMD,PWM-CONTROLLER,SOIC8(SS)
X6, X7	2	S25068-1SMT	IC,SMD,VOLTAGE REGULATOR,FIXED,3-TERMINAL,0.5A,+5V
X8	1	S15128-6SMT	IC,SMD,VOLTAGE REGULATOR,FIXED,3-TERMINAL,1A,+15V
X9	1	S25068-10SMT	IC,SMD,VOLTAGE REGULATOR,FIXED,3-TERMINAL,0.5A,-15V

NOTES:

N.A. SEE HEAT SINK MOUNTING DETAILS.

N.B. ALL CONNECTORS MUST BE GREASED WITH ITEM 10 PRIOR TO ENCAPSULATION.

N.C. ATTACH ITEM 1 TO ITEM 7 (2 PLACES) WITH ITEM 8 (TORQUE = 5.3 +/- .05 IN-LB). ITEM 1 SHOULD BE ALLIGNED SO THAT THE DISTANCE BETWEEN ITEM 1's CONNECTORS AND ITEM 7 IS AS LARGE AS POSSIBLE.

N.D. ENCAPSULATION PER E1911-E TO A MINIMUM DEPTH SO ALL OF THE COMPONENTS LEADS ARE COVERED.

N.E . TIGHTEN TO 6-8 in. lbs. WITHOUT APPLYING ANY PRESSURE TO PLASTIC CASE OF Q1 AND Q2.

N.G. PLACE BARCODED ASSEMBLY NUMBER IDENTIFICATION AND BARCODED SERIAL NUMBER IDENTIFICATION IN AREA SHOWN.

N.H. PLACE A HEAVY FILM OF ITEM 4 ON HEAT SINK SURFACE. DO NOT GET ON THREADS.

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

BUY AS
G3632-3F0
PART NO. — IDENTIFICATION CODE

SCHEMATIC REFERENCE: G3631-3F0

BUY PER E3867
TEST PER E3856-P

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS B = .02
ON 3 PLACE DECIMALS B = .002
ON ALL ANGLES B = .5 OF A DEGREE
MATERIAL TOLERANCE = +/-1TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: INVERTER WELDERS	PAGE 1 OF 1
DRAWN BY:	G3632-2	SUBJECT: DIGITAL POWER P.C. BOARD ASSBLY	
ENGINEER:	SCALE: NONE	MATERIAL DISPOSITION: UF	APPROVAL DATE: 9/30/2004
APPROVED:		PROJECT NUMBER: CRM35510-B	DOCUMENT NUMBER: G3632-3
			DOCUMENT REVISION: B

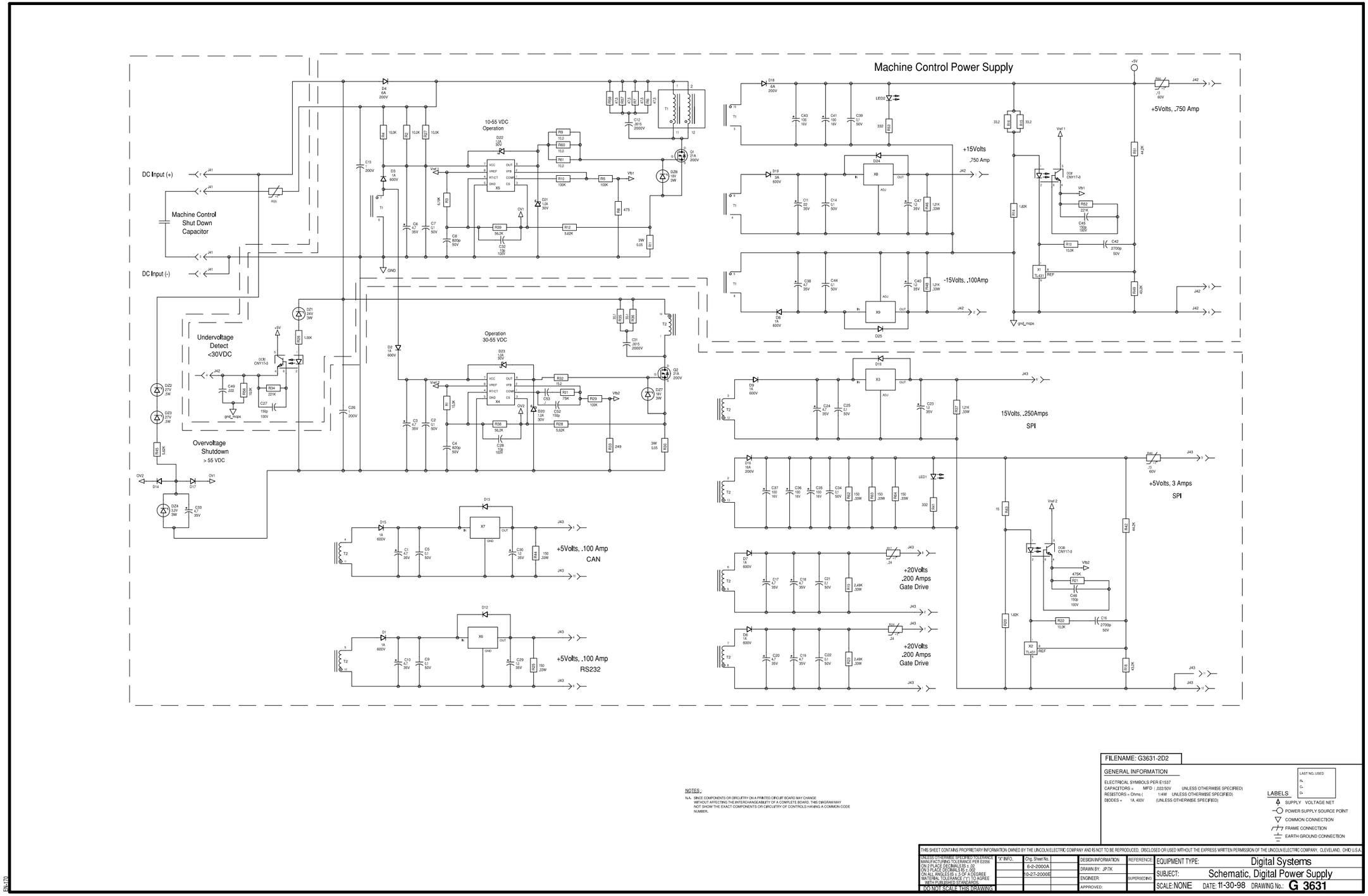
BU-170

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SCHEMATIC - DIGITAL POWER BOARD (G3631)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

PC BOARD ASSEMBLY - VOLTAGE SENSE BOARD (M19540-2)

M19540-2

ENGINEERING CONTROLLED
MANUFACTURER: No

CHANGE DETAIL: REVISED ITEM J2

	ITEM	REQD	PART NO.	IDENTIFICATION
	C1	1	S20500-4	.0047 1000V
	D1	1	T12199-1	1N4004
N.A.	J1	1	S24020-6	HEADER
N.A.	J2	1	S24020-2G	HEADER
	L1	1	T12218-7	330uH
	OCI1,OCI2	2	S15000-20	PHOTO FET
	R1,R2	2	S19400-4750	475 1/4W
	R3	1	S18380-1	THERMISTOR,PTC
	TP1,TP2	2	T13640-18	160J

P.C. BOARD BLANK INFORMATION

MAKE FROM S19399 (MAKES 54 BOARDS PER PANEL,
SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION)

BLANK PART NUMBER M19540-B

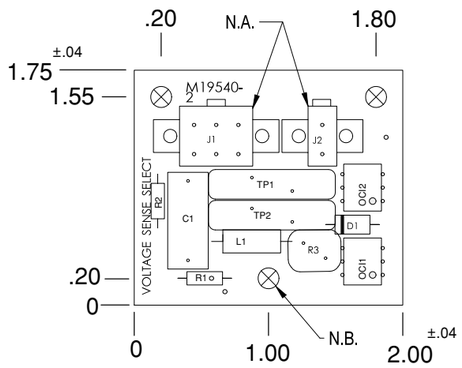
CAPACITORS = MFD/VOLTS
RESISTORS = OHMS
INDUCTANCE = HENRYS

ITEM	REQD	PART NO.	DESCRIPTION
1	1	SEE BLANK INFO	P.C. BOARD BLANK

SCHEMATIC REFERENCE: S24779-2BO

N.A. DO NOT COAT WITH ENCAPSULATION MATERIAL.

N.B. DO NOT COAT WITH ENCAPSULATION MATERIAL
.23 MIN. DIA. (3 PLACES) ON NON COMPONENT SIDE.



MANUFACTURED AS

M19540-2BO

IDENTIFICATION CODE

MAKE PER E1911
ENCAPSULATE WITH E1844 (2 DIPS)
TEST PER E3689-VS

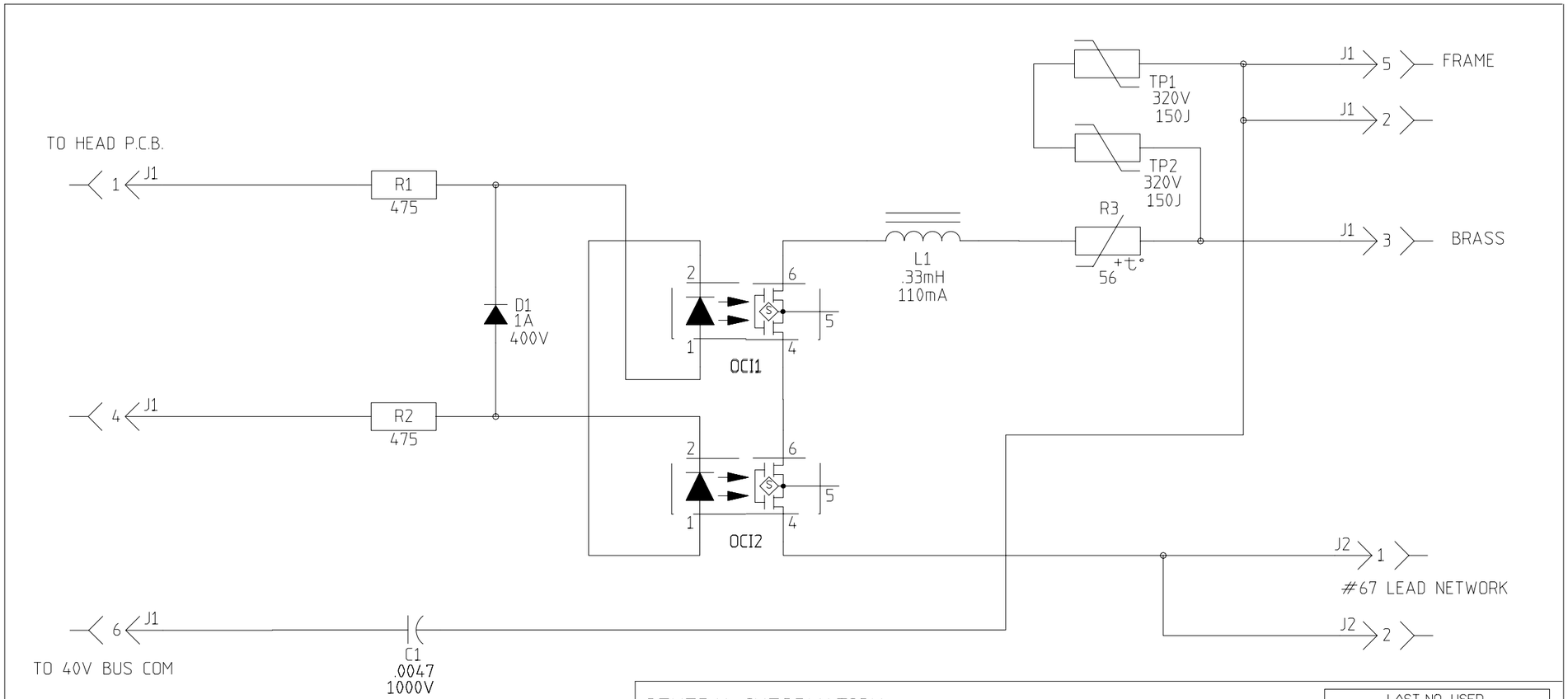
UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056 ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("t") TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	DESIGN INFORMATION	REFERENCE: M19540-1	EQUIPMENT TYPE: COMMON DIGITAL CONTROLS	PAGE 1 OF 1	
	DRAWN BY: FEI		SUBJECT: VOLTAGE SENSE PC BRD AS'BLY	DOCUMENT NUMBER: M19540-2	DOCUMENT REVISION: B
	ENGINEER:	SCALE: 1:1	MATERIAL DISPOSITION: UF / APPROVAL DATE: 03/24/2003 / PROJECT NUMBER: CRM22115-ED		
	APPROVED: -				

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

Return to Section TOC
Return to Master TOC

SCHEMATIC - VOLTAGE SENSE BOARD (S24779)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED	
R-	3
C-	1
D-	1

LABELS

- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.	DESIGN INFORMATION DRAWN BY: JPZ ENGINEER: APPROVED:	REFERENCE: S24779 DO NOT SCALE THIS DRAWING	EQUIPMENT TYPE: WIRE FEEDERS			PAGE 01 OF 01	
			SUBJECT: SCHEMATIC, V SENSE SELECT PCB			DOCUMENT NUMBER: S 24779-2B0	DOCUMENT REVISION: A.01
			MATERIAL DISPOSITION: NA	APPROVAL DATE: 10/02/2002	PROJECT NUMBER: -------		

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
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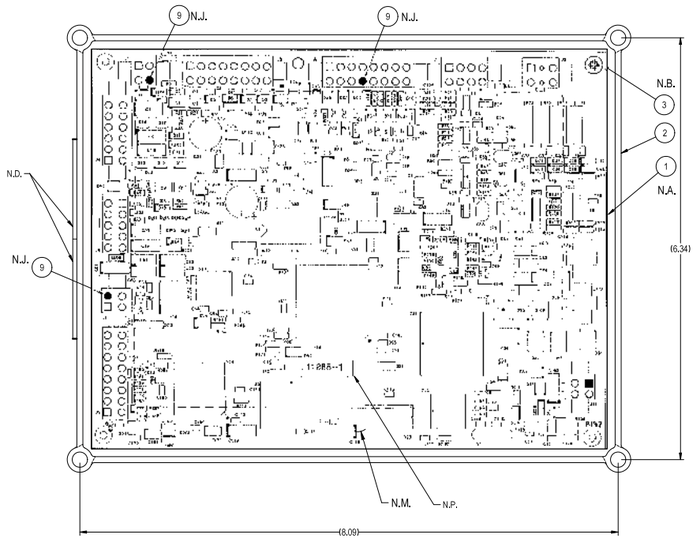
Return to Section TOC
Return to Master TOC

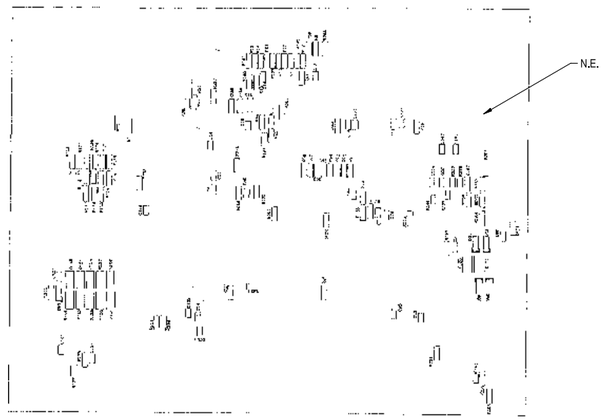
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

PC BOARD ASSEMBLY - CONTROL BOARD (L12518-1)

L12518-1 | ENGINEERING CONTROLLED MANUFACTURER: Yes | CHANGE DETAIL: REVISED ITEM 6, 106, 109 AND 111; SCHEMATIC REFERENCE, IDENTIFICATION CODE AND BUY PART NUMBERS; REMOVED ITEMS 100 AND 110 MOVED ITEM 101 TO ITEM 8



COMPONENT SIDE



OPPOSITE COMPONENT SIDE (BACKSIDE)

ITEM	PART NO.	REQ'D	DESCRIPTION	REFERENCE-DESIGNATOR
1	L11088-E	1	DIGITAL CONTROL P.C. BD. BLANK (REF., ONLY)	
2	M19436-1	1	POTTING TRAY	
3	S8025-80	2	SELF TAPPING SCREW	
4	E2527	6.01 oz.	EPOXY ENCAPSULATION RESIN	
5	E3539	0.01 oz.	ELECTRICAL INSULATING COMPOUND	
6	S26382-4	1	FLASH SOFTWARE	
7	S24804-3	1	CPLD FIRMWARE	
8	X17, X25 LABEL	2	LABEL	
9	S24671	3	PLUG, KEYING PLUG	
	FOR ITEMS LISTED BELOW REFER TO ELECTRICAL DATABASE FOR COMPONENT SPECIFICATIONS			
10	E3868-4	2	LAB,THT-53-423-3,BRADY,PLY	Barcode Labels
11	S25020-15SMT	4	SCAP,22pF,0805,50V,COG,5%,TR,N	C118 C116 C128 C130
12	S25024-10SMT	4	SCAP,22uF,TAN,7343,25V,10%	C119 C110 C49 C54
13	S25024-5SMT	9	SCAP,4.7uF,7343,,35V,10%,TR,NP	C12 C102 C1 C9 C10 C39 C40 C16 C61
14	S25020-23SMT	1	SCAP,1200pF,CER,1206,50V,X7R,10%	C126
15	S14390-183	1	SCAP,120MF,25V,20%, RADIAL,AE	C13
16	S14390-173	2	CAP,1uF,RA,63V,10%,NP	C136 C135
17	S25020-3SMT	68	SCAP,0,1uF,,0805,50V,X7R,10%,,TR	C138 C134 C133 C125 C55 C96 C98 C100 C28 C82 C14 C11 C83 C103 C121 C101 C117 C115 C111 C113 C85 C90 C48 C93 C109 C120 C127 C106 C95 C105 C73 C88 C8 C114 C108 C89 C77 C76 C75 C84 C79 C67 C88 C80 C50 C78 C23 C21 C91 C51 C92 C58 C57 C52 C60 C59 C131 C123 C
18	S25020-14SMT	1	SCAP,330pF,,100V	C143
19	S25020-12SMT	5	SCAP,,100pF,,0805,,COG,,100V,,5%	C15, C18, C22, C25, C27
20	S25020-18SMT	1	SCAP,,10pF,,CER,,0805,,100V,,5%	C32
21	S25020-24SMT	11	SCAP,,820pF,,0805,,50V,,COG,,5%,,TR,	C43 C4 C74 C3 C71 C19 C70 C5 C72 C6 C17
22	S25020-10SMT	2	SCAP,,4700pF,,0805,,50V,,X7R,,10%	C44 C69
23	S13490-179	1	CAP,,1000uF,,ALU,,35V,,20%,,NP	C45
24	S24833-1	2	CAP,,0,27uF,,MF,,50V,,5mm,,5%,,TR,,NP	C56 C34
25	S25020-13SMT	7	SCAP,,150pF,,0805,,100V,,COG,,5%,,TR,	C64 C89 C26 C35 C36 C38 C37
26	S25024-8SMT	4	SCAP,,10uF,,TAN,,6032,,TR,,NP	C66 C62 C65 C63
27	S25020-2SMT	3	SCAP,,0,022uF,,0805,,50V,,X7R,,10%,	C7 C86 C87
28	S25024-2SMT	8	SCAP,,1uF,,TAN,,3528,,35V,,TR,,NP	C94 C97 C104 C107 C47 C81 C2 C46
29	S25044-4SMT	2	SDIO,,B5929,,15V,,1,5W,,ZENER,,TR,,N	D10 D11
30	S25044-10SMT	3	SDIO,,B5930,,16V,,1,5W,,ZENER,,TR,,N	D18 D15 D43
31	S25046-1SMT	19	SDIO,,MMSZ5231BT1,,5,1V,,NP	D25 D45 D44 D17 D9 D6 D2 D5 D7 D8 D35 D36 D38 D37 D42 D41 D40 D39 D69
32	S25044-5SMT	9	SDIO,,1SMB5931BT3,,3W,,18V,,5%	D27 D32 D26 D30 D31 D29 D24 D14 D16
33	S25049-4SMT	8	SDIO,,BAT54S,,DUAL,,30V,,200mA	D34 D54 D28 D47 D80 D81 D82 D83
34	S25040-12SMT	8	SDIO,,MURS320T3,,3A,,200V,,ULTRAFAST	D51 D55 D56 D57 D98 D99 D100 D101
35	S25046-3SMT	4	SDIO,,MMSZ5248B,,18V,,ZENER,,TR,,NP	D53 D52 D58 D59
36	S25044-9SMT	7	SDIO,,1SMB5920BT3,,6,2V,,NP	D62 D61 D60 D13 D12 D1 D46
37	S25040-5SMT	13	SDIO,,BAV99LT1,,SOT23,,DUAL SWITC	D66 D50 D33 D49 D19 D78 D79 D102 D103 D104 D105 D106 D107
38	S25040-2SMT	13	SDIO,,1A,,400V,,DO-214BA,,GLS	D68 D67 D4 D3 D75 D63 D64 D65 D70 D72 D71 D73 D74
39	S25049-2SMT	4	SDIO,,MBRA130LT3,,1A,,30V,,SCHOTKY	D76 D77 D114 D115
40	S25040-6SMT	6	SDIO,,BAV70	D84 D85 D86 D89 D90 D91
41	T12702-59	2	DIO,,1N5333B	DZ1 DZ2
42	T12702-60	2	DIO,,1N5356B	DZ3 DZ4
43	S25083-1SMT	1	SIND,,FERRITEBEAD,,TR,,NP	E1
44	S18248-16	1	CON,,16P,,MINI,,NP	J1
45	S24020-2	2	CON,,2P,,TIN,,MINI,,NP	J10A J10B
46	S18248-10	1	CON,,10P,,MINI,,NP	J3
47	S24020-12	1	CON,,12P,,TIN,,MINI,,NP	J4
48	S24020-4	3	CON,,4P,,TIN,,MINI,,NP	J5 J11 J2
49	S24020-16	2	CON,,16P,,TIN,,MINI,,NP	J6 J7
50	S24020-8	1	CON,,8P,,TIN,,MINI,,NP (or TH600-265)	J8
51	S24020-6	1	CON,,6P,,TIN,,MINI,,NP	J9
52	S25080-1SMT	2	SLED,,RED,,1206,,TR,,NP	LED7 LED10
53	S25080-2SMT	8	SLED,,GRN,,1206,,TR,,NP	LED8 LED1 LED5 LED3 LED2 LED4 LED6 LED9
54	S15000-28SMT	4	SICS,,HCPL-0601,,OPTOCOUPLER	OCI1 OCI2 OCI3 OCI4
55	N/A	1	1E0 ARTWORK	PCB
56	S25051-7SMT	1	SICS,,IRF7103,,NP	Q11
57	S25050-1SMT	9	STRA,,MMBT4401LT,,NPN,,SOT-23	Q12 Q4 Q7 Q5 Q6 Q1 Q18 Q19 Q20
58	S25050-2SMT	5	STRA,,2N4403,,SOT23,,TR,,(500475),,N	Q17 Q16 Q15 Q13 Q14
59	S25051-4SMT	2	STRA,,2N7002,,TR,,NP	Q3 Q2
60	S25051-6SMT	2	STRA,,IRLR120N,,10A,,100V,,MOSFET,	Q9 Q10
61	S25001-4753SMT	1	SRES,,475K,,1206,,1%,,1/8W,,TR,,NP	R100
62	S25000-2802SMT	1	SRES,,28K,,0805,,1%,,1/10W,,TR	R107
63	S25001-2671SMT	1	SRES,,2,67K,,1206,,1%,,1/8W,,TR,,NP	R109
64	S25001-1501SMT	7	SRES,,1,5K,,TKF,,1206,,1%,,1/4W,,TR	R113 R118 R122 R74 R76 R80 R78
65	S25001-1503SMT	2	SRES,,150K,,1206,,1%,,1/8W,,TR	R117 R125
66	S25001-3321SMT	6	SRES,,3,32K,,1206,,1%,,1/8W,,TR	R123 R128 R129 R179 R246 R251
67	S25001-6811SMT	2	SRES,,6,81K,,1206,,1%,,1/4W,,TR	R127 R130
68	S25003-2000SMT	2	SRES,,200,,2512,,5%,,1W,,TR,,NP	R132 R133
69	S25006-10R0	10	SRES,,10,	R151 R154 R157 R160 R148 R161 R158 R155 R152 R149
70	S25001-1001SMT	33	SRES,,1K,,1206,,1%,,1/4W,,TR	R171 R178 R177 R193 R231 R167 R61 R34 R89 R82 R163 R135 R136 R169 R131 R112 R60 R56 R126 R71 R54 R69 R68 R143 R144 R58 R206 R213 R214 R90 R168 R255 R256
71	S25001-1002SMT	47	SRES,,10K,,MF,,1206,,1%,,1/8W	R173 R191 R181 R164 R170 R172 R188 R186 R180 R91 R82 R93 R94 R95 R96 R97 R98 R22 R174 R201 R185 R104 R87 R33 R99 R260 R261 R139 R140 R121 R200 R199 R103 R221 R229 R204 R242 R241 R216 R217 R218 R252 R253 R254 R257 R258 R259
72	S25001-7500SMT	1	SRES,,750,,1206,,1%,,1/4W,,TR	R183
73	S25001-2672SMT	4	SRES,,26,7K,,THK,,1206,,1%,,1/8W,,10	R187 R114 R120 R72
74	S25001-4751SMT	15	SRES,,4,75K,,1206,,1%,,1/8W,,TR	R190 R192 R182 R184 R137 R146 R209 R210 R222 R42 R43 R46 R47 R51 R67
75	S25001-4750SMT	24	SRES,,475,,1206,,1%,,1/8W,,TR,,NP	R195 R194 R41 R11 R83 R86 R166 R165 R21 R15 R20 R88 R81 R17 R19 R18 R141 R138 R119 R116 R85 R84 R40 R36
76	S25001-1500SMT	2	SRES,,150,,1206,,1%,,1/8W,,TR,,NP	R196 R198

ITEM	PART NO.	REQ'D	DESCRIPTION	REFERENCE-DESIGNATOR
77	S25001-1004SMT	2	SRES,,1M,,1206,,1%,,1/8W,,TR	R212 R211
78	S25000-1000SMT	6	SRES,,100,,0805,,1%,,1/10W	R223, R224, R240, R226, R227, R228
79	S25001-4752SMT	8	SRES,,47,,5K,,1206,,1%,,1/8W,,TR	R230 R27 R28 R26 R53 R29 R110 R57
80	S25001-5110SMT	2	SRES,,511,,MF,,1206,,1%,,1/8W,,TR	R24 R23
81	S25001-2211SMT	10	SRES,,2,21K,,1206,,1%,,1/8W,,TR	R25 R13 R12 R32 R1 R31 R134 R66 R268 R269
82	S25001-3320SMT	6	SRES,,332,,1206,,1%,,1/4W	R262 R263 R264 R265 R266 R267
83	S25001-47R5SMT	2	SRES,,47,,5,TKF,,1206,,1%,,1/4W,,TR	R3 R2
84	S25001-2212SMT	6	SRES,,22,1K,,1206,,1%,,1/8W,,TR,,NP	R37 R38 R35 R203 R8 R39
85	S25001-1003SMT	10	SRES,,100K,,1206,,1%,,1/8W,,200PPM,	R55 R111 R49 R108 R115 R124 R142 R208 R207 R106
86	S25001-2210SMT	13	SRES,,221,,1206,,1%,,1/8W,,TR	R59 R48 R102 R197 R45 R9 R10 R14 R16 R101 R50 R64 R105
87	S25001-1000SMT	4	SRES,,100,,1206,,1%,,1/8W,,TR,,NP	R62 R44 R52 R30
88	S25001-3322SMT	3	SRES,,33,2K,,1206,,1%,,1/8W,,TR,,NP	R63 R65 R233
89	S25001-1213SMT	1	SRES,,121K,,1206,,MF,,1%,,1/4W	R70
90	S20620-1003	4	RES,,100K,,AX,,5%,,1/2W,,HI VOLT,,TR	R73 R79 R75 R77
N.C. 91	S19859-8	1	SWT,,78B08S,,DIP,,SPST,,8P,,NP	S1
92	S15128-13SMT	1	SICS,,OP-27G,,OPAMP,,SO8,,TR,,NP	X1
93	S25065-3SMT	2	SICS,,74VHC14,,NP	X10 X30
94	S25069-2SMT	1	SICS,,25128,,SERIAL,,EEPR,,NP	X11
95	M15105-9SMT	1	SICS,,7945 (old package)	X12
96	S25067-3SMT	2	SICS,,ADG417,,SPST,,CMOS,,SWT,,SO8	X13 X31
97	S25067-2SMT	1	SICS,,ADG409BR	X15
98	S20353-1SMT	1	SICS,,MC145407,,RECEIVER/DRVR,,RS	X16
N.G. 99	S25070-3SMT	1	ICS,,XC9536-15 VQ44	X17
102	S25070-4SMT	1	SICS,,XCS20,,FPGA	X18
103	S25066-2SMT	1	SICS,,AD7862,,DUAL,,12BIT,,250kSPS	X19
104	S15018-21SMT	2	ICS,,MIC4451BM	X2 X3
105	S25065-2SMT	1	SICS,,74ACT573,,OCTAL,,TRANS,,,LAT	X21
106	S25070-2SMT	1	SICS,,TMS320F240PQA,,NP	X22
107	S25068-7SMT	1	SICS,,4,6V,,2%,,VOLT,,DETECTOR,,SO	X23
108	M15101-14SMT	1	SICS,,MC68332	X24
109	S25069-24SMT	1	SICS,,28F800B5-90,,FLASH RO,,90n	X25
111	S25069-7SMT	1	SICS,,128Kx16,,20nS,,TSOP	X27
N.F. 112	S20353-5	1	SICS,,AN82527	X28
113	S20353-4SMT	1	SICS,,MAX485ESA,,NP	X29
114	S17500-11SMT	1	74HC245, NEW PACKAGE	X33
115	S25068-8SM	1	SICS,,MC79L05ABD	X4
116	S15128-21SMT	2	SICS,,LT1016,,COMPARATOR	X5 X7
117	S25057-3SMT	2	SICS,,AD8403ARU10	X6 X32
118	S15128-18SMT	3	SICS,,MC33074,,QUAD,,OPAMP,,SO14,,T	X8 X14 X20
119	S25082-1SMT	1	SXTL,,19MHZ,,HC40,,20PF,,NP	Y1

NOTES:

N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. LINCOLN ELECTRIC TO SEE **E2454** BEFORE HANDLING.

N.B. SECURE P.C. BOARD ASSEMBLY IN PLACE WITH (***ITEM 3***) (2 PLACES, 4.8-5.8 IN. LBS.)

N.C. TOP OF THESE COMPONENTS MUST BE FREE OF POTTING MATERIAL.

N.D. PLACE BARCODED ASSEMBLY NUMBER IDENTIFICATION AND BARCODED SERIAL NUMBER IDENTIFICATION IN AREA SHOWN.

N.E. THERE ARE COMPONENTS ON BOTTOM SIDE OF P.C. BOARD.

N.F. PROGRAM ***ITEM 109*** WITH ***ITEM 6.***

N.G. PROGRAM ***ITEM 99*** WITH ***ITEM 7.***

N.J. PLACE CONNECTOR KEYING PLUG (***ITEM 9***) OVER HEADER PIN, IN LOCATION SHOWN. PLUG SHOULD BE INSERTED BELOW CONNECTOR TOP SURFACE.

N.K. ALL CONNECTORS MUST BE GREASED WITH (***ITEM 5***) PRIOR TO ENCAPSULATION.

N.L. ENCAPSULATION PER **E1911-E** TO A MINIMUM DEPTH, SUCH THAT ALL COMPONENT LEADS ARE COVERED.

N.M. SOLDER A #30 INSULATED COPPER WIRE FROM PIN 23 OF X27 TO POSITIVE TERMINAL ON C119 AS SHOWN.

N.P. PLACE LABEL INDICATING "**L12518-1E0**" OVER THE CURRENT PART NUMBER.

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

SCHEMATIC REF. G4986-1E1

BUY AS

L12518-1E1

PART NO. — **IDENTIFICATION CODE**

BUY PER E3867
TEST PER E3856-C

EN-170

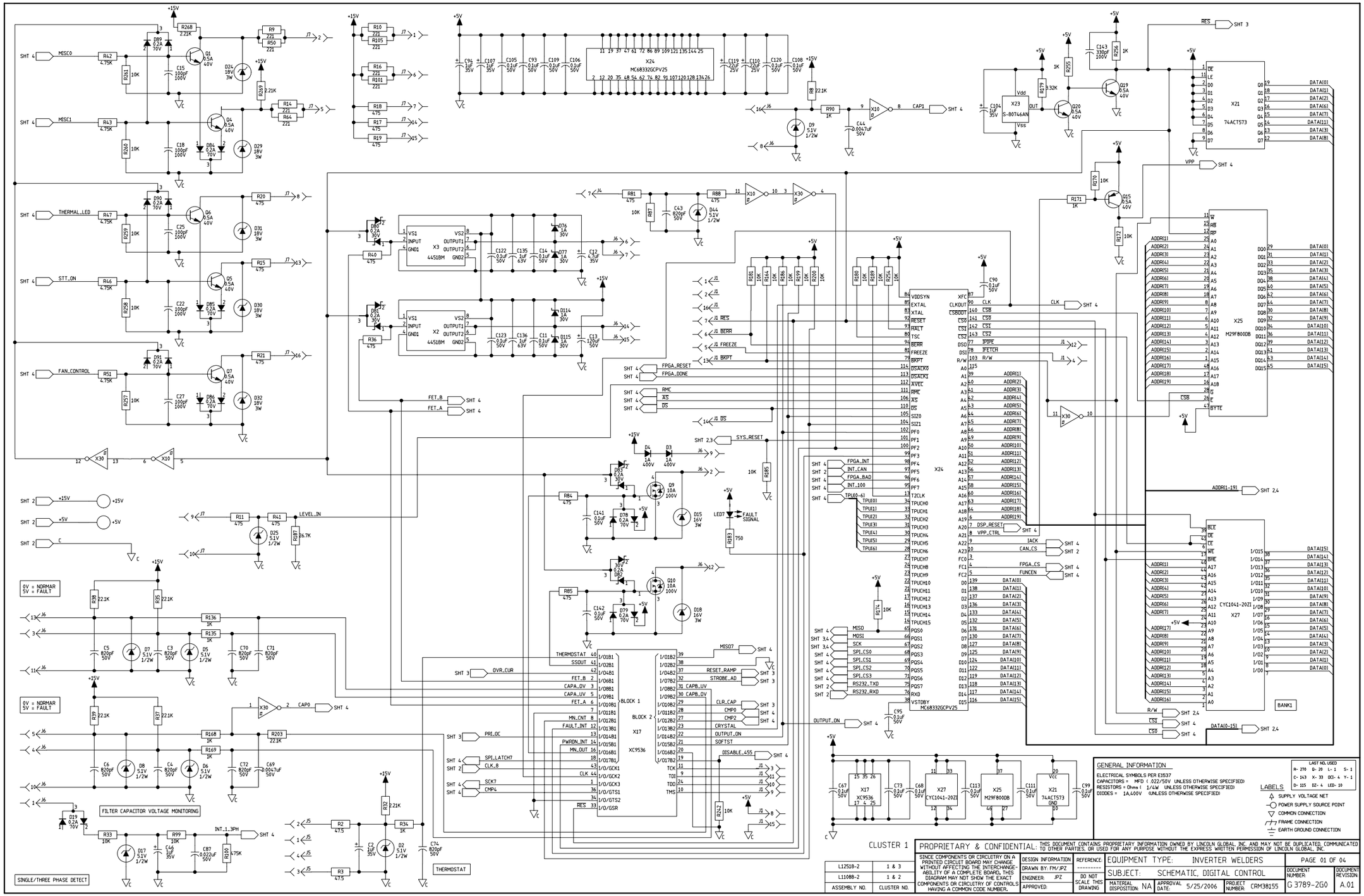
UNLESS OTHERWISE SPECIFIED: TOLERANCE MANUFACTURING TOLERANCE PER ES006
ON 3 PLACE DECIMALS IS ± .005
ON 2 PLACE DECIMALS IS ± .020
ON ALL ANGLES IS ± 1.0° A DEGREE
MATERIAL TOLERANCE (*1) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: POWERWAVE AC/DC 1000	PAGE 1 OF 1
DRAWN BY: RAS	L11088-1	SUBJECT: CONTROL P.C. BOARD ASBLY	
ENGINEER: TS	SCALE: NONE		
APPROVED: .	MATERIAL DISPOSITION: UF	APPROVAL DATE: 6/23/2006	PROJECT NUMBER: CRM38280
		DOCUMENT NUMBER: **L12518-1**	DOCUMENT REVISION: **C**

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

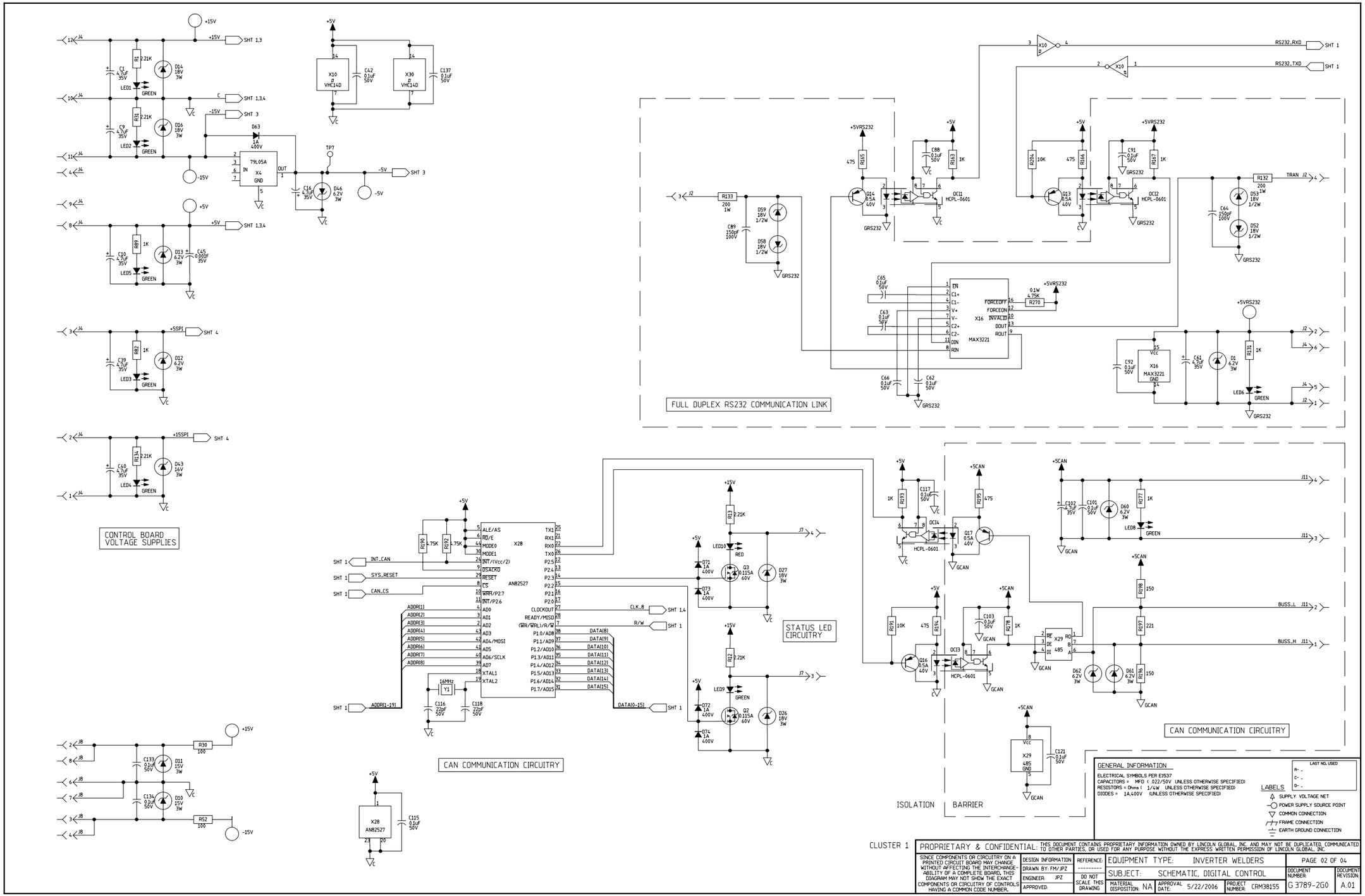
SCHEMATIC - CONTROL BOARD (G3789-1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

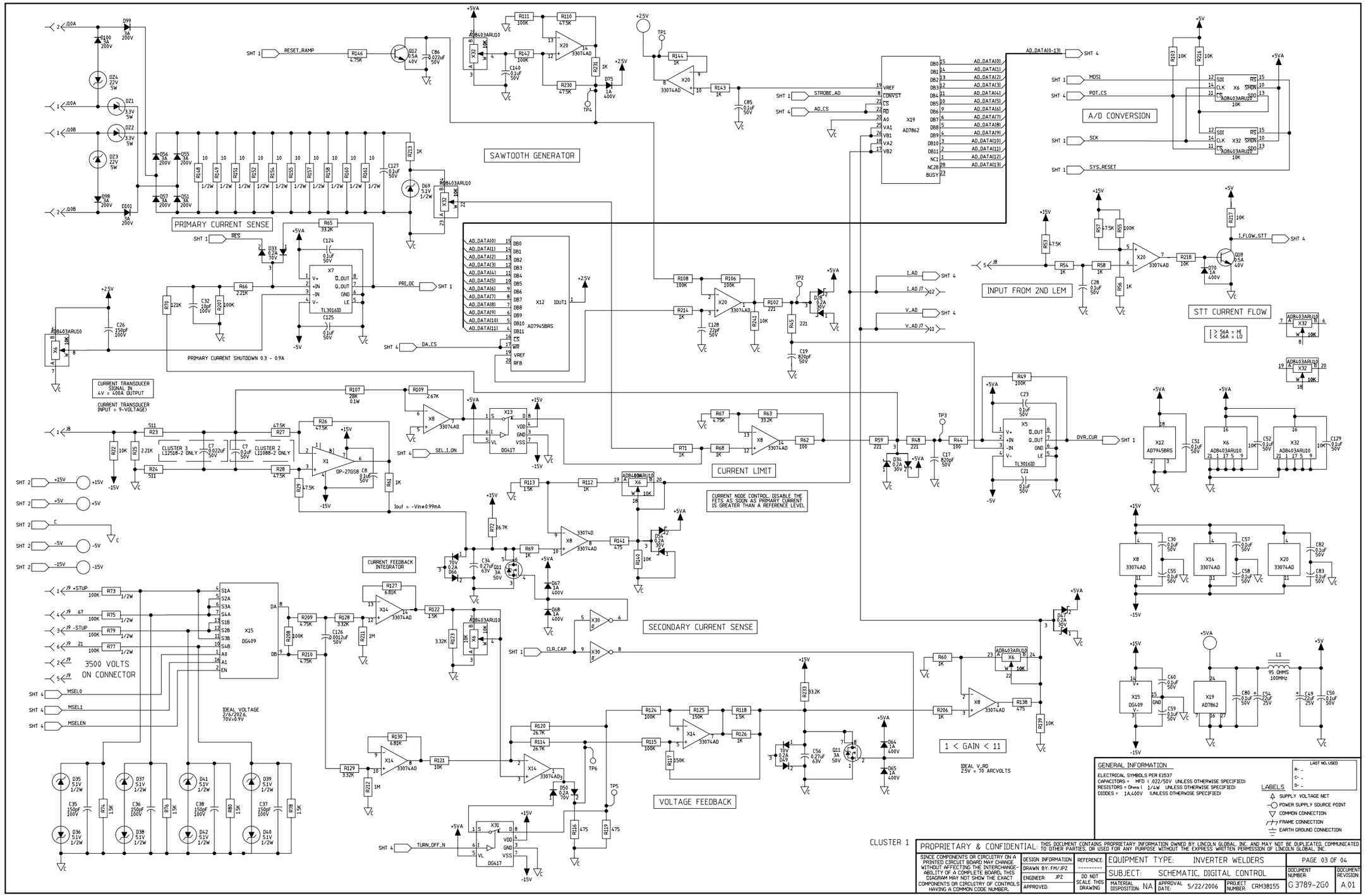
Return to Section TOC
Return to Master TOC

SCHEMATIC - CONTROL BOARD (G3789-2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

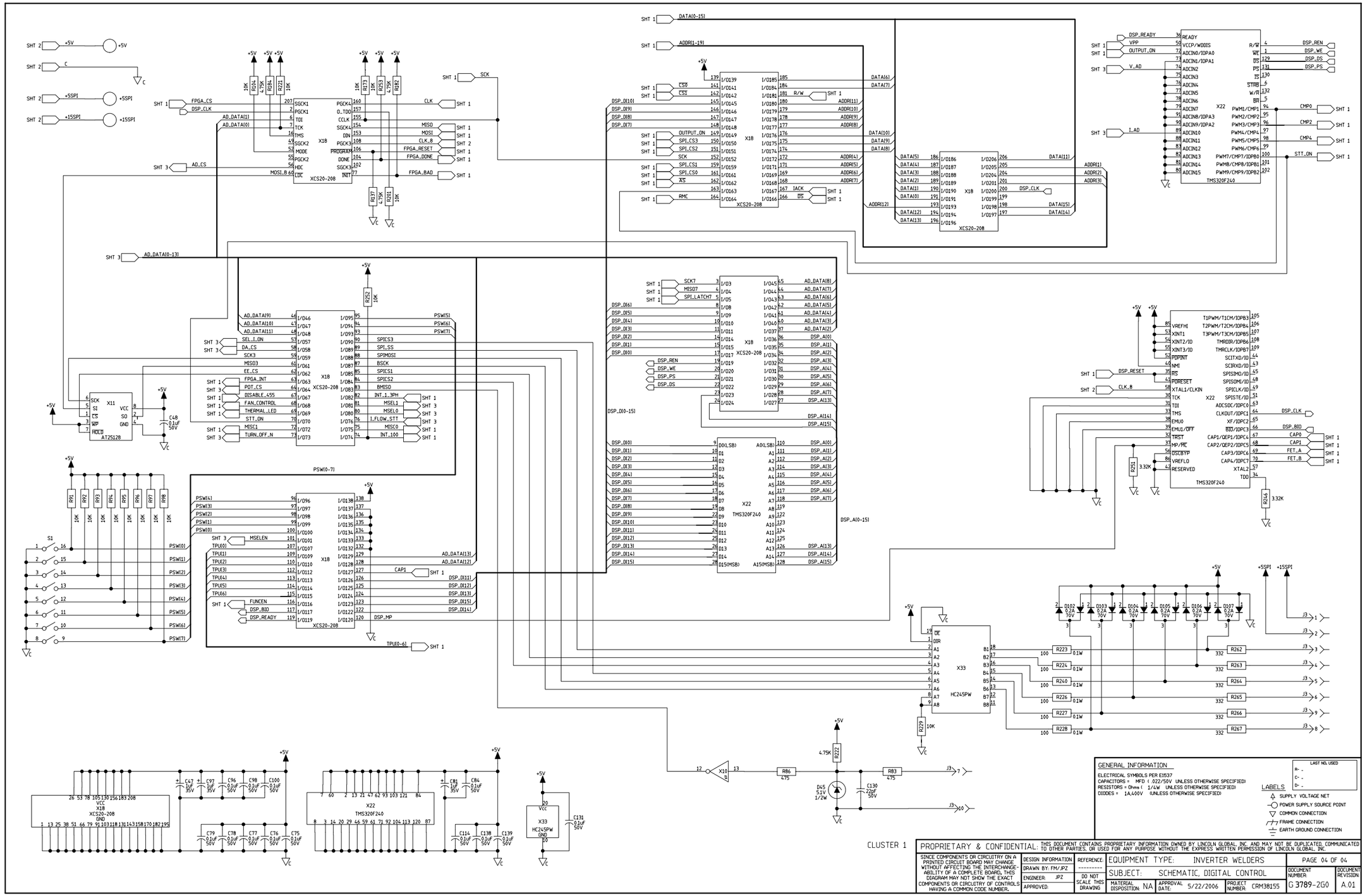
SCHEMATIC - CONTROL BOARD (G3789-3)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

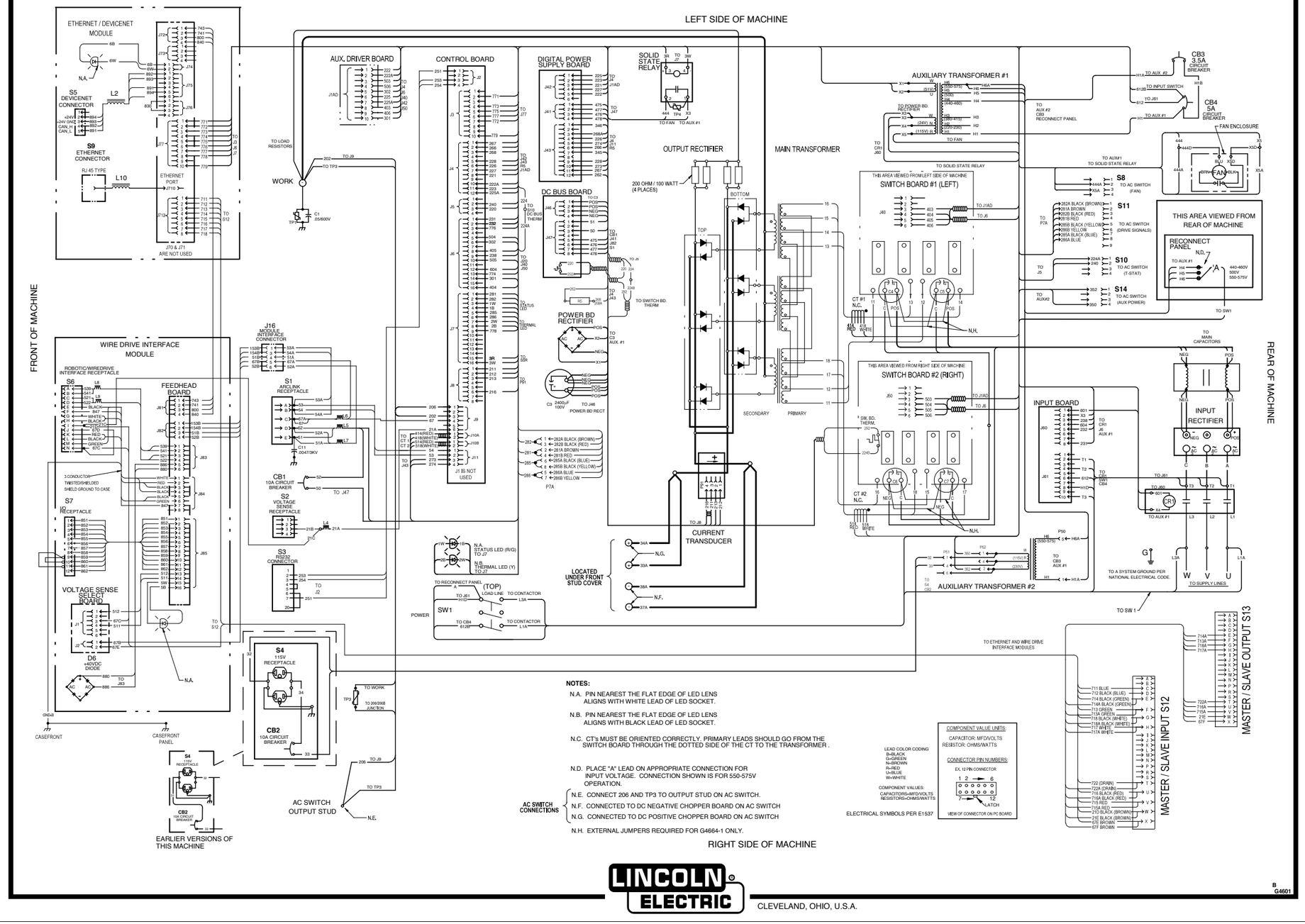
SCHEMATIC - CONTROL BOARD (G3789-4)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

POWER SOURCE SCHEMATIC - G4601

POWER WAVE™ AC/DC 1000 (460/500/575) POWER SOURCE WIRING DIAGRAM



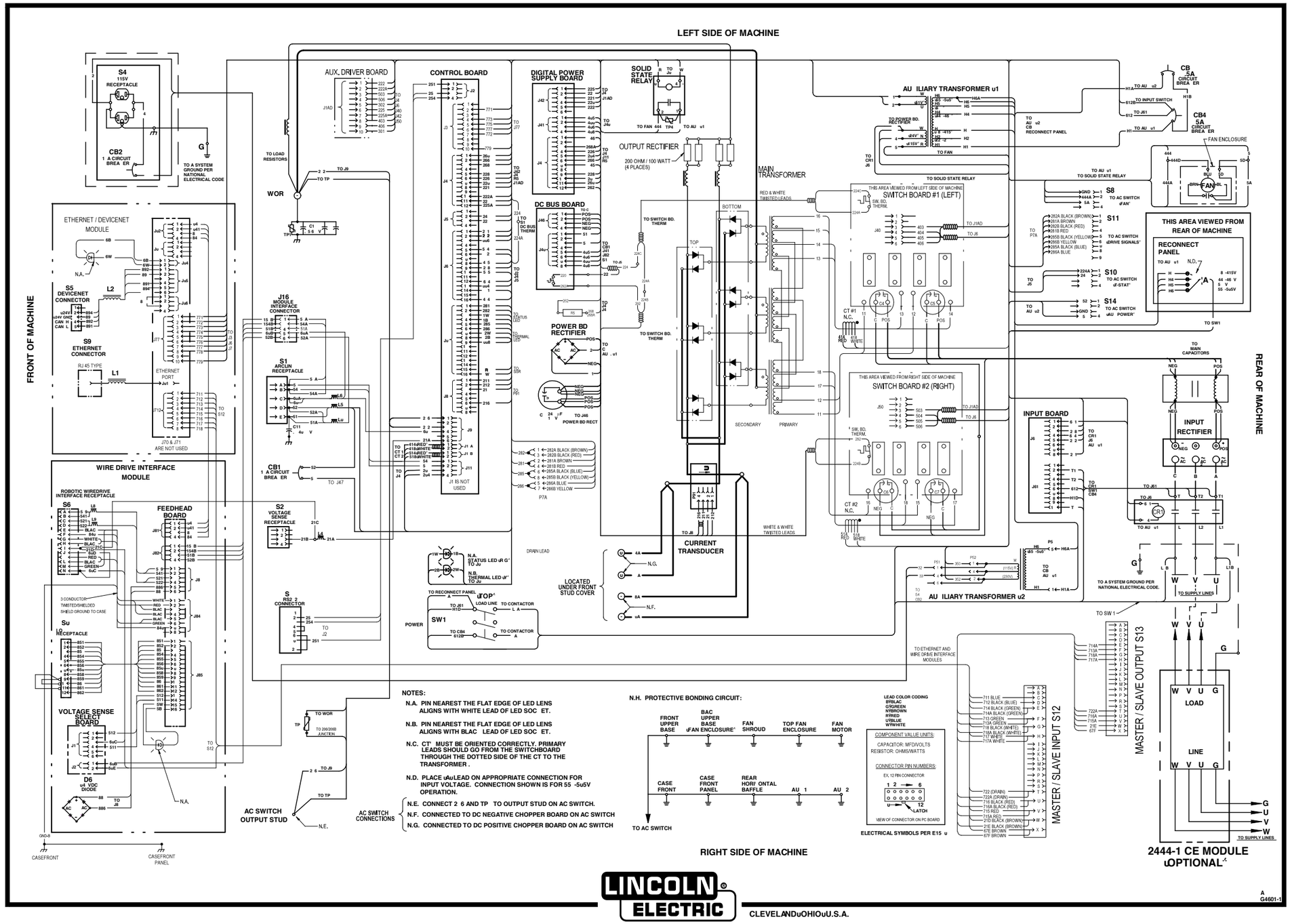
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

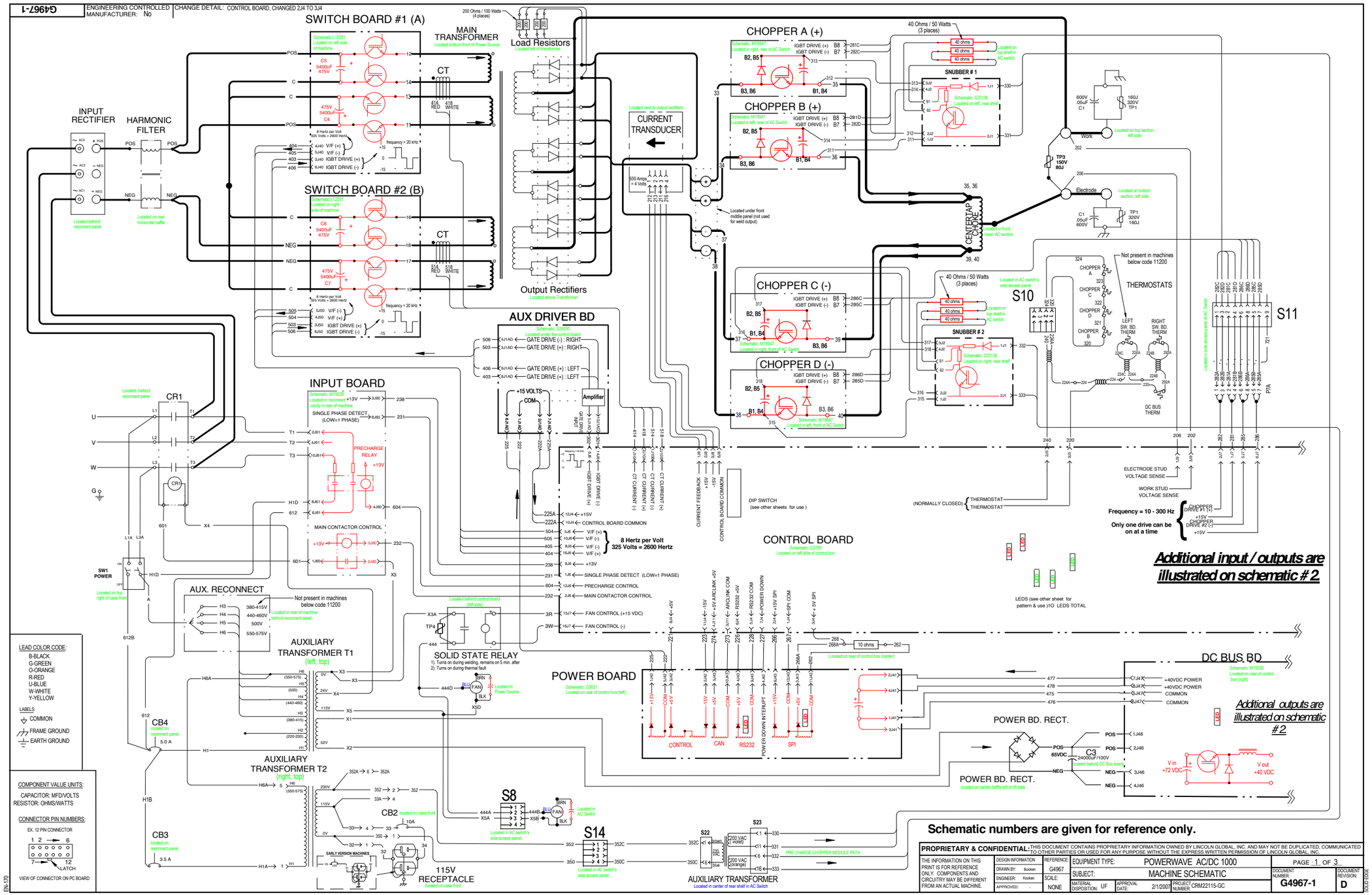
POWER SOURCE SCHEMATIC - G4601-1

POWER WAVE™ AC DC 1 u4 46 5 5u5-.- POWER SOURCE WIRING DIAGRAM



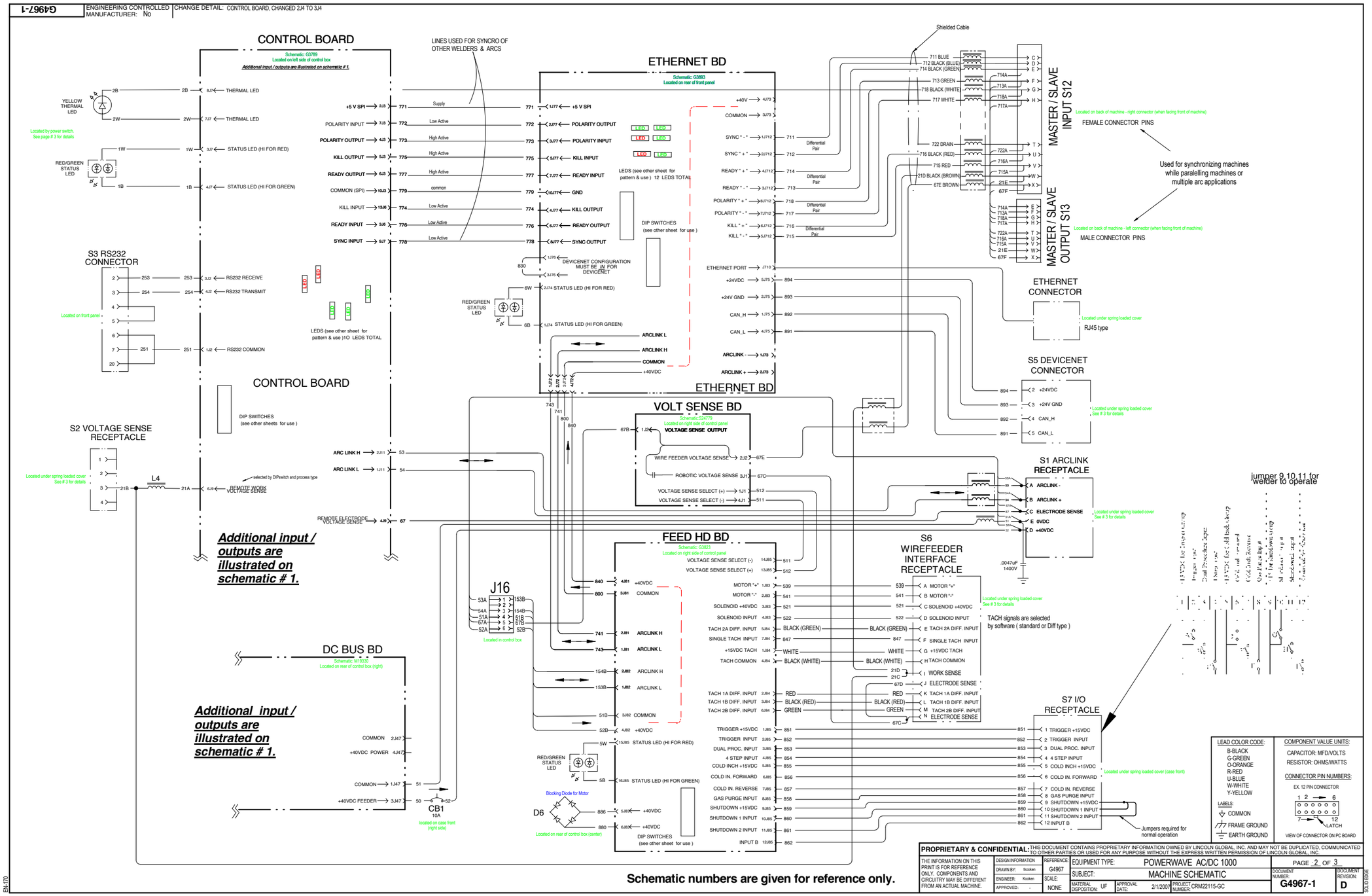
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

MACHINE SCHEMATIC (G4967-1) PAGE 1



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

MACHINE SCHEMATIC (G4967-1) PAGE 2

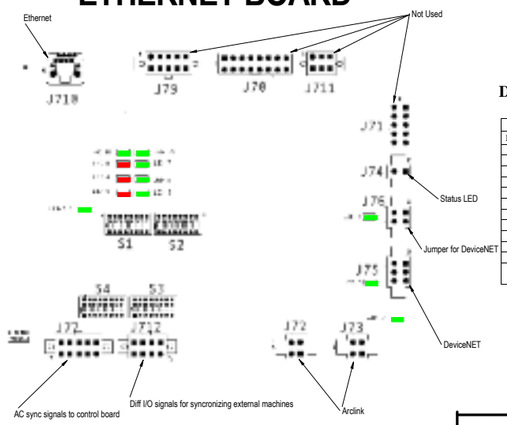


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

MACHINE SCHEMATIC (G4967-1) PAGE 3

G4967-1 | ENGINEERING CONTROLLED | CHANGE DETAIL: CONTROL BOARD, CHANGED 2J4 TO 3J4
MANUFACTURER: No

ETHERNET BOARD



Description of LED functions on the Power Wave AC/DC

For reference only

G3894 Ethernet Gateway PC Board		
LED #	COLOR	FUNCTION
1	Green	Indicates Isolated Module Section Supply is ON
2	Green	Indicates DeviceNet Supply is ON
3	Green	ArcLink Status Indicators (Main System ***Slave*** ArcLink Connection) Solid Green only when functional (See software for error codes)
4	Red	
5	Green	Reserved For Future Use
6	Red	
7	Green	DeviceNet Status Indicators (See software group for coding)
8	Red	
9	Green	Indicates Isolated ArcLink Section Supply is ON
10	Green	10Base-T Link Status ON indicates functional ethernet link has been established
11	Green	Receiver Polarity ON indicates proper ethernet signal polarity
12	Green	Indicates I/O+5V Supply is ON This is used by differential I/O pair 4 circuitry, J712 pins 1 and 2.

Ethernet Board DIP Switch :

Bank S1

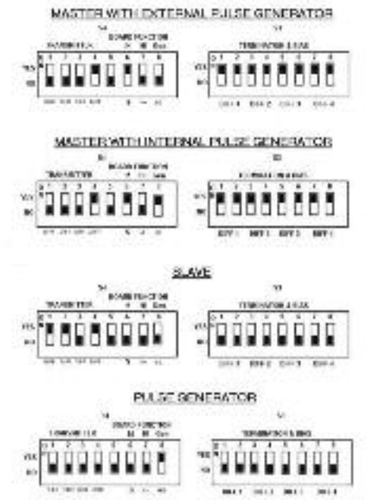
Switch	Description	Comments
1	Object Instance LSB	Used for Arclink Configuration
2	Object Instance MSB	
3	Equipment Group 1 Select	
4	Equipment Group 2 Select	
5	Equipment Group 3 Select	
6	Equipment Group 4 Select	
7	Reserved for future use	
8	Reserved for future use	

Table 15

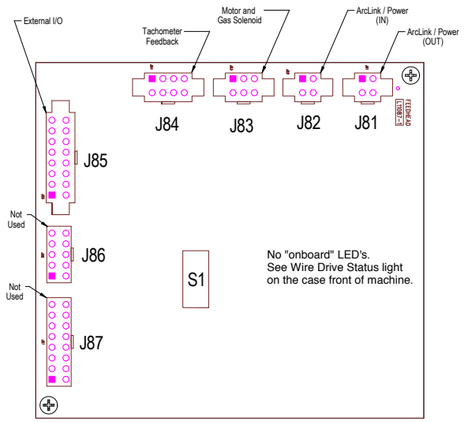
Bank S2

Switch	Description	Comments
1 - 2	Devicenet Baud Rate	Used for DeviceNet configuration
3 - 8	Devicenet Mac ID	

Configuring the DIP Switches on the Ethernet-Gateway Board



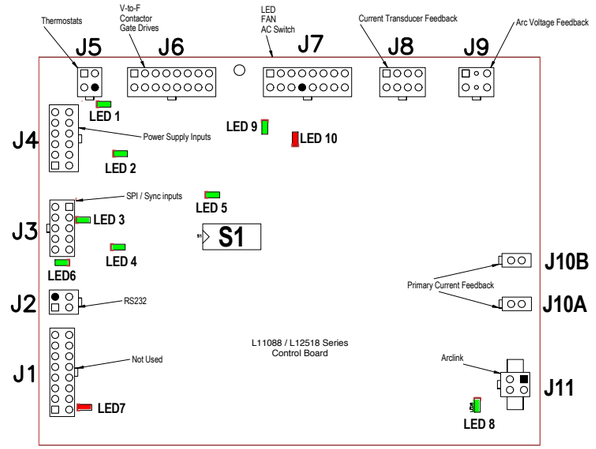
FEEDHEAD BOARD



Feed Head Board DIP Switch:

Switch		Description	Comments
1		Object Instance LSB	Used for Arclink Configuration
2		Object Instance MSB	
3		Equipment Group 1 Select	
4		Equipment Group 2 Select	
5		Equipment Group 3 Select	
6		Equipment Group 4 Select	
7	off	Electrode polarity positive (default)	**MUST** be set to **POSITIVE** polarity
	on	Electrode polarity negative	
8	off	Low speed gear (default)	Used for configuring wirefeeder gear ratio

CONTROL BOARD



Control Board DIP Switch:

Switch		Description	Comments
1		Object Instance LSB	Used for Arclink configuration
2		Object Instance MSB	
3		Equipment Group 1 Select	
4		Equipment Group 2 Select	
5		Equipment Group 3 Select	
6		Equipment Group 4 Select	
7	off	Auto Map Enabled (default)	Automatic ArcLink Configuration
	on	Auto Map Disabled	
8	off	work sense lead not connected	Used for configuring work sense lead
	on	work sense lead connected (default)	

Description of LED functions on the Power Wave AC/DC

For reference only

L11088 Digital Control PC Board		
LED #	COLOR	FUNCTION
1	Green	Indicates +15VDC from power supply board is present
2	Green	Indicates –15VDC from power supply board is present
3	Green	Indicates +5VDC for +5SPI from power supply board is present
4	Green	Indicates +15VDC for +15SPI from power supply board is present
5	Green	Indicates +5VDC for +5V from power supply board is present
6	Green	Indicates +5VDC for +5VRS232 from power supply board is present
7	Red	FAULT Signal (See software group for coding)
8	Green	Indicates +5VDC for +5CAN from power supply board is present
9	Green	ArcLink Status Indicators (Main System ***Master*** ArcLink Connection) Solid Green only when functional (See software for error codes)
10	Red	

Description of LED functions on the Power Wave AC/DC

For reference only

G3632 Digital Power Supply Board		
LED #	COLOR	FUNCTION
1	Red	Indicates +5VDC SPI supply is present
2	Red	Indicates +5VDC control supply is present

L11078 +40 Volt DC Bus Board		
LED #	COLOR	FUNCTION
1	Red	Indicates +40 VDC supply is present

Troubleshooting the PowerWave AC/DC

Using the Status LED

LIGHT CONDITION	MEANING
Steady Green	System OK. Power source communicating normally with wire feeder and its components.
Blinking Green	Occurs during a reset, and indicates the Power Wave AC/DC 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
Alternating Green and Red	Non-recoverable system fault. If the PS Status light is flashing any combination of red and green, errors are present in the Power Wave AC/DC. **Read the error code before the machine is turned off.** **Error Code interpretation** through the Status light is detailed in the 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. To clear the error, turn power source off, and back on to reset.

Error codes for the PowerWave

The following is a list of possible error codes that the Power Wave AC/DC can output via the status light

Error Code #	Indication
11 CAN communication bus off.	Probably due to excessive number of communication errors.
12 User Interface time out error.	UI is no longer responding to the Power Source. The most likely cause is a fault/bad connection in the communication leads or control cable.
21 Unprogrammed Weld Mode.	Contact the Service Department for instructions on reloading the Welding Software.
22 Empty Weld Table.	Contact the Service Department for instructions on reloading the Welding Software.
23 Weld Table checksum error.	Contact the Service Department for instructions on reloading the Welding Software.
31 Primary overcurrent error.	Excessive Primary current present. May be related to a switch board or output rectifier failure.
32 Capacitor "A" under voltage (Left side facing machine)	Low voltage on the main capacitors. May be caused by improper input configuration, or an open/short circuit in the primary side of the machine.
33 Capacitor "B" under voltage (Right side facing machine)	
34 Capacitor "A" over voltage (Left side facing machine)	Excess voltage on the main capacitors. May be caused by improper input configuration, or an open/short circuit in the primary side of the machine.
35 Capacitor "B" over voltage (Right side facing machine)	
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.
37 Softstart error	Capacitor precharge failed. Usually accompanied by codes 32-35.
41 Secondary overcurrent error	The secondary (weld) current limit has been exceeded. When this occurs the machine output will phase back to 100 amps, typically resulting in a condition refered to as "noodle welding"
43 Capacitor delta error	The maximum voltage difference between the main capacitors has been exceeded. May be accompanied by errors 32-35.
49 Single phase error	Indicates machine is running on single phase input power. Usually caused by the loss of the middle leg (L2).
Other	Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the PS Control Board. If cycling the input power on the machine does not clear the error, try reloading the operating system. If this fails, replace the control board.

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THE INFORMATION ON THIS PRINT IS FOR REFERENCE ONLY. COMPONENTS AND CIRCUITRY MAY BE DIFFERENT FROM AN ACTUAL MACHINE.

DESIGN INFORMATION	REFERENCE: G4967	EQUIPMENT TYPE:	POWERWAVE AC/DC 1000
DRAWN BY: lkooken	SCALE: NONE	SUBJECT:	MACHINE SCHEMATIC
ENGINEER: lkooken		MATERIAL DISPOSITION: UF	APPROVAL DATE: 2/1/2007
APPROVED: -		PROJECT NUMBER: CRM22115-GC	

PAGE 3 OF 3 | DOCUMENT NUMBER: G4967-1 | DOCUMENT REVISION: D | SOLIDEDGE

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

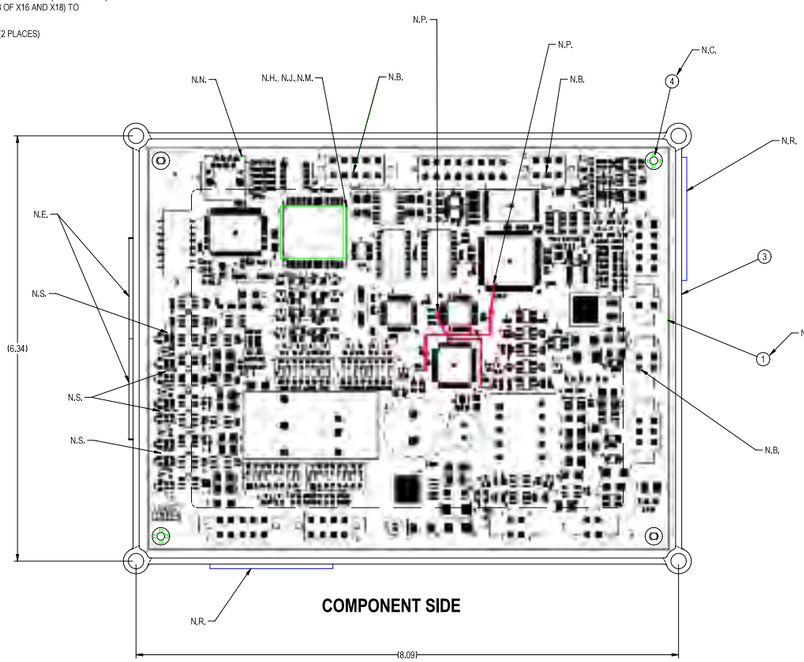
G 894-1 | ENGINEERING CONTROLLED MANUFACTURER: Yes | CHANGE DETAIL: ADDED ADDITIONAL BARCODED AND UPDATED NOTE N.R.

NOTES:

N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. LINCOLN ELECTRIC TO SEE E2454 BEFORE HANDLING
N.B. PLACE CONNECTOR KEYING PLUG, OVER HEADER PIN. IN LOCATION SHOWN. PLUG SHOULD BE INSERTED BELOW CONNECTOR TOP SURFACE.
N.C. SECURE P.C. BOARD ASSEMBLY IN PLACE WITH **ITEM 4.** (2 PLACES, 5.3 +/-.5 IN.LBS.)
N.D. NO COMPONENTS ON BOTTOM SIDE OF BOARD.
N.E. PLACE BARCODED ASSEMBLY NUMBER IDENTIFICATION AND BARCODED SERIAL NUMBER IDENTIFICATION IN AREA SHOWN.
N.F. PROGRAM **ITEM 84** WITH **ITEM 7.**
N.G. PROGRAM **ITEM 82** WITH **ITEM 8.**
N.H. ASSEMBLE AFTER ALL SOLDERING AND CLEANING OPERATIONS ARE COMPLETED.
N.J. **ITEM 5** MUST NOT PENETRATE THIS COMPONENT, BUT MUST COVER LEADS.
N.K. ALL CONNECTORS MUST BE GREASED WITH **ITEM 6A** PRIOR TO ENCAPSULATION.
N.L. ENCAPSULATION PER E1911-E TO A MINIMUM DEPTH, SUCH THAT ALL COMPONENT LEADS ARE COVERED.
N.M. SEAL ALL 4 SIDES OF **ITEM 9** TO P.C. BOARD WITH **ITEM 6B** SUCH THAT ALL LEADS ARE COVERED.
N.N. SEAL **ITEM 37** ON ALL 4 SIDES ON COMPONENT SIDE AND ALL OPENINGS ON NON-COMPONENT SIDE OF P.C. BOARD WITH **ITEM 6B.**
N.P. REWORK BY THE FOLLOWING:
1. CUT LAND TO PIN 5 OF X10 ON COMPONENT SIDE.
2. SOLDER A #30 INSULATED COPPER WIRE FROM PIN 5 OF X10 TO BOTTOM PAD OF R101 (PIN 39 OF X40).
3. SOLDER A #30 INSULATED COPPER WIRE FROM RIGHT PAD OF R60 (PIN 23 OF X16 AND X18) TO BOTTOM PAD OF R123 (PIN 41 OF X40).

N.R. PLACE BARCODED ETHERNET ADDRESS IDENTIFICATION IN AREAS SHOWN. (2 PLACES)
N.S. REWORK BY THE FOLLOWING:
1. ADD A CAPACITOR (S25050-25MT) ACROSS THE TOP ENDS OF R143 AND R154, AND SOLDER THE RESPECTIVE ENDS TOGETHER.
2. ADD A CAPACITOR (S25020-25MT) ACROSS THE TOP ENDS OF R146 AND R151, AND SOLDER THE RESPECTIVE ENDS TOGETHER.
3. ADD A CAPACITOR (S25020-25MT) ACROSS THE TOP ENDS OF R145 AND R152, AND SOLDER THE RESPECTIVE ENDS TOGETHER.
4. ADD A CAPACITOR (S25020-25MT) ACROSS THE TOP ENDS OF R144 AND R153, AND SOLDER THE RESPECTIVE ENDS TOGETHER.

P.C. BOARD BLANK REFERENCE INFORMATION
BUY BLANK COMPLETE AS G3894-A
(4 LAYER BOARD PER E3281)



COMPONENT SIDE

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

Notes	ITEM	PART NO.	QTY	PC BOARD REFERENCE DESIGNATORS	DESCRIPTION
	1	G3894-A	1		GATEWAY PC BOARD,BLANK
	2	S24671	3		PLUG, KEYING PLUG.
	3	M19435-1	1		POTTING TRAY
	4	S8025-80	2		SELF TAPPING SCREW
	5	E2527	2.75fl.oz.		EPOXY ENCAPSULATING RESIN
	6A	E3539	.38fl.oz.		ELECTRICAL INSULATING COMPOUND
	6B	E2861	1fl.oz.		RTV COMPOUND
N.F., N.P.	7	S24639-4	1	X40	FIRMWARE CPLD
N.G.	8	S24440-2	1	X37	SOFTWARE, FLASH
N.H.,N.J.,N.M.	9	S25125-1	1	X43	BATTERY,LITHIUM POWERCAP,CRYSTAL
	FOR ITEMS LISTED BELOW REFER TO ELECTRONIC COMPONENT DATABASE FOR COMPONENT SPECIFICATIONS				
	10	S25020-130SMT	2	C2,C7	CAPACITOR,SMD,CERAMIC,150pF,100V,5%,C0G,S0805
	11	S25024-65MT	5	C3,C4,C5,C6,C8	CAPACITOR,SMD,TANTALUM,10MF,16V,10%,S6032
	12	S13490-179	1	C9	CAPACITOR,ALEL,1000,35V,20%
	13	S25024-55MT	4	C10,C13,C27,C30	CAPACITOR,SMD,TANTALUM,4.7MF,35V,10%,S7343
	14	S25024-66MT	8	C11,C12,C43,C93,C96,C97 C98,C100	CAPACITOR,SMD,TANTALUM,22MF,16V,10%,S6032
	15	S25024-26MT	5	C14,C16,C23,C25,C99	CAPACITOR,SMD,TANTALUM,1.0MF,35V,10%,S3528
	16	S25020-36MT	68	C15,C17,C18,C19,C21,C22,C23 C24,C26,C28,C31,C32,C33,C35 C36,C37,C38,C41,C42,C44,C45 C46,C47,C48,C49,C50,C51,C53 C54,C58,C61,C62,C63,C64,C65 C66,C67,C68,C69,C70,C71,C72 C73,C74,C75,C76,C77,C78,C79 C80,C81,C82,C83,C84,C85,C86 C87,C88,C89,C90,C91,C92,C93 C101,C102,C103,C104,C105	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
	17	S25020-155MT	5	C29,C39,C40,C94,C95	CAPACITOR,SMD,CERAMIC,22PF,50V,5%,C0G,S0805
	18	S13490-182	1	C56	CAP,ALEL,3300,63V,20%
	19	S13490-181	1	C59	CAP,ALEL,22,63V,20%
	20	S25040-105MT	2	D1,D5	DIODE,SMD,3A,400V,DO-214AB
	21	S25040-65MT	1	D2	DIODE,SMD,3A,200V,DO-214AB,ULTRA-FAST RECOVERY
	22	S25040-25MT	4	D3,D6,D21,D35	DIODE,SMD,1A,400V,DO-214BA/C
	23	S25040-115MT	3	D4,D16,D20	DIODE,SMD,1A,600V,S403A,ULTRA-FAST RECOVERY
	24	S25040-48MT	10	D7,D8,D9,D10,D12,D13,D14 D15,D36,D37	DIODE,SMD,DUAL,0.200A,70V,UFR
	25	S25040-38MT	1	D17	DIODE,SMD,3A,40V,SCHOTTKY,CASE 403-3
	26	S25040-45MT	1	D19	DIODE,SMD,DUAL,200MA,30V,SCHOTTKY,SOT-23
	27	S25040-56MT	13	D22,D23,D24,D25,D26,D27 D28,D29,D30,D31,D32,D33 D34	DIODE,SMD,DUAL,0.200A,70V,UFR
	28	S25046-15MT	1	DZ1	ZENER DIODE,SMD,0.5W,5.1V, 5%, SOD123
	29	S25046-38MT	4	DZ2,DZ3,DZ4,DZ5	ZENER DIODE,SMD,0.5W,18V, 5%, SOD123
	30	S25044-66MT	16	DZ6,DZ7,DZ8,DZ10,DZ11,DZ12 DZ13,DZ14,DZ15,DZ16,DZ17 DZ18,DZ19,DZ20,DZ21,DZ22	ZENER DIODE,SMD,3W,6.2V,5% , SMB
	31	S18245-16	1	J20	CONNECTOR,MOLEX,MINI-PCB,15-PIN
	32	S18245-10	1	J11	CONNECTOR,MOLEX,MINI-PCB,10-PIN
	33	S24020-4	3	J12,J13,J16	CONNECTOR,MOLEX,MINI-PCB,4-PIN,TIN
	34	S24020-2	1	J14	CONNECTOR,MOLEX,MINI-PCB,2-PIN,TIN
	35	S24020-6	2	J15,J111	CONNECTOR,MOLEX,MINI-PCB,6-PIN,TIN
	36	S24020-10	2	J17,J19	CONNECTOR,MOLEX,MINI-PCB,10-PIN,TIN
N.N.,	37	S25104-1	1	J110	CONNECTOR,MODULAR,HIGH-SPEED,VERTICAL,INTERNAL-
	38	S24020-8	1	J112	CONNECTOR,MOLEX,MINI-PCB,8-PIN,TIN
	39	S25060-25MT	9	LED1,LED2,LED3,LED5,LED7 LED9,LED10,LED11,LED12	LED,SMD,GREEN,CLEAR,S1206
	40	S25060-19MT	3	LED4,LED6,LED8	LED,SMD,RED,CLEAR,S1206
N.A.	41	S15000-285MT	4	OC1,OC2,OC3,OC14	OPTOCOUPLER,SMD,TTL,<OUT HI-SPD,HI-CMR
N.A.	42	S15000-326MT	15	OC5,OC6,OC7,OC8,OC9 OC10,OC11,OC12,OC13 OC14,OC15,OC16,OC17 OC18,OC19	OPTOCOUPLER,SMD,CMOS,HIGH SPEED,HIGH CMR,SO-8(S
	43	S25050-26MT	4	Q4,Q5,Q12,Q13	TRANSISTOR,SMS,PNP,SOT23,0.5A, 40V,MMBT4403LT1
	44	S25051-43MT	6	Q6,Q7,Q8,Q9,Q10,Q11	TRANSISTOR,SMD,NMF,SOT-23,0.115A,60V,7002LT1(SS
	45	S25000-4750SMT	6	R1,R2,R39,R40,R66,R67	RESISTOR,SMD,METAL FILM,1/10W,4750HMS,1%,S0805
	46	S25003-2000SMT	2	R3,R4	RESISTOR,SMD,1W,2000HMS,1%
	47	S25000-1002SMT	31	R5,R8,R9,R10,R11,R12,R13 R14,R15,R16,R17,R19,R20 R21,R22,R23,R24,R25,R29 R42,R61,R69,R116,R117 R118,R119,R120,R121,R122 R162,R163	RESISTOR,SMD,METAL FILM,1/10W,10,0K,1%,S0805
	48	S25000-4751SMT	4	R6,R38,R43,R123	RESISTOR,SMD,METAL FILM,1/10W,4,75K,1%,S0805
	49	S25000-1001SMT	5	R18,R37,R41,R65,R68	RESISTOR,SMD,METAL FILM,1/10W,1,00K,1%,S0805
	50	S25001-1002SMT	2	R27,R28	RESISTOR,SMD,10K,1/4W,1206,1% ,TR
	51	S25000-1501SMT	1	R30	RESISTOR,SMD,METAL FILM,1/10W,1,50K,1%,S0805
	52	S25001-3320SMT	13	R31,R32,R33,R46,R47,R72 R102,R103,R104,R105,R106 R107,R108	RESISTOR,SMD,332OHMS,1/4W,1206,1%,TR
	53	S25000-7500SMT	4	R36,R44,R76,R127	RESISTOR,SMD,METAL FILM,1/10W,7500HMS,1%,S0805
	54	S25001-1211SMT	2	R48,R49	RESISTOR,SMD,1,21K,1/4W,1206,1%,TR
	55	S25001-2670SMT	10	R50,R51,R52,R53,R57,R58 R59,R124,R125,R126	RESISTOR,SMD,267OHMS,1/4W,1206,1%,TR
	56	S25000-1000SMT	13	R54,R55,R56,R80,R81,R82 R109,R110,R111,R112,R113 R114,R115	RESISTOR,SMD,METAL FILM,1/10W,100OHMS,1%,S0805
	57	S25001-24R9SMT	6	R73,R74,R75,R128,R129,R130	RESISTOR,SMD,24,90HMS,1/4W,1206,1%,TR
	58	S25001-1500SMT	8	R131,R132,R133,R134,R135 R136,R137,R138	RESISTOR,SMD,150OHMS,1/4W,1206,1%,TR
	59	S25001-2210SMT	8	R139,R140,R141,R142,R143 R144,R145,R146	RESISTOR,SMD,221OHMS,1/4W,1206,1%,TR
	60	S25000-3321SMT	3	R147,R149,R150	RESISTOR,SMD,METAL FILM,1/10W,3,32K,1%,S0805
	61	S25000-6810SMT	1	R148	RESISTOR,SMD,METAL FILM,1/10W,681OHMS,1%,S0805
	62	S25000-2212SMT	7	R151,R152,R153,R154,R155 R156,R157	RESISTOR,SMD,METAL FILM,1/10W,22,1K,1%,S0805
	63	S25000-39R2SMT	4	R158,R159,R160,R161	RESISTOR,SMD,METAL FILM,1/10W,39,2OHMS,1%,S0805
	64	S25000-4R70SMT	1	R164	RESISTOR,SMD,METAL FILM,1/10W,4,70OHMS,1%,S0805
	65	S18869-8	4	S1,S2,S3,S4	SWITCH,DIP,SPST,8-CIRC,ETS
	66	S20375-8	1	T1	TRANSFORMER,PCB,PWM,FLYBACK
	67	S25021-53MT	1	T2	TRANSFORMER-MODULE,SMD,ETHERNET,AUI
N.A.	68	S20353-16MT	1	X2	IC,SMD,CMOS,DRIVER,RECEIVER,EIA232,145407,SOG
	69	S15128-25SMT	1	X3	IC,SMD,VOLTAGE REGULATOR,FIXED,POSITIVE VOLTAGE
	70	S25058-65MT	3	X4,X24,X36	IC,SMD,VOLT REG,FIXED,-5.7,(+),0.1A,5V,SOIC-8
	71	S15129-56MT	1	X5	IC,VOLT REG,SMD,FIXED,-3.7,(+),1A,5V
	72	S24841-1	1	X6	IC,MODULE,CONVERTER,DC-DC ,+5V/3A OUT, 36-75V I
N.A.	73	S25068-70MT	2	X7,X9	IC,SMD,CMOS,UNDERVOLT-SENSING,RESET,MCU,SOT-89(
N.A.	74	S25069-23MT	1	X8	IC ,SMD,CMOS,EEPROM,SERIAL,SPI,64Kx8,SOIC-8
N.A.	75	M15101-145MT	1	X10	IC,SMD,CMOS,MCU,32-BIT 2K-RAM,TPU 25M
N.A.	76	S17900-115MT	1	X14	IC,SMD,CMOS,TRANCEIVER,BUS,3-STATE,OCTAL,TSSOP-
N.A.	77	S20353-55MT	2	X16,X18	IC ,CMOS,CONTROLLER,COMMUNICATION,SERI
N.A.	78	S20353-43MT	6	X17,X22,X32,X33,X34,X35	IC ,CMOS,SMD,XCVR,EIA485(SS)-
N.A.	79	S25068-43MT	1	X20	IC,SMD,TRANSCEIVER,CAN,UCS350,SOIC-8
N.A.	80	S17900-245MT	1	X23	IC ,SMD,CMOS,GATE,NAND,2-INPUT,QUAD,SCHM(SS)
N.A.	81	S25065-25MT	1	X31	IC ,SMD,ACT,LATCH,OCTAL,3-STATE,TSSOP-20
N.A.	82	S25069-65MT	1	X37	IC ,SMD,CMOS,EEPROM,FLASH,16-BIT,1024K,1MX16
N.A.	83	S25069-75MT	2	X38,X39	IC ,SMD,CMOS,RAM,STATIC,16-BIT,256K,256KX16(SS)
N.A.,N.P.,	84	S25070-65MT	1	X40	IC ,SMD,CMOS,CPLD,3KV18,TQ100
N.A.,	85	S25070-86MT	1	X41	IC ,CMOS,MACE,79C940(SS)
	86	S25067-43MT	1	X42	FILTER-MODULE,SMD,ETHERNET, 10BASE-T
N.A.,N.J.,	87	S25069-85MT	1	X43	IC ,CMOS,RTC/RAM-MODULE,32K(SS)
N.A.,	88	S25072-15MT	1	X44	IC ,SMD,CMOS,AND,3-INPUT,TRIPLE,HS,SO14(SS)
	89	S25082-15MT	1	Y1	CRYSTAL,SMD,QUARTZ,16MHZ
	90	S25082-25MT	1	Y2	CRYSTAL,SMD,QUARTZ,20MHZ

BUY AS
G3894-1A1
PART NO. — IDENTIFICATION CODE

BUY PER E3867
TEST PER E3826-E

SCHEMATIC REFERENCE -G3893-1AO

EM-170

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UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS B = .02
ON 3 PLACE DECIMALS B = .005
ON ANGLES B = 1 DEGREE
MATERIAL TOLERANCES (*) TO AGREE WITH PUBLISHED STANDARDS
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION		REFERENCE:	L11088-1
DRAWN BY:	tpeam		
ENGINEER:	TK	SCALE:	NONE
APPROVED:	TK		

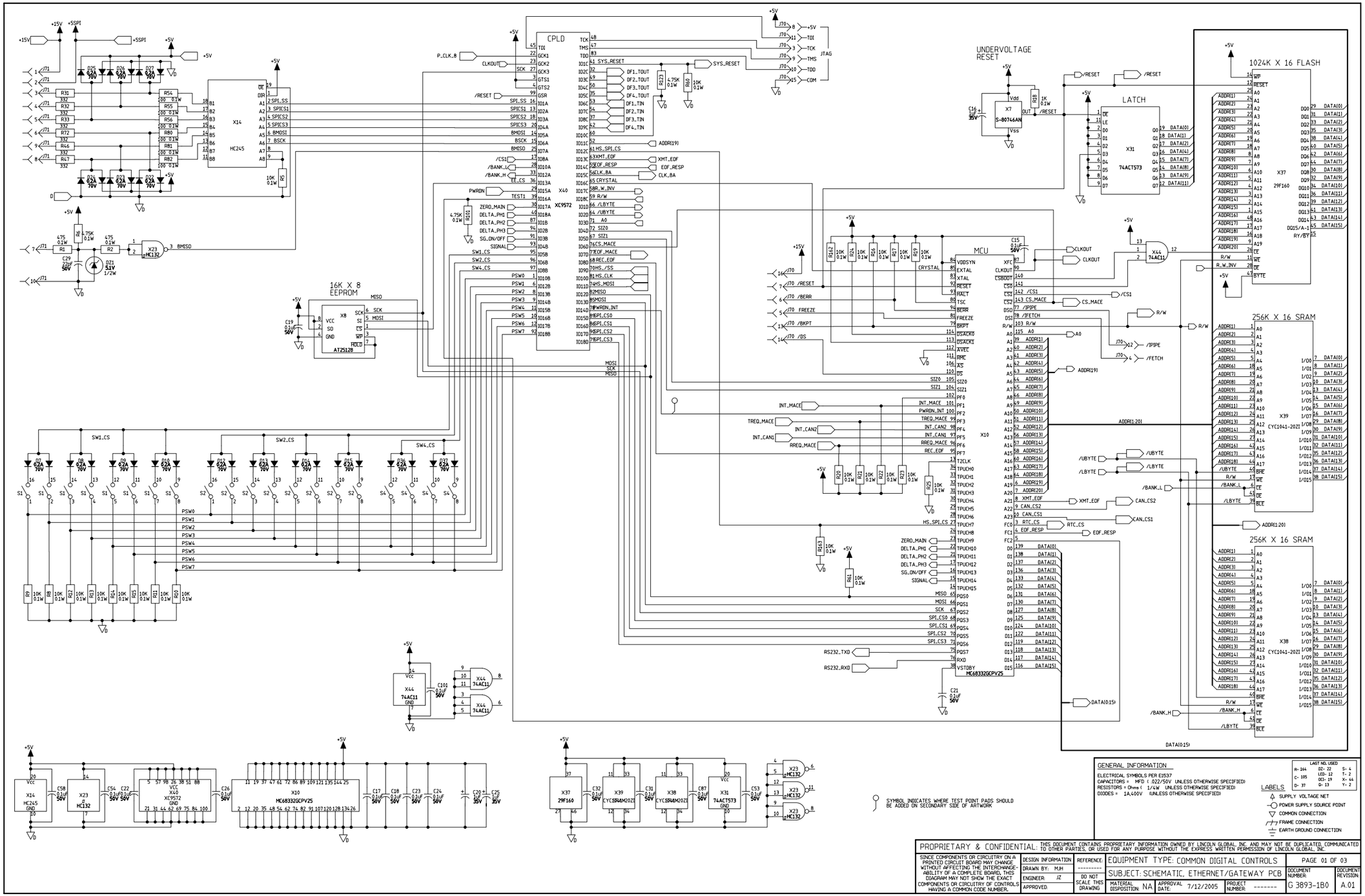
EQUIPMENT TYPE: INVERTER WELDERS
SUBJECT: ETHERNET PC BOARD ASSEMBLY
MATERIAL DISPOSITION: UF | APPROVAL DATE: 12/10/2004 | PROJECT NUMBER: CRM22115-FD

PAGE 1 OF 1
DOCUMENT NUMBER: G 894-1
DOCUMENT REVISION: C

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

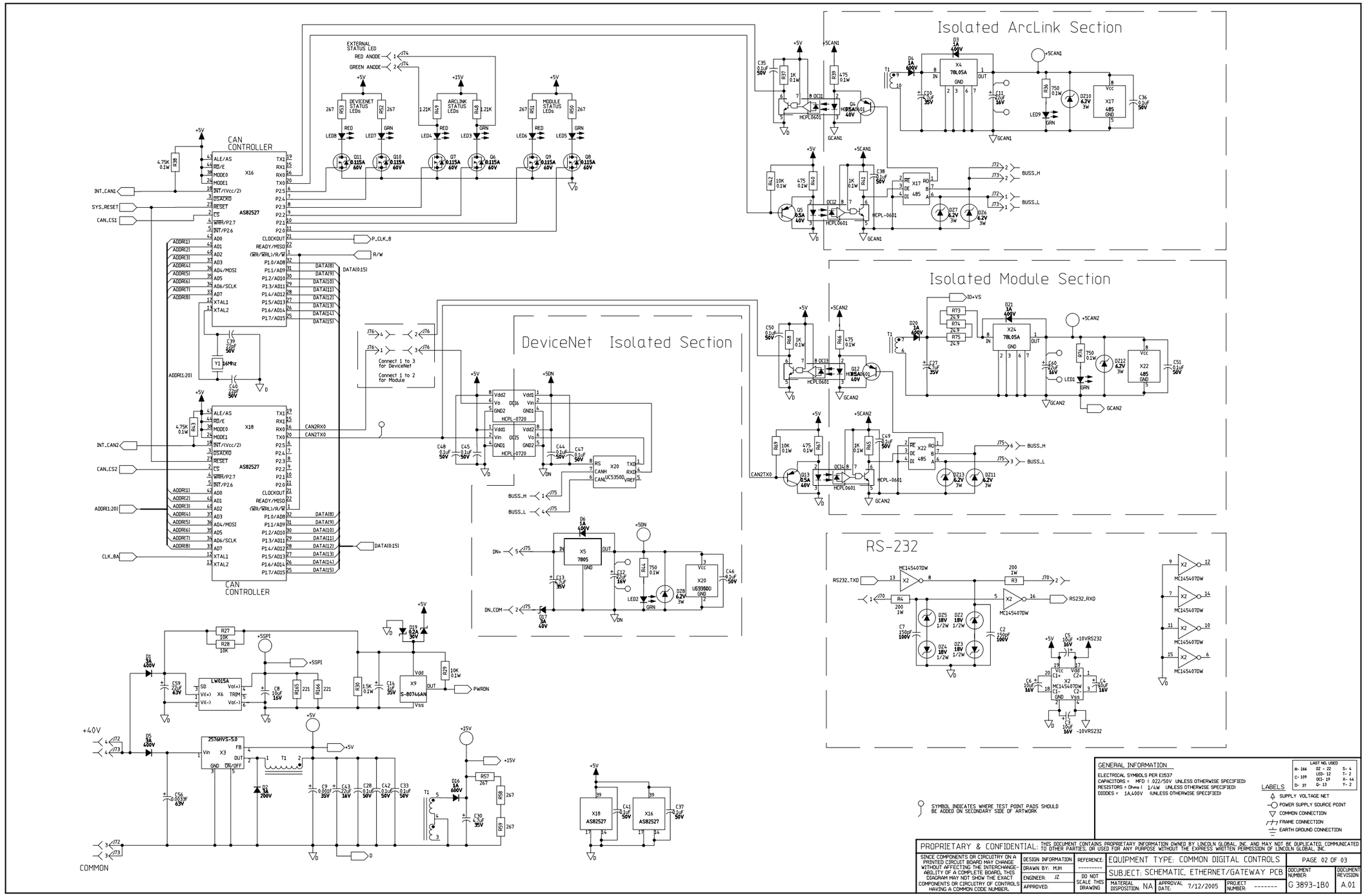
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

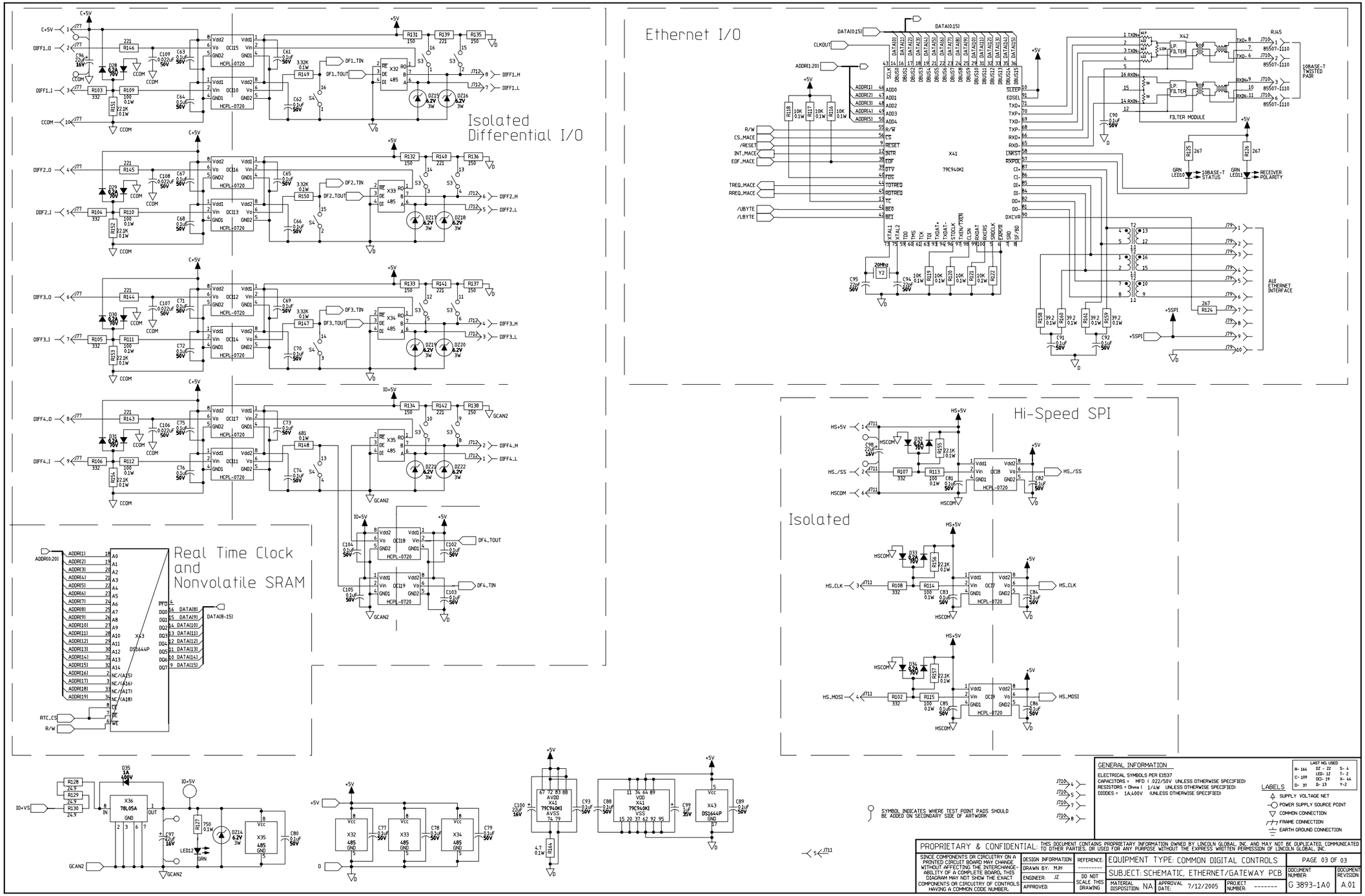
LINCOLN ELECTRIC

SCHEMATIC - ETHERNET BOARD (G3893) PAGE 2



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - ETHERNET BOARD (G3893) PAGE 3

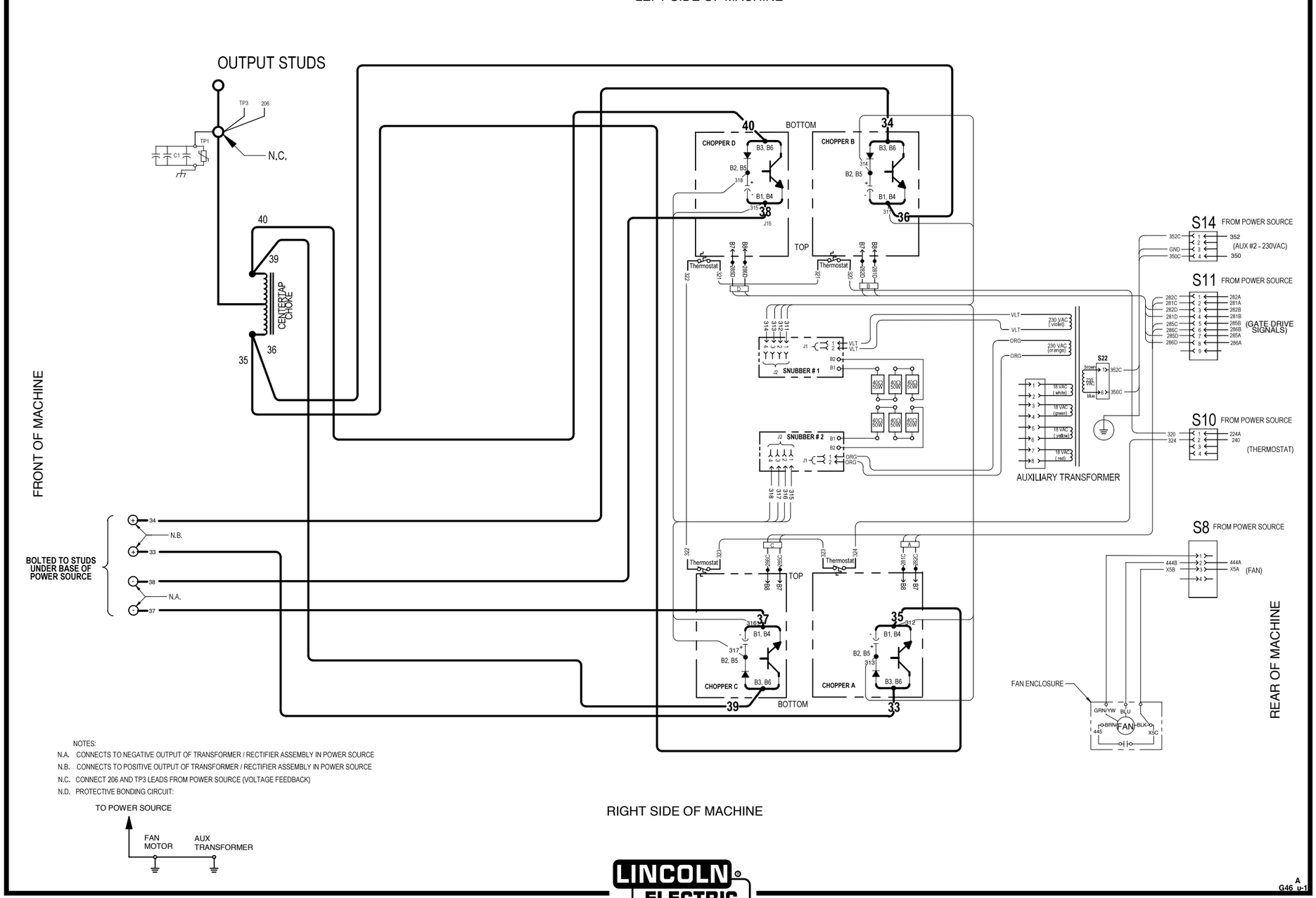


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - AC SWITCH (G4637-1)

POWER WAVE™ AC/DC 1000 (400/460/500/575) AC SWITCH WIRING DIAGRAM



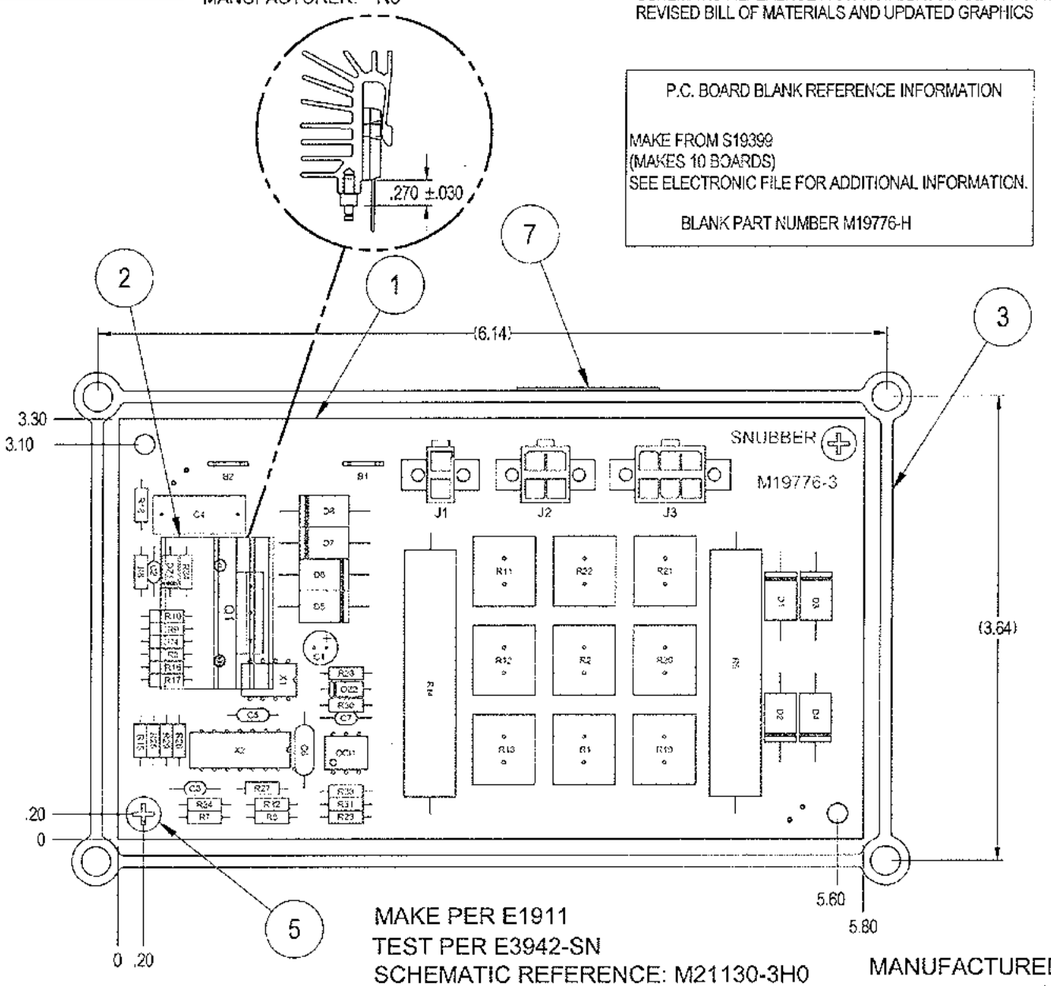
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - AC SWITCH SNUBBER BOARD (M19776)

M19776-3

ENGINEERING CONTROLLED
MANUFACTURER: No

CHANGE DETAIL: REVISED IDENTIFICATION CODE, MANUFACTURER AS PART NUMBER, SCHEMATIC REFERENCE PART NUMBER AND BLANK PART NUMBER REVISED BILL OF MATERIALS AND UPDATED GRAPHICS



MAKE PER E1911
TEST PER E3942-SN
SCHEMATIC REFERENCE: M21130-3H0

MANUFACTURED AS:

M19776-3H0

IDENTIFICATION CODE

	ITEM (USE WITH)*	QTY	PART NUMBER	DESCRIPTION
	1	1	M19776-H	PC BOARD BLANK
	2 (Q1)*	1	S20590-3	HEAT SINK, EXTRUDED, FOR TO-247
	REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW			
	REFERENCES	QTY	PART NUMBER	DESCRIPTION
	B1, B2	2	T13157-24	CONNECTOR,TAB,QC,VERTICAL,1/4,EXTENDED
	C1	1	S13490-193	CAPACITOR,ALEL,3.3,200V,20%
	C2	1	S16668-5	CAPACITOR,CEMO,.022,50V,20%
	C3	1	S16668-6	CAPACITOR,CEMO,4700pF,50V,10%
	C4	1	S20500-4	CAPACITOR,PPMF,.0047,1000V,BOX
	C5	1	S16668-11	CAPACITOR,CEMO,0.1, 50V,10%
	C6	1	S16668-10	CAPACITOR,CEMO,4700pF, 50V,2%
	C7	1	S16668-9	CAPACITOR,CEMO,150pF, 100V,5%
	D1, D2, D3, D4, D5, D6, D7, D8	8	T12705-45	DIODE,AXLDS,3A,1000V
	DZ1	1	T12702-45	ZENER DIODE,1W,18V,5%,1N4746A
	DZ2	1	T12702-4	ZENER DIODE,1W,20V,5%,1N4747A
N.A.	J1	1	S24020-2G	CONNECTOR,MOLEX,MINI,PCB,2-PIN,GOLD
N.A.	J2	1	S24020-4	CONNECTOR,MOLEX,MINI,PCB,4-PIN,TIN
N.A.	J3	1	S24020-6	CONNECTOR,MOLEX,MINI,PCB,6-PIN,TIN
	OC1	1	S15000-10	OPTOCOUPLER,PHOTO-Q,70V,CNY17-3
N.C, N.F	Q1	1	T12704-84	TRANSISTOR,IGBT,TO247,600V,65A,FAST(SS)
	R1, R2, R19, R20, R21, R22	6	S25923-1501	RESISTOR,STAND-UP,MF,5W,1.50K,5%
	R3, R24	2	S19400-3321	RESISTOR,MF,1/4W,3.32K,1%
	R4	1	S19400-1652	RESISTOR,MF,1/4W,16.5K,1%
	R5, R14	2	S24376-2	RESISTOR,WW,10W,40,5%
	R6, R23, R30	3	S19400-2213	RESISTOR,MF,1/4W,221K,1%
	R7	1	S19400-4321	RESISTOR,MF,1/4W,4.32K,1%
	R8	1	S19400-3011	RESISTOR,MF,1/4W,3.01K,1%
	R9, R15, R16, R25, R26, R27	6	S19400-1002	RESISTOR,MF,1/4W,10.0K,1%
	R10, R18, R28	3	S19400-1000	RESISTOR,MF,1/4W,100,1%
	R11, R12, R13	3	S25365-3300	RESISTOR,STAND-UP,WW,5W,330,5%
	R17, R29	2	S19400-4753	RESISTOR,MF,1/4W,475K,1%
	R31	1	S19400-3323	RESISTOR,MF,1/4W,332K,1%
	R32	1	S19400-1003	RESISTOR,MF,1/4W,100K,1%
	R33	1	S19400-1501	RESISTOR,MF,1/4W,1.50K,1%
	R34	1	S19400-4751	RESISTOR,MF,1/4W,4.75K,1%
N.C.	X1	1	S15128-10	VOLTAGE REF,ADJ, PRECISION,431I
N.C	X2	1	S15128-18	OP-AMP,QUAD, HIGH-PERF,33074

CAPACITORS = MFD/VOLTS
RESISTORS = OHMS

	ITEM	QTY	PART NO.	DESCRIPTION
	3	1	M19436-3	POTTING TRAY
	4	115g. (4.1oz)	E2527	EPOXY ENCAPSULATING RESIN
	5	2	S8025-80	SELF TAPPING SCREW
	6	AS REQ'D.	E3539	ELECTRICAL INSULATING COMPOUND
N.E.	7	1	E3768-4	LABEL

NOTES:
- N.A. ALL CONNECTORS MUST BE GREASED WITH ITEM 6 PRIOR TO ENCAPSULATION.
- N.B. SECURE P.C. BOARD ASSEMBLY IN PLACE WITH ITEM 5 (2 PLACES, TORQUE TO 4.8/5.8 IN-LBS.)
- N.C. CAUTION: THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
- N.D. ENCAPSULATE PER E1911-E TO A MINIMUM DEPTH, SUCH THAT ALL COMPONENT LEADS ARE COVERED.
- N.E. PRINT "M19776-[ ]" [LATEST DASH NUMBER AND I.D. CODE] ON LABEL.
- N.F. TRIM Q1 LEADS TO MAX LENGTH OF .060" AFTER SOLDERING.

EN-166

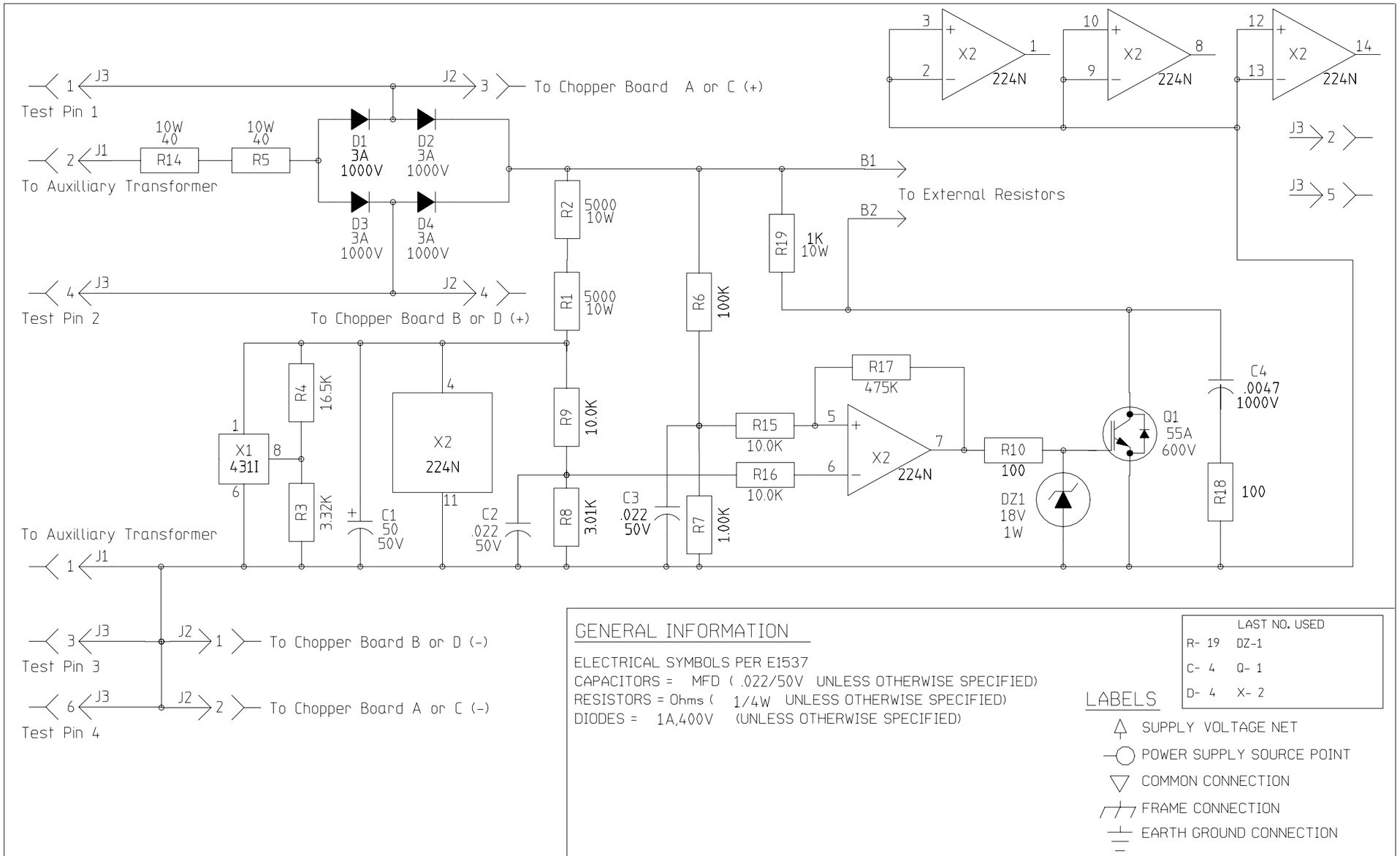
UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056 ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("L") TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	DESIGN INFORMATION	REFERENCE: L11037-1	EQUIPMENT TYPE: POWERWAVE AC/DC			PAGE 1 OF 1	
	DRAWN BY: RAS	SCALE: 1:1	SUBJECT: SNUBBER P.C. BOARD ASSEMBLY			DOCUMENT NUMBER: M19776-3	DOCUMENT REVISION: D
	ENGINEER: TK		MATERIAL DISPOSITION: UF	APPROVAL DATE: 5/30/2006	PROJECT NUMBER: CRM37720		
	APPROVED:						

STRP

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

LINCOLN ELECTRIC

SCHEMATIC - AC SWITCH SNUBBER BOARD (S25136)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED	
R- 19	DZ-1
C- 4	Q- 1
D- 4	X- 2

LABELS

- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.	DESIGN INFORMATION	REFERENCE: ---------	EQUIPMENT TYPE: POWERWAVE AC SWITCH		PAGE 01 OF 01	
	DRAWN BY: TK		SUBJECT: SCHEMATIC, SNUBBER PCB		DOCUMENT NUMBER: S 25136-3E0	DOCUMENT REVISION: A.01
	ENGINEER: TK	DO NOT SCALE THIS DRAWING	MATERIAL DISPOSITION: NA	APPROVAL DATE: 03/12/2003	PROJECT NUMBER: 5008232	
	APPROVED:					

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - CHOPPER BOARD & ASSEMBLY (G4619-1)

G4619-1 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: REVISED ITEM 8 , IDENTIFICATION CODE AND SCHEMATIC REFERENCE

MAKE PER E1911 AND E3875.

TEST PER E4107-CH

SCHEMATIC REFERENCE: M20298-1E1

MANUFACTURE AS:

G 4 6 1 9 - 1 E 1

PART NUMBER IDENTIFICATION CODE

NOTES:

N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.

N.B. AFTER SOLDERING, INSPECT TERMINAL CONNECTIONS PER E1880 (4 PLACES PER BOARD, 8 PLACES TOTAL).

N.C. THESE COMPONENTS ON A COMMON P.C. BOARD ARE TO BE SUPPLIED BY THE SAME VENDOR.

N.D. WITHIN EACH BOARD (NOT HEATSINK), ELECTRONIC MODULES ON A COMMON P.C. BOARD ASSEMBLY TO HAVE SAME VENDOR CODE AND SAME $V_{CE(SAT)}$, $V_{GE(TH)}$ IS TO BE WITHIN 5 SORT CODES FOR IGBTs AND SAME CODE ON DIODES.

N.E. MODULE IDENTIFICATION LABELS TO BE PLACED IN THIS AREA, AT END SHOWN.

N.F. ENCAPSULATE TO WITHIN .10 OF TRAY TOP WITH **ITEM 10.**

N.G. TOP SURFACES AND THREADS (WITHIN .63 FROM TOP SURFACE) TO BE FREE OF ENCAPSULATING MATERIAL (4 TERMINALS PER BOARD, 8 PLACES TOTAL).

N.H. PRINT **"G4619-[ ]"** [LATEST DASH NUMBER AND REVISION CODE]. ONE LABEL TO COVER BLANK NUMBER ON BOARD AND ONE LABEL TO BE ON POTTING TRAY.

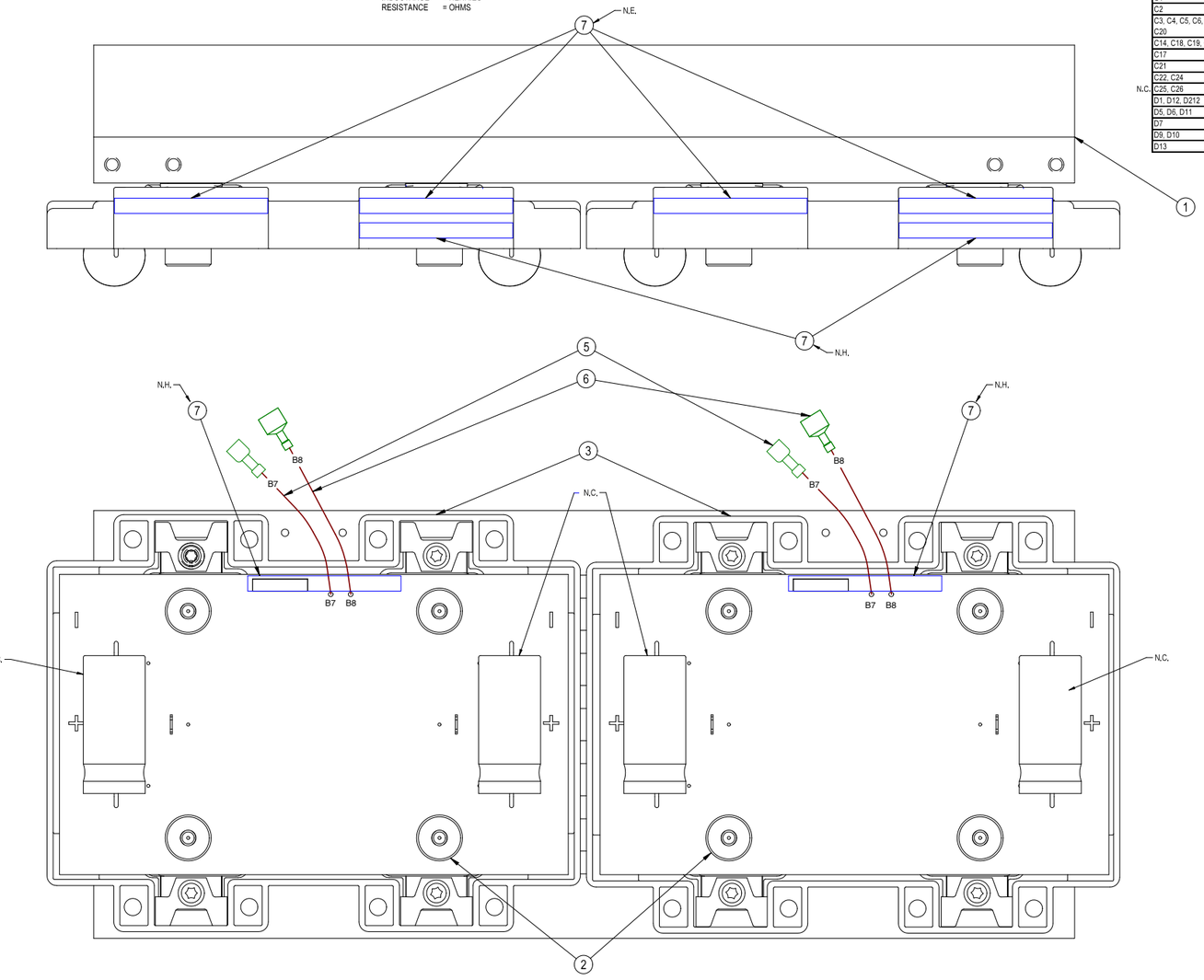
N.J. THIS ASSEMBLY IS NOT ESD AFTER POTTING.

N.K. TERMINAL TO BE FREE OF ENCAPSULATION MATERIAL (2 PLACES PER BOARD, 4 PLACES TOTAL).

N.L. TEST EACH BOARD SEPARATELY PER E4107-CH.

CURRENT PRODUCTION USES LATEST DASH NUMBER, ALL PREVIOUS DASH NUMBERS ARE SUPERSEDED.

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

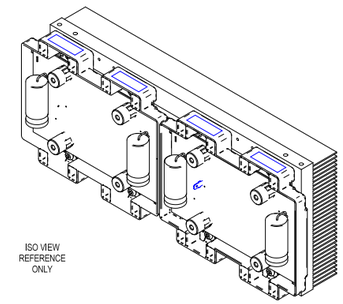


ITEM	QTY	PART NO.	DESCRIPTION
1	1	G4581	HEATSINK
	2	G4619-E	P, C, BOARD BLANK
2	8	S25930-6	TORX BUTTON HEAD SCREW
	8	E106A-2	LOCK WASHER
	8	S25792	POTTING TRAY CLAMP WASHER
3	2	M19436-7	POTTING TRAY
5	2	W-18-3-10-167/B7	LEAD
6	2	W-18-3-133-167/B8	LEAD
7	8	E3768-4	LABEL
8	2	S25346-3	GASKET
9	560g	E2527	EPOXY ENCAPSULATING RESIN
10	4	S25347	THERMAL INTERFACE PAD
13	4	S20590-3	HEATSINK

	ITEM	QTY	PART NO.	DESCRIPTION
N.A.	A1, A2	4	M16100-63	ELECTRONIC-MODULE,7-IGBT,T12704-96S(SS)
	B1, B3, B4, B6	8	S23006-1	CONNECTOR,TERMINAL,POWER,6-PIN
	B2, B5	4	T13157-24	CONNECTOR,TAB,QC,VERTICAL,1/4,EXTENDED
	B7, B8	4	S8053-167	HOLE IN BOARD FOR S8053-167 TERMINAL
	C1	2	S13490-8	CAPACITOR,ALEL,50,25V,+75/-10%
	C2	2	S13490-173	CAPACITOR,PEMF,1,0,63V,10%
	C3, C4, C5, C6, C7, C13, C15, C16, C20	18	S16668-11	CAPACITOR,CEMO,0,1, 50V, 10%
	C14, C18, C19, C23	8	S16668-5	CAPACITOR,CEMO,,022,50V,20%
	C17	2	S16668-6	CAPACITOR,CEMO,4700p,50V,10%
	C21	2	S13490-12	CAPACITOR,ALEL,10,25V,+75/-10%
	C22, C24	4	S16668-8	CAPACITOR,CEMO,330p,100V,5%
N.C.	C25, C26	4	S13490-211	CAPACITOR,ALEL,82,450V,-10% +75%
	D1, D12, D212	6	T12199-1	DIODE,AXLDS,1A,400V
	D5, D6, D11	6	T12705-23	DIODE,SCHOTTKY,AXLDS,1A,30V,1N5818
	D7	2	T12705-61	DIODE,T247,70A,600V,ULTRA-FAST
	D9, D10	4	T12705-59	DIODE,AXLDS,3A,600V,UFR
	D13	2	T12705-53	DIODE,TO220,25A,600V

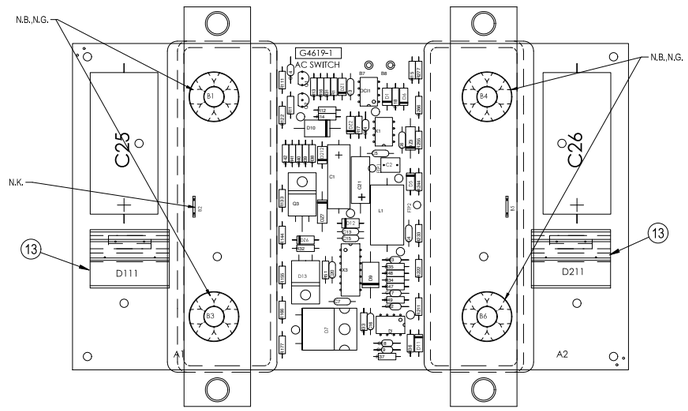
ITEM	QTY	PART NO.	DESCRIPTION
D111, D211	4	T12705-61K3	DIODE,T247,70A,600V,FR,S20590-3HS
DZ1	2	T12702-52	ZENER DIODE, 1W,5.1V,5% 1N4733A
DZ2	2	T12702-27	ZENER DIODE, 1W,10V,5% 1N4740A
DZ3	2	T12702-25	ZENER DIODE,5W,20V,5% 1N5357B
DZ6	2	T12702-45	ZENER DIODE, 1W,18V,5% 1N4746A
DZ7	2	T12702-50	ZENER DIODE,5W,17V,5% 1N5354B
L1	2	T12218-18	CHOKE,3,3MH,0,4A
OC1	2	S15000-28	OPTOCOUPLER,TTL-OUT,HI-SPD,HI-CMR
N.A. Q1, Q2	4	T12704-68	TRANSISTOR,NPN,TO226,0,5A,40V,2N4401
N.A. Q3	2	T12704-72	TRANSISTOR,NMF,T220,8A,500V,IRF840(SS)
R1	2	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
R11, R13	4	S19400-4752	RESISTOR,MF,1/4W,47.5K ,1%
R12, R31	4	S19400-1002	RESISTOR,MF,1/4W,10.0K,1%
R14, R15	4	S19400-4751	RESISTOR,MF,1/4W,4.75K,1%
R16	2	S19400-5620	RESISTOR,MF,1/4W,562,1%
R17	2	S19400-4750	RESISTOR,MF,1/4W,475,1%
R18	2	S19400-1211	RESISTOR,MF,1/4W,1.21K,1%
R32	2	S19400-33R2	RESISTOR,MF,1/4W,33,2,1%
R33	2	S19400-1000	RESISTOR,MF,1/4W,100,1%
R34	2	S19400-2671	RESISTOR,MF,1/4W,2,67K,1%
R35	2	S19400-1502	RESISTOR,MF,1/4W,15.0K,1%
R36	2	S19400-2213	RESISTOR,MF,1/4W,221K,1%
R37	2	S19400-1821	RESISTOR,MF,1/4W,1.82K,1%
R38, R39, R40, R41, R42	10	S19400-6813	RESISTOR,MF,1/4W,681K,1%
R47	2	S19400-1003	RESISTOR,MF,1/4W,100K,1%
R48	2	S19400-2210	RESISTOR,MF,1/4W,221,1%
R49	2	S19400-3322	RESISTOR,MF,1/4W,33,2K,1%
R51	2	S19400-15R0	RESISTOR,MF,1/4W,15,0,1%
R111, R122, R133, R144, R155, R166, R177, R211, R222, R233, R244, R255, R266, R277	28	S19400-5110	RESISTOR,MF,1/4W,511,1%
N.A. X1	2	S15018-21	IC,CMOS,DRIVER,MOSFET,4451(SS)
N.A. X2	2	M15458-4	IC,PWM-CONTROLLER,IMODE,2842A
N.A. X3	2	S15018-16	IC,CMOS,DRIVER,MOSFET,2110(SS)

COMPONENT QUANTITIES SHOWN MAKE TWO COMPLETE BOARDS FOR ONE ASSEMBLY



ISO VIEW REFERENCE ONLY

P.C. BOARD BLANK REFERENCE INFORMATION
BUY COMPLETE AS G4619-E (4 LAYER BOARD PER E3867)
OUTER COPPER WEIGHT 4.0 OZ/FT^2, INNER COPPER WEIGHT 2.0 OZ/FT^2
(SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION)



CHOPPER P.C. BOARD ASSEMBLY DETAIL

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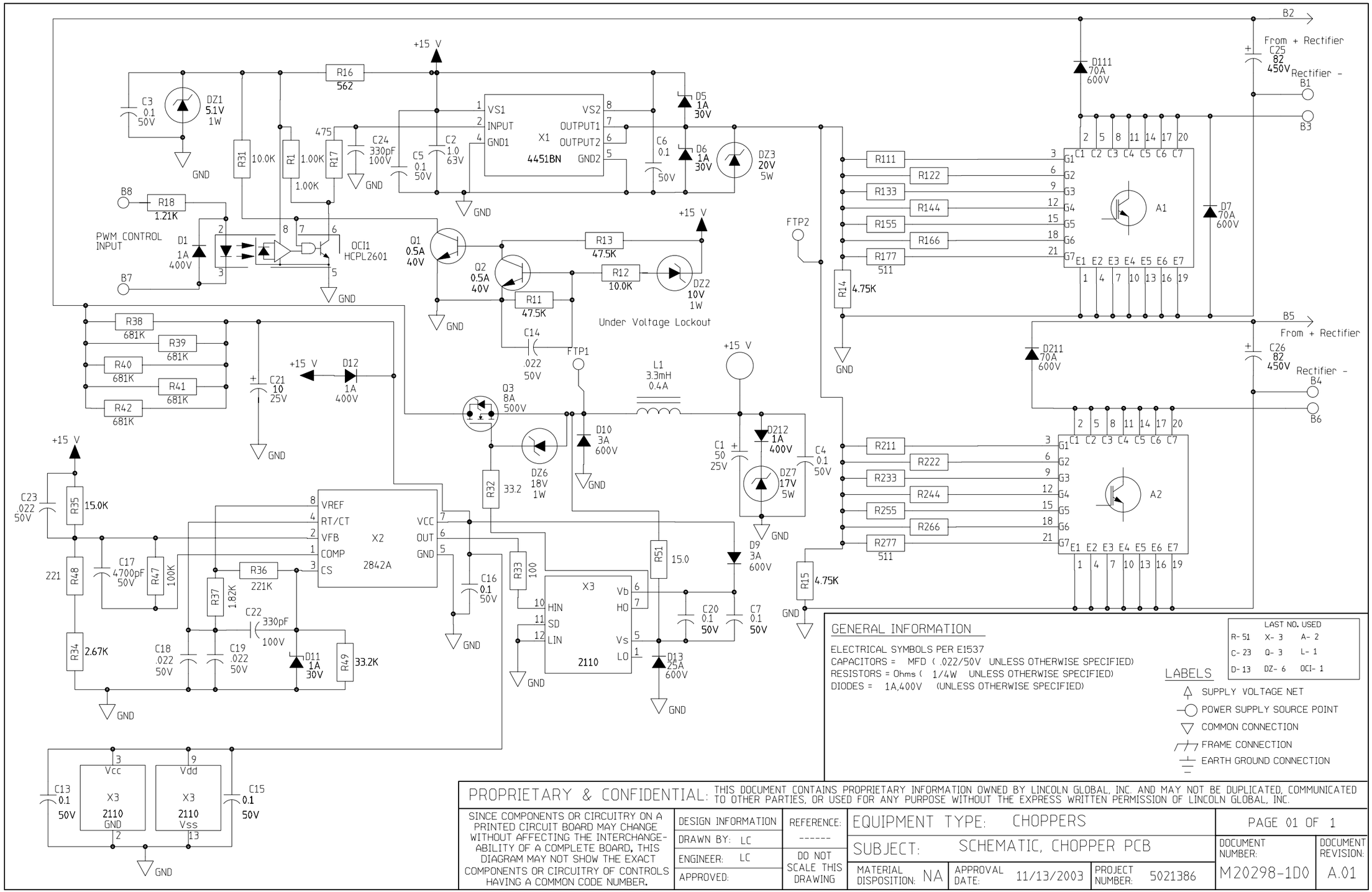
UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS ± .02
ON 3 PLACE DECIMALS ± .002
ON FILLANGLES ± .5 OF A DEGREE
MATERIAL TOLERANCE TYP. TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION: REFERENCE: L11774-1
DRAWN BY: F.Vallence
ENGINEER: T.Spear
APPROVED: -
SCALE: 1:1
EQUIPMENT TYPE: POWERWAVE AC/DC 1000
SUBJECT: MODULE & HEATSINK ASSEMBLY
MATERIAL DISPOSITION: UF
APPROVAL DATE: 03/10/2005
PROJECT NUMBER: CRM37193
PAGE 1 OF 1
DOCUMENT NUMBER: G4619-1
DOCUMENT REVISION: D

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the

LINCOLN ELECTRIC

Return to Section TOC
Return to Master TOC

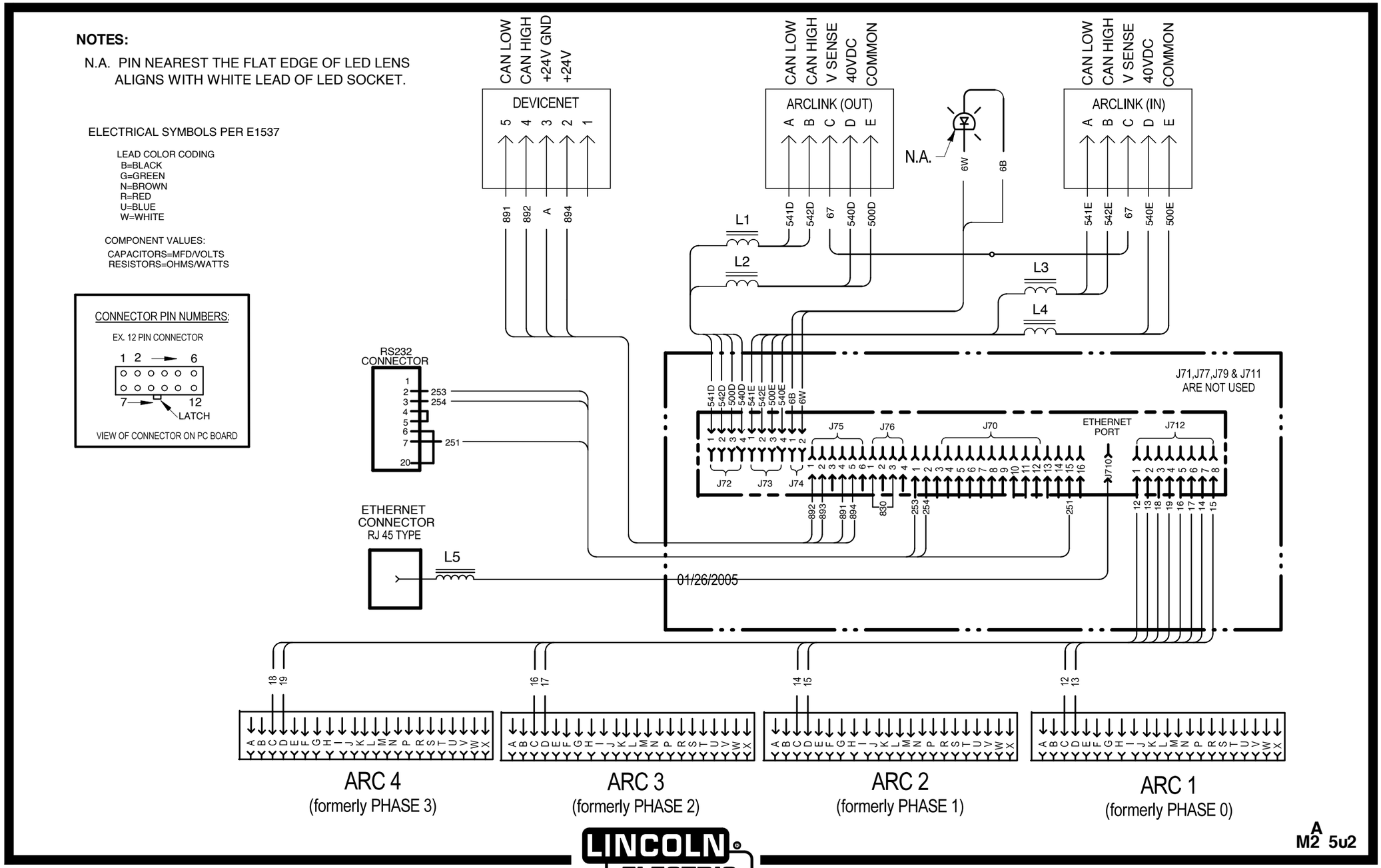


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

LINCOLN ELECTRIC

SCHEMATIC - WIRE DIAGRAM SYSTEM INTERFACE (M20572-1)

POWER WAVE™ SYSTEM INTERFACE WIRING DIAGRAM



LINCOLN ELECTRIC

CLEVELAND, OHIO, U.S.A.

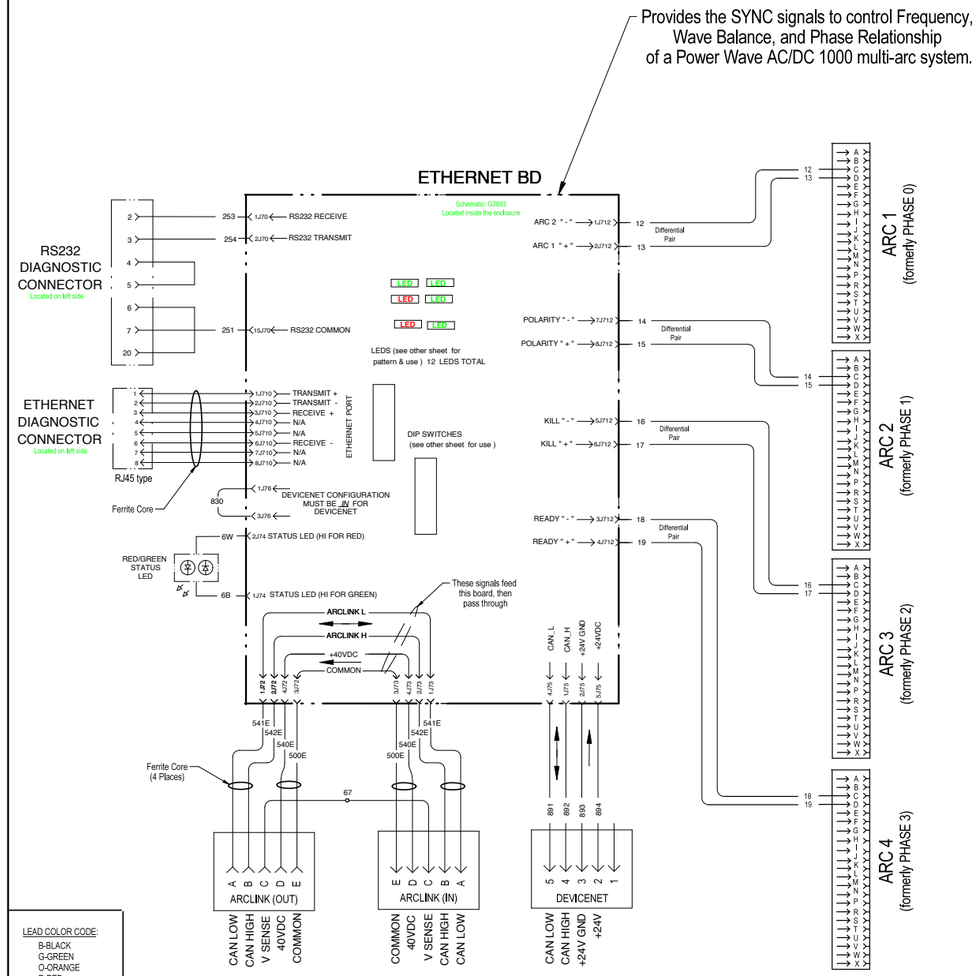
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - MACHINE DIAGRAM SYSTEM INTERFACE (G5123)

G5123 | ENGINEERING CONTROLLED RELEASED A.01 FROM X.
MANUFACTURER: No

Provides the SYNC signals to control Frequency, Wave Balance, and Phase Relationship of a Power Wave AC/DC 1000 multi-arc system.

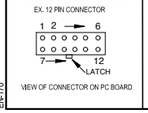


LEAD COLOR CODE:
B-BLACK
G-GREEN
O-ORANGE
R-RED
U-BLUE
W-WHITE
Y-YELLOW

LABELS:
COMMON
FRAME GROUND
EARTH GROUND

COMPONENT VALUE UNITS:
CAPACITOR: MFD/VOLTS
RESISTOR: OHMS/WATTS

CONNECTOR PIN NUMBERS:
EX. 12 PIN CONNECTOR



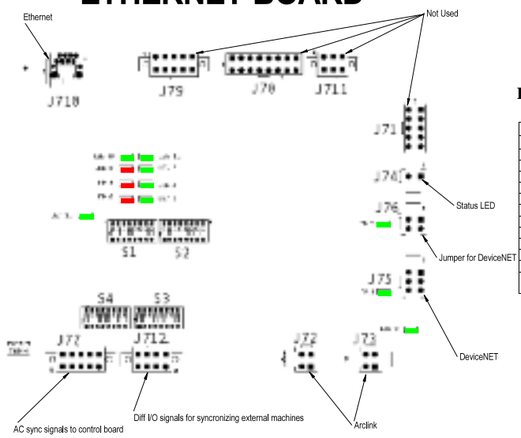
VIEW OF CONNECTOR ON PC BOARD

EN-170

Located on the top of enclosure

Schematic numbers are given for reference only.

ETHERNET BOARD



Description of LED functions on the Power Wave AC/DC

For reference only

G3894 Ethernet Gateway PC Board		
LED #	**COLOR**	**FUNCTION**
1	Green	Indicates Isolated Module Section Supply is ON
2	Green	Indicates DeviceNet Supply is ON
3	Green	ArcLink Status Indicators (Main System *Slave* ArcLink Connection) Solid
4	Red	Green only when functional (See software for error codes)
5	Green	Reserved For Future Use
6	Red	
7	Green	DeviceNet Status Indicators (See software group for coding)
8	Red	
9	Green	Indicates Isolated ArcLink Section Supply is ON
10	Green	10Base-T Link Status ON indicates functional ethernet link has been established
11	Green	Receiver Polarity ON indicates proper ethernet signal polarity
12	Green	Indicates I/O+5V Supply is ON This is used by differential I/O pair 4 circuitry, J712 pins 1 and 2.

Ethernet Board DIP Switches:

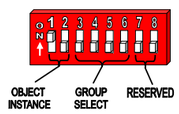
Bank S1 – ArcLink Set-up

Switch	Description	Comments
1	Object Instance LSB	Used for Arclink Configuration
2	Object Instance MSB	
3	Equipment Group 1 Select	
4	Equipment Group 2 Select	
5	Equipment Group 3 Select	
6	Equipment Group 4 Select	
7	Reserved for future use	
8	Reserved for future use	

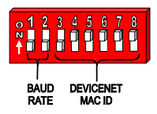
Bank S2 – DeviceNet Set-up

Switch	Description	Comments
1	DeviceNet Baud Rate	Used for DeviceNet configuration (see Instruction Manual)
2		
3	DeviceNet Mac ID	
4		
5		
6		
7		
8		

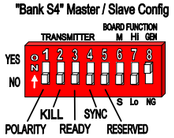
"Bank S1" ArcLink Configuration



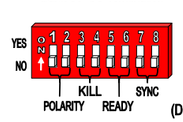
"Bank S2" DeviceNet Configuration



"Bank S4" Master / Slave Config



"Bank S3" I/O Termination



(Default Settings Shown)

Troubleshooting the PowerWave System Interface

Using the Status LED

LIGHT CONDITION	MEANING
Steady Green	System OK. Unit is operational, and is communicating normally with the ArcLink network.
Blinking Green	Occurs during power up or a system reset, and indicates the Power Wave 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.
Fast Blinking Green	Indicates Auto-mapping has failed
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.** **Error Code interpretation** through the Status light is detailed in the 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*** (included on the ***Power Wave Submerged Arc Utilities*** and ***Service Navigator*** *CD's*). 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.
Blinking Red	Not applicable.

PowerWave System Interface Error Codes (partial listing)

Error Code #	Indication
118 DeviceNet connection error	Lost Connection with DeviceNet Master
119 DeviceNet de-allocation error	The DeviceNet Master de-allocated the connection
133 Write ArcLink action failure	May be caused by activating Cold Inch while welding through DeviceNet
145 Duplicate MAC ID error	Check MAC ID assignments on DeviceNet Setup Dipswitch Bank (S2)
146 DeviceNet Bus off	Check condition of onboard DeviceNet Status indicators
147 DeviceNet polled I/O error	Problem changing attribute over polled I/O
149 DeviceNet I/O data error	Received DeviceNet I/O data with wrong number of bytes
169 Ethernet Connection Timeout	Loss of communication with PC Application. Note: These errors are only valid when the System Interface is connected directly to an Ethernet network (typically for diagnostic purposes). During normal operation it communicates via ArcLink or DeviceNet.
171 Ethernet Socket Timeout	
172 Ethernet Watch Dog Timeout	
Other	Error codes that contain four (4) digits are defined as fatal errors. These codes generally indicate internal errors on the Ethernet PC Board. If cycling the input power on the machine does not clear the error, try reloading the operating system. If this fails, replace the Ethernet PC Board.

THE INFORMATION ON THIS PRINT IS FOR REFERENCE ONLY. COMPONENTS AND CIRCUITRY MAY BE DIFFERENT FROM AN ACTUAL MACHINE.	DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: POWERWAVE SYSTEM INTERFACE	PAGE _1_ OF _1	
	DRAWN BY: rdodge	G4967-1	SUBJECT: MACHINE SCHEMATIC	DOCUMENT NUMBER: G5123	DOCUMENT REVISION: A
	ENGINEER: tlodge	SCALE: NONE	MATERIAL DISPOSITION: NA	APPROVAL DATE: 1-26-2005	PROJECT NUMBER: CRM36676
	APPROVED: Approve				

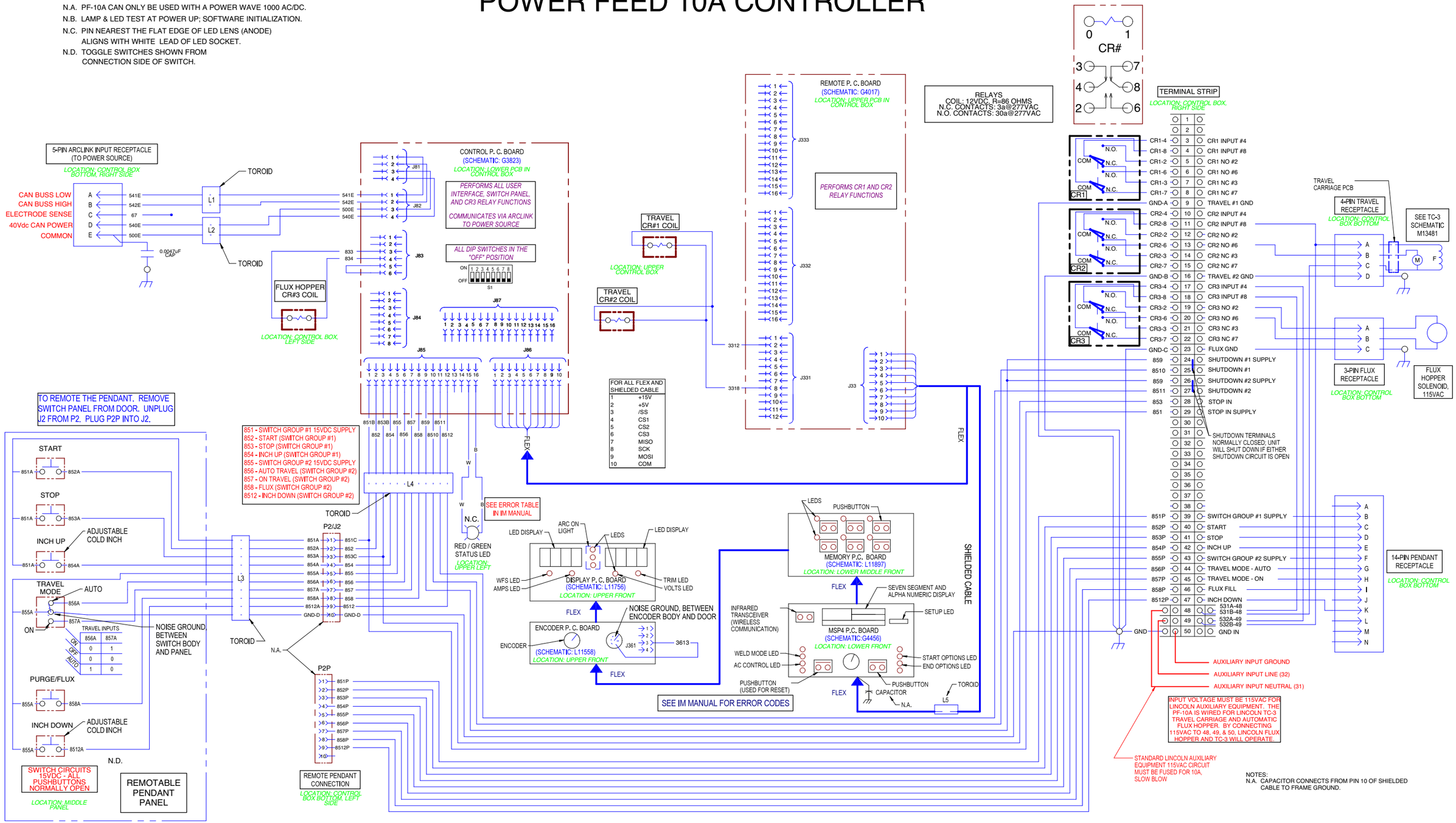
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

LINCOLN ELECTRIC

SCHEMATIC - MACHINE DIAGRAM (G4906)

POWER FEED 10A CONTROLLER

N.A. PF-10A CAN ONLY BE USED WITH A POWER WAVE 1000 AC/DC.
N.B. LAMP & LED TEST AT POWER UP; SOFTWARE INITIALIZATION.
N.C. PIN NEAREST THE FLAT EDGE OF LED LENS (ANODE) ALIGNS WITH WHITE LEAD OF LED SOCKET.
N.D. TOGGLE SWITCHES SHOWN FROM CONNECTION SIDE OF SWITCH.

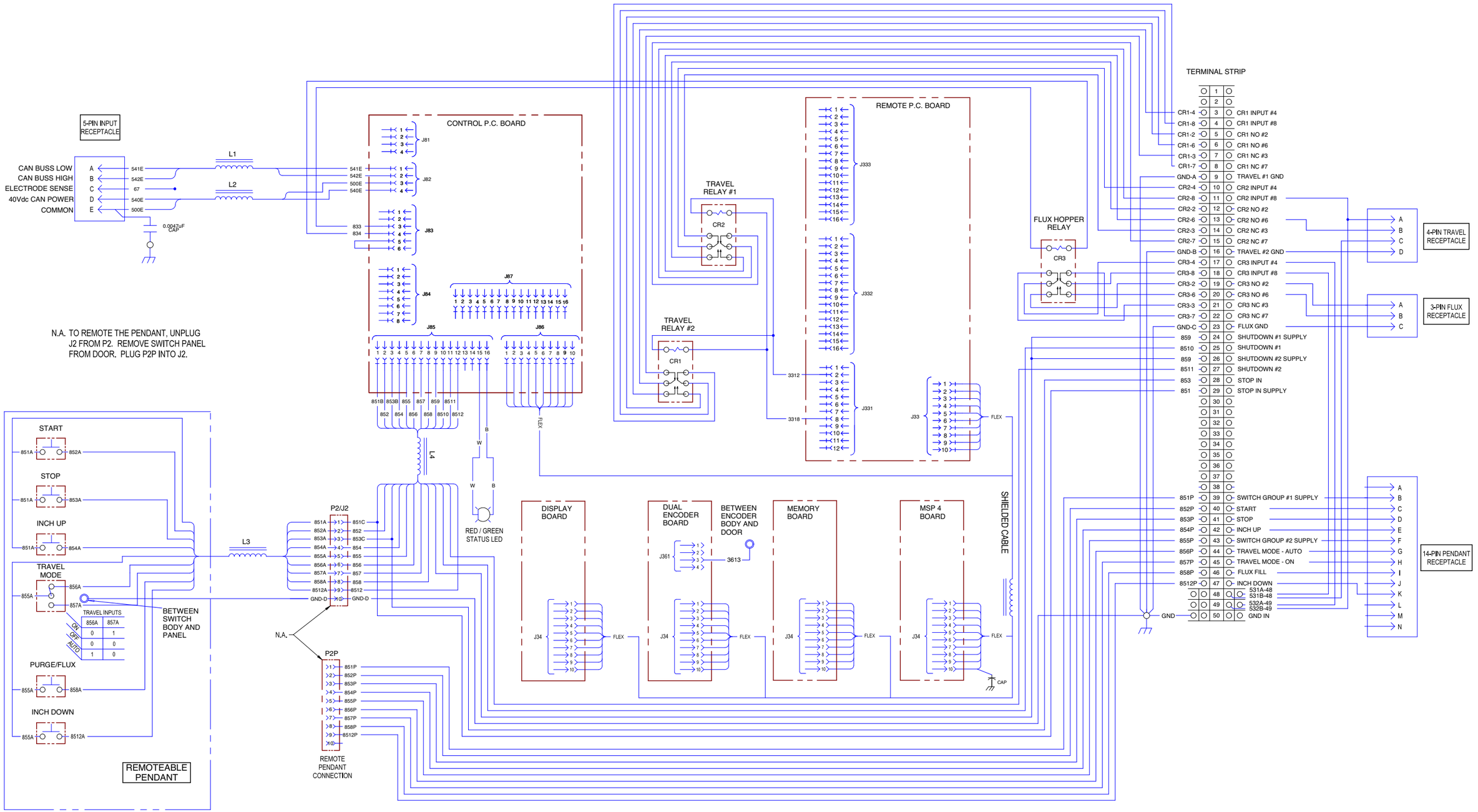


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - WIRING DIAGRAM (G4610)

POWER FEED 10A CONTROLLER



B
G4610

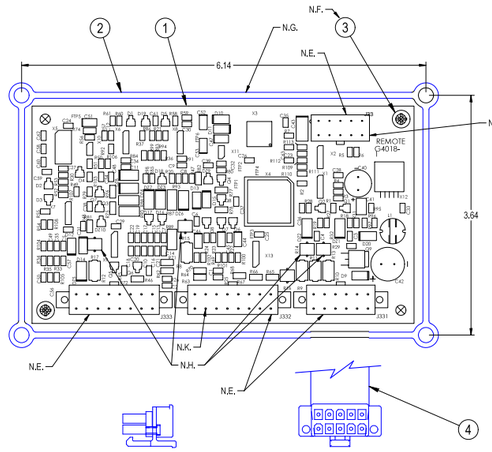
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

PC BOARD ASSEMBLY - REMOTE SPI BOARD (G4018-1)

G4018-1

ENGINEERING CONTROLLED | **CHANGE DETAIL:** J33, J331, J332 AND J333, CALLED OUT NOTE N.E.
MANUFACTURER: Yes



	ITEM	REQ'D	PART No.	DESCRIPTION
	1	1	G4018-D	SPI REMOTE/UI PC BOARD BLANK
	2	1	M19438-3	POTTING TRAY
	3	2	S8025-80	SELF TAPPING SCREW
	4	1	L11166-1	FLEX CIRCUIT ASSEMBLY
	5	4.00 fl oz	E2527	EPOXY ENCAPSULATING RESIN
	6	.108 fl oz	E3539	ELECTRICAL INSULATING COMPOUND
N.B.	7	1	S25336-1	SOFTWARE CPLD (X3)
N.C.	8	1	S25337-1	SOFTWARE CPLD (X4)
N.K.	10	1	S24671	KEYING PLUG
	FOR ITEMS BELOW, REFER TO ELECTRONIC COMPONENTS DATABASE FOR COMPONENT SPECIFICATIONS			
	C1,C2,C3,C4,C5,C6,C7,C8,C9 C10,C11,C12,C13,C14,C15 C16,C17,C18,C19,C20,C21 C22,C23,C24,C25,C26,C27 C28,C29,C30,C31,C32,C33 C34,C35,C36,C37,C48,C49 C50,C54,C55,C56,C57	44	S25020-3SMT	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
	C38,C39	2	S25020-5SMT	CAPACITOR,SMD,CERAMIC,2700pF,50V,5%,X7R,S0805
	C40	1	S13490-183	CAPACITOR,ALEL,120MF,50V,20%
	C41	1	S25020-175MT	CAPACITOR,SMD,CERAMIC,0.27MF,50V,10%,X7R,S1812
	C42	1	S13490-179	CAPACITOR,ALEL,1000,35V,20%
	C43	1	S25024-105MT	CAPACITOR,SMD,TANTALUM,22MF,25V,10%,S7343
	C44,C45,C46	3	S25024-25MT	CAPACITOR,SMD,TANTALUM,1.0MF,35V,10%,S3528
	C47,C51,C52,C53	4	S25024-3SMT	CAPACITOR,SMD,TANTALUM,2.2MF,20V,10%,S3528
	C58,C59,C60,C61,C62	5	S25020-2SMT	CAPACITOR,SMD,CERAMIC,0.022MF,50V,10%,X7R,S0805
	C63	1	S25020-12SMT	CAPACITOR,SMD,CERAMIC,100pF,100V,5%,COG,S0805
	D1,D2,D3,D4,D5,D6,D7,D8	8	S25049-4SMT	DIODE,SMD,DUAL,0.200A,30V,SCHOTTKY,SOT-23
	D9,D10,D11	3	S25040-1SMT	DIODE,SMD,1A,400V,FAST RECOVERY,DO-214BA
	D12,D13,D14,D15	4	S25040-2SMT	DIODE,SMD,1A,400V,DO-214BA/AC
	D16,D17	2	S25040-5SMT	DIODE,SMD,DUAL,0.200A,70V,UFR
	D18,D19	2	S25040-4SMT	DIODE,SMD,DUAL,0.200A,70V,UFR
	D20	1	S25049-2SMT	DIODE,SMD,1A,30V,SMA,SCHOTTKY
	DZ1,DZ2	2	S25044-1SMT	ZENER DIODE,SMD,3W,5.1V,5%, SMB
	DZ3,DZ4,DZ5,DZ6,DZ7,DZ8	6	S25044-3SMT	ZENER DIODE,SMD,3W,12V,5%, SMB
	DZ9,DZ10	2	S25045-1SMT	ZENER DIODE,SMD,225mW,12V,5%,SOT-23
	FTP1,FTP2,FTP3,FTP4,FTP5 FTP6	6	TESTPT_FUNTION	FUNCTIONAL TEST POINT
N.E.	J33	1	S18248-10	CONNECTOR,MOLEX,MINI.PCB,10-PIN
N.E.	J331	1	S24020-12	CONNECTOR,MOLEX,MINI.PCB,12-PIN,TIN
N.E.	J332,J333	2	S24020-16	CONNECTOR,MOLEX,MINI.PCB,16-PIN,TIN
	L1	1	S25083-3SMT	CHOKE,SMD,POWER,47UH,10%,1.25A,
N.A.	Q1,Q2,Q3,Q4	4	S25050-1SMT	TRANSISTOR,SMD,NPN,0.5A,40V,SOT-23,MMBT4401LT1
	Q5,Q6	2	S25051-4SMT	TRANSISTOR,SMD,NMF,SOT-23,0.115A,60V,7002LT1(SS
N.A.	Q7,Q8	2	S25050-2SMT	TRANSISTOR,SMS,PNP,SOT23,0.5A, 40V,MMBT4403LT1
	R1,R2,R3,R4,R5,R6	6	S25000-1212SMT	RESISTOR,SMD,METAL FILM,1/10W,12.1K,1%,S0805
	R7	1	S25000-2670SMT	RESISTOR,SMD,METAL FILM,1/10W,267OHMS,1%,S0805
	R8,R9,R10,R11,R12	5	S25004-2430SMT	RESISTOR,SMD,1W,243OHMS,1%
	R13,R14,R15,R16,R17	5	S18380-14	THERMISTOR,PTC,500OHMS,28mA
	R18,R19	2	S25000-3320SMT	RESISTOR,SMD,METAL FILM,1/10W,332OHMS,1%,S0805
	R20,R21,R25,R26,R27,R28 R29,R30,R109,R110,R111	11	S25000-4751SMT	RESISTOR,SMD,METAL FILM,1/10W,4.75K,1%,S0805
	R22,R23,R24,R36,R37,R45 R46,R47,R48,R49	10	S25000-1002SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0K,1%,S0805
	R31,R32	2	S25000-2210SMT	RESISTOR,SMD,METAL FILM,1/10W,221OHMS,1%,S0805
	R33	1	S25000-1000SMT	RESISTOR,SMD,METAL FILM,1/10W,100OHMS,1%,S0805
	R34,R35	2	S25008-1002SMT	RESISTOR,SMD,PREC,MF,1/10W,10.0K,0.5%,S0805
	R50,R51,R52,R53,R54,R55 R56,R57,R58,R59,R60,R61	12	S25008-4751SMT	RESISTOR,SMD,PREC,MF,1/10W,4.75K,0.5%,S0805
	R62,R63,R64,R65,R66,R67 R71,R72	8	S25001-1211SMT	RESISTOR,SMD,1.21K,1/4W,1206,1%,TR
	R68,R69,R70	3	S25000-2671SMT	RESISTOR,SMD,METAL FILM,1/10W,2.67K,1%,S0805
	R74	1	S25001-1001SMT	RESISTOR,SMD,1K,1/4W,1206,1%,TR
	R75,R76,R77,R78	4	S25001-1000SMT	RESISTOR,SMD,100OHMS,1/4W,1206,1%,TR
	R79,R80	2	S25000-2211SMT	RESISTOR,SMD,METAL FILM,1/10W,2.21K,1%,S0805
	R81,R82	2	S25001-1213SMT	RESISTOR,SMD,121K,1/4W,1206,1%,TR
	R83,R84,R85,R86	4	S25000-3321SMT	RESISTOR,SMD,METAL FILM,1/10W,3.32K,1%,S0805
	R87,R88,R89,R90	4	S25010-3SMT	RESISTOR,SMD,MF,1W,20.0K,1%,SURGE
	R91,R92	2	S25000-4752SMT	RESISTOR,SMD,METAL FILM,1/10W,47.5K,1%,S0805
	R93,R94	2	S25000-2001SMT	RESISTOR,SMD,METAL FILM,1/10W,2.00K,1%,S0805
	R95	1	S25000-3741SMT	RESISTOR,SMD,METAL FILM,1/10W,3.74K,1%,S0805
	R96	1	S25000-3011SMT	RESISTOR,SMD,METAL FILM,1/10W,3.01K,1%,S0805
	R97	1	S25000-2672SMT	RESISTOR,SMD,METAL FILM,1/10W,26.7K,1%,S0805
	R98,R99	2	S25000-2002SMT	RESISTOR,SMD,METAL FILM,1/10W,20.0K,1%,S0805
	R100,R101,R102	3	S25000-1001SMT	RESISTOR,SMD,METAL FILM,1/10W,1.00K,1%,S0805
	R103,R104,R105,R106,R107	6	S25000-5622SMT	RESISTOR,SMD,METAL FILM,1/10W,56.2K,1%,S0805
N.A.	R108			
N.A.	R112	1	S25000-4750SMT	RESISTOR,SMD,METAL FILM,1/10W,475OHMS,1%,S0805
N.A.	R113	1	S25000-2212SMT	RESISTOR,SMD,METAL FILM,1/10W,22.1K,1%,S0805
N.A.	X1	1	S17900-8SMT	IC,SMD,CMOS,INVERTER,SCHMITT,HEX,HC14A(SS)
N.A.	X2	1	S15128-11SMT	IC,SMD,COMPARATOR,QUAD,2901D
	X3	1	S25070-3SMT	CPLD,PROGRAMMABLE,XC9536,44-PIN,VOFP(SS)
N.A.	X4	1	S25070-10SMT	IC,SMD,CMOS,CPLD,XC9572,PLCC44(SS)
	X5	1	M15105-7SMT	IC,SMD,CMOS,CONVERTER,A/D,MPU,10-BIT(SS)
N.A.	X6,X7,X8	3	S15128-18SMT	IC,OP-AMP,SMT,QUAD,HIGH-PERF,3304D
	X9	1	S15018-11SMT	IC,SMD,CMOS,SWITCH,ANALOG,QUAD,201(SS)
	X10	1	S15128-10SMT	IC,SMD,VOLTAGE REF,ADJ, PRECISION,431I,SOIC-8
	X11	1	S15018-21SMT	IC,SMD,CMOS,DRIVER,MOSFET,4451, SOIC-8(SS)
	X12	1	S25068-14SMT	IC,SMD,VOLTAGE REGULATOR,ADJ,FLYBACK,3A,TO-263
	X13	1	M15102-4SMT	IC,ARRAY,DRIVER,PERIPHERAL,NPN,DARLINGTON

P.C. BOARD BLANK REFERENCE INFORMATION
BUY COMPLETE AS G4018-D (4 LAYER BOARD PER E3281)

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

BUY PER E3867
TEST PER E3964-RM

NOTES:
N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
N.B. PROGRAM **X3** WITH **ITEM 7.**
N.C. PROGRAM **X4** WITH **ITEM 8.**

N.E. ALL CONNECTORS MUST BE GREASED WITH **ITEM 6** PRIOR TO ENCAPSULATION.
N.F. ATTACH **ITEM 1** TO **ITEM 2** WITH **ITEM 3.** TIGHTEN **ITEM 3** TO .60 ± .05 Nm (5.3 ± .5 in-lbs.).
N.G. PLACE BARCODED ASSEMBLY NUMBER IDENTIFICATION AND BARCODED SERIAL IDENTIFICATION IN AREA SHOWN.
N.H. THESE COMPONENTS MUST BE COMPLETELY COVERED WITH **ITEM 5.**

N.K PLACE **ITEM 10** ON PIN 8 OF J332 AS SHOWN.
N.L. BOARD TO BE POTTED WITH **ITEM 4** LAYING ACROSS BOARD AS SHOWN. ONLY 0.4" OR LESS OF **ITEM 4** TO BE COVERED WITH **ITEM 5.**

SCHEMATIC REFERENCE: G4017-1D0

BUY AS:
G4018-1D0
PART NUMBER IDENTIFICATION CODE

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2058
ON 2 PLACE DECIMALS ± .02
ON 3 PLACE DECIMALS ± .010
ON ALL ANGLES ± 1/2 OF A DEGREE
MATERIAL TOLERANCE (T) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE:	MISCELLANEOUS
DRAWN BY: fvalencia	L11346-1		PAGE 1 OF 1
ENGINEER: E. FURMAN	SCALE:	SUBJECT:	SPI REMOTE PC BOARD ASSEMBLY
APPROVED: -	1:1	MATERIAL DISPOSITION: UF	APPROVAL DATE: 3/31/2006
		PROJECT NUMBER: CRM37628	DOCUMENT NUMBER: G4018-1
			DOCUMENT REVISION: C

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

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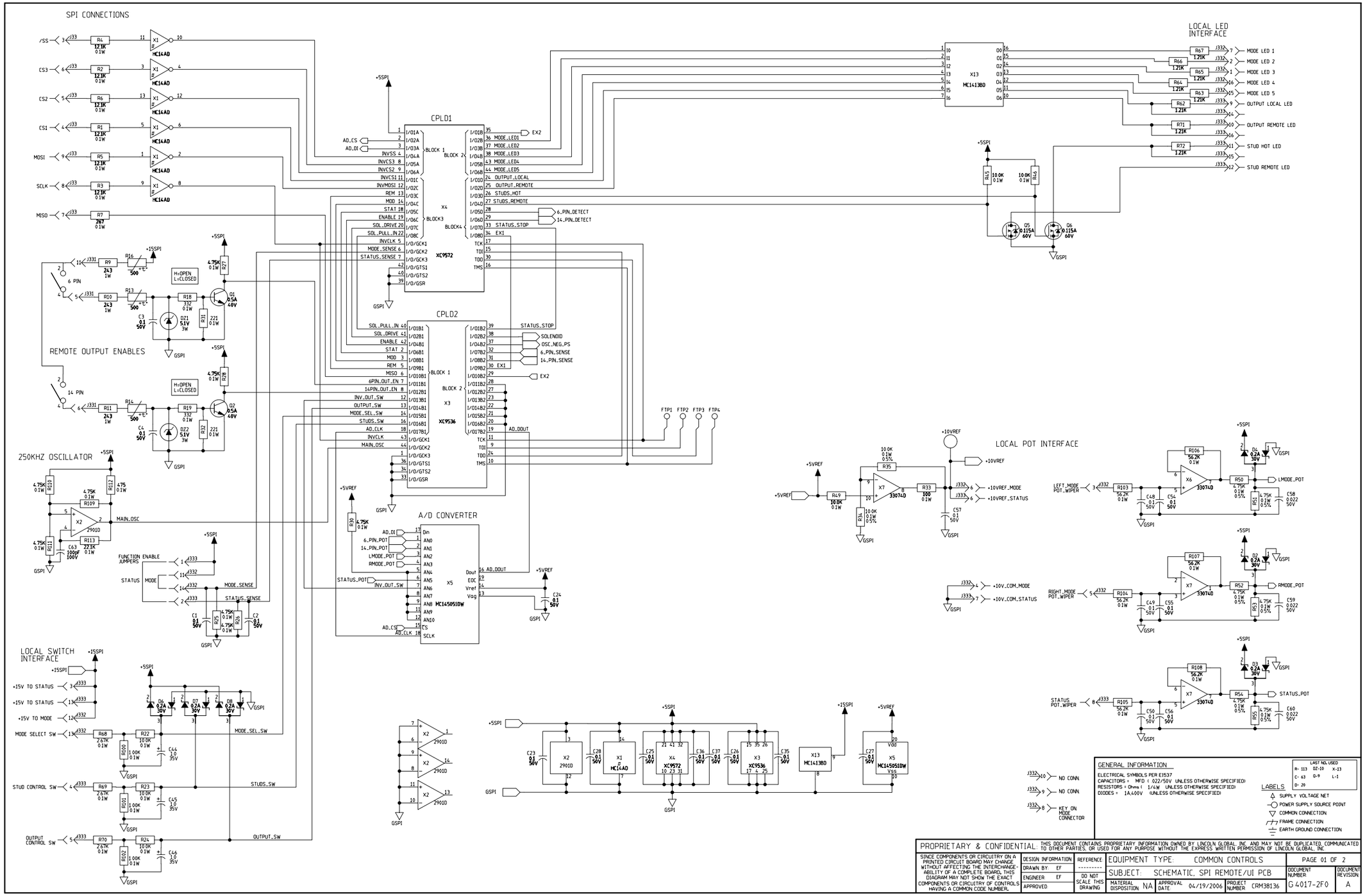
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

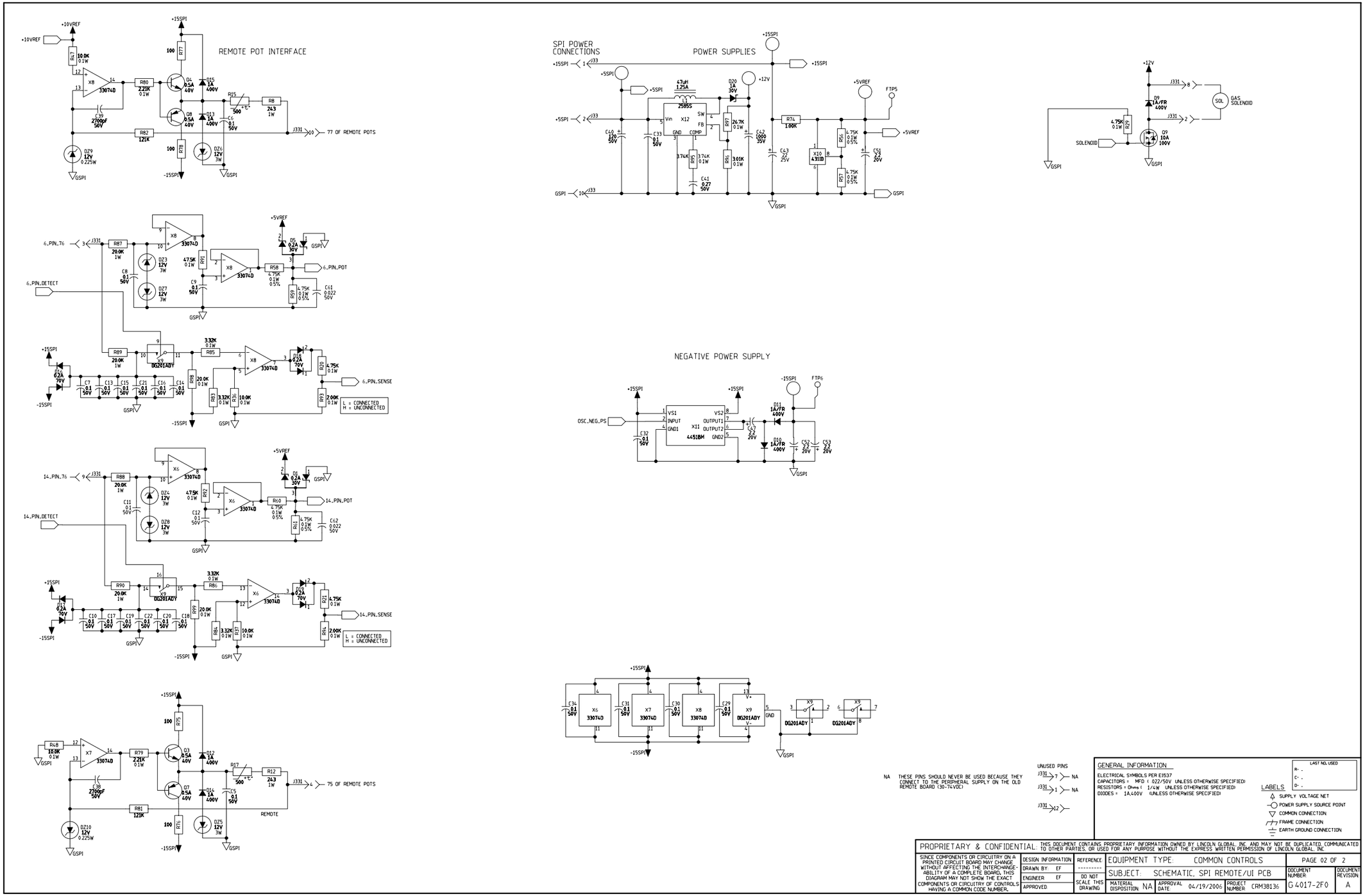
SCHEMATIC - REMOTE SPI BOARD (G4017-1) PAGE 1



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - REMOTE SPI BOARD (G4017-1) PAGE 2



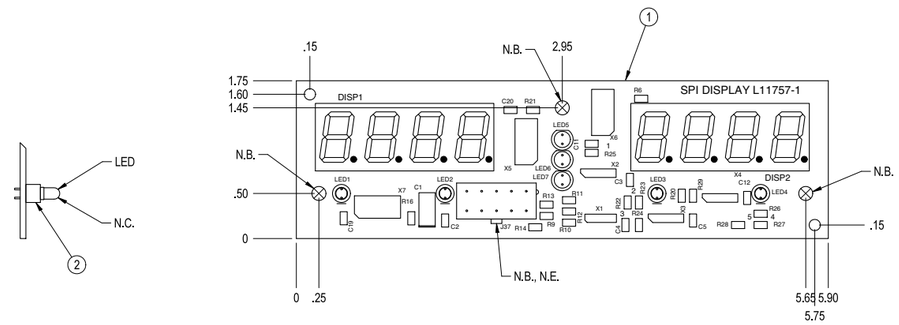
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

PC BOARD ASSEMBLY - DISPLAY BOARD (L11757-1)

L11757-1 | ENGINEERING CONTROLLED MANUFACTURER: Yes | CHANGE DETAIL: LED5, 6 & 7, REVISED PART NUMBER AND DESCRIPTION. REVISED IDENTIFICATION CODE AND SCHEMATIC REF. NUMBER.

	ITEM / REFERENCE DESIGNATORS	QTY	PART NUMBER	DESCRIPTION
	1	1	L11757-E	P.C. BOARD BLANK
	2	4	T15176-2	LED, SPACER, 0.140 HIGH
	3	.01 OZ.	E3539	ELECTRICAL INSULATING COMPOUND
	FOR ITEMS BELOW REFER TO ELECTRONIC COMPONENTS DATABASE FOR COMPONET SPECIFICATIONS			
	C1	1	S25024-7SMT	CAPACITOR,SMD,TANTALUM,47MF,20V,10%,S7343
	C2, C3, C4, C5, C11, C12, C19, C20	8	S25020-3SMT	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
N.A., N.D.	DISP1, DISP2	2	S17395-9	LED,DISPLAY,7-SEGMENT,CC,4-DIGIT
	J37	1	S18248-10	CONNECTOR,MOLEX,MINI,PCB,10-PIN
N.C.	LED1, LED2, LED3, LED4	4	T13657-6	LED,T-1,RED,HLMP-K101
N.A.	LED5, LED6, LED7	3	T13657-14	LED,T-1,3/4,AMBER,HIGH-INTENSITY
	R6, R16	2	S25000-1501SMT	RESISTOR,SMD,METAL FILM,1/10W,1.50K,1%,S0805
	R9, R10, R11, R12, R13, R14	6	S25000-1212SMT	RESISTOR,SMD,METAL FILM,1/10W,12.1K,1%,S0805
	R20	1	S25000-2670SMT	RESISTOR,SMD,METAL FILM,1/10W,267OHMS,1%,S0805
	R21, R25, R26, R28, R29	5	S25000-1001SMT	RESISTOR,SMD,METAL FILM,1/10W,1.00K,1%,S0805
	R22, R23	2	S25000-10R0SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0OHMS,1%,S0805
	R24	1	S25000-4751SMT	RESISTOR,SMD,METAL FILM,1/10W,4.75K,1%,S0805
	R27	1	S25000-4752SMT	RESISTOR,SMD,METAL FILM,1/10W,47.5K,1%,S0805
N.A.	X1	1	S17900-8SMT	IC,SMD,CMOS,INVERTER,SCHMITT,HEX,HC14A(SS)
N.A.	X2	1	S17900-26SMT	IC,CMOS,SMD,MUX,DAT,8-INPUT,HC151(SS)
N.A.	X3	1	S17900-28SMT	IC,SMD,CMOS,HEX INVERTING BUFFER,3-ST (SS)
N.A.	X4	1	S17900-10SMT	IC,SMDCMOS,REGISTER,SHFT,S-PI/SO,8-BIT(SS)
N.A.	X5, X6, X7	3	S20496-1SMT	IC,SMD,CMOS,DRIVER,DISPLAY,LED,CC,MCU



SCHEMATIC REFERENCE: L11756-1E1

UNLESS OTHERWISE SPECIFIED:
CAPCITANCE = MFD/VOLTS
RESISTANCE = OHMS
INDUCTANCE = HENRIES

NOTE:
N.A. CAUTION: THIS DEVICE SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
N.B. DO NOT COAT WITH ENCAPSULATION MATERIAL.
N.C. USE ITEM 2 TO STAND LED1, LED2, LED3 AND LED4 FROM THE P.C. BOARD THERE MUST NOT BE MORE THAN .020 GAP BETWEEN SPACER AND P.C. BOARD OR BETWEEN SPACER AND LED. ENCAPSULATE P.C. BOARD, SPACER AND LOWER HALF OF LED.
N.D. DISP1 AND DISP2 MUST ALWAYS BE MATCHED BY VENDOR NAME. DO NOT MIX DIFFERENT VENDORS ON THE SAME BOARD ASSEMBLY. ENCAPSULATE LOWER HALF OF DISPLAYS ONLY, FACE AND UPPER HALF MUST BE FREE OF ENCAPSULATION.
N.E. CONNECTOR MUST BE GREASED WITH ITEM 3 PRIOR TO ENCAPSULATION.

BUY AS:
L11757-1E1
IDENTICATION CODE

ENCAPSULATE WITH HUMISEAL 1A27LU
PER E1844 OR WITH EQUIVALENT AS
APPROVED BY LINCOLN ELECTRIC COMPANY.
(2 COATS)

BUY PER E3867
TEST PER E3856-D

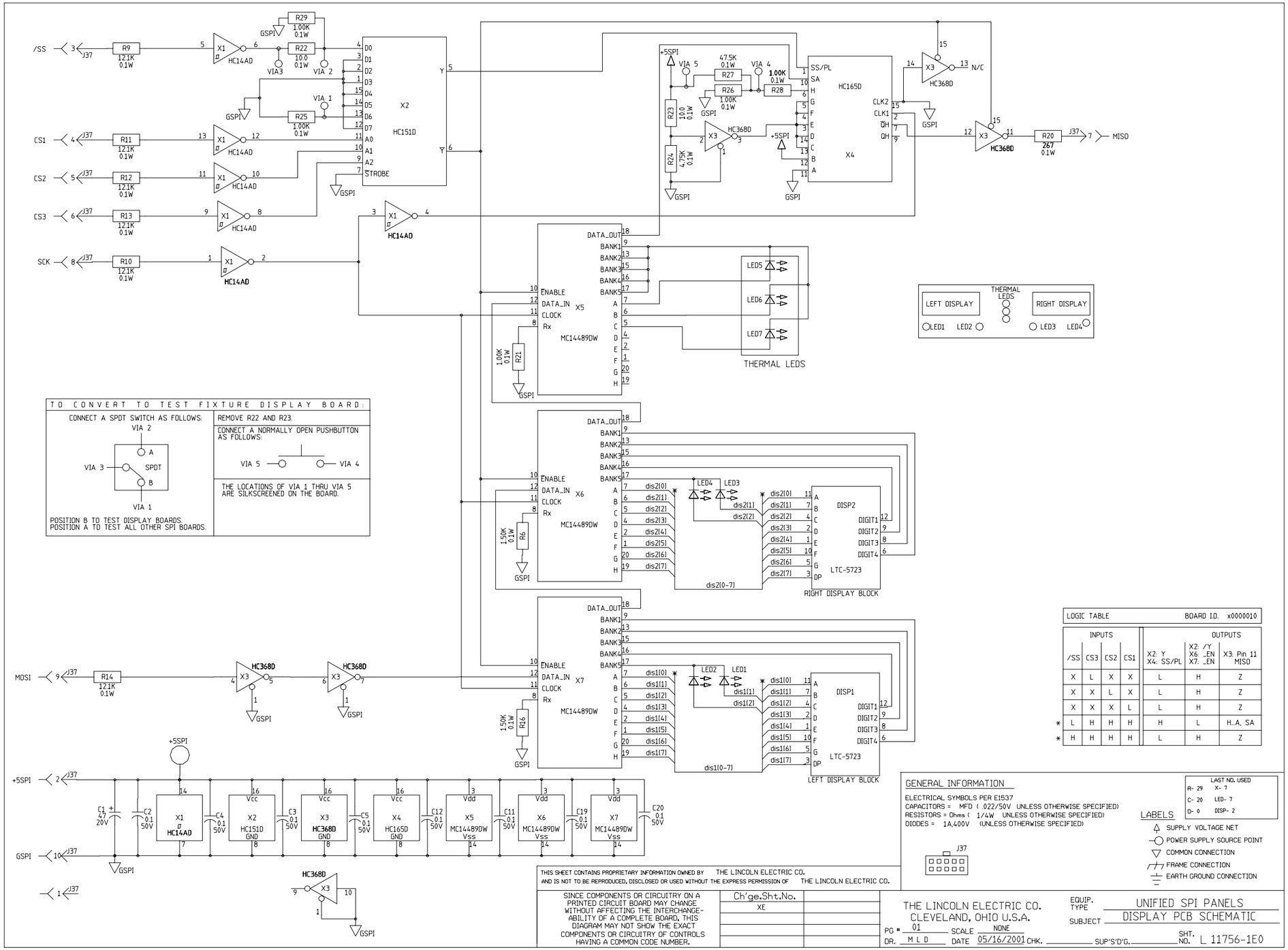
EN-168

MANUFACTURING TOLERANCE PER E2056 UNLESS OTHERWISE SPECIFIED TOLERANCE: ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("t") TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	DESIGN INFORMATION	REFERENCE: -	EQUIPMENT TYPE: MISCELLANEOUS	PAGE 1 OF 1	
	DRAWN BY: gmaddle		SUBJECT: SPI DISPLAY P.C. BOARD ASSEMBLY	DOCUMENT NUMBER: L11757-1	DOCUMENT REVISION: A
	ENGINEER: -	SCALE: 1:1	MATERIAL DISPOSITION: UF	APPROVAL DATE: 11/05/2004	PROJECT NUMBER: CRM36635
	APPROVED: -				

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

Return to Section TOC
Return to Master TOC

SCHEMATIC - DISPLAY BOARD (L111756-1)

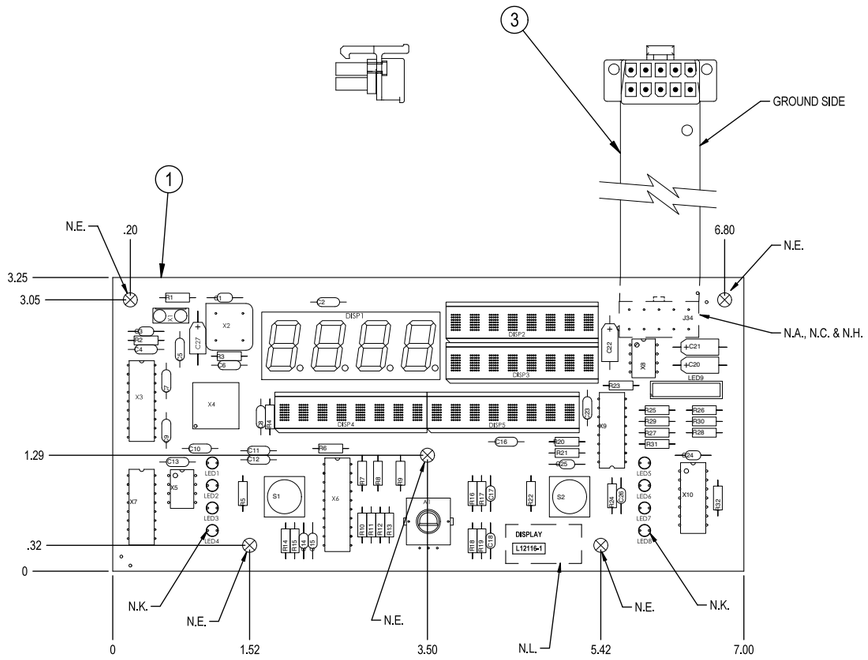


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - MSP4 PANEL BOARD (L12116-1)

L12116-1 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: REVISED NOTE N.L., IDENTIFICATION CODE, MANUFACTURED AS AND SCHEMATIC REFERENCE NUMBERS

P.C. BOARD BLANK REFERENCE INFORMATION
BUY BLANK COMPLETE AS L12116-B
(**4 LAYER BOARD PER E**3281)
(MAKES **6 BOARDS PER PANEL**, **SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION**)



	ITEM	QTY	PART NO.	DESCRIPTION
	1	1	SEE BLANK INFO	P. C. BOARD BLANK
N.G.	2	1	Y00257-1	SOFTWARE
	3	1	L11166-1	FLEX CIRCUIT
	4	.01OZ.	E2519	ELECTRICAL INSULATING COMPOUND
N.A., N.J.	A1	1	M17789-4	ENCODER,INCREMENTAL,2-BIT,PEC12
	C1,C3,C14,C15,C17,C18,C24 C25,C26	9	S16668-5	CAPACITOR,CEMO,.022,50V,20%
	C2,C4,C5,C6,C7,C8,C9,C10 C11,C12,C13,C16,C23	13	S16668-11	CAPACITOR,CEMO,0.1, 50V,10%,THIN
	C20,C21	2	S13490-39	CAPACITOR,TAEL,18,15V 10%
	C22	1	S13490-30	CAPACITOR,TAEL,39,10V,10%
	C27	1	S13490-25	CAPACITOR,TAEL,4.7,35V,10%
N.D.	DISP1	1	S17395-9	LED,DISPLAY,7-SEGMENT,CC,4-DIGIT
N.B., N.D.	DISP2,DISP3,DISP4,DISP5	4	S17395-7	DISPLAY,DIGITAL,PROGRAMMABLE,8-DIGIT(SS)
N.C.	J34	1	S18248-10	CONNECTOR,MOLEX,MINI,PCB,10-PIN
N.D.	LED1,LED2,LED3,LED4,LED5 LED6,LED7,LED8	8	T13657-6	LED,T-1,RED,HLMP-K101
N.D.	LED9	1	M18875-2	LED,LIGHT BAR (RED)
	R1,R6,R7,R8,R9,R10,R11,R12, R13	9	S19400-15R0	RESISTOR,MF,1/4W,15.0,1%
	R2	1	S19400-47R5	RESISTOR,MF,1/4W,47.5,1%
	R3,R4,R5,R14,R16,R18,R22	7	S19400-4751	RESISTOR,MF,1/4W,4.75K,1%
	R15,R17,R19,R24,R27,R28 R29,R30,R31,R32	10	S19400-1212	RESISTOR,MF,1/4W,12.1K,1%
	R20,R21	2	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
	R23	1	S19400-2670	RESISTOR,MF,1/4W,267,1%
	R25,R26	2	S19400-68R1	RESISTOR,MF,1/4W,68.1,1%
N.A.	S1,S2	2	T13381-18	SWITCH,PUSHBUTTON,SPST,BLUE
N.B., N.D.	X1	1	S25080-3SMT	IC,SMD,TRANSCEIVER,INFRARED,SIR,TFDU4100
N.B.	X2	1	M14428-5	OSCILLATOR,TRI-STATE,3.3V,11.0592MHz(SS)
N.B.	X3	1	S20353-6	IC,CMOS,CONTOLLER,STACK,MCP2150(SS)
N.B.	X4	1	S25070-14SMT	IC,SMD,FPGA,XCS20XL,SQFP,100PIN(SS)
N.B.	X5	1	M15101-20	IC,SMD,PROM,CONFIG,XC17S10XL,IC-8(SS)
N.B.	X6	1	S19650-9	IC,ACT,LATCH,OCTAL,3-STATE,IC20(SS)
	X7	1	M15102-4	IC,ARRAY,DRIVER,PERIPHERAL,NPN,DARL
	X8	1	S15128-34	IC,VOLT REG,FIXED,3-T,(+),3.3V
N.B.	X9	1	S17900-28	IC,CMOS,HEX,BUFFER,3-STATE,2-BIT,4-BIT,(SS)
N.B.	X10	1	S17900-8	IC,CMOS,INVERTER,SCHMITT,HEX,HC14A(SS)

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
RESISTANCE = OHMS

NOTES:
N.A. DO NOT COAT WITH ENCAPSULATION MATERIAL.

N.B. CAUTION: THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING

N.C. CONNECTOR MUST BE GREASED WITH ITEM 4 PRIOR TO ENCAPSULATION.

N.D. DO NOT COAT THE TOP SURFACE OF COMPONENT WITH ENCAPSULATION MATERIAL.

N.E. DO NOT COAT WITH ENCAPSULATION MATERIAL .23 MINIMUM DIAMETER (5 PLACES) ON BOTH SIDES OF BOARD.

N.F. DISP2 THRU DISP5 MUST ALWAYS BE MATCHED BY VENDOR NAME. DO NOT MIX DIFFERENT VENDORS ON THE SAME BOARD ASSEMBLY.

N.G. PROGRAM ITEM (X5) WITH ITEM 2 BEFORE INSERTION.

N.H. J34 TO BE MOUNTED ON OPPOSITE COMPONENT SIDE OF BOARD.

N.J. APPLY ITEM 4 AROUND BASE OF A1 PRIOR TO ENCAPSULATION.

N.K. LED1 THROUGH LED 8 MUST BE PERPENDICULAR TO BOARD WITHIN +/- 10° ALL DIRECTIONS).

N.L. PLACE A LABEL THAT READS "L12116-1B2" ON THE BOTTOM SIDE OF THE BOARD IN THE AREA INDICATED.

MANUFACTURED AS
L12116-1B2
IDENTIFICATION CODE

MAKE **PER E**1911
ENCAPSULATE WITH E1844, 2 **COAT**S
TEST PER E4100-MSP
SCHEMATIC REFERENCE: G4456-1B2

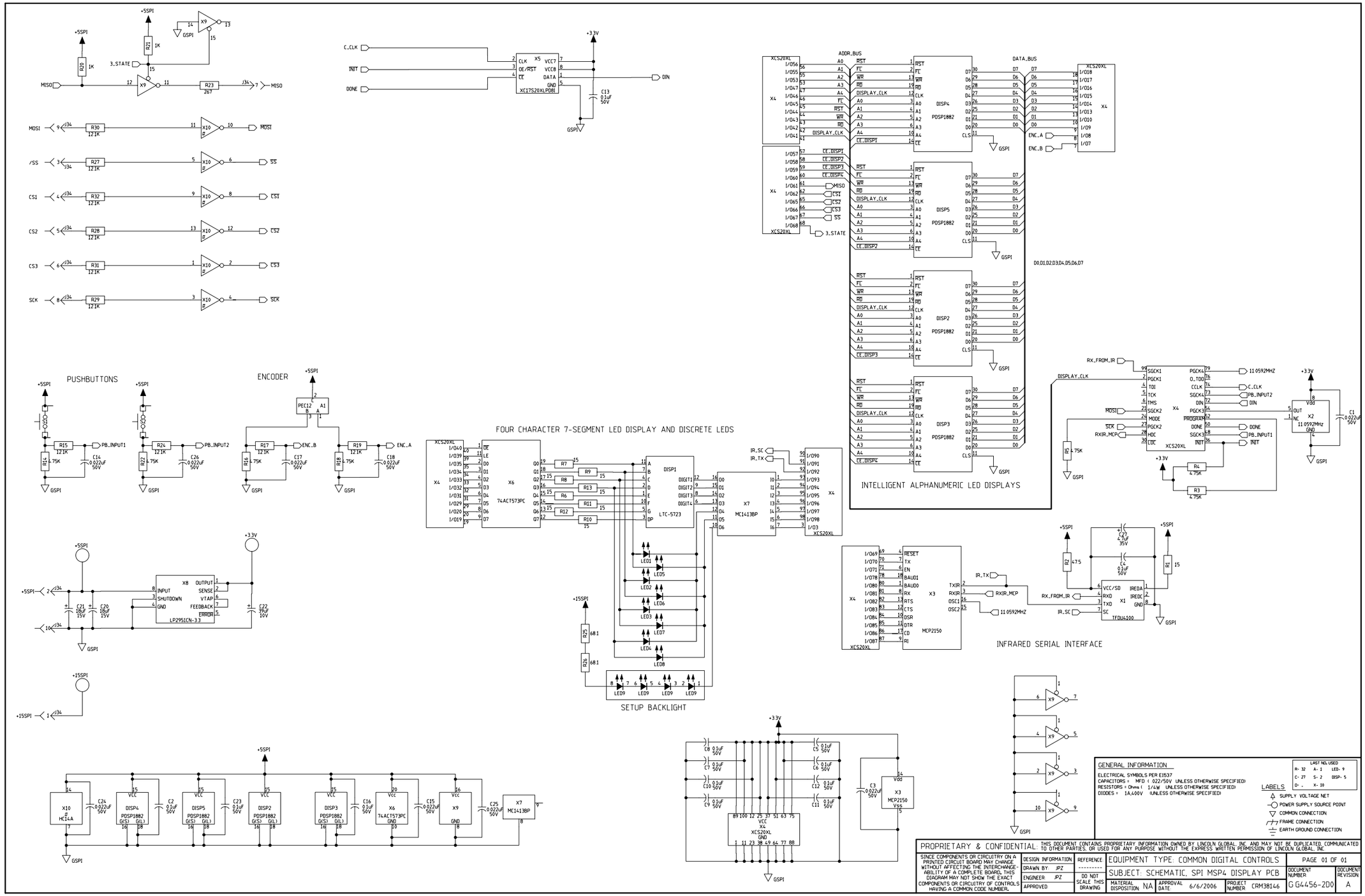
EN-168

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056 ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE (T) TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	DESIGN INFORMATION DRAWN BY: TJP ENGINEER: ZUCKER APPROVED:	REFERENCE: SCALE: 1:1	EQUIPMENT TYPE: PF 10M SUBJECT: MSP4 DISPLAY P.C. BD. ASSEMBLY MATERIAL DISPOSITION: UF APPROVAL DATE: 03/17/2005 PROJECT NUMBER: CRM37154	PAGE 1 OF 1 DOCUMENT NUMBER: L12116-1 DOCUMENT REVISION: C	

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

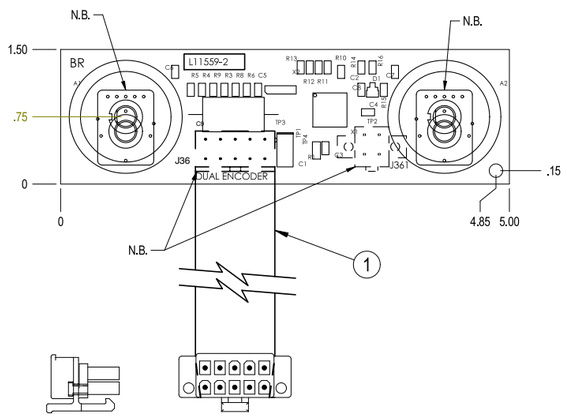
Return to Section TOC
Return to Master TOC

SCHEMATIC - MSP4 PANEL BOARD (G4456-1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - DUAL ENCODER BOARD (L11559-2)



	ITEM	REQ'D	PART No.	DESCRIPTION
	1	1	L11166-1	FLEX CIRCUIT
	2	.01 OZ	E3539	ELECTRICAL INSULATING COMPOUND
	3	1	S24951-4	CPLD SOFTWARE
	FOR ITEMS BELOW, REFER TO ELECTRONIC COMPONENTS DATABASE FOR COMPONENT SPECIFICATION			
	A1,A2	2	M17789-2	ENCODER,ROTARY,OPTICAL,61JY2049
	C1	1	S25024-7SMT	CAPACITOR,SMD,TANTALUM,47MF,20V,10%,S7343
	C2,C3,C4,C5,C6,C7,C8	7	S25020-3SMT	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
	C9	1	S13490-94	CAPACITOR,PEMF,0.33,200V,10%
	D1	1	S25040-5SMT	DIODE,SMD,DUAL,0.200A,70V,UFR
	J36	1	S18248-10	CONNECTOR,MOLEX,MINI,PCB,10-PIN
	J361	1	S24020-4	CONNECTOR,MOLEX,MINI,PCB,4-PIN,TIN
	R1	1	S25001-2670SMT	RESISTOR,SMD,267OHMS,1/4W,1206,1%,TR
	R3,R4,R5,R6,R8,R9 R10,R11,R12,R13	10	S25000-1212SMT	RESISTOR,SMD,METAL FILM,1/10W,12.1K,1%,S0805
	R14	1	S25000-1501SMT	RESISTOR,SMD,METAL FILM,1/10W,1.50K,1%,S0805
	R15	1	S25000-28R7SMT	RESISTOR,SMD,METAL FILM,1/10W,28.7OHMS,1%,S0805
	R16	1	S25000-4750SMT	RESISTOR,SMD,METAL FILM,1/10W,475OHMS,1%,S0805
N.A.	X1	1	S25070-3SMT	CPLD,PROGRAMMABLE,XC9536,44-PIN,VQFP(SS)
N.A.	X2	1	S17900-8SMT	IC,SMD,CMOS,INVERTER,SCHMITT,HEX,HC14A(SS)

NOTES:
N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
N.B. DO NOT COAT WITH ENCAPSULATION MATERIAL.

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

ENCAPSULATE WITH HUMISEAL 1A27LU PER E1844 OR WITH EQUIVALENT AS APPROVED BY THE LINCOLN ELECTRIC COMPANY. (2 COATS)

SCHEMATIC REFERENCE: L11558-2B0

MANUFACTURE OR BUY AS:
L11559-2B1
PART NUMBER IDENTIFICATION CODE

BUY PER E3867
TEST PER E3856-EN

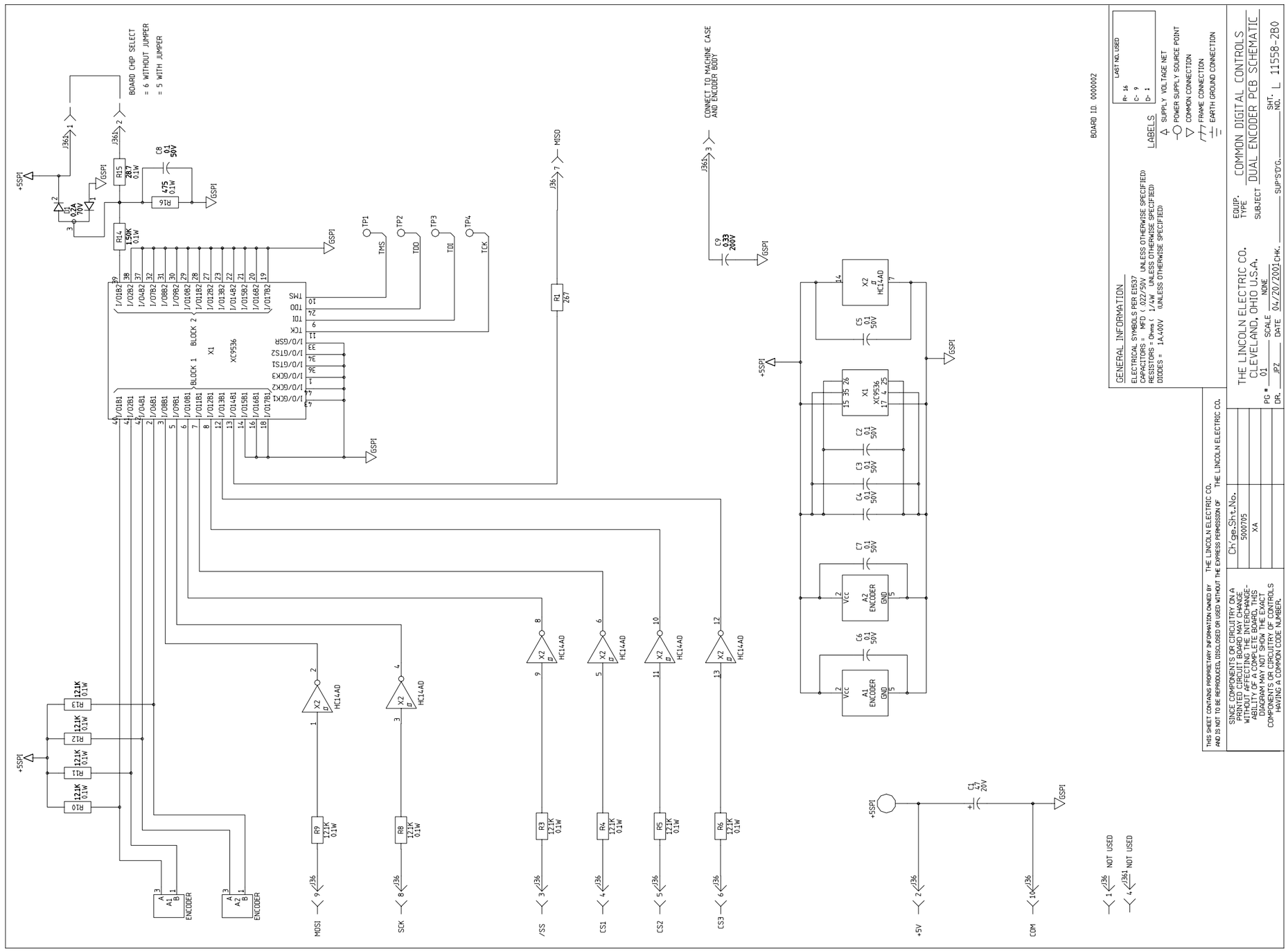
FN-488

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056 ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE (*1*) TO AGREE WITH PUBLISHED STANDARDS DO NOT SCALE THIS DRAWING	"X" INFO.	Chg. Sheet No.	DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: MISCELLANEOUS	
		XB-UF	DRAWN BY: C.S./	L11559-1	SUBJECT: SPI DUAL ENCODER P.C. BOARD ASSEMBLY	
		12-21-2001A	ENGINEER:	SUPERSEDING:	SCALE: FULL	DATE: 4-20-2001 DRAWING No.: L 11559-2
			APPROVED:			

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

Return to Section TOC
Return to Master TOC

SCHEMATIC - DUAL ENCODER BOARD (L11558-2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - SPI MEMORY BOARD (M20077-1)

M20077-1	ENGINEERING CONTROLLED MANUFACTURER: Yes	CHANGE DETAIL: RELEASED FROM 5014819-A

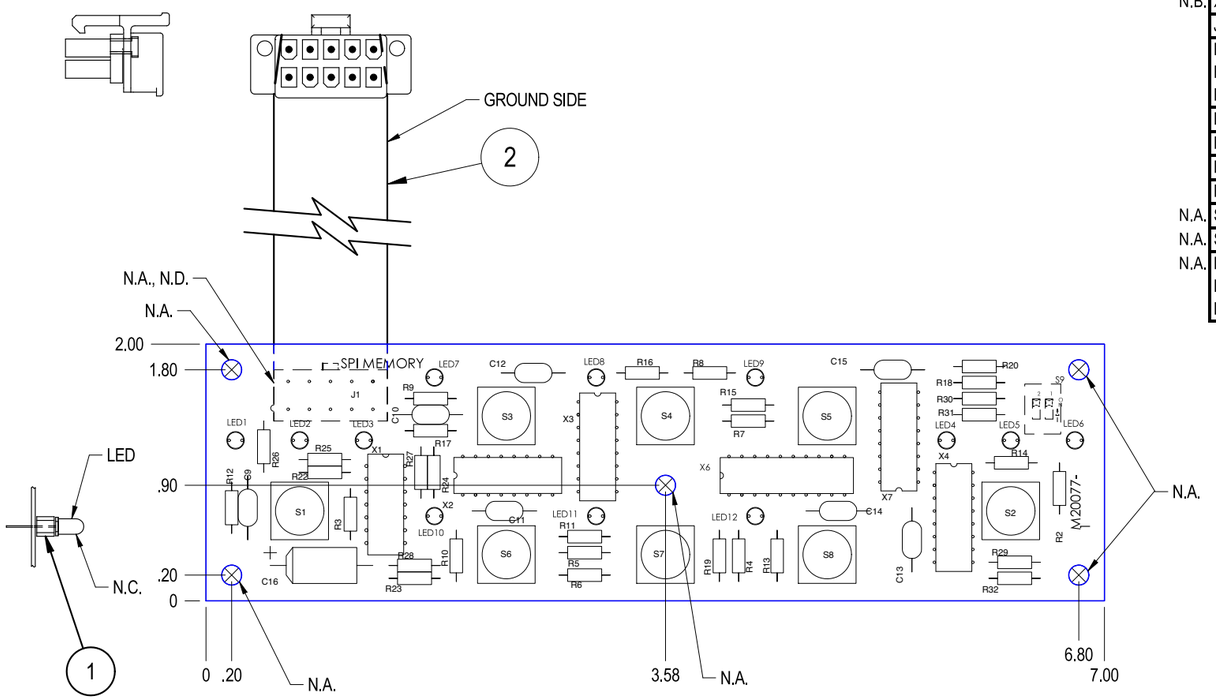
NOTES:

N.A. DO NOT COAT WITH ENCAPSULATION MATERIAL.

N.B. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE **E2454** BEFORE HANDLING.

N.C. USE **ITEM 1** TO STAND LED1 THRU LED12 FROM THE P.C. BOARD. THERE MUST NOT BE MORE THAN .020 GAP BETWEEN SPACER AND P.C. BOARD OR BETWEEN SPACER AND LED. ENCAPSULATE P.C.BOARD, SPACER AND LOWER HALF OF LED.

N.D. CONNECTOR MUST BE GREASED WITH **ITEM 3** PRIOR TO ENCAPSULATION.



	ITEM	REQ'D	PART No.	DESCRIPTION
	1	12	T15176-2	LED SPACER
	2	1	L11166-1	FLEX CIRCUIT
	3	.01 OZ.	E3539	ELECTRICAL INSULATING COMPOUND
	FOR ITEMS BELOW REFER TO ELECTRONIC COMPONENTS DATABASE FOR COMPONENT SPECIFICATIONS			
	C16	1	S13490-104	CAPACITOR,TAEL,39,20V,10%
	C9,C10,C11,C12,C13,C14,C15	7	S16668-11	CAPACITOR,CEMO,0.1, 50V, 10%
N.B.	X1	1	S17900-8	IC,CMOS,INVERTER,SCHMITT,HEX,HC14A(SS)
N.B.	X2	1	S17900-26	IC,CMOS,MUX,DAT,8-INPUT,HC151(SS)
N.B.	X3,X4	2	S17900-10	IC,CMOS,REGISTER,SHFT,S-PI/SO,8-BIT(SS)
N.B.	X6	1	S20496-1	IC,CMOS,DRIVER,DISPLAY,LED, CC,MCU (SS)
N.B.	X7	1	S17900-28	IC,CMOS,HEX,BUFFER,3-STATE,2-BIT,4-BI (SS)
	J1	1	S18248-10	CONNECTOR, MOLEX,MINI,PCB,10-PIN
	R2,R3,R4,R5,R6,R7,R8,R9 R10,R11,R12,R13,R14,R15 R16,R17,R19	17	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
	R22,R23,R24,R25,R26,R27	6	S19400-1212	RESISTOR,MF,1/4W,12.1K,1%
	R18,R20,R29	3	S19400-2002	RESISTOR,MF,1/4W,20.0K,1%
	R28	1	S19400-2670	RESISTOR,MF,1/4W,267,1%
	R30,R31,R32	3	S19400-9091	RESISTOR,MF,1/4W,9.09K,1%
N.A.	S1,S2,S3,S4,S5,S6,S7,S8	8	T13381-16	SWITCH,PUSHBUTTON,SPST
N.A.	S9	1	S19869-2	SWITCH,DIP,SPST,2-CIRCUITS
N.A.	LED1,LED2,LED3,LED4,LED5, LED6,LED7,LED8,LED9,LED10, LED11,LED12	12	T13657-6	LED,T-1,RED,HLMP-K101

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

ENCAPSULATE WITH HUMISEAL 1A27LU PER E1844 OR WITH EQUIVALENT AS APPROVED BY THE LINCOLN ELECTRIC COMPANY. (2 COATS)

BUY AS:
M 2 0 0 7 7 - 1 B 0
PART NUMBER IDENTIFICATION CODE

BUY PER E3867.

TEST PER E3856-MY.

SCHEMATIC REFERENCE: L11897-1B0

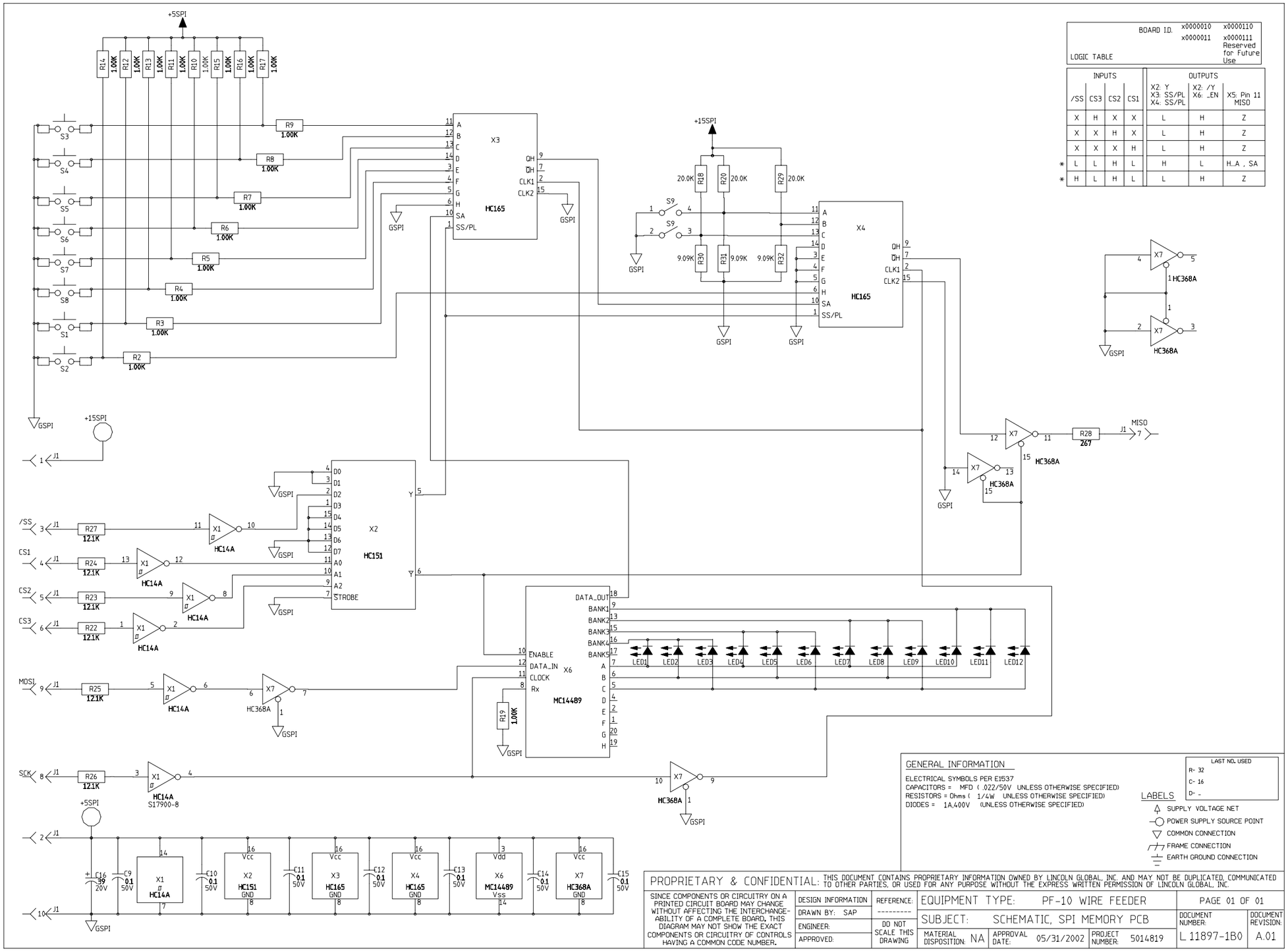
UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056 ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("t") TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	DESIGN INFORMATION DRAWN BY: RAS ENGINEER: SP APPROVED:	REFERENCE: M19790-1 SCALE: 1:1	EQUIPMENT TYPE: MISC. SUBJECT: SPI MEMORY P.C. BOARD ASSEMBLY MATERIAL DISPOSITION: NA APPROVAL DATE: 02/04/2004 PROJECT NUMBER: CRM35346	PAGE 1 OF 1	DOCUMENT NUMBER: M20077-1	DOCUMENT REVISION: A

LIT-100

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

Return to Section TOC
Return to Master TOC

SCHEMATIC - SPI MEMORY BOARD (L11897-1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

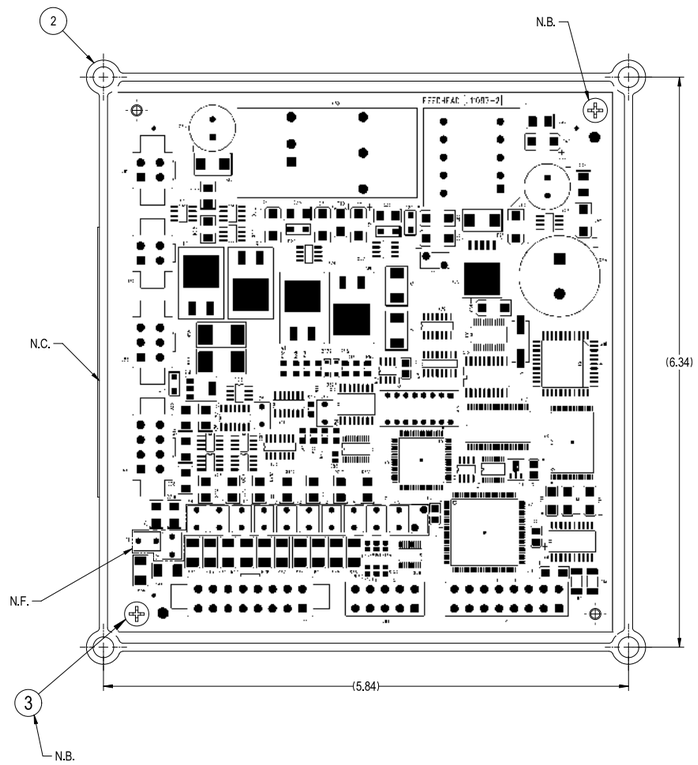
Return to Section TOC
Return to Master TOC

PC BOARD ASSEMBLY - FEED HEAD BOARD (L11087-2)

L11087-2

ENGINEERING CONTROLLED MANUFACTURER: Yes

CHANGE DETAIL: REVISED ITEM 93



	74	S25001-3320SMT	6	R139,R140,R141,R142,R143,R144	RESISTOR,SMD,332ohms,1/4W,1206,1%
	75	S25005-1SMT	2	R97,R98	SRES,0,05,3W,1%, TR,NP
	76	S25001-4751SMT	4	R99,R114,R132,R137	SRES,4,75K,1206,1% ,1/8W,NP,(SM
	77	S25000-4751SMT	12	R101,R104,R125,R126,R127, R128,R129,R130,R131,R133, R134,R145	SRES,4,75K,0805,1%, TR,NP
	78	S25001-1503SMT	1	R115	SRES,150K,1206,1% ,1/8W,NP
	79	S25000-1211SMT	1	R135	SRES,1,21K,0805,1% ,1/10W,TR,NP
	80	S25000-2002SMT	3	R146,R147,R76	SRES,20K,TKF,0805,1% ,01/10W,TR
	81	S25007-9091SMT	2	R90,R109	RESISTOR,SMD,9,09K,1/10W,0805,0,1%
	82	S19869-8	1	S1	SWT,78B08S,DIP,SPST,.8P,NP
	83	S20375-8	1	T1	TFM,L5936,Noreast,Switching Pwr
	84	S25068-7SMT	1	X1	SICS,4.6V,2% ,VOLT, DETECTOR
	85	M15101-14SMT	1	X2	SICS,MC68332,MICRCONTROLLER,TQ
	86	S25069-2SMT	1	X3	SICS,2512B,SERIAL EEPR,NP
	87	S20353-1SMT	1	X4	SICS,MC145407,RECEIVER/DRVR,RS
N.D.	88	S25070-6SMT	1	X5	SICS,XC9572-15,CPLD,TQ100,NP
	89	S17900-24SMT	2	X7,X29	SICS,74HC132,NP
N.E.	90	S25069-24SMT	1	X9	SICS, FLASH ROM, 16 x 256K, 70 NS
	91	S25066-2SMT	1	X10	SICS,AD7862,DUAL,12BIT,250kSPS
	92	S25057-3SMT	1	X11	SICS,AD8403ARU10,DIGITAL POT,NP
	93	M15105-9ASM	1	X12	SICS,AD7945 ,12BIT,PARALLEL,DAC
	94	S15128-21SMT	1	X13	SICS,LT1016,COMPARATOR,NP
	95	S15128-18SMT	2	X14,X20	SICS,MC33074,QUAD,OPAMP,SO14,T
	96	S15128-16SMT	1	X15	ICS,SMD,OP-AMP,QUAD,HIGH PERFORMANCE 1014
	97	S15018-20SMT	1	X16	SICS,HIP4082,H-BRIDGE,FET DRIVE
	98	M15104-15	1	X17	IC,SMD,CMOS,RAM,STATIC,16-BIT,64K X 16
	99	S20353-5	1	X18	SICS,AN82527,CAN CONTROLLER,PL
	100	S25065-2SMT	1	X19	SICS,74ACT573,OCTAL,TRANS. LAT
	101	S20353-4SMT	3	X21,X26,X27	SICS,MAX485,TRANSCEIVER,NP
	102	S25068-8SMT	1	X22	SICS,79L05,V-REG,-5V,SO8
	103	S25068-5SMT	2	X23,X24	SICS,78L05,V-REG,+5V,SO8
	104	S15128-25SMT	1	X25	SICS,LM2576HVS-5.0,VREG,60V,SW
	105	S17900-11SMT	1	X28	SICS,74HC245,SOL20,HCMOS,NP
	106	S24841-1	1	X30	ICS,DC/DC,5V 3A OUT,36-75V IN
	107	S25082-1SMT	1	Y1	SXTL,16MHz,HC40,20pF,NP
	108	S25000-1000SMT	6	R155,R156,R157,R158,R159,R160	RESISTOR,SMD,100,1/10W,0805,1%

UNLESS OTHERWISE SPECIFIED:
RESISTANCE = OHMS

SCHEMATIC REFERENCE -G3823-2D8

BUY AS

L11087-2D8

ASSEMBLY PART NO. — IDENTIFICATION CODE

	ITEM	PART NO.	QTY	PC BOARD REFERENCE DESIGNATORS	DESCRIPTION
	1	G3822-D	1		FEED HEAD PC BOARD BLANK
	2	M19436-5	1		POTTING TRAY
	3	S8025-80	2		SELF TAPPING SCREW
	4	E2527	195g 6.88 OZ.		EPOXY ENCAPSULATING RESIN
	5	E3539	AS REQ.		ELECTRICAL INSULATING COMPOUND
N.D.	6	Y00552-5	1	X5	SOFTWARE,CPLD
N.E.	7	S24823-5	1	X9	SOFTWARE,FLASH
		FOR ITEMS LISTED BELOW REFER TO ELECTRONIC COMPONENT DATABASE FOR COMPONENT SPECIFICATIONS			
	8	S25024-2SMT	4	C1,C2,C7,C50	SCAP,1uF,TAN,3528,35V,TR,NP
	9	S25020-3SMT	47	C3,C4,C5,C6,C8,C9,C12,C14, C15,C19,C20,C22,C25, C26,C27,C28,C29,C30,C31, C32,C34,C35,C38,C39,C41, C43,C45,C46,C47,C48,C49, C51,C54,C56,C57,C59,C60, C64,C65,C69,C72,C75,C76, C77,C78,C81,C82	SCAP,0.1uF,0805,50V,X7R,10%,TR
	10	S25024-8SMT	5	C10,C11,C17,C18,C80	SCAP,10uF,TAN,6032,16V,10% ,TR,NP
	11	S25020-13SMT	2	C13,C16	SCAP,150pF,CER,0805,100V,COG,5% ,TR,NP
	12	S25024-5SMT	6	C23,C63,C66,C67,C68,C71	SCAP,4,7uF,TAN,7343,35V,10% ,TR,NP
	13	S25024-10SMT	3	C24,C36,C73	SCAP,22uF,TAN,7343,25V,10% ,POLAR,TR
	14	S25020-2SMT	1	C37	SCAP,0.022uF,0805,50V,X7R,10%
	15	S25020-10SMT	3	C40,C42,C44	SCAP,4700pF,0805,50V,X7R,10% ,T
	16	S25020-9SMT	2	C52,C79	SCAP,47pF,0805,50V,COG,5% ,TR,N
	17	S25020-15SMT	3	C55,C58,C83	SCAP,22pF,0805,50V,COG,5% ,TR,N
	18	S24833-1	2	C61,C62	CAP,0,27uF,PCF,63V,5% ,TR,NP
	19	S13490-179	1	C70	CAP,1000uF,ALU,.35V,20% ,NP
	20	S13490-182	1	C74	CAP,330uF,ALU,63V,20% ,NP
	21	S13490-184	1	C84	CAP,330uF ,100V
	22	S25020-4SMT	2	C85,C86	CAPACITOR ,SMD CERAMIC,820PF,50V,5% COG,S0805
	23	S25040-12SMT	2	D1,D12	SDIO,MURS320T3,3A,200V,ULTRAFA
	24	S25040-2SMT	4	D2,D17,D20,D27	SDIO,400V,0,8A,NP
	25	S25040-5SMT	10	D3,D4,D5,D6,D9,D18,D21,D28,D29, D31	SDIO,BAV99LT1,SOT23,DUAL SWITC
	26	S25049-4SMT	4	D7,D8,D10,D19	SDIO,BAT54S,DUAL/SERIES,30V,20
	27	S25040-4SMT	5	D11,D13,D14,D15,D16	SDIO,BAW56LT1,SOT23,DUAL SWT,T
	28	S25040-11SMT	4	D22,D23,D24,D25	SDIO,MURS160,1A,600V,FAST RECO
	29	S25040-9SMT	1	D26	SDIO,3A,200V,DO-214AB,UFR
	30	S25040-10SMT	1	D30	DIODE,SMD,3A,400V
	31	S25045-3SMT	4	DZ1,DZ2,DZ3,DZ4	SDIO,MMSZ5248B,18V,ZENER,TR,NP
	32	S25046-1SMT	3	DZ5,DZ28,DZ29	SDIO,MMSZ5231BT1,5,1V,NP
	33	S25044-9SMT	6	DZ6,DZ7,DZ8,DZ9,DZ26,DZ27	SDIO,1SMB5920BT3,6,2V,NP
	34	S25044-1SMT	9	DZ10,DZ11,DZ12,DZ13,DZ14, DZ15,DZ16,DZ17,DZ18	SDIO,1SMB5918BT3,3W,5,1V,5% ,TR,NP
	35	S25046-2SMT	4	DZ20,DZ21,DZ22,DZ23	SDIO,MMSZ5240BT1,10V,500mW,ZEN
	36	S18380-5	2	F1,F2	RES,50,VAR,PTC,NP
	37	S18380-14	12	F3,F4,F5,F6,F7,F8,F9,F10, F11,F12,F13,F14	RES,500,PTC,265V
	38	S24020-4	2	J81,J82	CON,MOLEX,15-97-7042,MINI,PCB,4 PIN,TIN
	39	S24020-6	1	J83	CON,MOLEX,15-97-7062,MINI,PCB,6 PIN,TIN
	40	S24020-8	1	J84	CON,MOLEX,15-97-7082,MINI,PCB,8 PIN,TIN
	41	S24020-16	1	J85	CON,MOLEX,15-97-7162,MINI,PCB,16 PIN,TIN
	42	S18248-10	1	J86	CON,10P,MINI,NP
	43	S18248-16	1	J87	CON,MOLEX,39-28-1163,PCB,16 PIN,TIN
	44	S15000-28SMT	4	OC1,OC12,OC13,OC14	SICS,Optocoupler, HCPL-0601 (SO-8)
	45	S15000-26SMT	1	OC15	SICS,HCPL-0201,OPTOCOUPLE
	46	S25051-4SMT	5	Q1,Q12,Q13,Q15,Q16	STRA,2N7002,TR,NP ,(SM400-020)
	47	S25050-2SMT	5	Q2,Q3,Q7,Q14,Q17	STRA,2N4403,SO23,TR,(500475),N
	48	S25050-1SMT	9	Q4,Q5,Q6,Q19,Q20,Q21,Q22,Q23,Q 24	STRA,2N4401,SOT-23,NPN,TR,
	49	S25051-16SMT	4	Q8,Q9,Q10,Q11	STRA,75A,55V,0,007 OHM FET,N-CHAN
	50	S23060-1SMT	1	Q18	IC,SMD,SWITCH,LO-SIDE,2,2A60V,
	51	S25000-1002SMT	24	R2,R3,R4,R5,R6,R7,R9,R16, R17,R18,R19,R20,R21,R22, R23,R53,R54,R77,R80,R106, R116,R138,R148,R149	SRES,10K,0805,1% ,1/10W,TR,NP
	52	S25001-1002SMT	6	R8,R10,R13,R83,R100,R118	SRES,10K,MF,1206,1% ,1/8W,TR
	53	S25011-9092SMT	4	R84,R85,R86,R152	RESISTOR,SMD,90,9K,1/4W,1206,0,1%
	54	S25003-2000SMT	2	R11,R12	SRES,200,2512,5% ,1W,TR,NP
	55	S25001-4750SMT	9	R14,R15,R62,R68,R78,R102, R103,R107,R112	SRES,475,1206,1% ,1/8W,TR,NP
	56	S25000-1001SMT	8	R24,R25,R55,R105,R113, R136,R153,R154	SRES,1K,0805,1% ,1/10W,TR,NP
	57	S25000-4750SMT	2	R26,R27	SRES,475,0805,1% ,TR,NP
	58	S25004-2430SMT	12	R28,R29,R30,R31,R32,R33, R34,R35,R36,R37,R38,R39	SRES,243,WSC-1,1% ,1W,TR,NP
	59	S25000-3320SMT	9	R41,R42,R48,R49,R50,R51, R52,R121,R123	SRES,332,0805,1% ,1/10W,TR,NP
	60	S25000-2210SMT	9	R43,R44,R45,R46,R47,R65, R108,R122,R124	SRES,221,TKF,0805,1% ,1/10W,TR
	61	S25001-2000SMT	8	R56,R57,R58,R61,R64,R66, R110,R111	SRES,200,1206,1% ,1/8W,TR,NP
	62	S25001-7500SMT	1	R1	RESISTOR,SMD,750ohms,1/4W,1206,1%
	63	S25000-2213SMT	1	R63	SRES,221K,TKF,0805,1% ,01/10W,TR
	64	S25000-4752SMT	2	R67,R72	SRES,47,5K,TKF,0805,1% ,01/10W,TR
	65	S25000-1003SMT	6	R69,R71,R73,R75,R82,R117	SRES,100K,TKF,0805,1% ,01/10W,TR
	66	S25001-1001SMT	1	R70	SRES,1K,1206,1% ,1/8W,TR,NP,(09
	67	S25000-9092SMT	2	R74,R81	SRES,90,9K,TKF,0805,1% ,1/10W
	68	S25000-3921SMT	1	R79	SRES,3,92K,TKF,0805,1% ,1/10W,TR
	69	S25001-4753SMT	2	R87,R120	SRES,475K,1206,1% ,1/8W,TR,NP
	70	S25001-4752SMT	2	R88,R119	SRES,47,5K,1206,1% ,1/8W,TR,NP
	71	S25001-1000SMT	3	R89,R93,R96	SRES,100,1206,1% ,1/8W,TR,NP
	72	S25001-15R0SMT	2	R91,R92	SRES,15,1206,1% ,1/8W,TR,NP
	73	S25001-1500SMT	4	R94,R95,R150,R151	SRES,150,1206,1% ,1/8W,TR,NP

NOTES:

N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. LINCOLN ELECTRIC TO SEE E2454 BEFORE HANDLING.

N.B. SECURE PC BOARD ASSEMBLY IN PLACE WITH **ITEM 4.** (2 PLACES) TIGHTEN SCREWS TO A TORQUE OF 5,3±0,5 IN-LBS.

N.C. PLACE BARCODED ASSEMBLY NUMBER IDENTIFICATION AND BARCODED SERIAL NUMBER IDENTIFICATION IN AREA SHOWN.

N.D. PROGRAM **ITEM 88** WITH **ITEM 6** .

N.E. PROGRAM **ITEM 90** WITH **ITEM 7** .

N.F. PARTS INDICATED MUST BE COMPLETELY COVERED WITH ENCAPSULATION.

BUY PER E3867
TEST PER E3856-FH

FOR PARTS ORDERS ONLY:

DO NOT SEND THIS ASSEMBLY. SEND THE APPROPRIATE HARDWARE/SOFTWARE ASSEMBLY ONLY

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± .5 OF A DEGREE
MATERIAL TOLERANCE (**!**) TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	
DRAWN BY:	ILD
ENGINEER:	DRS
APPROVED:	-
REFERENCE:	-
SCALE:	1:1

EQUIPMENT TYPE: COMMON DIGITAL CONTROLS
SUBJECT: FEED HEAD PC BOARD ASSEMBLY
MATERIAL DISPOSITION: UF
APPROVAL DATE:
PROJECT NUMBER: CRM22115-FZ

PAGE 1 OF 1

DOCUMENT NUMBER: L11087-2
DOCUMENT REVISION: J.01

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

Return to Section TOC
Return to Master TOC

SCHEMATIC - FEED HEAD BOARD (G3823-2) PAGE 1

G3823-2D8 | ENGINEERING CONTROLLED | CHANGE DETAIL: NEW
MANUFACTURER: No

ARCLINK CONFIGURATION

SWITCHING POWER SUPPLY

VOLTAGE SENSE CIRCUITRY

MICRO_CONTROLLER

NOTES:

N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

LAST NO. USED
R= -
C= -
D= -

FILENAME: ----------

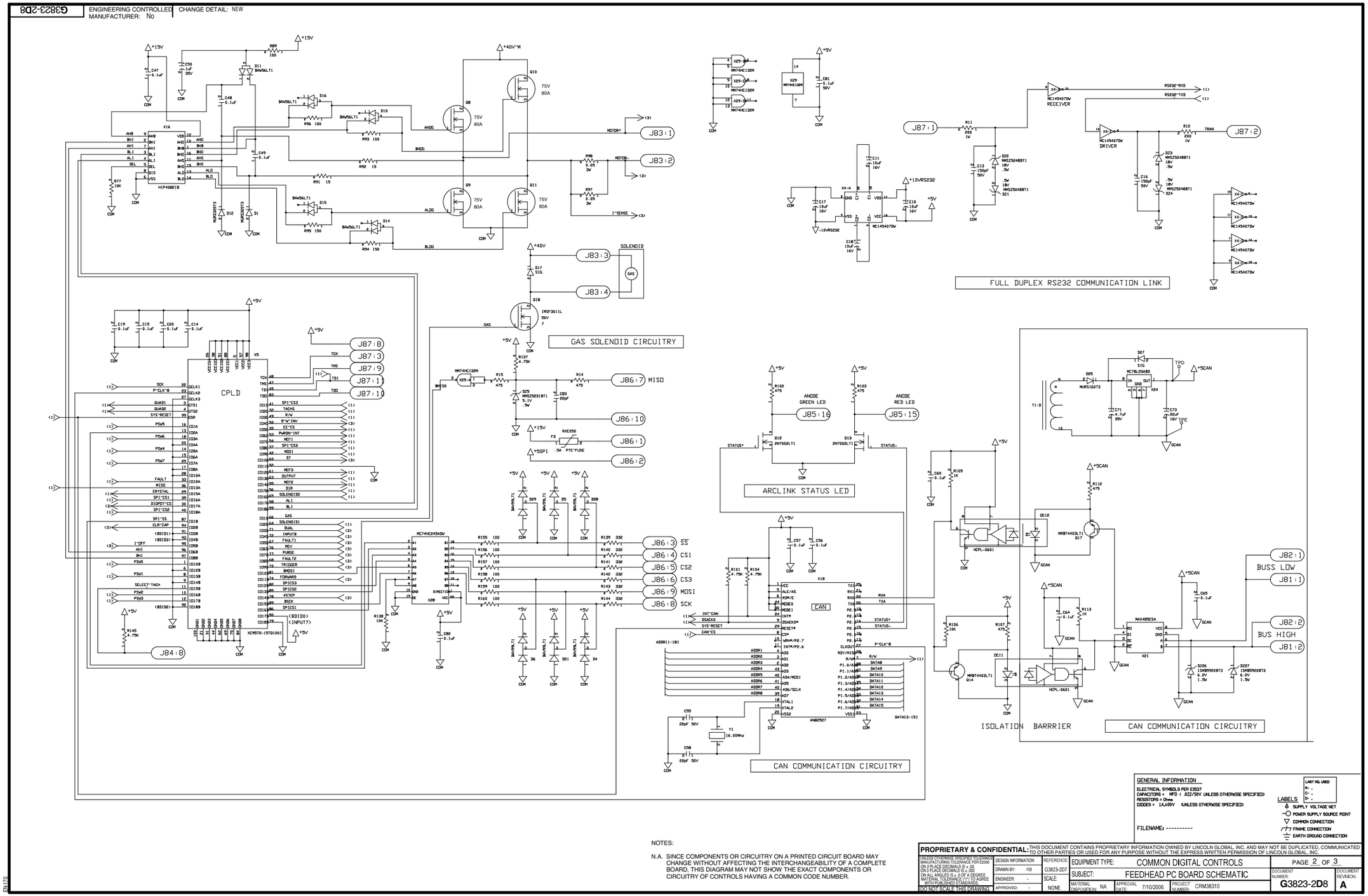
UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± 3.0 OF A DEGREE
MATERIAL TOLERANCE ("+") TO ACCREL WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE:	COMMON DIGITAL CONTROLS
DRAWN BY: FEI	G3823-2D7	SUBJECT:	FEEDHEAD PC BOARD SCHEMATIC
ENGINEER: -	SCALE: NONE	MATERIAL DISPOSITION: NA	APPROVAL DATE: 7/10/2006
APPROVED: -		PROJECT NUMBER: CRM38310	

PAGE 1 OF 3

DOCUMENT NUMBER: G3823-2D8 | DOCUMENT REVISION: A

SCHEMATIC - FEED HEAD BOARD (G3823-2) PAGE 2



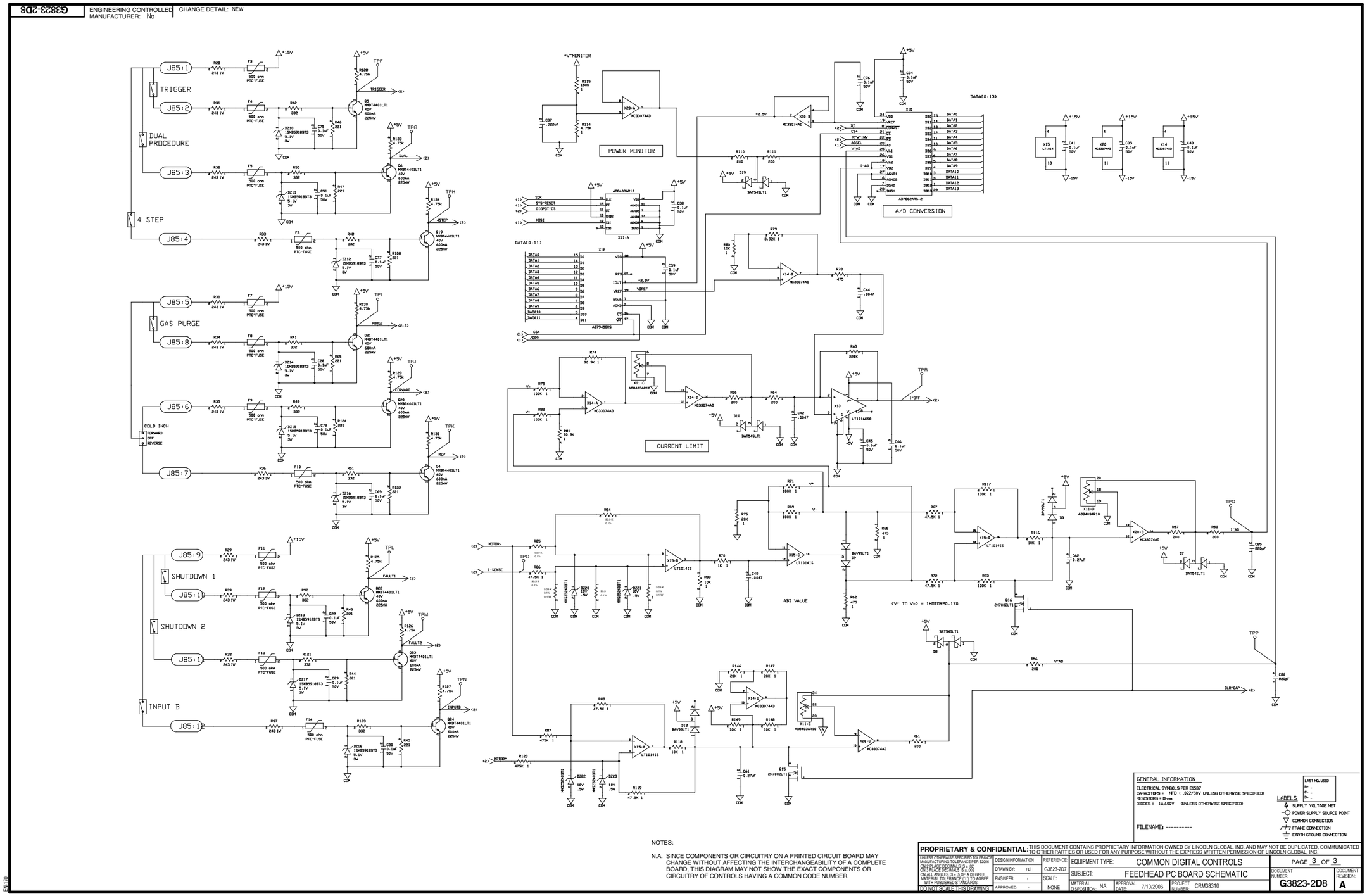
NOTES:

N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - FEED HEAD BOARD (G3823-2) PAGE 3

G3823-2D8 | ENGINEERING CONTROLLED | CHANGE DETAIL: NEW
MANUFACTURER: No



NOTES:

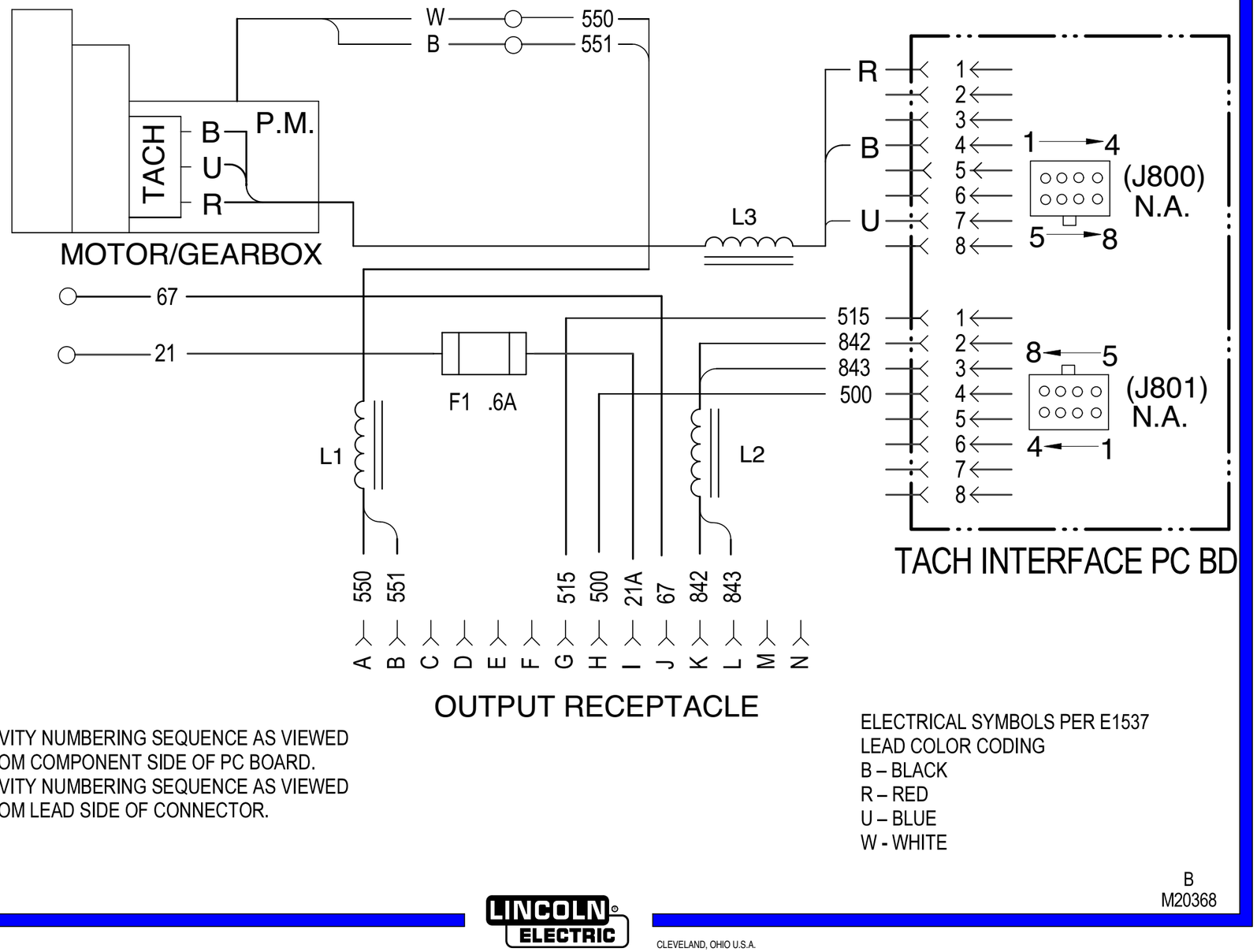
N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

Return to Section TOC
Return to Master TOC

WIRING DIAGRAM POWER FEED 10 S



NOTES:
N.A. CAVITY NUMBERING SEQUENCE AS VIEWED FROM COMPONENT SIDE OF PC BOARD.
N.B. CAVITY NUMBERING SEQUENCE AS VIEWED FROM LEAD SIDE OF CONNECTOR.

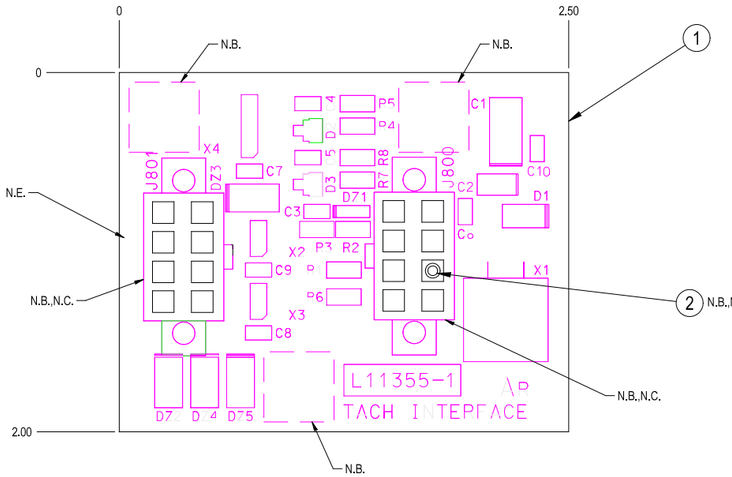
ELECTRICAL SYMBOLS PER E1537
LEAD COLOR CODING
B – BLACK
R – RED
U – BLUE
W - WHITE

B
M20368

LINCOLN ELECTRIC
CLEVELAND, OHIO U.S.A.

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY - TACK FEEDBACK BOARD (L11355-1)



ITEM	PART NUMBER	REQ'D.	DESCRIPTION	REFERENCE DESIGNATOR
1	L11355-A	1	TACH INTERFACE P.C.BD. BLANK	
2	S24671	1	KEYING PLUG	
3				
4				
5	E2861	AS REQ'D	ELECTRICAL INSULATING COMPOUND	
FOR ITEMS LISTED BELOW REFER TO ELECTRONIC COMPONENT DATABASE FOR COMPONENT SPECIFICATIONS				
6	S15128-5SMT	1	IC,VOLT REG,SMD,FIXED,3-T,(+),1A,5V	X1
7	S17900-24SMT	1	IC,SMD,CMOS,GSTE,NAND,2-INPUT,QUAD,SC	X4
8	S20353-4SMT	2	IC,CMOS,SMD,XCVR,EIA485(SS)	X2 X3
9	S24020-8	2	CONNECTOR,MOLEX,MINI,PCB,8-PIN,TIN	J800 J801
10	S25001-1002SMT	1	RESISTOR,SMD,10K,1/4W,1206,1%,TR	R2
11	S25001-3321SMT	2	RESISTOR,SMD,3.32K,1/4W,1206,1%,TR	R5 R8
12	S25001-4751SMT	5	RESISTOR,SMD,4.75K,1/4W,1206,1%,TR	R1 R3 R4 R6 R7
13	S25020-3SMT	5	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X	C6 C7 C8 C9 C10
14	S25020-9SMT	3	CAPACITOR,SMD,CERAMIC,47pF,50V,5%,COG	C3 C4 C5
15	S25024-2SMT	1	CAPACITOR,SMD,TANTALUM,1.0MF,35V,10%	C2
16	S25024-5SMT	1	CAPACITOR,SMD,TANTALUM,4.7MF,35V,10%	C1
17	S25040-2SMT	1	DIODE,SMD,1A,400V,DO-214BA/AC	D1
18	S25040-5SMT	2	DIODE,SMD,DUAL,0.200A,70V,UFR	D2 D3
19	S25044-9SMT	4	ZENER DIODE,SMD,3W,6.2V,5%,SMB	DZ2 DZ3 DZ4 DZ5
20	S25046-1SMT	1	ZENER DIODE,SMD,0.5W,5.1V,5%,SOF123	DZ1

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

V

BUY AS:

L11355-1A0

PART NO. — IDENTIFICATION CODE

NOTES:

N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.

N.B. DO NOT COAT WITH ENCAPSULATION MATERIAL.

N.C. ALL CONNECTORS MUST BE GREASED WITH **ITEM 5** PRIOR TO ENCAPSULATION.

N.D. INSERT **ITEM 2** INTO **J800, PIN 3.**

N.E. IDENTIFY COMPLETE ASSEMBLY WITH A PRINTED LABEL OR OTHER PERMANENT MARKING ON SOLDER SIDE OF BOARD BEFORE ENCAPSULATION.

ENCAPSULATE WITH HUMISEAL 1A27LU PER E1844 OR WITH EQUIVALENT AS APPROVED BY LINCOLN ELECTRIC COMPANY. (2 COATS)

SCHEMATIC REFERENCE: L11422

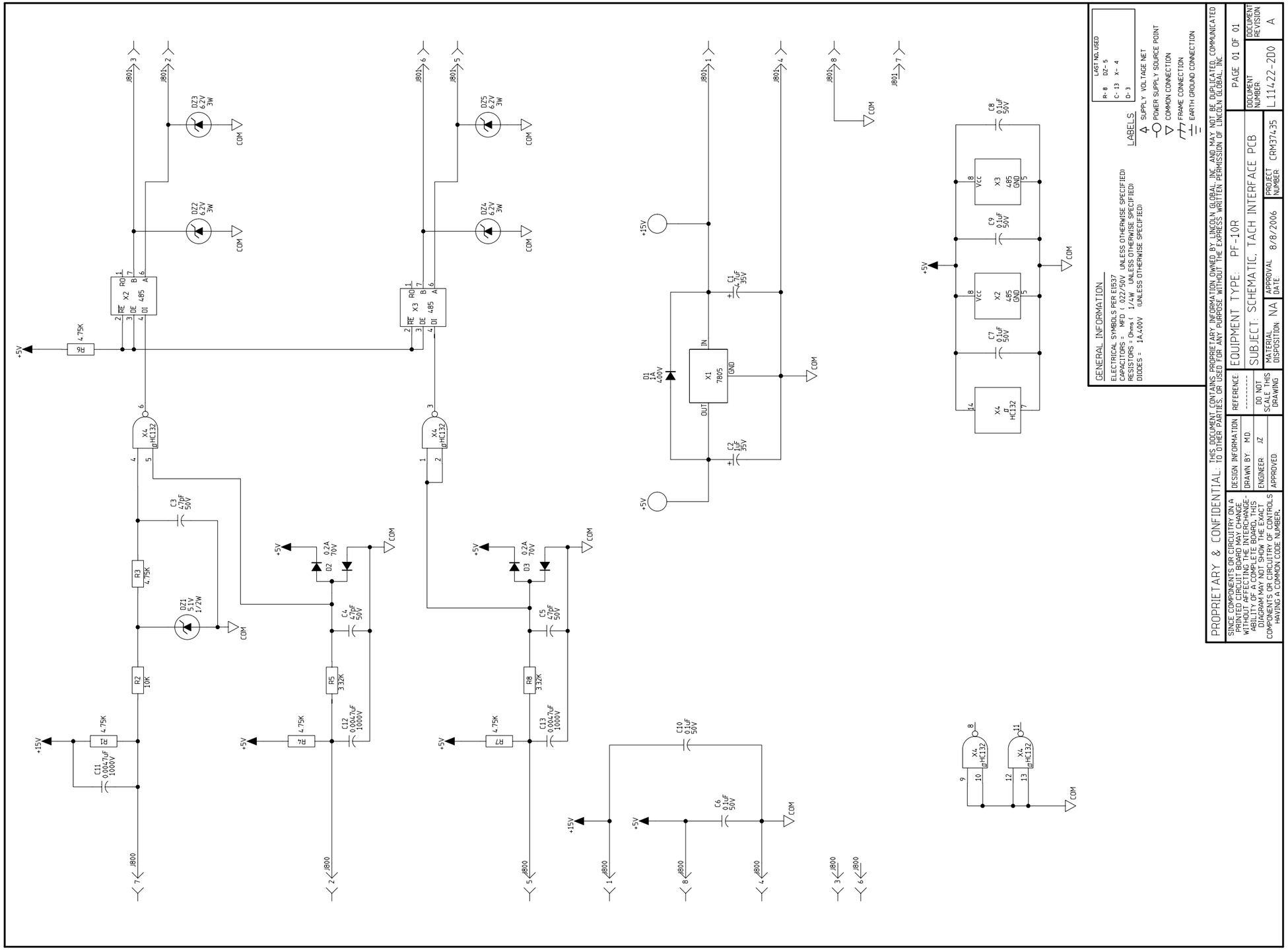
BUY PER E3867
TEST PER E3881-I

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056 ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .002 ON ALL ANGLES IS ± .5 OF A DEGREE MATERIAL TOLERANCE ("T") TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	"X" INFO.	Chg. Sheet No.	DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: PF-10R
	XB	12-21-2000	DRAWN BY: RAS	L11107-2	SUBJECT: TACH INTERFACE P.C. BOARD ASSEMBLY
			ENGINEER: ZUCKER	SUPERSEDING:	SCALE: 2:1 DATE: 10-30-99 DRAWING No.: L 11355-1
			APPROVED:		

EN168

Return to Section TOC
Return to Master TOC

SCHEMATIC - TACK FEEDBACK BOARD (L11422)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.