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.

MAXsa™ 10, MAXsa™ 19, MAXsa™ 22 & 29

SERVICE MANUAL

Controller & Wire Drives

For use with machines having Code Numbers:

11590, 11614, 11615, 11616, 11777, 11778, 11815, 11816, 12433, 12441, 12424

SVM223-A | Issue Date 12-Oct

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.

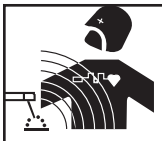
1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

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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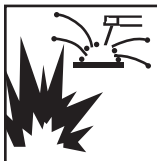

WELDING and CUTTING SPARKS can cause fire or explosion.

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 adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

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

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

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

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

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

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

6.h. Also see item 1.c.

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

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

CYLINDER may explode if damaged.

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

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

7.c. Cylinders should be located:

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

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

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

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

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

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.

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ELECTROMAGNETIC COMPATABILITY (EMC)

CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC). 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.

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

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FIGURE E.1 BLOCK LOGIC DIAGRAM

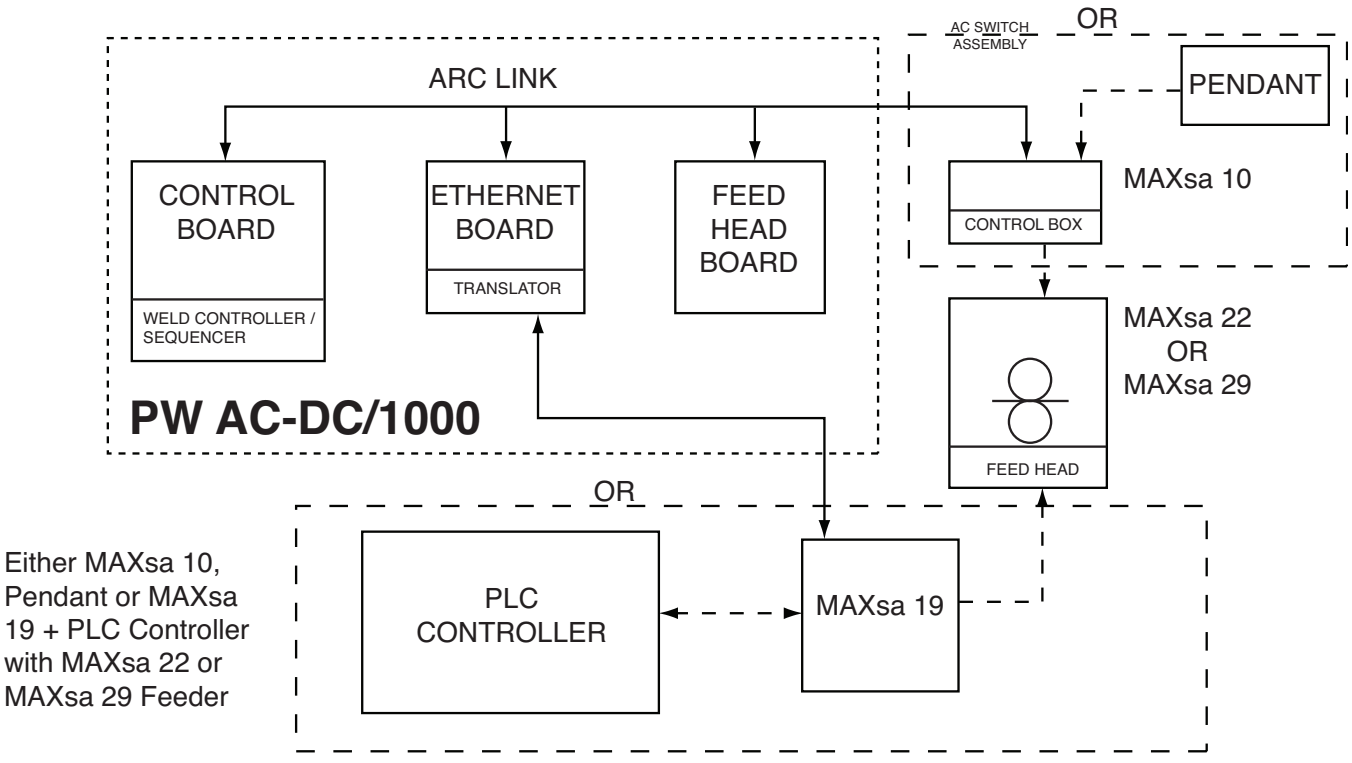
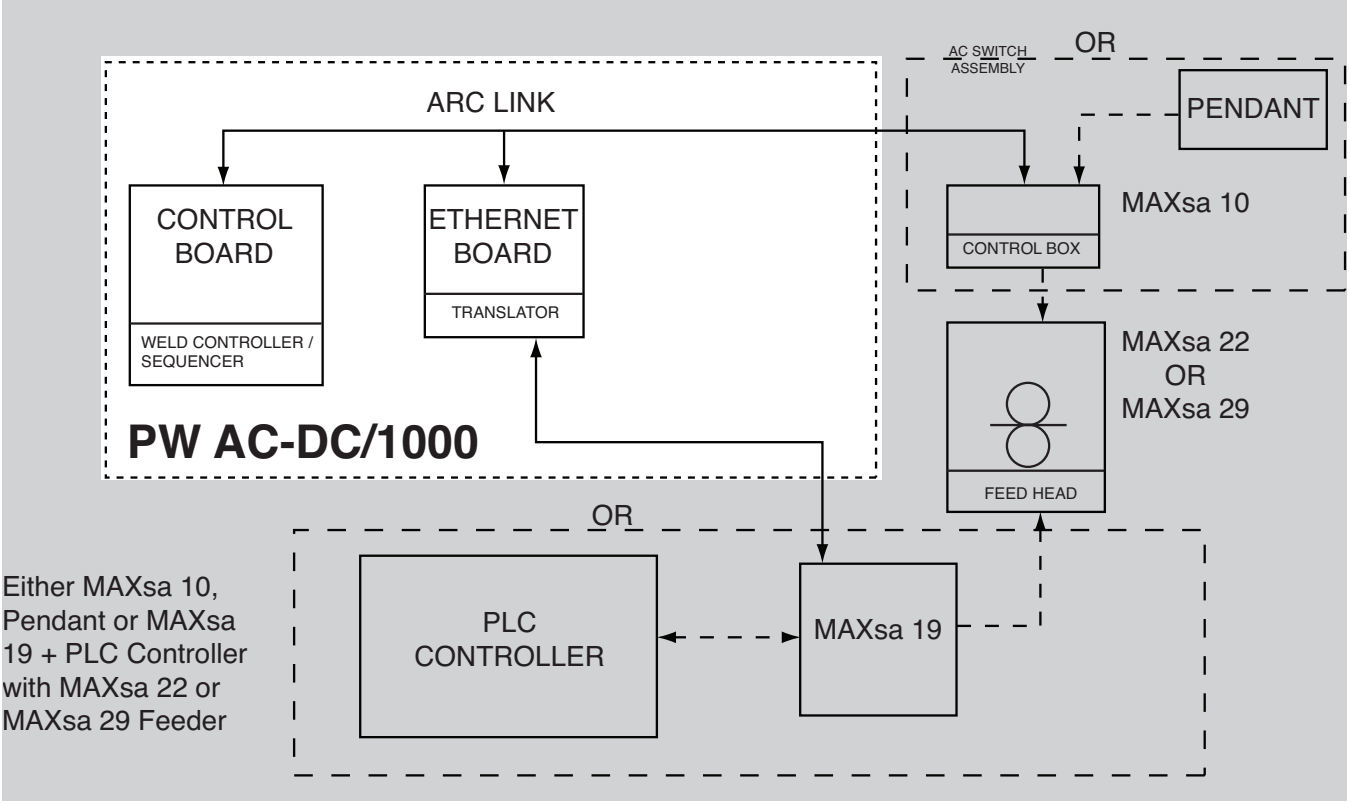


FIGURE E.2 – GENERAL DESCRIPTION



GENERAL DESCRIPTION

The Power Wave® AC/DC 1000® SD is a high performance, digitally 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 voltage welding modes in each of its output configurations.

The Power Wave® AC/DC 1000® SD 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 by interconnecting the units with a control cable to improve performance and reduce the effects of arc blow.

The Power Wave® AC/DC 1000® SD 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.

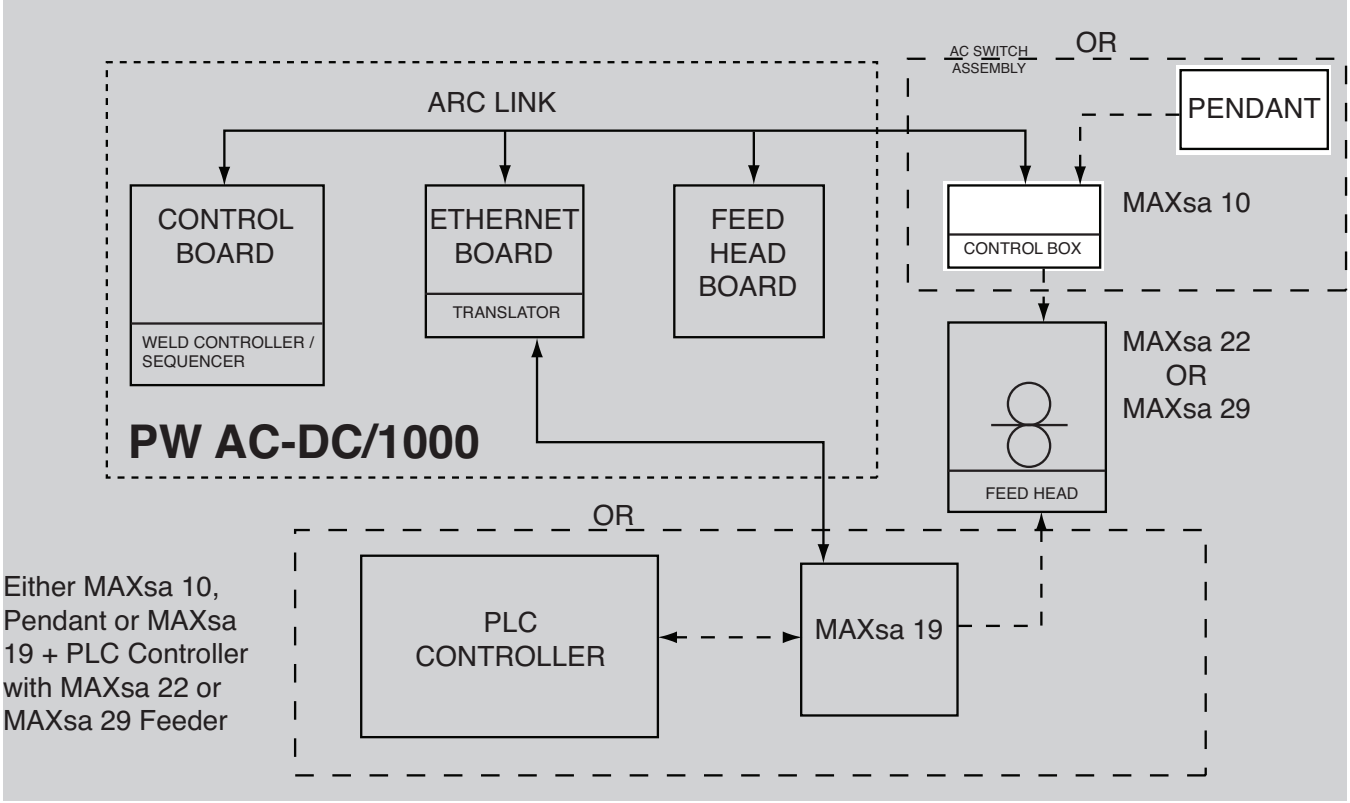
Only the MAXsa™ 22 or MAXsa™ 29 Wire Drives and MAXsa™ 10 or MAXsa™ 19 Controllers may be used with a K2803-1 Power Wave® AC/DC 1000® SD in a Multi Arc system. Other Lincoln or non-Lincoln Wire Drives can only be used with custom interfaces.

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

The Power Wave® AC/DC 1000® SD is suitable only for the Submerged Arc Process (SAW)

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

FIGURE E.3 – MAXsa 10 CONTROLLER



MAXsa 10 CONTROLLER

The MAXsa 10 controller is the main user interface for the POWER WAVE® AC/DC 1000® SD. The following elements are controlled from the MAXsa 10 Pendant:

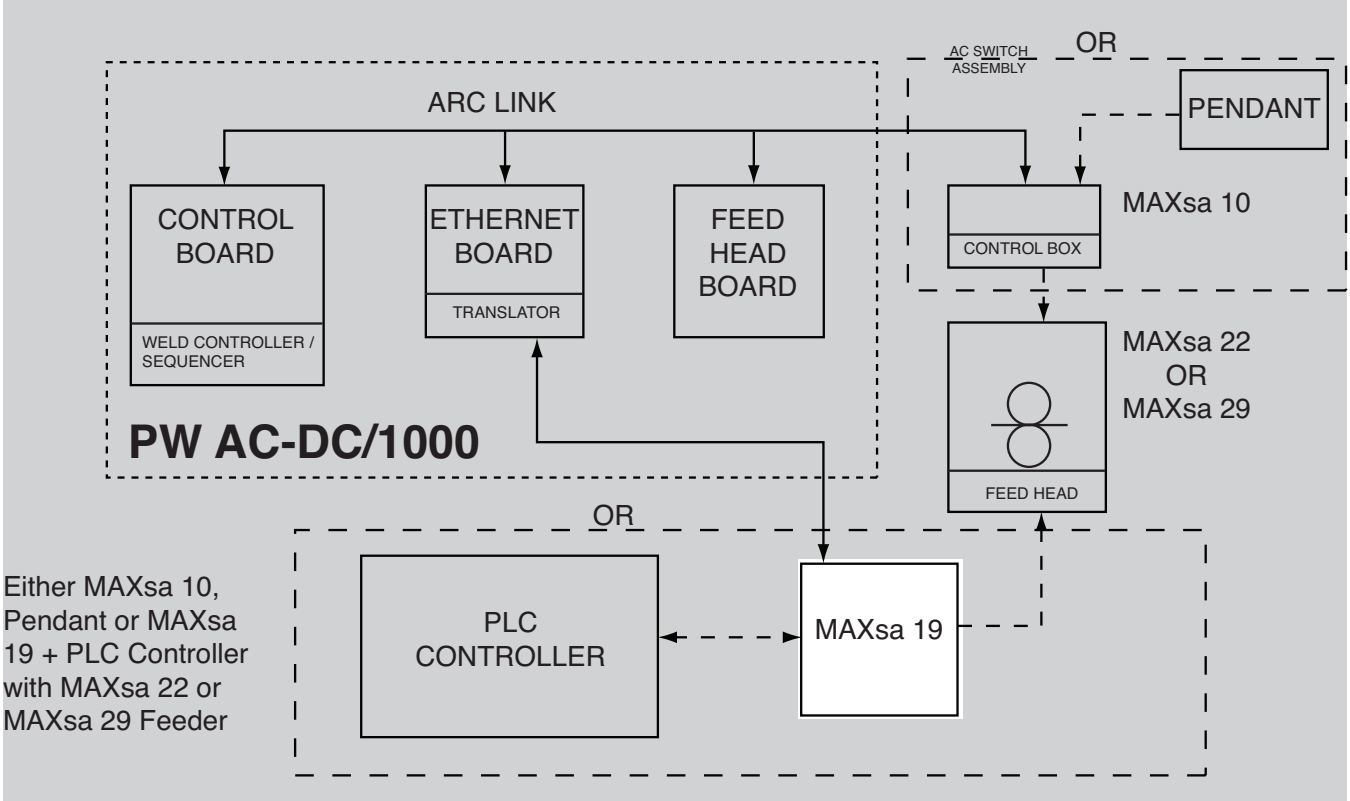
- All weld parameters
- Timers
- Start / stop commands
- Motion control (travel) multi-procedures
- Memory configuration
- Diagnostics
- Touch sense
- Remote interface
- Security of procedure settings

It should be noted that the MAXsa 10 does 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 MAXsa 10. Flux hopper, travel and flow switch input is directly driven by the MAXsa 10. 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*.)

Only a MAXsa10 or MAXsa 19 Controller but no both is used along with either a MAXsa 22 or MAXsa 29 wire drive. One controller and one drive per machine setup.

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

FIGURE E.4 – MAXsa 19 CONTROLLER



MAXsa™ 19 CONTROLLER

The MAXsa™ 19 is a versatile controller designed to operate in a Power Wave® AC/DC 1000 SD system and is responsible for relaying wire feed commands to a MAXsa™ 29 Wire Drive. It is connected to the Power Wave® AC/DC 1000 SD by a K2683-xx Arclink Cable and to the Wire Drive by a K1785-xx 14 Pin Control Cable.

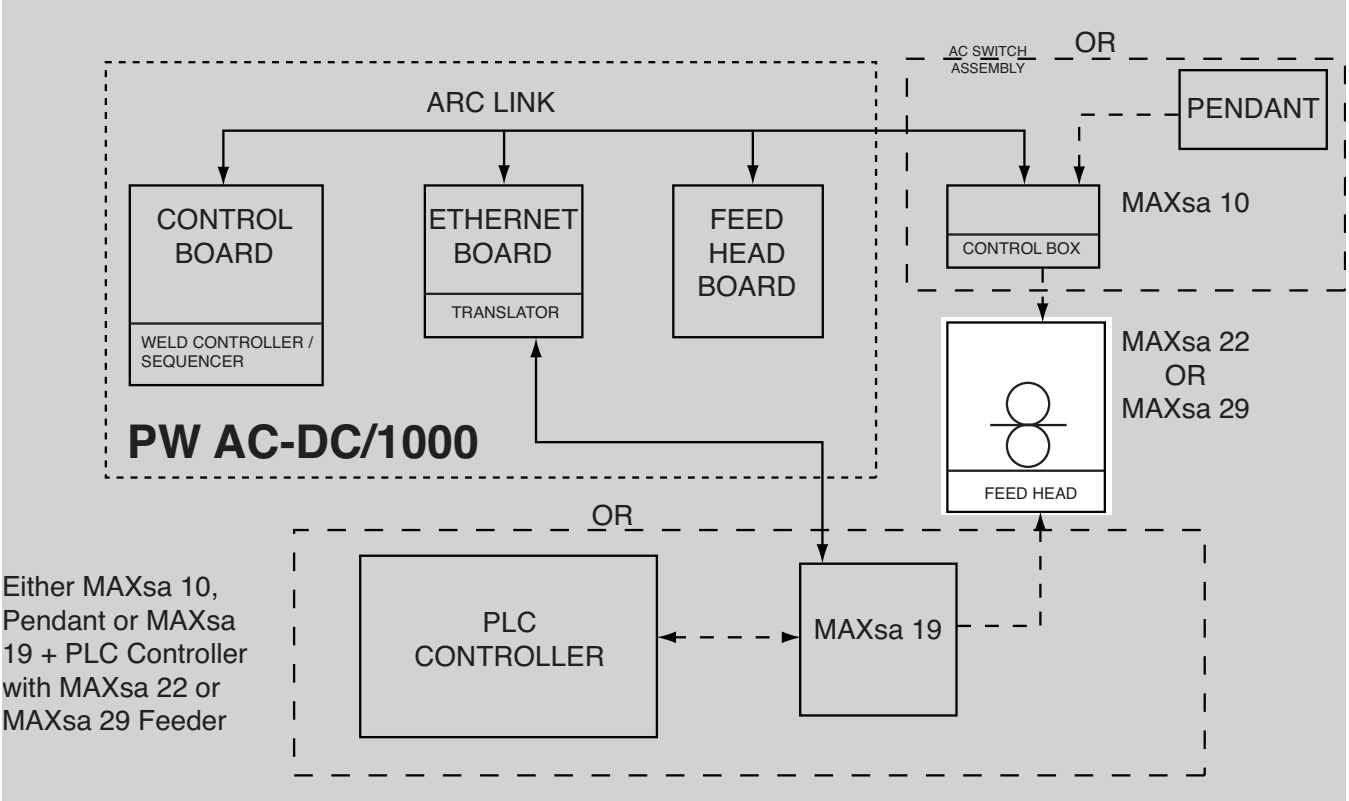
The MAXsa™ 19 controller is also designed to interface with Programmable Logic Controllers (PLCs) or custom controls.

The MAXsa™ 19 is required whenever a customer supplied user interface is used in place of a MAXsa™ 10 Controller.

Only one controller (MAXsa 10 or 19) and one wire drive (MAXsa 22 or 29) is used per machine setup.

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

FIGURE E.5 – MAXsa 22 & 29 WIRE DRIVES



MAXsa™ 22 & 29 WIRE DRIVES

The MAXsa™ 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 MAXsa™ 22 & 29 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. Depending on which options are used, the MAXsa™ has many axes of rotation for ease of fixturing and locating.

RECOMMENDED PROCESSES

- The MAXsa™ series of wire drive packages are best suited for submerged arc welding.

Only the MAXsa™ 22 or MAXsa™ 29 Wire Drives and MAXsa™ 10 or MAXsa™ 19 Controllers may be used with a K2803-1 Power Wave® AC/DC 1000® SD in a Multi Arc system. Other Lincoln or non-Lincoln Wire Drives can only be used with custom interfaces.

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

The Power Wave® AC/DC 1000® SD is suitable only for the Submerged Arc Process (SAW)

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

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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 listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, wire feeding problems, and welding 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. RECOMMENDED COURSE OF ACTION
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 specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

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

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ CAUTION

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

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

PC board can be damaged by static electricity.

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

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

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

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

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

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

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

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

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

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

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

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

Observe all Safety Guidelines detailed throughout this manual

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS - MAXsa 10

The MAXsa 10 is equipped with a Status Light. 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 and Wire Drive Module Status LEDs, and some basic troubleshooting charts for both machine and weld performance.

The STATUS LIGHTS are dual-color LEDs that indicate system errors. Normal operation for each is steady green. Error conditions are indicated in the following Table F.1.

TABLE F.1

Light Condition	Meaning
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 POWER WAVE® i400 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	Under normal conditions indicates Auto-mapping has failed. Also used by the Diagnostics Utility (included on the POWER WAVE® Utilities and Service Navigator CD's or available at www.powerwavesoftware.com) to identify the selected machine when connecting to a specific IP address.
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® Utilities and Service Navigator CD's or available at www.powerwavesoftware.com). This is the preferred method, since it can access historical information contained in the error log. To clear the active error(s), turn power source off, and back on to reset.
Steady Red	Not applicable.
Blinking Red	Not applicable.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)		POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ARCLINK SYSTEM ERROR CODES			
Err 31	Primary overcurrent.	1. 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. 2. See the power source Instruction Manual.	1. Perform the ***Output Rectifier Test***. 2. Perform the ***IGBT Switch Board Test***. 3. Perform the ***Input Rectifier Test***.
Err 32	Capacitor bank "A" under voltage.	1. The power source input power may be wired incorrectly. Verify the power source reconnect panel wiring matches the input power. 2. See the power source Instruction Manual.	
Err 33	Capacitor bank "B" under voltage.	1. The power source input power may be wired incorrectly. Verify the power source reconnect panel wiring matches the input power. 2. See the power source Instruction Manual.	
Err 34	Capacitor bank "A" over-voltage.	1. The power source input power may be wired incorrectly. Verify the power source reconnect panel wiring matches the input power. 2. See the power source Instruction Manual.	

⚠ 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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Below are errors implemented for the MAXsa™ 10.

Error Code	Source	UI Text	Reason
N/A	User Interface	" Limits Exceed " "Gear Box Type"	When a mode is selected with a work point low limit greater than the high WFS limit (no event is logged).
28	Feeder	"OUTPUT DISABLED"	The shutdown 2 input on the Feeder Board is open and P.21 is selected for "Output Disable".
83	Feeder	" UI Shutdown 1 "	The shutdown 1 input on the Feeder Board is open.
84	Feeder	" UI Shutdown 2 "	The shutdown 2 input on the Feeder Board is open.

Typical User Interface 3 digit error codes (not blinked on the status LED).

Error Code	Source	UI Text	Reason
213	User Interface	Power Source is Off-Line	User Interface could not communicate with control board in power source.
215		Feeder Board is Off-Line	Either no feed head board is connected, being reprogrammed or experiencing a fatal event.
247		N/A	Arc control has a latched fault. The UI will indicate a Reset button needs to be pressed to clear the fault.
274		N/A	Weld set change required clearing of user memory.
275		N/A	UI memory could not be saved. Contact Lincoln Electric Service Department for further support.
276		N/A	UI memory could not be restored. Contact Lincoln Electric Service Department for further support.
277		N/A	UI memories were converted due to change in number of UI parameters. Info only.
278		N/A	UI limits were converted due to change in number of UI parameters with limits. Info only.
281		(Varies based on the error type and who caused the error)	Internal Error. Collect all displayed values and contact Lincoln Electric Service Department.
282		(Varies based on the error type and who caused the error)	Internal Error. Collect all displayed values and contact Lincoln Electric Service Department.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)		POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ARCLINK SYSTEM ERROR CODES			
Err 35	Capacitor bank “B” overvoltage.	1. The power source input power may be wired incorrectly. Verify the power source reconnect panel wiring matches the input power. 2. See the power source Instruction Manual.	1. Perform the ***Thermostat Circuit Test***. 2. Perform the ***IGBT Test***.
Err 36	Thermal.	1. Power source overheating. Verify duty cycle is correct. Ensure adequate airflow around power source.	
Err 41	Long term secondary overcurrent.	1. The power source has exceeded the output current limits. Adjust the welding procedure to reduce the current draw. The welding procedure may exceed the capacity of the power source. 2. See the power source Instruction Manual.	
Err 43	Capacitors are out of balance.	1. Verify the power source reconnect panel wiring matches the input power. 2. See the power source Instruction Manual.	

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)		POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ARCLINK SYSTEM ERROR CODES			
Err 44	Main CPU problem.	1. Verify the earth ground connection to the power source is wired correctly. 2. See the power source Instruction Manual.	See ***Output Problems*** in Troubleshooting 3 column chart in SVM 205. Perform the Voltage Sense Lead Test: located in Power Wave Manager at powerwavesoftware.com which includes: 1. Weld Cable Test. 2. Output Rectifier Test.
Err 53	Voltage sense loss.	1. Verify correct sense lead connection.	
Err 54	Short term secondary overcurrent.		
Err 81	Motor overload, long term.	1. The wire drive motor has overheated. Check that the electrode slides easily through the nozzle. 2. Remove tight bends from conduit. 3. Check that the spindle brake is not too tight. 4. Verify a high quality electrode is being used. 5. Wait for the error to reset and the motor to cool (approximately 1 minute). 6. Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).	If all recommended possible areas of misadjustment have been checked and the problem persists. Perform the ***Wire Feed Motor Test***. Perform the ***Wire Feed Motor Test***: SVM 205.
Err 82	Motor overload, short term.	1. The wire drive motor current draw has exceeded limits, usually because the motor is in a locked rotor state. Check that motor can turn freely when idle arm is open. 2. Verify that the gears are free of debris and dirt.	

⚠ 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 CAUSE	RECOMMENDED COURSE OF ACTION
ARCLINK SYSTEM ERROR CODES			
Err 263	No usable weld modes.	1. The power source does not have any welding programs loaded. 2. See the power source Instruction Manual for load welding programs.	1. Perform snap shot and email to L.E. Powerwave Group.

Below are errors implemented for the MAXsa™ 10.

Error Code	Source	UI Text	Reason
N/A	User Interface	" Limits Exceed " " Gear Box Type "	When a mode is selected with a work point low limit greater than the high WFS limit (no event is logged).
28	Feeder	" OUTPUT DISABLED "	The shutdown 2 input on the Feeder Board is open and P.21 is selected for "Output Disable".
83	Feeder	" UI Shutdown 1 "	The shutdown 1 input on the Feeder Board is open.
84	Feeder	" UI Shutdown 2 "	The shutdown 2 input on the Feeder Board is open.

Typical User Interface 3 digit error codes (not blinked on the status LED).

Error Code	Source	UI Text	Reason
213	User Interface	Power Source is Off-Line	User Interface could not communicate with control board in power source.
215		Feeder Board is Off-Line	Either no feed head board is connected, being reprogrammed or experiencing a fatal event.
247		N/A	Arc control has a latched fault. The UI will indicate a Reset button needs to be pressed to clear the fault.
274		N/A	Weld set change required clearing of user memory.
275		N/A	UI memory could not be saved. Contact Lincoln Electric Service Department for further support.
276		N/A	UI memory could not be restored. Contact Lincoln Electric Service Department for further support.
277		N/A	UI memories were converted due to change in number of UI parameters. Info only.
278		N/A	UI limits were converted due to change in number of UI parameters with limits. Info only.
281		(Varies based on the error type and who caused the error)	Internal Error. Collect all displayed values and contact Lincoln Electric Service Department.
282		(Varies based on the error type and who caused the error)	Internal Error. Collect all displayed values and contact Lincoln Electric Service Department.

⚠ 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.

Typical User Interface 3 digit error codes (not blinked on the status LED).

Error Code	Source	UI Text	Reason
283	User Interface	(Varies based on the error type and who caused the error)	Internal Error. Collect all displayed values and contact Lincoln Electric Service Department.
285		N/A	UI memory could not be restored. Contact Lincoln Electric Service Department for further support.
612		{" Phase Gen Init "}, {"Duplicate Arc # "}, {" Mult Lead Arcs "}, {" Missing an Arc "}, {" Too Many Arcs "}, {"Missing Lead Arc"}, {" Missing an Arc "}	1 = Initializing Phase Generator 2 = Duplicate Arc #'s found 3 = Mult Lead Arcs found 4 = Missing a Trail Arc 5 = Too Many Arcs 6 = Missing Lead Arc 7 = Trail Arc dropped communication with Lead Arc

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The feeder does not power up - no display, no feed.	1. The Power Wave power source is OFF. Turn ON the Power Wave source. 2. The circuit breaker for the wire feeder on power source has tripped. Reset the circuit breakers. 3. The control cable may be loose or damaged. Tighten, repair or replace the control cable. 4. The power switch is damaged. Replace the power switch.	1. Perform the ***DC Bus 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		
Inconsistent wire feeding or wire not feeding but drive rolls turning.	1. The electrode is rusty or dirty. Use only clean electrode. Use quality electrode, like L-50 or L-56 from Lincoln Electric. 2. The contact tip is partially melted or has spatter. Replace the contact tip. 3. Improper tip, drive rolls and/or inner wire guide. Verify the proper parts are installed. 4. Incorrect tension arm pressure on the drive rolls. Adjust the tension arm per the Instruction Manual. Most electrodes feed well at a tension arm setting of "3". 5. Worn drive roll. Replace the drive rolls if worn or filled with dirt.	1. Perform the ***Wire Drive Test: Tachometer Test***.
Wire feed speed consistently operates at the wrong value.	1. The wire feeder gear setting is not properly set. Verify that the software setting matches the gear mounted. See the Instruction Manual for setting the gear ratio.	
Variable or "hunting" arc.	1. Wrong size, worn and/or melted contact tip. Replace the contact tip. 2. Worn work cable or poor work connection. Verify all work and electrode connections are tight and that the cables are in good condition. Clean/replace as necessary. 3. Wrong polarity. Adjust polarity to the recommended procedure. Verify DIP switch #7 setting matches the electrode polarity.	1. Confirm correct gear ratio on feeder. 2. Select matching ratio on MAXsa 10 controller. 3. Perform the ***Tachometer 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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USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS - MAXsa 19

The MAXsa™ 19 is equipped with a Status Light. 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 and Wire Drive Module Status LEDs, and some basic troubleshooting charts for both machine and weld performance.

The STATUS LIGHTS are dual-color LEDs that indicate system errors. Normal operation for each is steady green. Error conditions are indicated in the following Table F.2.

TABLE F.2

Light Condition	Meaning
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 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	Under normal conditions indicates Auto-mapping has failed. Also used by the Weld Manager Utility (included on the POWER WAVE® Submerged Arc Utilities and Service Navigator CD's or available at www.powerwavesoftware.com) to identify the selected machine when connecting to a specific IP address.
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 Weld Manager Utility (included on the POWER WAVE® Submerged Arc Utilities and Service Navigator CD's or available at www.powerwavesoftware.com). This is the preferred method, since it can access historical information contained in the error log. To clear the active error(s), turn power source off, and back on to reset.
Steady Red	Not applicable.
Blinking Red	Not applicable.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)		POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ARCLINK SYSTEM ERROR CODES			
Err 81	Motor Overload (long term).	1. The wire drive motor has overheated. Check that the electrode slides easily through feed system. 2. Remove tight bends from the feed conduit. 3. Check that the wire reel brake is not too tight. 4. Verify a high quality electrode is being used. 5. Wait for the error to reset and the motor to cool (approximately 1 minute). 6. Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).	1. Perform the Cold Inch Wire Speed Test. 2. Perform the WFS Feedback Test. 3. Perform the Power Feedback Status Test in PWM Power Wave Manager at powerwavesoftware.com
Err 82	Motor overload, short term.	1. The wire drive motor current draw has exceeded limits, usually because the motor is in a locked rotor state. Check that motor can turn freely when idle arm is open. 2. Verify that the gears are free of debris and dirt. 3. Check items listed for long term overload (Err 81).	
Err 83	Shutdown #1 is open.	1. This refers to the 'green' I/O connector on the bottom of the controller. If not being externally accessed, verify the integrity of the connector and jumper. If accessed through a remote circuit, verify the integrity of that circuit	1. Check for closed circuit on 9-0 at green I/O connector on MAXsa 19. 2. Check jumpers on 24 and 25 on terminals strip on MAXsa 10.

⚠ 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.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)		POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
ARCLINK SYSTEM ERROR CODES			
Err 84	Shutdown #2 is open.	1. This refers to the 'green' I/O connector on the bottom of the controller. If not being externally accessed, verify the integrity of the connector and jumper. If accessed through a remote circuit, verify the integrity of that circuit.	1. Verify closed circuit 9-11 on green connector MAXsa 19. 2. Check jumper closed circuit 26-27 on terminal strip of MAXsa 10. 3. Perform the ***Tachometer Test***. 4. Run Wire Feed Tests in PWManager.
Err 6311	Unstable or "noisy" wire feed speed (WFS) feedback signal.	1. Check the cables and connections to the Wire Drive. 2. Check the Wire Drive control cable routing (see Control Cable Connection- General Guidelines). 3. Check the Tachometer Interface Board.	

⚠ 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 Controller/Interface (MAXsa 10 or 19) does not power up: No display, no cold wire feed.	1. Make certain the PowerWave AC/DC 1000 SD is receiving the correct three phase input voltage and the machine is turned on. 2. The Arclink control cable between the power source and the interface may be loose or damaged.	1. Check for the presence of 40VDC at pin D+ to pin E- at the Arclink receptacle. See the ***Wiring Diagram***. 2. If the 40VDC is not present at the Arclink receptacle check the leads between the DC Bus Board and the Arclink receptacle. See the ***Wiring Diagram***. 3. If the 40VDC is not present at the Arclink receptacle perform the ***DC Bus Board Test***. 4. If the 40VDC is present at the Arclink receptacle and the Controller/Interface does not power-up there is a problem in the Arclink control cable or the Controller/Interface.

⚠ 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.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The feeder does power up but there is no wire feed.	1. The control cable may be loose or damaged. Tighten, repair or replace the control cable. 2. Check for the proper command information from the customer supplied user interface.	1. Perform the Cold Inch WFS Test in Power Wave Manager. Verify proper performance. 2. Perform the ***Wire Feed Motor Test***. 3. Replace Feed Head Board.
Inconsistent wire feeding or wire not feeding but drive rolls turning.	1. The electrode is rusty or dirty. Use only clean electrode. Use quality electrode, like L-50 or L-56 from Lincoln Electric. 2. The contact tip is partially melted or has spatter. Replace the contact tip. 3. Improper tip, drive rolls and/or inner wire guide. Verify the proper parts are installed. 4. Incorrect tension arm pressure on the drive rolls. Adjust the tension arm per the Instruction Manual. Most electrodes feed well at a tension arm setting of “3”. 5. Worn drive roll. Replace the drive rolls if worn or filled with dirt.	1. Perform Cold Feed checks in Power Wave Manager to verify operation 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.

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Wire feed speed consistently operates at the wrong value.	1. The wire feeder gear setting is not properly set. Verify that the software setting matches the gear mounted. See the Instruction Manual for setting the gear ratio.	1. Verify gear box ratio of MAXsa 10 ratio P18 matches gear box ratio of drive. 2. Verify P.C.C./gear box speeds match via PWM and submerged arc utilities software.
Variable or “hunting” arc.	1. Wrong size, worn and/or melted contact tip. Replace the contact tip. 2. Worn work cable or poor work connection. Verify all work and electrode connections are tight and that the cables are in good condition. Clean/replace as necessary. 3. Wrong polarity. Adjust polarity to the recommended procedure. Verify DIP switch #7 setting matches the electrode polarity.	1. Power Wave Manager 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.

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MAXsa 10 PENDANT MODULE TEST 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.

TEST DESCRIPTION

This procedure will aid the technician in the test and repair of the MAXsa™ 10 Pendant.

MATERIALS NEEDED

Torx Number 27 Driver
Digital Voltmeter / Ohmmeter With Frequency Measuring Capability
Cruiser Tractor And AC / DC 1000 Subarc Setup

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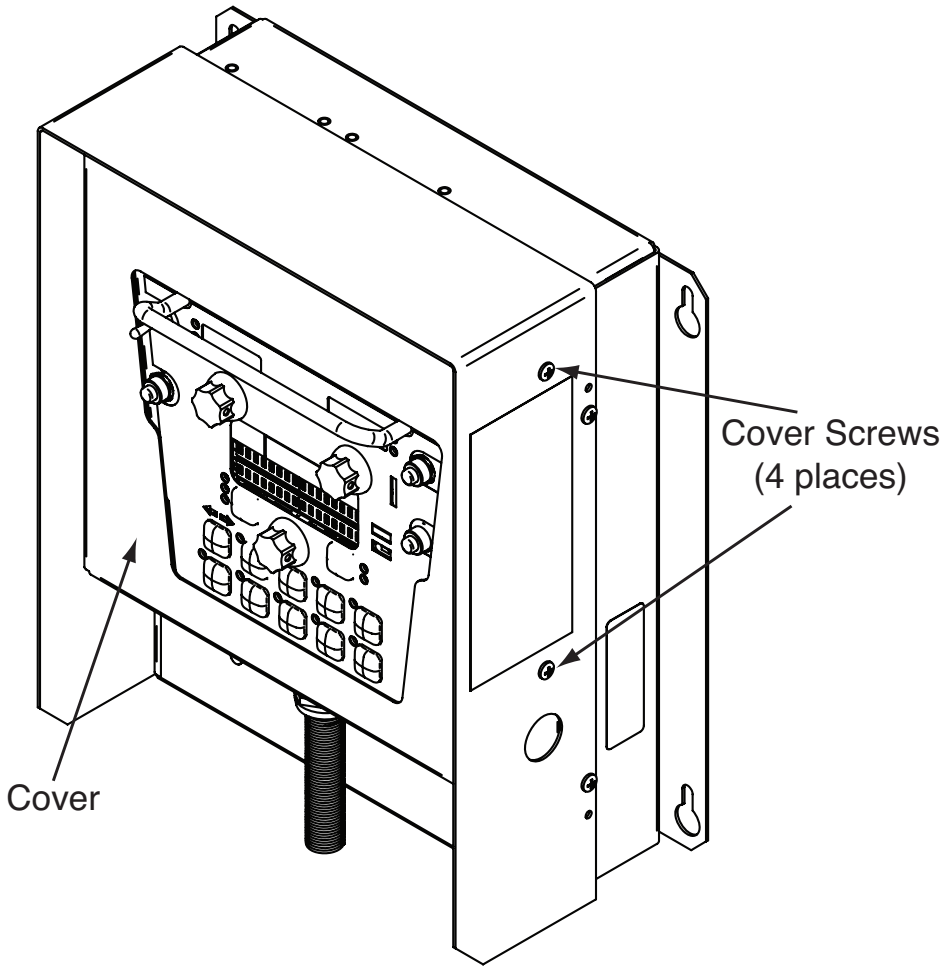
MAXsa 10 PENDANT MODULE TEST PROCEDURE (continued)

FIGURE F.1 – MAXsa 10 CONTROLLER PENDENT MODULE



PROCEDURE

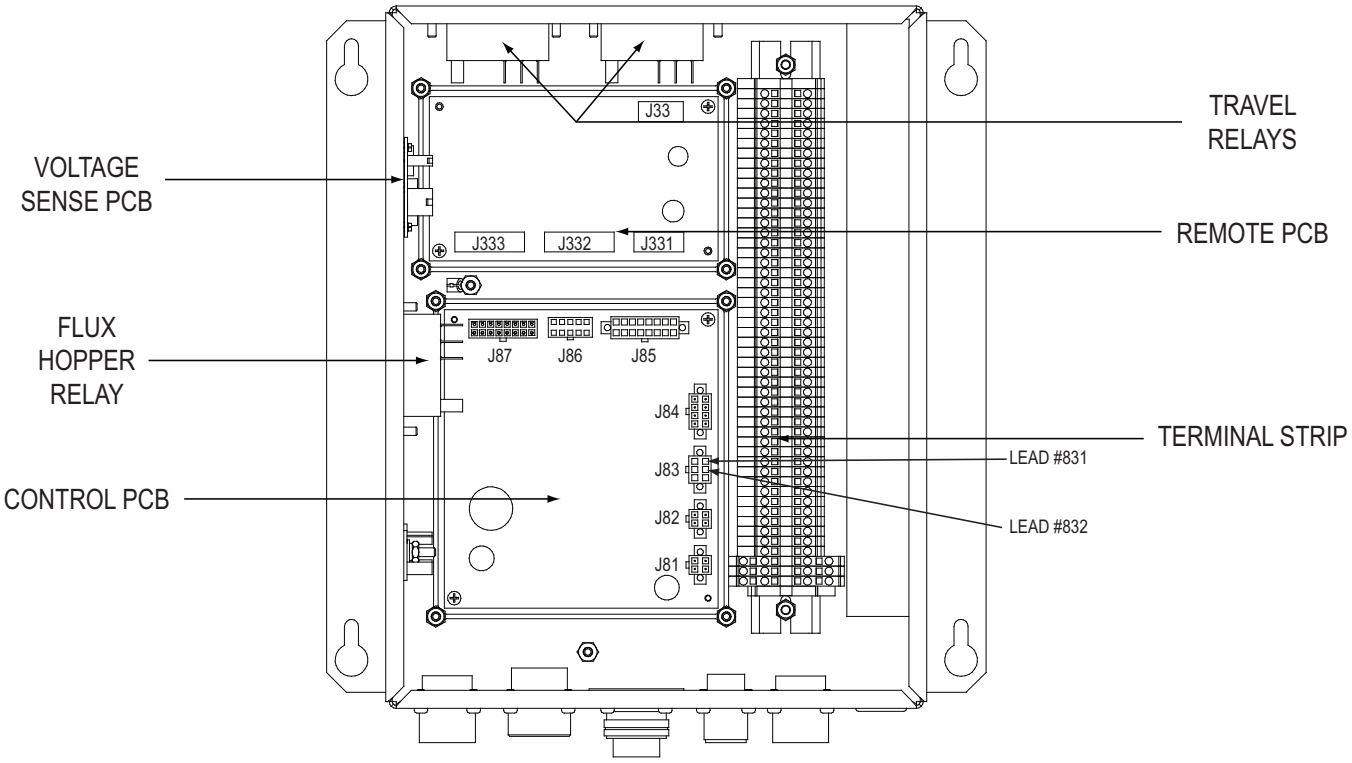
1. Turn off AC/DC 1000 and open input power disconnect. Insure power is off to Pendant by attempting to turn on the AC / DC 1000. Leave in the off position.
2. Carefully push each of the buttons and feel for the click of the switch under each protective pad. Rotate the three encoders, paying close attention to the feel of the shaft within the knobs. If a knob and shaft are loose, or come off the Pendant, or if one or more switches covered with rubber protectors does not actuate, the Pendant circuit board must be replaced.
3. Remove the six #27 Torx head machine screws which secure the back cover of the Pendant box, and remove back.
4. Turn on the AC / DC 1000. Check for any LED lights on the Pendent. If no LEDs light, check for 40 volts dc at cavities 3, and 4, at J31 while the input cable to the Pendent is plugged into J31.
5. Switch your meter to measure frequency and check for Hertz at J31 cavities 1 and 2.

If 40 volts are present, and frequency is present, but no LEDs are lit on the pendent, the Pendent PC board is suspect.

If 40 volts is present, and all LEDs appear to function as intended, but nothing operates when required, locate the center tab of the travel switch, S1. With power removed, using an ohmmeter, check for continuity from this center tab to the stop push button, S2 - terminal that has a single lead, 624 attached.

MAXsa 10 PENDANT MODULE TEST PROCEDURE (continued)

FIGURE F.2 – MAXsa 10 CONTROLLER LAYOUT



If open, the stop switch is defective, if continuity is present, the stop switch is not suspect.

If 40 volts is not present, and or no frequency is present, the Pendent itself is not suspect, but it is necessary to check continuity of the five leads from J31, and ground to J82 at the wire drive motor PC board, J82.

With power once again disconnected from the AC/DC 1000 SD, check continuity from J31 in the Pendent - cavities one thru four to the corresponding cavities one thru four at the wire drive PC board (upper) in the MAXsa 10 controller.

If continuity checks OK, the Pendent and cable are not suspect. Go to the ***Wire Feed Motor Test***.

Return to Section TOC
Return to Master TOC

NOTES

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

VOLTAGE SENSE BOARD

⚠ 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.

TEST DESCRIPTION

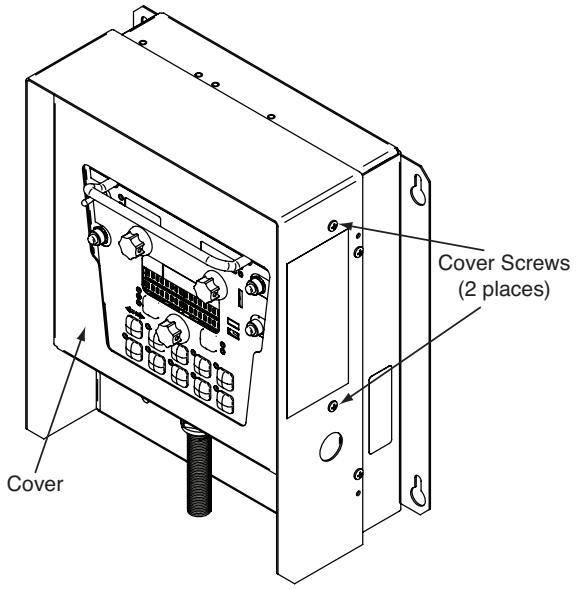
This test will help determine if the Voltage Sense Board is functioning correctly.

MATERIALS NEEDED

Phillips Screwdriver
Volt / Ohmmeter
Wiring Diagram

VOLTAGE SENSE BOARD (continued)

FIGURE F.3 – MAXsa 10 CONTROLLER



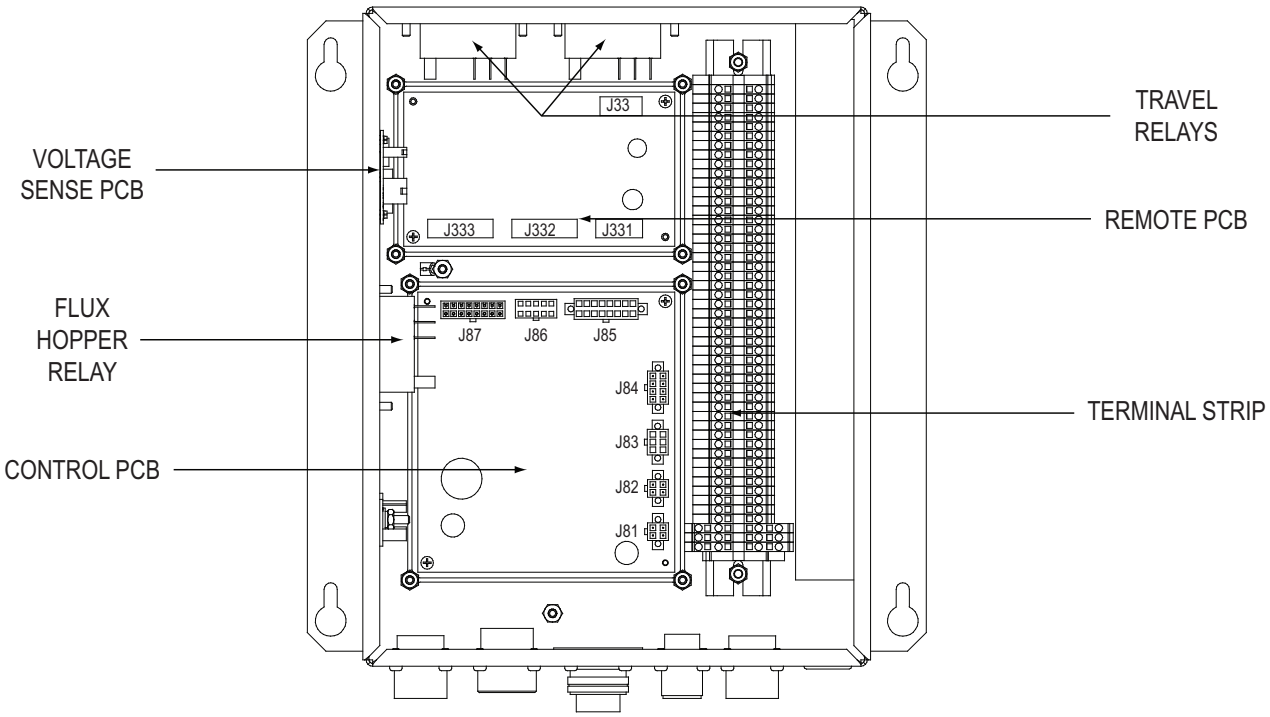
⚠ WARNING

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. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Using the phillips screwdriver, remove the two screws from the right side of the MAXsa 10 control box. See Figure F.3.
3. Open the access door and locate the Voltage Sense Board in the MAXsa 10 or 19 Controller. Figure F.4.

FIGURE F.4 – MAXsa 10 CONTROLLER LAYOUT



VOLTAGE SENSE BOARD (continued)

TABLE F.3 – VOLTAGE SENSE BOARD VOLTAGE TEST

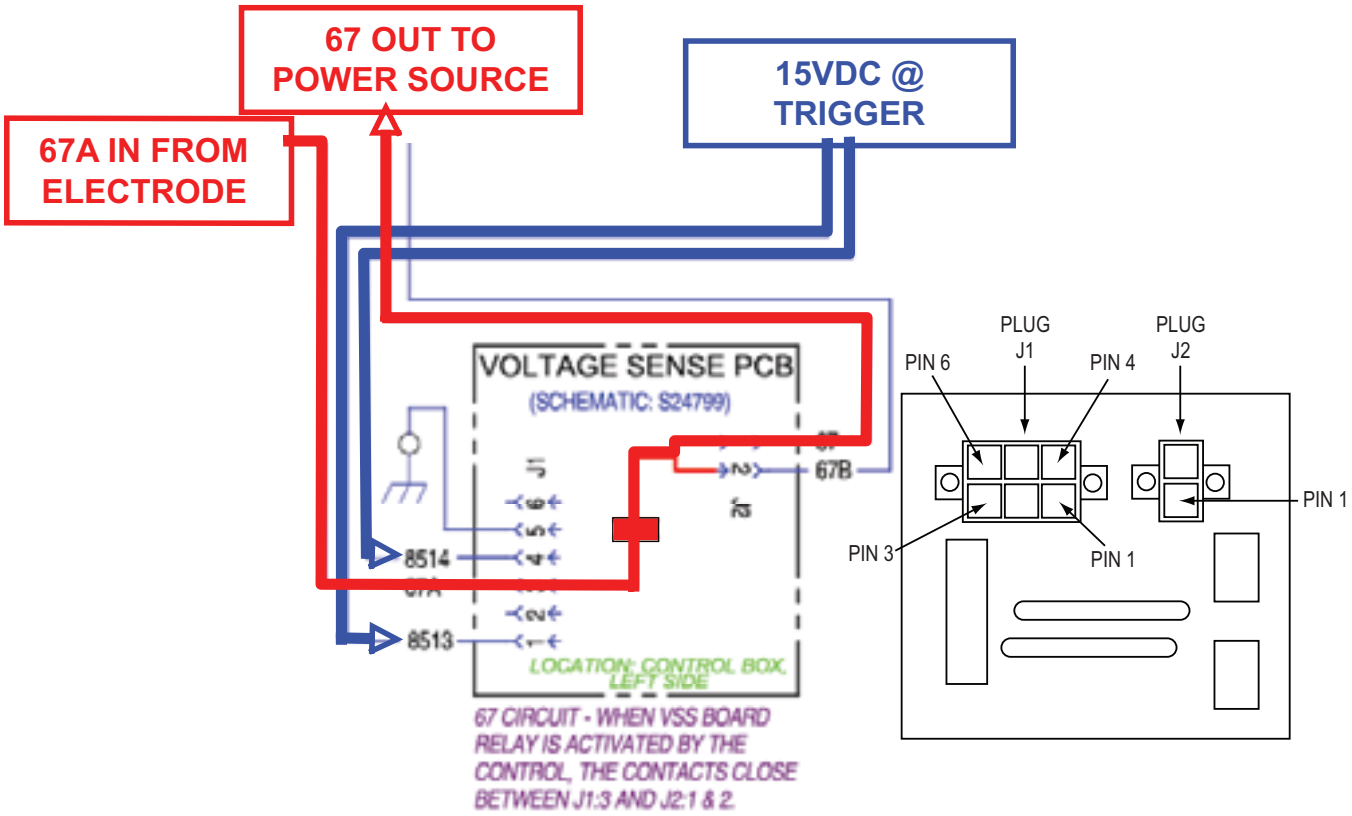
Description	Test Point	Test Point	Expected Reading	Conditions & Comments
Check electrode voltage from PW AC/DC 1000 SD and 67A Lead	Plug J1 Pin 3 (Lead 67A)	Power Wave Work Stud	Approximately 85 VDC	Start Switch energized. Lead 67A must be connected to electrode potential
Check activation signal from MAXsa 10 or 19 Control Board	Plug J1 Pin 1 (Lead 8513+)	Plug J1 Pin 4 (Lead 8514-)	15VDC	Start Switch energized
Check electrode voltage from PW AC/DC 100 SD and 67 Lead	Plug J2 Pin 1 (Lead 67)	Power Wave Work Stud	Approximately 85 VDC	Start Switch energized and activation signal present at Voltage Sense Board. See previous check above.

4. Apply the correct input power to the Power Wave® AC/DC 1000® SD and turn on the machine. Make sure the MAXsa 10 or MAXsa 19 Controller and the wire drive are connected properly to the Power Wave® AC/DC 1000® SD.
5. Perform the tests in Table F.3. ***See Figure F.5***.
6. If the test results are OK per Table F.3 the Voltage Sense Board is functioning correctly.
7. If the activation signal is present and the electrode voltage is present at lead 67A but not at lead 67 the Voltage Sense Board may be faulty.
8. If the electrode voltage is not present at lead 67A check the continuity of lead 67A. See the 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

VOLTAGE SENSE BOARD (continued)

FIGURE F.5 – VOLTAGE SENSE BOARD DRAWING AND TEST POINTS



WIRE 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.

TEST DESCRIPTION

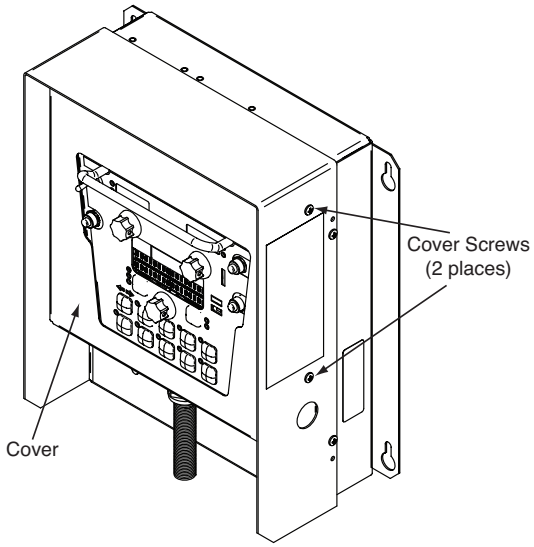
This test will help determine if the Wire Feed Motor is working properly and if it is receiving the correct voltages from the Control Board in the MAXsa™ 10 or 19 Controller.

MATERIALS NEEDED

Phillips Screwdriver
Volt / Ohmmeter
Variable External 32VDC Supply
Wiring Diagram

WIRE FEED MOTOR TEST (continued)

FIGURE F.6 – MAXsa 10 OR 19 CONTROLLER



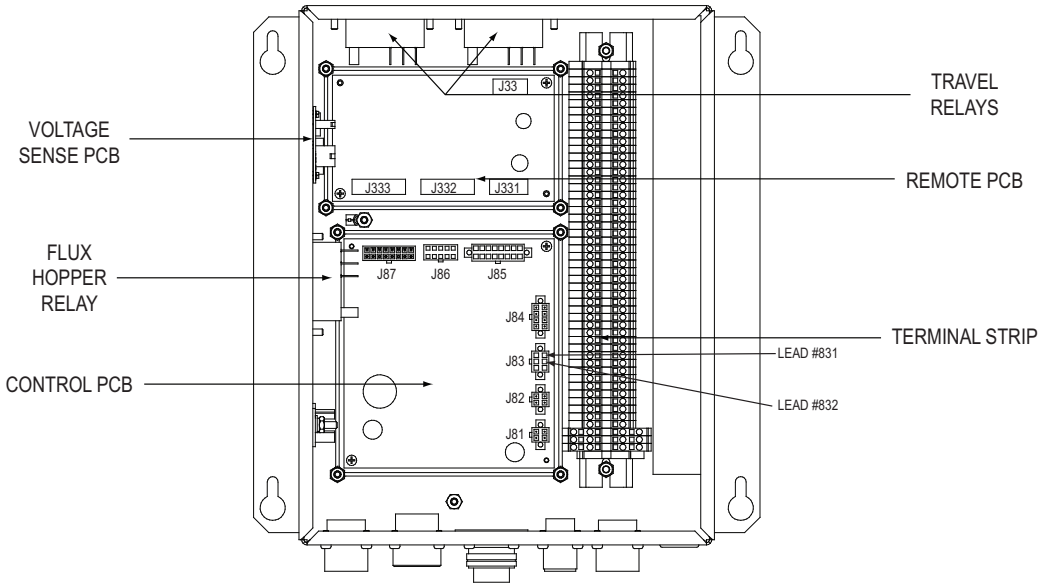
⚠ WARNING

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.**

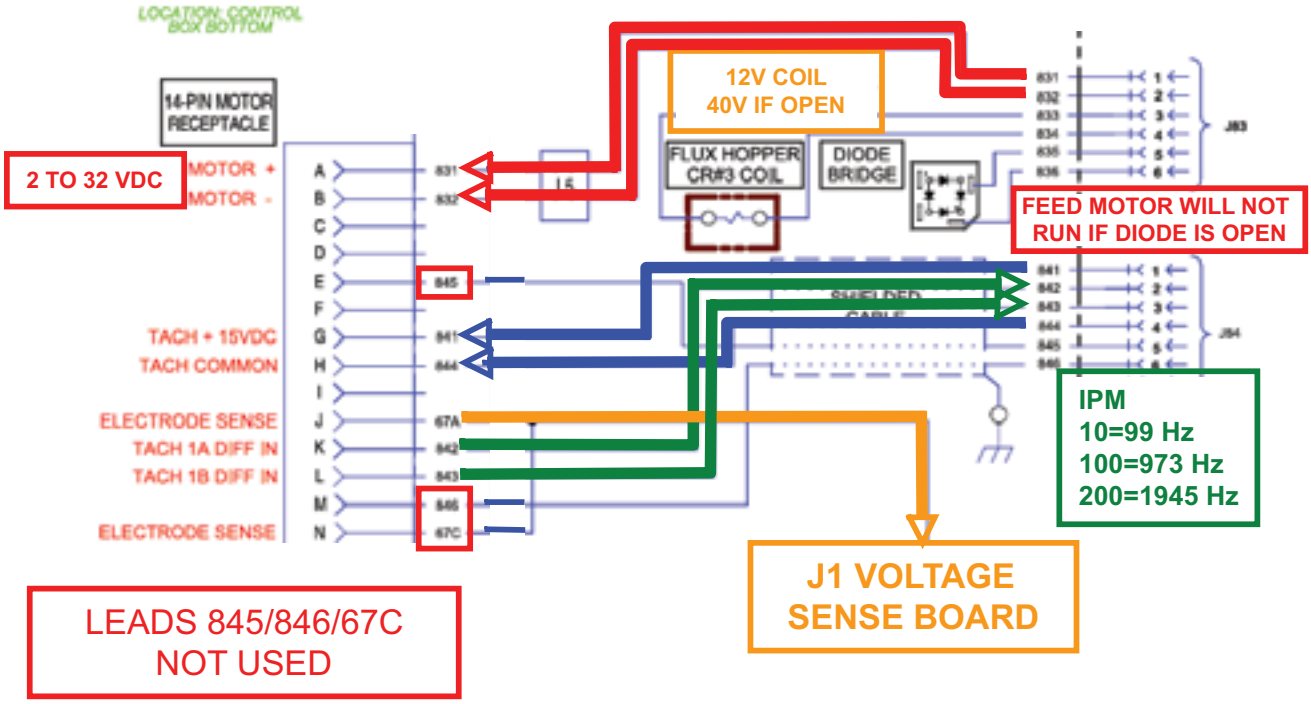
1. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Using the phillips screwdriver, remove the two screws from the right side of the MAXsa 10 control box. See Figure F.6.
3. Open the access door and locate the control board in the MAXsa 10 or 19 Controller. Figure F.7.
4. Locate and remove Plug J83 on the control board. See Figure F.7.

FIGURE F.7 – MAXsa 10 CONTROLLER LAYOUT



WIRE FEED MOTOR TEST (continued)

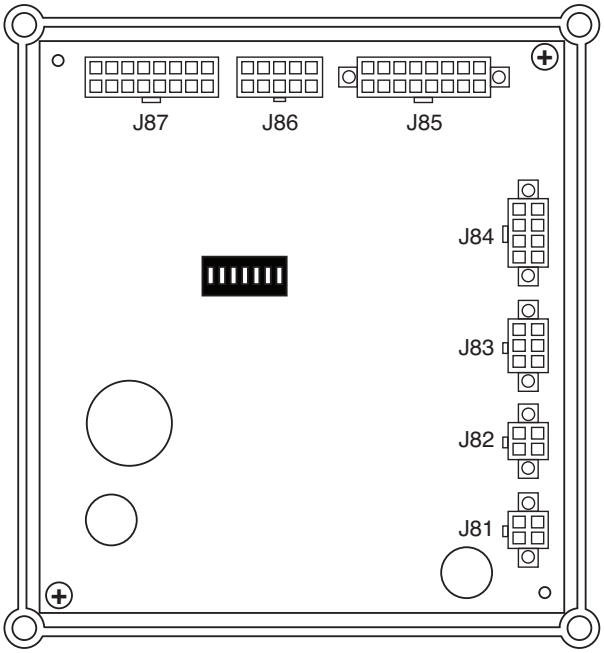
FIGURE F.8 – MAXsa 10 AND 19 MOTOR CONTROL FEED HEAD BOARD



5. Check the motor armature resistance from pin 1 (lead 831) to pin 2 (lead 832). The normal armature resistance is approximately 0.7 ohms. ***See Figure F.7*** and Figure F.8.
6. Check the resistance from either armature lead to the motor case. The acceptable resistance should be greater than 1 million ohms.
7. Replace Plug 83 into the control board.
8. Apply the correct input power to the Power Wave® AC/DC 1000® SD and turn on the machine. Make sure the MAXsa 10 or 19 Controller and the wire drive are connected properly to the Power Wave machine.
9. Check the armature voltage being applied to the motor at Plug J83 pin 1 (lead 831) to pin 2 (lead 832). ***See Figure F.7***. The voltage should range from 2.0VDC to 31.5VDC depending upon the motor speed setting. The armature voltage can be varied by changing the inching speed. If this voltage is not present the control board may be faulty.
10. If the armature voltage is present, variable and linear and the motor speed is erratic, check for worn brushes or signs of arcing on the commutator. This may indicate a shorted or grounded armature.
11. To further check the functionality of the motor remove plug J83 from the control board and apply the external variable 32VDC supply to leads #831 to #832. As the external supply is varied from low to high voltage the motor speed should increase accordingly.

WIRE FEED MOTOR TEST (continued)

FIGURE F.9 – WIRE FEED BOARD (L11087 SERIES)



Functions

– Controls operation of welding apparatus
  – MAXsa Feeder
    • Drive
    • Tachometer Feedback
  – Flux Hopper Relay
  – Travel Carriage Relay via G4018
  – Two Shutdown Inputs
  – Remote Start and Stop
– Contains hardware to drive related peripherals
  – Voltage Sense Select PC Board

J81 – ArcLink and Input Power

J82 – ArcLink and Input Power

J83 – Motor Power, Flux Hopper Control

J84 – Tachometer Input

J85 – External Inputs, Status LED, Voltage Sense Control

J86 – To Remote Board (SPI)

J87 – N/C

WIRE FEED MOTOR TEST (continued)

WIRE FEED BOARD (L11087 SERIES)

Simplified Test Procedure

- Not equipped with on board status indicators.
  - External Status Indicator located on front panel.
- If status light is not lit suspect a power problem
  - Check for 40VDC supply at 3:J81 and 4:J81
  - If voltage is present, and status LED circuit is intact, reload software or replace board
- If board appears functional, but will not communicate:
  - Suspect a communication problem
  - Use Power Wave Manager to verify the board is present in the system

Go to “Powerwavesoftware.com”, and download the Weld Manager software which will enable you to view the wire feed board, and determine if it is receiving and communicating with the control board of the AC/DC 1000 SD.

NOTES

Return to Section TOC
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Return to Master TOC

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.

TEST DESCRIPTION

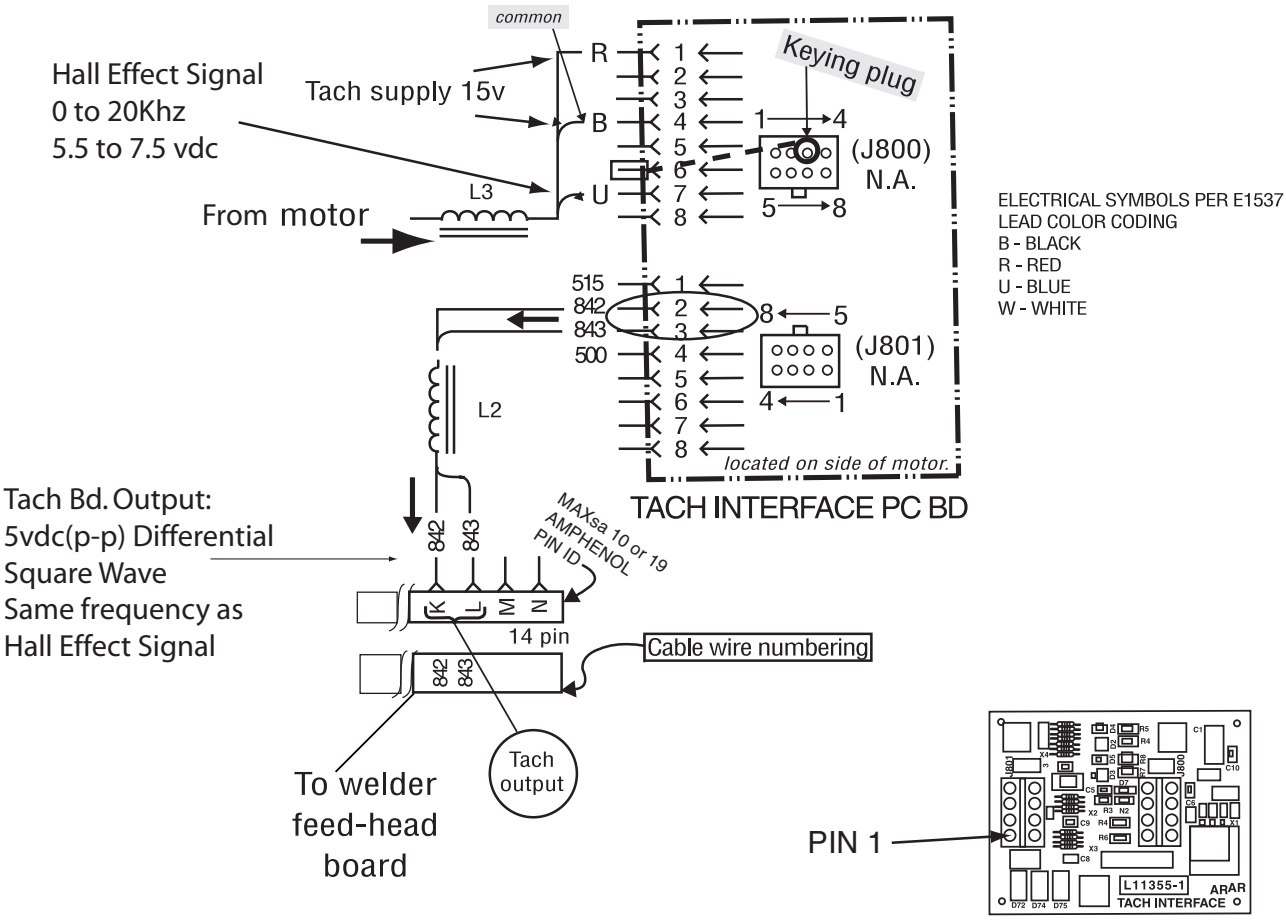
This test will help determine if the Tachometer Feedback Circuit is working correctly.

MATERIALS NEEDED

Voltmeter (With A Frequency Counter)

TACHOMETER TEST (continued)

FIGURE F.10 – TACHOMETER SCHEMATIC DIAGRAM



PROCEDURE

The Tachometer is located in the connection box on the side of the MAXsa 22 or 29 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.

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.

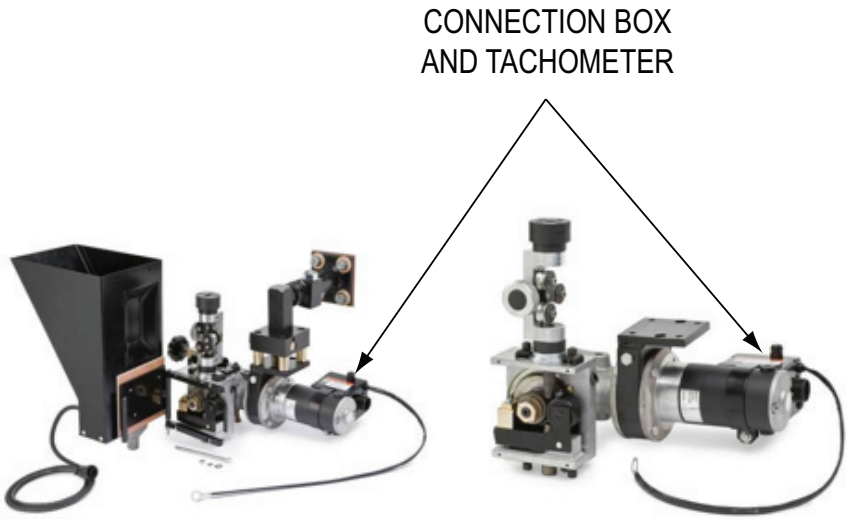
   5 VDC (peak to peak) square wave.

   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.

TACHOMETER TEST (continued)

FIGURE F.11 – CONNECTION BOX LOCATION



⚠ 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. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Locate the connection box. See Figure F.11.
3. Using the 7/16 inch wrench, remove the screw securing the connection box to the motor housing.
4. Locate the Tach Interface board inside of the connection box.
5. Carefully apply the correct input power to the Power Wave® AC/DC 1000® SD machine.
6. Using the Voltmeter, carefully perform the tests per Table F.4. ***See Figure F.12***.

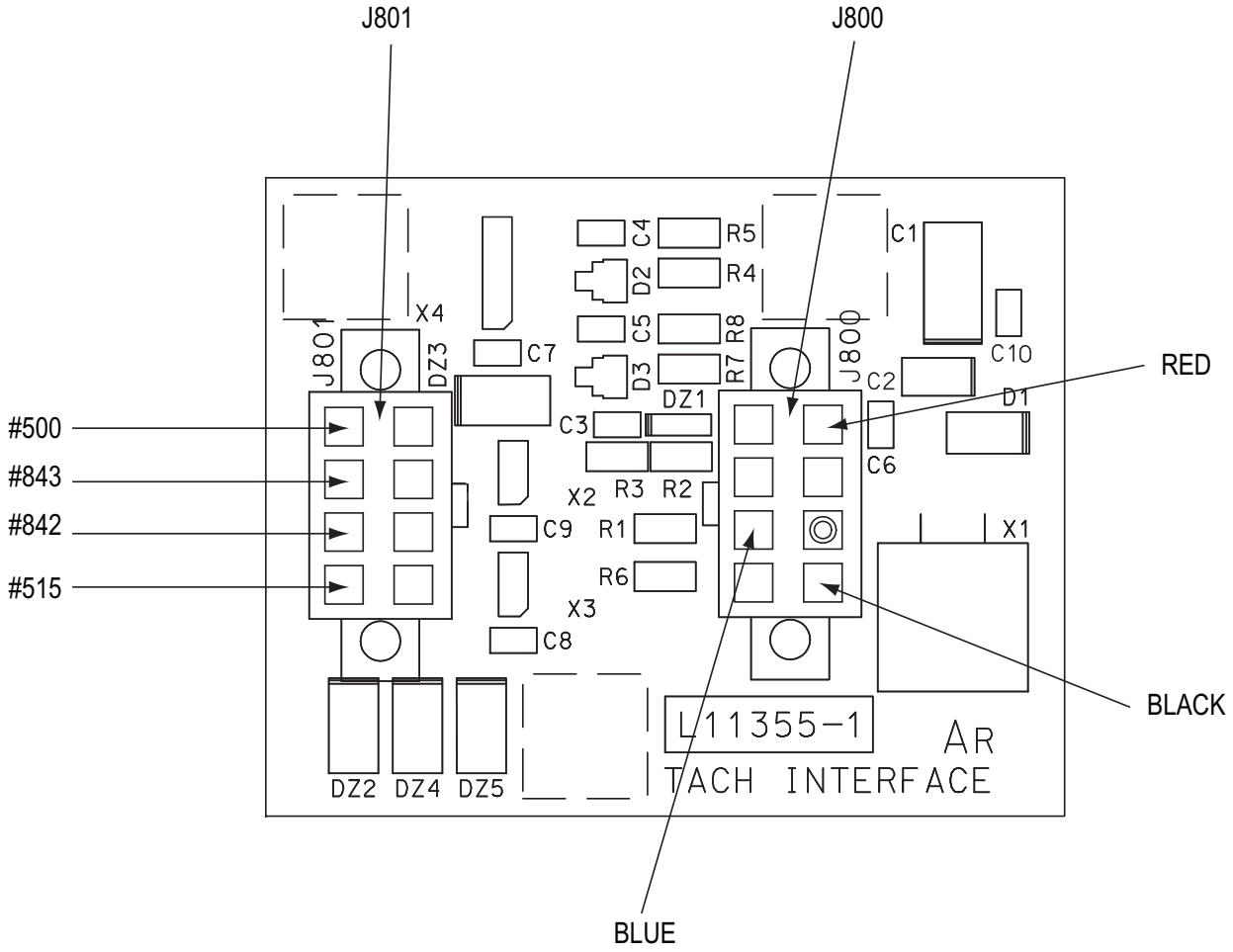
TABLE F.4 – TACHOMETER INTERFACE BOARD VOLTAGE TESTS

Description	Test Point	Test Point	Expected Reading	Conditions / Comments
Supply from MAXsa 10 to Tach	Plug J801 Pin 1 (Lead 515+)	Plug J801 Pin 4 (Lead 500-)	15 VDC	MAXsa 10 or 19 energized
Supply from Interface Board to Hall Effect Device	Plug J800 Pin 1 (Red Lead +)	Plug J800 Pin 4 (Black Lead-)	15 VDC	MAXsa 10 or 19 energized
Feedback from Hall Effect Device to Interface Board	Plug J800 Pin 7 (Blue Lead +)	Plug J800 Pin 4 (Black Lead-)	5.5 to 7.5VDC @ 0-50khz	Motor running. Feedback voltage and frequency dependent on motor RPM
Output from Tach Interface Board	Plug J801 Pin 2 (Lead 842)	Plug J801 Pin 3 (Lead 843)	0VDC (+/- 2.5VDC)	Motor running. Differential signal @ 0-50khz

Return to Section TOC
Return to Master TOC

TACHOMETER TEST (continued)

FIGURE F.12 – TACH INTERFACE BOARD TEST POINTS



7. If the 15VDC supply voltage is not present check at the feed head board in the MAXsa 10 or 19 Controller.
8. If the 15VDC supply voltage from the Tach Interface board to the Hall Effect Device is present but the feedback voltage/frequency is not present or not correct check the adjustment of the Hall Effect Device as follows.
   - Remove the input power to the unit.
   - Loosen the locking nut on the Hall Effect Device.
   - Gently “bottom out” the device and then back it out ½ turn.
   - Carefully tighten the locking nut without allowing the Hall Effect Device to move.
   - Check the Hall Effect feedback per ***Table F.4***.

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.

TEST DESCRIPTION

The Input Filter Capacitors are located on both the top left and top right sides of the power source. This procedure should be performed before any internal maintenance or repair procedures are attempted on the Power Wave® AC/DC 1000® SD.

MATERIALS NEEDED

3/8” Wrench
Volt / Ohmmeter
Resistor (25-1000 Ohms @25 Watts (Minimum))
Electrically Insulated Gloves And Pliers

Return to Section TOC
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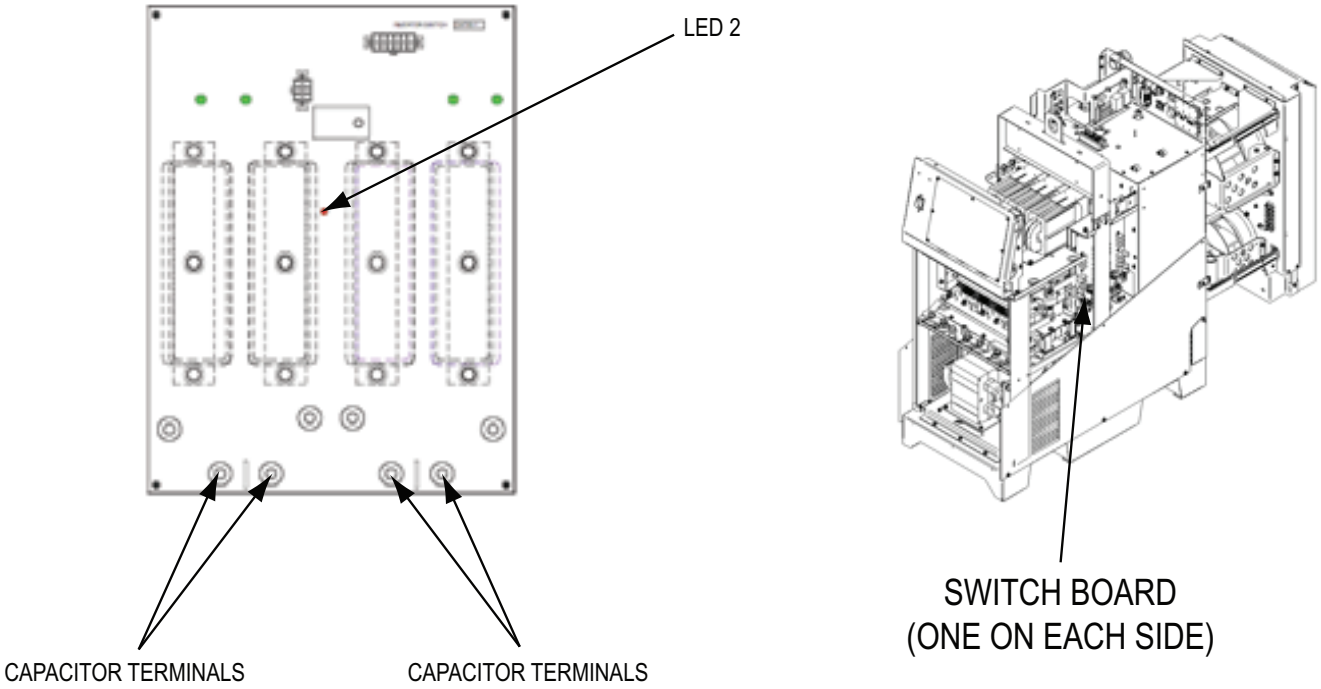
Return to Master TOC

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE (continued)

FIGURE F.13 – SWITCH BOARD



⚠ 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. Remove the input power to the Power Wave AC/DC 1000 SD machine.
2. Using the 3/8 inch wrench, remove the upper left and right metal case sides.
3. Take note of the red LEDs #2 located on both switch boards. (left and right sides). See Figure F.13. If either of the red LEDs #2 are ON, this is an indication of a voltage greater than 2.0 VDC on the filter capacitors.

Even if the LEDs #2 are NOT ON continue with this test procedure to verify that the filter capacitors are fully discharged and no voltage is present.

4. Be careful not to make contact with the capacitor terminals that are located in the lower portion of the left and right side switch boards. See Figure F.13.
5. Carefully check for a DC voltage at the capacitor terminals on both switch boards. There are two filter capacitors on each switch board for a total of four filter capacitors per machine. See Figure F.13.

NOTE: The capacitor polarity is marked on the switch boards.

6. If any voltage is present proceed to the next step. If no capacitor voltage is present the filter capacitors are fully discharged.

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

7. Using the high wattage resistor (25-1000 ohms @ 25 watts) and the electrically insulated gloves and pliers, carefully connect the resistor across the two capacitor terminals. Hold the resistor in place for ten seconds. See Figure F.13. Repeat this discharge procedure for all of the four filter capacitors. (two filter capacitors on each switch board). **DO NOT TOUCH THE FILTER CAPACITOR TERMINALS WITH YOUR BARE HANDS. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.**
8. Recheck the voltage across all of the filter capacitor terminals. The voltage should be zero. If any voltage remains repeat the discharge procedure.

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.

TEST DESCRIPTION

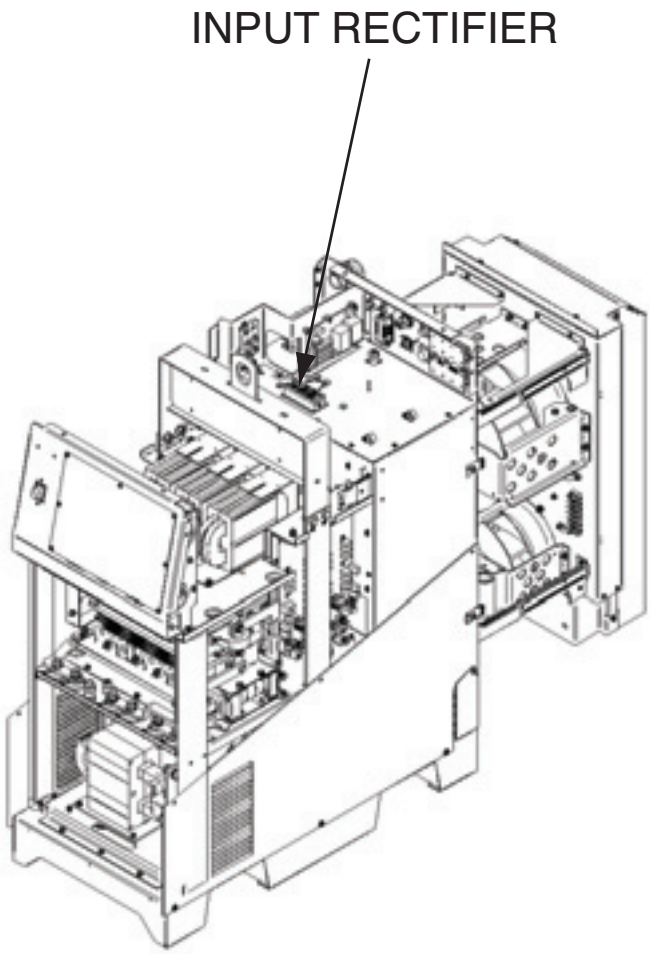
This test will help determine if the Input Rectifier is operational or “open or shorted”.

MATERIALS NEEDED

Volt / Ohmmeter
Wiring Diagram

INPUT RECTIFIER TEST (continued)

FIGURE F.14 – INPUT RECTIFIER LOCATION



PROCEDURE

1. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Using the 3/8 inch wrench, remove the case top.
3. Perform the ***Input Filter Capacitor Discharge Procedure***.
4. Locate the Input Rectifier. See Figure F.14.

Return to Section TOC
Return to Master TOC
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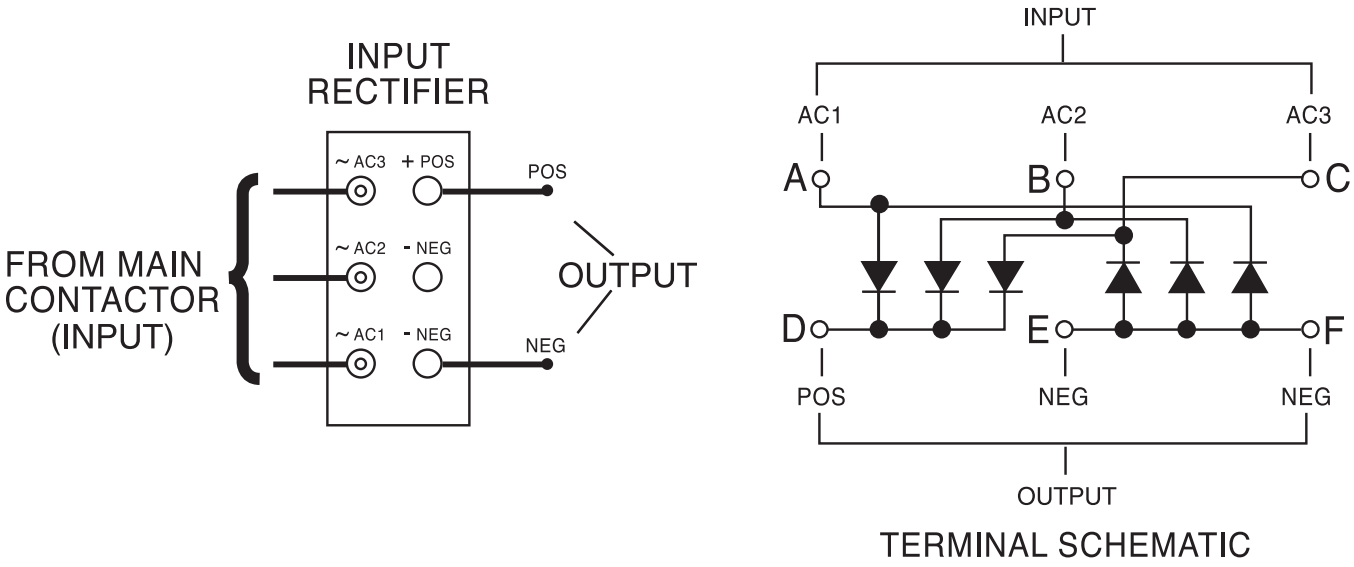
INPUT RECTIFIER TEST (continued)

FIGURE F.15 – INPUT RECTIFIER TERMINAL LOCATIONS



5. Using the Volt / Ohmmeter (diode test), check the Input Rectifier per Table F.5. Also see Figure F.15. See the Wiring Diagram.
6. Failure of the Input Rectifier is typically the result of another problem. If the Input Rectifier does not pass the tests detailed in Table F.5. perform the ***IGBT Switch Board Test***.
7. If the Input Rectifier is faulty replace it.

TABLE F.5 – INPUT RECTIFIER TEST POINTS AND ACCEPTABLE READINGS

+ Probe (RED)	- Probe (BLACK)	Result
A (Contactor T1)	**D** (Left Switchboard "+" Cap Terminal)	0.3V - 0.7V
B (Contactor T2)	**D** (Left Switchboard "+" Cap Terminal)	0.3V - 0.7V
C (Contactor T3)	**D** (Left Switchboard "+" Cap Terminal)	0.3V - 0.7V
D (Left Switchboard "+" Cap Terminal)	**A** (Contactor T1)	OPEN
D (Left Switchboard "+" Cap Terminal)	**B** (Contactor T2)	OPEN
D (Left Switchboard "+" Cap Terminal)	**C** (Contactor T3)	OPEN
F (Right Switchboard "-" Cap Terminal)	**A** (Contactor T1)	0.3V - 0.7V
F (Right Switchboard "-" Cap Terminal)	**B** (Contactor T2)	0.3V - 0.7V
F (Right Switchboard "-" Cap Terminal)	**C** (Contactor T3)	0.3V - 0.7V
A (Contactor T1)	**F** (Right Switchboard "-" Cap Terminal)	OPEN
B (Contactor T2)	**F** (Right Switchboard "-" Cap Terminal)	OPEN
C (Contactor T3)	**F** (Right Switchboard "-" Cap Terminal)	OPEN

NOTES

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

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.

TEST DESCRIPTION

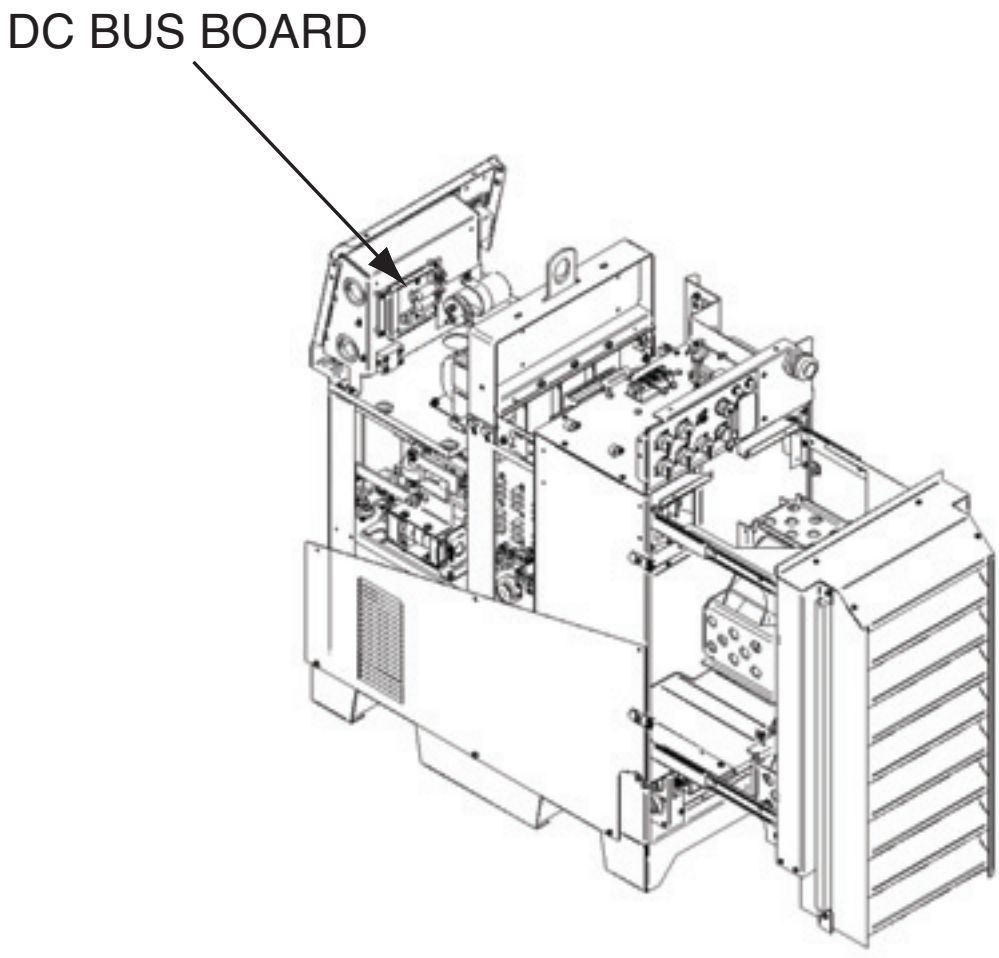
This test will help determine if the DC Bus Board is receiving the correct input voltage and if the board is functioning correctly.

MATERIALS NEEDED

Volt / Ohmmeter
Wiring Diagram

DC BUS BOARD TEST (continued)

FIGURE F.16 – DC BUS BOARD LOCATION



⚠ 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.**

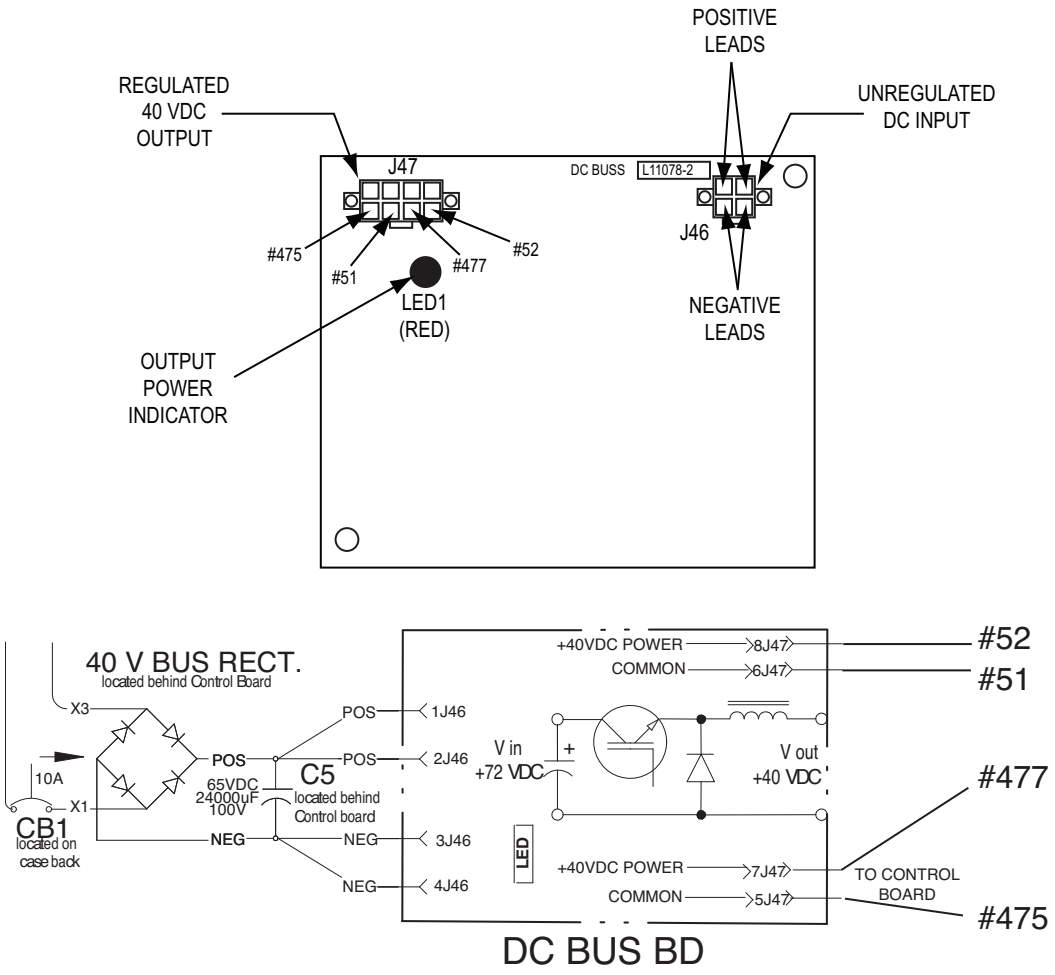
PROCEDURE

1. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Using the 3/8 inch wrench, remove the case top.
3. Locate the DC Bus Board. See Figure F.16.
4. Carefully apply the correct input power to the Power Wave® AC/DC 1000® SD machine.

Return to Section TOC
Return to Master TOC

DC BUS BOARD TEST (continued)

FIGURE F.17 – DC BUS BOARD TEST POINTS



5. Locate the red LED on the DC Bus Board. See Figure F.17.
6. If the red LED is lit the DC Bus Board is receiving input voltage from the DC Bus Rectifier circuit.
7. If the red LED is blinking, carefully remove plug J46 from the DC Bus Board. See Figure F.17. If the blinking stops and the red LED stays lit and steady, this is an indication of a heavy load on the 40VDC output line. See the Wiring Diagram.
8. If the red LED is not lit check circuit breaker CB1. Reset if tripped.
9. Perform the voltage tests per ***Table F.6***. See Figure F.17.
10. If the correct input voltage is being applied to the DC Bus Board and the correct output voltages are not being generated the DC Bus Board is faulty.
11. If faulty, Perform the ***DC Bus Board Removal and Replacement Procedure***. As listed in SVM 205.

DC BUS BOARD TEST (continued)

TABLE F.6 – DC BUS BOARD TEST POINTS AND ACCEPTABLE READINGS

DESCRIPTION	TEST POINT	TEST POINT	EXPECTED READINGS
Input from DC Rectifier Circuit	Plug J46 Pin 1 (+)	Plug J46 Pin 3 (-)	65VDC
40VDC Output to ArcLink Receptacle	Plug J47 Pin 8 (+) Lead #52	Plug J47 Pin 6 (-) Lead #51	40VDC
40VDC Output to Control Board	Plug J47 Pin 7 (+) Lead #477	Plug J47 Pin 5 (-) Lead #475	40VDC

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 trouble-shooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

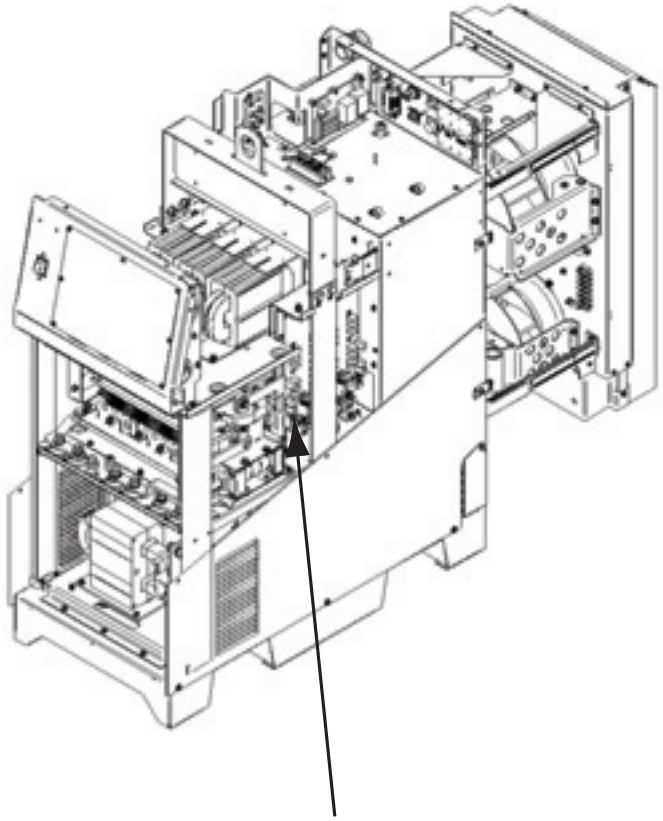
This test will help determine if the IGBT Switch Board is shorted and if the Voltage to Frequency Converter is functioning correctly.

MATERIALS NEEDED

Volt / Ohmmeter (Diode Tester)
Wiring Diagram

IGBT SWITCH BOARD TEST (continued)

FIGURE F.18 – IGBT SWITCH BOARD LOCATIONS



Resistance Test

1. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Perform the ***Input Filter Capacitor Discharge Procedure***.

⚠ 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.**

---

3. Locate the IGBT Switch Boards. One on each side of the machine See Figure F.18.
4. Using the volt / ohmmeter (diode test), check the IGBT Switch Boards for a shorted IGBT component. ***See Table F.7***. Also ***See Figure F.19***. See the Wiring Diagram.
5. If the test results from the previous step are not acceptable, label and disconnect the following leads from the IGBT Switch Board in question and using a diode tester perform the checks detailed in ***Table F.8***. ***See Figure F.19***. See the Wiring Diagram.
   a. Two “C” leads
   b. Two Pos. or two Neg. leads.
   c. #11 or #16
   d. #13 or #18
   e. #12 or #15
   f. #14 or #17

IGBT SWITCH BOARD TEST (continued)

TABLE F.7 – IGBT SWITCH BOARD RESISTANCE TEST POINTS AND ACCEPTABLE READINGS

Test Point	Test Point	Expected Reading	Comments
Left Capacitor Negative Terminal	#11 or #16 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Left Capacitor Negative Terminal	#13 or #18 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Left Capacitor Positive Terminal	#11 or #16 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Left Capacitor Positive Terminal	#13 or #18 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Right Capacitor Negative Terminal	#12 or #15 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Right Capacitor Negative Terminal	#14 or #17 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Right Capacitor Positive Terminal	#12 or #15 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component
Right Capacitor Positive Terminal	#14 or #17 Terminal	Greater than 1000 Ohms	Less than 100 Ohms indicates a shorted component

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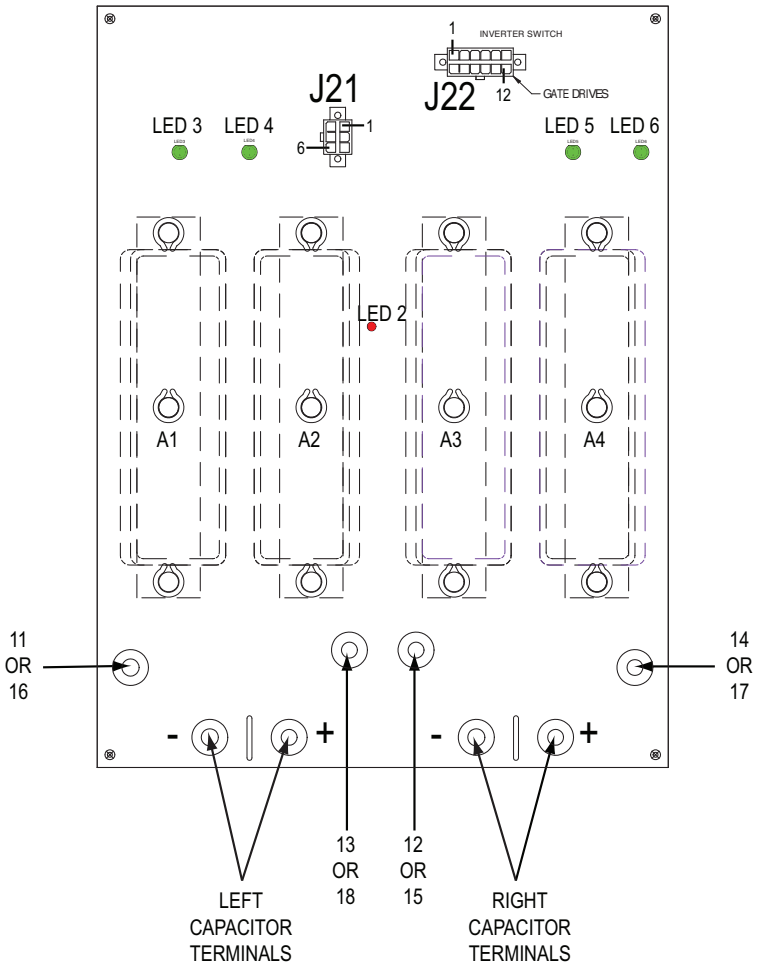
IGBT SWITCH BOARD TEST (continued)

FIGURE F.19 – IGBT SWITCH BOARD TEST POINTS AND LEAD LOCATIONS



6. If the board fails the diode test it should be replaced.
7. When the testing is complete replace all leads previously disconnected.
8. If an IGBT Switch Board is faulty perform the ***IGBT Switch Board Removal and Replacement Procedure***. Refer to SVM 205.

TABLE F.8 – IGBT SWITCH BOARD DIODE TEST POINTS AND ACCEPTABLE READINGS

Positive Meter Lead Test Point	Negative Meter Lead Test Point	Expected Reading
Negative Capacitor Terminals	#11 or #16 and #12 or #15	0.33V ±0.1V
Negative Capacitor Terminals	#14 or #17 and #13 or #18	0.46V ±0.1V
#14 or #17 and #13 or #18	Positive Capacitor Terminals	0.33V ±0.1V
#11 or #16 and #12 or #15	Positive Capacitor Terminals	0.46V ±0.1V

IGBT SWITCH BOARD TEST (continued)

TABLE F.9 – IGBT SWITCH BOARD VOLTAGES AND FREQUENCIES

Description	Test Point	Test Point	Expected Reading	Comments
DC Supply from Control Board	Plug J22 Pin 3 (-) Right Side IGBT Switch Board	Plug J22 Pin 9 (+) Right Side IGBT Switch Board	+15VDC	If not present Perform the Control Board Test
DC Supply to Left Side IGBT Switch Board	Plug J22 Pin 4 (-) Left Side IGBT Switch Board	Plug J22 Pin 10 (+) Left Side IGBT Switch Board	+15VDC	If not present see the wiring diagram for possible wiring problem
Capacitor Voltage to Frequency Feedback	Plug J21 Pin 4 (-) Left and Right Switch Boards	Plug J21 Pin 1 (+) Left and Right Switch Boards	2600 Hz. @ 325VDC Capacitor Voltage	Each capacitor volt equals 8Hz. of frequency feedback

Supply voltages, Voltage to Frequency Converter and LEDs

⚠ 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. Locate the five LEDs on the IGBT Switch Board. ***See Figure F.19***.
2. Carefully apply the correct three phase input power to the Power Wave® AC/DC 1000® SD machine.
3. LEDs 2 through 6 indicate the following conditions.
   a. LED 2 indicates there is greater then 40VDC on the input filter capacitors. Most likely 325VDC.

NOTE: LEDs 3 through 5 will be lit only when the machine is developing welding output.

   b. LED3 indicates module A 1 gate drives are functioning
   c. LED4 indicates module A 2 gate drives are functioning
   d. LED5 indicates module A 3 gate drives are functioning
   e. LED6 indicates module A 4 gate drives are functioning
4. Locate plugs J21 and J22 on the IGBT Switch Board. ***See Figure F.19***.
5. Carefully check for the expected voltages and frequencies per Table F.9. See the Wiring

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THERMOSTAT CIRCUIT 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.

TEST DESCRIPTION

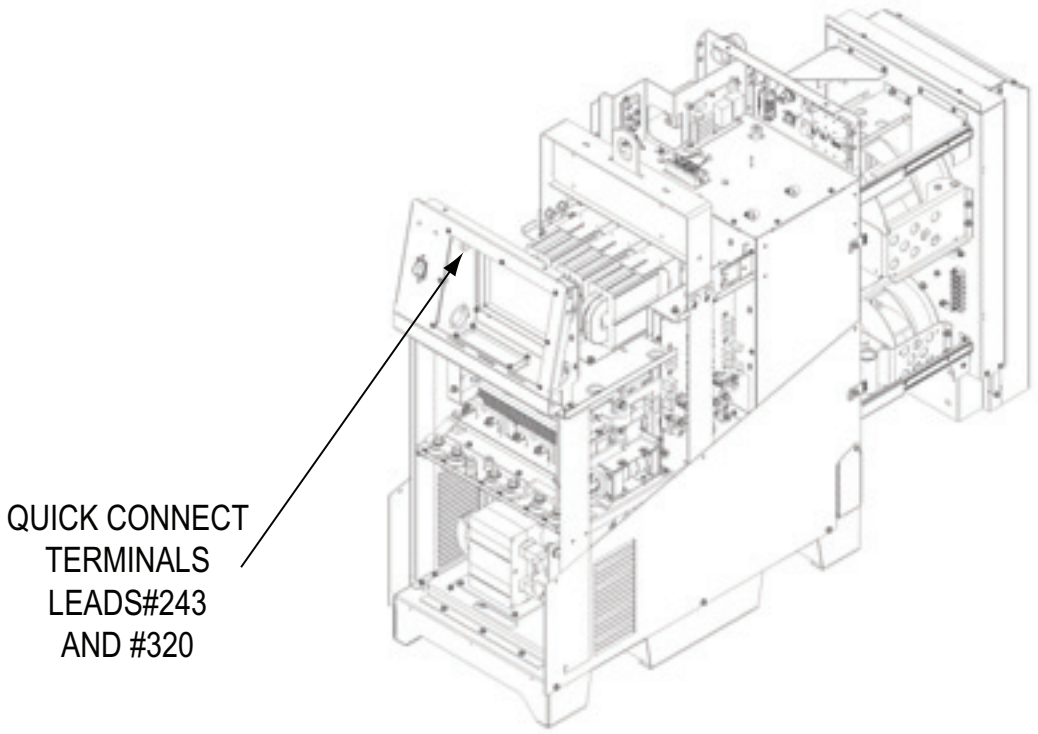
This test will help determine if the Thermostat Circuit is operational.

MATERIALS NEEDED

Volt / Ohmmeter
Phillips Screwdriver
Wiring Diagram

THERMOSTAT CIRCUIT TEST (continued)

FIGURE F.20 – CONTROL BOX AND QUICK CONNECTOR LOCATION



⚠ 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. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Using the phillips screwdriver, remove the seven screws securing the control box door to the case front assembly. See Figure F.20.
3. Locate the quick connect terminals located in the upper left corner of the control box. (Leads #243 and #320). See Figure F.20.
4. Disconnect the two quick connect terminals. ***See Figure F.21***.

THERMOSTAT CIRCUIT TEST (continued)

FIGURE F.21 – THERMOSTAT CIRCUIT

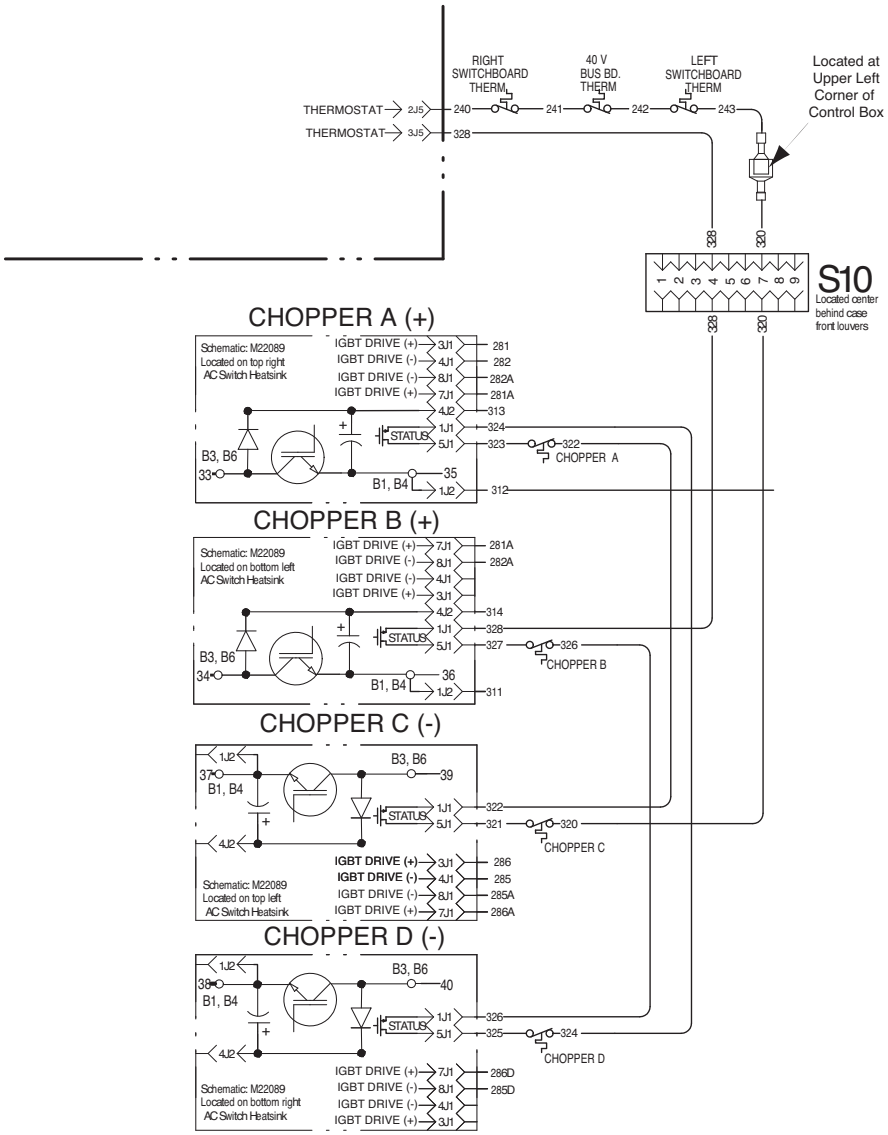
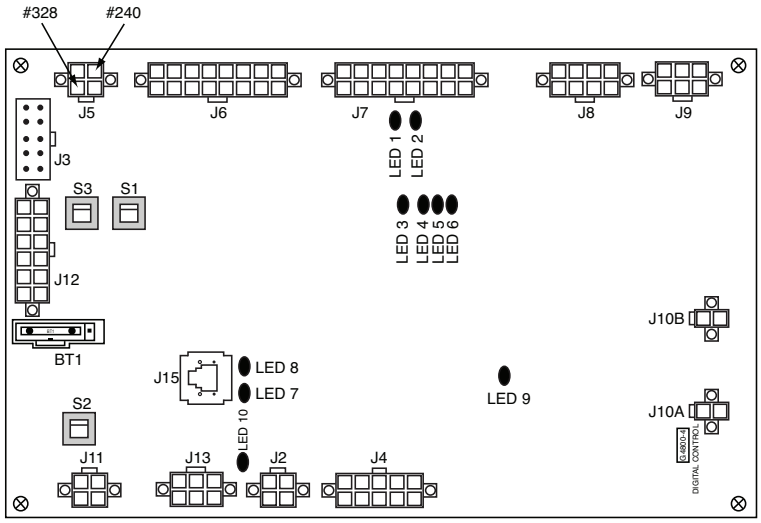


FIGURE F.22 – CONTROL BOARD PLUG J5



THERMOSTAT CIRCUIT TEST (continued)

TABLE F.10 – THERMOSTAT CIRCUIT RESISTANCE CHECKS

Description	Test Point	Test Point	Expected Reading	Conditions & Comments
Check the Switch board and DC Bus board thermostats and associated wiring	Lead #243 at quick connector	Lead #240 at Plug J5 Pin 2 on Control board	Less than 1 Ohm	If greater than 1 Ohm check for faulty thermostats or faulty wiring. ***See Figure F.21 and F.22***
Check the AC Switch chopper thermostats, PC boards and associated wiring	Lead #320 at quick connector	Lead #328 at Plug J5 Pin 3 on Control board	17-18 Ohms	Carefully apply the correct input power to the machine. The machine must be powered-up so that the Chopper boards are on. ***See Figure F.21 and F.22***. If greater than 18 Ohms check the status LED's on the chopper boards, the thermostats and associated wiring.

5. Perform the resistance checks per Table. F.10.
6. If the resistance checks in Table F.10 do not lead to a solution, jumper leads #240 to #328 at the Control Board. ***See Figure F.22***. If the Thermal LED stays lit the Control Board may be faulty. Replace.
7. When testing is completed reconnect the two quick connects previously disconnected and replace the control box door.

OUTPUT 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.

TEST DESCRIPTION

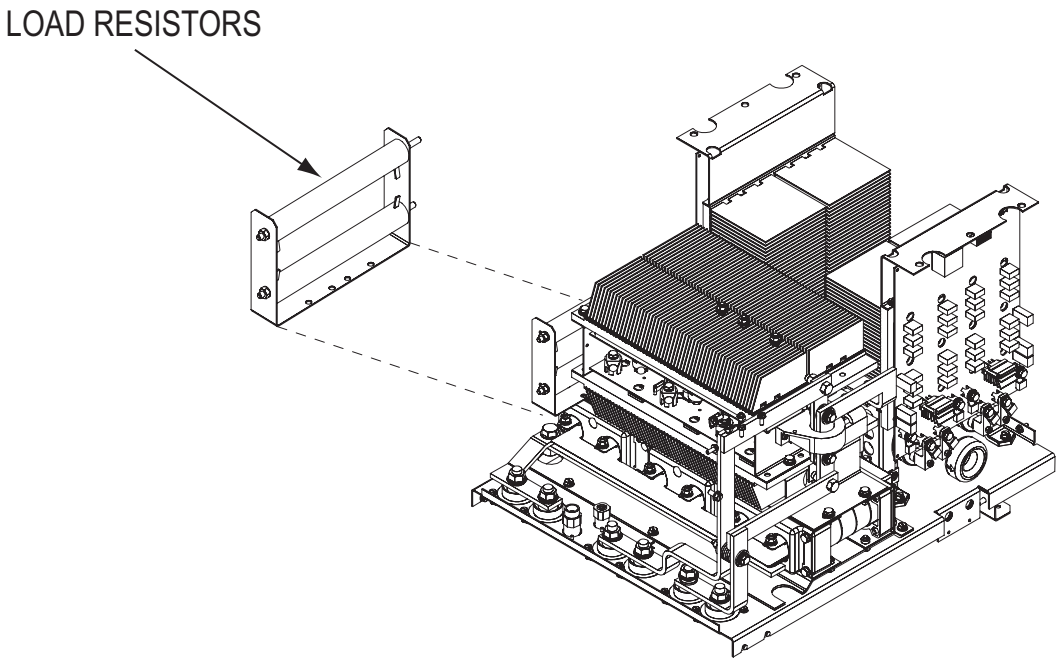
The Output Rectifier Assembly consists of two Full Wave Rectifiers (one for each polarity) interleaved on two separate Heat Sink Assemblies. This test will help determine if the Output Rectifier has a “shorted” or “open” Diode.

MATERIALS NEEDED

Volt / Ohmmeter
Wiring Diagram
7/16” Wrench

OUTPUT RECTIFIER TEST (continued)

FIGURE F.23 – LOAD RESISTORS



⚠ 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.**

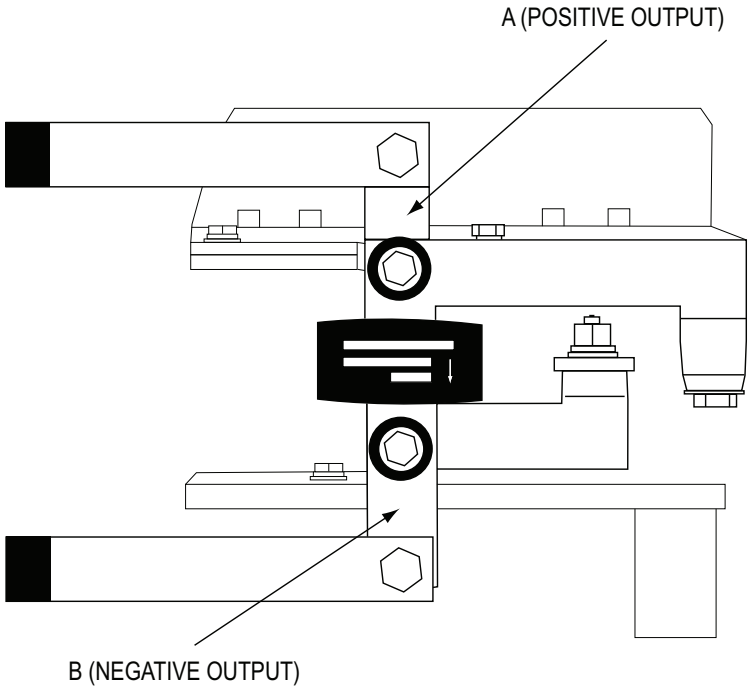
1. Remove the input power to the Power Wave® AC/DC 1000® SD.
2. Perform the ***Input Filter Capacitor Discharge Procedure***.
3. Locate and disconnect the two load resistors located on the left side of the machine. See Figure F.23.
4. Using the volt / ohmmeter, check the diodes per Table F.11. ***See Figure F.24***. If the results are not acceptable or an individual "open" diode is suspect proceed with Step 5.

TABLE F.11 – RESISTANCE CHECKS

Description	Positive Test Probe	Negative Test Probe	Expected Reading	DVM Mode
Testing Positive Section of Bridge	Work Stud	Positive Bridge Output	0.25V to 0.50V	Diode Test
Testing Positive Section of Bridge	Work Stud	Negative Bridge Output	Open	Diode Test
Testing Negative Section of Bridge	Positive Bridge Output	Work Stud	Open	Diode Test
Testing Negative Section of Bridge	Negative Bridge Output	Work Stud	0.25V to 0.50V	Diode Test

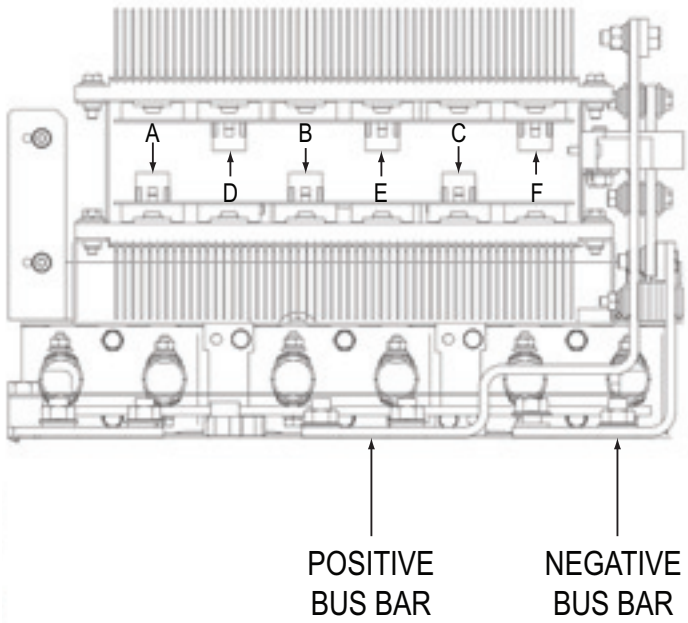
OUTPUT RECTIFIER TEST (continued)

FIGURE F.24 – POSITIVE AND NEGATIVE OUTPUT TESTING POINTS



5. Label the leads and using the 7/16 inch wrench, disconnect the six transformer secondary leads from the Output Rectifier. See Figure F.25 and the Wiring Diagram.
6. Check the individual diodes per ***Table F.12***.
7. If any of the diodes are faulty both Output Rectifier boards must be replaced. They are a matched set.
8. When the testing is completed replace the six transformer leads and reconnect the load resistors.

FIGURE F.25 – TRANSFORMER LEADS AND TESTING POINTS



OUTPUT RECTIFIER TEST (continued)

TABLE F.12 – INDIVIDUAL DIODE CHECKS

+ Meter Probe	- Meter Probe	Expected Reading	DVM Mode
Points A thru F	Positive Bus Bar	0.3V to 0.7V	Diode Test
Positive Bus Bar	Points A thru F	Open	Diode Test
Negative Bus Bar	Points A thru F	0.3V to 0.7V	Diode Test
Points A thru F	Negative Bus Bar	Open	Diode Test

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TEST AFTER REPAIR

SOFTWARE TOOLS

Power Wave® AC/DC 1000® SD software tools and other documents related to the integration, configuration, and operation of the system is available at **www.powerwavesoftware.com**. Power Wave® Submerged Arc Utilities includes the following items and all of the documentation to support them.

Name	Purpose
Weld Manager	Setup Ethernet address information, and apply security settings. 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. • Gear Box / Feeder Selection • Memory Labels • DeviceNet setup and Verification • UI setup (Lockout and Limits) • Ethernet setup and Verification • Diagnostic -snapshot -weldview -error lookup -inductance test -sense lead test • Calibration (I,V,WFS) • Cable Test -inductance -sense leads
Command Center	AC/DC system tool to observe and log welding operation, verify DeviceNet 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. • Multi Arc setup • Generators Command Center connection file • Setup Verification -output cables (cables crossed) -software versions (Master to slave and Arc to Arc) -I/O verification (Master to Master and Master to slave) -sense lead -inductance test

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Power Wave Manager™
User Manual

Y50050-02

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1 Description

Power Wave Manager™ is an application that allows you to configure and manage a multitude of settings and configuration options within the full range of Lincoln Electric's Power Wave® line of welding machines. It also provides in-depth diagnostics of the machine's hardware and firmware to help identify and eliminate any issues with welding or configuration.

2 System Requirements

Minimum hardware requirements:

- 256MB system RAM.
- 1.0GHz processor speed.
- 1024×768 display resolution.
- 50 MB free disk space.
- Connection to a Lincoln Electric Power Wave or compatible machine through an Ethernet network or serial (RS-232) cable.

Power Wave Manager runs under the Microsoft .NET Framework. Therefore, it may be run within any of the following versions of Microsoft Windows:

- Windows 7
- Windows Vista
- Windows XP Service Pack 2
- Windows 2000 Service Pack 4
- Windows 98 Second Edition

Must be logged on as an Administrator to the PC.

3 Compatible Equipment

Power Wave Manager may be used with any welding machine in Lincoln Electric's Power Wave® family that utilizes the digital controls platform. This list includes, but is not limited to:

- Power Wave 355M
- Power Wave 405M
- Power Wave 455M, 455M/STT, 455R (and corresponding CE models)
- Power Wave 655
- Power Wave AC/DC 1000, AC/DC 1000 SD
- Power Wave i400
- Power Wave C300
- Power Wave S350

The program may also be used to diagnose and modify settings in the following machines outside the Power Wave family that also use the digital common controls platform:

- Invertec V350, V450
- Power MIG 300
- Power MIG 350

The program is not compatible with legacy Power Wave models such as the Power Wave 450.

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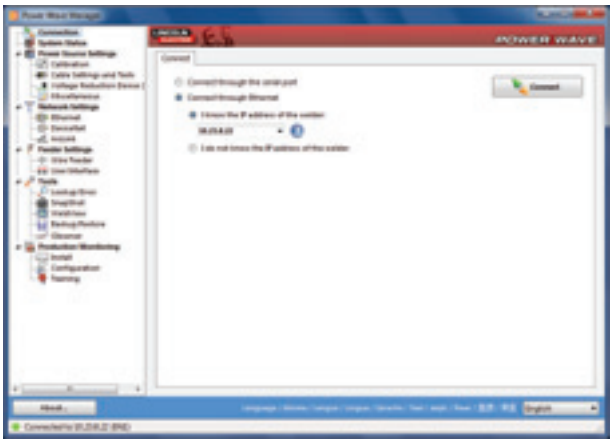
4 Establishing a Connection

When Power Wave Manager is started, it displays a list of categorized configuration sections on the left.

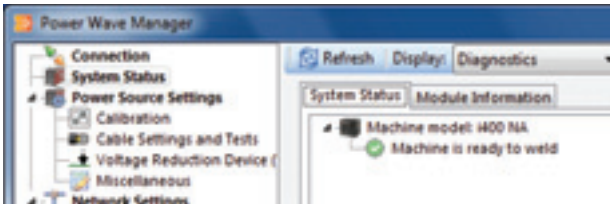


These sections are *Connection*, *System Status, Power Source Settings, Network Settings, Feeder Settings*, and *Tools*. By default, Power Wave Manager starts up in the Connection section, since a connection is required for accessing most of the other sections, except Lookup Error and WeldView.

For assistance with connecting to your welding machine, please refer to the *Help Me Connect Guide* included with the Power Wave Utilities installation. The guide is also downloadable from http://powerwavesoftware.com.

5 System Status

When the program first establishes a connection to the machine, it switches to the System Status section. In this tab the program displays any problems that might be present in the machine, no matter how benign the issue might be.

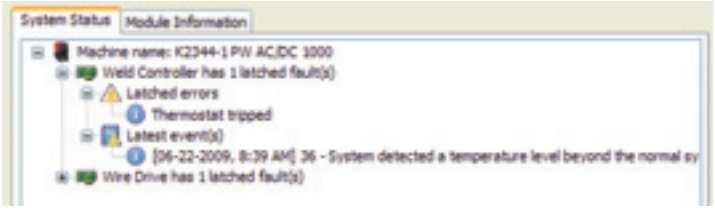


If there are no problems in the machine, the program will show a green check mark, and display a "Machine is ready to weld" message, as shown in the illustration.

At the top of this section is a drop-down box that provides the selections "Diagnostics" and "Detailed Status." The default selection is Diagnostics.

5.1 Diagnostics

If the program detects a malfunction in the system, it will attempt to determine which hardware module caused the malfunction.



Note: To retrieve more information about a certain error code, refer to the "Lookup Error" section, discussed in section 10.1. You may also double-click on the error to automatically go to the Lookup Error section.

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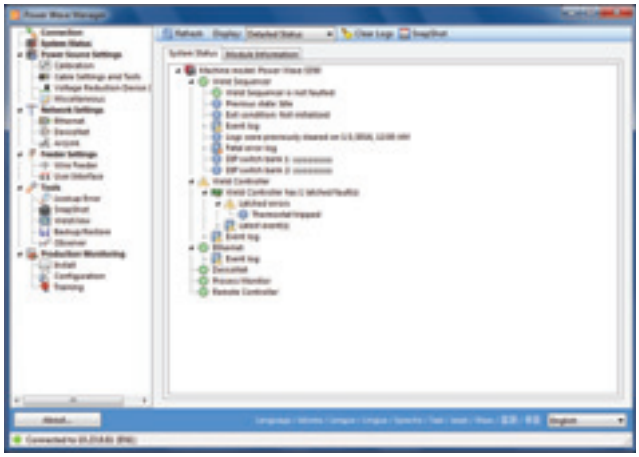
5.2 Detailed Status



The "Detailed Status" selection shows the status of each logical object in the machine. In the illustration on the right, all objects are functioning normally, except one (the Weld Controller).

When the faulted object is expanded, the program shows the number and description of the fault that the object is currently experiencing.

In addition to the actual faulted condition, an object may also have events recorded in its historical Event Log. These events can provide additional information about the cause of any problem. An event may be residual from a previous malfunction, or it could be associated with the current malfunction. An event does not always indicate a malfunction, but can be posted as a status item. Even objects that are ready to weld might still have events recorded in their log. Each event has a time stamp and a textual description of the event. For modules that have a real-time clock, such as a Robot or Ethernet object, the time stamp will indicate the time of the event. Otherwise, the time stamp indicates the amount of time elapsed since the machine was powered up.

It is generally recommended to periodically clear the event logs of any object that might have events, so that it will be certain that any logged events will be recent, and will apply to the most recent problem. If the machine experiences an error severe enough that the machine is forced to reset, the error is recorded in a Fatal Error Log entry as shown above.

5.3 Module Information

The Module Information tab displays information about each hardware module inside the Power Wave. This information includes versions of the hardware and firmware of each module, serial numbers, Weld Set name, and miscellaneous information such as firmware revision numbers and checksums.

Switch between different tabs at the top to view information about the corresponding hardware module.

5.4 Additional Options

- **Refresh button**: Click this button to re-scan the machine for problems and refresh the results in the status window.
- **Clear Logs button**: Click this button to clear the logs in all modules in the system. This includes Event Logs and Fatal Error Logs. After the logs are cleared in this manner, the machine will remember the last time its logs were cleared, and this data will be available the next time system status information is shown. Note that this action will reset the machine, so it should not be done while the machine is in use.
- **SnapShot button**: Click this button to go directly to the SnapShot section (10.2), so that a snapshot of the system can be easily acquired.

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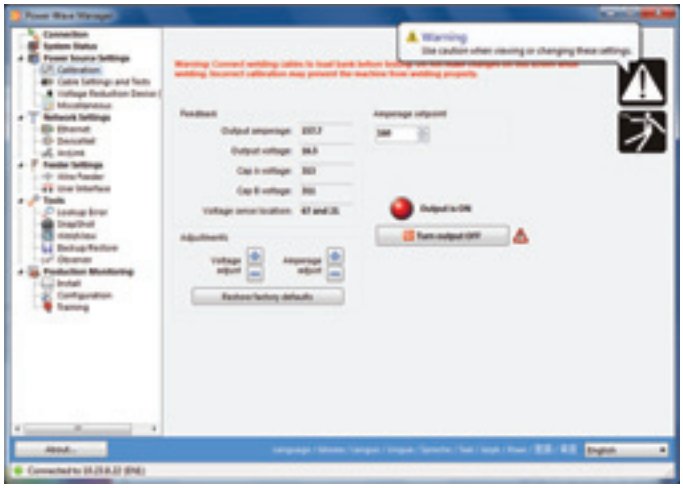
6 Power Source Settings

The Power Source Settings section consists of various subsections that contain settings for to the power source component of the welding system.

6.1 Calibration

The Calibration section allows calibrating the machine by adjusting the amperage and voltage outputs so that they match a setpoint value. This function can also be used to activate the machine output for other troubleshooting purposes.



The "Turn Output On" button enables the output of the machine. When output turns on, the "Output is ON" indicator will begin to flash red, and values will appear for Output Amperage, Output Voltage, Capacitor Voltages, and Voltage Sense Location. While output is on, make the necessary adjustments by clicking the up/down buttons that appear on the bottom left of the window. The amperage setpoint can be changed by clicking the up/down arrows next to the text box, or by entering the desired amperage directly into the text box.

Note: When adjusting Amperage from Power Wave Manager, any external ammeter will adjust to the "set" amperage value. When adjusting Voltage, the displayed diagnostic voltage will adjust to the external voltmeter which would be holding steady. Do not calibrate voltage at voltages greater than 50V.

When finished making adjustments, click the "Turn Output Off" button to disable the machine's output. Output will be disabled automatically if you leave the Calibration section, or if you exit the application entirely.

6.1.1 Recommended Procedure

1. Attach machine output cables to a 300A/30V resistive grid load.
2. Turn output "ON."
3. Use adjustments to trim the feedback values to match actual measured values.

6.1.2 Quick Procedure (Amperage adjustment only)

1. Short the output studs with a cable at least 10ft long (in place of a Grid Load).
2. Turn output "ON."
3. Use adjustments to trim the feedback values to match actual measured values.

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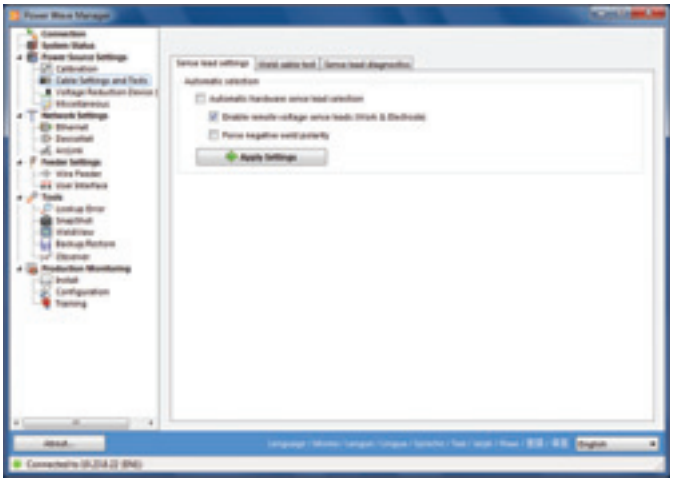
6.2 Cable Settings



These settings allow you to configure and test your welding cables and sense leads.

6.2.1 Sense Lead Settings

Note: These settings will only be shown for machines that do not have DIP switches for modifying the sense lead location. They will also be hidden for machines that do not support changing the sense lead selection.

Use these settings to enable or disable automatic hardware sense lead selection, and to modify its behavior. For most applications, the "Automatic hardware sense lead selection" is the best method to use; it reduces the chance of fairing and losing tips due to sense lead lose.

The system can be configured to force sense arc voltage from the work sense lead (21 lead) instead of the negative output stud. This requires connecting to the voltage sense connector and attaching the work lead to the work. To enable the work sense lead, uncheck the "Automatic hardware sense lead selection" checkbox, and check the "**Enable remote voltage sense leads**" checkbox, then click the "Apply Settings" button. The system will reset, and the arc voltage will then be detected at the electrode (67 lead) and the work (21 lead).

If negative welding polarity is required, then you may need to manually configure the correct voltage sense location. If the system is already configured to sense arc voltage at the remote voltage sense leads, then no changes are required. Otherwise, uncheck the "Automatic hardware sense lead selection" checkbox, and check the "**Force negative weld polarity**" checkbox, then click the "Apply Settings" button. The system will reset, and the arc voltage will then be detected at the electrode (67 lead) and the positive stud.

Note: If the sense lead selection is specified within the welding procedure in use, it will have precedence over these settings. Therefore, some welding processes, such as TIG, Stick, and SMAW, will override these settings.

6.2.2 Weld Cable Test

The weld cable test allows you to automatically measure the resistance and the inductance of your welding circuit. This can be used to determine how setup changes affect the welding circuit. In order to run this test, the contact tip must be shorted to the work piece.

Click the "Perform Test" button to begin the inductance and resistance test. Note that when this test is preformed, the machine's output will be turned on for a very short time (100 milliseconds). Once the test is complete, it will display the resistance and inductance values that were calculated based on the downloaded weld trace. The resistance value is displayed in the upper text box (measured in milliohms), and the inductance value is displayed in the lower text box (measured in microhenries).

Note: It is good practice to record the results of these tests when the welding system is operating well, so that they can be compared to values taken when there are welding problems on the same weld cell. This may help isolate the problem when the old and new numbers are significantly different.

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6.2.3 Sense Lead Diagnostics

Use these settings to troubleshoot welding issues or verify setup by manually changing the location of the sense lead. Any changes made in this tab are temporary, and will be reset when the machine's power is turned off.

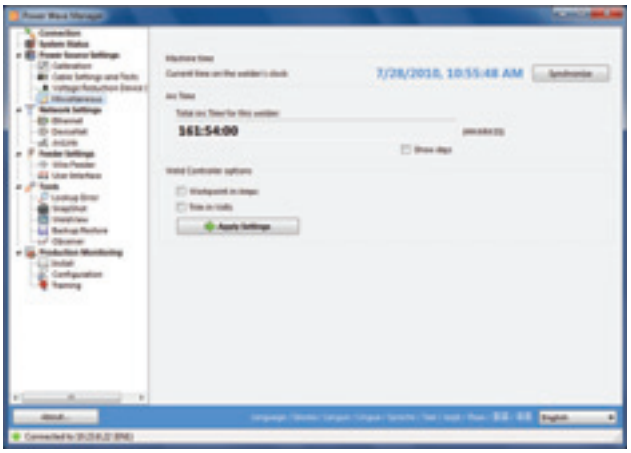
Arc voltage sense leads can become detached over time due to constant movement of equipment such as robot motion. The settings on this tab allow you to test and verify the connectivity and reliability of the current voltage sense selection. This is done by a process of testing voltage sense starting at the studs, then incrementally moving to the remote voltage sense locations. Note that this test can not be done with Servo Torch.

Automatic Test
The "**Test sense lead selection**" button can additionally help troubleshoot sense lead issues by attempting to detect the sense lead location by turning on the machine's output in an OCV (open circuit voltage) mode, and automatically reading back voltage while stepping through the various manual sense lead locations, determining which location is most likely the one being used. Make sure your welding circuit is open before performing this test.

Manual Test
To start testing the voltage sense leads, click on the "**Select sense lead location manually**" selection. This will force the machine to sense voltage from the selected location. Click the "Apply" button when changing the sensing selection. The first location to test is "**Output Studs**." This configuration utilizes arc voltage sensing from inside the machine and does not require polarity to be configured. Once the output studs arc voltage sensing location has been verified, you may select the next sensing location such as "**67 Positive**" or "**67 Negative**," depending on the welding polarity in which the system is configured to operate. Once the 67 sensing location has been verified, you may select to sense at "**67 and 21**" if you are utilizing both remote voltage sense leads.

When the testing is complete, reset the power to the machine to clear any changes made to the voltage sense location.

6.3 Miscellaneous



The Machine time section displays the current time on the machine's internal clock. This time is used when recording internal events, errors, and Production Monitoring information. The Production Monitoring application, if present, periodically sets the machine's clock to match the time of the Production Monitoring server. You can also manually sync the clock by clicking the "Synchronize" button.

The Arc time section also displays the total arc time of the Power Wave (total amount of time that the machine has generated an arc). The time will be shown in HH:MM:SS format (hours, minutes, and seconds). If the number of hours is greater than 23, click the "Show days" check box to convert the hours into days and display the result.

The Weld Controller options section can be used to set various control options for welders that support these options. The Workpoint in Amps item is used to set the output level based on Amps instead of WFS. The Trim in Volts item is used to set the output level based on voltage instead of an unitless control.

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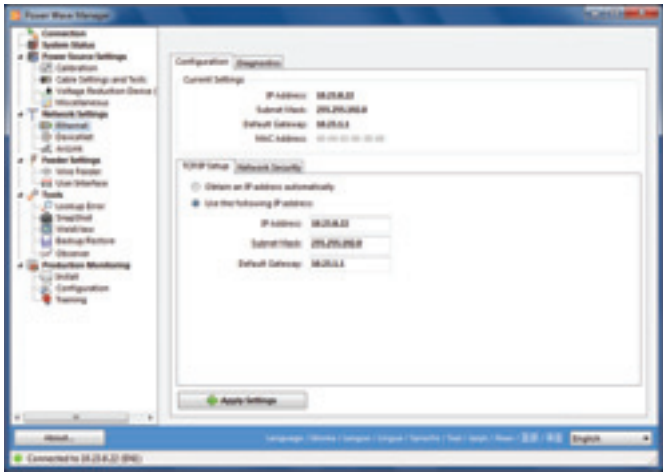
7 Network Settings

This section consists of three subsections, all of which configure the various ways that a Power Wave can be networked with other equipment.

7.1 Ethernet

This section provides options for configuring the Power Wave's network settings for use on an Ethernet network.



7.1.1 Configuration Section

At the top of the section Power Wave Manager displays the machine's current network settings, including IP Address, Subnet Mask, and Default Gateway:

- **IP Address**: This is the address at which the Power Wave is located on the network. Any network device attempting to communicate with the Power Wave must use this address.
- **Subnet Mask**: This number, assigned by the network administrator.
- **Default Gateway**: This is the IP Address of a router or other device that allows communication with addresses that are outside the local area network.

8 TCP/IP Setup

In the TCP/IP setup tab, click the "Obtain an IP address automatically" check box to allow the machine to automatically obtain network settings, or click the "Use the following IP address" check box to manually enter network settings.

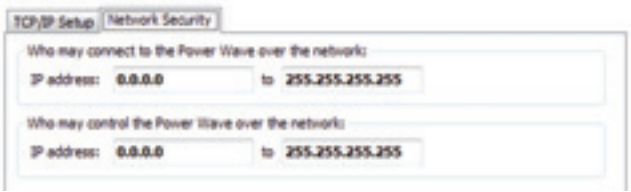
***Caution**: Assigning an incorrect IP address to the Power Wave may cause it to become unreachable on the network. If you are unsure about what IP address to assign to the machine, consult your IT department or network administrator.*

Once all network settings have been configured, click the Apply Settings button to confirm the settings and reset the machine (this is necessary for the new settings to take effect). If you have modified the machine's IP address, and would like to modify more settings, you will need to connect to the machine using the new address.

Note: If the machine will be used for ArcLink XT (e.g. for use with a robotic controller), you must select "Obtain an IP address automatically."

8.1.1.1 Network Security

The Network Security tab allows the configuration of a range of IP addresses that are allowed to connect to the machine, as well as another range of addresses that are allowed to *modify* parameters on the machine (the latter range is a subset of the first).



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For each of the two ranges, the user can select either all addresses, addresses only within the machine's subnet, or a custom range of addresses.

For example, if the custom range is from 192.168.1.0 to 192.168.1.255, then a computer whose IP address is 192.168.1.10 will be able to access this machine, but a computer whose IP address is 192.168.2.1 will not.

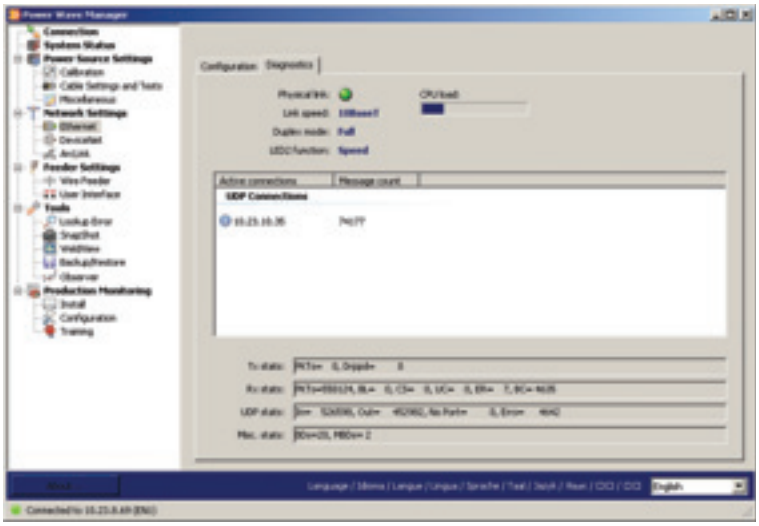
8.1.1.2 Multiple Ethernet Modules

If the system to which Power Wave Manager is connected contains more than one Ethernet module (e.g. a Power Wave AC/DC 1000 connected to a System Interface module), the different modules will show up as a pull-down list at the top of the Ethernet section. Switch between the pull-down selections to configure settings for each module.

To identify which of the multiple modules is currently selected, click the "Blink status light" button. This will cause the status light of the selected module to start blinking rapidly, so that it can be visually identified.

8.1.2 Diagnostics Section

The diagnostic tab under the Ethernet Network Setting item shows how the Ethernet communications are configured in the machine and gives some basic diagnostic information, see below.



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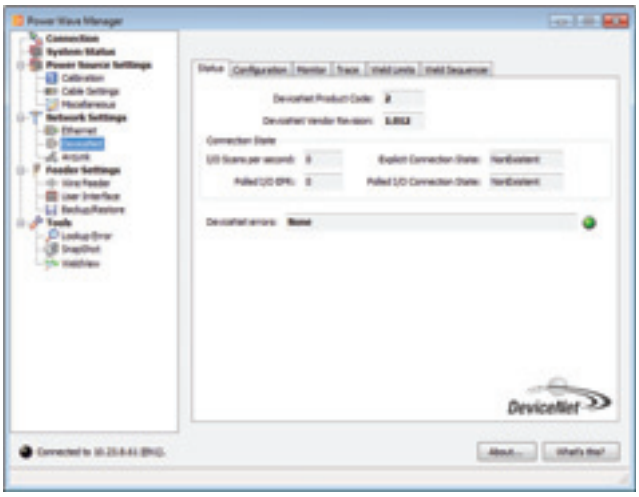
8.2 DeviceNet

The DeviceNet section allows the setup and verification of a DeviceNet interface to the Power Wave.

This section consists of several tabs that are discussed below.



8.2.1 Status

This tab contains basic status information about the Power Wave's DeviceNet interface, as well as any errors currently present on the interface.

8.2.2 Configuration

This tab contains detailed configuration options for the DeviceNet interface. For general information on setting up the DeviceNet interface, refer to the DeviceNet Interface Specification document (Y50031) included with the Power Wave Utilities installation.

8.2.2.1 Mac ID

This field indicates the current configuration of the Power Wave's DeviceNet MAC ID. For the PW455, PW455M, ACDC1000, and PW655 and welders that use the K2436-1 Ethernet/DeviceNet Communication Interface, this value will only change if the DIP switches on the Power Wave's DeviceNet interface boards are configured to allow retrieval of the MAC ID from EEPROM memory. For other welders, this setting will set the Mac ID of the DeviceNet interface. If this value is altered, the Power Wave must be reset (cycle power) in order for the change to become effective.

8.2.2.2 Baud Rate

This field indicates the current configuration of the Power Wave's DeviceNet Baud Rate. For the PW455, PW455M, ACDC1000, and PW655 and welders that use the K2436-1 Ethernet/DeviceNet Communication Interface,, this value will only change if the DIP switches on the Power Wave's DeviceNet interface boards are configured to allow retrieval of the Baud Rate from EEPROM memory. For other welders, this setting will set the Baud Rate of the DeviceNet interface. If this value is altered, the Power Wave must be reset (cycle power) in order for the change to become effective.

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8.2.2.3 Analog Input Channels/Hysteresis

These values indicate the magnitude of change that must occur on the first three polled I/O analog DeviceNet channels before the Power Wave will respond to the change. In the case of a command value that is sourced from an A/D whose output may dither slightly, this configuration prevents unintended parameter changes. This attribute is not useful for command values whose source is completely digital and should be set to 0. One exception is when the Power Wave has an Analog Interface module, in this case set these values to a 30. Input channels will be ignored if their Active boxes are unchecked in which case the Power Wave will assign default values to the associated parameters.

8.2.2.4 Interface Support

This item will only appear for ACDC1000SD machines. This item sets how the DeviceNet interface behaves. The two available options are “Standard” and “Legacy AC/DC 1000”. Using the “Standard” option will have the DeviceNet interface operate like a standard “Mig” interface does and the DeviceNet master must initialize all Sequencer state items. Using the “Legacy AC/DC 1000” option will have the DeviceNet interface operate like an AC/DC1000 DeviceNet interface where certain Sequencer state items are fanned out to other states, duplicating what was done in the older AC/DC1000 DeviceNet interface.

8.2.2.5 Enable Passive Mode Operation

If checked, then the DeviceNet polled inputs will have no effect on the system except for the Weld Output disable bit and the Production Monitoring Fault Reset bit. Enable this when the DeviceNet connection is used only to monitor system operation.

8.2.2.6 Restore Settings from Memory on Reset

DeviceNet will automatically restore weld schedule values on power-up that are not accessible from a polled connection. These include Weld Mode, strike, restrike and cold inch wire feed speeds, and times for preflow, postflow and burnback. If the system contains an UI with memory a memory panel or a robot/PLC that restore settings on power up, do not check this box.

8.2.2.7 Fault if No Polled Connection Detected

Disables welding if a polled DeviceNet connection is not present. Check this when a DeviceNet master controls the machine.

8.2.2.8 Workpoint Input

This indicates whether the values passed to the system through the analog DeviceNet channels for the Workpoint parameter are raw values or scaled engineering values. Selecting the “Engineering Units” option indicates that scaled engineering values for Workpoint will be passed across the analog DeviceNet channel. For example when the workpoint is in Inches per Minute and scaled engineering units are used, then a value of 50 to 800 might be expected to be commanded on the DeviceNet analog input for the workpoint. This would represent a value of 50 to 800 inches/per minute. When the “Unscaled Values” option is selected, the commands for Workpoint range from 0 to 32767 corresponding to the minimum and maximum workpoint of the selected weld mode. For most applications, Engineering Units is normally selected.

8.2.2.9 Trim/Wave Control Input

This indicates whether the values passed to the system through the analog DeviceNet channels for the Trim and Wave Control parameters are raw values or scaled engineering values. Selecting the “Engineering Units” option indicates that scaled engineering value for Trim or Wave Control 1 will be passed across the analog DeviceNet channels. For example when the Trim is in volts and scaled engineering units are used, then a value of 75 to 520 might be expected to be commanded on the DeviceNet analog input for the trim. This would represent a value of

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7.5 to 52.0 volts. When the "Unscaled Values" option is selected, the commands range for Trim and Wave Control 1, 2, 3, 4 range from –32768 to 32767 with 0 representing a nominal value. A great majority of applications will require Trim and Wave Control command values to be set near the nominal value.

8.2.2.10 Report Trim/Wave Outer Process Limits

When the Trim and Wave are being reported in Engineering Units and these inputs are depended on the workpoint, then this item is used to determine how to report back the trim and wave high and low limits. If the above conditions are meet, then checking this box will have the absolute high and low limit always be returned, unchecking the box will have the returned limits be based on the workpoint. As the workpoint changes, the acceptable range that the trim and waves can be in will change as well, unchecking this box will have the limits report back what this range is. Normally this item is checked.

8.2.2.11 TAST Update Frequency

This parameter is used for Through the Arc Seam Tracking. The lower the number the more often the feedback is updated, but higher the system load on the boards. If Through the Arc Seam tracking is being used, then this is usually set to a value of 10 to 20, otherwise a value of 100 is usually acceptable. This value is only relevant for the PW455, 455M, 655, 355, and ACDC1000.

8.2.2.12 Meter Time Constant

This parameter sets the filtering of the feedback data. The default value of 400 is usually used unless Through the Arc Seam Tracking is being done, then this item is usually set to a value of around 75. This value is only relevant for the PW455, 455M, 655, 355, and ACDC1000.

8.2.2.13 Analog Scans between Updates

This determines how often the analog input channels (workpoint, trim, and wave control) update the system in terms of Polled I/O scans. For example a value of 50 means that every 50th I/O scan will be accepted. The setting of this item depends on how often the Power Wave is scanned. For systems with a scan rate of 200 or more, then the default of 50 is usually acceptable. For systems with very low scan rates, such as 10 Hz, a setting as low as 2 might be needed. Once a DeviceNet connection has been established, see IO Scans/Sec item in the DeviceNet monitor screen in Observer for the current scan rate. Note that this setting does not affect the digital I/O bits updating rate.

8.2.2.14 Cold Inch Wire Feed Speed

This parameter sets the feed speed of the wire while cold inching or jogging the wire. This value is used for either cold inching forward (Jog +) or cold inching reverse (Jog -). This value is in units of IPM.

8.2.3 Monitor

This tab contains detailed information about the polled I/O data coming to and from the Power Wave's DeviceNet interface. This is a troubleshooting tool for those customers implementing a DeviceNet connection to the Power Wave. Refer to the DeviceNet Interface Specification for further information.

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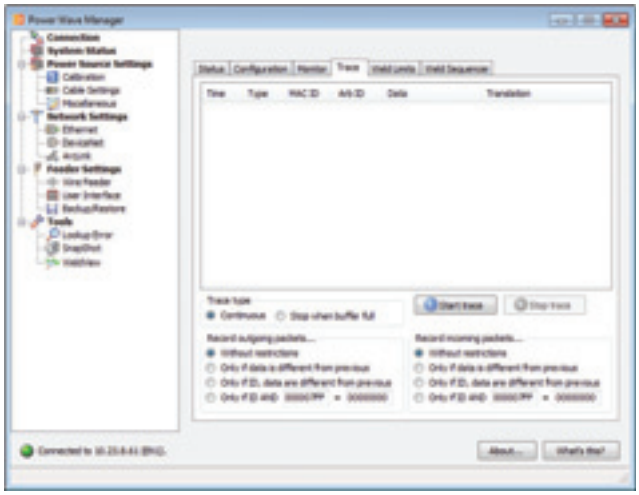
8.2.4 Trace

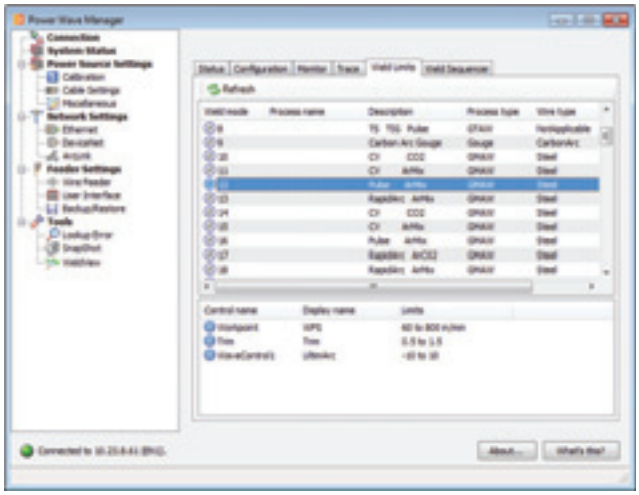


This tab allows you to record a trace of DeviceNet network traffic coming to and from the Power Wave's DeviceNet interface.

You may select from several configuration options, including whether to run the trace continuously or stop when the internal buffer is full, and whether to filter incoming or outgoing packets based on data contents or arbitration ID.

Click the "Start trace" button to inform the interface to begin capturing DeviceNet messages. Click "Stop trace" when finished recording. The recorded messages will be downloaded from the DeviceNet module and displayed in the list, with all relevant fields decoded.

8.2.5 Weld Limits



This tab displays a list of all available weld procedures supported by the Power Wave, and basic information for each procedure.

Click on a procedure to view the types of controls associated with the procedure (Workpoint, Trim, Wave Control, etc.), and the outer limits of each control. This section can be used to verify that the correct weld mode information is being read over the DeviceNet connection.

Note: Updating the machine's firmware may cause the limits of some procedures to become different.

8.2.6 Weld Sequencer

This tab contains advanced configuration settings for the Weld Sequencer component of the system. It presents an array of sequencer-controlled system attributes, grouped by welding state. Double-click on one of the cells to modify a system variable in a certain state. This section can be used to verify that writes over DeviceNet are going to the correct locations.

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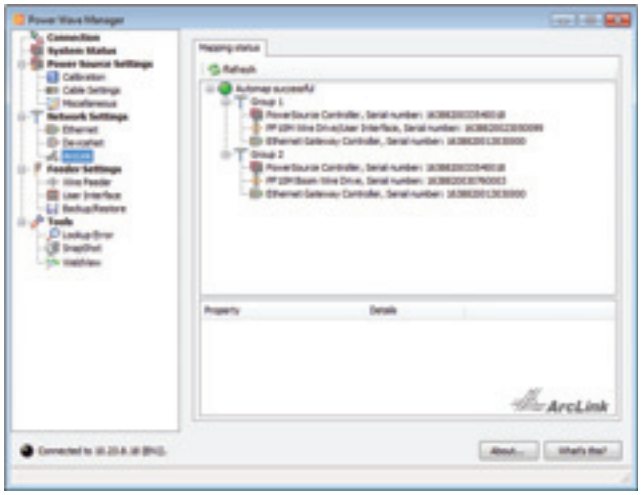
8.3 ArcLink

This section shows an overview of the logical layout (or "mapping") of the welding system's ArcLink network, which is the internal protocol used by the individual modules in the system.

Some systems can be configured to map automatically or manually. The display shows the current mapping of the system, and whether it is mapped automatically or manually.



8.3.1 Pairing Setup

Certain Lincoln components can be "paired" together, such as certain models of wire feeders and user interfaces. These components are usually paired automatically and transparently to the user. However, if there was a problem with pairing between two or more components, this section of Power Wave Manager will show a "Pairing" tab where components can be paired manually.

Each module that requires one or more other modules to be paired with it will be shown in the list on the left, with "slots" that can be filled by modules from the list on the right. Click on an unused slot to see which modules can be paired with it. Then, select the correct modules from the list on the right, and drag-and-drop it over to the unused slot, or use the arrow buttons in the middle.

When finished all of the required modules, click the "Apply Settings" button.

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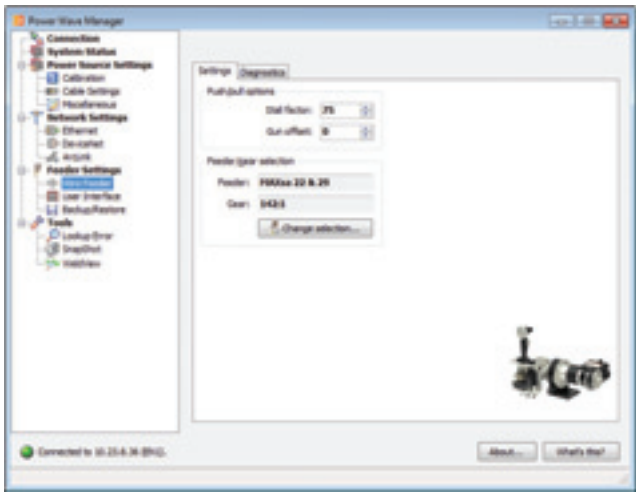
9 Feeder Settings

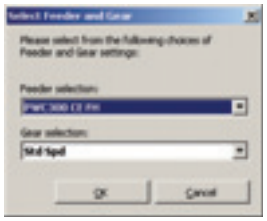
This section allows you to configure a multitude of parameters related to the wire feeder and user interface of the machine (if available).

9.1 Wire Feeder



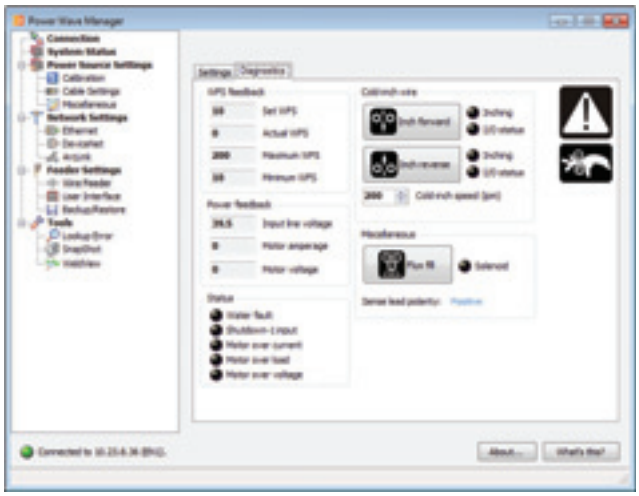
The Wire Feeder section contains settings and diagnostic information about any wire feeders that are attached to the welding system.

Under the “Settings” tab, you can change the feeder and gear type selection, as well as stall factor and gun offset for push-pull operation. The feeder and gear selection appears only for feeders that support custom selections. Clicking on the Change selection button will bring up a window like below:



Select the Feeder and Gear from the listed items and then click on the OK button to change the setting.
Note: The feeder/gear selection settings will not be shown if your feeder requires its selection to be set up using DIP switches.

The “Diagnostics” tab can be used to troubleshoot and verify the operational state of your feeder. The tab is separated into the following items:



- **WFS feedback** – Used to verify wire feed settings.
- **Power feedback** – Used to verify feed ability of system.
- **Cold-inch wire** – Used for testing feeding of wire without welding.
- **Miscellaneous** – Used to verify gas purge (or flux fill for submerged arc systems) and voltage polarity settings.
- **Status** – Displays any faults in the currently selected feeder.

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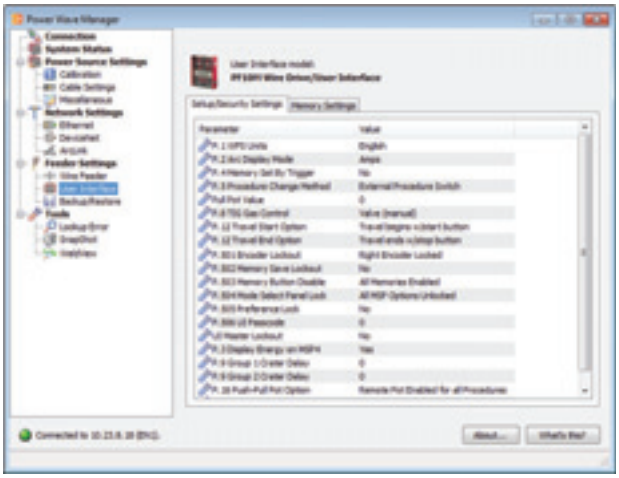
9.1.1 Multiple Wire Feeders

If the system to which Power Wave Manager is connected contains more than one wire feeder module, the different modules will show up as a pull-down list at the top of the Wire Feeder section. Switch between the pull-down selections to configure settings for each module.

To identify which of the multiple modules is currently selected, click the “Blink status light” button. This will cause the status light of the selected module to start blinking rapidly, so that it could be visually identified.

9.2 User Interface

This section contains settings that pertain to the User Interface of the welding system, if one is present.



9.2.1 Setup/Security Settings

The Setup/Security section allows the user to modify several User Interface parameters and security settings.

The configurable parameters will be shown in a table, as shown in the illustration. Each parameter can be changed by double-clicking it. After double-clicking on a certain parameter, Power Wave Manager will display a window where the new value for the parameter can be entered.

There are two different types of parameters: numeric (where the value can be a number within a certain range), and selectable (where the value can be selected from one of several text descriptions).

When changing a certain parameter, Power Wave Manager brings up the appropriate window for changing the setting based on its type. For selectable parameters, the window will contain a drop-down box with the possible selections for the parameter. For numeric parameters, the window will contain a text box where the value can be entered directly.

Different models of Lincoln user interfaces may give a different list of configurable parameters, since different models may support varying sets of features.

To obtain help with a particular setup parameter, click the “What’s this?” button at the bottom right corner of the window, then click on the parameter for which you would like more information. A small window will pop up that contains a detailed description of the specified parameter.

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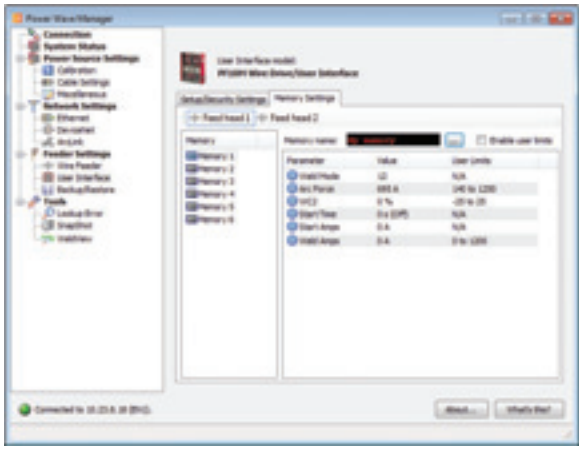
9.2.2 Memory Settings



The Memory Settings section allows the configuration of any parameter stored within any of the memory slots (accessible by memory buttons) of the User Interface.

If the User Interface is a dual feed head system, select the feed head to configure by clicking on the appropriate Feed Head button on top.

Select which memory to configure by clicking the appropriate memory item (Memory 1, Memory 2, etc.) The list of parameters corresponds to the currently selected memory item.

To change the "name" of the current memory, click the "…" button next to the name box and enter the new name for the memory. This will be the name that is displayed on the Mode Select Panel of the User Interface when this memory is selected.

To change any of the parameters in the list, double-click on the desired parameter. This will bring up a window where the new value for the parameter can be entered. Certain parameters also have configurable user limits. These limits can also be configured from this window. The "Machine Limits" displayed below the parameter value represent the "absolute" limits of this parameter. The User Limits, as well as the Value, must be within this range. When finished modifying the parameter, click OK to accept the changes and write the new settings to the machine.

The "Enable User Limits" check box in the Memory Setup section informs the machine whether or not to actually enforce the User Limits defined for certain parameters. If this is not checked, the User Limits will have no effect.

9.2.3 Multiple User Interfaces

If the machine is connected to more than one user interface, the User Interface section will provide a drop-down selection at the top of the screen to select which User Interface is to be configured.

To identify which of the multiple modules is currently selected, click the "Blink status light" button. This will cause the status light of the selected module to start blinking rapidly, so that it could be visually identified.

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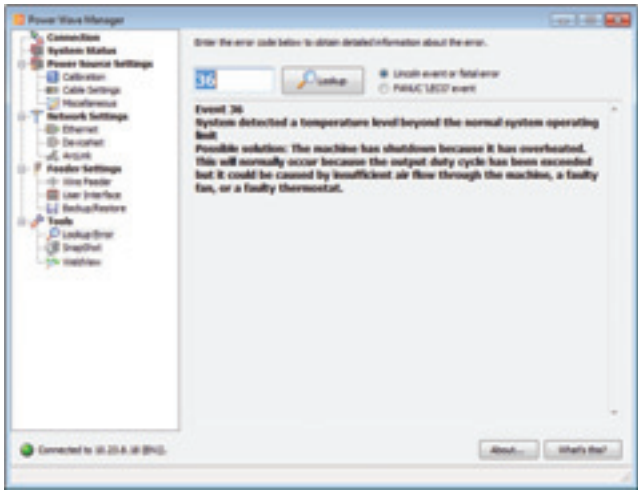
10 Tools

10.1 Lookup Error



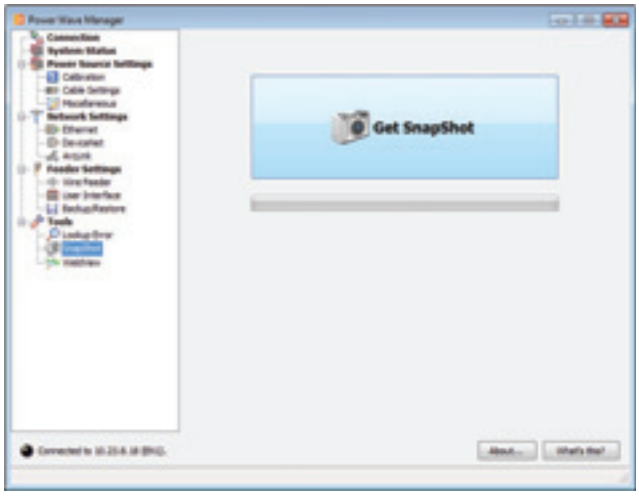
The Lookup Error section allows you to obtain information about any error code given by a Lincoln Electric machine, or error codes given by a FANUC robot controller regarding a Lincoln power source. When a welder is in a faulted condition, it will flash out an error code on it's Status LEDs; see the welders operator manual for how to interpret the Status LED.

To look up a certain error code, select what type of error it is by clicking one of the two checkboxes, then type in the error number in the text box, and click the Lookup button.

A description of the error will be shown, as well as a possible solution or possible course of action to resolve the error.

This section can be accessed without connecting to a Power Wave, so that error information can be acquired at any time.

10.2 SnapShot



A SnapShot is a small file that contains very detailed configuration and debugging information collected from each module in the Power Wave.

This file can be sent to Lincoln Electric Support to troubleshoot any possible issues that cannot be easily resolved by the user.

To obtain a SnapShot of the Power Wave, click the "Get SnapShot" button, and select a location on your computer where the file will be saved. When the file is saved, it can be e-mailed to Lincoln Electric Support for analysis.

When a problem or issue occurs, it is recommended to record a SnapShot of the machine, then clear the logs (in the System Status section), then attempt to reproduce the issue. If the issue is reproduced, record another SnapShot, and send both SnapShots to Lincoln Electric Support for analysis.

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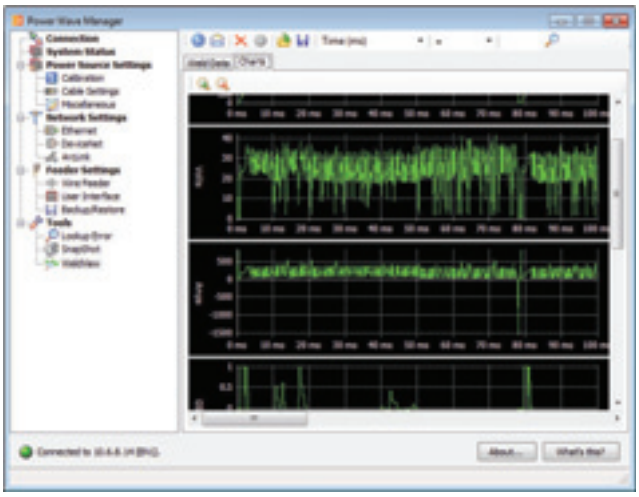
10.3 WeldView



WeldView is a feature of Power Wave Manager that allows you to capture a high-speed trace of a portion of a weld performed by your Power Wave.

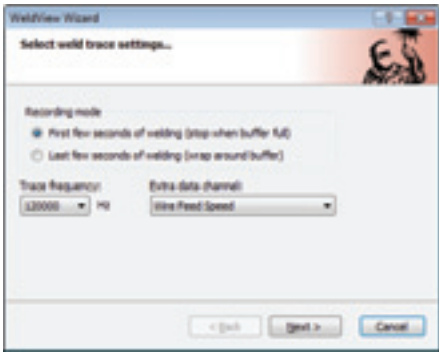
The trace is a series of data points that the machine stores while welding. Each record consists of several variables, including Amperage and Voltage at the time that the record was written.

The weld trace can be used to troubleshoot or fine-tune welding performance by examining the waveform of the weld during starting and ending.

A weld trace may also be requested by Lincoln Electric Service personnel to aid in resolving welding issues. The trace can be saved to a file and sent to Lincoln Support for evaluation.

The WeldView section can be accessed without connecting to a Power Wave, so that previously saved weld traces can be reviewed at any time.

10.3.1 WeldView Wizard



To capture a weld trace, click the WeldView Wizard button at the top left of the section.

The WeldView wizard allows you to fully configure the trace before starting it, including the frequency, triggers, or extra channels to record with the trace. Follow the on-screen instructions in the Wizard to proceed.

The last step of the Wizard will wait until a weld is completed with the Power Wave. This will be the weld that is recorded in the trace. When the weld is completed, WeldView will download the trace data from the machine and display it in the table and charts.

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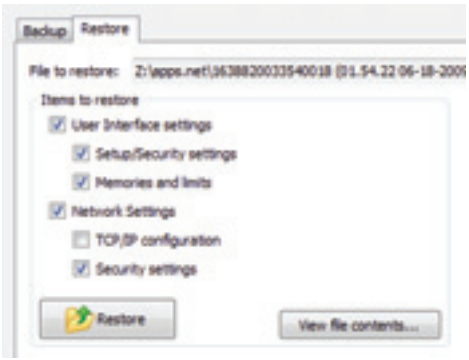
10.4 Backup/Restore

The Backup/Restore section allows the user to save Power Wave settings (memory configuration, lockout parameters, and network settings) to a file, and then restore the saved settings at a later time to the same, or to a different, Power Wave.

10.4.1 Backup

To create a backup of the currently-connected Power Wave, switch to the Backup tab, then click the Backup button. The program will ask for a location and name to be given to the new file. Power Wave Manager initializes the file name with the serial number of the machine's control board plus the current date and time. Once the file name is selected, backing up will begin, and will take a few moments.

10.4.2 Restore



To restore a saved backup file onto the currently-connected machine, switch to the Restore tab and click the Browse button to find the desired backup file, or simply drag-and-drop the backup file into Power Wave Manager.

Next, select the various settings that should be restored from the backup file. These settings are User Interface Settings, which includes Setup/Security Settings and Memory and Limit settings, and Network Settings, which includes TCP/IP Configuration and Security Settings. If a certain set of settings should not be restored to the current machine, leave the corresponding check box unchecked.

***Note**: Use caution when restoring TCP/IP configuration. Since only one machine can have a specific IP address on the network, restoring an IP address to more than one machine can cause problems on the network. It is recommended to restore TCP/IP configuration only to the machine from which it was originally backed up. After an IP address is restored, the machine must be reset in order for the setting to take effect.*

The Backup/Restore section can be accessed without connecting to a Power Wave, so that the contents of a backup file can be viewed at any time.

10.4.3 Viewing File Contents

The contents of a backup file can be viewed without restoring it to the machine. After a backup file is opened or dragged onto Power Wave Manager, click the View File Contents button. This will display a window where the backed up information can be browsed. The browsing is nearly identical to working in Power Wave Manager online with the machine, except that no parameters can be modified.

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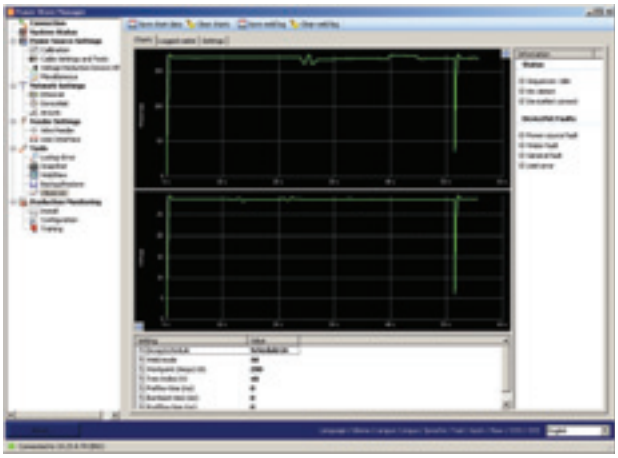
10.5 Observer

While WeldView gives a detailed view of a portion of a weld with a short duration, Observer graphs welding feedback at a slower rate over the course of several entire welds. It also allows changing of basic welding parameters including the weld mode, workpoint, and wave control values.

10.5.1 Charts

The plots are produced by periodically reading feedback values from the machine while it is welding, as shown in the figure on the right. The data is updated whenever the machine output is on. It is possible to view amperage, voltage, wire feed speed, WeldScore™ (if available), and global scale factor. To save the data in the charts to a tab-delimited text file, click the "Save chart data" button in the toolbar at the top of the screen. The charts can be cleared by clicking the "Clear charts" button.

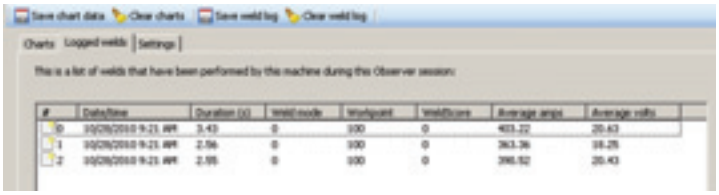


To change one of the welding values listed in the Setting box, double-click the value and enter the desired value in the resulting dialog.

The sidebar on the right side of the screen shows the status of various system components. If there is a fault, the respective gray dot will become red.

10.5.2 Logged Welds

The Logged Welds screen displays a list of the welds that have been made during the Observer session. For each weld the date/time of the weld, weld duration, weld mode, workpoint, WeldScore™, and average amperes and volts are listed. A new weld appears in the list when the machine's output turns off after the weld is completed. To save the log to a tab-delimited text file, click the "Save weld log" button in the toolbar the top of the screen. To clear the log, click the "Clear weld log" button.



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10.5.3 Settings

The Settings tab allows you to change which signals are visible in the graphs, whether an output on/off button is displayed, and the parameter state fanout (i.e. which weld sequencer states are modified when you change a welding setting such as workpoint or trim).

To choose which charts are visible, select the desired charts using the checkboxes in the "Visible charts" box. Note that if you add a new chart after welds have been logged, the data displayed in the new chart for the old welds may not be valid.

If you want to control the machine's output from within Power Wave Manager, check the "Show Output ON/OFF button" option. A button will appear in the toolbar allowing the machine output to be turned on or off. For safety, you must press and hold the Control key on the keyboard while clicking the button in order for it to turn the machine on or off. **Use caution when controlling the output from Power Wave Manager.**

11 Production Monitoring™

Production Monitoring™ is a technology available in some Lincoln Electric Power Wave® power sources. This is a collection of features that allow the collecting of welding logs and gathering of statistics, saving of weld profiles, sending emails, and tracking consumable usage and providing low package warnings. For more information, refer to the *Production Monitoring 2.1 User Manual*, available from Lincoln Electric.

Power Wave Manager is used to assist in installing Production Monitoring™, setting up weld profiles and limits, training for WeldScore™, and backing up and restoring information.

11.1 Install

This section is used to create an install key that is used to install a welder into Production Monitoring™ 2.1. Before this step is done, make sure the welder has the correct IP. If the welder is connected to the network through a robot Ethernet connection, connect to the robot IP. Do the follow steps to create an install key:

- Connect to the machine you wish to install using Power Wave Manager.
- Under "Production Monitoring," select "Install."
- Click the "Save Production Monitoring Install Key" button. A standard Windows "Save file…" window will open.
- Save the file in the desired location.
- The file, which has a .tok extension, can now be imported into the Admin section of Production Monitoring™ to add the welder to the system.

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11.2 Configuration

The items in the Configuration section are used to set up Production Monitoring™. These items are discussed in detail in the *Production Monitoring 2.1 User Manual*, and include:

- **Weld Profile Selection** – Used to set up how the Production Monitoring™ profiles are selected.
- **Out of Limits Actions** – Used to set up what action the Power Wave® will take when a weld exceeds the Production Monitoring™ limits for weld duration, WeldScore™, arc current, arc voltage, or wire feed speed.
- **Profile Limits** – Used to select a weld profile and display the limits associated with it.
- **Wire Package** – Production Monitoring™ allows the configuration of the wire package used for welding, so that its usage can be tracked by the Power Wave®, and the user notified when the package begins to run low.
- **E-mail Setup** – The e-mail screen provides access to all of the configuration options for the e-mail feature of Production Monitoring™. This window allows the configuration of e-mail recipients, address book, and e-mail settings.
- **Miscellaneous** – Used to set a Part, Operator, or Consumable serial number in the power source.

11.3 Training

Weld Profile Training is used to automatically generate limits for Time, Voltage, Current, and WFS for a profile. It will also generate the necessary data in order to use WeldScore™. See section 13.1 for more information on Weld Profiles and section 13.2 for more information on WeldScore™.

This feature removes the necessity of setting up limits manually for each of the Weld Profiles allowing the operator to make several "training" welds in the same manner as they would be done in normal production. Then, based on the training welds, Production Monitoring™ automatically generates limits for arc current, voltage, wire feed speed, and time. The operator can remove any welds made during the training that are considered "bad" welds.

Important: A weld profile must be trained before a WeldScore™ will be given. Note at this time, the longest weld that can be trained for determining WeldScore data is one minute. If training is being done in order to determine Voltage, Current, and WFS limits, then the maximum duration is 21 minutes.

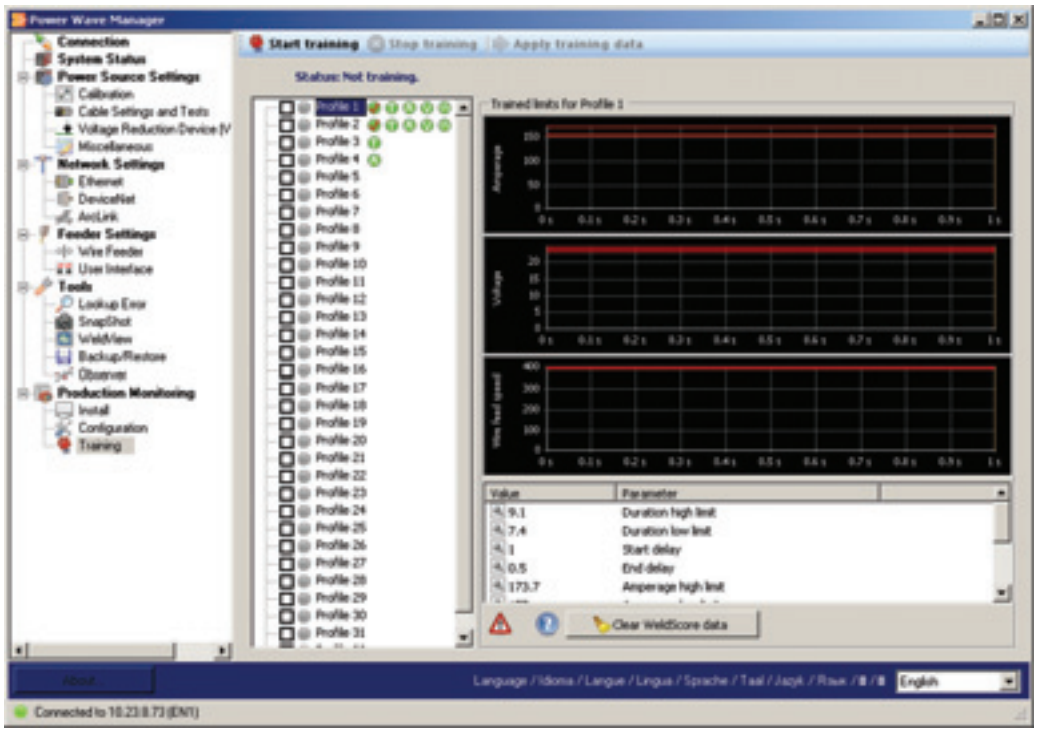
11.3.1 Selecting a Profile

The first step to training a weld profile is to set how a profile will be selected. See the Production Monitoring 2.1 manual, section 4.2.1, Weld Profile Selection Tab, for setting how profiles are selected.

11.3.2 Training a Profile

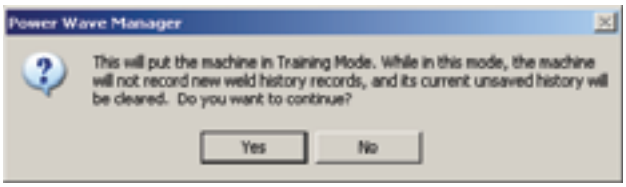
To begin training, select the "Training" option under "Production Monitoring" in Power Wave Manager.

This will bring up a screen that looks like the following:



The green icons next to each profile name indicate which parameters have non-zero limits, where T is time, A is amperage, V is voltage, and W is wire feed speed. These limits can be manually set and do not necessarily mean the profile has been trained for WeldScore™. The checkmark icon indicates the profile contains WeldScore™ data which cannot be manually set, showing the profile has been trained. In the above example, profiles 1 and 2 have been trained and contain WeldScore™ data.

To begin training, verify the weld profile selection has been properly configured and click on the Start training item located at the top of the window. This will bring up the following message:



Clicking on yes will cause the Power Wave® to enter training mode and will cause any weld history to be cleared and will prevent any more history collection until the training has completed as the above message indicates. Various profiles can be trained while in this mode. The selected profile can be changed as needed without leaving training mode.

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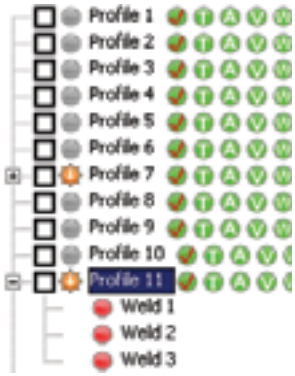
11.3.3 Profile Training Operation

Before a weld starts, the status on the top of the screen will read Status: Waiting for next weld to start... . While welding, it will say Status: Waiting for weld to complete... , and then after a weld is finished it will once again read Status: Waiting for next weld to start... . When a profile has unsaved weld data, the icon next to the profile number will change to a icon.

In the following example, profile 7 has new weld data but the individual welds are hidden.
Clicking on + will show the welds. Profile 11 also has new weld data, and the individual welds are showing.
Clicking on - will hide the welds.



None of the other visible profiles have new weld data, as signified by the icon.

11.3.4 What Welds to Train

WeldScore™ works by comparing production welds to welds that have been trained. In order for an accurate score to be assigned, it is recommended to train at least 5 welds at each allowable production extreme. For example, if the electrical stickout is allowed to vary from $\frac{5}{8}$" to ¾", then train 5 welds at each of these stickouts. Only train the *allowable* extremes; if the stickout may be able to increase to 1.0" but this causes a bad quality weld, do not include this in training. The purpose of training is to show the Power Wave® the types of welds considered acceptable.

11.3.5 Deleting a Weld from Training

If there was a problem with a weld during training, it can be deleted from the profile before training data is saved. To delete a weld, expand the profile by clicking on the + icon next to the profile being trained. Then right click on the desired weld to delete. Now a popup menu will appear, containing the following option:

Click on this choice and the weld will be deleted from training.

11.3.6 Saving Training Data

When all of the training welds have been completed, click on the Stop training button. The status will now change to Status: Not training. . Check the boxes next to each of the profiles to be saved. Not all the profiles that had training welds taken need to be checked. After the appropriate boxes are checked, click on the Apply training data button.

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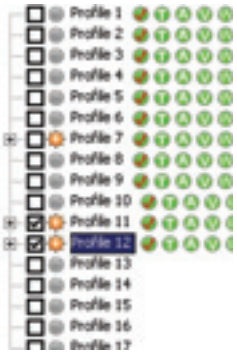
For example, the below section shows that welds were trained for profiles 7, 11, and 12 as indicated by the icon. But since only profiles 11 and 12 are checked, these are the only profiles settings that will be saved.



11.3.7 Clearing WeldScore™ Training Data

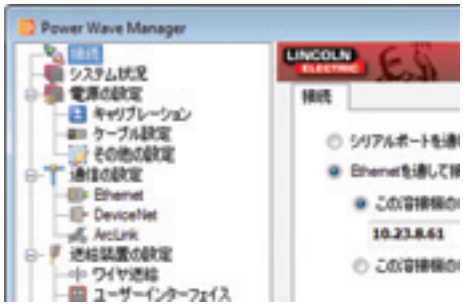
To clear WeldScore™ training data for a profile, select the profile and click on the "Clear WeldScore™ data" button. The icon next to the profile number will disappear.

Clicking this button tells Power Wave Manager that WeldScore™ data is going to be cleared, but does not send the command to the Power Wave® to erase it. To do that, the profile must be saved by checking the box next to the profile and clicking on the Apply training data button. If training data is not applied, WeldScore™ data will not be cleared and the icon will reappear next time the profile screen is loaded in Power Wave Manager.

12 Language Selection

Power Wave Manager has built-in support for multiple languages in its user interface. The following languages are presently supported:

- Chinese (Simplified)
- Czech (Čeština)
- Dutch (Nederlands)
- English
- French (Français)
- German (Deutsch)
- Italian (Italiano)
- Japanese (日本語)
- Polish (Polski)
- Portuguese (Português)



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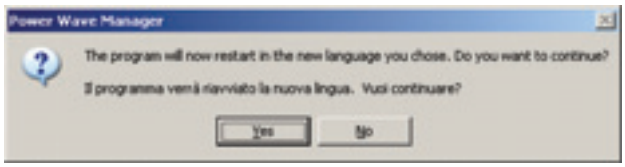
- Russian (Русский)
- Spanish (Español)

Other languages may be included in future releases.

By default, the program automatically detects the language used by the operating system, and switches the language of its user interface accordingly. For example, on a Japanese installation of Windows, Power Wave Manager will automatically switch to using Japanese text and messages.

If you would like to change the language used by Power Wave Manager, select the appropriate language from the box in the lower right-hand corner of the screen:

You will be prompted to confirm your choice before continuing:



13 Additional Information

13.1 Weld Profiles

One of the features of Power Wave Manager is the ability to see and set limit data for voltage, current, wire feed speed, duration, and WeldScore™. These parameters can vary widely from weld to weld. The concept of weld profiles allows the Power Wave® to store this data for up to 32 different welds. The Power Wave® can then compare the limits stored in a weld profile to the real time data values while performing a weld and take various actions if these limits are exceeded.

As an example, consider a part that requires 10 different welds for proper assembly. The user will begin by configuring 10 of the 32 programmable Weld Profiles, with proper limit settings for each of the different welds. The user can then begin welding the part, selecting the proper profile for each of the 10 welds.

When the Power Wave® is trained to use WeldScore™, the taught welds are stored in a weld profile. The same profile must be selected when teaching a weld as when performing a weld to receive the proper WeldScore™.

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13.2 WeldScore™

WeldScore™, a new feature available in all third generation Power Wave® models including the i400, C300, S350, R350, and AC/DC 1000 SD, can be used to assist a weld quality control program. It assigns a score to welds on a 0-100% scale that indicates the quality of the weld. The score is based on a comparison to previously trained welds. Any weld with a score of 90 or above can be considered with a reasonable amount of confidence to be a good weld. This is not a guarantee of quality and is not intended to replace a quality control system. WeldScore™ can be used independent of or together with Production Monitoring™ 2.1 or newer.

13.2.1 How It Works

Traditional weld monitoring systems measure voltage and current and must then guess what the power supply is trying to do before attempting to determine how well it is actually doing it. WeldScore™ is built right into the power supply controller which gives it a significant advantage in that it removes the guesswork involved with how the supply should be functioning. In addition to traditional voltage and current measurements, WeldScore™ also looks at 40-50 additional variables which help to make it more reliable and accurate than any previous weld monitoring system.

In order to assign a score, the Power Wave® must first be taught what is considered to be a good weld. This is done through the training section of Power Wave Manager. When a score is assigned to a future weld, it is done by comparing it to the taught weld. Therefore, it is necessary to teach the Power Wave® every weld that a WeldScore™ is desired for. Some examples of when new training is required include changes in wire feed speed, voltage, joint type, travel speed, or position.

WeldScore™ is able to accommodate both welds with very tight tolerances and welds that have some acceptable process variation. If the welds taught to the Power Wave® all have very little variation, then the only welds that will receive a passing WeldScore™ are ones that meet that very tight tolerance. Likewise, if there is room for some variation (ex. Changes in electrical stickout or work angle) and the acceptable variations are used in the teaching process, then WeldScore™ will assign passing scores to welds that fall within those variations.

13.2.2 Where to Use It

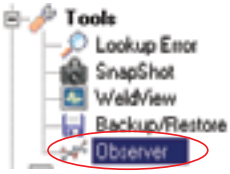
WeldScore™, like any statistical analysis, requires a controlled process. It will produce the most accurate results with single pass welds or welds with a small number of passes because as more passes are used, the process inherently becomes less repeatable. If there are a large number of variables that are allowed a significant amount of variation, the criteria may be too broad for the WeldScore™ to be a meaningful value.

13.2.3 What the Score Means

An instantaneous WeldScore™ value is calculated every 0.25 seconds. The average of these scores over the entire weld is reported as an overall score in Production Monitoring™. A weld may receive a passing overall score if there is only a problem for a short portion of the weld time. For example, if a 50 inch weld has a score of 95 for 49 inches, but a score of 45 for the last inch, the overall score will be a 94. Out of limit error reporting is calculated over a user-defined moving window of time. This means that even a weld with a good overall score will cause an error to be reported if the WeldScore™ falls out of bounds for this defined amount of time.

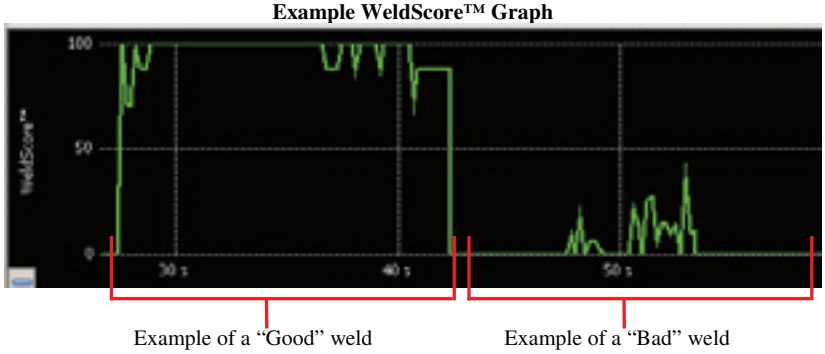
13.2.4 Viewing Using Observer

Once a profile has been trained, WeldScore™ data can be viewed in Power Wave Manager by selecting the “Observer” option under “Tools.”



Select the appropriate weld profile using one of the three options described previously and begin a weld. A real-time view of amperage, voltage, wire-feed speed, and WeldScore™ can be graphed under the "Charts" tab in the observer window. The "Settings" tab allows selection of which items will be graphed. For more information about the Observer function of Power Wave Manager, see section 9.4 of this manual.

Example WeldScore™ Graph



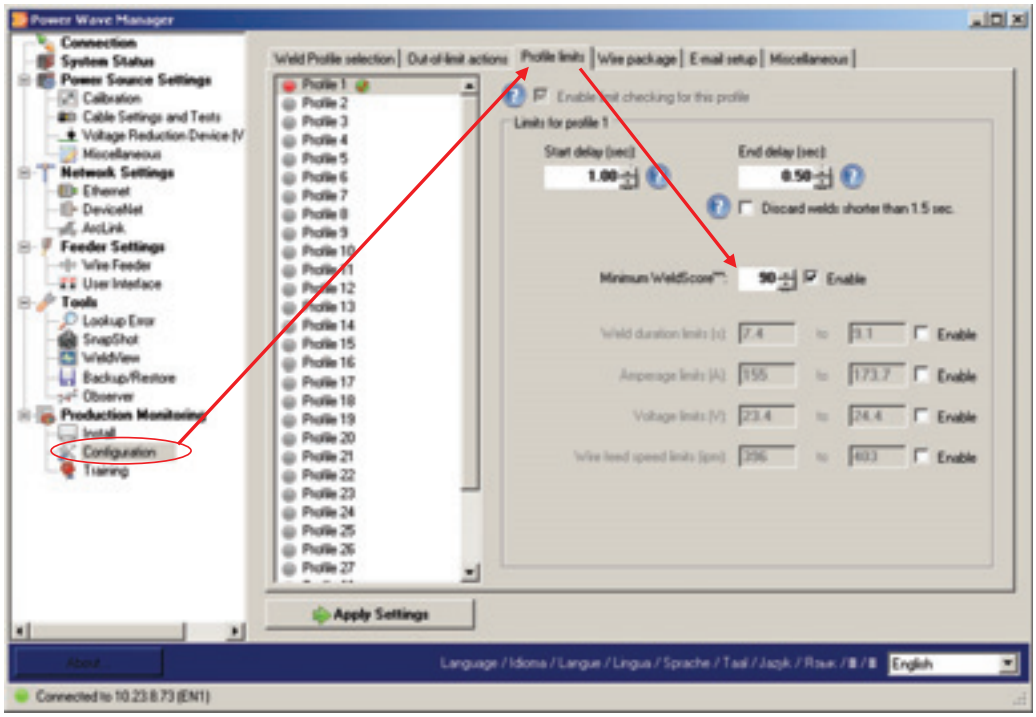
The overall WeldScore™ can be viewed under the "Logged welds" tab as the following example shows.

#	Date/time	Duration (s)	Weld mode	Workpoint	WeldScore	Average amps	Average volts
0	10/5/2010 8:52 AM	11.41	12	400	81.3	172.47	23.72
1	10/5/2010 8:52 AM	0.22	12	400	81.3	0.1	38.2
2	10/5/2010 8:53 AM	14.63	12	400	40.8	178.56	23.97
3	10/5/2010 8:54 AM	15.47	12	400	96.9	155.68	23.82

13.2.5 Performing Out of Limit Actions Using WeldScore™

Power Wave Manager can be used to configure a desired minimum for WeldScore™ and ranges for weld duration, amperage, voltage, and wire feed speed for each weld profile. It can then setup actions to be taken if these values are not met for a certain amount of time.

The "Profile limits" tab under "Configuration" in the "Production Monitoring" section of Power Wave Manager is used to setup profile limits, as shown below:



To set a minimum value for WeldScore™, first select the appropriate weld profile, and then check the enable box next to "Minimum WeldScore™". The default as well as minimum value for this setting is 80. If a minimum WeldScore™ limit of less than 80 is required to keep good welds from being flagged as bad, this is an indication that either the training was done incorrectly or that a variable has changed since the training was done. The profile should be retrained if this is the case; lowering the minimum WeldScore™ is not an appropriate way to compensate for training not matching the production weld.

To perform an action if the WeldScore™ falls below the minimum value set here, click on the "Out-of-limit actions" tab and a screen will appear that looks like the following:

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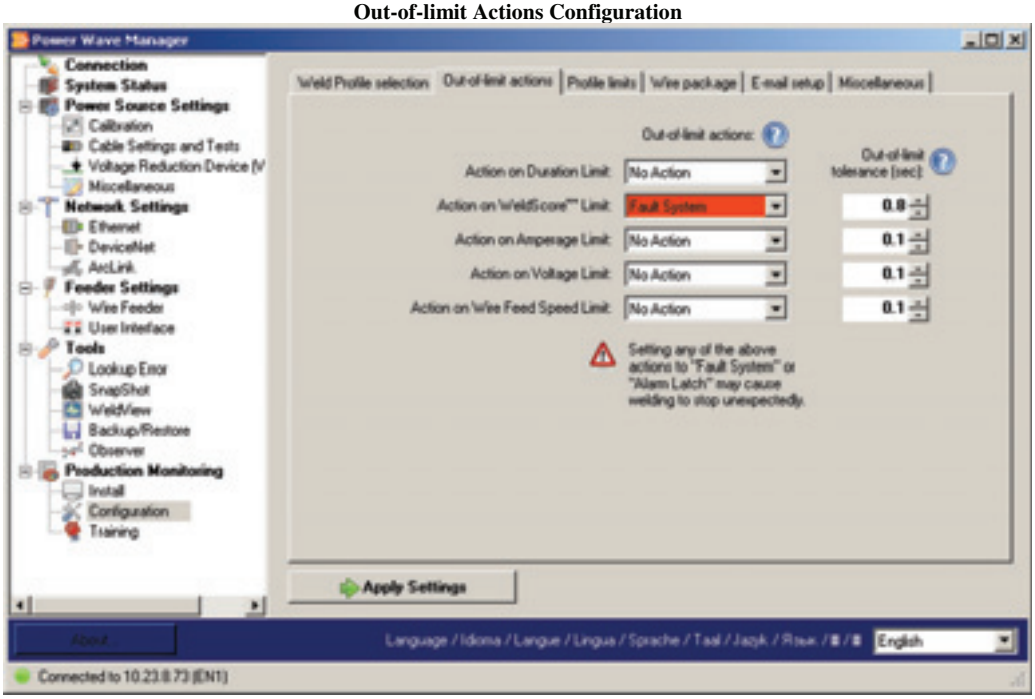
Out-of-limit Actions Configuration



The possible actions are:

- No Action – The Power Wave® will take no action, and will not mark the weld as out-of-limits.
- Log Event – The Power Wave® will mark the weld as out-of-limits.
- Fault System – The Power Wave® will stop welding when an out-of-limit condition is detected.
- Alarm Latch – The Power Wave® will enter into a faulted state when the weld ends, and remain faulted until the fault is reset by the operator (a so-called "latched fault"). A latched fault can be reset either through a UI such as a PF10M, through a DeviceNet polled IO connection, or through an ArcLink compatible controller that supports this feature. Note, resetting or cycling the power to the Power Wave will also reset a latched fault.

The field labeled "Out-of-limit tolerance" sets how long the WeldScore™ can fall below the minimum limit specified under the profile limits tab before the action set here takes place. This time represents the total amount of time the item can be out of limit for the duration of the whole weld. This value is represented in seconds and has a 250 millisecond resolution.

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*** NOTE:** Many PC Board Assemblies are now totally encapsulated, surface mounted and or multi-layered and are therefore considered to be unserviceable. Assembly drawings of these boards are no longer provided.

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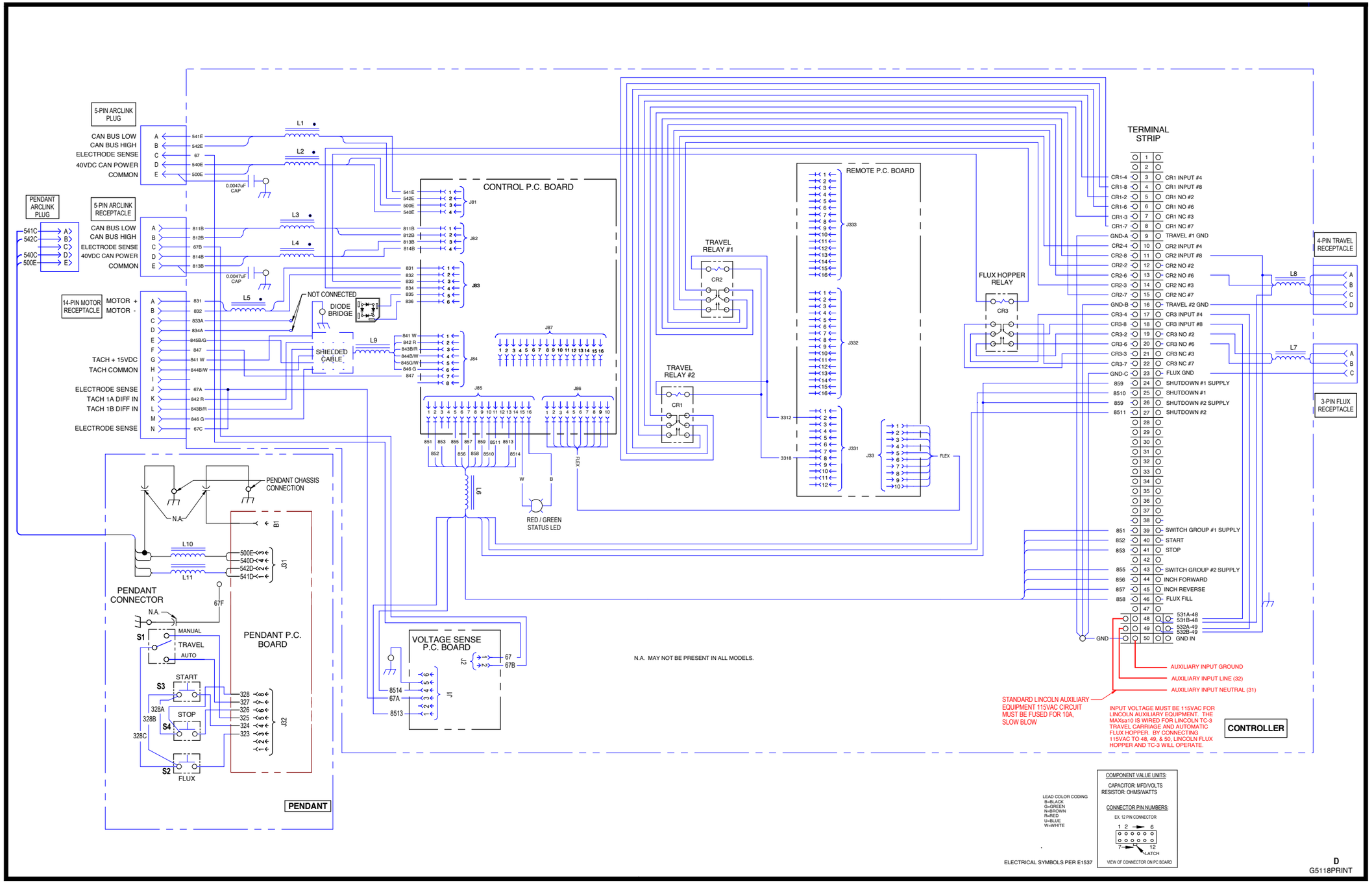
MAXsa 10 CONTROLLER WIRING DIAGRAM



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.

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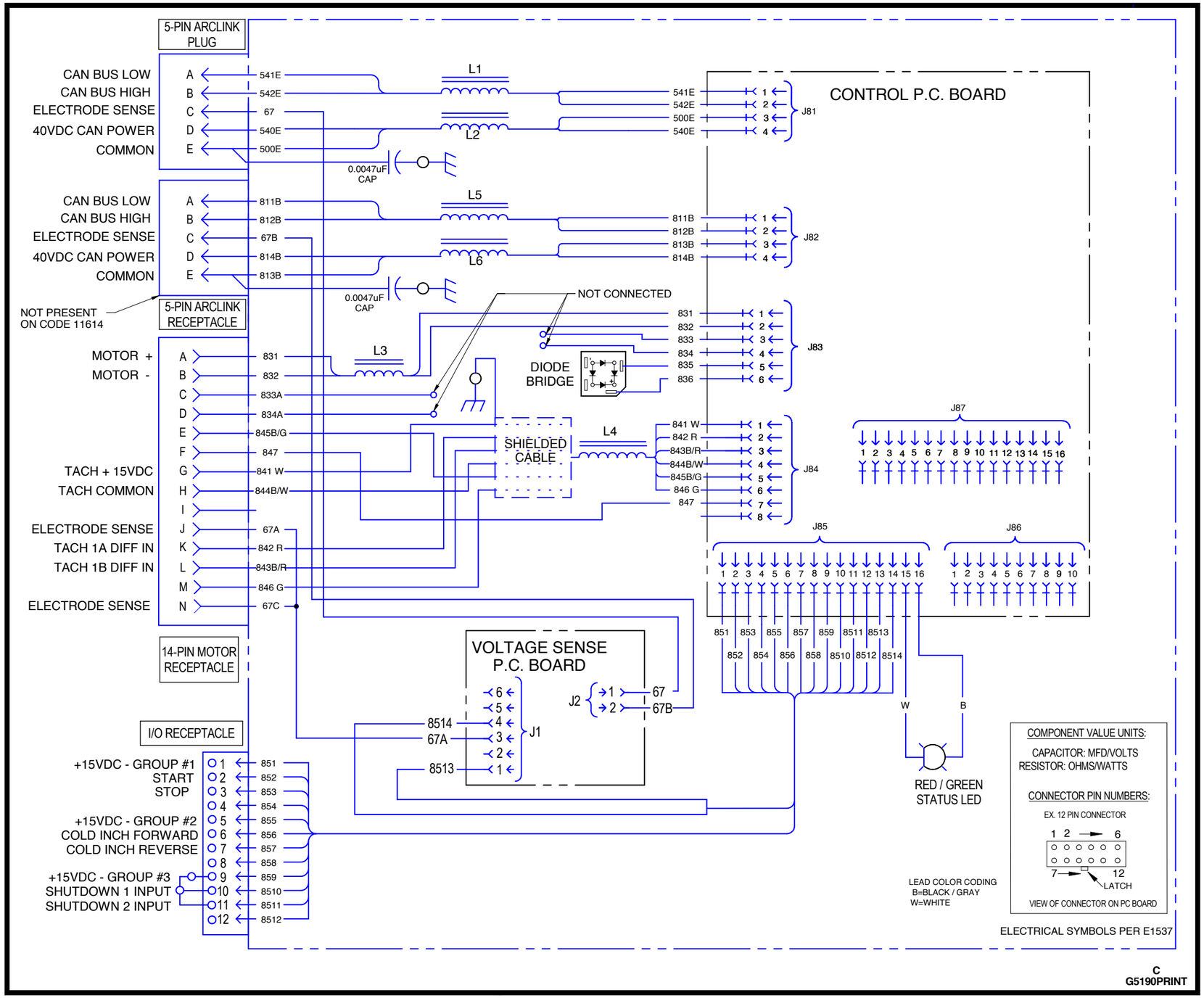
WIRING DIAGRAM - MAXsa™ 19 (G5190)

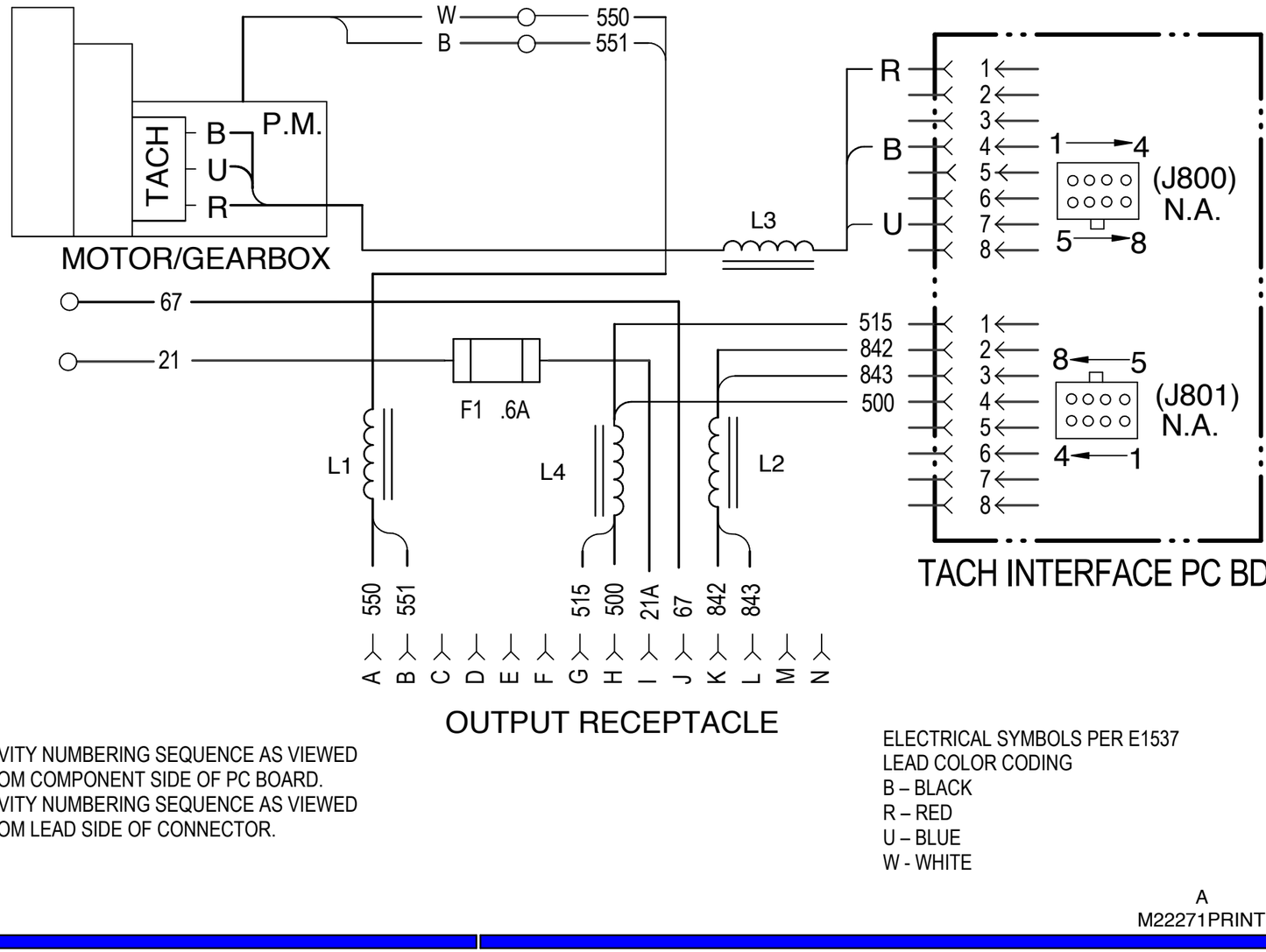
MAXsa 19 WIRING DIAGRAM



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

WIRING DIAGRAM MAXsa 22



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.

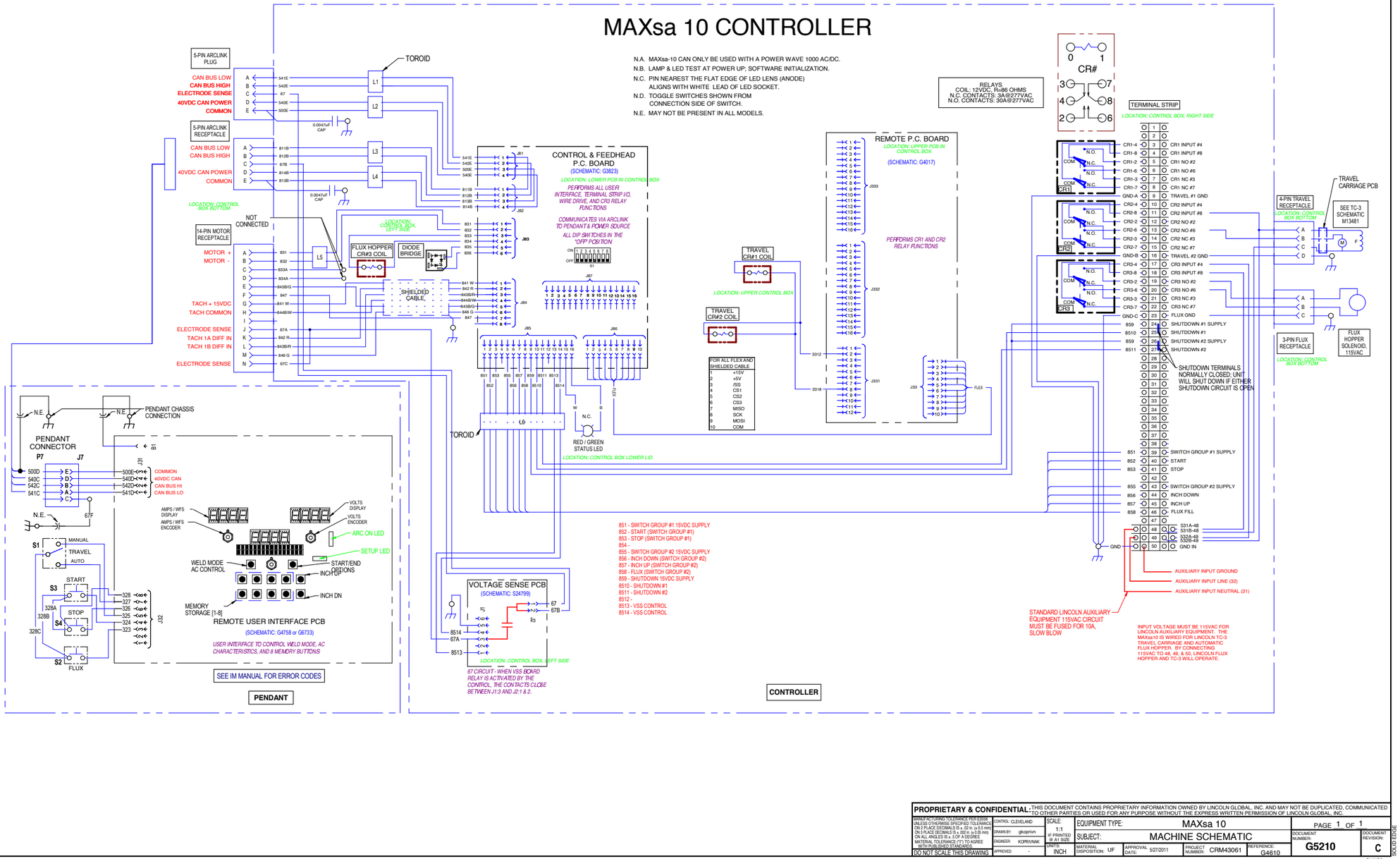
ELECTRICAL SYMBOLS PER E1537
LEAD COLOR CODING
B – BLACK
R – RED
U – BLUE
W - WHITE

A
M22271PRINT

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 - MAXsa™ 10 (G5210)

G5210 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: 14 PIN MOTOR RECEPTACLE ADDED LEADS 833A, 834A, AND 847. REVISED LEAD NUMBERS OF J82 ON CONTROL BOARD.



MANUFACTURING TOLERANCE PER E0709 UNLESS OTHERWISE SPECIFIED TOLERANCES ON 2 PLACE DECIMALS IS ± .02 in. (±0.5 mm) ON 3 PLACE DECIMALS IS ± .002 in. (±0.05 mm) ON ALL ANGLES IS ± .5 OF A DEGREE. MATERIAL TOLERANCE FITTO AGREE WITH PUBLISHED STANDARDS.	CONTROL: CLEVELAND	SCALE: 1:1 IF PRINTED @ A1 SIZE	EQUIPMENT TYPE: MAXsa 10		PAGE 1 OF 1
	DRAWN BY: gkoprivn		SUBJECT: MACHINE SCHEMATIC		
	ENGINEER: KOPRIVNAK	UNITS: INCH	MATERIAL DISPOSITION: UF	APPROVAL DATE: 5/27/2011	PROJECT NUMBER: CRM43061	REFERENCE: G4610	DOCUMENT NUMBER: G5210	DOCUMENT REVISION: C
DO NOT SCALE THIS DRAWING	APPROVED: -							

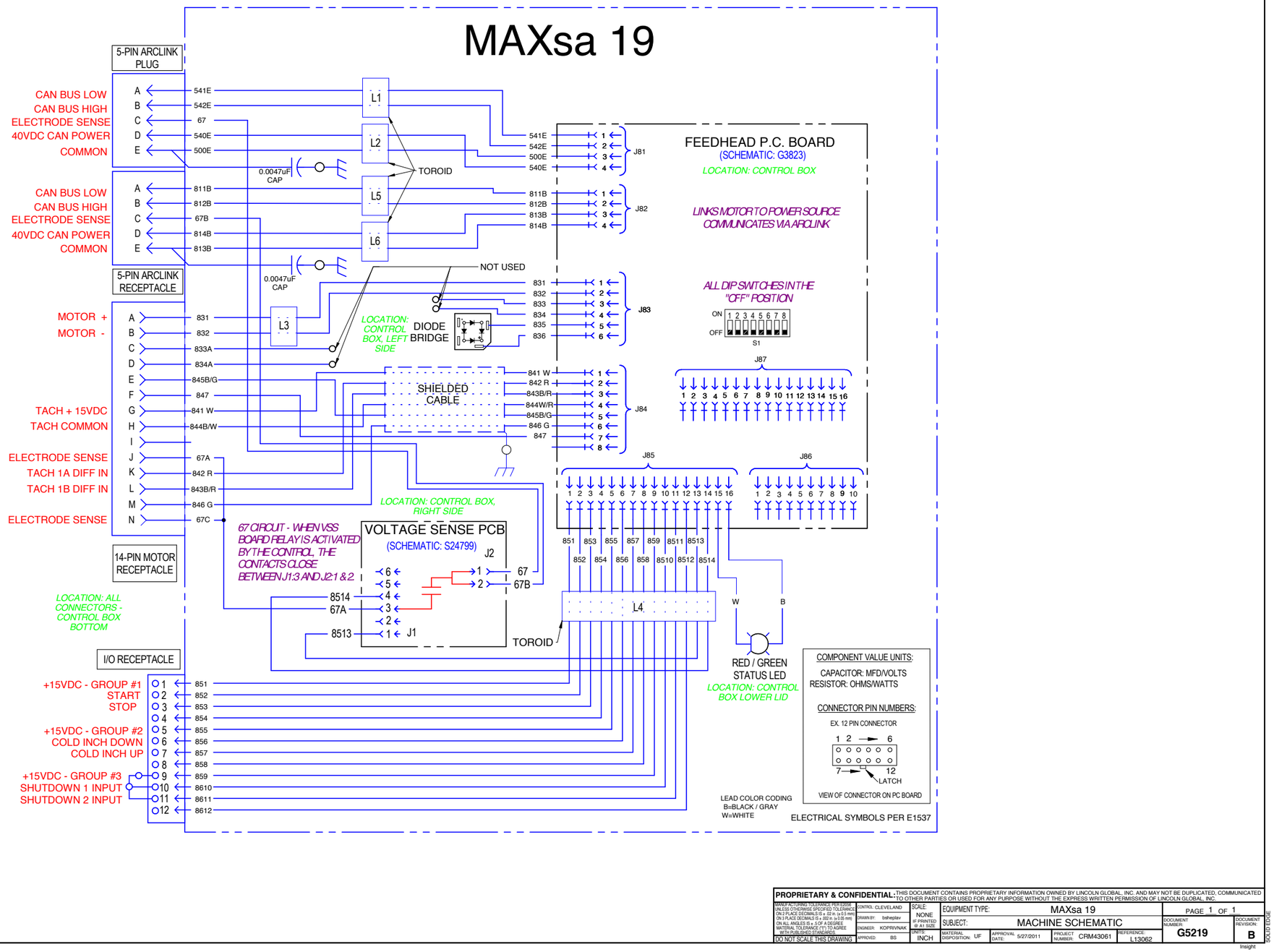
EN-170 SOLID EDGE Insight

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 - MAXsa™ 19 (G5219)

G5219 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: ADDED 5-PIN RECEPTACLE. ADDED LEADS 833A, 834A, & 847. REVISED LEAD NUMBERS OF J82 ON CONTROL BOARD.



UNLESS OTHERWISE SPECIFIED TOLERANCE ON 3 PLACE DECIMALS 0.05 ± .02 in. (± 0.5 mm) ON 3 PLACE DECIMALS 0 ± .002 in. (± 0.05 mm) ON ALL ANGLES 0 ± 1/2° A DEGREE MATERIAL TOLERANCE (*T*) TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING	CONTROL: CLEVELAND	SCALE: NONE IF PRINTED @ A1 SIZE	EQUIPMENT TYPE: MAXsa 19
	DRAWN BY: bsheplav		SUBJECT: MACHINE SCHEMATIC
	ENGINEER: KOPRIVNAK	UNITS: INCH	MATERIAL DISPOSITION: UF
	APPROVED: BS		APPROVAL DATE: 5/27/2011
			PROJECT NUMBER: CRM43061
			REFERENCE: L13062

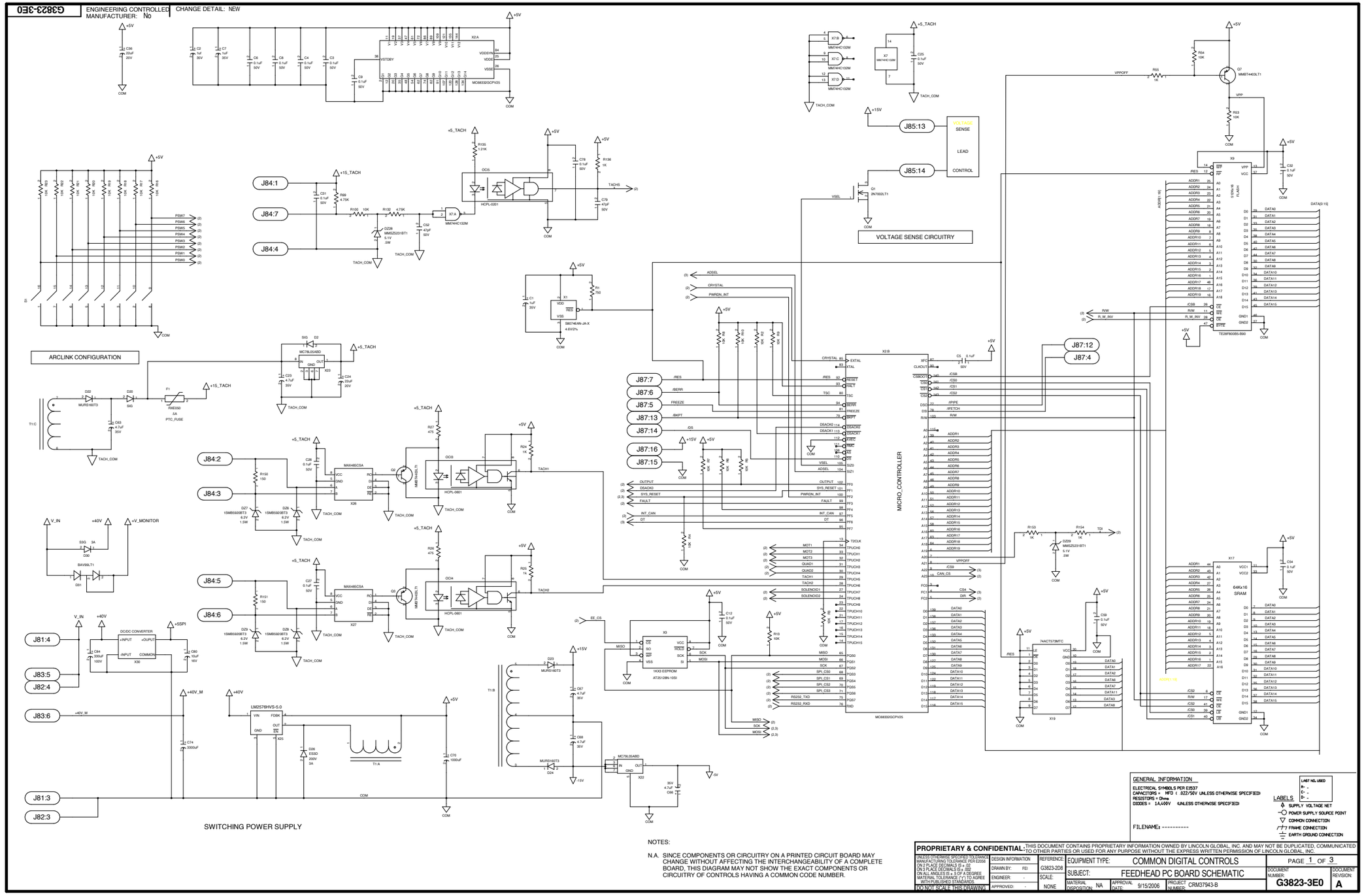
PAGE 1 OF 1 | DOCUMENT NUMBER: G5219 | DOCUMENT REVISION: B

EN-170 | SOLID EDGE Insight

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

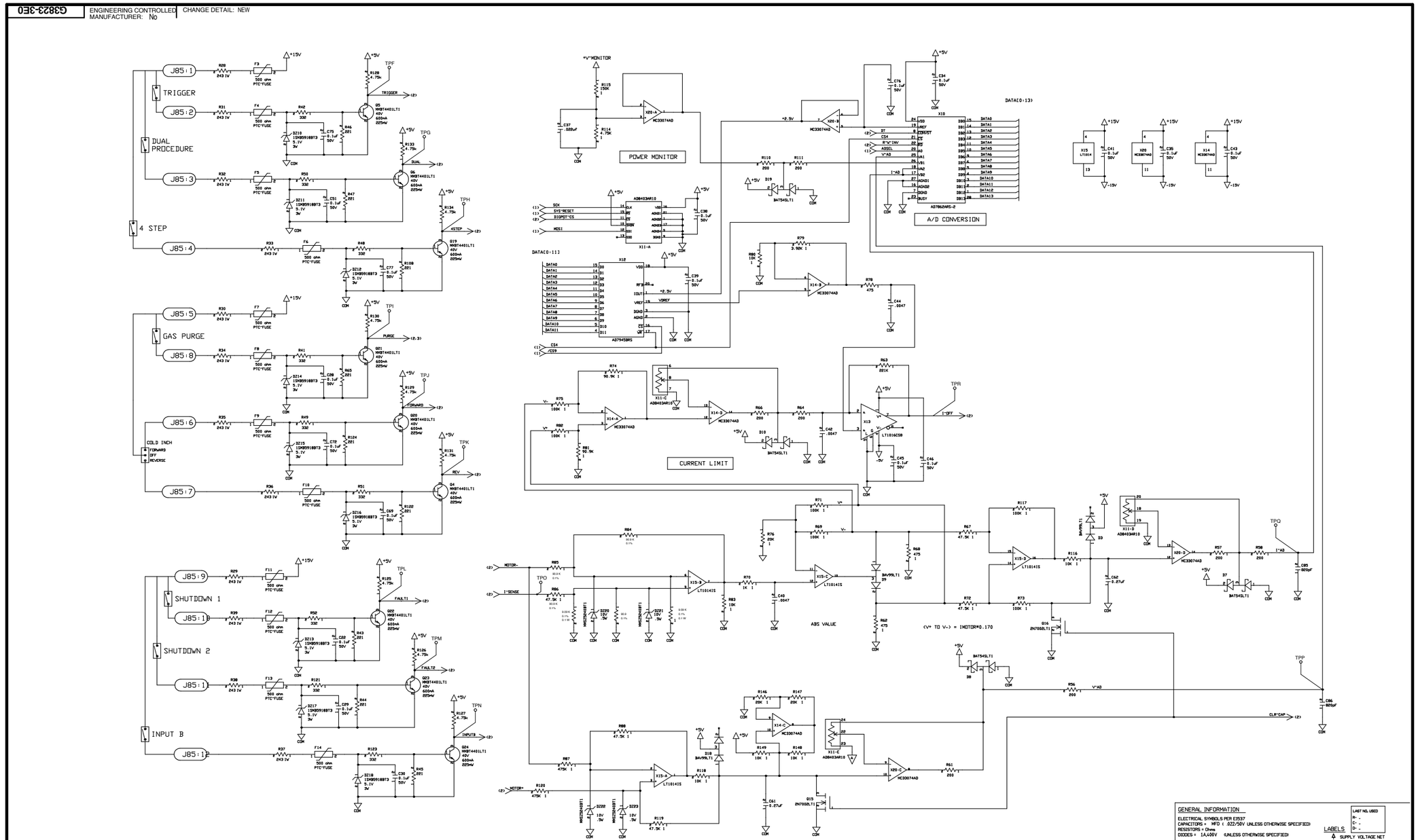
SCHEMATIC - FEED HEAD PC BOARD (G3823-3 PG1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - FEED HEAD PC BOARD (G3823-3 PG2)

G3823-3E0 ENGINEERING CONTROLLED CHANGE DETAIL: NEW
MANUFACTURER: No

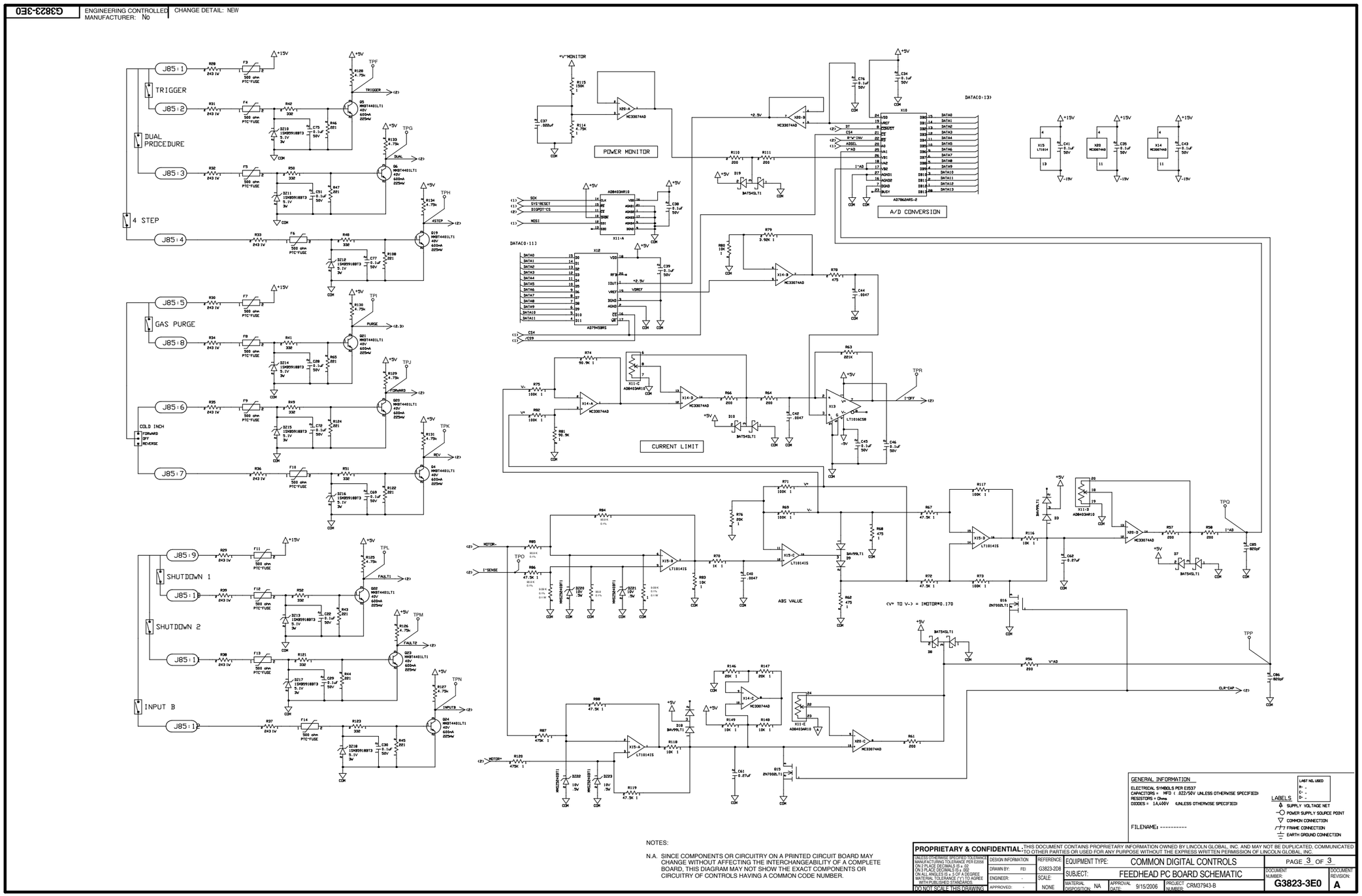


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

Return to Section TOC
Return to Master TOC

SCHEMATIC - FEED HEAD PC BOARD (G3823-3 PG3)

G3823-3E0 | ENGINEERING CONTROLLED | CHANGE DETAIL: NEW
MANUFACTURER: No



NOTES:

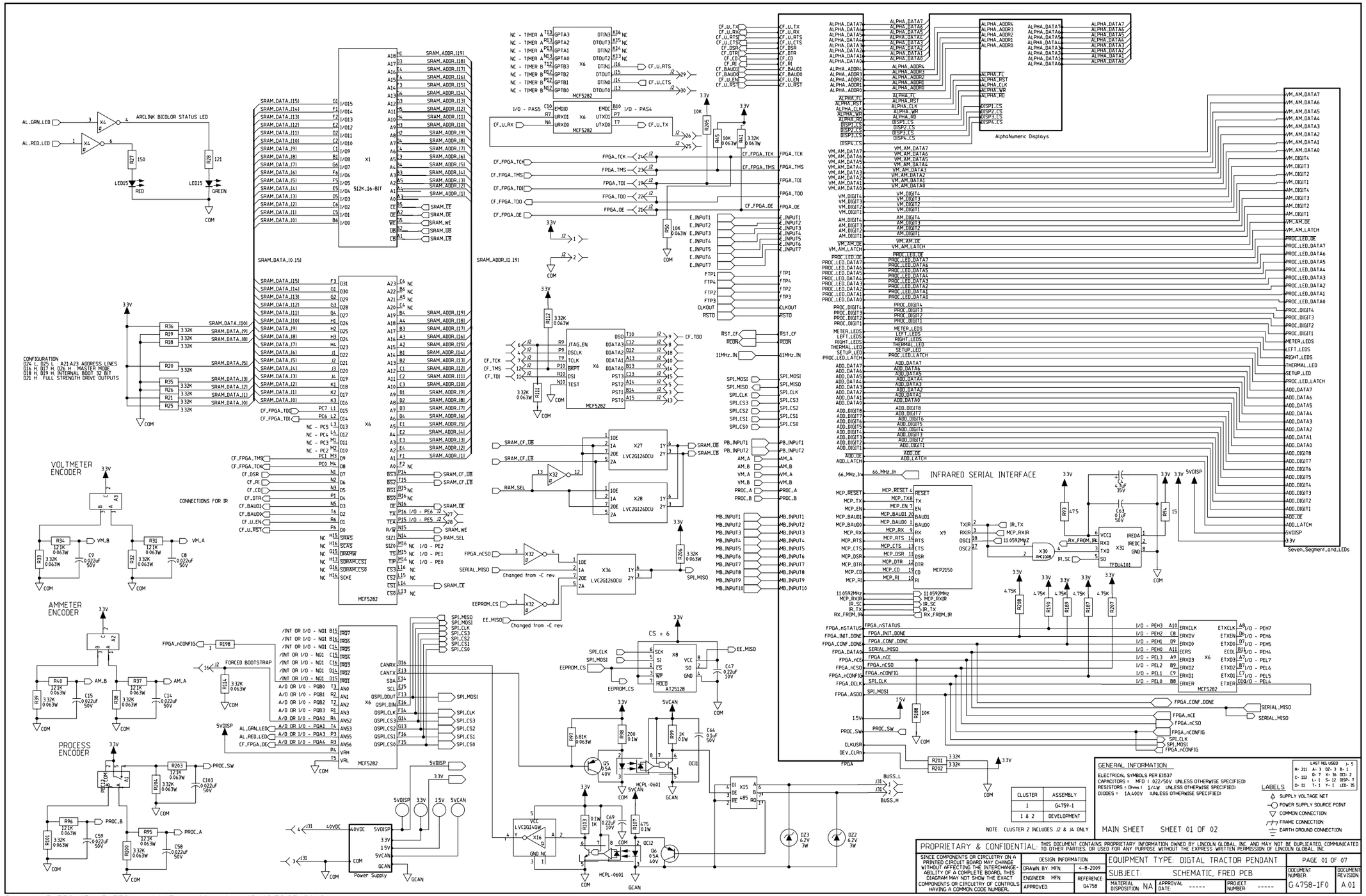
N.A. SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGEABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.

UNLESS OTHERWISE SPECIFIED TOLERANCES MANUFACTURING TOLERANCE PER E2000 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	DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: COMMON DIGITAL CONTROLS		PAGE 3 OF 3
	DRAWN BY: FEI	G3823-2D8	SUBJECT: FEEDHEAD PC BOARD SCHEMATIC		
	ENGINEER: -	SCALE: NONE	MATERIAL DISPOSITION: NA	APPROVAL DATE: 9/15/2006	DOCUMENT NUMBER: G3823-3E0 / DOCUMENT REVISION: A
DO NOT SCALE THIS DRAWING	APPROVED: -			PROJECT NUMBER: CRM3943-B	

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

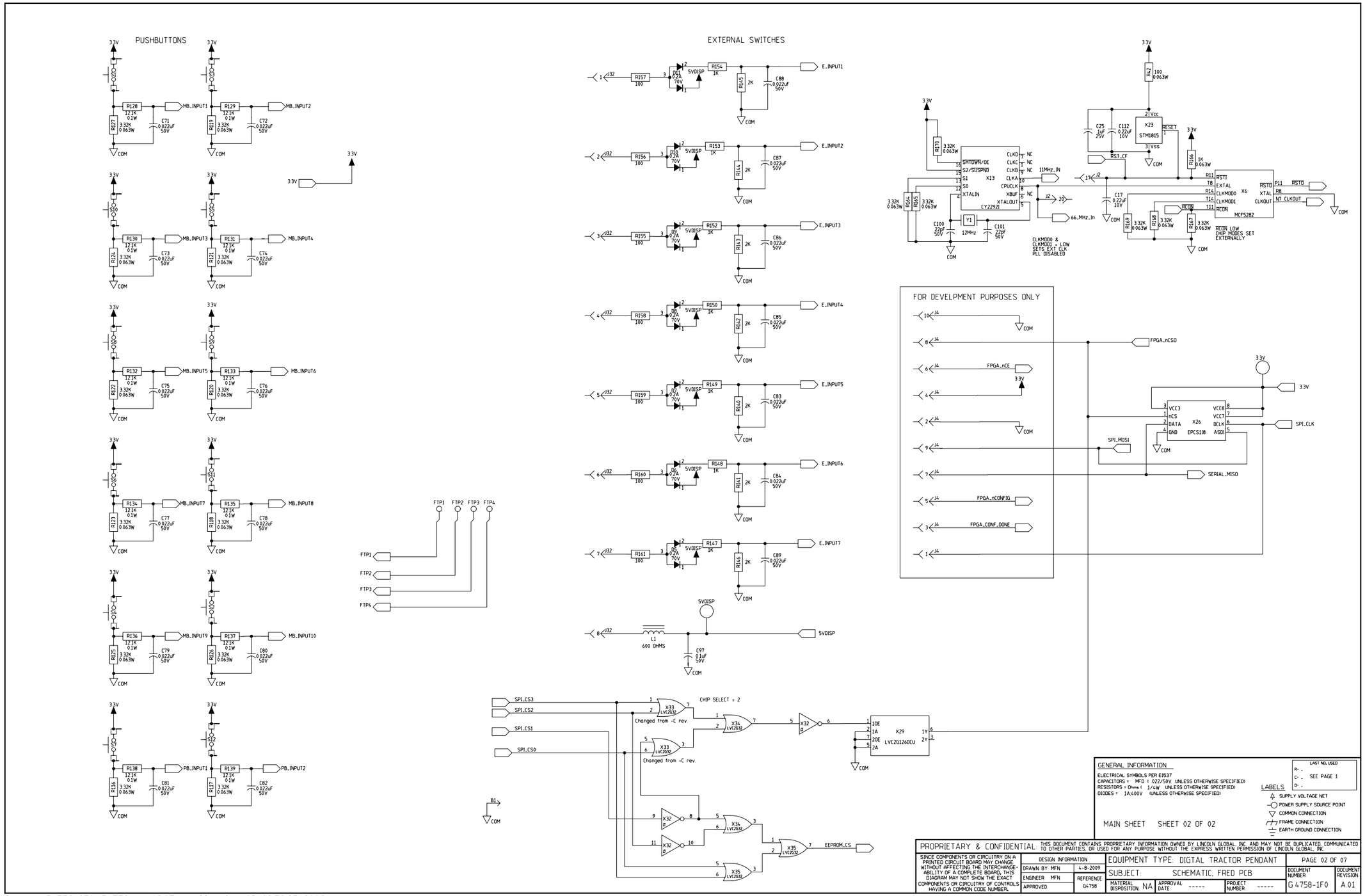
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG1)



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

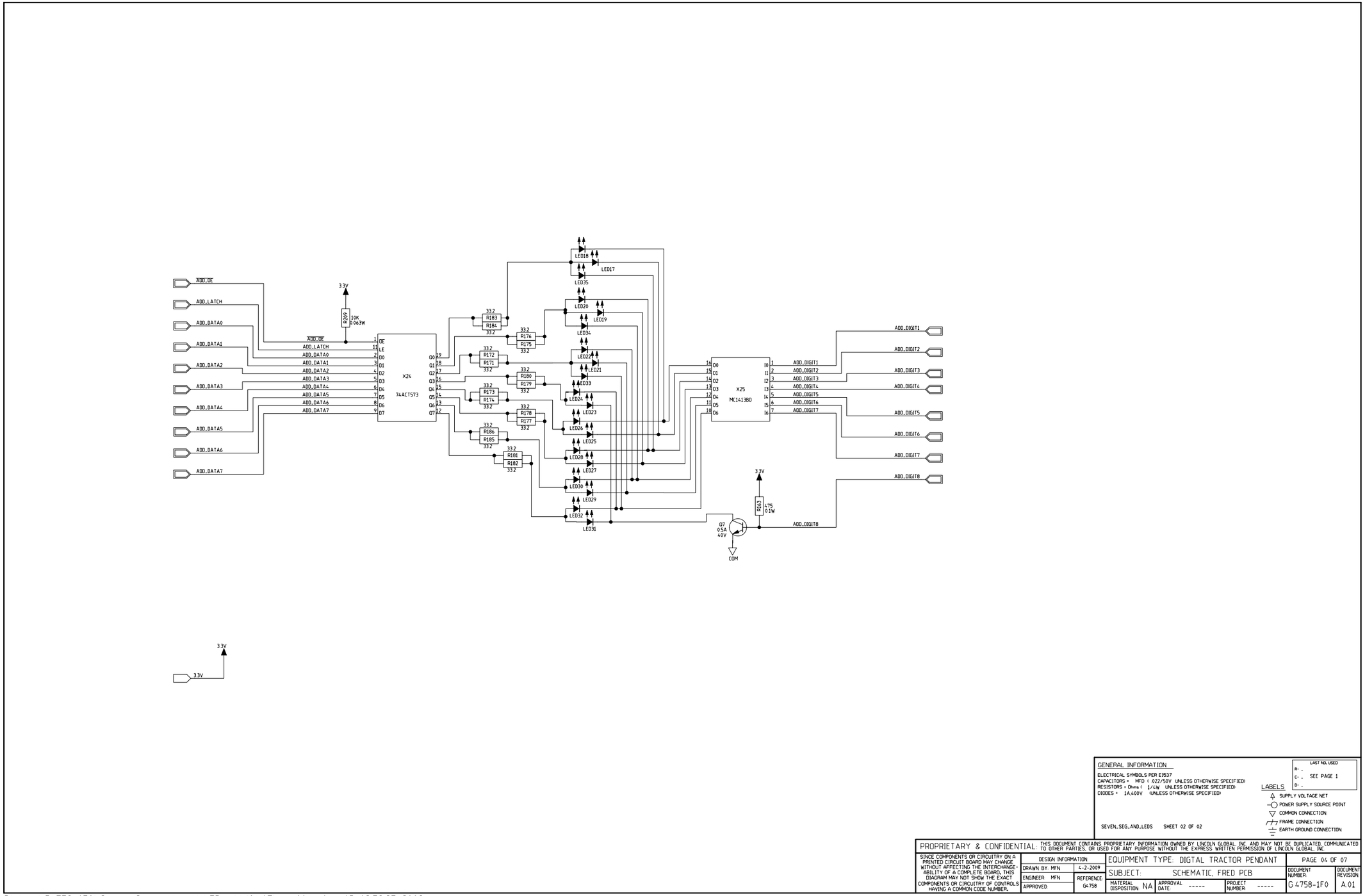
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG2)



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

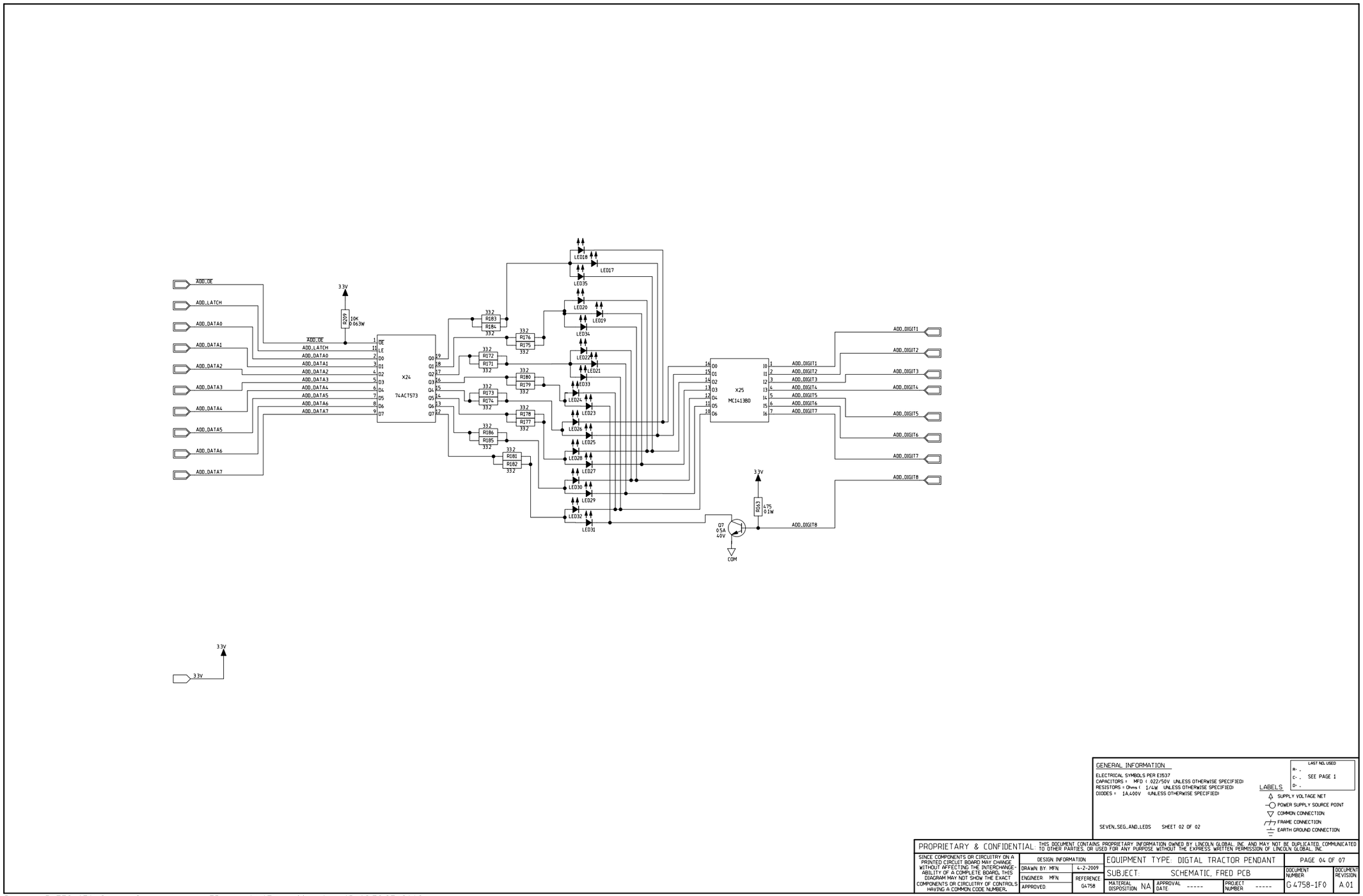
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG3)



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

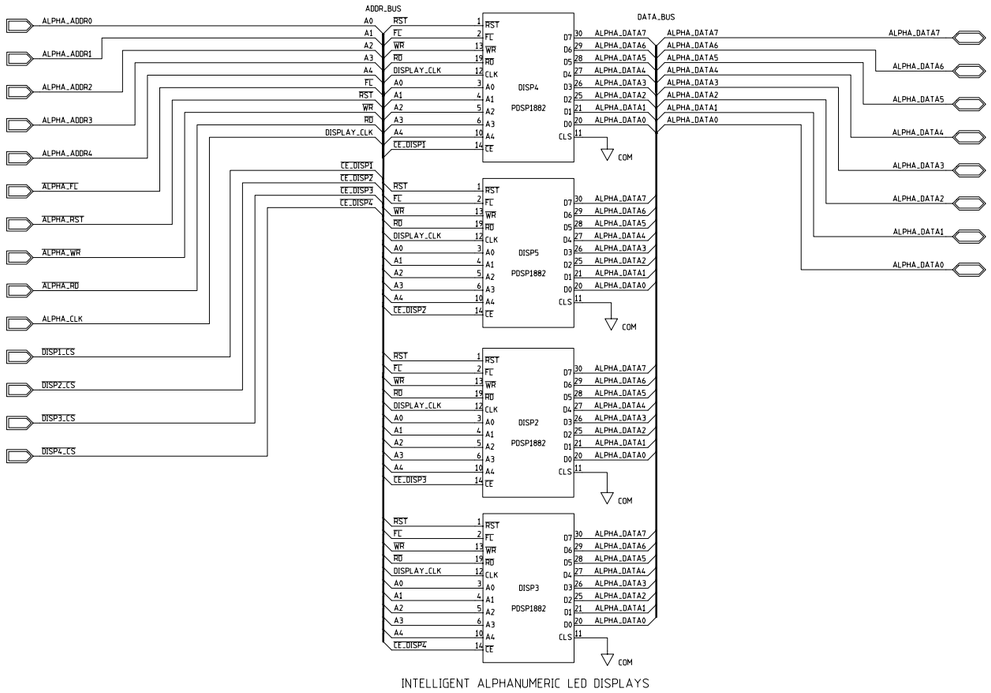
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG4)



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

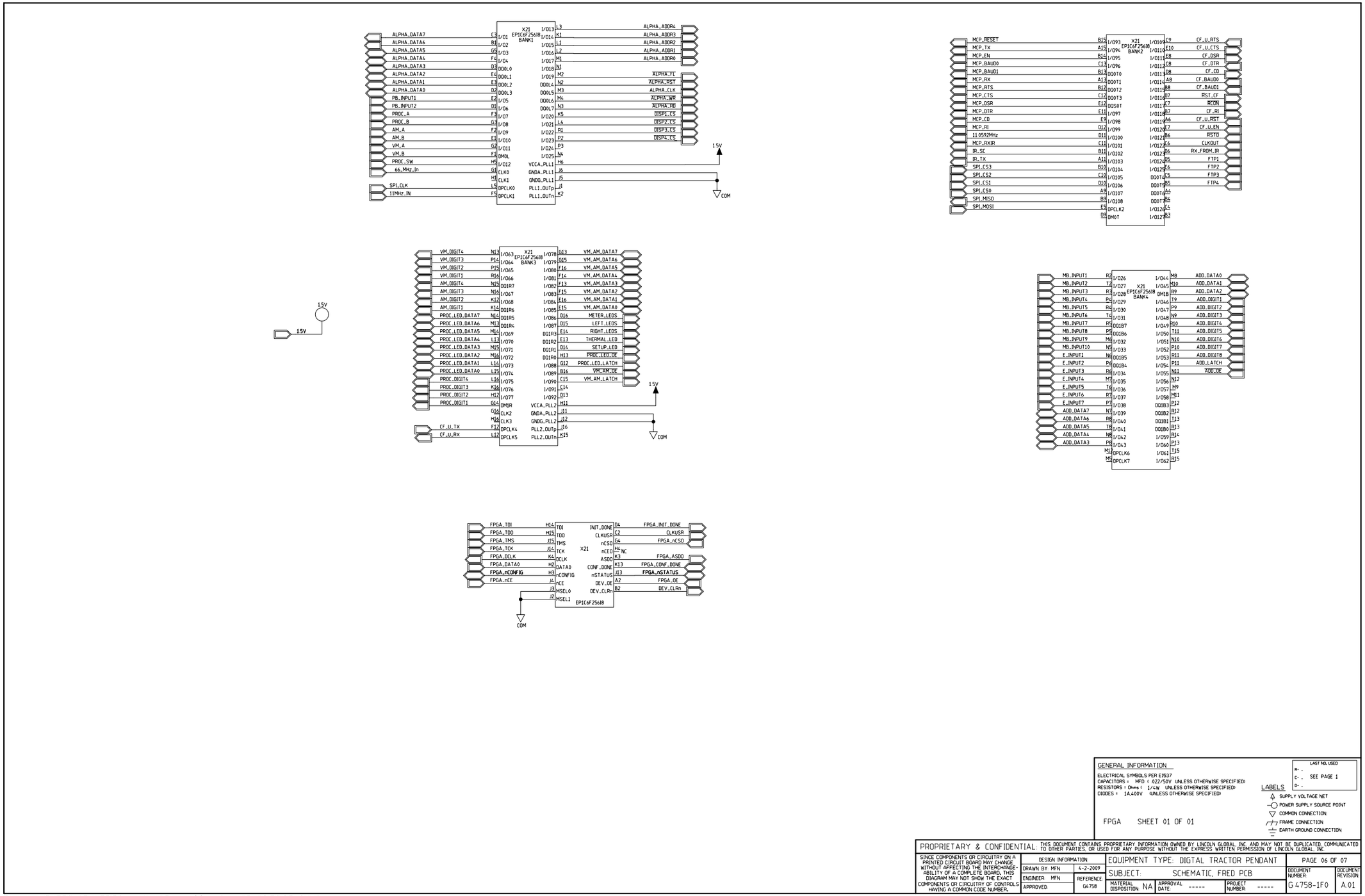
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG5)



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

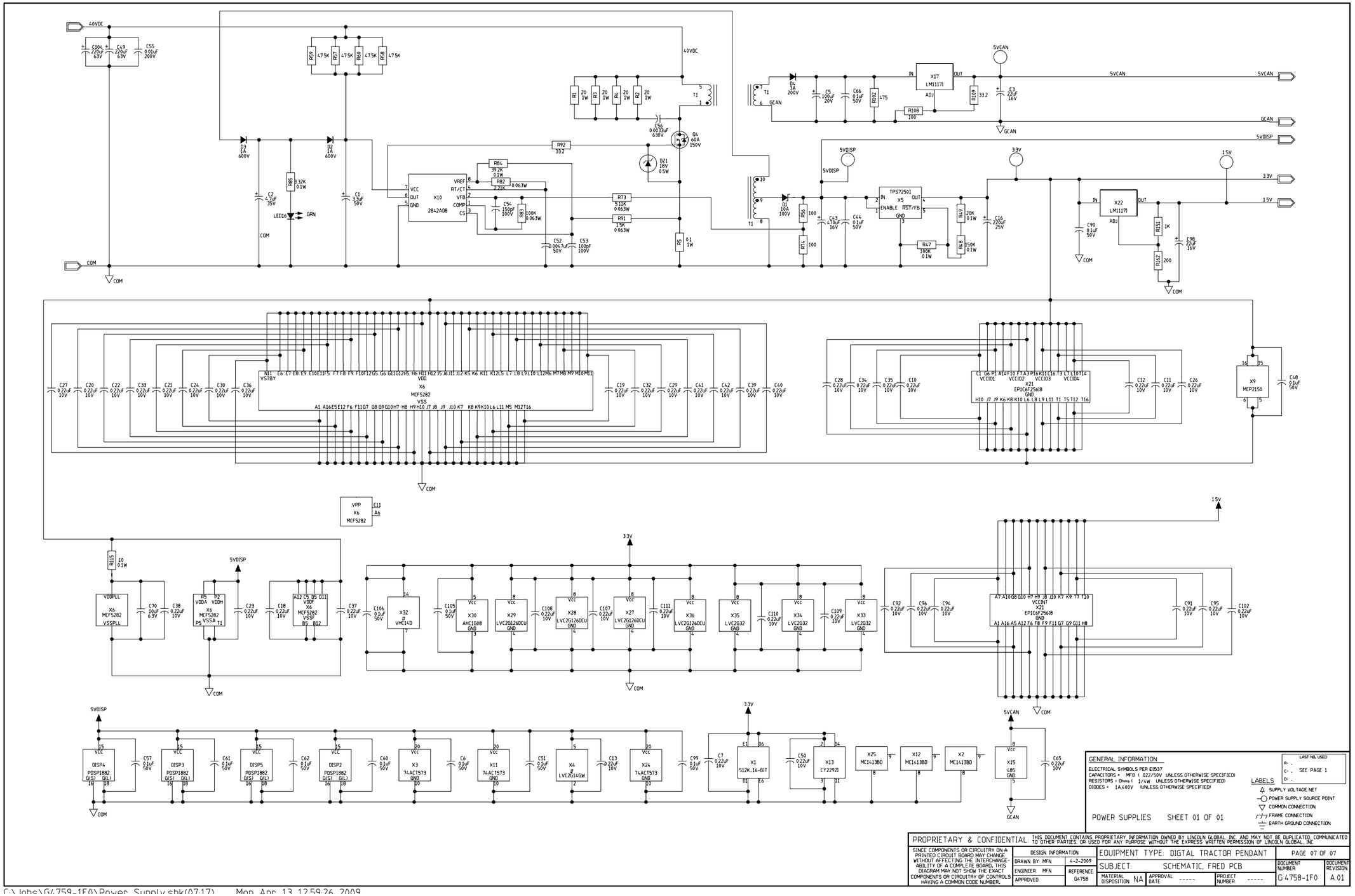
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG6)



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

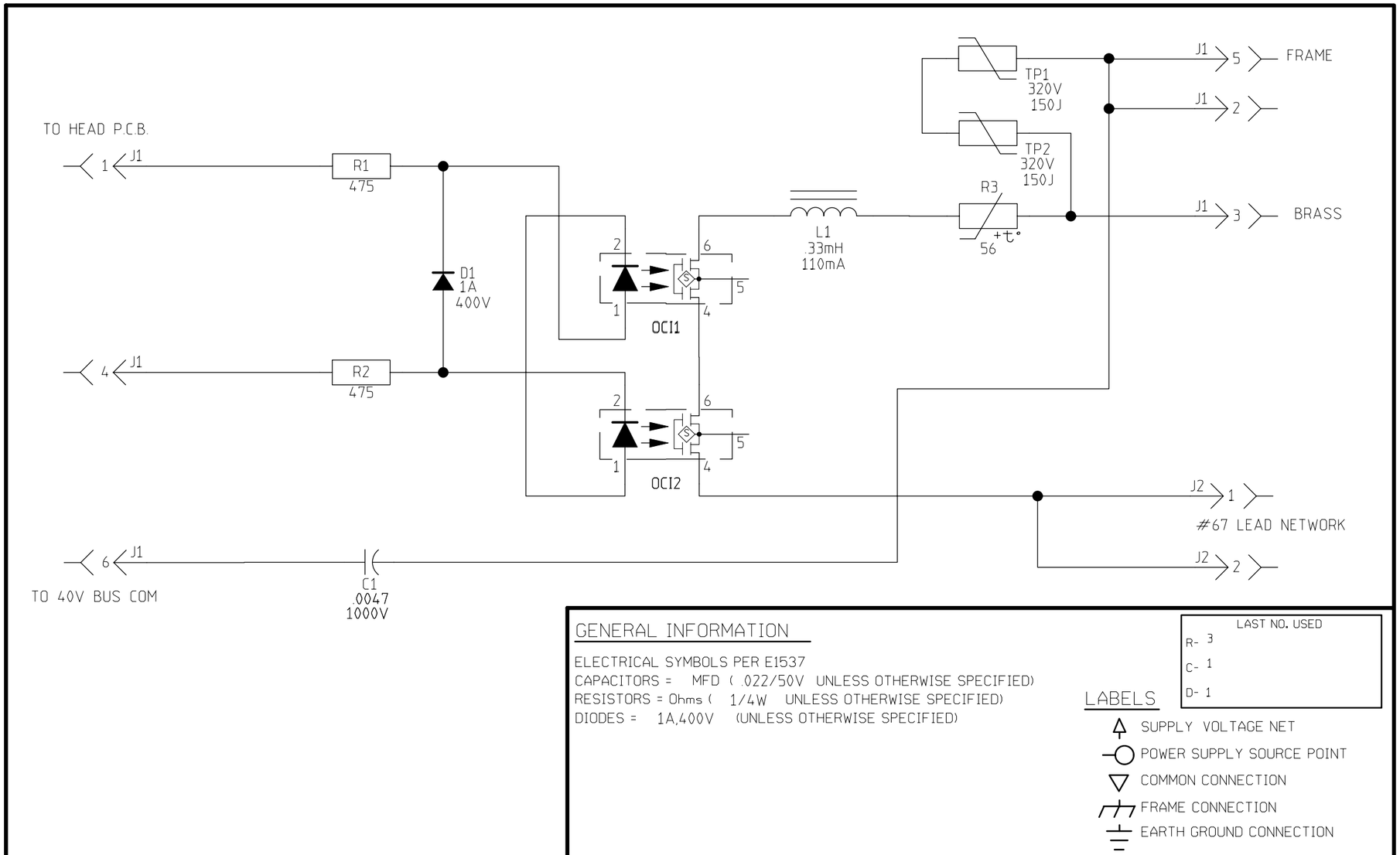
SCHEMATIC - F.R.E.D. PC BOARD (G4758-1 PG7)



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 - VOLTAGE SENSE PC BOARD (S24779-3)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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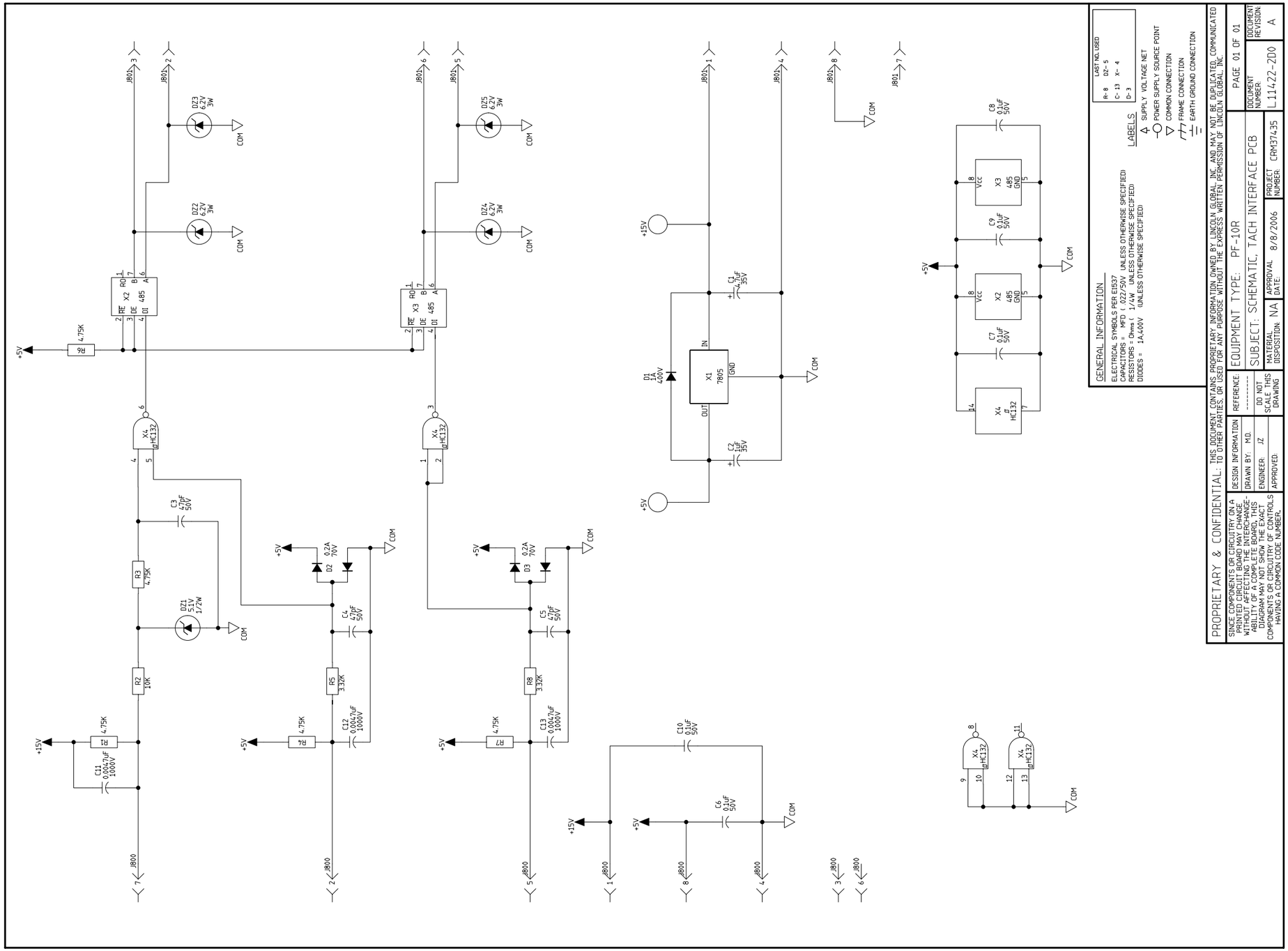
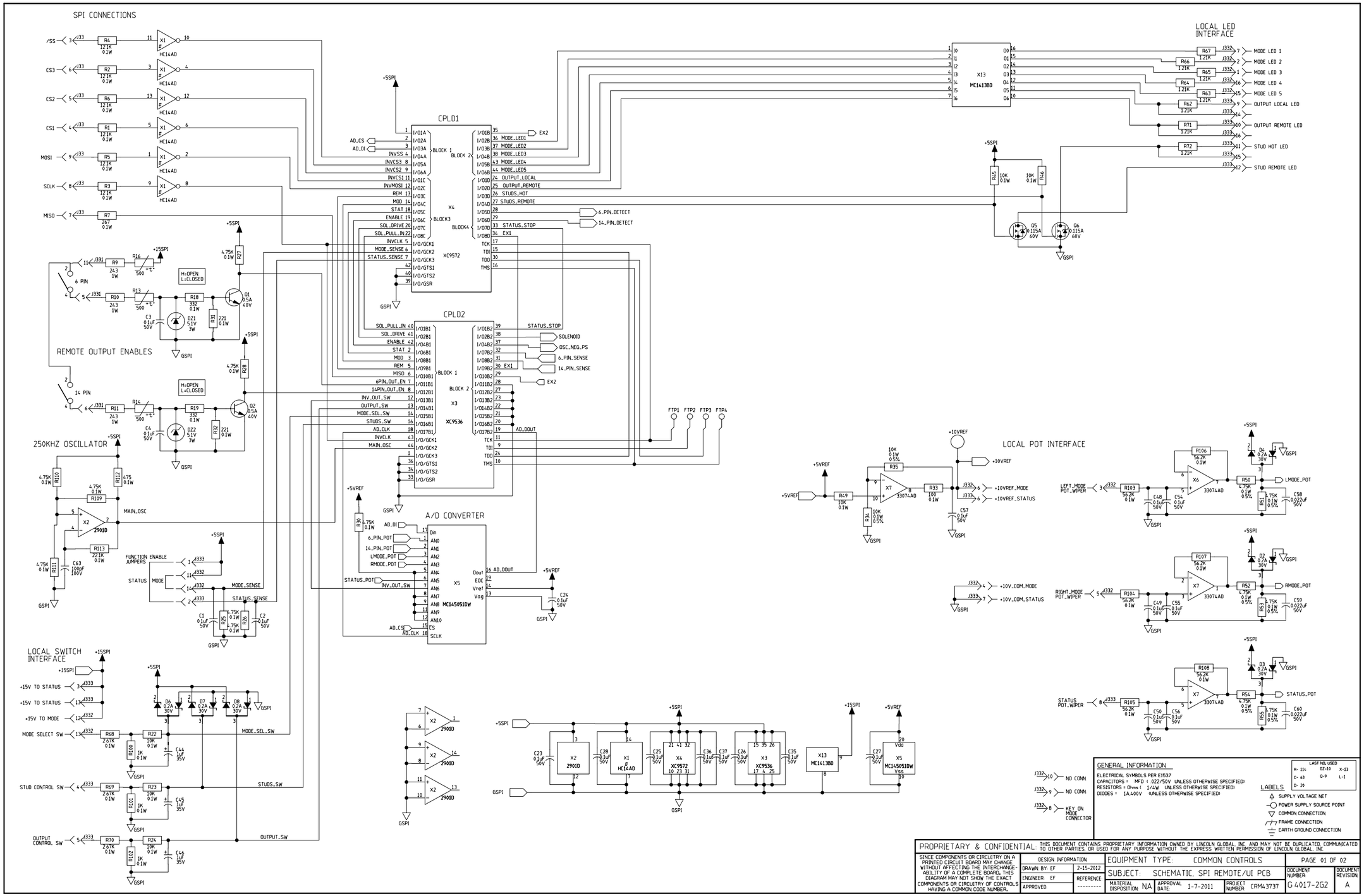
Return to Master TOC
Return to Section TOC
Return to Master TOC
Return to Section TOC
Return to Master TOC

SCHEMATIC - TACH INTERFACE PC BOARD (L11422-2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

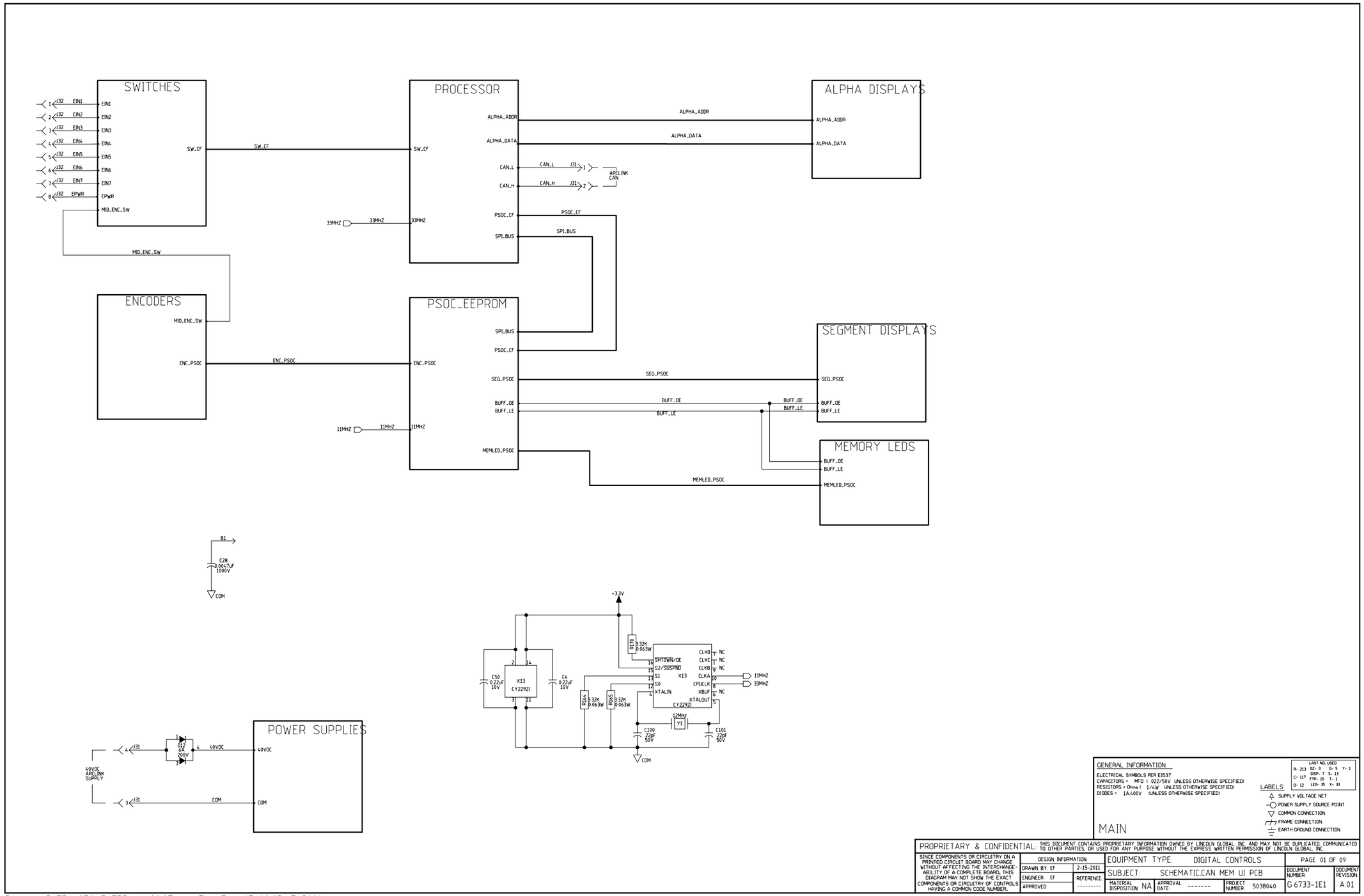
SCHEMATIC - SPI REMOTE PC BOARD (G4017-2)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

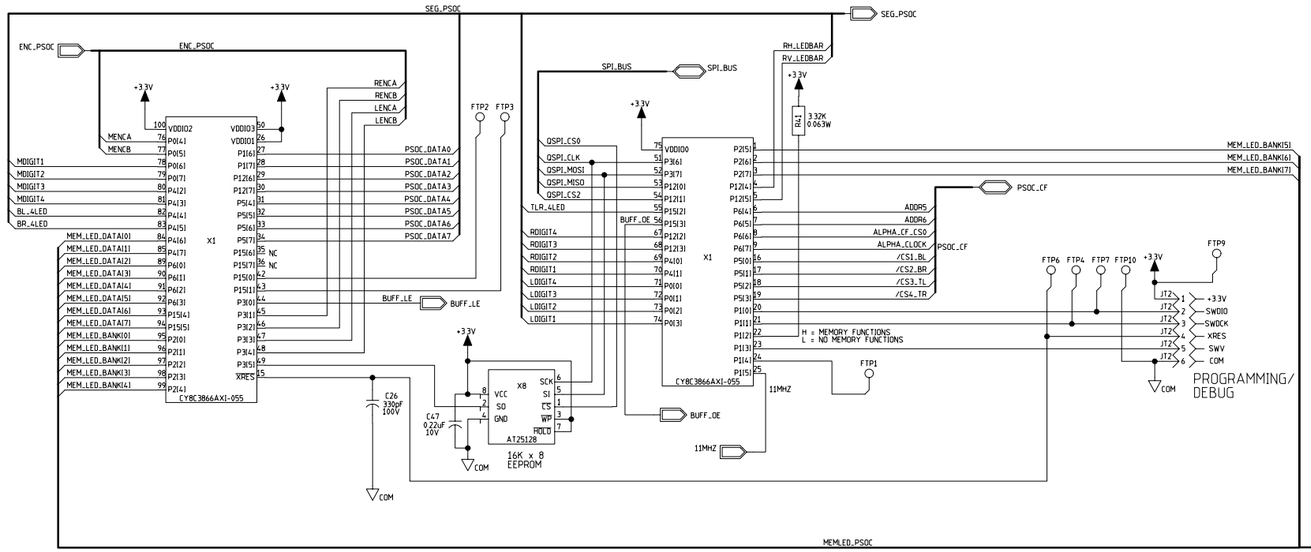
Return to Section TOC
Return to Master TOC

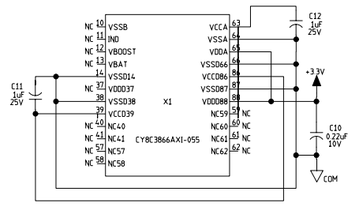
SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG1)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG2)





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- .
C- . SEE PAGE 1
D- .

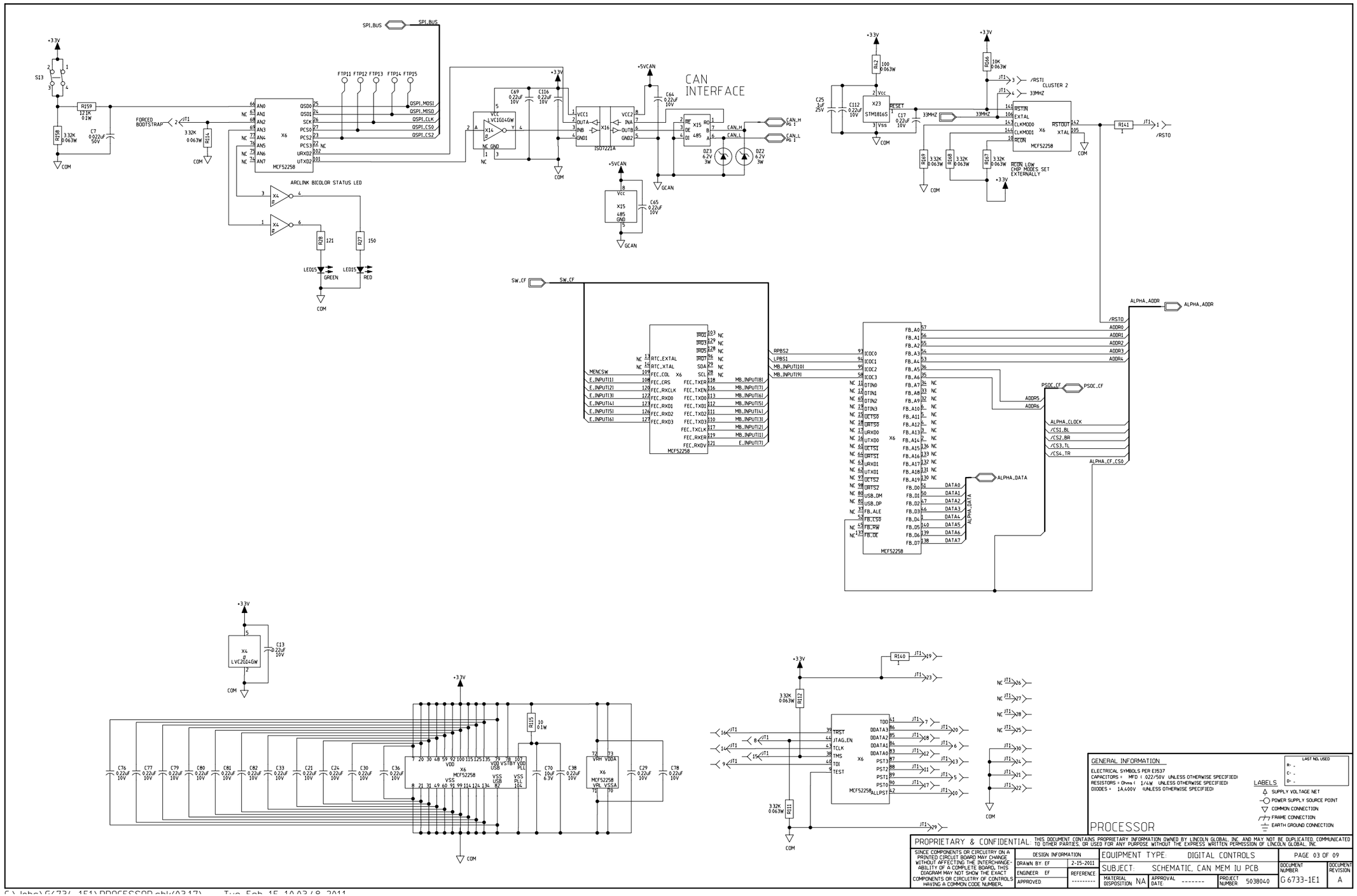
LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

PSOC_EEPROM

DESIGN INFORMATION		EQUIPMENT TYPE: DIGITAL CONTROLS	PAGE 02 OF 09
DRAWN BY: EF	2-15-2011	SUBJECT: SCHEMATIC, CAN MEM UI PCB	DOCUMENT NUMBER: G6733-1E1 / DOCUMENT REVISION: A.01
ENGINEER EF	REFERENCE: ---------		
APPROVED		MATERIAL DISPOSITION: NA / APPROVAL DATE: ------- / PROJECT NUMBER: 5038040	

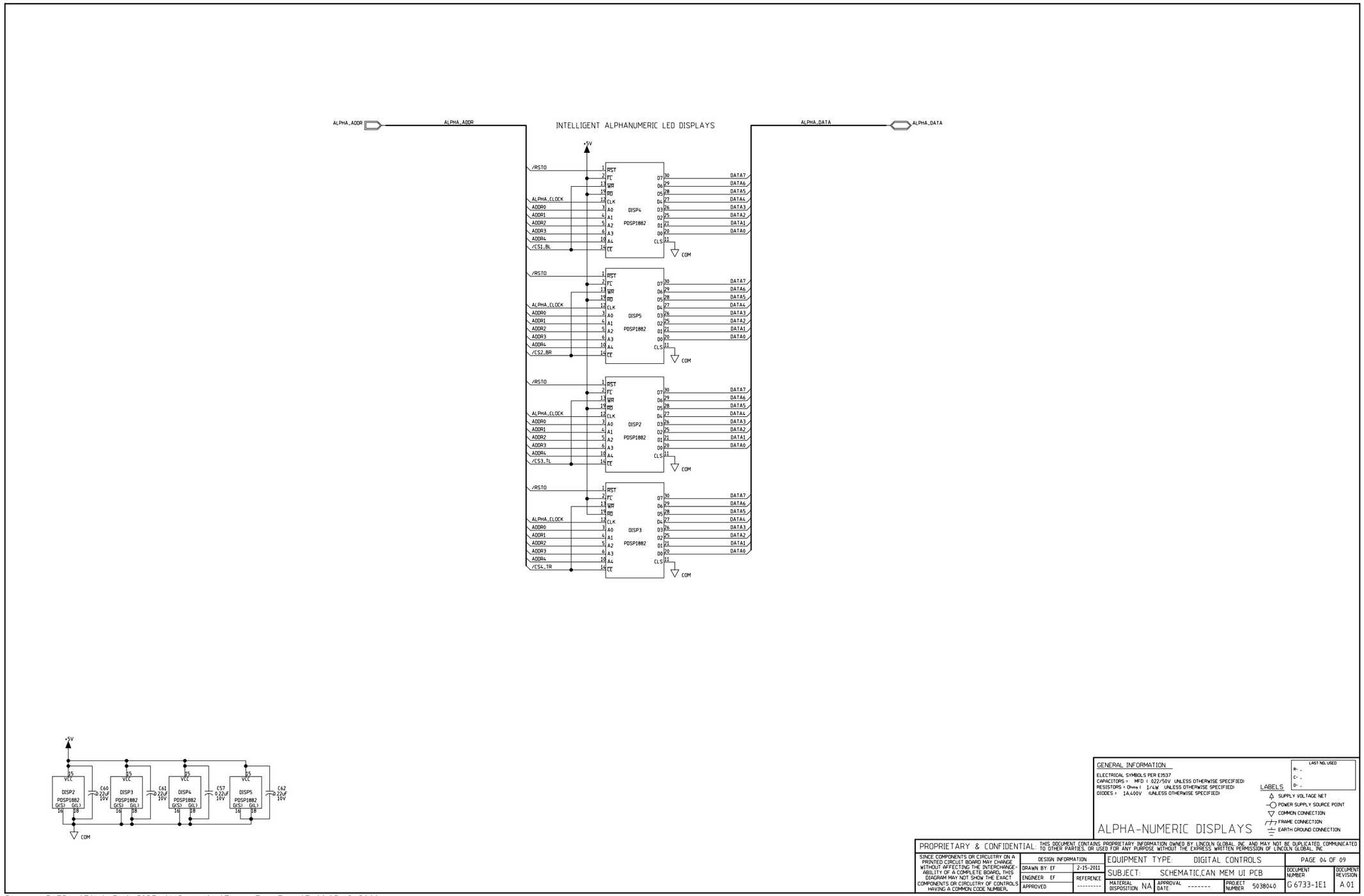
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG3)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG4)



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- -
C- -
D- -

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

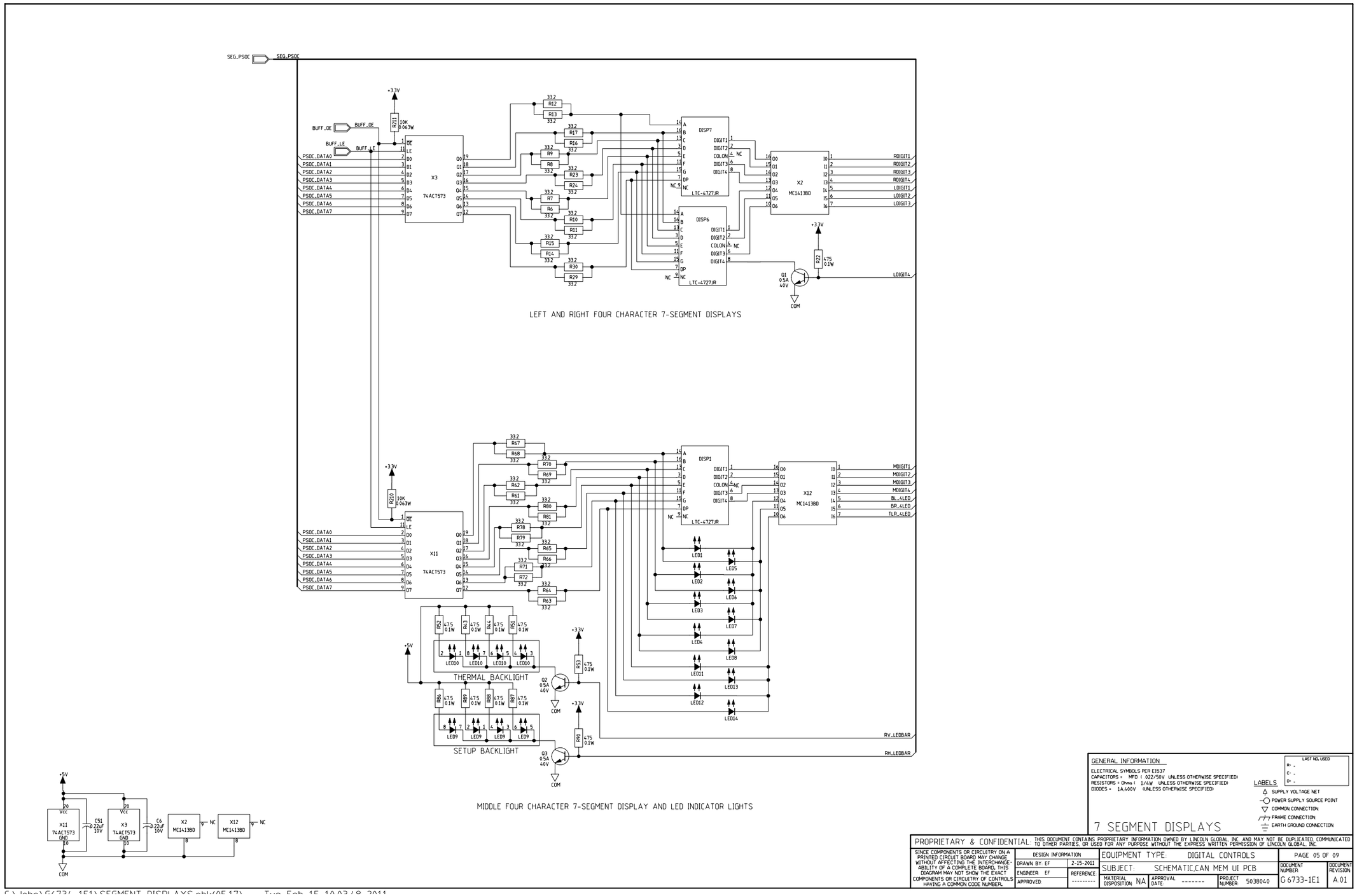
ALPHA-NUMERIC DISPLAYS

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.

DESIGN INFORMATION		EQUIPMENT TYPE: DIGITAL CONTROLS	PAGE 04 OF 09
DRAWN BY: EF	2-15-2011	SUBJECT: SCHEMATIC,CAN MEM UI PCB	
ENGINEER: EF	REFERENCE ---------		
APPROVED		MATERIAL DISPOSITION: NA / APPROVAL DATE: ------- / PROJECT NUMBER: 503804.0	DOCUMENT NUMBER: G6733-1E1 / DOCUMENT REVISION: A.01

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

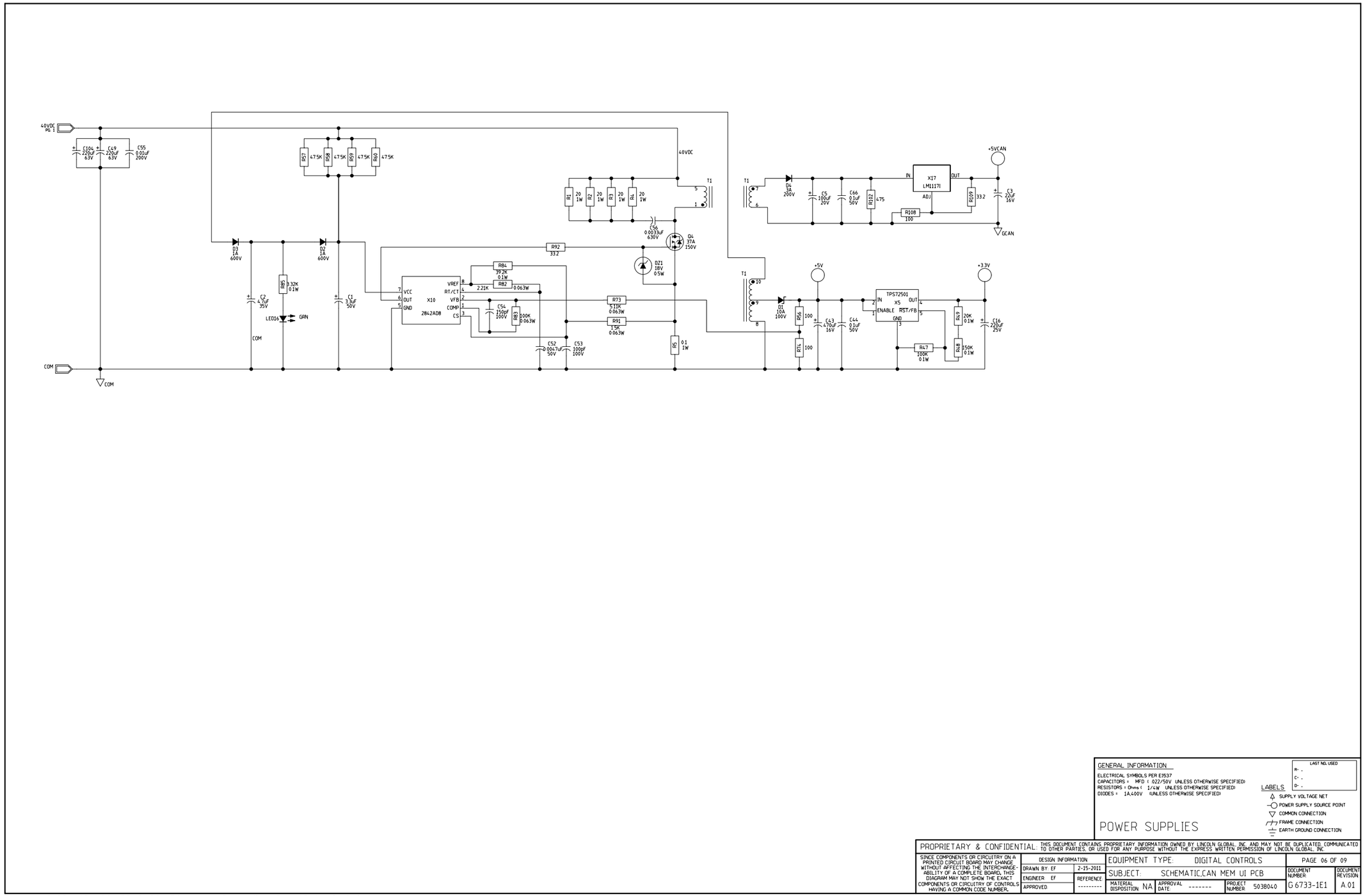
SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG5)



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 - USER INTERFACE PC BOARD (G6733-3 PG6)



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- -
C- -
D- -

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

POWER SUPPLIES

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.

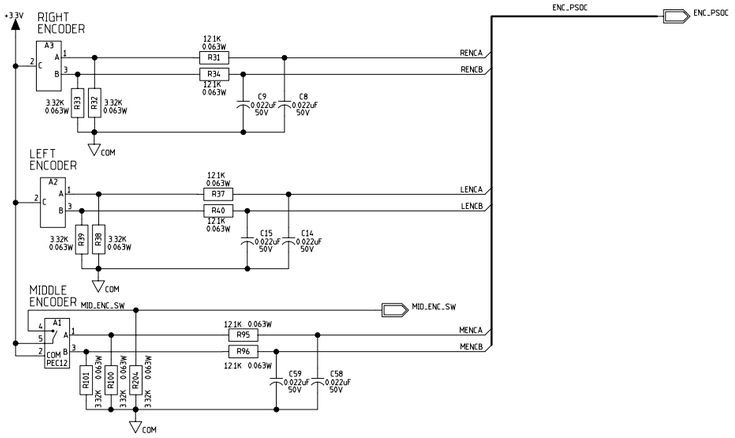
DESIGN INFORMATION		EQUIPMENT TYPE: DIGITAL CONTROLS	PAGE 06 OF 09
DRAWN BY: EF	2-15-2011	SUBJECT: SCHEMATIC,CAN MEM UI PCB	
ENGINEER EF	REFERENCE		
APPROVED	--------	MATERIAL DISPOSITION NA / APPROVAL DATE ------- / PROJECT NUMBER 503804.0	DOCUMENT NUMBER G 6733-1E1 / DOCUMENT REVISION A.01

C:\Jobs\G673(..1E1\POWER_SUPPLIES.sch(04.17) Tue Feb 15 10:03:48 2011

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 - USER INTERFACE PC BOARD (G6733-3 PG7)



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- .
C- . SEE PAGE 1
D- .

LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

ENCODERS

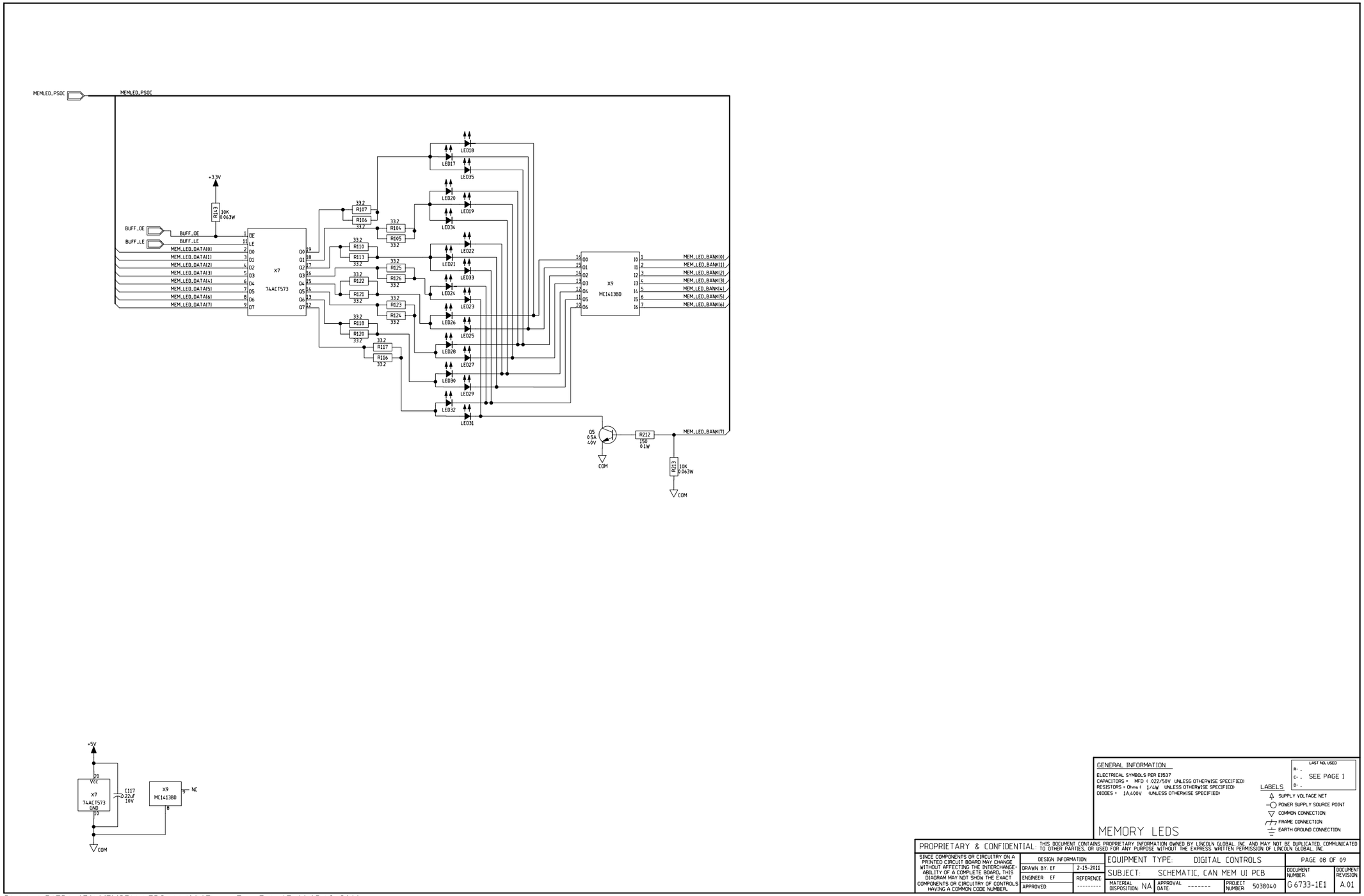
DESIGN INFORMATION		EQUIPMENT TYPE: DIGITAL CONTROLS		PAGE 07 OF 09	
DRAWN BY: EF	2-15-2011	SUBJECT: SCHEMATIC, CAN MEM UI PCB		DOCUMENT NUMBER	DOCUMENT REVISION
ENGINEER EF	REFERENCE			G6733-1E1	A.01
APPROVED:	---------	MATERIAL DISPOSITION NA	APPROVAL DATE: -------	PROJECT NUMBER 5038040	

C:\Jobs\G6733-1E1\ENCODERS.sch(01.17) Tue Feb 15 10:03:8 2011

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

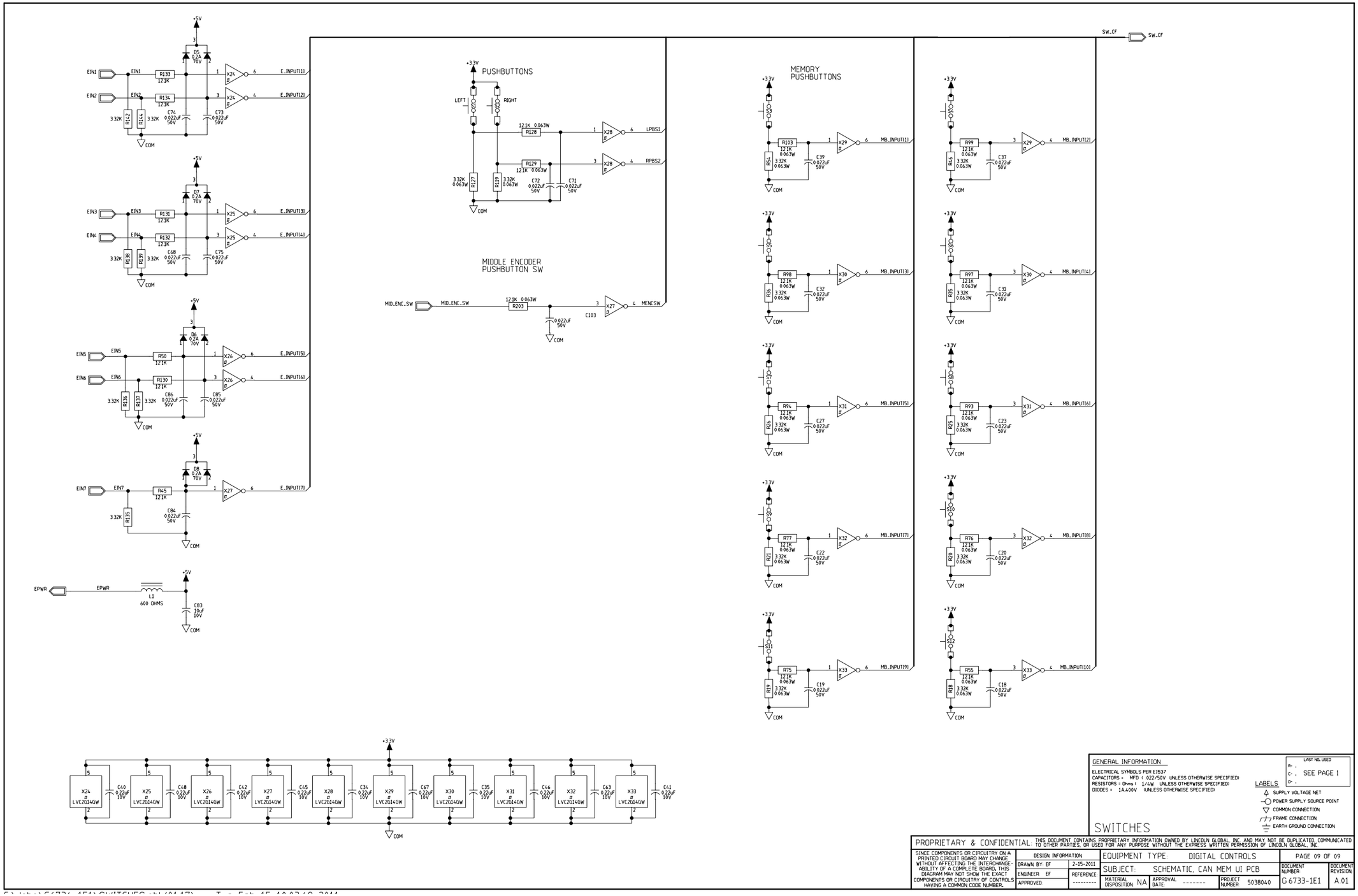
Return to Section TOC
Return to Master TOC

SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG8)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - USER INTERFACE PC BOARD (G6733-3 PG9)



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