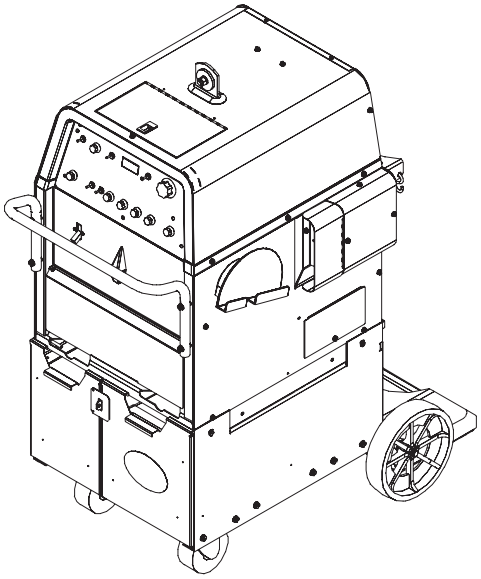
NOTE: This manual will cover most of the troubleshooting and repair procedures for the code numbers listed. Some variances may exist when troubleshooting/repairing later code numbers.

PRECISION TIG 375

For use with machines having Code Numbers:

10809, 10810, 10894, 11161, 11162

SERVICE MANUAL



Need Help? Call 1.888.935.3877
to talk to a Service Representative

Hours of Operation:
8:00 AM to 6:00 PM (ET) Mon. thru Fri.

After hours?
Use "Ask the Experts" at lincolnelectric.com
A Lincoln Service Representative will contact you no later than the following business day.

For Service outside the USA:
Email: globalservice@lincolnelectric.com

SVM163-B | Issue Date 08-Apr

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

SAFETY DEPENDS ON YOU

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

⚠ WARNING

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

⚠ CAUTION

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

KEEP YOUR HEAD OUT OF THE FUMES.

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

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

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

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

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

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

WEAR CORRECT EYE, EAR & BODY PROTECTION

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

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

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

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

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

SPECIAL SITUATIONS

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

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

Additional precautionary measures

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

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

REMOVE all potential fire hazards from welding area.

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

SECTION A: WARNINGS

CALIFORNIA PROPOSITION 65 WARNINGS

Diesel Engines

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

Gasoline Engines

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

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

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

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

FOR ENGINE POWERED EQUIPMENT.

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

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

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

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

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

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

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

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

ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS

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

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

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

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

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

ELECTRIC SHOCK CAN KILL.

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

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

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

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

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

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

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

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

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

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

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

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

ARC RAYS CAN BURN.

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

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

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

FUMES AND GASES CAN BE DANGEROUS.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding 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.

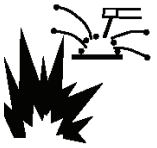
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

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.

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.l. 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.

Welding Safety Interactive Web Guide for mobile devices

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."

As a rule of thumb, for many mild steel electrode, if the air is visibly clear and you are comfortable, then the ventilation is generally adequate for your work. The most accurate way to determine if the worker exposure does not exceed the applicable exposure limit for compounds in the fumes and gases is to have an industrial hygienist take and analyze a sample of the air you are breathing. This is particularly important if you are welding with stainless, hardfacing or Special Ventilation products. All Lincoln MSDS have a maximum fume guideline number. If exposure to total fume is kept below that number, exposure to all fume from the electrode (not coatings or plating on the work) will be below the TLV.

There are steps that you can take to identify hazardous substances in your welding environment. Read the product label and material safety data sheet for the electrode posted in the work place or in the electrode or flux container to see what fumes can be reasonably expected from use of the product and to determine if special ventilation is needed. Secondly, know what the base metal is and determine if there is any paint, plating, or coating that could expose you to toxic fumes and/or gases. Remove it from the metal being welded, if possible. If you start to feel uncomfortable, dizzy or nauseous, there is a possibility that you are being overexposed to fumes and gases, or suffering from oxygen deficiency. Stop welding and get some fresh air immediately. Notify your supervisor and co-workers so the situation can be corrected and other workers can avoid the hazard. Be sure you are following these safe practices, the consumable labeling and MSDS to improve the ventilation in your area. Do not continue welding until the situation has been corrected.

NOTE: The MSDS for all Lincoln consumables is available on Lincoln's website: www.lincolnelectric.com

Before we turn to the methods available to control welding fume exposure, you should understand a few basic terms:

Natural Ventilation is the movement of air through the workplace caused by natural forces. Outside, this is usually the wind. Inside, this may be the flow of air through open windows and doors.

Mechanical Ventilation is the movement of air through the workplace caused by an electrical device such as a portable fan or permanently mounted fan in the ceiling or wall.

Source Extraction (Local Exhaust) is a mechanical device used to capture welding fume at or near the arc and filter contaminants out of the air.

The ventilation or exhaust needed for your application depends upon many factors such as:

- Workspace volume
- Workspace configuration
- Number of welders
- Welding process and current
- Consumables used (mild steel, hardfacing, stainless, etc.)
- Allowable levels (TLV, PEL, etc.)
- Material welded (including paint or plating)
- Natural airflow

Your work area has adequate ventilation when there is enough ventilation and/or exhaust to control worker exposure to hazardous materials in the welding fumes and gases so the applicable limits for those materials is not exceeded. See chart of TLV and PEL for Typical Electrode Ingredients, the OSHA PEL (Permissible Exposure Limit), and the recommended guideline, the ACGIH TLV (Threshold Limit Value), for many compounds found in welding fume.

Ventilation

There are many methods which can be selected by the user to provide adequate ventilation for the specific application. The following section provides general information which may be helpful in evaluating what type of ventilation equipment may be suitable for your application. When ventilation equipment is installed, you should confirm worker exposure is controlled within applicable OSHA PEL and/or ACGIH TLV. According to OSHA regulations, when welding and cutting (mild steels), natural ventilation is usually considered sufficient to meet requirements, provided that:

1. The room or welding area contains at least 10,000 cubic feet (about 22' x 22' x 22') for each welder.
2. The ceiling height is not less than 16 feet.
3. Cross ventilation is not blocked by partitions, equipment, or other structural barriers.
4. Welding is not done in a conned space.

Spaces that do not meet these requirements should be equipped with mechanical ventilating equipment that exhausts at least 2000 CFM of air for each welder, except where local exhaust hoods or booths, or air-line respirators are used.

Important Safety Note:

When welding with electrodes which require special ventilation such as stainless or hardfacing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce hazardous fumes, keep exposure as low as possible and below exposure limit values (PEL and TLV) for materials in the fume using local exhaust or mechanical ventilation. In conned spaces or in some circumstances, for example outdoors, a respirator may be required if exposure cannot be controlled to the PEL or TLV. (See MSDS and chart of TLV and PEL for Typical Electrode Ingredients.) Additional precautions are also required when welding on galvanized steel.

BIBLIOGRAPHY AND SUGGESTED READING

ANSI Z87.1, Practice for Occupational and Educational Eye and Face Protection, American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

Arc Welding and Your Health: A Handbook of Health Information for Welding. Published by The American Industrial Hygiene Association, 2700 Prosperity Avenue, Suite 250, Fairfax, VA 22031-4319.

NFPA Standard 51B, Cutting and Welding Processes, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9146, Quincy, MA 02269-9959.

OSHA General Industry Standard 29 CFR 1910 Subpart Q. OSHA Hazard Communication Standard 29 CFR 1910.1200. Available from the Occupational Safety and Health Administration at http://www.osha.org or contact your local OSHA office.

The following publications are published by The American Welding Society, P.O. Box 351040, Miami, Florida 33135. AWS publications may be purchased from the American Welding society at http://www.aws.org or by contacting the AWS at 800-443-9353.

ANSI, Standard Z49.1, Safety in Welding, Cutting and Allied Processes. Z49.1 is now available for download at no charge at http://www.lincolnelectric.com/community/safety/ or at the AWS website http://www.aws.org.

AWS F1.1, Method for Sampling Airborne Particulates Generated by Welding and Allied Processes.

AWS F1.2, Laboratory Method for Measuring Fume Generation Rates and Total Fume Emission of Welding and Allied Processes.

AWS F1.3, Evaluating Contaminants in the Welding Environment: A Strategic Sampling Guide.

AWS F1.5, Methods for Sampling and Analyzing Gases from Welding and Allied Processes.

AWS F3.2, Ventilation Guide for Welding Fume Control.

AWS F4.1, Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances.

AWS SHF, Safety and Health Facts Sheets. Available free of charge from the AWS website at http://www.aws.org.

LISTED BELOW ARE SOME TYPICAL INGREDIENTS IN WELDING ELECTRODES AND THEIR TLV (ACGIH) GUIDELINES AND PEL (OSHA) EXPOSURE LIMITS

INGREDIENTS	CAS No.	TLV mg/m3	PEL mg/m3
Aluminum and/or aluminum alloys (as Al)*****	7429-90-5	10	15
Aluminum oxide and/or Bauxite*****	1344-28-1	10	5**
Barium compounds (as Ba)*****	513-77-9	****	****
Chromium and chromium alloys or compounds (as Cr)*****	7440-47-3	0.5(b)	.005(b)
Fluorides (as F)	7789-75-5	2.5	2.5
Iron	7439-89-6	10*	10*
Limestone and/or calcium carbonate	1317-65-3	10	15
Lithium compounds (as Li)	554-13-2	10*	10*
Magnesite	1309-48-4	10	15
Magnesium and/or magnesium alloys and compounds (as Mg)	7439-95-4	10*	10*
Manganese and/or manganese alloys and compounds (as Mn)*****	7439-96-5	0.2	5.0(c)
Mineral silicates	1332-58-7	5**	5**
Molybdenum alloys (as Mo)	7439-98-7	10	10
Nickel*****	7440-02-0	1.5	1
Silicates and other binders	1344-09-8	10*	10*
Silicon and/or silicon alloys and compounds (as Si)	7440-21-3	10*	10*
Strontium compounds (as Sr)	1633-05-2	10*	10*
Zirconium alloys and compounds (as Zr)	12004-83-0	5	5

Supplemental Information:

(*) Not listed. Nuisance value maximum is 10 milligrams per cubic meter. PEL value for iron oxide is 10 milligrams per cubic meter. TLV value for iron oxide is 5 milligrams per cubic meter.

(**) As respirable dust.

(*****) Subject to the reporting requirements of Sections 311, 312, and 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40CFR 370 and 372.

(b) The PEL for chromium (VI) is .005 milligrams per cubic meter as an 8 hour time weighted average. The TLV for water-soluble chromium (VI) is 0.05 milligrams per cubic meter. The TLV for insoluble chromium (VI) is 0.01 milligrams per cubic meter.

c) Values are for manganese fume. STEL (Short Term Exposure Limit) is 3.0 milligrams per cubic meter. OSHA PEL is a ceiling value.

(****) There is no listed value for insoluble barium compounds. The TLV for soluble barium compounds is 0.5 mg/m3.

TLV and PEL values are as of April 2006. Always check Material Safety Data Sheet (MSDS) with product or on the Lincoln Electric website at http://www.lincolnelectric.com

MASTER TABLE OF CONTENTS FOR ALL SECTIONS

E-1

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-THEORY OF OPERATION SECTION-

FIGURE E.1 – PRECISION TIG 375 BLOCK LOGIC DIAGRAM

Precision Tig 375

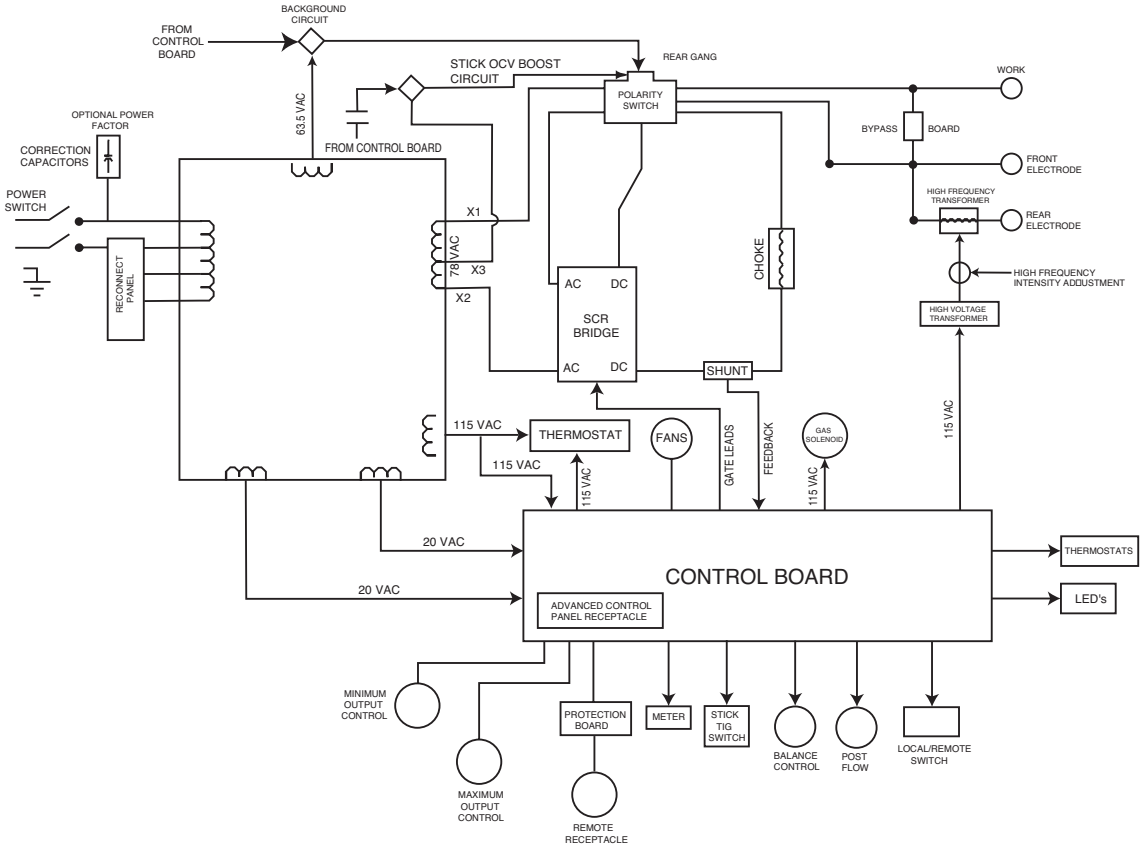
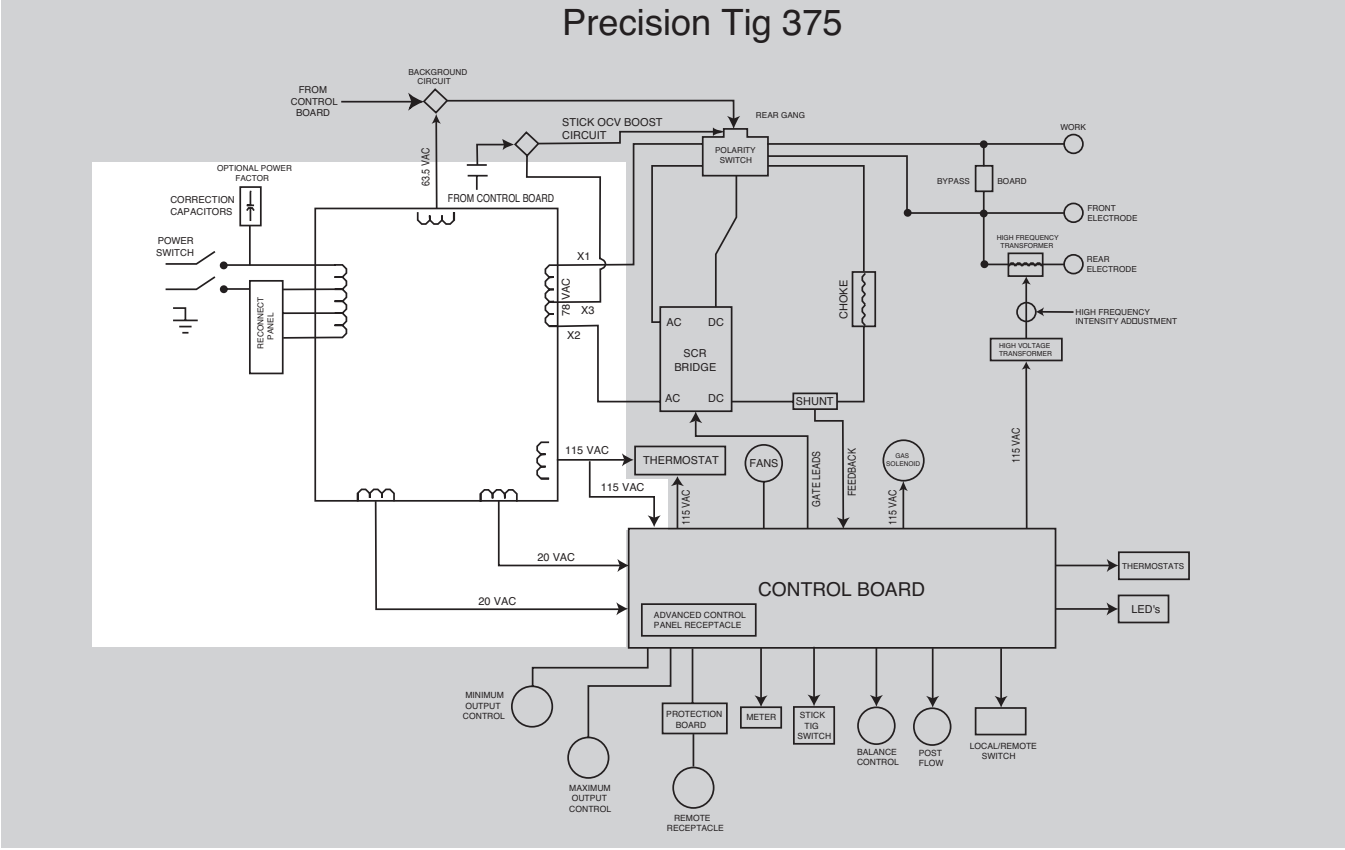


FIGURE E.2 – GENERAL DESCRIPTION AND INPUT POWER CIRCUIT



GENERAL DESCRIPTION

The Precision TIG 375 is part of a new family of industrial arc welding power sources able to provide constant current and single range square wave AC/DC Tig (GTAW) with new Micro-Start™ Technology. It incorporates independent presettable minimum and maximum output control with built-in high frequency stabilization for continuous AC Tig welding and reliable DC Tig starting. The Precision TIG 375 also has AC/DC stick (SMAW) capabilities. This new design includes advanced features such as a digital meter, presettable controls, auto balance™ , fan as needed and timers for fixed preflow and variable post flow of shielding gas. It features a stick output terminal (front) and a universal Tig torch connection box (rear) for simultaneous, but separate, electrode outputs.

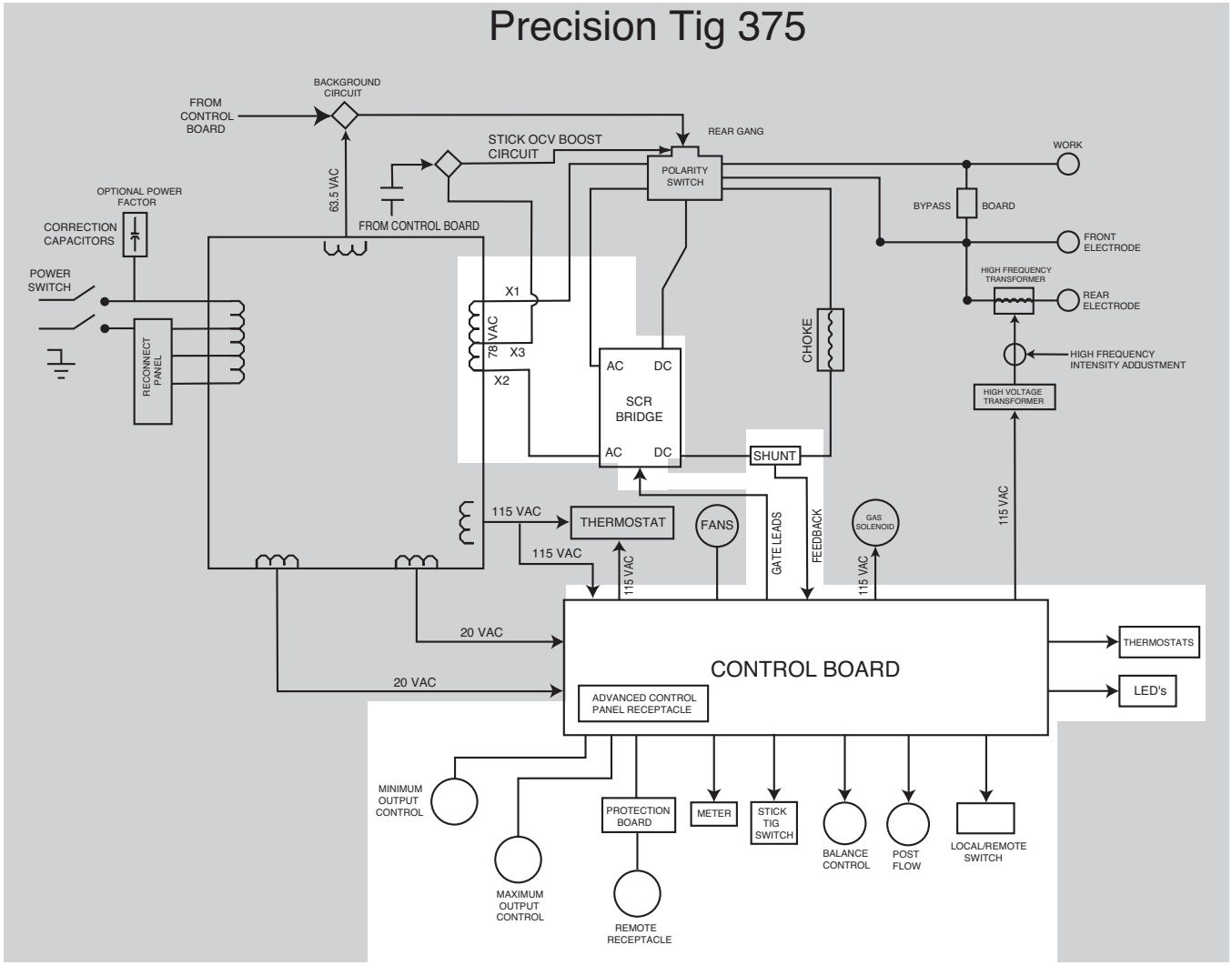
INPUT POWER CIRCUIT

The desired single-phase input power is connected to the Precision TIG 375 through the power switch to the reconnect panel located in the rear of the machine. The machine can be configured for any one of three input voltages (208 VAC, 230 VAC or 460 VAC) by connecting the jumper strap to the appropriate terminal on the reconnect panel. When the input power switch is turned "on," the input voltage is applied directly to the primary winding of the main transformer.

The main transformer changes the high voltage, low current input power to a low voltage, high current output available at the main secondary winding (X1 and X2). This 78 VAC winding supplies power to the welding arc. This 78 VAC is tapped at X3 to provide power to the stick OCV boost circuit. In addition, four auxiliary windings are incorporated in the main transformer. The 115 VAC winding supplies power to the 115 VAC receptacle. Through the control board, it also powers the gas solenoid, the high voltage transformer, and the cooling fan. The cooling fan is activated only when welding current is sensed. The 63.5 VAC winding provides power for the DC background current. This circuit is active in the DC TIG welding mode. The 20 VAC windings are included in the main transformer assembly. The 20 VAC winding is rectified on the control board and is used in the trigger circuitry. The other 20 VAC winding is used by the control board for phase detection. This AC voltage is also rectified to several DC voltages and regulated to +15 VDC and +5 VDC power supplies that operate the circuitry on the control board.

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

FIGURE E.3 – OUTPUT RECTIFICATION, CONTROL BOARD AND FEEDBACK



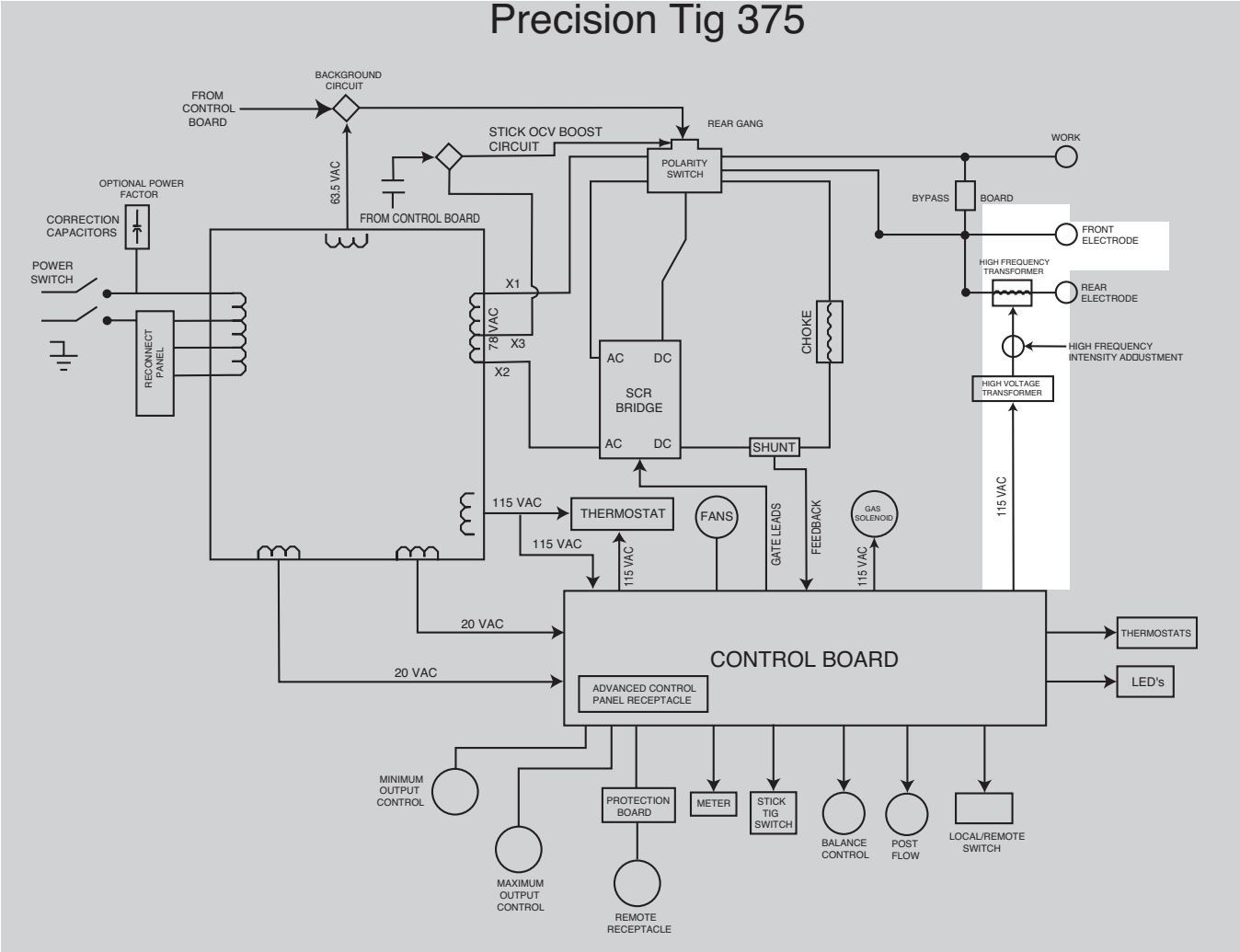
OUTPUT RECTIFICATION, CONTROL BOARD AND FEEDBACK

The AC output from the main transformer secondary is rectified and controlled through the SCR bridge. Output current is sensed at the shunt as a low voltage signal and fed back to the control board. The control board senses the status and settings of the various operator controls such as the Stick/TIG switch, the output controls, the remote control receptacle, the local/remote switch, the balance control and the postflow control. Circuitry on the control board evaluates these commands, compares them to the feedback information received from the shunt and sends the appropriate gate firing signals to the output SCR bridge. The control board regulates the firing of the output SCRs, which, in turn, control the output of the machine. ***See SCR Operation***.

The control board also monitors the thermostats and controls the gas solenoid, the thermal light, the high voltage transformer and the cooling fan. The advanced control panel also plugs into and interfaces with the control board.

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

FIGURE E.4 – HIGH VOLTAGE / HIGH FREQUENCY CIRCUIT



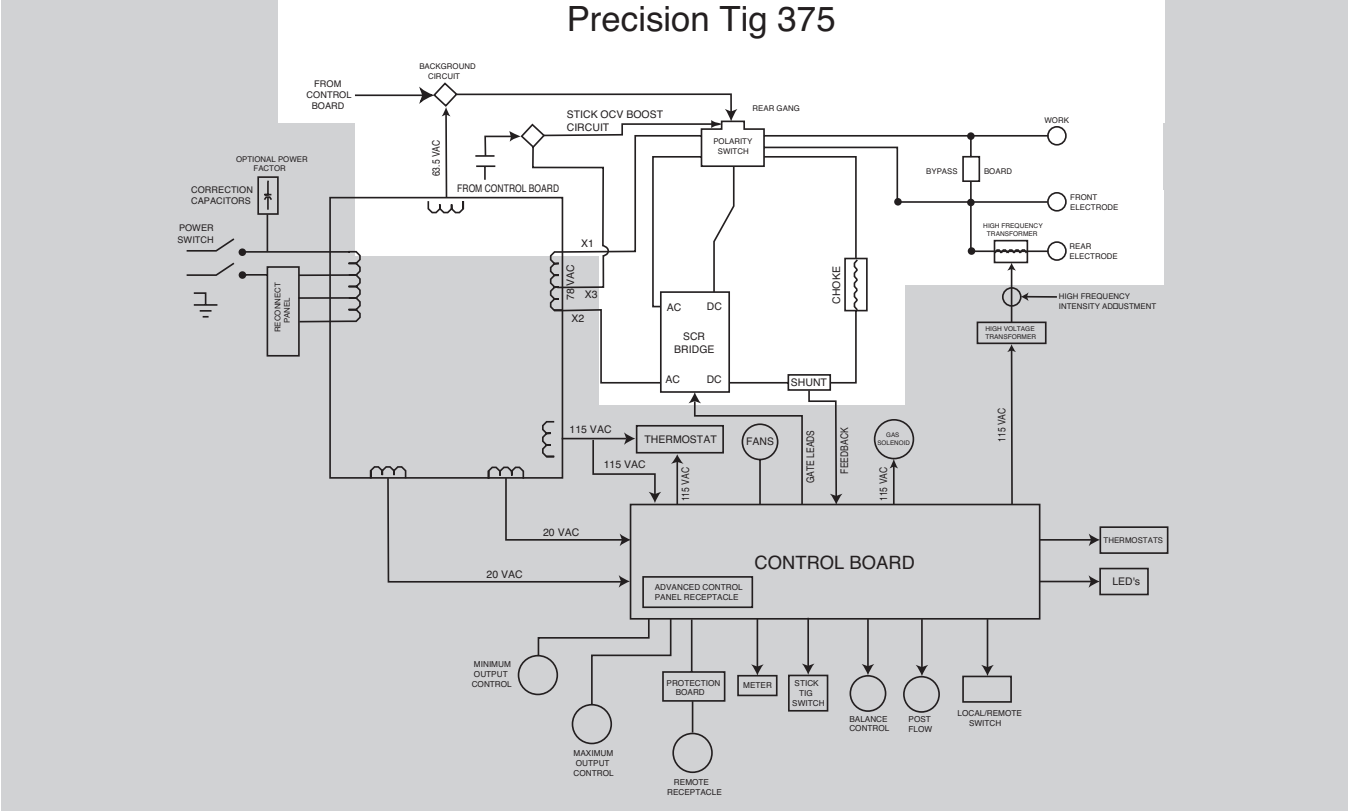
HIGH VOLTAGE/HIGH FREQUENCY CIRCUIT

The control board passes the 115 VAC voltage to the primary of the high voltage transformer. The secondary of the high voltage transformer is coupled to a spark gap generator and also to the primary winding of the high frequency transformer. The secondary of the high frequency transformer is in series with the rear electrode output terminal. The high frequency "spark" is present at the electrode terminal and is transferred to the Tig torch.

The Precision TIG 375 has a high frequency adjustment that allows the operator to control the intensity of the high frequency circuit.

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

FIGURE E.5 – DC WELDING OUTPUT

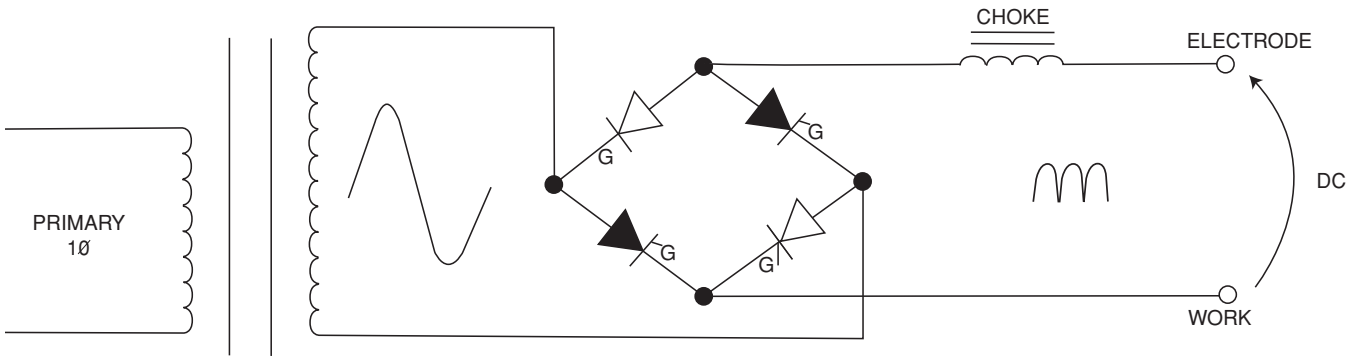


DC WELDING OUTPUT

When the polarity switch is placed in either DC position, the AC voltage from the main transformer secondary is applied to the SCR bridge. The SCR bridge and choke circuits are connected in the conventional full wave bridge and filter configuration, resulting in a controlled DC output. Since the choke is in series with the negative leg of the bridge and also in series with the welding load, a filtered DC is applied to the output terminals. The bypass board protects the internal circuitry from interference.

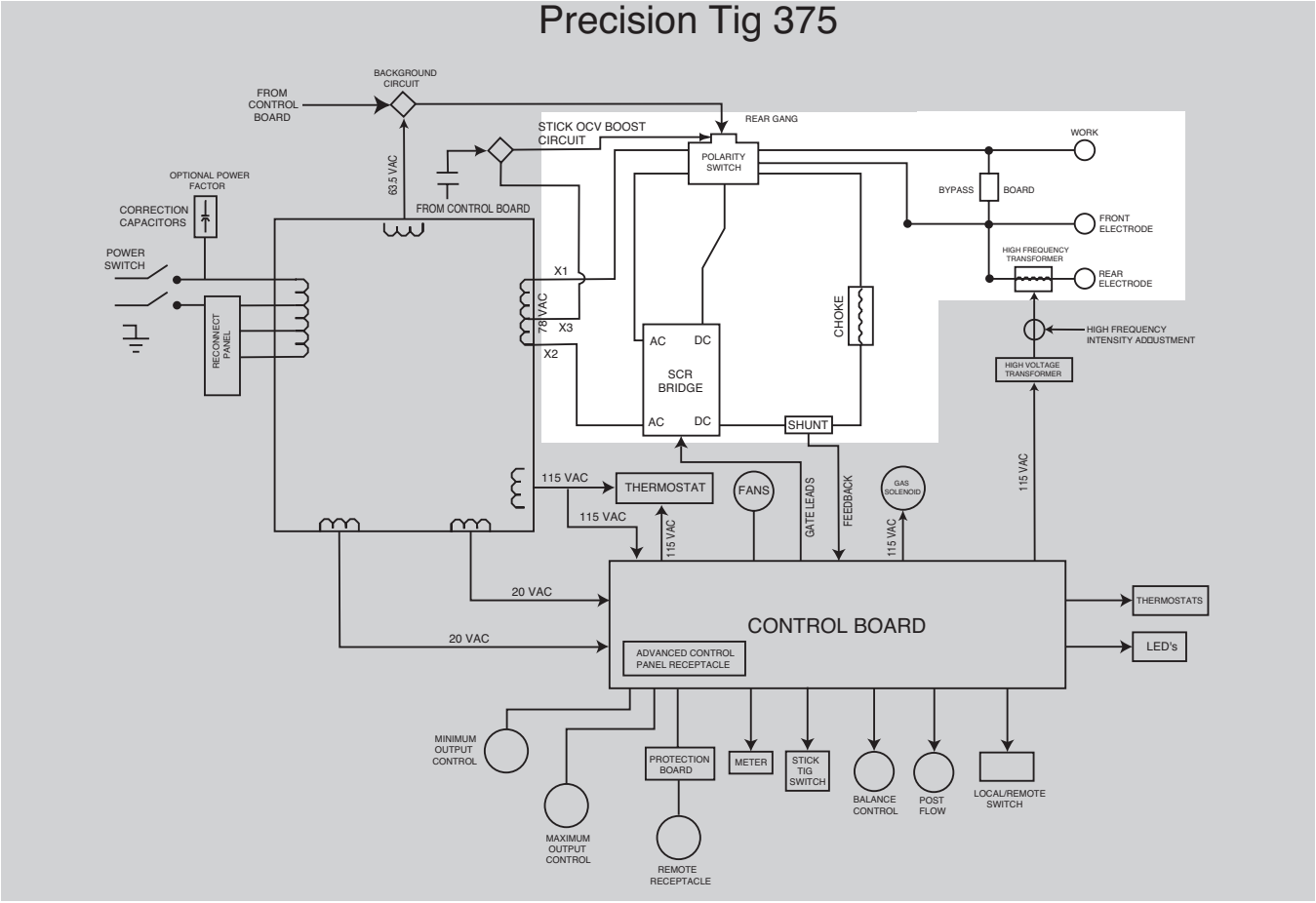
When the machine is in the DC mode, the background circuitry provides an add boost voltage to the output terminals. This circuitry is controlled by the control board.

FIGURE E.6 DC WELDING CURRENT GENERATION



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

FIGURE E.7 – AC WELDING OUTPUT

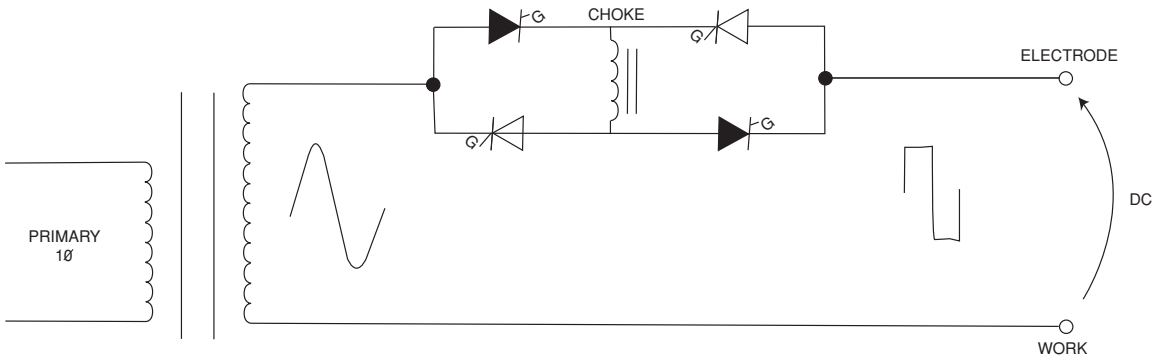


AC WELDING OUTPUT

Rotating the polarity switch to the AC position changes the welding power circuit. One lead (X1) of the main transformer secondary is connected to the machine's output work terminal. The other secondary lead (X2) is connected to one of the AC connections of the SCR bridge. The electrode terminal is connected to the other AC side of the bridge.

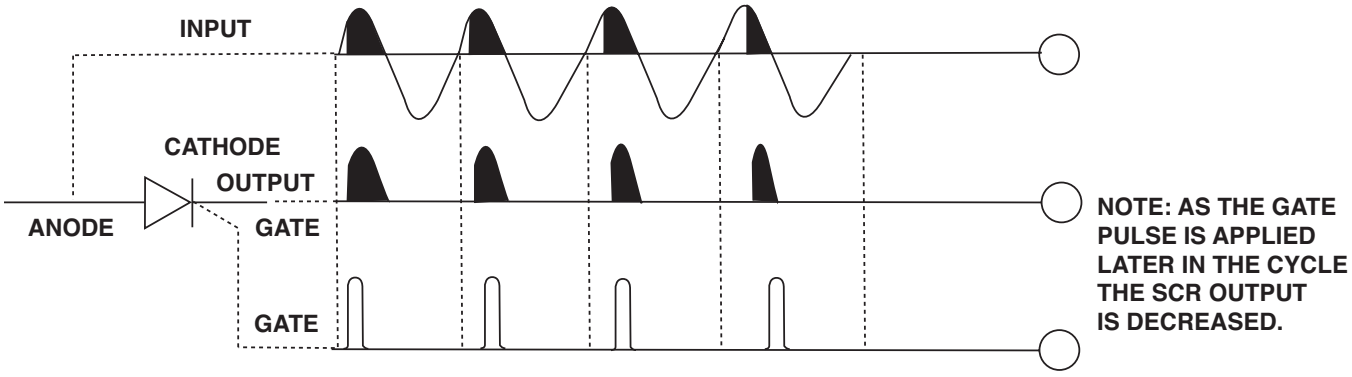
The choke is now electrically across the negative and positive SCR bridge connections. With the ability of the choke to store energy and the SCRs to turn on at the appropriate times, an AC square wave is developed and applied to the output terminals. The bypass board protects the internal circuitry from interference.

FIGURE E.8 DC WELDING CURRENT GENERATION



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

FIGURE E.9 – SCR OPERATION



SCR OPERATION

A silicon controlled rectifier (SCR) is a three-terminal device used to control rather large currents to a load . An SCR acts very much like a switch. When a gate signal is applied to the SCR, it is turned ON and there is current flow from anode to cathode. In the ON state the SCR acts like a closed switch. When the SCR is turned OFF there is no current flow from anode to cathode. Thus, the device acts like an open switch. As the name suggests, the SCR is a rectifier, so it passes current only during positive half cycles of the AC supply. The positive half cycle is the portion of the sine wave in which the anode of the SCR is more positive than the cathode.

When an AC supply voltage is applied to the SCR, the device spends a certain portion of the AC cycle time in the on state and the remainder of the time in the off state. The amount of time spent in the ON state is controlled by the gate.

An SCR is fired by a short burst of current into the gate. This gate pulse must be more positive than the cathode voltage. Since there is a standard PN junction between gate and cathode, the voltage between these terminals must be slightly greater than 0.6V. Once the SCR has fired, it is not necessary to continue the flow of gate current. As long as current continues to flow from anode to cathode, the SCR will remain on. When the anode to cathode current drops below a minimum value, called holding current, the SCR will shut off. This normally occurs as the AC supply voltage passes through zero into the negative portion of the sine wave. If the SCR is turned on early in the positive half cycle the conduction time is longer, resulting in greater SCR output. If the gate firing occurs later in the cycle the conduction time is less, resulting in lower SCR output.

PROTECTION CIRCUITS

Protection circuits are designed into the Precision TIG 375 machine to sense trouble and shut down the machine before the trouble damages internal machine components. Both thermal protection and current overload are included.

FAN-AS-NEEDED (F.A.N.)

The Precision Tig 375 has the F.A.N. (fan as needed) circuit feature, which means that the cooling fan will operate only while welding; then for about eight minutes after welding has stopped to assure proper machine cooling. This helps reduce the amount of dirt and dust drawn into the machine along with the cooling air. The cooling fan will operate briefly when the machine power is initially turned on, and continuously while the *yellow* Thermal shutdown light is lit.

THERMAL PROTECTION

This welder has thermostatic protection from excessive duty cycles, overloads, loss of cooling and excessive ambient temperatures. When the welder is subjected to an overload, or inadequate cooling, the primary coil thermostat and/or secondary coil thermostat will open. This condition will be indicated by the illumination of the *yellow* Thermal Shutdown light on the front panel. The fan will continue to run to cool the power source. Postflow occurs when Tig welding is shut down, but no welding is possible until the machine is allowed to cool and the *yellow* Thermal Shutdown light goes out. Once the machine cools sufficiently, the thermostats are self-resetting. If the shutdown is caused by excessive output or duty cycle and the fan is operating normally, the power may be left on and the reset should occur within a 15 minute period. If the fan is not functioning properly or the air intake louvers are obstructed, the input power must be removed and the fan problem or air obstruction corrected.

OVERLOAD PROTECTION

The machine is electronically protected from producing excessively high output currents.

TABLE OF CONTENTS
TROUBLESHOOTING & REPAIR SECTION

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

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

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

Step 3.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 referred to test points, components, terminal strips, etc., can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

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

⚠ WARNING

HIGH VOLTAGE/ HIGH FREQUENCY can damage test equipment.

* Perform all voltage and wave form checks with high frequency circuit OFF. Perform **High Frequency Disable Procedure.**

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment. Turn the machine OFF before working on equipment. Do not touch electrically hot parts.

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 unpainted, 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-disipative.
- 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 Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine is dead. No weld output – no 115 VAC at the receptacle.	1. Check the input voltage. The input voltage must match the rating plate and the voltage connection. Refer to ***Reconnect Procedure*** in the Installation section of this manual. 2. Make sure that the input power switch is in the "ON" position. 3. Check for blown or missing fuses in the input lines. 4. Check circuit breaker CB1. Reset if necessary.	1. Check the input power switch, reconnect panel and associated wires for loose or faulty connections. 2. The input power switch may be faulty. 3. Perform the ***T1 Transformer Test.***

⚠ CAUTION

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

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No welding output. The 115 VAC is present at the receptacle. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. Make sure the polarity switch is in the proper position and functioning correctly. 2. One of the thermostats may be tripped. Allow the machine to cool. The thermal light will be on. 3. Make sure the welding cables, torch and connections are in good operating condition.	1. Check for loose or faulty connections on the heavy current carrying leads. (Polarity switch, output choke, output terminals, etc.) 2. Check for faulty connections or a defective thermostat. Check leads #213 and #214. See the Wiring Diagram. The thermal light will be on. 3. Check the N.O. Micro Switch on the Input Power switch. See Wiring Diagram. 4. Perform the ***T1 Transformer Test***. 5. Perform the ***SCR Bridge Test.*** 6. Check the output controls R1, R4 and associated wiring. See Wiring Diagram. 7. Check the J4 connection on the control board. 8. The control board may be faulty.

⚠ CAUTION

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

Observe Safety Guidelines
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TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No output from the machine in either Stick or TIG modes. The thermal light is on. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. The welding application may have exceeded the recommended duty cycle. Allow the fans to cool the until the thermal light is off. 2. The air louvers may be blocked. Remove the air obstruction and allow the unit to cool.	1. One of the thermostats may be faulty. Check or replace. See the Wiring Diagram. 2. Check for loose or faulty wires on the thermostats and associated circuitry. See the Wiring Diagram. 3. Check the N.O. Micro Switch on the Input Power Switch. See Wiring Diagram. 4. The fan motor may be faulty or mechanically obstructed. The fan should run when welding or when a thermostat is open. 5. The control board may be faulty.
The machine does not respond (no gas flow, no high frequency and no open circuit voltage) when the arc start switch or Amptrol is activated. The thermal light is not lit. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. Make sure the machine is in the TIG mode. 2. The Amptrol or arc start switch may be defective. Check for continuity (zero ohms) between pins “D” and “E” on the cable connector when the Amptrol or arc start is pressed. 3. Check the Local/Remote switch for proper operation.	1. Perform the ***Protection Board Test.*** 2. Perform the ***T1 Transformer Test.*** 3. The control board may be faulty.

⚠ CAUTION

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

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine does not have welding output in the Stick mode. The machine operates correctly in the TIG mode. **SEE NOTE BELOW**	1. Check the electrode cable and holder for loose or faulty connections. 2. Make sure the Stick/TIG switch is in the proper position and operating correctly.	1. Check the Stick/TIG switch and associated leads. See the Wiring Diagram. 2. The control board may be faulty.
The machine has welding output in the Stick mode but no output in the TIG mode. (no gas flow or high frequency). **SEE NOTE BELOW**	1. Make sure the Stick/TIG switch is in the proper position and operating correctly. 2. The remote control device may be faulty.	1. Check the remote control receptacle and associated wiring. See the Wiring Diagram. 2. Perform the ***Protection Board Test.*** 3. Check the J11 plug on the control board. See the Wiring Diagram. 4. The control board may be faulty.
The machine welds at a very low output regardless of the current control setting. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. If welding in the TIG mode, the remote control device may be defective. 2. Make certain the input line voltage is correct for the machine's reconnect configuration. 3. Check the welding cables and/ or torch for loose or faulty connections.	1. Check the polarity switch and associated leads. 2. Check the interior connections of the heavy current carrying leads. 3. Perform the ***SCR Bridge Test.*** 4. Perform the ***T1 Transformer Test.*** 5. Check the output current controls for proper operation. Normal resistance is 10,000 ohms. See the Wiring Diagram. 6. The control board may be faulty.

⚠ CAUTION

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

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TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine welds at a very high output regardless of the current control setting. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. If welding in the TIG mode, the remote control device may be defective.	1. Perform the ***SCR Bridge Test.*** 2. Perform the ***T1 Transformer Test.*** 3. Check the output current controls for proper operation. Normal resistance is 10,000 ohms. See the Wiring Diagram. 4. Check leads #221 and #222 between the output shunt and the control board. See the Wiring Diagram. 5. The control may be faulty.
Accessories plugged into the 120 volt receptacle do not work.	1. Make sure the accessory, plug and associated leads are in good working condition. 2. Make certain the correct input voltage is being applied to the machine. (The reconnect lead must be in the correct position.) 3. The circuit breaker CB1 may be tripped. Reset if necessary. 4. Only the top part of the receptacle is electronically “Hot” all of the time.	1. The circuit breaker (CB1) may be faulty. 2. Check the receptacle and associated leads for loose or faulty connections. 3. Perform the ***T1 Transformer Test.***
Output stays on after releasing hand/ foot Amptrol (machine with Advanced Control panel only)	1. Downslope is not set at min. 2. Bad Downslope potentiometer R12 or its connection.	1. Check Downslope setting. 2. Check R12 & its connection.

⚠ CAUTION

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

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The machine makes a very loud buzzing noise in DC Stick or in DC TIG modes. There is no current draw from the machine's output terminals. (The machine is not externally loaded).	1. Inspect the output terminal insulators for cracks or signs of overheating.	1. Diode D1 may be shorted. Check and replace if necessary. 2. Check the polarity switch (S2) for proper function and correct connections. 3. Perform the ***SCR Bridge Tests.***

⚠ CAUTION

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

Observe Safety Guidelines
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TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
TIG WELDING PROBLEMS		
The machine output is intermittently lost. Gas flow and high frequency are also interrupted. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. The problem may be caused by high frequency interference. Make sure that the machine is grounded properly according to the installation instructions. If there are other high frequency sources in the area, make certain that they are grounded properly. 2. Make sure the Amptrol is operating properly. 3. Check to make sure that the input voltage is correct for the machine. Refer to Reconnect Procedure in the Operators manual.	1. Check for the loose or faulty connections on the leads between the remote receptacle, the protection board and plug J22 on the protection board. See the Wiring Diagram. 2. Check plugs J5 and J23 on the protection board for loose or faulty connections. 3. Perform the ***Protection Board Test.*** 4. The control board may be faulty. 5. Check the ground connection of the bypass/ stabilizer pc board. See the Wiring Diagram.
No gas or water flow (with optional water solenoid) when the arc start switch or Amptrol is activated in the TIG mode. All other machine functions are normal.	1. The gas (or water) supply is either empty or not turned on. 2. The flow regulator may be set too low. 3. Check the supply hoses for kinks or blockages. 4. The filters may be blocked.	1. Perform the ***Gas Solenoid Test.*** 2. The control board may be faulty.

⚠ CAUTION

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

TROUBLESHOOTING & REPAIR

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
TIG WELDING PROBLEMS		
No high frequency. The machine is in the TIG mode and has normal output. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. If the machine is in a dirty environment with conductive contaminants, check and clean the spark gap with a low pressure air stream per the maintenance instructions. 2. Check the spark gap operations and setting. Normal is (0.015"). Refer to the Maintenance Section of the Operators manual. 3. Check circuit breaker CB1. Reset if necessary. 4. Check connection J12 on the control board.	1. Check the high voltage transformer (T2). The normal resistance of the secondary winding is 12.5k ohms. **⚠ WARNING**  **ELECTRIC SHOCK CAN KILL.** When 115 VAC is applied to T2, a very high voltage is developed on the secondary winding. For assistance, call the Lincoln Electric Service Department. 1-888-935-3877. 2. Check R5, C6, C7, L2, R13 and L3. Replace if defective. See Wiring Diagram 3. The control board may be faulty,
The High frequency is on continuously in DC TIG or shuts off in AC TIG.	1. None	1. Check plug J11 on the control board. See the Wiring Diagram. 2. Check micro-switch S2A for proper operation. See the Wiring Diagram. 3. The control board may be faulty.

⚠ CAUTION

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

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
TIG WELDING PROBLEMS		
High frequency "spark" is present but weak.	1. The spark gap may be too large. Check and reset per instructions in the Maintenance Section of the Operators manual. 2. The work and/or torch cables may be in poor condition allowing the high frequency to "leak" to ground. Use good quality cables, preferably those with a high natural rubber content and as short as possible. 3. If helium shielding gas is being used, reduce the percentage of helium. 4. Make sure the tungsten electrode is the correct size for the process.	1. The high voltage transformer (T2) may be faulty. 2. Capacitor C6 may be faulty. 3. The high frequency transformer (T3) may be faulty.
Poor arc starting in the DC TIG mode.	1. The input line voltage may be low. 2. Check the torch and work cable for loose or faulty connections.	1. Check the J11 plug on the control board. See Wiring Diagram. 2. Check the back ground resistor R7. Normal resistance is 20 ohms. 3. Check the background diode bridge.

⚠ CAUTION

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

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
TIG WELDING PROBLEMS		
The high frequency "spark" is present at the tungsten electrode, but the operator is unable to establish a welding arc. The machine has a normal open circuit voltage. Refer to Technical Specifications in the Operators Manual.	1. The torch may be faulty. Check or replace. 2. The current control may be set too low. 3. The tungsten electrode may be contaminated. Replace or sharpen. 4. The electrode may be too large for the process. 5. If a helium blend is being used as a shielding gas, reduce the percentage of helium. 6. Check the welding cables for loose or faulty connections.	1. Check spark gap adjustment. See the Maintenance Section of the Operators Manual. 2. This may be a welding procedure problem.
When AC TIG welding, the arc is erratic and there is a loss of "cleaning" of the work piece.	1. The tungsten electrode may be small for the process. Use a larger diameter tungsten or a pure tungsten. 2. If a helium blend is used as a shielding gas, reduce the percentage of helium. 3. Check the balance control setting.	1. Check components R5 and C7 in the high voltage transformer primary circuit. 2. Perform the ***SCR Bridge Test.***
Arc "pulsates" in AC polarity. DC TIG is OK.	1. Check that the machine controls are set correctly for the process.	1. Micro switch S2A may be faulty. It should "open" in the AC mode. See the Wiring Diagram.

⚠ CAUTION

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

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
STICK WELDING PROBLEMS		
The stick electrode "blasts-off" when touched to the work piece. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. Welding current may be too high for the electrode size. Reduce current control setting or use a larger diameter electrode.	1. Perform the ***SCR Bridge Test.*** 2. The control board may be faulty.
Variable or sluggish welding arc when welding in the Stick mode.	1. Check the work and electrode cables for loose or poor connections. 2. The welding cables may be too small or too long to permit the desired current to flow. 3. The welding current may be set too low.	1. Check the polarity switch for excessive wear or faulty connections. 2. Check the interior heavy current carrying leads and connections.
When Stick Welding the ARC is difficult to get started.	1. Make sure the Stick/TIG switch is in the Stick position. 2. Make sure the output current control is set correctly for the electrode.	1. Check the Stick OCV Boost Circuit. See the Wiring Diagram. 2. Check the OCV Boost Rectifier. 3. Check CR3 and CR2 for proper operation.

⚠ CAUTION

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

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The meter does not display V (volt) or minimum current. **NOTE: BEFORE REPLACING A CONTROL BOARD** **If an Advanced Control Panel is installed, remove it and replace the Jumper in connector J-3. If the machine functions normally, the Advanced Process panel or harness is defective.**	1. Check that either the advanced control board or jumper plug is in J3 on the control board.	1. Check R1 potentiometer and associated leads between the control board and plug J9. See the Wiring Diagram. 2. The control board may be faulty.

⚠ CAUTION

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

Observe Safety Guidelines
detailed in the beginning of this manual.

TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The meter does not display V (volt) or minimum current.	1. Toggle the display switch. It may be dirty.	1. Check the leads between the display switch and the control board. See the Wiring Diagram. 2. The display switch may be faulty. 3. The control board may be faulty.
The meter does not light up. Other machine functions are OK.	1. None	1. Check the leads and connections between the meter and the control board. See the Wiring Diagram. 2. The meter may be faulty. 3. The control board may be faulty.

⚠ CAUTION

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

TROUBLESHOOTING GUIDE

Observe Safety Guidelines
detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The AC wave balance control does not function properly.	1. The AC wave balance control is operational only in the TIG mode.	1. Check the AC balance control (R2) and associated leads for loose or faulty connections. See the Wiring Diagram. 2. The control board may be faulty.
Gas pre-flow and post-flow time is too long.	1. If an advanced control board is installed, check dip switch setting on the board. See Operators Manual.	1. Check plug J3 on the control board. Either the jumper plug or the advanced control board must be plugged into J3.

⚠ CAUTION

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

METER CALIBRATION ADJUSTMENTS

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

This test will help aid the technician in meter circuits calibration.

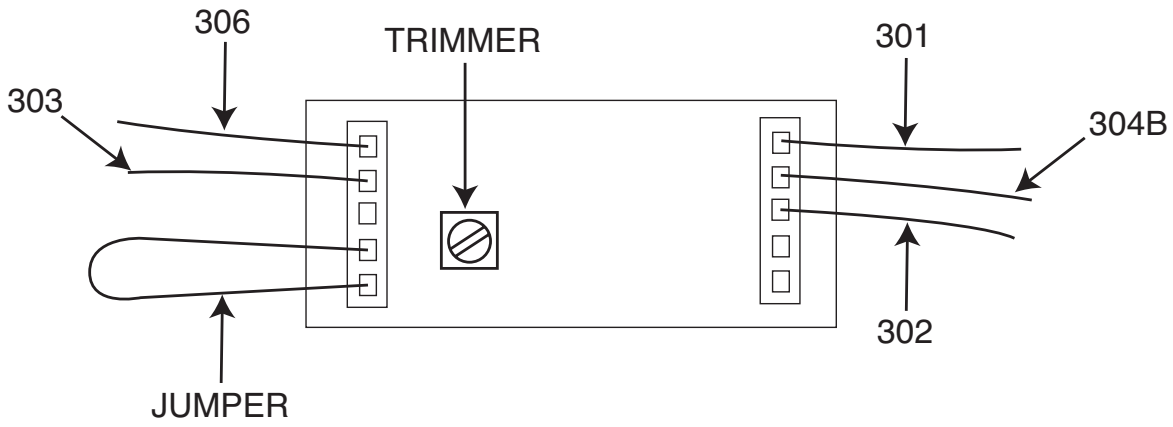
MATERIALS NEEDED

Voltmeter/Ohmmeter
3/8” Nut Driver
Wiring Diagram

NOTE: Meters used to check the calibration of the machine meters should be calibrated and traceable to National Standards.

METER CALIBRATION ADJUSTMENTS *(continued)*

FIGURE F.1 – METER TRIMMER



NOTE: The Precision TIG meter circuits are factory calibrated for the accuracy of the ammeter and voltmeter and should not need adjustment. However, the factory trimmers are accessible inside the control box:

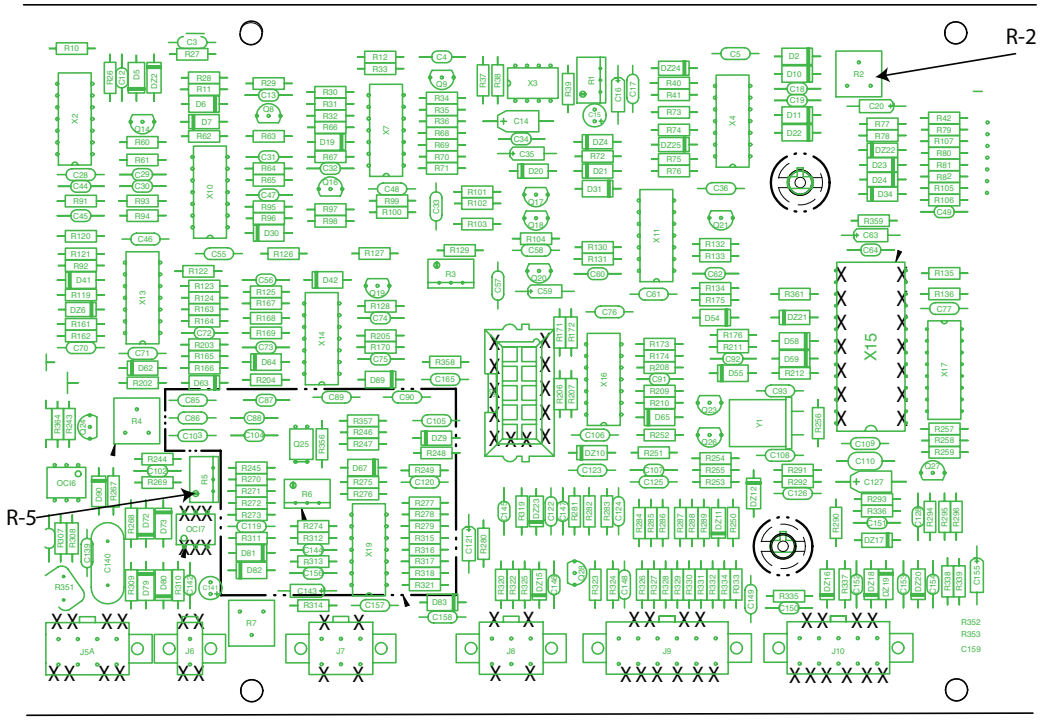
CALIBRATION CHECK

The Digital Meter Calibration Trimmer is located on the back of the meter housing near the right side connector plug (with two leads and a jumper attached). This trimmer adjusts calibration of the meter used for both ammeter and voltmeter readings, so its calibration should be checked first, as follows:

1. Set the Mode Switch to the TIG mode and, without closing the arc start switch, preset the panel maximum output control so the panel digital meter reads 200 amps.
2. Using a DC (avg.) digital test voltmeter with at least 0.5% accuracy at 1,000v, measure the DC voltage between (+) pin 2 (lead #303) and (-) pin 1 (lead #306) at the right side meter plug (nearest the trimmer).
3. This voltage should match the 200A panel meter reading (as 0.200v, or 200mv) within 1%. If not, adjust the trimmer so that the panel meter accuracy is corrected. (See Figure F.1).

METER CALIBRATION ADJUSTMENTS *(continued)*

FIGURE F.2 - CONTROL BOARD TRIMMERS



AMMETER CALIBRATION PROCEDURE

1. Locate the Ammeter Calibration Trimmer (R5). See Figure F.2.
2. Set to TIG mode with DC polarity and LOCAL control. Without closing the arc start switch, preset the maximum output panel control so the panel digital meter reads approx. 200 amps.
3. Using a DC (AVG.) test ammeter with at least 1% accuracy at up to 300 amps, connect it to measure the DC current through a short weld cable shorting out the work(+) to electrode(-) studs on the front stud panel. Remove the TIG torch if connected.
4. Close the arc start switch just long enough to compare the panel meter reading to that of the test ammeter. The short circuit current readings should match within 4% +/-2A. If not, adjust the trimmer so that the panel meter accuracy is corrected.

VOLTMETER CALIBRATION PROCEDURE

1. Locate the Voltmeter Calibration Trimmer (R2) on the control board. See Figure F2**.**
2. To prevent maximum OCV output, disconnect the SCR gate lead plug from receptacle J4.
3. Set to TIG mode with DC- polarity without closing the arc start switch.
4. Using a DC (avg.) test voltmeter with at least 1% accuracy at up to 100 volts, connect it across the work (+) and electrode(-) studs on the front stud panel. Remove the TIG torch, if connected.
5. Press the display panel switch to V (volts) position, then close the arc start switch just long enough to compare the panel meter reading to that of the test volt meter. The open circuit voltage readings (about 50 VDC) should match within 3% +/-1v. If not, adjust the trimmer so that the panel meter accuracy is corrected.

NOTE: If switch is held closed longer than about 15 seconds, the machine will shut down to protect internal holding resistor from overheating.

HIGH FREQUENCY CIRCUIT DISABLE PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

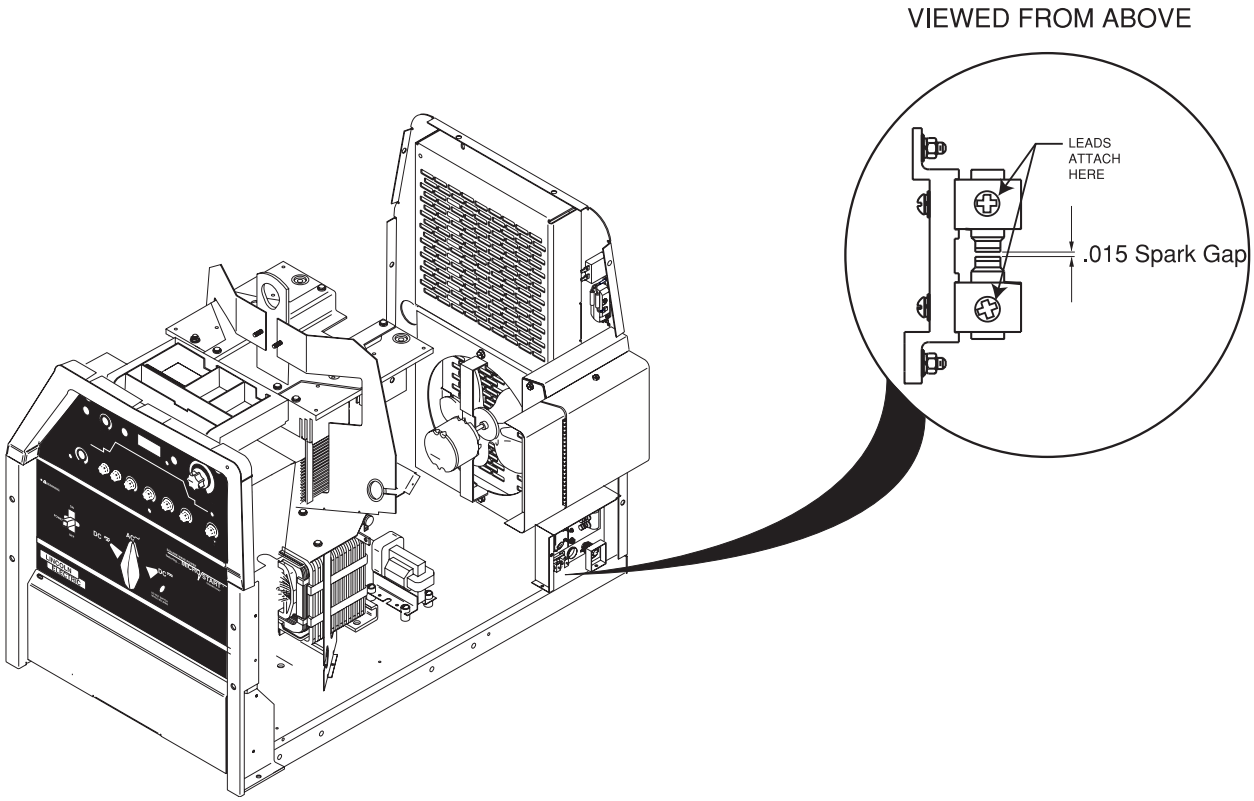
This procedure will disable the high frequency circuit allowing the technician to take voltage measurements without the possibility of high frequency damage to his test equipment.

MATERIALS NEEDED

3/8” Nut Driver
Electrical Insulating Tape

HIGH FREQUENCY CIRCUIT DISABLE PROCEDURE *(continued)*

FIGURE F.3 – SPARK GAP ASSEMBLY



PROCEDURE

1. Remove the input power to the Precision TIG 375 machine.
2. Using the 3/8” nut driver, remove the right side case cover.
3. Locate the Spark Gap Assembly at the lower rear right side of the machine. See Figure F.3.
4. Carefully remove the three leads from the Spark Gap Assembly. See Figure F.3.
5. Insulate the leads from each other and from the case.
6. When voltage testing and scope measurements are complete, reconnect the three leads to the Spark Gap Assembly.
7. Reassemble the right side case cover.

PROTECTION BOARD TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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 determine if the Protection board is functioning properly.

MATERIALS NEEDED

3/8" Nut Driver
Voltmeter/Ohmmeter (Multimeter)
Tig 375 Wiring Diagrams

PROTECTION BOARD TEST *(continued)*

1. Using a 3/8" nut driver, remove the case top and sides.
2. Check that P5 is connected to J5, not J5A. See the Wiring Diagram.
3. Unplug P5 from the control board. Measure resistance at P5. See Figure F.4. See tables below.

Table F.1

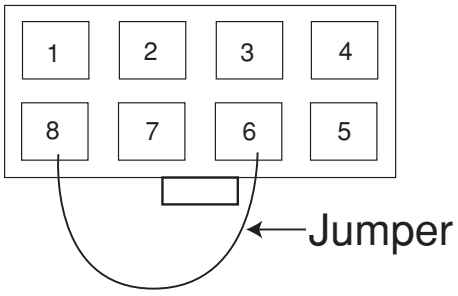
	RESISTANCE BETWEEN	READING
TRIGGER	Pins 5 & 7	Open when trigger open, short when trigger closed.
B-C	Pins 3 & 4	Increasing from 0 to 10K when working on remote amptrol from min. to max.
B-A	Pins 2 & 3	Decreasing from 10K to 0 when working on remote amptrol from min. to max.

4. If the readings above are OK, the protection board is OK. If not, go to step 5.
5. Unplug P23 from the protection board and check continuity from P23 to P5. If OK, go to step 6. See Wiring Diagram.
6. Unplug P22 from protection board. Measure resistance at P22. See Tables.
7. If readings below are OK, protection board is bad.
8. If readings below are wrong, remote amptrol or remote receptacle is bad.

Table F.2

	RESISTANCE BETWEEN	READING
TRIGGER	Pins 3 & 6	Open when trigger open, short when trigger closed.
B-C	Pins 1 & 2	Increasing from 0 to 10K when working on remote amptrol from min. to max.
B-A	Pins 1 & 4	Decreasing from 10K to 0 when working on remote amptrol from min. to max.

FIGURE F.4 – Plug J5 (viewed from pin end)



T1 MAIN TRANSFORMER TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

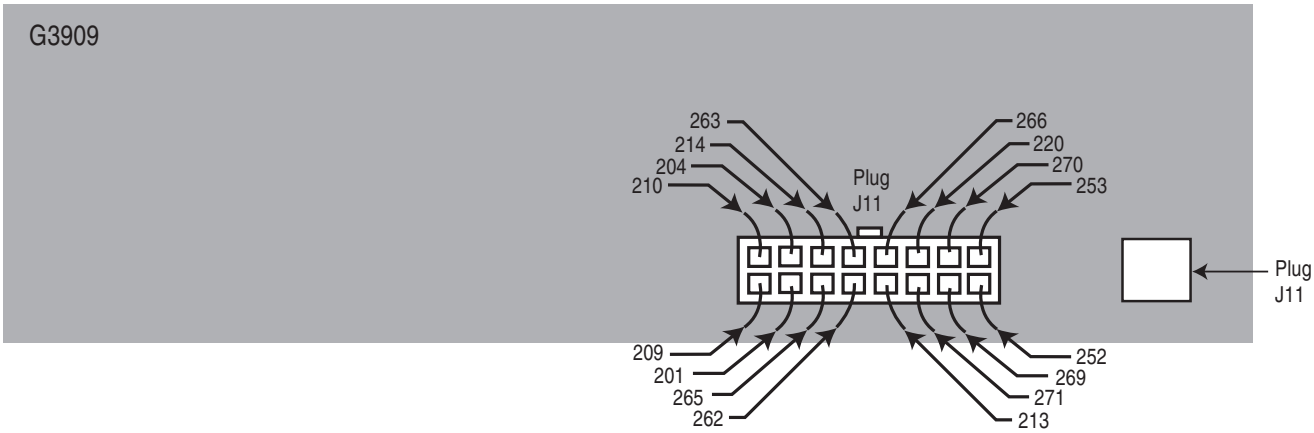
This procedure will determine if the correct voltage is being applied to the primary of the T1 transformer and also if the correct voltages are being induced on the secondary windings of the transformer.

MATERIALS NEEDED

3/8" Nut Driver
Voltmeter/Ohmmeter (Multimeter)
Tig 375 Wiring Diagrams

T1 MAIN TRANSFORMER TEST *(continued)*

Figure F.5 - Plug J11



TEST PROCEDURES

1. Using the 3/8" nut driver, remove the two screws from the front control panel. Carefully lower the panel. This will allow access to the control board.
2. Locate plug J11 on the control board. See Figure F.5.

⚠ WARNING

ELECTRIC SHOCK can kill

- **With input power ON, there are high voltages inside the machine. Do not reach into the machine or touch any internal part.**

3. Carefully apply the correct input power making certain the reconnect configuration at the reconnect panel is correct for the input voltage applied. Turn the Precision TIG 375 ON.
4. Using the voltmeter, carefully test for the correct transformer secondary voltages per ***Table F.3.***
5. Carefully check for 63.5 VAC at leads 267 to lead 268. Lead 268 is located at the background rectifier.

NOTE: Lead 267 is located at resistor R8. See Wiring Diagram.

6. Carefully check for 115 VAC at leads 231 to 232.

NOTE: Lead 231 is located at the 115 VAC receptacle on the back of the machine. Lead 232 is located at the 15 amp circuit breaker CB1.

7. If all of the secondary voltages are correct, the T1 transformer is functioning properly.
   a. If all of the secondary voltages are missing or incorrect, make certain that the correct input voltage is being applied to the correct primary leads. ***See Table F.3.***
   b. If the correct input voltage is being applied to the primary leads and any or all of the secondary voltages are incorrect, the T1 transformer may be faulty. Also check the leads for broken or loose connections between plug J11 and the T1 transformer.
8. Replace the case side covers

T1 MAIN TRANSFORMER TEST *(continued)*

Table F.3 - T1 Transformer Voltages

TEST POINTS	ACCEPTABLE VOLTAGES
SECONDARY WINDINGS	**SECONDARY VOLTAGES**
PLUG J11 PIN 8 (LEAD W209) TO PLUG J11 PIN 16 (LEAD R210)	20 VAC
PLUG J11 PIN 7 (LEAD #201) TO PLUG J11 PIN 15 (LEAD #204)	18VAC
X1 TO X2	85 VAC
X1 TO X3	75 VAC
PRIMARY WINDINGS	**PRIMARY VOLTAGES**
H1 TO H2	208 VAC
H1 TO H3	230 VAC
H1 TO H4	460 VAC

NOTE: If the input voltages vary, the secondary voltages will vary accordingly.

Based on 208/230/460 models. For other voltage models refer to appropriate Wiring Diagram.

GAS (WATER) SOLENOID TEST

⚠ WARNING

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

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

TEST DESCRIPTION

This procedure will help the technician to determine if the solenoid is receiving the correct voltage also if the solenoid is functional.

MATERIALS NEEDED

3/8" Nut Driver
Voltmeter/Ohmmeter (Multimeter)
Isolated 115 VAC Power Supply

GAS (WATER) SOLENOID TEST *(continued)*

TEST PROCEDURE

1. Remove input power to the Precision TIG 375 machine.
2. Remove the left case side.
3. Perform the ***High Frequency Circuit Disable Procedure.***
4. Locate the gas solenoid in the torch connection box.
5. Put the mode switch S3 in the 2-Step TIG position.

⚠ WARNING

ELECTRIC SHOCK CAN KILL.

***With input power ON, there are high voltages inside the machine. Do not reach into the machine or touch any internal part**

6. Apply the correct input power to the TIG 375.
7. Activate the torch trigger and check for approximately 115 VAC at the solenoid leads (#231A and # 235). If the correct voltage is present, the solenoid should activate and gas should flow.
8. If voltage is present at leads #231A and #235 and the solenoid does not activate, the solenoid may be defective. The solenoid can be further checked by removing leads #231A and #235 from the solenoid and applying the external isolated 115 VAC supply to the solenoid terminals. If the solenoid activates with the external supply but not when powered by the control board, the problem may be in the control board. If you hear solenoid activation but there is still no gas flow, check for restrictions in the line.
9. When the test is complete, replace leads #231A and #235.
10. Reassemble the two leads previously removed in the ***High Frequency Circuit Disable Procedure.***
11. Reassemble the left case side.
12. If a water solenoid is used, it can be tested using the same procedures.

STATIC SCR TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

The SCR test is a quick check to determine if an SCR is “shorted” or “leaky”. See machine waveform section for normal and abnormal SCR waveforms.

MATERIALS NEEDED

3/8” Nut Driver
Analog Ohmmeter (Multimeter)
TIG 375 Wiring Diagrams
SCR Heatsink Assembly Drawing

STATIC SCR TEST *(continued)*

Figure F.6 - Plug J4 Location

TEST PROCEDURE

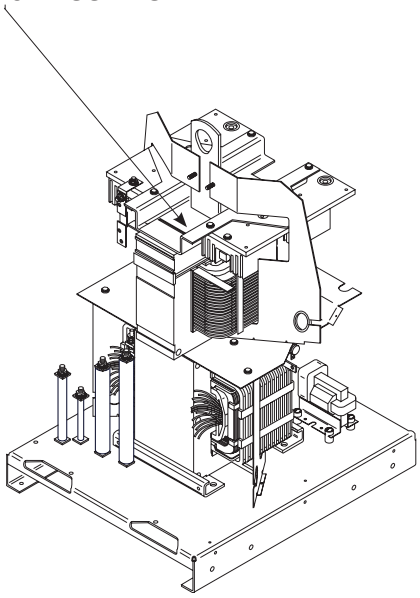
1. Remove main supply power to the Precision TIG 375 and remove the case top and left side.
2. Locate and remove plug J4 from the control board. See Figure F.6.
3. Using an analog ohmmeter, test the resistance from anode to cathode of SCR1. Reverse the meter leads and check from cathode to anode of SCR1. See Figure F.7. If a low resistance is indicated in either direction, SCR1 is faulty. Replace the SCR Bridge Assembly. See ***SCR Bridge Assembly Removal and Replacement.***
4. Repeat Step #3 testing SCR2, SCR3 and SCR4.
5. To further check the SCR's functions, use an SCR tester and proceed to the ***Active SCR Test.***

NOTE: Also check diode D1.

6. Replace plug J4 on the control board.
7. Replace the case top and left side.

Figure F.7 - SCR BRIDGE LOCATION

NOTE: The negative half of the SCR Bridge is located on the top left side of the machine. The "Finned" heat sinks are the cathode test points for SCR 3 and 4. The "Non-Finned" heat sink is the anode test point for SCR 3 and 4.
The Positive half of the SCR Bridge is located on the top right side of the machine. The "Finned" heat sinks are the anode test points for SCR 1 and 2. The "Non-Finned" heat sink is the cathode test point for SCR 1 and 2. See Wiring Diagram.



ACTIVE SCR TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

The Active SCR test will determine if the device is able to be gated “ON” and conduct current from anode to cathode.

MATERIALS NEEDED

3/8” Nut Driver
TIG 375 Wiring Diagrams
An SCR Tester as outlined in this procedure

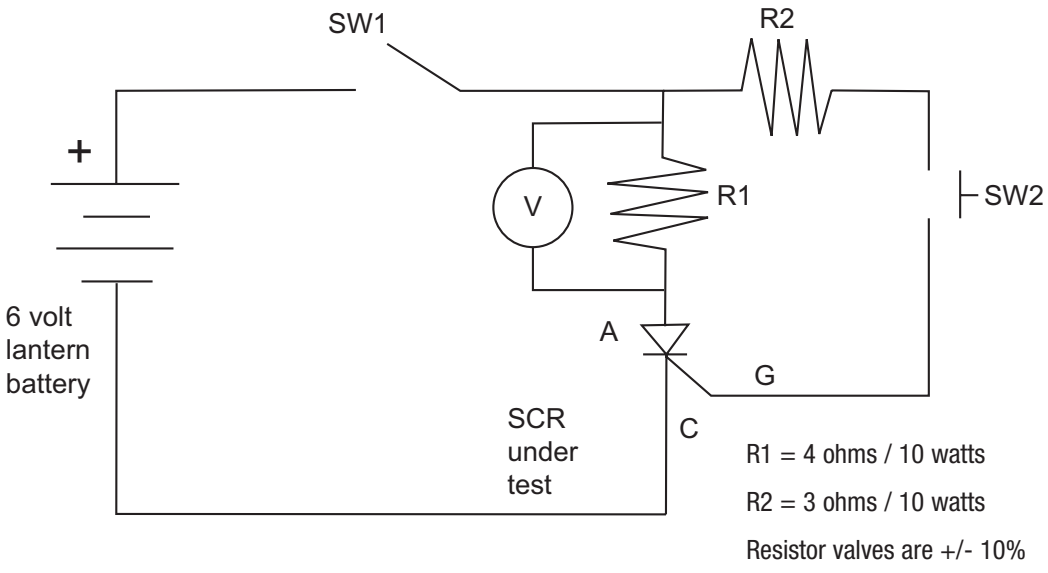
ACTIVE SCR TEST *(continued)*

Figure F.8 - Plug J4 Location

TEST PROCEDURE

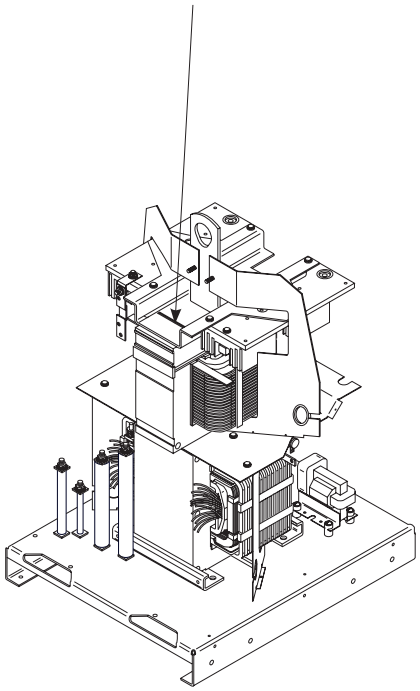
1. Remove main supply power to the Precision TIG 375 machine.
2. Locate and remove plug J4 from the control board. See Figure F.8.
3. Perform the following test for all four SCRs. See Figure F.8.
4. Construct the circuit outline in Figure F.9. One 6V lantern battery can be used. Resistor values are +\- 10%. The voltmeter scale should be approximately 0-5 or 0-10 volts.
5. Battery Test - Check the battery by shorting leads (A) and (C) and then close switch SW-1. Replace the battery if voltage is less than 4.5 volts.

Figure F.9 - Active SCR Test Set-Up



ACTIVE SCR TEST *(continued)*

Figure F.10 - SCR Bridge Location



6. Connect SCR into the test circuit as noted in ***Figure F.9.*** (A) Lead to anode (C) lead to cathode and (G) lead to the gate.

NOTE: The negative half of the Scr Bridge is located on the top left side of the machine. The "Finned" Heat Sinks are the cathode test points for SCR 3 and 4. The "Non-Finned" Heat Sink is the Anode Test point for SCR 3 and 4.

The Positive half of the SCR Bridge is located on the top right side of the machine. The "Finned" Heat Sinks are the Anode Test Points for SCR 1 and 2. The "Non-Finned" Heat Sink is the cathode Test Point for SCR 1 and 2. See Wiring Diagram.

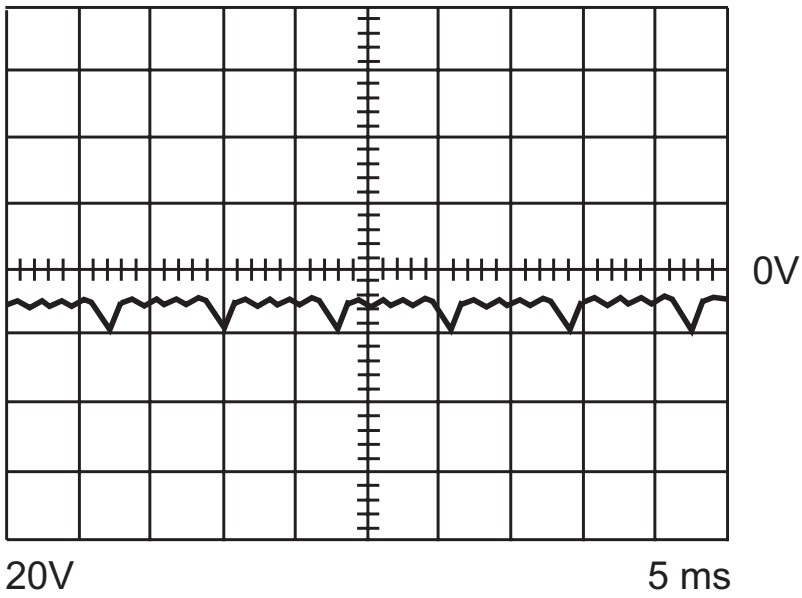
7. Close switch SW-1 (Switch SW-2 should be open). The voltmeter should read zero. If the voltmeter reads higher than zero, the SCR is shorted.
8. With switch SW-1 closed, close switch SW-2 for two seconds and release. The voltmeter should read 3 to 6 volts before and after switch SW-2 is released. If the voltmeter does not read, or reads only while SW-2 is depressed, the SCR or battery is defective. (Repeat Battery Test Procedure described in Step 5.)
9. Open switch SW-1, disconnect the gate lead (G) and reverse the (A) and (C) leads on the SCR. Close switch SW-1. The voltmeter should read zero. If the voltage is higher than zero, the SCR is shorted.
10. Replace the SCR Bridge Assembly if any SCRs that do not pass the test. See ***SCR Bridge Assembly Removal and Replacement.***
11. Replace plug J4 on the control board.
12. Replace the case sides and top.

TYPICAL OUTPUT VOLTAGE WAVEFORM - MACHINE LOADED TO 2 AMPS
DC - TIG MODE

HIGH VOLTAGE/ HIGH FREQUENCY can damage test equipment.

Perform all voltage and waveform checks with high frequency circuit OFF.

Perform ***High Frequency Disable Procedure***.



AC BALANCE CONTROL IN "AUTO"
OUTPUT CONTROL AT MINIMUM

This is the typical AC output voltage waveform generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes connected at machine output terminals: (+) probe to electrode, (-) probe to work.

SCOPE SETTINGS

Volts/Div.....20V/Div.
Horizontal Sweep.....5 ms/Div.
Coupling.....DC
Trigger.....Internal

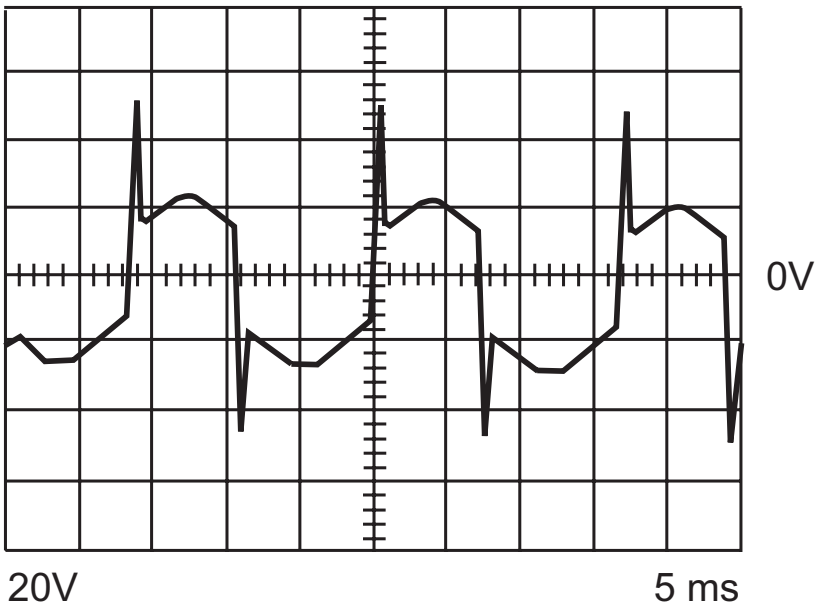
LINCOLN® ELECTRIC

TYPICAL OUTPUT VOLTAGE WAVEFORM - MACHINE LOADED TO 200 AMPS
AC - TIG MODE

HIGH VOLTAGE/ HIGH FREQUENCY can damage test equipment.

Perform all voltage and waveform checks with high frequency circuit OFF.

Perform ***High Frequency Disable Procedure***.



AC BALANCE CONTROL IN "AUTO"

This is the typical AC output voltage waveform generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time. The machine was loaded with a resistance grid bank.

NOTE: Scope probes connected at machine output terminals: (+) probe to electrode, (-) probe to work.

SCOPE SETTINGS

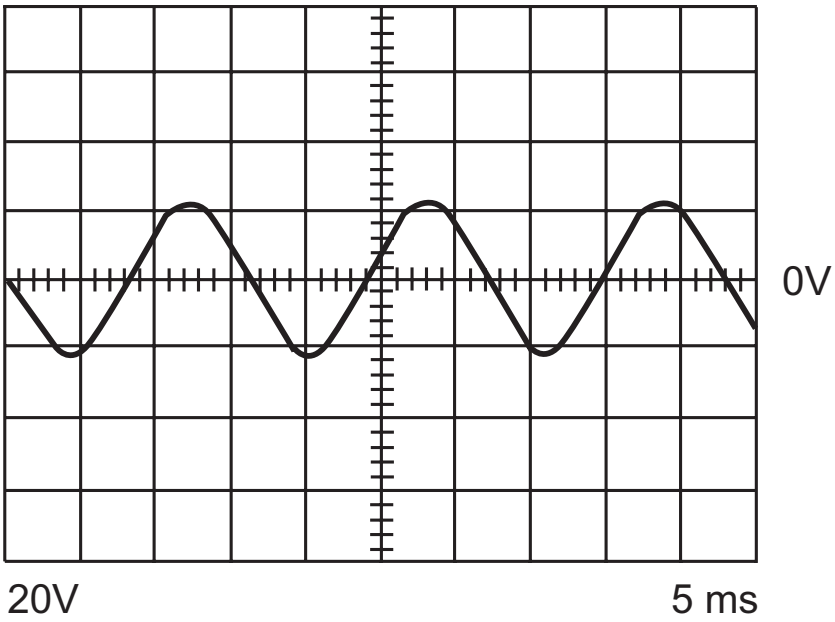
Volts/Div.....20V/Div.
Horizontal Sweep.....5 ms/Div.
Coupling.....DC
Trigger.....Internal

TYPICAL AC VOLTAGE WAVEFORM - MACHINE LOADED TO 50 AMPS
AC - TIG MODE

HIGH VOLTAGE/ HIGH FREQUENCY can damage test equipment.

Perform all voltage and waveform checks with high frequency circuit OFF.

Perform ***High Frequency Disable Procedure***.



AC BALANCE CONTROL IN "AUTO"

This is the typical DC (+) output voltage waveform generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes connected at machine output terminals: (+) probe to electrode, (-) probe to work.

SCOPE SETTINGS

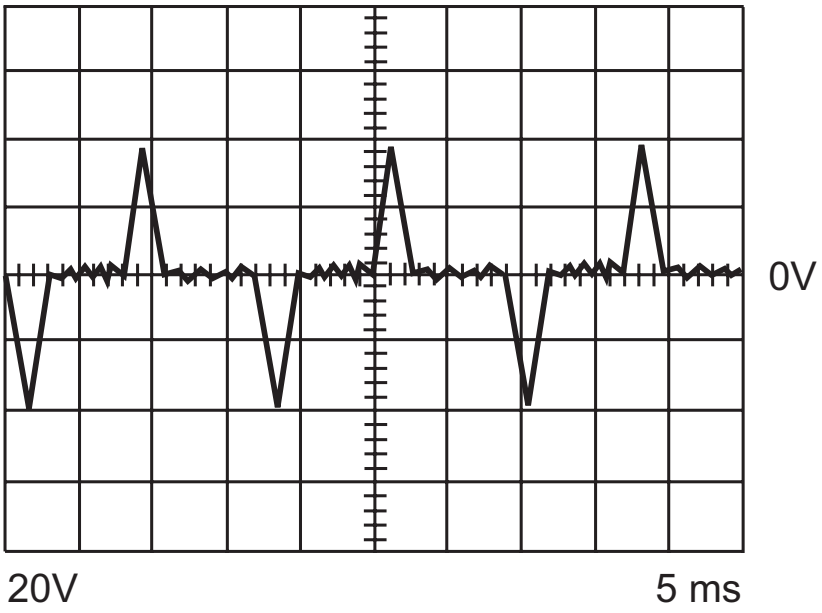
Volts/Div.....20V/Div.
Horizontal Sweep.....5 ms/Div.
Coupling.....DC
Trigger.....Internal

TYPICAL AC VOLTAGE WAVEFORM - MACHINE LOADED TO 2 AMPS
AC - TIG MODE

HIGH VOLTAGE/ HIGH FREQUENCY can damage test equipment.

Perform all voltage and waveform checks with high frequency circuit OFF.

Perform ***High Frequency Disable Procedure***.



AC BALANCE CONTROL IN "AUTO"
OUTPUT CONTROL AT MINIMUM.

This is the typical AC output voltage waveform generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes connected at machine output terminals: (+) probe to electrode, (-) probe to work.

SCOPE SETTINGS

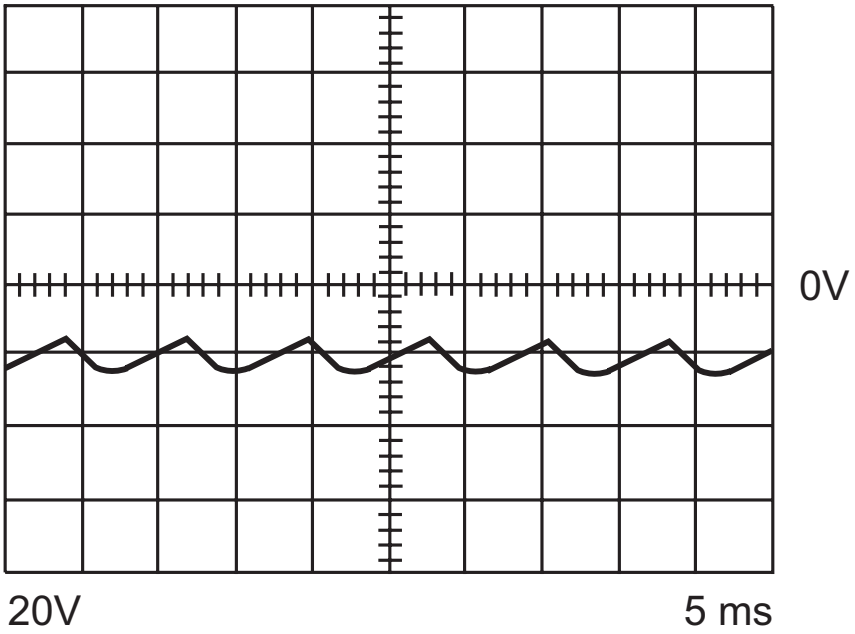
Volts/Div.....20V/Div.
Horizontal Sweep.....5 ms/Div.
Coupling.....DC
Trigger.....Internal

TYPICAL OUTPUT VOLTAGE WAVEFORM - MACHINE LOADED TO 200 AMPS DC - TIG MODE

HIGH VOLTAGE/ HIGH FREQUENCY can damage test equipment.

Perform all voltage and waveform checks with high frequency circuit OFF.

Perform ***High Frequency Disable Procedure***.



This is the typical AC output voltage waveform generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes connected at machine output terminals: (+) probe to electrode, (-) probe to work.

NOTE: AC balance control set at "Balanced" position.

SCOPE SETTINGS

Volts/Div.....20V/Div.
Horizontal Sweep.....5 ms/Div.
Coupling.....DC
Trigger.....Internal

NOTES

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HIGH VOLTAGE TRANSFORMER REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the high voltage transformer.

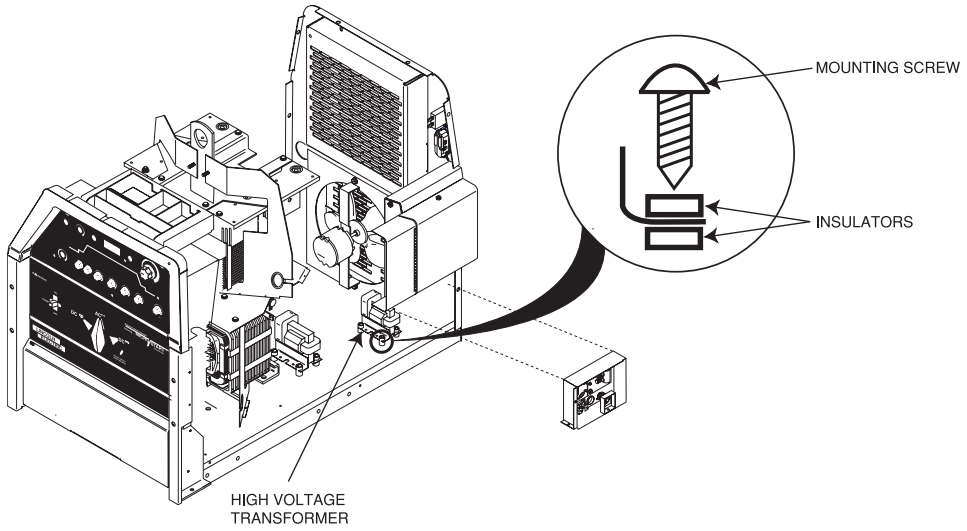
MATERIALS NEEDED

3/8” Nut Driver
7/16” Nut Driver
Phillips Head Screwdriver (Off-Set)
Wire Cutters

HIGH VOLTAGE TRANSFORMER

REMOVAL AND REPLACEMENT *(continued)*

Figure F.11 - High Voltage Transformer



REMOVAL PROCEDURE

1. Remove input power to the TIG 375 machine.
2. Using the 3/8" nut driver, remove the case sides and top.
3. Using a 3/8" nut driver, remove the case back.

NOTE: The case back will be connected to the fan assembly and will have leads connected to it, so just set aside.

4. Cut any necessary cable ties.
5. Disconnect black lead from the high voltage transformer connecting to leads 231D and 231E.
6. Disconnect the black lead from the high voltage transformer connecting to the capacitor. It may be necessary to cut lead.
7. Using a 7/16" nut driver, disconnect heavy black leads S and F. ***See Figure F.12.***
8. Using a 3/8" nut driver, remove the screw securing the spark gap assembly box. **See *Figure F.12.*** This will allow access to the high voltage transformer mounting screws.
9. Using an off set phillips head screw driver, remove the four high voltage transformer mounting screws. Note insulator positioning. See Figure F.11.
10. Remove the high voltage transformer.

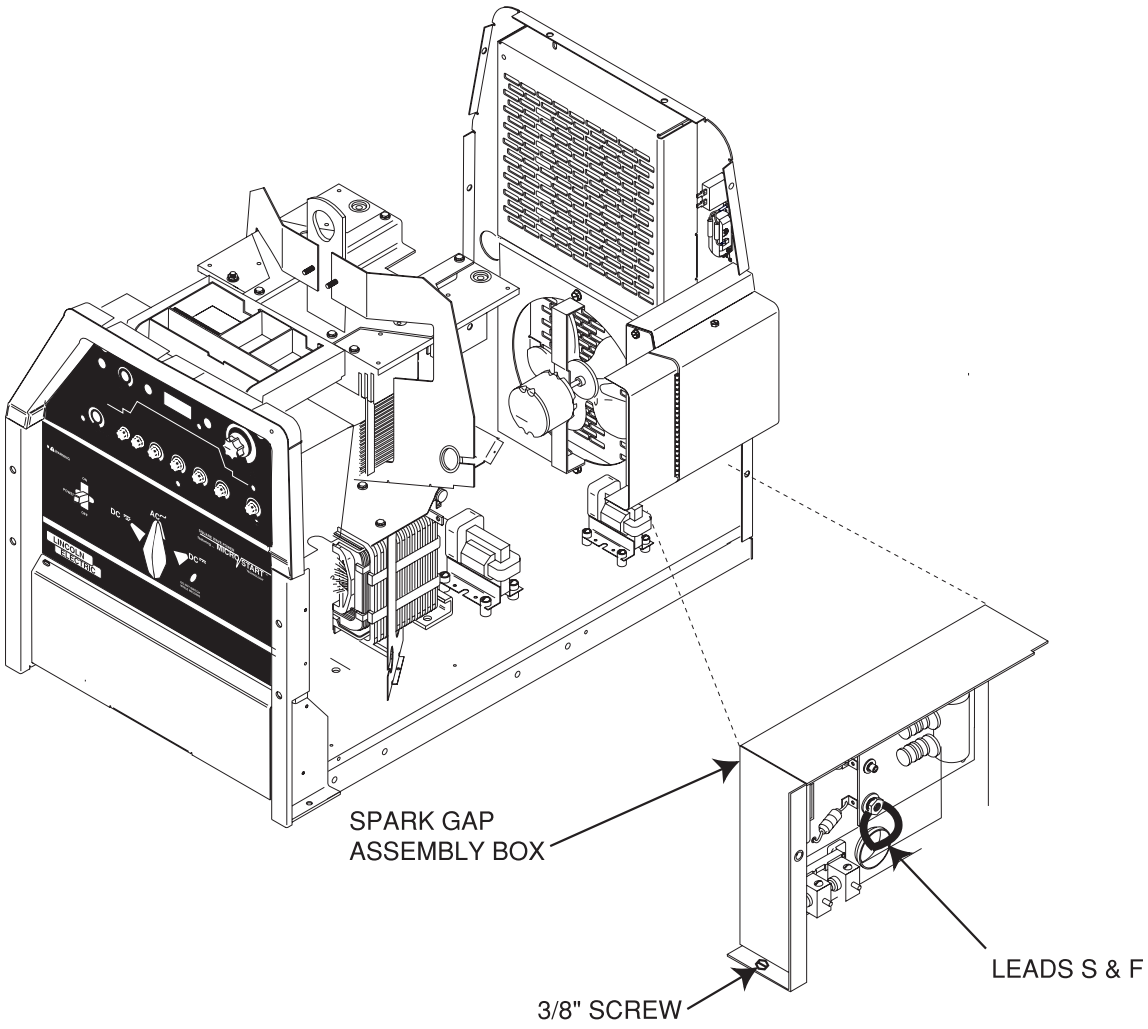
REPLACEMENT PROCEDURE

1. Replace the high voltage transformer.
2. Secure the new transformer using the four phillips head mounting screws. Refer to Figure F10 for insulator location.
3. Replace the 3/8" screw securing the spark gap assembly box.
4. Reconnect leads S and F.
5. Reconnect high voltage transformer lead to the capacitor.
6. Reconnect leads 231D and 231E to single black lead.
7. Replace any necessary cable ties.
8. Secure the case back using the 3/8" mounting bolts previously removed.
9. Replace the case sides and top.

HIGH VOLTAGE TRANSFORMER

REMOVAL AND REPLACEMENT *(continued)*

Figure F.12 - 3/8” Screw & Leads S and F Locations



CONTROL BOARD REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

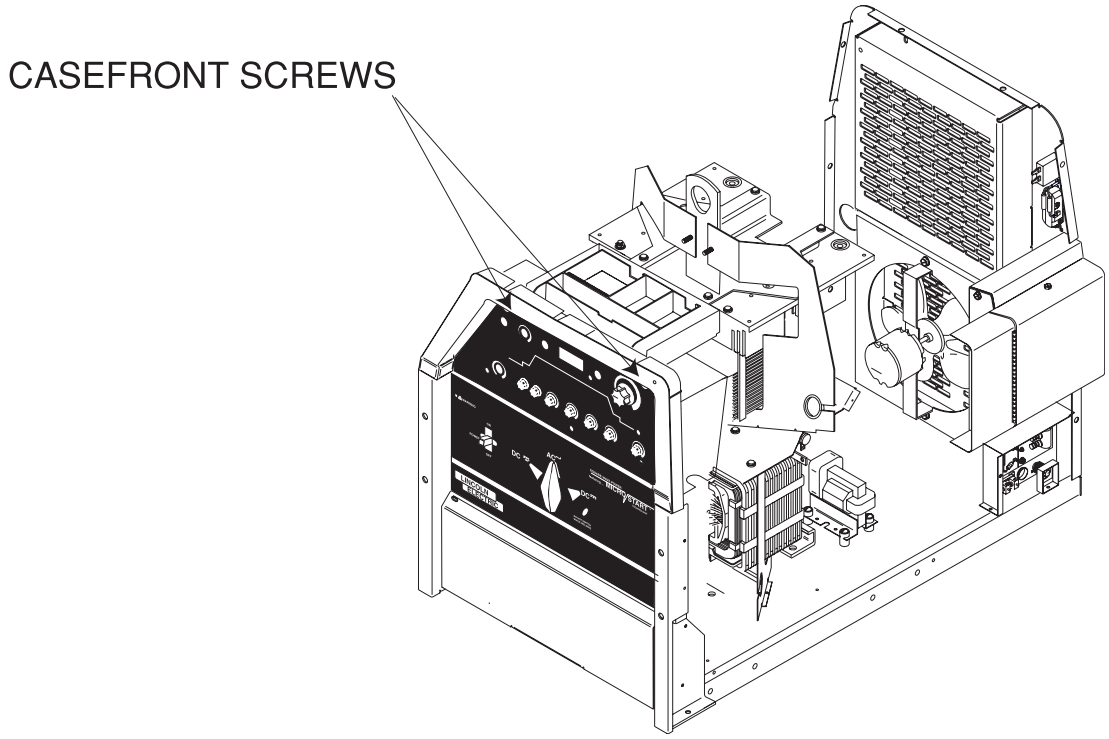
This procedure will aid the technician in the removal and replacement of the control board.

MATERIALS NEEDED

3/8" Nut Driver
Phillips Head Screwdriver
Wire Cutters

CONTROL BOARD REMOVAL AND REPLACEMENT *(continued)*

Figure F.13 - Case Front Screw Location



REMOVAL PROCEDURE

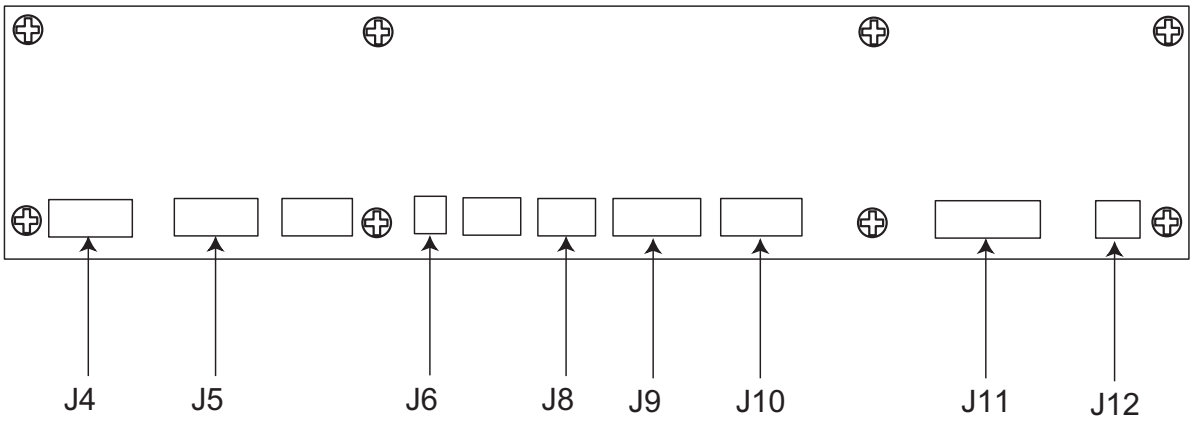
1. Remove input power to the TIG 375 machine.
2. Using a 3/8” nut driver, remove the two screws from the top of the case front. See Figure F.13.
3. The top front control box cover can now be tilted forward to gain access to the control board and its plugs.
4. From left to right, label and disconnect plugs J4, J5, J6, J8, J9, J10, J11, J12. **See *Figure F.14.***
5. Cut any necessary cable ties.
6. Using a phillips head screwdriver, remove the eight PC Board mounting screws. **See *Figure F.14.***
7. Carefully maneuver the control board out of the front of the machine.

REPLACEMENT PROCEDURE

1. Replace the control board.
2. Mount the new control board in its proper position using the eight phillips head mounting screws.
3. Replace any necessary cable ties.
4. Reconnect plugs previously removed from the control board.
5. Secure the control box assembly using the two 3/8” mounting screws previously removed.

CONTROL BOARD REMOVAL AND REPLACEMENT *(continued)*

Figure F.14 - Control Board Plug Locations



SCR BRIDGE ASSEMBLY REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the SCR bridge for maintenance or replacement.

MATERIALS NEEDED

3/8” Nut Driver
1/2” Nut Driver
7/16” Nut Driver
Pliers
Crimp Wire Cutters

SCR BRIDGE ASSEMBLY REMOVAL AND REPLACEMENT *(continued)*

REMOVAL PROCEDURE

Left Side (Negative Half)

1. Remove input power to the TIG 375 machine.
2. Using the 3/8" nut driver, remove the case sides and top.
3. Remove the Glastic Baffle.
4. Label and cut leads G3 and G4 or remove from J4 Plug.
5. Label and remove all leads connected to the Negative Heat Sink Assembly. See Wiring Diagram.
6. Remove the three screws mounting the Heat Sink Assembly to the Lift Bale Assembly. Note placement of Insulators for reassembly.
7. See ***SCR Replacement Procedures.***
8. Replace all leads, baffles and insulators previously removed.

REMOVAL PROCEDURE

Right Side (Positive Half)

1. Remove input power to the TIG 375 machine.
2. Using the 3/8" nut driver, remove the case sides and top.
3. Remove the Glastic Baffle.
4. Label and cut Lead G1 and G4 or remove from J4 Plug.
5. Label and remove all leads connected to the Negative Heat Sink Assembly. See Wiring Diagram.
6. Remove the three screws mounting the Heat Sink Assembly to the Lift Bale Assembly. Note placement of insulators for reassembly.
7. See ***SCR Replacement Procedures.***
8. Replace all leads, baffles and insulators previously removed.

MOUNTING OF STUD TYPE DIODES TO ALUMINUM HEAT SINKS

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the stud type diodes in their heatsinks for maintenance or replacement.

MATERIALS NEEDED:

1/2" Open End Wrench.
Penetrox Heat Sink Compound (Lincoln Part #T12837-1).
"Slip" Type Torque Wrench.

MOUNTING OF STUD TYPE DIODES TO ALUMINUM HEAT SINKS (CONT'D)

PROCEDURE

1. Loosen the appropriate diode nut and remove the diode that is to be replaced.

2. Clean the area on the heat sink around the diode mounting surface using a putty knife, or similar tool, DO NOT SCRATCH THE DIODE MOUNTING SURFACE.

3. Polish each heat sink's mounting surface using NO. 000 fine steel wool. Wipe surface clean with a lint free cloth or paper towel.

4. Inspect the mounting surfaces of each new diode. Remove all burrs and wipe clean. Do not use steel wool or any abrasive cleanser on the diode mounting surface.

5. Apply a thin (0.0003" to 0.0007") uniform layer of Penetrox heat sink compound (Lincoln part #T12837-1) to the heat sink mounting surface.

    a. Do not apply compound to diode stud or mounting threads.

    b. The diode threads must be clean and free of defects so that the nut can be finger tightened before applying torque. A "slip" type torque wrench must be used to tighten the diode nut.

6. Tighten the diode nuts to the specifications in the following table.

    a. The nuts for diodes with steel studs are to be started by hand and then torqued as per the following table.

    b. The nuts for diodes with copper studs are to run on all the way by hand then torqued as per the following table.

    c. Turn a minimum of 1/2 turn more while torquing per the table.

DIODE STUD SIZE	FOOT-POUNDS	INCH-POUNDS
3/4 - 16	25-27	300-324
3/8 - 24	10±.5	125+0/-5
1/4 - 28		22-25

SCR REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the SCRs for maintenance or replacement.

MATERIALS NEEDED:

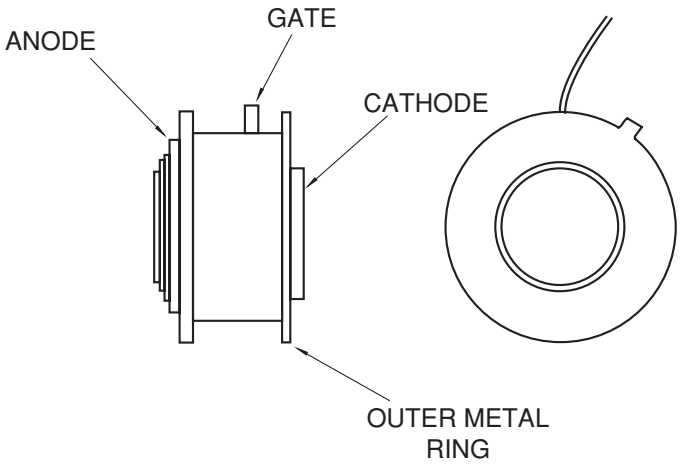
NO.000 Fine Steel Wool.
Penetrox Heat Sink Compound (Lincoln Part #T12837-1).
7/16” Open End Wrench.
Allen Head Type Wrenches.

SCR REMOVAL AND REPLACEMENT (CONTINUED)

PROCEDURE:

NOTE: Before disassembling the existing rectifier, note which heat sink the outer metal ring of the power SCR is mounted towards. Also, note the positioning of the gate lead of the SCR. Failure to reinstall the new SCR in the same orientation as the original may result in subsequent damage to the new SCR and other components of the welder. See Figure F.15.

Figure F.15 - SCR



⚠ CAUTION

The unclamping and clamping procedure outlined below is critical for the prevention of internal SCR damage. Failure to follow this procedure may result in subsequent damage of the SCR. Handle all SCRs with care.

1. Alternately loosen nuts 1/2 turn each until heat sinks are loose. Remove nuts and leaf spring. IT IS RECOMMENDED THAT ALL NEW HARDWARE, LEAF SPRING AND HOUSING BE USED FOR REASSEMBLY.

2. Remove the old SCR.

3. Clean the area on the heat sink around the SCR mounting surface. Using a putty knife, or similar tool. DO NOT SCRATCH THE SCR MOUNTING SURFACE.

4. Polish each heat sink's mounting surface using NO. 000 fine steel wool. Wipe surface clean with a lint free cloth or paper towel.

5. Inspect the mounting surfaces of each new SCR.

    a. Remove all burrs and wipe clean. Do not use steel wool or any abrasive cleanser on the SCR mounting surfaces.

6. Apply a thin (0.001" to 0.003") layer of Penetrox heat sink compound (Lincoln part #T12837-1) to each heat sink's SCR mounting surface.

    a. Care must be used to prevent foreign material contamination of the SCR to heat sink junction.

7. Place the new SCR between the heat sinks. Be sure that the outer metal ring of the SCR is facing towards the same heat sink as the old SCR's metal ring. Be sure that the roll pin of the heat sink engages the "hole" in the SCR. The SCR contact surfaces must sit flat against both heat sink surfaces.

SCR REMOVAL AND REPLACEMENT (CONTINUED)

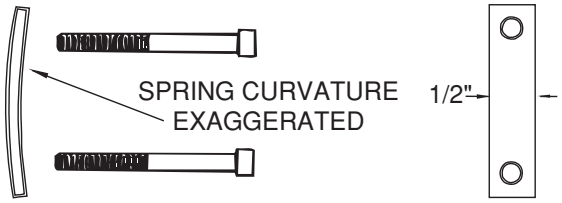
8. Go to procedure that matches cap screws. NOTE WHICH THREAD IS ON YOUR CAP SCREWS BEFORE PROCEEDING TO THE ASSEMBLY PROCEDURE. Two different designs of leaf springs and housings have been used to clamp the SCR to the rectifier. The two different designs can be identified by the size of the leaf spring. One design uses a 1/2 inch wide leaf spring and the other uses a 5/8 inch wide spring. The different designs require different assembly and clamping procedures. The assembly procedure will be different depending upon the thread on the cap screws. A 1/4-28 thread requires a different tightening procedure than a 1/4-20 thread.

PROCEDURE FOR THE 1/2 INCH WIDE SPRING

1. Place a piece of sleeving around each bolt.

2. Insert bolts thru the leaf spring. Orient the leaf spring so that it's ends are curved upward toward the bolt heads. See figure F.21. Pressing on the bolt heads should produce a "rocking" motion of the spring in its housing. If the spring does NOT rock it is installed upside down. Remove the spring and turn it over. Check for "rocking" motion. See Figure F.16.

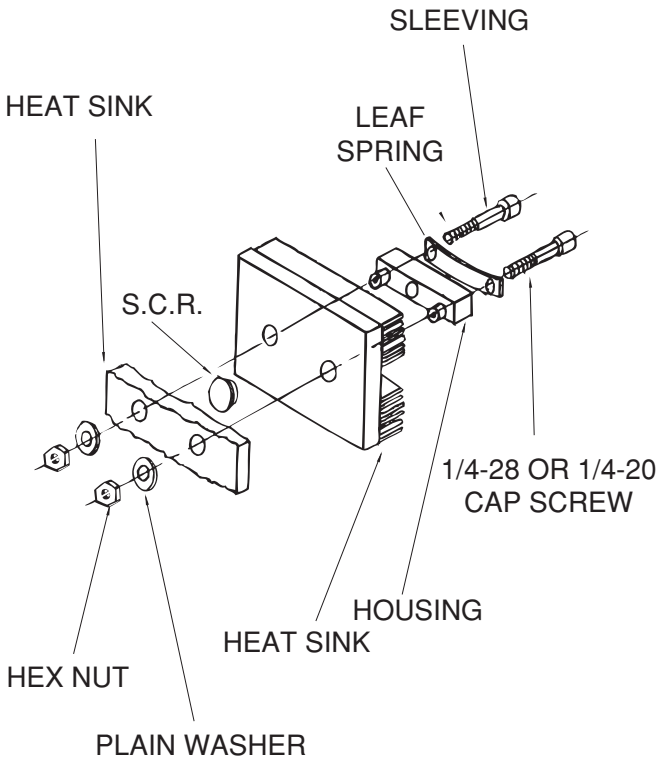
Figure F.16 - 1/2" Wide Leaf Spring



3. Insert bolts and leaf spring into the plastic housing.

4. Insert clamp assembly thru heat sinks. Install nuts. Tighten clamp nuts equally on bolts until finger tight. (See Figure F.17. Heat sinks may not be exactly as pictured.)

Figure F.17 - Clamp Assembly



5. Re-inspect the SCR for proper seating.

SCR REMOVAL AND REPLACEMENT (CONTINUED)

CLAMPING PROCEDURE FOR 1/4-28 BOLTS.

NOTE: This procedure can only be used with 1/4-28 bolts.

Do not use bolts with any other type thread or new SCR will be damaged.

Do not over tighten cap screws. The leaf spring will apply the required clamping force to the SCR.

1. Do not turn the nuts. While holding the nuts stationary, turn the cap screws only with the following procedure.
2. Tighten first cap screw 1/4 turn.
3. Tighten second cap screw 1/2 turn.
4. Tighten first cap screw 1/2 turn.
5. Tighten second cap screw 1/2 turn.
6. Tighten first cap screw 1/4 turn.
7. Assembly now has proper clamping force.
8. Perform the ***Active SCR Test.***

CLAMPING PROCEDURE FOR 1/4-20 BOLTS.

NOTE: This procedure can only be used with 1/4-20 bolts.

Do not use bolts with any other type thread or new SCR will be damaged.

Do not over tighten cap screws. The leaf spring will apply the required clamping force to the SCR.

1. Do not turn the nuts. While holding the nuts stationary, turn the cap screws only with the following procedure.
2. Tighten first cap screw 1/4 turn.
3. Tighten second cap screw 1/2 turn.
4. Tighten first cap screw 1/2 turn.
5. Tighten second cap screw 1/4 turn. STOP.
6. Assembly now has the proper clamping force.
7. Perform the ***Active SCR Test***.

SCR REMOVAL AND REPLACEMENT (CONTINUED)

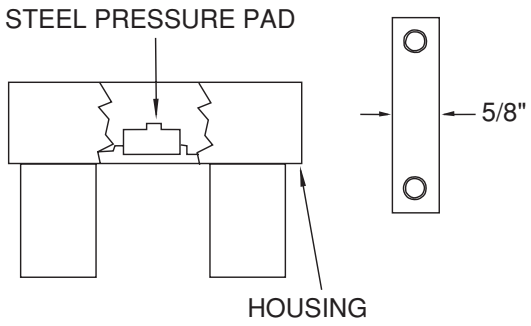
PROCEDURE FOR THE 5/8 INCH WIDE SPRING

1. Place a piece of sleeving around each bolt.

2. Insert bolts thru the leaf spring. The leaf spring is flat so the orientation of the leaf spring does not matter.

3. Place the steel pressure pad in the housing with the 1/8 inch wide standoff facing up. See Figure F.18.

Figure F.18 - Housing and Pressure Pad for 5/8" Wide leaf spring

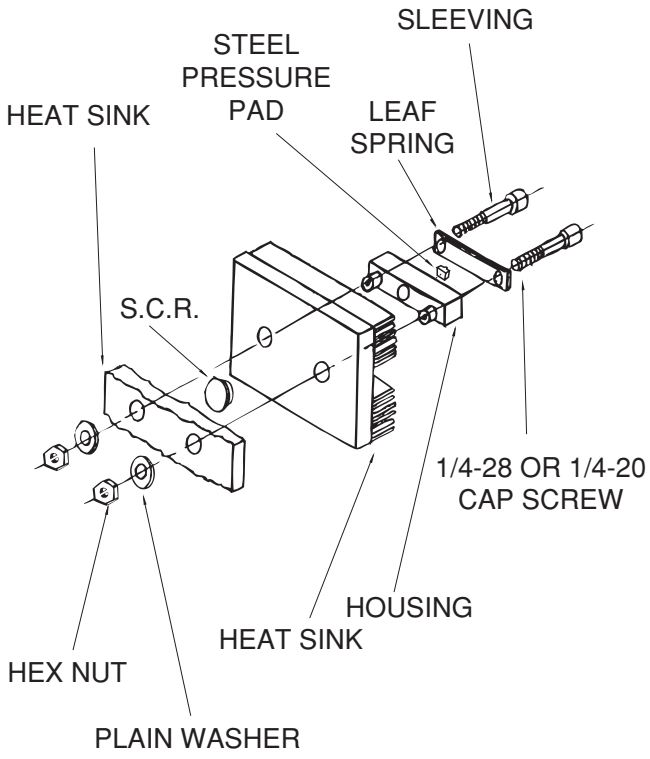


4. Insert bolts and leaf spring into plastic housing being sure that the steel pressure pad remains in position. Pressing on the bolt heads should produce a rocking action of the spring in it's housing.

5. Insert clamp assembly thru heat sinks. Install nuts. Tighten clamp nuts equally on bolts until finger tight. Be sure that the leaf spring is not cocked in the housing. See Figure F.19. Heat sinks may not be exactly as pictured.

6. Re-inspect the SCR for proper seating.

Figure F.19 - Clamp Assembly



POLARITY SWITCH REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician 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.

DESCRIPTION

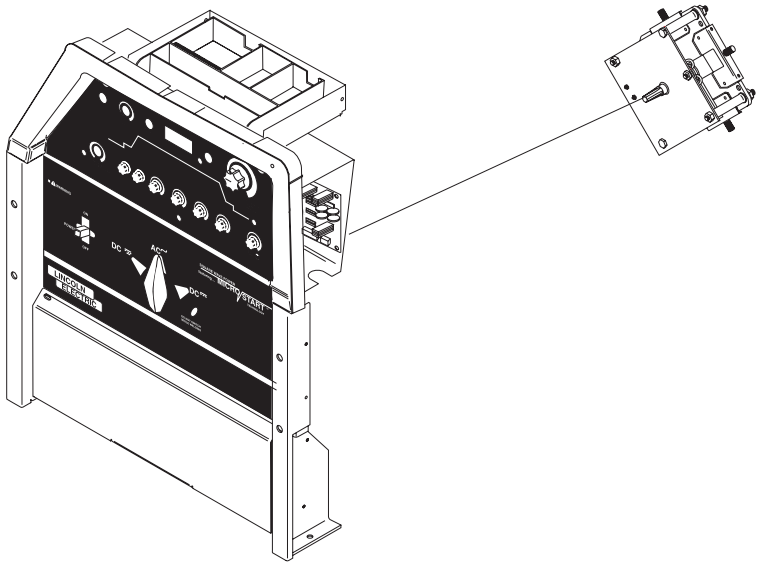
This procedure will aid the technician in the removal and replacement of the polarity switch.

MATERIALS NEEDED

3/8” Nut Driver
1/2” Wrench
7/16” Wrench
Phillips Head Screw Driver
Slot Head Screw Driver (2 Required)

POLARITY SWITCH REMOVAL AND REPLACEMENT *(continued)*

Figure F.20 - Switch Location



REMOVAL PROCEDURE

1. Remove the input to the Precision TIG375 machine.
2. Using the 3/8” nut driver, remove the case sides and top.
3. Locate the polarity switch. See Figure F.20.
4. Using a 1/2”wrench, label and disconnect leads B, C, 252, Pos, Neg, D2 diode assembly,S ,253, choke lead, X2 and all leads from the main transformer. Be sure to label leads for reassembly.
5. Disconnect leads 265 and 266A using quick disconnects.
6. Using a phillips head screw driver, remove the screw from the polarity switch handle.
7. With the 2 slot head screw drivers, carefully pry the polarity switch handle from the shaft.
8. Carefully peel back the lower nameplate on the case front located around the polarity switch to gain access to the polarity switch mounting nuts.

NOTE: Do not remove the sticker completely.

9. Using a 7/16” nut driver, remove the two polarity switch mounting nuts located behind the previously removed nameplate.
10. The polarity switch is ready for removal.

REPLACEMENT PROCEDURE

1. Replace the polarity switch.
2. Secure the polarity switch in its original position with the 7/16” mounting nuts.
3. Firmly press the lower nameplate back into its original position on the case front.
4. Press the polarity switch handle back onto its shaft.
5. Secure polarity switch handle with the phillips head screw previously removed.
6. Reconnect leads 265 and 266A previously removed.
7. Reconnect all previously removed leads to their proper terminals. See Wiring Diagram.
8. Replace case sides and top.

RETEST AFTER REPAIR

Should a machine under test be rejected for any reason requiring the removal of any mechanical part that could effect the machine's electrical characteristics, or if any electrical components are required or replaced, the machine must be retested.

INPUT IDLE AMPS		
Input Volts/Hertz	**Maximum Idle Amps (without PFC)**	**Maximum Idle Amps (without PFC)**
208/60	6	36
230/60	5	32
460/60	3	16
575/60	2	13

OPEN CIRCUIT VOLTAGES	
MAXIMUM AC OPEN CIRCUIT VOLTAGE	75 VAC
MAXIMUM DC OPEN CIRCUIT VOLTAGE	68 VDC

MAXIMUM ACCEPTABLE OUTPUT VOLTAGE AT MINIMUM OUTPUT SETTINGS	
DC TIG Mode	2.5 Amps @ 20 Volts

MAXIMUM ACCEPTABLE OUTPUT VOLTAGE AT MAXIMUM OUTPUT SETTINGS	
DC TIG Mode	400 Amps @ 36 Volts

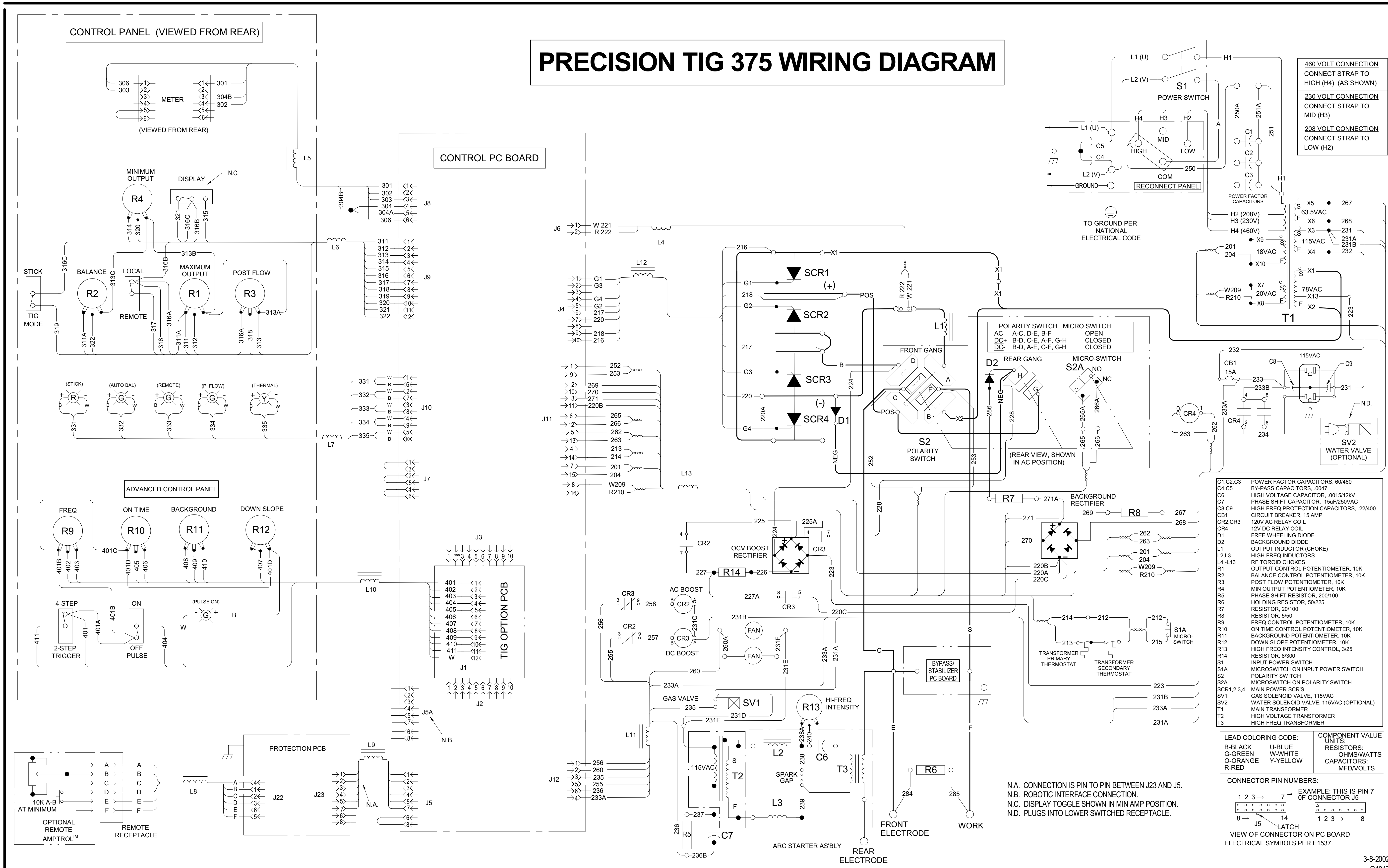
RECOMMENDED METERS FOR MACHINE OUTPUT TESTS

VOLTMETER: AC and DC True RMS Meter - Fluke 8922A or equivalent
AMMETER: Columbia Type AX AC or DC Tong Ammeter

IMPORTANT: IF OTHER TYPE METERS ARE USED, RESULTS MAY NOT BE ACCURATE.

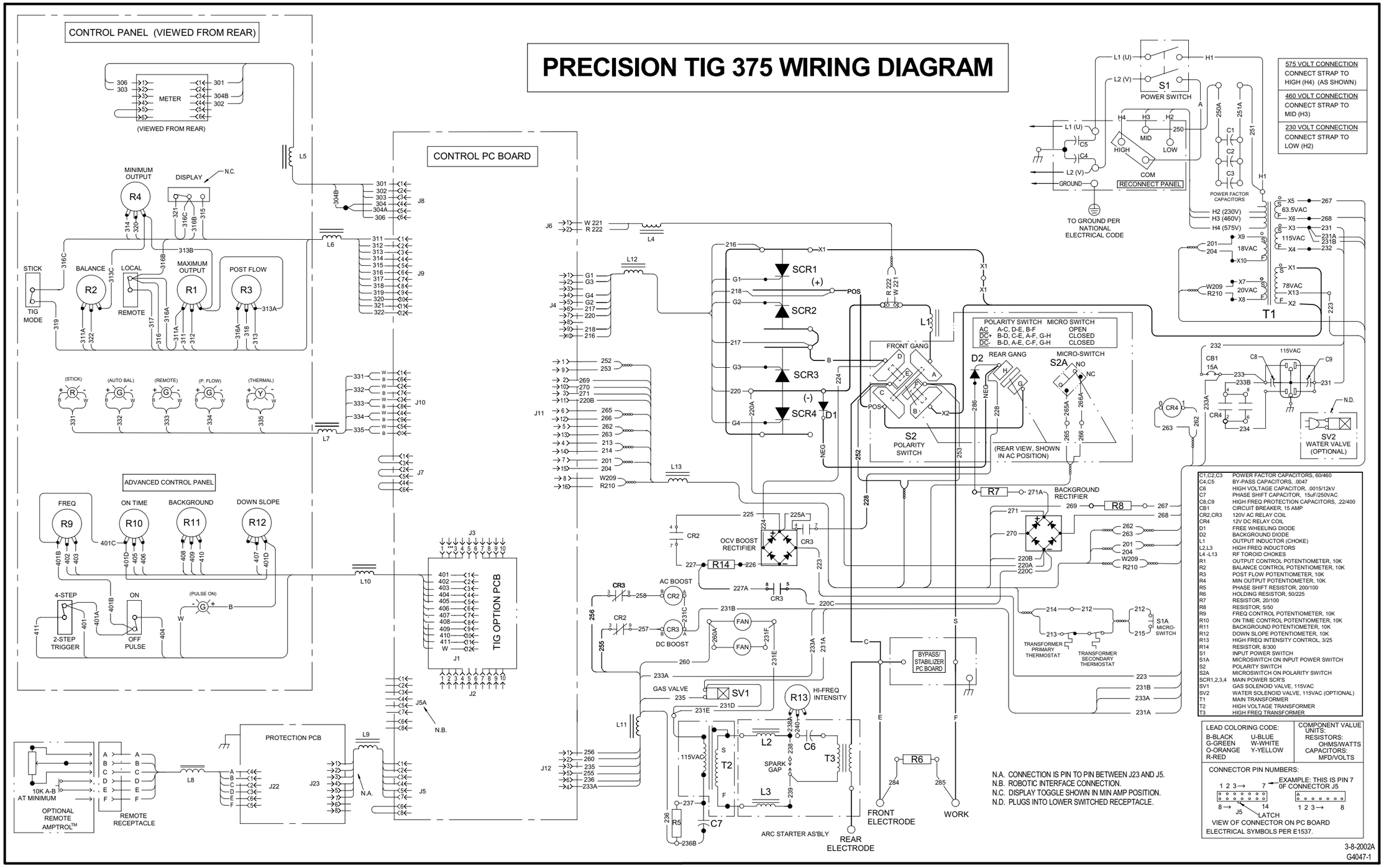
TABLE OF CONTENTS
ELECTRICAL DIAGRAMS SECTION

WIRING DIAGRAM - ENTIRE MACHINE - CODE 10809 (G4047)



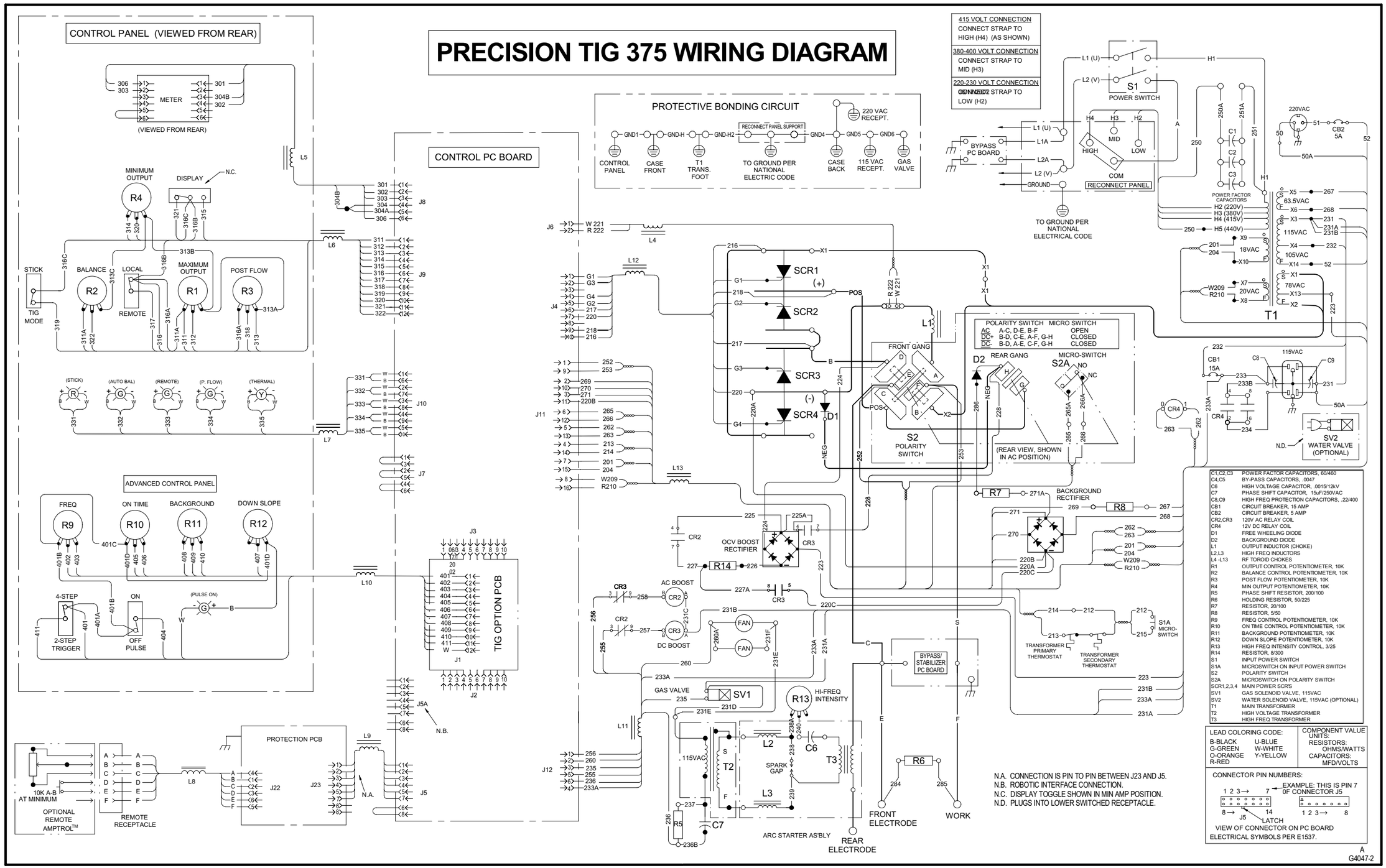
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

WIRING DIAGRAM - ENTIRE MACHINE - CODE 10810 (G4047-1)



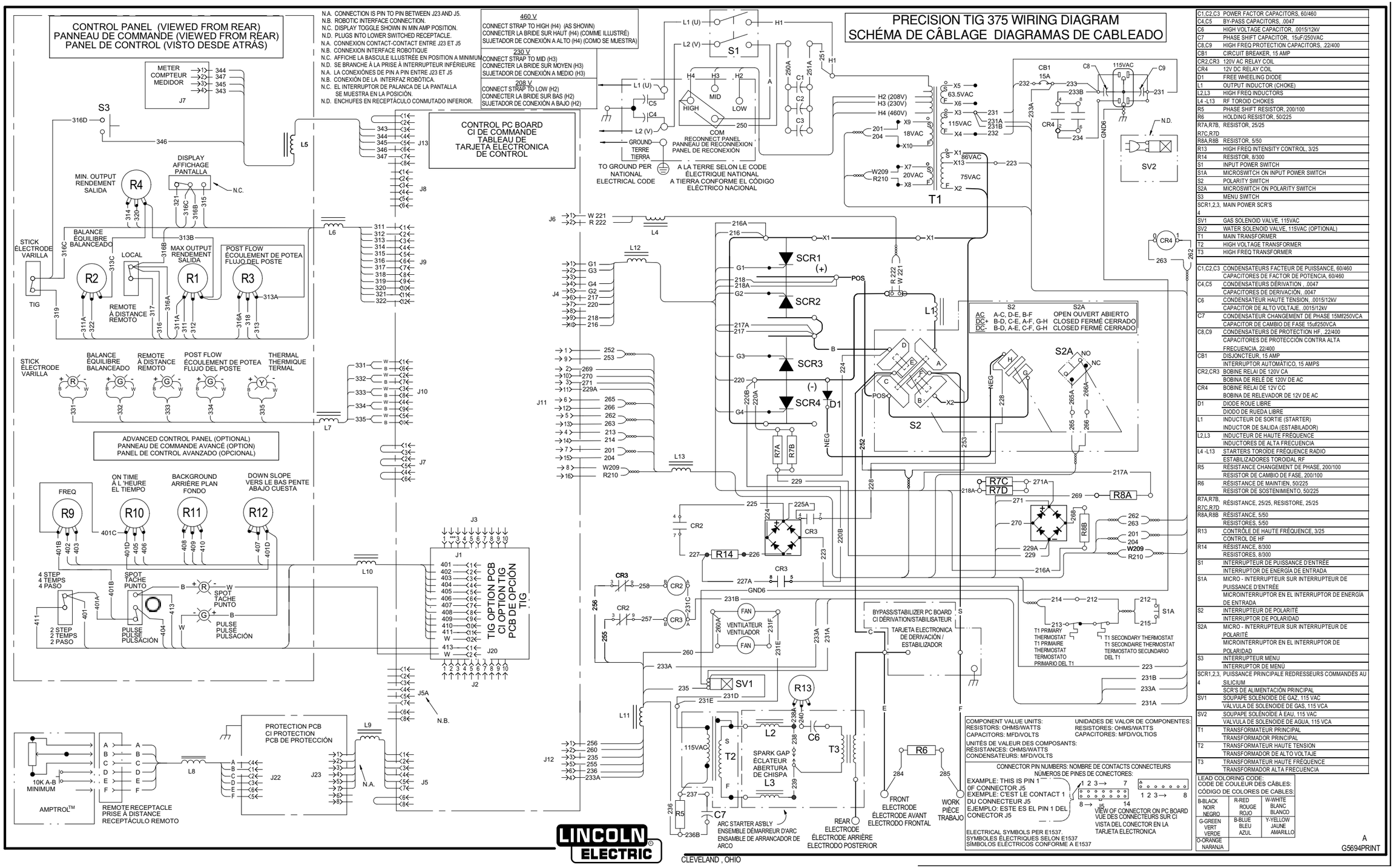
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

WIRING DIAGRAM - ENTIRE MACHINE - CODE 10894 (G4047-2)



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.

WIRING DIAGRAM - ENTIRE MACHINE - CODE 11161 (G5694)



C1,C2,C3	POWER FACTOR CAPACITORS, 60/460
C4,C5	BY-PASS CAPACITORS, .0047
C6	HIGH VOLTAGE CAPACITOR, .0015/12KV
C7	PHASE SHIFT CAPACITOR, 15uF/250VAC
C8,C9	HIGH FREQ PROTECTION CAPACITORS, .22/400
CB1	CIRCUIT BREAKER, 15 AMP
CR2,CR3	120V AC RELAY COIL
CR4	12V DC RELAY COIL
D1	FREE WHEELING DIODE
L1	OUTPUT INDUCTOR (CHOKE)
L2,L3	HIGH FREQ INDUCTORS
L4 -L13	RF TOROID CHOKES
R5	PHASE SHIFT RESISTOR, 200/100
R6	HOLDING RESISTOR, 50/225
R7A,R7B, R7C,R7D	RESISTOR, 25/25
R8A,R8B	RESISTOR, 5/50
R13	HIGH FREQ INTENSITY CONTROL, 3/25
R14	RESISTOR, 8/300
S1	INPUT POWER SWITCH
S1A	MICROSWITCH ON INPUT POWER SWITCH
S2	POLARITY SWITCH
S2A	MICROSWITCH ON POLARITY SWITCH
S3	MENU SWITCH
SCR1,2,3, 4	MAIN POWER SCR'S
SV1	GAS SOLENOID VALVE, 115VAC
SV2	WATER SOLENOID VALVE, 115VAC (OPTIONAL)
T1	MAIN TRANSFORMER
T2	HIGH VOLTAGE TRANSFORMER
T3	HIGH FREQ TRANSFORMER

C1,C2,C3	CONDENSATEURS FACTEUR DE PUISSANCE, 60/460
	CAPACITORES DE FACTOR DE POTENCIA, 60/460
C4,C5	CONDENSATEURS DÉRIVATION , .0047
	CAPACITORES DE DERIVACIÓN, .0047
C6	CONDENSATEUR HAUTE TENSION, .0015/12KV
	CAPACITOR DE ALTO VOLTAJE, .0015/12kV
C7	CONDENSATEUR CHANGEMENT DE PHASE 15MF/250VCA
	CAPACITOR DE CAMBIO DE FASE 15uf/250VCA
C8,C9	CONDENSATEURS DE PROTECTION HF, .22/400
	CAPACITORES DE PROTECCIÓN CONTRA ALTA FRECUENCIA, 22/400
CB1	DISJONCTEUR, 15 AMP
	INTERRUPTOR AUTOMÁTICO, 15 AMPS
CR2,CR3	BOBINE RELAI DE 120V CA
	BOBINA DE RELÉ DE 120V DE AC
CR4	BOBINE RELAI DE 12V CC
	BOBINA DE RELEVADOR DE 12V DE AC
D1	DIODE ROUE LIBRE
	DIODO DE RUEDA LIBRE
L1	INDUCTEUR DE SORTIE (STARTER)
	INDUCTOR DE SALIDA (ESTABILADOR)
L2,L3	INDUCTEUR DE HAUTE FRÉQUENCE
	INDUCTORES DE ALTA FRECUENCIA
L4 -L13	STARTERS TOROIDE FRÉQUENCE RADIO
	ESTABILIZADORES TOROIDAL RF
R5	RÉSISTANCE CHANGEMENT DE PHASE, 200/100
	RESISTOR DE CAMBIO DE FASE, 200/100
R6	RÉSISTANCE DE MAINTIEN, 50/225
	RESISTOR DE SOSTENIMIENTO, 50/225
R7A,R7B, R7C,R7D	RÉSISTANCE, 25/25, RESISTORE, 25/25
R8A,R8B	RÉSISTANCE, 5/50
	RESISTORES, 5/50
R13	CONTRÔLE DE HAUTE FRÉQUENCE, 3/25
	CONTROL DE HF
R14	RÉSISTANCE, 8/300
	RESISTORES, 8/300
S1	INTERRUPTEUR DE PUISSANCE D'ENTRÉE
	INTERRUPTOR DE ENERGÍA DE ENTRADA
S1A	MICRO - INTERRUPTEUR SUR INTERRUPTEUR DE PUISSANCE D'ENTRÉE
	MICROINTERRUPTOR EN EL INTERRUPTOR DE ENERGÍA DE ENTRADA
S2	INTERRUPTEUR DE POLARITÉ
	INTERRUPTOR DE POLARIDAD
S2A	MICRO - INTERRUPTEUR SUR INTERRUPTEUR DE POLARITÉ
	MICROINTERRUPTOR EN EL INTERRUPTOR DE POLARIDAD
S3	INTERRUPTEUR MENU
	INTERRUPTOR DE MENÚ
SCR1,2,3, 4	PUISSANCE PRINCIPALE REDRESSEURS COMMANDÉS AU SILICIUM
	SCR'S DE ALIMENTACIÓN PRINCIPAL
SV1	SOUPAPE SOLÉNOÏDE DE GAZ, 115 VAC
	VÁLVULA DE SOLENOIDE DE GAS, 115 VCA
SV2	SOUPAPE SOLÉNOÏDE À EAU, 115 VAC
	VÁLVULA DE SOLENOIDE DE AGUA, 115 VCA
T1	TRANSFORMATEUR PRINCIPAL
	TRANSFORMADOR PRINCIPAL
T2	TRANSFORMATEUR HAUTE TENSION
	TRANSFORMADOR DE ALTO VOLTAJE
T3	TRANSFORMATEUR HAUTE FRÉQUENCE
	TRANSFORMADOR ALTA FRECUENCIA

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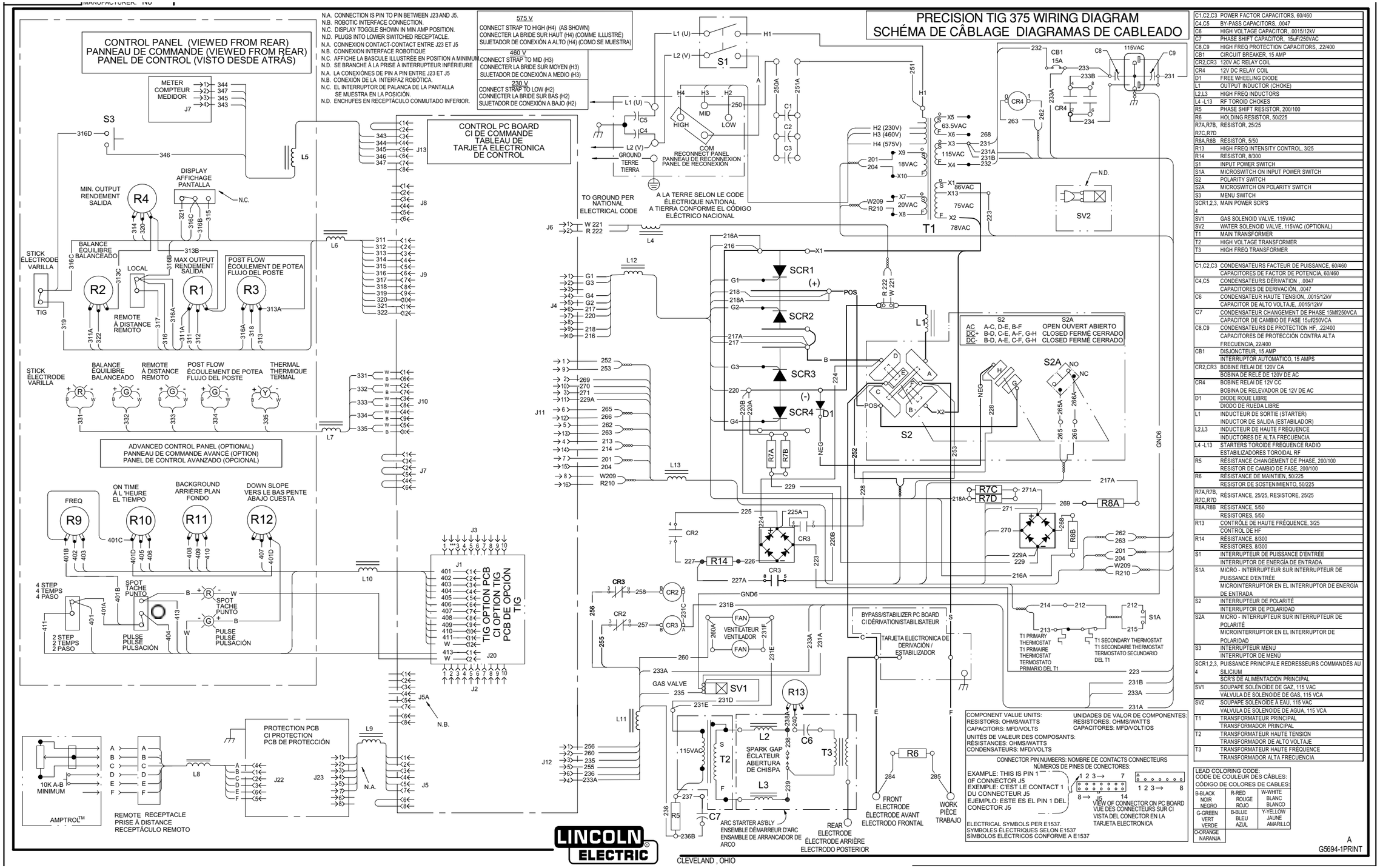
WIRING DIAGRAM - ENTIRE MACHINE - CODE 11162 (G5694-1)



C1,C2,C3	POWER FACTOR CAPACITORS, 60/460
C4,C5	BY-PASS CAPACITORS, .0047
C6	HIGH VOLTAGE CAPACITOR, .0015/12kV
C7	PHASE SHIFT CAPACITOR, 15uF/250VAC
C8,C9	HIGH FREQ PROTECTION CAPACITORS, .22/400
CB1	CIRCUIT BREAKER, 15 AMP
CR2,CR3	120V AC RELAY COIL
CR4	12V DC RELAY COIL
D1	FREE WHEELING DIODE
L1	OUTPUT INDUCTOR (CHOKE)
L2,L3	HIGH FREQ INDUCTORS
L4 -L13	RF TOROID CHOKES
R5	PHASE SHIFT RESISTOR, 200/100
R6	HOLDING RESISTOR, 50/225
R7A,R7B, R7C,R7D	RESISTOR, 25/25
R8A,R8B	RESISTOR, 5/50
R13	HIGH FREQ INTENSITY CONTROL, 3/25
R14	RESISTOR, 8/300
S1	INPUT POWER SWITCH
S1A	MICROSWITCH ON INPUT POWER SWITCH
S2	POLARITY SWITCH
S2A	MICROSWITCH ON POLARITY SWITCH
S3	MENU SWITCH
SCR1,2,3, 4	MAIN POWER SCR'S
SV1	GAS SOLENOID VALVE, 115VAC
SV2	WATER SOLENOID VALVE, 115VAC (OPTIONAL)
T1	MAIN TRANSFORMER
T2	HIGH VOLTAGE TRANSFORMER
T3	HIGH FREQ TRANSFORMER
C1,C2,C3	CONDENSATEURS FACTEUR DE PUISSANCE, 60/460
	CAPACITORES DE FACTOR DE POTENCIA, 60/460
C4,C5	CONDENSATEURS DÉRIVATION , .0047
	CAPACITORES DE DERIVACIÓN, .0047
C6	CONDENSATEUR HAUTE TENSION, .0015/12KV
	CAPACITOR DE ALTO VOLTAJE, .0015/12kV
C7	CONDENSATEUR CHANGEMENT DE PHASE 15MF/250VCA
	CAPACITOR DE CAMBIO DE FASE 15uf/250VCA
C8,C9	CONDENSATEURS DE PROTECTION HF, .22/400
	CAPACITORES DE PROTECCIÓN CONTRA ALTA FRECUENCIA, 22/400
CB1	DISJONCTEUR, 15 AMP
	INTERRUPTOR AUTOMÁTICO, 15 AMPS
CR2,CR3	BOBINE RELAI DE 120V CA
	BOBINA DE RELÉ DE 120V DE AC
CR4	BOBINE RELAI DE 12V CC
	BOBINA DE RELEVADOR DE 12V DE AC
D1	DIODE ROUE LIBRE
	DIODO DE RUEDA LIBRE
L1	INDUCTEUR DE SORTIE (STARTER)
	INDUCTOR DE SALIDA (ESTABILADOR)
L2,L3	INDUCTEUR DE HAUTE FRÉQUENCE
	INDUCTORES DE ALTA FRECUENCIA
L4 -L13	STARTERS TOROIDE FRÉQUENCE RADIO
	ESTABILIZADORES TOROIDAL RF
R5	RÉSISTANCE CHANGEMENT DE PHASE, 200/100
	RESISTOR DE CAMBIO DE FASE, 200/100
R6	RÉSISTANCE DE MAINTIEN, 50/225
	RESISTOR DE SOSTENIMIENTO, 50/225
R7A,R7B, R7C,R7D	RÉSISTANCE, 25/25, RESISTORE, 25/25
R8A,R8B	RESISTANCE, 5/50
	RESISTORES, 5/50
R13	CONTRÔLE DE HAUTE FRÉQUENCE, 3/25
	CONTROL DE HF
R14	RÉSISTANCE, 8/300
	RESISTORES, 8/300
S1	INTERRUPTEUR DE PUISSANCE D'ENTRÉE
	INTERRUPTOR DE ENERGÍA DE ENTRADA
S1A	MICRO - INTERRUPTEUR SUR INTERRUPTEUR DE PUISSANCE D'ENTRÉE
	MICROINTERRUPTOR EN EL INTERRUPTOR DE ENERGÍA DE ENTRADA
S2	INTERRUPTEUR DE POLARITÉ
	INTERRUPTOR DE POLARIDAD
S2A	MICRO - INTERRUPTEUR SUR INTERRUPTEUR DE POLARITÉ
	MICROINTERRUPTOR EN EL INTERRUPTOR DE POLARIDAD
S3	INTERRUPTEUR MENU
	INTERRUPTOR DE MENÚ
SCR1,2,3, 4	PUISSANCE PRINCIPALE REDRESSEURS COMMANDÉS AU SILICIUM
	SCR'S DE ALIMENTACIÓN PRINCIPAL
SV1	SOUPAPE SOLENOÏDE DE GAZ, 115 VAC
	VÁLVULA DE SOLENOIDE DE GAS, 115 VCA
SV2	SOUPAPE SOLENOÏDE À EAU, 115 VAC
	VÁLVULA DE SOLENOIDE DE AGUA, 115 VCA
T1	TRANSFORMATEUR PRINCIPAL
	TRANSFORMADOR PRINCIPAL
T2	TRANSFORMATEUR HAUTE TENSION
	TRANSFORMADOR DE ALTO VOLTAJE
T3	TRANSFORMATEUR HAUTE FRÉQUENCE
	TRANSFORMADOR ALTA FRECUENCIA

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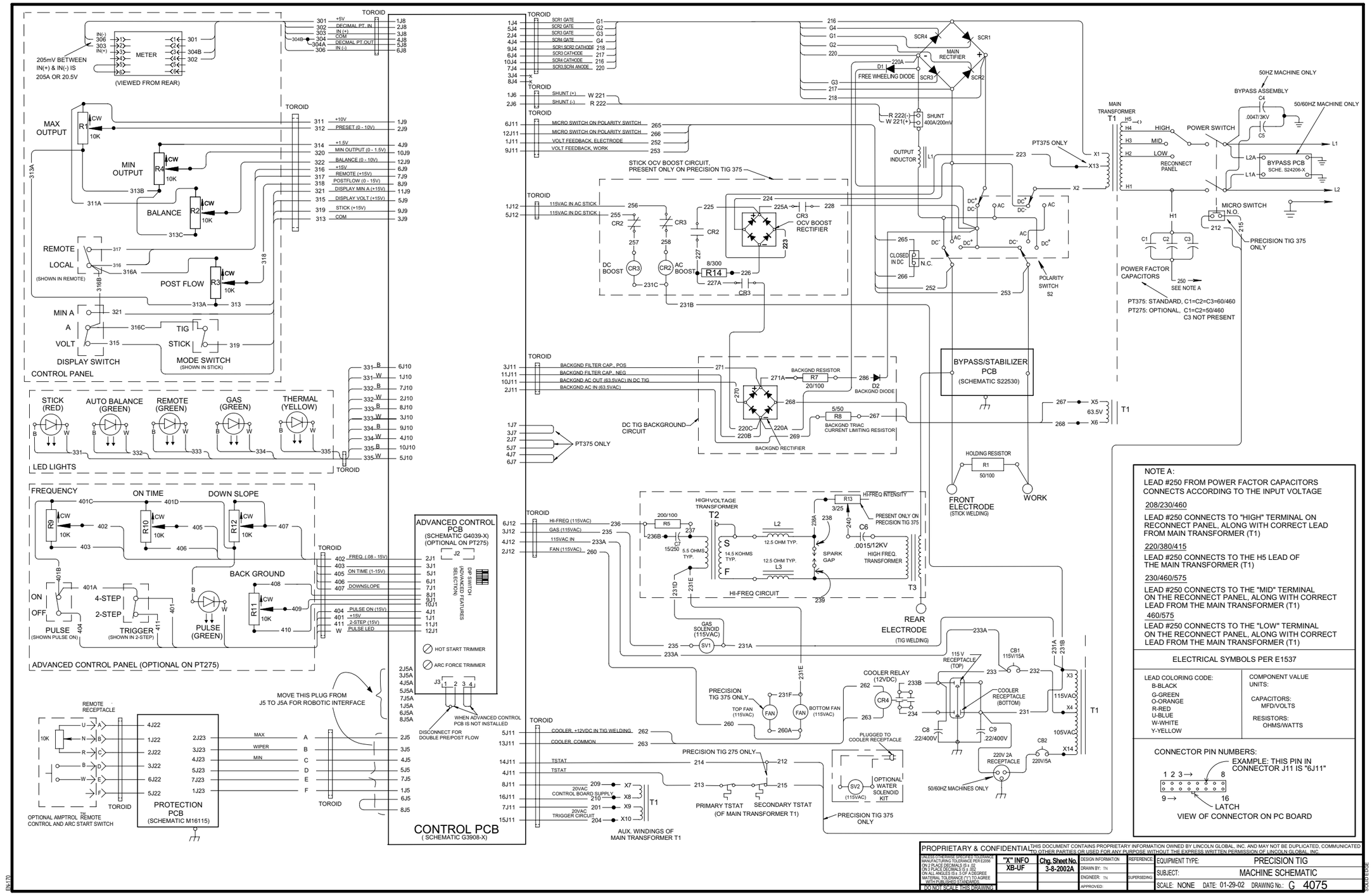
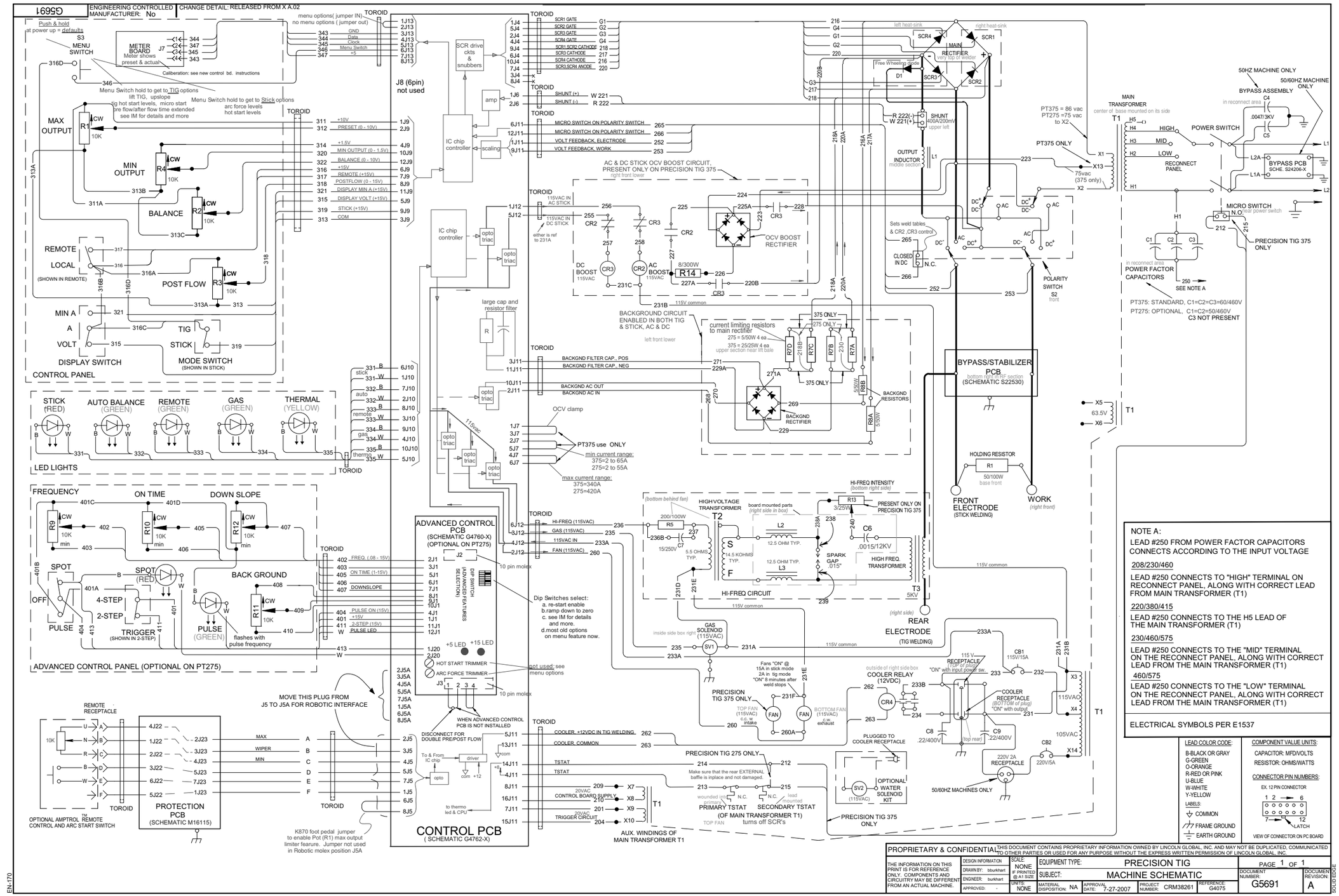
SCHEMATIC - ENTIRE MACHINE - BELOW CODE 11000 (G4075)



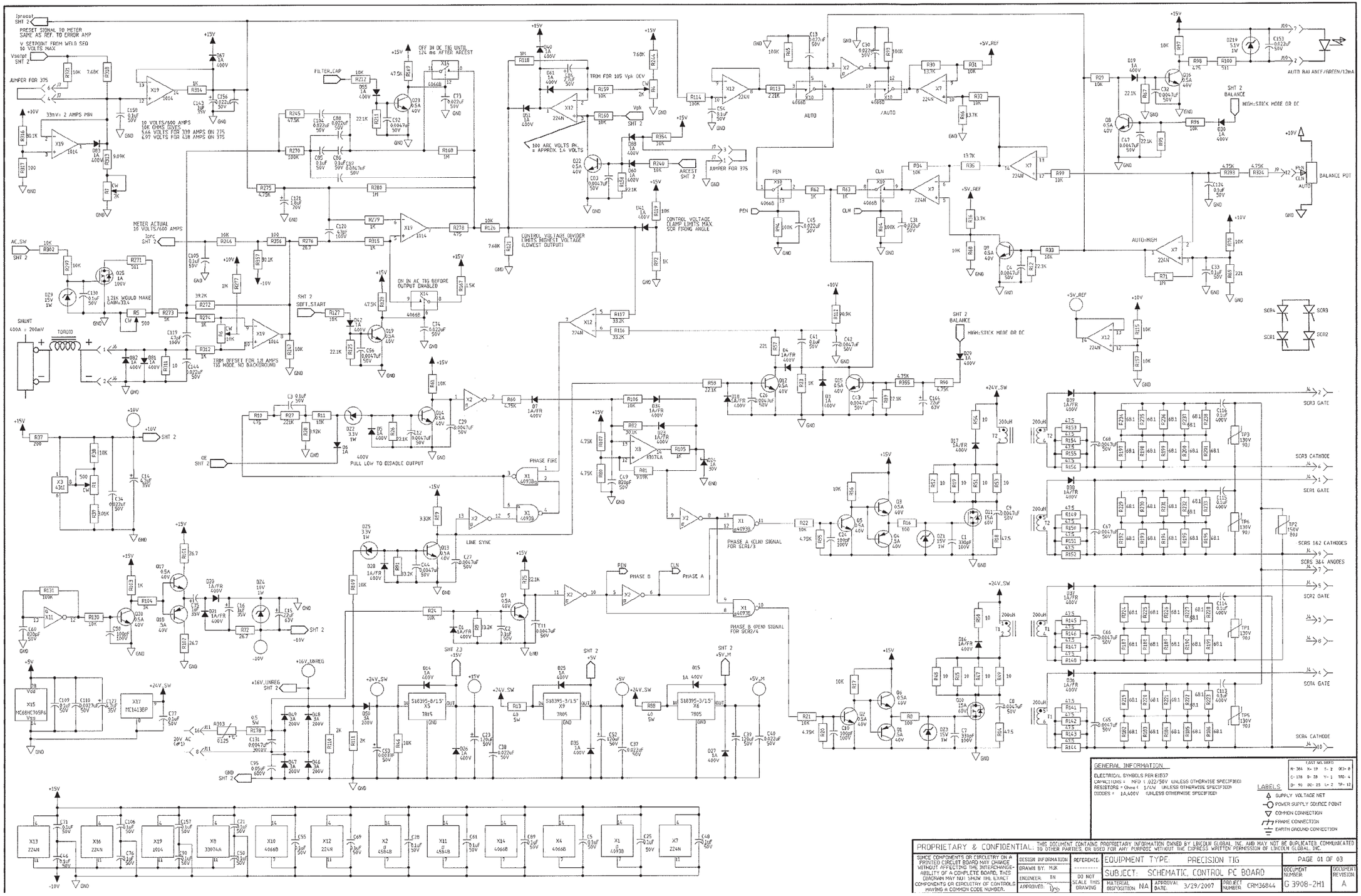
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - ENTIRE MACHINE - ABOVE CODE 11000 (G5691)



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

SCHEMATIC - CONTROL PC BOARD - BELOW CODE 11000 (G3908 PAGE 1)



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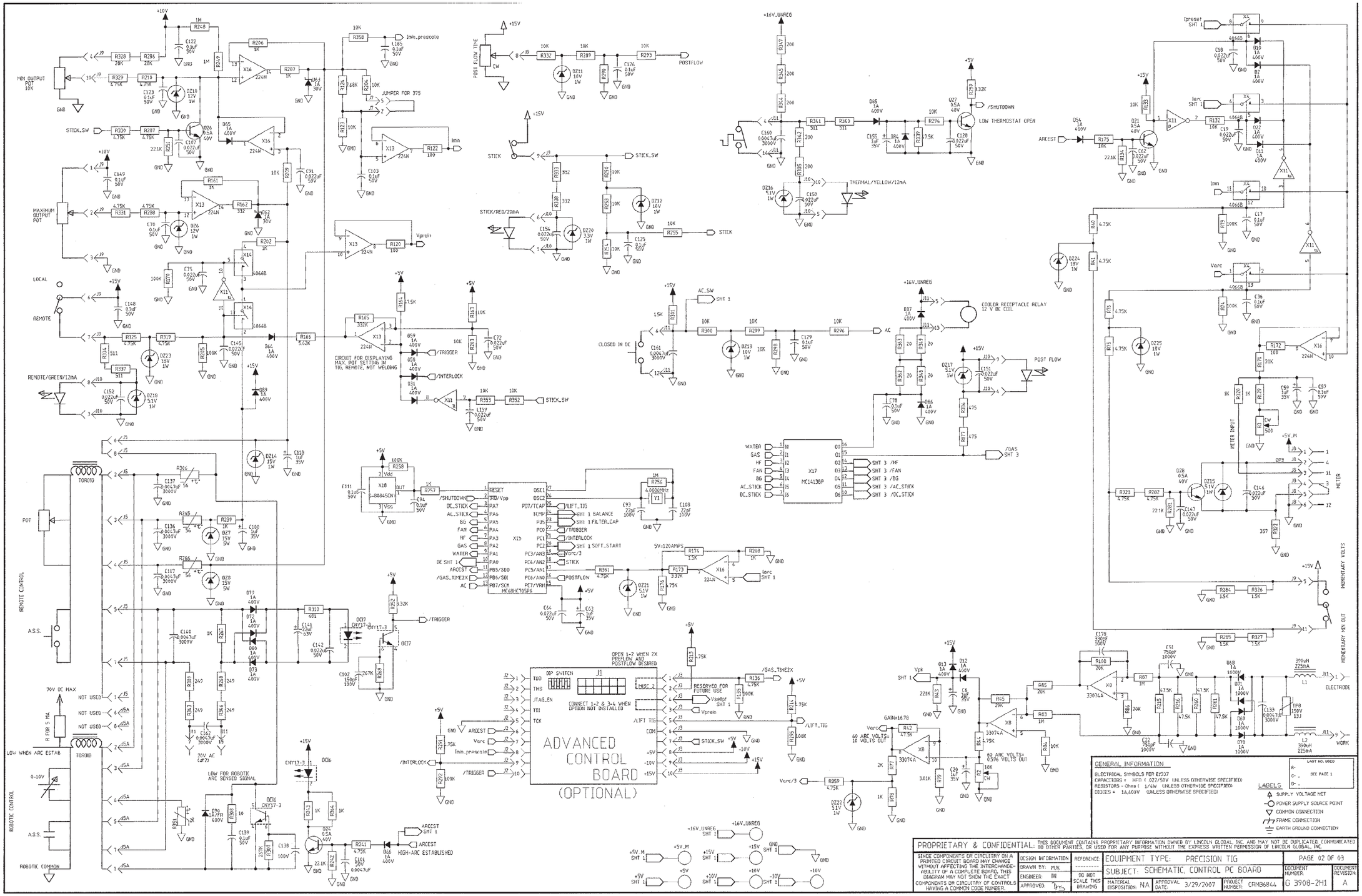
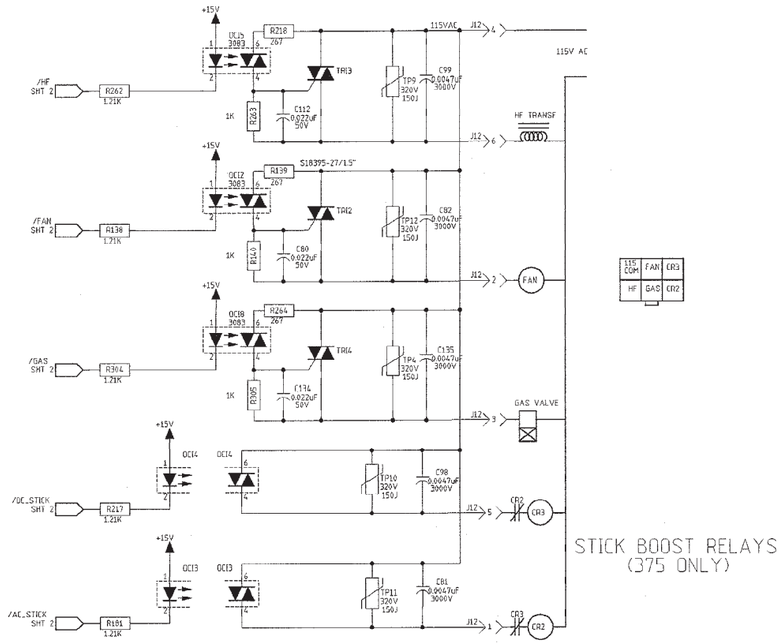
SCHEMATIC - CONTROL PC BOARD - BELOW CODE 11000 (G3908 PAGE 2)



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

SCHEMATIC - CONTROL PC BOARD - BELOW CODE 11000 (G3908 PAGE 3)



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- SEE PAGE 1
C- -
D- -

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

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

DESIGN INFORMATION	REFERENCE	EQUIPMENT TYPE: PRECISION TIG		PAGE 03 OF 03	
DRAWN BY: MJK		SUBJECT: SCHEMATIC, CONTROL PC BOARD		DOCUMENT NUMBER: G 3908-2H1	DOCUMENT REVISION: A
ENGINEER: TN	DO NOT SCALE THIS DRAWING	MATERIAL DISPOSITION: NA	APPROVAL DATE: 3/29/2007	PROJECT NUMBER: CRM36844	
APPROVED: TMS					

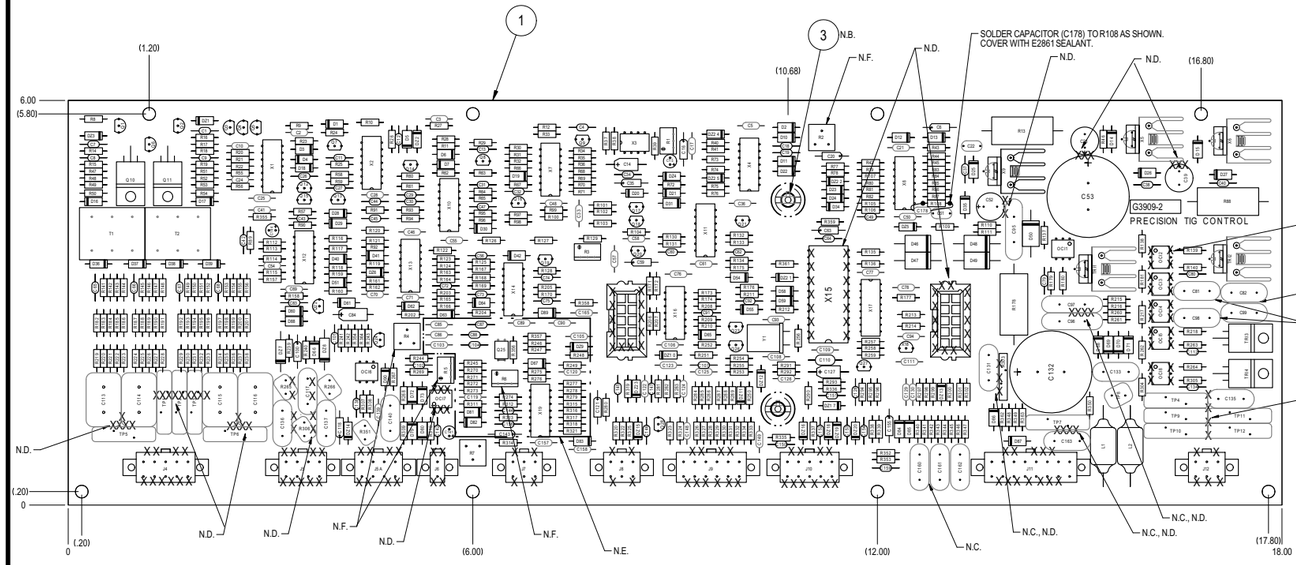
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

PC BOARD ASSEMBLY-CONTROL (G3909-2)

G3909-2

ENGINEERING CONTROLLED MANUFACTURER: No

CHANGE DETAIL: ADDED C178 AND REVISED DZ14 PART NUMBER
REVISED MANUFACTURE AS, IDENTIFICATION CODE AND SCHEMATIC REFERENCE PART NUMBERS
ADDED SOLDER AND SEALANT NOTE FOR C178 TO ASSEMBLY



ITEM	REQD	PART NO.	DESCRIPTION
1	1	SEE BLANK INFO.	P.C. BOARD BLANK REF.
2	5 OZ.	E2861	SEALANT
3	2	S19300-7	PCB SUPPORT

NOTES:

N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.

N.B. KEEP THIS AREA FREE OF ENCAPSULATION MATERIAL (Ø .50 MIN.) BOTH SIDES OF BOARD.

N.C. SQUEEZE COMPONENTS TOGETHER BEFORE APPLYING ITEM 2 AND / OR ENCAPSULATION MATERIAL.

N.D. APPLY ITEM 2 ON COMPONENT SIDE ONLY, AS SHOWN.

N.E. APPLY ITEM 2 ON BOTH SIDES OF BOARD AS SHOWN, EXCEPT TOP SURFACE OF TRIMMER.

N.F. KEEP TOP SURFACE OF TRIMMER FREE OF ENCAPSULATION MATERIAL INCLUDING RTV.

ENCAPSULATE WITH E1844
MAKE PER E1911-ROHS
TEST PER E3937-C
SCHEMATIC REFERENCE G3908-2H1

MANUFACTURED AS:

G3909-2H1

PART NUMBER IDENTIFICATION CODE

REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW

REFERENCES	QTY	PART NUMBER	DESCRIPTION
C1, C7, C178	3	S16668-8	CAPACITOR,CEMO.330pF.100V.5%
C2, C3, C5, C17, C21, C25, C28, C33, C36, C41, C46, C48, C50, C54, C55, C57, C61, C69, C70, C71, C76, C77, C78, C85, C86, C89, C90, C94, C103, C105, C106, C109, C111, C122, C123, C124, C125, C126, C129, C130, C139, C148, C149, C157, C158, C165	46	S16668-11	CAPACITOR,CEMO,0.1, 50V,10%
C4, C8, C9, C11, C12, C26, C27, C29, C32, C42, C43, C44, C47, C56, C65, C66, C67, C68, C83, C87, C92, C101	22	S16668-6	CAPACITOR,CEMO,4700pF.50V,10%
C6, C16, C20, C35, C59, C63, C100, C118, C143, C155	10	S13490-42	CAPACITOR,TAEL,1.0,35V,10%
C10, C24, C58	3	S16668-3	CAPACITOR,CEMO.100pF..100V.5%
C13, C18, C19, C30, C31, C34, C37, C38, C40, C45, C62, C64, C72, C73, C74, C75, C79, C80, C88, C91, C104, C107, C112, C128, C134, C142, C144, C145, C146, C147, C150, C151, C152, C153, C154, C156, C159	37	S16668-5	CAPACITOR,CEMO,.022,50V.20%
C14, C127	2	S13490-25	CAPACITOR,TAEL,4.7,35V.10%
C15, C141, C164	3	S13490-181	CAPACITOR,ALEL,22.63V.20%
C22, C51	2	T11577-54	CAPACITOR,CD.750PF.1000V.10%
C23, C39, C52	3	S13490-183	CAPACITOR,ALEL,120MF.50V.20%
C49, C60	2	S16668-7	CAPACITOR,CEMO,820pF,50V,5%
C53	1	S13490-92	CAPACITOR,ALEL,3300, 50V,+30/-10%
C81, C82, C98, C99, C117, C131, C133, C135, C136, C137, C140, C163, C161, C162, C163	15	T11577-58K	CAPACITOR,CD,.0047,3000V.20%
C84	1	S13490-40	CAPACITOR,TAEL,2.7.50V.10%
C93, C108	2	S16668-1	CAPACITOR,CEMO,22pF,.100V.5%
C95, C96, C97	3	T11577-48K	CAPACITOR,CD,.05,600V,+80/-20%
C102, C138	2	S16668-9	CAPACITOR,CEMO,150pF,.100V.5%
C110	1	S16668-4	CAPACITOR,CEMO,.270pF,.50V.5%
C113, C114, C115, C116	4	S13490-81	CAPACITOR,PEF,0.1MF,400V,10%,RADIAL
C119, C120	2	S16668-2	CAPACITOR,CEMO,47pF,.100V.5%
C121	1	S13490-19	CAPACITOR,TAEL,1.8,20V.10%
C132	1	S13490-186	CAPACITOR,ALEL,1800,160V,20%
D1, D4, D7, D16, D17, D18, D20, D21, D23, D28, D34, D36, D37, D38, D39, D90	16	T12705-34	DIODE,AXLDS,1A,400V,FR,1N4936
D2, D3, D5, D6, D10, D11, D12, D13, D14, D15, D19, D22, D25, D26, D27, D29, D30, D31, D35, D40, D41, D42, D51, D54, D55, D58, D59, D60, D61, D64, D65, D66, D67, D72, D73, D79, D80, D81, D82, D83, D84, D85, D86, D87, D88, D89	46	T12199-1	DIODE,AXLDS,1A,400V
D24, D62, D63	3	T12705-23	DIODE,SCHOTTKY,AXLDS,1A,30V,1N5818
D46, D47, D48, D49, D99	5	T12705-14	DIODE,AXLDS,3A,200V,1N5402
D68, D69, D70, D71	4	T12199-2	DIODE,AXLDS,1A,1000V
DZ1, DZ3, DZ9, DZ14	4	T12702-29	ZENER DIODE,1W,15V,5%,1N4744A
DZ2, DZ5, DZ20	3	T12702-53	ZENER DIODE,1W,3.3V,5%,1N4728A
DZ4, DZ11, DZ12, DZ13	4	T12702-27	ZENER DIODE,1W,10V,5%,1N4740A
DZ6, DZ10	2	T12702-19	ZENER DIODE,1W,12V,5%,1N4742A
DZ7, DZ8	2	T12702-23	ZENER DIODE,5W,15V,5%,1N5352B
DZ15, DZ16, DZ17, DZ18, DZ19, DZ21, DZ22	7	T12702-52	ZENER DIODE,1W,5.1V,5%,1N4733A
DZ23, DZ24, DZ25	3	T12702-45	ZENER DIODE,1W,18V,5%,1N4746A
J2, J3	2	S21134-10	CONNECTOR,MOLEX,MINI,BLIND,F,10-PIN
J4, J10	2	S24220-10	CONNECTOR,MOLEX,MINI,PCB,10-PIN,TIN
J5, J5A	2	S24220-8	CONNECTOR,MOLEX,MINI,PCB,8-PIN,TIN
J6	1	S24020-2G	CONNECTOR,MOLEX,MINI,PCB,2-PIN,GOLD
J7, J8, J12	3	S24220-6	CONNECTOR,MOLEX,MINI,PCB,6-PIN,TIN
J9	1	S24220-12	CONNECTOR,MOLEX,MINI,PCB,12-PIN,TIN
J11	1	S24220-16	CONNECTOR,MOLEX,MINI,PCB,16-PIN,TIN
L1, L2	2	T12218-9	CHOKE,RF,990UH,5%, 225MA,CONFORMAL
OC1, OC2, OC5, OC8	4	S15000-16	OPTOCOUPLER,TRIAC,DRIVER,ZVC,3083
OC3, OC4	2	S15000-31	OPTOCOUPLER,TRIAC,DRV RANDOM,800V
OC6, OC7	2	S15000-15	OPTOCOUPLER,PHOTO-Q,70V,CNY17-3
Q1, Q4, Q18	3	T12704-69	TRANSISTOR,PNP,TO226,0.5A, 40V,2N4403
Q2, Q3, Q5, Q6, Q7, Q8, Q9, Q12, Q13, Q14, Q15, Q16, Q17, Q19, Q20, Q21, Q22, Q23, Q24, Q26, Q27, Q28	22	T12704-68	TRANSISTOR,NPN,TO226,0.5A,40V,2N4401
Q10, Q11	2	T12704-54	TRANSISTOR,NMF,TO220,15A,60V (SS)
Q25	1	T12704-73	TRANSISTOR,NMF,4-PIN DIP,1A,100V,IRFD110(SS)
R1, R3, R5	3	S16396-3	TRIMMER,MT,1/2W,500, 10%,LINEAR
R2	1	T10812-41	TRIMMER,ST,1/2W,10K, 10%,LINEAR
R4, R7	2	T10812-73	TRIMMER,ST,1/2W,2K, 10%,LINEAR
R6	1	S16296-5	TRIMMER,MT,1/2W,10K, 10%,LINEAR
R8, R16, R120, R122, R172, R317, R356	7	S19400-1000	RESISTOR,MF,1/4W,100,1%
R9, R91, R116, R117, R350	5	S19400-3322	RESISTOR,MF,1/4W,33.2K,1%
R10, R98, R177, R278, R336	5	S19400-4750	RESISTOR,MF,1/4W,475,1%
R11, R17, R21, R22, R24, R29, R31, R32, R33, R34, R38, R46, R56, R61, R68, R70, R84, R96, R97, R99, R106, R109, R115, R119, R123, R126, R127, R130, R132, R133, R157, R159, R160, R163, R175, R203, R204, R209, R212, R240, R246, R247, R250, R253, R254, R255, R289, R290, R293, R294, R296, R297, R298, R299, R300, R302, R321, R332, R352, R353, R354, R358	62	S19400-1002	RESISTOR,MF,1/4W,10.0K,1%
R12, R25, R26, R58, R67, R89, R95, R125, R134, R158, R211, R242, R251, R281	14	S19400-2212	RESISTOR,MF,1/4W,22.1K,1%
R13, R88	2	T14648-4	RESISTOR,WW,5W,40.5%,SQ
R14, R18, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156	18	S19400-47R5	RESISTOR,MF,1/4W,47.5,1%
R15, R19, R47, R48, R49, R50, R51, R52, R53, R54, R308, R311	12	S19400-10R0	RESISTOR,MF,1/4W,10.0,1%
R20, R40, R41, R44, R55, R60, R75, R76, R80, R90, R107, R136, R176, R210, R213, R214, R241, R275, R282, R283, R287, R288, R291, R319, R323, R324, R325, R329, R330, R331, R355, R359, R361	33	S19400-4751	RESISTOR,MF,1/4W,4.75K,1%
R23, R62, R63, R78, R92, R103, R104, R105, R129, R140, R161, R179, R202, R206, R207, R208, R239, R243, R257, R263, R267, R273, R274, R279, R305, R312, R314, R315, R320, R364	30	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
R27, R43	2	S19400-2213	RESISTOR,MF,1/4W,221K,1%
R28	1	S19400-3921	RESISTOR,MF,1/4W,3.92K,1%
R30, R35, R36, R66	4	S19400-1372	RESISTOR,MF,1/4W,13.7K,1%
R37, R335, R342, R344, R345, R347	6	S19400-2000	RESISTOR,MF,1/4W,200,1%
R39, R79	2	S19400-3011	RESISTOR,MF,1/4W,3.01K,1%
R42, R128, R164, R169, R215, R216, R245, R260, R261, R339	10	S19400-4752	RESISTOR,MF,1/4W,47.5K ,1%
R45, R85, R86, R108, R171	5	S19400-2002	RESISTOR,MF,1/4W,20.0K,1%
R57, R69	2	S19400-2210	RESISTOR,MF,1/4W,221,1%
R59, R173, R252, R259	4	S19400-3321	RESISTOR,MF,1/4W,3.32K,1%
R64, R65, R73, R74, R93, R94, R114, R131, R135, R170, R205, R258, R270, R292, R295	15	S19400-1003	RESISTOR,MF,1/4W,100K,1%
R71, R83, R87, R118, R168, R248, R249, R256, R277, R280	10	S19400-1004	RESISTOR,MF,1/4W,1.00M,1%
R72, R101, R102, R276	4	S19400-26R7	RESISTOR,MF,1/4W,26.7,1%
R77, R110, R111	3	S19400-2001	RESISTOR,MF,1/4W,2.00K,1%
R81, R313	2	S19400-9091	RESISTOR,MF,1/4W,9.09K,1%
R82, R316, R357	3	S19400-3012	RESISTOR,MF,1/4W,30.1K,1%
R100, R271, R334, R337, R340, R341	6	S19400-5110	RESISTOR,MF,1/4W,511,1%
R112	1	S19400-9092	RESISTOR,MF,1/4W,90.9K,1%
R113	1	S19400-2211	RESISTOR,MF,1/4W,2.21K,1%
R121, R124, R244, R318	4	S19400-7681	RESISTOR,MF,1/4W,7.68K,1%
R137, R138, R181, R217, R262, R304	6	S19400-1211	RESISTOR,MF,1/4W,1.21K,1%
R139, R180, R216, R264	4	S19400-2670	RESISTOR,MF,1/4W ,267,1%
R162, R333, R338	3	S19400-3320	RESISTOR,MF,1/4W ,332,1%
R165	1	S19400-3323	RESISTOR,MF,1/4W ,332K,1%
R166	1	S19400-5621	RESISTOR,MF,1/4W ,5.62K,1%
R167, R174, R284, R285, R301, R326, R327	7	S19400-1501	RESISTOR,MF,1/4W ,1.50K,1%
R178	1	T14648-24	RESISTOR,WW,5W,0.5,5%,SQ
R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, R199, R200, R201, R219, R220, R221, R222, R223, R224, R225, R226, R227, R228, R229, R230, R231, R232, R233, R234, R235, R236, R237, R238	40	S19400-68R1	RESISTOR,MF,1/4W ,68.1,1%
R265, R266, R306, R351	4	S18380-1	THERMISTOR,PTC,56 OHMS,90MA
R268, R309, R343, R346	4	S19400-2490	RESISTOR,MF,1/4W ,249,1%
R269, R307	2	S19400-2673	RESISTOR,MF,1/4W ,267K,1%
R272	1	S19400-3922	RESISTOR,MF,1/4W ,39.2K,1%
R286, R328	2	S19400-2802	RESISTOR,MF,1/4W ,28.0K,1%
R303	1	S18380-3	THERMISTOR,PTC,.08-0.19 OHMS,1.85A
R310	1	S19400-6810	RESISTOR,MF,1/4W ,681,1%
R322	1	S19400-3570	RESISTOR,MF,1/4W ,357,1%
R348, R349, R362, R363	4	S19400-20R0	RESISTOR,MF,1/4W ,20.0,1%
T1, T2	2	T12737-2	TRANSFORMER,PULSE,3-WINDING,1:1:1
TP1, TP3, TP5, TP6	4	T13640-25	MOV,130VRMS,90J,20MM
TP2	1	T13640-16	MOV,150VRMS,80J,20MM
TP4, TP7, TP8, TP10, TP11, TP12	6	T13640-18	MOV,320VRMS,150J,20MM
TP9	1	T13640-14	MOV,150VRMS,13J,7MM
TR1, TR12	2	S18395-27	TRIAC,T220,8A,800V WITH S18104-3HS
TR3, TR14	2	S15161-27	TRIAC,T220,8A,800V
U1	1	S15018-15	IC,CMOS,GATE-NAND,2-INPUT,QUAD,SCHM(SS)
U2, X11	2	S15018-4	IC,CMOS,INVERTER,SCHMITT, HEX,4584(SS)
U3	1	S15128-10	VOLTAGE REF,ADJ, PRECISION,431
U4, X10, X14	3	S15018-6	IC,CMOS,SWITCH,ANALOG,QUAD, 4066(SS)
U5	1	S18395-8	REGULATOR,HEAT-SINKASBLY,S15128-6,S18104-3
U6, X9	2	S18395-3	REGULATOR,HEAT-SINKASBLY,S15128-5,S18104-3
U7, X12, X13, X16	4	S15128-4	OP-AMP,QUAD, GEN-PURPOSE,224N
U8	1	S15128-18	OP-AMP,QUAD, HIGH-PERF,33074
U15	1	S25431-2	ROM ASSEMBLY (SS)
U17	1	M15102-4	IC,ARRAY,DRIVER,PERIPHERAL,NPN,DARL
U18	1	M15102-3	IC,CMOS,UNDERVOLT-SENSING,RESET,MC(SS)
U19	1	S15128-16	IC,OP-AMP,QUAD,HIGH-PERF,1014
Y1	1	S16665-2	CRYSTAL,QUARTZ,4.0000MHZ,HC-18/U

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

P.C. BOARD BLANK REFERENCE INFORMATION
BUY BLANK COMPLETE AS G3909-H (4 LAYER BOARD PER E3281)
(MAKES 2 BOARDS PER PANEL, SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION)

ALL COMPONENTS AND MATERIALS USED IN THIS ASSEMBLY ARE TO BE RoHS COMPLIANT PER E4253.

FOR PARTS ORDERS:
INCLUDE (1) S25597 PRINT PARTS ORDERS INSTRUCTION SHEET.

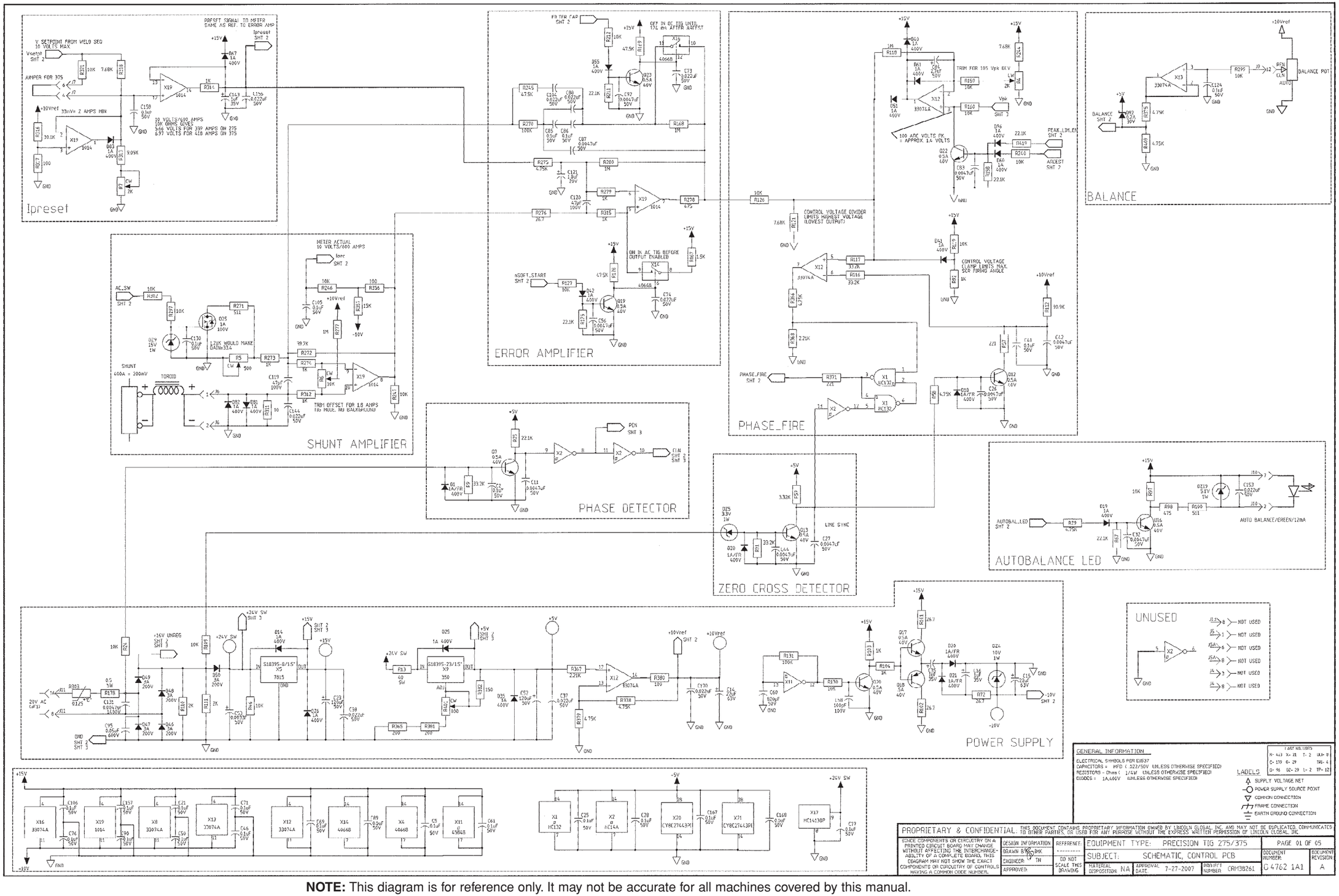
UNLESS OTHERWISE SPECIFIED TOLERANCES MANUFACTURING TOLERANCE PER E2856
ON 2 PLACE DECIMALS IS ± .02
ON 1 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± 3 OF A DEGREE
MATERIAL TOLERANCE (*) TO AGREE WITH PUBLISHED STANDARDS
DO NOT SCALE THIS DRAWING

DESIG N INFORMATION
DRAWN BY: FEI
ENGINEER:
APPROVED: -
REFERENCE: G3909-1
SCALE: 1:1
MATERIAL DISPOSITION: UF
APPROVAL DATE: 3/29/2007
PROJECT NUMBER: CRM36844

EQUIPMENT TYPE: PRECISION TIG
SUBJECT: CONTROL P.C. BOARD ASSEMBLY
PAGE 1 OF 1
DOCUMENT NUMBER: G3909-2
DOCUMENT REVISION: C

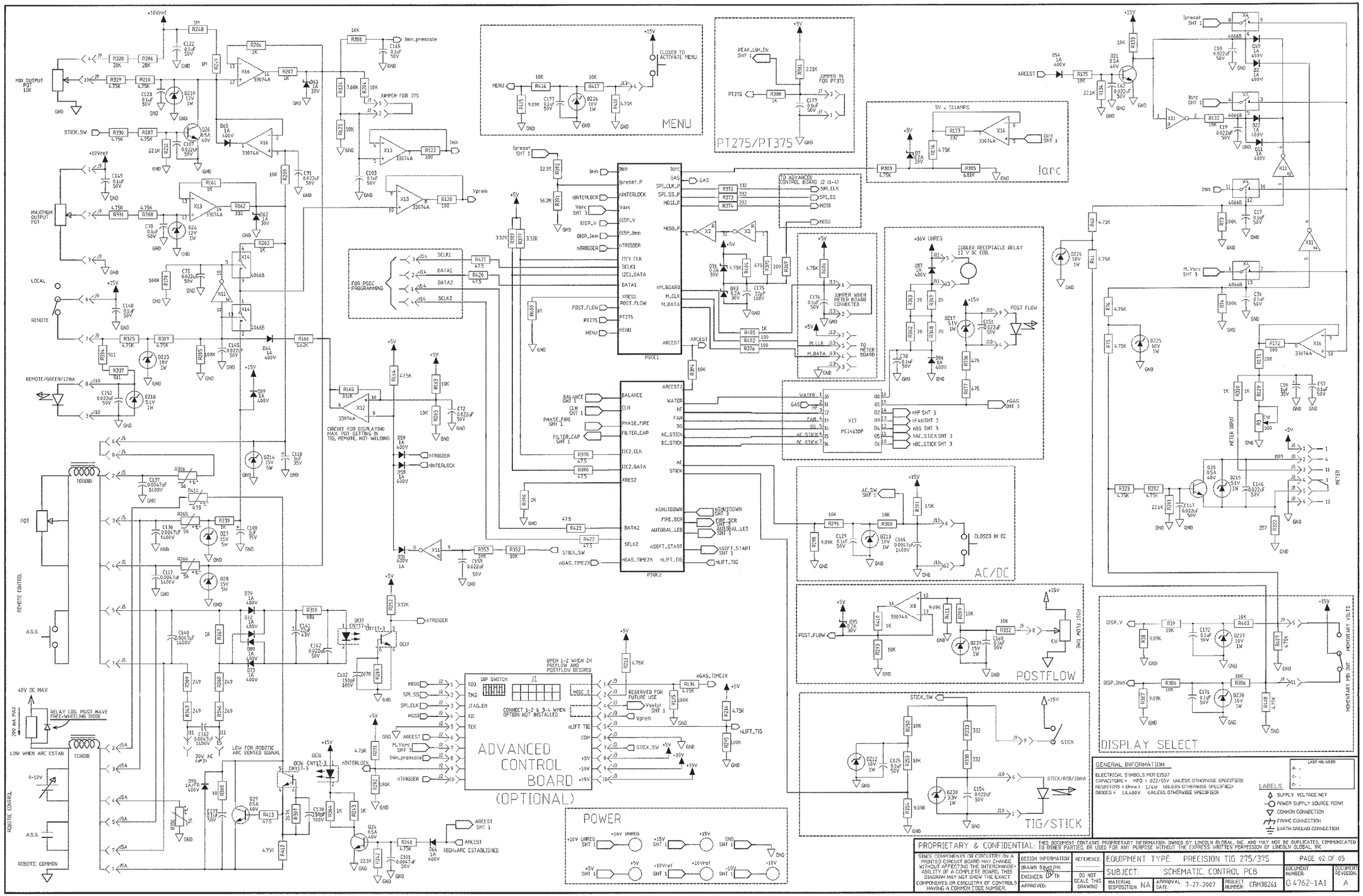
NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC - CONTROL PC BOARD - ABOVE CODE 11000 (G4762 PAGE 1)



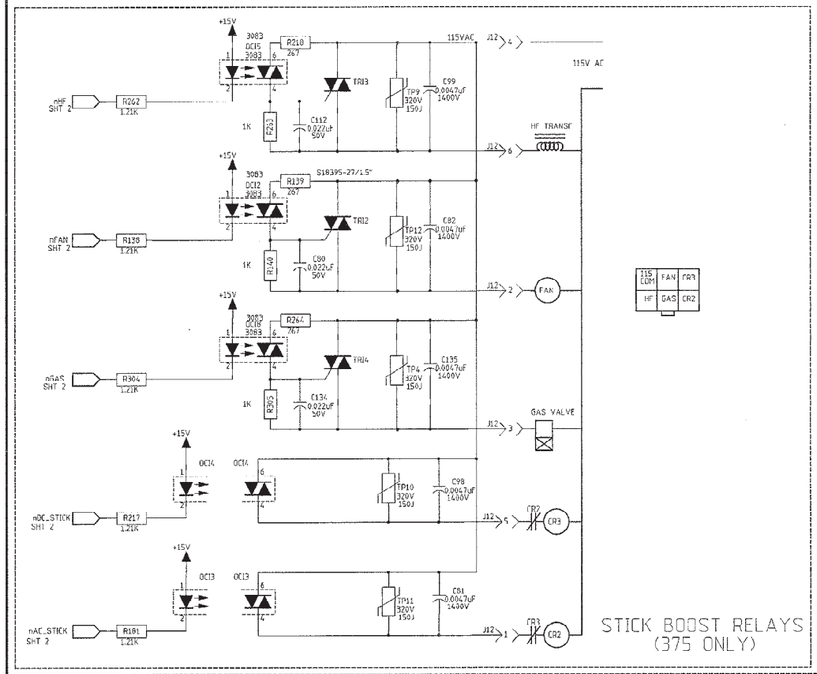
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

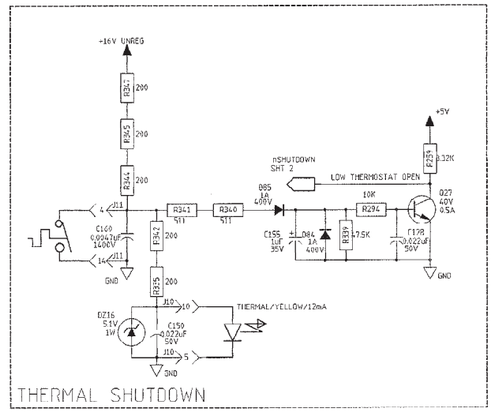
SCHEMATIC - CONTROL PC BOARD - ABOVE CODE 11000 (G4762 PAGE 2)

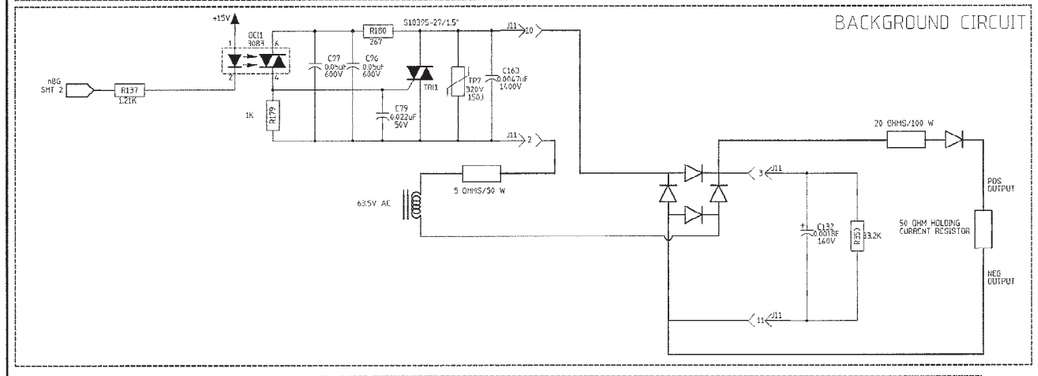


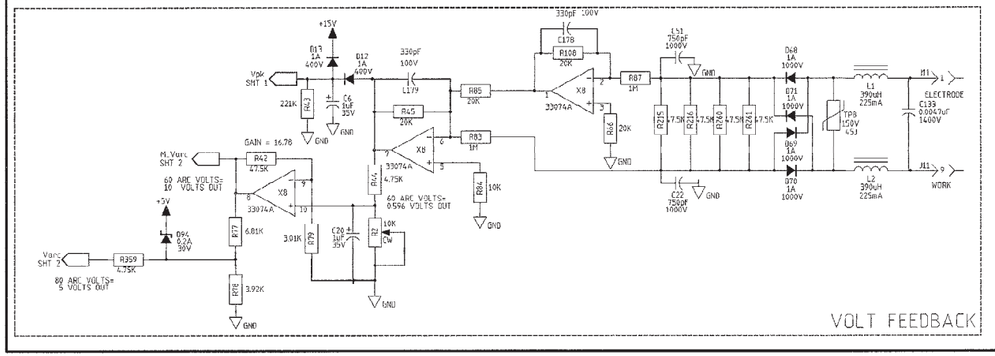
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

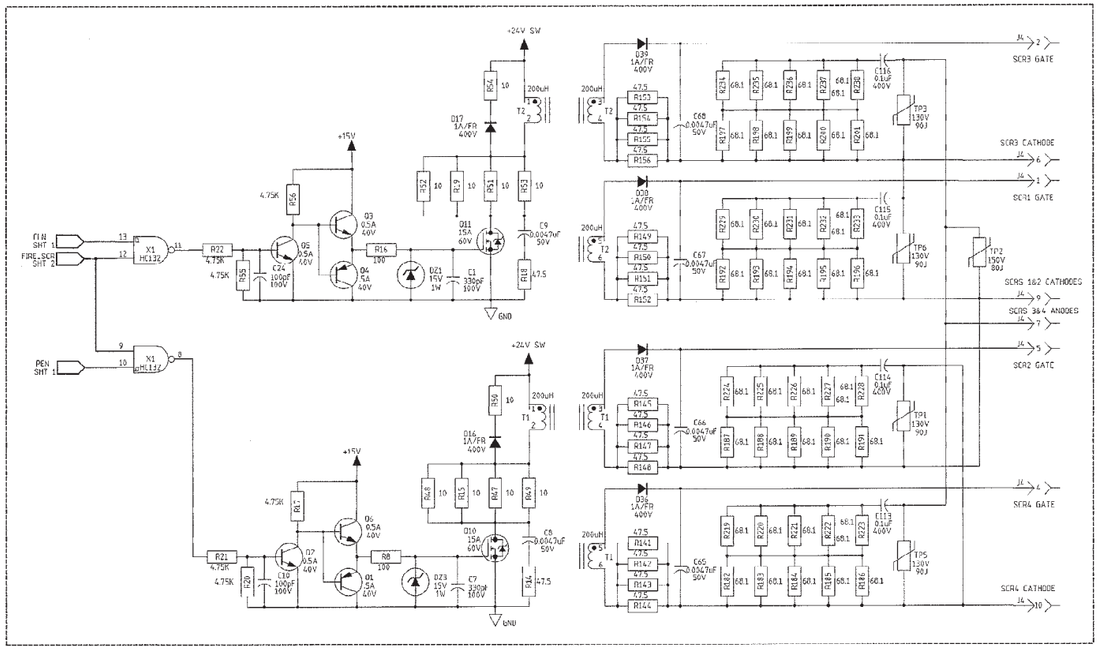
SCHEMATIC - CONTROL PC BOARD - ABOVE CODE 11000 (G4762 PAGE 3)

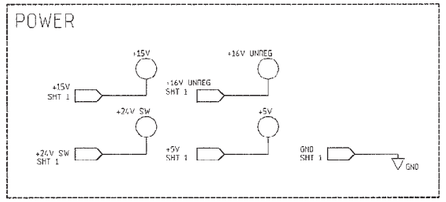












GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD & .022/50V UNLESS OTHERWISE SPECIFIED
RESISTORS = OHMS & 1/4W UNLESS OTHERWISE SPECIFIED
DIODES = 1A,400V UNLESS OTHERWISE SPECIFIED

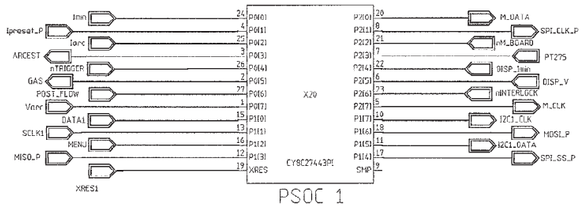
LABELS
- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

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	REFERENCE:	EQUIPMENT TYPE: PRECISION TIG 275/375			PAGE 03 OF 05
DRAWN BY: JMC		SUBJECT: SCHEMATIC, CONTROL PCB			DOCUMENT NUMBER: G4762-1A1 / DOCUMENT REVISION: A
ENGINEER: TN	DO NOT SCALE THIS DRAWING	MATERIAL DISPOSITION: NA	APPROVAL DATE: 7-27-2007	PROJECT NUMBER: CRM38261	
APPROVED:					

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

SCHEMATIC - CONTROL PC BOARD - ABOVE CODE 11000 (G4762 PAGE 4)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD x 622/50V UNLESS OTHERWISE SPECIFIED
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- -
P- -
D- -

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

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

DESIGN INFORMATION
DRAWN BY: JMK
ENGINEER: TN
APPROVED

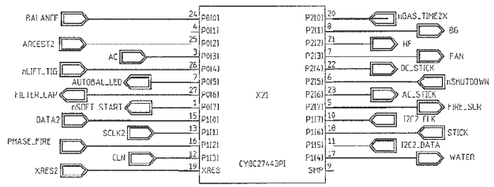
REFERENCE
DO NOT SCALE THIS DRAWING

EQUIPMENT TYPE: PRECISION TIG 275/375
SUBJECT: SCHEMATIC, CONTROL PCB
MATERIAL DISPOSITION: NA
APPROVAL DATE: 7-27-2007
PROJECT NUMBER: LAM98261

PAGE 04 OF 05
DOCUMENT NUMBER: G4762-1A1
DOCUMENT REVISION: A

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

SCHEMATIC - CONTROL PC BOARD - ABOVE CODE 11000 (G4762 PAGE 5)



PSOC 2

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,600V UNLESS OTHERWISE SPECIFIED

LAST NO. USED
R= .
C= .
D= .

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

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

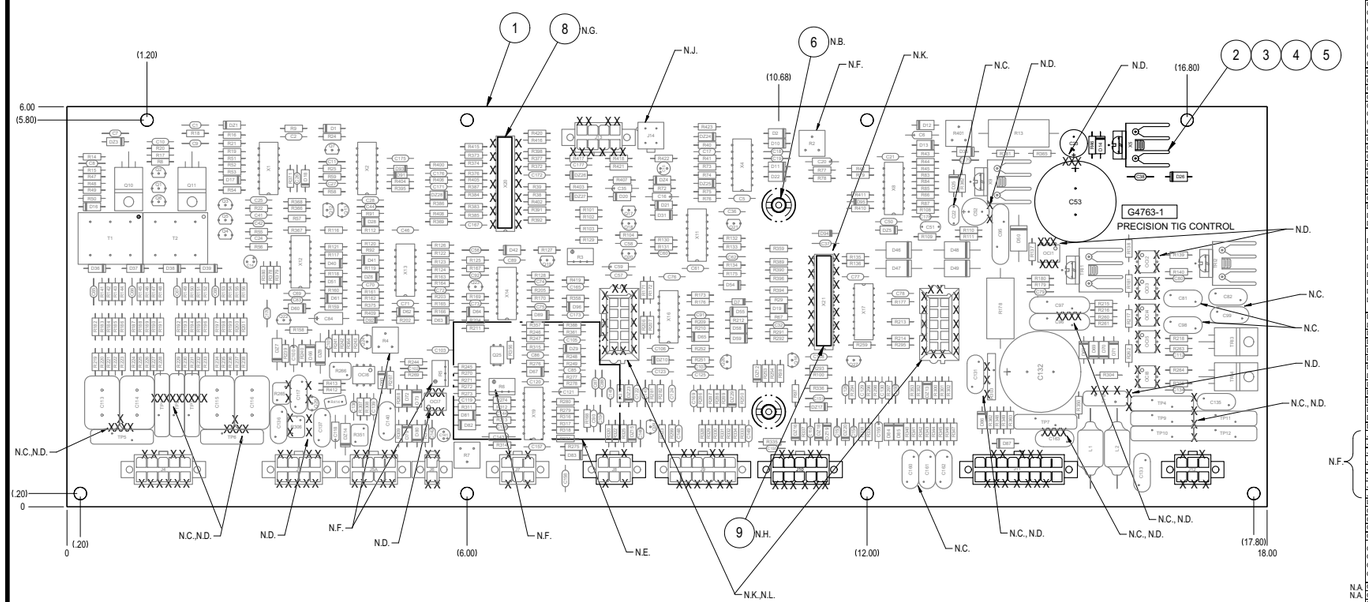
DESIGN INFORMATION	REFERENCE	EQUIPMENT TYPE: PRECISION TIG 275/375		PAGE 05 OF 05	
DRAWN BY: JMK		SUBJECT: SCHEMATIC, CONTROL PCB		DOCUMENT NUMBER: G4762-1A1	DOCUMENT REVISION: A
ENGINEER: TN	DO NOT SCALE THIS DRAWING	MATERIAL DISPOSITION: NA	APPROVAL DATE: 7-27-2007	PROJECT NUMBER: CRM38261	
APPROVED					

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

PC BOARD ASSEMBLY - CONTROL PC BOARD - ABOVE CODE 11000 (G4763-1)

G4763-1

ENGINEERING CONTROLLED | CHANGE DETAIL: RELEASED FROM X A.02
MANUFACTURER: No



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	G4763-A	PC BOARD BLANK
2 (TR1, TR2, X6, X9)*	4	CF000003	6-32 X .375 ROUND HEAD MACHINE SCREW
3 (TR1, TR2, X5, X9)*	4	E106A-13	# 6 LOCK WASHER
4 (TR1, TR2, X5, X9)*	AS REQ	E1868	THERMO JOINT COMPOUND
5 (TR1, TR2, X5, X9)*	4	S18104-3	HEAT SINK,ALUMINUM,EXTRUDED,FOR 1 TO-220
6	2	S19300-7	SUPPORT,PCB,SNAP=IN,063,WHT
7	5.0 OZ	E2961	SEALANT
8	1	S26860-1	PSOC SOFTWARE
9	1	S26861-1	PSOC SOFTWARE

REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW

REFERENCES	QTY	PART NUMBER	DESCRIPTION
C1, C7, C178, C179	4	S16668-8	CAPACITOR,CEMO,330pF,100V,5%
C2, C5, C17, C21, C25, C28, C36, C41, C46, C50, C57, C61, C69, C70, C71, C76, C77, C78, C85, C86, C89, C90, C103, C105, C106, C122, C123, C124, C125, C129, C130, C139, C148, C149, C157, C158, C165, C167, C168, C169, C171, C172, C173, C176, C177	45	S16668-11	CAPACITOR,CEMO,0.1, 50V,10%
C6, C16, C20, C35, C59, C100, C118, C143, C155	9	S13490-42	CAPACITOR,TAEL,1.0,35V,10%
C8, C9, C11, C26, C27, C32, C42, C44, C56, C65, C66, C67, C68, C83, C87, C92, C101	17	S16668-6	CAPACITOR,CEMO,4700pF,50V,10%
C10, C24, C58	3	S16668-3	CAPACITOR,CEMO,100pF, 100V,5%
C14, C15, C141	3	S13490-181	CAPACITOR,ALEL,22.63V,20%
C18, C19, C37, C38, C62, C72, C73, C74, C75, C79, C80, C88, C91, C104, C107, C112, C128, C134, C142, C144, C145, C146, C147, C150, C151, C152, C153, C154, C156, C159, C170	31	S16668-5	CAPACITOR,CEMO,.022,50V,20%
C22, C51	2	T11577-54	CAPACITOR,CD,750PF,1000V,10%
C23, C52	2	S13490-183	CAPACITOR,ALEL,1200MF,50V,20%
C53	1	S13490-92	CAPACITOR,ALEL,3300, 50V, +30/-10%
C60	1	S16668-7	CAPACITOR,CEMO,820pF,50V,5%
C81, C82, C98, C99, C117, C131, C133, C135, C136, C137, C140, C160, C161, C162, C163	15	T11577-52K	CAPACITOR,CD, .0047/.005,1400V,20%
C84	1	S13490-40	CAPACITOR,TAEL,2.7,50V,10%
C95, C96, C97	3	T11577-46K	CAPACITOR,CD, 05,600V, +80/-20%
C102, C138	2	S16668-9	CAPACITOR,CEMO,150pF, 100V,5%
C113, C114, C115, C116	4	S13490-81	CAPACITOR,PEF,0.1MF,400V,10%,RADIAL
C119, C120	2	S16668-2	CAPACITOR,CEMO,47pF, 100V,5%
C121	1	S13490-19	CAPACITOR,TAEL,1.8,20V,10%
C132	1	S13490-186	CAPACITOR,ALEL,1800,160V,20%
C177	1	S16668-1	CAPACITOR,CEMO,22pF, 100V,5%
D1, D16, D17, D18, D20, D21, D28, D36, D37, D38, D39, D90	12	T12705-34	DIODE,AXLDS,1A,400V,FR,1N4936
D2, D10, D11, D12, D13, D14, D19, D22, D25, D26, D31, D35, D40, D41, D42, D51, D54, D55, D58, D59, D60, D61, D64, D65, D66, D67, D72, D73, D79, D80, D81, D82, D83, D84, D85, D86, D87, D89, D96	39	T12199-1	DIODE,AXLDS,1A,400V
D7, D91, D92, D93, D94, D95	6	T12705-64	DIODE,SCHOTTKY,AXLDS,0.2A,30V,BAT42
D46, D47, D48, D49, D50	5	T12705-14	DIODE,AXLDS,3A,200V,1N5402
D62, D63	2	T12705-23	DIODE,SCHOTTKY,AXLDS,1A,30V,1N5818
D68, D69, D70, D71	4	T12199-2	DIODE,AXLDS,1A,1000V
D23, D24, D25, DZ29	4	T12702-29	ZENER DIODE,1W,15V,5%,1N4744A
D24, DZ12, DZ13, DZ26, DZ27, DZ28	6	T12702-27	ZENER DIODE,1W,10V,5%,1N4740A
D25, DZ20	2	T12702-53	ZENER DIODE,1W,3.3V,5%,1N4728A
D26, DZ10	2	T12702-19	ZENER DIODE,1W,12V,5%,1N4742A
D27, DZ8, DZ14	3	T12702-23	ZENER DIODE,5W,15V,5%,1N5352B
DZ15, DZ16, DZ17, DZ18, DZ19	5	T12702-52	ZENER DIODE,1W,5.1V,5%,1N4733A
DZ23, DZ24, DZ25	3	T12702-45	ZENER DIODE,1W, 18V,5%,1N4746A
J2, J3	2	S21134-10	CONNECTOR,MOLEX,MINI,BLIND,F,10-PIN
J4, J10	2	S24020-10	CONNECTOR,MOLEX,MINI,PCB,10-PIN,TIN
J5, J13, J5A	3	S24020-8	CONNECTOR,MOLEX,MINI,PCB,8-PIN,TIN
J6	1	S24020-2G	CONNECTOR,MOLEX,MINI,PCB,2-PIN,GOLD
J7, J8, J12	3	S24020-6	CONNECTOR,MOLEX,MINI,PCB,6-PIN,TIN
J9	1	S24020-12	CONNECTOR,MOLEX,MINI,PCB,12-PIN,TIN
J11	1	S24020-16	CONNECTOR,MOLEX,MINI,PCB,16-PIN,TIN
J14	1	S18248-4	CONNECTOR,MOLEX,MINI,PCB,4-PIN
L1, L2	2	T12218-9	CHOKE,RF,390UH,5%, .225MA,CONFORMAL
OC1, OC2, OC6, OC8	4	S15500-16	OPTOCOUPLER,TRIAC,DRIVER,ZVC,3063
OC3, OC14	2	S15500-31	OPTOCOUPLER,TRIAC,DRV,RANDOM,800V
OC5, OC17	2	S15500-10	OPTOCOUPLER,PHOTO-Q,70V,CNY17-3
Q1, Q4, Q18	3	T12704-69	TRANSISTOR,PNP,TO226,0.5A, 60V,,2N4403
Q2, Q3, Q5, Q6, Q7, Q12, Q13, Q16, Q17, Q19, Q20, Q21, Q22, Q23, Q24, Q26, Q27, Q28, Q29	19	T12704-68	TRANSISTOR,NPN,TO226,0.5A,40V,2N4401
N.A. Q10, Q11	2	T12704-54	TRANSISTOR,NMF,TO220,15A,60V,(SS)
N.A. Q25	1	T12704-73	TRANSISTOR,NMF,4-PIN,DIP,1A, 100V,IRFD110(SS)
R2	1	T1081241	TRIMMER,ST,12W, 10K, 10%, LINEAR
R3, R5	2	S16296-3	TRIMMER,MT,1/2W,500, 10%, LINEAR
R4, R7	2	T1081273	TRIMMER,ST,12W, 2K, 10%,LINEAR
R6	1	S16296-5	TRIMMER,MT,1/2W, 10K, 10%, LINEAR
R8, R16, R120, R122, R172, R317, R356, R369, R376, R380, R402	11	S19400-1000	RESISTOR,MF, 1/4W,100,1%
R9, R91, R118, R117, R350	5	S19400-3322	RESISTOR,MF, 1/4W,33.2K,1%
R13	1	T14648-4	RESISTOR,WW,5W,40,5%,SQ
R14, R18, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R260, R398, R413, R420, R421, R422, R423	25	S19400-47R5	RESISTOR,MF, 1/4W,47.5,1%
R15, R19, R47, R48, R49, R50, R51, R52, R53, R54, R308, R311	12	S19400-10R0	RESISTOR,MF, 1/4W, 10.0,1%
R17, R20, R21, R22, R29, R40, R41, R44, R55, R56, R58, R75, R76, R136, R176, R210, R213, R214, R241, R275, R282, R287, R288, R291, R319, R323, R325, R329, R330, R331, R359, R366, R375, R378, R379, R383, R404, R406, R407, R408, R409, R412, R418	43	S19400-4751	RESISTOR,MF,1/4W,4.75K,1%
R24, R39, R46, R84, R87, R109, R119, R123, R126, R127, R130, R132, R133, R159, R160, R163, R175, R203, R204, R259, R212, R240, R246, R247, R250, R253, R289, R293, R294, R296, R297, R299, R300, R302, R321, R332, R352, R353, R358, R384, R386, R394, R403, R4	45	S19400-1002	RESISTOR,MF,1/4W,10.0K,1%
R25, R87, R125, R134, R158, R211, R242, R251, R261, R392, R419	11	S19400-2212	RESISTOR,MF,1/4W,22.1K,1%
R38, R254, R298, R313, R387, R411, R415	7	S19400-9091	RESISTOR,MF,1/4W,9.09K,1%
R42, R128, R164, R169, R215, R216, R245, R260, R261, R339	10	S19400-4752	RESISTOR,MF,1/4W,47.5K ,1%
R43	1	S19400-2213	RESISTOR,MF,1/4W,221K, 1%
R45, R66, R85, R108, R171	5	S19400-2002	RESISTOR,MF,1/4W,20.0K,1%
R57, R371	2	S19400-2210	RESISTOR,MF,1/4W,221,1%
R59, R252, R259, R377, R389	5	S19400-3321	RESISTOR,MF,1/4W,3.32K,1%
R72, R101, R102, R276	4	S19400-26R7	RESISTOR,MF,1/4W,26.7,1%
R73, R74, R131, R135, R170, R205, R270, R292, R295	9	S19400-1003	RESISTOR,MF,1/4W,100K,1%
R77, R385	2	S19400-6811	RESISTOR,MF,1/4W,6.81K,1%
R78	1	S19400-3921	RESISTOR,MF,1/4W,3.92K,1%
R79	1	S19400-3011	RESISTOR,MF,1/4W,3.01K,1%
R83, R87, R118, R168, R248, R249, R277, R280	8	S19400-1004	RESISTOR,MF,1/4W,1.00M,1%
R92, R103, R104, R129, R140, R161, R179, R202, R206, R207, R239, R243, R263, R267, R273, R274, R279, R305, R312, R314, R315, R320, R364, R388, R396, R400, R405, R410	28	S19400-1001	RESISTOR,MF,1/4W,1.00K,1%
R98, R177, R278, R336, R395	5	S19400-4750	RESISTOR,MF,1/4W,475,1%
R100, R271, R334, R337, R340, R341	6	S19400-5110	RESISTOR,MF,1/4W,511,1%
R110, R111	2	S19400-2001	RESISTOR,MF,1/4W,2.00K,1%
R112	1	S19400-9092	RESISTOR,MF,1/4W,90.9K,1%
R121, R124, R244, R318	4	S19400-7681	RESISTOR,MF,1/4W,7.68K,1%
R137, R138, R181, R217, R262, R304	6	S19400-1211	RESISTOR,MF,1/4W,1.21K,1%
R139, R180, R218, R264	4	S19400-2670	RESISTOR,MF,1/4W,267,1%
R162, R173, R333, R338, R372, R373, R374	7	S19400-3320	RESISTOR,MF,1/4W,332,1%
R165	1	S19400-3323	RESISTOR,MF,1/4W,332K,1%
R166	1	S19400-5621	RESISTOR,MF,1/4W,5.62K,1%
R167, R301	2	S19400-1501	RESISTOR,MF,1/4W,1.50K,1%
R178	1	T14648-24	RESISTOR,WW,5W,0.5,5%,SQ
R182, R183, R184, R185, R186, R187, R188, R189, R190, R191, R192, R193, R194, R195, R196, R197, R198, R199, R200, R201, R219, R220, R221, R222, R223, R224, R225, R226, R227, R228, R229, R230, R231, R232, R233, R234, R235, R236, R237, R238	40	S19400-68R1	RESISTOR,MF,1/4W,68.1,1%
R265, R266, R306, R351	4	S18380-1	THERMISTOR,PTC,56 OHMS,90MA
R268, R309, R343, R348	4	S19400-2490	RESISTOR,MF,1/4W,249,1%
R269, R307	2	S19400-2673	RESISTOR,MF,1/4W,267K,1%
R272	1	S19400-3922	RESISTOR,MF,1/4W,39.2K,1%
R296, R328	2	S19400-2802	RESISTOR,MF,1/4W,28.0K,1%
R303	1	S18380-3	THERMISTOR,PTC,.08-0.19 OHMS,1.8BA
R310	1	S19400-6810	RESISTOR,MF,1/4W,681,1%
R315	1	S19400-3012	RESISTOR,MF,1/4W,30.1K,1%
R322	1	S19400-3570	RESISTOR,MF,1/4W,357,1%
R335, R342, R344, R345, R347, R365, R381	7	S19400-2000	RESISTOR,MF,1/4W,200,1%
R348, R349, R362, R363	4	S19400-20R0	RESISTOR,MF,1/4W,20.0,1%
R357	1	S19400-1502	RESISTOR,MF,1/4W,15K,1%
R361, R367, R368	3	S19400-2211	RESISTOR,MF,1/4W,2.21K,1%
R382	1	S19400-1500	RESISTOR,MF,1/4W,150,1%
R391	1	S19400-5622	RESISTOR,MF,1/4W,56.2K,1%
R401	1	T10812-79	TRIMMER,ST,1/2W,100, 10%,LINEAR
R414	1	S18380-5	THERMISTOR,PTC,0.5-1.17 OHMS,0.5A
T1, T2	2	T12737-2	TRANSFORMER,PULSE,3.3/WINDING,1:1:1
TP1, TP3, TP5, TP6	4	T13640-25	MOV,130VRMS,90J,20MM
TP2	1	T13640-16	MOV,150VRMS,80J,20MM
TP4, TP7, TP9, TP10, TP11, TP12	6	T13640-18	MOV,320VRMS,150J,20MM
TP8	1	T13640-11K	MOV,150VRMS,45J,14MM
TR1, TR2, TR3, TR4	4	S15161-27	TRIAC,TO220,8A,800V
N.A. X1	1	S17900-24	IC,CMOS,GATE,NAND,2-INPUT,QUAD,SCHM(SS)
N.A. X2	1	S17900-8	IC,CMOS,INVERTER,SCHMITT,HEX,HC14A(SS)
N.A. X6, X14	2	S15018-6	IC,CMOS,SWITCH,ANALOG,QUAD, 4066(SS)
X5	1	S15128-5	IC,VOLT REG,7.0ED,3-T,(+),1A,15V,TO220
N.A. X8, X12, X13, X16	4	S15128-18	OP-AMP,QUAD, HIGH-PERF,33074
X9	1	S15128-15	IC,VOLT REG,ADJ,3-T,(+),3A,350,TO220
N.A. X11	1	S15018-4	IC,CMOS,INVERTER,SCHMITT, HEX,4584(SS)
X17	1	M15102-4	IC,ARRAY,DRIVER,PERIPHERAL, NPN,DARL
N.A. X19	1	S15128-16	IC,OP-AMP, QUAD, HIGH-PERF, 1014
N.A. X20, X21	2	S25073-9	IC,CMOS,PSOC,8-BIT,CY8C27443,DIP-28(SS)

NOTES:
- N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
- N.B. KEEP THIS AREA FREE OF ENCAPSULATION MATERIAL (∅ .50 MIN.) BOTH SIDES OF BOARD.
- N.C. SQUEEZE COMPONENTS TOGETHER BEFORE APPLYING ***ITEM 7*** AND / OR ENCAPSULATION MATERIAL.
- N.D. APPLY ***ITEM 7*** ON COMPONENT SIDE ONLY, AS SHOWN.
- N.E. APPLY ***ITEM 7*** ON BOTH SIDES OF BOARD AS SHOWN, EXCEPT TOP SURFACE OF TRIMMER. MAXIMUM ***ITEM 7*** HEIGHT NEAR CONNECTOR J2 IS .50 INCHES.
- N.F. KEEP TOP SURFACE FREE OF ENCAPSULATION MATERIAL INCLUDING RTV.
- N.G. PROGRAM X20 WITH ***ITEM 8*** AND LABEL X20 WITH PART NO. OF ***ITEM 8.***
- N.H. PROGRAM X21 WITH ***ITEM 9*** AND LABEL X21 WITH PART NO. OF ***ITEM 9.***
- N.J. COVER WITH TAPE AFTER PROGRAMMING.
- N.K. APPLY ***ITEM 7*** ON COMPONENT SIDE ONLY, AS SHOWN. MAXIMUM ***ITEM 7*** HEIGHT IS .50 INCHES.
- N.L. APPLY ***ITEM 7*** TO CONNECTOR'S PLASTIC MOUNTING PINS ON NON-COMPONENT SIDE.

REVISION CONTROL

G4763-1A1

PART NO. IDENTIFICATION CODE
TEST PER E4298-C
COAT WITH E1844 AND E3668
SCHEMATIC REFERENCE: G4762-1A1

MAKE DETAIL
MANUFACTURE PER E1911
BUY BLANK COMPLETE
(2 BOARDS PER PANEL)

4 LAYER BOARD BLANK PANEL
SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION.

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

ALL COMPONENTS AND MATERIALS USED IN THIS ASSEMBLY ARE TO BE RoHS COMPLIANT PER E4253

FOR PARTS ORDERS:

INCLUDE (1) S2559?PRINT PARTS ORDERS INSTRUCTION SHEET.

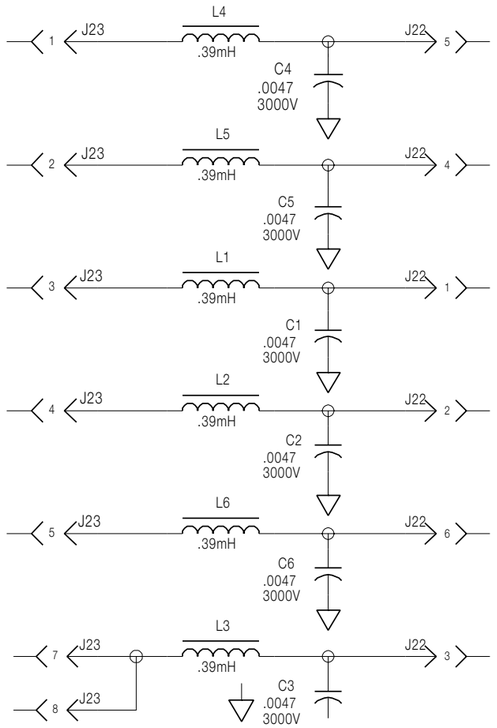
UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± 5.0F A DEGREE
MATERIAL TOLERANCE (*) TO AGREE WITH PUBLISHED STANDARDS
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION		REFERENCE:	EQUIPMENT TYPE:	PRECISION TIG	PAGE 1 OF 1
DRAWN BY:	JB	G3909	SUBJECT:	CONTROL P.C. BOARD ASSEMBLY	DOCUMENT NUMBER: G4763-1 / DOCUMENT REVISION: A
ENGINEER:	TNguyen	SCALE: 1:1	MATERIAL DISPOSITION: NA	APPROVAL DATE: 7-27-2007	PROJECT NUMBER: CRM38261
APPROVED:	-				

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC-PROTECTION P.C. BOARD (M16115)

M 16115



NOTES :

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

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R- _
C- _
D- _

LABELS

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

UNLESS OTHERWISE SPECIFIED TOLERANCE
ON HOLE SIZES PER E2056
ON 2 PLACE DECIMALS IS .02±
ON 3 PLACE DECIMALS IS .00±
ON ALL ANGLES IS .5 ◐F A DEGREE
MATERIAL TOLERANCE (" ") TO AGREE WITH PUBLISHED STANDARDS.

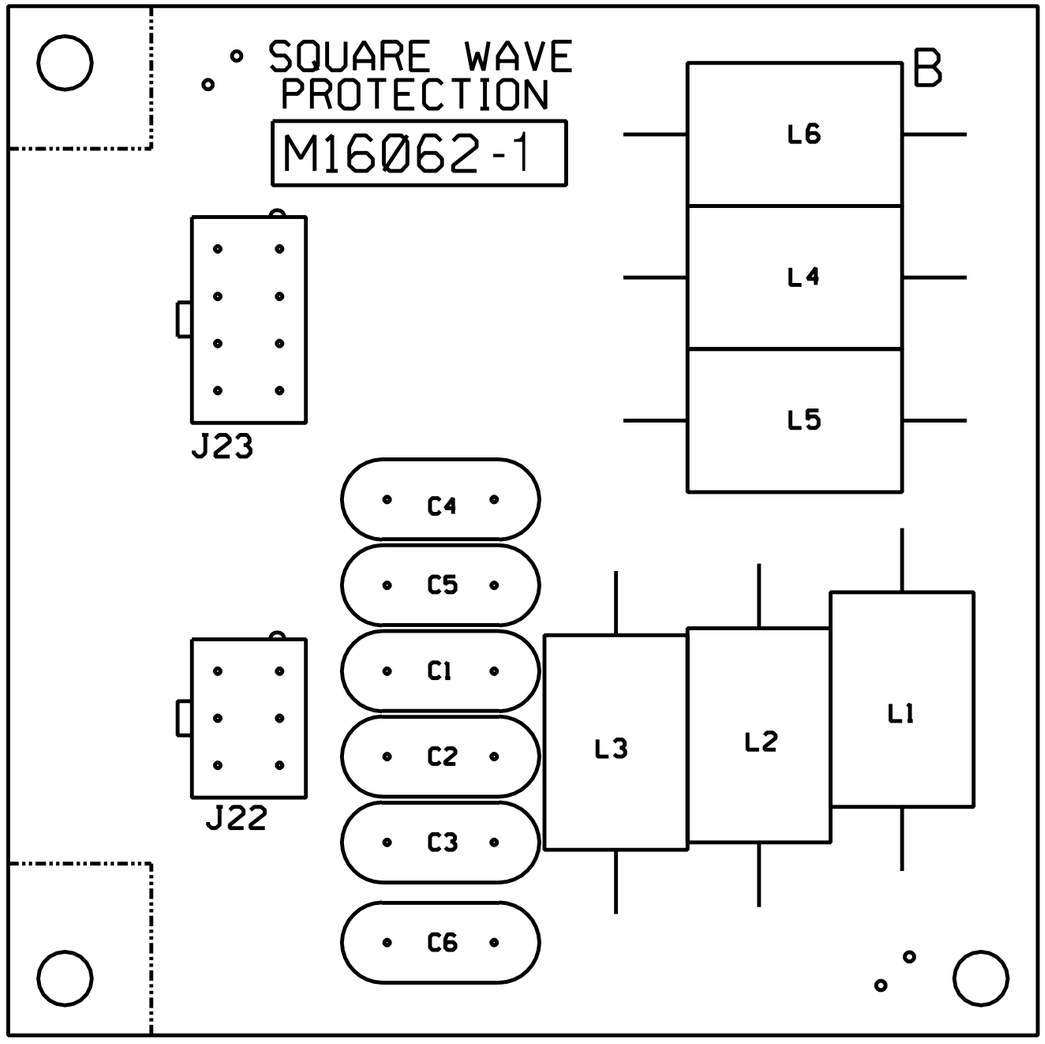
Ch'ge. Sht. No.				
5-29-90SPA				

THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.

EQUIP. TYPE SQARE WAVE TIG 350
SUBJECT PROTECTION P.C. BOARD SCHEMATIC
SCALE NONE
DR MK/DRS DATE 1-12-90 CHK GM/BS REF. SUP'S'D'G SHT. NO. M 16115

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

PC BOARD ASSEMBLY-PROTECTION (M16062-1)



	ITEM	REQ'D	PART NO.	IDENTIFICATION
	C1, C2, C3, C4, C5, C6	6	T11577-58	.0047/3000 V
	L1, L2, L3, L4, L5, L6	6	T12218-9F	.39 mH
	J22	1	S18248-6	HEADER
	J23	1	S18248-8	HEADER
	1	1	L8081-B	P.C. BD BLANK

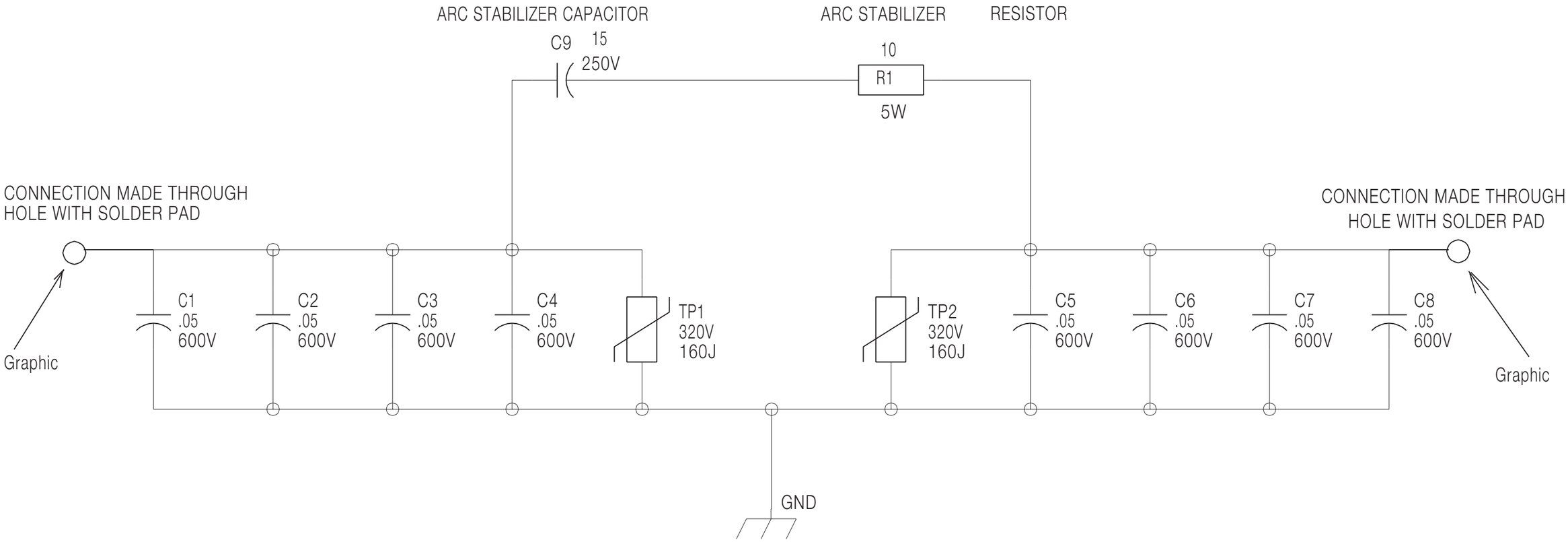
M16062-1

CAPACITORS = MFD/VOLTS

9-28-2001M

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC-BYPASS / STABILIZER P.C. BOARD (S22530-1) (CODE 10806 & 10807)



S22530-1B0
Rev A

NOTES :

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

GENERAL INFORMATION

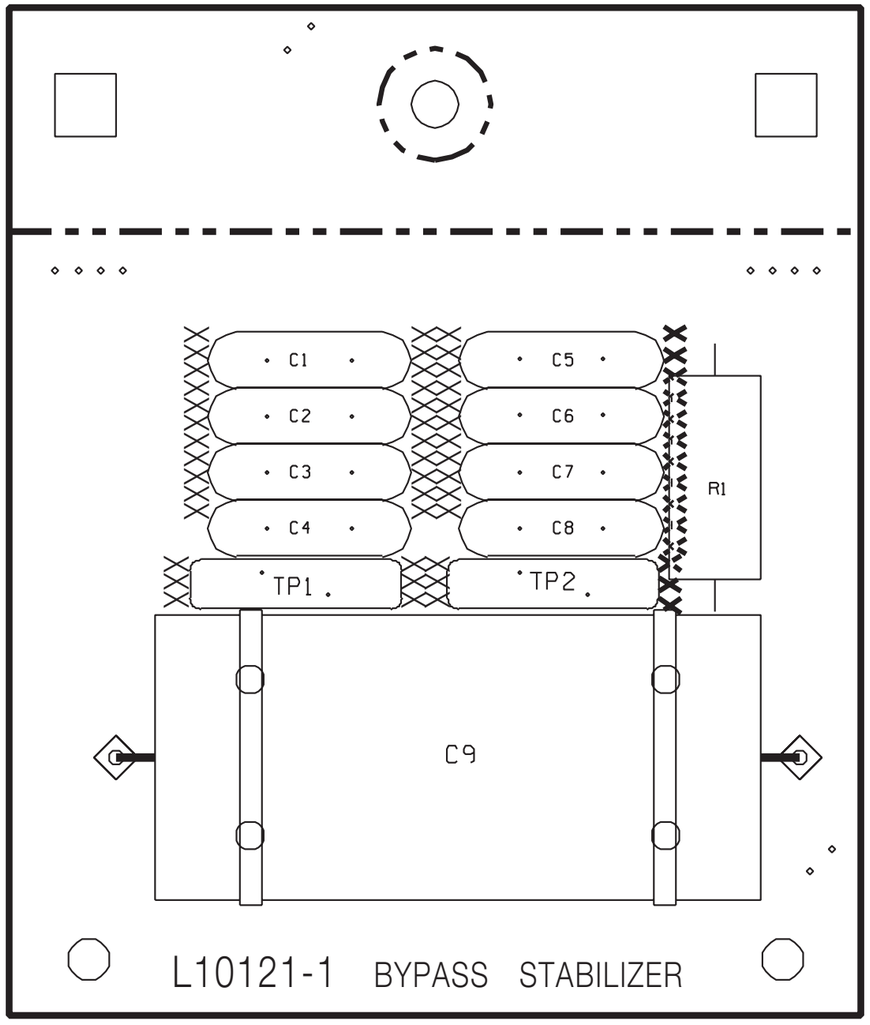
ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LABELS

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

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

PC BOARD ASSEMBLY-BYPASS / STABILIZER (L10121-1) (CODE 10806 & 10807)



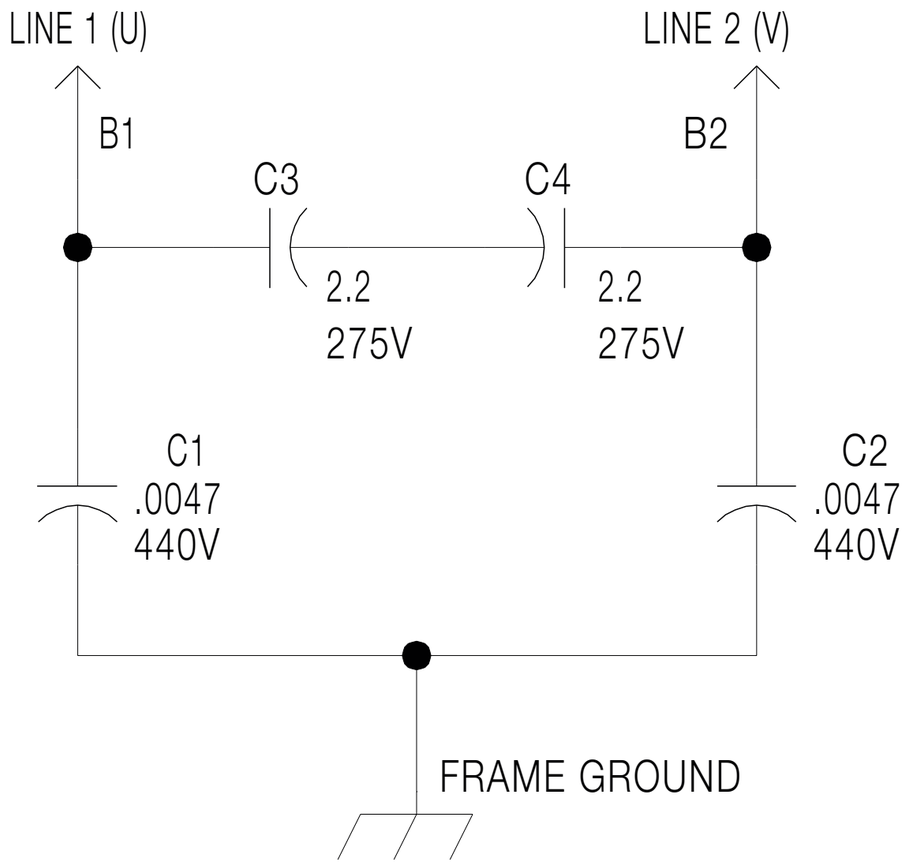
L10121-1
Rev B

ITEM	REQ'D	PART NO.	IDENTIFICATION
C1, C2, C3, C4, C5, C6, C7, C8	8	T11577-46	.05/600V
C9	1	S13490-155	15/250V
R1	1	T14648-25	10 5W
TP1, TP2	2	T13640-18	320V, 160J

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC-BYPASS AND CE P. C. BOARD (S24206) (CODE 10894)

S 24206



FILE NAME: S24206_1AA

NOTES :

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

GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A, 400V (UNLESS OTHERWISE SPECIFIED)

LABELS

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

UNLESS OTHERWISE SPECIFIED TOLERANCE
ON HOLES SIZES PER E-2056
ON 2 PLACE DECIMALS IS + .02
ON 3 PLACE DECIMALS IS + .002
ON ALL ANGLES IS + .5 OF A DEGREE
MATERIAL TOLERANCE (*t*) TO AGREE
WITH PUBLISHED STANDARDS

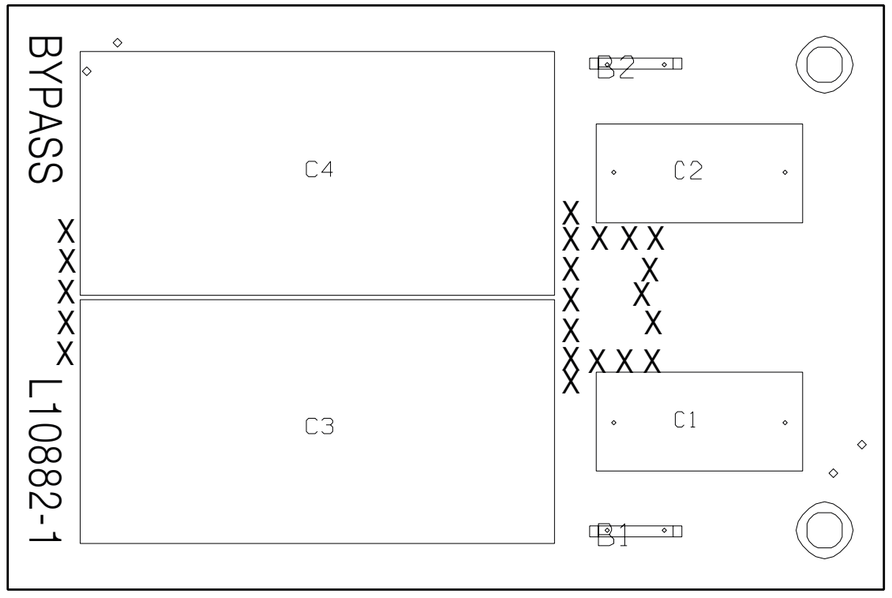
Ch'ge.Sht.No.			
XA			
3-20-98			

THE LINCOLN ELECTRIC CO.
CLEVELAND, OHIO U.S.A.

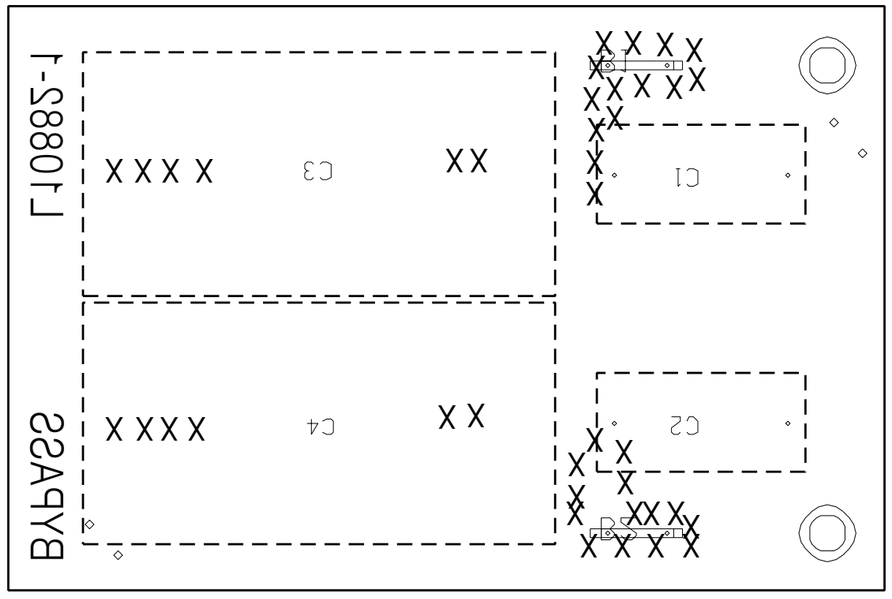
EQUIP. TYPE
SUBJECT SCHEMATIC, BYPASS
SCALE NONE
DR. APM DATE 9/29/97 CHK. SUP'S'D'G.
SHT. NO. S 24206

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

PC BOARD ASSEMBLY-BYPASS AND CE (L10882-1) (CODE 10894)



ITEM	REQ'D	PART NO.	IDENTIFICATION
B1, B2	2	T13157-14	TAB TERMINAL
C1, C2	2	S23020-3	CAPACITOR, PM, .0047, 440VAC
C3, C4	2	S23020-2	CAPACITOR, PEMF, 2.2, 275VAC

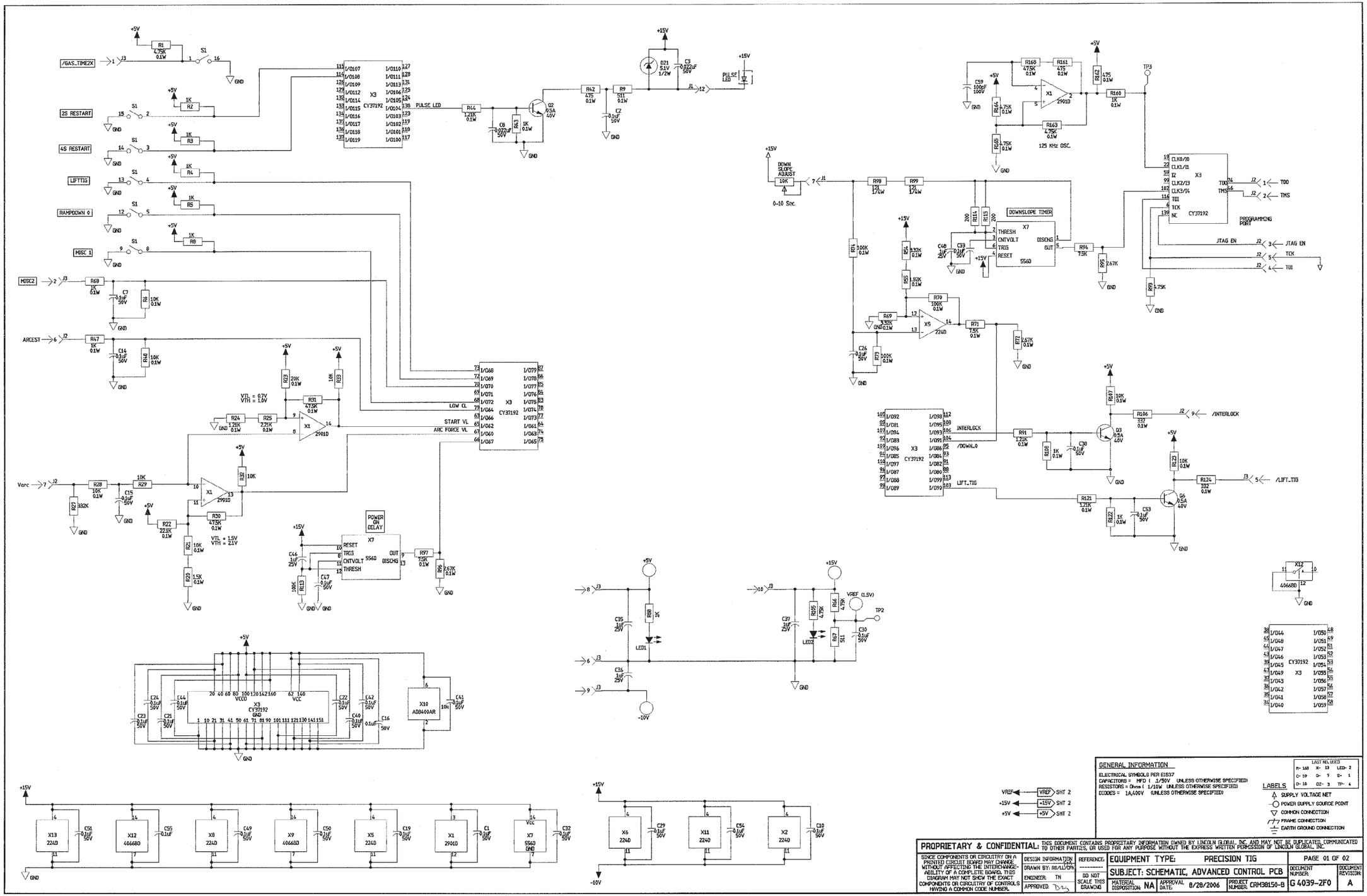


BOTTOM VIEW

L 10882-1
3-20-98

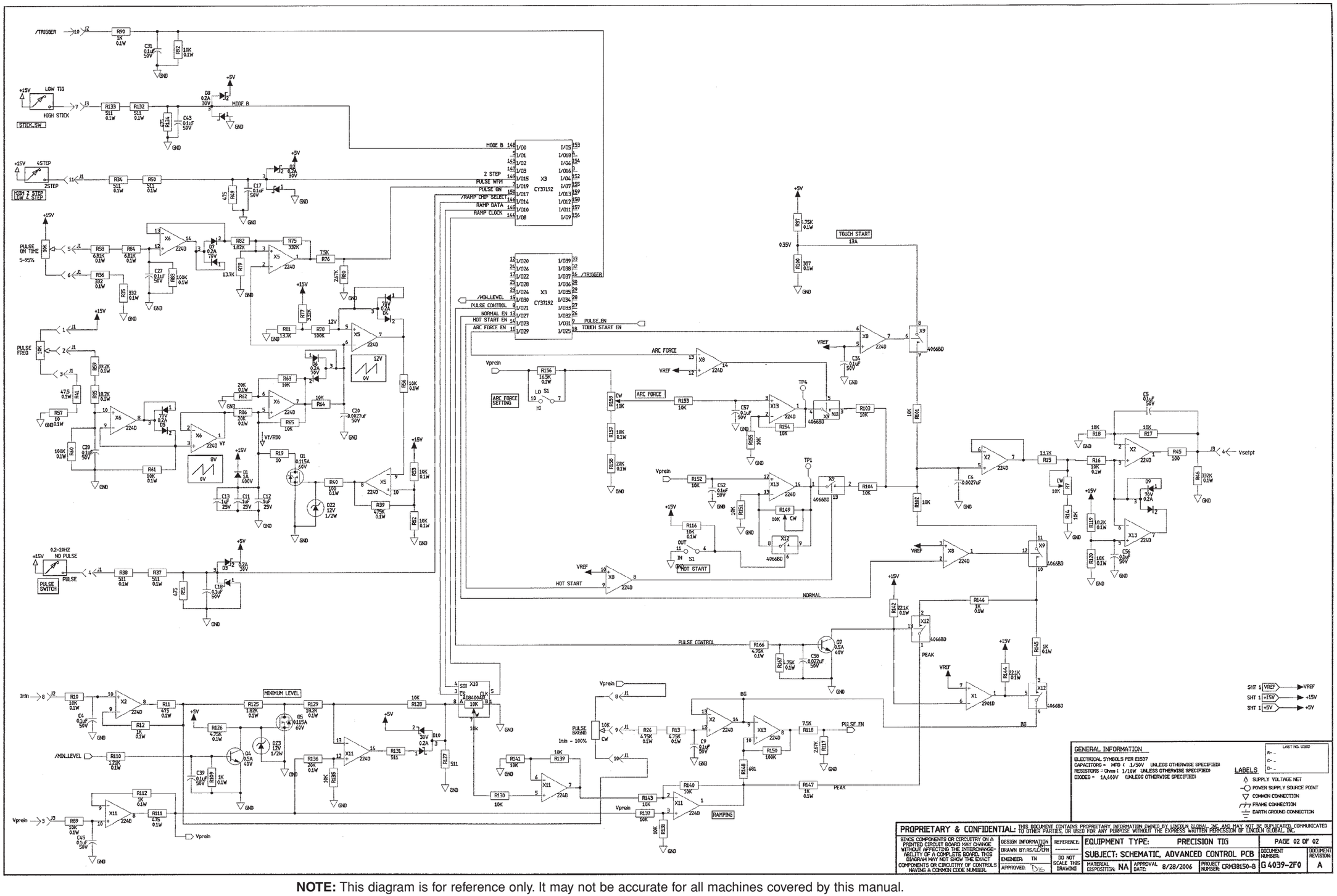
NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC - TIG OPTION PC BOARD - BELOW CODE 11000 (G4039 PAGE 1)



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

SCHEMATIC - TIG OPTION PC BOARD - BELOW CODE 11000 (G4039 PAGE 2)



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

PC BOARD ASSEMBLY - TIG OPTION - BELOW CODE 11000 (G4040-2)

G4040-2 | ENGINEERING CONTROLLED MANUFACTURER: Yes | CHANGE DETAIL: REVISED MANUFACTURER SPECIFICATION

REVISION CONTROL

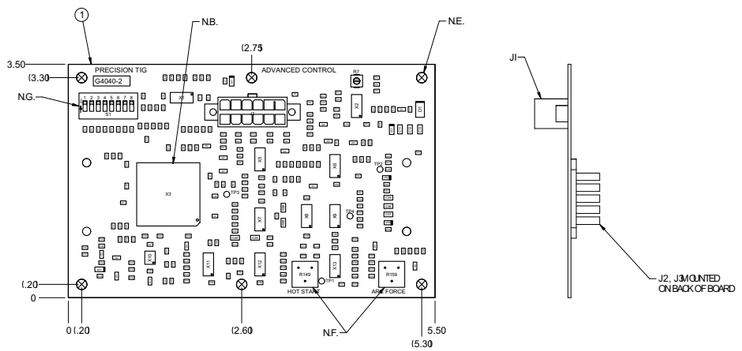
G4040-2F0

PART NO. IDENTIFICATION CODE

TEST PER E3937-AC
COAT WITH E1844 AND E3668 (1 COAT EACH)
SCHEMATIC REFERENCE: G4039-2F0

BUY DETAIL	MAKE DETAIL
BUY PER E3867	MANUFACTURE PER E1911-ROHS BUY BLANK COMPLETE (6 BOARDS PER PANEL)

4 LAYER BOARD BLANK PANEL.
SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION.



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	G4040-F	PC BOARD BLANK
2	1	S25409-1	SOFTWARE CPLD (X3)
REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW			
REFERENCES	QTY	PART NUMBER	DESCRIPTION
C1, C2, C4, C5, C7, C9, C10, C14, C15, C16, C17, C18, C19, C21, C22, C23, C24, C26, C27, C28, C29, C30, C31, C32, C33, C34, C38, C39, C40, C41, C42, C43, C44, C45, C47, C49, C50, C51, C52, C53, C54, C55, C56, C57	44	S25020-3SMT	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
C3, C8, C58	3	S25020-2SMT	CAPACITOR,SMD,CERAMIC,0.022MF,50V,10%,X7R,S0805
C6, C20	2	S25020-5SMT	CAPACITOR,SMD,CERAMIC,2700pF,50V,5%,X7R,S0805
C11, C12, C13, C35, C36, C37, C46, C48	8	S25020-24SMT	CAPACITOR,SMD,CERAMIC,1.0MF,25V,10%,X7R,S1206
C59	1	S25020-12SMT	CAPACITOR,SMD,CERAMIC,100pF,100V,5%,C0G,S0805
D1	1	S25040-2SMT	DIODE,SMD,1A,400V,DO-214BA/AC
D2, D3, D8, D10	4	S25049-4SMT	DIODE,SMD,SCHOTTKY,DUAL,0.200A,30V,SOT-23
D4, D5, D6, D7, D9	5	S25040-5SMT	DIODE,SMD,DUAL,0.200A,70V,UFR
DZ1	1	S25046-1SMT	ZENER DIODE,SMD,0.5W,5.1V,.5%,SOD123
DZ2, DZ3	2	S25046-4SMT	ZENER DIODE,SMD,0.5W,12V,5%,SOD-123
N.D. J1	1	S24020-12	CONNECTOR,MOLEX,MINI,PCB,12-PIN,TIN
N.D. J2, J3	2	S21135-10	CONNECTOR,MOLEX,MINI,BLIND,F,10-PIN
LED1, LED2	2	S25080-2SMT	LED,SMD,GREEN,CLEAR,S1206
Q1, Q5	2	S25051-4SMT	TRANSISTOR,SMD,NMF,SOT-23,0.115A,60V,7002LT1(SS)
Q2, Q3, Q4, Q6, Q7	5	S25050-1SMT	TRANSISTOR,SMD,NPN,0.5A,40V,SOT-23,MMBT4401LT1
R1, R13, R26, R66, R87, R93, R105, R126, R163, R164, R165, R166, R167	13	S25000-4751SMT	RESISTOR,SMD,METAL FILM,1/10W,4.75K,1%,S0805
R2, R3, R4, R5, R8, R12, R43, R47, R68, R88, R90, R108, R109, R112, R122, R145, R146, R147, R160	19	S25000-1001SMT	RESISTOR,SMD,METAL FILM,1/10W,1.00K,1%,S0805
R6, R10, R14, R16, R17, R18, R21, R28, R29, R32, R33, R48, R52, R53, R56, R61, R63, R64, R65, R89, R92, R101, R102, R103, R104, R107, R116, R120, R123, R128, R130, R135, R137, R138, R139, R140, R141, R143, R151, R152, R153, R154, R155, R157	44	S25000-1002SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0K,1%,S0805
R7	1	S25058-1SMT	TRIMMER,SMD,ST,1/4W,10K,10%,LINEAR
R9, R34, R37, R38, R50, R67, R127, R131, R132, R133	10	S25000-5110SMT	RESISTOR,SMD,METAL FILM,1/10W,511OHMS,1%,S0805
R11, R42, R49, R51, R111, R134, R161, R162	8	S25000-4750SMT	RESISTOR,SMD,METAL FILM,1/10W,475OHMS,1%,S0805
R15, R79, R81	3	S25000-1372SMT	RESISTOR,SMD,METAL FILM,1/10W,13.7K,1%,S0805
R19, R57	2	S25000-10R0SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0OHMS,1%,S0805
R20	1	S25000-1501SMT	RESISTOR,SMD,METAL FILM,1/10W,1.50K,1%,S0805
R22, R142, R144	3	S25000-2212SMT	RESISTOR,SMD,METAL FILM,1/10W,22.1K,1%,S0805
R23, R62, R86, R136, R158	5	S25000-2002SMT	RESISTOR,SMD,METAL FILM,1/10W,20.0K,1%,S0805
R24, R44, R91, R110, R121	5	S25000-1211SMT	RESISTOR,SMD,METAL FILM,1/10W,1.21K,1%,S0805
R25	1	S25000-2211SMT	RESISTOR,SMD,METAL FILM,1/10W,2.21K,1%,S0805
R27, R46, R75	3	S25000-3323SMT	RESISTOR,SMD,METAL FILM,1/10W,332K,1%,S0805
R30, R31, R168	3	S25000-4752SMT	RESISTOR,SMD,METAL FILM,1/10W,47.5K,1%,S0805
R35, R36, R106, R124	4	S25000-3320SMT	RESISTOR,SMD,METAL FILM,1/10W,332OHMS,1%,S0805
R39	1	S25000-4753SMT	RESISTOR,SMD,METAL FILM,1/10W,475K,1%,S0805
R40, R45	2	S25000-1000SMT	RESISTOR,SMD,METAL FILM,1/10W,100OHMS,1%,S0805
R41	1	S25000-47R5SMT	RESISTOR,SMD,METAL FILM,1/10W,47.5OHMS,1%,S0805
R54, R69, R77	3	S25000-3321SMT	RESISTOR,SMD,METAL FILM,1/10W,3.32K,1%,S0805
R55, R82, R125	3	S25000-1821SMT	RESISTOR,SMD,METAL FILM,1/10W,1.82K,1%,S0805
R58, R84	2	S25000-6811SMT	RESISTOR,SMD,METAL FILM,1/10W,6.81K,1%,S0805
R59	1	S25000-3922SMT	RESISTOR,SMD,METAL FILM,1/10W,39.2K,1%,S0805
R60, R70, R73, R74, R78, R83, R113, R150	8	S25000-1003SMT	RESISTOR,SMD,METAL FILM,1/10W,100K,1%,S0805
R71, R76, R94, R97, R118	5	S25000-7501SMT	RESISTOR,SMD,METAL FILM,1/10W,7.50K,1%,S0805
R72, R80, R95, R96, R117	5	S25000-2671SMT	RESISTOR,SMD,METAL FILM,1/10W,2.67K,1%,S0805
R85, R119, R129	3	S25000-1822SMT	RESISTOR,SMD,METAL FILM,1/10W,18.2K,1%,S0805
R98, R99	2	S25001-1210SMT	RESISTOR,SMD,121OHMS,1/4W,1206,1%,TR
R100	1	S25000-3570SMT	RESISTOR,SMD,METAL FILM,1/10W,357OHMS,1%,S0805
R114, R115	2	S25000-2000SMT	RESISTOR,SMD,METAL FILM,1/10W,200OHMS,1%,S0805
R148	1	S25000-6810SMT	RESISTOR,SMD,METAL FILM,1/10W,681OHMS,1%,S0805
R149, R159	2	T10812-41	TRIMMER,ST,1/2W,10K,10%,LINEAR
R156	1	S25000-1652SMT	RESISTOR,SMD,METAL FILM,1/10W,16.5K,1%,S0805
S1	1	S19869-8	SWITCH,DIP,SPST,8-CIRCUITS????SET_SWITCH_POSITIONS????
N.A. X1	1	S15128-11SMT	IC,SMD,COMPARATOR,QUAD,2901D
N.A. X2, X5, X6, X8, X11, X13	6	S15128-4SMT	OP-AMP,SMD,QUAD, GEN-PURPOSE,224D
N.A. X3	1	S25070-12SMT	IC,SMD,CMOS,CPLD,CY37192,160-TQFP(SS)
N.A. X7	1	S25067-1SMT	IC,BIPOLAR,TIMER,SOIC-14
N.A. X9, X12	2	S15018-6SMT	IC,SMD,CMOS,SWITCH,ANALOG,QUAD, 4066BD(SS)
N.A. X10	1	S25057-2SMT	POT,SMD,DIGITAL,10K,1-CHNL,SOIC-8

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

NOTES:
N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
N.B. PROGRAM X3 WITH IT ***ITEM 2***.

N.D. DO NOT COAT WITH ENCAPSULATION MATERIAL.
N.E. KEEP MOUNTING HOLES FREE OF ENCAPSULATION MATERIAL. (5 PLACES)
N.F. KEEP TOP SURFACE OF TRIMMERS FREE OF ENCAPSULATION MATERIAL. (2 PLACES)
N.G. KEEP TOP SURFACE OF DIP SWITCH FREE OF ENCAPSULATION MATERIAL.

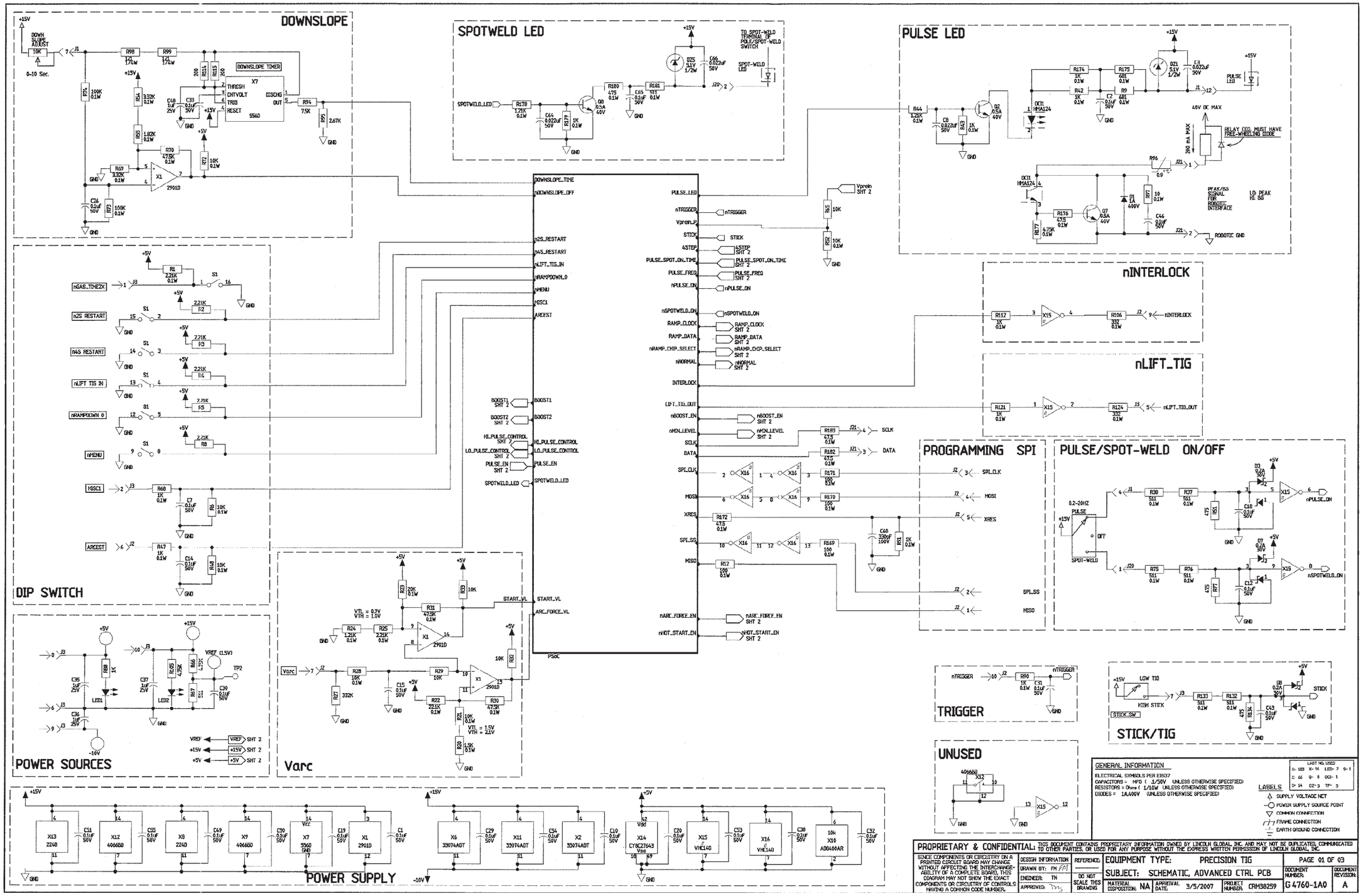
ALL COMPONENTS AND MATERIALS USED IN THIS ASSEMBLY ARE TO BE RoHS COMPLIANT PER E4253.

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .010
ON ALL ANGULAR DIMENSIONS ± 1 DEGREE
MATERIAL TOLERANCE "X" = TO AGREE WITH PUBLISHED STANDARDS
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: INDUSTRIAL TIG	PAGE 1 OF 1
DRAWN BY: FEI	G4040-	SUBJECT: ADVANCED CONTROL PC BOARD ASSEMBLY	DOCUMENT NUMBER: G4040-2 / DOCUMENT REVISION: B
ENGINEER:	SCALE: 1:1	MATERIAL DISPOSITION: UF / APPROVAL DATE: 3/16/07 / PROJECT NUMBER: ORM34409	
APPROVED: -			

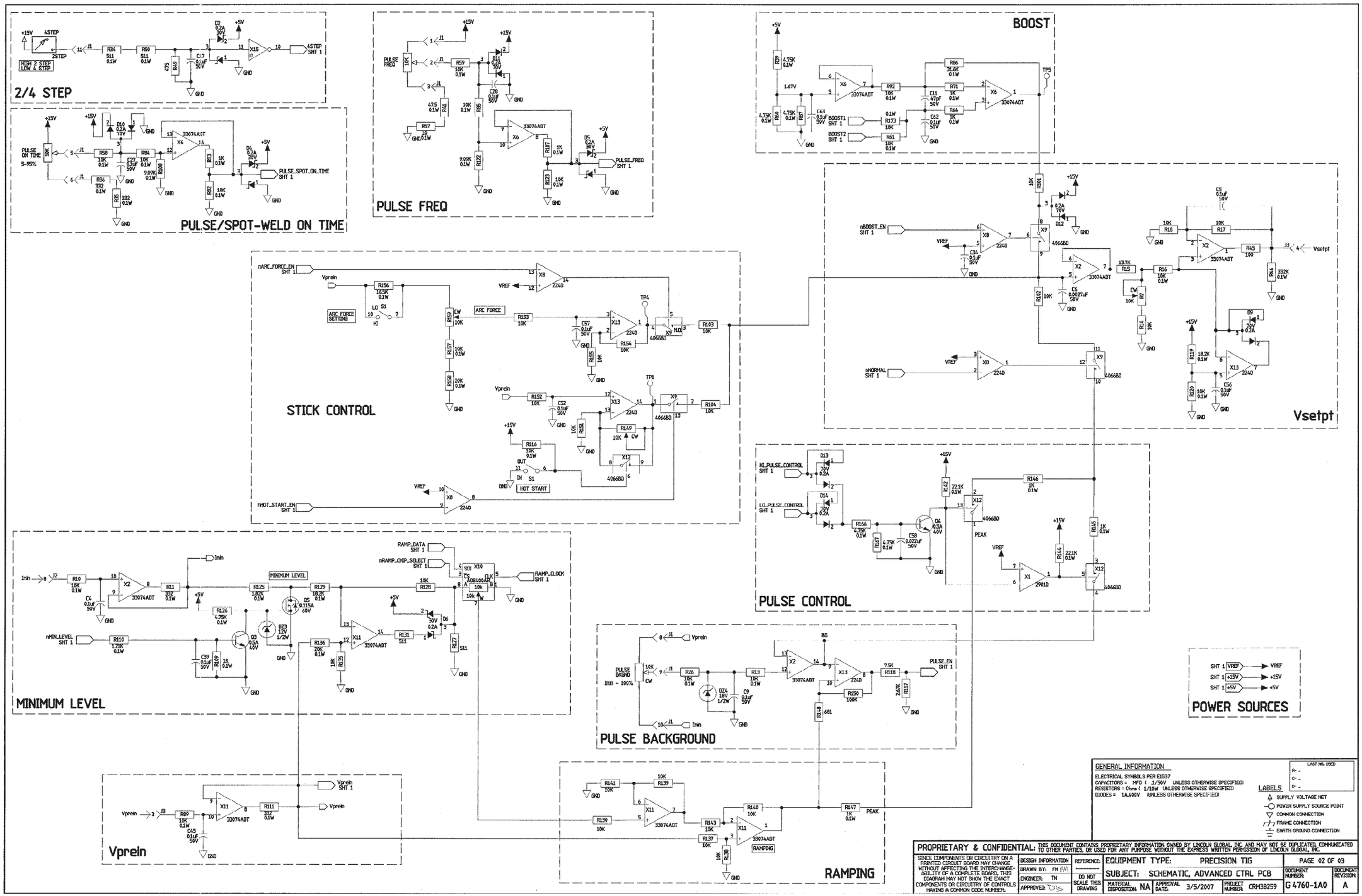
NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

SCHEMATIC - TIG OPTION PC BOARD - ABOVE CODE 11000 (G4760 PAGE 1)



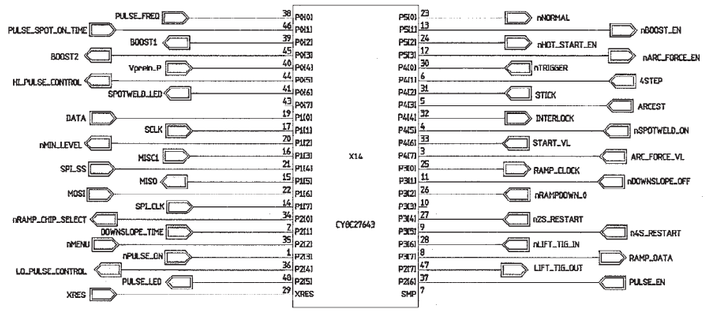
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - TIG OPTION PC BOARD - ABOVE CODE 11000 (G4760 PAGE 2)



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

SCHEMATIC - TIG OPTION PC BOARD - ABOVE CODE 11000 (G4760 PAGE 3)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,600V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED
R= _
C= _
D= _

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

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

DESIGN INFORMATION	
DRAWN BY: FM	
ENGINEER: TN	
APPROVED:	
REFERENCE:	
DO NOT SCALE THIS DRAWING	

EQUIPMENT TYPE: PRECISION TIG — PAGE 03 OF 03

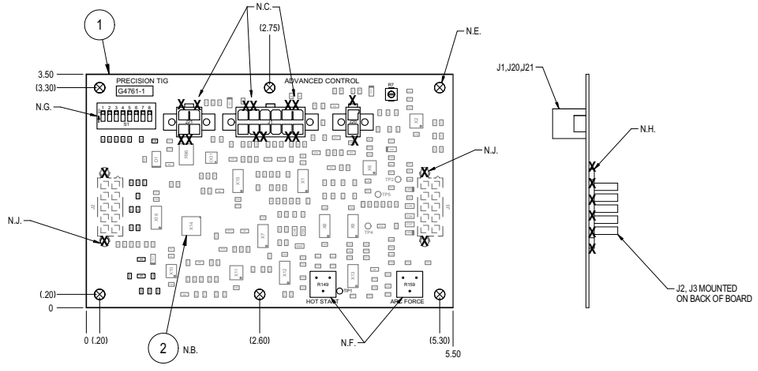
SUBJECT: SCHEMATIC, ADVANCED CTRL PCB

MATERIAL DISPOSITION:	APPROVAL DATE:	PROJECT NUMBER:	DOCUMENT NUMBER:	DOCUMENT REVISION:
NA	3/5/2007	CRM38259	G4760-1A0	A

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

PC BOARD ASSEMBLY - TIG OPTION - ABOVE CODE 11000 (G4761-1)

G4761-1 | ENGINEERING CONTROLLED | CHANGE DETAIL: RELEASED A.01 FROM "X"
MANUFACTURER: No



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	G4761-A	PC BOARD BLANK
2	1	S26859-1	PSOC SOFTWARE (X14)
3	AS REQ	E2861	SEALANT
REFER TO ELECTRONIC COMPONENT DATABASE FOR SPECIFICATIONS ON ITEMS LISTED BELOW			
REFERENCES	QTY	PART NUMBER	DESCRIPTION
C1, C2, C4, C5, C7, C10, C12, C14, C15, C17, C18, C19, C20, C26, C29, C30, C31, C32, C33, C34, C38, C39, C43, C45, C49, C50, C51, C52, C53, C54, C55, C56, C57, C62, C63, C65	36	S25020-3SMT	CAPACITOR,SMD,CERAMIC,0.1MF,50V,10%,X7R,S0805
C3, C8, C58, C64, C66	5	S25020-2SMT	CAPACITOR,SMD,CERAMIC,0.022MF,50V,10%,X7R,S0805
C6	1	S25020-5SMT	CAPACITOR,SMD,CERAMIC,2700pF,50V,5%,X7R,S0805
C9, C27, C28, C46	4	S25020-27SMT	CAPACITOR,SMD,CER,0.1MF,50V,-20%+80%,Z5U,S0805
C11	1	S25020-9SMT	CAPACITOR,SMD,CERAMIC,47pF,50V,5%,COG,S0805
C35, C36, C37, C48	4	S25020-24SMT	CAPACITOR,SMD,CERAMIC,1.0MF,25V,10% ,X7R,S1206
C60	1	S25020-14SMT	CAPACITOR,SMD,CERAMIC,330pF,100V,5%,COG,S0805
D1	1	S25040-2SMT	DIODE,SMD,1A,400V,DO-214BA/AC
D2, D3, D4, D5, D6, D7, D8	7	S25049-4SMT	DIODE,SMD,SCHOTTKY,DUAL,0.200A,30V,SOT-23
D9, D10, D11, D12, D13, D14	6	S25040-5SMT	DIODE,SMD,DUAL,0.200A,70V,UFR
DZ1, DZ5	2	S25046-1SMT	ZENER DIODE,SMD,0.5W,5.1V, 5%,SOD123
DZ3	1	S25046-4SMT	ZENER DIODE,SMD,0.5W,12V,5%,SOD-123
DZ4	1	S25046-3SMT	ZENER DIODE,SMD,0.5W,18V, 5%,SOD123
J1	1	S24020-12	CONNECTOR,MOLEX,MINI,PCB,12-PIN,TIN
J2, J3	2	S21135-10	CONNECTOR,MOLEX,MINI,BLIND,F,10-PIN
J20	1	S24020-2	CONNECTOR,MOLEX,MINI,PCB,2-PIN,TIN
J21	1	S24020-4	CONNECTOR,MOLEX,MINI,PCB,4-PIN,TIN
LED1, LED2	2	S25080-2SMT	LED,SMD,GREEN,CLEAR,S1206
OC1	1	S15000-34SMT	IC,SMD,OPTOCOUPLER,HMA124
Q2, Q3, Q6, Q7, Q8	5	S25050-1SMT	TRANSISTOR,SMD,NPN,0.5A,40V,SOT-23,MMBT4401LT1
Q5	1	S25051-4SMT	TRANSISTOR,SMD,NMF,SOT-23,0.115A,60V,7002LT1(SS)
R1, R2, R3, R4, R5, R8, R25	7	S25000-2211SMT	RESISTOR,SMD,METAL FILM,1/10W,2.21K,1%,S0805
R6, R10, R13, R14, R16, R17, R18, R21, R26, R28, R29, R32, R33, R48, R52, R58, R59, R61, R65, R72, R82, R84, R85, R89, R92, R101, R102, R103, R104, R116, R120, R123, R128, R130, R135, R137, R138, R139, R140, R141, R143, R151, R152, R153, R154, R155, R157,	48	S25000-1002SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0K,1%,S0805
R7	1	S25058-1SMT	TRIMMER,SMD,ST,1/4W,10K,10%,LINEAR
R9, R148, R175	3	S25000-6810SMT	RESISTOR,SMD,METAL FILM,1/10W,681OHMS,1%,S0805
R11, R35, R36, R106, R111, R124	6	S25000-3320SMT	RESISTOR,SMD,METAL FILM,1/10W,332OHMS,1%,S0805
R12, R45, R169, R170, R171	5	S25000-1000SMT	RESISTOR,SMD,METAL FILM,1/10W,100OHMS,1%,S0805
R15	1	S25000-1372SMT	RESISTOR,SMD,METAL FILM,1/10W,13.7K,1%,S0805
R20	1	S25000-1501SMT	RESISTOR,SMD,METAL FILM,1/10W,1.50K,1%,S0805
R22, R142, R144	3	S25000-2212SMT	RESISTOR,SMD,METAL FILM,1/10W,22.1K,1%,S0805
R23, R136, R158	3	S25000-2002SMT	RESISTOR,SMD,METAL FILM,1/10W,20.0K,1%,S0805
R24, R44, R110, R178	4	S25000-1211SMT	RESISTOR,SMD,METAL FILM,1/10W,1.21K,1%,S0805
R27, R46	2	S25000-3323SMT	RESISTOR,SMD,METAL FILM,1/10W,332K,1%,S0805
R30, R31, R70	3	S25000-4752SMT	RESISTOR,SMD,METAL FILM,1/10W,47.5K,1%,S0805
R34, R37, R38, R50, R67, R75, R76, R127, R131, R132, R133, R181	12	S25000-5110SMT	RESISTOR,SMD,METAL FILM,1/10W,511OHMS,1%,S0805
R39, R60, R66, R87, R105, R126, R166, R167, R177	9	S25000-4751SMT	RESISTOR,SMD,METAL FILM,1/10W,4.75K,1%,S0805
R41, R172, R176, R182, R183	5	S25000-47R5SMT	RESISTOR,SMD,METAL FILM,1/10W,47.5OHMS,1%,S0805
R42, R43, R47, R64, R68, R71, R83, R88, R90, R91, R107, R109, R112, R121, R145, R146, R147, R174, R179	19	S25000-1001SMT	RESISTOR,SMD,METAL FILM,1/10W,1.00K,1%,S0805
R49, R51, R77, R134, R180	5	S25000-4750SMT	RESISTOR,SMD,METAL FILM,1/10W,475OHMS,1%,S0805
R54, R69	2	S25000-3321SMT	RESISTOR,SMD,METAL FILM,1/10W,3.32K,1%,S0805
R55, R125	2	S25000-1821SMT	RESISTOR,SMD,METAL FILM,1/10W,1.82K,1%,S0805
R57, R97	2	S25000-10R0SMT	RESISTOR,SMD,METAL FILM,1/10W,10.0OHMS,1%,S0805
R73, R74, R150	3	S25000-1003SMT	RESISTOR,SMD,METAL FILM,1/10W,100K,1%,S0805
R86	1	S25000-3162SMT	RESISTOR,SMD,METAL FILM,1/10W,31.6K,1%,S0805
R94, R118	2	S25000-7501SMT	RESISTOR,SMD,METAL FILM,1/10W,7.50K,1%,S0805
R95, R117	2	S25000-2671SMT	RESISTOR,SMD,METAL FILM,1/10W,2.67K,1%,S0805
R96	1	S25084-2SMT	THERMISTOR,SMD,PTC,0.35,1.4OHMS,2.0A
R98, R99	2	S25001-1210SMT	RESISTOR,SMD,1210HMS,1/4W,1206,1%,TR
R108, R122	2	S25000-9091SMT	RESISTOR,SMD,METAL FILM,1/10W,9.09K,1%,S0805
R114, R115	2	S25000-2000SMT	RESISTOR,SMD,METAL FILM,1/10W,200OHMS,1%,S0805
R119, R129	2	S25000-1822SMT	RESISTOR,SMD,METAL FILM,1/10W,18.2K,1%,S0805
R149, R159	2	T10812-41	TRIMMER,ST,1/2W,10K, 10%,LINEAR
R156	1	S25000-1652SMT	RESISTOR,SMD,METAL FILM,1/10W,16.5K,1%,S0805
	1	S19869-8	SWITCH,DIP,SPST,8-CIRCUITS????SET_SWITCH_POSITIONS????
	1	S15128-11SMT	IC,SMD,COMPARATOR,QUAD,2901D
X6, X11	3	S15128-28SMT	IC,OP-AMP,SMT,QUAD,HIGH-PERF,33074ADT
	1	S25067-1SMT	IC,BIPOLAR,TIMER,SOIC-14
X3, X13	2	S15128-4SMT	OP-AMP,SMD,QUAD, GEN-PURPOSE,224D
X9, X12	2	S15018-6SMT	IC,SMD,CMOS,SWITCH,ANALOG,QUAD, 4066BD(SS)
10	1	S25057-2SMT	POT,SMD,DIGITAL,10K,1-CHNL,SOIC-8
4	1	S25073-12SMT	IC,SMD,CMOS,PSOC,8-BIT,CY8C27643,TFN49(SS)
5, X16	2	S25065-3SMT	IC,SMD,CMOS,INVERTER,SCHMITT,HEX,VHC14(SS)

N.D.

N.A.

NOTES:
N.A. **CAUTION:** THIS DEVICE IS SUBJECT TO DAMAGE BY STATIC ELECTRICITY. SEE E2454 BEFORE HANDLING.
N.B. PROGRAM **X14** WITH **ITEM 2** AND LABEL X14 WITH PART NUMBER OF **ITEM 2.**
N.C. APPLY **ITEM 3** TO COMPONENT SIDE OF BOARD AS SHOWN.
N.D. DO NOT COAT WITH ENCAPSULATION MATERIAL.
N.E. KEEP MOUNTING HOLES FREE OF ENCAPSULATION MATERIAL. (5 PLACES)
N.F. KEEP TOP SURFACE OF TRIMMERS FREE OF ENCAPSULATION MATERIAL. (2 PLACES)
N.G. KEEP TOP SURFACE OF DIP SWITCH FREE OF ENCAPSULATION MATERIAL.
N.H. APPLY **ITEM 3** AROUND BASE OF J2 & J3 ON BACK SIDE OF BOARD, LIMIT HEIGHT TO .125 +0/-.0625 INCHES.
N.J. APPLY **ITEM 3** TO CONNECTOR'S PLASTIC MOUNTING PINS.

REVISION CONTROL

G4761-1A0

PART NO. IDENTIFICATION CODE
TEST PER E4298-AC
COAT WITH E1844 AND E3668
SCHEMATIC REFERENCE: G4760-1A0

MAKE DETAIL
MANUFACTURE PER E1911
BUY BLANK COMPLETE
(6 BOARDS PER PANEL)

4 LAYER BOARD BLANK PANEL
SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION.

UNLESS OTHERWISE SPECIFIED:
CAPACITANCE = MFD/VOLTS
INDUCTANCE = HENRIES
RESISTANCE = OHMS

ALL COMPONENTS AND MATERIALS USED IN THIS ASSEMBLY ARE TO BE RoHS COMPLIANT PER E4253

UNLESS OTHERWISE SPECIFIED TOLERANCE MANUFACTURING TOLERANCE PER E2056
ON 2 PLACE DECIMALS IS ± .02
ON 3 PLACE DECIMALS IS ± .002
ON ALL ANGLES IS ± 3.0° A DEGREE
MATERIAL TOLERANCE (1") TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE: G4040	EQUIPMENT TYPE: INDUSTRIAL TIG		PAGE 1 OF 1	
DRAWN BY: Jbarto	SCALE: 1:1	SUBJECT: ADVANCED CONTROL PC BOARD ASSEMBLY		DOCUMENT NUMBER: G4761-1	DOCUMENT REVISION: A
ENGINEER: T Nguyen		MATERIAL DISPOSITION: NA	APPROVAL DATE: 3/5/2007	PROJECT NUMBER: CRM38259	
APPROVED: -					

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.