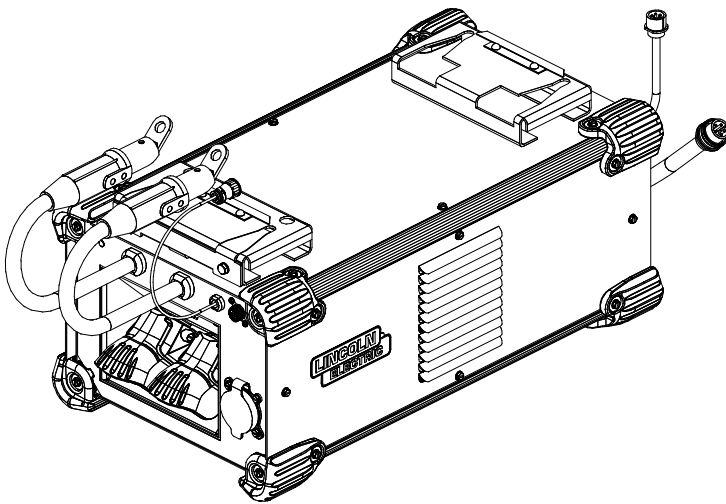


Operator's Manual

POWER WAVE[®] ADVANCED MODULE & ADVANCED MODULE ALUMINUM



For use with machines having Code Numbers:

11935, 12334*, 12376, 12474



Register your machine:

www.lincolnelectric.com/register

Authorized Service and Distributor Locator:

www.lincolnelectric.com/locator

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

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



THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

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

SAFETY DEPENDS ON YOU

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

WARNING

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

CAUTION

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



KEEP YOUR HEAD OUT OF THE FUMES.

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

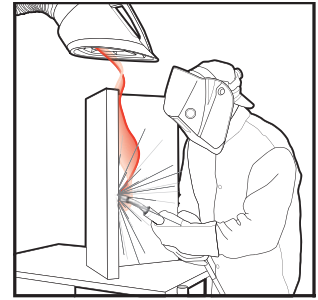
READ and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

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

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

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

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



WEAR CORRECT EYE, EAR & BODY PROTECTION

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

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

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

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

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



SPECIAL SITUATIONS

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

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

Additional precautionary measures

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

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

REMOVE all potential fire hazards from welding area.

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



SECTION A: WARNINGS



CALIFORNIA PROPOSITION 65 WARNINGS



WARNING: Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects, or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an exposed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to www.P65warnings.ca.gov/diesel

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code § 25249.5 *et seq.*)



WARNING: Cancer and Reproductive Harm
www.P65warnings.ca.gov

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 Z87.1 standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



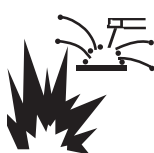
FUMES AND GASES CAN BE DANGEROUS.



- 5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also be required. Additional precautions are also required when welding on galvanized steel.**
- 5.b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.
- 5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
- 5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 5.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS forms are available from your welding distributor or from the manufacturer.
- 5.f. Also see item 1.b.




WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



- 6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.i. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 022690-9101.
- 6.j. Do not use a welding power source for pipe thawing.



CYLINDER MAY EXPLODE IF DAMAGED.

- 7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition. 
- 7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.
- 7.c. Cylinders should be located:
 - Away from areas where they may be struck or subjected to physical damage.
 - A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- 7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.
- 7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- 7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- 7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-1, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.



FOR ELECTRICALLY POWERED EQUIPMENT.



- 8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.
- 8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.
- 8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

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

Installation	Section A
Technical Specifications.....	A-1
Safety Precautions.....	A-2
Electromagnetic Compatibility.....	A-2
Location and Mounting	A-2
Machine Grounding and High Frequency Interference Protection	A-3
Control Cable Connection.....	A-4
Connection between Power Source and Advance Module.....	A-4
ArcLink Pigtail	A-4
Voltage Sense Pigtail	A-4
Electrode and Work Connections.....	A-5
Output Cable Guide Lines.....	A-6
Cable Inductance and its Effects on Welding	A-6
Remote Sense lead Connections.....	A-7, A-8
Connection Diagrams System and Connection Diagrams CE System.....	A-9 thru A-23
<hr/>	
Operation	Section B
Safety Precautions.....	B-1
General Description.....	B-1
Power-Up Sequence	B-1
Duty Cycle	B-1
Common Welding Procedures	B-1
Special Information Regarding AC-Welding	B-2
Recommended Processes and Limitations	B-2
Equipment Limitations	B-3
Common Equipment Packages	B-3
Case Front Descriptions	B-4
Case Back Descriptions	B-5
<hr/>	
Maintenance	Section D
Safety Precautions.....	D-1
Routine Maintenance and Calibration Specification	D-1
<hr/>	
Troubleshooting	Section E
How to Use Troubleshooting Guide	E-1
Advanced Module Functional Test	E-2
Test Procedure Part 1 of 2 (STT Test Short Circuit).....	E-3
Test Procedure Step 2 (STT Test Open Circuit)	E-3
Using the Status LED to Troubleshoot System Problems.....	E-5
Error Codes for the Advanced Module	E-6
Troubleshooting Guide	E-7, E-8
<hr/>	
Wiring Diagram and Dimension Print	Section F
<hr/>	
Parts List	parts.lincolnelectric.com

Content/details may be changed or updated without notice. For most current Instruction Manuals, go to parts.lincolnelectric.com.

**TECHNICAL SPECIFICATIONS - POWER WAVE® Advanced Module (K2912-1)
& Advanced Module AL (K4192-1*)**

Advance Module - Input Voltage and Current		
Voltage	Input Amperes	Notes
40Vdc	3.0	
Advance Module - *Output Current Capacity		
Duty Cycle	Amperes	Notes
100%	300	600A Peak (Max.)
40%	350	

* Defines capability of the output switch. The actual output current is supplied by host power source.

PHYSICAL DIMENSIONS			
HEIGHT	WIDTH	DEPTH	WEIGHT
11.5 in. (29.2 cm)	13.94 in. (35.4 cm)	24.8 in. (62.99 cm)	70 lbs. (32.0 kg.)
TEMPERATURE RANGES			
OPERATING TEMPERATURE RANGE Environmentally Hardened: -4°F to 104°F (-20°C to 40°C)			
STORAGE TEMPERATURE RANGE Environmentally Hardened: -40°F to 185°F (-40°C to 85°C)			

IP23

*Aluminum Model

SAFETY PRECAUTIONS Read this entire installation section before you start installation.

⚠ WARNING

ELECTRIC SHOCK can kill.



- Turn off the power source at the disconnect switch before connecting or working inside of the equipment.
- Only a qualified electrician should install and connect the Advanced Module.

ELECTROMAGNETIC COMPATIBILITY (EMC)

The EMC classification of the Power Wave® Advanced Module is Industrial, Scientific and Medical (ISM) group 2, class A. The Power Wave® Advanced Module is for industrial use only. (See print L10093 for further details).

Locate the Advanced Module away from radio controlled machinery. The normal operation of the Advanced Module may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

LOCATION AND MOUNTING

(See Figures A.1 and A.2)

Mount the Advanced Module directly to the bottom of a compatible Power Wave® “S” series power source utilizing the quick lock mechanism as shown. The total stack height of a system including the Power Wave Advanced module shall not exceed one power source and two modules. For example, from top to bottom: power source, Advanced Module and optional cooler. The Advanced Module will operate in harsh environments and can be used outdoors. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

- The machine must be located where there is free circulation of clean air such that movement into and out of the louvers will not be restricted.
- Dirt and dust that can be drawn into the machine should be kept to a minimum. The use of air filters on the air intake is not recommended because normal air flow may be restricted. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.
- Keep the machine dry. Shelter from rain and snow. Do not place on wet ground or in puddles.
- Do not mount the Power Wave® “S” series power source and Advanced Module combination over combustible surfaces. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .060” (1.6mm) thick, which shall extend not less than 5.90” (150mm) beyond the equipment on all sides.

FIGURE A.1

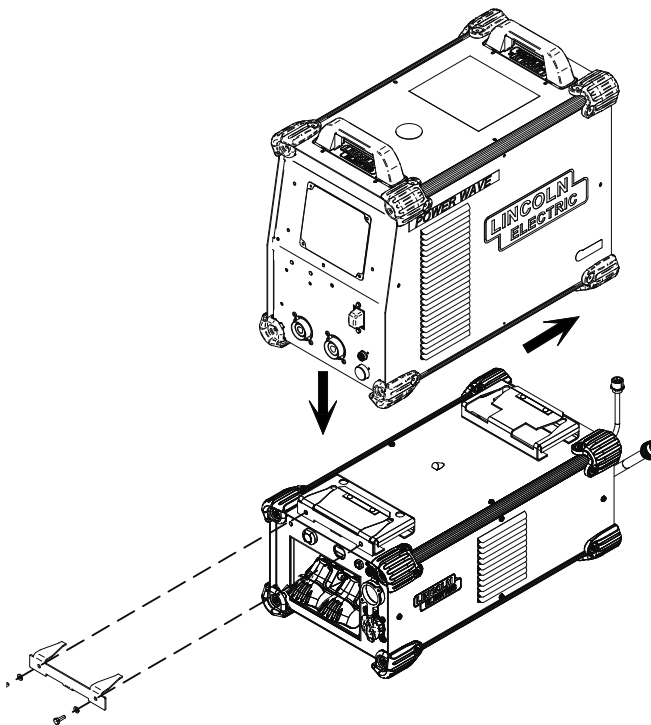
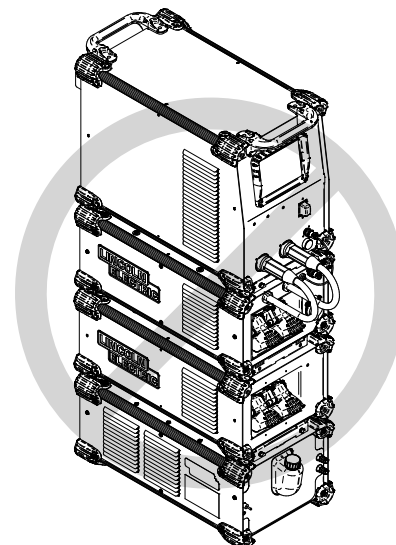


FIGURE A.2



STACK HEIGHT
NOT TO EXCEED
ONE POWER SOURCE
AND TWO MODULES

MACHINE GROUNDING AND HIGH FREQUENCY INTERFERENCE PROTECTION

The host power source must be earth grounded! See your local and national electrical codes for proper grounding methods.

The Advanced Module utilizes a high frequency impulse to initiate the arc of selected GTAW (TIG) welding procedures. Although the power of this impulse is significantly less than traditional arc stabilization circuits, it is best to locate the power source and Advanced Module away from radio controlled machinery as it may adversely affect the operation of the RF controlled equipment, which may result in bodily injury or damage to the equipment.

The high frequency starting impulse may also cause radio, TV and electronic equipment interference problems. These problems may be the result of radiated interference. Proper grounding methods can reduce or eliminate radiated interference.

Radiated interference can develop in the following four ways:

1. Direct interference radiated from the welder.
2. Direct interference radiated from the welding leads.
3. Direct interference radiated from feedback into the power lines.
4. Interference from re-radiation of "pickup" by ungrounded metallic objects.

Keeping these contributing factors in mind, installing equipment per the following instructions should minimize problems.

1. Keep the welder power supply lines as short as possible and enclose as much of them as possible in rigid metallic conduit or equivalent shielding for a distance of 50 feet (15.2m). There should be good electrical contact between this conduit and the welder case ground. Both ends of the conduit should be connected to a driven ground and the entire length should be continuous.
2. Keep the work and electrode leads as short as possible and as close together as possible. Lengths should not exceed 25 ft (7.6m). Tape the leads together when practical.
3. Be sure the torch and work cable rubber coverings are free of cuts and cracks that allow high frequency leakage.
4. Keep the torch in good repair and all connections tight to reduce high frequency leakage.

5. The work piece must be connected to an earth ground close to the work clamp, using one of the following methods:
 - A metal underground water pipe in direct contact with the earth for ten feet or more.
 - A 3/4" (19mm) galvanized pipe or a 5/8" (16mm) solid galvanized iron, steel or copper rod driven at least eight feet into the ground.

The ground should be securely made and the grounding cable should be as short as possible using cable of the same size as the work cable, or larger. Grounding to the building frame electrical conduit or along pipe system can result in re-radiation, effectively making these members radiating antennas.

6. Keep cover and all screws securely in place.
7. Electrical conductors within 50 ft (15.2m) of the welder should be enclosed in grounded rigid metallic conduit or equivalent shielding, wherever possible. Flexible metallic conduit is generally not suitable.
8. When the welder is enclosed in a metal building, the metal building should be connected to several good earth driven electrical grounds around the periphery of the building.

Failure to observe these recommended installation procedures can cause radio or TV and electronic equipment interference problems and result in unsatisfactory welding performance resulting from lost high frequency power.

CONTROL CABLE CONNECTIONS

General Guidelines

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

CAUTION

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

SPECIAL CONSIDERATIONS FOR HIGH FREQUENCY GTAW (TIG) WELDING

Although the equipment has been designed to withstand the high frequency starting impulse, special care should be taken to isolate this energy from the control signals of the welding system and other equipment. The following guidelines apply:

- Follow the recommendations in the *Machine Grounding and High Frequency Interference Protection* section of this document.
- Locate the control cables and adjacent equipment away from the weld cables and TIG torch.
- Consider optical isolation for critical applications via the Ethernet interface on the power source (such as ArcLink XT, Production Monitoring, etc.). Ethernet to fiber media converters are commercially available, and will significantly improve the electrical and magnetic interference immunity of these signals.

CONNECTION BETWEEN POWER SOURCE AND ADVANCED MODULE (ARCLINK®, VOLTAGE SENSE AND DIFFERENTIAL I/O PIGTAILS)

The pigtail connections on the Advanced Module include all signal and power lines required for proper operation. With the Advanced Module securely fastened to the power source, connect the pigtails to their respective receptacles on the back and front of the power source per the connection diagrams located in this document.

ARCLINK PIGTAIL (5 pin)

Provides power to the Advanced Module as well as a digital link for system information.

VOLTAGE SENSE PIGTAIL (4 pin)

Provides accurate voltage feedback to the power source from either the output studs of the module or remote sense lead locations based on the process.

DIFFERENTIAL I/O PIGTAIL (6 pin)

Provides high speed control signals for polarity and STT function.

SPECIAL INSTRUCTIONS

CE machines:

A special ArcLink® and Differential I/O receptacle kit is provided with the Advanced Module CE Kit (K3980-1) for installation into the host power source. Follow the instructions provided with the kit. (reference instruction sheet M22499)

Power Wave S350 (Code 11589)

Some earlier vintage S350 power sources may not include a 6 pin Differential I/O receptacle. If the receptacle is not present on the host power source, contact the Lincoln Electric Service Department to obtain an S350/STT Retrofit Kit (S28481).

CONNECTION BETWEEN ADVANCED MODULE AND ARCLINK® WIRE FEEDERS (K1543 OR K2683 ARCLINK® CONTROL CABLE)

The K2912-1 Advanced Module includes an ArcLink® output receptacle for connection to compatible wire feeders.

The control cable consists of two power leads, one twisted pair for digital communication, and one lead for electrode voltage sensing. The 5 pin ArcLink® receptacle is located on the lower rear portion of the Advanced Module. The control cable is keyed and polarized to prevent improper connection. Best results will be obtained when control cables are routed separate from the weld cables, especially in long distance applications. The recommended combined length of the ArcLink® control cable network should not exceed 200ft.

CE machines:

S350 and S500 CE Power Source have an ArcLink output receptacle located on the case front. The ArcLink wire feeder can be attached to either the receptacle on the power source case front or Advanced Module case back.

ELECTRODE AND WORK CONNECTIONS

Connect the positive and negative input connections and electrode and work output cables per the connection diagrams included in this document. Size and route the cables per **Table A.1**.

- Wire feeders should always be connected to the GMAW electrode stud.
- TIG (GTAW) torches and Stick (SMAW) holders should always be connected to the GTAW/SMAW electrode.
- The workpiece should always be connected to the work stud.
- The output polarity is automatically configured based on the selected weld mode. There is no need to reverse the output cables.

CAUTION

Never reverse the polarity at the input of the Advanced Module (DO NOT connect the negative stud of the power source to the positive input of the Advanced Module). Although this will not damage the Advanced Module, it will prevent welding output.

For additional Safety information regarding the electrode and work cable set-up, See the standard **“SAFETY INFORMATION”** located in the front of the Instruction Manuals.

FIGURE A.3

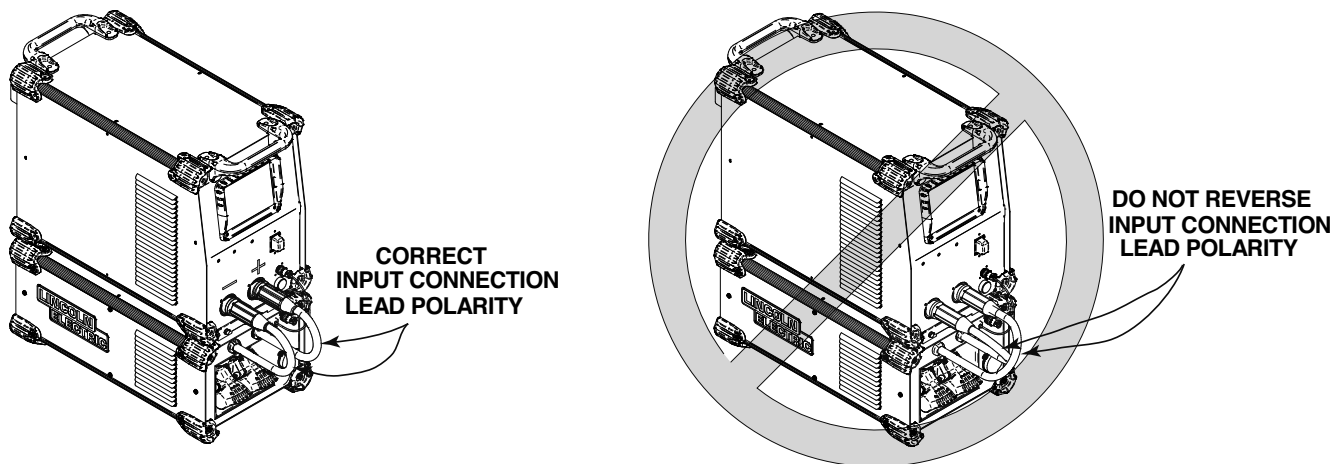


TABLE A.1

OUTPUT CABLE GUIDELINES						
Amperes	Percent Duty Cycle	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLES (RUBBER COVERED COPPER - RATED 75°C)**				
		0 to 50 Ft	50 to 100 Ft.	100 to 150 Ft.	150 to 200 Ft.	200 to 250 Ft.
200	60	2	2	2	1	1/0
200	100	2	2	2	1	1/0
225	20	4 or 5	3	2	1	1/0
225	40 & 30	3	3	2	1	1/0
250	30	3	3	2	1	1/0
250	40	2	2	1	1	1/0
250	60	1	1	1	1	1/0
250	100	1	1	1	1	1/0
300	60	1	1	1	1/0	2/0
325	100	2/0	2/0	2/0	2/0	3/0
350	60	1/0	1/0	2/0	2/0	3/0

** Tabled values are for operation at ambient temperatures of 40°C and below. Applications above 40°C may require cables larger than recommended, or cables rated higher than 75°C.

GENERAL GUIDELINES

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

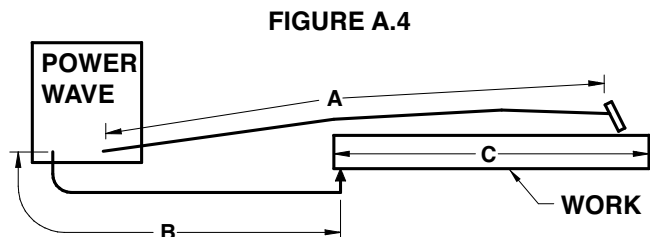
Note: Excessive heat in the weld circuit indicates undersized cables and/or bad connections.

- Route all cables directly to the work and wire feeder, avoid excessive lengths and do not coil excess cable. Route the electrode and work cables in close proximity to one another to minimize the loop area and therefore the inductance of the weld circuit.
- Always weld in a direction away from the work (ground) connection.

See **Table A.1** for copper cable sizes recommended for different currents and duty cycles. Lengths stipulated are the distance from the welder to work and back to the welder again. Cable sizes are increased for greater lengths primarily for the purpose of minimizing cable drop.

CABLE INDUCTANCE AND ITS EFFECTS ON WELDING

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (see **Figure A.4** below). To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and do not coil excess cable. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.



REMOTE SENSE LEAD CONNECTIONS

Voltage Sensing Overview

Certain welding processes require the use of remote voltage sense leads to more accurately monitor the conditions of the arc. These leads originate in the power source, and are connected and configured through the Advanced Module. Consult the connection diagrams included in this manual for detailed information.

Note:

Not all processes run through the Advanced Module require sense leads, but they may benefit from their use. Consult the power source instruction manual for recommendations.

WARNING

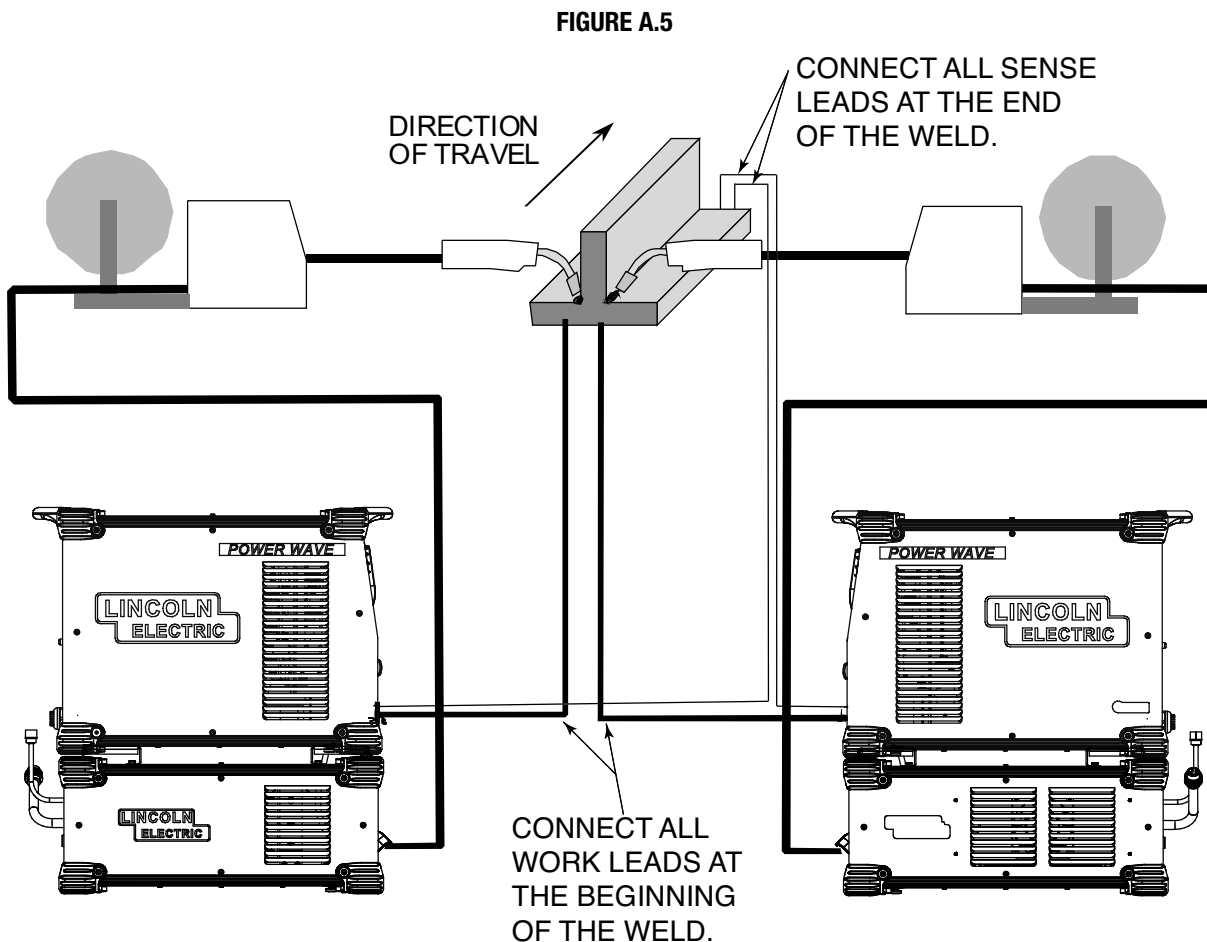
DO NOT connect the remote electrode sense (67) lead to the TIG (GTAW) output.

General Voltage Sensing Considerations for Multiple Arc Systems

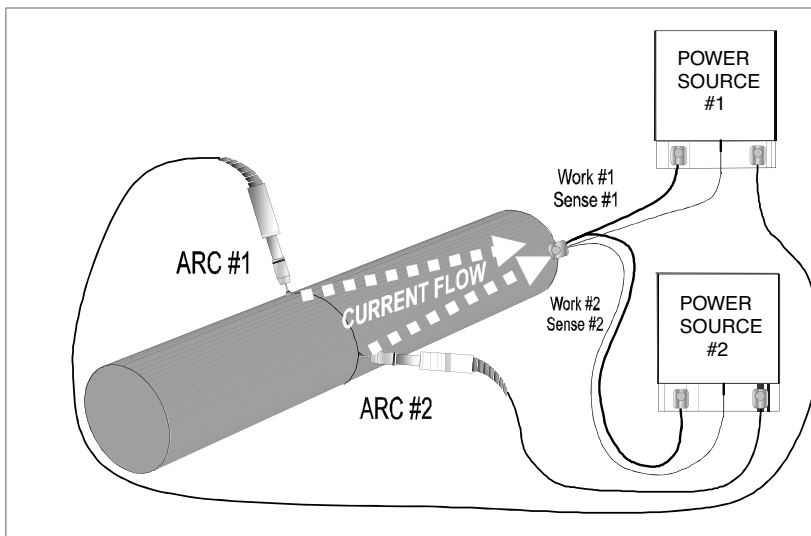
Special care must be taken when more than one arc is welding simultaneously on a single part. The placement and configuration of remote work voltage sense leads is critical to the proper operation of multiple arc AC and STT® applications.

RECOMMENDATIONS:

- **Position the sense leads out of the path of the weld current.** Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.
- **For longitudinal applications,** connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads. (See Figure A.5)

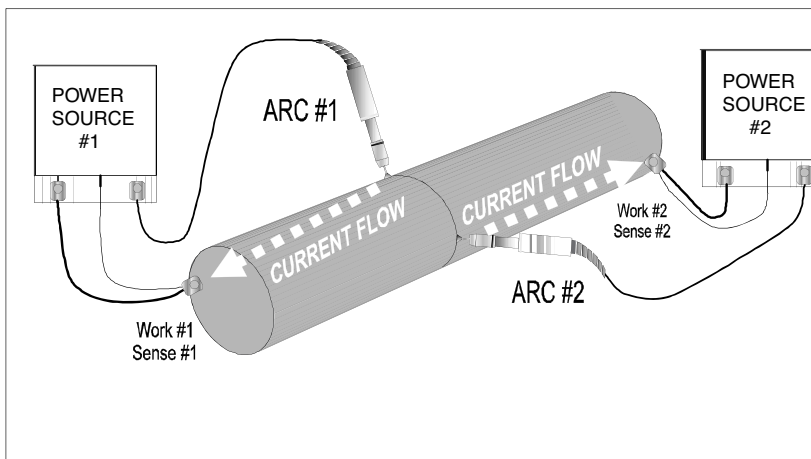


- For circumferential applications, connect all work leads on one side of the weld joint, and all of the work voltage sense leads on the opposite side, such that they are out of the current path.



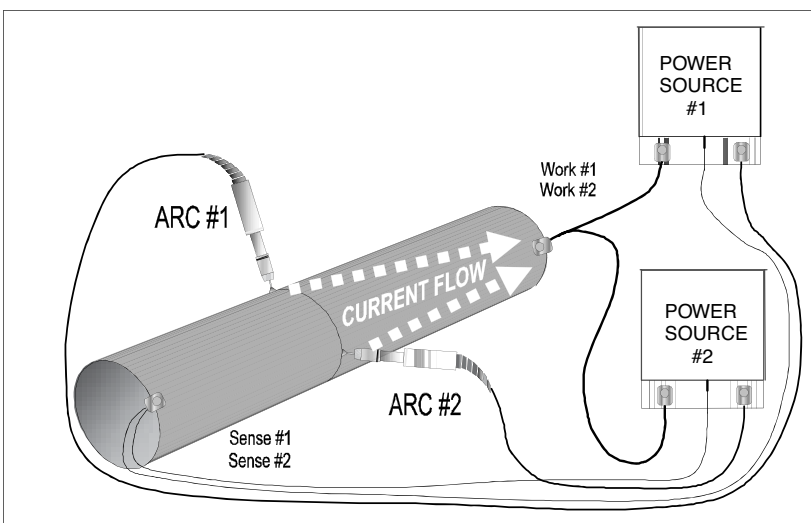
BAD

- CURRENT FLOW FROM ARC #1 AFFECTS SENSE LEAD #2
- CURRENT FLOW FROM ARC #2 AFFECTS SENSE LEAD #1
- NEITHER SENSE LEAD PICKS UP THE CORRECT WORK VOLTAGE, CAUSING STARTING AND WELDING ARC INSTABILITY



BETTER

- SENSE LEAD #1 IS ONLY AFFECTED BY CURRENT FLOW FROM ARC #1
- SENSE LEAD #2 IS ONLY AFFECTED BY CURRENT FLOW FROM ARC #2
- DUE TO VOLTAGE DROPS ACROSS THE WORKPIECE ARC VOLTAGE MAY BE LOW, CAUSING NEED FOR DEVIATION FROM STANDARD PROCEDURES

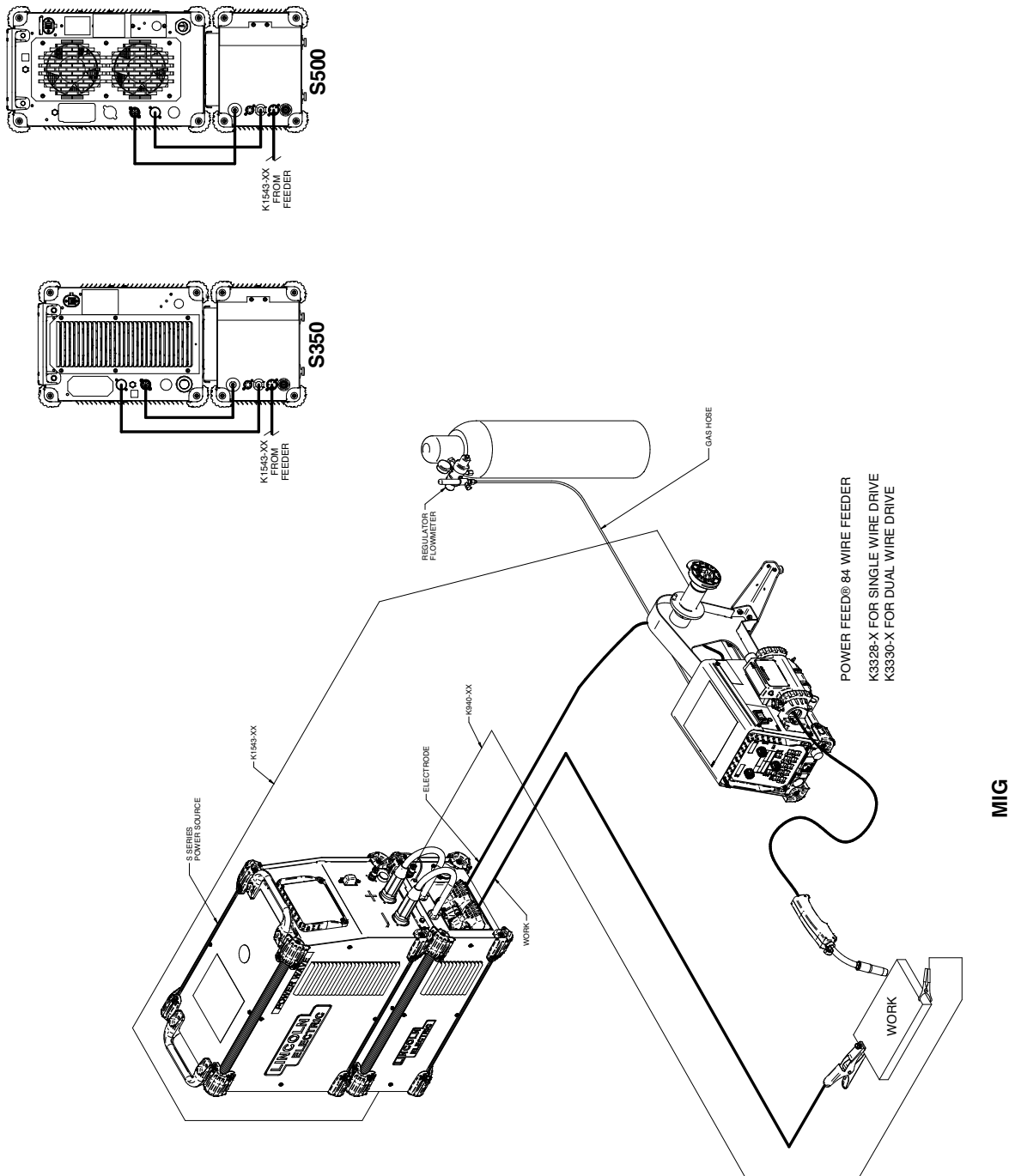


BEST

- BOTH SENSE LEADS ARE OUT OF THE CURRENT PATHS
- BOTH SENSE LEADS DETECT ARC VOLTAGE ACCURATELY
- NO VOLTAGE DROP BETWEEN ARC AND SENSE LEAD
- BEST STARTS, BEST ARCS, MOST RELIABLE RESULTS

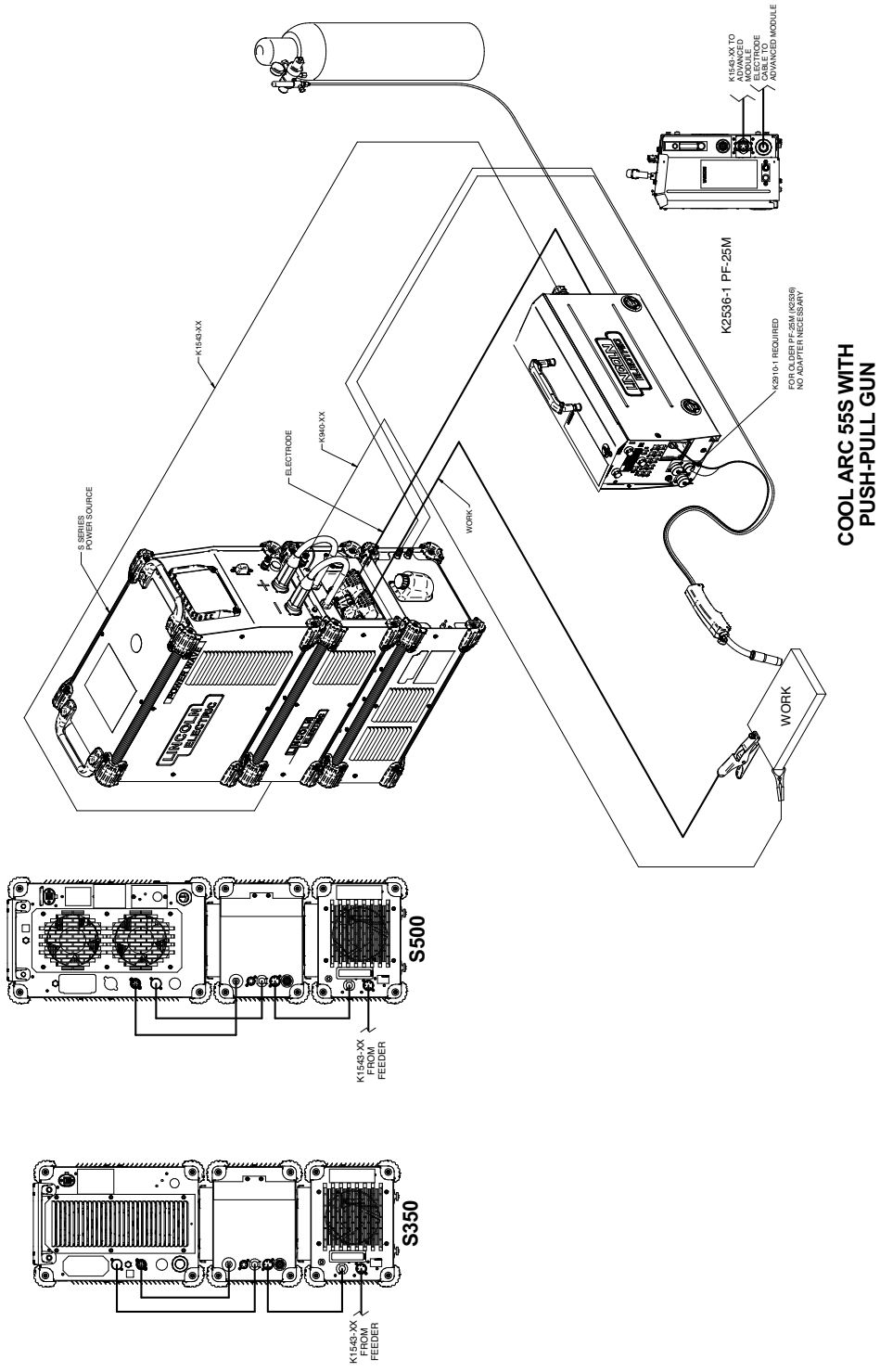
POWER WAVE® S350 OR S500 GMAW CONNECTION DIAGRAM

FIGURE A.6



POWER WAVE® S350 OR S500 COOL ARC 55S AND WATER COOLED PUSH-PULL GUN GMAW
 CONNECTION DIAGRAM

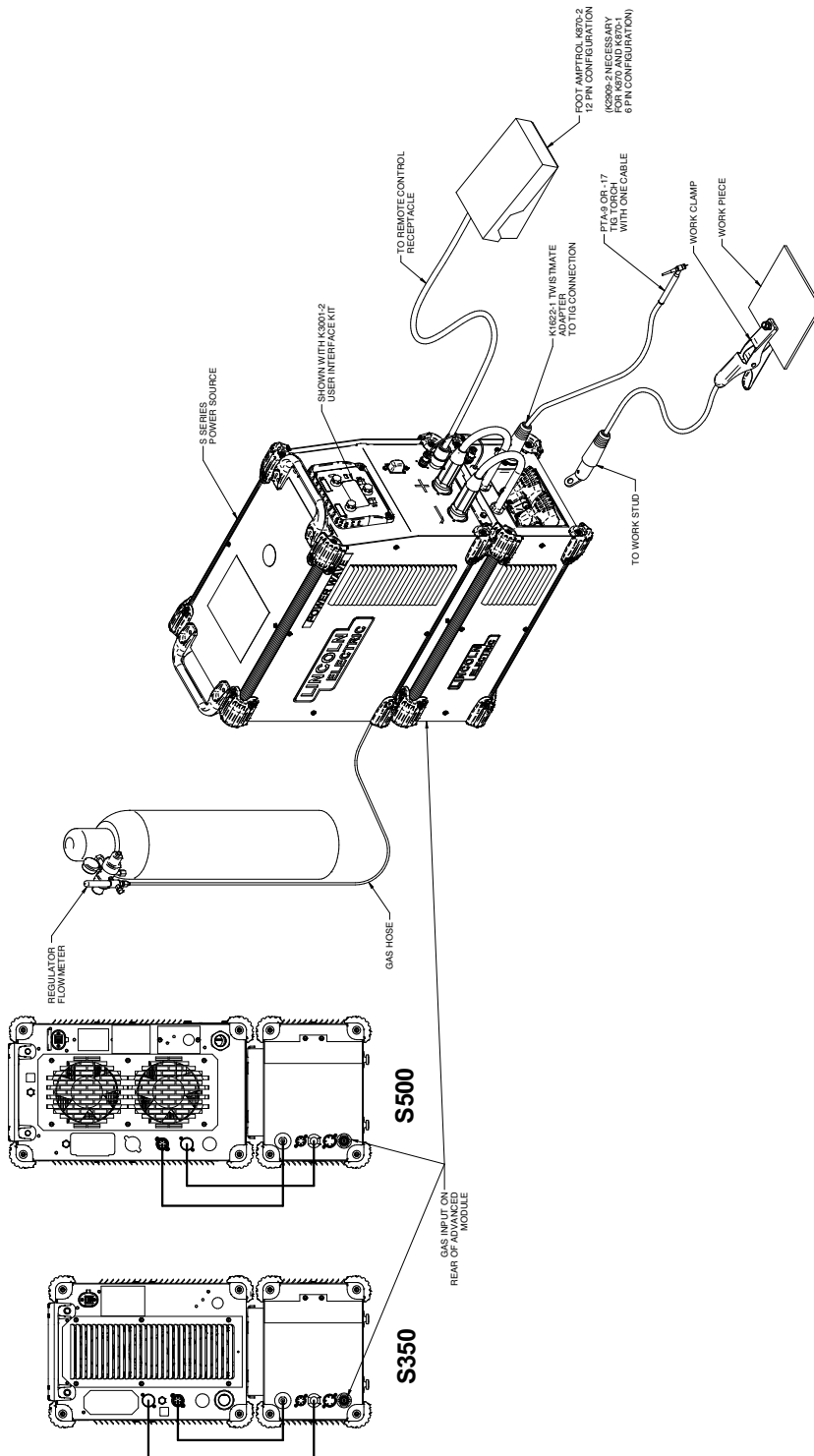
FIGURE A.7



COOL ARC 55S WITH
 PUSH-PULL GUN

POWER WAVE® S350 OR S500 WITH USER INTERFACE KIT GTAW CONNECTION DIAGRAM

FIGURE A.8

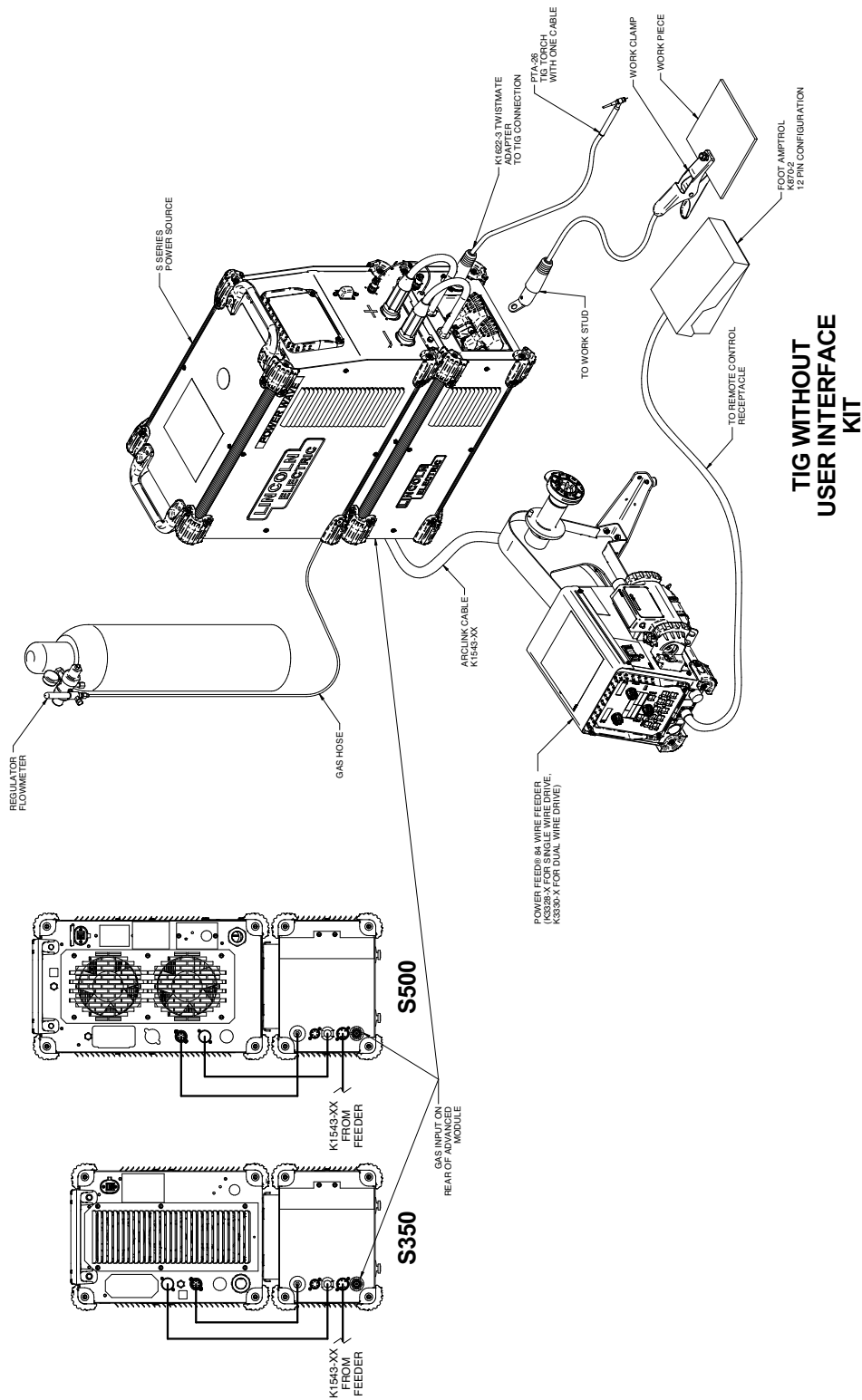


TIG WITH USER INTERFACE KIT

NOTE:
THE PTA-26 AND -17 TIG TORCHES WITH TWO CABLES CAN BE USED WITH K492-3 ADAPTER, BUT THEY WILL NOT PROVIDE HIGH FREQUENCY STARTING.

POWER WAVE® S350 OR S500 GTAW CONNECTION DIAGRAM

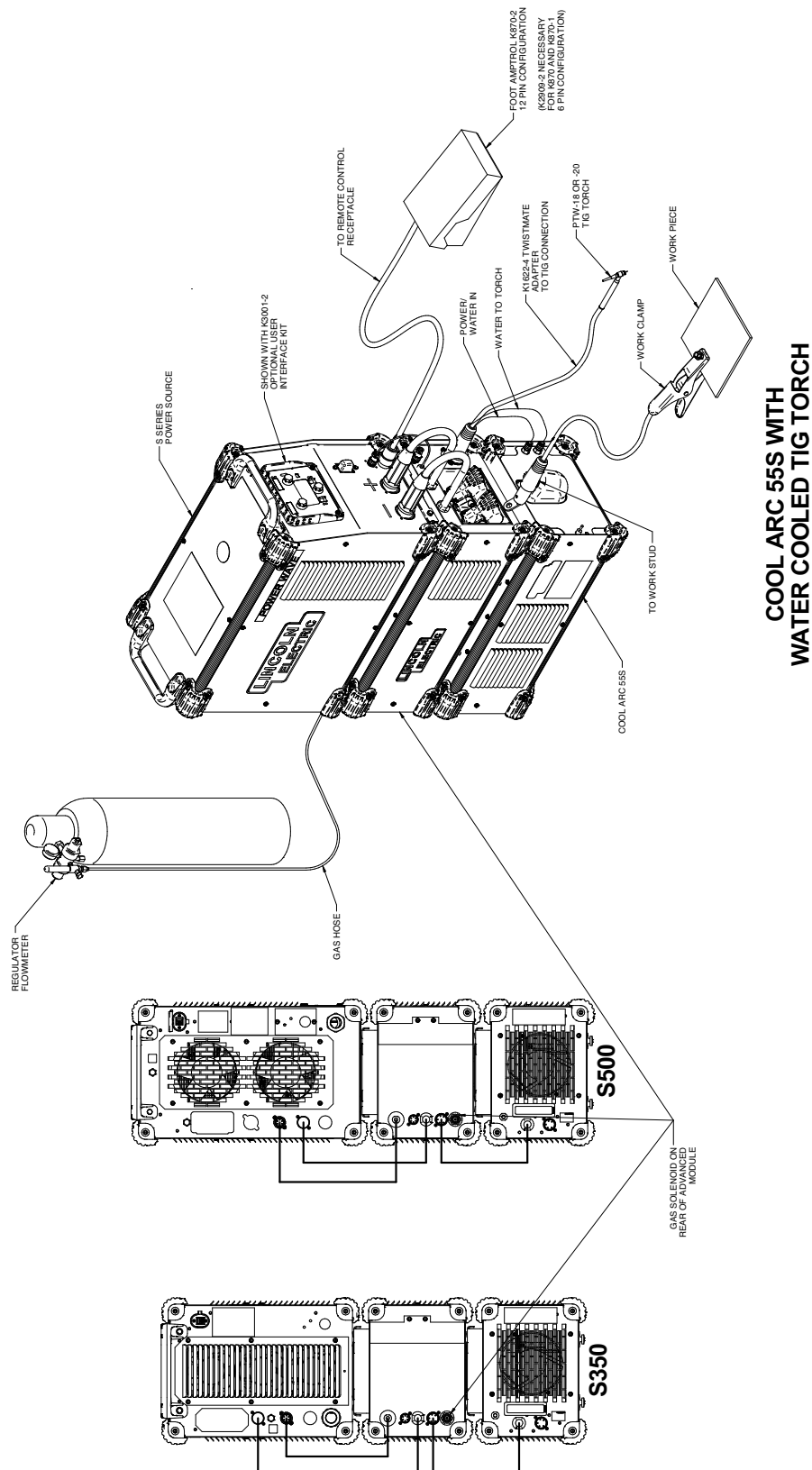
FIGURE A.9



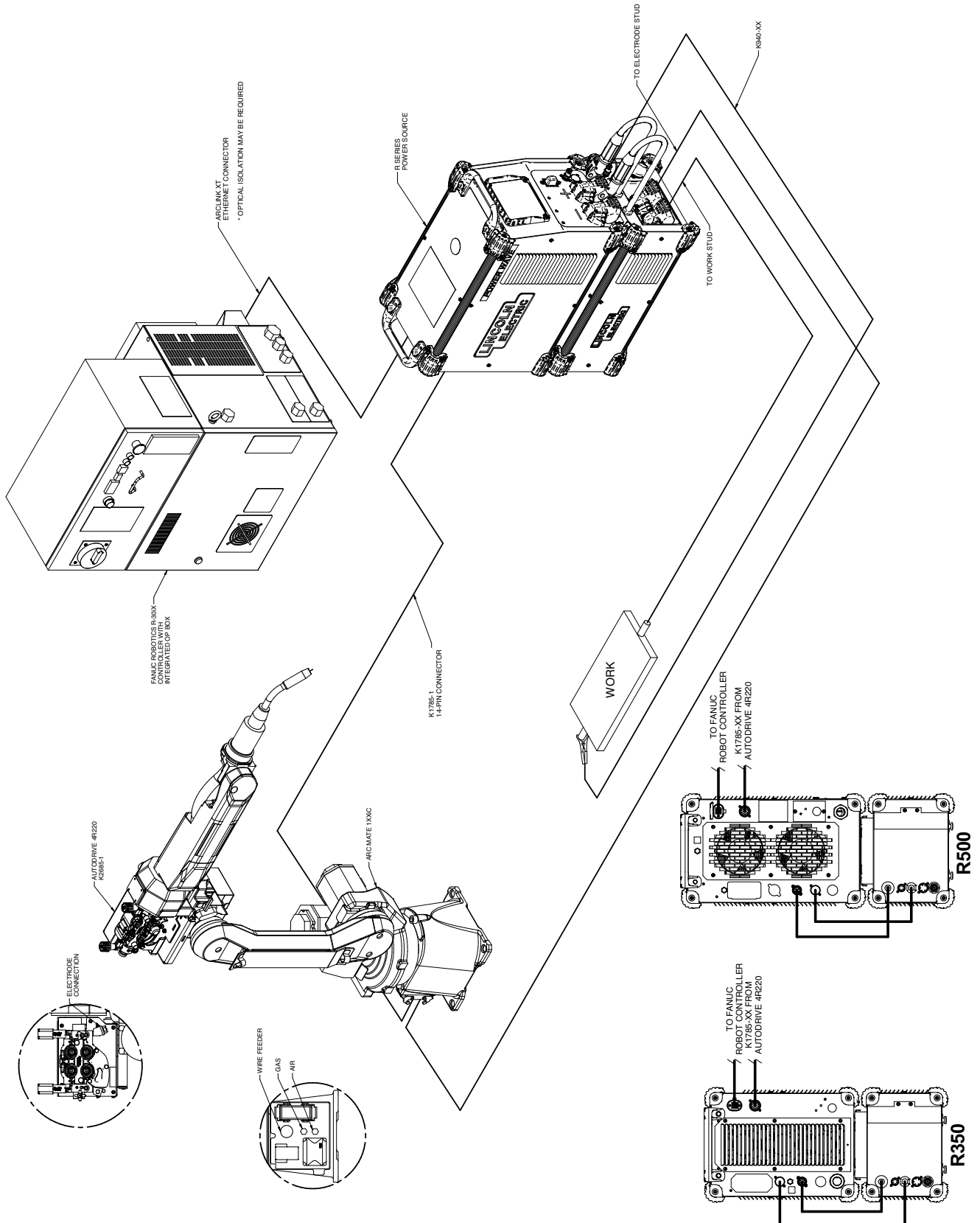
NOTE:
THE PTA-26 AND -17 TIG TORCHES WITH TWO CABLES CAN BE USED WITH K1622-3 ADAPTER, BUT THEY WILL NOT PROVIDE HIGH FREQUENCY STARTING.

POWER WAVE® S350 OR S500 WITH COOL ARC 55S AND WATER COOLED TORCH GTAW CONNECTION DIAGRAM

FIGURE A.10

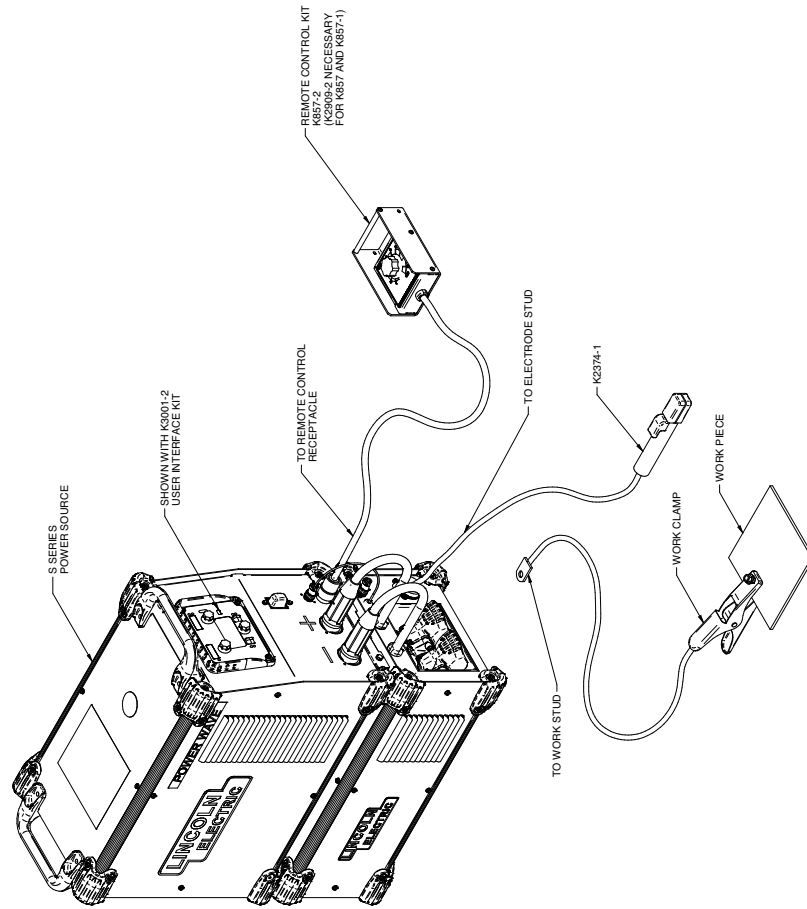


POWER WAVE® S350 OR S500 ROBOTIC CONNECTION DIAGRAM
FIGURE A.11

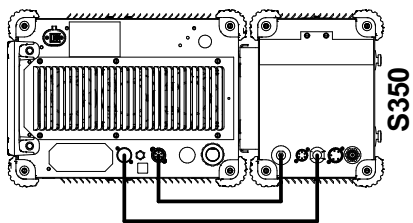
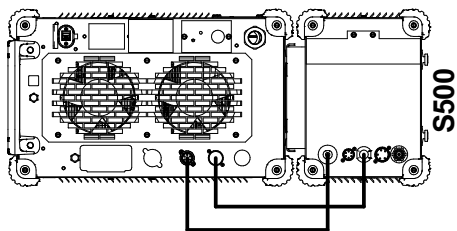


POWER WAVE® S350 OR S500 WITH USER INTERFACE KIT SMAW CONNECTION DIAGRAM

FIGURE A.12

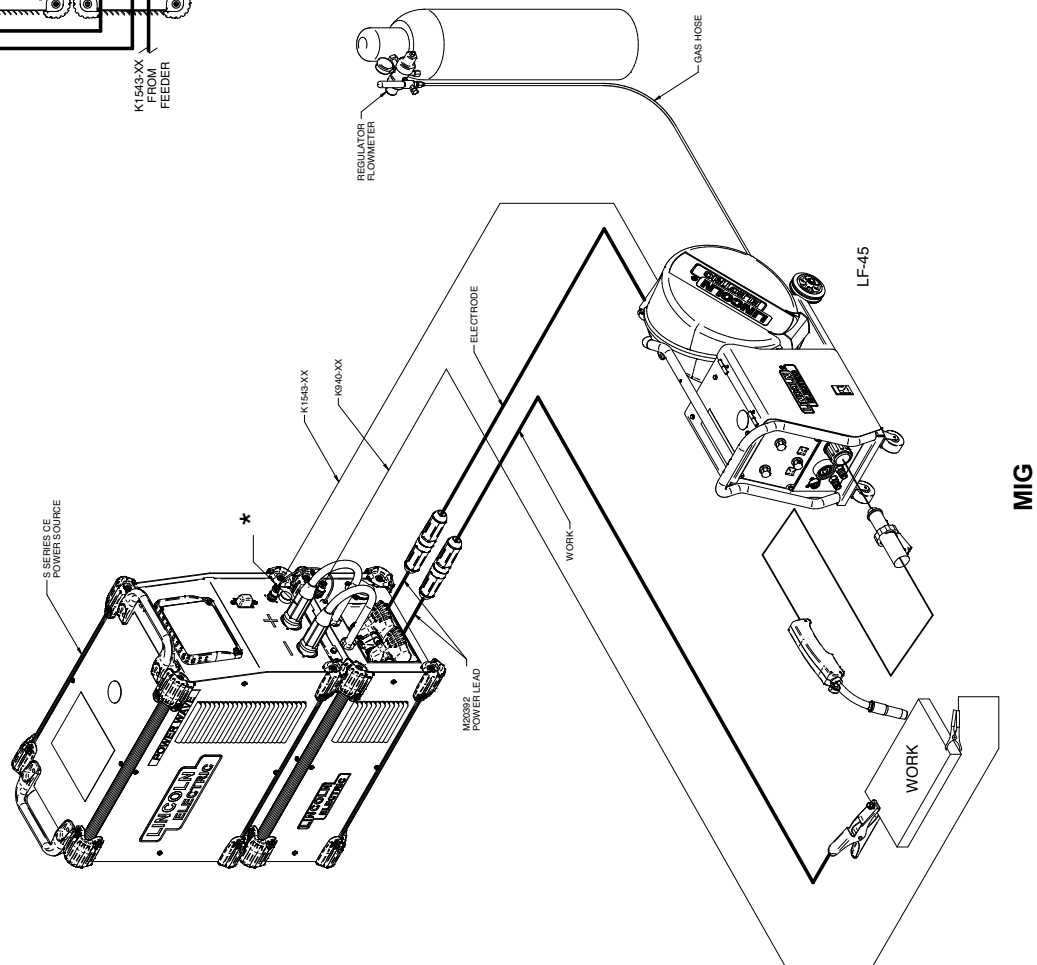
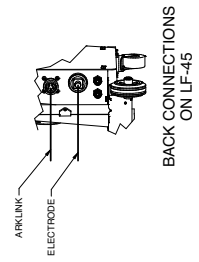
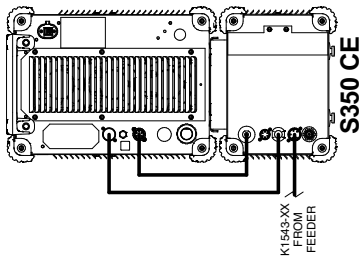
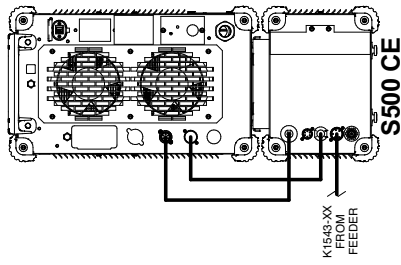


STICK

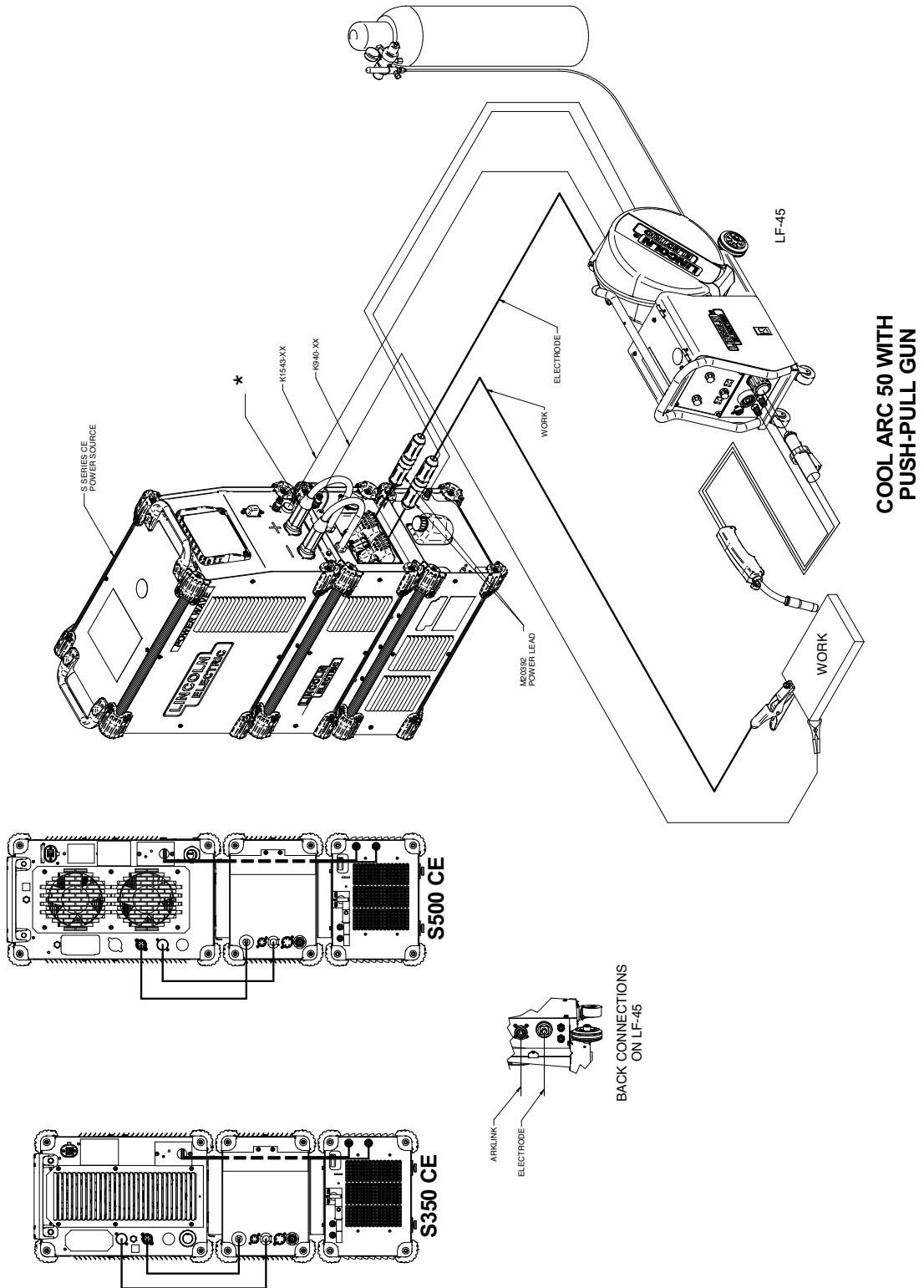


POWER WAVE® S350 CE OR S500 CE GMAW CONNECTION DIAGRAMS

FIGURE A.13

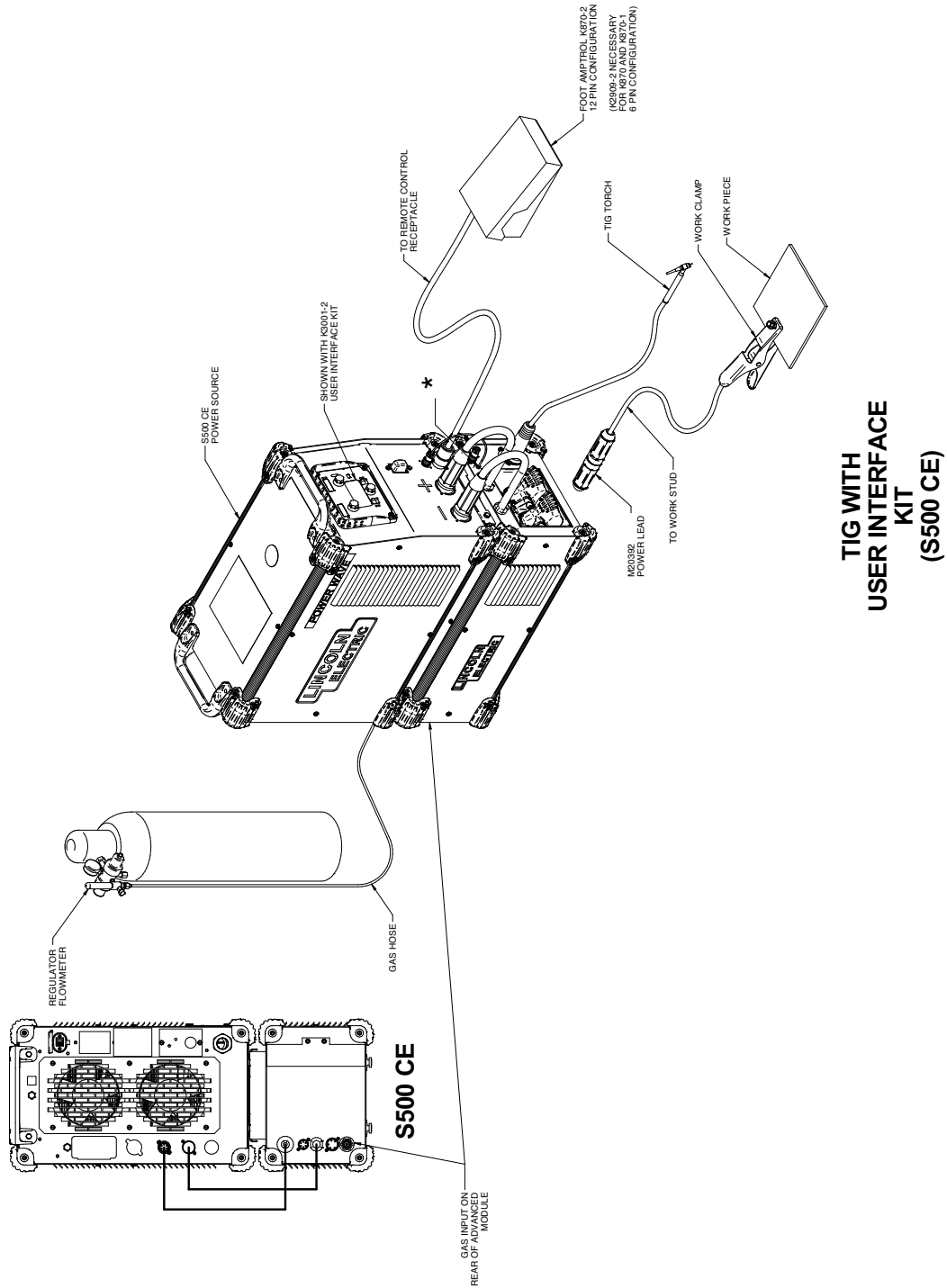


POWER WAVE® S350 CE OR S500 CE WITH COOL ARC 50 WATER COOLED PUSH-PULL GUN GMAW CONNECTION
DIAGRAM (FIGURE A.14)

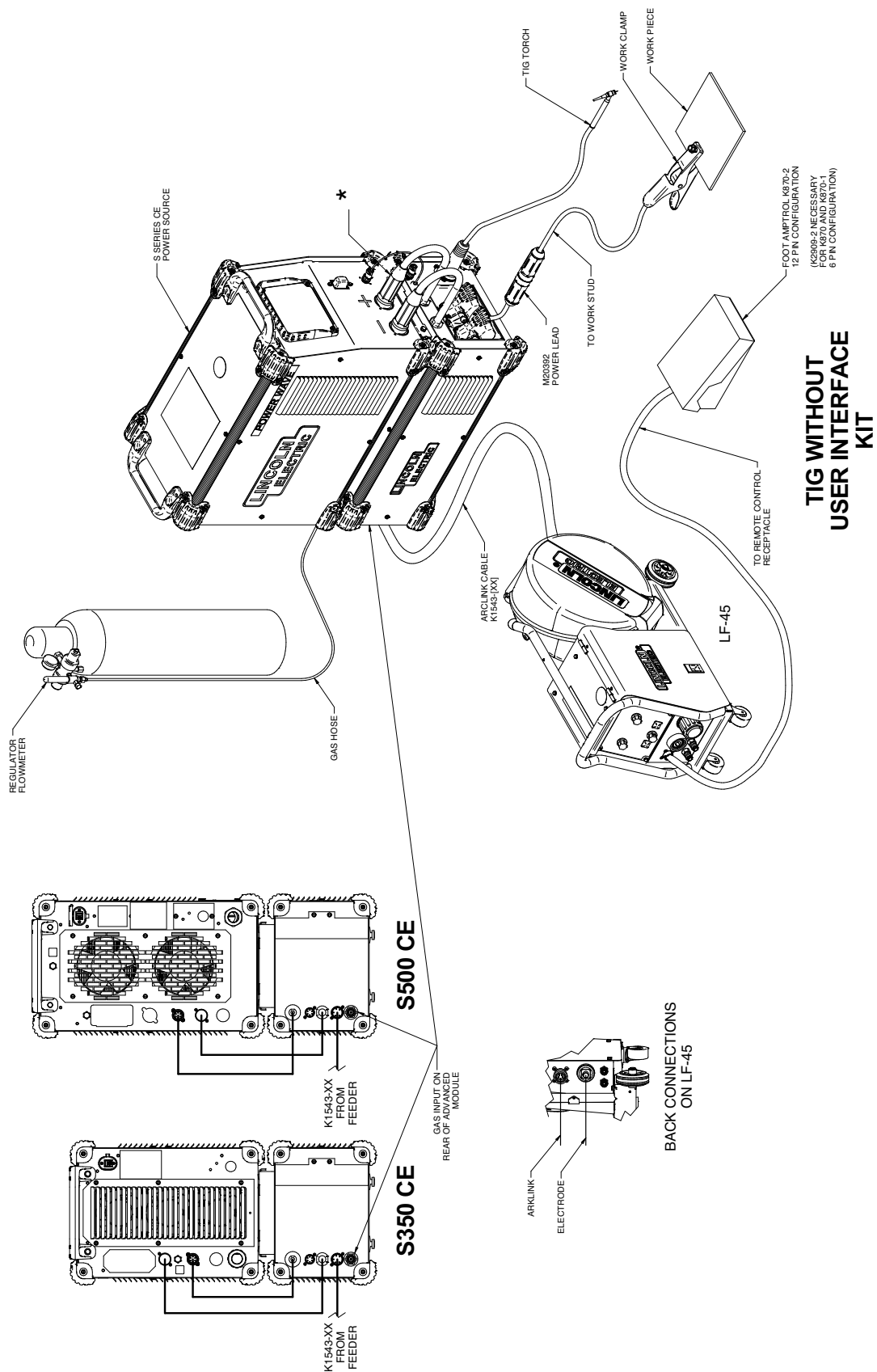


POWER WAVE® S500(Only) WITH USER INTERFACE GTAW CONNECTION DIAGRAM

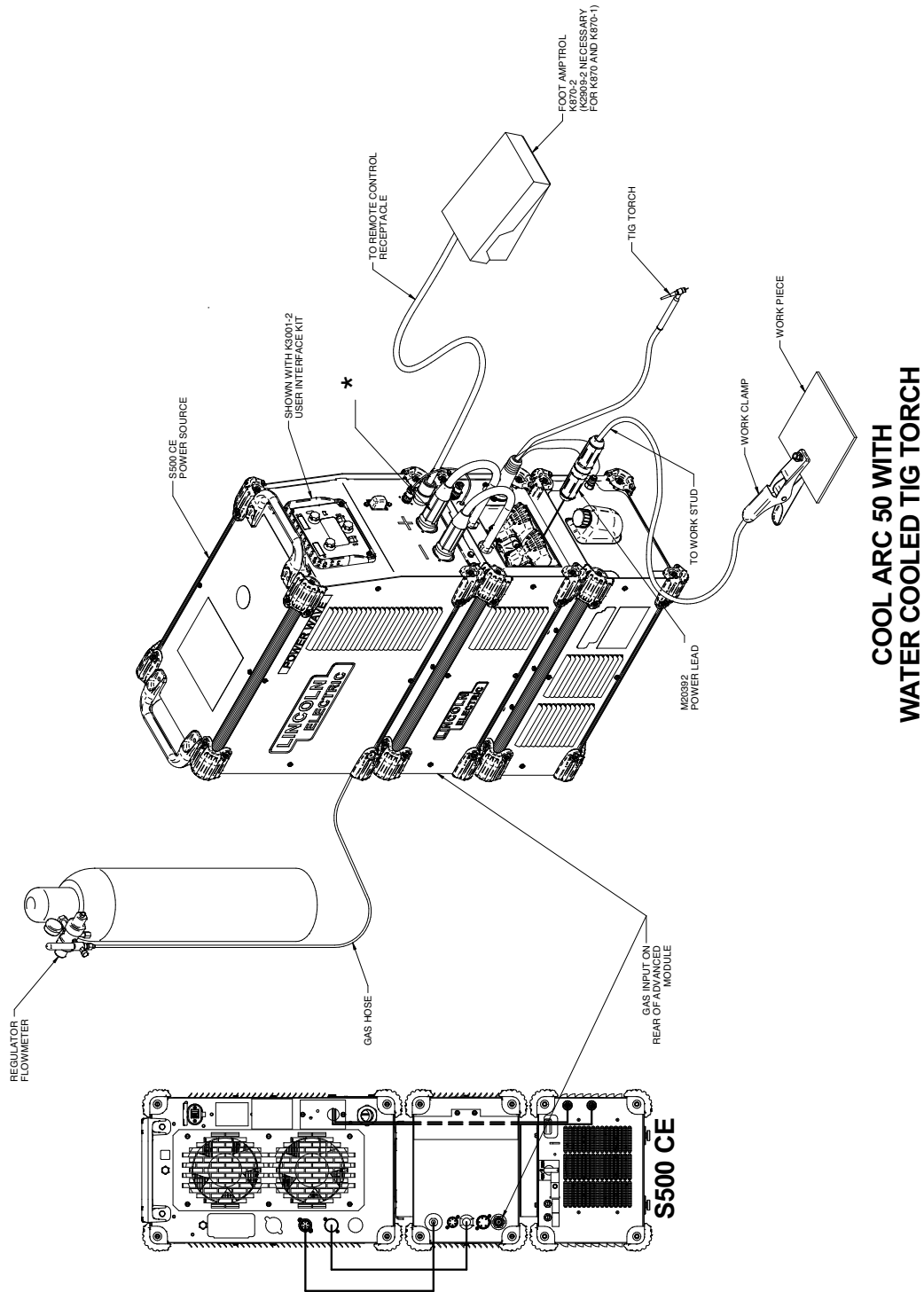
FIGURE A.15



POWER WAVE® S350 CE OR S500 CE GTAW CONNECTION DIAGRAM
FIGURE A.16



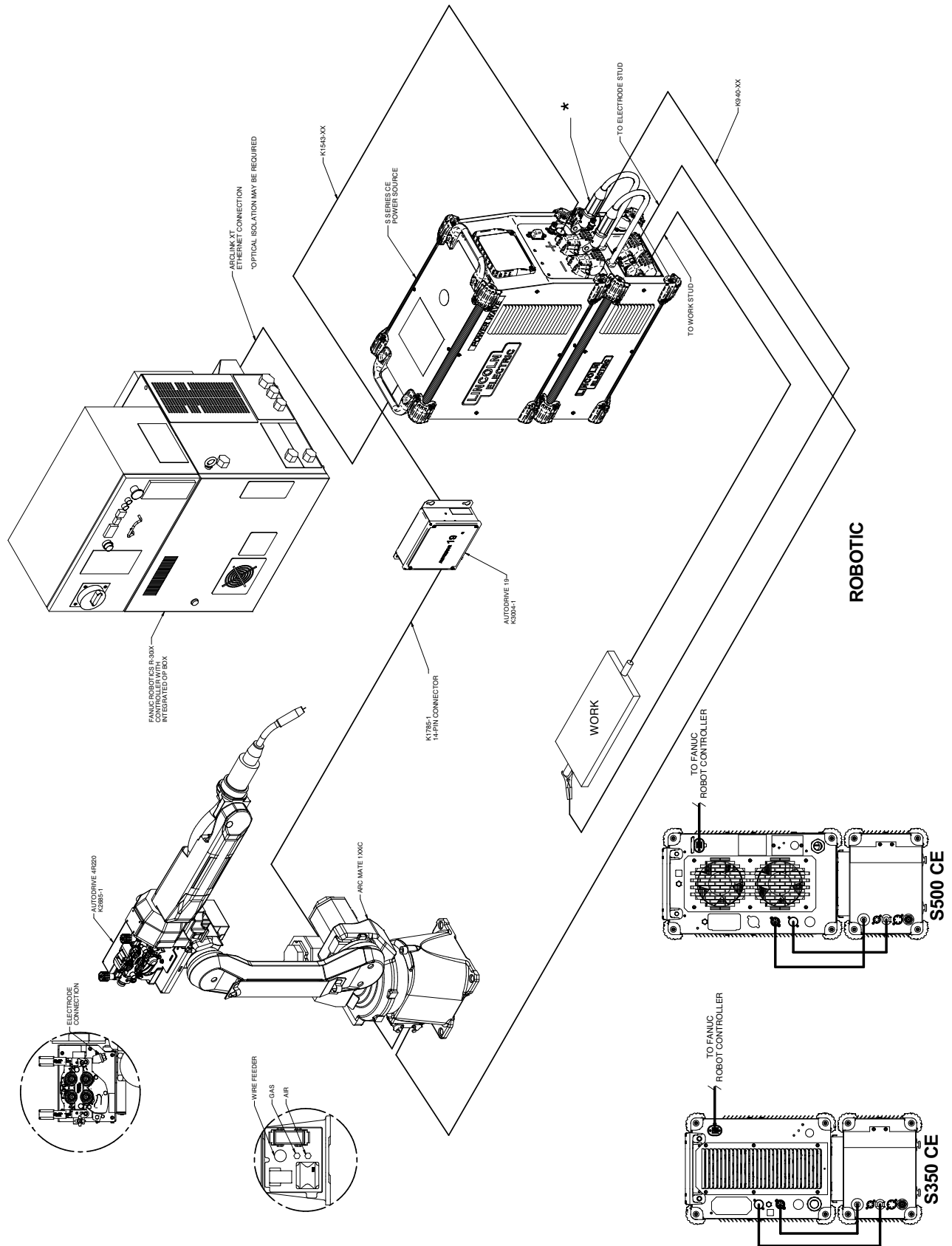
POWER WAVE® S500 CE (Only) WITH USER INTERFACE KIT COOL ARC 50 AND WATER COOLED TORCH GTAW
CONNECTION DIAGRAM (FIGURE A.17)



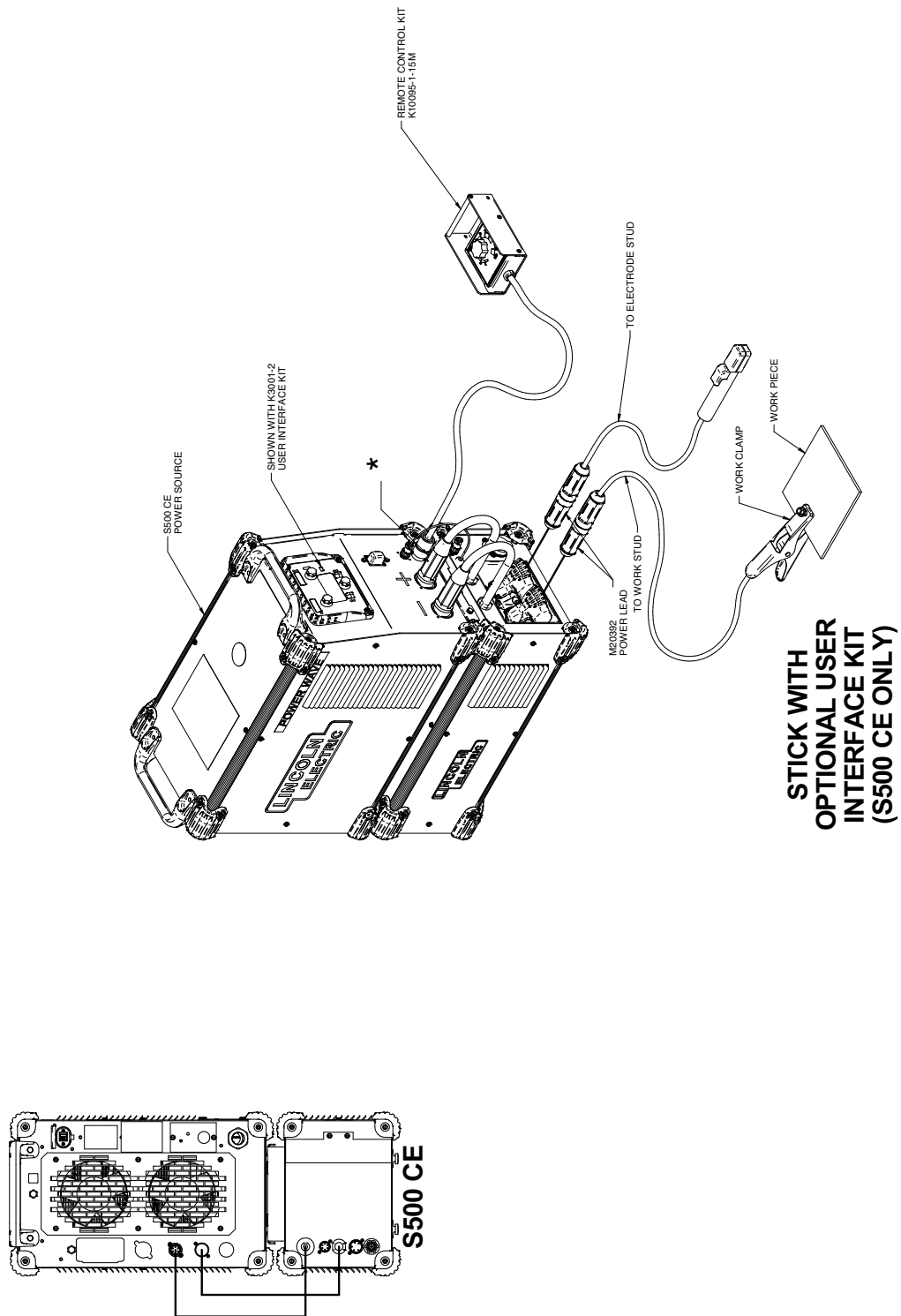
COOL ARC 50 WITH
WATER COOLED TIG TORCH

POWER WAVE® S350 CE OR S500 CE WITH AUTODRIVE 19 ROBOTIC CONNECTION DIAGRAM

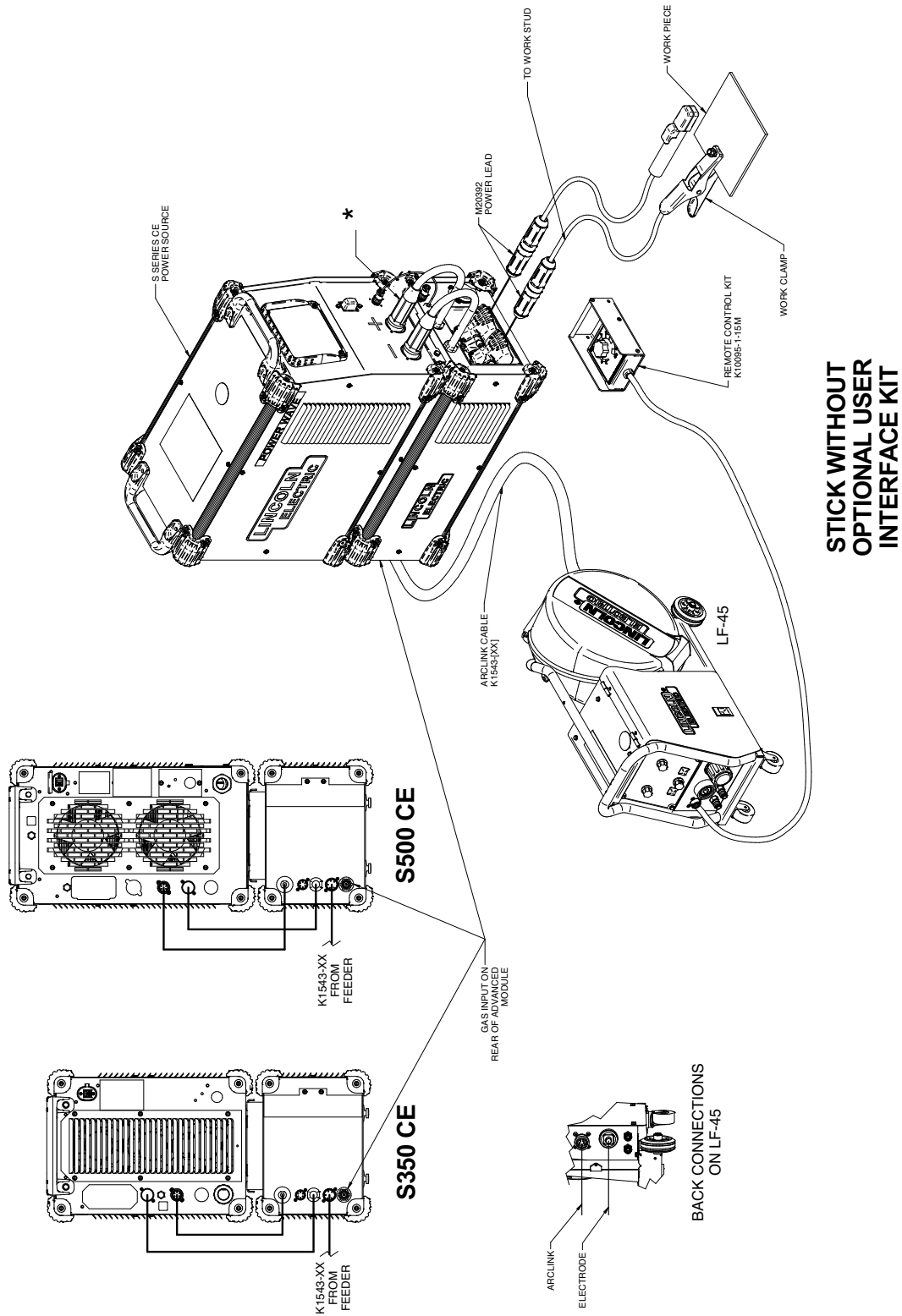
FIGURE A.18



POWER WAVE® S500 CE (Only) WITH USER INTERFACE KIT SMAW CONNECTION DIAGRAM
FIGURE A.19



POWER WAVE® S350 CE OR S500 CE SMAW CONNECTION DIAGRAM
FIGURE A.20



SAFETY PRECAUTIONS

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



WARNING



ELECTRIC SHOCK can kill.

- **Disconnect input power before servicing.**
- **Do not operate with covers removed.**
- **Do not touch electrically live parts.**
- **Only qualified persons should install, use or service this equipment.**

GENERAL DESCRIPTION

General Physical Description

The Power Wave® Advanced Module is an accessory enabling compatible power sources to perform the DC +, DC-, AC, STT or any combination of these functions. It is intended for use with medium range “S” – series Power Wave power sources such as the S350 or S500. The Advanced Module will limit the output of an S500 (CE) or R500 to a maximum of 350 amps, regardless of process. The module itself is a low profile pedestal, designed to seamlessly integrate with compatible power sources and water coolers.

POWER-UP SEQUENCE

The Advanced Module will be powered up at the same time as the power source. The status light will blink green for about a minute while the system is configuring. After this time, the status lights will turn a steady green indicating the machine is ready.

The fan in the Advanced Module will run when the output is enabled, and for 5 minutes after the output has been disabled. The speed of the fan is determined by the average output current flowing through the Advanced Module.

DUTY CYCLE

The Advanced Module is rated at 300 amps at a 100% duty cycle. It is further rated to support 350 amps at a 40% duty cycle. The duty cycle is based on a ten-minute period. A 40% duty cycle represents 4 minutes of welding and 6 minutes of idling in a ten-minute period.

Note:

The Advanced Module is capable of withstanding a peak output current of 600 amps. The allowable maximum average output current is time dependant, and ultimately limited by the host power source.

COMMON WELDING PROCEDURES

MAKING A WELD

Select the weld mode that best matches the desired welding process. The standard weld set shipped with the host power source encompasses a wide range of common processes that will meet most needs. If the AC or STT modes are not available, visit www.powerwavesoftware.com or contact the local Lincoln Electric sales representative.

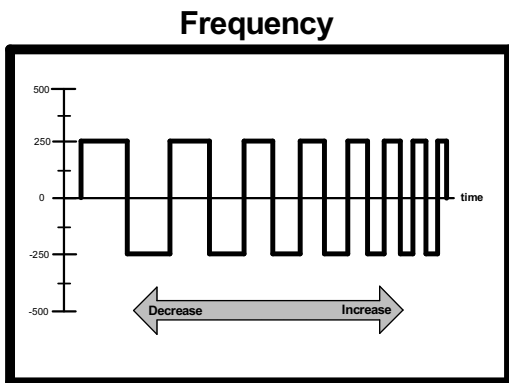
Certain welding processes require a reversed output polarity. The Advanced Module will recognize the specific weld modes and automatically reconfigure the output polarity. No change needs to be made to output cable connections.

For specific operating instructions consult the power source and feeder instruction manuals. For a detailed description of available welding modes, visit www.powerwavesoftware.com.

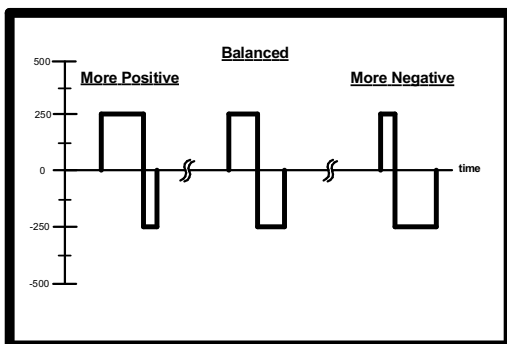
SPECIAL INFORMATION REGARDING AC-WELDING

The AC output capability of the Advanced Module combined with the flexibility of Waveform Control Technology™ enables a nearly infinite combination of output waveforms. The AC waveform Frequency, Wave Balance and Offset can now be utilized to further optimize the characteristics of a given arc. For a complete description of how these variables are used to adjust the arc performance characteristics of a specific weld mode visit www.powerwavesoftware.com

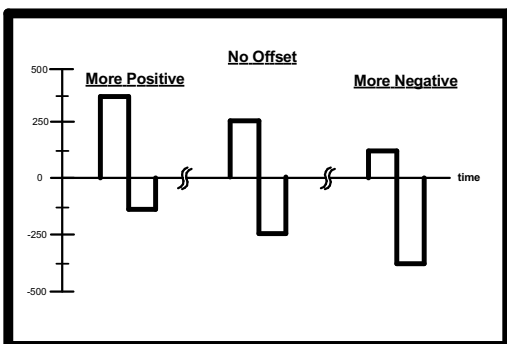
FIGURE B.1



Wave Balance



DC Offset



RECOMMENDED PROCESSES AND EQUIPMENT

RECOMMENDED PROCESSES

The Power Wave® Advanced Module is recommended for all process supported by the host power source including, but not limited to SMAW, GMAW, GMAW-P, GMAW-STT, GTAW.

PROCESS LIMITATIONS

The Advanced Module is rated for 300 amps at a 100% duty cycle and 350 amps at a 40% duty cycle rating. When connected to an S500 (CE) or R500 power source, the power source will acknowledge that the Advanced Module is connected and reduce the output capability to match that of the S350(CE) or R350 (300 amps, 32 volts at a 100% duty cycle and 350 amps, 34 volts at a 40% duty cycle).

The Power Wave® Advanced Module is designed to protect itself from the excessive transient voltages associated with highly inductive weld circuits. These high inductance circuits may result in unsatisfactory performance, but will not damage the module.

Care should be taken to properly configure the input and output welding cables to the Advanced Module per the connection diagrams. If a negative electrode polarity process such as Innershield is required, the switch will automatically reconfigure the output of the Advanced Module. If the input of the Advanced Module is reversed, the module will protect itself and block output capability.

EQUIPMENT LIMITATIONS

The Power Wave Advanced Module is intended for use with compatible medium range “S” – series Power Wave power sources such as the S350.

Legacy wire feeders such as the PF-10M are NOT RECOMMENDED for High Frequency TIG (GTAW) welding applications with the Advanced Module.

COMMON EQUIPMENT PACKAGES

BASIC PACKAGE (STANDARD)	
K2912-1	Advanced Module
K2823-1	Power Wave® S350
K3328-x	POWER FEED®-84
K1543-xx	ArcLink® Cable (5 pin) – connects wire feeder to power source.
K3086-1	Cool Arc 55
K2212-2	Python – water cooled push pull gun
BASIC PACKAGE (ALUMINUM)	
K4912-1	Advanced Module Aluminum
K4188-1	Power Wave® S350 Aluminum
K4191-1	POWER FEED®-25M Aluminum
K4190-1	Cool Arc 55 Aluminum
K3355-2	Magnum Pro Aluminum Push Pull Gun (Air Cooled)
K3357-2	Magnum Pro Aluminum Push Pull Gun (Water Cooled)
OPTIONAL WIRE FEEDERS	
K2536	POWER FEED®-25M
BASIC PACKAGE (CE)	
K2912-1	Advanced Module
K2823-2	Power Wave® S350 (CE)
K14072-1	LF-45
K1543-xx	ArcLink® Cable (5 pin) – connects wire feeder to power source.
K14050-1	Cool Arc 50

CASE FRONT DESCRIPTIONS

(See Figure B.2)

1. **NEGATIVE** – Connects to Negative output of power source.
2. **POSITIVE** – Connects to Positive output of power source.
3. **VOLTAGE SENSE PIGTAIL**- Provides voltage feedback to the power source from the module.

⚠ CAUTION**MUST BE CONNECTED TO PROVIDE ACCURATE VOLTAGE FEEDBACK, EVEN WHEN SENSING FROM THE STUDS.**

4. **POWER SOURCE MOUNTING BRACKET** – Provides a quick and reliable union between power source and module.
5. **STATUS LED** – Provides ArcLink® status of Power Wave® Advanced Module.

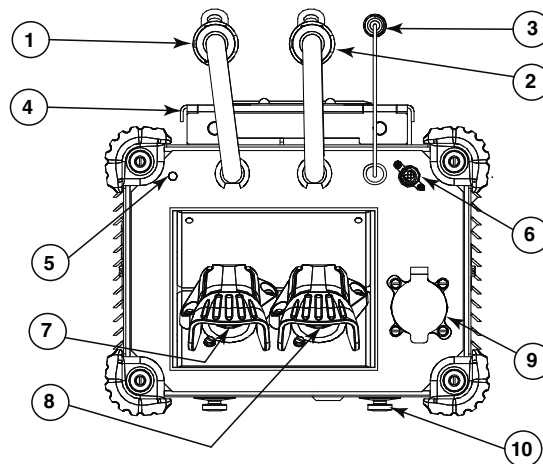
Note: During normal power-up, the LED will flash green up to 60 seconds as the equipment performs self tests.

6. **SENSE LEAD OUTPUT** – Provides connection point for remote electrode and work sense leads.

LED condition	Definition
Steady green.	System okay. The power source, wire feeder and module are communicating normally.
Blinking green.	Occurs during a reset and indicates the power source is identifying each component in the system. This is normal for the first 60 seconds after power-up, or if the system configuration is changed during operation.
Alternating green and red.	Non-recoverable system fault. If the power source, wire feeder or modules status LED are flashing any combination of red and green, errors are present in the system. Read the error code before the machine is turned off.

Note: The electrode sense (67) lead in the Sense Lead Output connector may not be available when the Advanced Module is connected to certain S350 CE models.

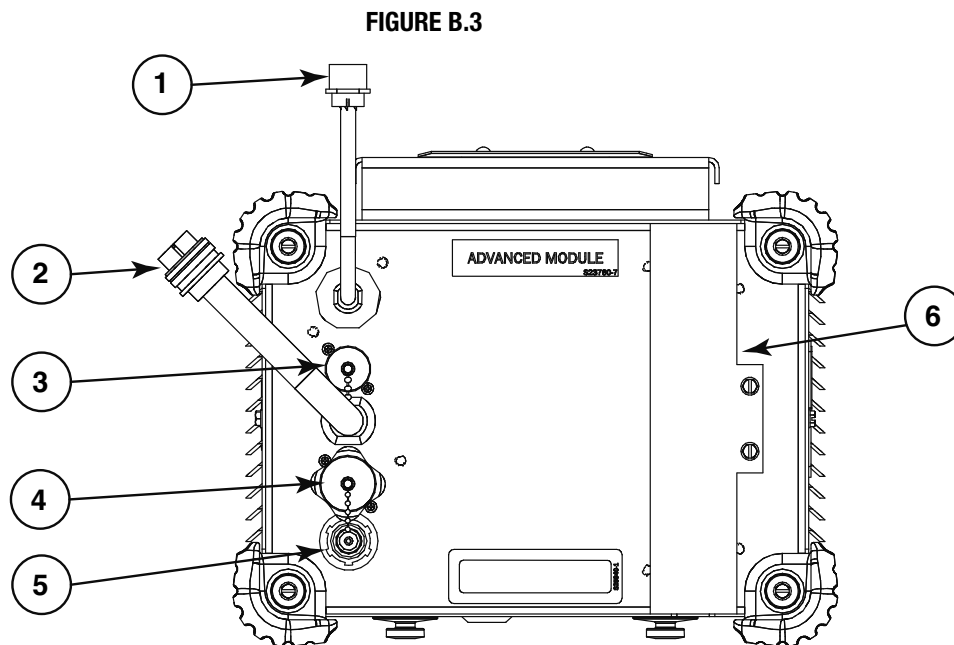
7. **WORK** – Connects to workpiece, regardless of process.
8. **GMAW ELECTRODE** – Connects to feeder for GMAW welding, regardless of process.
9. **GTAW/SMAW ELECTRODE** – Connected internally to GMAW ELECTRODE, but also provides high frequency capability for TIG starting, provides solenoid controlled gas pass through.
10. **POWER SOURCE MOUNTING FEET** – Provides a quick and reliable union between the module and a cooler or cart.

FIGURE B.2

CASE BACK DESCRIPTIONS

(See Figure B.3)

- 1. DIFFERENTIAL I/O PIGTAIL** – Connects directly to the Differential I/O output receptacle on the rear of the power source.
- 2. ARCLINK® PIGTAIL** – Connects directly to the ArcLink® Out receptacle on the rear of the power source.
- 3. DIFFERENTIAL I/O (SYNC TANDEM) OUTPUT** – Supports Synchronized Tandem MIG Welding with other compatible power sources.
- 4. ARCLINK® (OUT)** – Provides an ArcLink® pass through connection for all compatible ArcLink® wire feeders.
- 5. GAS INPUT** – Provides a solenoid controlled gas feed to TIG ELECTRODE on Case Front.
- 6. WATER COOLER PASS THROUGH** – Provides a channel to conceal and protect the power and control leads for the optional integrally mounted CE Water Cooler.



SAFETY PRECAUTIONS

WARNING



ELECTRIC SHOCK can kill.

- **Disconnect input power before servicing.**
- **Do not operate with covers removed.**
- **Do not touch electrically live parts.**
- **Only qualified persons should install, use or service this equipment.**

See additional warning information throughout this operator's manual.

ROUTINE MAINTENANCE

Routine maintenance consists of periodically blowing out the machine, using a low-pressure air stream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine. Also verify the Advanced Module fan is operational when the power source fan is activated.

CALIBRATION SPECIFICATION

Due to the nature of its operation, calibration of the Advanced Module is not required. From a system perspective, the output calibration of the power source and wire feeder should be performed as directed in their respective instruction manuals.

When calibrating the power source voltage with an Advanced Module installed, the actual output voltage should be measured directly at the "Electrode" and "Work studs of the Advanced Module, not the output studs of the power source. This is necessary as the power source is configured to monitor voltage at the output studs of the Advanced Module, not the output studs of the power source. The Advanced Module has no effect on the output current calibration.

HOW TO USE TROUBLESHOOTING GUIDE

WARNING

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

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

Step 1. LOCATE PROBLEM (SYMPTOM).

Look under the column labeled “PROBLEM (SYMPTOMS)”. This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting.

Step 2. POSSIBLE CAUSE.

The second column labeled “POSSIBLE CAUSE” lists the obvious external possibilities that may contribute to the machine symptom.

Step 3. RECOMMENDED COURSE OF ACTION

This column provides a course of action for the Possible Cause, generally it states to contact your local Lincoln Authorized Field Service Facility.

If you do not understand or are unable to perform the Recommended Course of Action safely, contact your local Lincoln Authorized Field Service Facility.

CAUTION

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

Observe all Safety Guidelines detailed throughout this manual

ADVANCED MODULE FUNCTIONAL TEST

⚠ WARNING

ELECTRIC SHOCK can kill.



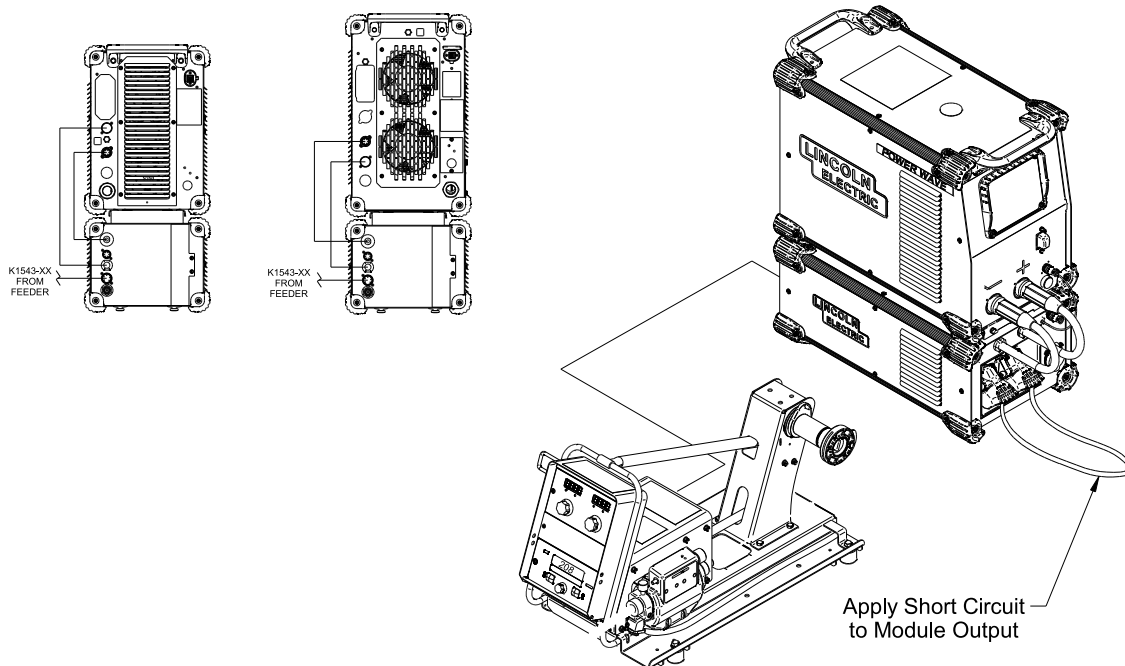
- Turn off the power source at the disconnect switch before connecting or working inside of the equipment.
- Only a qualified electrician should perform this test.

PREPARATION

1. Connect the Advanced Module and power source (S350/S500) to a compatible wire feeder (PF-10, PF-84, PF-25M, etc.) per the diagram below.

NOTE: This test assumes the host power source is properly calibrated.

2. Short the Electrode to Work output terminals on the Advanced Module. (Total Cable Length < 10ft.)
3. Turn the machine ON, and enable test modes on the UI of the Wire Feeder. See Wire Feeder instruction manual (set-up menu P.99)
4. Verify the latest software is loaded in the Power Wave machine. (Test modes 208, 213 AND 219 MUST be present)
5. Select test mode 208.



⚠ CAUTION

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

Observe all Safety Guidelines detailed throughout this manual

AC/STT® FUNCTIONAL TEST PREPARATION

TEST PROCEDURE – PART 1 OF 2 (STT TEST - SHORT CIRCUIT)

1. Enable the output by pulling the trigger, or turning the trim knob clockwise.
NOTE: An audible “buzz” from the Advanced Module is normal.
2. Read the Voltage feedback displayed on the Wire Feeder Display and compare to the table below.
3. Disable the output, and turn the machine OFF.

Voltage	Indication / Possible Cause
< 2V	<p>AC Switch Shorted:</p> <ul style="list-style-type: none"> • Faulty or disconnected Differential I/O control signal (grey cable located at rear of module). Verify cable connections. If connections appear intact, contact your local Lincoln Authorized Field Service Facility to inspect the internal wiring of the module and host power source. • AC Switch Shorted (typically accompanied by Error 99). Contact your local Lincoln Authorized Field Service Facility to perform AC Switch PCB Test.
10 - 15VAC	Normal Operation
> 40V	<p>AC Switch Open:</p> <ul style="list-style-type: none"> • Loose, open or improper cable connection. Verify weld cable input (polarity) and output connections. If connections appear intact, contact your local Lincoln Authorized Field Service Facility to inspect the internal wiring of the module and host power source). • AC Switch not closing (may be accompanied by Error 99). Contact your local Lincoln Authorized Field Service Facility to verify the status of the AC Switch board via the “on board” diagnostic LED’s. • Open Blocking Diode. Contact your local Lincoln Authorized Field Service Facility to test the blocking diode.

CAUTION

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

Observe all Safety Guidelines detailed throughout this manual

AC/STT® FUNCTIONAL TEST PREPARATION

TEST PROCEDURE – PART 2 OF 2 (AC TEST - OPEN CIRCUIT)

1. With the machine OFF, remove the short from Work to Electrode studs on the Advanced Module.
2. Attach a Digital Multi Meter (set for AC voltage) across the Work and Electrode studs of the Advanced Module.
3. Turn the machine ON, enable the test modes and select test mode 208.
4. Enable the output by pulling the trigger or turning the trim knob clockwise.
NOTE: A high pitched “squeal” from the Advanced Module is normal.
5. Read the voltage measured on the Digital Multi Meter and compare to the table below.
6. Disable the output, and turn the machine OFF.

Voltage	Indication / Possible Cause
< 70VAC	<p>AC Switch Not Changing Polarity:</p> <ul style="list-style-type: none"> • Faulty or disconnected Differential I/O control signal (grey cable located at rear of module). Verify cable connections. If connections appear intact, contact your local Lincoln Authorized Field Service Facility to inspect the internal wiring of the module and host power source. • AC Switch Shorted (typically accompanied by Error 99). Contact your local Lincoln Authorized Field Service Facility to perform AC Switch PCB Test. • Background Circuit Shorted. Contact your local Lincoln Authorized Field Service Facility to perform the Background Circuit Test. • Loss of Active Snubber Resistors (typically accompanied by Error 99). Contact your local Lincoln Authorized Field Service Facility to verify the snubber resistor circuit.
≥ 70VAC	<p>Normal Operation</p>

NOTE: If machine faults immediately after output is enabled (Error 99), there may be a problem with the active snubber discharge circuit. Contact your local Lincoln Authorized Field Service Facility.



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

Observe all Safety Guidelines detailed throughout this manual

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

The Advanced Module is equipped with a Status Light. If a problem occurs it is important to note the condition of the status lights. **Therefore, prior to cycling power to the system, check the power source status light for error sequences as noted below.**

TABLE E.1

Light Condition	Meaning
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink® network.
Blinking Green	Occurs during power up or a system reset, and indicates the power source is mapping (identifying) each component in the system. Normal for first 1-30 seconds after power is turned on, or if the system configuration is changed during operation.
Fast Blinking Green	Under normal conditions indicates Auto-mapping has failed. Also used by the diagnostic utility (included in the Power Wave Manager® Utilities available at www.powerwavesoftware.com) to identify the selected machine when connecting to a specific IP address.
Alternating Green and Red	Non-recoverable system fault. If the Status lights are flashing any combination of red and green, errors are present. Read the error code(s) before the machine is turned off. Error Code interpretation through the Status light is detailed in the Service Manual. Individual code digits are flashed in red with a long pause between digits. If more than one code is present, the codes will be separated by a green light. Only active error conditions will be accessible through the Status Light. Error codes can also be retrieved with the diagnostics utility (included in the Power Wave Manager® Utilities available at www.powerwavesoftware.com). This is the preferred method, since it can access historical information contained in the error log. To clear the active error(s), turn power source off, and back on to reset.
Steady Red	Not applicable.
Blinking Red	Not applicable.

CAUTION

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ERROR CODES FOR THE ADVANCED MODULE

The following is a partial list of possible error codes for the ADVANCED MODULE.

ADVANCED MODULE	
Error Code #	Indication
36 Thermal error (Advanced Module)	Thermal error appearing on the Advanced Module Status LED accompanied by Thermal LED and thermal error on the power source indicates over temperature in the module. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
36 Thermal error (Host Power Source)	Thermal LED and thermal error on the power source ONLY indicates over temperature in power source. Status LED in Advanced Module will be steady green. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
54 Over Current Shutdown	Average output current threshold has been exceeded.
99 Advanced Module Status error	Error reported by the AC Switch PC Board. Generally caused by overvoltage protection circuitry. Have qualified technician observe diagnostic LED's on the H-Bridge PC Board to determine the exact cause.
Other	A complete list of error codes is available in the Power Wave Manager Utility (available at www.powerwavesoftware.com). Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the Advanced Module Status PC Board. If cycling the input power on the machine does not clear the error, contact the Service Department.

CAUTION

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

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
BASIC MACHINE PROBLEMS		
Input fuses keep blowing	1. Improperly sized input fuses.	1. Make sure fuses are properly sized. See installation section of this manual for recommended sizes.
	2. Improper Weld Procedure requiring output levels in excess of machine rating.	2. Reduce output current, duty cycle, or both.
	3. Major physical or electrical damage is evident in the power source when the sheet metal covers are removed.	3. Contact your local authorized Lincoln Electric Field Service facility for technical assistance.
Machine will not power up (no lights on power source, Advanced Module or Wire Feeder).	1. No Input Power.	1. Make sure input supply disconnect has been turned ON. Check input fuses. Make certain that the Power Switch on the power source is in the "ON" position.
No Status Light on Advanced Module	1. 40VDC input not present at Advanced Module.	1. Check ArcLink® cable. Verify 40VDC per wiring diagram. • If wire feeder is functional and connected through the Advanced Module, suspect connection issue in Advanced Module. Verify condition of LED's on AC Switch PCB (viewable through left side louvers).
	2. Malfunctioning Status LED.	2. Verify status LED is properly installed and has not disengaged from the lens.
Machine won't weld, when attached to Advance Module.	1. Status Error.	1. Check LED's on AC Switch PCB to investigate cause of Status Error.
	2. Thermal Error.	2. See "Thermal error indication..." section.
	3. 40VDC input not present at Advanced Module.	3. See "No Status Light on ADVANCED..." section.
	4. Internal open circuit	4. Check for loose or broken connection in Advanced Module weld circuit.
	5. Reversed input leads.	5. Check polarity of input leads.

⚠ CAUTION

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

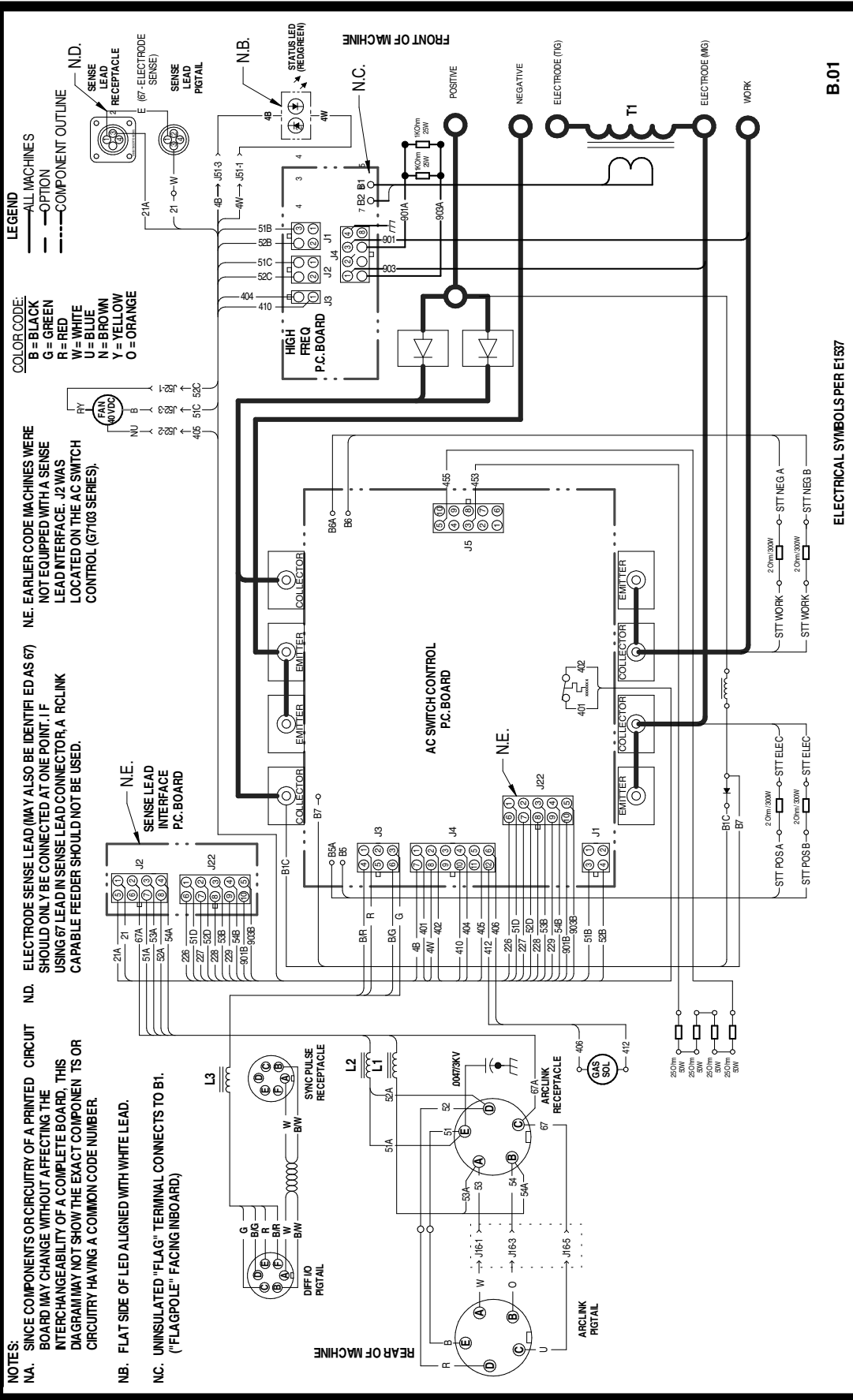
Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
BASIC MACHINE PROBLEMS		
Thermal error indication on Advanced Module (error 36).	1. Improper fan operation.	1. Check for proper fan operation. (Fans typically run whenever output power is on.) Check for material blocking intake or exhaust louvers, or for excessive dirt clogging cooling channels in machine.
	2. Switch PC board thermostat.	2. After machine has cooled, reduce load, duty cycle, or both. Check for material blocking intake or exhaust louvers and heat sink fins.
	3. Open thermostat circuit.	3. Check for broken wires, open connections or faulty thermostat in the Advanced Module.
WELD AND ARC QUALITY PROBLEMS		
General degradation of weld performance.	1. Wire feed problem.	1. Check for feeding problems. Check actual WFS vs. preset. Verify proper wire drive and gear ratio has been selected.
	2. Cable Connections.	2. Check for bad connections, excessive loops in cable, etc. NOTE: The presence of heat in the external welding circuit indicates poor connections or undersized cables.
	3. Loss of, or improper Shielding Gas.	3. Verify gas flow and type are correct.
	4. Verify weld mode is correct for process.	4. Select the correct weld mode for the application.
	5. Machine calibration.	5. Verify the calibration of the power source output current and voltage.
	6. STT Process ONLY: Excessive cable inductance or STT snubber resistor failure.	6. Excessive cable inductance or STT snubber resistors failure can cause the transient voltage to exceed the safe operating threshold on the AC Switch PC board. Under these conditions the AC Switch PC board faults to protect itself. Follow recommended cable guidelines to minimize the inductance, and inspect the snubber resistor circuit for damage.
	7. AC Process ONLY: Excessive cable inductance or snubber discharge resistor failure.	7. Excessive cable inductance or snubber discharge resistors failure can cause the operating voltage to exceed the safe operating threshold on the AC Switch PC board. Under these conditions the AC Switch PC board faults to protect itself. Follow recommended cable guidelines to minimize the inductance, and inspect the snubber resistor circuit for damage.
	8. Sense Lead Connections	8. Verify that the voltage sense pigtail is connected to the power source. If remote voltage sens leads are being used, verify connection.

⚠ CAUTION

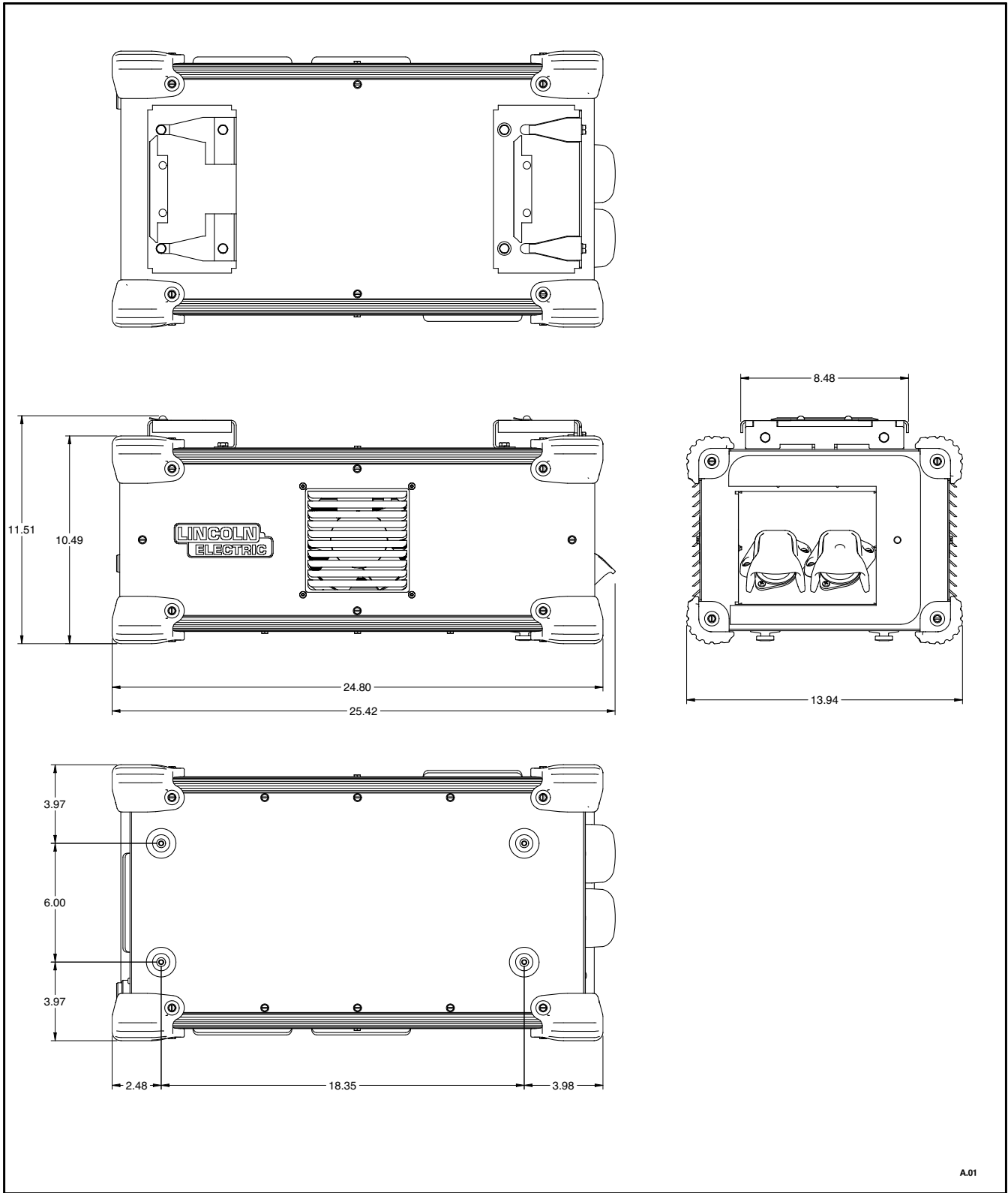
If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your **Local Lincoln Authorized Field Service Facility** for technical troubleshooting assistance before you proceed.

WIRING DIAGRAM - POWER WAVE ADVANCED MODULE



IM24668

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a particular code is pasted inside the machine on one of the enclosure panels. If the diagram is illegible, write to the Service Department for a replacement. Give the equipment code number.



A.01

L15814-2

			
WARNING	<ul style="list-style-type: none"> ● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground. 	<ul style="list-style-type: none"> ● Keep flammable materials away. 	<ul style="list-style-type: none"> ● Wear eye, ear and body protection.
Spanish AVISO DE PRECAUCION	<ul style="list-style-type: none"> ● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aíslese del trabajo y de la tierra. 	<ul style="list-style-type: none"> ● Mantenga el material combustible fuera del área de trabajo. 	<ul style="list-style-type: none"> ● Protéjase los ojos, los oídos y el cuerpo.
French ATTENTION	<ul style="list-style-type: none"> ● Ne laissez ni la peau ni des vêtements mouillés entrer en contact avec des pièces sous tension. ● Isolez-vous du travail et de la terre. 	<ul style="list-style-type: none"> ● Gardez à l'écart de tout matériel inflammable. 	<ul style="list-style-type: none"> ● Protégez vos yeux, vos oreilles et votre corps.
German WARNUNG	<ul style="list-style-type: none"> ● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden! 	<ul style="list-style-type: none"> ● Entfernen Sie brennbares Material! 	<ul style="list-style-type: none"> ● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese ATENÇÃO	<ul style="list-style-type: none"> ● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra. 	<ul style="list-style-type: none"> ● Mantenha inflamáveis bem guardados. 	<ul style="list-style-type: none"> ● Use proteção para a vista, ouvido e corpo.
Japanese 注意事項	<ul style="list-style-type: none"> ● 通電中の電気部品、又は溶材にヒフやぬれた布で触れないこと。 ● 施工物やアースから身体が絶縁されている様にして下さい。 	<ul style="list-style-type: none"> ● 燃えやすいものの側での溶接作業は絶対にしてはなりません。 	<ul style="list-style-type: none"> ● 目、耳及び身体に保護具をして下さい。
Chinese 警告	<ul style="list-style-type: none"> ● 皮肤或湿衣物切勿接触带电部件及焊缝。 ● 使你自己与地面和工件绝缘。 	<ul style="list-style-type: none"> ● 把一切易燃物品移离工作场所。 	<ul style="list-style-type: none"> ● 佩戴眼、耳及身体劳动保护用具。
Korean 위험	<ul style="list-style-type: none"> ● 전도체나 용접봉을 젖은 헝겊 또는 피부로 절대 접촉치 마십시오. ● 모재와 접지를 접촉치 마십시오. 	<ul style="list-style-type: none"> ● 인화성 물질을 접근 시키지 마시오. 	<ul style="list-style-type: none"> ● 눈, 귀와 몸에 보호장구를 착용하십시오.
Arabic تحذير	<ul style="list-style-type: none"> ● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الألكترود بجند الجسم أو بالملابس المبللة بالماء. ● ضع عازلًا على جسمك خلال العمل. 	<ul style="list-style-type: none"> ● ضع المواد القابلة للاشتعال في مكان بعيد. 	<ul style="list-style-type: none"> ● ضع أدوات وملابس واقية على عينيك وأذنيك وجسمك.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTION FOR THIS EQUIPMENT AND THE CONSUMABLES TO BE USED AND FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.

SE RECOMIENDA LEER Y ENTENDER LAS INSTRUCCIONES DEL FABRICANTE PARA EL USO DE ESTE EQUIPO Y LOS CONSUMIBLES QUE VA A UTILIZAR, SIGA LAS MEDIDAS DE SEGURIDAD DE SU SUPERVISOR.

LISEZ ET COMPRENEZ LES INSTRUCTIONS DU FABRICANT EN CE QUI REGARDE CET EQUIPMENT ET LES PRODUITS A ETRE EMPLOYES ET SUIVEZ LES PROCEDURES DE SECURITE DE VOTRE EMPLOYEUR.

LESEN SIE UND BEFOLGEN SIE DIE BETRIEBSANLEITUNG DER ANLAGE UND DEN ELEKTRODENEINSATZ DES HERSTELLERS. DIE UNFALLVERHÜTUNGSVORSCHRIFTEN DES ARBEITGEBERS SIND EBENFALLS ZU BEACHTEN.

			
<ul style="list-style-type: none"> ● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone. 	<ul style="list-style-type: none"> ● Turn power off before servicing. 	<ul style="list-style-type: none"> ● Do not operate with panel open or guards off. 	WARNING
<ul style="list-style-type: none"> ● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases. 	<ul style="list-style-type: none"> ● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio. 	<ul style="list-style-type: none"> ● No operar con panel abierto o guardas quitadas. 	Spanish AVISO DE PRECAUCION
<ul style="list-style-type: none"> ● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail. 	<ul style="list-style-type: none"> ● Débranchez le courant avant l'entretien. 	<ul style="list-style-type: none"> ● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés. 	French ATTENTION
<ul style="list-style-type: none"> ● Vermeiden Sie das Einatmen von Schweißrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes! 	<ul style="list-style-type: none"> ● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!) 	<ul style="list-style-type: none"> ● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen! 	German WARNUNG
<ul style="list-style-type: none"> ● Mantenha seu rosto da fumaça. ● Use ventilação e exaustão para remover fumo da zona respiratória. 	<ul style="list-style-type: none"> ● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas. 	<ul style="list-style-type: none"> ● Mantenha-se afastado das partes moventes. ● Não opere com os painéis abertos ou guardas removidas. 	Portuguese ATENÇÃO
<ul style="list-style-type: none"> ● ヒュームから頭を離すようにして下さい。 ● 換気や排煙に十分留意して下さい。 	<ul style="list-style-type: none"> ● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切ってください。 	<ul style="list-style-type: none"> ● パネルやカバーを取り外したまま機械操作をしないで下さい。 	Japanese 注意事項
<ul style="list-style-type: none"> ● 頭部遠離煙霧。 ● 在呼吸區使用通風或排風器除煙。 	<ul style="list-style-type: none"> ● 維修前切斷電源。 	<ul style="list-style-type: none"> ● 儀表板打開或沒有安全罩時不準作業。 	Chinese 警告
<ul style="list-style-type: none"> ● 얼굴로부터 용접가스를 멀리하십시오. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시오. 	<ul style="list-style-type: none"> ● 보수전에 전원을 차단하십시오. 	<ul style="list-style-type: none"> ● 판넬이 열린 상태로 작동치 마십시오. 	Korean 위험
<ul style="list-style-type: none"> ● ابعء رأسك بعبعءاً عن الءءان. ● اسءءعمل ءءهوءة أو ءءهاز سءءء الءءان للءءارء لكى ءبعء الءءان عن المنءءة الءى ءءءفس فبها. 	<ul style="list-style-type: none"> ● القءع ءءبار ءءهرباءى قبل القبام بأبة صباءة. 	<ul style="list-style-type: none"> ● لا ءءشل هءا الءءهاز اذا ءاءء الاءءببة الءءبءبة الءاءفة لبءء عبه. 	Arabic ءءذبر

LEIA E COMPREENDA AS INSTRUÇÕES DO FABRICANTE PARA ESTE EQUIPAMENTO E AS PARTES DE USO, E SIGA AS PRÁTICAS DE SEGURANÇA DO EMPREGADOR.

使う機械や溶材のメーカーの指示書をよく読み、まず理解して下さい。そして貴社の安全規定に従って下さい。

請詳細閱讀並理解製造廠提供的說明以及應該使用的銀焊材料，並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

اقراء بتمعن وافهم تعليمات المصنع المنتج لهذه المعدات والمواد قبل استعمالها واتبع تعليمات الوقاية لصاحب العمل.

CUSTOMER ASSISTANCE POLICY

The business of The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice, and assumes no liability, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

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