INSTRUCTION MANUAL

POWER WAVE® R450+ AND R450



For use with Product/Code Numbers:

12644, 12645, 12712, 12713, 12714, 12847, 12848, 12849, 13203, 13386, 13387, 14106, 13657, 13657, 13659, 13660, 14106, 14107, 14108, 14109, 14110

Save for future reference

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THE LINCOLN ELECTRIC COMPANY
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SAFETY INFORMATION

SAFETY DEPENDS ON YOU

Lincoln welding, cutting, and heating 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.

⚠ DANGER

This statement indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

This statement indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

This statement indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

Notice: This statement indicates the possibility of damage to equipment if the potential risk is not avoided.

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.

KEEP YOUR HEAD OUT OF THE FUMES



- **DON'T** get too close to the weld. Use corrective lenses if necessary to stay a reasonable distance away from the weld.
- **USE ENOUGH VENTILATION** or exhaust at the weld, 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.
- **USE NATURAL DRAFTS** or fans to keep the fumes away from your face.
- **READ** and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

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

WEAR CORRECT EYE, EAR AND BODY PROTECTION



- **PROTECT** your eyes and face with 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 spatter, flash, and glare with protective screens or barriers.
- **PROTECT** your eyes and face with welding helmet
- **IN SOME AREAS**, protection from noise may be appropriate.
- **BE SURE** protective equipment is in good condition.



- **AT ALL TIMES**, wear safety glasses in work area.
- **DO NOT WELD, CUT, OR HEAT** containers or materials which previously had been in contact with hazardous substances unless they are properly cleaned. This is extremely dangerous.

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

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.

⚠ 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.)

For more information go to https://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. 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



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



- 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.



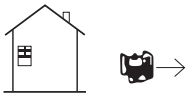
- In some cases it may be necessary to remove safety guards to perform required maintenance. **REMOVE GUARDS ONLY** when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- **DO NOT** put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- 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.



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



- Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell.
- Using a generator indoors **CAN KILL YOU IN MINUTES**.
- **NEVER** use inside a home or garage, EVEN IF doors and windows are open.



- **ONLY** use **OUTSIDE** and far away from windows, doors and vents.
- Avoid other generator hazards. **READ MANUAL BEFORE USE**.

ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS



- Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding and heating current creates EMF fields around cables and equipment.
- EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- Exposure to EMF fields in welding may have other health effects which are now not known.

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

- Route the electrode and work cables together - Secure them with tape when possible.
- Never coil the electrode lead around your body.
- 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.
- Connect the work cable to the workpiece as close as possible to the area being welded.
- Do not work next to welding power source.

ELECTRIC SHOCK CAN KILL



- 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.
- 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.
- In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
- 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.
- Ground the work or metal to be welded to a good electrical (earth) ground.
- Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- Never dip the electrode in water for cooling.

- 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.
- When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
- **Also see** WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION **and** FOR ELECTRICALLY POWERED EQUIPMENT

ARC RAYS CAN BURN



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



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.**
- 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.
- 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.
- Shielding gases used for welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.
- 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.
- Also see FOR ENGINE POWERED EQUIPMENT

WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION



- 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.
- 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.

- 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.
- Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to ensure 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.
- Vent hollow castings or containers before heating, cutting or welding. They may explode.
- Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuff-less 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.
- 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.
- **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.
- **DO NOT** use a welding power source for pipe thawing.

CYLINDER MAY EXPLODE IF DAMAGED



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

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.
- Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.
- Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-l, “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



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

BATTERY HANDLING, STORAGE, AND DISPOSAL



Batteries can be flammable substances such as lithium or other organic solvents, which may result in overheating, rupture, or combustion. Failure to follow the battery manufactures instructions may result in fire, personal injury, and damage to property if used improperly.

- DO NOT short circuit, disassemble, deform, or heat batteries.
- DO NOT attempt to recharge batteries unless they are specifically marked as "rechargeable".
- DO NOT use or charge the battery if it appears to be leaking, deformed or damaged in any way.
- Store in a cool location. Keep batteries away from direct sunlight, high temperature, and high humidity.
- Immediately discontinue use of the battery if, while using, charging, or storing the battery, the battery emits an unusual smell, feels hot, changes color, changes shape, or appears abnormal in any other way.
- Keep batteries out of reach of children, should a child swallow a battery, consult a physician immediately.
- Recycle or dispose of batteries in accordance with local and federal laws.

FOR LASER EMITTING EQUIPMENT



- Hazardous Class 4 (IV) laser products emit invisible, infrared laser radiation which can permanently damage the eye's retina and/or cornea, burn skin, and pose a fire risk. End users shall assign a qualified Laser Safety Officer (LSO) who has the certifications required by applicable law/standards, have a documented Laser Safety Program and have a Laser Controlled Area (LCA) that confirms to ANSI Z136.1 & Z136.9.
- Do not operate laser before end user's LSO has completed a risk assessment and all the prescribed Risk Mitigations measures have been fully implemented. Ensure the laser is operated/ demonstrated safely by trained personnel and that the environment surrounding the laser welding cell or laser-controlled area is safe for people nearby when the laser is in operation.
- Never point the laser at yourself or others. Never look directly into a laser aperture, even if wearing full eye protection.
- All persons inside LCA must wear proper PPE to avoid eye or skin exposure to laser radiation. The end user's LSO shall select proper PPE including, but not limited to, heat-resistant gloves, flame-resistant clothing, laser safety eye wear and laser-safe helmets that conform to ANSI Z136.1 Optical Density requirements for the wavelength and output power of the laser in use. Standard safety glasses and welding helmets DO NOT provide adequate protection from laser beam hazards. Always inspect PPE for damage or improper fit before use.
- Only qualified persons shall install, operate or service this unit per ANSI Z136.1 standards and your LSO's instruction. Read and follow all labels and manuals before installing, operating, or servicing hand held any laser welding equipment.
- Do not operate outside of a LCA, or if the laser protective housing is modified or damaged, or if safety interlocks have been bypassed or otherwise defeated. Inspect all equipment and LCA for damage or tampering prior to use.
- Reflected beams from the laser can damage eyes and skin and can pose a fire risk. Prior to use, the LCA should be assessed by the LSO to understand the surfaces where hazardous reflected beams can exist. Never position yourself or flammable material in the anticipated laser beam path and take extra precautions when working on reflective materials like aluminum and stainless steel.
- Follow all standards, individual facility or building regulations, and national, state, and local codes.

DEALER LOCATOR & PRODUCT REGISTRATION

Register your machine:

https://www.lincolnelectric.com/register

Authorized Service and Distributor Locator:

https://www.lincolnelectric.com/locator

ADDITIONAL SAFETY INFORMATION

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

INSTALLATION

ELECTROMAGNETIC COMPATIBILITY (EMC)

CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2014/30/EU. 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.

Warning: This Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.

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 constructing 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. Follow your local and national standards for installation and use. Changing the earthing arrangements should only be authorized by a person who is competent to assess 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

Public Supply System

Welding equipment should be connected to the public supply system according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the system. 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 manufacturer's 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 the 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, nor connected to earth because of its size and position, e.g., ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding

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

ECO DESIGN INFORMATION

The equipment has been designed in order to be compliant with the Directive 2009/125/EC and the Regulation 2019/1784/EU.

EFFICIENCY AND IDLE POWER CONSUMPTION	
Name	**Efficiency when max power consumption / Idle power consumption**
POWER WAVE R450 CE	86% / 34.1W
NO EQUIVALENT MODELS	

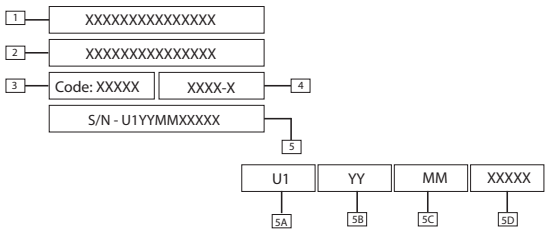
Idle state follow instructions to test idle mode:

1. Connect an Ethernet cable from the port on the machine to a laptop and start up the machine.
2. Open the Pow er Wave Manager and configure the connection to the machine that is plugged in through the Ethernet.
3. Check the box for the 'System Hibernation Timer' to allow the machine to enter hibernation mode. Set the Hibernation Timer to 15 minutes (the low est it can go). Wait 15 minutes and once the fans stop spinning the machine is in Hibernate Mode (Idle State).
4. The machine needs to be turned off and back on to come out of the hibernation mode

Efficiency: The Efficiency procedure itself requires the use of a grid. Power Wave Manager can be downloaded from powerwavesoftware.com along with the Power Wave Manager instruction. The Power Wave Manager instructions explain how to test a machine using a resistive load. This is described in section 6 under calibration.

The value of efficiency and consumption in idle state have been measured by method and conditions defined in the product standard EN 60974-1

Manufacturer's name, product name, code number, product number, serial number and date of production can be read from rating plate and serial number label.



1. Manufacturer name and address
2. Product name
3. Code Number
4. Product Number

5. Serial Number
   - 5A. Country of Production
   - 5B. Year of Production
   - 5C. Month of Production
   - 5D. Progressive Number Different for each machine

Table 1 :Typical gas usage for MIG/MAG equipment

Material Type	Wire Diameter [mm]	DC Electrode Positive		Wire Feeding [m/min]	Shielding Gas	Gas Flow [l/min]
		Current [A]	Voltage [V]			
Carbon, Alloy Steel	0,9 - 1,1	95-200	18 - 22	3,5 - 6,5	Ar 75%, CO2 25%	12
Aluminum	0,8 - 1,6	90-240	18 - 26	5,5 - 9,5	Argon	14 - 19
Austenitic Stainless Steel	0,8 - 1,6	85-300	21 - 28	3 - 7	Ar 98%, O2 2% / He 90%, Ar 7,5% CO2 2,5%	14 - 16
Copper Alloy	0,9 - 1,6	175 - 385	23 - 26	6 - 11	Argon	12 - 16
Magnesium	1,6 - 2,4	70-335	16 - 26	4 - 15	Argon	24 - 28

GTAW (TIG) Process:

In TIG welding process, gas usage depends on cross-sectional area of the nozzle.

Helium: 14-24 l/min
Argon: 7-16 l/min

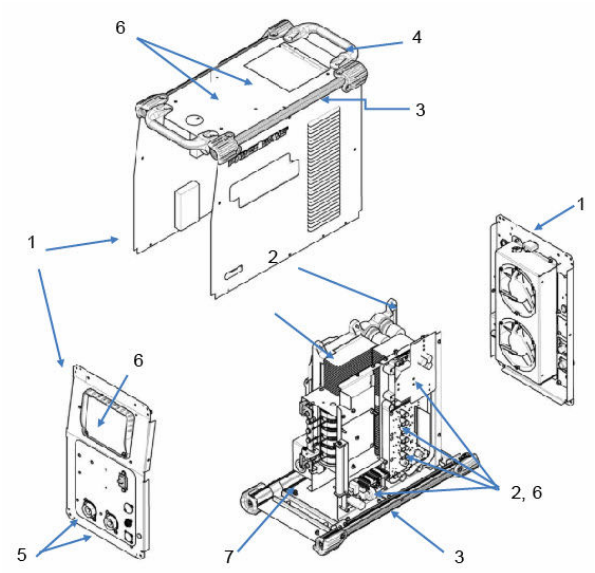
Notice: Excessive flow rates causes turbulence in the gas stream which may aspirate atmospheric contamination into the welding pool.

Notice: A cross wind or draft moving can disrupt the shielding gas coverage, in the interest of saving of protective gas use screen to block air flow.



End of life

At end of life of product, it has to be disposal for recycling in accordance with Directive 2012/19/EU (WEEE), information about the dismantling of product and Critical Raw Material (CRM) present in the product, can be found at: www.lincolnelectriceurope.com



ITEM	COMPONENT	MATERIAL FOR RECOVERY	CRM	SELECTIVE TREATMENT
1	ENCLOSURE	STEEL	-	-
2	HEATSINK, 4 TOTAL	ALUMINUM	Si, 38g Mg, 64 g	-
3	RAIL, 4 TOTAL	ALUMINUM	Si, 21g Mg, 14 g	-
4	HANDLE, 2 TOTAL	ALUMINUM	Si, 118 g Mg, 1 g	-
5	OUTPUT TERMINALS	BRASS	-	-
6	PC BOARD, 7 TOTAL	-	-	REQUIRED
7	CHOKE INTERNAL CABLES	COPPER	-	-
8	EXTERNAL CABLES- NOT SHOWN	COPPER	-	REQUIRED

Reference: P-1258-A, code 12848

TECHNICAL SPECIFICATIONS - POWER WAVE R450+ AND R450

POWER SOURCE-INPUT VOLTAGE AND CURRENT					
MODEL	**DUTY CYCLE**	**INPUT VOLTAGE +/- 10%**	**INPUT AMPERES**	**IDLE POWER**	**POWER FACTOR @ RATED OUTPUT**
K3451-1 K3451-2 K5570-1 K5570-2 K6178-1 K6178-2 Code 13386 and above	100% RATING	208/230/1 50/60Hz	57/52	500 WATTS MAX. (FAN ON)	.89/.87
K3451-1 K3451-2 K5570-1 K5570-2	40% RATING	208/230/400* 460/575/3 50/60Hz (INCLUDES 380V TO 413V)	80/73/41/37/29		.95
K6178-1 K6178-2 All Codes	100% RATING		60/54/31/27/21		

RATED OUTPUT									
INPUT VOLTAGE/PHASE FREQUENCY	**GMAW**			**SMAW**			**GTAW-DC**		
	40%	60%	100%	40%	60%	100%	40%	60%	100%
208/1/50/60	-	-	300 Amps	-	-	275 Amps	-	-	300 Amps
230/1/50/60	-	-	29 Volts	-	-	31 Volts	-	-	22 Volts
230/3/50/60	550 AMPS	500 AMPS	450 AMPS	550 AMPS	500 AMPS	450 AMPS	550 AMPS	500 AMPS	450 AMPS
380-415/3/50/60									
460/3/50/60	41.5 VOLTS	39 VOLTS	36.5 VOLTS	42 VOLTS	40 VOLTS	38 VOLTS	32 VOLTS	30 VOLTS	28 VOLTS
575/3/50/60									

RECOMMENDED INPUT WIRE AND FUSES[1]			
INPUT VOLTAGE/PHASE FREQUENCY	**MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE**	**CORD SIZE[3] AWG SIZES (mm^2)**	**TIME DELAY FUSE OR BREAKER[2] AMPERAGE**
208/1/50/60	57A, 100%	4 (25)	80
230/11/50/60	52A, 100%	6 (16)	80
200-208/3/50/60	80A, 100%	4 (25)	100
230/3/50/60	73 A, 40%	4 (25)	90
380-415/3/50/60	41 A, 40%	8 (10)	60
460/3/50/60	37 A, 40%	8 (10)	45
575/3/50/60	29 A, 40%	10 (7)	35

Note: Idle power is less than 50 watts when in Hibernation mode[4].

1. Based on U.S. National electrical Code
2. Also called " inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases
3. Type SO cord or similar in 30° C ambient
4. If supported by the robotic controller software version.

TECHNICAL SPECIFICATIONS - POWER WAVE R450+ AND R450 CE

POWER SOURCE-INPUT VOLTAGE AND CURRENT					
MODEL	**DUTY CYCLE**	**INPUT VOLTAGE +/- 10%**	**INPUT AMPERES**	**IDLE POWER**	**POWER FACTOR @ RATED OUTPUT**
K3455-1 K3455-2 K5592-2 K6178-4	40% RATING	230/400* 460/575 50/60Hz **(Includes 380V TO 413V)**	73/41/37/29	300 WATTS MAX. (FAN ON)	.95
	100% RATING		59/31/27/21		

RATED OUTPUT									
INPUT VOLTAGE/PHASE FREQUENCY	**GMAW**			**SMAW**			**GTAW-DC**		
	40%	60%	100%	40%	60%	100%	40%	60%	100%
230/3/50/60 380-415/3/50/60 460/3/50/60 575/3/50/60	550 AMPS 41.5 VOLTS	500 AMPS 39 VOLTS	450 AMPS 36.5 VOLTS	550 AMPS 42 VOLTS	500 AMPS 40 VOLTS	450 AMPS 38 VOLTS	550 AMPS 32 VOLTS	500 AMPS 30 VOLTS	450 AMPS 28 VOLTS

RECOMMENDED INPUT WIRE AND FUSES[1]			
INPUT VOLTAGE/PHASE FREQUENCY	**MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE**	**CORD SIZE[3] AWG SIZES (mm²)**	**TIME DELAY FUSE OR BREAKER[2] AMPERAGE**
230/3/50/60	73 A, 40%	4 (25)	90
380-415/3/50/60[4]	41 A, 40%	8 (10)	60
460/3/50/60[4]	37 A, 40%	8 (10)	45
575/3/50/60	29 A, 40%	10 (7)	35

Note: Idle power is less than 50 watts when in Hibernation mode[5].

Note: * For voltages higher than 460V or applications outside the European union replace input cord with properly rated cable.

1. Based on U.S. National electrical Code
2. Also called " inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases
3. Type SO cord or similar in 30° C ambient
4. Supplied K3389-1 input cord for these input applications only. For all others consult chart and connect per electrical code.
5. If supported by the robotic controller software version.

TECHNICAL SPECIFICATIONS - POWER WAVE R450+ AND R450 CCC

POWER SOURCE-INPUT VOLTAGE AND CURRENT					
MODEL	**DUTY CYCLE**	**INPUT VOLTAGE +/- 10%**	**INPUT AMPERES**	**IDLE POWER**	**POWER FACTOR @ RATED OUTPUT**
K3456-1 K6178-3	40% RATING	400* 460/575 50/60Hz **(Includes 380V TO 413V)**	41/37/29	500 WATTS MAX. (FAN ON)	.95
	100% RATING		31/27/21		

RATED OUTPUT									
INPUT VOLTAGE/PHASE FREQUENCY	**GMAW**			**SMAW**			**GTAW-DC**		
	40%	60%	100%	40%	60%	100%	40%	60%	100%
380-415/3/50/60 460/3/50/60 575/3/50/60	550 AMPS 41.5 VOLTS	500 AMPS 39 VOLTS	450 AMPS 36.5 VOLTS	550 AMPS 42 VOLTS	500 AMPS 40 VOLTS	450 AMPS 38 VOLTS	550 AMPS 32 VOLTS	500 AMPS 30 VOLTS	450 AMPS 28 VOLTS

RECOMMENDED INPUT WIRE AND FUSES[1]			
INPUT VOLTAGE/PHASE FREQUENCY	**MAXIMUM INPUT AMPERE RATING AND DUTY CYCLE**	**CORD SIZE[3] AWG SIZES (mm²)**	**TIME DELAY FUSE OR BREAKER[2] AMPERAGE**
380-415/3/50/60	41 A, 40%	8 (10)	60
460/3/50/60	37 A, 40%	8 (10)	45
575/3/50/60	29 A, 40%	10 (7)	35

Note: Idle power is less than 50 watts when in Hibernation mode[4].

1. Based on U.S. National electrical Code
2. Also called " inverse time" or "thermal / magnetic" circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of the current increases
3. Type SO cord or similar in 30° C ambient
4. If supported by the robotic controller software version.

TECHNICAL SPECIFICATIONS ALL MODELS

WELDING PROCESS			
PROCESS	**OUTPUT RANGE (AMPERES)**	**OCV (U_o)**	
		MEAN	**PEAK**
GMAW	40-550 A	60 V	73V
GMAW-PULSE			
FCAW			
GTAW-DC	5-550 A	24 V	36V
SMAW		60 V	63V

PHYSICAL DIMENSIONS				
MODEL	**HEIGHT**	**WIDTH**	**DEPTH**	**WEIGHT**
K3451-1, K3451-2, K3455-1, K3455-2, K3456-1, K3470-1, K3470-2, K5592-2, K5593-2, K6178-1, K6178-2, K6178-3, K6178-4, K5570-1, K5570-2	22.45 in (570mm)	14.00 in (356 mm)	24.80 in (630 mm)	150 lbs (68 kg)*

***Weight does not include input cord**

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE	STORAGE TEMPERATURE RANGE
Environmentally Hardened -4ºF to 104ºF (-20C to 40C)	Environmentally Hardened -40ºF to 185ºF (-40C to 85C)

IP23 155º(F) Insulation Class

SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

⚠ WARNING



ELECTRIC SHOCK can kill.

Only qualified personnel should perform this installation.

Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.

Do not touch electrically hot parts.

Always connect thePOWER WAVE® R450+ grounding lug to a proper safety (Earth) ground

SELECT SUITABLE LOCATION

The POWER WAVE® R450+ will operate in harsh environments. Even so, it is important that simple preventative measures are followed in order to assure long life and reliable operation.

- The machine must be located where there is free circulation of clean air such that air movement in the back, out the sides and bottom 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 machine dry. Shelter from rain and snow. Do not place on wet ground or in puddles.
- Do not mount the POWER WAVE® R450+ 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.

LIFTING

Both handles should be used when lifting the POWER WAVE® R450+. When using a crane or overhead device a lifting strap should be connected to both handles. Do not attempt to lift the POWER WAVE® R450+ with accessories attached to it.

STACKING

The POWER WAVE® R450+ cannot be stacked.

TILTING

Place the machine directly on a secure, level surface or on a recommended undercarriage. The machine may topple over if this procedure is not followed.

INPUT AND GROUND CONNECTIONS

Only a qualified electrician should connect the POWER WAVE® R450+. Installation should be made in accordance with the appropriate National Electrical Code, all local codes and the information in this manual.

MACHINE GROUNDING

The frame of the welder must be grounded. A ground terminal marked with a ground symbol is located next to the input power connection block.



See your local and national electrical codes for proper grounding methods.

HIGH FREQUENCY PROTECTION

Locate the POWER WAVE® R450+ away from radio controlled machinery. The normal operation of the POWER WAVE® R450+ may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

FCC REGULATORY STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device. For FCC ID number see the complete regulatory statement at the beginning of this manual.

⚠ WARNING



Only qualified electrician should connect the input leads to the POWER WAVE® R450+ Connections should be made in accordance with all local and national electrical codes and the connection diagrams. Failure to do so may result in bodily injury or death.

INPUT CONNECTION

(SeeFigure 1 : CONNECTION FOR K3451-1 AND K3455-2 on page A-13)

Use a three-phrase supply line. A 1.40 inch diameter access hole with strain relief is located on the case back. Route input power cable through this hole and connect L1, L2, L3 and ground per connection diagrams and National Electric Code. To access the input power connection block, remove three screws holding the access door to the side of the machine.

ALWAYS CONNECT THE POWER WAVE GROUNDING LUG TO A PROPER SAFETY (EARTH) GROUND.

INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

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



INPUT VOLTAGE SELECTION

The POWER WAVE® R450+ automatically adjusts to work with different input voltages. No reconnect switch settings are required.

⚠ WARNING



The POWER WAVE® R450+ ON/OFF switch is not intended as a service disconnect for this equipment. Only a qualified electrician should connect the input leads to the POWER WAVE® R450+. Connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect access door of the machine. Failure to do so may result in bodily injury or death.

On some models, toroids are on the power cord. When replacing the power cord, it is important to put the toroids on the new power cord in the same location and with the same number of turns.

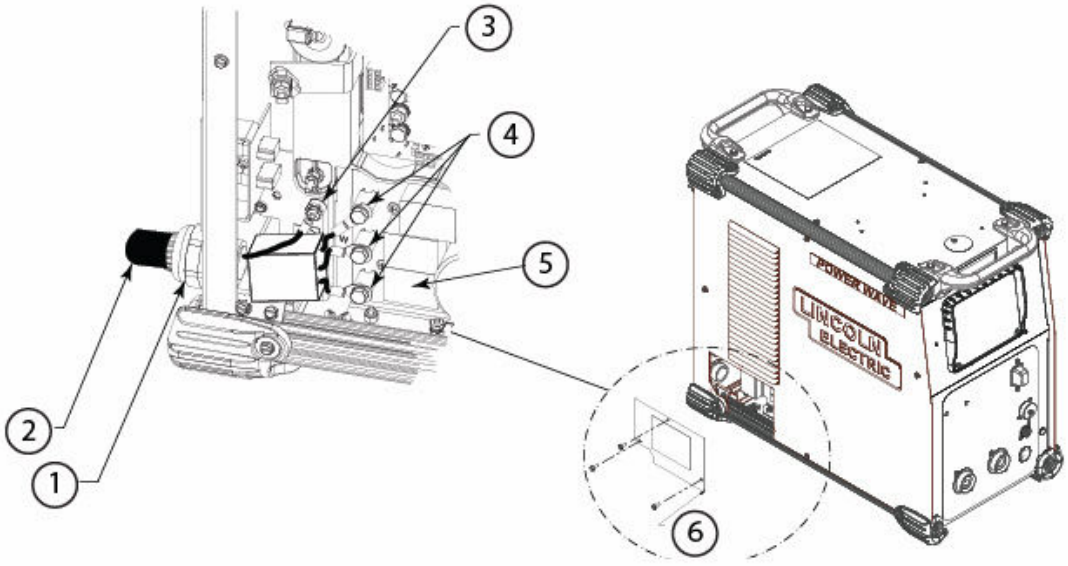


Figure 1 : CONNECTION FOR K3451-1 AND K3455-2

1. INPUT STRAIN RELIEF: Route input cord through relief and twist nut to tighten
2. INPUT CORD
3. GROUND CONNECTION: Connect ground lead per local and national electric code
4. POWER CONNECTION BLOCK: Connect each phase of a Three-Phase connector here

5. CE FILTER
6. INPUT POWER ACCESS DOOR

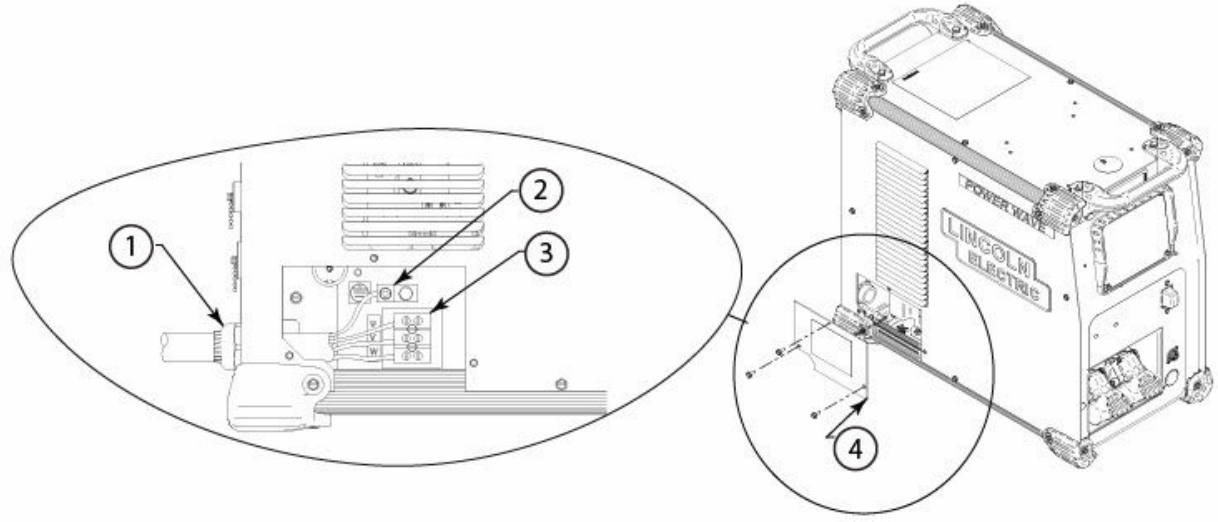


Figure 2 : CONNECTION FOR K3451-1, K3451-2 AND K3456-1

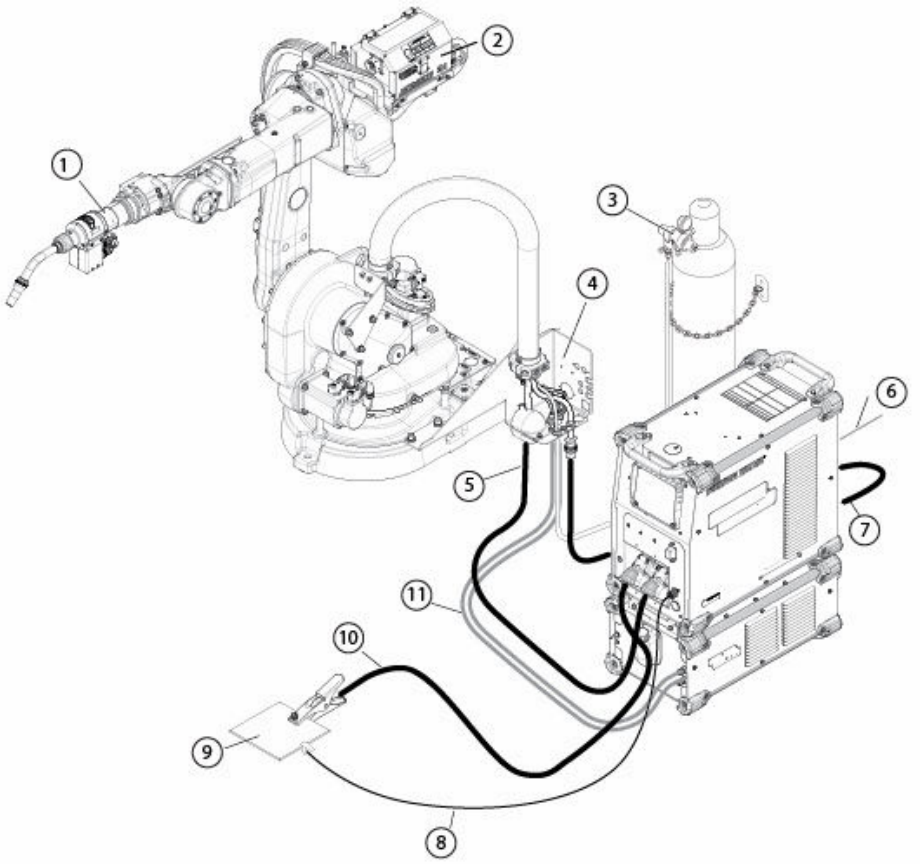
1. INPUT STRAIN RELIEF: Route input cord through relief and twist nut to tighten
2. GROUND CONNECTION: Connect ground lead per local and national electric code
3. POWER CONNECTION BLOCK: Connect each phase of a Three-Phase connector here
4. INPUT POWER ACCESS DOOR

GMAW (MIG) WELDING

GMAW (MIG) WELDING

An ArcLink compatible wire feeder is recommended for MIG welding.

ROBOTIC CONNECTION DIAGRAM



1. TORCH
2. FEEDER
3. FLOWMETER
4. DRESS OUT KIT
5. ELECTRODE CABLE
6. ETHERNET CONNECTION (REAR)
7. CONTROL CABLE
8. REMOTE SENSE LEAD
9. WORK PIECE
10.WORK CABLE
11.COOLER WATER LINE

RECOMMENDED WORK CABLE SIZES FOR ARC WELDING

Connect the electrode and work cables between the appropriate output studs of the POWER WAVE® R450+ per the following guidelines:

⚠ CAUTION

Negative electrode polarity operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set. See the Remote Sense Lead Specification section of this document for further details.

For additional Safety information regarding the electrode and work cable set-up, See the standard "SAFETY INFORMATION" located in the front of this Instruction Manual.

GENERAL GUIDELINES

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

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

Table below shows 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.

OUTPUT CABLE GUIDELINES

AMPERES	PERCENT DUTY CYCLE	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORKCABLES [RUBBER COVERED COPPER-RATED 167º(75ºC)**				
		0 to 50 Ft.	50 to 100 Ft.	100 to 150 Ft.	150 to 200 Ft.	200 to 250 Ft.
200	100	2	2	2	1	1/0
250	100	1	1	1	1	1/0
300	100	2/0	2/0	2/0	2/0	3/0
350	100	2/0	2/0	3/0	3/0	4/0
400	100	3/0	3/0	4/0	4/0	4/0
450	100	3/0	3/0	4/0	4/0	2-3/0
500	60	2/0	2/0	3/0	3/0	4/0
550	40	2/0	2/0	3/0	3/0	4/0

** Tabled values are for operation at ambient temperatures of 104°F (40˚C) and below. Applications above 104˚F (40˚C) may require cables larger than recommended, or cables rated higher than 167˚F (75˚C).

CABLE INDUCTANCE AND ITS EFFECT 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 3 : VOLTAGE SENSING DIAGRAM on page A-18)

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 SPECIFICATIONS

Voltage Sensing Overview

The best arc performance occurs when the POWER WAVE® R450+ has accurate data about the arc conditions.

Depending upon the process, inductance within the electrode and work cables can influence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. Remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board. Sense Lead Kits (K940-xx) are available for this purpose.

The POWER WAVE® R450+ has the ability to automatically sense when remote sense leads are connected. With this feature there are no requirements for setting-up the machine to use remote sense leads. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu (if a user interface is installed into the power source).

GENERAL GUIDELINES FOR VOLTAGE SENSE LEADS

Sense leads should be attached as close to the weld as practical, and out of the weld current path when possible. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

Voltage sense leads requirements are based on the weld process

Process	Electrode Voltage Sensing[1] 67 Lead	Work Voltage Sensing[2] 21 Lead
GMAW	67 Lead required	21 Lead optional [3]
GMAW-P	67 Lead required	21 Lead optional [3]
STT[4]	67 Lead required	21 Lead required
FCAW	67 Lead required	21 Lead optional [3]
GTAW	Voltage sense at studs	Voltage sense at studs

1. The electrode voltage sense lead (67) is automatically enabled by the weld process, and integral to the 5 pin arclink control cable (K1543-xx).
2. When a work voltage sense lead (21) is connected the power source will automatically switch over to using this feedback (if the auto sense feature is enable).
3. Negative polarity semi-automatic process operation WITHOUT use of a remote work sense lead (21) requires the Negative Electrode Polarity attribute to be set.
4. STT requires an STT or Advanced Module.

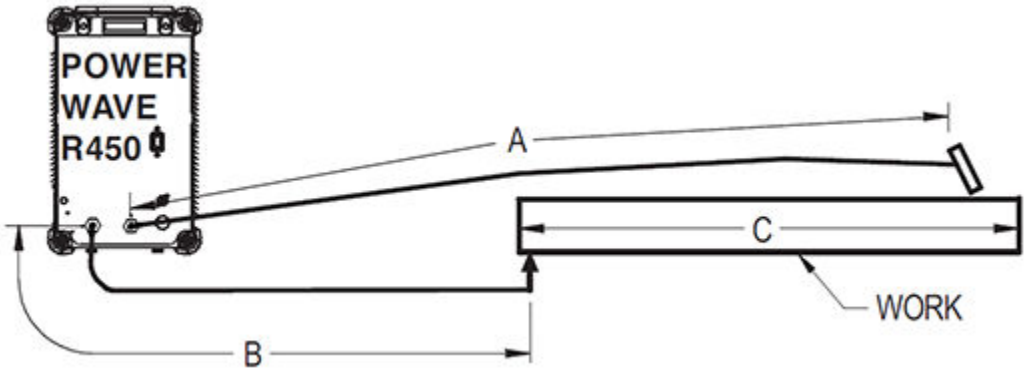


Figure 3 : VOLTAGE SENSING DIAGRAM

Electrode Voltage Sensing

The remote ELECTRODE sense lead (67) is built into the 5-pin arclink control cable and is always connected to the wire drive feed plate when a wire feeder is present. Enabling or disabling electrode voltage sensing is application specific, and automatically configured by the active weld mode.

⚠ CAUTION

AUTO SENSE LEAD

If the auto sense lead feature is disabled and the weld polarity attribute is improperly configured extremely high welding outputs may occur.

Work Voltage Sensing

While most applications perform adequately by sensing the work voltage directly at the output stud, the use of a remote work voltage sense lead is recommended for optimal performance. The remote WORK sense lead (21) can be accessed through the four-pin voltage sense connector located on the control panel by using the K940 Sense Lead Kit. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see in this section entitled "Voltage Sensing Considerations for Multiple Arc Systems."

Negative Electrode Polarity

The POWER WAVE® R450+ has the ability to automatically sense the polarity of the sense leads. With this feature there are no set-up requirements for welding with negative electrode polarity. This feature can be disabled through the Weld Manager Utility (available at www.powerwavesoftware.com) or through the set up menu (if a user interface is installed into the power source).

VOLTAGE SENSING CONSIDERATION FOR MULTIPLE ARC SYSTEMS

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

If Sense Leads ARE NOT Used:

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

If Sense Leads ARE Used:

- Position the sense leads out of the path of the weld current. Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each other's 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.

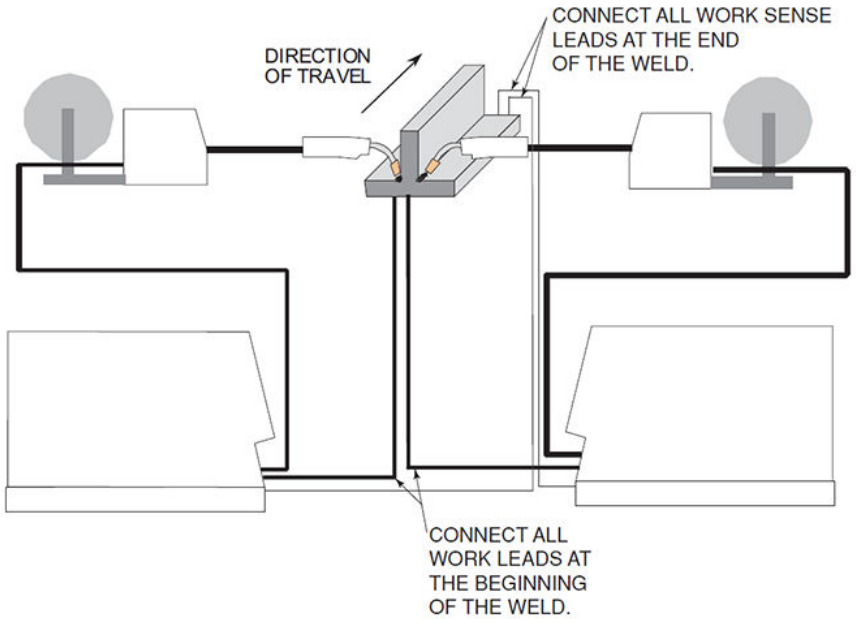
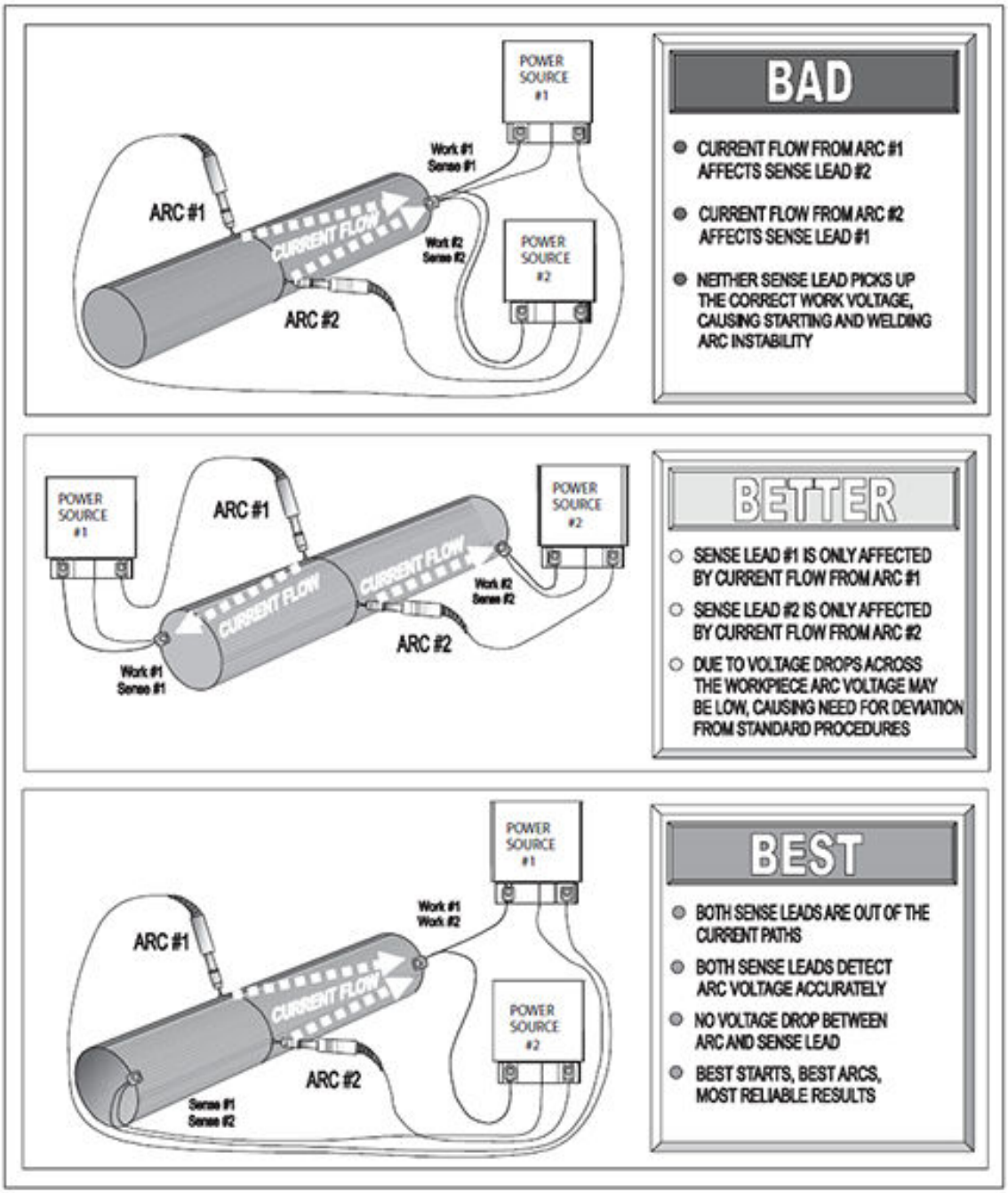


Figure 4 : MULTI-ARC LONGITUDINAL WELDS

- **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.



CONTROL CABLE CONNECTIONS

General Guidelines

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

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

Product specific Installation Instructions

Connection Between Power Source and ArcLink® Compatible Wirefeeders (K1543, K2683 – ArcLink Control Cable)

The 5-pin ArcLink control cable connects the power source to the wire feeder. The control cable consists of two power leads, one twisted pair for digital communication, and one lead for voltage sensing. The 5-pin ArcLink connection on the POWER WAVE® R450+ is located on the rear panel (See Case Back Controls in the Operation Section). 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. (61.0m).

Connection Between Power Source and Ethernet Networks

The POWER WAVE® R450+ is equipped with an IP67 rated ODVA compliant RJ-45 Ethernet connector, which is located on the rear panel. All external Ethernet equipment (cables, switches, etc.), as defined by the connection diagrams, must be supplied by the customer. It is critical that all Ethernet cables external to either a conduit or an enclosure are solid conductor, shielded cat 5e cable, with a drain. The drain should be grounded at the source of transmission. For best results, route Ethernet cables away from weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field. For additional guidelines refer to ISO/IEC 11801. Failure to follow these recommendations can result in an Ethernet connection failure during welding.

OPERATION

SAFETY PRECAUTIONS

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

⚠ WARNING



ELECTRIC SHOCK can kill

- Do not touch electrically live part or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Always wear dry insulating gloves.
- Do not operate with covers, panels or guards removed or open.

⚠ WARNING



FUMES AND GASES can be dangerous

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

⚠ WARNING



WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.

⚠ WARNING



ARC RAYS can burn

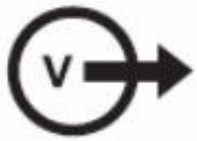
- Wear eye, ear, and body protection.

SEE ADDITIONAL WARNING INFORMATION UNDER ARC WELDING SAFETY PRECAUTIONS AND IN THE FRONT OF THIS OPERATING MANUAL.

GRAPHIC SYMBOL DESCRIPTIONS

GRAPHIC SYMBOLS USED IN THE MANUAL OR BY THIS MACHINE

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	INPUT POWER	U_0	OPEN CIRCUIT VOLTAGE
	ON	U_P	PEAK VOLTAGE
	OFF	U_1	INPUT VOLTAGE
	HIGH TEMPERATURE	U_2	OUTPUT VOLTAGE
	CIRCUIT BREAKER	I_1	INPUT CURRENT
	POSITIVE OUTPUT	I_2	OUTPUT CURRENT
	NEGATIVE OUTPUT		PROTECTIVE GROUND
	INPUT POWER CONNECTION		WARNING OR CAUTION
	SINGLE PHASE		EXPLOSION
	DIRECT CURRENT		DANGEROUS VOLTAGE

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	ALTERNATING CURRENT		SHOCK HAZARD
	DIRECT AND ALTERNATING CURRENT		TIG TORCH
	FAULT		STICK ELECTRODE HOLDER
	OUTPUT ACTIVE		REFER TO OPERATOR'S MANUAL
	REMOTE		1 PHASE INVERTER POWER SOURCE

POWER UP SEQUENCE

When the POWER WAVE® R450+ is powered up, it can take as long as 30 seconds for the machine to be ready to weld. During this time period the user interface will not be active.

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. Refer to the technical specification section for the POWER WAVE® R450+'s duty cycle ratings.

PRODUCT DESCRIPTION

The POWER WAVE® R450+ is a portable multi-process power source with high-end functionality capable of Stick, DC TIG, MIG, Pulsed MIG and Flux-Cored welding. It is ideal for a wide variety of materials including aluminum, stainless, and nickel — where arc performance is critical.

The POWER WAVE® R450+ is designed to be a very flexible welding system. Like existing Power Wave's®, the software based architecture allows for future upgradeability. One significant change from the current range of Power Wave® units is that the Ethernet communication feature is standard on the POWER WAVE® R450+ which allows for effortless software upgrades through Powerwavesoftware.com. A Devicenet option allows the POWER WAVE® R450+ to be used in a wide range of configurations and the POWER WAVE® R450+ is designed to be compatible with advanced welding modules like STT.

RECOMMENDED PROCESSES AND EQUIPMENT

The POWER WAVE® R450+ is recommended for robotic and semiautomatic welding. The POWER WAVE® R450+ can be set up in a number of configurations, some requiring optional equipment or welding programs.

Recommended Processes

The POWER WAVE® R450+ is a high speed, multi-process power source capable of regulating the current, voltage, or power of the welding arc. With an output range of 5 to 550 amperes, it supports a number of standard processes including synergic GMAW, GMAW-P, FCAW, FCAW-SS, SMAW, GTAW and GTAW-P on various materials especially steel, aluminum and stainless.

PROCESS LIMITATIONS

The software based weld tables of the POWER WAVE® R450+ limit the process capability within the output range and the safe limits of the machine. In general the processes will be limited to .030 .052 solid steel wire, .030 -.045 stainless wire, .035 -1/16 cored wire, and .035 - 1/16 Aluminum wire.

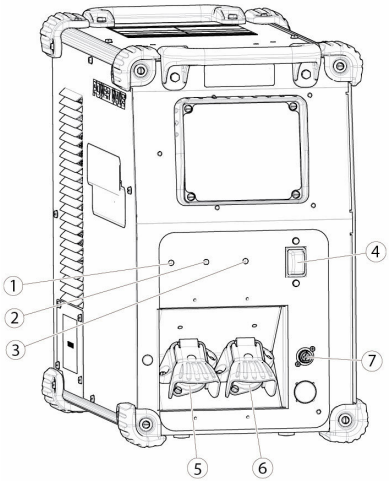
EQUIPMENT LIMITATIONS

Only ArcLink compatible semiautomatic wire feeders and users interfaces may be used. If other Lincoln wire feeders or non Lincoln wire feeders are used there will be limited process capability and performance and features will be limited.

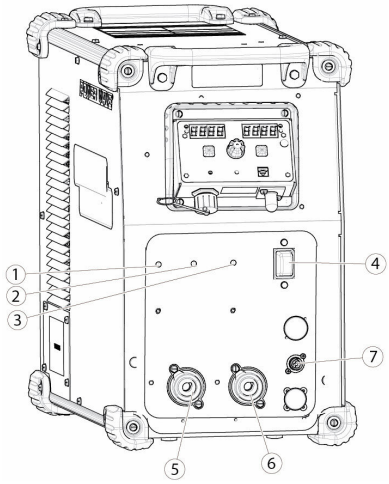
The POWER WAVE® R450+’s are not compatible with the S-Series user Interface Kit.

CASE FRONT CONTROLS

K3451-1, K3451-2, K3456-1, K6178-1, K6178-2, K6178-3, & K6178-5



K3455-1, K3455-2, & K6178-4



1. **Status LED** - (See Troubleshooting Section for operational functions).
2. **Thermal LED**- Indicates when machine has thermal fault.
3. **FEEDER Status LED**- A two color LED that indicates system errors. The Power Wave R450 is equipped with two indicators. One is for the inverter power source, while the other indicates the status of the feeder control system. Normal operation is a steady green light. For more information and a detailed listing, see the troubleshooting section of this document or the Service Manual for this machine. (See Troubleshooting Section for operational functions.)

   Note: The Power Wave R450 status light will flash green, and sometimes red and green, for up to one minute when the machine is first turned on. This is a normal situation as the machine goes through a self test at power up.
4. **Power Switch** -Controls power to the POWER WAVE®R450.
5. **NEGATIVE WELD OUTPUT**
6. **POSITIVE WELD OUTPUT**
7. **Voltage Sense Connector** - Allows for separate remote electrode and work sense leads.

VOLTAGE SENSE PINS

- Pin 3, Lead 21, Work Voltage Sense
- Pin 1, Lead 67E, Electrode Voltage Sense

CASE BACK CONTROLS

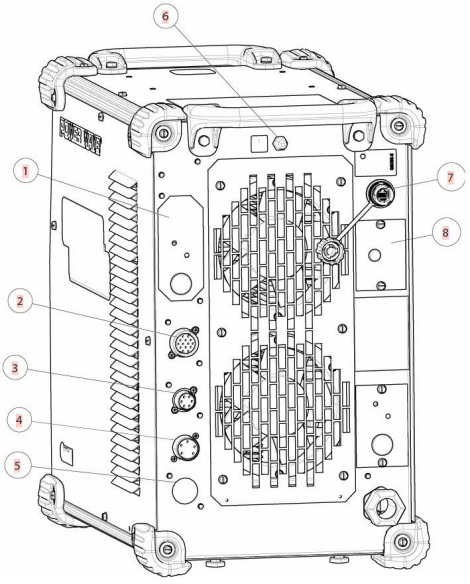
1. **115 VAC RECEPTACLES (Optional Kit - K2829-1)**
2. **WIRE FEEDER RECEPTACLE (14 Pin)** - Robotic wire feeder connector (for 4R220, Power Feed 10 Robotic, etc).
3. **DIFFERENTIAL I/O CONNECTOR** - For (Optional) K2902-1 STT or K2912-1 Advanced Module.
4. **ArcLink OUTPUT CONNECTOR (5 PIN)** - Provides power and communication to ArcLink periferals (semi-automatic feeder, Cool Arc 55S, etc).
5. **Devicenet Kit (optional - K2827-2)** - For PLC control.
6. **40V CIRCUIT BREAKER**
7. **Ethernet (SHIELDED)** - For ArcLink XT enabled robot, computer or network connection.
8. **Internal I/O CONNECTOR** -Terminal Strip for making simple input signal connections.

   The terminal strip is divided into three groups:

   Group #1 - TRIGGER

   Group #2 - FEED FORWARD/REVERSE

   Group #3 - SHUTDOWN INPUTS



12	
11	Shutdown 2 Input
10	Shutdown 1 Input
9	+15VDC - Group #3
8	Gas Purge
7	Feed Reverse
6	Feed Forward
5	+15VDC - Group #2
4	2/4 Step
3	Dual Procedure
2	Trigger
1	+15VDC - Group #1

All inputs use "normally open" logic except the shutdown group. The shutdown inputs use "normally closed" logic, and are always enabled. Unused shutdowns must be tied to the +15V supply for the shutdown group. Machines are shipped from the factory with jumpers installed on both shutdown inputs.

Shutdown 1 and shutdown 2 inputs are for weld system faults and should not be used as emergency or safety shutdowns.

COMMON WELDING PROCEDURES

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

Choose the electrode material, electrode size, shielding gas, and process (GMAW, GMAW-P etc.) appropriate for the material to be welded.

Select the weld mode that best matches the desired welding process. The standard weld set shipped with the encompasses a wide range of common processes that will meet most needs. If a special weld mode is desired, contact the local Lincoln Electric sales representative.

All adjustments are made through the user interface. Because of the different configuration options your system may not have all of the following adjustments.

See Accessories Section for Kits and Options available to use with the POWER WAVE® R450+.

DEFINITION OF WELD MODES

Non-Synergic Welding Modes

- A Non-synergic welding mode requires all welding process variables to be set by the operator.

Synergic Welding Modes

- A Synergic welding mode offers the simplicity of single knob control. The machine will select the correct voltage and amperage based on the Wire Feed Speed (WFS) set by the operator.

BASIC WELDING CONTROLS

Weld Mode

Selecting a weld mode determines the output characteristics of the Power Wave® power source. Weld modes are developed with a specific electrode material, electrode size, and shielding gas. For a more complete description of the weld modes programmed into the POWER WAVE® R450+ at the factory, refer to the Weld Set Reference Guide supplied with the machine or available at www.powerwavesoftware.com.

Wire Feed Speed (WFS)

In synergic welding modes (synergic CV, GMAW-P), WFS is the dominant control parameter. The user adjusts WFS according to factors such as wire size, penetration requirements, heat input, etc. The POWER WAVE® R450+ then uses the WFS setting to adjust the voltage and current according to settings contained in the POWER WAVE®.

In non-synergic modes, the WFS control behaves like a conventional power source where WFS and voltage are independent adjustments. Therefore, to maintain proper arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

Amps

In constant current modes, this control adjusts the welding amperage.

Volts

In constant voltage modes, this control adjusts the welding voltage.

Trim

In pulse synergic welding modes, the Trim setting adjusts the arc length. Trim is adjustable from 0.50 to 1.50. 1.00 is the nominal setting and is a good starting point for most conditions.

UltimArc™ Control

UltimArc™ Control allows the operator to vary the arc characteristics. UltimArc™ Control is adjustable from –10.0 to +10.0 with a nominal setting of 0.0.

SMAW (STICK) WELDING

The welding current and Arc Force settings can be set through a Power Feed™ 84 or Power Feed™ 25M wire feeder. Alternatively an optional Stick / TIG UI can be installed into the power source to control these settings locally.

In a SMAW (STICK mode), Arc Force can be adjusted. It can be set to the lower range for a soft and less penetrating arc characteristic (negative numeric values) or to the higher range (positive numeric values) for a crisp and more penetrating arc. Normally, when welding with cellulosic types of electrodes (E6010, E7010, E6011), a higher energy arc is required to maintain arc stability. This is usually indicated when the electrode sticks to the work piece or when the arc becomes unstable during manipulative technique. For low hydrogen types of electrodes (E7018, E8018, E9018, etc.) a softer arc is usually desirable and the lower end of the Arc Control suits these types of electrodes. In either case the arc control is available to increase or decrease the energy level delivered to the arc.

GTAW (TIG) WELDING

The welding current can be set through a Power Feed™ 84 or Power Feed™ 25M wire feeder. Alternatively an optional Stick / Tig UI can be installed into the power source to control these settings locally.

The TIG mode features continuous control from 5 to 550 amps with the use of an optional foot amptrol. The POWER WAVE® R450+ can be run in either a Touch Start TIG mode or Scratch start TIG mode.

CONSTANT VOLTAGE WELDING

Synergic CV

For each wire feed speed, a corresponding voltage is preprogrammed into the machine through special software at the factory.

The nominal preprogrammed voltage is the best average voltage for a given wire feed speed, but may be adjusted to preference. When the wire feed speed changes, the POWER WAVE® R450+ automatically adjusts the voltage level correspondingly to maintain similar arc characteristics throughout the WFS range.

Non Synergic CV

In non-synergic modes, the WFS control behaves more like a conventional CV power source where WFS and voltage are independent adjustments. Therefore to maintain the arc characteristics, the operator must adjust the voltage to compensate for any changes made to the WFS.

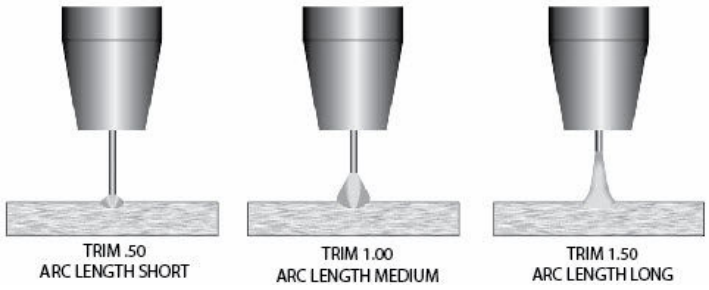
All CV Modes

Pinch adjusts the apparent inductance of the wave shape. The “pinch” function is inversely proportional to inductance. Therefore, increasing Pinch Control greater than 0.0 results in a crisper arc (more spatter) while decreasing the Pinch Control to less than 0.0 provides a softer arc (less spatter).

PULSE WELDING

Pulse welding procedures are set by controlling an overall “arc length” variable. When pulse welding, the arc voltage is highly dependent upon the waveform. The peak current, back ground current, rise time, fall time and pulse frequency all affect the voltage. The exact voltage for a given wire feed speed can only be predicted when all the pulsing waveform parameters are known. Using a preset voltage becomes impractical and instead the arc length is set by adjusting “trim”.

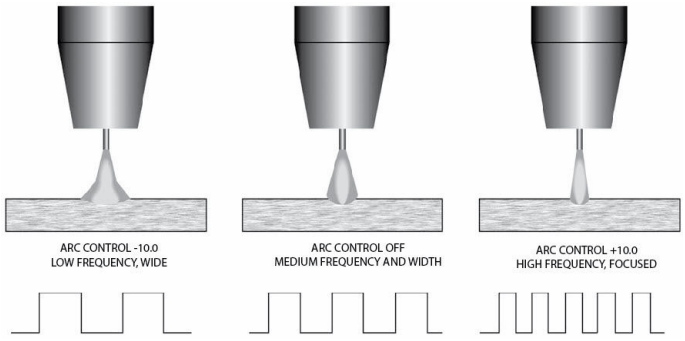
Trim adjusts the arc length and ranges from 0.50 to 1.50 with a nominal value of 1.00. Trim values greater than 1.00 increase the arc length, while values less than 1.00 decrease the arc length (see Figure B.3).



Most pulse welding programs are synergic. As the wire feed speed is adjusted, the POWER WAVE® R450+ will automatically recalculate the waveform parameters to maintain similar arc properties.

The POWER WAVE® R450+ utilizes “adaptive control” to compensate for changes in the electrical stick-out while welding. (Electrical stick-out is the distance from the contact tip to the work piece.) The POWER WAVE® R450+ waveforms are optimized for a 0.75” stick-out. The adaptive behavior supports a range of stick outs from 0.50 to 1.25”. At very low or high wire feed speeds, the adaptive range may be less due to reaching physical limitations of the welding process.

UltimArc™ Control adjusts the focus or shape of the arc. UltimArc™ Control is adjustable from -10.0 to +10.0 with a nominal setting of 0.0. Increasing the UltimArc™ Control increases the pulse frequency and background current while decreasing the peak current. This results in a tight, stiff arc used for high speed sheet metal welding. Decreasing the UltimArc™ Control decreases the pulse frequency and background current while increasing the peak current. This results in a soft arc good for out of position welding.



ACCESSORIES AND OPTIONS

ACCESSORIES

All Kits Options and Accessories are found on the Web site: (www.lincolnelectric.com)

Welding Fume Extractors

Lincoln offers a wide range of fume extraction environmental system solutions, ranging from portable systems easily wheeled around a shop to shop-wide central systems servicing many dedicated welding stations.

Request Lincoln publication E13.40

(See www.lincolnelectric.com)

MAINTENANCE

SAFETY PRECAUTIONS

⚠ WARNING



ELECTRIC SHOCK can kill.

- Do not operate with covers removed.
- Turn off power source before installing or servicing
- Do not touch electrically hot parts.
- Turn the input power to the welding power source off at the fuse box before working in the terminal strip.
- Only qualified personnel should install, use or service this- equipment.

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.

PERIODIC MAINTENANCE

Calibration of the POWER WAVE® R450+ is critical to its operation. Generally speaking the calibration will not need adjustment. However, neglected or improperly calibrated machines may not yield satisfactory weld performance. To ensure optimal performance, the calibration of output Voltage and Current should be checked yearly.

CALIBRATION SPECIFICATION

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

The calibration procedure itself requires the use of a grid, and certified actual meters for voltage and current. The accuracy of the calibration will be directly affected by the accuracy of the measuring equipment you use. SVM251 VERIFICATION AND CALIBRATION PROCEDURES includes detailed instructions at

www.powerwavesoftware.com.

TROUBLESHOOTING

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.

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.

2. **POSSIBLE CAUSE**

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

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.

⚠ CAUTION



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

Observe all additional safety guidelines detailed throughout this manual.

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

Not all of the POWER WAVE® R450+ errors will be displayed on the user interface if it is installed). There are two status lights that display error codes. If a problem occurs it is important to note the condition of the status lights. Therefore, prior to cycling power to the system, check the power source status light for error sequences as noted below.

There is one externally mounted status light located on the case front of the machine. This status light corresponds to the main control board and input control board's status.

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

The status light for the main control board and input control board are dual-color LED's. Normal operation for each is steady green.

Error conditions are indicated in the following table.

Table 2 :

Light Condition	Meaning	
	Main Control Board Status Light	**Input Control Board**
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.	Not applicable.
Blinking Green	Occurs during power up or a system reset, and indicates the POWER WAVE® S350 is mapping (identifying) each component in the system. Normal for first 1-10 seconds after power is turned on, or if the system configuration is changed during operation.	Not applicable.
Fast Blinking Green	Indicates Auto-mapping has failed.	Not applicable.

Light Condition	Meaning	
	Main Control Board Status Light	**Input Control Board**
Alternating Green and Red	Non-recoverable system fault. If the Status lights are flashing any combination of red and green, errors are present. **Read the error code(s) before the machine is turned off.**	Not applicable.
	Error Code interpretation through the Status light is detailed in 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** (available at https://www.powerwavesoftware.com). This is the preferred method, since it can access historical information contained in the error logs.	
	To clear the active error(s), turn power source off, and back on to reset.	
Steady Red	Not applicable.	
Blinking Red	Not applicable.	**Error Code interpretation** - Individual code digits are flashed in red with a long pause between digits. These error codes are three digit codes that all start with a number three.
Status LED off	Not applicable.	Not applicable.

⚠ CAUTION

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

ERROR CODES FOR THE POWER WAVE® R450+

The following is a partial list of possible error codes for the POWER WAVE® R450+. For a complete listing consult the Service Manual for this machine.

MAIN CONTROL BOARD ("STATUS" LIGHT)	
Error Code #	**Indication**
36 Thermal error	Indicates over temperature. Usually accompanied by Thermal LED. Check fan operation. Be sure process does not exceed duty cycle limit of the machine.
54 Secondary (Output) over current error	The long term average secondary (weld) current limit has been exceeded. **Note:** The long term average secondary current limit is 325 amps.
56 Chopper communication error	Indicates communication link between main control board and chopper has errors. If cycling the input power on the machine does not clear the error, contact the Service Department.
58 Primary Fault error	Review error code from input board status light or status beeper. Most likely caused by an over power condition which caused an under voltage on the primary bus. If cycling the input power on the machine does not clear the error, contact the Service Department.
71 Secondary (Output) over power error	The long term secondary (Weld) power limit has been exceeded. **Note:** The long term average secondary current limit is 25kw (3 Phase), 14kw (1 Phase).
Other	Error codes that contain three or four digits are defined as fatal errors. These codes generally indicate internal errors on the Power Source Control Board. If cycling the input power on the machine does not clear the error, contact the Service Department.

INPUT CONTROL BOARD		
Error Code #	**Indication**	**Type**
331 Instantaneous Input Current Limit	Input current limit has been exceeded. Typically indicates short term power overload. If problem persists contact Service Department.	Persistent
334 Startup Current Check Failure	Input current limit was exceeded during machine power-up. If problem persists contact Service Department.	Persistent

INPUT CONTROL BOARD		
Error Code #	**Indication**	**Type**
335 Startup Voltage Check Failure	Input voltage was too high or too low during machine power-up. Verify that the input voltage is between 200V and 650V.	Temporary
336 Thermal Fault	Thermostat on primary module tripped. Typically caused by bottom fan not working.	Temporary
337 Pre-charge timeout	Problem with start-up sequence. If problem persists contact Service Department.	Persistent
338 Input Power Limit	The input power drawn by the machine exceeded a safe level. If problem persists, contact the Service Department.	Persistent
341 Input Voltage Dropout	The input voltage momentarily dropped out. Check connections and verify quality of input power.	Temporary
346 Transformer primary over current	Transformer current too high. Typically indicates short term power overload. If problem persists contact service department.	Persistent
347 Average Input Current Limit	Average input current limit has been exceeded. Typically indicates short term power overload. If problem persists contact Service Department.	Persistent
349 Bus Undervoltage	The DC bus voltage dropped below the allowable limit. If problem persists, contact the Service Department.	Temporary

Persistent errors require power to be cycled for the error to clear.

Temporary faults will go away on their own if the error condition is removed.

WIRE DRIVE MODULE	
Error Code #	**Indication**
81 Motor Overload	Long term average motor current limit has been exceeded. Typically indicates mechanical overload of system. If problem continues consider higher torque gear ratio (lower speed range).
82 Motor Overcurrent	Absolute maximum motor current level has been exceeded. This is a short term average to protect drive circuitry.

WIRE DRIVE MODULE	
Error Code #	**Indication**
83 Shutdown #1 Is Open	**Note:** This refers to the 'green' I/O connector on the bottom of the controller. If not being externally accessed, verify the integrity of the connector and jumper. If accessed through a remote circuit, verify the integrity of that circuit.
84 Shutdown #2 Is Open	**Note:** This refers to the 'green' I/O connector on the bottom of the controller. If not being externally accessed, verify the integrity of the connector and jumper. If accessed through a remote circuit, verify the integrity of that circuit.

⚠ 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.

TROUBLESHOOTING GUIDE

Observe all Safety Guidelines detailed throughout this manual.

PROBLEM (SYMPTOM)	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 when the covers are removed.	**3.** Contact your local authorized Lincoln Electric Field Service facility for technical assistance.
Machine will not power up (no lights)	**1.** No Input Power.	**1.** Make sure input supply disconnect has been turned ON. Check input fuses. Make certain that the Power Switch (SW1) on the power source is in the “ON” position.
	2. Input voltage is too low or too high.	**2.** Make certain that input voltage is correct, according to the Rating Plate located on the rear of the machine.
Machine won’t weld, can’t get any output. This problem will normally be accompanied by an error code. See “Status Light” section of this document for additional information.	**1.** Input voltage is too low or too high.	**1.** Make certain that input voltage is correct, according to the Rating Plate located on the rear of the machine.
	2. Thermal Error.	**2.** See “Thermal LED is ON” section.
	3. Secondary current limit has been exceeded. (see error 54) **a.** Input control board fault (see input control board error status).	**3.** Possible short in output circuit. RECOMMENDED COURSE OF ACTION If condition persists, contact an authorized Lincoln Electric Field Service facility.

PROBLEM (SYMPTOM)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
BASIC MACHINE PROBLEMS		
Thermal LED is ON.	**1.** Improper fan operation.	**1.** Check for proper fan operation. Fan should run in a low speed setting when the machine is idle and increase in speed as the machine temperature increases. Check for material blocking intake or exhaust louvers, or for excessive dirt clogging cooling channels in machine.
	2. Open thermostat circuit.	**2.** Check for broken wires, open connections or faulty thermostats in the thermostat circuit.
"Real Time Clock" no longer functioning	**1.** Control PC Board Battery.	**1.** Replace the battery (Type: BS2032).
PROBLEM (SYMPTOM)	**POSSIBLE CAUSE**	**RECOMMENDED COURSE OF ACTION**
WELDING AND ARC QUALITY PROBLEMS		
General degradation of weld performance	**1.** Wire feed problem.	**1.** Check for feeding problems.
	2. Cabling problems.	**2.** Check for bad connections, excessive loops in cable, etc.
	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.** The power source may require calibration. (current, voltage, WFS).
Wire burns back to tip at the end of the weld.	**1.** Burnback Time	**1.** Reduce burnback time and/or work point.
Machine output shuts down during a weld.	**1.** Secondary current limit has been exceeded, and the machine shuts down to protect itself.	**1.** Adjust procedure or reduce load to lower current draw from the machine.
	2. System Fault	**2.** A non-recoverable fault will interrupt welding. This condition will also result in a status light blinking. See the Status Light section for more information.
Machine won't produce full output.	**1.** Input voltage may be too low, limiting output capability of the power source.	**1.** Make certain that the input voltage is proper, according to the Rating Plate located on the rear of the machine.
	2. The input may be single phase.	**2.** Verify all 3 phases are present.
	3. Machine calibration.	**3.** Calibrate secondary current and voltage.

PROBLEM (SYMPTOM)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
WELDING AND ARC QUALITY PROBLEMS		
Excessively long and erratic arc.	**1.** Wire feed problem.	**1.** Check for feeding problems. Make sure proper gear ratio has been selected.
	2. Loss of, or improper Shielding Gas	**2.** Verify gas flow and type are correct.
	3. Machine calibration.	**3.** Calibrate secondary current and voltage.
PROBLEM (SYMPTOM)	**POSSIBLE CAUSE**	**RECOMMENDED COURSE OF ACTION**
ETHERNET		
Cannot Connect	**1.** Physical connection.	**1.** Verify that the correct patch cable or across over cable is being used (refer to local IT department for assistance). **a.** Verify the cables are fully inserted into the bulk head connector. **b.** The LED under the PC board ethernet connector will be lit when the machine is connected to another network device.
	2. IP address information.	**2.** Use the appropriate PC utility to verify the correct IP address information has been entered. **a.** Verify no duplicate IP addresses exist on the network.
	3. Ethernet Speed	**3.** Verify that the network device connected to the Power Wave is either a 10-baseT device or a 10/100-baseT device. 10-baseT is recommended
Connection Drops while welding	**1.** Cable Location	**1.** Verify Network cable is not located next to current carrying conductors. This would include input power cables and welding output cables.

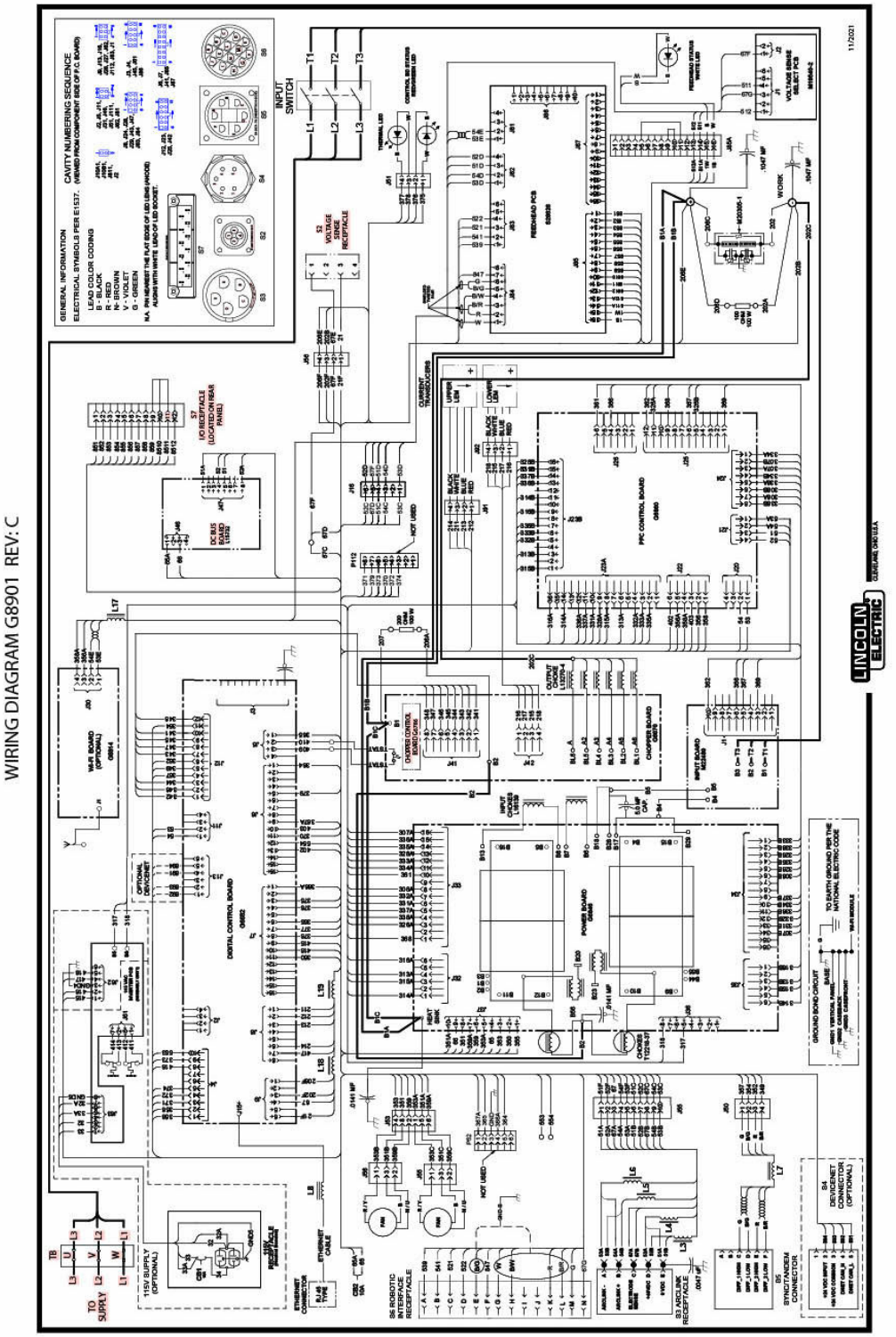
⚠ CAUTION

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

APPENDIX

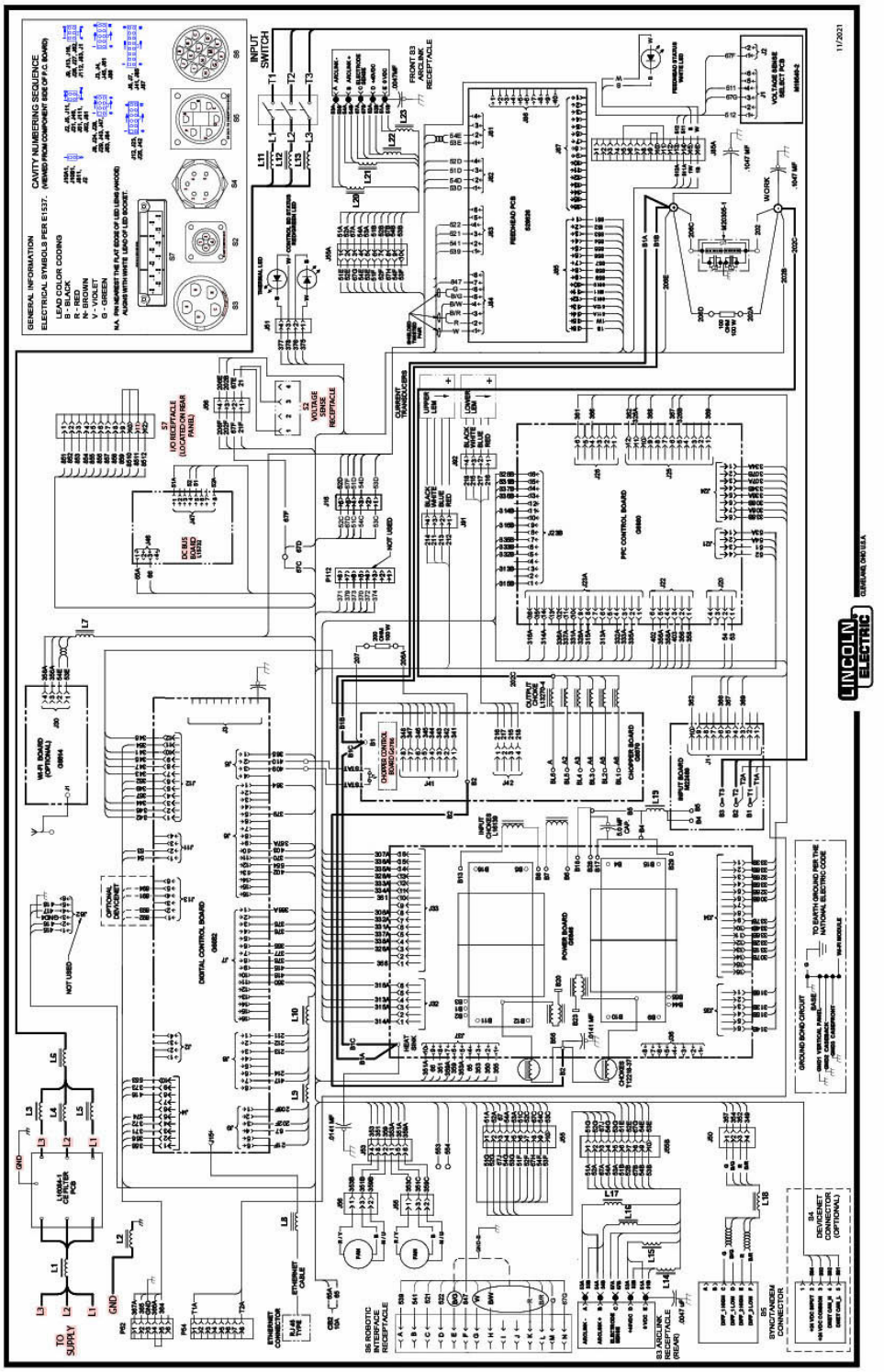
WIRING DIAGRAM G8901

FOR CODES: 12644, 12645, 12847, 13386, 13387, 13657, 13658, 13660, 14108, 14109, & 14110



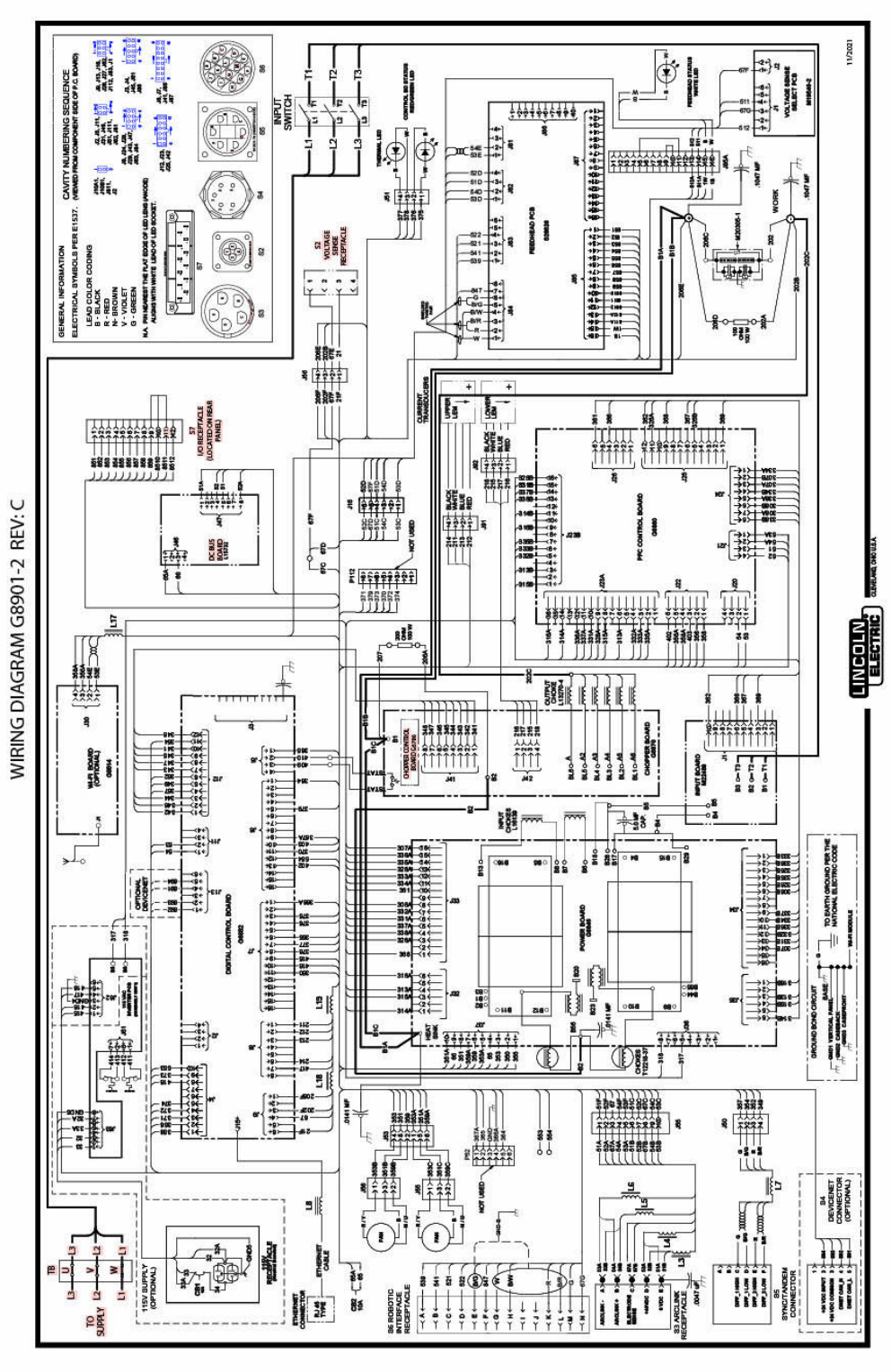
WIRING DIAGRAM G8901-1

FOR CODES: 12712, 12713, 12848, 13659, & 14107

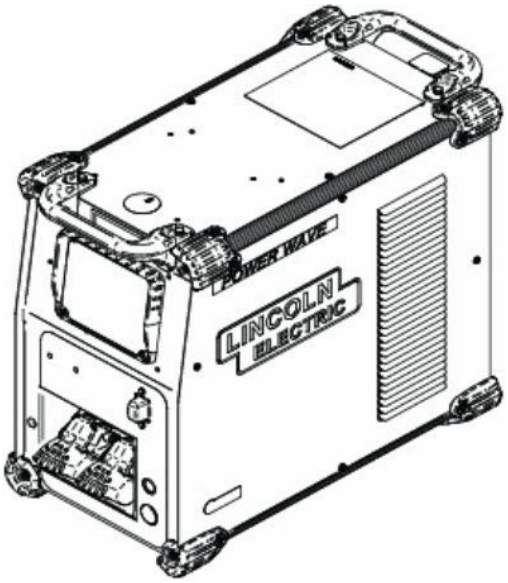


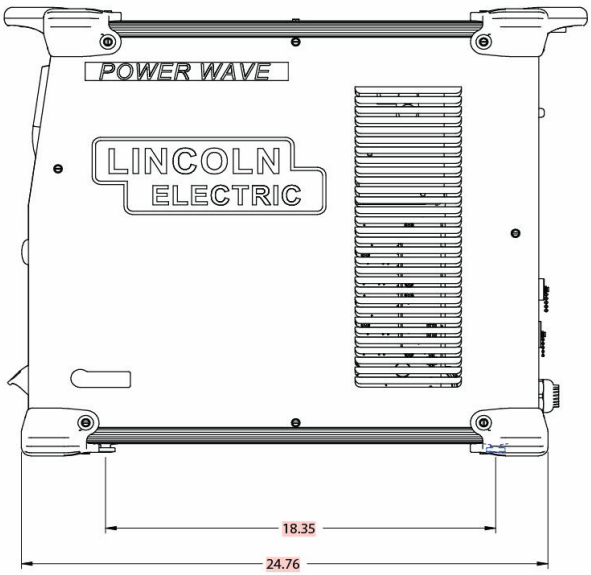
WIRING DIAGRAM G8901-2

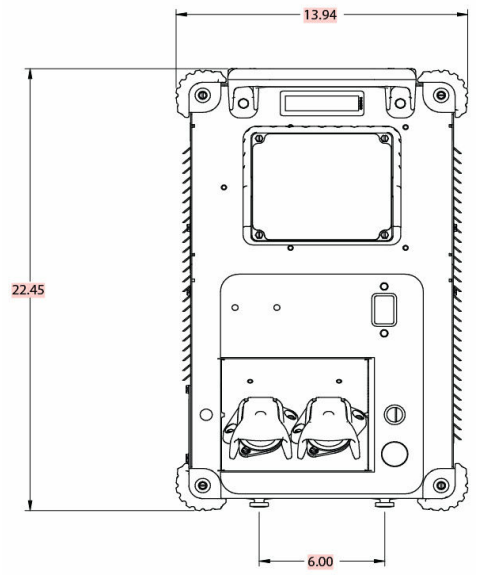
FOR CODES: 12714, 12849, & 14106

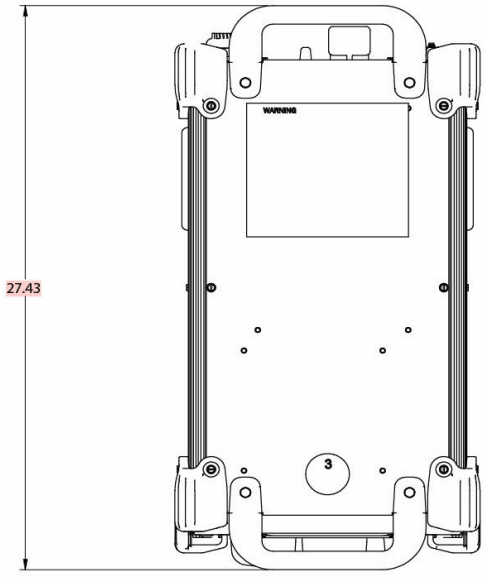


DIMENSION PRINT









CUSTOMER ASSISTANCE POLICY

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WELD FUME CONTROL EQUIPMENT

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.

PARTS LIST

Content/Details may be changed or updated without notice. For most current Instruction Manuals, go to PARTS.LINCOLNELECTRIC.COM.