INSTRUCTION MANUAL

SQUARE WAVE® 205

For use with Product/Code Numbers:

13702

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

IM10714 | Issue Date MAY - 2025

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
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SAFETY DEPENDS ON YOU

Lincoln 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.

⚠ 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 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.
- **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 current creates EMF fields around welding cables and welding machines.
- 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

GENERAL DESCRIPTION

GRAPHIC SYMBOLS USED IN THE MANUAL OR BY THIS MACHINE

INPUT POWER

ON

OFF

HIGH TEMPERATURE

CIRCUIT BREAKER

POSITIVE OUTPUT

NEGATIVE OUTPUT

INPUT POWER

SINGLE PHASE

DIRECT CURRENT

ALTERNATING CURRENT

OPEN CIRCUIT VOLTAGE

PEAK VOLTAGE

INPUT VOLTAGE

OUTPUT VOLTAGE

INPUT CURRENT

OUTPUT CURRENT

PROTECTIVE GROUND

WARNING OR CAUTION

EXPLOSION

DANGEROUS VOLTAGE

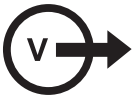
SHOCK HAZARD

DIRECT AND ALTERNATING CURRENT

TIG TORCH

FAULT

STICK ELECTRODE HOLDER



OUTPUT ACTIVE

REFER TO OPERATOR'S MANUAL

REMOTE

1 PHASE INVERTER POWER SOURCE

PRODUCT DESCRIPTION

The SQUARE WAVE® 205 is a portable TIG and Stick welding machine that lets hobbyists, small fabricators, and craftsmen explore their creativity. It is designed to help expand your welding expertise. You can take advantage of the additional functionality of the SQUARE WAVE® 205 as your skills and confidence grow. The SQUARE WAVE® 205 provides smooth and stable AC TIG welding on aluminum and DC TIG welding on steel, stainless steel, and chrome-moly. A user friendly interface enables the operators to set it, forget it, and weld.

CHARACTERISTICS

- The power source incorporates a high frequency arc start circuit to allow for contactless arc starting.
- A smooth stable arc on AC or DC polarity.
- 6010 and 7018 stick welding capabilities for outdoor work or thicker materials.
- Three handles for carrying in multiple orientations; single hand or two hand carry.

PROCESSES

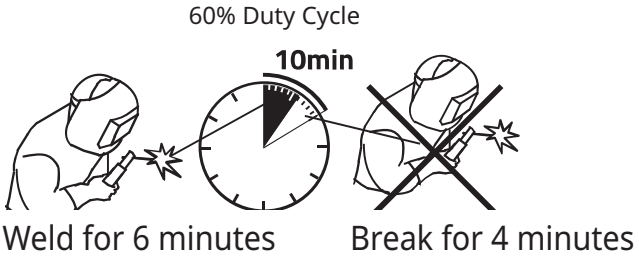
- AC STICK
- DC STICK
- DC TIG
- AC TIG

WELDING CAPABILITY

The SQUARE WAVE® 205 supports GTAW and SMAW constant current welding modes. The static characteristic of machine is drooping. Please see Technical Specifications in the Installation Section for rated outputs for the SQUARE WAVE® 205 inverter machine as it is capable of higher duty cycles at lower output currents.

If the duty cycle is exceeded, a thermal protector will shut off the output until the machine cools.

A Duty Cycle of 60% example is:



THERMAL PROTECTION

Thermostats protect the machine from excessive operating temperatures. Excessive temperatures may be caused by a lack of cooling air or operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the thermostats will prevent output voltage or current.

INSTALLATION

TECHNICAL SPECIFICATIONS

SQUARE WAVE® 205 (K5613-1)

OUTPUT RANGE				
INPUT POWER	**WELDING MODE**	**INPUT RANGE**	**OUTPUT RANGE**	**OPEN CIRCUIT VOLTAGE(1) (OCV)**
120 V 1 PHASE 60 Hz	TIG (AC/DC)	120 V	8 - 125 A*	U_0 = 90 V
		230 V	8 - 205 A	
	STICK (DC)	120 V	15 - 90 A	U_0 = 90 V
		230 V	15 - 170 A	
220 / 230 V 1 PHASE 60 Hz	STICK (AC)	120 V	15 - 70 A	U_0 = 90 V
		230 V	15 - 140 A	

ARC STRIKING OUTPUT
RATED PEAK VOLTAGE
U_p = 10.6 kV

TIG RATED OUTPUT	
INPUT VOLTAGE	**CURRENT/ DUTY CYCLE (2)**
120 V	125 A / 25 % *
	100 A / 60 %
	85 A / 100 %
230 V	205 A / 25 %
	160 A / 60 %
	130 A / 100 %

DC STICK RATED OUTPUT	
INPUT VOLTAGE	**CURRENT/ DUTY CYCLE (2)**
120 V	80 A / 25 %
	70 A / 60 %
	65 A / 100 %
230 V	170 A / 25 %
	130 A / 60 %
	100 A / 100 %

AC STICK RATED OUTPUT	
INPUT VOLTAGE	**CURRENT/ DUTY CYCLE (2)**
120 V	70 A / 100 %
230 V	140 A / 25 %
	115 A / 60 %
	100 A / 100 %

RECOMMENDED BREAKER AND FUSE SIZES AND MAXIMUM EFFECTIVE CURRENT			
INPUT VOLTAGE	**FUSE (SUPER LAG) OR BREAKER SIZE[3][4]**	**EFFECTIVE CURRENT DRAW**	**MAXIMUM CURRENT DRAW**
230 V	30 A	11.7 A	23.3 A
120 V	20 A	12.1 A	21.3 A

* 110 A for AC TIG

[1] Open Circuit Voltages are present across the output studs only when the "Output Active" indicator is on. The voltage will be in the 10V range when the machine is in an idle state.

[2] Based upon 10 minute time period (i.e., for 60% duty cycle, it is 6 minutes on and 4 minutes off).

[3]Also called 'inverse time' or 'thermal/magnetic' circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of current increases.

[4] Refrain from operating at maximum output and exceeding rated duty cycle to prevent nuisance breaker trips.

PHYSICAL DIMENSIONS			
LENGTH	**WIDTH**	**HEIGHT**	**WEIGHT**
21.01 IN. (534 MM)	9.27 IN. (235 MM)	14.75 IN. (375 MM)	36 LBS (16.33 KGS)

TEMPERATURE RANGE	
OPERATING TEMPERATURE RANGE	14 °F~104 °F(-10 °C ~ +40 °C)
STORAGE TEMPERATURE RANGE	14 °F~104 °F(-10 °C ~ +40 °C)

Note: PROTECTION CLASS IP21S

SAFETY PRECAUTIONS

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating, maintenance instructions, and parts lists.

⚠ WARNING

ELECTRIC SHOCK can kill.

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

⚠ WARNING

MOVING PARTS can injure.

- Do not operate with doors open or guards off.
- Keep away from moving parts.

See additional warning information at the front of this operator's manual.

Only qualified personnel should install, use, or service this equipment.

LOCATION AND VENTILATION

⚠ CAUTION

This power source should not be subjected to rain or snow, nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

The welder should be located to provide an unrestricted flow of clean, cool air to the cooling air inlets and to avoid restricting the cooling air outlets.

Locate the machine away from radio controlled machinery. Normal operation of the welder may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

STACKING

The SQUARE WAVE® 205machines **CANNOT** be stacked.

TILTING

⚠ CAUTION

The bottom of machine must always be placed on a firm, secure, and level surface. There is a danger of the machine toppling over if this precaution is not taken.

Do not place or operate the machines on a surface with an incline greater than 15° from horizontal.

Place the welder where clean cooling air can freely circulate in through the rear louvers and out through the front side. Water, dirt, dust or any foreign material that can be drawn into the welder should be kept to a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdowns.

INPUT POWER CONNECTION

Before starting the installation check with the local power company if there are any questions about whether your power supply is adequate for the voltage, amperage, phase, and frequency specified on the welder rating plate. Also be sure the planned installation will meet the U.S. National Electrical Code and local code requirements. This welder may be operated from a single phase 120V line or from a split phase 230V line. The center contact in the receptacle is for the grounding connection. A green wire in the input cable connects this contact to the frame of the welder, which ensures proper grounding of the welder frame when the welder plug is inserted into a grounded receptacle.

The SQUARE WAVE® 205 is shipped with a hardwired 230V cord and NEMA 6-50 plug. A 120V power cord adapter is provided. The power cord adapter shall only be used with the SQUARE WAVE® 205 unit.

⚠ CAUTION

When using a 230V input voltage with the power source, ensure that the supply network is a single-phase, three wire system with an earthed neutral.

INPUT VOLTAGE

The machine can be connected to either 120V, 220V or 230V input voltage ±10 %. The supplied 230V to 120V adapter must be used when connecting to 120V power.

An output amperage guide based on input voltage is provided in the technical specification section of this manual.

The power switch is located on the rear of the machine. Note that it is normal for the machine to take 2-3 seconds to boot and to shut off after pressing the power switch.

CIRCUIT BREAKER

If the current conducted through the breaker exceeds breaker rating for an extended period of time, the breaker will open and require manual reset (see Figure 3 : on page B-7).

ENGINE DRIVEN GENERATOR

The machine is designed to operate on engine driven generators as long as the auxiliary can supply adequate voltage, frequency, and power as indicated in the "Technical Specification" Installation Section of this manual. The auxiliary supply of the generator must also meet the following conditions:

Frequency: 60 Hz for 100-240V Input.

RMS voltage of the AC waveform: 100-240 V; Out of this range will trigger undervoltage and overvoltage protections.

Generator minimum output of 8 kW

It is important to check these conditions because many engine driven generators produce high voltage spikes. Operation of this machine with engine driven generators not conforming to these conditions is not recommend and may damage the machine and is also NOT covered by warranty.

⚠ WARNING

ELECTRIC SHOCK can kill.

- Keep the electrode holder and cable insulation in good condition.
- Do not touch electrically live parts or electrode with skin or wet clothing.
- Insulate yourself from work and ground.
- Turn the input line Switch on the machines “Off” before connecting or disconnecting output cables or other equipment.

⚠ CAUTION

For secure electrical connection the power source output sockets connecting cable plugs must be tightened. Damage may occur to the output socket or welding performance maybe compromised.

To avoid interference problems with other equipment and to achieve the best possible operation, route all cables directly to the work. Avoid excessive lengths and do not coil excess cable.

OUTPUT CONNECTIONS

A quick disconnect system using twist mate cable plugs is used for the welding cable connections. Refer to the following sections for more information on connecting the machine for operation of stick welding (SMAW) or TIG welding (GTAW).

STICK WELDING

Determine the proper electrode polarity for the electrode to be used by consulting the electrode data for this information. Most DC electrodes will run well in the DC(+) configuration. Connect the output cables to the output terminals of the machine for the selected polarity. Figure 1 : on page B-6 shows the connection method for DC(+) welding.

Connect the welding cable to the (+) terminal and the work clamp to the (-) terminal. Insert the connector with the key lining up with the keyway and rotate approximately 1/4 turn clockwise. Do not over tighten.

For DC(-) stick welding, switch the cable connections at the machine so that the welding cable is connected to (-) and the work clamp is connected to (+). See Figure 2 : on page B-6 .

Note: Polarity is not relevant for AC stick welding.

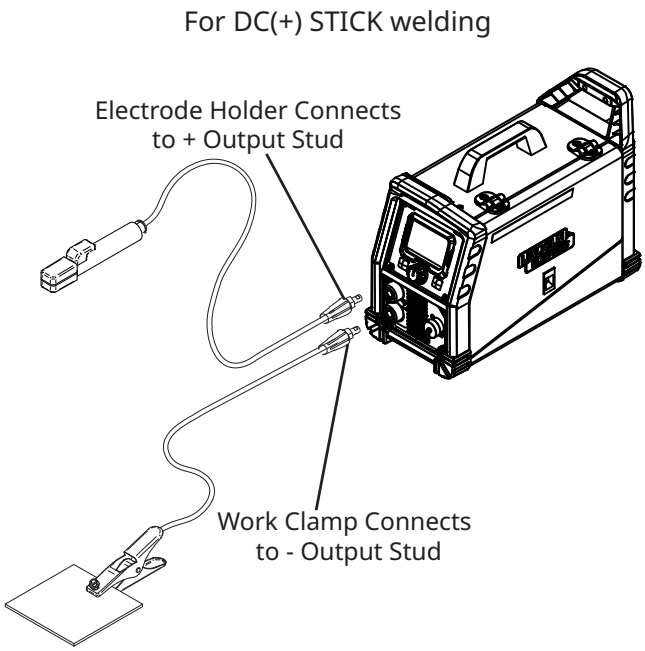


Figure 1 :

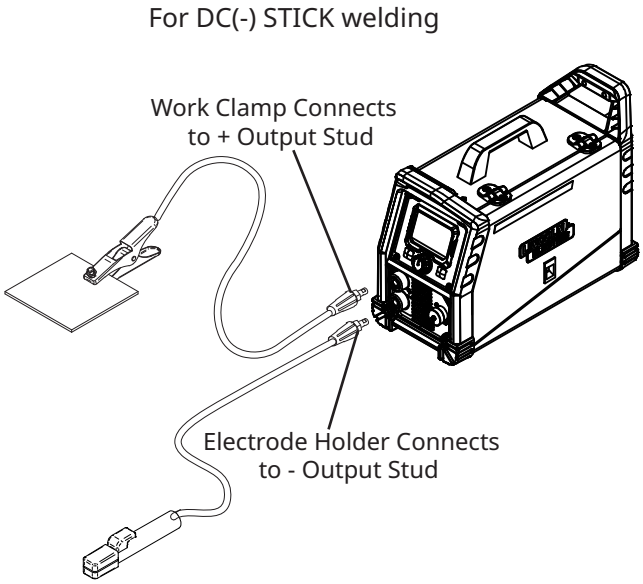


Figure 2 :

TIG WELDING (GTAW)

The machine features a built in gas solenoid. A TIG Torch with a one-piece power and gas cable is included with a pre-installed twist-mate adapter.

Connect the gas hose to the gas inlet at the back of the machine. Refer to the "Shielding Gas" section of this manual for more details on setting up the gas supply.

Connect the torch cable to the (-) terminal of the machine and the work clamp to (+) terminal - refer to Figure 3 : on page B-7 and Figure 4 : on page B-7 . Insert the connector with key lining up with the keyway and rotate approximately 1/4 turn clockwise. Do not over tighten. Depending on if touch start or high frequency start is needed, a foot pedal or desired remote can be connected to the female 6 pin connector on the case front.

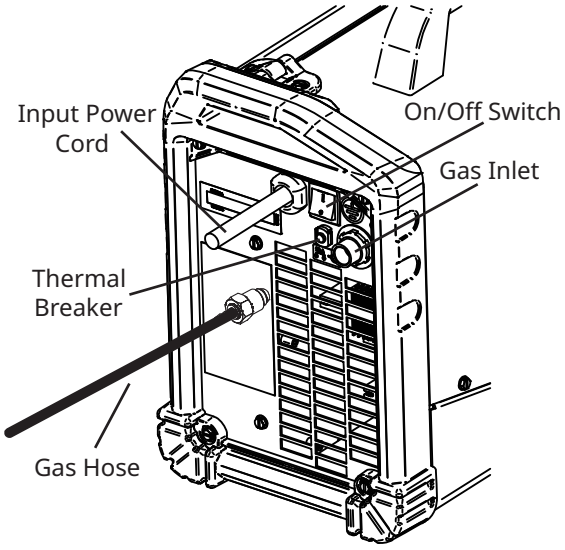


Figure 3 :

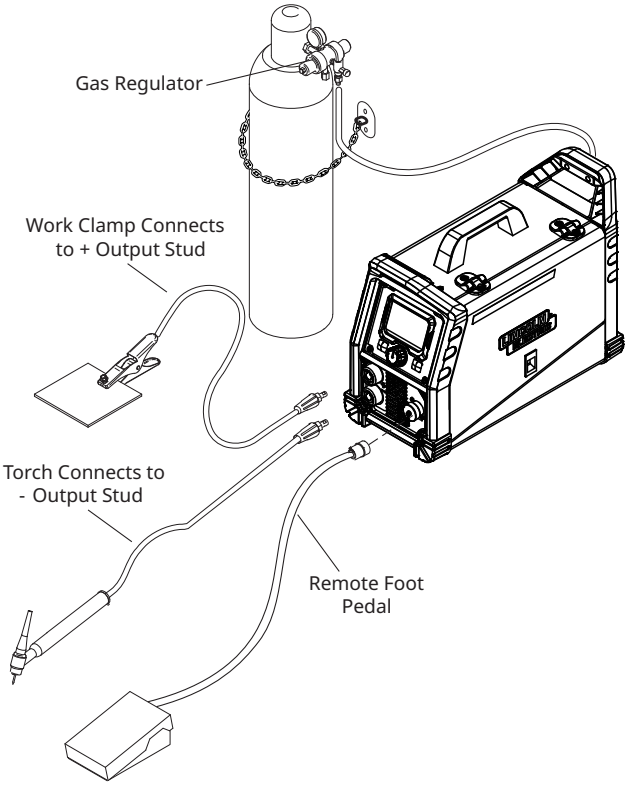


Figure 4 :

HIGH FREQUENCY ARC STARTING

If high frequency starting is desired, ensure the foot pedal connector is firmly tightened to the front of the machine. When the foot pedal or any other amptrol is connected to the 6 pin receptacle, the remote symbol should appear at the upper right hand corner of the main screen. Press and hold the toe of the foot pedal down to initiate high frequency arc starting; gas should flow immediately and the high voltage, high frequency pulse should fire about a second later.- After the arc is started, the pedal is used to adjust the output amperage with the toe down position being the amperage set point that was selected on the main screen. The pedal can be rocked back towards the heel side to continuously reduce the output current.

Note: High Frequency Arc Start is present for 1/2 second after foot pedal is pressed. To start the arc, position the tungsten 1/2 inch or less from the work piece and then press the pedal.

LIFT START TIG

If lift start TIG is desired, remove the foot pedal or any other amptrol connections to the 6 pin connector. The remote icon should not be present in the upper right hand corner of the user interface main screen.

In this configuration, a welding arc can be started by touching the tungsten electrode to the work piece for about a second and lifting off. If the touch is too brief, the gas will begin to flow but the arc may not have started. In this case the arc can be started by quickly and gently touching the tungsten against the work piece again. In some situations, gas coverage can be improved by using this method intentionally to initiate gas flow before striking an arc.

PREPARING THE TIG TORCH

The TIG torch may be assembled to use a variety of differently sized gas cups, tungstens, and back caps. The gas lens cup provides more efficient gas coverage than the collet body cup, which results in the use of less shielding gas.

The most important consideration is the diameter of the tungsten electrode. This is primarily determined by the welding current. The procedure guide section below may be referenced to determine approximate welding currents for different applications as well as the recommended tungsten electrode diameter. The collet, and collet body or gas lens must be matched to the tungsten diameter used.

The cup should be selected by considering the tungsten diameter according to the table below. The back cap length may be reduced to allow for welding in tight spaces.

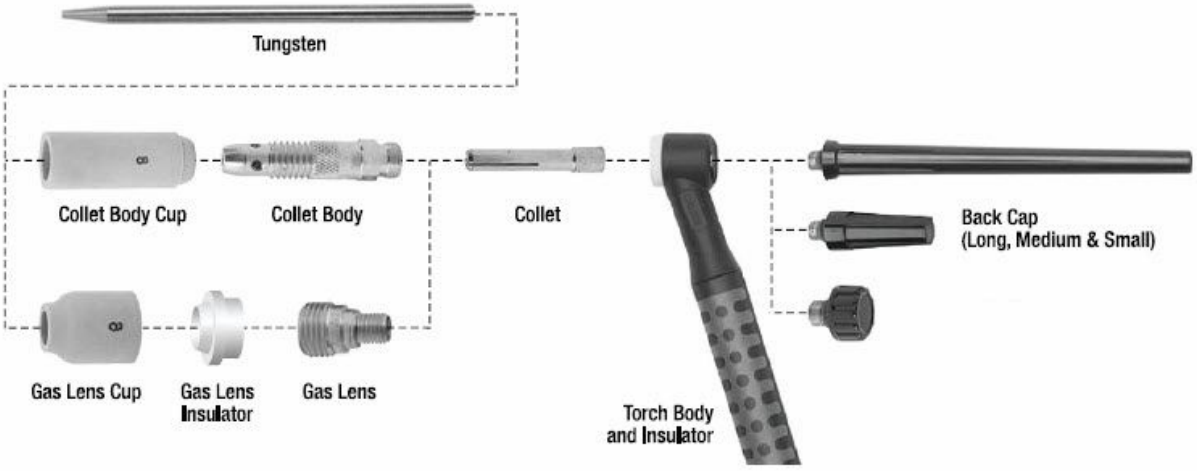


Figure 5 :

TUNGSTEN - PURE TUNGSTEN IS NOT RECOMMENDED				
COLOR	**TUNGSTEN TYPES**	**AC POLARITY**	**DC POLARITY**	**APPLICATIONS**
Gold	1.5% Lanthanated	X		Good choice for welding titanium, nickel, copper, mild steel and stainless steel.
Blue	2% Lanthanated	X	X	Good all around choice for both AC and DC, in welding lo alloyed & non-corroding steel, aluminum, magnesium, titanium, nickel and copper.
Grey	2% Ceriated	X	X	
Chartreuse or Purple (E3®)	1.5% Lanthanum, 0.08% Zirconium, 0.08% Yttrium	X	X	
White	0.8% Zirconiated	X		A very good choice for aluminum or magnesium alloys.

TUNGSTEN DIAMETER	CUP SIZE
0.020"	3, 4 or 5
0.040"	4 or 5
1/16"	4, 5 or 6
3/32"	6, 7 or 8
1/8"	7, 8 or 10
5/32"	8 or 10

Tungsten Preparation

Tungsten should have a blunt tip.

SHIELDING GAS

100% Argon shielding gas must be used for TIG welding processes. Customer must provide cylinder of appropriate type shielding gas for the process being used.

A gas flow regulator and inlet gas hose are factory provide the SQUARE WAVE® 205. The gas flow regulator has a CGA #580 male fitting provided for connecting directly to Argon gas cylinders.

⚠ WARNING

CYLINDER may explode if damaged.

- Gas under pressure is explosive. Always keep gas cylinders in an upright position and always keep chained to undercarriage or stationary support.

See American National Standard Z49.1, “Safety in Welding and Cutting” published by the American Welding Society.

Install shielding gas supply as follows:

1. If using the K520-1 accessory cart set the gas cylinder on the rear platform of the cart and hook the chain in place to secure the cylinder. Regardless of if a cart is used always ensure the cylinder is properly secured.
2. Remove the cylinder cap. Inspect the cylinder valves and regulator for damaged threads, dirt, dust, oil, or grease. Remove dust and dirt with a clean cloth. DO NOT ATTACH THE REGULATOR IF OIL, GREASE, OR

DAMAGE IS PRESENT! Inform your gas supplier of this condition. Oil or grease in the presence of high pressure oxygen is explosive.

3. Stand to one side away from the outlet and open the cylinder valve for an instant. This blows away any dust or dirt which may have accumulated in the valve outlet.

⚠ WARNING

Be sure to keep your face away from the valve outlet when “cracking” the valve.

4. Attach the flow regulator to the cylinder valve and tighten the union nut(s) securely with a wrench.
5. Attach one end of the inlet gas hose to the outlet fitting of the flow regulator, the other end to the SQUARE WAVE® 205 rear fitting and tighten the union nuts securely with a wrench.
6. Before opening the cylinder valve, turn the regulator adjusting knob counterclockwise until the adjusting spring pressure is released.
7. Standing to one side, open the cylinder valve slowly a fraction of a turn. When the cylinder pressure gauge pointer stops moving the valve may be fully opened.

⚠ WARNING

Never stand directly in front of or behind the flow regulator when opening the cylinder valve. Always stand to one side.

8. With the machine in TIG mode, the foot pedal can be used to briefly trigger the gas flow. While the gas is flowing, the regulator can be adjusted to the appropriate flow rate. Gas flow rate of 15-20 CFH are recommended for the processes achievable by the SQUARE WAVE® 205. However, flow rates down to 10 CFH can be used when running at a low output amperage with a #6 or smaller gas lens cup.
9. Be sure to close the gas cylinder valve when not in use or when disconnecting the gas hose or regulator.

MACHINE GROUNDING AND HIGH FREQUENCY INTERFERENCE PROTECTION

The welder must be grounded. See your local and national electrical codes for proper grounding methods.

The high frequency generator, being similar to a radio transmitter, can be blamed for 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 ft (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 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. It is recommended that the work piece should be connected to an earth ground close to the work clamp by using one of the following methods:

   a. A metal underground water pipe in direct contact with the earth for ten feet or more.

   b. 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.

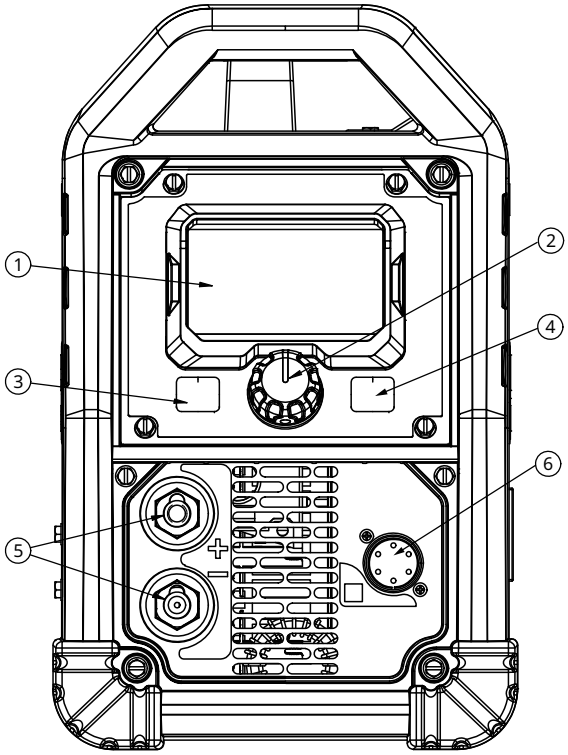
   The ground should be securely made and the grounding cable should be as short as possible using cable of the same size as the work cable or larger. Grounding to the building frame electrical conduit or a long pipe system can result in re-radiation, effectively making these members radiating antennas.
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. 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 (as in 5 (b) above) 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.

OPERATION

CASE FRONT CONTROLS

The front panel includes a “Process” button, a “Back” button, and one encoder knob.



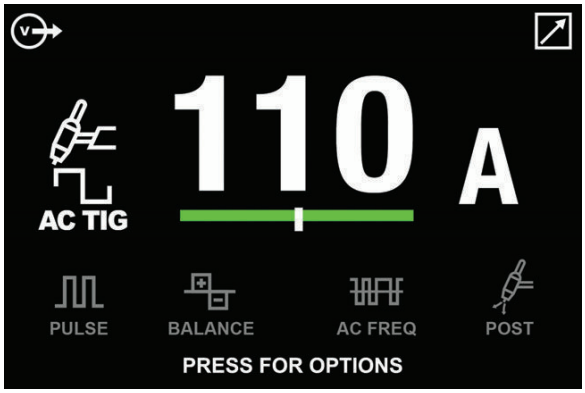
ITEM	DESCRIPTION
1	Digital Display
2	Control Knob
3	Process Button
4	Back Button
5	Twist Mate™ Receptacle
6	Remote Connector

NAVIGATING THE DISPLAY

PROCESS SELECTION

Push process button, Rotate knob to desired process and press knob to select. Then press the select button.

MAIN SCREEN



Indicates the selected mode and all available parameters. Rotate knob to adjust the amperage set point. Then press the select button.

VIEW PARAMETERS

Rotate knob to view all parameter set points. Press to select.

ADJUST PARAMETERS

Rotate knob to adjust parameter values. Press knob to save values.

MODE SELECTION

Weld mode should be selected according to the material being welded. The capability of each weld mode is shown in the table below.

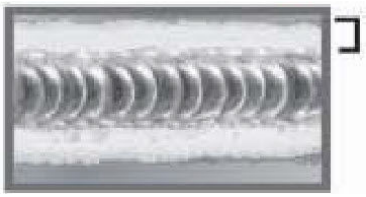
MATERIAL	AC TIG	DC TIG	DC STICK	AC STICK
Aluminum	X			
Magnesium	X			
Steel Alloys		X	X	X
Stainless Steel		X	X	X
Nickel Alloys		X		
Copper Alloys		X		
Titanium		X		

PARAMETERS AND ICONS

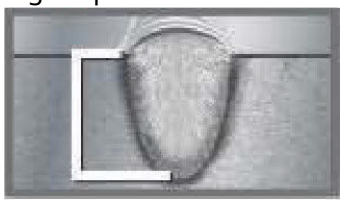
Balance:

Range 60-90% (Default = Auto). In AC TIG mode, the output polarity is constantly switched between positive and negative. The balance control adjusts the percentage of time that the tungsten Electrode is Negative (%EN).

A lower AC Balance (%EN) results in an arc with increased cleaning action.



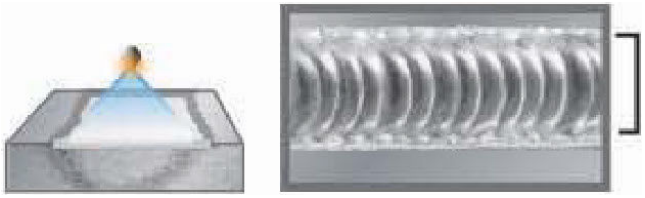
A higher AC Balance (%EN) results in an arc with higher penetration.



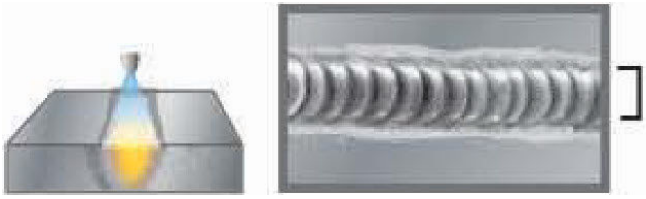
AC Frequency:

Range 50-160 Hz (Default = 90 Hz). In AC TIG mode, the AC Frequency control adjusts frequency that the output polarity is switched between positive and negative.

A lower AC frequency results in a wider bead.



A higher AC frequency results in a more focused bead.



Pulse:

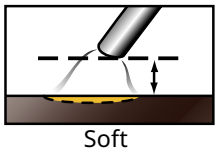
0.1-20 Hz (Default = Off). In TIG modes, the pulse function makes the output amperage oscillate between peak and background values. The peak amperage is the same as the amperage setpoint on the main screen. The background current is half of the amperage setpoint. The durations of the peak and background amperage are equal. Low pulse frequencies can help weld consistency. Higher pulse frequencies can prevent burn through.

Post Flow:

Range 1-25 seconds (Default = Auto). Allows a time to be selected for shielding gas to continue to flow after the arc has been extinguished.

Soft Mode:

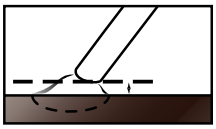
Lower arc force for E7018 and other drag electrodes.



Soft

Crisp Mode:

Higher arc force for XX10 E6010 and other whip electrodes.



Crisp

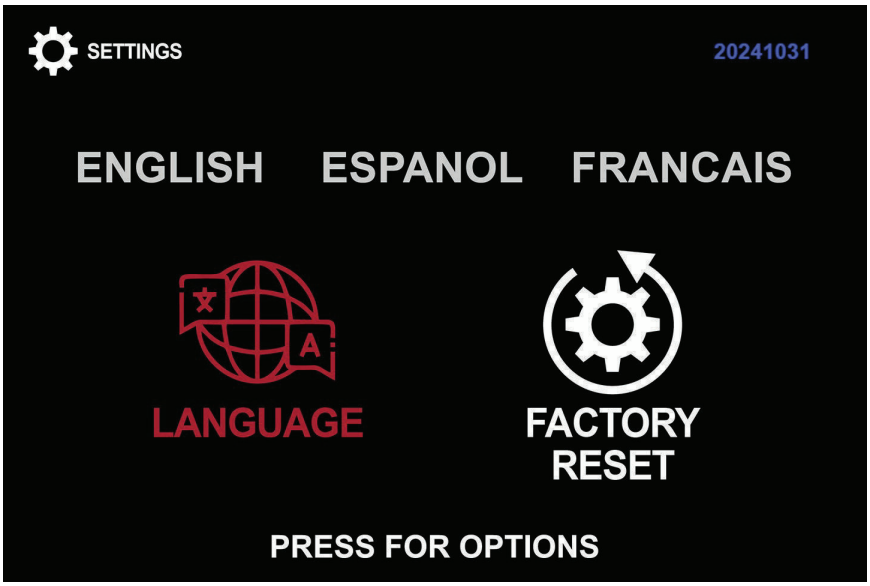
Remote:

In TIG modes, this icon appears in the top right corner of the main screen when a remote is plugged in to the 6 pin connector.

Output Active:

This icon appears in the top left corner of the main screen when the welding circuit is energized. In stick modes, the output is always active. In TIG modes, while the machine is idling, the output is not active and the voltage across the output studs should be around 5-10 volts.

SETTINGS MENU



To enter the Settings Menu, press and hold both the Process and Back buttons for two seconds.

Language:

Select between English, French and Spanish.

Factory Reset:

Execute to return all set points and parameters to their recommended values.

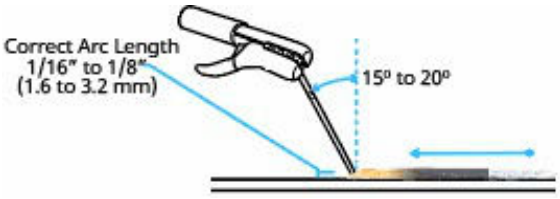
STICK ELECTRODE SELECTION

When using Stick mode, the table below can be used to select a recommended electrode class. Recommended mode settings are shown for DC Stick applications.

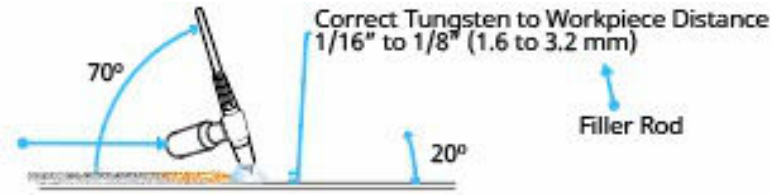
AWS CLASS	APPLICATIONS	RECOMMENDED DC STICK MODE
6010	Deeper arc penetration, excellent vertical and overhead capability. Can be used on coated steels or when moderate surface contamination is present. Commonly used pipefitting repairs and maintenance, and pipeline. (ex: Fleetweld 5P/5P+ for DC only).	
6011	Deep penetrating electrode that can be used in all positions. Can be used on steel with poor surface conditions. Frequently used for joining pipe. Running 6011 on AC polarity optimizes welding on thinner materials (ex: Fleetweld 35 for DC and Fleetweld 180 for AC).	
6013	Shallower penetrating electrode that allows for higher deposition rates. Ideal for sheet metal with wide root openings or condition of poor fit up. Best suited for vertical down and horizontal positions. Good performance on Irregular short welds that change angles/positions. (ex: Fleetweld 37 for AC or DC).	
7018	Low hydrogen electrode used for joints involving high strength (structural), high carbon or low alloy steels. Smooth arc with medium penetration. Can be used in all positions except vertical down. Running 7018 on AC polarity allows for easy cold restrikes and is ideal for thin sections and for tacking. (ex: Excalibur or IronArc 7018 MR for DC and Lincoln 7018 AC for AC).	

WELDING TECHNIQUES

Stick Drag Technique



TIG Push Technique



ACCESSORIES AND OPTIONS

SQUARE WAVE 205 ACCESSORIES

K520-1 - Utility Cart

Heavy duty cart stores and transports welder, 150 cubic foot shielding gas cylinder, welding cables, and accessories. Includes stable platforms for welder and gas bottle, lower tray for added storage capacity, and adjustable height handle.

K2377-1 - Canvas Cover

Protect your machine when not in use. Made from attractive red canvas that is flame retardant, mildew resistant, and water repellent. Includes a convenient side pocket to hold welding torch or gun.

TIG Torch Options

- K1782-1 – PTA-17 with 12.5’ one piece cable assembly
- K1782-3 – PTA-17 with 25’ one piece cable assembly
- K1782-10 – PTA-17F Flexible Head with 25’ one piece cable assembly
- K1783-1 – PTA-26 with 12.5’ one piece cable assembly
- K1783-3 – PTA-26 with 25’ one piece cable assembly
- K1783-10 – PTA-26F with 25’ one piece cable assembly
- K1781-1 – PTA-9 with 12.5’ one piece cable assembly
- K1781-9 – PTA-9F Flexible Head, with 12.5’ flexible one piece cable assembly
- K1782-15 – PTA-17F Flexible Head with 12.5’ Ultra-flex ™one piece cable assembly
- K1782-14 – PTA-17F Package with Flexible Head Torch, Ultra-flex ™ cable assembly, one 1/16” E3® tungsten electrode, one 3/32” E3® tungsten electrode, one 1/16” collet and collet body, one 3/32” collet and collet body, #7 nozzle, cable cover and Twist-Mate ™ adapter.

K1622-1 - Twist Mate™ Torch Adapter for PTA-9 and PTA-17 Series Torches

Use to connect 1-piece air-cooled TIG torches (PTA-9 125 Amp / PTA-17 150 Amp) to power sources with combined gas/power Twist-Mate™ connectors

K1622-3 - Twist Mate ™ for PTA-26 Series Torches

Use to connect 1-piece air-cooled TIG torches (PTA-26 200 Amp) to power sources with combined gas/power Twist Mate ™ connectors

K963-3 - Hand Amptrol ™ with 6-pin Universal Connector

Provides 25 ft. (7.6 m) of remote current control for TIG welding.

Parts Kit

Parts Kits provide all the torch accessories you need to start welding. Parts Kits provide collets, collet bodies, a back cap, alumina nozzles, and tungstens in a variety of sizes. All packaged in an easy to carry reclosable box. Five kits are available.

- KP508 - for PTA-17 Series Torches
- KP509 - for PTA-26 Series Torches
- KP507 - for PTA-9 Series Torches
- KP501 - for 20H-320 and PTW-20 Torches

K2374-1 200 Amp Electrode Holder

Includes Twist Mate ™ connector. 12.5 ft. cable length.

K814 Arc Start Switch

with 25 ft. (7.6m) cable assembly and 6-pin Universal Connector.

Needed for High Frequency Starting if an Foot or Hand Amptrol is not used when TIG welding to initiate current. Current will rise to selected amperage setpoint upon depression of switch.

KP4765-ST Caliber ® Stubby Torch Parts Kit - 17/18/26 Torches

KP4760-MD Caliber ® 17/18/26 Series TIG Torch Parts Kit - 0.040"-3/32"

KP4760-HD Caliber ® 17/18/26 Series TIG Torch Parts Kit - 1/16"-1/8"

Caliber TIG Expendables Kits include all of the front end parts needed to run a Gas Lens set up on 17/18/26 Series TIG Torches. Caliber TIG Expendables are compatible with both Lincoln Electric and competitive TIG Torches.

K870 Foot Pedal

Depress pedal to increase current. Depressing pedal fully achieves maximum set current. Fully raising the Afterflow cycle. Equipped with a 6 pin connector and optional heel rest.

MAINTENANCE

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK CAN KILL.

For safety while maintaining the machine, please shut off the supply power and wait for 5 minutes, until capacitor voltage drops to safe voltage.

All service work should be conducted by an authorised Lincoln Electric field service agent.

⚠ WARNING

To avoid receiving a high frequency shock, keep the TIG torch and cables in good condition.

ROUTINE AND PERIODIC MAINTENANCE

In order to guarantee the arc welding machine works efficiently and safely, it must be maintained regularly. Refer to the maintenance items in the following table.

MAINTENANCE ITEMS	
DAILY EXAMINATION	• Check for correct operation of the control knob, switches, and buttons on the front of the power source. • If the switch is not operational, replace immediately. • Check the function of the LCD display. If it doesn't work, maintain or replace the display PCB. • Check to see if fan is operating normally. If the fan is not rotating and obstruction is not present then replace the fan. • Check the output terminals for overheating, if so change output terminals. Ensure welding lead plugs are connected tightly. • Check welding leads and power cord for damage. If damaged replace parts. • Check all warning labels and rating plates. Ensure all are legible. If damaged, replace parts.
MONTHLY EXAMINATION	Use a gentle dry compressed air to clean the inside of arc welding machine. Especially for removing dust from heat sinks, and PCB components.

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.

TROUBLESHOOTING GUIDE

Observe all Safety Guidelines detailed throughout this manual

PROBLEM	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Machine is Dead - No Output - No Fan	**1.** Make certain that the input power switch is in the “ON” position and machine is plugged in. **2.** Check the input voltage at the machine. Input voltage must match the rating plate and voltage connection. Refer to the Installation section of this manual. **3.** Blown or missing fuses in input line. **4.** Circuit breaker on the back of the machine has opened.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Fan runs - No output from machine in either Stick or TIG modes.	**1.** Check for proper input voltages per nameplate and voltage reconnection. **2.** Check to make sure cables are firmly connected.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Machine does not respond (no gas flow, no high frequency and no open circuit voltage) when arc start switch or Amptrol is activated - fan is working.	**1.** Machine MUST be in AC or DC TIG Mode. **2.** The Amptrol may be defective. Check for continuity between pins “D” and “E” on cable connector when Amptrol is depressed.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Machine regularly over heats -thermostat opens. The fan runs but machine has no output.	**1.** Welding application may exceed recommended duty cycle. Reduce the duty cycle. **2.** Dirt and dust may have clogged the cooling channels inside the machine. Blow out unit with clean, dry low pressure air. **3.** Air intake, brickwork and exhaust louvers may be blocked due to inadequate clearance around machine.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Machine output is intermittently lost.	**1.** Check Amptrol for proper operation and loose connections. **2.** Check for proper input voltage and proper voltage reconnection.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Arc “Flutters” when TIG welding.	**1.** Tungsten electrode may be too large in diameter for the current setting. **2.** Tungsten not prepared properly - should have slight blunt. **3.** Gas shielding may be insufficient. Increase gas flow; reduce tungsten stickout beyond gas cup. **4.** Check for contaminated gas or leaks in the gas line, torch, or connections. **5.** If a helium blend is used as a shielding gas, then reduce the percentage of helium.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Arc “Pulsates” when TIG welding	**1.** Check to see if the Pulse setting is active. Set pulse to "OFF" if not desired.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Black areas along weld bead.	**1.** Clean any oily or organic contamination from the work piece. **2.** Tungsten electrode may be contaminated. Replace or sharpen. **3.** Check for contaminated gas or leaks in the gas line, torch, or connections **4.** Gas shielding may be insufficient. Increase gas flow; reduce tungsten stickout beyond gas cup.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Weak high frequency -machine has normal welding output.	**1.** Check for poor connections in the welding circuit. **2.** Gas shielding may be insufficient. Increase gas flow; reduce tungsten stickout beyond gas cup. **3.** Check for work and torch cables in poor condition allowing high frequency to “Leak Off”. **4.** Keep cables as short as possible.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
High frequency “spark” is present at tungsten electrode, but operator is unable to establish a welding arc. Machine has normal open circuit voltage (refer to Technical Specifications in the Installation Chapter).	**1.** The tungsten electrode may be contaminated. Replace or sharpen. **2.** The current control may be set too low. **3.** The tungsten electrode may be too large for the process. **4.** If a helium blend is used as a shielding gas, then reduce the percentage of helium. **5.** Tungsten is too far from the workpiece when starting.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
No high frequency.	**1.** Ensure gas flow is present and cables are connected.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
No gas flow when Amptrol is activated in the TIG Mode. Machine has output - fan runs. A “Click” can be heard indicating that the gas solenoid valve is operating.	**1.** Gas supply is empty or not turned on. **2.** Flow regulator may be set too low. **3.** Gas hose may be pinched. **4.** Gas flow may be blocked with dirt.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
When AC TIG welding, the arc is erratic and there is a loss of “cleaning” of the work piece.	**1.** Tungsten electrode may be too small for process. Use a larger diameter tungsten or a pure tungsten. **2.** If a helium blend is used as a shielding gas, then reduce the percentage of helium.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
The end of the tungsten electrode melts away.	**1.** The welding current is too high for the electrode type and/or size. **2.** Ensure the TIG Torch is connected to the negative output stud.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Stick electrode “Blasts Off” when arc is struck.	**1.** Weld current may be set too high for electrode size. Reduce current control setting, or use a larger diameter electrode.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Stick electrode “sticks” in the weld puddle.	**1.** The weld current may be set too low. Increase the current control setting or use a smaller diameter electrode.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
TIG welds are porous or burnt looking	**1.** Check for adequate gas flow at the end of the torch. Check for leaks along the gas hose, TIG torch cable and at all connections. Ensure the TIG Torch is connected to the negative output stud. **2.** Make sure the tungsten end is clean and properly ground. **3.** Ensure the surfaces that are being welded on are clean of debris, oil, rust or other impurities. Surface grinding may be necessary.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Machine controls do not behave as expected	**1.** Perform a factory reset by holding down both the “PROCESS" and the "BACK” buttons, then select "YES" under the factory reset option. **2.** Disconnect the power to the machine, wait for the UI screen to go completely black and then reapply power.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Screen displays F01: THERMAL TRIP FAULT CODE	**1.** Make sure the welding circuit is open by physically separating the welding accessories that are plugged into the positive and negative output studs. **2.** Acknowledge the fault code by pressing the center knob. **3.** Leave the machine powered on so that the fans continue to run. The machine should recover once it cools off. **4.** If the fault code remains for longer than 10 minutes, then cycle power to the machine.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.
Screen displays F05: TIG TRIGGER STUCK ON	**1.** Ensure the 6 pin accessory is functioning properly and restart the machine. **2.** If fault clears when the 6 pin accessory is unplugged, the accessory is defective.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.

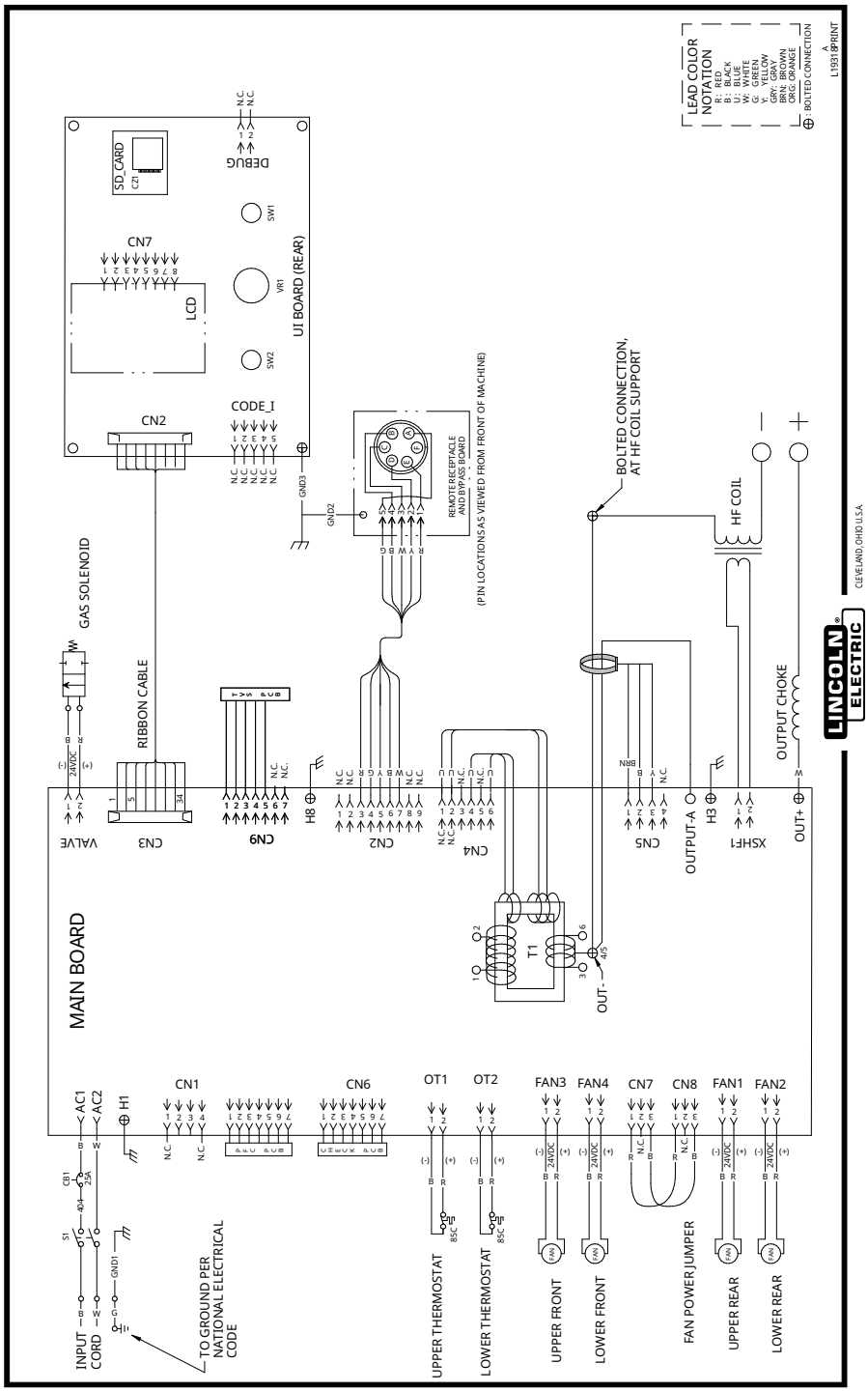
PROBLEM	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
Screen displays F09: SHORTED OUTPUT	**1.** Ensure the welding accessories are not in contact. **2.** With the machine powered off and disconnected from input power, clean and dry the output studs of the machine as necessary. **3.** If the error persists when nothing is connected to the output studs or 6 pin receptacle, then the machine may be damaged.	Contact your Local Lincoln Authorized Field Service Facility for technical troubleshooting assistance.

⚠ 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.

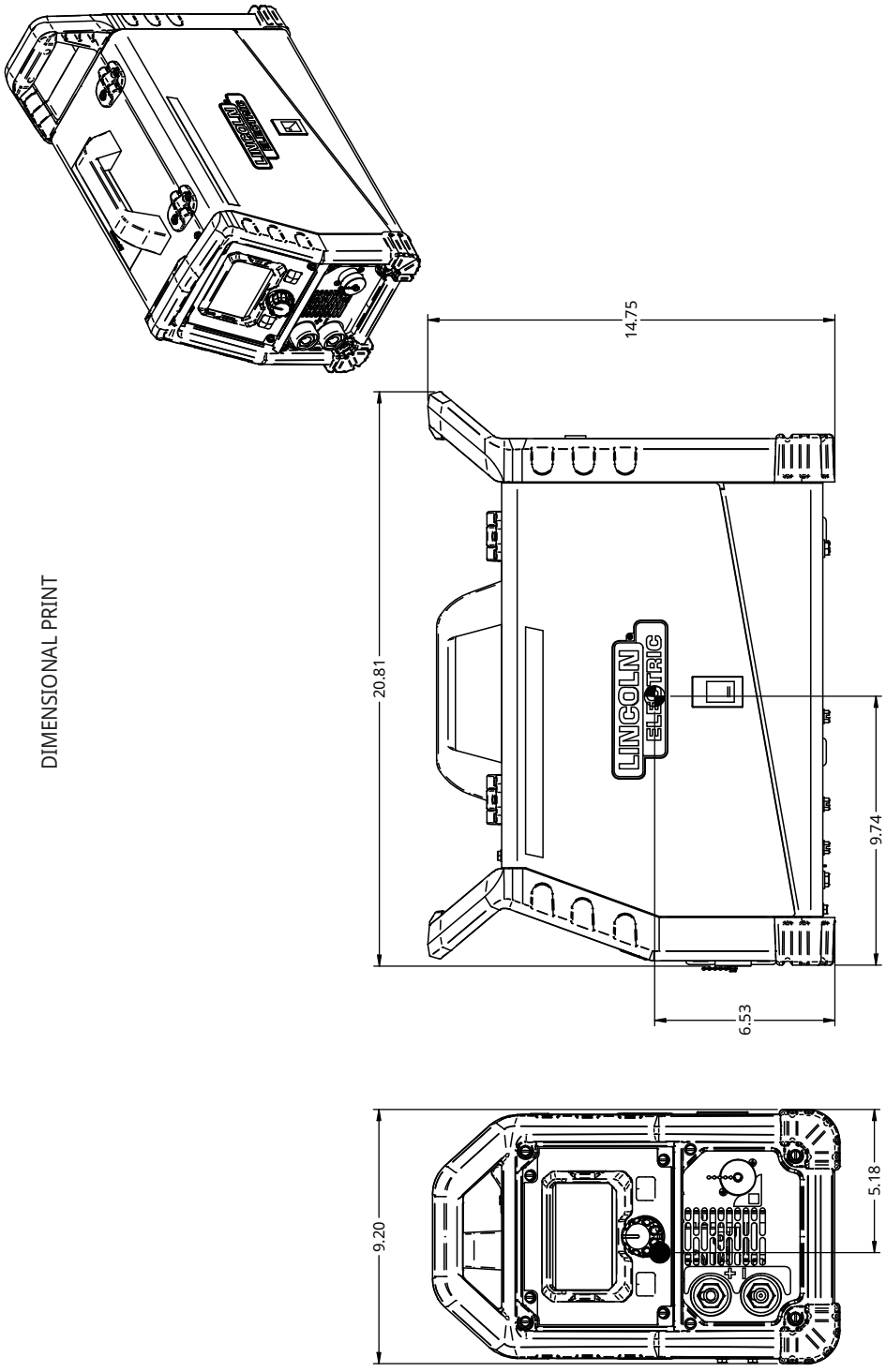
APPENDIX

WIRING DIAGRAM



DIMENSION DIAGRAM

DIMENSIONAL PRINT



CUSTOMER ASSISTANCE POLICY

CUSTOMER ASSISTANCE POLICY

The business of Lincoln Electric is manufacturing and selling high quality welding equipment, automated welding systems, consumables, and cutting equipment. Our challenge is to meet the needs of our customers, who are experts in their fields, and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or technical information about their use of our products. Our employees respond to inquiries to the best of their ability based on information and specifications provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment, or to provide engineering advice in relation to a specific situation or application. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or communications. Moreover, the provision of such information or technical information does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or technical information, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose or any other equivalent or similar warranty is specifically disclaimed.

Lincoln Electric is a responsive manufacturer, but the definition of specifications, and the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

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

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