

## Operator's Manual

# VRTEX<sup>®</sup> 360



For use with machines having Code Numbers:  
**11382, 11383**



**Register your machine:**

[www.lincolnelectric.com/register](http://www.lincolnelectric.com/register)

**Authorized Service and Distributor Locator:**

[www.lincolnelectric.com/locator](http://www.lincolnelectric.com/locator)

**Save for future reference**

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

**Need Help? Call 1.888.935.3878**

to talk to a VRTEX Representative

**Hours of Operation:**

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

**After hours?**

Use "Ask the Experts" at [lincolnelectric.com](http://lincolnelectric.com)  
A Lincoln Service Representative will contact you  
no later than the following business day.

**For Service outside the USA:**

Email: [VRTEX360@lincolnelectric.com](mailto:VRTEX360@lincolnelectric.com)

# THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

## PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

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

## SAFETY DEPENDS ON YOU

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

### **WARNING**

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

### **CAUTION**

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



## KEEP YOUR HEAD OUT OF THE FUMES.

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

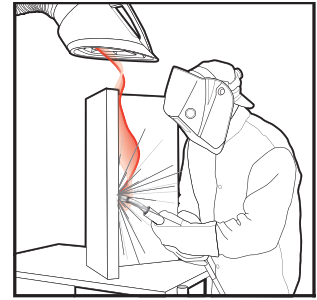
**READ** and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

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

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

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

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



## WEAR CORRECT EYE, EAR & BODY PROTECTION

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

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

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

**IN SOME AREAS**, protection from noise may be appropriate.

**BE SURE** protective equipment is in good condition.

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



## SPECIAL SITUATIONS

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

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

## Additional precautionary measures

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

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

**REMOVE** all potential fire hazards from welding area.

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



## SECTION A: WARNINGS



### CALIFORNIA PROPOSITION 65 WARNINGS



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

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

For more information go to [www.P65warnings.ca.gov/diesel](http://www.P65warnings.ca.gov/diesel)

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



**WARNING:** Cancer and Reproductive Harm  
[www.P65warnings.ca.gov](http://www.P65warnings.ca.gov)

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

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

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



### FOR ENGINE POWERED EQUIPMENT.

- Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.
- Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.
- 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.



### 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.



- 3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- 3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

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

- Semiautomatic DC Constant Voltage (Wire) Welder.
  - DC Manual (Stick) Welder.
  - AC Welder with Reduced Voltage Control.
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
  - 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
  - 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
  - 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
  - 3.g. Never dip the electrode in water for cooling.
  - 3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
  - 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
  - 3.j. Also see Items 6.c. and 8.



## ARC RAYS CAN BURN.



- 4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87.1 standards.
- 4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.
- 4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.



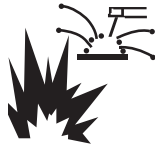
## FUMES AND GASES CAN BE DANGEROUS.



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



## WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



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



## CYLINDER MAY EXPLODE IF DAMAGED.



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



## FOR ELECTRICALLY POWERED EQUIPMENT.



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

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

# ELECTROMAGNETIC COMPATABILITY (EMC)

## CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC). It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

## INTRODUCTION

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc. Be aware that interference may result and extra precautions may be required when a welding power source is used in a domestic establishment.

## INSTALLATION AND USE

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions. If electromagnetic disturbances are detected then it shall be the responsibility of the user of the welding equipment to resolve the situation with the technical assistance of the manufacturer. In some cases this remedial action may be as simple as earthing (grounding) the welding circuit, see Note. In other cases it could involve construction of an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

Note: The welding circuit may or may not be earthed for safety reasons according to national codes. Changing the earthing arrangements should only be authorized by a person who is competent to access whether the changes will increase the risk of injury, e.g., by allowing parallel welding current return paths which may damage the earth circuits of other equipment.

## ASSESSMENT OF AREA

Before installing welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a. other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the welding equipment;
- b. radio and television transmitters and receivers;
- c. computer and other control equipment;
- d. safety critical equipment, e.g., guarding of industrial equipment;
- e. the health of the people around, e.g., the use of pacemakers and hearing aids;
- f. equipment used for calibration or measurement
- g. the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h. the time of day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

## METHODS OF REDUCING EMISSIONS

### Mains Supply

Welding equipment should be connected to the mains supply according to the manufacturer's recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the mains supply. Consideration should be given to shielding the supply cable of permanently installed welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length. The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure.

### Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the 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 floor level.

### Equipotential Bonding

Bonding of all metallic components in the welding installation and adjacent to it should be considered. However, metallic components bonded to the work piece will increase the risk that the operator could receive a shock by touching these metallic components and the electrode at the same time. The operator should be insulated from all such bonded metallic components.

### Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, not connected to earth because of its size and position, e.g., ships hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the work piece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the work piece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

### Screening and Shielding

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

<sup>1</sup> Portions of the preceding text are contained in EN 60974-10: "Electromagnetic Compatibility (EMC) product standard for arc welding equipment."

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

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

NOTE: The MSDS for all Lincoln consumables is available on Lincoln's website: [www.lincolnelectric.com](http://www.lincolnelectric.com)

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

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

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

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

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

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

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

## Ventilation

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

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

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

### **Important Safety Note:**

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

**BIBLIOGRAPHY AND SUGGESTED READING**

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

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

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

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

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

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

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

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

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

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

AWS F3.2, Ventilation Guide for Welding Fume Control

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

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

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

INGREDIENTS	CAS No.	TLV mg/m <sup>3</sup>	PEL mg/m <sup>3</sup>
Aluminum and/or aluminum alloys (as Al)*****	7429-90-5	1.0	15
Aluminum oxide and/or Bauxite*****	1344-28-1	1.0	5**
Barium compounds (as Ba)*****	513-77-9	0.5	0.5
Chromium and chromium alloys or compounds (as Cr)*****	7440-47-3	0.5(b)	0.5(b)
Hexavalent Chromium (Cr VI)	18540-29-9	0.05(b)	.005(b)
Copper Fume	7440-50-8	0.2	0.1
Cobalt Compounds	7440-48-4	0.02	0.1
Fluorides (as F)	7789-75-5	2.5	2.5
Iron	7439-89-6	10*	10*
Limestone and/or calcium carbonate	1317-65-3	10*	15
Lithium compounds (as Li)	554-13-2	15	10*
Magnesite	1309-48-4	10	15
Magnesium and/or magnesium alloys and compounds (as Mg)	7439-95-4	10*	10*
Manganese and/or manganese alloys and compounds (as Mn)*****	7439-96-5	0.02	5.0(c)
Mineral silicates	1332-58-7	5**	5**
Molybdenum alloys (as Mo)	7439-98-7	10	10
Nickel*****	7440-02-0	0.1	1
Silicates and other binders	1344-09-8	10*	10*
Silicon and/or silicon alloys and compounds (as Si)	7440-21-3	10*	10*
Strontium compounds (as Sr)	1633-05-2	10*	10*
Zirconium alloys and compounds (as Zr)	12004-83-0	5	5

**Supplemental Information:**

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

(\*\*) As respirable dust.

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

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

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

(\*\*\*\*) The TLV for soluble barium compounds is 0.5 mg/m<sup>3</sup>.

TLV and PEL values are as of October 2013. Always check Safety Data Sheet (SDS) with product or on the Lincoln Electric website at <http://www.lincolnelectric.com>



	Page
<b>Installation .....</b>	
EC Declaration Of Conformity .....	1
Graphic Symbols That Appear On This Machine Or In This Manual .....	2
Technical Specifications .....	3
Safety Precautions.....	4
Select Suitable Location .....	5
Environmental Area .....	5
Stacking .....	5
Tilting .....	5
Lifting .....	6
High Frequency Interference Protection .....	6
Radio Frequency Interference .....	6
Design Features .....	7
Hardware Uncrating.....	7
Table & Swing Arm Setup.....	8
Monitor Setup .....	9
System Power.....	9
Tracking System Fundamentals .....	9
Machine Decals .....	10
<b>Operation .....</b>	
Product Description .....	12
User Interface Overview .....	12
Hardware Specifics.....	13-16
Instructor Mode.....	17-24
Powering ON.....	17
End User License Agreement .....	17
Instructor Mode .....	18
Options.....	19
Update.....	19
Software .....	19
Configuration File .....	19
License Information .....	19
Weldometer.....	20
Tolerance Editor.....	21-24
User Mode .....	25-37
Powering ON.....	25
End User License Agreement .....	25
To Enter The User Screen .....	26
Login Screen .....	26-27
Joint Configuration Selection Screen .....	28
Process Selection Screen .....	28
Table Setup Screen.....	29
Environment Screen.....	29
Gas Setup Screen.....	30
Weld Machine Settings Screen .....	30
Virtual Welding Overview .....	31
Visual Cues .....	32
New Coupon.....	33
LASER Screen .....	34
Technique Parameters.....	35
Pass Number.....	36
Travel Direction .....	36

	Page
<b>Operation (continued)</b> .....	
Bead Render .....	37
Discontinuity Indicator .....	37
End Pass .....	37
Score .....	37
Student Report .....	37
VRTEX 360 Extensions™ Upgrade Program .....	38
License Agreement.....	38
VRTEX 360 Extensions™ Upgrade 2.....	39-43
VRTEX 360 Extensions™ Upgrade 3.....	44-46
VRTEX 360 Extensions™ Upgrade 4.....	47-48
VRTEX 360 Extensions™ Upgrade 5.....	49-50
Default Weld Process Settings .....	51-52
<b>Accessories</b> .....	
Accessories and Options .....	54
<b>Maintenance</b> .....	
Cleaning & Maintenance.....	56
<b>Troubleshooting</b> .....	
How To Use Troubleshooting Guide.....	58
Troubleshooting Guide .....	59-60
<b>Diagrams</b> .....	
Wiring Diagram .....	62
<b>Parts</b> .....	P-755

# GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL



INPUT POWER



INPUT VOLTAGE



ON



INPUT CURRENT



OFF



PROTECTIVE GROUND



CIRCUIT BREAKER



WARNING OR CAUTION  
Documentation must be consulted in all cases where this symbol is displayed.



INPUT POWER



EXPLOSION



SINGLE PHASE ALTERNATING CURRENT



DANGEROUS VOLTAGE



READ THIS OPERATORS MANUAL COMPLETELY



SHOCK HAZARD



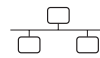
USB



SHOCK HAZARD



WFS/AMPS



ETHERNET



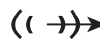
VOLTS



VGA OUTPUT



DO NOT INTERVENE;  
FOR SERVICE USE ONLY



AUDIO OUTPUT

# TECHNICAL SPECIFICATIONS

INPUT			
MODEL	DESCRIPTION	INPUT VOLTAGE ± 10%	INPUT CURRENT (MAX.)
K3962-1	Standard Frequency	115/230 VAC (50/60 HZ)	4/2A Single Phase
K3962-2	Alternate Frequency	115/230 VAC (50/60 HZ)	4/2A Single Phase
<b>⚠ WARNING</b>			
THIS PRODUCT INCORPORATES A PROTECTIVE EARTH CIRCUIT IN THE AC POWER CORD. THE AC PLUG SHOULD ONLY BE INSERTED INTO A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT.			
PHYSICAL DIMENSIONS (MACHINE WITH MONITOR)			
HEIGHT	WIDTH	DEPTH	WEIGHT
66.0 in. 1677 mm	30.0 in. 762 mm	42.0 in. 1067 mm	315 lbs. 143 kgs.
PHYSICAL DIMENSIONS (STAND)			
HEIGHT	WIDTH	DEPTH	WEIGHT
80.0 in. 2032 mm	39.0 in. 991 mm	47.0 in. 1194 mm	105 lbs. 48 kgs.
PHYSICAL DIMENSIONS (CRATE WITH MACHINE)			
HEIGHT	WIDTH	DEPTH	WEIGHT
72.0 in. 1829 mm	48.0 in. 1220 mm	72.0 in. 1829 mm	850 lbs. 386 kgs.
TEMPERATURE RANGES			
OPERATING TEMPERATURE RANGE		STORAGE TEMPERATURE RANGE	
59° - 95° F (15° - 35° C)		32° - 149° F (0° - 65° C)	
RELATIVE HUMIDITY*		OPERATING ALTITUDE	
80% For Temperatures Up To 88° F / 31° C 50% @ 104° F / 40° C		6562 Feet (2000 Meters)	
ENVIRONMENT			
This product is for use in Pollution Degree 2 environment.			

\*Condensation on lenses may appear in high humidity environment. Run FMD (Face Mounted Display) for approximately 10 minutes to clear up moisture from the lenses.

**Read entire installation section before starting installation.**

**Do not place objects on the VR Table, Arm or on Machine.**

**Handle the Face Mounted Display (FMD) integrated helmet with care. When not in use, the helmet should be placed on the front of machine, in the drawer or on the helmet hanger peg. If you will not be using the system for longer than 4 hours, shut down your VRTEX 360 System.**

**Handle the VR SMAW device and VR GMAW/FCAW gun with care. When not in use, these items should be placed on the appropriate holders located on the sides of the VR machine. These devices are customized and cannot be used on normal welding machines.**

**Handle the VR coupons with care. When not in use, store them in the coupon compartment on the left side of the VRTEX 360 machine.**

**During lightning storms, turn off the system and unplug it from the power outlet.**

**Before using the FMD please carefully read these safety instructions.**

**Read this handbook and use the FMD device in strict accordance in order to prevent any damage to your eyes, other injury, loss of visual functions, property damage or death.**

**We strongly advise you to get familiar with the FMD device and its capabilities before you use it for the first time.**

## SAFETY PRECAUTIONS

### WARNING

**ELECTRIC SHOCK can kill.**

- Only qualified personnel should perform this installation.
- Turn the input power OFF and unplug the machine from the receptacle before working on this equipment.
- Always connect the VRTEX 360 to a power supply grounded according to the National Electrical Code and local codes.
- Do not use or store the FMD when wet or in wet areas.
- Do not wrap the cable around your neck, body or arms.



### CAUTION

**Misuse or overuse of this product may injure your eyes or affect visual function.**

Overexposure to video and flashing light may cause or aggravate the following health effects to light-sensitive users:

- Eye disease and/or injury, Glaucoma.
- Epileptic (and other) Seizures.
- Heart disease or high blood pressure.

Consult your physician before using the FMD if you have been diagnosed with or are susceptible to any of the above health effects.

Some users may experience a seizure when exposed to certain visual images, including flashing lights or patterns. Even people who have no history of seizures or epilepsy may have an undiagnosed condition that can cause “photosensitive epileptic seizures.”

Seizures may cause loss of consciousness or convulsions that can lead to injury from falling down or striking nearby objects.

Do not use the FMD when you are drowsy or fatigued.

Immediately, stop using the FMD and consult your physician if you experience any of the following symptoms:

- Double vision or inability to focus on the display.
- Nausea or motion sickness.
- Eye fatigue or irritation.
- Headaches or dizziness.
- Aches and pain in the neck or shoulders.

### FMD SAFETY PRECAUTIONS

Adjust the headband so the FMD helmet is secure and will not fall off in use. Do not use the FMD if temperature is below 32°F/0°C or above 104°F/40°C or in wet, humid, dusty or smoky areas.

Avoid dropping or impact of the FMD frame and displays. If the FMD is damaged contact your retailer. There are no user serviceable parts. Only qualified service personnel should perform any repair on this product.

Avoid exposing the FMD to direct sunlight or intense / high-powered lighting.

### ESD SENSITIVITY

This headset eyepiece device may be sensitive to electrostatic discharge of 8 kV or higher. Observe static precautions such as discharging the body by touching the metal chassis of the grounded equipment prior to touching the eyepiece.



# SELECT SUITABLE LOCATION

The machine will not operate in harsh environments. It is important that simple preventative measures are followed in order to assure long life and reliable operation. This product is for INDOOR USE ONLY.

- Dirt and dust that can be drawn into the machine should be kept to a minimum. Failure to observe these precautions can result in excessive operating temperatures and nuisance shutdown.
- See **Technical Specifications** for operating environment conditions.
- Do not locate where monitor and/or helmet is exposed to direct sunlight or high powered lighting.
- Do not place equipment near radiant heat sources.
- Do not place in a confined space. Allow a minimum of three feet of clearance around machine and stand at all times. Adequate ventilation is necessary.
- The fused power switch on the rear panel is the input power disconnect device. Do not position the equipment so that it is difficult to operate the fused power switch.
- Route and protect all cables to minimize exposure to damage.
- Single or Multi-Outlet surge protector (or Surge Suppressor) is highly recommended to protect the machine from voltage spikes going through the input line.
- An uninterruptible power supply (UPS) may be required for the protection of the system from power irregularities and disruption.

1. Decide on a location for your unit.

**NOTE: The system requires approximately 8' L x 8' D x 8' H (2.4 m L x 2.4 m D x 2.4 m H) of space.**

Keep the area free of obstruction for at least 3 feet in all directions of both the stand and VR weld machine. In addition, be conscious of where you are placing the unit to avoid magnetic fields, conductive and high frequency objects and processes.

**NOTE: Avoid setting up the VRTEX 360 near high frequency TIG machines and power sources.**

Having these types of objects in the area can cause interference and result in increased jitter and/or distortion in the motion tracking.

For best results, do not install VRTEX 360 machine in the welding lab. Electrical interference from power lines, though generally small, can be present. Therefore all electrical power or lighting wiring within 50 feet of the welding area shall be enclosed in grounded rigid metallic conduit. In the event the VRTEX 360 is affected by interference, it is the user's responsibility to take steps to isolate and/or eliminate the interference.

An uninterruptible power supply (UPS) may be required for the protection of the system from power irregularities or disruption.

It is strongly recommended that a single or Multi-Outlet surge protector be used to protect the machine from any unwanted voltages above a safe threshold.

## MULTIPLE SYSTEM INSTALLATIONS

If multiple systems are required to operate together in one location, a unique frequency transmitter can be installed during the manufacturing process at Lincoln Electric to reduce potential interference between systems. K3962-1 systems have a standard frequency source installed. K3962-2 systems have an alternate frequency source installed. For multiple system installations, alternate the K3962-1 and K3962-2 systems for best operation:

**For Example:** If 8 systems are to be installed in the VR welding lab, the standard and alternate frequencies should be positioned as seen below.

K3962-1	K3962-2	K3962-1	K3962-2
K3962-2	K3962-1	K3962-2	K3962-1

## ENVIRONMENTAL AREA

Keep the machine inside and dry at all times. Do not place it on wet ground or in puddles. Never place liquids on top of the machine.

## STACKING

The VRTEX 360 cannot be stacked.

## TILTING

Place the VRTEX 360 directly on a secure, level surface.

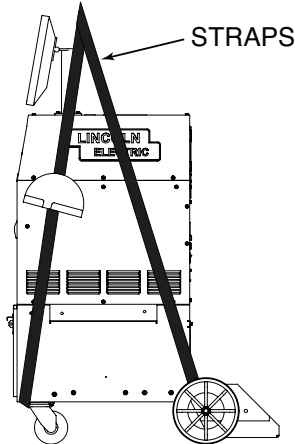
## SHORE POWER

A conductive-type interference in which an irregular input voltage and/or improper grounding can adversely affect the proper operation of your VRTEX 360 when connected to a shore power. As indicated in this manual, electrical interference from the power line, though small, can be present. Input line irregularities and/or improper grounding of any equipment sharing the same input line circuit could potentially affect the system. An uninterruptible power supply (UPS) may be required for the protection of the system from power irregularities and disruption.

## LIFTING

If lifting the VRTEX 360 is required, use two straps; each rated for 500 pounds (226.8 kg) or more. **Do not attempt to lift the VRTEX 360 with accessories attached to it.**

Figure 1 – Machine lifting



### ! WARNING

FALLING EQUIPMENT can cause injury.

- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.
- Do not operate machine while suspended or when lifting.



## HIGH FREQUENCY INTERFERENCE PROTECTION

### ! CAUTION

USE CAUTION WHEN OPERATING THIS MACHINE AROUND OTHER EQUIPMENT.

- Large equipment, such as cranes, may interfere with the operation of this machine.
- This machine may interfere with the operation of other equipment in work / training area.
- High frequency process, such as TIG machines, may interfere with the operation of this machine.
- Welding / cutting machine with improper grounding may interfere with the operation of this machine.

## RADIO FREQUENCY INTERFERENCE

This system contains a sensitive magnetic positioning sensor that can become disturbed in the presence of conducted RF noise in the 8 to 11 Mhz range on the AC powerline of the system or on the gray cable leading to the Polhemus sensor. Disturbances can manifest themselves in slight jarring of the virtual environment shown on the LCD display or via the headset eyepiece.

If interference on the sensor cable is an issue, it should be repositioned until the jarring stops. In the case of noise on the AC port being an issue, a noise suppressing ferrite bead can be added to the AC power cord which will eliminate the interference. Please contact your Lincoln Electric Support Center for details.

# DESIGN FEATURES

## HARDWARE OVERVIEW:

- Virtual Welding Machine, including:
  - Touchscreen Monitor
  - Coupon Compartment (left side)
  - VR GMAW/FCAW Gun
  - VR SMAW Device
  - VR GMAW/FCAW Gun Holder
  - VR SMAW Device Holder
  - VR Helmet w/Face Mounted Display (FMD)
  - Swing Arm
  - Five VR Coupons
    - Flat Plate
    - T-Joint
    - V Groove
    - 2" Pipe XXS
    - 6" Pipe Schedule 40
    - Lap Joint (optional)
- Stand, including:
  - Post
  - Table
  - Pins
  - Base
  - Weights

Figure 2



# HARDWARE UNCRATING

## TOOLS NEEDED

No tools are needed for uncrating and installation of the VRTEX 360 machine.

1. Remove and save wing nuts, bolts and associated washers from end of the crate. See Figure 3 and 4.

**NOTE:** End of the crate is now loose and can be removed.

## CAUTION

Do not damage or discard crate, front panel/ramp, packaging or any associated hardware during this procedure as it will need to be re-used in order to transport the machine in the future.

Figure 3 – Uncrating

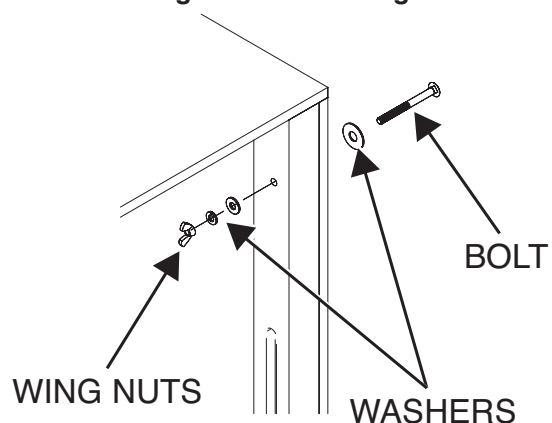
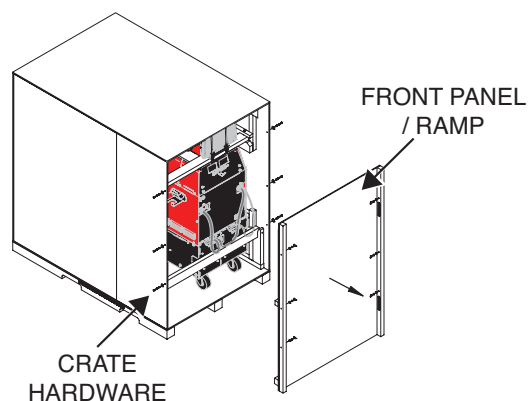


Figure 4 – Uncrating



2. Position the front panel of the crate on the floor so it forms a ramp ideal for safely unloading the VRTEX 360 machine. See **Figure 6**.
3. Loosen straps holding monitor in place. See **Figure 5**.
4. Remove and save the hardware securing the padded shipping braces inside front of the crate. Note proper positioning of padded shipping brace for future installation. See **Figure 6**.
5. Using the ramp/front panel, carefully remove the machine from the crate. See **Figure 6**.

Figure 5 – Monitor straps

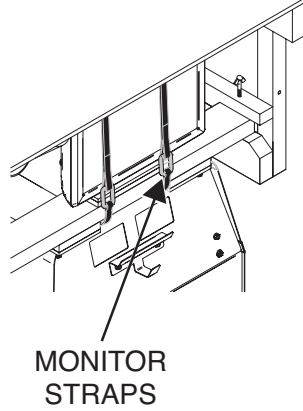


Figure 8 – Stand removal

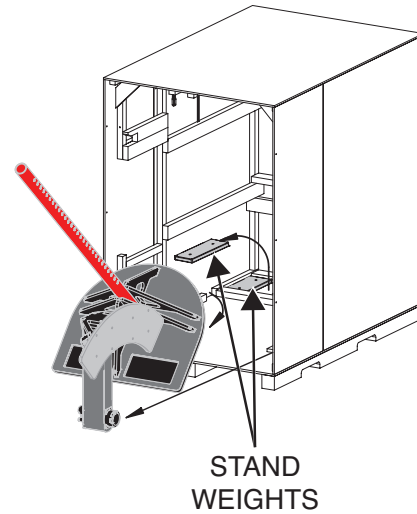
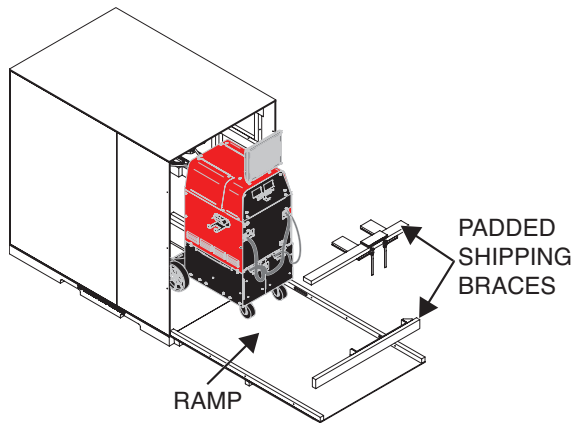


Figure 6 – Machine removal



3. Place stand weights on base.
4. Obtain pins from the rear compartment of the machine. See Figure 9.
5. Insert one of the pins into the post at the #6 location.
6. From the top, slide the table onto the post letting it rest on the pin inserted in the previous step.
7. Insert the second pin into the post at the #13 position.
8. Obtain the swing-arm from the rear of the VRTEX 360. Grey cable should remain connected to the VRTEX 360 (**DO NOT CUT THE GREY CABLE!**).

## TABLE & SWING ARM SETUP

1. Loosen rubber tie down and hook and loop strap securing the table and stand to the crate and remove table and stand. See Figure 7 and 8.

Figure 7 – Table and stand removal

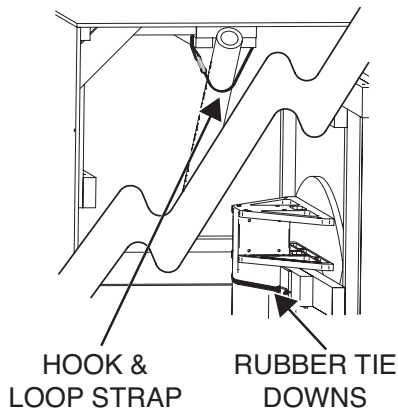
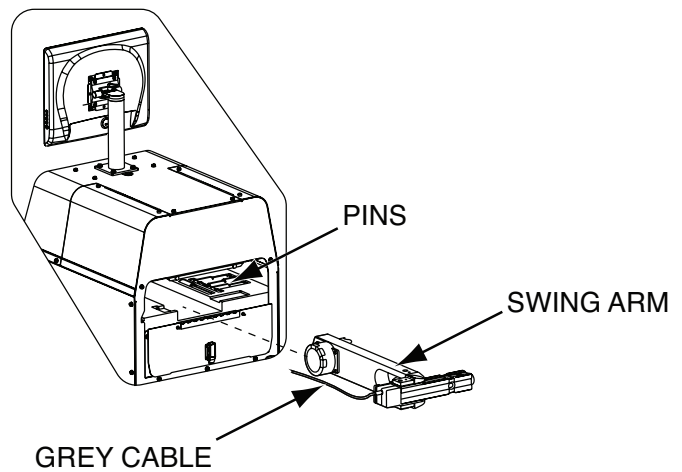


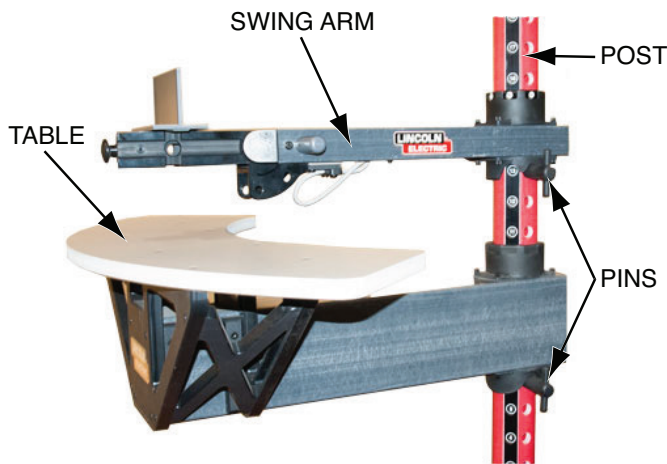
Figure 9 – Pins and swing arm



2. Remove stand weights from crate. See Figure 8.

- Carefully slide swing-arm onto post with the letters (on the collar) "ABC" up and the grey cable located on the bottom of the swing arm assembly.
- Insert the third pin at a convenient height for holding the helmet.

**Figure 10 – Table and stand set-up**



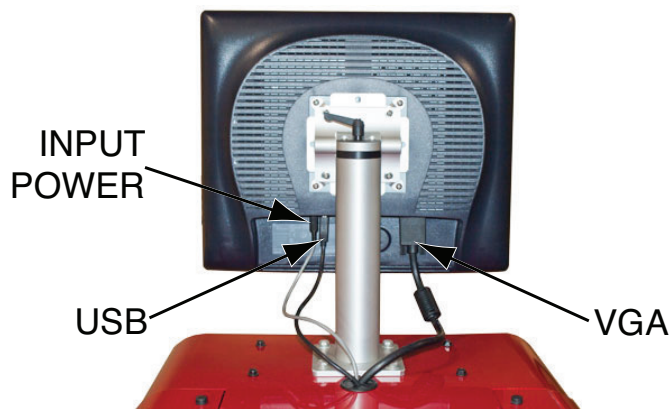
**⚠ CAUTION**

Route the grey cable so it does not create a tripping hazard.

## MONITOR SETUP

- If necessary, attach the input power cable, USB cable and VGA cable to the monitor.

**Figure 11 – Monitor connections**



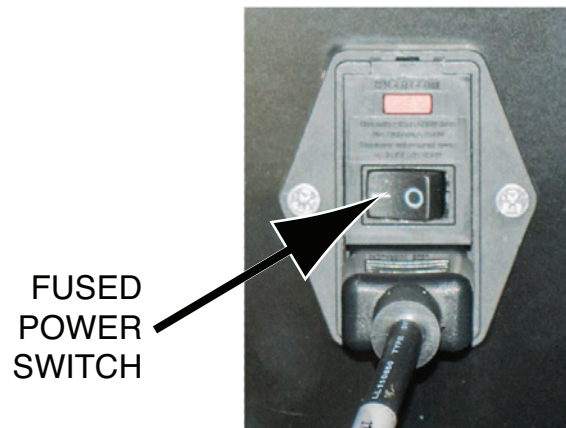
## SYSTEM POWER

- Insert the input supply power cord into the back of the VRTEX 360 and into a standard electrical outlet capable of 115/230 VAC at 4/2 amps.

**NOTE:** Surge protector (or Surge Suppressor) may be required to protect the electronic components of the machine from input power surges.

- Verify fused power switch/rocker switch is in the ON position. See Figure 12.

**Figure 12 – Back of machine**



### ADDITIONAL FEATURES

- The welding coupons are stored in the coupon compartment on the left side of the machine.
- The weld simulation can be displayed on an external monitor or projector by using the VGA output on the back of the machine. The external display must support 1024x768 resolution.

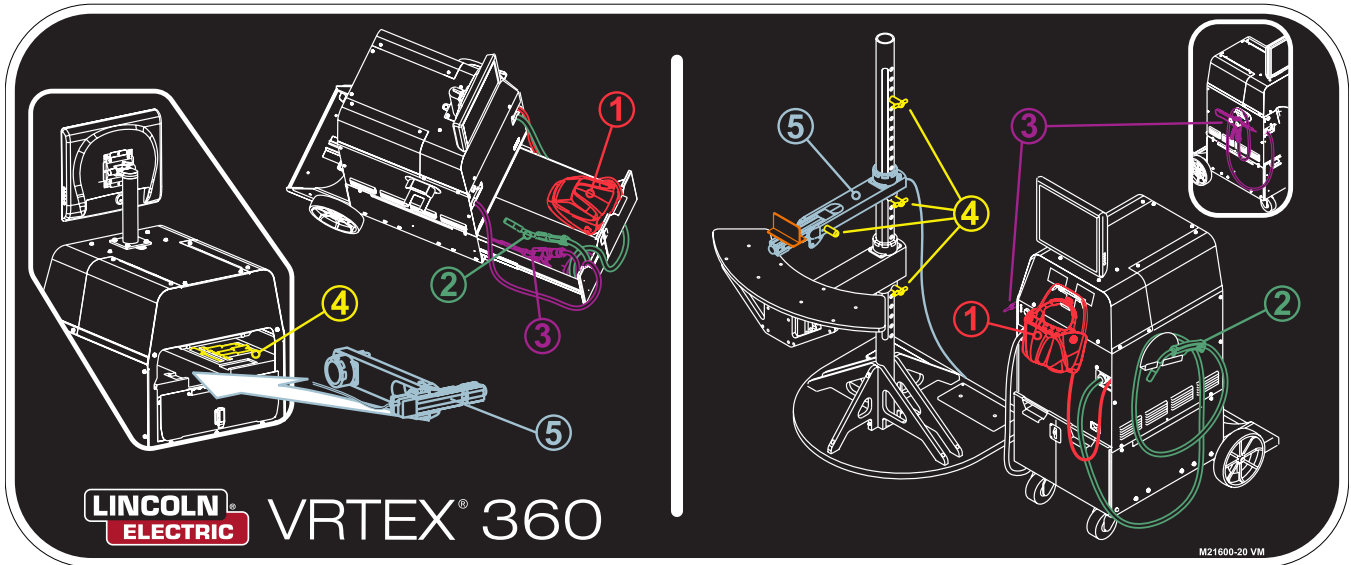
## TRACKING SYSTEM FUNDAMENTALS

The magnetic tracking system is composed of the following:

- Control Unit (Inside VR Machine)
  - Contains the hardware and software necessary to compute spatial information.
- Source (part of the Swing Arm)
  - The source contains electromagnetic coils enclosed in a plastic shell that emit a magnetic field. The source is the system's reference frame for sensor measurements.
- Sensor (in the VR GMAW/FCAW gun, VR SMAW device and helmet)
  - The sensor contains electromagnetic coils enclosed in a plastic shell that detect the magnetic fields emitted by the source. The sensor's position and orientation are precisely measured as it moves in reference to the source. The sensor is completely passive, having no active voltage applied to it.

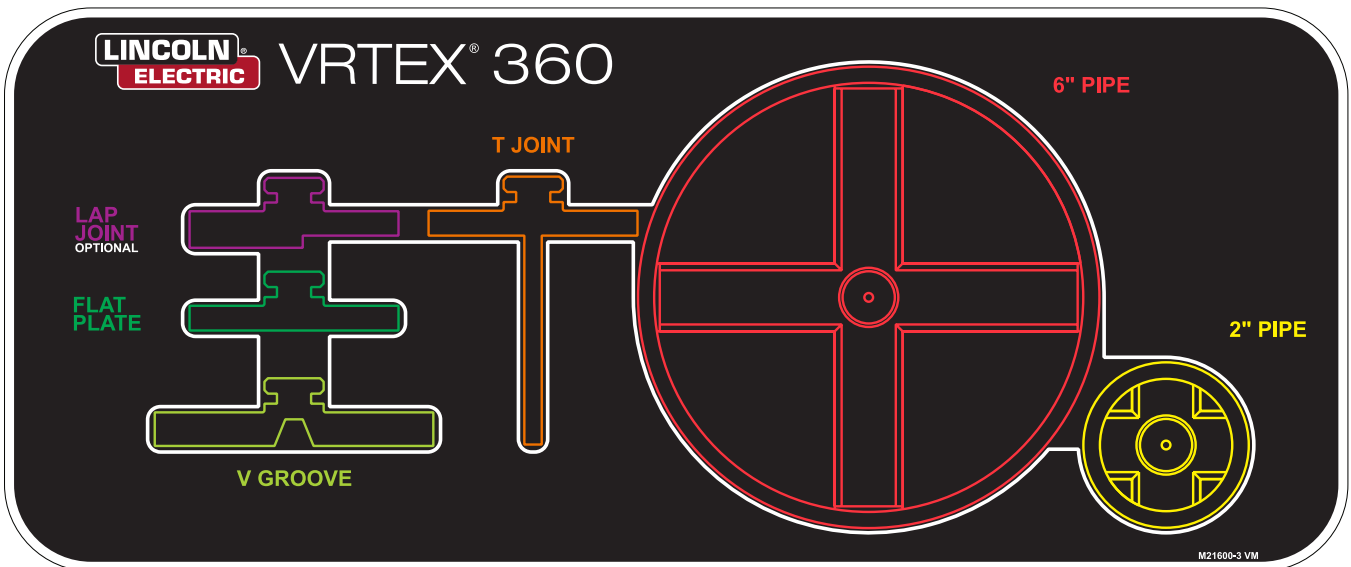
# MACHINE DECALS

Figure 13 - Machine components and set-up decal



1. FMD (Face Mounted Display) / Helmet
2. VR GMAW/FCAW Gun
3. VR SMAW Device
4. Pins
5. Swing Arm

Figure 14 - Coupon decal



- 2" Pipe XXS
- 6" Pipe Schedule 40
- T Joint
- Flat Plate
- V Groove
- Lap Joint (optional)



## PRODUCT DESCRIPTION

The VRTEX 360 is a virtual reality arc welding trainer. This computer based training system is an educational tool designed to allow students to practice their welding technique in a simulated environment. It promotes the efficient transfer of welding skills from the classroom to the welding booth, while reducing material waste and energy consumption associated with traditional welding training.

The VRTEX 360 is a virtual reality arc welding training machine only and NOT a real arc welding machine. Please be aware of all standard safety practices associated with welding. Some standard warnings are included in this manual.

If the equipment is used in a manner not specified by the manufacturer, the protection provided to the equipment and user may be impaired.

Access panels are not to be removed except by qualified service personnel due to risk of electric shock from accessible live parts.

## USER INTERFACE OVERVIEW

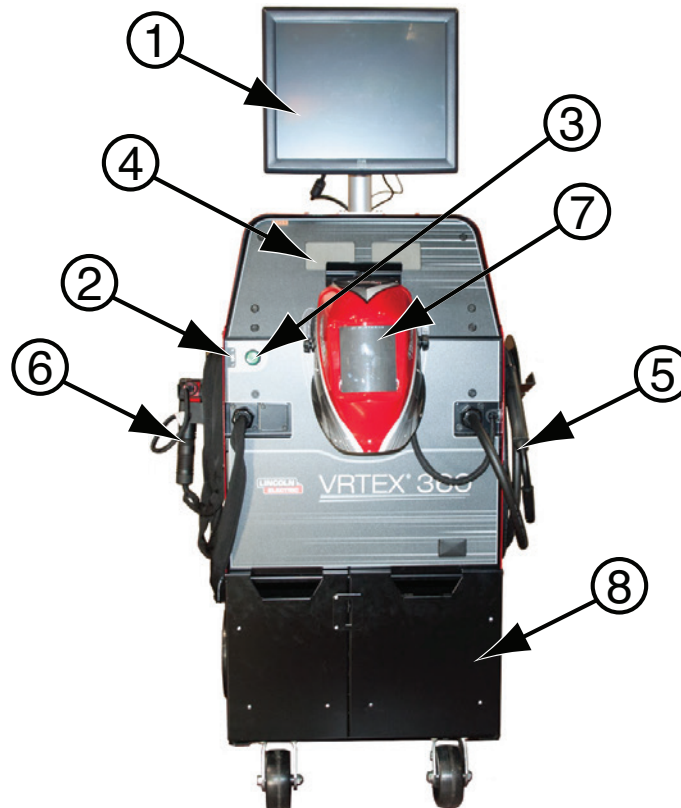
See Figure 15 for locations of operator controls and indicators.

1. The **touchscreen monitor** allows the student to view the setup screens and provides an active view of the actual welding process for teachers and students. The monitor can be rotated for ease of viewing. Make certain the power button located on the side of the monitor is ON.
2. The **USB port** is used to upload software and download user data from the system.
3. The **green circular button** powers up the VRTEX 360 system.

**NOTE:** The green power button does not power down the system. Select Log Out and Shutdown from the red menu icon to turn off the system.

4. The **speakers** provide proper welding sounds for the user and teacher.
5. The **VR GMAW/FCAW gun** is used during the simulation of GMAW and FCAW processes.
6. The **VR SMAW device** is used during the simulation of SMAW processes.
7. The **helmet** is worn by the user during the simulation of all welding processes and procedures.
8. The **front storage drawers** are used to store the helmet, VR/GMAW/FCAW gun and VR/SMAW device when the machine is not in use or in transit.

Figure 15 – Front of machine



## HARDWARE SPECIFICS

### VR GMAW/FCAW GUN

The VR gun has a trigger that is used during the simulation of GMAW and FCAW processes to initiate and maintain the simulated welding arc. The VR GMAW/FCAW gun should be placed on the round gun holder on the right side of the machine when not in use.

Figure 16 – VR GMAW/FCAW gun



### ⚠ CAUTION

Store gun as shown below to avoid damage.

Figure 17 – VR GMAW/FCAW gun (properly stored)



### VR SMAW DEVICE

The VR SMAW device has a rod that represents a stick electrode. This rod retracts when a virtual arc is struck to simulate the electrode burning off during the virtual welding process. When the virtual electrode burns down to a stub, the rod will stop retracting and the user will no longer be able to weld. When the user presses “new stick” in the orange actions and cues menu icon, the rod extends out, simulating that a new electrode was put into the VR SMAW device. When not in use, the VR SMAW device should be placed in the VR SMAW holder on the left side of the VR weld machine.

In order to strike an arc with the VR SMAW device, gently strike or tap the tip of the rod (of the VR SMAW device) on the coupon being welded. To break the arc, move the VR SMAW device rod away from the work piece.

### ⚠ CAUTION

**Do not try to strike the arc with excessive force, as the arc start is distance based. Excessive force may result in damage to the VR SMAW device.**

The angle of the rod can be changed by squeezing the handle of the VR SMAW device. This allows the rod to be moved into the 45 or 90 degree position. Once the rod is at one of these angles, release the handle. The rod should now be fixed in that position. **Do not change the rod angle while the rod is extending or retracting.**

Figure 18 – VR SMAW device



### ⚠ CAUTION

Store device as shown below to avoid damage.

Figure 19 – VR SMAW device (properly stored)



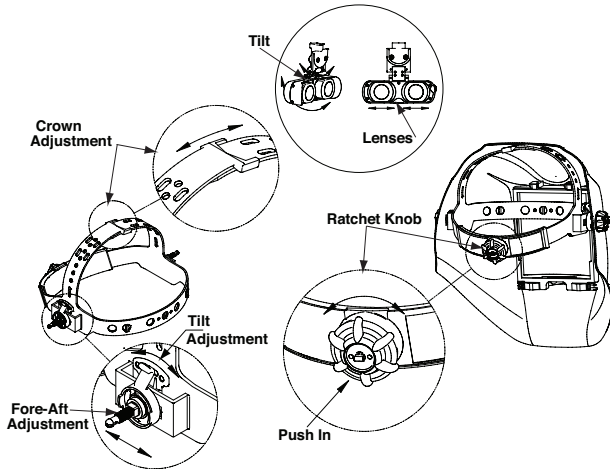
**HELMET**

**HEAD SIZE ADJUSTMENT:** HEADGEAR TIGHTNESS is adjusted by pushing in the Ratchet Knob and turning to adjust for the desired head size. This knob is located at the back of the helmet.

**NOTE:** Polyethylene foam pipe insulation may be used to accommodate smaller head sizes.

**HEADGEAR CROWN ADJUSTMENT** is made by adjusting for comfort and snapping the pin into the hole to lock securely in place.

**Figure 20 – Helmet adjustment**



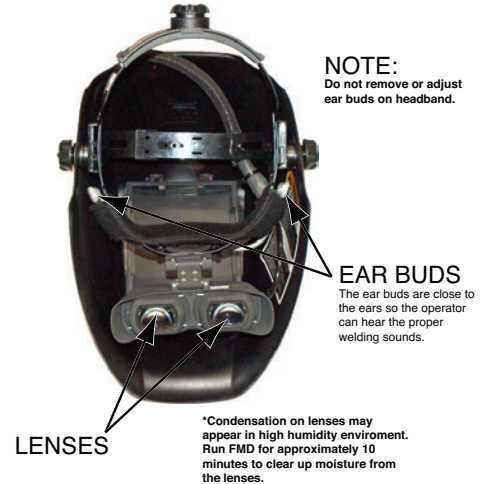
**TILT:** Tilt adjustment is located on right side of helmet. Loosen the right headgear tension knob and push the top end of the adjustment lever outward until the lever's Stop Tab clears the notches. Then rotate the lever forward or back to the desired tilt position. The Stop will automatically engage again when released locking the helmet into position.

**FORE / AFT ADJUSTMENT:** Adjusts the distance between the FMD and the front of the helmet. To adjust, loosen the outside tension knobs and slide forward or back to desired position and re-tighten.

**NOTE:** Make sure both sides are equally positioned for proper operation.

The helmet has an FMD (Face Mounted Display) on the inside. These FMD lenses display the virtual environment to the user. Each lens can be shifted left or right to align with the users eyes by applying gentle pressure. In addition, the lenses can be lifted up and down as well as shifted forward and back for the best fit. The user should make sure the lenses are parallel to their eyes. Keep the lenses clean at all times. See Cleaning and Maintenance **Section D**.

**Figure 21 – Helmet lenses\***



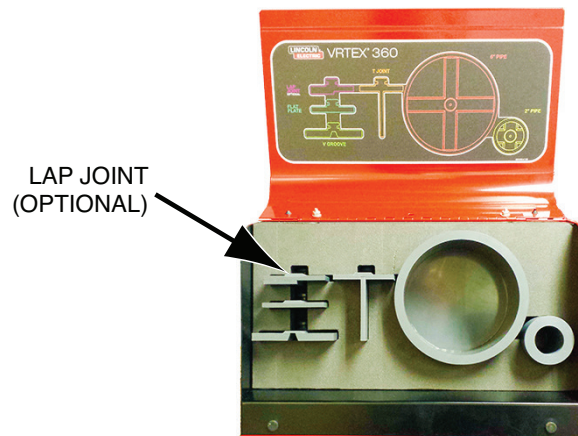
When not in use, the helmet should be hung from the front of machine, the stand or placed in the right front drawer to avoid being damaged.

A welding cap should be used and headgear should be cleaned before using the Helmet.

**COUPON COMPARTMENT**

The coupon compartment houses the physical coupons. When not in use, the coupons should be stored in the compartment. To open the compartment, lift the compartment door up. Each coupon fits in its own area defined by the foam located in the compartment.

**Figure 22 – Coupon compartment**



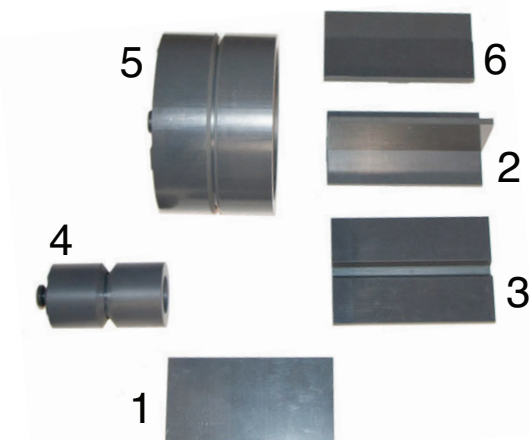
**COUPONS**

The coupons represent the various workpieces on which the user can virtually weld. During the virtual welding process, they provide physical feedback to the student.

There are five VR Coupons:

1. Flat Plate
2. T-Joint
3. V Groove
4. 2" Pipe XXS
5. 6" Pipe Schedule 40
6. Lap Joint (optional with VRTEX 360 Extensions™ Upgrade 5)

**Figure 23 – VR Coupons**



The coupons along with the VR SMAW device and VR GMAW/FCAW gun have been factory calibrated by The Lincoln Electric Company.

**STAND ASSEMBLY**

The stand is comprised of the post, arm (attached to the machine), table, three pins, base and two weights. Users should position themselves at the stand during virtual welding.

**POST**

The arm and table slide up and down and rest on the collar pins that are inserted into the post. Hole numbers 1 through 28 indicate position of welding for program accuracy. The position that the table or arm is located is read by identifying the numbered hole that the pin has been inserted into.

**Figure 24 – Post w/pin inserted in #13**



**COUPON POSITIONING IN SWING ARM**

The coupons can be inserted into the arm to accommodate flat, horizontal, vertical or overhead welding positions. The knob on the front of the swing arm can be pulled out for coupons to be inserted or removed and pushed in for coupons to be secured. The front of the swing arm can be rotated down at a 45 or 90-degree angle to allow 2G, 5G and 6G pipe welding positions. The arm can also be rotated around the post to comfortably accommodate left and right handed welders or simulate specific welding applications.

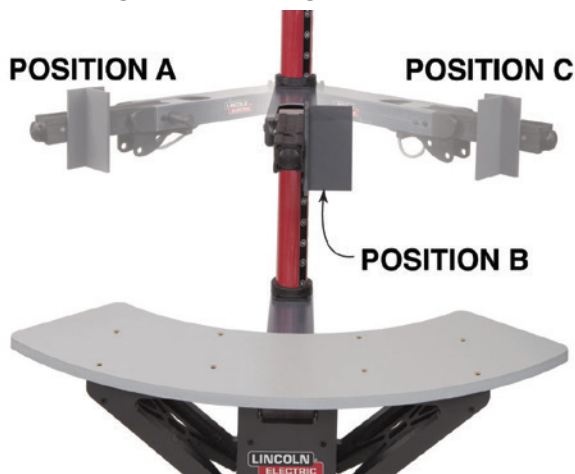
**Figure 25 – Coupon insertion / removal**



**CAUTION**

Do not use excessive force when inserting and removing coupons into the arm.

**Figure 26 – Swing arm rotation**



**TABLE**

The table can be used to gain stability and learn proper body positioning. The base supports the stand and has weights on the back to maintain stability. The table can be swung out of the way when not in use.

**⚠ CAUTION**

Do not use the Stand/Table without the base counter weights properly positioned.

Figure 27 – Table rotation

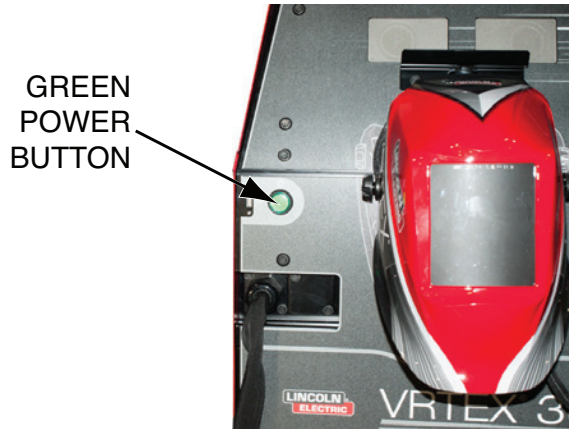


# POWERING ON

1. Pressing and holding the **green circular button** on the front of the machine for 5 seconds powers up the VRTEX 360 system. See Figure 28.

**NOTE:** The green power button does not power down the system. Select Log Out and Shutdown from the red menu icon to turn off the system.

Figure 28 – Green power button



2. The **touchscreen monitor** allows the student to view the setup screens which provide an active view of the actual welding process for instructors and students. The monitor can be rotated for ease of viewing. Make certain the power button on the monitor is ON. See Figure 29.

Figure 29 – Monitor power button



The following user controls (icons) may be displayed on the monitor screen.

1. The **wire feed speed/amperage dial icon** allows the user to input wire feed speed or amperage depending on the VR welding process selected.
2. The **voltage dial icon** allows the user to input the welding voltage. This dial also allows input of trim values when pulse process is in use.
3. The left and right **white screen select arrow icons** allow the operator to cycle through various screens.
4. The **process selector icon** is used to select the virtual welding process (GMAW, FCAW or SMAW).
5. The **polarity selector icon** is used to indicate the welding polarity for any given process (DC+, DC- or AC).

6. The **USB port** located at the front of the machine is used to upload software and download user data from the system.
7. The **key icon** is located on the monitor screen and allows the instructor to access the instructor mode which includes the Weldometer®, Tolerance Editor, Options, License Info and Update screens.
8. The **highlighted icons, white arrows and multi-colored icons** perform various functions depending upon the command shown.
9. Selecting **Back** takes the user to the previous screen.

# END USER LICENSE AGREEMENT

The End User License Agreement (EULA) will appear at start up of machine for the first time. Selecting "I Agree" will allow access to the VRTEX 360. The machine will shut down when "I Disagree" is selected.

**NOTE:** EULA can be accessed and saved to USB in the instructor mode screen.

# INSTRUCTOR MODE

## TO ENTER INSTRUCTOR MODE

1. Touch the “Key” icon located in the lower left corner of the screen. See Figure 30.

Figure 30 – Menu and instruction key



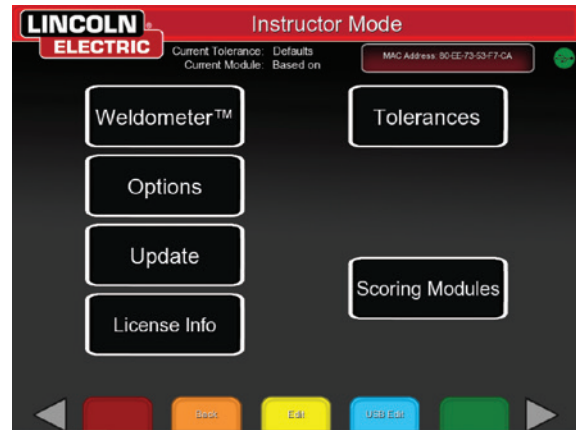
2. The default password is 1,2,3,4,5. To change the password, use the icon with the key and + sign. See Figure 31.
3. To continue, follow the on screen instructions.

Figure 31 – Instruction entry menu



4. Select the license info icon.
5. Select the End User License Agreement (EULA) icon using white arrows.
6. The license agreement is available to read and save to a USB drive.
7. When complete touch the “license” icon and then the “back” icon.
8. The instructor’s mode screen will be displayed. See Figure 32.

Figure 32 – Instructors mode screen



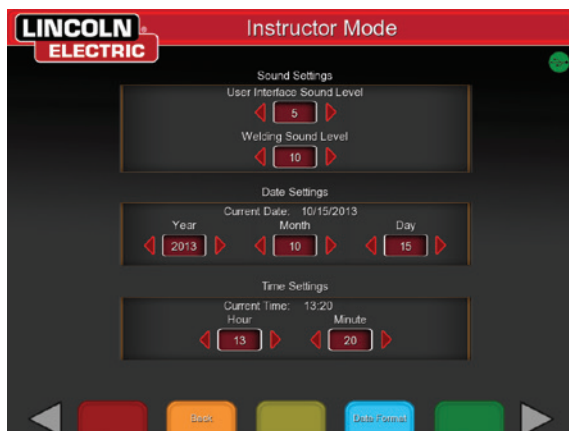
The instructor mode includes the following:

- Options
- Update
- License Information
- Weldometer
- Tolerances

## OPTIONS

The options screen, in the instructor mode, allows the user to change the volume of the user interface and welding sounds, date and time settings. See Figure 33.

Figure 33 – Instructor mode options



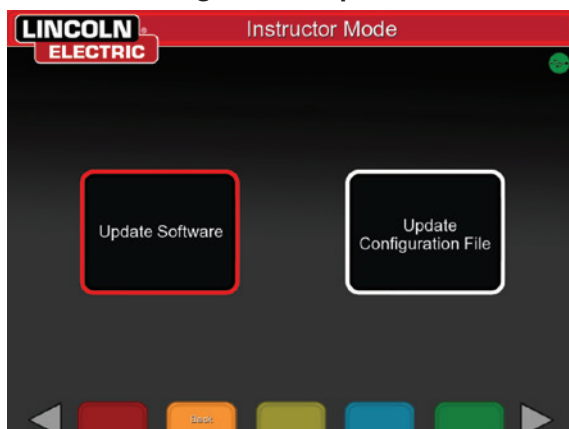
## UPDATE

### OVERVIEW

The update screen in the instructor mode allows the user to update their software or to update specific configuration files from the USB memory device in the front of the VRTEX 360. Selecting this brings up two options (See Figure 34):

- Update Software
- Update Configuration File

Figure 34 – Update



## SOFTWARE

Selecting this option loads a newer version of the software if one is available on a USB inserted in the front of the machine. Updating to a different version may shut down or restart the system.

After updating, the system may need to be shut down and restarted for changes to be implemented.

## CONFIGURATION FILE

Selecting this option loads any configuration changes from the USB inserted in the front of the machine. This is used for part replacement.

## LICENSE INFORMATION

The VRTEX 360 is a full featured virtual reality arc welding training solution. As a software based system, the VRTEX 360 provides the end user with features and functionality that are licensed or enabled, when they operate on the machine.

An example of such a feature is the bend test on the VRTEX 360. If a new upgrade is added to the VRTEX 360, it would be enabled as a Licensed Feature as well. The licensed features on the VRTEX 360 are specific to the MAC Address or computer address of each machine specifically.

Figure 35 – License information screen



This means that a machine with different versions of software, may have different enabled features or functions. The License screen is available within the Instructor Mode. It provides a list of the features that are enabled or operational on your VRTEX 360 training system and the MAC Address of your machine. You can scroll through the list of features to see the complete list.

The License screen also shows Reserved spots which can be loaded with future enhancements through the VRTEX 360 Software Upgrade program.

For more information on the VRTEX 360 Upgrade Program, please contact your Lincoln Electric sales representative or Lincoln Electric Automation. **TEL: 1-888-935-3878** or visit [VRTEX.COM](http://VRTEX.COM).

# WELDOMETER

## OVERVIEW

The Weldometer tracks virtual consumables, arc time, base material and gas usage. This information can be used to track materials and cost savings incurred by the use of virtual welding training. The Weldometer tracks material usage and arc time over a “trip” (since last reset) and over the VR system’s lifetime. See Figure 36.

**Arc Time** keeps track of the amount of time (hours:min:seconds) students have a virtual arc struck with each process.

**Base Metal** tracks metal type and how many virtual coupons have been used and their cumulative weight. Note that plate 3/8” includes groove joints as well as T-joints, while plate 10GA. and 1/4” includes both T-joints and practice plates.

**Gas** tracks how much virtual gas has been used.

**Consumables** tracks the cumulative weight of each type of virtual consumable used. It also displays how many virtual SMAW electrodes are used.

At the bottom of the screen, the **Simulated Welder Time** keeps track of how long the unit has been on (time in hours:minutes:seconds).

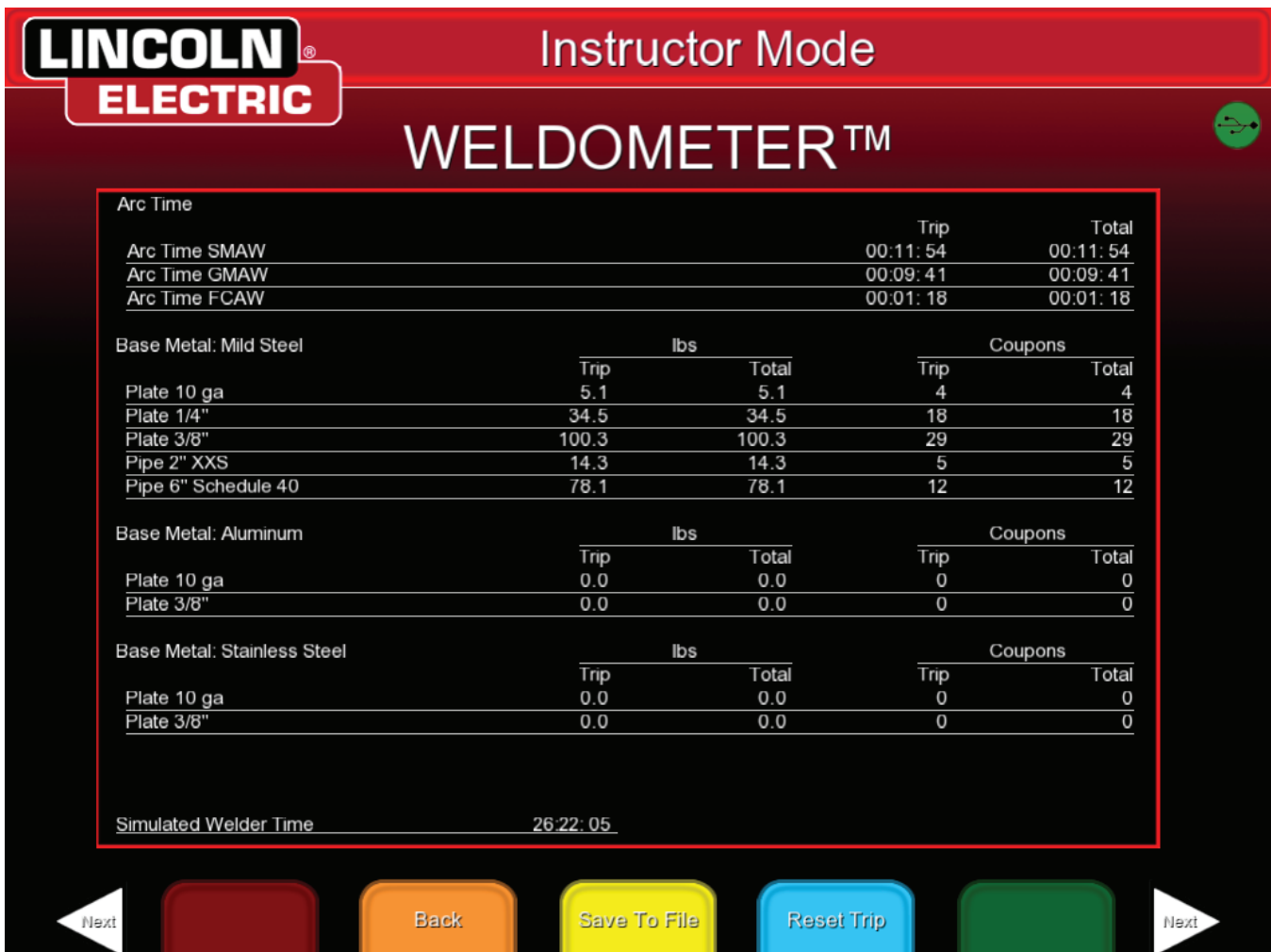
## RESET TRIP

Selecting Reset Trip zeroes out all items in the trip column. This allows an instructor to track VR material savings over a certain time period.

## SAVE TO FILE

If a USB memory device is inserted in the unit, selecting “save to file” saves a file with all of the current Weldometer information in a text format. Once the file has saved, the user can take the USB to a computer or printer to print, email, copy, store or view the file.

Figure 36 – Weldometer



# TOLERANCE EDITOR

## OVERVIEW

The tolerance editor allows users to modify the system settings from the default to fit their curriculum. See Figure 37.

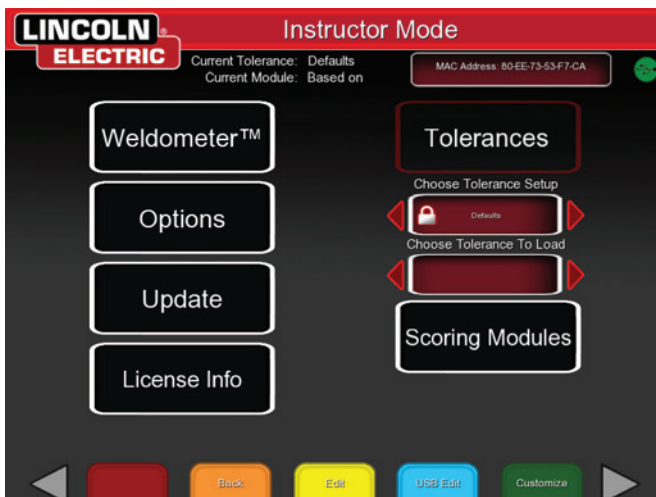
The VRTEX 360 ships with Lincoln “default” welding parameters pre-installed. The parameters can be modified by the instructor to reflect a specific welding application or technique. The weld parameters that can be modified include:

- WFS Range
- Voltage Range
- Amperage Range
- Gas Mixture
- Gas Flow Rate
- Polarity

The technique parameters ideal range values can also be modified:

- Aim Tolerance
- CTWD/Arc Length
- Work Angle
- Travel Angle
- Travel Speed
- Whip
- Weave
- Pattern
- Position

Figure 37 – Tolerances



## EDIT

This menu icon affects the file currently being shown in the “choose tolerance” setup window. This menu has the following options:

- Create New
- Save to USB
- Copy
- Delete
- Rename

Selecting **Create New** creates a new file on the unit. The file starts with the default settings. Selecting this icon takes the user to a keyboard screen so that a new file name can be entered.

Selecting **Save to USB** saves the current file to a USB memory device, if a USB memory device is inserted in the front of the machine.

Selecting **Copy** makes a copy of the file currently being shown on the choose tolerance setup window. The copy is identified with the same name plus an incremented number after it.

Selecting **Delete** brings up an “are you sure” dialogue. Selecting “Yes” deletes the file currently shown. The user can cancel out by selecting “No” or selecting the **Back** icon.

Selecting **Rename** brings the user to a keyboard screen where the name of the current file can be changed.

## USB EDIT

This menu relates only to the files on the USB memory device. If there is a file name currently listed in the choose tolerance to load box, selecting the options on the menu will take action on that file. This menu has the following options:

- Copy to List
- Delete
- Rename
- Load from USB

Selecting **Copy to List** copies the file currently being shown on the choose tolerance to load box and saves it to the VRTEX 360.

Selecting **Delete** brings up an “are you sure” dialogue. Selecting “Yes” deletes the file currently being shown on the choose tolerance to load. This deletes the file from the USB memory device. The user can also cancel out by selecting “No” or selecting the **Back** icon.

Selecting **Rename** brings the user to a keyboard screen where the name of the current file can be changed.

Selecting **Load** loads the names of the files currently on the USB memory device. The names show up in the ‘choose tolerance to load’ box. The user will need to select this in order to see what is on their USB memory device.

## CAUTION

Changing the settings in the tolerance editor will dramatically affect how the system runs, including scoring, visual cues and discontinuities. Take care in changing the settings of the tolerance editor as not to reflect unrealistic welding situations.

**CHOOSE TOLERANCE SET-UP**

Displays the list of all tolerance settings currently stored on the unit. All units ship with default settings. If the user creates multiple tolerance files, the file in use is selected by selecting the red icon. This affects the visual cues, graphs, discontinuities and score. The current tolerance settings in use are also listed on this screen.

**CHOOSE TOLERANCE TO LOAD**

This displays the list of all tolerance sets currently stored on the USB device. Files can be transferred to and from a VRTEX 360 with a USB memory device.

**CHANGING TOLERANCE LEVELS**

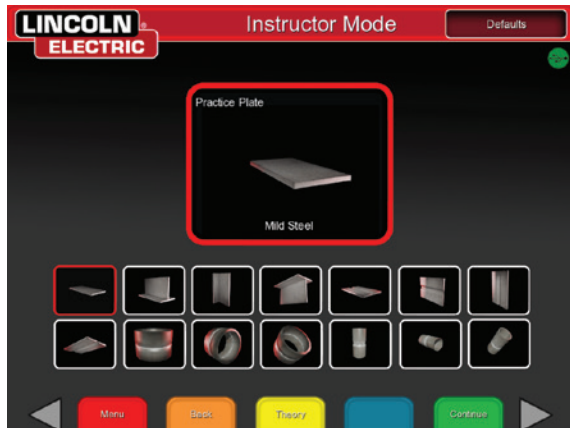
The following steps describe the procedure to change tolerances for the VRTEX 360:

1. Select **Tolerances**.
2. Select **Edit**.
3. Select **Create New**.
4. Enter a new tolerance name on the keyboard screen.
5. Select **Continue**.
6. Scroll through “Choose Tolerance Setup” menu.
7. Select icon with desired name by touching the name displayed in the field.

**NOTE:** When desired tolerance name is properly selected, that name will be displayed at the top of the screen next to “Current Tolerance”.

8. Select “Customize”.
9. The user selects which configuration to modify. See Figure 38.

**Figure 38 – Joint configuration selection screen**



10. The user selects which process to modify. See Figure 39.

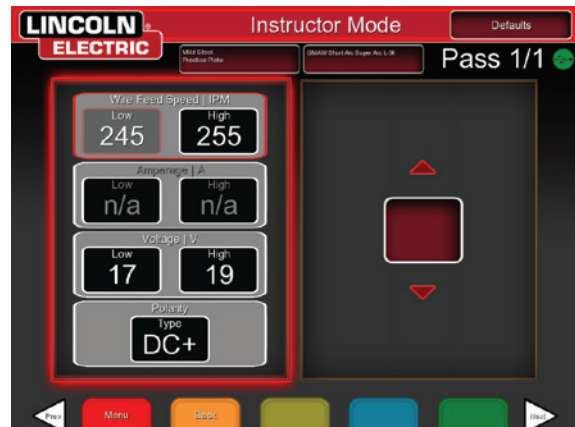
**Figure 39 – Process selection screen**



11. The equipment settings screen allows for the modification of the following welding parameters (See Figure 40):

- Wire Feed Speed
- Amperage
- Voltage
- Polarity

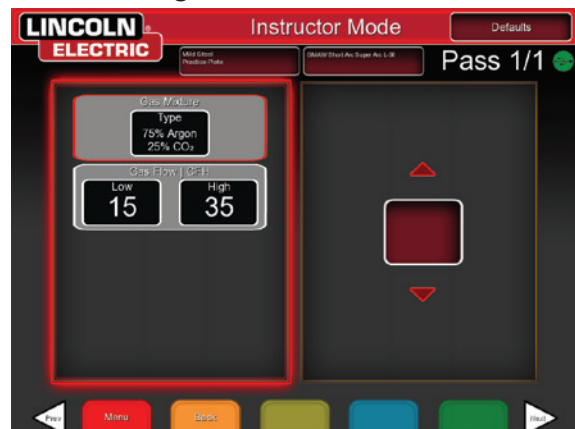
**Figure 40 – Equipment settings screen**



12. The gas screen allows for the modification of the following welding parameters (See Figure 41):

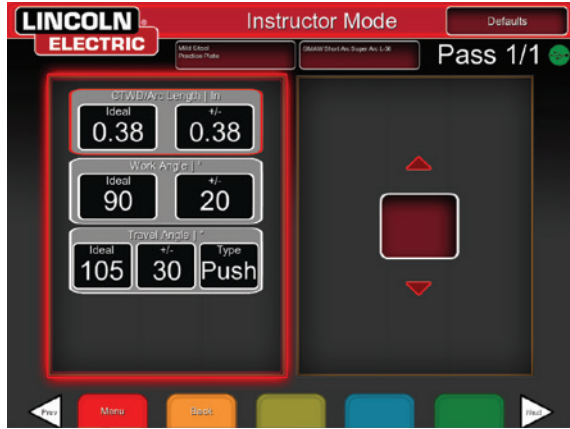
- Gas Mixture Selected
- Gas Flow Rate

**Figure 41 – Gas screen**



13. The welding technique parameters screen allows the modification of (See Figure 42):
- CTWD/Arc Length
  - Work Angle
  - Travel Angle

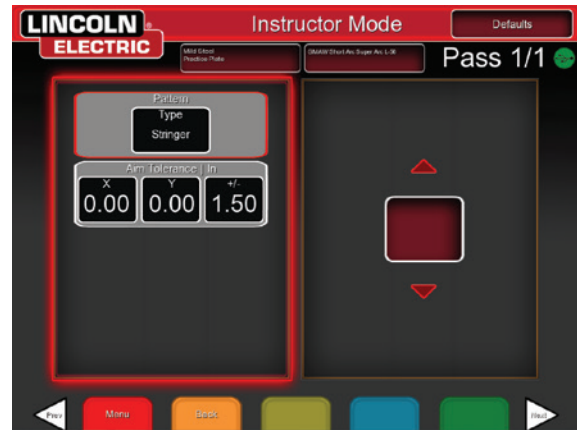
**Figure 42 – Welding techniques parameters screen**



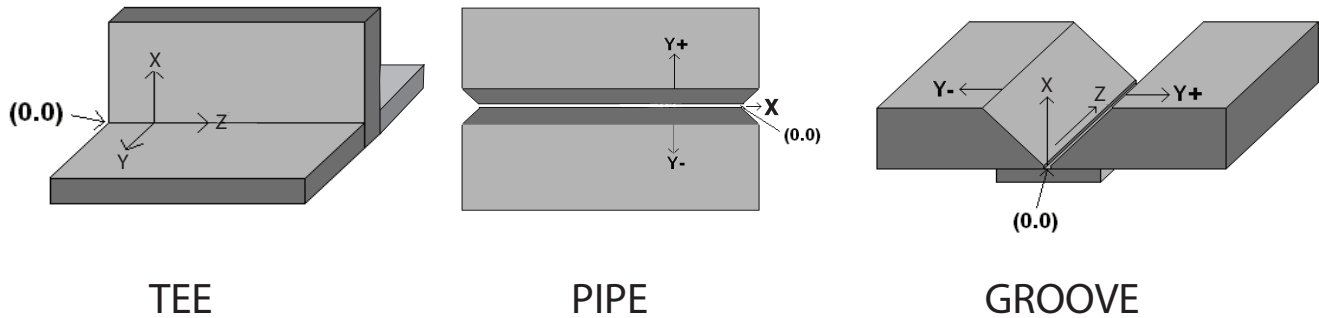
**NOTE:** The travel angle for drag welding techniques should always be less than 90 degrees. The travel angle for pushing technique should always be greater than 90 degrees.

14. The pattern & aim screen allows the user to change the type of pattern being used (stringer, box weave, straight weave, whip, triangle weave) and the position of the root of the weld. See Figure 43. The X and Y values change the location of where the weld bead should be placed. See Figure 44. This affects the position parameter on the Live Action Student Evaluation Report (LASER) screen. The +/- determines how far off from the ideal position the student can place the electrode before it results in a misplaced weld.

**Figure 43 – Pattern & aim screen**



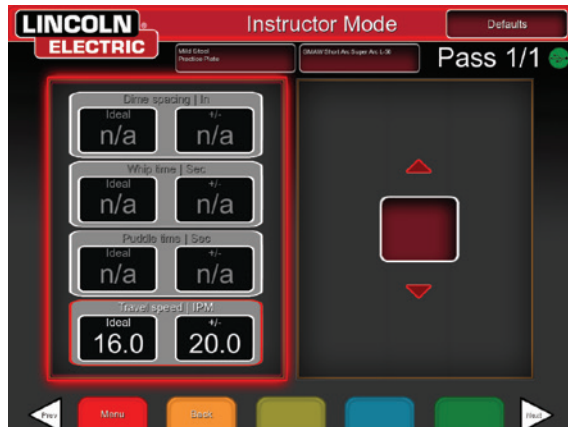
**Figure 44 – Coordinate chart for weld placement (position)**



15. The whip & travel screen allows for the modification of technique parameters relating to the whipping welding technique and travel speed including (See Figure 45):

- Dime Spacing
- Whip Time
- Puddle Time
- Travel Speed

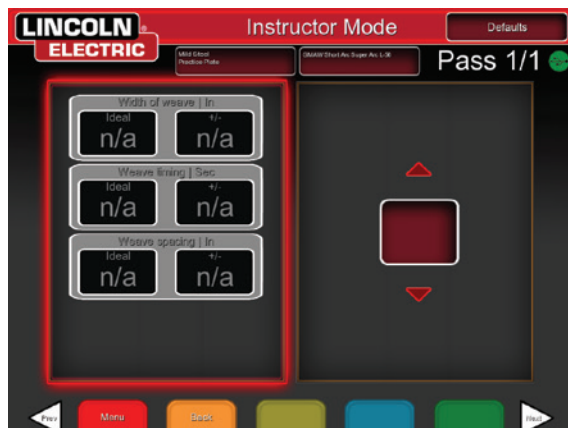
Figure 45 – Whip & travel



16. The weave screen allows for the modification of weaving welding technique including (See Figure 46):

- Width of Weave
- Weave Timing
- Weave Spacing

Figure 46 – Weave screen

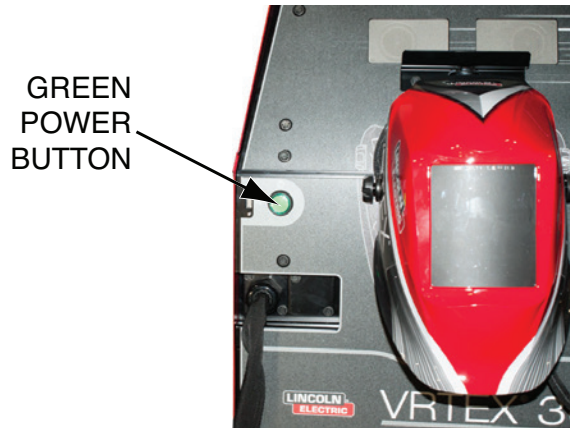


# POWERING ON

1. Pressing and holding the **green circular button** on the front of the machine for 5 seconds powers up the VRTEX 360 system. See Figure 47.

**NOTE:** The green power button does not power down the system. Select Log Out and Shutdown from the red menu icon to turn off the system.

**Figure 47 – Green power button**



2. The **touchscreen monitor** allows the student to view the setup screens which provide an active view of the actual welding process for instructors and students. The monitor can be rotated for ease of viewing. Make certain the power button on the monitor is ON. See Figure 48.

**Figure 48 – Monitor power button**



The following user controls (icons) are displayed on the monitor touch screen.

1. The **wire feed speed/amperage dial icon** allows the user to input wire feed speed or amperage depending on the VR welding process selected.
2. The **voltage dial icon** allows the user to input the welding voltage. This dial also allows input of trim values when pulse process is in use.
3. The left and right **white screen select arrow icons** allow the operator to cycle through various screens.
4. The **process selector icon** is used to select the virtual welding process (GMAW, FCAW or SMAW).

5. The **polarity selector icon** is used to indicate the welding polarity for any given process (DC+, DC- or AC).
6. The **USB port** located at the front of the machine is used to upload software and download user data from the system.
7. The **key icon** is located on the monitor screen and allows the instructor to access the instructor mode which includes the Weldometer®, Tolerance Editor, Options, License Info and Update screens.
8. The **highlighted icons, white arrows and multi-colored icons** perform various functions depending upon the command shown.
9. Selecting **Back** takes the user to the previous screen.

# END USER LICENSE AGREEMENT

The End User License Agreement (EULA) will appear at start up of machine for the first time. Selecting "I Agree" will allow access to the VRTEX 360. The machine will shut down when "I Disagree" is selected.

**NOTE:** EULA can be accessed and saved to USB in the instructor mode screen.

# TO ENTER THE USER SCREEN

## SYSTEM SETUP INFORMATION

When setting up the virtual equipment, the user must set the welding parameters (e.g. wire feed speed for VR GMAW) within the ranges set in the tolerance editor. The system ships with Lincoln default tolerances. Lincoln default tolerances can be reviewed in the tolerance editor or refer to the Default Weld Process Settings Chart (if using the default settings) located at the end of this OPERATION SECTION. See **Figures 124 and 125**.

However, users can set and use their own tolerances for teaching beginner welders. The tolerances also determine how the user is scored on such parameters as work angle, travel angle, travel speed, position and contact tip to work distance or arc length. The software will step the user through the following setup screens:

- Login
- Joint configuration selection
- Process selection
- Stand set up
- Environment
- Gas set up
- Weld machine settings
- Instructor's view
- Welder's view
- LASER (Live Action Student Evaluation Report)

The key icon located at the lower left corner of the screen allows the user to access the Instructor Mode with additional information and set-up pages. See Operation (Instructor Mode).

- Weldometer
- Tolerance Editor
- Options
- Update
- License Information

**NOTE:** If the login screen does not appear, touch the back icon repeatedly until the login screen appears. See Figure 49.

# LOGIN SCREEN

Figure 49 – Login screen



## OVERVIEW

This page allows the user to: (See Figure 49):

- Enter Username
- Select Language Preference “Orange Icon”
- Select Imperial or Metric Units “Blue Icon”
- Shutdown System “Red Menu Icon”
- Continue to the next Setup Screen “Green Icon”
- Select Theory “Yellow Icon”

### 1. On Screen Keyboard

The user enters their name by using the on screen keyboard. The user can select shift or lock (equivalent to caps lock on a standard keyboard) at any time. If the user makes a mistake, they can select the back arrow to delete the last character entered.

### 2. Language

Selecting the orange language menu icon brings up the list of languages the software supports. Touch the desired icon. Select the orange language menu icon again to exit the language menu. The system stores the language selection and will automatically start up in the same language the next time.

Figure 50 – Language screen



### 3. Measurement Units

The blue unit menu icon brings up the measurement system. Touch the desired unit icon. Select the blue icon again to exit the measurement unit menu. Selecting **Metric** or **Imperial** converts the user interface into the corresponding measurement system. The system stores the measurement selection, so it will automatically start up in the same unit of measurement the next time. The system uses the units shown in Table 1.

### 4. Menu

The red menu icon allows the student to shut down the system. If the user selects shutdown, a submenu appears asking the user if they are sure that they want to shut down the system. This prompt prevents the user from accidentally shutting down the system. If the user selects “Yes”, the VRTEX 360 will shut down.



**THIS METHOD SHOULD ALWAYS BE USED TO SHUT DOWN THE VRTEX 360. Failure to do this could cause damage to the system.**

### 5. Continue

After the user enters their name and all selections outlined above have been made, the green icon is selected to continue to set up process.

### 6. USB Indicator

The circular USB icon in the upper right corner of the screen indicates the presence of a USB memory stick in the front of the machine. A translucent icon indicates no USB memory stick is present. A green icon indicates a USB memory stick is inserted into the front of the machine.

### 7. Theory Screen

The theory icon has been implemented to assist users with additional content, images and information related to the area of the application where you are working. See Figure 51. This information can be accessed by selecting the yellow theory icon. When selected, the icon allows the student to access visual and definitional information about the different welding terms being used on each screen. Welding terms that correspond with each page are listed in the boxes on the left-hand side of the screen. When finished reviewing the theory data, the student can select the theory icon again to exit the screen.

Figure 51 – Theory screen

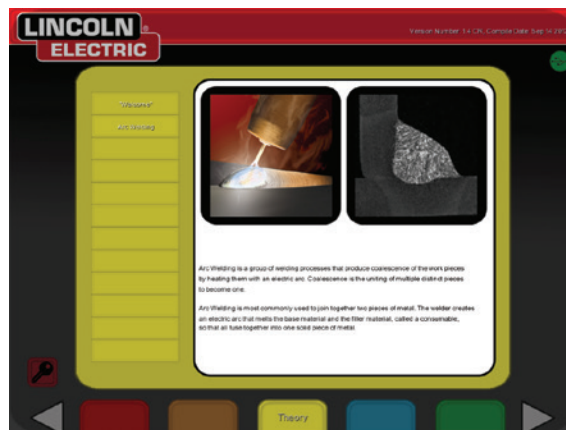


Table 1 – Measurement units

MEASUREMENT UNITS	Imperial		Metric	
	Abbrev.	Details	Abbrev.	Details
Coupon Thickness	in.	inches	mm	millimeters
Gas Flow Rate	CFM	cubic feet per minute	LPM	liters per minute
Wire Feed Speed	IPM	inch per minute	MPM	meters per minute
Weldometer - Base Metal	lbs	pounds	kg	kilograms
Weldometer - Gas	CF	cubic feet	L	liters
Weldometer - Consumables	lbs	pounds	kg	kilograms

# JOINT CONFIGURATION SELECTION SCREEN

## OVERVIEW

The user selects which joint configuration they want to virtually weld. First, the user selects the joint and position. A rotating view of the highlighted coupon appears. For some configurations, the user will be given the choice of material thickness to choose from. See Figure 52.

Figure 52 – Joint configuration screen



## BACK

Selecting **Back** takes the user back to the previous screen.

# PROCESS SELECTION SCREEN

## OVERVIEW

This screen allows the user to select the welding processes. See Figure 53. To change among VR GMAW, VR FCAW and VR SMAW, the user touches the desired processes. If a process is not supported for the selected material/thickness, it is grayed out on this screen and cannot be selected. To choose among different sub-processes, touch the appropriate icon.

At the top of the screen, the user can see the coupon position and thickness selected. As the user continues to set up the simulation, additional information will be added to the right of this readout so that the user can reference what has previously been selected.

Figure 53 – Process selection screen



## MENU ICON

Selecting **Logout** brings the user back to the login screen, with the user's name removed.

## CHANGE COUPON TYPE

Selecting **Change Coupon Type** goes back to the configuration selection screen.

## BACK

Selecting **Back** takes the user to the previous screen.

# TABLE SETUP SCREEN

## OVERVIEW

The correct VR table information must be put into the software for the VRTEX 360 to operate properly in all virtual welding applications. See Figure 54.

Figure 54 – Table setup screen



## COUPON INSERTION

Insert one of the VR coupons into the desired position in the physical VR table. See Figure 55. Make sure the coupon is fully seated into the track and then lock the coupon in place by pushing in the knob at the end of the arm. To release, pull the knob into the unlocked position and remove the coupon. When the system is in use, the coupon should always be locked in place to assure system accuracy.

## CAUTION

Position coupon stand at least eighteen inches from monitor and any potential source of electrical and magnetic interference.

Figure 55 – VR coupon (unlocked position)



# ENVIRONMENT SCREEN

## OVERVIEW

The VRTEX 360 comes pre-configured with a number of different virtual welding environments. To select an environment, the user touches the desired icon. See Figure 56.

## CAUTION

When welding in virtual reality be mindful of your real world surroundings and hazards at all times to avoid injury.

Figure 56 – Environment screen



## MENU

Selecting **Logout** takes the user back to the login screen, with the user's name removed.

## BACK

Selecting **Back** takes the user to the previous screen.

# GAS SETUP SCREEN

## OVERVIEW

On this screen, the user selects the gas mixture and gas flow rate. See Figure 57. The correct gas mixture and flow rate must be entered according to the tolerance editor. If acceptable values are not entered, this will be indicated on a later screen and the user may have to go back and change the selection on this screen.

To select the gas mixture, touch the desired icon. The available gas mixtures are shown on the gas set-up screen below.

To select the gas flow rate, touch the desired arrow icon or the gas flow meter.

Figure 57 – Gas setup screen



## MENU

Selecting **Logout** takes the user back to the login screen, with the user's name removed.

## BACK

Selecting **Back** takes the user to the previous screen.

## POLARITY SELECTOR

Change the polarity by selecting the virtual polarity selector icon. The user can select the following:

- AC
- DC+
- DC-
- The wire feed speed or amperage and voltage can be adjusted by rotating the virtual dials.

The user changes the wire feed speed or amperage by rotating the virtual wire feed speed/amperage dial. The display above the dial indicates the setting.

The user changes the voltage by rotating the virtual voltage dial. The display above the dial indicates the setting. Some processes may not allow the user to pre-set the voltage, in which case the display will be blank.

**If default tolerances are being used, see the Default Weld Process Settings included in this manual.**

Once the user has set the welding parameters, they should select the green check settings icon. If the user has entered any settings outside the acceptable range specified by the settings in the tolerance editor, the incorrect weld setting screen will appear.

Figure 58 – Polarity selector screen



# WELD MACHINE SETTINGS SCREEN

## OVERVIEW

The user must enter the proper welding procedure and process settings, including wire feed speed, amperage, voltage, polarity and trim where applicable. See Figure 59. As in the gas setup screen, the user must enter values within the acceptable range as governed by the tolerance editor. If not, they will be notified by the incorrect weld setting screen when the green check settings icon is selected. See **Figures 60 and 61**.

Figure 59 – Weld machine setting screen



The user will then have to change any settings that are incorrect. If the settings are correct and the green check settings icon is selected, the welder’s view screen will appear on the monitor and in the helmet’s visor. The user will then be able to begin virtual welding.

**Figure 60 – Incorrect weld settings screen**



**Figure 61 – Correct weld settings screen**



**MENU**

Selecting Logout brings the user back to the login screen, with the user’s name removed.

**VIRTUAL WELDING OVERVIEW**

While a user is welding, observers can see the welder’s view, Live Action Student Evaluation Report (LASER) screen or instructor’s view displayed on the monitor. See Figure 62. The welder’s view shows what the user with the helmet on is seeing through the FMD. The Live Action Student Evaluation Report (LASER) screen displays a real time graph of the weld being made and gives a score when the user selects “end pass”. The instructor’s view allows another user to zoom in/out, pan and rotate the coupon to view the weldment from different angles in real time.

**UPPER OVERLAYS**

The welding technique set in the tolerance editor and other process details are displayed on the upper right portion of the screen.

**MENU**

Selecting **Logout** brings the user back to the login screen, with the user’s name removed.

**ORANGE ACTION AND CUES ICON**

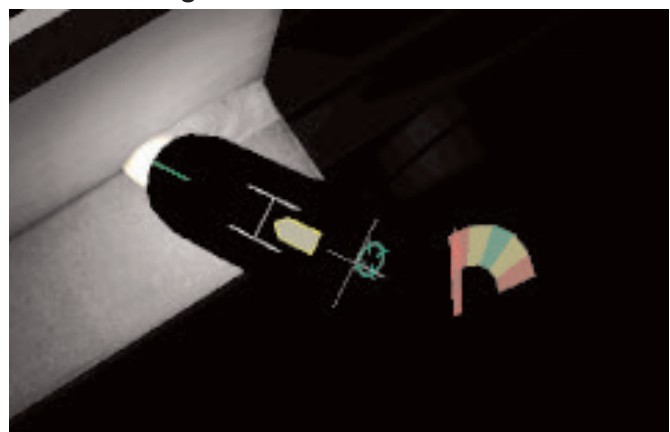
The orange action menu icon has the following options:

- Quench
- “Cheater” Lens – Off, 1.25X, 1.5X, 1.75X, 2X
- Travel Speed Visual Cue
- AIM Visual Cue
- Travel/Work Angles Visual Cue
- CTWD (Contact To Work Distance) Visual Cue
- Arc Length Visual Cue
- Trim
- Weave Visual Cues
- Whip Visual Cues
- Clean
- New Stick

These options are only available when applicable to the welding process.

**Trim** cuts back the VR GMAW or VR FCAW wire. **Quench** simulates quickly cooling the metal.

**Figure 62 – User screen view**



## VISUAL CUES

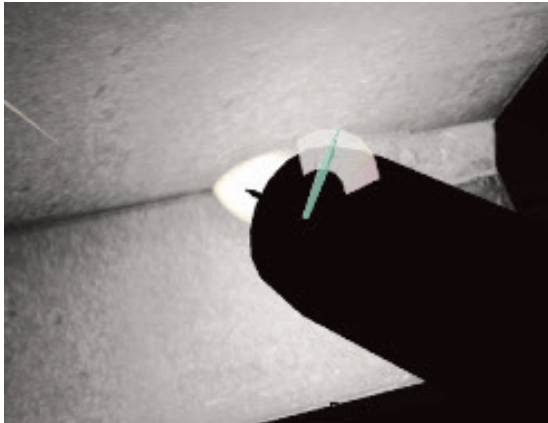
Visual cues are aids to help users learn faster. The travel speed, CTWD, arc length and travel/work angle cues indicate whether the user is within the tolerances set in the tolerances editor. Generally, these cues are color coded as well as symbolic. When cues are red, they indicate being out of tolerance. Yellow cues indicate close to tolerance, but not optimal. Green cues indicate being within tolerance and close to optimal.

The “**Cheater**” **Lens** magnifies the image as seen by the user in the helmet and in the welder’s view. The user can toggle between Off, 1.25X, 1.5X, 1.75X, 2X select their option with the red select icon.

**Travel Speed** turns on the travel speed visual cue. This cue is located on the side of the VR GMAW/FCAW Gun or VR SMAW device. See Figure 63. This cue uses the color coding position to indicate travel speed.

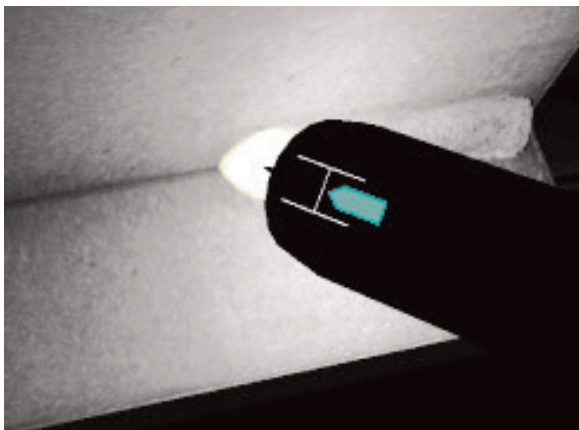
**NOTE:** The goal is to keep the arrow in the center of the graph which will also keep it green.

**Figure 63 – Travel speed**



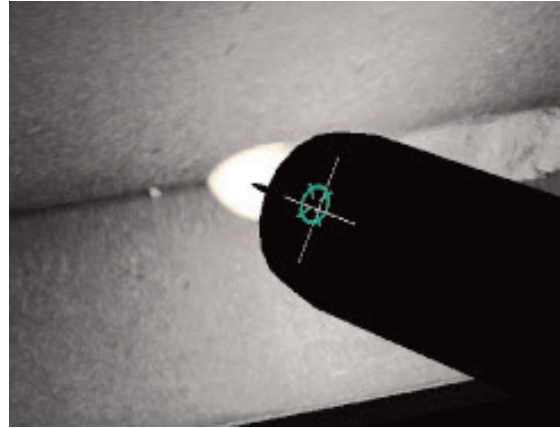
The **CTWD** (Contact Tip To Work Distance) cue is only available for VR GMAW and VR FCAW processes. This cue uses color and position to indicate proper CTWD. See Figure 64. The goal is to get the tip of the green arrow on the line of the “H” bar and keep the arrow color green.

**Figure 64 – CTWD (contact tip to work distance)**



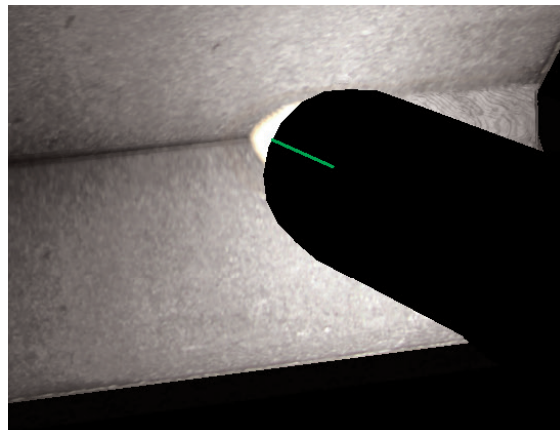
The **Travel/Work Angle** cue can be used with the SMAW, GMAW or FCAW processes. See Figure 65. The goal of this cue is to center the circle in the cross hair and keep the color green.

**Figure 65 – Travel/work angle**



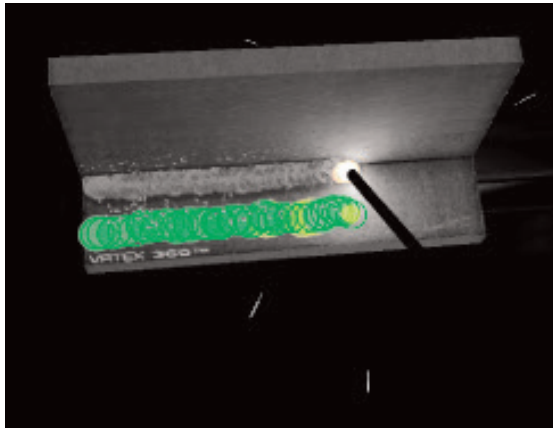
The **Aim** cue can be used with the VR SMAW, VR GMAW or VR FCAW processes. See Figure 66. The goal of this cue is to position the VR GMAW/FCAW Gun or VR SMAW device so the aim cue is a thin green line. This indicated that the weld is being made in the correct location or position.

**Figure 66 – Aim**



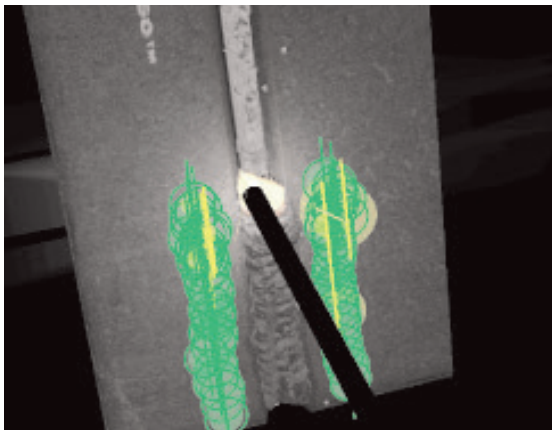
The **Whip** cue can be used with the E6010 VR SMAW process. This cue helps the student use correct spacing between whipping motions, puddle time and whip time. Correct whipping technique is indicated by a green outer ring (spacing) with a green center (puddle and whip timing).

**Figure 67 – Whip**



The **Weave** cue can be used with the VR SMAW, VR GMAW or VR FCAW processes but is only available if the technique identified in the Tolerance Editor is a type of weave. The goal of this cue is to space the weave so the outer ring is green (good weave spacing), set the width of the weave so line is green (good weave width) and a green filled ring (good dwell time on the toes of the previous weld).

**Figure 68 – Weave**



## NEW COUPON

Selecting the blue new coupon menu icon instantly replaces the current coupon with a fresh, unwelded coupon. Note that this is a quick way to start over on the same configuration and process but that it will remove all passes from the coupon and the graphs on the LASER screen.

### WHITE SCREEN SELECT ARROWS

Touching the white screen select arrows allow the user to rotate through the LASER screen, instructor’s view and welder’s view.

### WELDER’S VIEW SCREEN

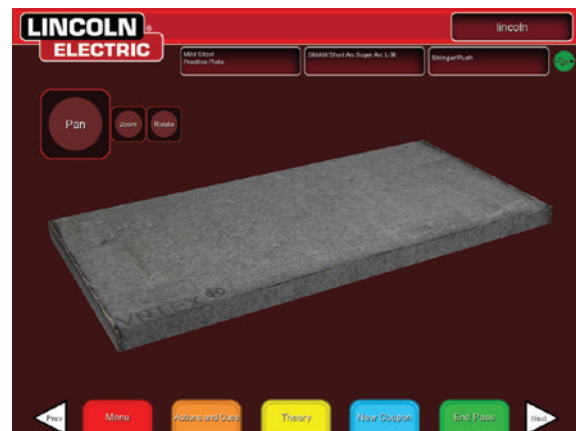
This screen shows the virtual view as seen by the user wearing the helmet.

### INSTRUCTOR’S VIEW SCREEN

This screen shows the coupon and virtual weld in real time. See Figure 69. An observer can rotate, pan and/or zoom in or out on the coupon. This view also shows the VR GMAW/FCAW gun or VR SMAW device being used.

**NOTE:** Changing views on the monitor does not change the user’s view in the helmet.

**Figure 69 – Instructors view**



# LASER SCREEN

(Live Action Student Evaluation Report)

## OVERVIEW

This screen summarizes the student's welding performance. Detailed information about the student's welding technique for each pass are displayed on this screen. See Figures 70, 71 and 72.

Figure 70 – Laser screen (good weld)



Figure 71 – Laser screen horizontal weld (no weld)



Figure 72 – Laser screen (good vertical weld)

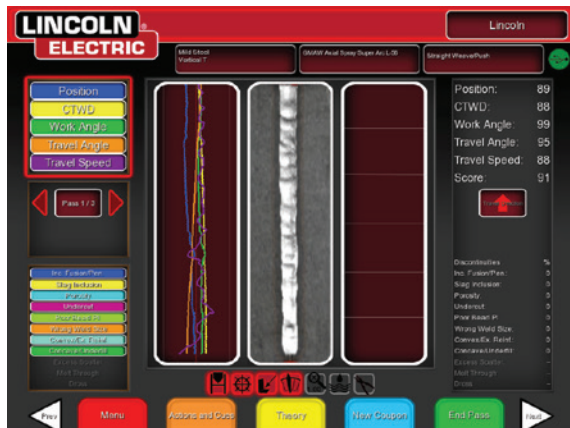
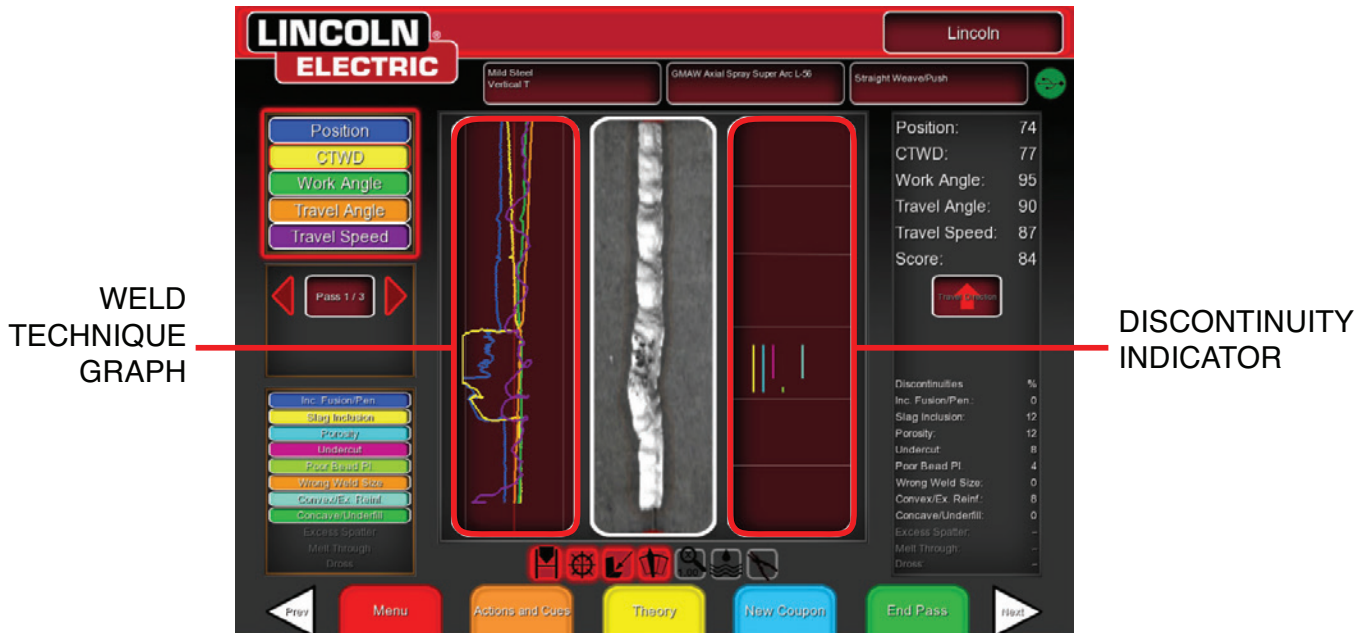


Figure 73 – Laser screen (graph, defects, discontinuities, etc.)



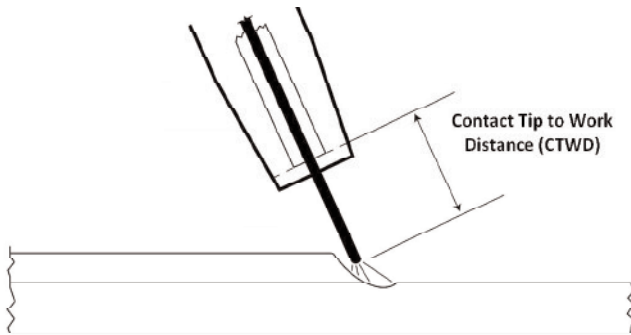
## TECHNIQUE PARAMETERS

The upper left area of the screen shows the technique parameters being tracked and the graph of these parameters is located to the right. See Figure 73. When the user welds, each parameter is graphed using a line that is of the same color as the technique parameter box. For example, “position” is written in the blue box and indicated by the blue line. The left side of the graph represents the left side of the coupon and the right side represents the right side of the coupon. For vertical welds, the graph is rotated so that it is vertical, with the bottom representing the bottom of the coupon and the top representing the top of the coupon. The graph also shows how close the parameter was to the ideal value. The ideal value is indicated by the red line located in the center of the graph. This value is determined by the tolerance editor settings. The upper and lower white lines represent the acceptable maximum and minimum values that the parameter should be within. These values are also determined by the tolerance editor setting. Anything above the top white line or below the bottom white line is out of tolerance. The closer the user is to the ideal line, the better the weld. Each parameter can be toggled on or off of the graph by touching the appropriate icon.

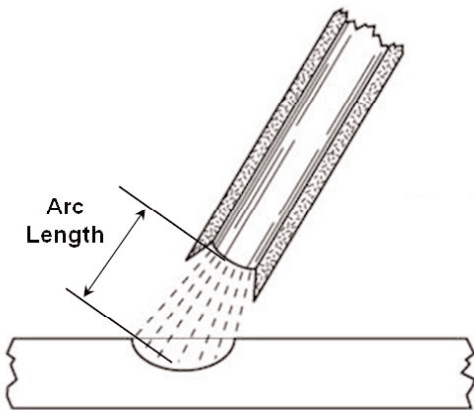
**Position** is the user's ideal weld root location. This location can change with each pass. When weaving, the ideal location is considered the centerline of the weave.

**Contact Tip to Work Distance (CTWD)** (for VR GMAW and VR FCAW) and **Arc Length** (for VR SMAW) are the distances from the tip of the VR GMAW/FCAW gun or VR SMAW device to a plane going through the ideal position location. See Figures 74 and 75.

**Figure 74 – Contact tip to work distance (ctwd)**

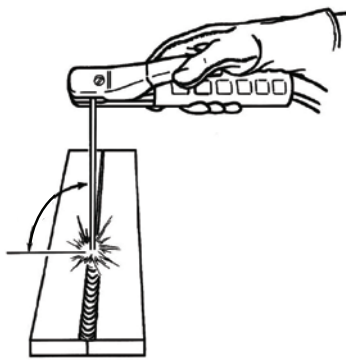


**Figure 75 – Arc length**



**Work Angle** is the angle between the electrode and workpiece as seen in Figure 76.

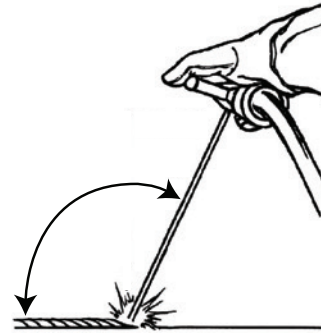
**Figure 76 – Work angle**



**WORK ANGLE**

**Travel Angle** is the angle between the electrode and the workpiece in the direction of travel. See Figure 77. The upper right area of the screen displays if the user should be pushing or dragging. If the user pushes when they should be dragging, they will not receive maximum points. For pipe welding, this is the angle between the electrode and the tangent of the pipe at that point.

**Figure 77 – Travel angle**



**TRAVEL ANGLE**

**Travel Speed** is how fast the electrode is traveling in respect to the workpiece.

**Dime Spacing** is the distance from one solidified weld puddle to the next (whip technique only).

**Whip Time** is the time the user is in the whipping motion or not dwelling in the weld puddle (whip technique only).

**Puddle Time** is the time the user is dwelling or keeping the VR Stick electrode in the virtual puddle (whip technique only).

**Width of Weave** is the side-to-side distance of where the VR GMAW/FCAW gun or VR SMAW device was aimed when completing one weave cycle in a series that make up a weld (weave technique only).

**Weave Timing** is the time taken to complete one side to side weaving motion (weave technique only).

**Weave Spacing** is the distance in the overall direction of travel between one weave cycle in a series that make up a weld (weave technique only).

## PASS NUMBER

The pass number is displayed on the left center of the screen. To change the pass being viewed touch the arrow icons.

## TRAVEL DIRECTION

The travel direction is located on the right side in the middle of the screen. When the user first starts to weld, a travel direction is sensed by the system and an arrow indicating the direction is displayed. For visual cues, the system assumes these directions. The visual cues will automatically adapt to the travel direction used when the arc is struck.

# BEAD RENDER

An image of the completed pass appears in the middle of the screen.

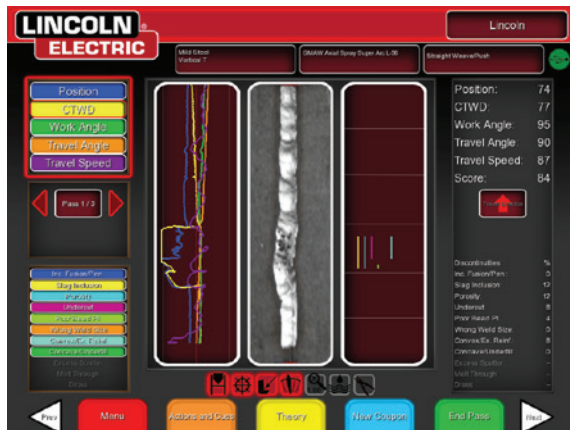
## DISCONTINUITY INDICATOR

The lower left side of the screen list potential discontinuities. See Figure 78. When a student uses incorrect welding techniques, this causes specific weld discontinuities. A line is drawn at the location indicating these discontinuities. For example, too long an arc length will cause porosity.

Potential discontinuities include:

- Incomplete Fusion/Penetration
- Porosity
- Undercut
- Poor Bead Placement
- Wrong Weld Size
- Convex/Excessive Reinforcement
- Concave/Underfill
- Excess Spatter
- Melt Through / Blow Through

Figure 78 – Potential discontinuities



# END PASS

When the user selects the green “End Pass” menu icon, the pass is scored, a snapshot of the weld is taken and the percentages of the weld containing discontinuities are calculated. **If the user has inserted a USB device, selecting “End Pass” also automatically saves a student report to the USB memory device at the front of the weld machine.** If no USB memory stick is present, a red circle with a cross through it will appear on the USB icon in the upper right hand corner of the screen. This also indicates that the student report has not saved. Allow 10 seconds after selecting the “End Pass” icon to allow time for the file to be saved. **Student reports are not saved internally on the VRTEX 360.** If the file is not saved on the USB device at the time of the weld and another weld is made, the previous weld data will be lost.

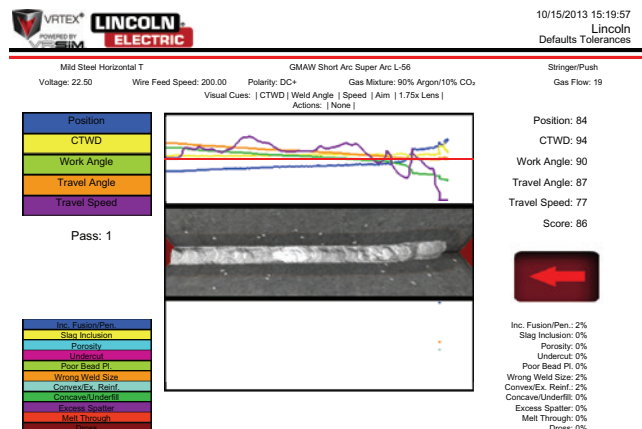
## SCORE

On the upper right of the screen, a score for each parameter is calculated. The closer each parameter is to the ideal value, the higher the score will be (out of 100). The total score at the bottom of the scoring section is calculated as an average of each parameter. To achieve the maximum score, the weld must be made on the entire length of the coupon.

# STUDENT REPORT

The student report is a PDF file that captures the graph, discontinuities, bead render, score and other information about the weld. See Figure 79. This PDF file can be printed or archived from another computer to track student progress. Example of PDF below shows student’s record.

Figure 79 – Student report



# VRTEX 360 EXTENSIONS™ UPGRADE PROGRAM

The VRTEX 360 Extensions™ upgrade program is designed to expand and enhance features and functionality on the VRTEX 360. The VRTEX 360 Upgrade Program can be purchased from Lincoln Electric. The upgrade packages are sent directly to customers who purchase them with supporting literature, materials and curriculum components to be used in any welding training environment. For more information on the VRTEX 360, please contact: The Lincoln Electric Company - Automation at 22221 St. Clair Avenue, Cleveland, OH 44117-2522, via phone at (888) 935-3878 or e-mail at vrtext@lincolnelectric.com.

For more information, visit <http://www.vrtext.com/>

## LICENSE AGREEMENT

The License Agreement is an agreement to the terms and conditions on which Lincoln Electric grants to the business entity registered with Lincoln on the purchase of the Software (“Software Licensee”), a non-exclusive license to use the Software and Documentation accompanying this license on the VRTEX 360 Virtual Reality Welding Trainer. The license granted herein is strictly limited to the installation of said Software on the VRTEX 360 Virtual Reality Welding Trainer that the Licensee has properly registered with Lincoln.

This is the first screen that will appear once the Software upgrade has been accomplished. In past upgrades the system would move directly into the License page of the Instructors mode. This upgrade the user must agree to the terms and conditions before moving forward.

### READING THE AGREEMENT

To fully read the End User License Agreement (EULA), use the down motion to toggle through the pages ensuring to read each page carefully.

### SELECTING AGREE OR DO NOT AGREE

Once the user has completely read the EULA select the “I have read the EULA and agreed to its terms” and move forward or select “I do not agree” which will turn off the machine. Selecting the “I have read the EULA and agreed to its terms” will take the user to the “License” screen.

**NOTE:** The user cannot continue on the VRTEX 360 until they AGREE to the License Agreement.

Figure 80 – End user license agreement (EULA)



### THE LICENSE SCREEN

The License screen allows the user to view the upgrades that are unlocked with a brief description for the current software version. Selecting each file allows the user to toggle between the “Sets.” The “Sets” will list the current unlocked items and show some of the future items coming soon. To view each license that have been unlocked select the licenses and view the different components of the upgrades.

### PRINTING THE EULA

The user has the option of printing the EULA for future viewing of the agreement. Once the user has selected “I have read and agreed to its terms” the VRTEX 360 program will take the user to the “License” screen and they can view and print a .pdf formatted version of the agreement.

Once the user has agreed to the terms of the EULA they can view a pdf copy of the EULA by pressing the white “EULA” arrow. Pressing the arrow will take the user directly to a copy of the EULA that can be saved and printed. To return to the License Information screen press the white arrows labeled “License” or press the orange “Back” icon.

### GETTING TO THE EULA

Saving the EULA to a USB can be done by plugging a USB memory device into the USB port and selecting the blue “Save to USB” icon. In the top right hand corner of the screen there is a ghosted image of the USB symbol. Once the USB device has been recognized this will turn green and blink when the data is being transferred. Once the data has been transferred remove the USB device from the VRTEX 360 and take it to a computer that is connected to a printer to print the document.

**NOTE:** You cannot print directly from the VRTEX 360.

# VRTEX 360 EXTENSIONS™ UPGRADE 2

## BEND TEST

Many welding codes require bend tests as part of the testing required to qualify welders according to welding procedures specifications (WPS's). By adding the virtual bend test to the VRTEX 360, a student can see what causes a bend test to pass and fail. This functionality also enhances the instructor tool set by reinforcing classroom instruction and allows students to pass and fail in a virtual environment before entering a real welding booth, saving both time and money.

The virtual bend test certificate serves as recognition of a student's achievement on a certain level in training. The bend test certificate also adds motivation for the students in their welding training program.

The BEND TEST application has been implemented to allow the user to see the results of their weld by simulating the destructive testing method used in many shops and schools called the Bend Test. The virtual bend test gives the user instant results of the quality of their weld by bending the weld 180°. Once the user completes a groove or pipe weld the BEND TEST option appears in the same location as the green CONTINUE icon. The user can select this option by pressing the green BEND TEST icon once the weld is completed.

**NOTE: Fillet welds cannot be bent on the VRTEX 360.**

Figure 81 – Bend test



CONTINUE  
button  
becomes  
BEND TEST  
button upon  
completion of  
the weld

## SELECTING SAMPLES TO BEND

Select the A or B sample to bend.

Figure 82 – Sample A



Figure 83 – Sample B



**SELECTING ROOT OR FACE**

Select the direction of the bend to the ROOT or FACE. Once the desired sample is chosen, press the green BEND icon to begin the bend test.

**Figure 84 – Root**



**Figure 85 – Face**

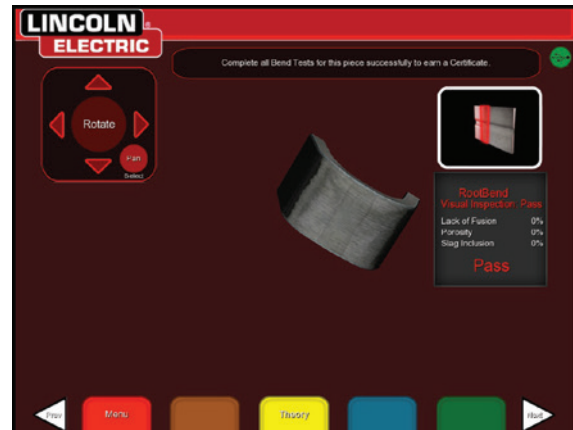


Once the first sample has been bent, use the white NEXT or PREV arrow to select the next tab to bend.

**Figure 86 – Green to bend**



**Figure 87 – White icon “next” or “prev”**

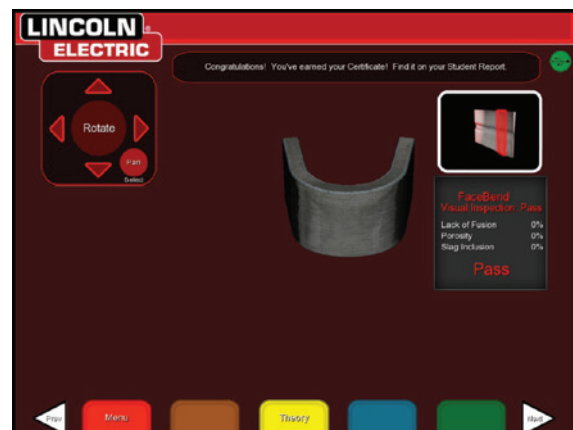


The bent sample can also be rotated for further visual inspection.

**Figure 88 – Bent sample**



**Figure 89 – Bent sample rotation**



**BEND TEST FAILURE**

The VRTEX 360 will visually inspect the weld before allowing it to be bent. If the weld passes the visual inspection, the user can move proceed with the bend test. If a weld fails the bend test, the details such as a percentage of failure will be displayed in the information box on the right side of the screen. The weld failure is measured in three different aspects including Lack of Fusion, Porosity, and Slag Inclusion. If the user fails the bend test there will not be a virtual bend test certificate in the student report.

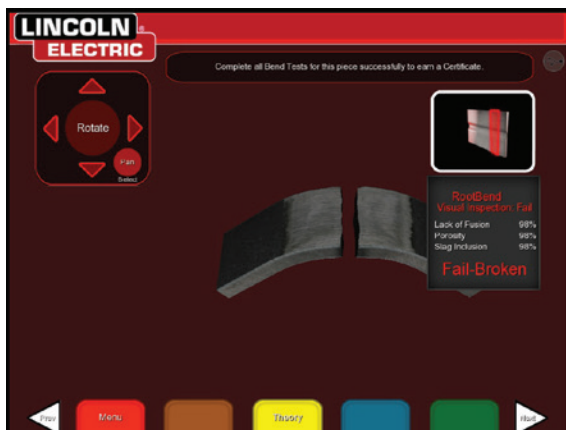
**Figure 90 – Beginning to fail**



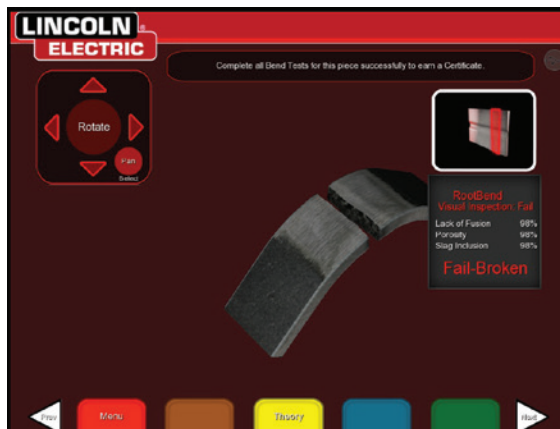
**Figure 91 – Failed**



**Figure 92 – Percentages of rootbend failure**



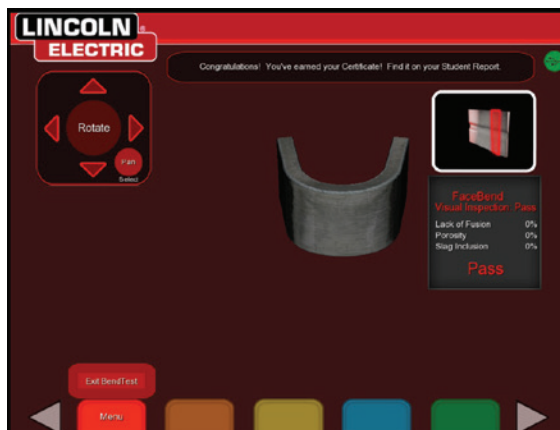
**Figure 93 – Rotate rootbend failure**



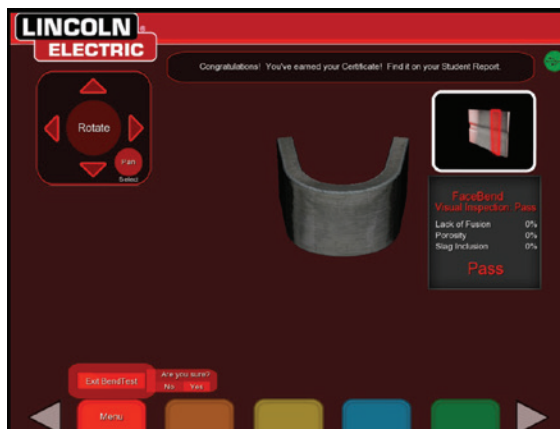
**EXITING THE BEND TEST**

To exit the bend test application, press the red MENU icon, LOGOUT and YES. This will take the user back to the welding screens.

**Figure 94 – Press red menu icon to exit**



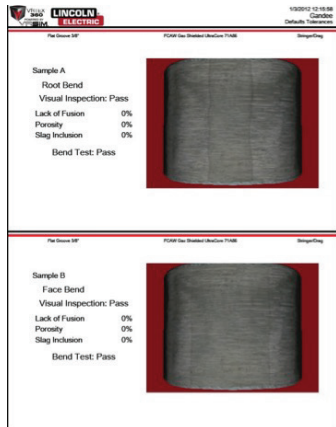
**Figure 95 – Are you sure press yes red select icon**



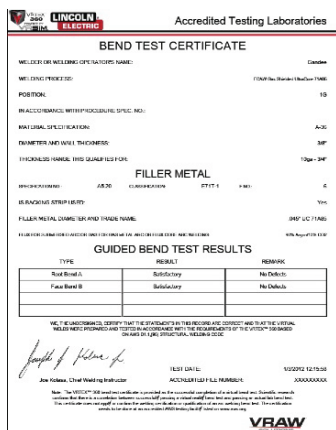
**THE CERTIFICATE**

The BEND TEST CERTIFICATE is located in the STUDENT REPORT, which can be saved and accessed if there is a USB memory device in the USB slot on the front of the VRTEX 360 while performing the virtual bend test procedure.

**Figure 96 – Sample A root bend and B face bend guided results**



**Figure 97 – Bend test certificate**

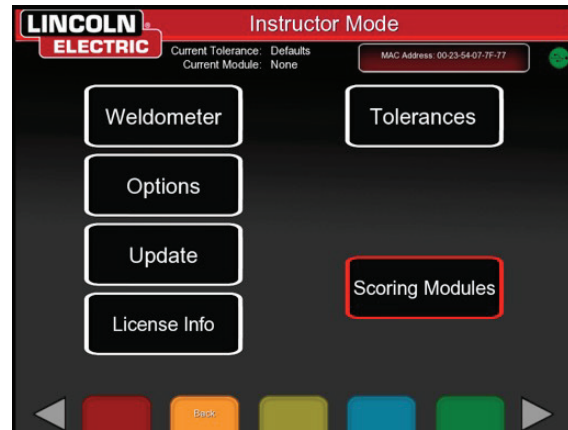


**SCORING MODULES**

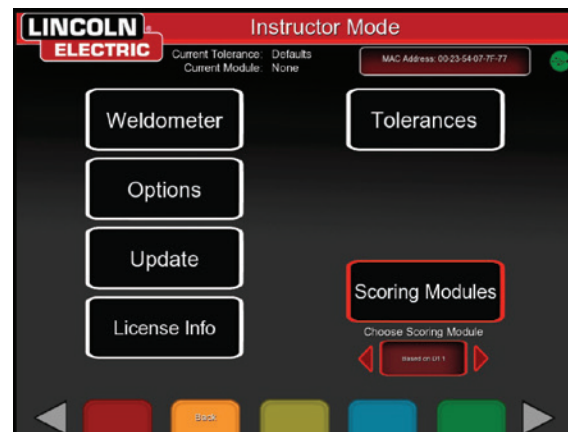
After welding a pass, the user can now see whether each defect/discontinuity was within acceptable standards (passed) or not (failed). The acceptable standards implemented in VRTEX 360 are known as scoring modules. Instructors can use the Instructor Mode to enable the scoring module they would like to use (i.e., AWS D1.1 or ASME). The pass/fail marks will appear on the LASER screen for relevant passes (scoring modules do not cover all of the available VRTEX 360 welds).

The SCORING MODULE feature can be used when the user wishes to have their welding evaluated against the ASME or AWS D1.1 standards. This option can be selected by entering the INSTRUCTORS MODE. The only screen the Instructors Mode can be accessed from is the Sign In screen. Select the SCORING MODULE located at the bottom right corner of the Instructors Mode screen. Toggle between Based on ASME Standards, Based on D1.1 Standards, and None. Press the orange BACK icon twice to return to the Sign In screen.

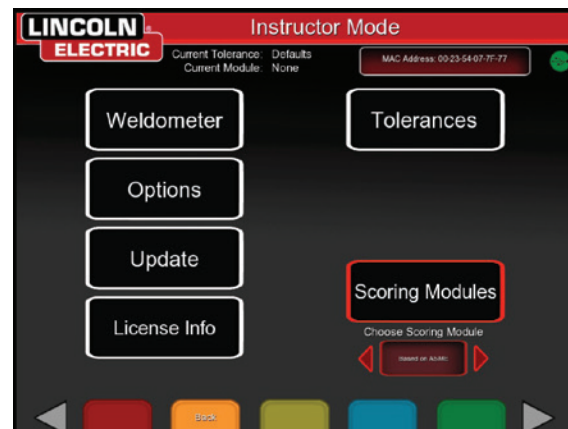
**Figure 98 – Instructor mode (scoring modules)**



**Figure 99 – Scoring modules select icon**



**Figure 100 – Choose scoring module standards**



**VISUAL CUES ON LASER SCREEN**

The Visual Cues and Actions that have been selected by the user will now appear as icons on the LASER screen below the Discontinuities window. The icons will remain ghosted until the user selects the option to use the Visual Cue or Action. The icons will be highlighted when a cue or action is/has been used.

**Figure 101 – Laser screen icon ghosted**



**Figure 102 – Selects visual cues or action**



**Figure 103 – Selects visual cues or action**



**PANNING MODE**

The panning view function enhances the instructor’s ability to view a weldment as a student welds to better train the student on proper welding technique. Three modes that include rotate, zoom and pan are now available.

The panning mode allows the user to move the weld piece on the Instructor View screen in any direction. This feature allows for better view of the work piece for both the user and the instructor. To use the Panning mode, use the white NEXT or PREV arrow icon to display the Instructor View screen and select the PAN option located on the top left corner of the screen.

**Figure 104 – Panning mode next or prev arrow icon**



**Figure 105 – Red select icon to select pan option**



# VRTEX 360 EXTENSIONS™ UPGRADE 3

## ALUMINUM WELDING SIMULATION

Figure 106 – Aluminum welding simulation



The Aluminum GMAW feature in your VRTEX 360 allows the system to simulate the look, sound, discontinuities, equipment settings and Theory definitions for the Aluminum GMAW process. Aluminum GMAW simulates Pulse and Spray welding on tee joints (2F and 3F) and groove (1G, 2G and 3G) on 3/8” and 10 gage material. The electrode of choice for this training is the SuperGlaze™ 4043 electrode and the base material is 6061 grade aluminum.

## SELECTING ALUMINUM WELDS

The general set up is the same as setting up for the mild steel welds. The user signs in on the “Sign in” screen. Once the users name has been placed in the name block the user will press the green “Continue” icon. This will take the user to the “Joint Selection” screen. There are some different applications on this screen with the new Software upgrade. The first thing the user should notice will be that there are red arrows located in the joint selection box.

Figure 107 – Material selection arrows

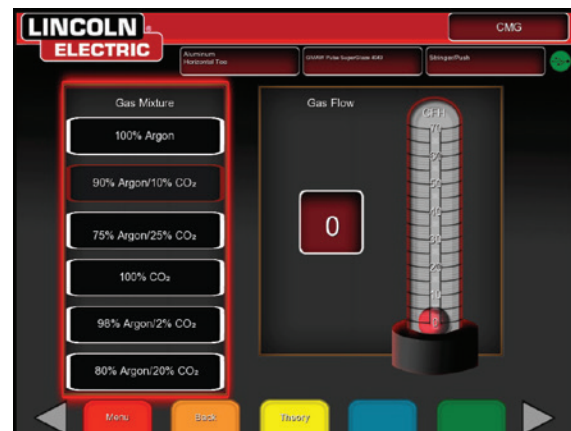


This is the box that the joint is rotating in. Once the desired joint is selected, if it is a joint that aluminum welds can be simulated, the user can toggle left and right to select between mild steel and aluminum. The joints aluminum is available in are 2F, 3F, 1G, 2G and 3G. Once the user selects the aluminum joint to be welded they may also have the option to select a material thickness. There are two distinct material thicknesses available on the VRTEX 360. They are 3/8” and 10 gage aluminum plate in the “F” or fillet weld selections. Once the user selects the material thickness the program will move into the process selection screen.

Process selection for aluminum is limited to GMAW-Spray transfer and GMAW-Pulse transfer. Use the “Process Selector” to select the GMAW process. Select Spray or Pulse transfer modes and continue. Continue using the normal setup process.

The gas selection for the aluminum welding process is 100% Argon. The next step is to set the gas flow rate. Refer to the WPS to see the recommended flow rate for the weld joint chosen. Continue normal set up.

Figure 108 – Gas selection screen



**NOTE:** Not all joints or material thicknesses have aluminum simulation capabilities. Please see the WPS book for this information.

## ALUMINUM THEORY

The theory is located inside the existing Theory application. To access the aluminum Theory on any screen, press the yellow “Theory” icon. Pressing this icon will cause the “Theory” menu to pop up. Toggle to make sure all of the theory terms and definition have been viewed.

Figure 109 – New aluminum theory



**REPLAY MODE**

The Video Replay feature in your VRTEX 360 provides the ability to view your virtual weld video once you have completed it. This feature offers students and instructors the ability to refine skills by replaying the weld performed from the different viewing angles and discussing technique.

**REPLAYING WELDS**

Upon completion of a weld, press the green “End Pass” icon. Once the weld has been scored, press the red Menu icon and Replay Mode to activate the replay video. This will take the user directly into the replay of the weld. The user can then toggle between the welders view, the instructor’s cam and the LASER screen during replay using the white “Prev” and “Next” icons. The user can pause the weld during replay by pressing the green Pause icon. The user can replay the weld as many times as needed by pressing the orange Reset icon. Pausing the video allows the user and instructor to view the angles and motions from many different vantage points. This allows the user to see the view of the instructor during the weld. It also allows the user to see what negative actions caused the negative reaction.

**Figure 110 – Replay mode selection**



To exit the “Video Replay” mode press the red Menu icon then Exit Weld Replay and Yes.

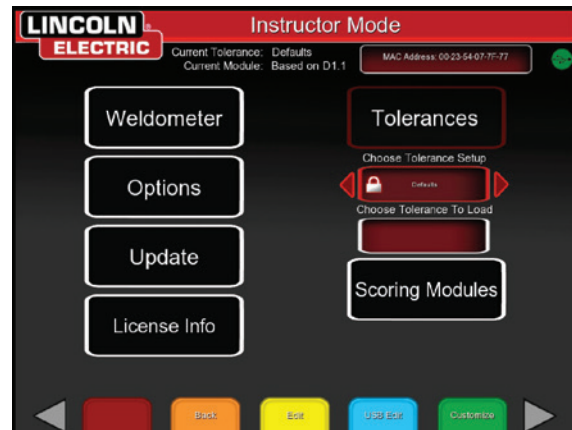
**LEARNING LEVELS**

The Learning Levels, or Tolerance Level, feature in your VRTEX 360 provides 3 skill levels (Entry Level, Intermediate and Advanced) for students in your welding training program. As the progression of skills and capabilities progress, you can enable different levels to keep students challenged, excited and engaged in learning.

**DEFAULT**

The “Default” settings are the original settings created for the VRTEX 360 program. They are a general setting used to teach the user the proper welding angles, distances and motions. See the Operators Manual provided with the unit for further information.

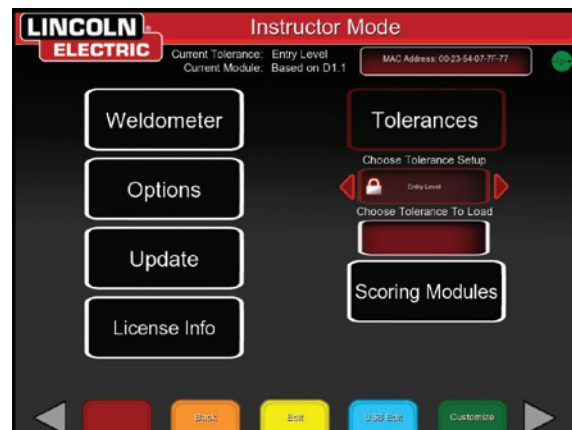
**Figure 111 – Default tolerance selection**



**ENTRY LEVEL**

The “Entry Level” Learning Level is designed to train the Entry Level welder. The tolerance settings are slightly easier to allow the beginner to become familiar with the welding motions. They are slightly more challenging than the “Default” settings but teach the same general techniques.

**Figure 112 – Entry level tolerance selection**



**INTERMEDIATE**

The “Intermediate” Learning Level is designed to be more challenging than the “Entry Level” setting. This level is for the student with some welding experience.

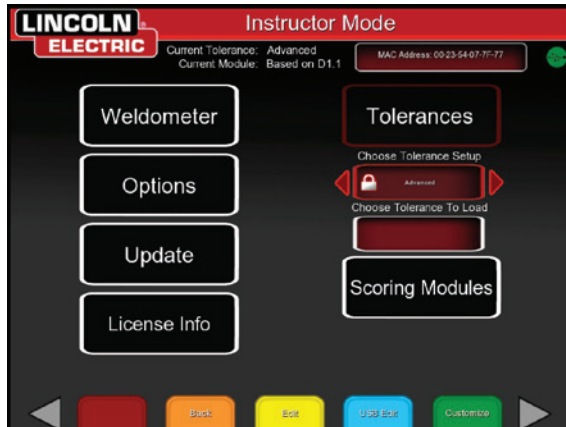
**Figure 113 – Intermediate tolerance selection**



## ADVANCED

The “Advanced” Learning Level is designed to be the most challenging. This level is for the student that has more welding experience. This level is the most challenging and hardest level to score well in. The tolerances are set very close forcing the user to almost perfect the angles, distance and motion of the welds.

**Figure 114 – Advanced tolerance selection**



## ACCESSING THE LEARNING LEVELS

From the Sign In screen, enter the Instructors Mode. Once in the Instructors Mode highlight the Tolerance block and Select the tolerance. The Tolerance Selection Box will appear below the Tolerance block. Toggle left or right through the available Learning Levels. The tolerance files are in alphabetical order.

## SELECTING A LEARNING LEVEL

Once Tolerance has been selected, toggle between the different Learning Levels. In the Tolerance Selection Box there will be four options that have an image of a lock next to them. The lock indicates the tolerance cannot be changed. The four tolerances are Default, Entry Level, Intermediate and Advanced. Select the tolerance to activate the Learning Level desired. Upon selection, a prompt box will appear asking if the selection is the intended tolerance level desired. Select the tolerance again and the change will be made.

Any additional tolerance settings that have been created by the user will also appear in this box. Those tolerance settings can still be accessed and changed as the user deems necessary. The Learning Levels are designed to teach student progression starting with the Entry Level and progressing through the Intermediate and Advanced levels until they become proficient with the welding movements.

## EXITING THE LEARNING LEVELS

Once the user has chosen the desired Learning Level, press the orange Back icon two times to exit the tolerance and Instructors Mode. This will take the program back to the Sign In screen. Follow the setup procedures to begin the learning experience.

# VRTEX 360 EXTENSIONS™ UPGRADE 4

## STAINLESS STEEL WELDING SIMULATION

The Stainless GMAW feature in your VRTEX 360 allows the system to simulate the look, sound, discontinuities, equipment settings and Theory definitions for Stainless GMAW. Stainless GMAW simulates Pulse and Spray welding on tee joints (2F and 3F) and groove (1G and 3G). For more information on how to operate the Stainless GMAW feature, visit: [www.vrtext.com](http://www.vrtext.com) for the latest instruction manual. The electrode of choice for this training is the Blue Max™ 308L Si electrode and the base material is 308 grade stainless steel.

Figure 115



Figure 116



## SELECTING STAINLESS STEEL WELDS

The general set up is the same as setting up for the mild steel welds. The user signs in on the Sign in screen. Once the users name has been placed in the name block the user will press the green Continue icon. This will take the user to the Joint Selection screen. There are some different applications on this screen with the new software upgrade. The first thing noticed will be that there are red arrows located in the joint selection box. This is the box that the joint is rotating in. Once you select the desired joint, if it is a joint that Stainless steel welds can be simulated, the user can select between mild steel and Stainless steel. The joints Stainless steel is available in are 2F, 3F, 1G and 3G. Once the user selects the Stainless steel joint to be welded they may also have the option to select a material thickness. There are two distinct material thicknesses available on the VRTEX 360. They are 3/8" and 10 gage Stainless steel plate in the "F" or fillet weld selections. Once the user selects the material thickness the program will move into the process selection screen.

Process selection for Stainless steel is limited to GMAW-Spray transfer and GMAW-Pulse transfer. Use the Process Selector icon to select the GMAW process. Select the desired mode of transfer.

**NOTE:** Not all joints or material thicknesses have Stainless steel simulation capabilities. Please see the WPS book for this information.

## STAINLESS STEEL THEORY

The theory is located inside the existing Theory application. To access the Stainless steel Theory on any screen, press the yellow Theory icon. Pressing this icon will cause the Theory menu to appear. Toggle through the different terms and definitions on each screen.

Figure 117

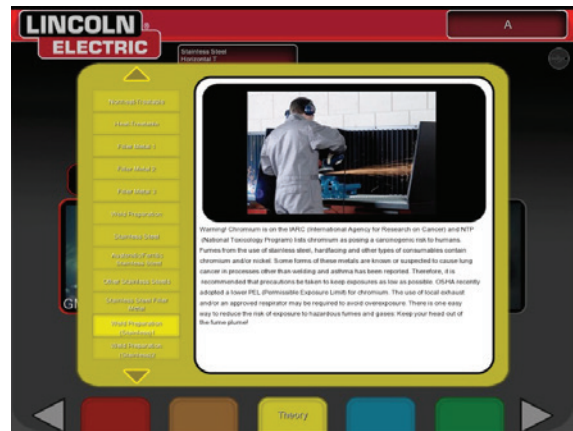


Figure 118



**DEMO WELD MODE**

The Demo Weld feature in your VRTEX 360 provides an example of the virtual weld you have selected. By selecting and viewing this virtual weld, you can see the suggested technique on how to successfully make the chosen weld.

Figure 119



**SELECTING A WELD DEMO**

Once the user completes the steps for setup and has entered the welder's screens, press the yellow Theory icon. The Demo Mode tab is located at the top of the Theory screen on the Instructor view and Welders view screens only. The demo video will instantly begin playing. Use the white Next and Prev arrows to toggle between the Welders view, LASER screen and the Instructors Cam. To view the Recorded Welders View press the red Menu icons then the Recorded Welders View. The program will automatically start in the Free Look view which allows the user to look at the demo weld from different view point inside the helmet. To move from the Recorded Welders View to the Free Look use the same steps.

**.052 WIRE SELECTIONS**

The 0.052" (1.3 mm) Solid Wire feature in your VRTEX 360 allows the system to simulate the equipment settings, tolerances and discontinuities for 0.052" (1.3 mm) Solid Wire. 0.052" (1.3 mm) Solid Wire simulates welding on tee joints (2F and 3F) and groove (1G, 2G and 3G). For more information on how to operate the 0.052" (1.3 mm) Solid Wire feature, visit: [www.vrtext.com](http://www.vrtext.com) for the latest instruction manual.

Figure 120



**SMAW ON THINNER MATERIAL**

The SMAW on Thinner Materials feature in your VRTEX 360 allows the system to simulate the equipment settings, tolerances and discontinuities for SMAW on Thinner Materials. SMAW on thinner materials such as 0.025" (0.6 mm) and 10 gauge (3.404 mm) simulates welding with E6010 and E7018 on tee joints (2F, 3F and 4F). For more information on how to operate the SMAW on thinner materials feature, see the VRTEX 360 website for the latest instruction manual.

Figure 121



Figure 122



Figure 123



**SAVING A WELD IN SET 4**

The save weld option has been changed to better accommodate the user interface. Saving a weld in past software iterations was done by pressing the green End Pass icon at the end of each weld. With the improvement, the weld save action is done now by pressing either the blue New Coupon icon or the red Menu icon and exiting the weld. This allows the user to save welds while conducting normal operations.

# VRTEX 360 EXTENSIONS™ UPGRADE 5

## LAP JOINT WELDING SIMULATION

The Lap Joint feature in your VRTEX 360 allows the system to simulate the look, sound, discontinuities, equipment settings and Theory definitions for lap joints. The lap joints can be simulated using the SMAW (6010, 6013 and 7018 electrodes) and GMAW (Short Circuit and pulse transfers) in the 2F position for all processes, the 3F using the SMAW 6010 and 6013, GMAW short circuit and on stainless steel using pulse. The 4F position can be practiced using the 6010 electrode. In addition to the lap joint welds several GMAW pulse welds were added using 3/8” plate in all positions. The ability to build a pad was also added to the 1.5 software upgrade. Surface building up can be practiced using SMAW (6010, 6013 and 7018), GMAW (Short Circuit and Pulse) and FCAW (Gas and Self Shielded). Visit the VRTEX 360 website for the latest instruction manual.

Figure 124



Figure 125

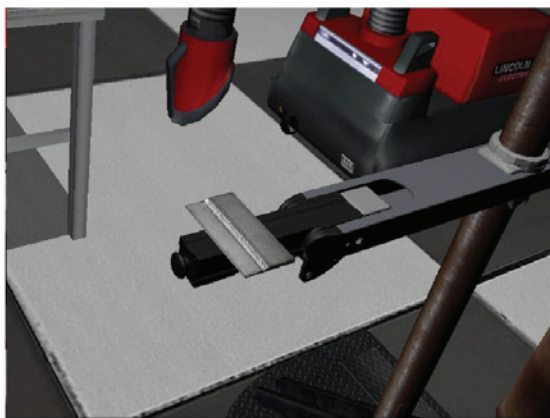


Figure 126

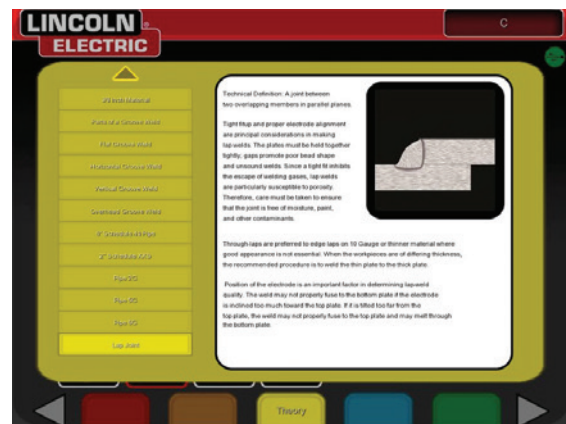


## SELECTING LAP JOINT COUPONS

The general set up is the same as setting up for the other joints. The user signs in on the “Sign in” screen then presses the green continue icon. This will take the user to the “Joint Selection” screen. There are some different applications on this screen with the new Software upgrade. The first thing should be that there are additional coupons located in the joint selection screen. Once you select the desired joint and material type press the green continue icon. The lap joint is available in the 2F, 3F and 4F positions. There is one distinct material thickness available on the VRTEX 360 for the lap joint. It is 10 gage mild steel, aluminum and stainless steel. Once the user selects the material the program will move into the process selection screen.

Process selection for the lap joint consists of SMAW (6010, 6013 and 7018) and GMAW (Short Circuit and Pulse). Rotate the “Process Selector” switch to the desired position. Select the consumable or desired mode of transfer then press the green continue icon.

Figure 127



**PULSE WELDS**

The pulse welds in your VRTEX 360 provide the ability to practice several more welds in all positions using the pulse transfer mode. By selecting and viewing this virtual weld, you can see the suggested technique on how to successfully make the chosen weld.

Figure 128



**SELECTING A PULSE WELD**

The general set up is the same as setting up for the other joints. The user signs in on the “Sign in” screen and presses the green continue icon. This will take the user to the “Joint Selection” screen. There are some different applications on this screen with the new Software upgrade. There will be additional coupons located in the joint selection screen. Once the desired joint is selected The pulse transfer is available in the 2F, 3F and 4F positions using 3/8” material as well as the 1G, 2G, 3G and 4G positions. Once the joint and material thickness has been selected, press the green continue icon to move to the next screen. The welding processes on the process selection screen and process selected press the green continue icon. The pulse transfer is only available by selecting the GMAW process. The choices of consumable available for the pulse process include .035, .045 and .052 ER70S-6. The wire diameter is selected by tapping the screen on the desired consumable. Continue normal setup operations.

**BUILDING A PAD OR SURFACE BUILDUP**

The building a pad or surface buildup option allows the user to complete a pad and grade each pass. Pads can be completed using SMAW, GMAW and FCAW processes. This option allows consistent movements while practicing a real world application.

**SELECTING SURFACE BUILD UP WELDS**

The building a pad option can be accessed by selecting the pad on the joint selection screen. The pad option is available for SMAW 6010, 6013 and 7018, GMAW short circuit, spray and pulse transfers and FCAW gas and self-shielded. The pad is 1/4” mild steel only. The pad can only be practiced in the flat position. The pad option creates the ability to grade each pass until the pad is completed. Scoring the weld can be accomplished by pressing the green end pass icon after each pass is completed. This option allows tracking of consistent repeatable movement during the process.

Figure 129



Figure 130



Figure 131

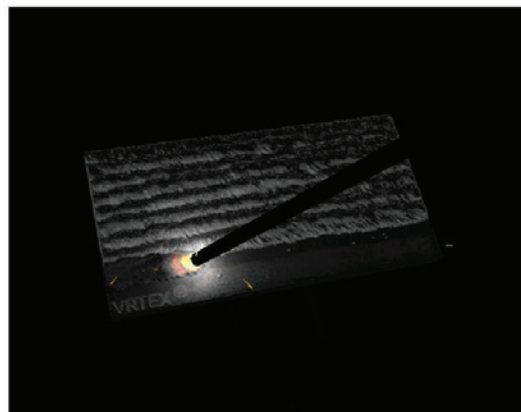


Figure 132 – Default weld process settings

VRTEX® 360 - Default Weld Process Settings (Standard)										
WPS #	VR Welding Process	Consumable Type	Lincoln Brand	Gas Mixture	Gas Flow (CFH)	Position	Mat'l (in)	WFS (ipm) or amps	Voltage	Polarity
1	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	Flat	1/4" (6.4 mm)	90 (±5)	NA	DC+
2,3,4	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	2F, 3F up, 4F	3/8" (9.6 mm)	90 (±5)	NA	DC+
5,6,7,8	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	1G, 2G, 3G up, 4G	3/8" (9.6 mm)	90 (±5)	NA	DC+
9	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	Flat	1/4" (6.4 mm)	125 (±5)	NA	DC+
10,11,12	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	2F, 3F up, 4F	3/8" (9.6 mm)	125 (±5)	NA	DC+
13,14,15,16	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	1G, 2G, 3G up, 4G	3/8" (9.6 mm)	125 (±5)	NA	DC+
17	SMAW	1/8" (3.2 mm) E6013	Fleetweld 37	NA	NA	Flat	1/4" (6.4 mm)	100 (±5)	NA	AC
18	SMAW	1/8" (3.2 mm) E6013	Fleetweld 37	NA	NA	2F	10 GA. (3.2 mm)	100 (±5)	NA	AC
19	SMAW	1/8" (3.2 mm) E6013	Fleetweld 37	NA	NA	3F down	10 GA. (3.2 mm)	125 (±5)	NA	AC
20	SMAW	1/8" (3.2 mm) E6013	Fleetweld 37	NA	NA	4F	10 GA. (3.2 mm)	100 (±5)	NA	AC
21,22	SMAW	1/8" (3.2 mm) E6013	Fleetweld 37	NA	NA	1G, 2G	3/8" (9.6 mm)	110 (±5)	NA	AC
23,24	SMAW	1/8" (3.2 mm) E6013	Fleetweld 37	NA	NA	3G, 4G	3/8" (9.6 mm)	90 (±5)	NA	AC
25	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	2G Pipe	6" (150 mm)	Root: 80 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
26	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	5G Pipe up	6" (150 mm)	Root: 80 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
27	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	6G Pipe up	6" (150 mm)	Root: 80 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
28	SMAW	1/8" (3.2 mm) E6010 3/32" (2.4 mm) E7018	Fleetweld 5P+ Excalibur 7018	NA	NA	2G Pipe	6" (150 mm)	Root: 90 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
29	SMAW	1/8" (3.2 mm) E6010 3/32" (2.4 mm) E7018	Fleetweld 5P+ Excalibur 7018	NA	NA	5G Pipe up	6" (150 mm)	Root: 90 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
30	SMAW	1/8" (3.2 mm) E6010 3/32" (2.4 mm) E7018	Fleetweld 5P+ Excalibur 7018	NA	NA	6G Pipe up	6" (150 mm)	Root: 90 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
31	SMAW	1/8" (3.2 mm) E6010 3/32" (2.4 mm) E7018	Fleetweld 5P+ Excalibur 7018	NA	NA	2G Pipe	2" (50 mm)	Root: 90 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
32	SMAW	1/8" (3.2 mm) E6010 3/32" (2.4 mm) E7018	Fleetweld 5P+ Excalibur 7018	NA	NA	5G Pipe up	2" (50 mm)	Root: 90 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
33	SMAW	1/8" (3.2 mm) E6010 3/32" (2.4 mm) E7018	Fleetweld 5P+ Excalibur 7018	NA	NA	6G Pipe up	2" (50 mm)	Root: 90 (±5) Hot: 100 (±5) Fill/Cap: 80 (±5)	NA	DC+
34	SMAW	3/32" (2.4 mm) E7018	Excalibur 7018	NA	NA	2G Pipe	2" (50 mm)	GTAW Root: NA Fill/Cap: 80 (±5)	NA	DC+
35	SMAW	3/32" (2.4 mm) E7018	Excalibur 7018	NA	NA	5G Pipe up	2" (50 mm)	GTAW Root: NA Fill/Cap: 80 (±5)	NA	DC+
36	SMAW	3/32" (2.4 mm) E7018	Excalibur 7018	NA	NA	6G Pipe up	2" (50 mm)	GTAW Root: NA Fill/Cap: 80 (±5)	NA	DC+
37	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	Flat	1/4" (6.4 mm)	250 (±5) (6.3 m/min)	18	DC+
38	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2F	10 GA. (3.2 mm)	250 (±5) (6.3 m/min)	18	DC+
39	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2F	1/4" (6.4 mm)	375 (±5) (9.5 m/min)	20	DC+
40	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	3F up	1/4" (6.4 mm)	275 (±5) (7.0 m/min)	18	DC+
41	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	3F down	10 GA. (3.2 mm)	250 (±5) (6.3 m/min)	18	DC+
42	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	4F	1/4" (6.4 mm)	325 (±5) (8.2 m/min)	19	DC+
43	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	1G	3/8" (9.6 mm)	350 (±5) (8.9 m/min)	20	DC+
44	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2G	3/8" (9.6 mm)	320 (±5) (8.0 m/min)	19.5	DC+
45	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	3G up	3/8" (9.6 mm)	250 (±5) (6.3 m/min)	17.9	DC+
46	GMAW - S	.035" (.89 mm) ER70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	4G	3/8" (9.6 mm)	270 (±5) (6.8 m/min)	18	DC+
47	GMAW - Spray	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	Flat	1/4" (6.4 mm)	400 (±5) (10.0 m/min)	27	DC+
48	GMAW - Spray	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	2F	3/8" (9.6 mm)	375 (±5) (9.5 m/min)	26.5	DC+
49	GMAW - Spray	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	1G	3/8" (9.6 mm)	370 (±5) (9.4 m/min)	26.5	DC+
50	GMAW - Pulse	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	2G	3/8" (9.6 mm)	130 (±5) (3.3 m/min)	.95(trim)	DC+
51	GMAW - Pulse	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	3G up	3/8" (9.6 mm)	130 (±5) (3.3 m/min)	.95(trim)	DC+
52	GMAW - STT	.045" (1.1 mm) ER70S-6	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	2G Pipe	6" (150 mm)	130 - 140 (3.3-3.8 m/min)	NA	DC+
	GMAW - Pulse	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	2G Pipe	6" (150 mm)	125 - 130 (3.2-3.3 m/min)	.95(trim)	
53	GMAW - STT	.045" (1.1 mm) ER70S-6	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	5G Pipe down	6" (150 mm)	130 - 140 (3.3-3.8 m/min)	NA	DC+
	GMAW - Pulse	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	5G Pipe up	6" (150 mm)	125 - 130 (3.2-3.3 m/min)	.95(trim)	
54	GMAW - STT	.045" (1.1 mm) ER70S-6	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	6G Pipe down	6" (150 mm)	130 - 140 (3.3-3.8 m/min)	NA	DC+
	GMAW - Pulse	.045" (1.1 mm) ER70S-6	SuperArc L-56	90/10	25-40 (12-19 l/min)	6G Pipe up	6" (150 mm)	125 - 130 (3.2-3.3 m/min)	.95(trim)	
55	GMAW - STT	.045" (1.1 mm) ER70S-6	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	2G Pipe	6" (150 mm)	130 - 140 (3.3-3.8 m/min)	NA	DC+
	FCAW - G	.045" (1.2 mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	2G Pipe	6" (150 mm)	275 (±5) (7.0 m/min)	25	
56	GMAW - STT	.045" (1.1 mm) ER70S-6	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	5G Pipe down	6" (150 mm)	130 - 140 (3.3-3.8 m/min)	NA	DC+
	FCAW - G	.045" (1.2 mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	5G Pipe up	6" (150 mm)	275 (±5) (7.0 m/min)	25	
57	GMAW - STT	.045" (1.1 mm) ER70S-6	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	6G Pipe down	6" (150 mm)	130 - 140 (3.3-3.8 m/min)	NA	DC+
	FCAW - G	.045" (1.1 mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	6G Pipe up	6" (150 mm)	275 (±5) (7.0 m/min)	25	
58	FCAW - G	.045" (1.1 mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	Flat	1/4" (6.4 mm)	275 (±5) (7.0 m/min)	25	DC+
59,60,61	FCAW - G	.045" (1.1 mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	2F, 3F up, 4F	3/8" (9.6 mm)	275 (±5) (7.0 m/min)	25	DC+
62,63,64,65	FCAW - G	.045" (1.1 mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	1G, 2G, 3G up, 4G	3/8" (9.6 mm)	275 (±5) (7.0 m/min)	25	DC+
66	FCAW - S	5/64" (2.0 mm) E71T-8	NR- 232/233	NA	NA	Flat	1/4" (6.4 mm)	140 (±5) (3.5 m/min)	20	DC-
67,68	FCAW - S	5/64" (2.0 mm) E71T-8	NR- 232/233	NA	NA	2F, 3F up	3/8" (9.6 mm)	155 (±5) (4.0 m/min)	21	DC-
69	FCAW - S	5/64" (2.0 mm) E71T-8	NR- 232/233	NA	NA	4F	3/8" (9.6 mm)	145 (±5) (3.7 m/min)	20	DC-
70,71	FCAW - S	5/64" (2.0 mm) E71T-8	NR- 232/233	NA	NA	1G, 2G	3/8" (9.6 mm)	130 (±5) (3.3 m/min)	21	DC-
72	FCAW - S	5/64" (2.0 mm) E71T-8	NR- 232/233	NA	NA	3G up	3/8" (9.6 mm)	125 (±5) (3.2 m/min)	19.5	DC-

Figure 133 – Default weld process settings (upgrades)

VRTEX® 360 - Default Weld Process Settings (Software Upgrade 2)										
WPS #	VR Welding Process	Consumable Type	Lincoln Brand	Gas Mixture	Gas Flow (CFH)	Position	Mat'l (in)	WFS (ipm) or amps	Voltage	Polarity

VRTEX® 360 - Default Weld Process Settings (Software Upgrade 3)										
WPS#	VR Welding Process	Consumable Type	Lincoln Brand	Gas Mixture	Gas Flow (CFH)	Position	Mat'l (in)	WFS (ipm) or amps	Voltage or trim	Polarity
3-1	GMAW - Spray	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	2F	3/8" (9.6 mm)	385 (+ 5) (9.8 m/min)	25	DC+
3-2	GMAW - Pulse	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	2G	3/8" (9.6 mm)	375 (+ 5) (9.5 m/min)	1.1(trim)	DC+
3-3	GMAW - Spray	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	1G	3/8" (9.6 mm)	375 (+ 5) (9.5 m/min)	25	DC+
3-4	GMAW - Pulse	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	2F	10 GA (3.2 mm)	240 (+ 5) (6.0 m/min)	1.1(trim)	DC+
3-5	GMAW - Pulse	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	3F up	3/8" (9.6 mm)	240 (+ 5) (6.0 m/min)	1.05(trim)	DC+
3-6	GMAW - Pulse	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	2F	3/8" (9.6 mm)	290 (+ 5) (7.4 m/min)	1.1(trim)	DC+
3-7	GMAW - Pulse	.045" (1.1 mm) ER 4043	SuperGlaze 4043	100 Ar	30-40 (16-19.5 l/min)	3G up	3/8" (9.6 mm)	350 (+ 5) (8.9 m/min)	1.05(trim)	DC+

VRTEX® 360 - Default Weld Process Settings (Software Upgrade 4)										
WPS#	VR Welding Process	Consumable Type	Lincoln Brand	Gas Mixture	Gas Flow (CFH)	Position	Mat'l (in)	WFS (ipm) or amps	Voltage or trim	Polarity
4-1	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	2F	10 GA (3.2 mm)	80 (+5)	NA	DC+
4-2	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	3F down	10 GA (3.2 mm)	80 (+5)	NA	DC+
4-3	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	4F	10 GA (3.2 mm)	80 (+5)	NA	DC+
4-4	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	2F	1/4" (6.4 mm)	85 (+5)	NA	DC+
4-5	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	3F up	1/4" (6.4 mm)	85 (+5)	NA	DC+
4-6	SMAW	1/8" (3.2 mm) E6010	Fleetweld 5P+	NA	NA	4F	1/4" (6.4 mm)	85 (+5)	NA	DC+
4-7	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	2F	10 GA (3.2 mm)	100 (+5)	NA	DC+
4-8	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	3F up	10 GA (3.2 mm)	100 (+5)	NA	DC+
4-9	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	4F	10 GA (3.2 mm)	100(+5)	NA	DC+
4-10	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	2F	1/4" (6.4 mm)	115 (+5)	NA	DC+
4-11	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	3F up	1/4" (6.4 mm)	115 (+5)	NA	DC+
4-12	SMAW	1/8" (3.2 mm) E7018	Excalibur 7018	NA	NA	4F	1/4" (6.4 mm)	115 (+5)	NA	DC+
4-13	GMAW - Spray	.052" (1.3 mm) ER70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	2F	3/8" (9.6 mm)	350 (+ 5) (8.9 m/min)	30	DC+
4-14	GMAW - Spray	.052" (1.3 mm) ER70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	3F up	3/8" (9.6 mm)	350 (+ 5) (8.9 m/min)	30	DC+
4-15	GMAW - Spray	.052" (1.3 mm) ER70S-6	SuperArc L-56	90/10	40-50 (19-23.5 l/min)	1G	3/8" (9.6 mm)	350 (+ 5) (8.9 m/min)	31	DC+
4-16	GMAW - Spray	.052" (1.3 mm) ER70S-6	SuperArc L-56	90/10	35-45 (16.5-21 l/min)	2F	1/4" (6.4 mm)	300 (+ 5) (7.5 m/min)	24	DC+
4-17	GMAW - S	.052" (1.3 mm) ER70S-6	SuperArc L-56	100 Co2	25-35 (12-16.5 l/min)	2F	1/4" (6.4 mm)	200 (+ 5) (5.0 m/min)	20	DC+
4-18	GMAW - S	.052" (1.3 mm) ER70S-6	SuperArc L-56	100 Co2	25-35 (12-16.5 l/min)	3F up	3/8" (9.6 mm)	150 (+ 5) (3.8 m/min)	19	DC+
4-19	GMAW - S	.052" (1.3 mm) ER70S-6	SuperArc L-56	100 Co2	25-35 (12-16.5 l/min)	3F down	1/4" (6.4 mm)	200 (+ 5) (5.0 m/min)	17	DC+
4-20	GMAW - Pulse	.052" (1.3 mm) ER70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	2F	3/8" (9.6 mm)	375 (+ 5) (9.5 m/min)	1.1 (trim)	DC+
4-21	GMAW - Pulse	.052" (1.3 mm) ER70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	3F up	3/8" (9.6 mm)	145 (+ 5) (3.6 m/min)	1.00 (trim)	DC+
4-22	GMAW - Spray	.045" (1.1 mm) ER 308	BlueMax 308L Si	98/2	25-35 (12-16.5 l/min)	1G	3/8" (9.6 mm)	360 (+ 5) (9.2 m/min)	26	DC+
4-23	GMAW - Spray	.045" (1.1 mm) ER 308	BlueMax 308L Si	98/2	25-35 (12-16.5 l/min)	2F	3/8" (9.6 mm)	360 (+ 5) (9.2 m/min)	26	DC+
4-24	GMAW - Pulse	.045" (1.1 mm) ER 308	BlueMax 308L Si	98/2	25-35 (12-16.5 l/min)	3G up	3/8" (9.6 mm)	276 (+ 5) (7.0 m/min)	.95 (trim)	DC+
4-25	GMAW - Pulse	.045" (1.1 mm) ER 308	BlueMax 308L Si	98/2	25-35 (12-16.5 l/min)	3F down	10 GA (3.2 mm)	212 (+ 5) (5.4 m/min)	.95(trim)	DC+
4-26	GMAW - Pulse	.045" (1.1 mm) ER 308	BlueMax 308L Si	98/2	25-35 (12-16.5 l/min)	2F	10 GA (3.2 mm)	212 (+ 5) (5.4 m/min)	.95(trim)	DC+

VRTEX® 360 - Default Weld Process Settings (Software Upgrade 5)										
WPS#	VR Welding Process	Consumable Type	Lincoln Brand	Gas Mixture	Gas Flow (CFH)	Position	Mat'l (in)	WFS (ipm) or amps	Voltage or trim	Polarity
5-1	SMAW	1/8" (3.2mm) E6010	Fleetweld 5P+	N/A	N/A	2F Lap	10 GA (3.2mm)	80 (+5)	N/A	DC+
5-2	SMAW	1/8" (3.2mm) E6010	Fleetweld 5P+	N/A	N/A	3F Up Lap	10 GA (3.2mm)	80 (+5)	N/A	DC+
5-3	SMAW	1/8" (3.2mm) E6010	Fleetweld 5P+	N/A	N/A	4F Lap	10 GA (3.2mm)	80 (+5)	N/A	DC+
5-4	SMAW	1/8" (3.2mm) E6013	Fleetweld 37	N/A	N/A	2F Lap	10 GA (3.2mm)	100 (+5)	N/A	AC
5-5	SMAW	1/8" (3.2mm) E6013	Fleetweld 37	N/A	N/A	3F Down Lap	10 GA (3.2mm)	125 (+5)	N/A	AC
5-6	SMAW	1/8" (3.2mm) E7018	Excalibur	N/A	N/A	2F Lap	10 GA (3.2mm)	125 (+5)	N/A	DC+
5-7	GMAW	.035" (.89mm) E70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2F Lap	10 GA (3.2mm)	250 (+ 5)(6.3 m/min)	18	DC+
5-8	GMAW	.035" (.89mm) E70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	3F Down Lap	10 GA (3.2mm)	250 (+ 5)(6.3 m/min)	18	DC+
5-9	GMAW-Pulse	.045" (1.1mm) ER4043	SuperGlaze 4043	100 Ar	30-40 (16-19 l/min)	2F Lap	10 GA (3.2mm)	240 (+ 5)(6.0 m/min)	1.1 (trim)	DC+
5-10	GMAW-Pulse	.045" (1.1mm) ER308	BlueMax 308	98/2	30-40 (16-19 l/min)	2F Lap	10 GA (3.2mm)	210 (+ 5)(5.4 m/min)	0.95 (trim)	DC+
5-11	GMAW-Pulse	.045" (1.1mm) ER308	BlueMax 308	98/2	30-40 (16-19 l/min)	3F Down Lap	10 GA (3.2mm)	210 (+ 5)(5.4 m/min)	0.95 (trim)	DC+
5-12	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	2F	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-13	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	3F up	3/8" (9.6mm)	145 (+ 5)(3.6 m/min)	1.00 (trim)	DC+
5-14	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	4F	3/8" (9.6mm)	145 (+ 5)(3.6 m/min)	1.00 (trim)	DC+
5-15	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	1G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-16	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	2G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-17	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	3G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-18	GMAW-Pulse	.035" (.89mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	4G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-19	GMAW-Pulse	.045" (1.1mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	2F	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-20	GMAW-Pulse	.045" (1.1mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	3F	3/8" (9.6mm)	145 (+ 5)(3.6 m/min)	1.00 (trim)	DC+
5-21	GMAW-Pulse	.045" (1.1mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	4F	3/8" (9.6mm)	145 (+ 5)(3.6 m/min)	1.00 (trim)	DC+
5-22	GMAW-Pulse	.045" (1.1mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	1G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-23	GMAW-Pulse	.045" (1.1mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	4G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-24	GMAW-Pulse	.052" (1.3mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	4F	3/8" (9.6mm)	145 (+ 5)(3.6 m/min)	1.00 (trim)	DC+
5-25	GMAW-Pulse	.052" (1.3mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	1G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-26	GMAW-Pulse	.052" (1.3mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	2G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-27	GMAW-Pulse	.052" (1.3mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	3G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-28	GMAW-Pulse	.052" (1.3mm) E70S-6	SuperArc L-56	90/10	30-40 (16-19 l/min)	4G	3/8" (9.6mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-29	SMAW	1/8" (3.2mm) E6010	Fleetweld 5P+	N/A	N/A	Flat Plate	1/4" (6.4mm)	90 (+ 5)	N/A	DC+
5-30	SMAW	1/8" (3.2mm) E6013	Fleetweld 37	N/A	N/A	Flat Plate	1/4" (6.4mm)	100 (+ 5)	N/A	AC
5-31	SMAW	1/8" (3.2mm) E7018	Excalibur	N/A	N/A	Flat Plate	1/4" (6.4mm)	125 (+ 5)	N/A	DC+
5-32	GMAW-Short	.035" (.89mm) E70S-6	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	Flat Plate	1/4" (6.4mm)	250 (+ 5)(6.3 m/min)	18.00	DC+
5-33	GMAW-Spray	.045" (1.1mm) E70S-6	SuperArc L-56	90/10	25-35 (12-16.5 l/min)	Flat Plate	1/4" (6.4mm)	400 (+ 5)(10.0 m/min)	27.00	DC+
5-34	GMAW-Pulse	.045" (1.1mm) ER308	BlueMax 308	98/2	25-35 (12-16.5 l/min)	Flat Plate	1/4" (6.4mm)	130 (+ 5)(3.3 m/min)	0.95 (trim)	DC+
5-35	FCAW-G	.045" (1.1mm) E71T-1	UC 71A85	75/25	40-50 (19-23.5 l/min)	Flat Plate	1/4" (6.4mm)	275 (+ 5)(7.0 m/min)	25.00	DC+
5-36	FCAW-S	5/64" (2.0mm) E71T-8	NR 232/233	N/A	N/A	Flat Plate	1/4" (6.4mm)	140 (+ 5)(3.5 m/min)	20.00	DC-



# ACCESSORIES AND OPTIONS

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**AD1390-1** – VRTEX 360 Extensions™ Upgrade 1.

- E6013
- Theory
- Process Piping

**AD1390-2** – VRTEX 360 Extensions™ Upgrade 2.

- Bend Test
- Motorsports
- Construction Yard
- Advanced Scoring
- Graphing Cues
- Bend Test Certificate

**AD1390-3** – VRTEX 360 Extensions™ Upgrade 3.

- Video Replay
- Aluminum GMAW (MIG / MAG)
- Learning Levels

**AD1390-4** – VRTEX 360 Extensions™ Upgrade 4.

- Demo Weld
- Stainless GMAW (MIG / MAG)
- 0.052in (1.3mm) Solid Wire
- SMAW On Thinner Materials

**AD1390-5** – VRTEX 360 Extensions™ Upgrade 5.

- Lap Joint
- Pulse Weld
- Surface Build Up



# CLEANING & MAINTENANCE

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## FMD

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Taking proper care of the FMD (Face Mounted Display) is important for optimal functioning of the equipment. Occasionally, the FMD lens should be wiped with the lint free lens wipe that is provided. This can be done to remove fingerprints from the lenses. You can also use a lens cloth (e.g., from a camera shop). Paper towels or household cloths may scratch or damage the lenses and should not be used. Avoid exposing the FMD to liquids. Cleaning solutions should not be used to clean the FMD. Do not use Isopropyl alcohol or solutions containing alcohol to clean the lenses or plastic parts on the FMD. You can also use a camera pressure canister to occasionally blow out dirt.

You may want to clean the inside of the helmet occasionally. Be sure to do so without exposing the FMD to any unacceptable materials, as explained above.

The FMD should be kept in a clean and dry location out of direct sunlight. Avoid dirty or sandy environments, as these can lead to scratching of optics and damage the FMD mechanical adjustments.

## TOUCHSCREEN MONITOR

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### CAUTION

**The monitor is a touch screen and can be damaged by poking it with any object other than the pad of your finger. Use care when cleaning screen. Use only a soft dry cloth (cotton or flannel). Avoid chemicals and solvents (alcohol, benzine, acidic or alkaline solvent cleaners). Avoid granular or abrasive cleaning agents.**

## COMPUTER

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The computer runs the clock of a Complementary metal-oxide-semiconductor (CMOS) battery (CR2032). It is recommended that the CMOS battery be replaced every 24 months.

### Note:

- In case of a drained battery, an additional step might be necessary to power up the unit. See **Troubleshooting Section**.
- Time and date will be reset on the student report.



# HOW TO USE TROUBLESHOOTING GUIDE

## WARNING

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

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

### **Step 1. LOCATE PROBLEM (SYMPTOM).**

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

### **Step 2. POSSIBLE CAUSE.**

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

### **Step 3. RECOMMENDED COURSE OF ACTION**

This column provides a course of action for the Possible Cause.

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

## CAUTION

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

Observe Safety Guidelines detailed in the beginning of this manual.

## TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
There is jitter, shake or wobble in the Helmet display and Monitor.	The helmet is too far from the work piece. The further the helmet is from the work piece the more jitter there may be in the helmet display.	Move helmet closer to work piece. Check for loose or faulty connections between the Helmet/Monitor and the VRTEX 360 machine. See the Wiring Diagram.
	Local interference such as fluorescent light, large metallic objects and/or high frequencies.	Make sure there are no objects or frequencies that are interfering with the system. See the <b>Installation</b> section.
The weld coupon image is a different configuration than the physical coupon.	Either the wrong coupon is on the stand or the wrong configuration has been selected.	Press the menu icon and select 'change coupon type'. Change the software selections so that the images on the screen match the hardware you are using.
When check settings is activated, the incorrect settings appear.	The settings in the Instructor Mode are incorrect.	Make sure all of the settings in the tolerance editor are correct for the process and parameters being used. Check for the acceptable ranges for the Lincoln defaults.
Holding the green button in does not shut down the VRTEX 360. This is normal.	Holding the green button in does not shut down the VRTEX 360. This is normal.	To shut down the VRTEX 360 select Menu and then select Shutdown. The green button is not used for system shutdown.
The students' reports are not accessible.	USB storage device not in front of machine.	The students' reports can only be saved via the USB port on the front of the VRTEX 360. Plug in a USB memory device into the front of the machine. If a USB memory stick is not plugged into the USB port or if there is no available memory on the USB stick, the students' reports will not be saved.
The VR FCAW/GMAW and/or SMAW device will not strike an arc.	Check to make certain the coupon is positioned correctly and the student is attempting to weld the correct side of the coupon.	VR weld the other side of the VR coupon. Make certain the VRTEX 360 logo on the VR coupon appear on the monitor and in the VR helmet.

### CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Automation Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3878.

Observe Safety Guidelines detailed in the beginning of this manual.

## TROUBLESHOOTING GUIDE

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
Previous weld pass data is not accessible on the LASER screen.	“End Pass” must be activated before starting a new pass. If a new coupon is started the data will only be available for the first pass. Again; “End Pass” must be selected before a new pass is started.	Use the touch screen to go to pass number and change which pass data you are looking for. Note that some configurations only have one pass capabilities. See the Lincoln default tolerances.
The user is not sure of which tolerance set they are using.	The tolerance set displayed in the tolerance editor is the one being used. The tolerance set can also be read from the student report.	Go to the instructor mode to change tolerances. Go to the login screen, select the key icon, enter pass code and select tolerances to verify tolerance set. See the <b>Operation</b> section.
The VR FCAW/GMAW and/or VR SMAW device(s) location does not correspond with the image shown in the FMD (Face Mounted Display) device.	The system may be located near large metal objects.	Move the system to a suitable location. See the <b>Installation</b> section.
The VRTEX 360 does not start up when the green circular button is pressed.	Make sure the correct input power is being applied to the machine. Verify fused power switch is in the ON position. Fuse may be faulty.	Be sure to hold the green circular button in for at least 5 seconds. If the green circular button does not stay on, remove the plug on lower part of case front. Press and hold the green circular button and then press up the push button inside the sheet metal. See <b>Figure 134</b> and <b>Figure 135</b> . Replace with 10A/250V fuse only.

### CAUTION

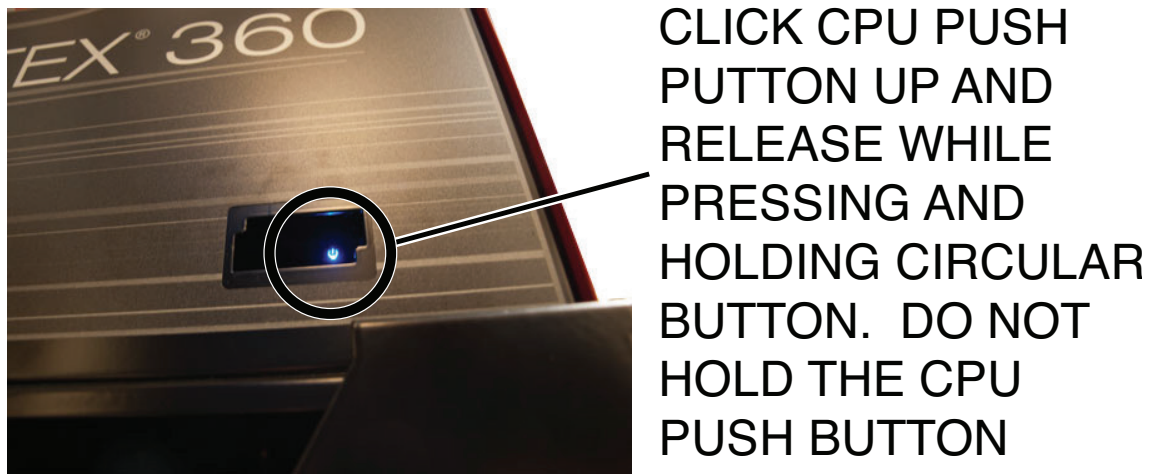
If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Automation Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3878.

Observe all Safety Guidelines detailed throughout this manual

Figure 134 – Plug location



Figure 135 – CPU push button

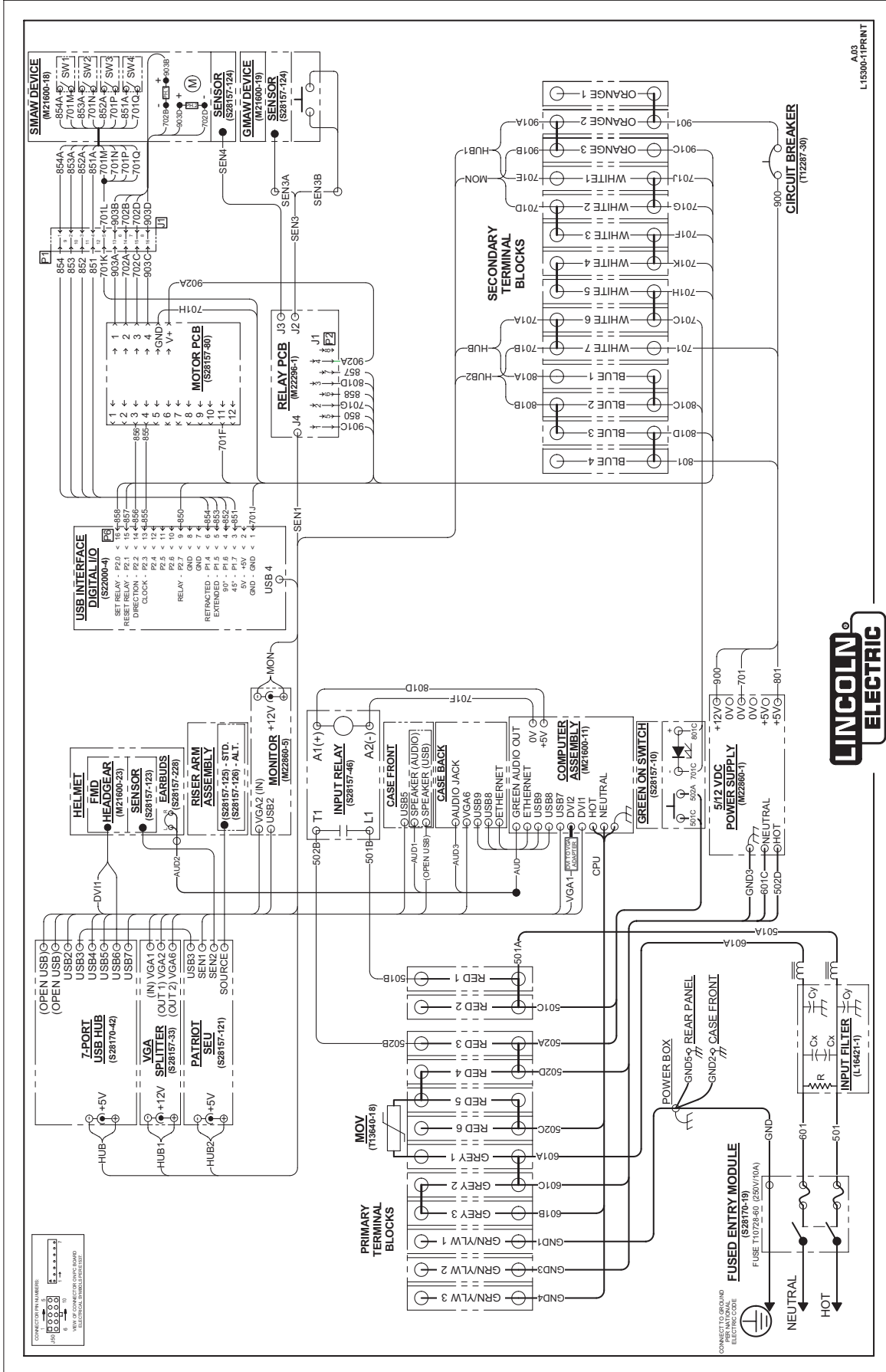


**⚠ CAUTION**

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Automation Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3878.

Figure 136 – Wiring diagram

K3962 - Series wiring diagram



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



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

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

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

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

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

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

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

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

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

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

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

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## **CUSTOMER ASSISTANCE POLICY**

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

Lincoln Electric is a responsive manufacturer, but 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.

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