

VRTEX® 360

For use with machines having Code Numbers: **AD1332-1**
AD1332-2
AD1332-4
AD1332-5

Software Version 1.2.4

Safety Depends on You

Lincoln 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.

NOTICE

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

**OPERATOR'S MANUAL**

LINCOLN®
ELECTRIC

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• World's Leader in Welding and Cutting Products •

• Sales and Service through Subsidiaries and Distributors Worldwide •

Cleveland, Ohio 44117-1199 U.S.A. TEL: 888.935.3878 FAX: 216.383.8823 WEB SITE: www.VRTEX360.com

⚠ WARNING



CALIFORNIA PROPOSITION 65 WARNINGS



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

The Above For Diesel Engines

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

The Above For Gasoline Engines

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

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

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



FOR ENGINE powered equipment.

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



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



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

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

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



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

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



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



ELECTRIC AND MAGNETIC FIELDS may be dangerous

- 2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines
- 2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.
- 2.c. Exposure to EMF fields in welding may have other health effects which are now not known.
- 2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:
 - 2.d.1. Route the electrode and work cables together - Secure them with tape when possible.
 - 2.d.2. Never coil the electrode lead around your body.
 - 2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
 - 2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.
 - 2.d.5. Do not work next to welding power source.



ELECTRIC SHOCK can kill.

- 3.a. The electrode and work (or ground) circuits are electrically “hot” when the welder is on. Do not touch these “hot” parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
- 3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.
- In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:**
- **Semiautomatic DC Constant Voltage (Wire) Welder.**
 - **DC Manual (Stick) Welder.**
 - **AC Welder with Reduced Voltage Control.**
- 3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
- 3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- 3.e. Ground the work or metal to be welded to a good electrical (earth) ground.
- 3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- 3.g. Never dip the electrode in water for cooling.
- 3.h. Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- 3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
- 3.j. Also see Items 6.c. and 8.



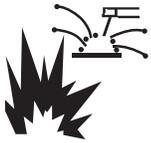
ARC RAYS can burn.

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



FUMES AND GASES can be dangerous.

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



WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire.

Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

- 6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.
- 6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- 6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).
- 6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.
- 6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- 6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- 6.h. Also see item 1.c.
- 6.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 1235 Jefferson Davis Highway, Arlington, VA 22202.



FOR ELECTRICALLY powered equipment.

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

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

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté spécifiques qui paraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protégez-vous contre la secousse électrique:
 - a. Les circuits à l'électrode et à la pièce sont sous tension quand la machine à souder est en marche. Éviter toujours tout contact entre les parties sous tension et la peau nue ou les vêtements mouillés. Porter des gants secs et sans trous pour isoler les mains.
 - b. Faire très attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher métallique ou des grilles métalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
 - c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état de fonctionnement.
 - d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
 - e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
 - f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces précautions pour le porte-électrode s'appliquent aussi au pistolet de soudage.
2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas où on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.
3. Un coup d'arc peut être plus sévère qu'un coup de soleil, donc:
 - a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
 - b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
 - c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.
4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans latéraux dans les zones où l'on pique le laitier.
6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.
7. Quand on ne soude pas, poser la pince à un endroit isolé de la masse. Un court-circuit accidentel peut provoquer un échauffement et un risque d'incendie.
8. S'assurer que la masse est connectée le plus près possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaînes de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'échauffement des chaînes et des câbles jusqu'à ce qu'ils se rompent.
9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particulièrement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumées toxiques.
10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistilage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgène (gas fortement toxique) ou autres produits irritants.
11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le châssis du poste conformément au code de l'électricité et aux recommandations du fabricant. Le dispositif de montage ou la pièce à souder doit être branché à une bonne mise à la terre.
2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.
3. Avant de faire des travaux à l'intérieur de poste, la débrancher à l'interrupteur à la boîte de fusibles.
4. Garder tous les couvercles et dispositifs de sûreté à leur place.

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

Handle the Face Mounted Display (FMD) integrated helmet with care. When not in use, the Helmet should be placed 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 Drawer at the back of the VR Weld Machine.

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

SAFETY PRECAUTIONS

Before using the FMD please read carefully these safety instructions.

Read this handbook and use the FMD device in strict accordance in order to prevent any damage to your eye, 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.

WARNINGS

Misuse or overuse of this product may injure your eye 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.

Electric Shock can kill:



- Do not use or store the FMD when wet or in wet areas.
- Do not wrap the cable around your neck, body or arms.
- Turn the power switch off and unplug the FMD when it will not be used.

General 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 0°C/32°F or above 40°C/104°F 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.



Recycling Welding Equipment at End of Life

Waste Electrical and Electronic Equipment (WEEE)

Recycling

Recycling and reclamation of used electrical and electronic equipment is important to many nations and localities. Lincoln Electric provides information to assist in the recycling of welding equipment.

This parts list contains a “WEEE” column. The WEEE column describes potential recyclable materials. Materials that require selective treatment, according to national regulations, are also identified in the WEEE column.

The following table describes substances that are potentially recyclable. Components with high substance content are identified within the parts list. Easily identified and common components such as steel screws, steel nuts, steel washers and copper wire are not identified on the list, but are also recyclable. Some components may contain mixed substances.

Substance	Recyclable Material Identification
Steel, Iron	Fe
Aluminum	Al
Copper	Cu

WEEE in Europe

This instruction is mandatory for equipment in Europe that displays this symbol:



Do not dispose of electrical equipment together with normal waste!

In observance of European Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) and its implementation in accordance with national law, electrical equipment that has reached the end of its life must be collected separately and returned to an environmentally compatible recycling facility. As the owner of the equipment, you should get information on approved collection systems from your local Lincoln representative. By applying this European Directive you will protect the environment and human health!

The following components must be removed from the welding equipment and shall be selectively treated. They shall be disposed of or recovered in compliance with Council Directive 75/442/EEC. They are identified within the parts pages:

Component	Selective Treatment Identification
Printed circuit boards with surface greater than 10 square centimeters	ST
Liquid crystal displays with surface greater than 100 square centimeters	ST
External electric cables (not all external cables are shown on parts pages)	ST
Electrolyte capacitors with height >25 mm and diameter >25 mm or proportionately similar in volume	ST

Thank You

for selecting a **QUALITY** product by Lincoln Electric. We want you to take pride in operating this Lincoln Electric Company product ••• as much pride as we have in bringing this product to you!

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.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

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.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Product _____

Model Number _____

Code Number or Date Code _____

Serial Number _____

Date Purchased _____

Where Purchased _____

Whenever you request replacement parts or information on this equipment, always supply the information you have recorded above. The code number is especially important when identifying the correct replacement parts.

On-Line Product Registration

- Register your machine with Lincoln Electric either via fax or over the Internet.
 - For faxing: Complete the form on the back of the warranty statement included in the literature packet accompanying this machine and fax the form per the instructions printed on it.
 - For On-Line Registration: Go to our **WEB SITE at www.lincolnelectric.com**. Choose "Support" and then "Register Your Product". Please complete the form and submit your registration.

Read this Operators Manual completely before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection. The level of seriousness to be applied to each is explained below:

WARNING

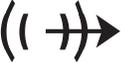
This statement appears where the information **must** be followed **exactly** to avoid **serious personal injury or loss of life**.

CAUTION

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

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GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

	INPUT POWER	U_1	INPUT VOLTAGE
	ON	I_1	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
$1 \sim$	SINGLE PHASE ALTERNATING CURRENT		Dangerous Voltage
	READ THIS OPERATORS MANUAL COMPLETELY		Shock Hazard
	USB		Shock Hazard
o/o	WFS/AMPS		
V	VOLTS		
	VGA OUTPUT		
	AUDIO OUTPUT		

TECHNICAL SPECIFICATIONS: AD1332-1,-4 (STD. FREQ.) / AD1332-2, -5 (ALT. FREQ.)**VRTEX™ 360 - VIRTUAL REALITY WELDING TRAINER**

INPUT			
MAKE/MODEL	DESCRIPTION	INPUT VOLTAGE +/- 10%	INPUT CURRENT (MAX.)
AD1332-1, -4	Standard Frequency	115-230 VAC (50-60 HZ)	4A-2A Single Phase
AD1332-2, -5	Alternate Frequency	115-230 VAC (50-60 HZ)	4A-2A Single Phase

⚠ WARNING

THIS PRODUCT INCORPORATES A PROTECTIVE EARTH IN THE AC POWER CORD. THE AC PLUG SHOULD ONLY BE INSERTED INTO A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT.

TRACKING SYSTEM FREQUENCY		
MAKE/MODEL	DESCRIPTION	OPERATING FREQUENCY
AD1332-1, -4	Standard Frequency	HIGH
AD1332-2, -5	Alternate Frequency	LOW

PHYSICAL DIMENSIONS (MACHINE W/MONITOR)			
HEIGHT	WIDTH	DEPTH	WEIGHT
71.0 in. 1803 mm	30.0 in. 762 mm	50.0 in. 1270 mm	360 lbs. 163 kg.

PHYSICAL DIMENSIONS (STAND)			
HEIGHT	WIDTH	DEPTH	WEIGHT
78.0 in. 1981 mm	39.0 in. 990 mm	47.0 in. 1194 mm	102 lbs. 46 kg.

TEMPERATURE RANGES			
OPERATING TEMPERATURE RANGE		STORAGE TEMPERATURE RANGE	
59° - 95° F	15° - 35° C	32° - 149° F	0° - 65° C

RELATIVE HUMIDITY*	OPERATING ALTITUDES
80% For Temperatures Up To 88° F / 31° C 50% @ 104° F / 40° C	6562 Feet (2000 Meters)

ENVIRONMENT
This Product is Pollution Degree 1.

*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. See **Section B (Helmet Lenses)**.

1

THIS PRODUCT HAS BEEN TESTED TO THE REQUIREMENTS OF CAN/CSA-C22.2 NO. 61010-1, 2ND EDITION, INCLUDING AMENDMENT 1, OR A LATER VERSION OF THE SAME STANDARD INCORPORATING THE SAME LEVEL OF TESTING REQUIREMENTS.

VRTEX® 360


**LINCOLN®
ELECTRIC**

READ ENTIRE INSTALLATION SECTION BEFORE STARTING INSTALLATION.

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.

- Insulate yourself from the work and ground.
- Always connect the VRTEX® 360 to a power supply grounded according to the National Electrical Code and local codes.

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.
- Do not locate where monitor is exposed to direct sunlight.
- Do not place equipment near radiant heat sources.
- Do not place in a confined space. Allow a minimum of 3 feet of clearance around machine and stand at all times. Adequate ventilation is necessary.
- The circuit breaker switch on the rear panel is the input power disconnect device. Do not position the equipment so that it is difficult to operate the circuit breaker.
- Route and protect power cable 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.

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

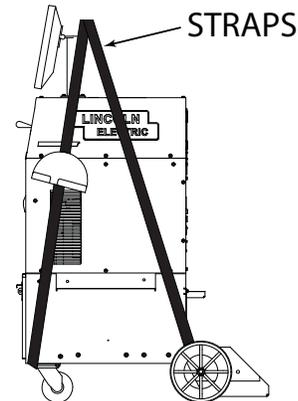
The VRTEX® 360 cannot be stacked.

TILTING

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

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.



⚠ WARNING



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

FALLING EQUIPMENT can cause injury.

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.

VRTEX® 360



GENERAL DESCRIPTION

The VRTEX® 360 is a Virtual Welding Training System and VRAW® (Virtual Reality Arc Welding) Solution. This computer controlled interactive system simulates arc welding through the use of realistic puddle graphics and sounds. This training system simulates multiple arc welding processes on a wide variety of weld joint configurations. The VRTEX® 360 represents the next generation of Virtual Reality (VR) welding training.

DESIGN FEATURES

HARDWARE OVERVIEW:

- Virtual Welding Machine, including:
 - Monitor
 - Coupon Drawer (back drawer)
 - VR GMAW/FCAW Gun
 - VR SMAW Device
 - VR GMAW/FCAW Gun Holder
 - VR SMAW Device Holder
 - VR Helmet w/Face Mounted Display (FMD)
 - Arm
 - Speakers
 - Five VR Coupons - Flat Plate
T-Joint
Groove Joint
2" Pipe XXS
6" Pipe Schedule 40
- Stand, including:
 - Post
 - Table
 - Pins
 - Base
 - Weights



HARDWARE UNCRATING:

TOOLS NEEDED

- 3/8" (9.5 mm) Wrench
- 3/16" (4.8 mm) Allen Wrench
- Phillips Screwdriver

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 at least 3 feet in all directions of both the stand and VR weld machine free from obstruction. 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

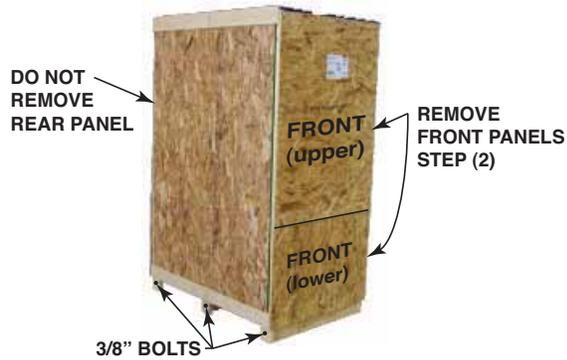
If multiple systems are required to operate together in one location, a unique frequency transmitter can be installed during the manufacturing process at Lincoln Electric to reduce potential interference between systems. **AD1332-1, -4** systems have a standard frequency source installed. **AD1332-2, -5** systems have an alternate frequency source installed. For multiple system installations, alternate the **-1, -4** and **-2, -5** 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.

-1/-4	-2/-5	-1/-4	-2/-5
-2/-5	-1/-4	-2/-5	-1/-4

- Using the 3/8" (9.5 mm) wrench, remove the screws from the upper and lower front panels on the shipping crate.

NOTE: Do not remove rear panel.



- Remove the six 3/8" bolts (three on each side) from the bottom of the crate assembly.



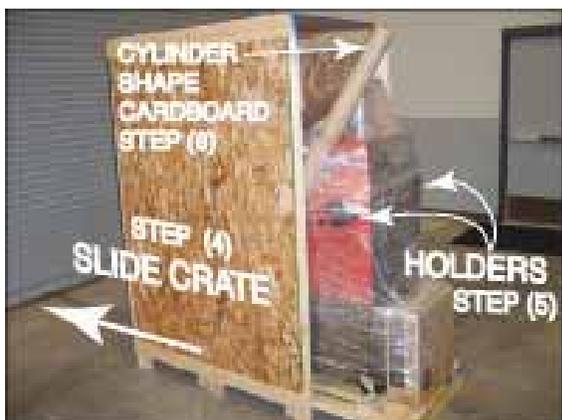
- Carefully cut and remove plastic wrapping.
- Remove the monitor from the front of the machine.



- Using the 3/8" wrench, remove the two screws from the rear base securing the unit to the wooden crate.



- Carefully slide the crate assembly from the VRTEX® 360.
- Slide towards the rear of the machine. Be careful to avoid damaging the welding device holders located on each side of the machine.
- Carefully remove the post (long cylinder-shaped cardboard) from the crate.



- Remove the four screws from the wooden rear cross brace.



- Remove the wooden cross brace while ensuring the unit is steady and secure.
- Carefully roll the machine off the rear of the skid. Ramping may be required.
- Uncrate and unpack the table and table base.

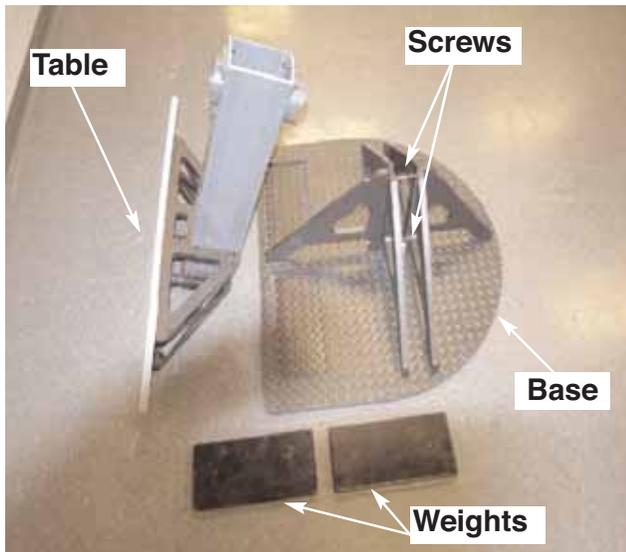


TABLE & SWING ARM SET-UP:

1. Place counter weights on base.
2. Using the 3/16" (4.8 mm) allen wrench, remove the two 1/4" x 20 Allen-head screws from the base assembly.

NOTE: The longer screw is in the top.

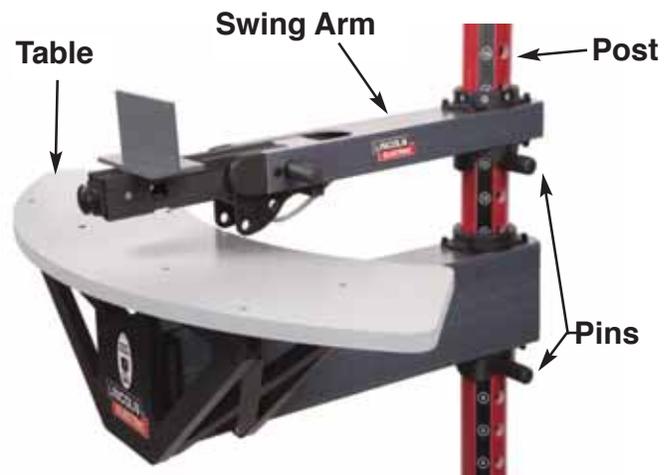


3. Insert red post into base assembly aligning the flat on the pole with the hole.

NOTE: The post will only insert one way.

4. Using the 3/16" (4.8 mm) allen wrench, secure the post into position by replacing and tightening the screws.

5. Obtain the three post T pins from the factory packaging of the VRTEX® 360.



6. Insert one of the pins into the post at the #6 location.
7. From the top, slide the table onto the post letting it rest on the pin inserted in previous step.
8. Insert the second pin into the post at the #13 position.
9. Obtain the swing-arm from the rear of the VRTEX® 360 by removing the cable ties from the swing arm and cable. Grey cable should remain connected to the VRTEX® 360 (**DO NOT CUT THE GREY CABLE!**).



VRTEX® 360

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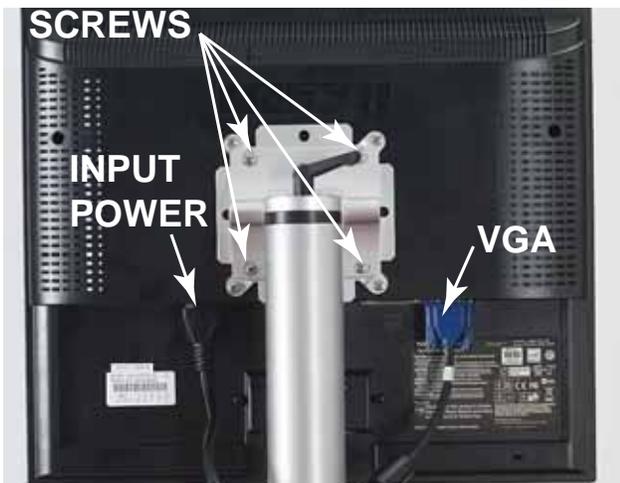
- Carefully slide swing-arm onto post with the letters (on the collar) "ABC" up and the grey cable located on the bottom of the swing arm assembly.
- Insert a third T pin at a convenient height for holding the helmet.

MONITOR:

Note: always use the factory supplied monitor with the VRTEX® 360

- Remove monitor from cardboard box.

MONITOR (Mounting Screws)



- Remove the cable ties from monitor cables secured to the monitor mounting post.
- Use a Phillips-head screwdriver to carefully mount the monitor onto the mounting post bracket. Tighten the four Phillips-head screws securely.
- Connect input power cable and VGA cable into the monitor.

APPLY SYSTEM POWER:

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

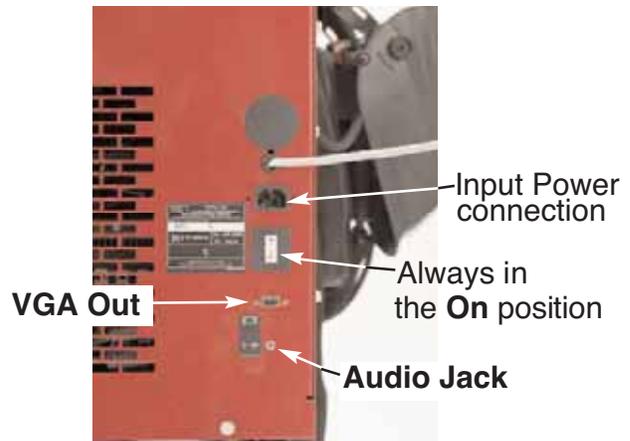
NOTE: Surge protector (or Surge Suppressor) may be required to protect the electronic components of the machine from input power surges.

- Verify Circuit Breaker/Rocker Switch is in the On position. (See Figure "Back of Machine")

ADDITIONAL FEATURES:

- The welding coupons are stored in the coupon drawer in the rear of the machine.

BACK OF 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 1024x780 resolution.
- External speakers may be connected using the **audio jack** located on the back of the machine.

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 position and orientation.
- 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.

VRTEX® 360

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PRODUCT DESCRIPTION

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.

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

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

FRONT OF MACHINE



VRTEX® 360



USER INTERFACE OVERVIEW

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.

See figure on page B-1 for locations of operator controls and indicators.

1. The **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 on the monitor is ON and the green LED is lit.
2. The **joystick** allows the operator to navigate through various options by moving the red highlighted box and zoom / rotate the coupon in the Instructor View.
3. The **colored buttons** on the front of the machine correlate to the colored rectangles at the bottom of the monitor screen when the simulation software is running. These buttons perform various functions depending upon the command shown in the corresponding box on the screen.
4. The **wire feed speed/amperage dial** allows the user to input wire feed speed or amperage depending on the VR welding process selected.
5. The **voltage dial** allows the user to input the welding voltage. This dial also allows input of trim values when pulse process is in use.
6. The left and right **white screen select arrows** allow the operator to cycle through various screens.
7. The **process selector switch** is used to selected the virtual welding process. (GMAW, FCAW, or SMAW)
8. The **polarity selector switch** is used to indicate the welding polarity for any given process. (DC+, DC-, or AC).
9. The **USB port** is used to upload software and download user data from the system.

10. The **key switch** is located on the lower right of the control panel. When the system is in the login screen the instructor may insert the key shipped with the system into the key lock and then rotate it 90 degrees to the right. This allows the instructor to access the instructor mode which includes the Weldometer®, Tolerance Editor, Options and Update screens.

11 Pressing and holding the **green circular button** for 5 seconds 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 to turn off the system

12. The **red select button** accepts (enters) the data displayed or highlighted on the monitor.

13. **VR GMAW/FCAW** gun holder should be used to store the VR GMAW/FCAW gun when not in use.

14. **VR SMAW** device holder should be used to store the VR SMAW device when not in use.

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 when not in use.

VR GMAW/FCAW GUN



⚠ CAUTION

Store gun as shown below to avoid damage.

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 button, 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, 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.

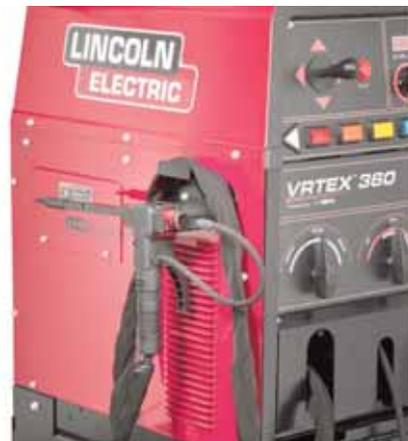
VR SMAW DEVICE



⚠ CAUTION

Store device as shown below to avoid damage.

VR SMAW DEVICE (Properly Stored)

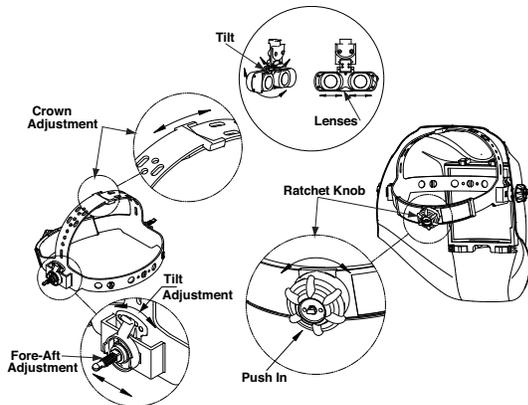


VRTEX® 360



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



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 user's face and lens. To adjust, loosen the outside tension knobs and slide forward or back to desired position and retighten. **NOTE:** Make sure both sides are equally positioned for proper operation.

HELMET LENSES*

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**.



NOTE:
Do not remove or adjust ear buds on headband.

EAR BUDS

The ear buds are close to the ears so the operator can hear the proper welding sounds.

*Condensation on lenses may appear in high humidity environment. Run FMD for approximately 10 minutes to clear up moisture from the lenses.

When not in use, the helmet should be hung from 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 Drawer

The coupon drawer houses the physical coupons. When not in use, the coupons should be stored in the drawer. To open the drawer, press the top indent down, and slide the drawer out. Each coupon fits in its own area defined by the foam locator in the drawer.

COUPON DRAWER



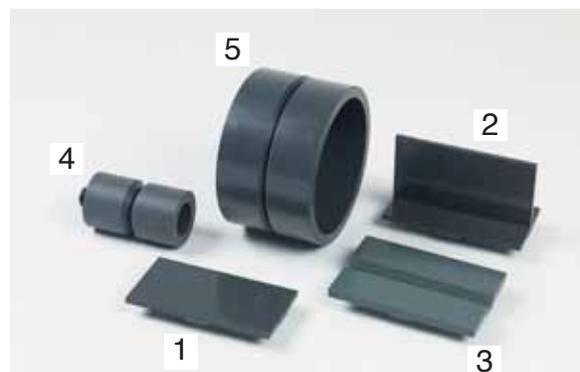
Coupons

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. 3/8" Groove Joint w/Backing Bar
4. 2" Diameter XXS Pipe
5. 6" Diameter Schedule 40 Pipe

VR COUPONS



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

Stand

The stand is comprised of the post, arm, 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 0 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.

POST W/PIN INSERTED IN #18



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.

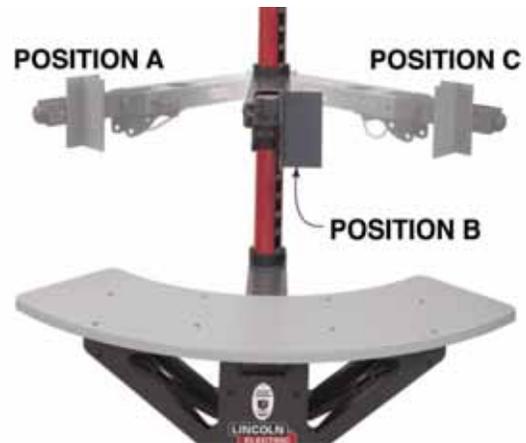
COUPON INSERTION / REMOVAL



CAUTION

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

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.

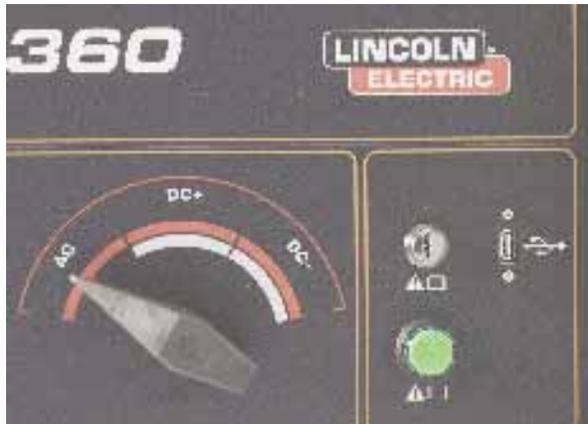
TABLE ROTATION



Powering Up Your System:

1. After you have set up the hardware and have become familiar with the user controls, you will be ready to use your system.
2. Plug the power cord into a standard outlet.
3. Press and hold the green circular button on the front panel until it lights up and you hear fans running inside the machine. (approx. 5 seconds)

GREEN CIRCULAR BUTTON LOCATION



4. Your system will start up.
5. Wait a few minutes until your system displays the login screen on your monitor.

LOGIN 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. Electronic copies of the WPS'S are available on the USB memory stick that is shipped with the VRTEX® 360 System.

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 provided with the system allows the user to access the Instructor Mode with additional information and set-up pages.

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

Login Screen:

Overview

This page allows the user to:

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

1. On Screen Keyboard

The user enters their name by using the joystick and red select button on the VR weld machine. The joystick allows the user to navigate the keyboard graphic to highlight letters. Pressing the red select button enters the letter highlighted into the enter name box as indicated. The virtual keyboard starts with shift enabled, so the first letter is automatically capitalized. 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.

LOGIN SCREEN



2. Language

Selecting the orange language menu button brings up the list of languages the software supports. Use the joystick to highlight the desired language. Press the red select button to accept.

Press the orange language menu button again to exit the language menu. The system stores the language selection and will automatically start up in the same language the next time.

3. Measurement Units

The blue unit menu button brings up the measurement system. Use the joystick to highlight the desired unit of measurement. Press the red select button to accept. Press the blue button 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 B.1**.

4. Menu

The red menu button 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.

⚠ CAUTION

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 panel button is pressed 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 in place in the front of the machine.

TABLE B.1

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

VRTEX® 360



7. Theory Button Screen

Overview

The THEORY button has been implemented to assist users with additional content, images and information related to the area of the application where you are working. This information can be accessed by selecting the yellow THEORY button on the front of the VRTEX® 360. When selected, the button 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. The joystick on the VRTEX® 360 is used to highlight the term and then open a description of that term. When finished with reviewing the THEORY data, the student can press the THEORY button again to exit the screen.

THEORY SCREEN



Joint Configuration Selection Screen:

Overview

The user selects which joint configuration they want to virtually weld. First, the user selects the joint and position. Using the joystick and the red select button, the user highlights and selects the joint type and position in which to weld. A rotating view of the highlighted coupon shows in the upper area. For some configurations, the user will be given the choice of material thicknesses to choose from. The user selects material thickness by using the joystick and red select button. See Table B.2 for supported joint configurations.

JOINT CONFIGURATION SELECTION SCREEN



Menu

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

Back

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

TABLE B.2

			GMAW			SMAW			FCAW	
Position	Thickness (in)	Thickness (mm)	Short Arc	Axial Spray	Pulse	STT	E7018	E6010	E6013	Gas Shielded
PLATE	Flat	1/4	6	X	X		X	X	X	X
		10 GA.	3	X					X	
	2F	1/4	6	X						
		3/8	10		X		X	X		X
	3F up	1/4	6	X						
		3/8	10				X	X		X
	3F down	10 GA.	3	X					X	
		10 GA.	3						X	
	4F	1/4	6	X						
		3/8	10				X	X		X
	1G	3/8	10	X	X		X	X	X	X
	2G	3/8	10	X		X	X	X	X	X
	3G	3/8	10	X		X	X	X	X	X
	4G	3/8	10	X			X	X	X	X
PIPE	2G	2" XXS	50				X			
		6" Sch 40	150			X	X	X		X
	5G	2" XXS	50				X			
		6" Sch 40	150			X	X	X	X	X
	6G	2" XXS	50				X			
		6" Sch 40	150			X	X	X	X	X

Process Selection Screen:

Overview

This screen allows the user to select the welding processes. To change among VR GMAW, VR FCAW, and VR SMAW, the user moves the process switch on the front of the weld machine. See the joint configuration chart for available processes. If a process is not supported for the selected material/thickness, it is greyed out on this screen and cannot be selected. To choose among different sub-processes, use the joystick and red select button or green continue button.

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.

PROCESS SELECTION SCREEN



Menu

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.

Stand Set-Up Screen:

Overview

The correct VR stand information must be put into the software for the VRTEX® 360 to operate properly in all virtual welding applications.

STAND SET-UP SCREEN



Coupon Insertion

Insert one of the VR coupons into the desired position in the physical VR stand. 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.

VR COUPON (UNLOCKED POSITION)



Table/Arm Rotation

Move the physical VR table and arm to the desired location for the position and joint configuration selected. To raise or lower the arm or table, hold the arm/table in place and pull out the pin in the pole supporting it. Replace the pin in the hole that supports the arm/table at the proper height and rest the arm/table on the pin. If the table is not needed, swing the table to the left or right and out of the way. The arm can also be rotated to the left (A), center (B) or right (C) of the table.

SWING ARM ROTATION

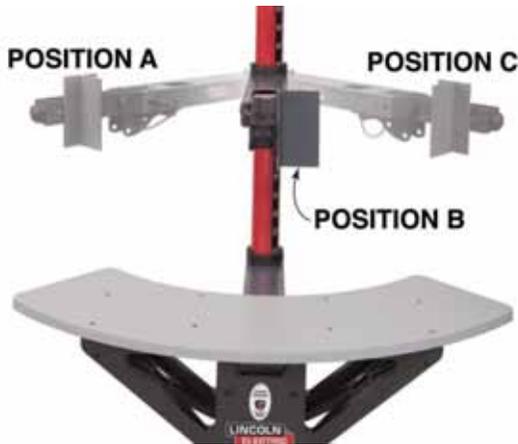


TABLE ROTATION



Pin Positions

When the physical stand is in the desired position, proceed with the following: Use the joystick and red select button to enter the numbers that appear next to the pin positions for the table and arm height into the stand setup screen. The image on the right side of the stand setup screen moves to match the selections entered on the left. If the table is in the “away” position, enter a table height value of 0. Next, enter the arm rotation position A (left), B (center), or C (right). The arm position letter aligns with the vertical pin number sticker. An arm height of 18 and arm rotation of A are shown in the picture below.

PIN POSITIONS 18 A



PIN POSITION

Note: If the table height indicator in the software cannot be moved to the pin height indicated on the post, move the arm height indicator in the software to a higher position and try again. See Troubleshooting Guide if necessary.

Indicate the coupon orientation used on the physical stand in the coupon rotation area of the stand setup screen. The red arrow indicates which side of the coupon that the weld will be made. For pipe configurations, the coupon rotation is replaced with arm angle. The arm angle can be adjusted by removing the pin at the end of the arm, rotating the arm to 45 or 90 degrees from its original location, and reinserting the pin. This is only used to accommodate 2G, 5G and 6G pipe welding.

STAND SET-UP SCREEN (PIPE)



The physical stand should match the stand image when these selections are completed. To continue, press the green continue button. The stand setup verification screen will be displayed. This screen serves as a reminder to make sure VR stand components match the screen. When verified, press the green continue button again.

STAND SET-UP SCREEN OVERLAY



Back

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

Environment Screen:

Overview

The VRTEX® 360 comes pre-configured with a number of different virtual welding environments. To select an environment, the user moves the joystick left or right and then presses the red select button or green continue button to choose the environment.

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 Set-Up Screen: Overview

On this screen, the user selects the gas mixture and gas flow rate. 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, use the joystick and the red select button. The available gas mixtures are shown on the gas set-up screen below.

To select the gas flow rate, use the joystick. Press the red select button or green continue button to proceed.

GAS SET-UP 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.

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. 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 button is pressed.

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

The user changes the voltage by rotating the 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.

WELD MACHINE SETTINGS SCREEN



Polarity Selector

Change the polarity by rotating the polarity selector switch. The user can select the following:

- AC
- DC+
- DC-

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

Once the user has set the welding parameters, they should press the green check settings button. 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.

The user will then have to change any settings that are not correct. If the settings are correct and the green check settings button is pressed, the welder's view screen will appear on the monitor and in the helmet's stereo visor. The user will then be able to start virtual welding.

THE INCORRECT WELD SETTINGS SCREEN



THE CORRECT WELD SETTINGS SCREEN



Menu

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

Back

Pressing **Back** goes back to the previous screen.

Virtual Welding Overview

While a user is welding, observers can see the Welder's view, LASER screen, or Instructor's view displayed on the monitor. The Welder's view shows what the user with the helmet on is seeing through the FMD. The 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 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.

Push Buttons

Menu

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

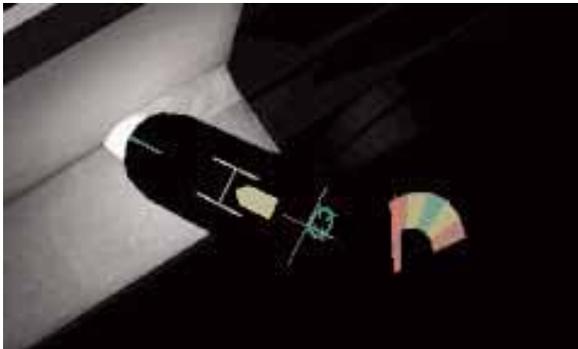
Orange Action and Cues Button

The orange action menu button has the following options:

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

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

Clean removes the weld slag. **Trim** cuts back the VR GMAW or VR FCAW wire. **Quench** simulates quickly cooling the metal. **New Stick** extends the rod stick out to a fixed length on the VR SMAW device to simulate replacing the consumed rod.



Visual Cues

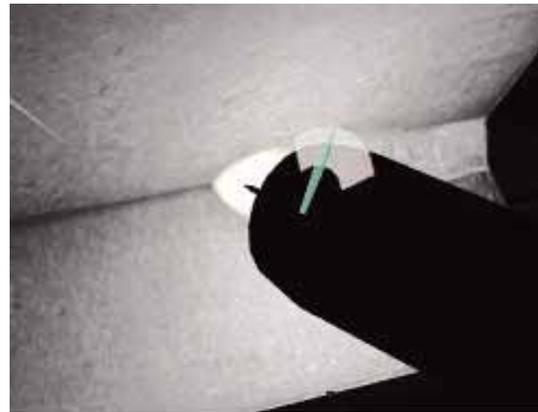
Visual cues are aids to help users learn faster. The travel speed, CTWD, arc length, and travel/work angle cues indicate whether the user is within the tolerances set in the tolerances editor. Generally, these cues are color coded as well as symbolic. When cues are red, they indicate being out of tolerance. 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 button.

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. This cue uses the color coding position to indicate travel speed.

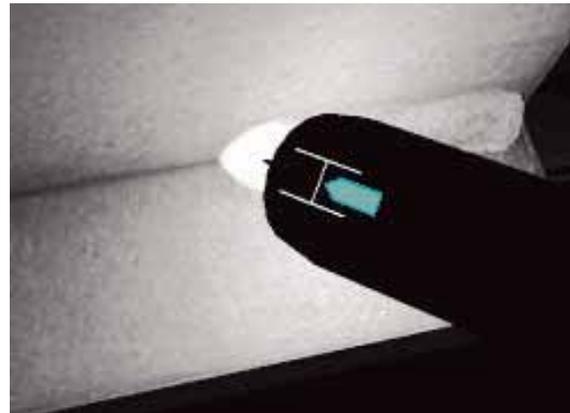
Note: The goal is to keep the arrow in the center of the graph which will also keep it green.

TRAVEL SPEED VISUAL CUE



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. The goal is to get the tip of the green arrow on the line of the “H” bar and keep the arrow color green.

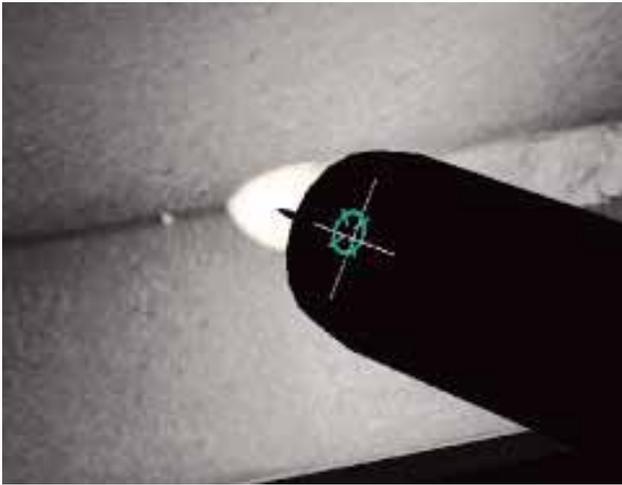
CTWD (Contact Tip to Work Distance)



The **Arc Length** cue is similar to the CTWD cue but represents arc length distance for the VR SMAW process. The goal is to get the tip of the arrow on the line and keep the arrow color Green.

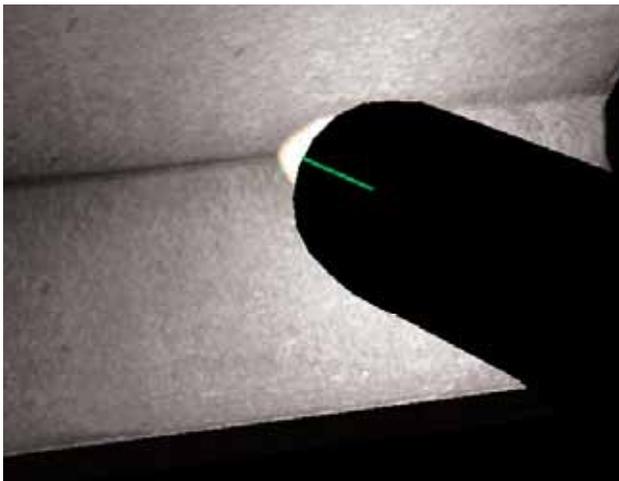
The **Travel/Work Angle** cue can be used with the SMAW, GMAW or FCAW processes. The goal of this cue is to center the circle in the cross hair and keep the color green.

TRAVEL/WORK ANGLE



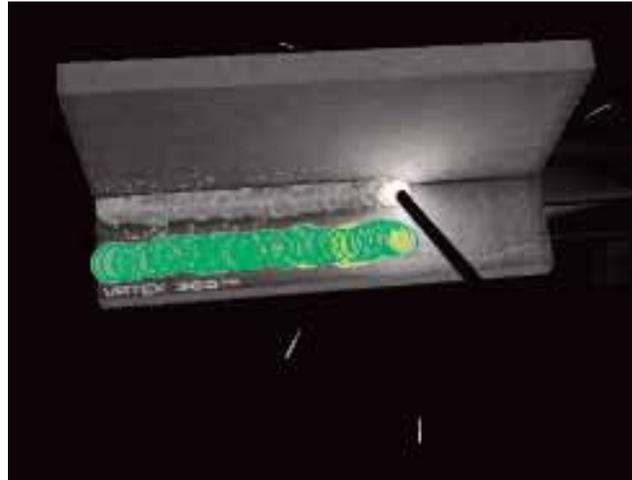
The **Aim** cue can be used with the VR SMAW, VR GMAW or VR FCAW processes. The goal of this cue is to position the VR GMAW/FCAW Gun or VR SMAW device so the aim cue is a thin green line. This indicated that the weld is being made in the correct location or position.

AIM



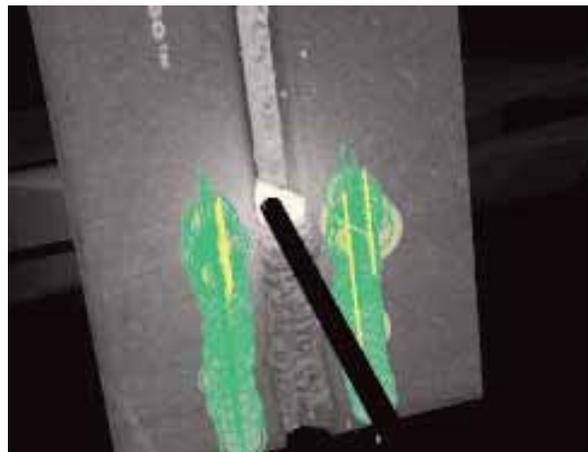
The **Whip** cue can be used with the E6010 VR SMAW process. This cue helps the student use correct spacing between whipping motions, puddle time and whip time. Correct whipping technique is indicated by a green outer ring (spacing) with a green center (puddle and whip timing).

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).

Weave



New Coupon

Pressing the blue new coupon menu button 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

Pressing 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

Overview

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

Instructor's View screen

Overview

This screen shows the coupon and virtual weld in real time. An observer can rotate and/or zoom in or out on the coupon. This view also shows the VR GMAW/FCAW gun or VR SMAW device being used. Move the joystick to rotate the coupon. Press the red select button to toggle the joystick from rotate to zoom mode. Use the joystick to zoom in and out when in zoom mode.

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

INSTRUCTORS VIEW (POOR WELD)



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.

LASER SCREEN (GOOD WELD)



**LASER SCREEN (HORIZONTAL WELD)
NO WELD**



LASER SCREEN (GOOD VERTICAL WELD)



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. 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 highlighting the parameter with the joystick and pressing the red select button. Whipping and weaving parameters are graphed when the system is set up to use these welding techniques (see tolerance editor section). The following technique parameters are used (See Table B.3).

TABLE B.3

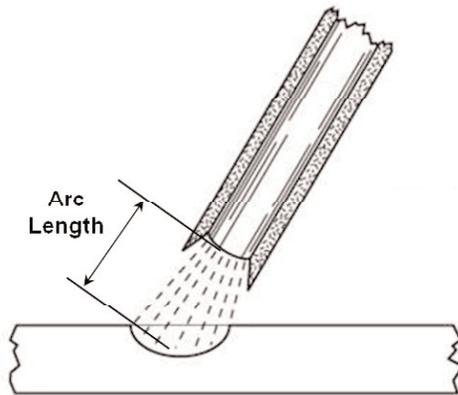
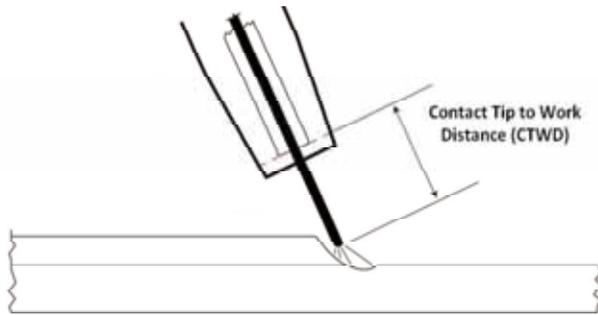
PARAMETER	STRINGER		WHIP	WEAVE	
	GMAW or FCAW	SMAW	SMAW E6010 Only	GMAW or FCAW	SMAW
Position	x	x	x	x	x
CTWD	x			x	
Arc Length		x	x		x
Work Angle	x	x	x	x	x
Travel Angle	x	x	x	x	x
Travel Speed	x	x			
Dime Spacing			x		
Whip Time			x		
Puddle Time			x		
Width of Weave				x	x
Weave Timing				x	x
Weave Spacing				x	x

VRTEX® 360

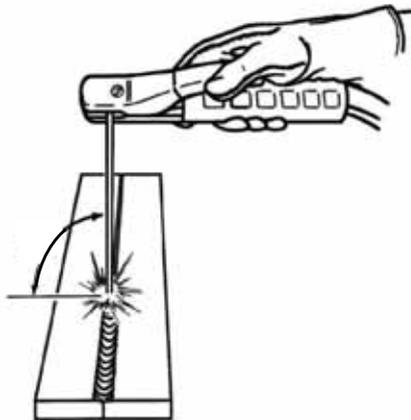


Position is the user's ideal weld root location. This location can change with each pass. When weaving, the ideal location is considered the centerline of the weave.

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.

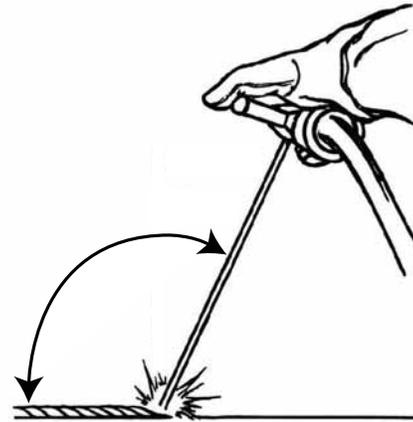


Work Angle is the angle between the electrode and workpiece as seen in the work angle picture below.



WORK ANGLE

Travel Angle is the angle between the electrode and the workpiece in the direction of travel. 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.



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)

Dwell 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, use the joystick to highlight the pass number and then joystick left or right to change the pass number. For pipe, the information is displayed in a similar manner on a 2D screen as though the pipe is unraveled and put on a flat surface. The user can choose between viewing the whole pipe or one of the four quadrants of the pipe. Use the joystick to highlight the pipe section desired.

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. 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
- Slag Inclusion
- Porosity
- Undercut
- Poor Bead Placement
- Wrong Weld Size
- Convex/Excessive Reinforcement
- Concave/Underfill
- Excess Spatter
- Melt Through/Blow Through



End Pass

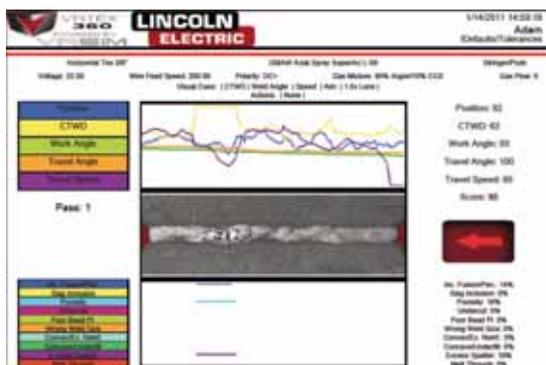
When the user presses the green “End Pass” menu button, the pass is scored, a snapshot of the weld is taken, and the percentages of the weld containing discontinuities are calculated. **If the user has inserted a USB device, pressing “End Pass” also automatically saves a student report to the USB memory 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 pressing the “End Pass” button 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. This PDF file can be printed or archived from another computer to track student progress. Example of PDF below shows students record.



Peak and Background Current

These welding parameters are shown on the LASER screen when the student is using the STT welding process. These settings cannot be modified but are indicated on the system to allow the student to become familiar with the terms.

Instructor Mode

Overview

The Instructor Mode gives users the option of viewing the Weldometer®, using the tolerance editor and setting other preferences. In order to access instructor mode, the user must first go back to the login screen.

This can be done on most screens by pressing menu, logout, and selecting yes. Then the user must place the key into the turn key slot at the front of the weld machine and rotate the key 90 degrees to the right. Selecting the orange back menu button brings the system out of the instructor mode.

Instructor mode includes the following:

- Options
- Update
- License Information
- Weldometer®
- Tolerances

INSTRUCTOR MODE



Options

The options screen in the instructor mode allows the user to change the volume of the user interface sounds and welding sounds. Move the joystick left and right and then hit the select button to choose the volume. A volume of 0 will mute the sound, while a volume of 10 is the loudest.

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 weld machine. Clicking on this brings up two options:

- Update Software
- Update Configuration File

Software

Selecting this option loads a newer version of the software if one is available on the USB 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 take effect.

Configuration File

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

VRTEX® 360



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 Desert Base Environment on the VRTEX® 360. If a new electrode or welding process 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.

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 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 the Lincoln Electric Automation Division. **TEL: 1-216-481-8100, Ask for the Automation Division.**

Weldometer® Overview

The Weldometer® tracks virtual consumables, 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.

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

WELDOMETER®



VRTEX® 360



Base Metal tracks 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 was 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

Pressing **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. 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.

Back

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

Tolerance Editor

Overview

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

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 welding parameters that can be modified include:

- WFS range
- Voltage range
- Amperage range
- Gas mixture
- Gas flow rate

The technique parameters ideal range values can also be modified:

- Position
- CTWD/Arc length
- Work angle
- Travel angle
- Travel Speed
- Whip
- Weave

TOLERANCES



⚠ 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

This 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 pressing the red button. 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.

Back

Pressing back returns the system to the login screen.

Edit

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

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

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

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

Pressing **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.

Pressing **Delete** brings up an “are you sure” dialogue. Selecting yes deletes the file currently shown. The user can cancel out by pressing no or pressing the back button.

Pressing **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, pressing 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

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

Pressing **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 pressing no or pressing the back button.

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

Pressing **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.

Tolerances Keyboard Screen

Overview

Allows the user to name or rename tolerance files.

TOLERANCES (KEYBOARD SCREEN)



TOLERANCES SELECTED (DEFAULTS)

**Back**

Pressing back returns the user to the previous page screen.

Continue

Pressing continue goes to the tolerance configuration selection screen, unless the user was renaming a file, in which case it goes back to the previous page.

Tolerances Joint Configuration Selection Screen

Overview

The user selects which configuration to modify.

TOLERANCE CONFIGURATION SELECTION

**Menu**

Selecting **Logout** and then yes in the submenu takes the user back to the Login screen.

Selecting **Change Process** brings the user back to the tolerances process selection screen.

Back

Pressing **Back** goes back to the previous screen.

Continue

Pressing **Continue** goes to the tolerance process selection screen.

Tolerances Process Selection Screen

Overview

The user selects which process to modify.

TOLERANCES PROCESS SELECTION SCREEN

**Menu**

Selecting **Logout** and then yes in the submenu brings the user back to the login screen in welding mode.

Selecting **Change Coupon Type** takes the user back to the tolerances configuration selection screen.

Back

Pressing **Back** goes back to the tolerance configuration selection screen.

Continue

Pressing **Continue** goes to the tolerance equipment settings screen.

Modifying Tolerances

Overview

The user can modify the tolerance values. This is done by:

- 1) Use the joystick to highlight the equipment setting or parameter to change.
- 2) Press the red select button.
- 3) Use the joystick to change the value. Pressing the green set tolerances button will save the changes.

The following screens are used to modify tolerances:

- Tolerances Equipment Settings screen
- Tolerances Gas screen
- Tolerances Welding Technique Parameters screen
- Tolerances Pattern and Aim screen
- Tolerances Whip and Travel Speed screen
- Tolerances Weave screen

Next & Previous

Use the arrow buttons to cycle through the tolerance editor screens.

The configuration and process selected are shown at the top of the screen.

In the upper right of the screen is the name of the tolerance set being modified.

Ideal values represent the ideal weld technique parameters. If the user welds using the technique listed as ideal, they will get the best score. The ideal values are represented by the red line on the LASER screen. Changing the +/- changes the acceptable tolerance indicated by the white lines on the LASER screen. Any welding technique used within that +/- range is acceptable but will be scored lower the further it is from the ideal value. As an example, a work angle with an ideal of 45 degrees and a +/- of 10 degrees means that the user can use a work angle between 35 and 55 degrees and create an acceptable weld.

Settings that are non-applicable to the process selected are greyed out and cannot be changed.

Menu

This is the same as the tolerance configuration selection screen.

Back

Pressing back goes to the previous screen without saving changes.

Prev Pass

The previous pass button changes the pass being modified. If this is the first pass, this option is not available. The pass number currently being modified is shown in the upper right of the screen.

Next Pass

The next pass button changes the pass being modified to the next pass in the series. If this is the last pass, this option will not be available.

Tolerances Equipment Settings Screen

TOLERANCES EQUIPMENT SETTINGS SCREEN



Overview

This screen allows for the modification of the following welding parameters:

- Wire Feed Speed
- Amperage
- Voltage
- Polarity

Tolerances Gas screen

Overview

This screen allows for the modification of:

- Gas Mixture Selected
- Gas Flow Rate

TOLERANCES GAS SCREEN



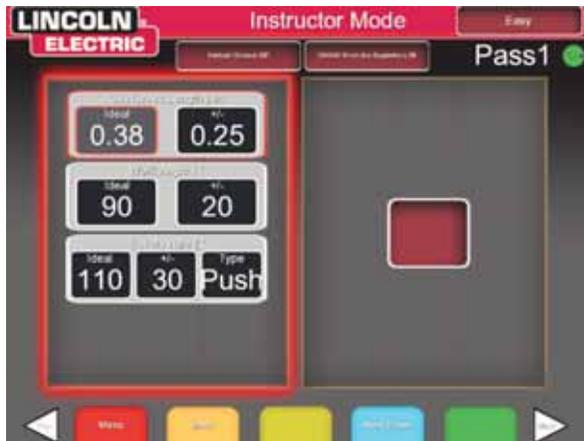
Tolerances Welding Technique Parameters Screen

Overview

This screen allows the modification of:

- CTWD/Arc Length
- Work Angle
- Travel Angle

TOLERANCES WELDING TECHNIQUE PARAMETERS

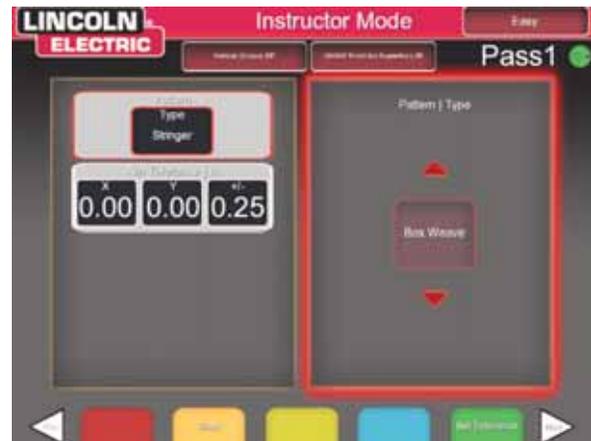


Note: The travel angle for drag welding techniques should always be less than 90 degrees. The travel angle for pushing technique should always be greater than 90 degrees.

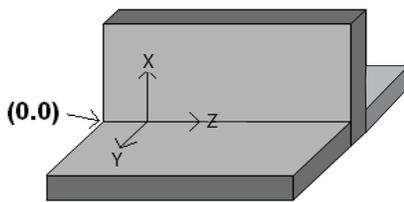
Tolerances Pattern and Aim Screen Overview

This 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. The X and Y values change the location of where the weld bead should be placed. This affects the position parameter on the LASER screen. The +/- determines how far off from the ideal position the student can place the electrode before it results in a misplaced weld.

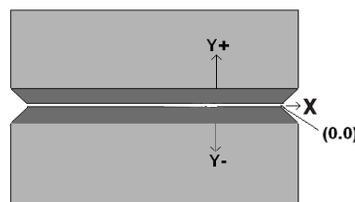
PATTERN & AIM SCREEN



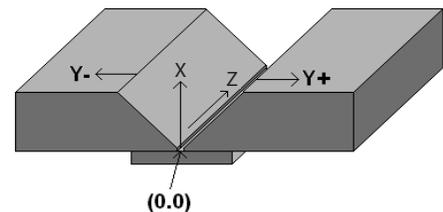
COORDINATE CHART FOR WELD PLACEMENT (POSITION)



TEE



PIPE



GROOVE

Tolerances Whip and Travel Speed Screen

Overview

This screen allows for the modification of technique parameter relating to the whipping welding technique and travel speed including:

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

WHIP & TRAVEL SPEED SCREEN



Tolerances Weave Screen

Overview

This screen allows for the modification of weaving welding technique including:

- Width of Weave
- Weave Timing
- Weave Spacing

TOLERANCES WEAWE SCREEN



VRTEX® 360 Extensions™ Upgrade 2

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 Division at 22221 St. Clair Avenue, Cleveland, OH 44117-2522, via phone at 1(888) 935-3878 or e-mail at:

vrtext@lincolnelectric.com.

For more information, visit <http://www.vrtext360.com/>

BEND TEST

Overview:

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 button. The user can select this option by pressing the green **BEND TEST** button once the weld is completed.

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



CONTINUE button becomes BEND TEST button upon completion of the weld.

Selecting Samples to bend:

Use the joystick to toggle between the "A" and "B" sample the user wishes to bend.

Sample A



Sample B



VRTEX® 360



Selecting Root or Face:

Use the joystick to highlight and toggle between the ROOT and FACE bend. Once the desired sample is chosen, press the red SELECT button to begin the bend test.

ROOT



FACE



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

GREEN TO BEND



BENDING



WHITE BUTTON "NEXT" OR "PREV"



The bent sample can also be rotated for further visual inspection by using the joystick. FaceBend visual inspection Passed.

FaceBend Visual Passed



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.

Failed



Percentages of RootBend Failure



Beginning to Fail



Joystick Rotate RootBend Failure



EXITING THE BEND TEST:

To exit the bend test application, press the red MENU button and use the joystick to toggle to YES then press the red SELECT button. This will take the user back to the LASER screen.

PRESS RED MENU BUTTON TO EXIT



ARE YOU SURE PRESS YES RED SELECT BUTTON



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.

Sample A Root Bend and B Face Bend Guided Results

1/10/2012 12:15:58
Gandoo
Defaults Tolerances

LINCOLN ELECTRIC

File Name: 30" Filler Gas Shielded UltraCore T1A8S Slinger Gray

Sample A

Root Bend

Visual Inspection: Pass

Lack of Fusion: 0%

Porosity: 0%

Slag Inclusion: 0%

Bend Test: Pass



File Name: 30" Filler Gas Shielded UltraCore T1A8S Slinger Gray

Sample B

Face Bend

Visual Inspection: Pass

Lack of Fusion: 0%

Porosity: 0%

Slag Inclusion: 0%

Bend Test: Pass



Bend Test Certificate

LINCOLN ELECTRIC Accredited Testing Laboratories

BEND TEST CERTIFICATE

WELDER OR WELDING OPERATOR'S NAME: Gandoo

WELDING PROCESS: Filler Gas Shielded UltraCore T1A8S

POSITION: 1G

IN ACCORDANCE WITH PROCEDURE SPEC. NO.:

MATERIAL SPECIFICATION: A-36

DIAMETER AND WALL THICKNESS: 30"

THICKNESS RANGE THIS QUALIFIES FOR: 10ga - 3/4"

FILLER METAL

SPECIFICATION NO.: A5.20 CLASSIFICATION: E71T-1 F.NO.: 6

IS BACKING STRIP USED: Yes

FILLER METAL DIAMETER AND TRADE NAME: ORP UC T1A8S

FILLER FOR SUBMERGED ARC OR GAS FOR GAS METAL, AND OR FLUX CORE AND WELDING: 90% Argon/10% CO2

GUIDED BEND TEST RESULTS

TYPE	RESULT	REMARKS
Root Bend A	Satisfactory	No Defects
Face Bend B	Satisfactory	No Defects

WE, THE UNDERSIGNED, CERTIFY THAT THE STATEMENTS IN THIS RECORD ARE CORRECT AND THAT THE VIRTUAL VALUES WERE PREPARED AND REPORTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE VRTEX™ AND BASED ON THE QUALITY STRUCTURAL WELDING CODE.

TEST DATE: 1/10/2012 12:15:58
ACCREDITED FILE NUMBER: XXXXXXXXX

VRVW
SCALFORD, OH

SCORING MODULES:

Overview:

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 using the instructor's key. From the Sign In screen, turn the Instructor's Key 90° to the right. Use the joystick to highlight SCORING MODULE located at the bottom right corner of the Instructors Mode screen. Use the red SELECT button to open the options in the module. Use the joystick to toggle between Based on ASME Standards, Based on D1.1 Standards, and None. Use the red SELECT button to choose a standard. Press the orange BACK button twice to return to the Sign In screen.

Scoring Modules Select Button



Choose Scoring Module Standards



Instructor Mode (Scoring Modules)



Overview:

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.

Selects Visual Cues or Action



LASER Screen Icon Ghosted



Selects Visual Cues or Action



PANNING MODE:

Overview:

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 button to display the Instructor View screen. Use the red SELECT button to select the PAN option and the joystick to move the work piece around the screen.

Panning Mode NEXT or PREV Arrow Button



Red Select Button To select PAN option and Joystick



VRTEX® 360 Extensions™ Upgrade 3

The VRTEX® 360 Extensions™ upgrade program is designed to enhance feature 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 Division at 22221 St. Clair Ave. Cleveland, OH 44117-2522, via phone at 1(888) 935-3878 or e-mail at: vrtext@lincolnelectric.com

For more information, visit
<http://www.vrtext360.com>

LICENSE AGREEMENT:

Overview:

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 joystick up and down motion to toggle through the pages ensuring to read each page carefully.

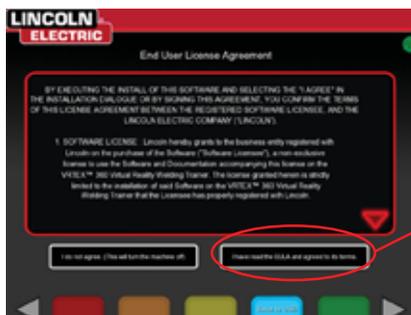
Selecting Agree or Do Not Agree:

Once the user has completely read the EULA using the joystick left and right motion they can highlight 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. Once the user has made their decision they use the red “Select” button to select their choice.

Selecting “I do not agree” will turn the machine off. 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.

End User License Agreement (EULA)



Use joystick to highlight and the red “Select” button to choose “I have read the EULA and agreed to its terms.”

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. Using the joystick up and down motion 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 was unlocked use the joystick left and right motion to highlight the licenses and the joystick up and down motion to toggle through 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 located on each end colored button bar on the face of the VRTEX® 360. 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” button located on the colored button bar.

VRTEX® 360



GETTING TO THE EULA

Saving the EULA to a USB can be done by plugging a USB memory device into the USB port next to the Instructor Key slot and selecting the blue “Save to USB” button located on the colored button bar. 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.

Aluminum Welding Simulation:



Overview:

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 using the joystick and the red “Select” button. Once the users name has been placed in the name block the user will press the green “Continue” button. 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.

Material Selection Arrows



This is the box that the joint is rotating in. Once you select the desired joint by using the joystick and red “Select” button, if it is a joint that aluminum welds can be simulated, the user can toggle left and right using the joystick 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” switch located on the face of the VRTEX® 360 to the GMAW position. Selecting between Spray and Pulse can be accomplished by moving the joystick in the up and down motion and pressing the red “Select” button to choose the desired mode of transfer. Continue using the normal setup process.

The gas selection for the aluminum welding process is 100% Argon. To select this gas use the joystick up motion to highlight 100% Argon and press the red “Select” button. 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.

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” button located on the colored button bar. Pressing this button will cause the “Theory” menu to pop up. Use the joystick up and down motion to toggle through the different terms and definitions on each screen.

New Aluminum Theory



REPLAY MODE:

Overview:

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” button located on the colored button bar. Once the weld has been scored, press the red “Menu” button located on the colored button bar. Use the joystick up motion to highlight “Replay Mode” and the red “Select” button, to activate the mode. 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” buttons located on the colored menu button bar. The user can pause the weld during replay by pressing the green “Pause” button located on the colored button bar. The user can replay the weld as many times as needed by pressing the orange “Reset” button located on the colored button bar. 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.

Replay Mode Selection



To exit the “Video Replay” mode press the red “Menu” button on the colored button bar then “Exit Weld Replay.” Use the joystick left and right motion to highlight “Yes” and press the red “Select” button.

LEARNING LEVELS:

Overview:

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.

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.

Entry Level Tolerance Selection



Intermediate:

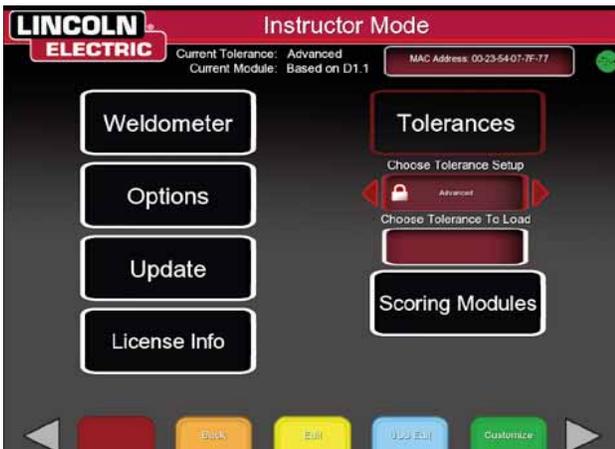
The “Intermediate” Learning Level is designed to be more challenging than the “Entry Level” setting. This level is for the student with some welding experience.

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.

Advanced Tolerance Setting**Accessing the Learning Levels:**

From the “Sign In” screen, turn the Instructors Key one quarter turn to the right. Once in the Instructors Mode use the joystick right motion to highlight the “Tolerance” block and press the red “Select” button. The Tolerance Selection Box will appear below the Tolerance block. Use the joystick left and right motion to toggle through the available Learning Levels.

Selecting a Learning Level:

Once “Tolerance” has been selected using the red Select button, use the joystick to 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.” Use the red “Select” button to activate the Learning Level desired. Upon selection, a prompt box will appear asking if the selection is the intended tolerance level desired. Press the red “Select” button again setting the chosen Learning Level.

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 Learning Level, press the orange “Back” button located on the colored button bar two times. This will take the program back to the “Sign In” screen. Follow the setup procedures to begin the learning experience.

VRTEX® 360 - Default Weld Process Settings

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" E6010 (3.2 mm)	Fleetweld 5P+	NA	NA	Flat	1/4" (6 mm)	90 (±5)	NA	DC+
2,3,4	SMAW	1/8" E6010 (3.2 mm)	Fleetweld 5P+	NA	NA	2F, 3F up, 4F	3/8" (10 mm)	90 (±5)	NA	DC+
5,6,7,8	SMAW	1/8" E6010 (3.2 mm)	Fleetweld 5P+	NA	NA	1G, 2G, 3G up, 4G	3/8" (10 mm)	90 (±5)	NA	DC+
9	SMAW	1/8" E7018 (3.2 mm)	Excalibur 7018	NA	NA	Flat	1/4" (6 mm)	125 (±5)	NA	DC+
10,11,12	SMAW	1/8" E7018 (3.2 mm)	Excalibur 7018	NA	NA	2F, 3F up, 4F	3/8" (10 mm)	125 (±5)	NA	DC+
13,14,15,16	SMAW	1/8" E7018 (3.2 mm)	Excalibur 7018	NA	NA	1G, 2G, 3G up, 4G	3/8" (10 mm)	125 (±5)	NA	DC+
17	SMAW	1/8" E6013 (3.2 mm)	Fleetweld 37	NA	NA	Flat	1/4" (6 mm)	100 (±5)	NA	AC
18	SMAW	1/8" E6013 (3.2 mm)	Fleetweld 37	NA	NA	2F	10 GA. (2.5 mm)	100 (±5)	NA	AC
19	SMAW	1/8" E6013 (3.2 mm)	Fleetweld 37	NA	NA	3F down	10 GA. (2.5 mm)	125 (±5)	NA	AC
20	SMAW	1/8" E6013 (3.2 mm)	Fleetweld 37	NA	NA	4F	10 GA. (2.5 mm)	100 (±5)	NA	AC
21,22	SMAW	1/8" E6013 (3.2 mm)	Fleetweld 37	NA	NA	1G, 2G	3/8" (10 mm)	110 (±5)	NA	AC
23,24	SMAW	1/8" E6013 (3.2 mm)	Fleetweld 37	NA	NA	3G, 4G	3/8" (10 mm)	90 (±5)	NA	AC
25	SMAW	1/8" E6010 (3.2 mm)	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" E6010 (3.2 mm)	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" E6010 (3.2 mm)	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" E6010 (3.2 mm) 3/32" E7018 (2.4 mm)	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" E6010 (3.2 mm) 3/32" E7018 (2.4 mm)	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" E6010 (3.2 mm) 3/32" E7018 (2.4 mm)	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" E6010 (3.2 mm) 3/32" E7018 (2.4 mm)	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" E6010 (3.2 mm) 3/32" E7018 (2.4 mm)	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" E6010 (3.2 mm) 3/32" E7018 (2.4 mm)	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" E7018 (2.4 mm)	Excalibur 7018	NA	NA	2G Pipe	2" (50 mm)	GTAW Root: NA Fill/Cap: 80 (±5)	NA	DC+
35	SMAW	3/32" E7018 (2.4 mm)	Excalibur 7018	NA	NA	5G Pipe up	2" (50 mm)	GTAW Root: NA Fill/Cap: 80 (±5)	NA	DC+
36	SMAW	3/32" E7018 (2.4 mm)	Excalibur 7018	NA	NA	6G Pipe up	2" (50 mm)	GTAW Root: NA Fill/Cap: 80 (±5)	NA	DC+
37	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	Flat	1/4" (6 mm)	250 (+5) (6.3 m/min)	18	DC+
38,39	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2F, 3F down	10 GA. (2.5 mm)	250 (+5) (6.3 m/min)	18	DC+
40	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2F	1/4" (6 mm)	375 (+5) (9.5 m/min)	20	DC+
41	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	3F up	1/4" (6 mm)	275 (+5) (7.0 m/min)	18	DC+
42	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	4F	1/4" (6 mm)	325 (+5) (8.2 m/min)	19	DC+
43	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	1G	3/8" (10 mm)	350 (+5) (8.9 m/min)	20	DC+
44	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	2G	3/8" (10 mm)	320 (+5) (8.0 m/min)	19.5	DC+
45	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	3G up	3/8" (10 mm)	250 (+5) (6.3 m/min)	17.9	DC+
46	GMAW - S	.035" ER70S-6 (1.0 mm)	SuperArc L-56	75/25	25-35 (12-16.5 l/min)	4G	3/8" (10 mm)	270 (+5) (6.8 m/min)	18	DC+
47	GMAW - Spray	.045" ER70S-6 (1.2 mm)	SuperArc L-56	90/10	25-40 (12-19 l/min)	Flat	1/4" (6 mm)	400 (+5) (10.0 m/min)	27	DC+
48	GMAW - Spray	.045" ER70S-6 (1.2 mm)	SuperArc L-56	90/10	25-40 (12-19 l/min)	2F	3/8" (10 mm)	375 (+5) (9.5 m/min)	26.5	DC+
49	GMAW - Spray	.045" ER70S-6 (1.2 mm)	SuperArc L-56	90/10	25-40 (12-19 l/min)	1G	3/8" (10 mm)	370 (+5) (9.4 m/min)	26.5	DC+
50	GMAW - Pulse	.045" ER70S-6 (1.2 mm)	SuperArc L-56	90/10	25-40 (12-19 l/min)	2G	3/8" (10 mm)	130 (+5) (3.3 m/min)	.95(trim)	DC+
51	GMAW - Pulse	.045" ER70S-6 (1.2 mm)	SuperArc L-56	90/10	25-40 (12-19 l/min)	3G up	3/8" (10 mm)	130 (+5) (3.3 m/min)	.95(trim)	DC+
52	GMAW - STT	.045" ER70S-6 (1.2 mm)	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	2G Pipe	6" (150 mm)	130 - 150 (3.3-3.8 m/min)	NA	DC+
	GMAW - Pulse	.045" ER70S-6 (1.2 mm)	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" ER70S-6 (1.2 mm)	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	5G Pipe down	6" (150 mm)	130 - 150 (3.3-3.8 m/min)	NA	DC+
	GMAW - Pulse	.045" ER70S-6 (1.2 mm)	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" ER70S-6 (1.2 mm)	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	6G Pipe down	6" (150 mm)	130 - 150 (3.3-3.8 m/min)	NA	DC+
	GMAW - Pulse	.045" ER70S-6 (1.2 mm)	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 - Spray	ER 4043	SuperGlaze 4043	100 Ar	25-35	2F	3/8" (10 mm)	385 (+5)	26	DC +
56	GMAW - Pulse	ER 4043	SuperGlaze 4043	100 Ar	25-35	2G	3/8" (10 mm)	375 (+5)	1.1 (trim)	DC +
57	GMAW - Spray	ER 4043	SuperGlaze 4043	100 Ar	25-35	1G	3/8" (10 mm)	375 (+5)	26	DC +
58	GMAW - Pulse	ER 4043	SuperGlaze 4043	100 Ar	25-35	2F	10 GA. (2.5 mm)	240 (+5)	1.1 (trim)	DC +
59	GMAW - Pulse	ER 4043	SuperGlaze 4043	100 Ar	25-35	3F	3/8" (10 mm)	240 (+5)	1.05 (trim)	DC +
60	GMAW - Pulse	ER 4043	SuperGlaze 4043	100 Ar	25-35	2F	3/8" (10 mm)	290 (+5)	1.1 (trim)	DC +
61	GMAW - Pulse	ER 4043	SuperGlaze 4043	100 Ar	25-35	3G up	3/8" (10 mm)	350 (+5)	1.05 (trim)	DC +
62	FCAW - G	.045" E71T-1 (1.2 mm)	UC 71A85	75/25	40-50 (19-23.5 l/min)	Flat	1/4" (6 mm)	275 (+5) (7.0 m/min)	25	DC+
63,64,65	FCAW - G	.045" E71T-1 (1.2 mm)	UC 71A85	75/25	40-50 (19-23.5 l/min)	2F, 3F up, 4F	3/8" (10 mm)	275 (+5) (7.0 m/min)	25	DC+
66,67,68,69	FCAW - G	.045" E71T-1 (1.2 mm)	UC 71A85	75/25	40-50 (19-23.5 l/min)	1G, 2G, 3G up, 4G	3/8" (10 mm)	275 (+5) (7.0 m/min)	25	DC+
70	GMAW - STT	.045" ER70S-6 (1.2 mm)	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	2G Pipe	6" (150 mm)	130 - 150 (3.3-3.8 m/min)	NA	DC+
	FCAW - G	.045" E71T-1 (1.2 mm)	UC 71A85	75/25	40-50 (19-23.5 l/min)			275 (+5) (7.0 m/min)	25	
71	GMAW - STT	.045" ER70S-6 (1.2 mm)	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	5G Pipe down	6" (150 mm)	130 - 150 (3.3-3.8 m/min)	NA	DC+
	FCAW - G	.045" E71T-1 (1.2 mm)	UC 71A85	75/25	40-50 (19-23.5 l/min)	5G Pipe up		275 (+5) (7.0 m/min)	25	
72	GMAW - STT	.045" ER70S-6 (1.2 mm)	SuperArc L-56	100% Co2	25-35 (12-16.5 l/min)	6G Pipe down	6" (150 mm)	130 - 150 (3.3-3.8 m/min)	NA	DC+
	FCAW - G	.045" E71T-1 (1.2 mm)	UC 71A85	75/25	40-50 (19-23.5 l/min)	6G Pipe up		275 (+5) (7.0 m/min)	25	
73	FCAW - S	5/64" E71T-8 (2.0 mm)	NR- 232/233	NA	NA	Flat	1/4" (6 mm)	140 (+5) (3.5 m/min)	20	DC-
74,75	FCAW - S	5/64" E71T-8 (2.0 mm)	NR- 232/233	NA	NA	2F, 3F up	3/8" (10 mm)	155 (+5) (4.0 m/min)	21	DC-
76	FCAW - S	5/64" E71T-8 (2.0 mm)	NR- 232/233	NA	NA	4F	3/8" (10 mm)	145 (+5) (3.7 m/min)	20	DC-
77,78	FCAW - S	5/64" E71T-8 (2.0 mm)	NR- 232/233	NA	NA	1G, 2G	3/8" (10 mm)	130 (+5) (3.3 m/min)	21	DC-
79	FCAW - S	5/64" E71T-8 (2.0 mm)	NR- 232/233	NA	NA	3G up	3/8" (10 mm)	125 (+5) (3.2 m/min)	19.5	DC-

VRTEX® 360



CLEANING & MAINTENANCE

FMD

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.

Monitor

 **CAUTION**

The monitor is not a touch screen and can be damaged by touching or poking it with any object. 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.

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 the Lincoln Electric Automation Division: 22221 St. Clair Ave. Cleveland, Ohio 44117-1199 U.S.A.

Phone: 1-888-935-3878

Fax: 216-383-8823

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

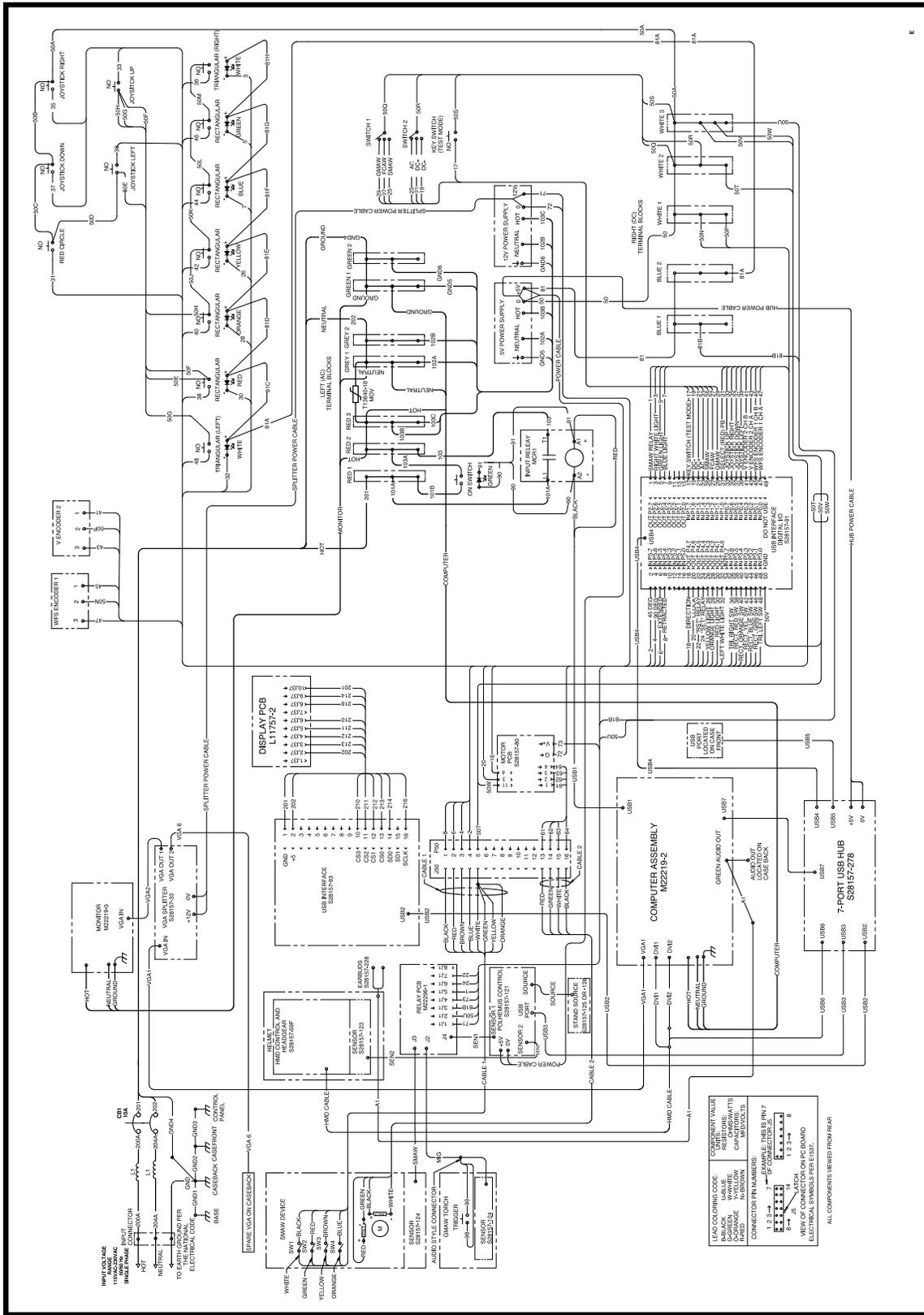
Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	RECOMMENDED COURSE OF ACTION
There is jitter, shake or wobble in the Helmet display and Monitor.	<p>Make sure the helmet is close to the work piece. The further the helmet is from the work piece the more jitter there may be in the helmet display.</p> <p>Local interference.</p>	<p>Check for loose or faulty connections between the Helmet/Monitor and the VRTEX 360 machine. See the wiring diagram.</p> <p>Make sure there are not other objects or frequencies that are interfering with the system. See the Installation Section of this manual.</p>
As viewed through the helmet the entire stand assembly appears in the middle of the screen and the environment does not move.	The leads to the Polhemus Interface Module may be faulty or loose.	Check all cables and leads to the Polhemus Interface Module.
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 in the software.	Press the menu button and select change coupon type. Change the software selections so that the images on the screen match the hardware you are using.
The arm and/or table are different than the visuals in the software.	The software information may be incorrect. Press the menu button and select change process. Make sure the images on the screen match the hardware being used.	N/A
When the check settings are 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 shut-down. The green button is not used for system shutdown.
The students' reports are not accessible.	USB 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 not available memory on the USB stick the students' reports will not be saved.

Observe all Safety Guidelines detailed throughout this manual

PROBLEMS (SYMPTOMS)	POSSIBLE CAUSE	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 pressed before a new pass is started	Use the joystick 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.
Some or none of the welding parameters, defects, or discontinuities are shown on the LASER screen graph.	These items may be "toggled" off.	Use the joystick to highlight the desired items and then press the red select button to toggle them on. Also, make sure that you are on a currently welded pass.
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, turn the key and select tolerances to verify tolerance set. See the Operation Section in this manual.
The machine was shut down and will not turn back on when the green circular button is pressed.	The system may still be in the shut down mode.	Wait 20 seconds, then press and hold the green circular button for 5 seconds to start the machine.
The user cannot weld a second pass.	The joint configuration may be set up for one pass only.	Check the tolerance editor to verify the joint configuration allows for multiple pass welding.
The VR FCAW/GMAW or VR SMAW device(s) location do 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 Installation Section of this manual.
Not all of the buttons are lit on the front of the machine.	Only the buttons that are available for use light up.	N/A
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 Circuit Breaker is in the On position.	Be sure to hold the green circular button in for at least 5 seconds. (See INSTALLATION SECTION) Heading " Apply System Power "

VRTEX™ 360 MACHINE SCHEMATIC FOR AD1332-1 AND AD1332-2



G3244-565

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.

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

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

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

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

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

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

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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