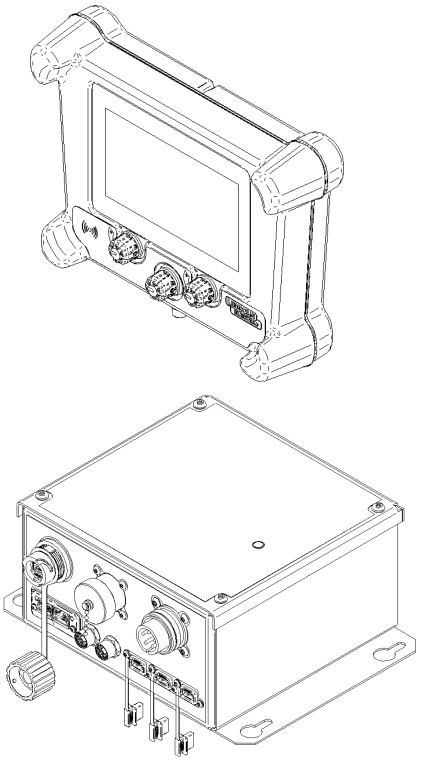
Operator's Manual

Power Wave® Automation Interface Pendant and Module



For use with machines having Code Numbers:
13520, 13550

GENUINE LINCOLN PARTS™

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A Lincoln Service Representative will contact you no later than the following business day.

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THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

THANK YOU FOR SELECTING A QUALITY PRODUCT BY LINCOLN ELECTRIC.

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

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

SAFETY DEPENDS ON YOU

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

⚠ WARNING

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

⚠ CAUTION

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

KEEP YOUR HEAD OUT OF THE FUMES.

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

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

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

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

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

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

WEAR CORRECT EYE, EAR & BODY PROTECTION

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

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

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

IN SOME AREAS, protection from noise may be appropriate.

BE SURE protective equipment is in good condition.

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

SPECIAL SITUATIONS

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

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

Additional precautionary measures

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

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

REMOVE all potential fire hazards from welding area.

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

SECTION A: WARNINGS

CALIFORNIA PROPOSITION 65 WARNINGS

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

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

For more information go to www.P65 warnings.ca.gov/diesel

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

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

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

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2. 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.

1.i. Using a generator indoors CAN KILL YOU IN MINUTES.

1.j. Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell.

1.k. NEVER use inside a home or garage, EVEN IF doors and windows are open.

1.l. Only use OUTSIDE and far away from windows, doors and vents.

1.m. Avoid other generator hazards. READ MANUAL BEFORE USE.

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. I standards.

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

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES CAN BE DANGEROUS.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding hardfacing (see instructions on container or SDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation unless exposure assessments indicate otherwise. In confined spaces or in some circumstances, outdoors, a respirator may also be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

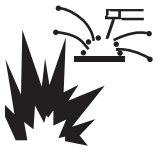
5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer’s instructions for this equipment and the consumables to be used, including the Safety Data Sheet (SDS) and follow your employer’s safety practices. SDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION.



6.a. Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to "Safety in Welding and Cutting" (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned". For information, purchase "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances", AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work", available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER MAY EXPLODE IF DAMAGED.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

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

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically "hot" parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, "Precautions for Safe Handling of Compressed Gases in Cylinders," available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.

FOR ELECTRICALLY POWERED EQUIPMENT.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer's recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer's recommendations.

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

ELECTROMAGNETIC COMPATIBILITY (EMC)

CONFORMANCE

Products displaying the CE mark are in conformity with European Community Council Directive of 15 Dec 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility, 2014/30/EU. It was manufactured in conformity with a national standard that implements a harmonized standard: EN 60974-10 Electromagnetic Compatibility (EMC) Product Standard for Arc Welding Equipment. It is for use with other Lincoln Electric equipment. It is designed for industrial and professional use.

INTRODUCTION

All electrical equipment generates small amounts of electromagnetic emission. Electrical emission may be transmitted through power lines or radiated through space, similar to a radio transmitter. When emissions are received by other equipment, electrical interference may result. Electrical emissions may affect many kinds of electrical equipment; other nearby welding equipment, radio and TV reception, numerical controlled machines, telephone systems, computers, etc.

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

This machine has been designed to operate in an industrial area. The operator must install and operate this equipment as described in this manual. If any electromagnetic disturbances are detected the operator must put in place corrective actions to eliminate these disturbances with, if necessary, assistance from Lincoln Electric. This equipment does not comply with IEC 61000-3-12. If it is connected to a public low-voltage system, it is responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

INSTALLATION AND USE

The user is responsible for installing and using the welding equipment according to the manufacturer's instructions.

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

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

ASSESSMENT OF AREA

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

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

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

METHODS OF REDUCING EMISSIONS

Public Supply System

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

Maintenance of the Welding Equipment

The welding equipment should be routinely maintained according to the manufacturer's recommendations. All access and service doors and covers should be closed and properly fastened when the welding equipment is in operation. The welding equipment should not be modified in any way except for those changes and adjustments covered in the manufacturer's instructions. In particular, the spark gaps of arc striking and stabilizing devices should be adjusted and maintained according to the manufacturer's recommendations.

Welding Cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the foor level.

Equipotential Bonding

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

Earthing of the Workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, e.g., ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and Shielding

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

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

TECHNICAL SPECIFICATIONS

PHYSICAL DIMENSIONS				
MODEL	**HEIGHT**	**WIDTH**	**DEPTH**	**WEIGHT**
Pendant	12.1 in (307 mm)	9.1 in (231 mm)	3.8 in (79 mm)	2.35 lbs (1.1 kg)
Module	4.5 in (114 mm)	9.25 in (235 mm)	10.4 in (264 mm)	6.3 lbs (2.9 kg)

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE -4°F to 104°F (-20C to 40C)	STORAGE TEMPERATURE RANGE -40°F to 185°F (-40C to 85C)

POWER SOURCE-INPUT VOLTAGE AND CURRENT		
Model	**Input Voltage ± 10%**	**Input Amperes**
Pendant/ Module	40 VDC	1A

INSTALLATION

SAFETY PRECAUTIONS

Read this entire installation section before you start installation.

⚠ WARNING

ELECTRIC SHOCK can kill.

- **Only qualified personnel should perform this installation.**
- **Turn the input power OFF at the disconnect switch or fuse box before working on this equipment. Turn off the input power to any other equipment connected to the welding system at the disconnect switch or fuse box before working on the equipment.**
- **Do not touch electrically hot parts.**
- **Always connect the POWER WAVE® grounding lug to a proper safety (Earth) ground.**

SELECT SUITABLE LOCATION

This is an indoor machine, and should be located in a dry environment.

INPUT AND GROUND CONNECTIONS

This unit is powered by 40VDC provided from the Power Wave.

HIGH FREQUENCY PROTECTION

During operation, distance the Automation Interface from radio controlled machinery. The normal operation of the Automation Interface may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

CONNECTION DIAGRAM(S), SYSTEM

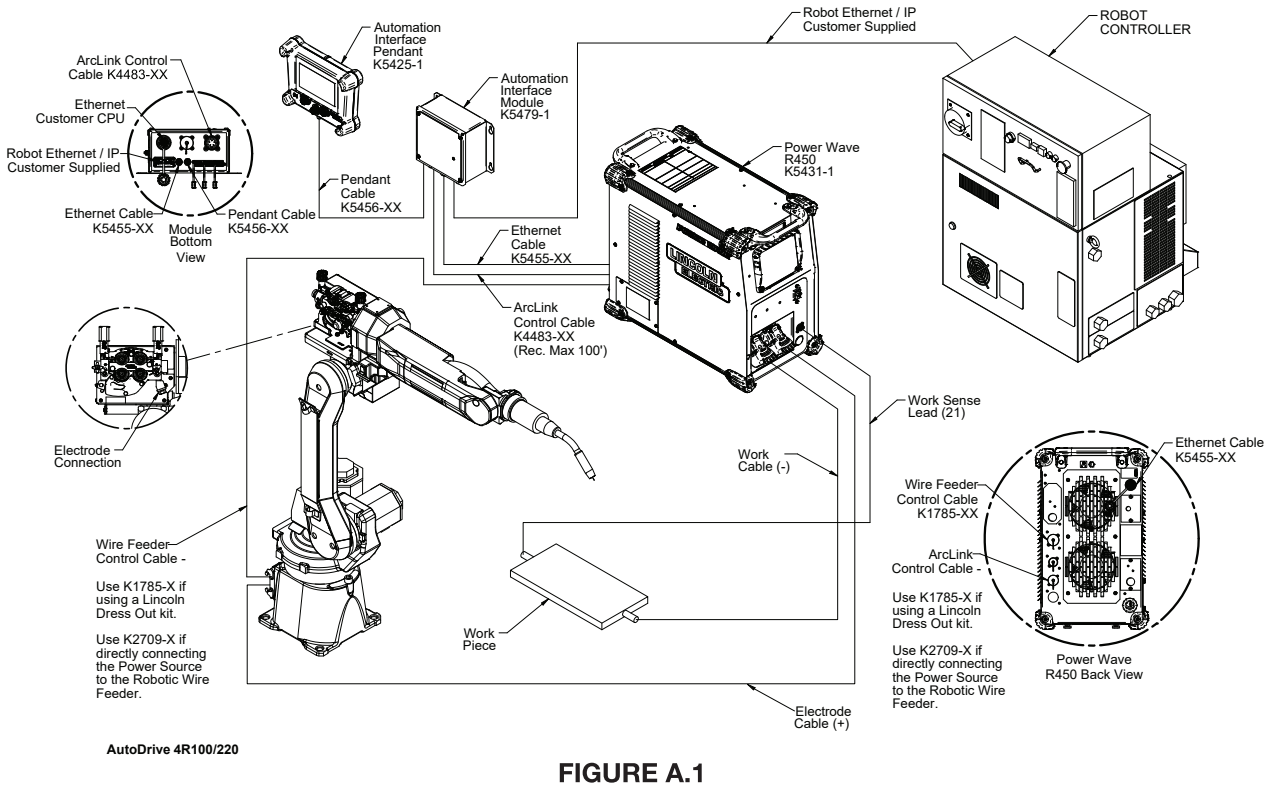


FIGURE A.1

PENDANT HOLDER MOUNTING

This is information needed for integration to a robotic system:

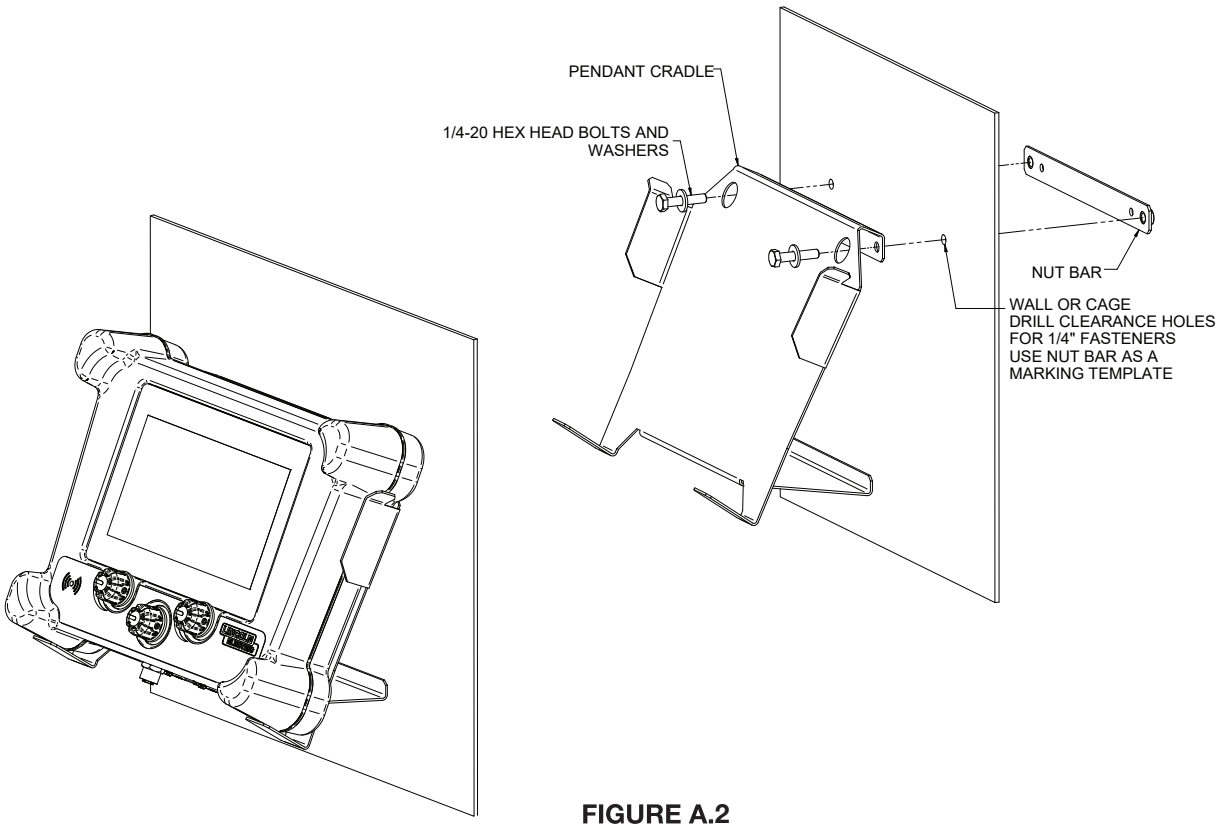


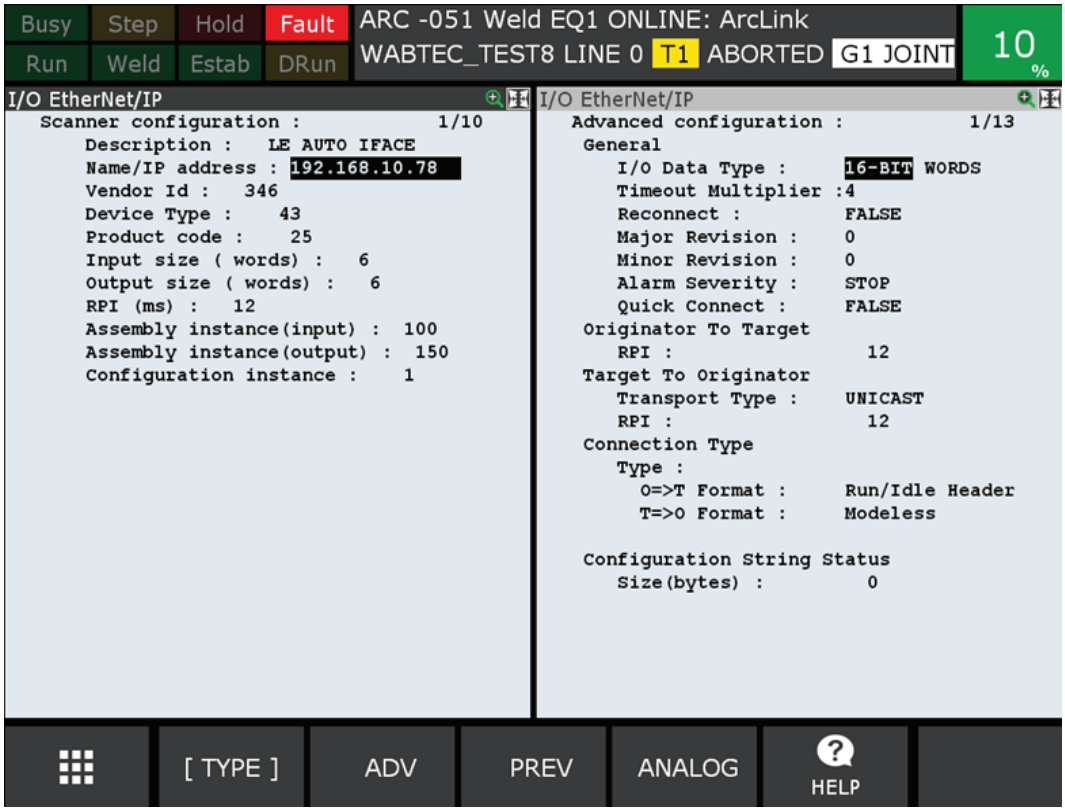
FIGURE A.2

INITIAL CONFIGURATION

EtherNet/IP Setup Parameters:

- VendCode = 346
- VendName = "Lincoln Electric Company"
- ProdType / Device Type = 43
- ProdTypeStr = "Generic Device (keyable)"
- ProdCode = 25
- MajRev = 1
- MinRev = 1
- ProdName = "LECO Automation Interface"
- I/O Data Type = 16-bit words
- Input Size (words) = 6
- Output Size (words) = 6
- RPI (ms) = 12
- Assembly Instance (input) = 100
- Assembly Instance (output) = 150

Example of a Fanuc integration:



IO FROM WELDER TO PLC/ROBOT CONTROLLER

IO from Welder to PLC/Robot Controller (see table “IO Bit Description from Welder” for more details)

Cyclic IO from Welder to PLC/Robot Controller								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Misc Module Fault	Wire Stick	WC Fault	Water Fault	WD Fault	Gas Fault	Touch Sense	Arc Detect
1	Halt	E-Stop	Job Manager Fault	PM Limit	PM Fault	Weld Complete	Limit Error	Hand Brake
2	Reserved				Weld Sequencer Current State			
3	Reserved							
4	Voltage Feedback, Low Byte (In Volts with 1 implied decimal places)							
5	Voltage Feedback, High Byte							
6	Current Feedback, Low Byte (In Amps with 1 implied decimal places)							
7	Current Feedback, High Byte							
8	Wire Drive Motor Current, Low Byte (Signed value In Amps with 2 implied decimal places)							
9	Wire Drive Motor Current, High Byte							
10	Wire Feed Speed Feedback, Low Byte							
11	Wire Feed Speed Feedback, High Byte							

IO Bit Description from Welder

Item	Description
Arc Detect	A True value indicates the Weld Controller detects an Arc.
Touch Sense	A True value indicates that the welder is testing for work piece contact and detected contact.
Gas Fault	A True value indicates there is a failure in the gas controller. If a fault occurs during the weld, Power Wave will turn the output off and will not weld until the problem is corrected and the fault is cleared.
WD Fault	Asserted when there is a fault in the Wire Drive. If a fault occurs during the weld, the Power Wave will turn the output off and will not weld until the problem is corrected and the fault is cleared.
Water Fault	True when Shutdown 1 input is open on the external I/O connector Power Wave / Power Feed Wire Feeder Interconnections section describing External I/O Connector in the Operator's Manual. If a fault occurs during the weld, the Power Wave will turn the output off and will not weld until the problem is corrected and the fault is cleared.
WC Fault	True when there is a Weld Controller fault. Refer to "Troubleshooting" in the Operator's Manual for a list of possible errors. If a fault occurs during the weld, the Power Wave will turn the output off and will not weld until the problem is corrected and the fault is cleared.
Wire Stick	A true value indicates that after the welding output is turned off there is a short between the electrode and the work piece. This will stay true until the welding output is turned on and the error is cleared or if a Touch Sense Command is asserted and the short has been cleared. This check is disabled by default and can be enabled using the attribute "Enable Wire Stick Check".
Misc Module Fault	A True value indicates that a module, like the Advance Pulse Module, STT Switch, High Frequency Switch has a fault.
Hand Brake	This bit is used to indicate that the Hand brake stop has tripped. This value is inverted from the faults. A value of 1 indicates everything is normal and a value of 0 means the hand brake has tripped.
Limit Error	Indicates that one of the Welding Job Parameters is out of limits. This will not stop welding.
Weld Complete	Indicates that the weld has completed (subsequent to the trigger going false) including any downslope, crater, burnback and postflow times. Can be true after the weld stopped due to a failure. Goes false as the next weld begins (trigger going true).
PM Fault	This bit is used to indicate that the Production Monitoring object is faulted, the usually cause for this is that the Production Monitoring object detected a limit error while welding and the Out Of Limit action was set to Alarm Latch. This faulted condition must be cleared before welding can resume; toggling the PM Flt Reset bit to the welder should clear this condition.
PM Limit	This bit is used to indicate that the Production Monitoring (PM) object detected a limit error. This bit is cleared automatically when the trigger input goes on or when the PM Flt Reset bit to the welder goes on. This bit is basically just a status item indicating a PM limit fault occurred, but depending on how PM is configured, other behavior can occur when this bit goes on. If PM is set to Fault System, then PM will shut the Power Source output off automatically when a limit error occurs, this will cause the Anybus sequencer to fault and stop welding. If PM is set to Alarm Latch and a limit error occurs, then the PM object will fault after the weld is over and welding can not resume until the PM fault is cleared (see the PM Fault bit).
E-Stop	This bit is used to indicate that the E-Stop stop has tripped. This value is inverted from the faults. A value of 1 indicates everything is normal and a value of 0 means the E-stopped has tripped.
Halt	This bit is used to indicate that the Halt stop has tripped. This value is inverted from the faults. A value of 1 indicates everything is normal and a value of 0 means the Halt has tripped.

IO Bit Description from Welder (continued)

Item	Description
Job Manager Fault	This bit is used to indicate that the Job Manager has a fault. This includes selecting a job with invalid Workpoint or Trim units, or selecting an invalid Job number.
Weld Sequencer Current State	This four bit field returns the state that the welding sequencer is currently in, where 0=Idle (Not welding), 2=Preflow, 3=Strike, 4=Start, 5=Upslope, 6=Weld, 8=Downslope, 9=Crater, 10=Burnback, 11=Postflow, 12=Restrike.
Voltage Feedback	Returns the Voltage feedback value. This value is in Volts with 1 implied decimal place.
Current Feedback	Returns the Current feedback value. This value is in Amps with 1 implied decimal place.
WD Motor Current Feedback	Returns the Wire Drive Motor Current feedback value. This is a signed value In Amps with 2 implied decimal places. A negative value indicates the motor is in reverse.
WFS Feedback	Returns the Wire Feed Speed feedback value. The units for this is depends on the setting of the attribute WFS Feedback Units. This can be either in English (Inches per Minute) or in Metric (CM per Minute). The default settings is Metric.

IO FROM PLC/ROBOT CONTROLLER TO WELDER

IO Format while in Job Mode
IO Format while using IO Parameter Inputs
IO from PLC/Robot Controller to Welder (see tables IO Bit Description to Welder for more details)

Cyclic IO from PLC/Robot Controller to Welder								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Reserved				Control Bit 1	Control Bit 0	Process Stop	Trigger
1	PM Flt Reset	Weld Disable	Reserved	Touch Sense	Reserved	CI Reverse	CI Forward	Gas Purge
2	Job Number (low byte) 1 to 1000							
3	Job Number (high byte)							
4	WorkPoint, Low Byte -32768 to 32767 (scaled to a multiplier of [0.0, 2.0])							
5	WorkPoint, High Byte							
6	Trim, Low Byte -32768 to 32767 (scaled to a multiplier of [0.0, 2.0])							
7	Trim, High Byte							
8	Production Monitoring Profile Number (1 to 200)							
9	Reserved							
10	Reserved							
11	Reserved							

IO BIT DESCRIPTION TO WELDER

IO Control Bits

Cyclic IO from PLC/Robot Controller to Welder (Control Bits)			
Control Bit #		Mode	Description
1	0		
0	0	Job Mode	Uses Job Mode and all parameters are from the stored settings.
0	1	Job Mode using IO Parameter Inputs	Uses Job Mode, but the Weld State welding parameters are from the inputs from the Cyclic IO to the welder. Note that the Trim might not be relevant for all weld modes.
1	0	N/A	Reserved for future use.
1	1	N/A	Reserved for future use.

IO FROM PLC/ROBOT CONTROLLER TO WELDER

IO Bit Descriptions to Welder

Item	Description
Trigger	The trigger is used to enable/disable welding. Can not trigger on when a cold inching input or when the Touch Sense Input is on. Trigger will only come On when these inputs are off. If set Trigger to On when one of these are On, then when these go off, must set Trigger to Off, then set Trigger back On. Before trigger on, make sure a valid Job Number is set.
Process Stop	A bit the robot can use to interrupt welding (possibly with burnback). A value of 1 interrupts welding. Has the same behavior as weld disable.
Gas Purge	Gas can be controlled explicitly by this bit if a preflow and postflow is desired. But Gas will come on and go off according to the sequencer's state machine; regardless of this bit if the Job is set to use a Preflow/Postflow if the selected mode requires Gas.
Touch Sense	This input will cause the power supply to emit only a low current, low voltage, short or zero voltage condition indicating that the wire has touched the work piece. The Touch Sensed output bit is true when touching; false otherwise. This bit should not be set while the Trigger input is true.
Weld Disable	When true in the idle state, this will prevent any welding. If this is turned on when welding and "Enable Burnback on a Fault" is true, then weld sequencer will transition to the Burnback state and then disable the weld controller preventing any welding. If this is turned on when welding and "Enable Burnback on a Fault" is set to false, then the weld will stop immediately and the weld controller will be disabled preventing any welding.
CI Fwd CI Rev	Cold Inch Forward or Cold Inch Reverse. These inputs will cause the wire to "cold inch". The direction is determined by which bit is true (the second bit set true is ignored). The wire feed speed is determined by the value of the Cold Inch Speed on the Wire drive. Note that these inch command inputs are ignored while welding (Trigger = true).
PM Flt Reset	Production Monitoring Fault Reset. This bit is used when using Production Monitoring to clear a production monitoring fault or alarm.
Job Number	This input to the welder is used to select the desired Job Number to weld with. The valid range is from 1 to 1000. Note that there must be a valid job "programmed" for the selected job number. The programmed Job Workpoint and Trim units must match the present units for these items in order to weld.
Workpoint	A Workpoint rescaling value. The rescaling input value range is -32767 to 32767. -32767 sets value to 0% of nominal; 0 sets value to 100% of nominal; 32767 sets value to 200% of nominal.
Trim	A Trim rescaling value. The rescaling input value range is -32767 to 32767. -32767 sets value to 0% of nominal; 0 sets value to 100% of nominal; 32767 sets value to 200% of nominal.
PM Profile number	The PM profile number to use

OPERATION

SAFETY PRECAUTIONS

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

⚠ WARNING

ELECTRIC SHOCK can kill.

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

FUMES AND GASES can be dangerous.

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

WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.
- Do not weld on containers that have held combustibles.

ARC RAYS can burn.

- Wear eye, ear, and body protection.

Observe additional guidelines detailed in the beginning of this manual.

GRAPHIC SYMBOLS THAT APPEAR ON THIS MACHINE OR IN THIS MANUAL

INPUT POWER

DIRECT CURRENT

U_1 INPUT VOLTAGE

I_1 INPUT CURRENT

WARNING OR CAUTION

EXPLOSION

DANGEROUS VOLTAGE

SHOCK HAZARD

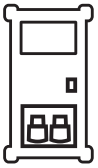
READ INSTRUCTION MANUAL

USB

CUSTOMER NETWORK

ROBOT NETWORK

PENDANT CONNECTION



WELDING POWER SOURCE CONNECTION

PRODUCT DESCRIPTION

Automation Interface is an add-on module intended to be used with Lincoln Electric Arclink welders such as Power Wave R450 and S500. The module mounts on a panel near the Power Source. The Automation Interface add-on contains a Lincoln Electric PCB with an HMS Anybus CompactCom M40 module. The Automation Interface works as a gate between an industrial network and the welder's internal Arclink network, to allow for a job mode style of operation. The Automation interface is designed for ease of use with an industrial PLC via the Ethernet/IP protocol.

It also works as the welding sequencer for the welder and is capable of storing up to 1000 welding jobs. A welding job contains all necessary welding parameters: from PostFlow, to Striking, Ramping up, Welding, Ramping down, Crater fill, Burnback operation, and Post Flow. Configuration of the job can be done in one of two different ways, using the Automation Interface Pendant or through the Power Wave Manager software.

When replacing an Automation Interface module or this board, the Jobs should be backed up first, and then restored when the new module/board is installed.

RECOMMENDED PROCESSES AND EQUIPMENT

The Automation interface module is designed for use in robotic welding applications. It can be used with GMAW and FCAW processes.

The unit is compatible with S-Series or R-Series Power Wave Power Sources. In some cases, an S-series Power Source will require an AutoDrive 19.

PROCESS LIMITATIONS

Not compatible with SAW or GTAW.

DESIGN FEATURES

- A device that acts as Power Wave to Robot interface when ArcLinkXT is unavailable
- A device to set job modes for robot retrieval
- A device that can communicate over industrial ethernet protocols
- A graphical user interface for easy setup and modification of jobs
- A device that sends welding data out via OPC-UA
- A device that acts as a Reveal credit activation system

EQUIPMENT LIMITATIONS

Locate the module in a dry location.

OPERATION OF MULTI-MODE SYSTEMS

An Automation Interface Pendant is not required in every Automation Module installation. One pendant is necessary to interface with a module to configure the system. This single pendant can by moved to other systems to be used for configuration

Job Modes are stored on the respective modules. The pendant will reflect the jobs stored on a given module. The pendant is not intended to be used to transfer jobs to another module. Using a pendant, jobs can be imported and exported from a USB storage device.

When a pendant is plugged or unplugged from a system the Power Wave will re-boot and re-establish an Ethernet/IP connection. This process takes approximately 30 seconds.

OPERATION OF MODULE

There are three modes of operation for the module; Job Mode, Job Mode with Parameter Inputs, and Pendant Weld Override Mode. The I/O Control Bits on the Cyclic I/O to the welder control Job Mode or Job Mode with Parameter Inputs. Pendant Weld Override Mode is selected on the Pendant itself. The Job Mode methods of operation assume that a “Job” or “Jobs” have been preconfigured using a pendant or perhaps by the Power Wave Manager.

A Job is basically the welding sequence that will be preformed when the trigger input is activated on the Cyclic I/O. The selected job will select the welding wave form (the weld mode), the welding parameters for the wave form, and the welding sequence. The welding sequence refers to things like ramping up or down, performing a crater fill, burnback, etc (see the section on Weld Sequencer). During welding, the actual job number can be changed at any time, however there are some limitations of this, see the Weld Sequencer, Sequencer Notes.

MODES OF OPERATION

Job Mode

This is the most basic and common mode of operation for the interface. All that is required to make a weld, provided that the jobs have been setup already, is to set a valid Job number, then assert the trigger bit. Then, during welding, monitor the digital feedback bits for any faults or possible issues such as the Arc Detect bit not coming on. The interface will automatically turn on the gas controller if a weld mode “requires” gas and turn on the Wire Drive.

Job Mode must be turned off to update jobs.

Job Mode with Parameter Inputs

This mode of operation is selected with the IO Control Bits and is similar to the Job Mode, except while in the Weld sequencer state (see Weld Sequencer). When in the Weld Sequencer state, the state wave form parameters will be set using I/O coming from the robot/PLC interface instead of the parameters from the Job setup. These I/O parameters can be changed as many times as desired. If the Job is set up to perform something like Up Slope or Crater, it will still do it. If it is desired for the interface to perform these functions, then make sure that selected Job is not setup to perform them. There are only two scaling inputs; Workpoint/(Non-Synergic Wire Feed Speed) and Trim/(Non-synergic Voltage). The Non-Synergic WFS is active for Non-Synergic wave forms only. For example for Synergic pulse modes, Trim controls “Trim” with engineer units from 0 to 2. This value is scaled from a range of -32768 to 32767 as such; -32768, 0, and 32767 correspond to 0, 1, and 2 respectively.

Example:
If one has a nominal workpoint of 300 IPM, A value of -32768 from the robot would correspond to a multiplier of 0.0 and a net workpoint of 0 IPM (This value would generate a scaling warning from the Automation Interface to the robot). Starting with the same 300 IPM workpoint, a value of 0 from the robot would correspond to a scaling of 1.0 and a net workpoint of 300 IPM. Finally a value of 32767 from the robot would correspond to a scaling of 2.0 and a net workpoint of 600 IPM.

PENDANT WELD OVERRIDE MODE

This mode of operation will force the Robot/PLC to weld with whatever the active settings are shown in the Automation Interface Pendant. This mode is entered into by holding the “Job Mode” text in the upper left part of the screen. In this mode the robot/PLC will always weld with what is shown on the pendant screen and any Job Mode adjustments over the communication protocol will be ignored.

WELD SEQUENCER

The Automation Interface has a built in welding sequencer that controls time and event related sequences of the welding process and operation of standard peripherals objects. For standardization purposes of application descriptions, communicating cause and effect relationships, a generalized model (shown below) was chosen for the sequencer. Sequencer states are shown on Figure B.1.

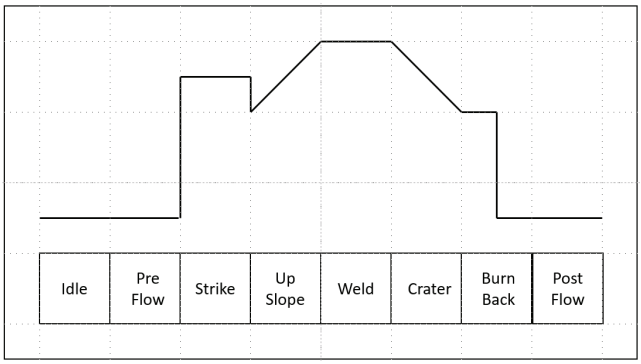


FIGURE B.1

Not all these sequencer states need to be used for a Job. For the Preflow, Up Slope, Crater, Burnback, and Post Flow states, these states are entered only if a state time is set for them. If their state time is 0, then the state will be bypassed. For the most basic welding, the only necessary states are Idle, Strike, and Weld; these states are always enabled. For the “welding” states (Strike, Upslope, Weld, Crater, and Burnback), each of these states has their own parameters that control the wave

form. For every welding state that is used, the state's control parameters must be initialized before welding. The only exception to this rule is if Job mode with Parameter Inputs is being used, then the welding state parameters are obtained from the I/O parameters inputs.

CASE FRONT CONTROLS

Pendant (See Figure B.2)

- **Left adjustment dial**: Rotate to increment values up or down for a selected function.
- **Center dial/pushbutton**: Rotate to select inputs, push to confirm selection.
- **Right adjustment dial**: Rotate to increment values up or down for a selected function.
- **M12 (module) port**: Connects and interfaces with Module.
- **USB ports (2 ports)**: Connects to USB devices and can be used to update software and import/export memories.

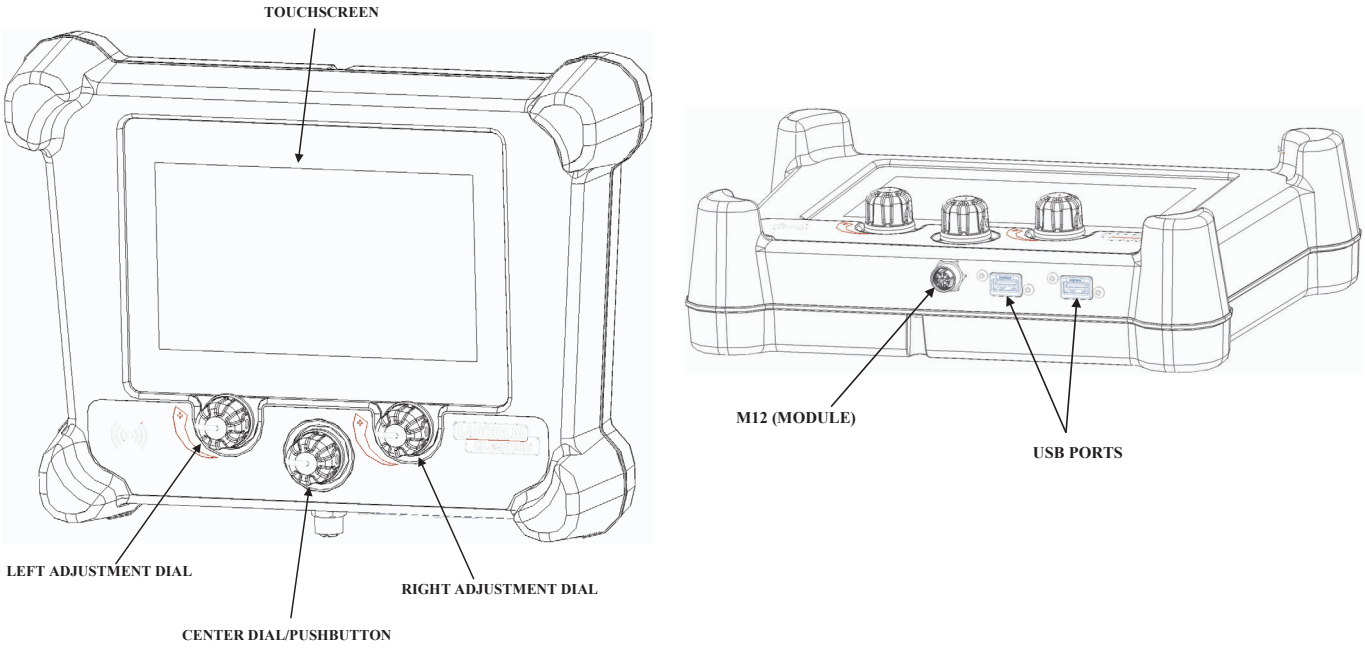


FIGURE B.2

CASE FRONT CONTROLS

Module (See Figure B.3)

- **Ethernet port**: Used to connect and run programs from laptop, for example Checkpoint and Power Wave Manager.
- **ArcLink "OUT" Connection**: This is the 5-pin Arclink 'OUT' connection for making downstream connections to the wire feeder when connecting in series.
- **ArcLink 'IN' connection**: This is the 5-pin Arclink 'IN' connection for connection to the weld power supply.
- **Status LED**: Light indicator to show power connectivity and error status.
- **AnyBus Module**: Connects to Robot using Ethernet/IP to allow for job mode style of operation.
- **M12 ports (2 ports)**: Connects and interfaces with power supply. Connects and interfaces with Pendant.
- **USB ports (3 ports)**: Connects to USB devices.

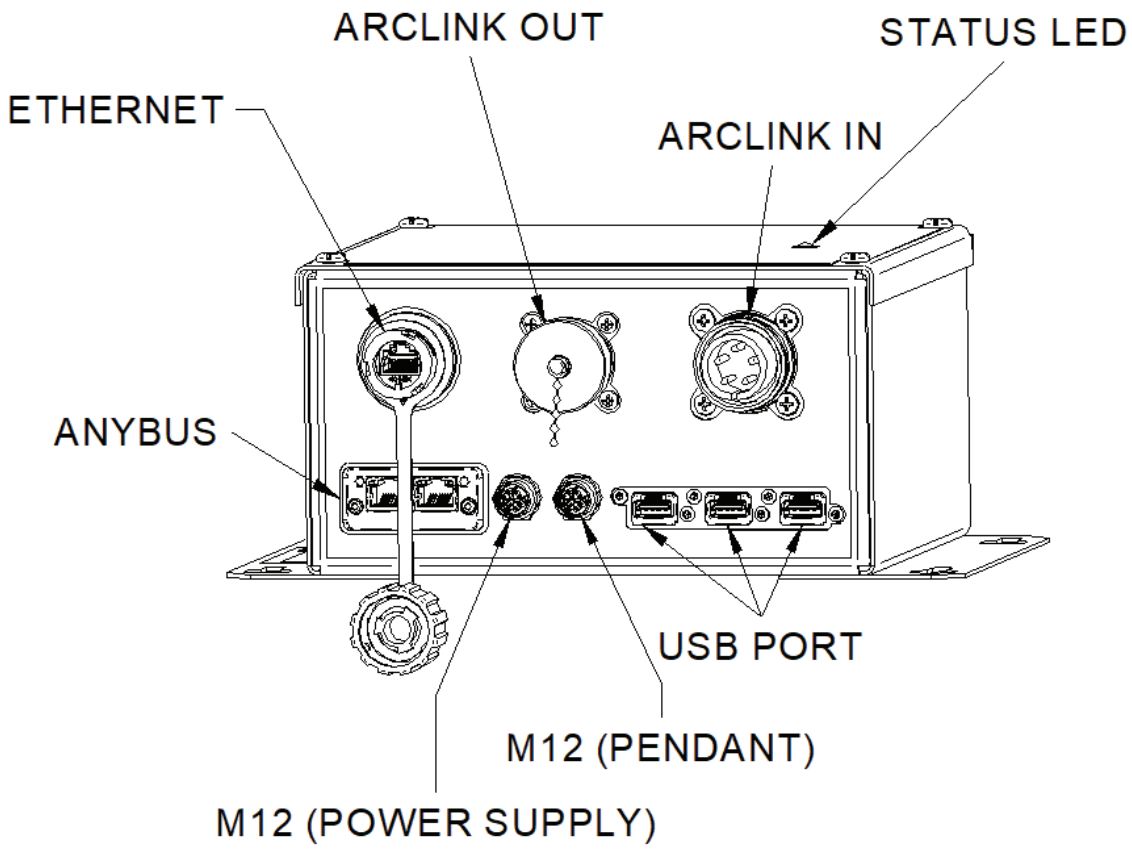


FIGURE B.3

MODULE M12 PIN ASSIGNMENTS

(See Figure B.4)

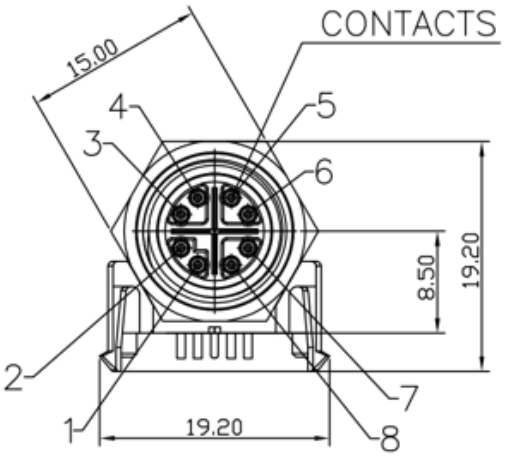


FIGURE B.4

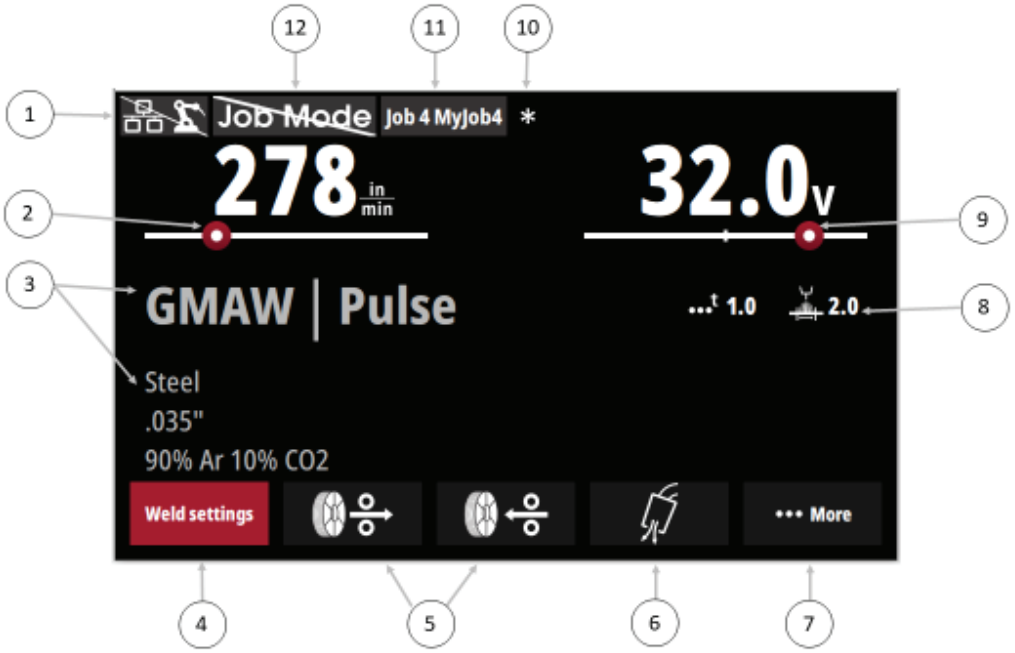
(J60) M12 TO POWER SUPPLY	
Pin	Function
1	Ethernet RX+
2	Ethernet RX-
3	Ethernet TX+
4	Ethernet TX-
5	N/C
6	N/C
7	N/C
8	N/C
9	Shield

(J61) M12 TO PENDANT	
Pin	Function
1	Ethernet RX+
2	Ethernet RX-
3	Ethernet TX+
4	Ethernet TX-
5	COMMON
6	40VDC
7	N/C
8	N/C
9	Shield

PENDANT OPERATION

Pendant Home Screen Layouts – can be displayed in two modes, Advanced and Simplified. This setting can be toggled by selecting "…More"/System Menu/Advanced System Settings/ Home Screen Layout.

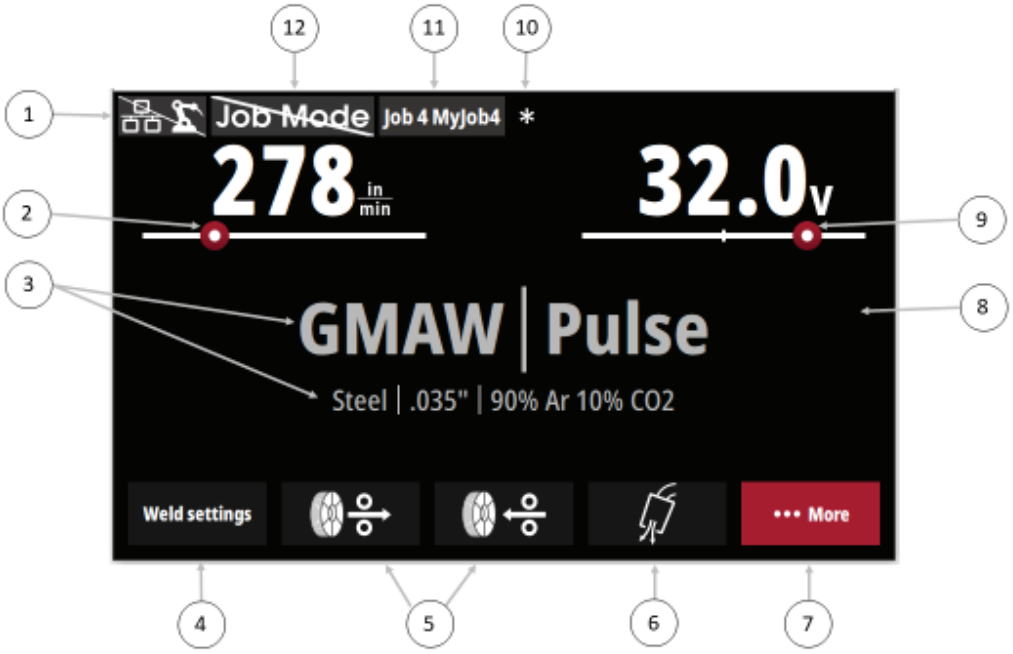
Advanced Screen Layout



Certain selections such as Wire cold-feed, Gas Purge, and Job Mode enable/disable can be activated with a "long press" or sustained press. The long press can be accomplished by touching and holding on the touch screen, or selecting with the center dial/pushbutton and pressing/holding the pushbutton.

1. Robot connection status
2. Wire feed speed adjustment slider – only visible when Job Mode is disabled. Press/drag to adjust.
3. Weld process information – set by selected Job Mode or by using Weld Settings button.
4. Weld settings button – accesses welding process settings.
5. Wire cold-feed buttons – enable with press/hold.
6. Gas Purge button – enable with press/hold.
7. More setting button. Touch to select.
8. Advanced settings not shown in Simplified Screen Layout.
9. Voltage adjustment slider – only visible when Job Mode is disabled. Press drag to adjust.
10. " * " indicator shows the job mode has been modified from its intended settings
11. Job mode number and user defined Job Name. Job mode number {1 – 1000} is used by the robot to access this job.
12. Job Mode indicator – show if Job Mode is enable or disabled. Toggle with long press.

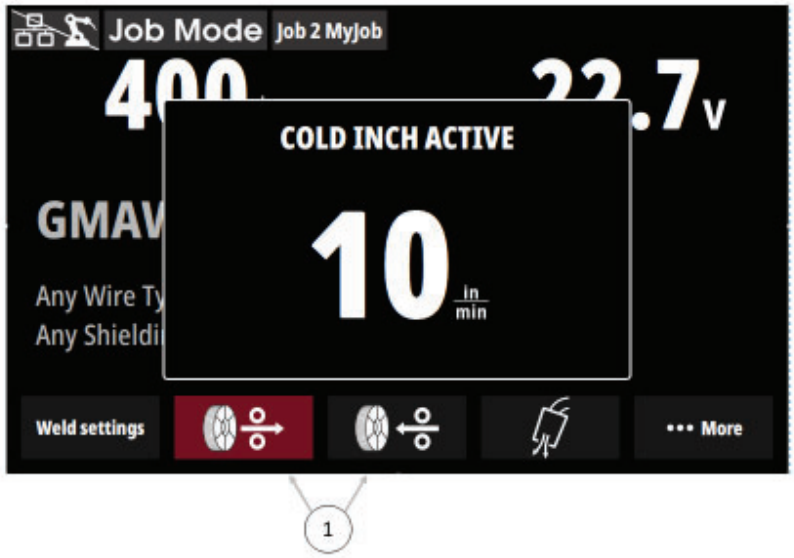
Simplified Screen Layout



Certain selections such as Wire cold-feed, Gas Purge, and Job Mode enable/disable can be activated with a “long press” or press/hold. The long press can be accomplished by touching and holding on the touch screen, or selecting with the center dial/pushbutton and pressing/holding the pushbutton.

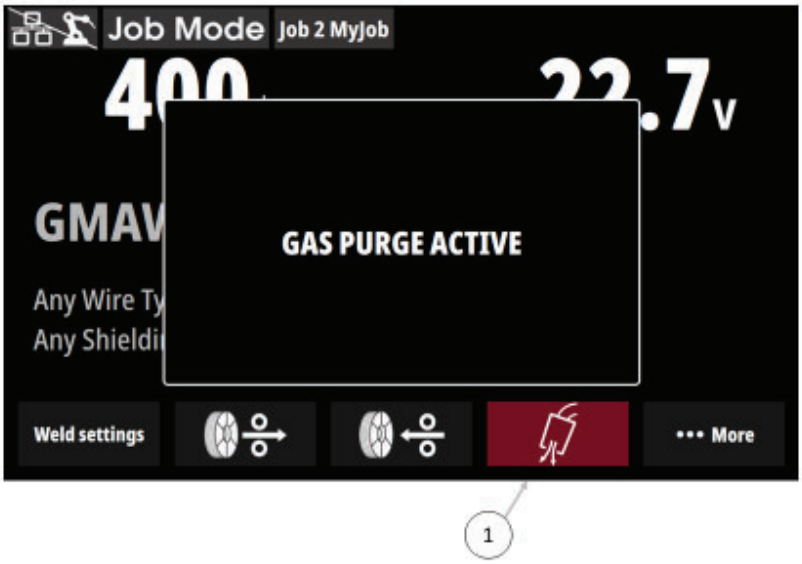
1. Robot connection status
2. Wire feed speed adjustment slider – only visible when Job Mode is disabled. Press/drag to adjust.
3. Weld process information – set by selected Job Mode or by using Weld Settings button.
4. Weld settings button – accesses welding process settings.
5. Wire cold-feed buttons – enable with press/hold.
6. Gas Purge button – enable with press/hold.
7. …More setting button. Touch to select.
8. Advanced settings not shown in Simplified Screen Layout.
9. Voltage adjustment slider – only visible when Job Mode is disabled. Press drag to adjust.
10. “ * “ indicator will appear after the job mode has been modified from its saved settings.
11. Job mode number and user defined Job Name. Job mode number is used by the robot to access this job.
12. Job Mode indicator – show if Job Mode is enable or disabled. Toggle with long press.

COLD FEEDING



1. Select the desired cold-feeding direction by rotating the center knob or by touching the touch screen button.
2. Press/hold the center pushbutton or hold the touch screen button to activate cold-feeding.
3. While cold-feed is active, rotate the left wire feed speed adjustment dial to adjust cold-feeding speed. This adjusts cold-feed speed only and does not affect the welding parameters. Once the center pushbutton or touch screen is released, the cold-feed speed will reset to its default value.

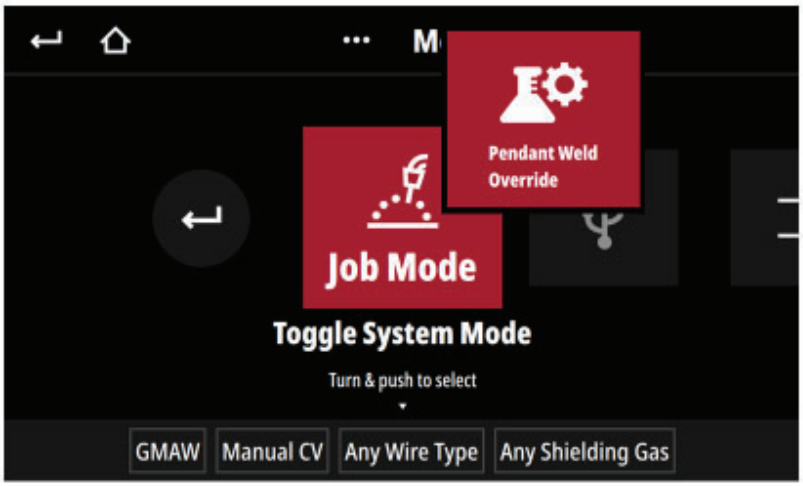
GAS PURGE



1. Select the Gas Purge by rotating the center knob or by touching the touch screen button.
2. Press/hold the center pushbutton or hold the touch screen button to activate gas purge.
3. Release the center push button or release the touch screen to stop gas purge.

…MORE SETTINGS MENU / JOB MODE / PENDANT MODE OVERRIDE

1. To toggle system mode between Job Mode and Pendant Override Mode, press/hold the Job Mode indicator at the top of the screen OR using the center knob or touch screen, select the …More button.
2. Select or touch the Job Mode / Pendant Mode Override button to toggle to the opposite mode.

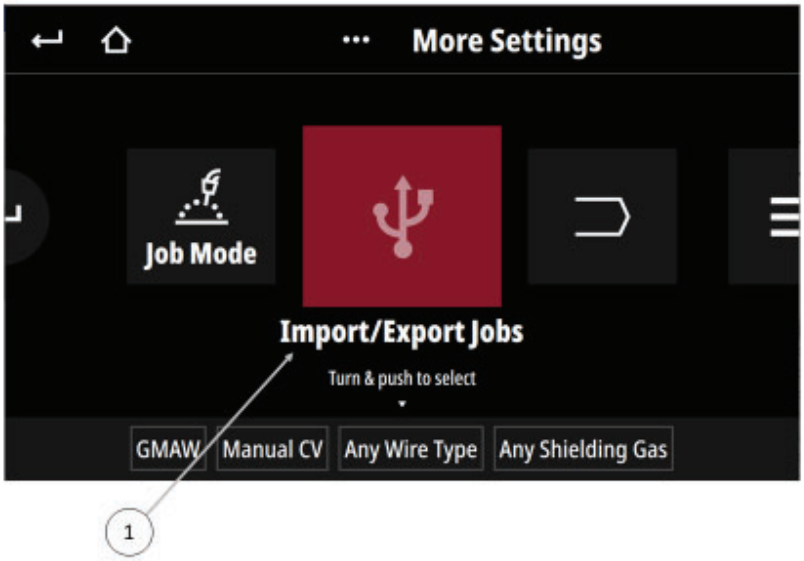


3. Select the BACK ↵ or HOME button to return to the Home Screen. The Job Mode Indicator on the Home Screen will show its current setting.

…MORE SETTINGS MENUT / IMPORT/ EXPORT JOBS

1. Insert a USB memory device into any USB port on the pendant. The USB symbol will change to white when a USB device is detected. Select IMPORT/EXPORT JOBS from the …MORE menu.

   NOTE: USB device must be formatted as FAT32

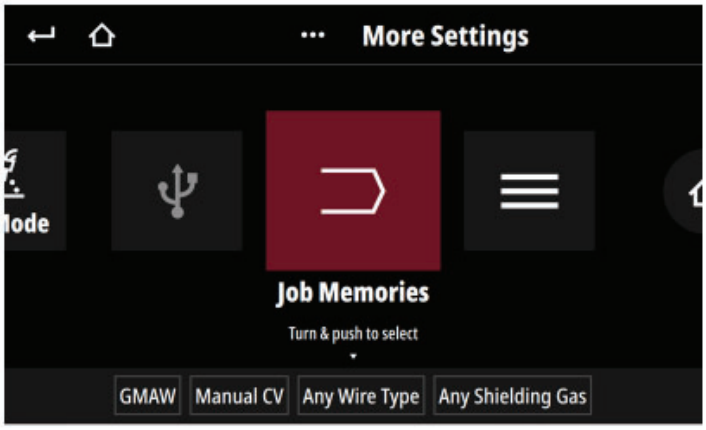


2. Select the option to “Import to Machine” or “Export to USB Storage”.

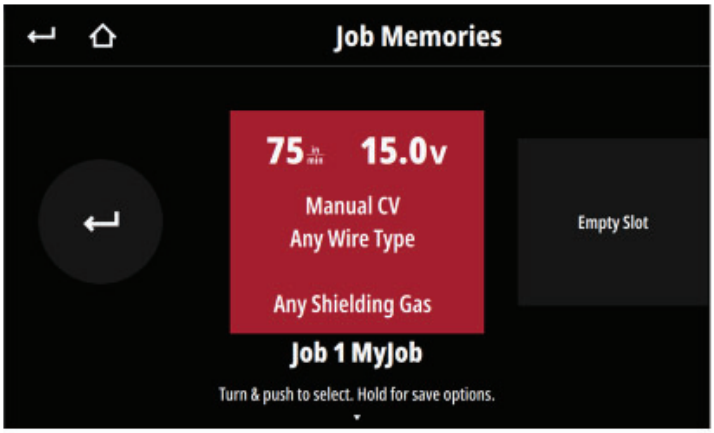
   Importing jobs to the machine will erase all jobs listed in the Job Memories menu currently on the machine and replace them with those on the USB storage device. If there are no valid jobs on the USB storage device an error will be displayed and the machine’s jobs will be unchanged.

   Exporting jobs to the USB storage device will erase any jobs on the USB storage device and replace them with the jobs listed in the Job Memories menu on the machine. If no valid jobs exist on the machine an error will be displayed and the jobs on the USB storage device will be unchanged.

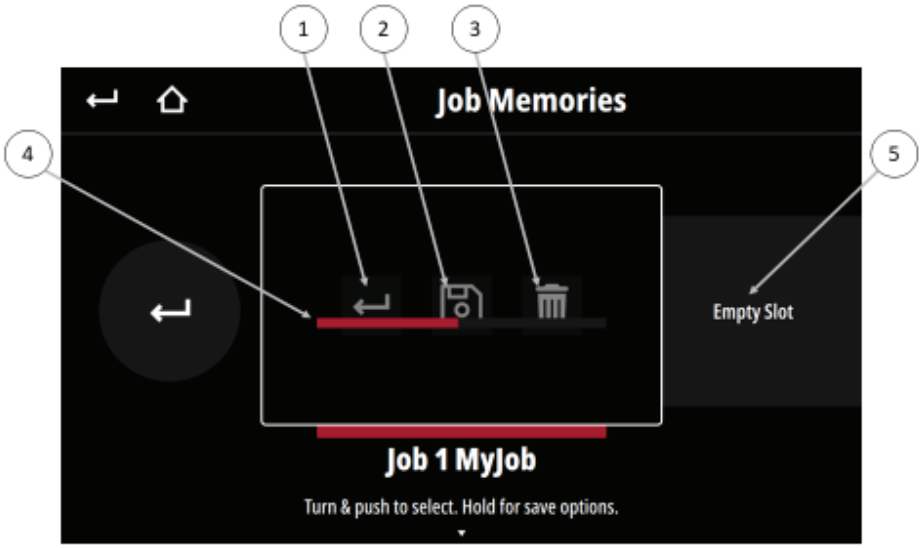
…MORE SETTINGS MENU / JOB MEMORIES



1. Select JOB MEMORIES from the …MORE menu. This will display the Job Memory slots and their contents.



2. Press/hold the touch screen or center pushbutton to save or delete Job Memories. When press/holding memory location, a progress bar will appear. Continue to hold until the bar completes and disappears. A menu to go back, save, or delete the contents of the memory location will remain after the progress bar completes.
   Select the desired option. If SAVE is selected, a touch-screen keyboard will appear and a custom memory name can be assigned. If a memory location is in use and a save is performed, the contents of the Job Memory contents will be replaced with the settings currently in use on the Home Screen.
   If delete is selected, the contents will be deleted and the location will display Empty Slot. Up to 1000 Job Memory slots are available.



1. Back 2. Save 3. Delete 4. Progress Bar 5. Empty Slot

Sequencer State Description

State	Purpose	Exit Conditions	Equipment State
IDLE	Ready to weld.	1) Trigger On	Output: Off Wire: Off Gas: Off
PREFLOW	Gas purge before welding.	1) Preflow Timer 2) Trigger Off	Output: Off Wire: Off Gas: On
STRIKE	Allow arc to establish. This is a Non-synergic state where Strike Speed is set independently of strike workpoint.	1) Arc Established 2) Strike Timer 3) Trigger Off	Output: On Wire: On Gas: On
START	Allow process to stabilize following initial arc establishment and prior to steady state.	1) Start Timer 2) Trigger Off 3) Arc Out	Output: On Wire: On Gas: On
UPSLOPE	Welding parameters are ramped (linearly) to their steady state welding (WELD) values.	1) Upslope Timer 2) Trigger Off 3) Arc Out	Output: On Wire: On Gas: On
WELD	Steady welding state.	1) Trigger Off 2) Arc Out	Output: On Wire: On Gas: On
DOWNSLOPE	Welding parameters are ramped (linearly) from their steady state welding values to arc ending values.	1) Downslope Timer 2) Trigger On 3) Arc Out	Output: On Wire: On Gas: On
CRATER	Allows the welding crater to be “filled”.	1) Crater Timer 2) Trigger On 3) Arc Out	Output: On Wire: On Gas: On
BURNBACK	Allows for proper wire stick out following a weld.	1) Burnback Timer 2) Trigger On 3) Arc Out	Output: On Wire: Off Gas: On
POSTFLOW	Gas purge after welding.	1) Postflow Timer 2) Trigger On	Output: Off Wire: Off Gas: On
RESTRIKE	Allows the arc to re-establish if extinguished unexpectedly during the weld. This is a Non-synergic state where “Restrike Speed” is set independently of strike workpoint.	1) Arc Established 2) Restrike Timer 3) Trigger Off	Output: On Wire: On Gas: On

Sequencer State Transitions

LGA Weld Sequencer State Transitions					
Current State	**Trigger On**	**Trigger Off**	**Arc On**	**Arc Off**	**Time Expires**
(0) Idle	If Preflow time goes to Preflow, else go to Strike.	-	-	-	-
(2) Preflow	-	Go to Idle	-	-	When time expires, go to Strike
(3) Strike	-	Go to Idle	If Start time go to Start, else if Upslope time go to Upslope , else go to Weld	-	If Strike fault timer set, go to Idle
(4) Start	-	if Burnback time go to BB, else if Postflow time go to Postflow, else go to Idle	-	Go to ReStike	if Upslope time go to Upslope , else go to Weld
(5) UpSlope	-	if Burnback time go to BB, else if Postflow time go to Postflow, else go to Idle	-	Go to ReStike	Go to Weld
(6) Weld	-	If Downslope time go to D.S., else if Crater time go to Crater, else if Burnback time go to BB, else if Postflow time go to Postflow, else go to Idle	-	Go to ReStike	-
(8) DownSlope	Go to Weld	-	-	if Postflow time go to Postflow , else go to Idle	if Crater time go to Crater, else if Burnback time go to BB, else if Postflow time go to Postflow, else go to Idle
(9) Crater	Go to Weld	-	-	if Postflow time go to Postflow ,	if Burnback time go to BB, else if Postflow time go to

Sequencer Notes

Item	Description
States	The Weld Sequencer supports the Idle, Preflow, Strike, Start, Upslope, Weld, Downslope, Crater, Burnback, Postflow, and Restrike states.
State Numbers	The state numbers follow the standard Weld Sequencer state numbering – Idle (0), Preflow (2), Strike (3), Start (4), Upslope (5), Weld (6), Downslope (8), Crater (9), Burnback (10), Postflow (11), and Restrike (12) states. This number is used only for certain events which might be logged when there is an issue.
Have a Downslope time, but no Crater time.	If have a Downslope Time, but no Crater time, then the Downslope time will be divided between the Downslope and Crater states.
Switching Jobs	If change Jobs numbers during a state with a State timer, then the new settings will be switched too, but the interface will continue using the old state timer from the last Job # for the current weld.
Upslope/Downslope	The time between slope updates is fixed at 100ms and the total slope time will always be rounded off to 100ms. Always one step will be done, even if the slope time is less than 100ms.
	The number of slope steps that are done is equal to the slope time divide by 100, with the reminder dropped. For example if a time of 240 ms is entered, then 2 steps will be done.
	WorkPoint, Trim, and WFS will be sloped.
	Sloping can go in a positive or negative direction for both Upslope and Downslope.
	Upslope goes from the Start settings to the Upslope settings. Downslope goes from the Downslope Settings to the Crater settings.
	If Job numbers will be change during upsloping, upsloping will stop and it will go to the welding state. If Job numbers change during downsloping, downsloping will stop, and it will proceed to the next enabled end state.

Miscellanous Notes

Item	Description
WorkPoint in Amps, Trim in Volts	These settings should be set to the desired values in the weld control before any jobs are setup. Once a job(s) is setup, these values must not be changed, else the job will be considered invalid. If these values are changed, then the welder must be reset in order to welding with the Interface.
Sending an Invalid Job	If an invalid job is sent to the board, it will be accepted and saved, but you can not weld with it. An invalid job is a job that has a non-existent welding mode or a WorkPoint or Trim value with the wrong units.
Updating the current Job Number in use.	If an updated Job is download to the board, any new setting will not take effect if that Job is currently in use and welding. When the welding goes to idle, it will be updated.
If weld mode uses gas	If the welding mode requires gas, the gas will be turned on when the Preflow or Strike is entered first. So the user does not have to turn on the Gas Purge bit on the I/O.
Setting Feedback Rate	Used to set the feedback rate in the Weld Controller for the Current and Voltage and the WFS feedback rate in the Wire Drive. This takes effect only after reset. If this value is greater than the present setting, then no update will be done.
Enable Wire Stick Check	After changing this setting the system must be reset in order to take effect.
Enable Burnback on a Fault	If Enable Burnback on a Fault is false, then if welding and a fault occurs, the sequencer should turn everything off and go to the Idle state immediately. If the Enable Burnback on a Fault is True, then if welding and a fault occurs, the sequencer will transition to the Burnback state if a Burnback state time is set. If it was the Weld controller that actually faulted, it stil will transition to the Burnback state, but the weld output will be off so no actual burnback will be done.
Production Monitoring Profile	The Interface can be setup to select the Production Monitoring Profile number when a job is selected. The valid profiles numbers range from 1 to 200. If an invalid profile number is set in the job setup, then the Interface will not write any profile number out and Production Monitoring should remain using the last valid profile number.
Job Mode with Parameter Inputs	The I/O control bit to put the interface into this mode must be set to True before the welding state is entered. If this is not done the welder will use the values defined in the Job setup when the weld state is first entered. If the input is set to False when in the weld state, the welder will keep using the last entered values that were sent over the I/O interface.

TROUBLESHOOTING GUIDE

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(S).

The second column labeled “POSSIBLE AREA(S) OF MISADJUSTMENTS” 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 Areas of Misadjustment(s).

Service and Technical Support

For information about specific adjustments, maintenance or repair jobs which are not dealt with in this manual, please contact Lincoln Electric Automation Department 888-935-3878.

Make sure you have the following data on hand:

- product name
- serial number
- purchase order (number + date) for warranty verification

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

Status LED Definition

LIGHT CONDITION	MEANING
	Automation Interface Module Status Light
Steady Green	System OK. Power source is operational, and is communicating normally with all healthy peripheral equipment connected to its ArcLink network.
Blinking Green	Occurs during power up or a system reset, and indicates the module is mapping (identifying) each component in the system. Normal for up to 30 seconds after power is turned on, or if the system configuration is changed during operation.
Fast Blinking Green	Indicates Auto-mapping has failed or the peripheral's IP address is selected when attempting to update the system.

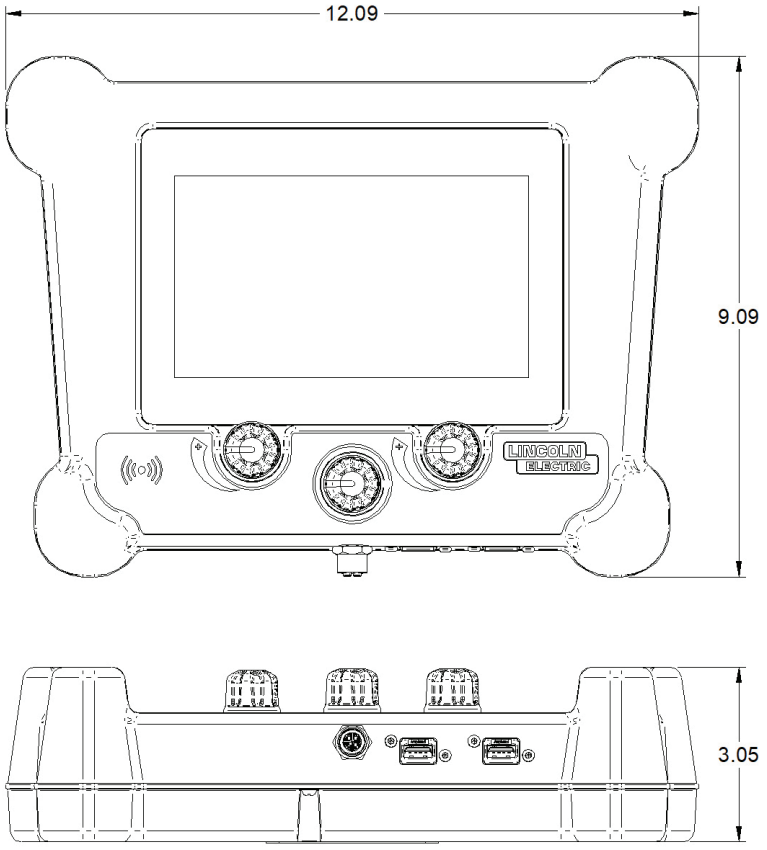
If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact your Lincoln Authorized Service Facility for technical troubleshooting assistance before you proceed.
WWW.LINCOLNELECTRIC.COM/LOCATOR

Observe all Safety Guidelines detailed throughout this manual

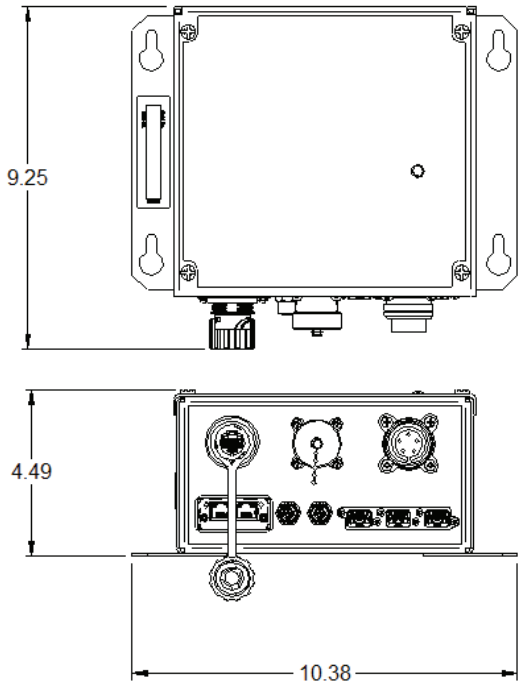
Observe all Safety Guidelines detailed throughout this manual		
PROBLEMS (SYMPTOMS)	**POSSIBLE CAUSE**	**RECOMMENDED COURSE OF ACTION**
FUNCTION PROBLEMS		
No Connection to Robot.	1. Incorrect Ethernet/IP communication settings.	Check Anybus communication settings in Advanced Setting menu.
	1. Incorrect IP address.	Check IP address has been set correctly in the Advanced Setting menu.
Pendant Screen Not Lit.	1. Incorrect M12 connector used on module.	Plug pendant cable into pendant connector of module.
	1. ArcLink cable disconnected.	Plug ArcLink cable into module and power source.
Module Status LED Not Lit.	1. ArcLink cable disconnected.	Plug ArcLink cable into module and power source.
Pendant continuously shows scrolling bar.	1. Module M12-RJ45 cable unplugged.	Connect cable to module and power source.
	1. Power Source has static IP address.	Change to automatically obtain an IP address.
	1. Old software in power source.	Update power source to latest software via powerwavesoftware.com.

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

Pendant



Module



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WARNING	● Do not touch electrically live parts or electrode with skin or wet clothing. ● Insulate yourself from work and ground.	● Keep flammable materials away.	● Wear eye, ear and body protection.
Spanish **AVISO DE PRECAUCION**	● No toque las partes o los electrodos bajo carga con la piel o ropa mojada. ● Aislese del trabajo y de la tierra.	● Mantenga el material combustible fuera del área de trabajo.	● Protéjase los ojos, los oídos y el cuerpo.
French **ATTENTION**	● 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.	● Gardez à l'écart de tout matériel inflammable.	● Protégez vos yeux, vos oreilles et votre corps.
German **WARNUNG**	● Berühren Sie keine stromführenden Teile oder Elektroden mit Ihrem Körper oder feuchter Kleidung! ● Isolieren Sie sich von den Elektroden und dem Erdboden!	● Entfernen Sie brennbarres Material!	● Tragen Sie Augen-, Ohren- und Körperschutz!
Portuguese **ATENÇÃO**	● Não toque partes elétricas e electrodos com a pele ou roupa molhada. ● Isole-se da peça e terra.	● Mantenha inflamáveis bem guardados.	● Use proteção para a vista, ouvido e corpo.
Japanese **注意事項**	● 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。	● 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。	● 目、耳及び身体に保護具をして下さい。
Chinese **警 告**	● 皮肤或湿衣物切勿接触带电部件及焊条。 ● 使你自己与地面和工件绝缘。	● 把一切易燃物品移离工作場所。	● 保戴眼、耳及身體勞動保護用具。
Korean **위 험**	● 전도체나 용접봉을 젖은 헝겁 또는 피부로 절대 접촉치 마십시요. ● 모재와 접지를 접촉치 마십시요.	● 인화성 물질을 접근 시키지 마시요.	● 눈, 귀와 몸에 보호장구를 착용하십시요.
Arabic **تحذير**	● لا تلمس الاجزاء التي يسري فيها التيار الكهربائي أو الالكترود بجلد الجسم أو بالملابس المبللة بالماء. ● ضع عازلا على جسمك خلال العمل.	● ضع المواد القابلة للاشتعال في مكان بعيد.	● 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.

			
● Keep your head out of fumes. ● Use ventilation or exhaust to remove fumes from breathing zone.	● Turn power off before servicing.	● Do not operate with panel open or guards off.	**WARNING**
● Los humos fuera de la zona de respiración. ● Mantenga la cabeza fuera de los humos. Utilice ventilación o aspiración para gases.	● Desconectar el cable de alimentación de poder de la máquina antes de iniciar cualquier servicio.	● No operar con panel abierto o guardas quitadas.	Spanish **AVISO DE PRECAUCION**
● Gardez la tête à l'écart des fumées. ● Utilisez un ventilateur ou un aspirateur pour ôter les fumées des zones de travail.	● Débranchez le courant avant l'entretien.	● N'opérez pas avec les panneaux ouverts ou avec les dispositifs de protection enlevés.	French **ATTENTION**
● Vermeiden Sie das Einatmen von Schweibrauch! ● Sorgen Sie für gute Be- und Entlüftung des Arbeitsplatzes!	● Strom vor Wartungsarbeiten abschalten! (Netzstrom völlig öffnen; Maschine anhalten!)	● Anlage nie ohne Schutzgehäuse oder Innenschutzverkleidung in Betrieb setzen!	German **WARNUNG**
● Mantenha seu rosto da fumaça. ● Use ventilação e exhaustão para remover fumo da zona respiratória.	● Não opere com as tampas removidas. ● Desligue a corrente antes de fazer serviço. ● Não toque as partes elétricas nuas.	● Mantenha-se afastado das partes moventes. ● Não opere com os paineis abertos ou guardas removidas.	Portuguese **ATENÇÃO**
● 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。	● メンテナンス・サービスに取りかかる際には、まず電源スイッチを必ず切って下さい。	● 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**
● 頭部遠離煙霧。 ● 在呼吸區使用通風或排風器除煙。	● 維修前切斷電源。	● 儀表板打開或沒有安全罩時不準作業。	Chinese **警 告**
● 얼굴로부터 용접가스를 멀리하십시요. ● 호흡지역으로부터 용접가스를 제거하기 위해 가스제거기나 통풍기를 사용하십시요.	● 보수전에 전원을 차단하십시요.	● 판넬이 열린 상태로 작동치 마십시요.	Korean **위 험**
● ابعد رأسك بعيداً عن الدخان. ● استعمل التهوية أو جهاز ضغط الدخان للخارج لكي تبعد الدخان عن المنطقة التي تتنفس فيها.	● اقطع التيار الكهربائي قبل القيام بأية صيانة.	● لا تشغل هذا الجهاز اذا 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，並請遵守貴方的有関勞動保護規定。

이 제품에 동봉된 작업지침서를 숙지하시고 귀사의 작업자 안전수칙을 준수하시기 바랍니다.

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

CUSTOMER ASSISTANCE POLICY

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

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

WELD FUME CONTROL EQUIPMENT

The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

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