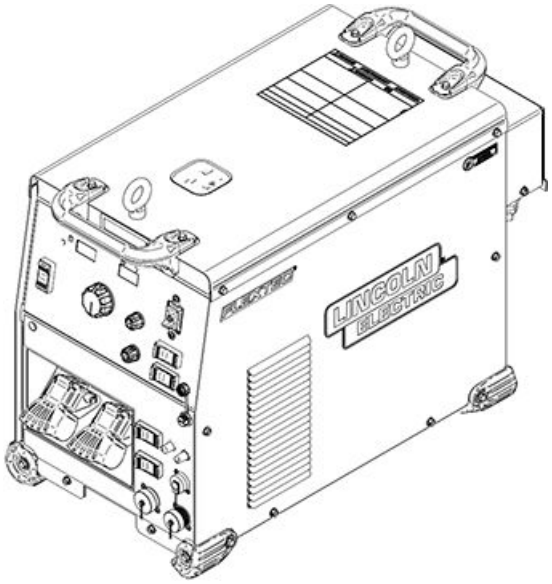
INSTRUCTION MANUAL

FLEXTEC® 650 SUBARC



For use with Product/Code Numbers:

13519

Save for future reference

Date Purchased

Code: (ex: 10859)

Serial: (ex: U1060512345)

IM10698 | Issue DateNov - 2025

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

Contents

SAFETY INFORMATION

SAFETY DEPENDS ON YOU

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

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

PLEASE EXAMINE CARTON AND EQUIPMENT FOR DAMAGE IMMEDIATELY

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

KEEP YOUR HEAD OUT OF THE FUMES

- **DON'T** get too close to the weld. Use corrective lenses if necessary to stay a reasonable distance away from the weld.
- **USE ENOUGH VENTILATION** or exhaust at the weld, or both, to keep the fumes and gases from your breathing zone and the general area.
- **IN A LARGE ROOM OR OUTDOORS** , natural ventilation may be adequate if you keep your head out of the fumes.
- **USE NATURAL DRAFTS** or fans to keep the fumes away from your face.
- **READ** and obey the Safety Data Sheet (SDS) and the warning label that appears on all containers of welding materials.

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

WEAR CORRECT EYE, EAR AND BODY PROTECTION

- **PROTECT** your eyes and face with properly fitted and with proper grade of filter plate (See ANSI Z49.1).
- **PROTECT** your body from welding spatter and arc flash with protective clothing including woolen clothing, flame-proof apron and gloves, leather leggings, and high boots.
- **PROTECT** others from spatter, flash, and glare with protective screens or barriers.
- **PROTECT** your eyes and face with welding helmet
- **IN SOME AREAS**, protection from noise may be appropriate.
- **BE SURE** protective equipment is in good condition.

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

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

- **DO NOT WELD OR CUT** painted or plated parts unless special precautions with ventilation have been taken. They can release highly toxic fumes or gases.
- **PROTECT** compressed gas cylinders from excessive heat, mechanical shocks, and arcs; fasten cylinders so they cannot fall.
- **BE SURE** cylinders are never grounded or part of an electrical circuit.
- **REMOVE** all potential fire hazards from welding area.

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

CALIFORNIA PROPOSITION 65 WARNINGS

⚠ WARNING

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

Always start and operate the engine in a well-ventilated area.

If in an exposed area, vent the exhaust to the outside.

Do not modify or tamper with the exhaust system.

Do not idle the engine except as necessary.

⚠ WARNING

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

For more information go to https://www.p65warnings.ca.gov

ARC WELDING CAN BE HAZARDOUS

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

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

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

FOR ENGINE POWERED EQUIPMENT

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

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

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

- In some cases it may be necessary to remove safety guards to perform required maintenance. **REMOVE GUARDS ONLY** when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.
- **DO NOT** put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.
- To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

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

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

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

ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS

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

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

- Route the electrode and work cables together - Secure them with tape when possible.
- Never coil the electrode lead around your body.
- Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.
- Connect the work cable to the workpiece as close as possible to the area being welded.
- Do not work next to welding power source.

ELECTRIC SHOCK CAN KILL

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

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

- Semiautomatic DC Constant Voltage (Wire) Welder.
- DC Manual (Stick) Welder.
- AC Welder with Reduced Voltage Control.
- In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically “hot”.
- Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.
- Ground the work or metal to be welded to a good electrical (earth) ground.
- Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.
- Never dip the electrode in water for cooling.

- Never simultaneously touch electrically “hot” parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
- When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.
- **Also see** WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION **and** FOR ELECTRICALLY POWERED EQUIPMENT

ARC RAYS CAN BURN

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

FUMES AND GASES CAN BE DANGEROUS

Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone.

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

WELDING AND CUTTING SPARKS CAN CAUSE FIRE OR EXPLOSION

- Remove fire hazards from the welding area. If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.
- Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to **“Safety in Welding and Cutting” (ANSI Standard Z49.1)** and the operating information for the equipment being used.

- When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
- Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to ensure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, **AWS F4.1** from the American Welding Society.
- Vent hollow castings or containers before heating, cutting or welding. They may explode.
- Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuff-less trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.
- Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
- **Read and follow NFPA 51B** “Standard for Fire Prevention During Welding, Cutting and Other Hot Work”, available from NFPA, 1 Batterymarch Park, PO box 9101, Quincy, MA 022690-9101.
- **DO NOT** use a welding power source for pipe thawing.

CYLINDER MAY EXPLODE IF DAMAGED

- Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.
- Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.
- Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.
- Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.
- Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.
- Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-l, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association, 14501 George Carter Way Chantilly, VA 20151.

FOR ELECTRICALLY POWERED EQUIPMENT

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

BATTERY HANDLING, STORAGE, AND DISPOSAL

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

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

FOR LASER EMITTING EQUIPMENT

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

DEALER LOCATOR & PRODUCT REGISTRATION

Register your machine:

https://www.lincolnelectric.com/register

Authorized Service and Distributor Locator:

https://www.lincolnelectric.com/locator

ADDITIONAL SAFETY INFORMATION

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

INSTALLATION

PRODUCT DESCRIPTION

The FLEXTEC® 650 SUBARC is a CC/CV DC inverter and is rated for 650 amps, 44 volts at a 100% duty cycle. The FLEXTEC® 650 SUBARC is intended for both factory and field operation. It comes in a compact, rugged case that is designed for portability and outdoor use with an IP23 environmental rating. The user interface of the FLEXTEC® 650 SUBARC is simple and intuitive. Weld modes are selected via a process indicator rocker switch. Volts and Amps are displayed on an easy to view LED display, and the amps and volts are set via a large output control knob. The FLEXTEC® 650 SUBARC is designed to support 115V controllers such as the NA-3S and NA-5 and LT-7 Tractor as well as ArcLink controller like the MAXsa 10 and Cruiser Tractor.

The FLEXTEC® 650 SUBARC is designed for the European market and operates on 3 phase 380V, 460V, or 575V at either 50hz or 60hz input power.

TECHNICAL SPECIFICATIONS

POWER SOURCE - INPUT VOLTAGE AND CURRENT					
MODEL	**DUTY CYCLE**	**INPUT VOLTAGE +/- 10%**	**INPUT AMPERES EFFECTIVE**	**IDLE POWER (W)**	**POWER FACTOR @ RATED OUTPUT**
K5441-1	60% RATING	380 /460/57 5/3/50/60	61/ 50/ 40	230 MAX (FAN ON)	88%
	100% RATING		57 /47 /38	100 MAX (FAN OFF)	

RATED OUTPUT			
PROCESS	**DUTY CYCLE**	**AMPERES**	**VOLTS AT RATED AMPERES**
SAW (CC)	60%	750*	44V
	100%	650*	
SAW (CV)	60%	750*	
	100%	650*	

Note: * Output is limited to 600A / 100% and 700A / 60% when used with K3091-1 Multi-Process Switch.

RECOMMENDED INPUT WIRE AND FUSE SIZES(1)					
VOLTAGE 50/60 Hz	**MAXIMUM INPUT AMPERES**	**CORD SIZE(3) AWG SIZES (mm2)**	**Type 75°C Copper Wire in Conduit AWG (mm2)**	**COPPER GROUNDING CONDUCTOR AWG (mm2)**	**Fuse (Super Lag) or Breaker Size(2)**
380/3/50	70A	4(21)	4(21)	8(8)	90
460/3/60	58A	4(21)	6(13)	8(8)	80
575/3/60	46A	6(13)	8(8)	10(5)	60

Note: (1) Cord and Fuse Sizes based upon the U.S. National Electric Code and maximum output for 40°C (104°) ambient.

Note: (2) Also called “inverse time” or “thermal/magnetic” circuit breakers; circuit breakers that have a delay in tripping action that decreases as the magnitude of current increases.

Note: (3) Type SJ cord or similar in 30°C ambient.

WELDING PROCESS			
PROCESS	**OUTPUT RANGE (AMPERES)**	**OCV (U_0)**	**OCV (U_r)**
SAW (CC)	100 - 815	60	15
SAW (CV)	40 - 815	60	15

PHYSICAL DIMENSIONS				
MODEL	**HEIGHT**	**WIDTH**	**DEPTH**	**WEIGHT**
K5441-1	21.8 in (554 mm)	16.14 in (410 mm)	30.31 in (770 mm)	183lbs (83 kg)*

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE Environmentally Hardened: 14°F to 131°F (-10°C to 55°C**)	STORAGE TEMPERATURE RANGE Environmentally Hardened: -40°F to 185°F (-40°C to 85°C)

IP23 180º(H) Insulation Class

Note: * Weight does not include input cord.

Note: ** Power Source is de-rated at temperatures above 40C.

AUXILIARY RECONNECT INPUT TEMPERATURES		
"A" LEAD POSITION	**VRD ENABLED**	**VRD DISABLED**
380 Volt RECONNECT	Low Limit - 340 VAC High Limit - 420 VAC	Low Limit - 340 VAC High Limit - 455 VAC
460 Volt RECONNECT	Low Limit - 390 VAC High Limit - 505 VAC	Low Limit - 390 VAC High Limit - 520 VAC
575 Volt RECONNECT	Low Limit - 485 VAC High Limit - 620 VAC	Low Limit - 485 VAC High Limit - 655 VAC

SAFETY PRECAUTIONS

⚠ WARNING

ELECTRIC SHOCK can kill.

• Only qualified personnel should perform this installation.

• Turn off input power to the power source 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.

• To not touch electrically hot parts.

• Always connect the FLEXTEC® 650 SUBARC grounding lug (located inside the reconnect input access door) to a proper safety (earth) ground.

VRD (VOLTAGE REDUCTION DEVICE)

The VRD™ feature provides additional safety in the CC-Stick mode. The VRD™ reduces the OCV (Open Circuit Voltage) at the welding output terminals while not welding to less than 35VDC peak.

The VRD™ requires that the welding cable connections be kept in good electrical condition because poor connections will contribute to poor starting. Having good electrical connections also limits the possibility of other safety issues such as heat-generated damage, burns and fires.

The machine is shipped with VRD™ "Disabled". The VRD™ function can be disabled or enabled via dip switches on the user interface P.C. board.

The user interface board and dip switches can be accessed by removing the case top and side for more information see Figure 1 : Dip Switch Location on page B-7 .

SELECT SUITABLE LOCATION

Location and ventilation for cooling

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

LIFTING

The FLEXTEC® 650 SUBARC has two lifting eyelets and two handles that can be used to lift the machine. Both handles or eyelets should be used when lifting the FLEXTEC® 650 SUBARC.

When using a crane or overhead device to lift using the handles, a lifting strap should be connected to both handles. **Do not attempt to lift the FLEXTEC® 650 SUBARC with accessories attached to it.**

TILTING

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

STACKING

The FLEXTEC® 650 SUBARC cannot be stacked.

ENVIRONMENTAL CONSIDERATIONS

The FLEXTEC® 650 SUBARC is IP23 rated for use in an outdoor environment. The FLEXTEC® 650 SUBARC should not be subjected to falling water during use nor should any parts of it be submerged in water. Doing so may cause improper operation as well as pose a safety hazard. The best practice is to keep the machine in a dry, sheltered area.

⚠ CAUTION

PROPER EQUIPMENT MOUNTING

Do not mount the FLEXTEC® 650 SUBARC over combustible surfaces. Where there is a combustible surface directly under stationary or fixed electrical equipment, that surface shall be covered with a steel plate at least .060” (1.6mm) thick, which shall extend not less than 5.90” (150mm) beyond the equipment on all sides.

MACHINE GROUNDING

The frame of the welder must be grounded. A ground terminal marked with a ground symbol is located inside the reconnect/input connection area for this purpose.

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

HIGH FREQUENCY PROTECTIONS

Locate the FLEXTEC® 650 SUBARC away from radio controlled machinery. The normal operation of the FLEXTEC® 650 SUBARC may adversely affect the operation of RF controlled equipment, which may result in bodily injury or damage to the equipment.

HIGH TEMPERATURE OPERATION

WELDER OUTPUT RATINGS AT 55°C ELEVATED TEMPERATURES			
AMPS	**DUTY CYCLE**	**VOLTS**	**TEMPERATURES**
600	100%	44 V	55°C
650	50%		
750	30%		

⚠ WARNING

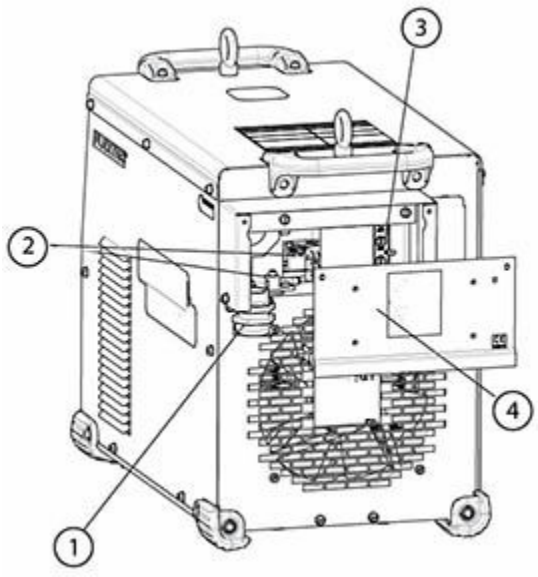
ELECTRIC SHOCK can kill

Only a qualified electrician should connect the input leads to the FLEXTEC® 650 SUBARC. connections should be made in accordance with all local and national electrical codes and the connection diagram located on the inside of the reconnect/input access door of the machine. Failure to do so may result in bodily injury or death.

INPUT CONNECTION

Use a three-phase supply line. A 1.75 inch (45 mm) diameter access hole for the input supply is located on the case back. Remove the reconnect access panel located on the case back and connect W, V, U and ground according to the Input Supply Connection Diagram decal

1. **POWER SUPPLY ACCESS HOLE**
   - Route input power cable through this hole.
   - Strain relief required. See your local and National Electrical codes for proper strain relief
2. **POWER SUPPLY TERMINAL BLOCK**
   - Line Cord/Cable attaches here.
   - A ground terminal marked with the symbol shown is provided separate from this block for connecting the ground lead of the line cord. (See your local and national electrical codes for proper grounding methods.)
3. **RECONNECT TERMINAL BLOCK**
   - Reconnects auxiliary transformer for the proper input voltage
4. **REMOVE FOUR SCREWS AND ACCESS PANEL**



INPUT FUSE AND SUPPLY WIRE CONSIDERATIONS

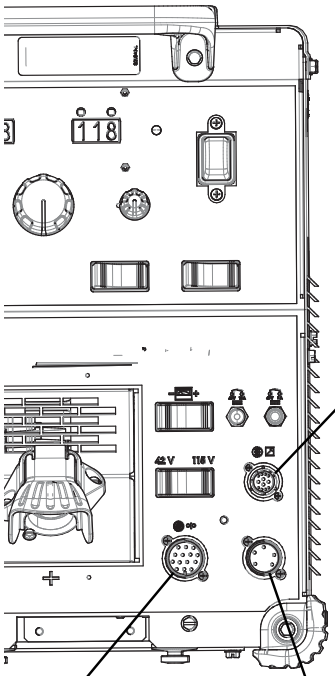
Refer to TECHNICAL SPECIFICATIONS on page A-1 in this Installation chapter for recommended fuse, wire sizes and type of the copper wires. Fuse the input circuit with the recommended super lag fuse or delay type breakers (also called "inverse time" or "thermal/magnetic" circuit breakers). Choose input and grounding wire size according to local or national electrical codes. Using input wire sizes, fuses or circuit breakers smaller than recommended may result in "nuisance" shut-offs from welder inrush currents, even if the machine is not being used at high currents.

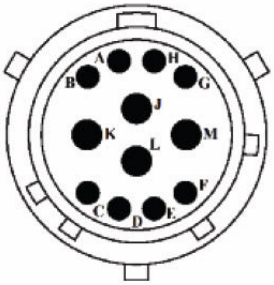
INPUT VOLTAGE SELECTION

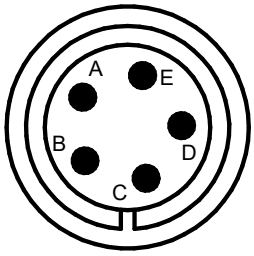
Welders are shipped connected for 380 Volt input voltage. To accommodate different input voltages, move the reconnect lead to the corresponding voltage. Refer to Auxiliary Reconnect Input Ranges table in the Technical Specification Section. If the Auxiliary lead (indicated as 'A') is placed in the wrong position and power is applied to the machine, the machine will protect itself and display an error message:

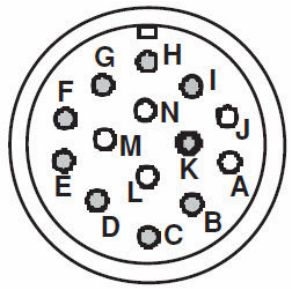
- "Err" "713 or 714" will be shown on the display.
- The control board and switch boards will blink out error 713 or 714 on their status LEDs.
- The weld output will be turned off and the control board will force itself into an idle state.
- The machine will need to have the misconnect condition removed before it will recover. Power must be removed prior to changing reconnect position.

CABLE CONNECTIONS



12-PIN ACCESSORY CONNECTIVITY			
	Function	Pin	Wiring
	12-pin remote control connector for remote or hand/foot amptrol and digital accessories.	A	ArcLink CAN
		B	ArcLink CAN
		C	Remote Potentiometer, Common
		D	Remote Potentiometer, Wiper
		E	Remote Potentiometer +10V
		F	ALPS Connection
		G	Trigger
		H	Trigger
		J	40 VDC Common
		K	40 VDC
		L	Not Used
		M	Not Used

5-PIN CONNECTOR FOR WIRE FEEDER			
	Function	Pin	Wiring
	5-pin connector for wire feeder connectivity.	A	ArcLink CAN
		B	ArcLink CAN
		C	Electrode Sense Lead
		D	40 VDC
		E	40 VDC Common

14-PIN CONNECTOR FOR WIRE FEEDER			
	Function	Pin	Wiring
	14 pin connector for wire feeder connectivity.	A	115 VAC
		B	Ground
		C	Trigger Common
		D	Trigger Input
		E	77 Remote Potentiometer, 5K
		F	76 Remote Potentiometer, Wiper
		G	75 Remote Potentiometer, Common
		H	Voltage Sense 21
		I	40 VDC Common
		J	115 VAC
		K	40 VDC
		L	
		M	
		N	

RECOMMENDED WORK CABLES SIZES

General Guidelines

Connect the electrode and work cables between the appropriate output studs of the FLEXTEC® 650 SUBARC per the following guidelines:

- Most welding applications run with the electrode being positive (+). For those applications, connect the electrode cable between the wire drive feed plate and the positive (+) output stud on the power source. Connect a work lead from the negative (-) power source output stud to the work piece
- When negative electrode polarity is required, such as in some Innershield applications, reverse the output connections at the power source (electrode cable to the negative (-) stud, and work cable to the positive (+) stud).

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

The following recommendations apply to all output polarities and weld modes:

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

  Note: Excessive heat in the weld circuit may indicate undersized cables and/or bad connections.

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

OUTPUT CABLE GUIDELINES

OUTPUT CABLE GUIDELINES						
AMPERES	PERCENT DUTY CYCLE	CABLE SIZES FOR COMBINED LENGTHS OF ELECTRODE AND WORK CABLE [RUBBER COVERED COPPER-RATED FOR 167ºF (75º C)]**				
		0 to 50 Ft. (0 to 15 m)	50 to 100 Ft. (15 to 30 m)	100 to 150Ft. (30 to 46 m)	150 to 200Ft. (46 to 61 m)	200 to 250Ft. (61 to 76 m)
200	60	2	2	2	1	1/0
200	100	2	2	2	1	1/0
250	30	3	3	2	1	1/0
250	40	2	2	1	1	1/0
250	60	1	1	1	1	1/0
250	100	1	1	1	1	1/0
300	60	1	1	1	1/0	2/0
300	100	2/0	2/0	2/0	2/0	3/0
350	40	1/0	1/0	2/0	2/0	3/0
400	60	2/0	2/0	2/0	3/0	4/0
400	100	3/0	3/0	3/0	3/0	4/0
500	60	2/0	2/0	3/0	3/0	4/0
600	60	3/0	3/0	3/0	4/0	2-3/00
600	80	2-1/0	2-1/0	2-1/0	2-2-2/0	2-2-3/0
600	100	2-1/0	2-1/0	2-1/0	2-2-2/0	2-2-3/0
650	60	3/0	3/0	4/0	2-2-2/0	2-3/0
650	80	2-1/0	2-1/0	2-1/0	2-2-2/0	2-2-3/0
700	100	2-2/0	2-2/0	2-3/0	2-3/0	2-4/0
800	80	3-1/0	3-1/0	3-1/0	2-30	2-4/0
800	100	2-3/0	2-3/0	2-3/0	2-3/0	2-4/0

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

CONTROL CABLE CONNECTIONS

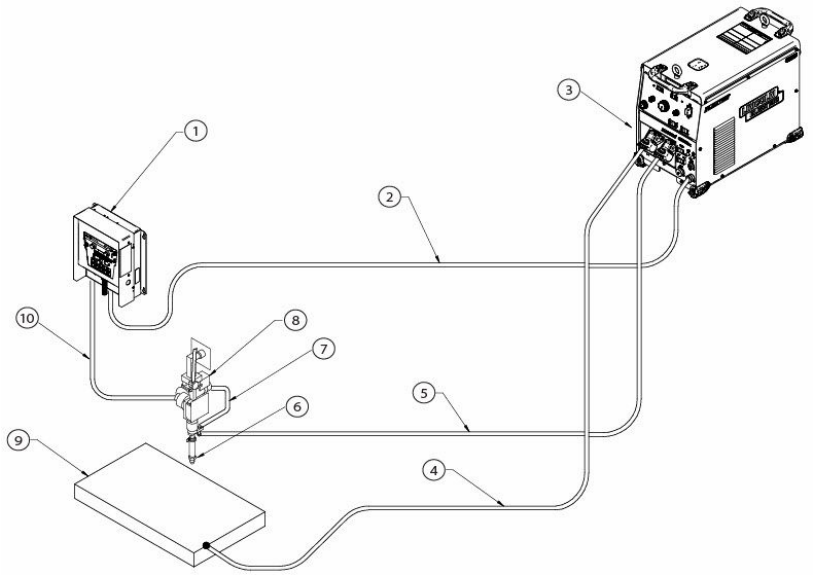
General Guidelines

Genuine Lincoln control cables should be used at all times

(except where noted otherwise). Lincoln cables are specifically designed for the communication and power needs of the FLEXTEC® 650 SUBARC. Most are designed to be connected end to end for ease of extension. Generally, it is recommended that the total length not exceed 100ft. (30.5m). The use of non-standard cables, especially in lengths greater than 25 feet, can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems). Always use the shortest length of control cable possible, and **DO NOT COIL EXCESS CABLE.**

Regarding cable placement, best results will be obtained when control cables are routed separate from the weld cables. This minimizes the possibility of interference between the high currents flowing through the weld cables, and the low level signals in the control cables.

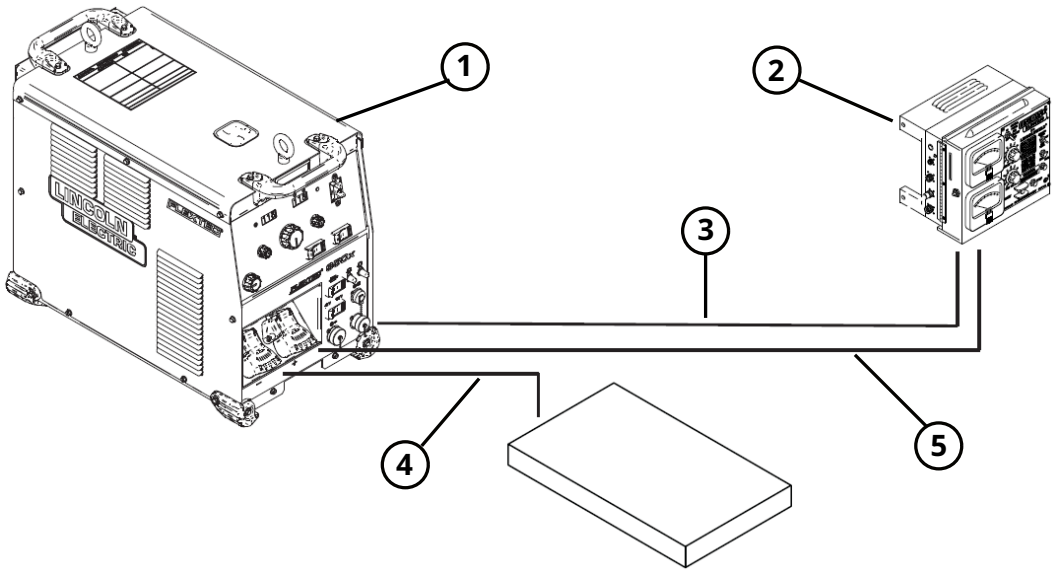
CONNECTION DIAGRAM - MAXSA 10



1. MAXsa 10 Controller
   K2814-4 or Newer
2. K1543-XXX Control Cable
3. FLEXTEC® 650 SUBARC
4. Weld Cable Connection to Negative Stud
5. Weld Cable Connection to Positive Stud
6. Contact Nozzle
   K231-XX
7. 67 Sense Lead
8. MAXsa 22 Feed Head
   K2370-2
9. Work Piece
10. MAXsa 22 Wire Drive 14-Pin Connection Cable
    K1785-XX

CONTROL SETTINGS	
WELD MODE	ARCLINK
WELD TERMINALS	N/A
REMOTE/LOCAL	N/A
VOLTMETER POLARITY	PROCESS DEPENDENT

CONNECTION DIAGRAM - NA-3/NA-5

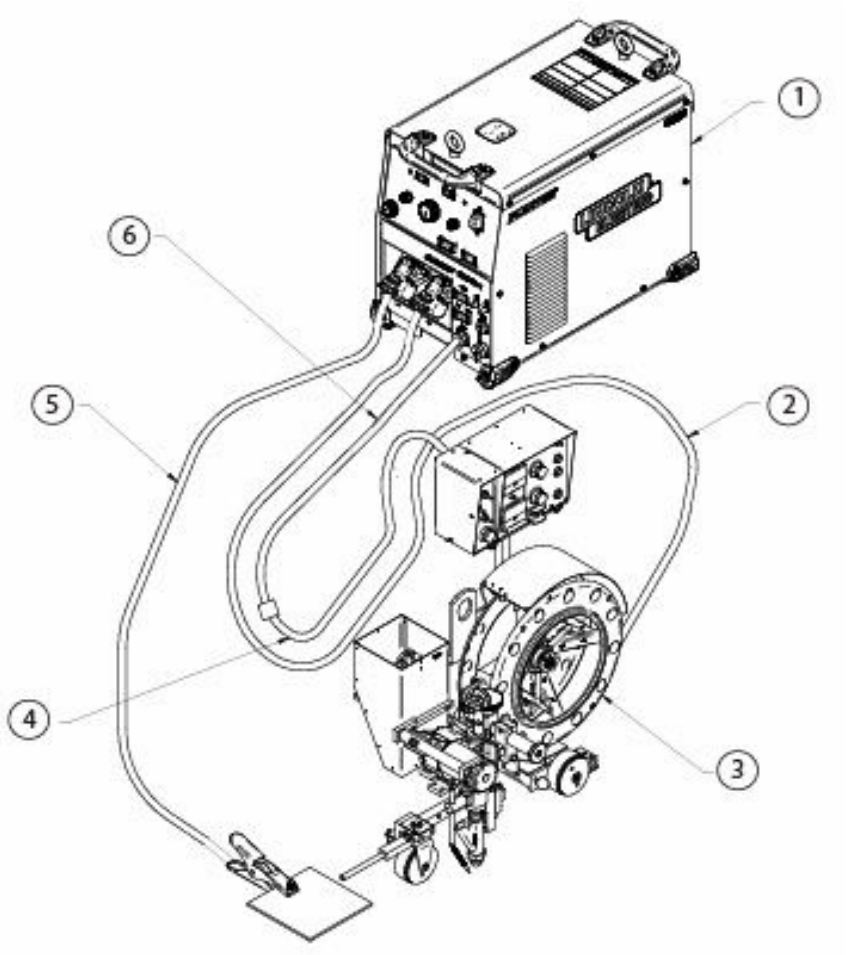


1. FLEXTEC® 650 SUBARC
2. NA-3, NA-5 Feeder
3. Control Cable 14-Pin

   K1820-XX
4. Weld Cable Connection to Negative Stud
5. Weld Cable Connection to Positive Stud

CONTROL SETTINGS	
WELD MODE	CV-SAW, CC-SAW
WELD TERMINALS	REMOTE
REMOTE/LOCAL	REMOTE
VOLTMETER POLARITY	PROCESS DEPENDENT

CONNECTION DIAGRAM - LT-7 TRACTOR



1. FLEXTEC® 650 SUBARC
2. Weld Cable Connection to Positive Stud
3. LT-7 Tractor
4. Control Cable 14-Pin

   K1820-XX
5. Weld Cable Connection to Negative Stud
6. 14-Pin to 14-Pin Extension Cable

CONTROL SETTINGS	
WELD MODE	CV-SAW, CC-SAW
WELD TERMINALS	REMOTE
REMOTE/LOCAL	REMOTE
VOLTMETER POLARITY	PROCESS DEPENDENT

OPERATION

SAFETY PRECAUTIONS

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

⚠ WARNING

ELECTRIC SHOCK can kill

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

⚠ WARNING

FUMES AND GASES can be dangerous

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

⚠ WARNING

WELDING SPARKS can cause fire or explosion.

- Keep flammable material away.

⚠ WARNING

ARC RAYS can burn

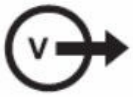
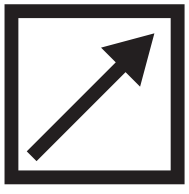
- Wear eye, ear, and body protection.

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

GRAPHIC SYMBOL DESCRIPTIONS

GRAPHIC SYMBOLS USED IN THE MANUAL OR BY THIS MACHINE

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	INPUT POWER	U_0	OPEN CIRCUIT VOLTAGE
	ON	U_P	PEAK VOLTAGE
	OFF	U_1	INPUT VOLTAGE
	HIGH TEMPERATURE	U_2	OUTPUT VOLTAGE
	CIRCUIT BREAKER	I_1	INPUT CURRENT
	POSITIVE OUTPUT	I_2	OUTPUT CURRENT
	NEGATIVE OUTPUT		PROTECTIVE GROUND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	INPUT POWER CONNECTION		WARNING OR CAUTION
	SINGLE PHASE		EXPLOSION
	DIRECT CURRENT		DANGEROUS VOLTAGE
	ALTERNATING CURRENT		SHOCK HAZARD
	DIRECT AND ALTERNATING CURRENT		TIG TORCH
	FAULT		STICK ELECTRODE HOLDER
	OUTPUT ACTIVE		REFER TO OPERATOR'S MANUAL
	REMOTE		1 PHASE INVERTER POWER SOURCE

DUTY CYCLE

The FLEXTEC® 650 SUBARC is capable of welding at a 100% duty cycle (continuous welding) at 650 amps rated output. The 60% duty cycle rating is 750 amps (based off of a ten minute cycle – 6 minutes on time and 4 minutes off time). The maximum output of the machine is 815 amps.

The FLEXTEC® 650 SUBARC is also rated for Desert Duty, elevated temperature operation, in a 55°C ambient. The machine is de-rated for this application. See TECHNICAL SPECIFICATIONS on page A-1 for more information.

DESIGN FEATURES

- Severe Duty Design for outdoor use (IP23 rating)
- Passive Power Factor Correction – reliably gives 88% power factor for lower installation costs.
- 91% Efficiency rating – reduces electrical utility costs.
- Simple user interface - user interface is designed with the operator in mind. Getting setup for the weld is several clicks away and even the most novice welder can be confident he is setup properly.
- F.A.N. (fan as needed). Cooling fan runs when the output is energized and for a 5 minute cool down period after output is disabled
- Thermal protection by thermostats with Thermal Indicator LED.
- Reversible handles for ease of lifting and transporting
- Multiple options for lifting / transporting: Reversible handles; eyelet lifting bolts; and single forklift fork access
- Error Codes display on LED screen for ease of trouble shooting
- Electronic over current protection.
- Input voltage misconnection protection.
- Utilizes digital signal processing and microprocessor control.
- VRD™ (Voltage Reduction Device)- Enable this function for reduced OCV in CC modes for added safety.

RECOMMENDED PROCESSES

The FLEXTEC® 650 SUBARC is designed for CC-SAW and CV-SAW welding processes. CAG (arc gouging) is also supported.

PROCESS LIMITATIONS

The FLEXTEC® 650 SUBARC is suitable only for the processes listed.

Note: When used with K3091-1 Multi-Process Switch, the output is limited to 600A / 100% and 700A / 60%.

EQUIPMENT LIMITATIONS

Operating Temperature Range is -10° C to + 55° C.

Output De-rated at Temperatures above 40°C.

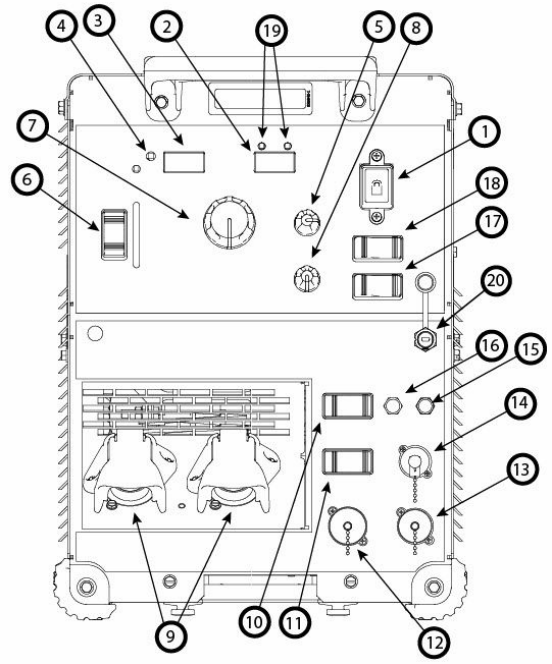
COMPATIBLE EQUIPMENT

Compatible Equipment	
ALL MODELS	LT-7 Tractor
	NA SERIES
	FLEX FEED 74HT
	FLEX FEED 84
	CRUISER
	MAXSA 10 (Latest K#)
	MAXSA 22 WIRE DRIVE
	MAXSA 29 WIRE DRIVE*
	MAXSA 19 CONTROLLER**

Note: * For fixture builders

Note: ** For fixture builders that do not require the Maxsa 10 controller

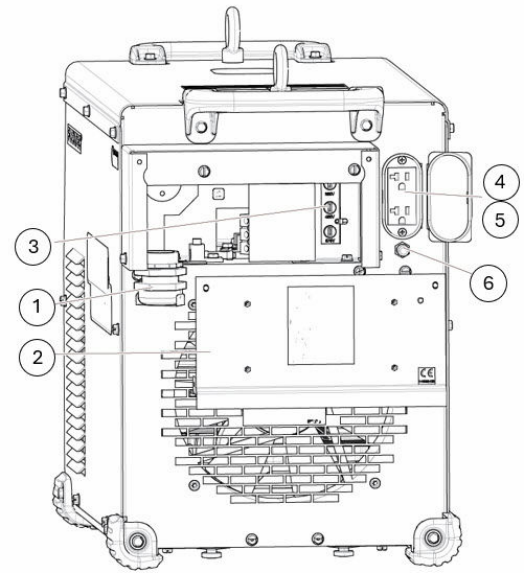
CASE FRONT CONTROL DESCRIPTIONS



1. **PowerSwitch:**Controls input power to the FLEXTEC® 650 SUBARC
2. **Voltage Display Meter**
3. **Current Display Meter**
4. **Thermal LED:** A yellow light that comes on when an over temperature situation occurs. Output is disabled until the machine cools down. When cool, the light goes out and output is enabled.
5. **Hot Start Control Dial**
6. **Process Indicator Switch:** Three available weld modes for the FLEXTEC® 650 SUBARC – CC-SAW, CV-SAW; Arc Link
7. **Output Control Dial:** Sets the output current or voltage for the selected weld process.
8. **Arc Force Control Dial**

9. Positive and Negative output studs
10.Wire Feeder Voltmeter polarity selection switch
11.115V or 42V wire feeder selector switch
12.14-pin wire feeder circular connector
13.5-pin ArcLink wire feeder circular connector
14.12-pin remote circular connector
15.Circuit breaker reset button for the 12-pin remote circular connector
16.Circuit breaker reset button for the 5 and 14-pin wire feeder connectors
17.Weld Terminals On / Remote selector switch
18.Local/Remote Selector Toggle Switch: Sets the control of the output to local (output control knob) or remote(K857-2hand amptrol, K870-2 foot amptrol or 14-pin wire feeder)
19.VRD™ (Voltage Reduction Device) Indicator Lights
20.USB CONNECTOR

CASE BACK CONTROLS



1. **Input Power Cord Access Hole.**
2. **Access Panel –** Allows access for connecting input power and configuring the machine.
3. **Input Power Reconnect –** Configures the machine for the input supply voltage.
4. **OPTION –** GFCI protection for the 115V auxiliary output (not shown).
5. **115 volt, 15 amp auxiliary output duplex with protective environmental cover.**
6. **15 Amp Circuit Breaker for the 115V auxiliary power.**

INTERNAL CONTROLS

Enabling VRD, Multi-Weld, And Current/Voltage Calibration

The User Interface PC Board has one bank of dip switches. As shipped from the factory and under normal conditions with the VRD function enabled for CC welding, DIP Switch #2 and #5 are in the "on" position . There are 3 instances that require a change of the dip switch.

1. Disable VRD Mode - CC (VRD Disabled)

   Turn switch #5 to the "**OFF**" Position
2. Enable VRD Mode - CV (VRD Enabled)

   Turn switch #6 to the "**ON**" Position
3. Factory Default Setting

   Turn switch #5 to the "**ON**" Position
4. Current/Voltage Calibration Setting

   Turn switch #1 to the "**ON**" Position

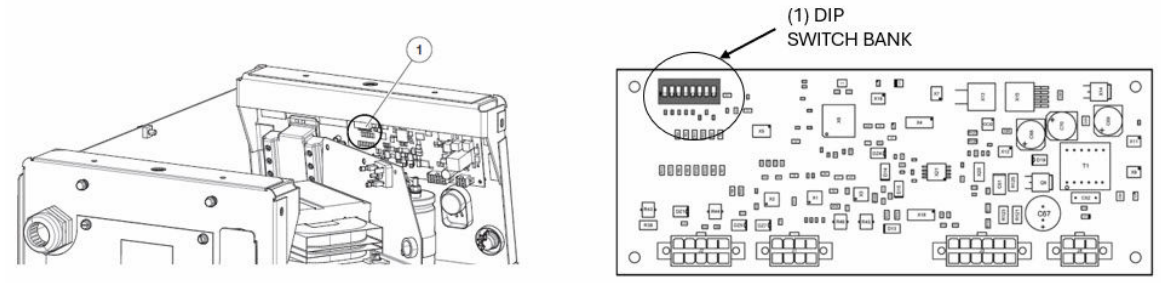
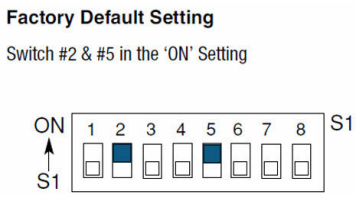


Figure 1 : Dip Switch Location

Factory Default setting- VRD CC Enabled

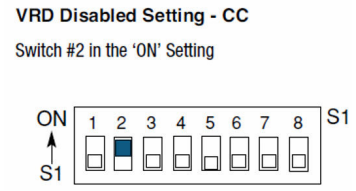
Machine is shipped with VRD enabled



Disabling VRD Function

Disable VRD Mode - CC (VRD Disabled)

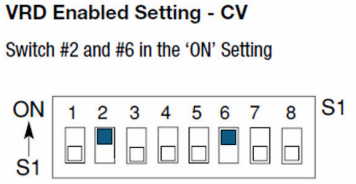
Turn switch #5 to the 'OFF' Position



Enabling VRD Function CV-Mode

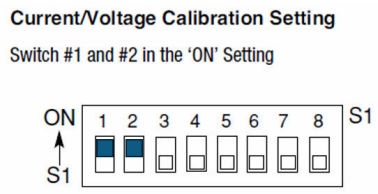
Enable VRD Mode - CV (VRD Enabled)

Turn switch #6 to the 'ON' Position



Enabling Calibration Mode for Voltage or Current

Current/Voltage Calibration Setting



POWER UP SEQUENCE

When power is applied to the FLEXTEC® 650 SUBARC, the displays will illuminate and display the voltage and/or amperage settings.

COMMON WELD PROCEDURES

⚠ WARNING

EQUIPMENT SERVICEABILITY

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

The FLEXTEC® 650 SUBARC is a multi-process inverter welder. The Weld Process Selector Switch is used to set the desired weld mode. The FLEXTEC® 650 SUBARC has 6 selectable welding modes:

1. CC-SAW –This is a CC (constant current) weld mode used for welding the SAW submerged arc welding process
2. CV-SAW – This is a CV (constant voltage) weld mode used for welding the SAW submerged arc welding process
3. ArcLink – This weld mode position is used to unlock Synergic modes when combined with an ArcLink feeder.

The FLEXTEC® 650 SUBARC is also capable of gouging. Gouging can be done in either the CV-SAW or CC-SAW.

In addition to the weld process selector switch, a hot start control dial, output control dial and arc control dial are provided to setup and fine tune the welding procedure.

WELD CONTROL AND DISPLAYS

Weld Process Selector Switch

Process Indicator switch used to select the welding process.

Hot Start Control Dial

- The Hot Start control regulates the starting current at arc initiation. Hot Start can be set to “0” and no additional current is added at arc start. Increasing from 0 to 10 will increase the additional current (relative to the preset current) that is added at arc initiation.

Arc Control Dial

Full range selection of arc control from -10 to +10. In CV mode, this control is an inductance control.

Output Control Dial

- Output control is conducted via a single turn potentiometer.
- Adjustment is indicated by the meters.
- When in REMOTE modes, this control sets the maximum welding current*. Full depression of a foot or hand amptrol results in the preset level of current.

Note: This is the case for CC modes only. In CV modes, maximum voltage is determined by the remote

Voltage Display Meter

- Prior to CV operation (current flow), the meter displays desired preset voltage value (+/- .5V).
- During welding, this meter displays actual average volts.
- After welding, the meter holds the actual voltage value for 5 seconds. The displays blink indicating that the machine is in the "Hold" period.
- Output adjustment while in the "Hold" period results in the "prior to operation" characteristics.

Amperage Display Meter

- Prior to CV operation, the meter displays three dashes indicating non-presettable AMPS.
- During welding, this meter displays actual average amps.
- After welding, the meter holds the actual current value for 5 seconds. The displays blink indicating that the machine is in the "Hold" period.
- Output adjustment while in the "Hold" period results in the "prior to operation" characteristics.

Weld Terminals On/Remote Toggle Switch

- This switch determines the trigger location.
- When set to the “ON” position, the weld terminals are at OCV (open circuit voltage) and ready to weld.
- When set to the “remote” position, output is enabled through a remote trigger.

Control - Local/Remote Toggle Switch

- Set the switch to “local” to control output at the Flextec via the Output Control dial.
- Set the switch to “remote” to control output via a remote device (K857-2 hand amptrol connected to the 12-pin remote connector or a SAW wire feeder connected to the 14- pin connector.

Wire Feeder Voltage Selector Switch

- This switch configures wire feeder supply voltage in the 14 pin connector to either 42 volts or 115 volts.
- If the switch is in the incorrect position for the attached wire feeder, there will be no power supplied to the wire feeder.

Wire Feeder Voltmeter Polarity Switch

- This switch configures the 21 sense lead in the 14 pin connector to the work weld terminal of the machine. It also configures the 292 lead to the User Interface board to determine if voltage sensing needs to be configured for Electrode Negative Polarity operation in “ArcLink” mode.

Thermal Light

- This status light indicates when the power source has been driven into thermal overload. If the output terminals were "ON", the output will be turned back on once the unit cools down to an acceptable temperature level. If the unit was operating in the "REMOTE" mode, the trigger will need to be opened before or after the thermal has cleared and closed after the machine has cooled down to an acceptable temperature to establish output.

VRD™ (VOLTAGE REDUCTION DEVICE) INDICATOR LIGHT

- There are 2 indicator lights on the case front of the FLEXTEC® 650 SUBARC above the Voltage LED Display to indicate the status of VRD™ operation. As shipped, the VRD™ function is enabled. VRD™ is disabled by setting dip switches on the User Interface P.C. board. When VRD™ is active:
  - A green light indicates the OCV (open circuit voltage) is less than 35V peak.
  - A red light indicates the OCV is at or above 35V peak.
  - Both lights will illuminate for 5 seconds at power up.

  Note: For each weld mode, the VRD™ lights function as shown below

<table>
<tr><th colspan="4">VRD™ Indicator Lights</th></tr>
<tr><th colspan="2">MODE</th><th>VRD™ "ON"</th><th>VRD™ "OFF"</th></tr>
<tr><td rowspan="4">CV-SAW
CC-SAW</td><td rowspan="3">OCV</td><td>RED (OCV Not reduced
Weld Terminals "ON"</td><td rowspan="4">NO LIGHTS ACTIVE</td></tr>
<tr><td>RED (OCV Not reduced
Weld Terminals Remotely Controlled
Gun Trigger Closed</td></tr>
<tr><td>GREEN (NO OCV)
Weld Terminals Remotely Controlled
Gun Trigger Open</td></tr>
<tr><td>While Welding</td><td>GREEN or RED (Depends on weld voltage*)</td></tr>
</table>

OPERATION - CV-SAW

This weld mode is a constant voltage (CV) mode featuring continuous control from 10 to 45 volts. It is intended for the CV SAW submerged arc welding process.

Hot Start – Not used for this welding process.

Arc Control – Not used for this welding process .

Weld Terminals On/Remote

- When set to the “ON” position, the weld terminals are at OCV (open circuit voltage) and ready to weld. This selection is used for across the arc wire feeders.
- When set to the “Remote” position, output is enabled through a remote trigger.

Amperage Display Meter – This display will display three dashed lines when the machine is in the idle state. This indicates that amperage is not settable in this weld mode. While output is enabled, the actual welding amperage will be displayed. After welding, the meter holds the actual amperage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "hold" period.

Voltage Display Meter – This display will display the pre-set welding voltage when the machine is in the idle state. After welding, the meter holds the actual voltage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "hold" period.

Output Control Local/Remote – When the control is set to “local” (no remote potentiometer/control plugged into the 12 pin or 14 pin connectors), the output is controlled through the Output Control Dial on the front of the Flextec® 650x. Set this switch to “Remote” when an external potentiometer/control is connected.

Output Control Dial

- When the Local/Remote is set to “local”, this dial sets the welding voltage.
- When the Local/Remote is set to “Remote”, this dial is disabled.

MODE OF OPERATION - CC-SAW

This weld mode is a constant CURRENT (CC) mode featuring continuous control from 10 to 45 volts, 10 to 815 amps. It is intended for the CC-SAW submerged arc welding process.

Hot Start – Not used for this welding process.

Arc Control – Not used for this welding process .

Weld Terminals On/Remote

- When set to the “ON” position, the weld terminals are at OCV (open circuit voltage) and ready to weld. This selection is used for across the arc wire feeders.
- When set to the “Remote” position, output is enabled through a remote trigger.

Voltage Display Meter – This display will display three dashed lines when the machine is in the idle state. This indicates that voltage is not settable in this weld mode. While output is enabled, the actual welding voltage will be displayed. After welding, the meter holds the actual voltage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "hold" period.

Amperage Display Meter – This display will display the pre-set welding amperage when the machine is in the idle state. After welding, the meter holds the actual amperage value for 5 seconds. Output adjustment

while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "hold" period.

Output Control Local/Remote – When the control is set to “local” (no remote potentiometer/control plugged into the 12 pin or 14 pin connectors), the output is controlled through the Output Control Dial on the front of the FLEXTEC® 650 SUBARC. Set this switch to “Remote” when an external potentiometer/control is connected.

Output Control Dial

- When the Local/Remote is set to “local”, this dial sets the welding voltage.
- When the Local/Remote is set to “Remote”, this dial is disabled and output is controlled by the connected remote control.

ARCLINK

This weld mode is intended to unlock basic non-synergic and synergic modes intended for use with compatible ArcLink submerged arc controllers. All of the FLEXTEC® 650 SUBARC user interface controls are disabled in this mode and controlling the power source is accomplished from the wire feeder user interface.

Hot Start – Not used in ArcLink Mode.

Arc Control – Not used in ArcLink Mode.

Weld Terminals On/Remote - Not used in ArcLink Mode.

Amperage Display – This display will show three dashed lines when the machine is in the idle state. This indicates that amperage is not settable in this weld mode. While output is enabled, the actual welding amperage will be displayed. After welding, the meter holds the actual amperage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "Hold" period.

Voltage Display – This display will show the pre-set welding voltage when the machine is in the idle state. After welding, the meter holds the actual voltage value for 5 seconds. Output adjustment while in the "hold" period results in the "prior to operation" characteristics stated above. The displays blink indicating that the machine is in the "Hold" period.

Output Control Local/Remote – Not used in ArcLink Mode.

Output Control Dial - Not used in ArcLink Mode.

MAINTENANCE

SAFTEY PRECAUTIONS

Additional SAFETY

⚠ WARNING

ELECTRICAL SHOCK CAN KILL

Before carrying out service, maintenance and/or repair jobs, fully disconnect power to the machine.

⚠ WARNING

FUMES AND GASES CAN BE DANGEROUS

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

⚠ WARNING

WELDING SPARKS CAN CAUSE FIRE OR EXPLOSION

Keep flammable material away
Do not weld on closed containers

⚠ WARNING

ARC RAYS CAN BURN EYES AND SKIN

Wear eye, ear and body protection.

⚠ WARNING

Have qualified personnel do all maintenance and troubleshooting work.

Observe all safety information throughout this manual.

VISUAL INSPECTION

Clean interior of machine with a low pressure air stream. Make a thorough inspection of all components.

Look for signs of overheating, broken leads or other obvious problems. Many problems can be uncovered with a good visual inspection.

ROUTINE MAINTENANCE

VRD™ Functionality should be checked once per day or once per shift. VRD functionality can be verified by the indicator lights on the front of the power source. One of the lights will be illuminated at all times when VRD is enabled. No lights will be illuminated when VRD is disabled. VRD can be verified by cycling power as well. When VRD is enabled, the VRD indicator lights will illuminate for 5 seconds at power up and one light will remain illuminated.

1. Every 6 months or so the machine should be cleaned with a low pressure air stream. Keeping the machine clean will result in cooler operation and higher reliability. Be sure to clean these areas:
   - All printed circuit boards
   - Power switch
   - Main transformer
   - Heatsink fins
   - Input rectifier
   - Auxiliary transformer
   - Reconnect switch area
   - Fan (blow air through the rear louvers)
2. Examine the sheet metal case for dents or breakage. Repair the case as required. Keep the case in good condition to insure that high voltage parts are protected and correct spacings are maintained. All external sheet metal screws must be in place to insure case strength and electrical ground continuity.

PERIODIC MAINTENANCE

Thermal Protection

Thermostats protect the machine from excessive operating temperatures. Excessive temperatures may be caused by a lack of cooling air or operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the thermostat will prevent output voltage or current. The meter will remain energized during this time. Thermostats are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fan is operating normally, the Power Switch may be left on and the reset should occur within a 15 minute period.

CURRENT CALIBRATION

1. Connect a resistive load bank to the machine configured for 300A/20V (750A/50V equivalent).
2. Connect a certified calibrated current probe or current meter and shunt to the output circuit.
3. Disconnect input power from the machine being calibrated; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch to “ON” as shown in INTERNAL CONTROLS - CALIBRATION DIP SWITCH SETTINGS section of this manual.(Note: additional dip switch positions may be different than pictured below depending on the configuration of your machine.

   Replace the right case side.
4. Rotate the Hot Start control and Arc Control knobs completely counter-clockwise.
5. Replace the right case side; reconnect input power to the machine and energize.
6. The display should read “Cur CAL”.
7. Rotate the Hot Start knob clockwise to enable the output which will be indicated by the scrolling message “AdJ Pot So rEAL Cur = 300 A” on the display.
8. The actual output current should be 300 +/- 2 A. If the actual output current is within the specified limits, skip to step 8.3. If the actual output current is not accurate perform the following:

   8.1. Adjust the output control knob until the actual output current reading is within the specified range.

   8.2. Toggle the Local/Remote switch to save the calibration. The display should flash “CAL SEt”.

   8.3. Rotate the Hot Start knob counter-clockwise to disable the output.
9. Disconnect input power from the machine being calibrated; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch back to “OFF”.

CURRENT CALIBRATION COMPLETE

VOLTAGE CALIBRATION

1. Connect a resistive load bank to the machine configured for 300A/20V (750A/50V equivalent).
2. Connect a certified calibrated voltmeter to the output circuit. Note: High speed voltage transients associated with inverter welders output can adversely affect the accuracy of some metering equipment. The M25303 low pass filter supplied with the K4171-1 Power Wave Calibration Kit is strongly recommended between the meter and the power source to reduce this effect.
3. Disconnect input power from the machine being calibrated; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch to “ON” as shown in the INTERNAL CONTROLS–ENABLING VRD, MULTI-WELD sections of the manual. (Note: additional dip switch positions may be different than pictured depending on the configuration of your machine. Replace the right case side.
4. Rotate the Hot Start control and Arc Control knobs completely counter-clockwise.
5. Replace the right case side; reconnect input power to the machine and energize.
6. The display should read “Cur CAL”.
7. Rotate the Arc Control knob until the display reads “VoL CAL”.
8. Rotate the Hot Start knob clockwise to enable the output which will be indicated by the scrolling message “AdJ Pot So rEAL VoL = 20 VoL” on the display.
9. The actual output voltage should be 20 +/- 0.5 V. If the actual output voltage is within the specified limits, skip to step 9.3. If the actual output voltage is not accurate perform the following:

   9.1. Adjust the output control knob until the actual output voltage reading is within the specified range.

   9.2.Toggle the Local/Remote switch to save the calibration. The display should flash “CAL SEt”.

   9.3.Rotate the Hot Start knob counter-clockwise to disable the output.

10. Disconnect input power from the machine being calibrated; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch back to “OFF”.

VOLTAGE CALIBRATION COMPLETE

RESTORE FACTORY CURRENT CALIBRATION

1. Connect the resistive load bank and test voltmeter to the welding output terminals.
2. Disconnect input power from the machine being calibrated; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch to “ON” as shown in INTERNAL CONTROLS-CALIBRATION DIP SWITCH SETTINGS
3. Rotate the Hot Start control and Arc Control knobs completely counter-clockwise.
4. Reconnect input power to the machine and energize.
5. The display should read “Cur CAL”.
6. Rotate the Arc Control knob until the display reads “Fct Cur”.
7. Rotate the Hot Start knob clockwise until a message scrolls across the screen.
8. Toggle the Local/Remote switch to save the calibration. The display should flash “CAL SEt”.
9. Rotate the Hot Start knob counter-clockwise to disable the output.
10. Disconnect input power from the machine; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch back to “OFF”.

RESTORE FACTORY VOLTAGE CALIBRATION

1. Connect the resistive load bank and test voltmeter to the welding output terminals.
2. Disconnect input power from the machine being calibrated; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch to “ON” as shown in INTERNAL CONTROLS-CALIBRATION DIP SWITCH SETTINGS
3. Rotate the Hot Start control and Arc Control knobs completely counter-clockwise.
4. Reconnect input power to the machine and energize.
5. The display should read “Cur CAL”.
6. Rotate the Arc Control knob until the display reads “Fct Vol”.
7. Rotate the Hot Start knob clockwise until a message scrolls across the screen.
8. Toggle the Local/Remote switch to save the calibration. The display should flash “CAL SEt”.
9. Rotate the Hot Start knob counter-clockwise to disable the output.
10. Disconnect input power from the machine; remove the right case side to provide access to the User Interface. Set position “1” on the dip switch back to “OFF”.

TROUBLESHOOTING

HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

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

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

The following “problems/symptoms” are a guide to solving issues that may be obvious with welding equipment. This document is not intended to be comprehensive. For further assistance see the Theory of Operation Section in this manual.

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, generally it states to contact your local Lincoln Authorized Field Service Facility.

⚠ CAUTION

TEST PROCEDURE

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

Observe all safety guidelines detailed throughout this manual		
PROBLEMS (SYMPTOM)	**POSSIBLE CAUSE**	**RECOMMENDED COURSE OF ACTION**
BASIC MACHNE PROBLEMS		
Major physical or electrical damage is evident when the sheet metal covers are removed.	Contact your local authorized Lincoln Electric Field Service facility for technical assistance.	

Observe all safety guidelines detailed throughout this manual		
PROBLEMS (SYMPTOM)	**POSSIBLE CAUSE**	**RECOMMENDED COURSE OF ACTION**
Machine won't weld, can't get any output.	**1.** If the displays show an Err ### see the fault section for corrective action **2.** if the thermal LED is lit refer to the thermal section **3.** If the output terminals are in remote control switch to "ON" and check for output voltage. If output voltage is now present check for correct remote control connection and operation.	If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local **Lincoln Authorized Field Service Facility**.
Thermal LED is lit	**1.** Check for proper fan operation. • Check for material blocking intake or exhaust louvers. • Blow air in the rear louvers to clear dirt from the fan **Note:** The Fan As Needed circuitry automatically shuts off the fan 5 minutes after welding has stopped. **2.** Welding output ratings may have been exceeded. Allow the machine to cool down and reset.	If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local **Lincoln Authorized Field Service Facility**.

Observe all safety guidelines detailed throughout this manual		
PROBLEMS (SYMPTOM)	**POSSIBLE CAUSE**	**RECOMMENDED COURSE OF ACTION**
Wire feeder won't work. Apparently no power to wire feeder	**1.** Check the 115/42V wire feeder switch (located on the case front) to make sure it is properly set for the input voltage requirement of the wire feeder. **2.** Check circuit breakers by the wire feeder receptacles on the front of the machine. Reset if required. **3.** Check the control cable between the power source and the wire feeder for continuity.	If all recommended possible areas of misadjustment have been checked and the problem persists, Contact your local **Lincoln Authorized Field Service Facility**.

USING THE STATUS LED TO TROUBLESHOOT SYSTEM PROBLEMS

Errors are displayed on the amperage and voltage display meters. In addition, there are status lights on the control pc board and the switch pc board that contain error sequences.

Included in this section is information about the fault codes indicated on the status lights and some basic troubleshooting charts for both machine and weld performance.

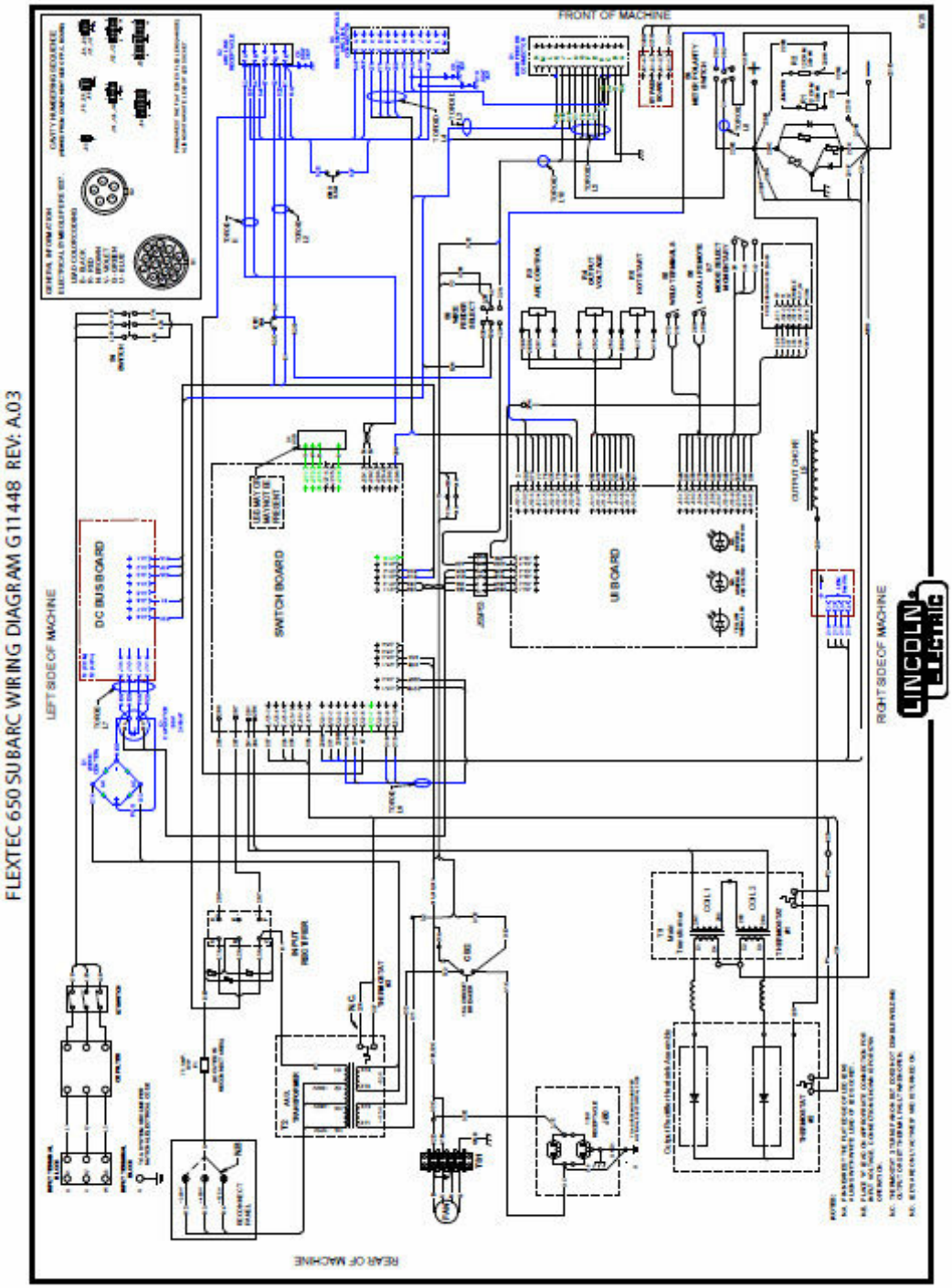
The status lights on the main control board and the switch pc board are dual-color LED's. Normal operation for each is steady green.

FLECTEC 650X FAULT CODES			
ERROR CODE #	DESCRIPTION	POSSIBLE CAUSE	CORRECTIVE ACTION
21	Device that controls sequence of the welding operation halted due to an error.		Weld Terminals Remote: Re-trigger to recover from error. Weld Terminals Local: Toggle Remote/Local Switch to recover from error.
31	Primary Over Current	Check the input power (voltage and frequency). Verify the primary reconnect is properly configured for the input voltage.	Machine needs to be turned off and back on to reset.

FLECTEC 650X FAULT CODES			
36	Thermal Fault	Machine shut off output due to elevated internal temperatures.	**1.** Check for proper fan operation. • Check for material blocking intake or exhaust louvers. • Blow air in the rear louvers to clear dirt from the fan **Note:** The Fan As Needed circuitry automatically shuts off the fan 5 minutes after welding has stopped. **2.** Welding output ratings may have been exceeded. Allow the machine to cool down and reset.
45	VRD™ Voltage limit exceeded	During OCV, the voltage exceeded allowable VRD™ levels. • Verify dip switch settings are correct for the input voltage	Machine needs to be turned off and back on to reset.
712	Communication Fault	CAN communication between the control PCB and switch PCB has been interrupted.	Inspect harness for damage / loose connections.
713	Input Power misconnect Supply Voltage is too HIGH	Occurs upon power up when the supply voltage to the switchboard exceeded acceptable levels	Verify the primary reconnect is properly configured for the input voltage. Machine needs to be turned off and back on to reset.
714	Input Power misconnect Supply Voltage is too LOW	Occurs upon power up when the supply voltage to the switchboard is below acceptable levels	Verify the primary reconnect is properly configured for the input voltage. Machine needs to be turned off and back on to reset.
715	Under Voltage Lockout	The supply voltage to the switch PCB is below acceptable levels	Machine needs to be turned off and back on to reset.
719	Switch PCB Error		Machine needs to be turned off and back on to reset.

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**

G11148-REV-A.03 WIRING DIAGRAM



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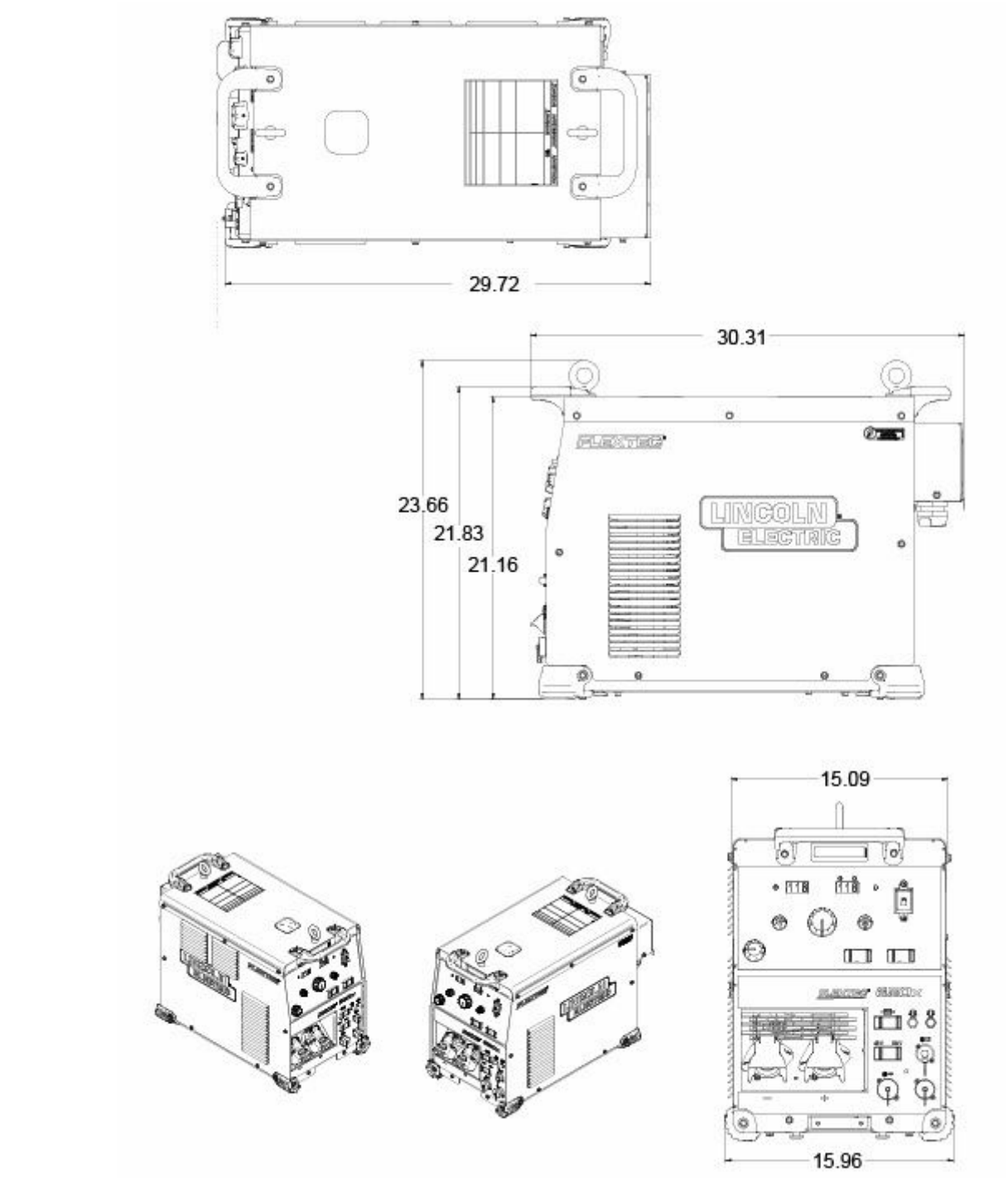

** For machines without handles

CUSTOMER ASSISTANCE POLICY

CUSTOMER ASSISTANCE POLICY

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

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

WELD FUME CONTROL EQUIPMENT

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

PARTS LIST

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