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REV01

POWER WAVE® AC/DC 1000 SD CE

OPERATOR'S MANUAL

ENGLISH

THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Ave., Cleveland Ohio 44117-1199 USA
www.lincolnelectric.eu

THE LINCOLN ELECTRIC COMPANY
EC DECLARATION OF CONFORMITY

Manufacturer and technical documentation holder:	The Lincoln Electric Company
Address:	22801 St. Clair Ave. Cleveland Ohio 44117-1199 USA
EC Company:	Lincoln Electric Europe S.L.
Address:	c/o Balmes, 89 - 8^0 2^a 08008 Barcelona SPAIN
Hereby declare that equipment:	K2803, Power Wave AC/DC 1000 SD K2444, CE Filter K2814, MAXsa 10 Controller K2626, MAXsa 19 Controller K2370, MAXsa 22 Feed Head K2312, MAXsa 29 Feed Head (Sales codes may contain suffixes and prefixes.)
Is in conformity with Council Directives and amendments:	Electromagnetic Compatibility (EMC) Directive 2014/30/EU Low Voltage Directive (LVD) 2014/35/EU
Standards:	EN 60974-1: 2012, Arc Welding Equipment – Part 1: Welding Power Sources; EN 60974-5: 2013, Arc Welding Equipment-Part 5: Wire Feeders; EN 60974-10: 2014, Arc Welding Equipment-Part 10: Electromagnetic compatibility (EMC) requirements;

CE marking affixed in 09

Samir Farah, Manufacturer
Compliance Engineering Manager
19 January 2017

Dario Gatti, European Community Representative
European Engineering Manager
20 January 2017

MCD240f

12/05

THANKS! For having chosen the QUALITY of the Lincoln Electric products.

- Please Examine Package and Equipment for Damage. Claims for material damaged in shipment must be notified immediately to the dealer.
  - For future reference record in the table below your equipment identification information. Model Name, Code & Serial Number can be found on the machine rating plate.

Model Name:	
.....	
Code & Serial number:	
.....	.....
Date & Where Purchased:	
.....	.....

ENGLISH INDEX

Technical Specifications

POWER WAVE® AC/DC 1000 SD CE (K2803-1*)

INPUT AT RATED OUTPUT – THREE PHASE ONLY					
INPUT VOLTS 3 PHASE 50/60Hz	**INPUT CURRENT AMPS**	**OUTPUT CONDITIONS**	**IDLE POWER WATTS**	**POWER FACTOR @ RATED OUTPUT**	**EFFICIENCY @ RATED OUTPUT**
380 400 460 500 575	82 79 69 62 55	1000A@44V. 100% Duty Cycle	225	.95	86%

OUTPUT			
OPEN CIRCUIT VOLTAGE	**AUXILIARY POWER (CIRCUIT BREAKER PROTECTED)**	**PROCESS CURRENT RANGES (AC or DC)**	
71V 70VACpk.	40 VDC AT 10 AMPS 115 VAC AT 10 AMPS	SAW-DC+	100amps@24Volts 1000Amps@44Volts (Actual range may be limited by process)
		SAW-DC-	
		SAW-AC	

RECOMMENDED INPUT WIRE AND FUSES SIZES[1]			
3 PAHESE INPUT VOLTAGE 50/60Hz	**TYPE 90°C COPPER WIRE[3] IN CONDUIT** **AWG (mm^2)**	**COPPER GROUNDING CONDUCTOR** **AWG (mm^2)**	**TIME DELAY FUSER OR BREAKER[2]** **AMPS**
380	3 (25)	8 (10)	100
400	3 (25)	8 (10)	90
460	4 (25)	8 (10)	90
500	4 (25)	8 (10)	80
575	6 (16)	10 (6)	70

PHYSICAL DIMENSIONS			
HEIGHT (mm)	**WIDTH (mm)**	**DEPTH (mm)**	**WEIGHT (kg)**
1248	501	1184	363

TEMPERATURE RANGES	
OPERATING TEMPERATURE RANGE (ºC)	**STORAGE TEMPERATURE RANGE (ºC)**
-10 to +40	-40 to +85

[1] Wire and Fuse Sizes based upon the U.S. National Electric Code and maximum output for 40°C ambient.
[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.
[3]Fail to use proper type of copper wire will cause fire hazards.
*****
An External filter will be required to meet CE or C-Tick/RCM conducted emission requirements. It will meet CE and C-Tick/RCM requirements with the use of an optional external filter. (K2444-3 CE and C-Tick/RCM Filter Kit).

WELDING PROCESSES			
PROCESS	**ELECTRODE DIAMETER RANGE**	**OUTPUR RANGE (Amperes)**	**WIRE FEED SPEED RANGE**
SAW	2 – 5.6mm	100 -1000	See Wire Drive Section

Insulation Class: Class F (155°C)

Electromagnetic Compatibility (EMC)

01/11

This machine has been designed in accordance with all relevant directives and standards. However, it may still generate electromagnetic disturbances that can affect other systems like telecommunications (telephone, radio, and television) or other safety systems. These disturbances can cause safety problems in the affected systems. Read and understand this section to eliminate or reduce the amount of electromagnetic disturbance generated by this machine.

This machine has been designed to operate in an industrial area. To operate in a domestic area it is necessary to observe particular precautions to eliminate possible electromagnetic disturbances. 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.

Before installing the machine, the operator must check the work area for any devices that may malfunction because of electromagnetic disturbances. Consider the following.

- Input and output cables, control cables, and telephone cables that are in or adjacent to the work area and the machine.
- Radio and/or television transmitters and receivers. Computers or computer controlled equipment.
- Safety and control equipment for industrial processes. Equipment for calibration and measurement.
- Personal medical devices like pacemakers and hearing aids.
- Check the electromagnetic immunity for equipment operating in or near the work area. The operator must be sure that all equipment in the area is compatible. This may require additional protection measures.
- The dimensions of the work area to consider will depend on the construction of the area and other activities that are taking place.

Consider the following guidelines to reduce electromagnetic emissions from the machine.

- Connect the machine to the input supply according to this manual. If disturbances occur if may be necessary to take additional precautions such as filtering the input supply.
- The output cables should be kept as short as possible and should be positioned together. If possible connect the work piece to ground in order to reduce the electromagnetic emissions. The operator must check that connecting the work piece to ground does not cause problems or unsafe operating conditions for personnel and equipment.
- Shielding of cables in the work area can reduce electromagnetic emissions. This may be necessary for special applications.

⚠ WARNING

EMC classification of this product is class A in accordance with electromagnetic compatibility standard EN 60974-10 and therefore the product is designed to be used in an industrial environment only.

⚠ WARNING

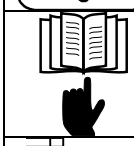
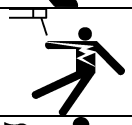
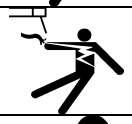
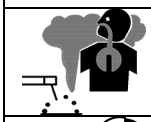
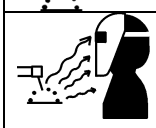
The Class A equipment is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There can be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radio-frequency disturbances.

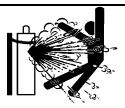
Safety

11/04

WARNING

This equipment must be used by qualified personnel. Be sure that all installation, operation, maintenance and repair procedures are performed only by qualified person. Read and understand this manual before operating this equipment. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment. Read and understand the following explanations of the warning symbols. Lincoln Electric is not responsible for damages caused by improper installation, improper care or abnormal operation.

	WARNING: This symbol indicates that instructions must be followed to avoid serious personal injury, loss of life, or damage to this equipment. Protect yourself and others from possible serious injury or death.
	READ AND UNDERSTAND INSTRUCTIONS: Read and understand this manual before operating this equipment. Arc welding can be hazardous. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment.
	ELECTRIC SHOCK CAN KILL: Welding equipment generates high voltages. Do not touch the electrode, work clamp, or connected work pieces when this equipment is on. Insulate yourself from the electrode, work clamp, and connected work pieces.
	ELECTRICALLY POWERED EQUIPMENT: Turn off input power using the disconnect switch at the fuse box before working on this equipment. Ground this equipment in accordance with local electrical regulations.
	ELECTRICALLY POWERED EQUIPMENT: Regularly inspect the input, electrode, and work clamp cables. If any insulation damage exists replace the cable immediately. Do not place the electrode holder directly on the welding table or any other surface in contact with the work clamp to avoid the risk of accidental arc ignition.
	ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS: Electric current flowing through any conductor creates electric and magnetic fields (EMF). EMF fields may interfere with some pacemakers, and welders having a pacemaker shall consult their physician before operating this equipment.
	CE COMPLIANCE: This equipment complies with the European Community Directives.
	FUMES AND GASES CAN BE DANGEROUS: Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. To avoid these dangers the operator must use enough ventilation or exhaust to keep fumes and gases away from the breathing zone.
	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. Use suitable clothing made from durable flame-resistant material to protect you skin and that of your helpers. Protect other nearby personnel with suitable, non-flammable screening and warn them not to watch the arc nor expose themselves to the arc.
	WELDING SPARKS CAN CAUSE FIRE OR EXPLOSION: Remove fire hazards from the welding area and have a fire extinguisher readily available. Welding sparks and hot materials from the welding process can easily go through small cracks and openings to adjacent areas. Do not weld on any tanks, drums, containers, or material until the proper steps have been taken to insure that no flammable or toxic vapors will be present. Never operate this equipment when flammable gases, vapors or liquid combustibles are present.
	WELDED MATERIALS CAN BURN: Welding generates a large amount of heat. Hot surfaces and materials in work area can cause serious burns. Use gloves and pliers when touching or moving materials in the work area.
	SAFETY MARK: This equipment is suitable for supplying power for welding operations carried out in an environment with increased hazard of electric shock.

	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. Always keep cylinders in an upright position securely chained to a fixed support. Do not move or transport gas cylinders with the protection cap removed. Do not allow the electrode, electrode holder, work clamp or any other electrically live part to touch a gas cylinder. Gas cylinders must be located away from areas where they may be subjected to physical damage or the welding process including sparks and heat sources.
	MOVING PARTS ARE DANGEROUS: There are moving mechanical parts in this machine, which can cause serious injury. Keep your hands, body and clothing away from those parts during machine starting, operating and servicing.
	EQUIPMENT WEIGHT OVER 30kg: Move this equipment with care and with the help of another person. Lifting may be dangerous for your physical health.

The manufacturer reserves the right to make changes and/or improvements in design without upgrade at the same time the operator's manual.

Installation and Operator Instructions

Read this entire section before installation or operation of the machine.

General Description

The Power Wave® AC/DC 1000 SD CE is a high performance, digitally controlled inverter welding power source. It is capable of producing a variable frequency and amplitude AC output, DC positive output, or DC negative output without the need for external reconnection. It utilizes complex, high-speed waveform control to support a variety of constant current and constant voltage welding modes in each of its output configurations.

The Power Wave® AC/DC 1000 SD CE power source is designed to be a part of a modular welding system. Each welding arc may be driven by a single machine, or by a number of machines in parallel. In multiple arc applications the phase angle and frequency of different machines can be synchronized by interconnecting the units with a control cable to improve performance and reduce the effects of arc blow.

The Power Wave® AC/DC 1000 SD CE is primarily designed to interface with compatible ArcLink equipment. However, it can also communicate with other industrial machines and monitoring equipment via DeviceNet, or Ethernet. The result is a highly integrated and flexible welding cell.

Recommended Process

The Power Wave® AC/DC 1000 SD CE is designed for submerged arc welding (SAW). Due to its modular design the Power Wave AC/DC can operate on either single arc or in multi-arc applications with up to six arcs. Each machine is factory preprogrammed with multiple welding procedures to support all types of submerged arc welding. The Power Wave® AC/DC 1000 SD CE carries an output rating of 1000 amps, 44 volts (at 100% duty cycle). If higher currents are required machines can be easily paralleled for up to 3000 amps on each arc (see Duty Cycle section)

Process Limitations

The Power Wave® AC/DC 1000 SD CE is suitable only for the Submerged Arc Process (SAW).

Equipment Limitations

The Power Wave® AC/DC 1000 SD can be used in outdoor environments. The Operating Temperature Range is 14°F to 104°F(0°C to +40°C).

Only the MAXsa™ 22 or MAXsa™ 29 Wire Drives and MAXsa™ 10 or MAXsa™ 19 Controllers may be used with a K2803-1 PowerWave® AC/DC 1000 SD CE in a Multi Arc system. Other Lincoln or non-Lincoln Wire Drives can only be used with custom interfaces.

The Power Wave® AC/DC 1000 SD CE will support a maximum average output current of 1000 Amps at 100% Duty Cycle.

Location and Mounting

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. See the Clearance Requirements and Figure #1 below.

Stacking

⚠ WARNING

DO NOT MOUNT OVER COMBUSTIBLE SURFACES.
Where there is a combustible surface directly under stationary or fixed electrical equipment, the surface shall be covered with a steel plate at least 1.6mm thick, which shall extend not more than 150mm beyond the equipment on all sides.

The Power Wave® AC/DC 1000 SD CE machine cannot be stacked.

Lifting

⚠ WARNING

FALLING EQUIPMENT can cause injury.
- Lift only with equipment of adequate lifting capacity.
- Be sure machine is stable when lifting.

- Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.
- Do not lift machine if lift bail is damaged.
- Do not operate machine while suspended from lift bail

Lift the machine by the lift bail only. The lift bail is designed to lift the power source only . Do not attempt to lift the Power Wave® AC/DC 1000 SD CE with accessories attached to it.

Duty Cycle

The Power Wave® AC/DC 1000 SD CE is capable of welding 1000Amps,. @44V, at a 100% Duty cycle.

Environmentasl Limitations

The Power Wave® AC/DC 1000 SD CE can be used in an outdoor environment with an IP 23 rating. It should not be subjected to falling water, 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.

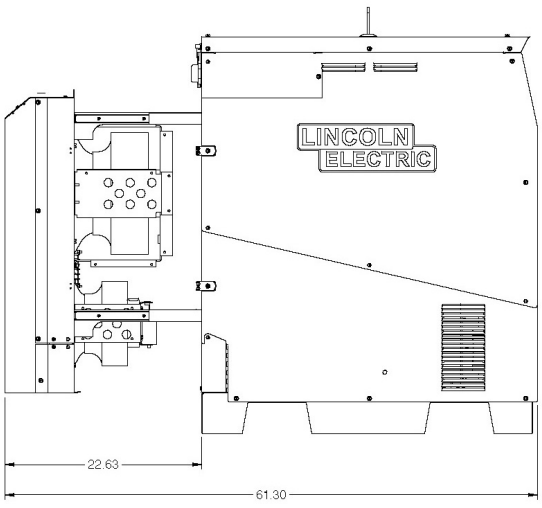
Clearence Requirements

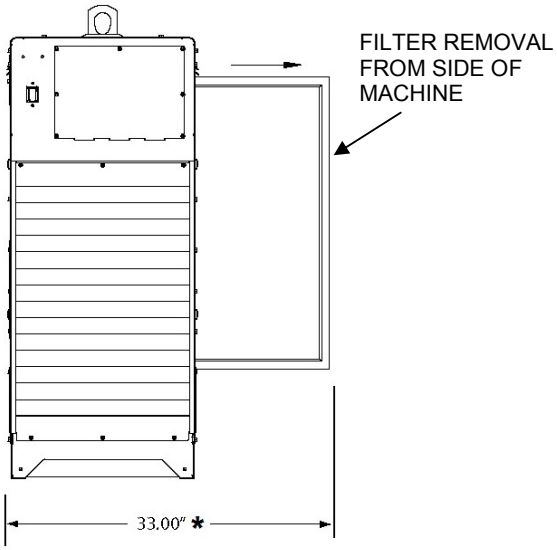
The maintenance requirements of the Power Wave® AC/DC 1000 SD CE demands that enough clearance behind the machine be maintained. This is especially important where more than one machine is to be used or if the machines are going to be rack mounted.

The rear portion of the machine that contains the filter and the cooling fans slides out for easy access to clean the heat sink fins.

Removing the four clips and pulling back on the rear portion of the machine will provide access for cleaning the machine and checking the filter. The filter is removed from the right side of the machine.

Where machines are mounted side by side, the machine that is furthest to the right will need to have the indicated clearance to the right side for filter removal. See Figure #1





*: 33.00" width needed for filter maintenance access.

Figure #1: Clearance Requirements

Input and Ground Connections

Machine Grounding

The frame of the welder must be grounded. A ground terminal marked with a ground symbol shown is located inside the reconnect/input access door for this purpose. See your local and national electrical codes for proper grounding methods.

Input Connection

⚠ WARNING

ELECTRIC SHOCK can kill
Only a qualified electrician should connect the input leads to the Power Wave. Connections should be made in accordance with all local and national electrical codes and the connection diagrams located on the inside of the reconnect/input access door of the machine. Failure to do so may result in bodily injury or death.

Use a three-phrase supply line. A 45mm diameter access hole for the input supply is located on the case back. Connect L1, L2, L3 and ground according to the Input Supply Connection Diagram.

Input Fuse and Supply Wire Considerations

Refer to Specifications page for recommended fuse and wire sizes. 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 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

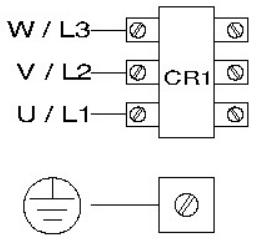
Welders are shipped connected for the highest input voltage listed on the rating plate. To move this connection to a different input voltage, see the diagram located on the inside of the input access door, or the Input Supply Connection Diagram below. If the Auxiliary lead (indicated as 'A') is placed in the wrong position, there are two possible results.

a) If the lead is placed in a position higher than the applied line voltage, the welder may not come on at all.
b) If the Auxiliary lead is placed in a position lower than the applied line voltage, the welder will not come on, and the two circuit breakers in the reconnect area will open. If this occurs, turn off the input voltage, properly connect the auxiliary lead, reset the breakers, and try again.

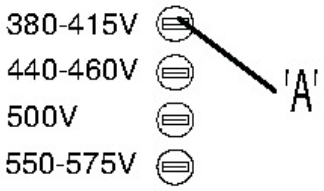
Input Supply Connection for K2803-1

⚠ WARNING

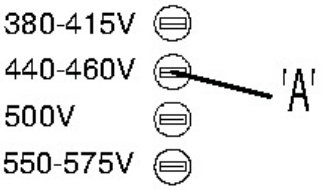
ELECTRIC SHOCK CAN KILL:
- Do not operate with covers removed
- Disconnect input power before servicing
- Do not touch electrically live parts
- Only qualified persons should install, use or service this equipment



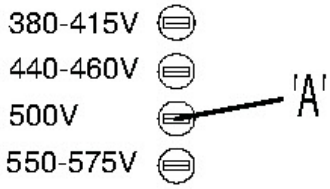
Voltage=380-415V



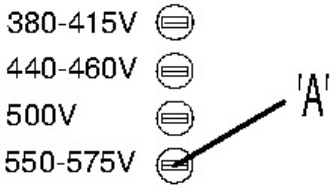
Voltage=440-460V



Voltage=500V



Voltage=550-575V



System Connection

System Overview

The Power Wave® AC/DC 1000 SD CE power source is designed to be a part of a modular welding system typically controlled by a MAXsa™ 10 Controller or a customer supplied Programmable Logic Controller (PLC). Each welding arc may be driven by a single power source or by a number of power sources connected in parallel. The actual number of power sources per arc will vary depending on the application. When only one power source is required for an arc group, it must be configured as a Master. When parallel machines are required, one is designated as the Master and the rest as Slaves. The synchronizing connectors for paralleled machines are on the back of the power source. The Master controls the AC switching for the arc group, and the Slaves respond accordingly. See Figure #3 below.

When employed in a multi-arc AC system the arcs must be synchronized to each other. The Master for each arc can be configured to follow a dedicated external synchronization signal to determine its frequency and balance. The Synchronizing Connectors on the back of the Power Wave® AC/DC 1000 SD CE provide the means to synchronize the AC wave shapes of up to six different arcs to a common carrier frequency. (See Figure #3). This frequency can range from 20 hertz to 100 hertz. It can also control the phase angle between arcs to reduce the effects of welding related issues such as "Arc Blow".

The arc to arc phase relationship is determined by the timing of each arc's "sync" signal relative to the "sync" signal of ARC 1. DIP Switches on the Control PC Board of each machine must be set to identify it as a Master Lead, Master Trail or Slave. See Figure #2.

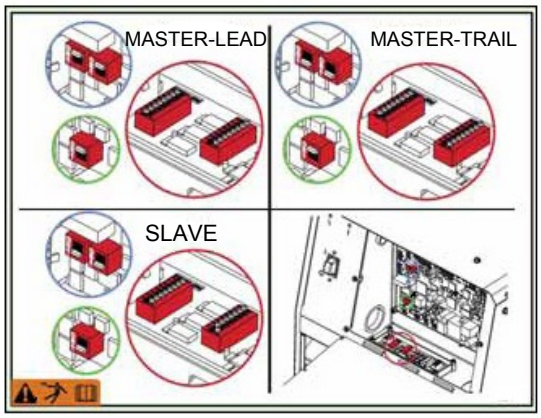


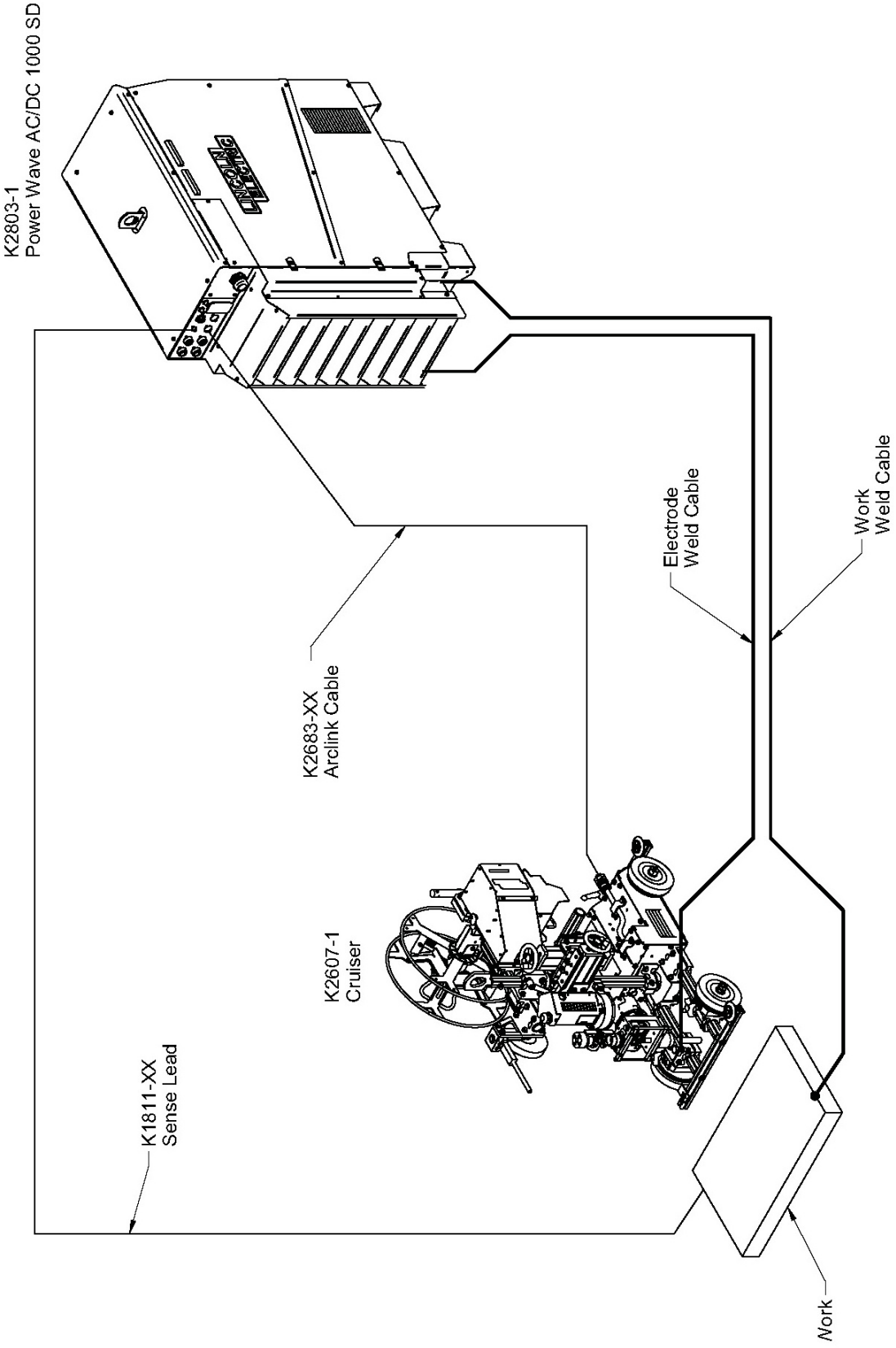
Figure #2: Dip Switch Settings

In a typical multi-arc system, each arc is controlled by its own MAXsa™10 Controller. The basic characteristics of the individual arcs such as WFS, amplitude, and offset are set locally by each arc's dedicated controller. The frequency, balance, and phase shift parameters of each arc are controlled by the MAXsa™ 10 Controller for ARC 1 (Master Lead).

NOTE: The K2803-1 Power Wave® AC/DC 1000® SD is backwards compatible with the K2344-2 Power Wave® AC/DC 1000 in tandem or multi-arc systems. The K2803- 1 and K2344-2 machines cannot be connected in parallel. Paralleled machines must be of the same type. A K1805- 1 (14 to 22 pin adapter cable) is required to interface to the K2282-1 Systems Interface in these setups A PLC interface is an alternate method of control for larger systems. The PLC is typically connected via DeviceNet directly to the Master power source of each arc group in the system. MAXsa™ 19 Controller is still required to power the Wire Drive. Contact your Local Lincoln Electric Representative for more information.

The connection diagrams describe the layout of several typical systems including Multi-Arc and Paralleled machine set-ups. Each system also has a step by step "Installation Checklist".

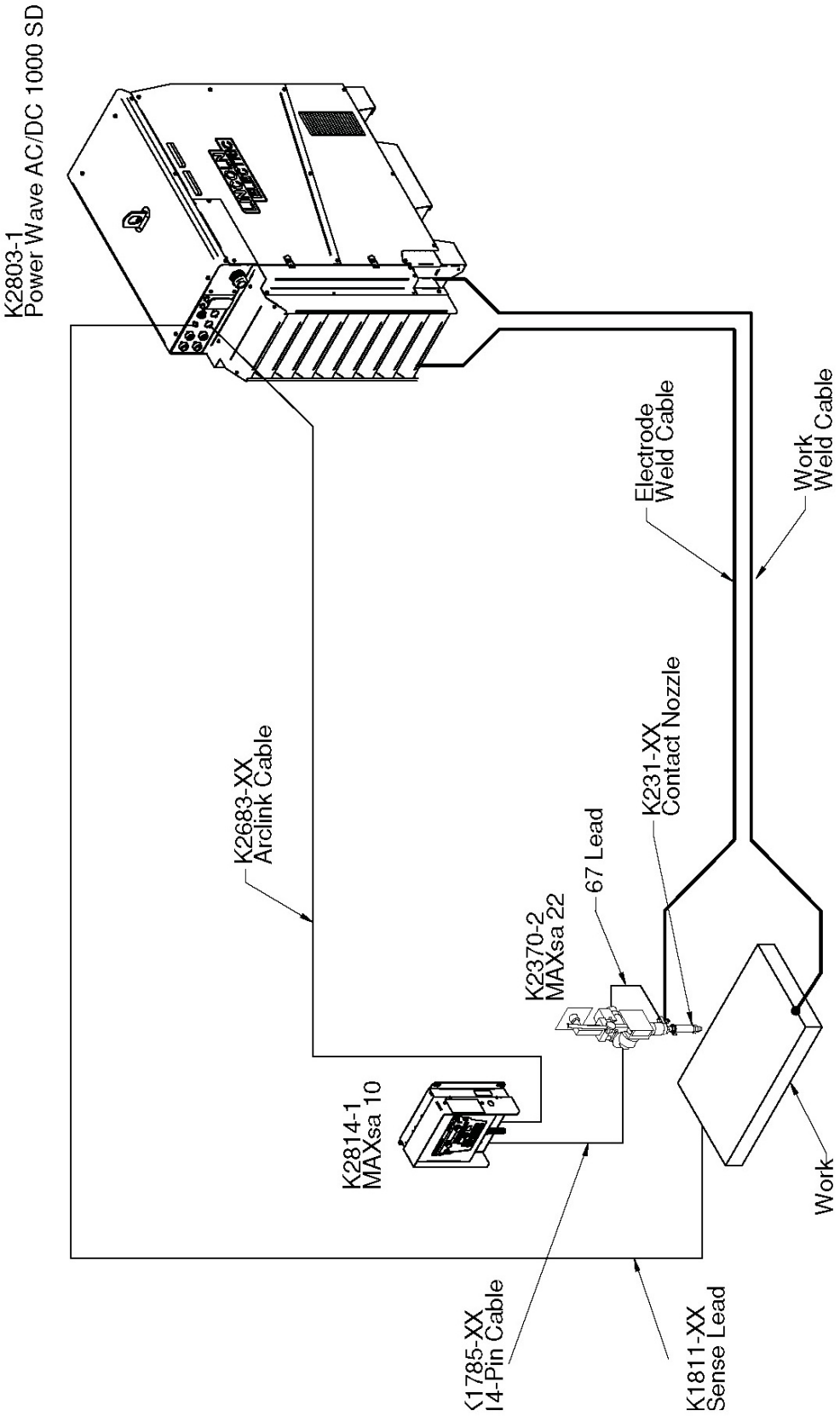
Cruiser Connection Diagram



CRUISER™ SYSTEM CHECKLIST (See Cruiser Connection Diagram)

- ☐ Place Power Wave® AC/DC 1000 SD CE in suitable operating location.
- ☐ Place the Cruiser™ Tractor in it's operating location.
- ☐ Connect K2683-xx Heavy Duty ArcLink Control Cable (5 pin) between Power Wave® AC/DC 1000 SD CE and the Cruiser™ Tractor.
- ☐ Install Work Voltage Sense Lead (21) from the Power Wave® AC/DC 1000 SD CE per recommended guidelines.
- ☐ Connect / Install welding cables per recommended "Output Cable Guidelines" (see **Table1: Output Cable Guidelines)**
- ☐ Open the Power Wave® AC/DC 1000 SD CE front panel and check the DIP switch settings per the decal on the panel. Factory Setting is "Master-Lead". **(**see **Figure #2: Dip Switch Settings)**.
- ☐ Connect input power to Power Wave® AC/DC 1000 SD CE per recommended guidelines
- ☐ Turn on Power Wave® AC/DC 1000 SD CE, and verify all system Status Lights are solid green.
- ☐ Select a Welding process and configure starting and ending options.

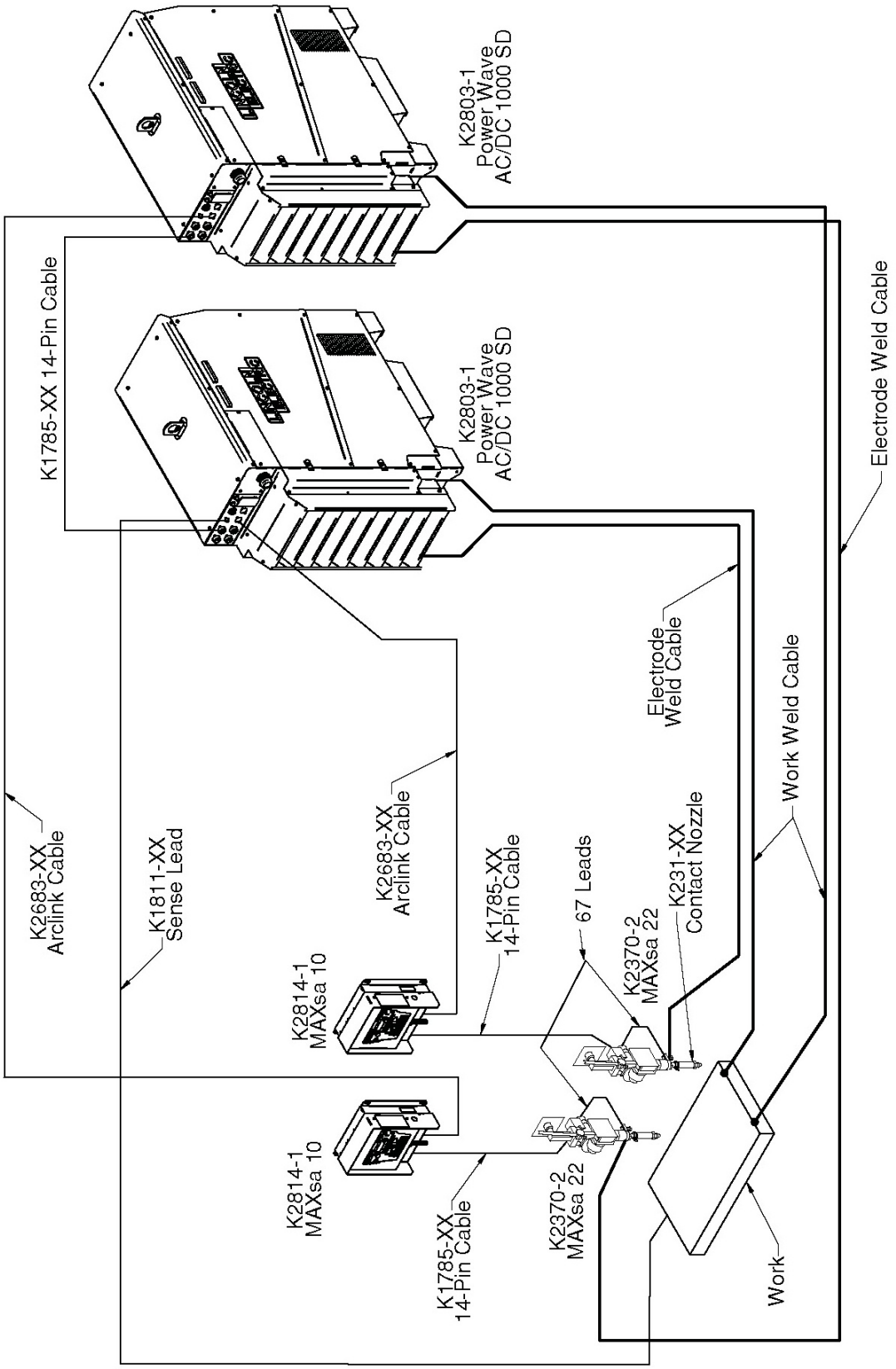
Single Arc Connection Diagram



SINGLE ARC SYSTEM CHECKLIST (See Single Arc Connection Diagram)

- ☐ Place Power Wave® AC/DC 1000 SD CE in suitable operating location.
- ☐ Mount MAXsa™ 10 Controller.
- ☐ Install MAXsa™ 22 Wire Drive and other accessories in their operating location.
- ☐ Connect K2683-xx Heavy Duty ArcLink Control Cable (5 pin) between Power Wave and MAXsa™ 10.
- ☐ Connect K1785-xx Wire Feeder Control Cable (14 pin) between the MAXsa™ 10 and the MAXsa™ 22.
- ☐ Install Electrode Sense Lead (67) at the feeder and the Work Sense Lead (21) from the Power Wave® AC/DC 1000 SD CE per recommended guidelines.
- ☐ Connect / Install welding cables per recommended "Output Cable Guidelines." (see **Table1: Output Cable Guidelines).**
- ☐ Open the Power Wave® AC/DC 1000 SD CE front panels and check the DIP switch settings per the decal on the panel. Factory Setting is “Master-Lead”. **(**see **Figure #2: Dip Switch Settings)**.
- ☐ Connect input power to Power Wave® AC/DC 1000 SD CE per recommended guidelines.
- ☐ Turn on Power Wave® AC/DC 1000 SD CE, and verify all system Status Lights are solid green.
- ☐ Select a Welding process and configure starting and ending options

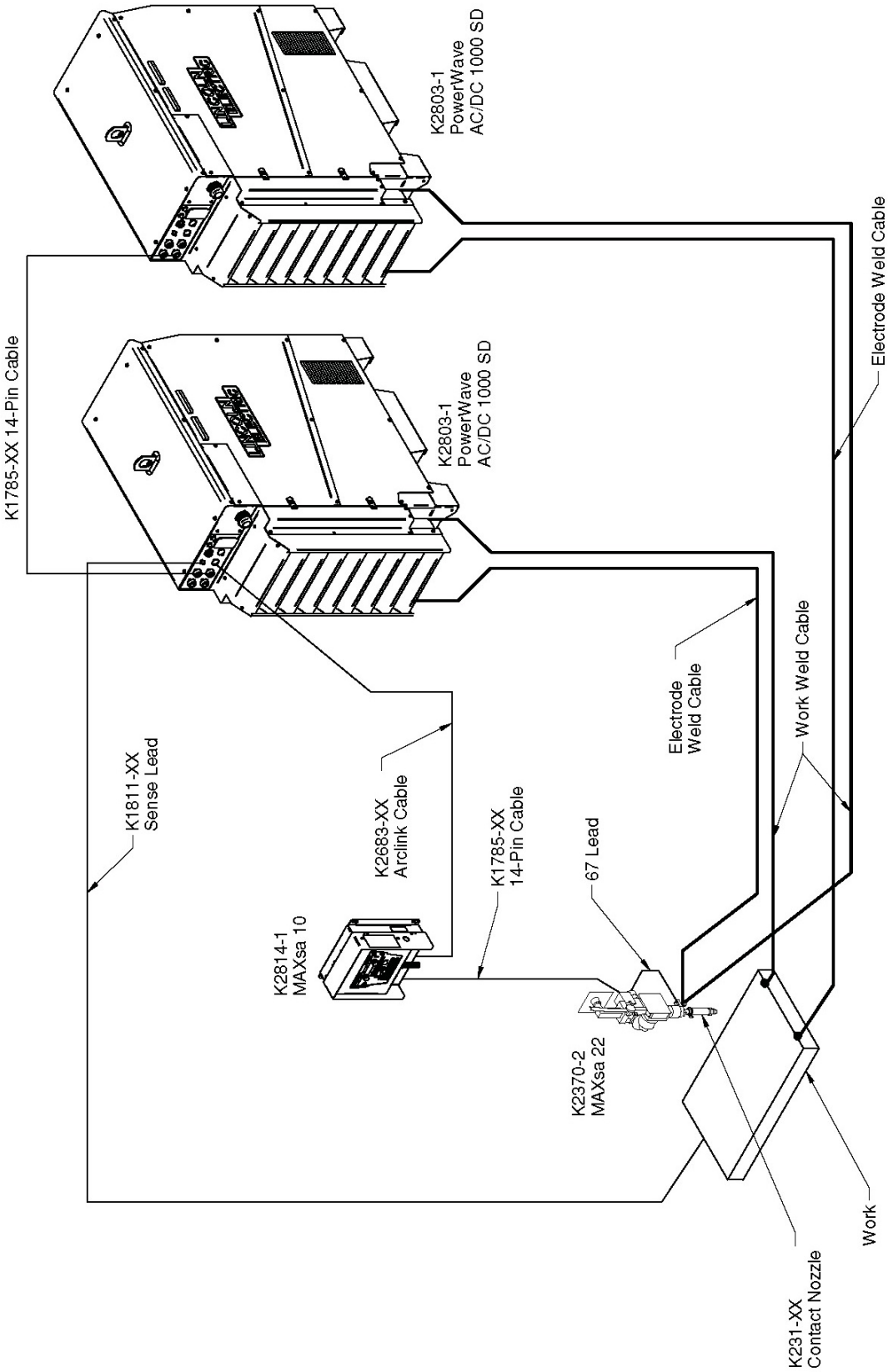
Tandem Arc Connection Diagram



TANDEM ARC (2-ARC) SYSTEM CHECKLIST (See Tandem Arc Connection Diagram)

- ☐ Place Power Wave® AC/DC 1000 SD CE units in suitable operating location.
- ☐ Mount MAXsa™ 10 Controllers.
- ☐ Install MAXsa™ 22 Wire Drives and other accessories in their operating location.
- ☐ Connect a K1785-xx Wire Feeder Control Cable (14 pin) between the two power sources (top connectors).
- ☐ Connect K2683-xx Heavy Duty ArcLink Control Cables (5 pin) between Power Wave units and MAXsa™ 10 controllers.
- ☐ Connect K1785-xx Wire Feeder Control Cable (14 pin) between the MAXsa™ 10 controllers and the MAXsa™ 22 feeders.
- ☐ Install Electrode Sense Lead (67) at each feeder and the Work Sense Lead (21) from the Lead Power Wave® AC/DC 1000 SD CE Master per guidelines.
- ☐ Connect / Install welding cables per recommended "Output Cable Guidelines" ." (see **Table1: Output Cable Guidelines)**
- ☐ Open the Power Wave® AC/DC 1000 SD CE front panels and configure DIP switch settings per the decal on the panel. (see **Figure #2: Dip Switch Settings)**.
- ☐ Connect input power to Power Wave® AC/DC 1000 SD CE units per recommended guidelines.
- ☐ Turn on Power Wave® AC/DC 1000 SD CE and verify all system Status Lights are solid green.
- ☐ Confirm that the latest software is updated in all equipment prior to installation (www.powerwavesoftware.com).
- ☐ Run the subarc cell configurator from PC Tools (see section accessories of this manual or go to www.powerwavesoftware.com).
- ☐ Select a Welding process and configure starting and ending options.

Paralleling Connection Diagram



PARALLEL CONNECTION CHECKLIST (See Parelleling Connection Diagram))

☐ Place the Power Wave® AC/DC 1000® SD units in a suitable operating location. Mount MAXsa™ 10 Controller. Install MAXsa™ 22 Wire Drive and other accessories in their operating location.

☐ The MAXsa™ Controller must be connected to the Master Power Source. Connect K2683-xx Heavy Duty ArcLink Control Cable (5 pin) between Power Wave and MAXsa™ 10 controller.

☐ Connect K1785-xx Wire Feeder Control Cable (14 pin) between the MAXsa™ 10 controller and the MAXsa™ 22 feeder.

☐ Connect a K1785-xx Wire Feeder Control Cable (14 pin) between the two power sources (top connectors).

☐ Install Electrode Sense Lead (67) at the feeder and the Work Sense Lead (21) from the Lead Power Wave® AC/DC 1000 SD CE Master per guidelines.

☐ Connect / Install welding cables to both the “master” and “slave” machine per recommended "Output Cable Guidelines" (see **Table1: Output Cable Guidelines)**.

☐ Open the Power Wave® AC/DC 1000 SD CE front panels and configure DIP switch settings per the decal on the panel. (see **Figure #2: Dip Switch Settings).**

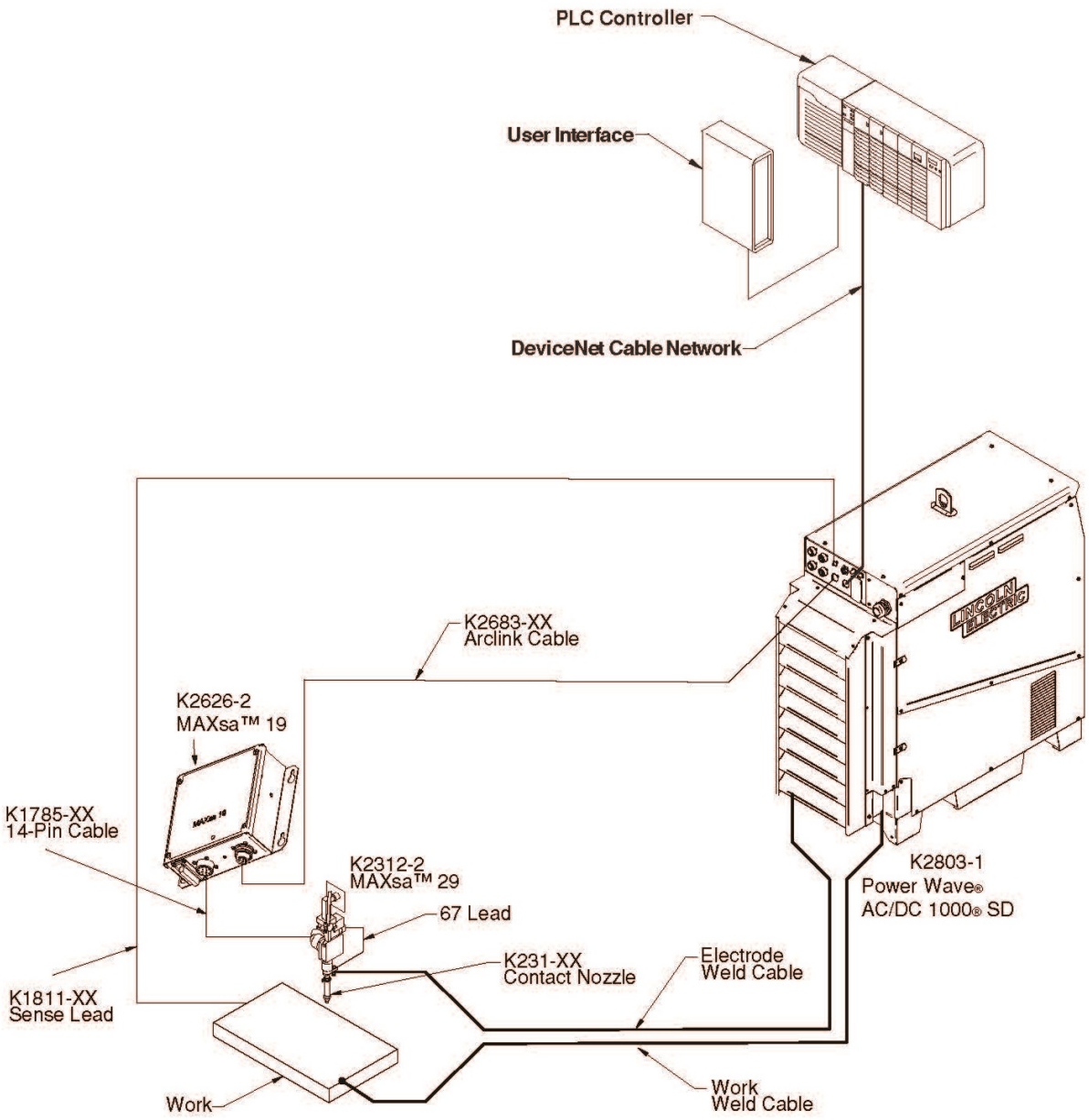
☐ Connect input power to Power Wave® AC/DC 1000 SD CE units per recommended guidelines. Turn on Power Wave® AC/DC 1000 SD CE, and verify all system Status Lights are solid green.

☐ Confirm that latest software is updated in all equipment prior to installation (www.powerwavesoftware.com)

☐ For tandem setups, run the subarc cell configurator from PC Tools (See Section "Accessories" of this manual or go to www.powerwavesoft- ware.com).

☐ Select a Welding process and configure starting and ending options.

MAXsa™ 19 Connection Diagram



MAXsa™ 19 SYSTEM CHECKLIST

- ☐ Place the Power Wave® AC/DC 1000 SD CE in a suitable operating location.
- ☐ DeviceNet PLC controlled systems: Mount DeviceNet PLC controller and User Interface.
- ☐ Mount MAXsa™ 19 in it's operating location.
- ☐ Connect K2683-xx Heavy Duty ArcLink Control Cables (5 pin) between Power Wave® AC/DC 1000 SD CE and MAXsa™ 19.
- ☐ Connect K1785-xx Wire Feeder Control Cable (14 pin) between the MAXsa™ 19 and the MAXsa™ 29.
- ☐ DeviceNet PLC controlled systems: Connect each Arc Master power source to the PLC via the DeviceNet network.
- ☐ Install Work Voltage Sense Lead (21) from Power Wave® AC/DC 1000 SD CE per recomennded guidelines.
- ☐ Connect / Install welding cables per recommended "Output Cable Guidelines" (Table 1).
- ☐ Open the Power Wave® AC/DC 1000 SD CE front panels and configure DIP switch settings per the decal on the panel. Factory setting is "Master-Lead".(See Figure #2).
- ☐ Connect input power to Power Wave® AC/DC 1000 SD CE per recommended guidelines.
- ☐ Turn on Power Wave® AC/DC 1000 SD and verify all system Status Lights are solid green.
- ☐ DeviceNet PLC controlled systems: Run Weld Manager. For each Arc Master connect to the power source. Under Network Settings -> DeviceNet-> Configuration, configure the DeviceNet MAC address and baud rate.
- ☐ Run Weld Manager. For each Arc Master connect to the power source. Under Feeder Settings -> Wire Feeder, verify the appropri- ate Feeder and gear ratio are selected.
- ☐ Confirm that latest software is updated in all equipment prior to installation (www.powerwavesoftware.com)
- ☐ Select a Welding process and configure starting and ending options.

Electrode and Work Connections

General Guidelines

The unique switching structure of the Power Wave® AC/DC 1000 SD CE allows it to produce DC positive, DC negative or AC output waveforms without reposition-ing the work and electrode leads. Additionally, no DIP switch changes are required to switch between the different polarities. All of this is controlled internally by the Power Wave® AC/DC 1000 CE, and based exclusively on the weld mode selection.

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

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

Note: Excessive heat in the weld circuit indicates 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.**

Table1: Output Cable Guidelines

Total Cable Length (m) Electrode and Work Combined	**Duty Cycle**	**Number of Parallel Cables**	**Cable Size Copper**
0 to 76.2	80%	2	4/0 (120 mm^2)
0 to 76.2	100%	3	3/0 (95 mm^2)

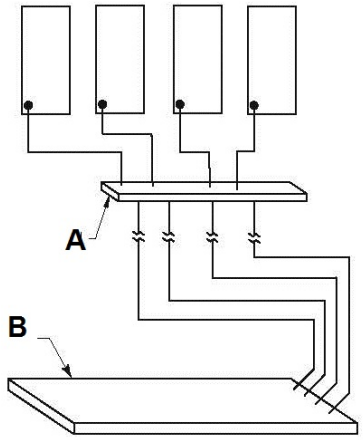
Electrode Connections

Connect cable(s) of sufficient size and length (Per Table 1: Output Cable Guidelines) to the "ELECTRODE" studs on the power source (located behind the cover plate on the lower right rear corner). Connect the other end of the elec-trode cable(s) to the tab of the contact nozzle. Be sure the connection to the nozzle makes tight metal-to-metal electrical contact.

Work Connections

Connect cable(s) of sufficient size and length (Per Table 1) between the "WORK" studs (located behind the cover on the lower left rear corner) and the work piece. Be sure the connec tion to the work makes tight metal-to-metal electrical contact.

NOTE: For parallel and/or multiple arc applications with excessive electrode cable lengths, a com-mon bus connection should be used. The common electrode connection serves to mini-mize voltage drops associated with resistive losses in the electrode path. It should be made of copper, and located as close as possible to the power sources. (See Figure #4).



A. Common connection (located close to power sources)
B. Work piece

Figure #4

Cable Inductance, and its Effects on Welding

Excessive cable inductance will cause the welding performance to degrade. There are several factors that contribute to the overall inductance of the cabling system including cable size, and loop area. The loop area is defined by the separation distance between the electrode and work cables, and the overall welding loop length. The welding loop length is defined as the total of length of the electrode cable (A) + work cable (B) + work path (C) (see Figure #6). To minimize inductance always use the appropriate size cables, and whenever possible, run the electrode and work cables in close proximity to one another to minimize the loop area. Since the most significant factor in cable inductance is the welding loop length, avoid excessive lengths and **do not coil excess cable**. For long work piece lengths, a sliding ground should be considered to keep the total welding loop length as short as possible.

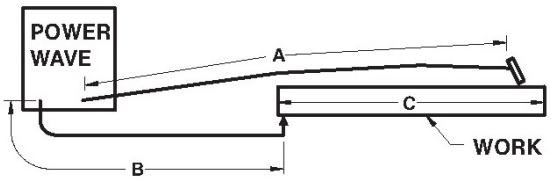


Figure #6

Remote Sense Lead Connections

Voltage Sensing Overview

The best arc performance occurs when the Power Wave® AC/DC 1000 SD CE has accurate data about the arc conditions. Depending upon the process, inductance within the electrode and work cables can influ-ence the voltage apparent at the studs of the welder, and have a dramatic effect on performance. To counteract this negative effect, remote voltage sense leads are used to improve the accuracy of the arc voltage information supplied to the control pc board.

There are several different sense lead configurations that can be used depending on the application. In extremely sensitive applications it may be necessary to route cables that contain the sense leads away from the electrode and work welding cables.

⚠ WARNING

If the remote voltage sensing is enabled but the sense leads are missing, improperly connected, or if the electrode polarity is improperly configured extremely high welding outputs may occur.

Electrode Voltage Sensing

The remote ELECTRODE sense lead (67) is built into the wire feeder control cable (K1785) and accessible at the wire drive. It should always be connected to the Contact Assembly where the Weld Cable is connect-ed. Enabling or disabling electrode voltage sensing is application specific, and automatically configured through software.

Work Voltage Sensing

For most applications the use of a remote work volt-age sense lead is recommended. The Power Wave® AC/DC 1000 SD CE is shipped from the factory with the remote work voltage sense lead enabled. It must be attached to the work as close to the weld as practical, but out of the weld current path. For more information regarding the placement of remote work voltage sense leads, see the section entitled "Voltage Sensing Considerations for Multiple Arc Systems". The remote WORK sense lead (21) can be accessed at the four-pin WORK sense lead connector located on the back panel of the Power Wave AC/DC 1000 SD CE.

NOTE: All of the machines of a given arc group (Master and Slaves) will relate to the Voltage Sense Lead of the Master machine.

⚠ WARNING

Never connect the WORK sense lead at two different locations.

⚠ WARNING

ELECTRIC SHOCK can kill.

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

Voltage Sensing Considerations for Multiple Arc Systems

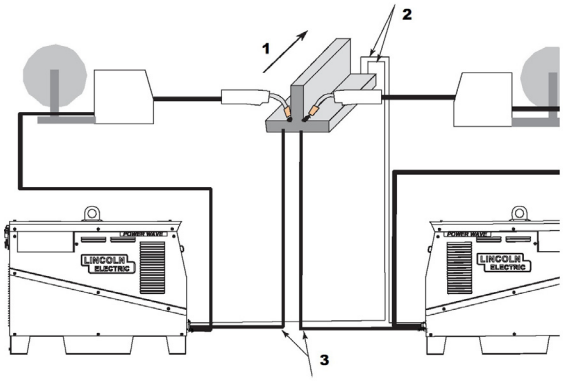
Special care must be taken when more than one arc is welding simultaneously on a single part. Remote sensing is required in Multi-arc applications.

- **Avoid common current paths**. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

- **Position the sense leads out of the path of the weld current.** Especially any current paths common to adjacent arcs. Current from adjacent arcs can induce voltage into each others current paths that can be misinterpreted by the power sources, and result in arc interference.

- **For longitudinal applications**, connect all work leads at one end of the weldment, and all of the work voltage sense leads at the opposite end of the weldment. Perform welding in the direction away from the work leads and toward the sense leads. See figure #7.

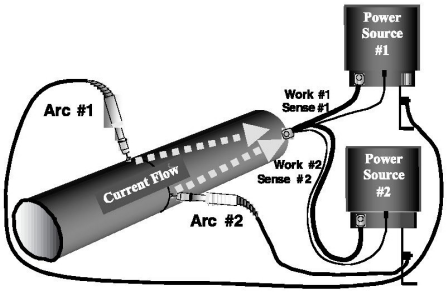
- **For circumferential applications**, connect all work leads on one side of the weld joint, and all of the work voltage sense leads on the opposite side, such that they are out of the current path. (see Figure #8).



1. Direction of travel.
2. Connect all sense leads at the end of the weld.
3. Connect all work leads at the beginning of the weld.

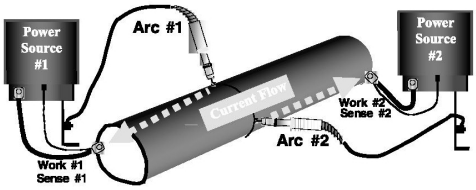
Figure #7

Bad connection



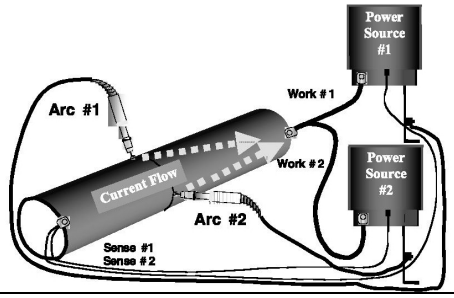
- Current flow from **Arc#1** affects **Sense#2**.
- Current flow from **Arc#2** affects **Sense#1**.
- Neither sense lead picks up the correct work voltage, causing starting and welding arc instability.

Better connection



- **Sense#1** is only affected by weld current from **Arc#1**.
- **Sense#2** is only affected by weld current from **Arc#2**.
- Due to voltage drops across work piece, Arc voltage may be low, causing need for deviation from standard procedures.

Best connection



- Both **Sense#** leads are out of the current paths.
- Both **Sense#** leads detect arc voltage accurately.
- No voltage drop between **Arc#** and **Sense#** leads.
- Best start, best arcs, most reliable results.

Figure #8

Control Cable Connections

General Guidelines

These Guidelines apply to all commumication cables including optional DeviceNet and Ethernet connections.

- **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 Power Wave®/MAXsa™ systems. Most are designed to be connected end to end for ease of operation.
- **Always use the shortest cable lenghts possible. DO NOT coil excess cable.** It is recommended that the total length of Control cable does not exceed 30.5m. The use of non standard cables, especially in lengths greater than 7,5m, can lead to communication problems (system shutdowns), poor motor acceleration (poor arc starting), and low wire driving force (wire feeding problems).
- **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.

Common Equipment Connections

Connection Between MAXsa™ Controller and MAXsa™ series Wire Drive (K1785-xx)

The 14 pin Wire Drive Control Cable (K1785-xx) connects the Controller (MAXsa™ 10 or MAXsa™ 19) to the Wire Drive (MAXsa™ 22 or MAXsa™ 29). This cable should be kept as short as possible.

Connection Between Power Source and the MAXsa™ Controller (K2683-xx - ArcLink Control Cable).

Single and tandem arc systems are typically controlled by a MAXsa™ 10 Controller. In a tandem, or multi-arc system, each arc requires its own dedicated controller.

The 5-pin ArcLink control cable connects the power source to the MAXsa™ 10. If there is more than one power source per arc, it connects from the MAXsa™ 10 to the power source designated as the Master for that arc. The control cable consists of two power leads, one twisted pair for digital communication, and one lead for voltage sensing (67).

NOTE: Connections Between Power Source and Optional DeviceNet Programmable Logic Controller(PLC).

It is sometimes more practical and cost effective to use a custom PLC interface to control a multi-arc sys-tem (refer to the "DeviceNet Configuration" section for interface information). The Power Wave AC/DC 1000 is equipped with a 5-pin DeviceNet mini style recepta-cle for this purpose. The receptacle is located on the rear panel of the machine See Figure Case Back Components. The DeviceNet cable is keyed and polarized to prevent improper connection.

NOTE: DeviceNet cables should not be routed with weld cables, wire drive control cables, or any other current carrying device that can create a fluctuating magnetic field.

In a typical system, a DeviceNet connection is made between the master power source of each arc, and the PLC interface. DeviceNet cables must be sourced locally by the customer. For additional guidelines refer to the "DeviceNet Cable Planning and Installation Manual" (Allen Bradley publication DN-6.7.2).

Connections Between Parallel Power Sources (K1785-xx - Control Cable).
To increase the output capacity for a given arc, the output studs of multiple Power Wave® AC/DC 1000 SD CE machines can be connected in parallel. The parallel machines utilize a master/slave control scheme to dis-tribute the load evenly and to coordinate AC switch-ing. K1785-xx cables connect the paralleled machines via the synchronizing connectors on the back of the machine. The system is currently limited to a maxi-mum of 2 slaves per master, or a total of 3 machines per arc.

Connections Between Power Sources in Multi-Arc Applications (K1785-xx - Control Cable).
Synchronizing Connectors are available on the rear panel of the machine for Multi-Arc applications using the K1875-xx control cables. The system is currently limited to six(6) arcs, or a “Lead” and five “Trail” arcs.

Definitions of Welding Modes

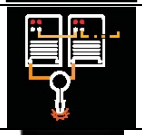
NON-SYNERGIC WELDING MODES
A Non-synergic welding mode requires all welding process variables to be set by the operator.

SYNERGIC WELDING MODES
A Synergic welding mode offers the simplicity of single knob control. The machine will select the correct voltage and amperage based on the wire feed speed (WFS) set by the operator.

COMMON WELDING ABBREVIATIONS

SAW
Submerged Arc Welding

Graphic Symbols that Appear on this Machine or in this Manual

	MULTI-ARC CONNECTOR
	PARALLEL ARC CONNECTOR
	ETHERNET CONNECTOR
	ARCLINK CONNECTOR

	DEVICENET CONNECTOR
	115VAC RECEPTABLE
	WORK SENSE LEAD CONNECTOR
	INPUT POWER
	ON
	OFF
	HIGH TEMPERATURE
	MACHINE STATUS
	CIRCUIT BREAKER
	WIRE FEEDER
	POSITIVE OUTPUT
	NEGATIVE OUTPUT
	3 PHASE INVERTER
	INPUT POWER
	THREEE PHASE
	DIRECT CURRENT
U_0	OPEN CIRCUIT
U_1	INPUT VOLTAGE
U_2	OUTPUT VOLTAGE
I_1	INPUT CURRENT
I_2	OUTPUT CURRENT
	PROTECTIVE GROUND

	WARNING or CAUTION
	EXPLOSION
	DANGEROUS VOLTAGE
	SHOCK HAZARD

Case Front Controls

1. **Power Switch:** Controls input power to the Power Wave® AC/DC 1000 SD CE and any auxiliary equipment that may be connected to it.

2. **Status Light:** A two color LED that indicates system errors. Normal operation is steady green. Flashing green or red/green indicates a system error.

NOTE: The Power Wave Status Light will flash green for up to 60 seconds at power up as the machine runs through a self test routine, and then go to steady green.

3. **Thermal Light:** A yellow light that comes ON when an over temperature situation occurs. The machine output is disabled until the machine cools down and the thermal light goes OFF

NOTE: The Thermal Light may also indicate a problem with the AC Switch portion of the power source.

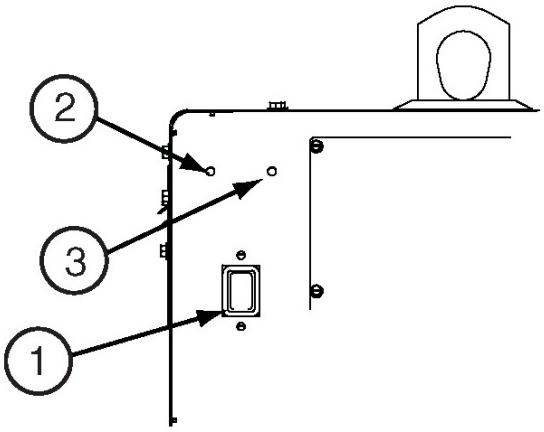


Figure: Case Front

Input Power Section

1. **Input Contactor**: Connection point for incoming 3 phase power. See the Installation Section for input wiring and fusing information.

2. **Case Ground**: Used to provide an “earth ground” for the frame of the welder. Consult your local and national electrical codes for proper grounding information.

3. **Auxiliary Reconnect**: Select the proper tap based on the supply voltage.

4. **Fuse (F1):** Protection for the primary side of the auxiliary transformer

5. **Cord Connector:** Input power cord strain relief.

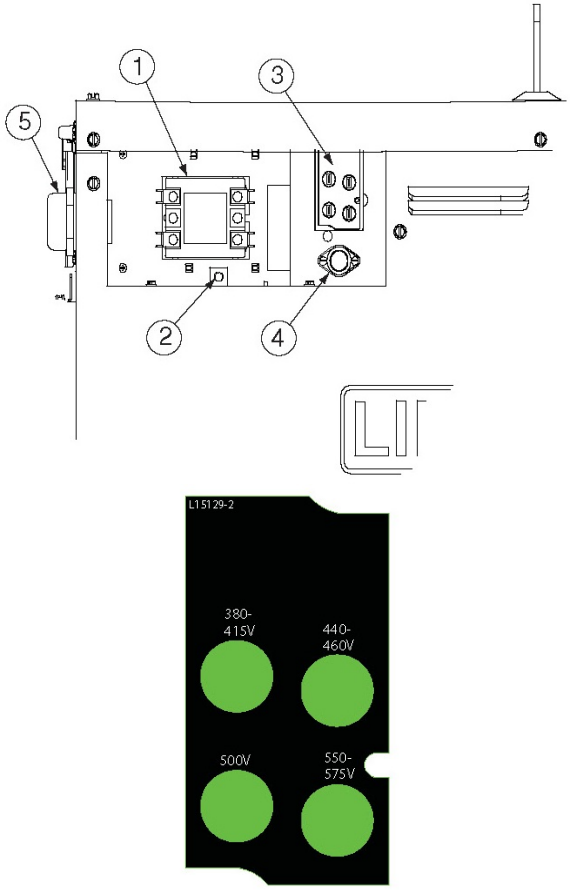


Figure: Input Section (left side)

Case Back Components

1. **10 Amp Circuir Breaker (CB1)**: Protects the 40VDC wire feeder power supply.

2. **10 amp Circuit Breaker (CB-2):** Protects the 115VAC Auxiliary Power Receptacle.

3. **Work Sense Lead Connector(4 Pin):** Connection point for the #21 lead.

4. **Arclink Connector (5 Pin):** Provides power and communication to the controller.

5. **Devicenet Connector:** Provides Devicenet communication to remote equipment.

6. **Output Studs (2) (WORK):** Connection point for welding cable(s) to the work piece.

7. **Output Studs (2) (ELECTRODE):** Connection point for welding cables to the Wire Drive.

8. **Auxilary Output Receptacle:** Provides 10 amps of 115VAC power.

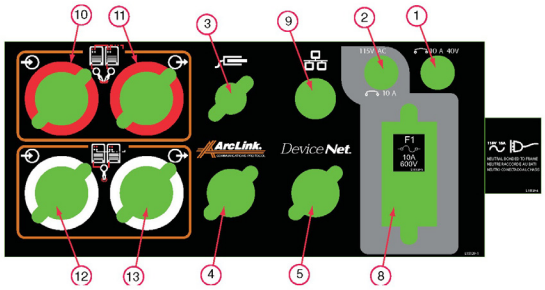
9. **Ethernet Connector (RJ-45):** Provides Ethernet communication to remote equipment.

10. **Master Input:** From Lead or previous trail arc in a Multi-arc system

11. **Master Output**: To subsequent trail arc in a Multi-arc system.

12. **Parallel Input:** From Master or previous Slave in a parallel machine set up.

13. **Parallel Output:** To Slave in a parallel machine set up



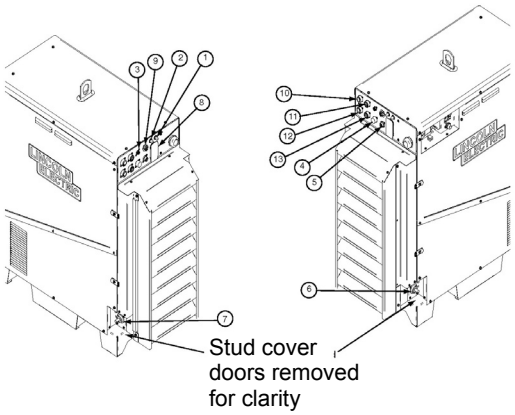


Figure: Case Back Components

Power-Up Sequence

When power is applied to the Power Wave® AC/DC 1000 SD CE, the status lights will flash green for up to 60 seconds. During this time the Power Wave® AC/DC 1000 SD CE is performing a self test, and mapping (identifying) each component in the local ArcLink system. The status lights will also flash green as a result of a system reset or configuration change during operation. When the status lights become steady green the system is ready for use.

Common Welding Procedures

Making a weld

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 steps for operating the Power Wave® AC/DC 1000 SD CE will vary depending upon the user interface of the welding system. The flexibility of the system lets the user customize operation for the best performance. Consult the User Interface documentation for more detailed set up information. (MAXsa™ 10, Command Center, PLC, Robot etc..)

First, consider the desired welding procedures and the part to be welded. Choose an electrode material, diameter, and flux.

Second, find the program in the welding software that best matches the desired welding process. The standard software shipped with the Power Wave® AC/DC 1000 SD CE encompasses a wide range of common processes and will meet most needs. If a special welding program is desired, contact the local Lincoln Electric sales representative.

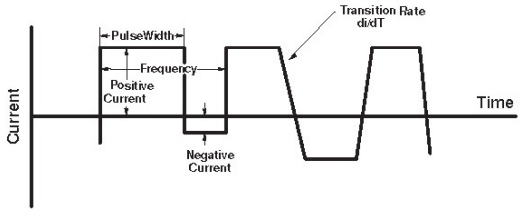
To make a weld, the Power Wave® AC/DC 1000 SD CE needs to know the desired welding parameters. Waveform Control Technology™ allows full customization of Strike, Run-in, Crater and other parameters for exacting performance.

Overview of the AC/DC Submerged Arc Process

The Power Wave® AC/DC 1000 SD CE combines the advantages of AC and DC Submerged Arc Welding (SAW) into a single power source. The limiting factor of AC-SAW welding has traditionally been the time it takes to transition from positive to negative polarity. This lag through the zero crossing can cause arc instability, penetration, and deposition problems in certain applications. The Power Wave® AC/DC 1000 SD CE utilizes the speed of an inverter based power source, and the flexibility of Waveform Control Technology™ to address this issue.

By adjusting the Frequency, Wave Balance and Offset of the AC waveform the operator can now control the balance (relationship) between the penetration of DC positive and the deposition of DC negative while taking full advantage of the reduction in arc blow associated with AC.

Output waveform variations made possible by Waveform Control Technology™



Depending on the process, different parts of the output waveform abd wire feed speed may be modulated at varying rates to achive a smooth and stable arc.

Multiple Arc System Consideration

Large scale SAW applications often employ multiple arcs to increase deposition rates. In multiple arc systems, magnetic forces created by like and opposing weld currents of adjacent arcs can result in arc interaction that can physically push or pull the arc columns together. See Figure below. To counteract this effect, the phase relationship between adjacent arcs can be set to alternate and equalize the duration of magnetic push and pull forces. This is accomplished through the synchronizing cables (K1785-xx). Ideally, the net result

is a cancellation of the interacting forces. See Figure below.

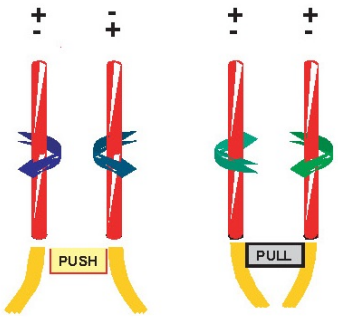


Figure: Arc Interference

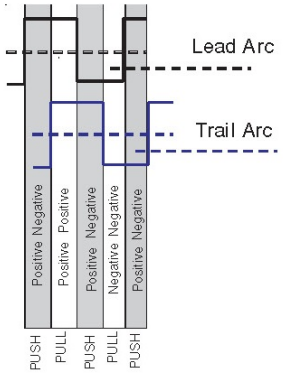


Figure: Synchronized Arcs

⚠ WARNING

Never simultaneously touch electrically "hot" parts in the electrode circuits of two different welders. The electrode to electrode no load voltage of multiple arc systems with opposite polarities can be double the no load voltage of each arc. Consult the Safety information located at the front of the Instruction Manual for additional information.

Basic Modes of Operation

Constant Current (CC)

CONSTANT CURRENT (CC)

- Operator presets Current and desired Voltage.
- The Power Source:
  - Goal is to maintain a constant arc length.
  - Drives a constant Current.
  - Synergically Controls WFS to Maintain Voltage at the desired Set point.
- Arc Length is proportional to Voltage.
- Traditionally used for larger diameter wires and slower travel speeds.

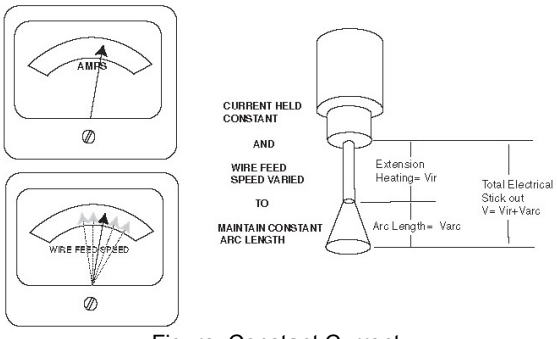


Figure: Constant Current

CONSTANT VOLTAGE (CV)

- Operator presets Wire Feed Speed and desired Voltage.
- The Power Source:
  - Goal is to maintain a constant arc length.
  - Commands constant wire feed speed.
  - Synergically Controls Current to Maintain Voltage at the desired Set point.
- Arc Length is proportional to Voltage.
- Traditionally used for smaller diameter wires and faster travel speeds.

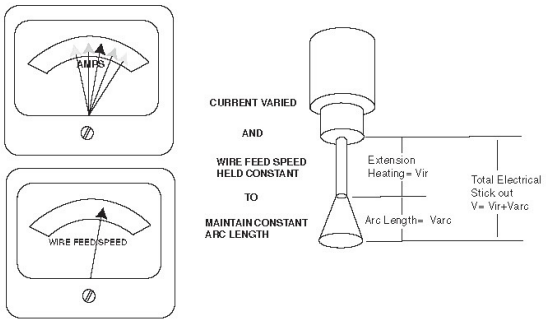


Figure: Constant Voltage

Weld Sequence

The weld sequence defines the weld procedure from beginning to end. The Power Wave® AC/DC 1000 SD CE not only provides adjustment of basic welding parameters, but also allows the operator to fine tune the start and finish of each weld for superior performance.

All adjustments are made through the user interface. Because of the different configuration options, your system may not have all of the following adjustments. Regardless of availability, all controls are described below.

Start Options

The Strike, Start, and Upslope parameters are used at the beginning of the weld sequence to establish a stable arc and provide a smooth transition to the welding parameters.

- **Arc Delay** inhibits the wire feed for up to 5 seconds to pro- vide an accurate weld start point. Typically used in multi-arc systems
- **Strike** settings are valid from the beginning of the sequence (Start Button Pressed) until the arc is established. They control Run-in (speed at which the wire approaches the workpiece), and provide the power to establish the arc.
  Typically output levels are increased and WFS is reduced during the Strike portion of the weld sequence
- **Start** values allow the arc to become stabilized once it is established.
  Extended Start times or improperly set parameters can result poor starting
- **Upslope** determines the amount of time it takes to ramp from the Start parameters to the Weld parameters. The transition is linear and may be up or down depending on the relationship between the Start and Weld settings.

End Options

The **Downslope**, **Crater**, **Burnback and Restrike Timer** parameters are used to define the end of the weld sequence.

- **Downslope** determines the amount of time it takes to ramp from the Weld parameters to the Crater parameters. The transition is linear and may be up or down depending on the relationship between the Weld and Crater settings.
- **Crater** parameters are typically used to fill the crater at the end of the weld, and include both time and output settings.
- **Burnback** defines the amount of time the output remains on after the wire has stopped. This feature is used to prevent the wire from sticking in the weld puddle, and condition the end of the wire for the next weld. A Burnback time of 0.4 sec is sufficient in most applications. The output level for Burnback is generally set to the same level as the last active weld sequence state (either Weld or Crater).
- **Re-strike Timer is u**sed to protect the welding system and/or work piece being welded. If the arc goes out for any reason (short circuit or open circuit), the Power Wave® AC/DC 1000 SD CE will enter a Re-strike state and automatically manipulate the WFS and output in an attempt to re-establish the arc. The Re-strike timer determines how long the system will attempt to re-establish the arc before it shuts down.
    - A Re-strike time of 1 to 2 sec is sufficient in most applications.
    - A Re-Strike setting of “OFF” allows for infinite restriking attempts until a shutdown occurs.

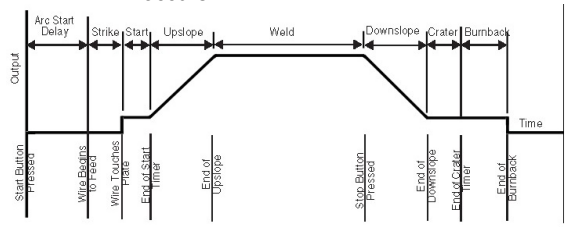


Figure: Weld Sequence

Weld Process Adjustments

Depending on the weld mode, there are a number of adjustments that can be made, including but not limited to Current, Voltage and WFS. These adjustments apply to either AC or DC processes, and control the basic parameters of the weld.

AC Adjustments

In addition to the basic weld parameters, there are a number of unique adjustments related to the AC waveform of the Power Wave® AC/DC 1000 SD CE. These adjustments enable the operator to balance the relationship between penetration and deposition to tailor the output for specific applications.

Wave Balance

- Refers to amount of time the waveform spends in DC+ portion of the cycle.
- Use Wave Balance to control the penetration and deposition of a given process.

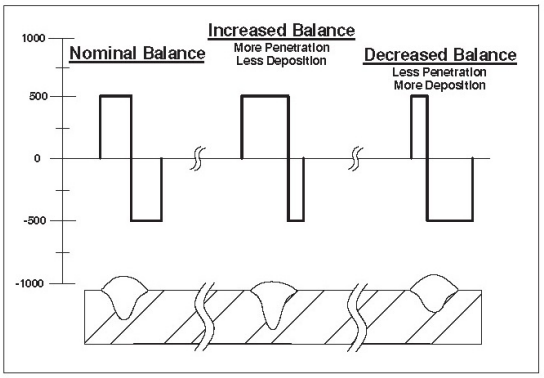


Figure: Wave Balance

DC Offset

- Refers to +/- shift of the current waveform with respect to the zero crossing.
- Use Offset to control the penetration and deposition of a given process.

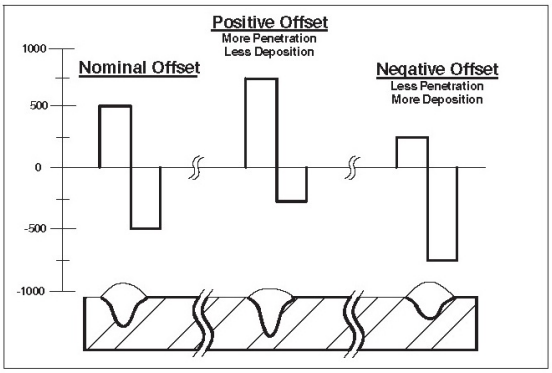


Figure: DC Offset

Frequency

- Power Wave® AC/DC 1000 SD CE can produce Output Frequencies from 10 - 100Hz
- Use Frequency to help provide stability.
- Higher frequencies in multiple arc setups can help reduce arc interaction.
- Lower frequencies will help overcome output limitations due to inductance in the Weld Circuit.

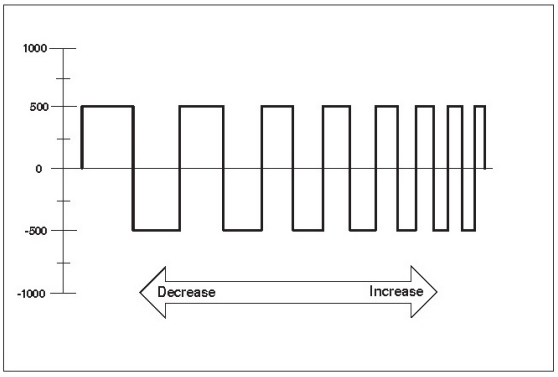


Figure: Frequency

Phase Adjustment for Multiple Arc Systems

Phase

- The phase relationship between the arcs helps to minimize the magnetic interaction between adjacent arcs. It is essentially a time offset between the waveforms of different arcs, and is set in terms of an angle from 0 to 360°, representing no offset to a full period offset. The offset of each arc is set independently with respect to the lead arc of the system (ARC 1).

Recommendations

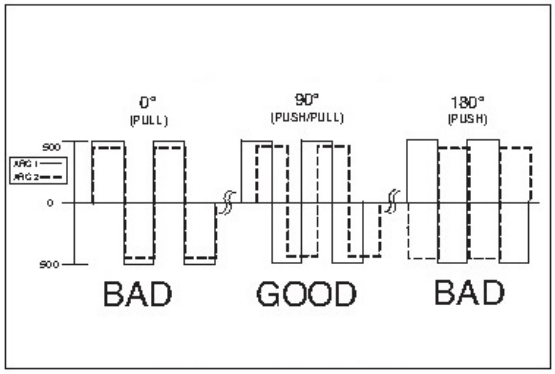
- For balanced waveforms a phase relationship of 90° should be maintained between adjacent arcs.
- For unbalanced waveforms:
  - Avoid switching at same time.
  - Break up long periods of unchanged polarity relative to adjacent arcs.

TABLE B.1 - PHASE RELATIONSHIP

	ARC 1 Lead	ARC 2 Trail	ARC 3 Trail	ARC 4 Trail	ARC 5 Trail	ARC 6 Trail
2 Arc System	0°	90°	**X**	**X**	**X**	**X**
3 Arc System	0°	90°	180°	**X**	**X**	**X**
4 Arc System	0°	90°	180°	270°	**X**	**X**
5 Arc System	0°	90°	180°	270°	0°	**X**
6 Arc System	0°	90°	180°	270°	0°	90°

Phase Relationship

Use Phase relation ship to minimize arc blow in multiple arc systems. (Balanced two arc system shown)



Best results obtained by alternating and equalizing the duration of magnetic forces between adjacebt arcs.

Maintenance

⚠ WARNING

For any maintenance or repair operations it is recommended to contact the nearest technical service center or Lincoln Electric. Maintenance or repairs performed by unauthorized service centers or personnel will null and void the manufacturers warranty.

⚠ WARNING

Do not open this machine and do not introduce anything into its openings. Power supply must be disconnected from the machine before each maintenance and service. After each repair, perform proper tests to ensure safety.

ROUTINE MAINTENANCE

Routine maintenance consists of periodically blowing out the machine, using a low-pressure airstream, to remove accumulated dust and dirt from the intake and outlet louvers, and the cooling channels in the machine.

The rear portion of the machine that contains the filter, the cooling fans and many of the heat sinks slides out for easy access. Removing the four(4) clips and pulling back on the rear portion of the machine will provide access for cleaning the machine and checking the filter. The filter may be removed from the right side of the machine.

PERIODIC MAINTENANCE

Calibration of the Power Wave® AC/DC 1000 SD CE is critical to its operation. Generally speaking the calibration will not need adjustment. However, neglected or improperly calibrated machines may not yield satisfactory weld performance. To ensure optimal performance, the calibration of output Voltage and Current should be checked yearly.

CALIBRATION SPECIFICATION

Output Voltage and Current are calibrated at the factory. Generally speaking the machine calibration will not need adjustment. However, if the weld performance changes, or the yearly calibration check reveals a problem, use the calibration section of the **Weld Manager Utility** to make the appropriate adjustments.

The calibration procedure itself requires the use of a grid (Resistive Load Bank), and certified actual meters for voltage and current. The accuracy of the calibration will be directly affected by the accuracy of the measuring equipment you use. The **Weld Manager Utility** includes detailed instructions, and is available on the internet at **powerwavesoftware.com** under **Power Wave® Submerged Arc Utilities**.

Customer Assistance Policy

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

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

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

WEEE

07/06

English

Do not dispose of electrical equipment together with normal waste!
In observance of European Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE) and its implementation in accordance with national law, electrical equipment that has reached the end of its life must be collected separately and returned to an environmentally compatible recycling facility. As the owner of the equipment, you should get information on approved collection systems from our local representative.
By applying this European Directive you will protect the environment and human health!

Spare Parts

12/05

For Spare Parts references visit the Web page: https://www.lincolnelectric.com/LEExtranet/EPC/

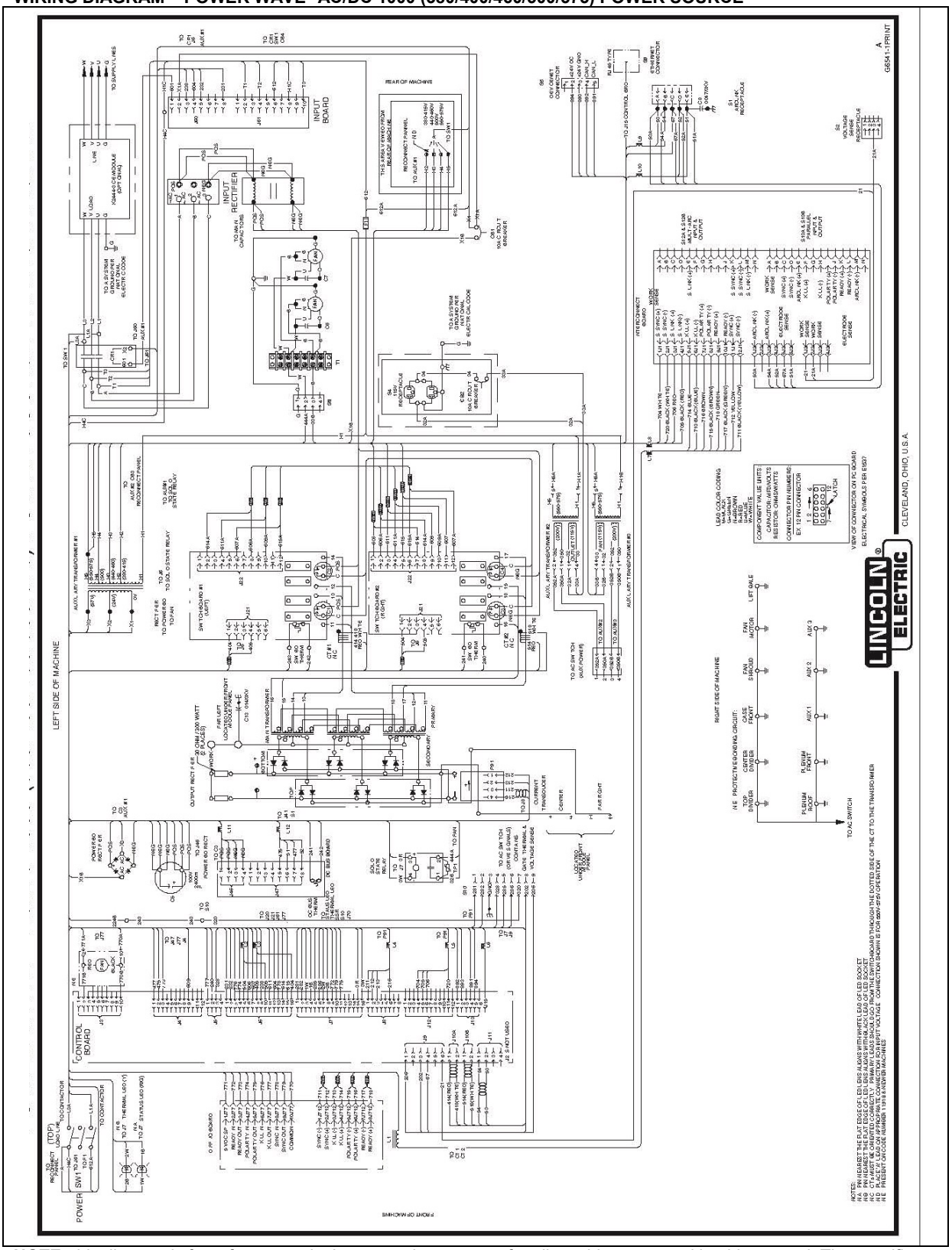
Authorized Service Shops Location

09/16

- The purchaser must contact a Lincoln Authorized Service Facility (LASF) about any defect claimed under Lincoln's warranty period.
- Contact your local Lincoln Sales Representative for assistance in locating a LASF or go to www.lincolnelectric.com/en-gb/Support/Locator.

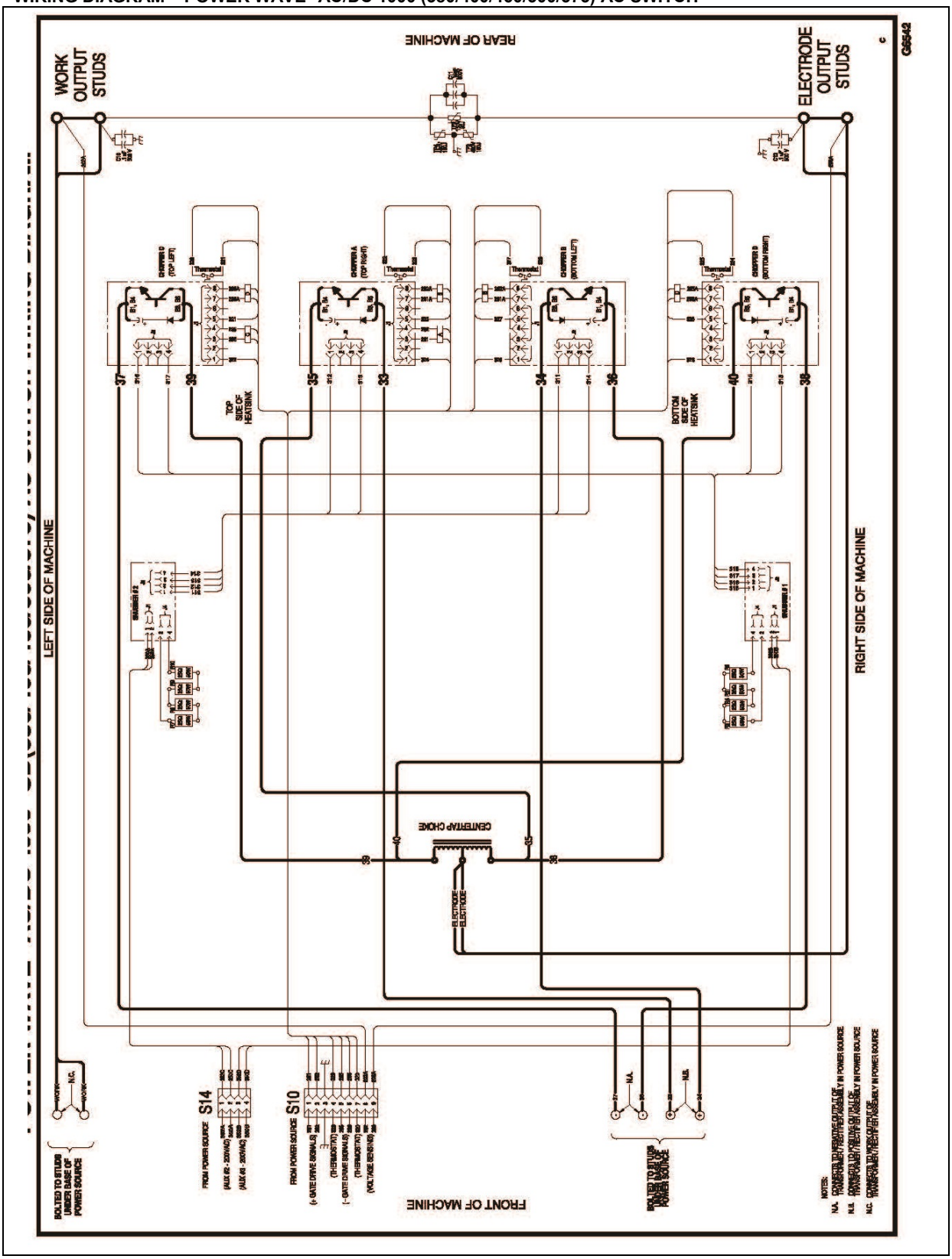
Electrical Schematic

WIRING DIAGRAM – POWER WAVE® AC/DC 1000 (380/400/460/500/575) POWER SOURCE



NOTE: this diagram is for reference only. It may not be accurate for all machines covered by this manual. The specific diagram for a partiuclar code is pasted inside the machine on one of the enclosure panels. If the diagram is ellegible, write to the Service Department for a raplacement. Give the equipment code number.

WIRING DIAGRAM – POWER WAVE® AC/DC 1000 (380/400/460/500/575) AC SWITCH



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Suggested Accessories

BASIC PACKAGE	
Item number	**Description**
K2803-1	Power Wave(R) AC/DC 1000 SD CE
K2370-2	MAXsa™ 22 Wire Drive
K2814-1	MAXsa™ 10 Controller/User interface
K2683-XX	Control Cable (5 pin- 5pin) – power source to controller
K1785-xx	Control Cable (14 pin- 14pin) – Controller to Wire Drive
OPTIONAL KITS	
K1785-xx	Control Cable (14 pin- 14pin) – for paralleling/multiple arc applications
K2312-2	MAXsa 29 Wire Drive (for Fixture builders)
K2311-1	Motor Conversion Kit (to convert existing NA-3/NA-4/NA-5 wire feeder gear boxes)
K2444-1	CE, C-Tick Filter Kit
K2626-2	MAXsa™ 19 Controller (for fixture builders that do not require the MAXsa 10 Controller)

Options and Accessories are available at **www.lincolnelectric.com**

Follow these steps:
1. Go to www.lincolnelectric.com
2. In the Serach field type E9.181 and click on the Search icon (or hit “Enter” on the keyboard)
3. On the results page, scroll down to the Equipment list and click on E9.181.

All of the information for the PowerWave System accessories ca be found in this document.

Software Tools

Power Wave® AC/DC 1000® SD software tools and other documents related to the integration, configuration, and operation of the system is available at **www.powerwavesoftware.com.** Power Wave® Submerged Arc Utilities includes the following items and all of the documentation to support them.

Name	Purpose
Weld Manager	Setup Ethernet address information, and apply security settings. Utility to diagnose Power Wave® problems, read system information, calibrate output voltage and current, test sense leads, and diagnose feed head issues. Can also setup and verify DeviceNet operation. • Gear Box / Feeder Selection • Memory Lables • DeviceNet setup and Verification • UI setup (Lockout and Limits) • Ethernet setup and Verification • Diagnostic -snapshot -weldview -error lookup -inductance test -sense lead test • Calibration (I,V,WFS) • Cable Test -inductance -sense leads
Command Center	AC/DC system tool to observe and log welding operation, verify DeviceNet welding configuration, and facilitate quality analysis.
Submerged Arc Cell Configuration	Used to configure and verify a multi-arc or parallel connected power source (more than one Power Wave® per arc) systems. • Multi Arc setup • Generators Command Center connection file • Setup Verification -output cables (cables crossed) -software versions (Master to slave and Arc to Arc) -I/O verification (Master to Master and Master to slave) -sense lead -inductance test