

Power Wave[®] AC/DC 1000™



Increase Productivity, Quality and Flexibility

The Power Wave AC/DC 1000 is the first power source to introduce Waveform Control Technology™ to submerged arc welding. Variable frequency and amplitude AC, DC positive or DC negative output allows the user to control the deposition rate and penetration. An operator can increase weld speeds, yield higher quality welds and improve efficiencies in a single or multi-arc environment. The phase angle and frequency of different machines can also be synchronized to balance the interactions between multiple arcs and minimize arc blow. Depending on the output, a welding arc may be driven by a single machine or multiple machines in parallel for applications that require more than 1000 amps of continuous operation.

Processes

Submerged Arc

Advantage Lincoln

- Eliminate downtime with easy polarity switching — no hardware reconfiguration required.
- Stable and independent arc controls for multiple arc applications.
- Improved efficiency and reliability with cooler operation through patented Coaxial Transformer Technology™.
- 95% power factor correction enables connection of more machines on the same plant infrastructure for lower installation costs compared to other machines.
- Remote process monitoring and control through ArcLink, Ethernet, and DeviceNet communication.
- Consistent operation over ± 10% input voltage variation through built-in line voltage compensation and reliable input voltage connection.
- Manufactured under a quality system certified to ISO 9001 requirements and ISO 14001 environmental standards.
- Three-year warranty on parts and labor.

Description

Output   Input  

Recommended General Options

System Interface, Interface Control Cable (22-pin), ArcLink Cable (5-pin), Feeder Control Cable (14-pin), TC-3 Self-Propelled Travel Carriage, CE Filter⁽¹⁾

Recommended Wire Feeders

Power Feed 10A Controller K2362-1 (requires either the K2312-1 Power Feed 10SF Wire Feed Head for fixed hard automation, or the K2370-1 Power Feed 10S Head for mounting a Lincoln TC-3 Travel Carriage), Power Feed 10SM Motor Conversion Kit K2311-1 (Other options may apply).

Order

K2344-1 Power Wave AC/DC 1000 460/500/575/3/60
 K2344-2 Power Wave AC/DC 1000 400/460/500/575/3/50/60

TECHNICAL SPECIFICATIONS

| Product Name | Product Number | Input Voltage | Rated Output Current/Voltage/Duty Cycle | Input Current @Rated Output | Output Range | Dimensions H x W x D in (mm) | Net Weight lbs (kg) |
|--------------------------------------|------------------------|-----------------------------|---|-----------------------------|--------------|--|---------------------|
| Power Wave AC/DC 1000 | K2344-1 | 460/500/575/3/60 | 1000/44/100% | 68/62/54 | 100-1000A | 43.5 x 19.2 x 33 (1105 x 488 x 838) | 600 (272) |
| Power Wave AC/DC 1000 ⁽¹⁾ | K2344-2 ⁽¹⁾ | 380/400/460/500/575/3/50/60 | 1000/44/100% | 82/79/69/62/55 | 100-1000A | 43.5 x 19.2 x 33 (1105 x 488 x 838) | 650 (295) |

⁽¹⁾ External Filter is required to meet CE conducted emission requirements. The K2444-1 must be used with the K2344-2.



WHAT IS NEXTWELD®?

Nextweld integrates Lincoln's technologies, processes and products to create a comprehensive, flexible, user-friendly welding system that can increase efficiency and reduce fabrication costs. Waveform Control Technology™ and digital communications

provide the foundation for Nextweld innovations like Pulse-On-Pulse™, Power Mode™, STT® and ArcLink®. Look for Nextweld products for ultimate arc control, high efficiency/reliability and seamless system integration.

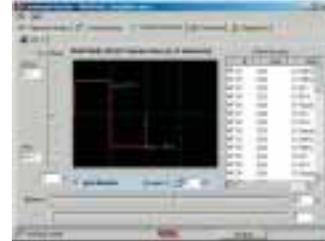
Waveform Control Technology™

Driving Superior Welding Performance

Lincoln's Waveform Control Technology controls and shapes the output waveforms (or weld modes) to adapt to virtually any application, material or weld position. In addition, you can have our Application Engineering department add or customize standard waveform programs.

For more information see Nextweld Document NX-1.10

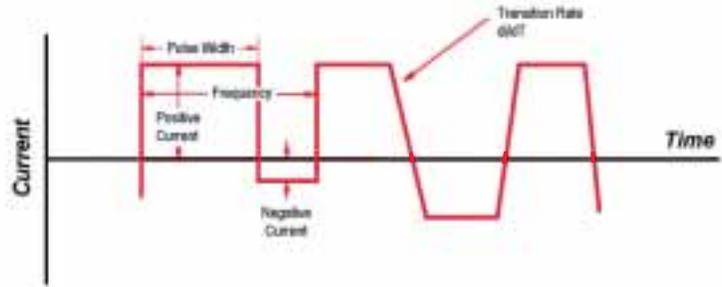
System Interface



Waveforms are easily changed through graphical interface

Waveform Control Technology

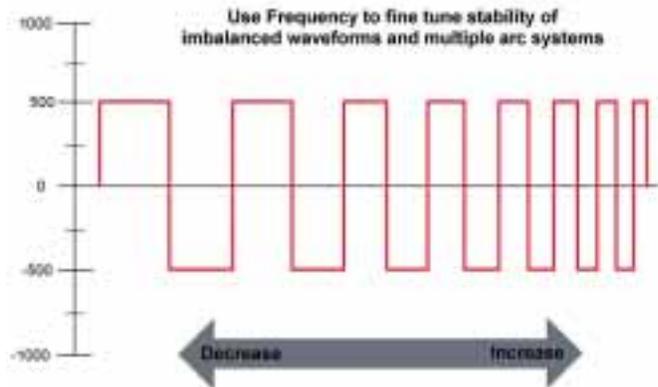
- Ultimate arc control — Many aspects of the waveform may be varied as a function of time in order to customize the arc exactly to your specifications.
- Dynamically controlled output — Arc Current, Voltage or Power may be controlled and regulated automatically so adjustments and corrections are made as they arise.
- Different parts of the waveform and wire feed speed may be modulated at varying rates to accomplish a constant average condition (Constant Voltage, Constant Current, etc.).



Refer to Publication NX-2.30 Nextweld AC/DC submerged arc process document for more details.

Variable Frequency – Control Arc Stability

The Power Wave AC/DC 1000™ has the widest range of wave frequency adjustment (10 - 100 Hz) in the industry. Adjust frequency with the turn of a knob to maximize arc stability.



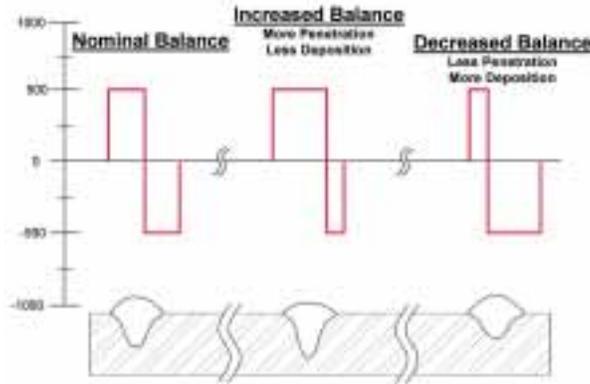
Turn Frequency down for more penetration (less energy) with a less stable arc.

Turn Frequency up for a more stable arc with less penetration (more energy in less time).

Variable Balance – Control Deposition

By setting the correct wave balance (that is, the ratio between positive and negative waveforms), the operator is able to work faster and fill the weld joint with fewer passes. The Power Wave AC/DC 1000™ has wave balance range of 25% to 75%.

The more positive the wave, the more penetration.

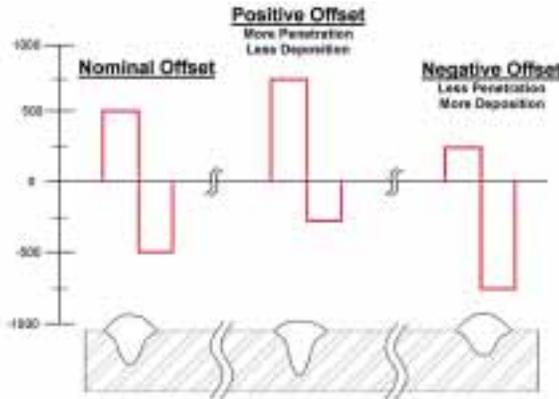


The more negative the wave, the greater the weld deposition.

DC Offset (Variable Amplitude) – Control Penetration

Wave amplitude and the duration of positive and negative cycles are independently adjustable, so the operator can obtain deep/shallow penetration and higher/lower deposition rates, depending on the application. The Power Wave AC/DC 1000 has the widest range of variable amplitude, or DC offset, (-25% to 25%) in the industry.

Increasing the negative amplitude (offset) decreases penetration.



Increasing the positive amplitude (offset) increases penetration.

Multi-Arc Environment

In a multiple arc welding, as many as five arcs operate in a single weld puddle. Changes to the positive/negative polarity phases and/or cycle balances of the AC waveform enable the operator to control deposition rate, penetration and travel speed without a change in voltage or current settings. Using the Power Wave AC/DC 1000 in a multi-arc system can increase your weld speeds, yield higher quality welds and improve efficiencies.

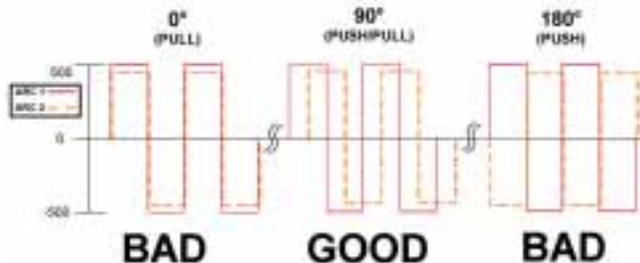
Phase Relationship – Controlling Arc Blow

In a multi-arc environment, arc interaction plays an important role in the behavior of the weld. Two positive electrodes pull together, as do two negative electrodes, while a positive and negative repel each other, causing arc blow. The Power Wave AC/DC 1000 balances the "push" and "pull" of the multi-arc relationship using phase shifting to prevent arc blow.

By phase shifting the AC waveforms, the amount of "push" and "pull" of the arc interactions can be balanced using alternating current to avoid arc blow.

Phase Relationship

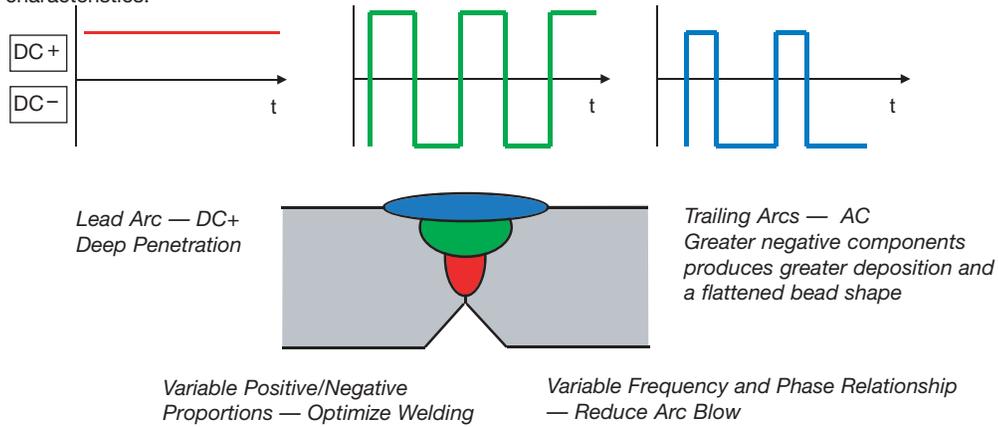
Use Phase Relationship to minimize arc blow in multiple arc systems. (Balanced two arc system shown)



A CLOSER LOOK

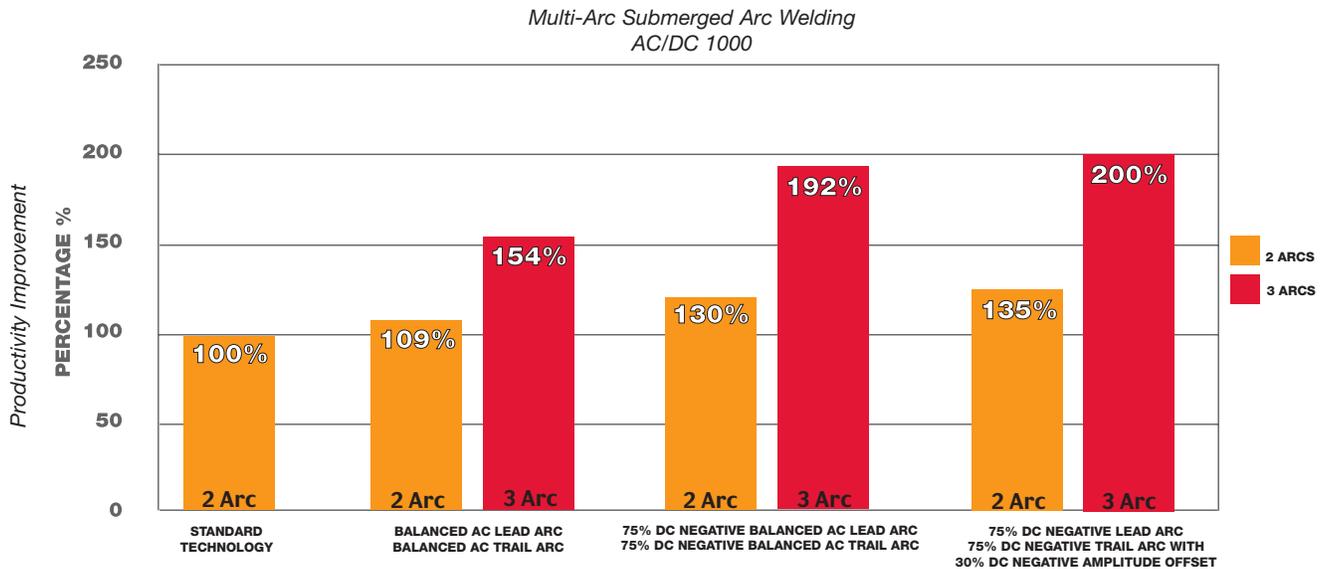
Arc Performance

The capabilities of the Power Wave AC/DC 1000™ in a multi-arc environment offer digital control over the critical welding variables for optimum performance whatever your needs require. As shown below, these digital controls can be used for each arc to provide unprecedented arc welding characteristics.



Productivity Comparison

The Power Wave AC/DC 1000 delivers optimized productivity through the ability to adjust phase relationships between the arcs. Multiple arcs can be tuned to work together rather than interfere with each other.



Applications

Whether it is a cross country pipeline or an offshore platform, the Power Wave AC/DC 1000 is meeting and exceeding expectations around the world.

| | |
|-------------------------------|---|
| Single Arc | Small diameter circumferential welds, pipe double-ending, storage tanks, seam welders |
| Tandem Arc | Large diameter circumferential welds [40"(1m) and up], spiral pipe mills, bridge girders, pressure vessels, wind mill towers. |
| Multiple Arcs (3 to 5) | Long straight welds, pipe mills, panel lines. |

A CLOSER LOOK

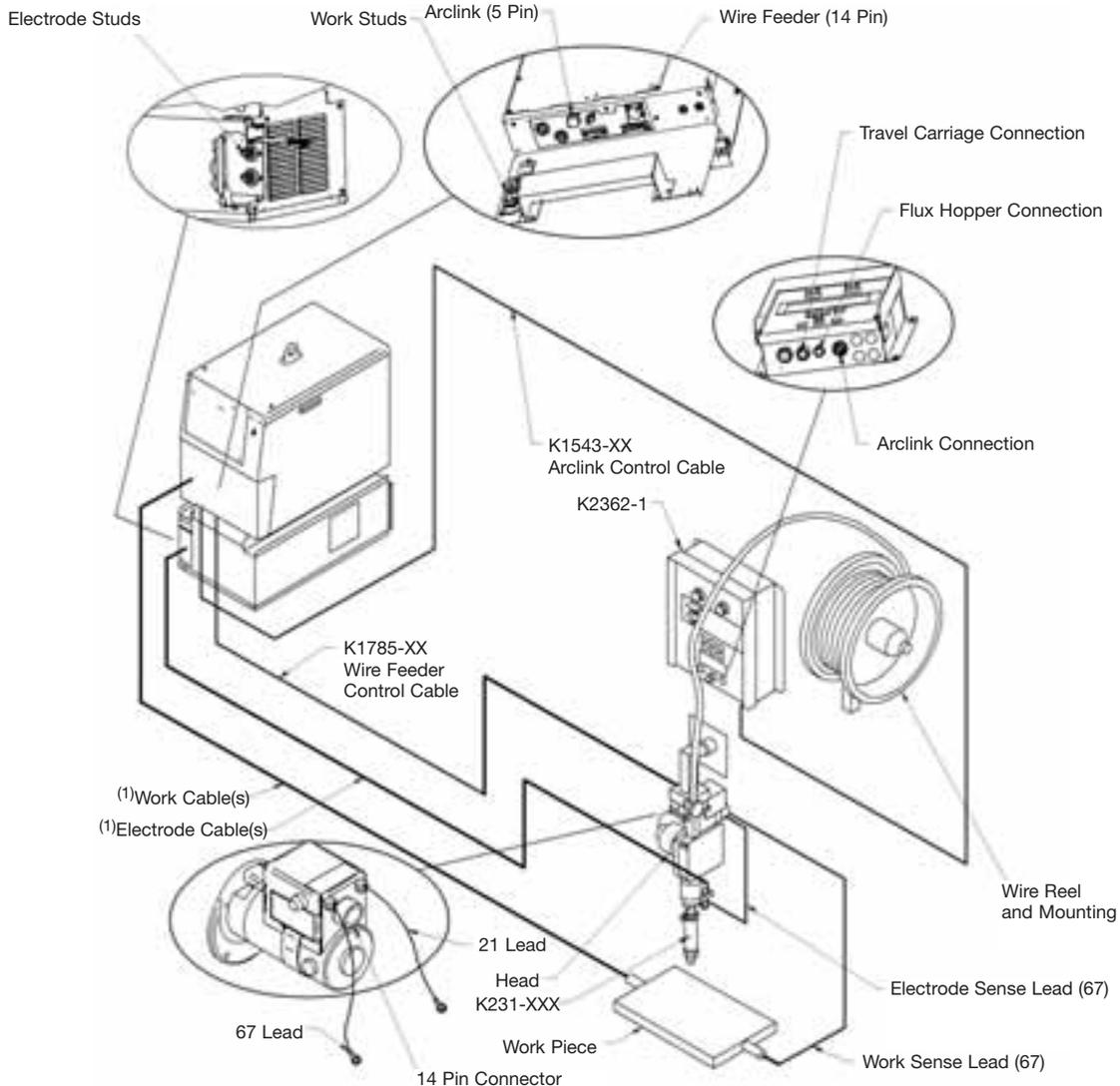
AC/DC Submerged Arc Single Arc

RECOMMENDED EQUIPMENT

| System Identifier | Product Number | Product Description | Qty. Required |
|-------------------------------------|----------------------|---|------------------|
| Power Source | K2344-1 or K2344-2 | Power Wave AC/DC 1000™ Power Source | 1 |
| Head | K2370-1 or K2312-1 | Power Feed 10S head for 3/32 to 7/32 in. solid wire (Includes hopper, wire straightener, cross seam adjuster, head mounting hardware) or Power Feed 10SF Head for 3/32 to 7/32 in. solid wire Fixture Builders Head (Insulators not included) | 1 |
| User Interface | K2362-1 | Power Feed 10A Controller | 1 |
| ArcLink Digital Communication Cable | K1543-xx | ArcLink Cables (5 pin) from Power Feed 10A Controller to Power Source. Can be extended. | 1 |
| Welding Cables | K2163-xx or K1842-xx | Weld Power Cables from the Power Source to the Contact Nozzle and from Power Source to Work | 4 Cables Per Arc |
| Power Source to Head Control Cable | K1785-xx | Feeder Control Cable (14 pin) from the Head to the Power Source. Cannot be extended. | 1 |
| Torch | K231-xx | Submerged Arc Contact Nozzle Assembly | 1 |

OPTIONAL EQUIPMENT

| System Component |
|---|
| PLC (customer supplied) |
| Ethernet Switch (customer supplied). Required for arcs > 1000A or with use of the Submerged Arc Software Suite. |
| Computer (customer supplied). Required for use of the Submerged Arc Software Suite. |
| K325-x TC-3 Travel Carriage |
| K96 Horizontal Lift Adjuster |
| K29 Vertical Lift Adjuster |
| K299 Wire Reel Assembly |
| K2462-1 Power Feed 10A Mounting Bracket (K299 cannot be used if the mounting bracket is attached. A K390 is recommended instead.) |



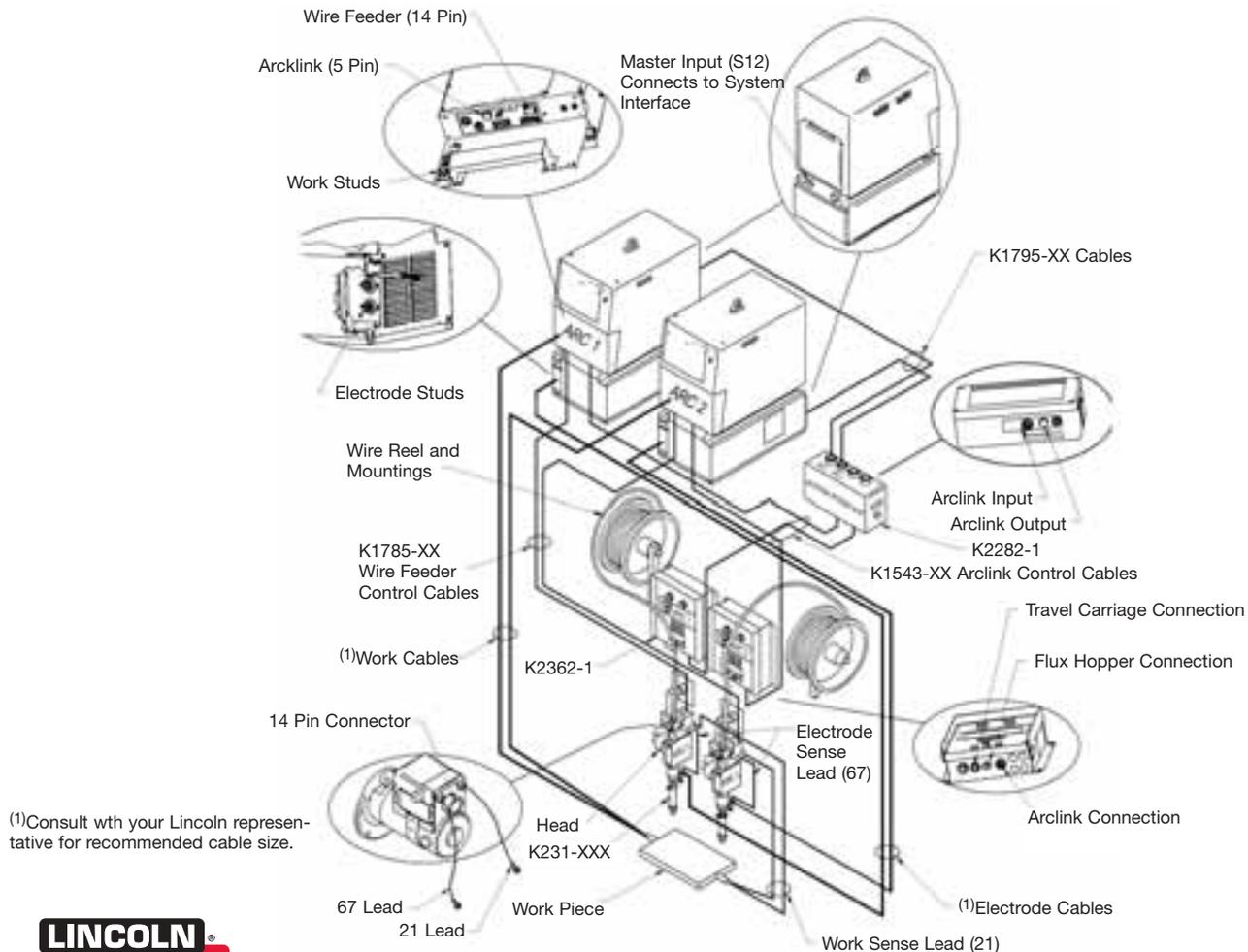
(1)Consult with your Lincoln representative for recommended cable size.

A CLOSER LOOK

AC/DC Submerged Arc Dual Arc

| RECOMMENDED EQUIPMENT | | | |
|--|----------------------|---|------------------|
| Product Name | Product Number | Product Description | Qty. Required |
| Power Source | K2344-1 or K2344-2 | Power Wave AC/DC 1000™ Power Source | 2 |
| Mounting for Heads | K387 | Tandem Arc Framework | 1 |
| Head | K2312-1 or K2370-1 | Power Feed 10S head for 3/32 to 7/32 in. solid wire (Includes hopper, wire straightener, cross seam adjuster, head mounting hardware) or Power Feed 10SF Head for 3/32 to 7/32 in. solid wire Fixture Builders Head (Insulators not included) | 2 |
| User Interface | K2362-1 | Power Feed 10A Controller | 2 |
| System Interface | K2282-1 | System Interface | 1 |
| ArcLink Digital Communication Cable | K1543-xx | ArcLink Cables (5 pin). Can be extended. (1) Lead Arc: Power Source to System Interface (2) System Interface to User Interface (3) Trail Arc: Power Source to User Interface | 3 |
| Welding Cables | K2163-xx or K1842-xx | Weld Power Cables from the Power Source to the contact Nozzle and from the Power Source to the Work | 4 Cables Per Arc |
| Power Source to Head Control Cable | K1785-xx | Feeder Cable (14 pin) from the Head to the Power Source Cannot be extended. | 2 |
| Torch | K231-xxx | Submerged Arc Contact Nozzle Assembly | 2 |
| System Interface to Power Source Cable | K1795-xx | Control Cable (22 pin) from each Power Wave AC/DC 1000 to System Interface. Can be extended. | 2 |

| System Component |
|---|
| Ethernet Switch (customer supplied). Required for arcs > 1000A or with use of the Submerged Arc Software Suite. |
| Computer (customer supplied). Required for use of the Submerged Arc Software Suite. |
| K325-x TC-3 Travel Carriage |
| K96 Horizontal Lift Adjuster |
| K29 Vertical Lift Adjuster |
| K299 Wire Reel Assembly |
| K390 Two Wire Reel Mounting for TC-3 |
| K389 Flux Hopper for K387 Mountings |
| K2462-1 Power Feed 10A Mounting Bracket (K299 cannot be used if the mounting bracket is attached. A K390 is recommended instead.) |

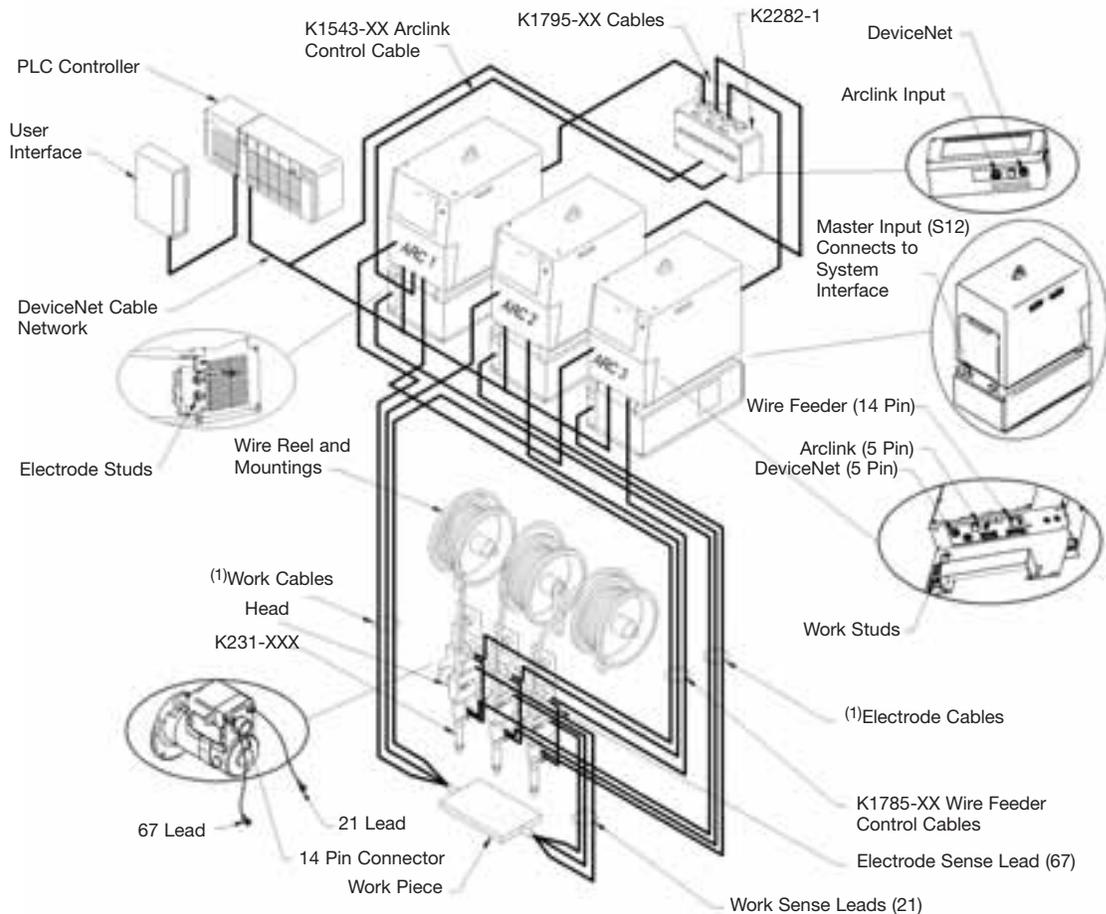


(1)Consult with your Lincoln representative for recommended cable size.

AC/DC Submerged Arc Multi-Arc

RECOMMENDED EQUIPMENT

| Product Name | Product Number | Product Description | Qty. Required |
|--|--|---|------------------|
| Ethernet Network Equipment | Customer Supplied | Ethernet Switch, Cables, etc. required for arcs >1000A or for use with Power Wave Submerged Arc Utilities software package | As Needed |
| Personal Computer | Customer Supplied | IBM Compatible PC (Windows NT SP6, Windows 2000, Windows XP, or greater) required for use with Power Wave Submerged Arc Utilities software package | 1 |
| Controls | Customer Supplied | Programmable Logic Controller | 1 |
| DeviceNet Cables | Automation Department or Customer Supplied | DeviceNet Cable from the Power Source to PLC and System Interface to PLC (Cables, Tees, and Terminators as required) | As Needed |
| Ethernet Switch | Customer Supplied | Ethernet Switch | 1 |
| Power Source | K2344-1 or K2344-2 | Power Wave AC/DC 1000™ Power Source | 3+ |
| Head | K2312-1 or K2370-1 | Power Feed 10S head for 3/32 to 7/32 in. solid wire (Includes hopper, wire, straightener cross seam adjuster, head mounting hardware) or Power Feed 10SF Head for 3/32 to 7/32 in. solid wire Fixture Builders Head (Insulators not included) | 3+ |
| System Interface | K2282-1 | System Interface | 1 |
| Welding Cables | K2163-xx or K1842-xx | Weld Power Cables from the Power Source to the Contact Nozzle and from the Power Source to the Work | 4 Cables Per Arc |
| Power Source to Head Control Cable | K1785-xx | Feeder Cable (14 pin) from the Head to the Power Source Cannot be extended. | 3+ |
| Torch | K231-xxx | Submerged Arc Contact Nozzle Assembly | 3+ |
| System Interface to Power Source Cable | K1795-xx | Control Cable (22 pin) from each Power Wave AC/DC 1000 to System Interface. Can be extended. | 3+ |



(1) Consult with your Lincoln representative for recommended cable size.

A CLOSER LOOK

Impeller Cooling Technology™

High Efficiency Cooling

Conventional-cooling mechanisms for welders rely on a fan to blow through the machine, while Lincoln's patented Impeller Cooling Technology uses an impeller fan to create a high-pressure chamber. This high-pressure chamber forces airflow across the heated components in the machine cooling the Power Wave AC/DC 1000™ transformer and power switchgear.



What is Coaxial Transformer Technology™?

To transform large amounts of power as is needed for welding, the power source transformer is a critical factor. Traditional transformers become more inefficient the larger they become. This becomes a problem especially for large power sources (i.e. submerged arc power sources). If the transformer becomes inefficient, it requires more power to be dissipated in all of the components before the transformer. This results in a drastically reduced overall efficiency, components that run at higher temperatures, and reduced reliability.

Coaxial Transformer Technology eliminates these problems. Regardless of the size (power level) a coaxial transformer has superior coupling and efficiency. This is obtained through the coaxial orientation of the primary and secondary windings.

The benefits for the customer include:

- Higher power capabilities (submerged arc inverters)
- Higher efficiency (reduced energy costs)
- Higher reliability (lower stresses on components)

Industry-leading Efficiency, Power Factor and Input Current Draw

Reduce Energy Spending!

The Power Wave® AC/DC 1000 has better efficiency and a higher Power Factor than the Summit Arc 1000™. Two Power Wave® AC/DC 1000 machines can be installed for the same capacity that it takes to install one Summit Arc 1000™.

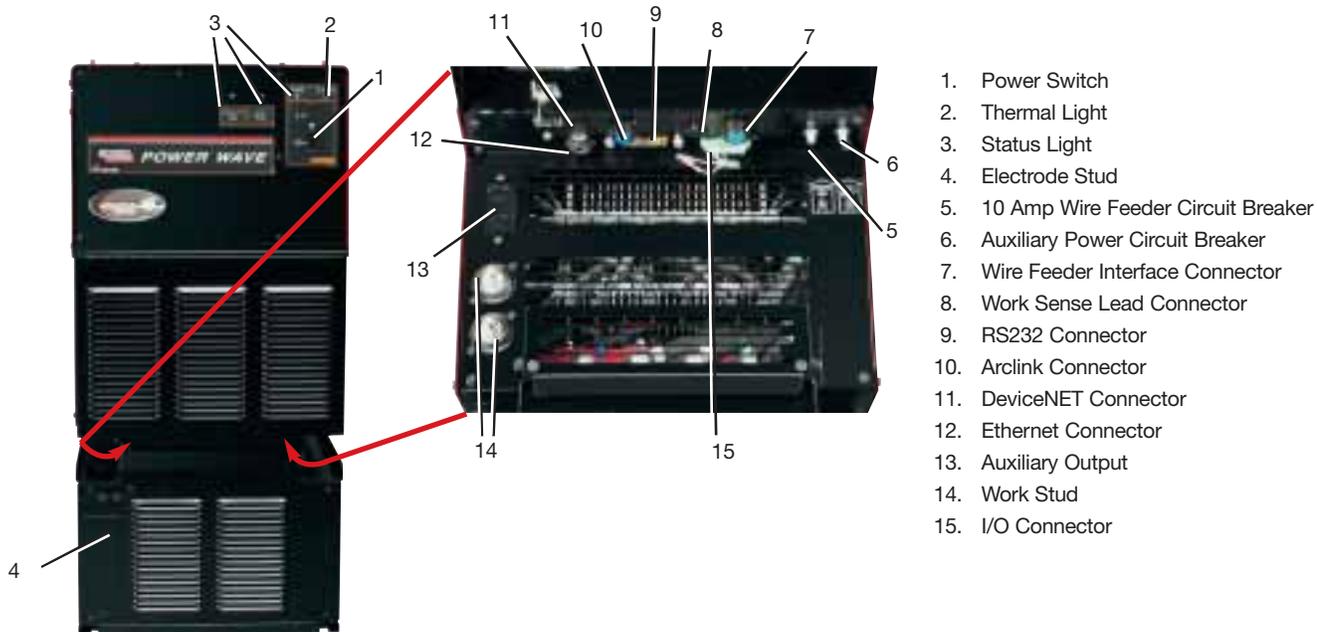
NOTE: Summit Arc 1000™ is not a trademark of the Lincoln Electric Company.

| Technology | Volts | Amps | Efficiency | Power Factor | Input Amps @ 460 Volt |
|-----------------------------------|-------|------|-------------|--------------|-----------------------|
| Miller Electric® Summit Arc 1000™ | 44 | 1000 | 0.84 | 0.54 | 122 |
| Power Wave AC/DC 1000 | 44 | 1000 | 0.86 | 0.95 | 68 |

FEATURES

- Machines can be easily configured for multiple arc applications.
- Fully programmable AC or DC wave shape.
- Ethernet capability gives the user the ability to monitor, control and troubleshoot from remote locations.
- All system components communicate and transfer information.
- Arc performance independent of input power variations.
- Utilizes digital signal processing and microprocessor control.
- Constant current or constant voltage capability.

Key Controls



QUALITY AND RELIABILITY

- Lincoln's design philosophy adds an extra factor of safety in all components and construction to maximize reliability and service.
- Open construction for preventative maintenance.
- Thermostatically protected against overheating.
- Electronic output over-current protection and electronic input over-voltage protection.
- Operating Temperature Range: -20°C (-37.7°F) to +40°C (-22.2°F); Storage Temperature Range: -40°C (-40°F) to +40°C (-22.2°F).
- Designed to the IEC 60974-1 standards.
- F.A.N. (Fan As Needed). Cooling fan runs during output and for five minutes after output is turned off.
- Manufactured under a quality system certified to ISO 9001 requirements and ISO 14001 environmental standards.
- Three-year warranty on parts and labor.
- Printed circuit boards are environmentally-shielded using Lincoln's engineered potting and protective frame trays.
- 100% software controlled – Software based controls can be upgraded as new features become available.
- Easy access for serviceability.
- Modular construction allows for easy service/maintenance.



Digital Communications
Fast, Reliable, System-Wide



ArcLink is the leading digital communications protocol for the arc welding industry. It integrates all welding components for seamless, time-critical data transfer. The strength of ArcLink lies in the ability to communicate with each system component in a pre-defined welding language. In addition, ArcLink is an open communications protocol, meaning that Lincoln Electric publishes how it works and encourages other companies to adopt it.

DeviceNet

DeviceNet is a communications protocol widely used throughout the automotive, semiconductor, and packaging industries. In its typical application, DeviceNet works in conjunction with a programmable Logic Controller (PLC) and several system devices to provide a framework for data trafficking and monitoring.



ETHERNET

Ethernet is a specification for networking that provides the ability to pull large amounts of information into monitoring and supervisory applications.

For more information see Nextweld Document NX-1.30

Remote Monitoring and Control

Monitor performance from anywhere in the world!

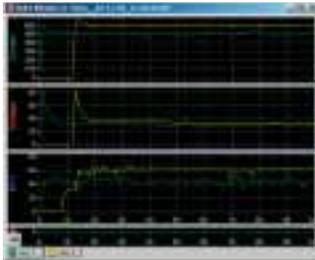
The Power Wave AC/DC 1000™ includes software products to assist with the installation and operation of the equipment. From an intelligent configuration utility that allows you to automatically sense and verify the system has been configured properly to a

tool capable of high-level monitoring, control, and data logging for the system these packages were designed for ease of use and convenience for the operators and the administrators.

Command Center

Provides monitoring and control of each arc in a multiple arc system, presenting master/slave relationships and configuration of the arcs in the system, as well as weld mode selection, parameters of weld states, and diagnostics.

Data Viewer



Real-time welding data is automatically recorded and saved

Operator Screen



Communication

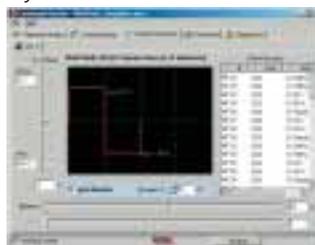


Diagnostics



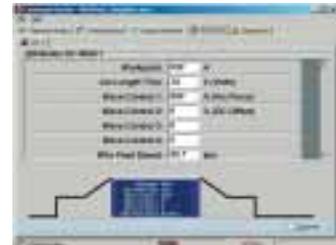
Remotely monitor and diagnose machine status and system information

System Interface



Waveforms are easily changed through graphical interface

Set Points



Effortlessly change welding parameters for all arc states

GENERAL OPTIONS



System Interface
External controller required for multi-arc applications provides arc-to-arc phase relationship.
Order K2282-1



Interface Control Cable (22-pin)
Required to parallel multiple Power Wave power sources — one per machine required. Can be extended.
Order K1795-XX



ArcLink/Linc-Net Cable (5-pin)
Includes two leads plus two mating terminals. Connects Power Feed to Power Wave. Can be extended.
Order K1543-XX



Feeder Control Cable (14-pin)
Connects Power Wave power source to wire feeder. Cannot be extended.
Order K1785-XX



TC-3 Self-Propelled Travel Carriage
Carries head and controls in either direction on a beam. Operates manually or automatically with the weld controls. Requires 115V AC 50 or 60 hertz input power.
Order K325x



CE Filter
The K2444-1 Power Wave AC/DC 1000™ CE Module is a high power filter that enables the K2344-2 Power Wave AC/DC 1000 CE "ready" machine to conform to the EMC standards of Europe and Australia. Electrically, the module is connected between the power line and the input of the K2344-2 machine. The filter provides high differential and common mode attenuation to reduce conducted emissions on the power line.
Note: K2344-1 can not be used with K2444-1 for CE conformance.
Order K2444-1

WIRE FEEDER OPTIONS



Power Feed 10A Controller
Control box required per arc. Includes MSP4 User Interface Panel, inputs/outputs for hard automation.
Order K2362-1



Power Feed 10S Head (3/32" to 7/32" solid wire)
Includes wire feeder head with straightener for solid wire, flux hopper with automatic valve, head mounting and cross stream adjuster. Does not include control box or wire reel brake and mounting.
Order K2370-1



Power Feed 10SF Head (3/32" to 7/32" solid wire)
For machinery and fixture builders. Fixture mount wire drive assembly includes motor, gear-box, drive rolls, guidelines, straightener. Does not include head mounting, electrode cables, cross seam adjuster, flux hopper and pointer.
Order K2312-1



Power Feed 10SM Motor Conversion Kit
For use with NA Series Gear Head. ArcLink™ motor retrofit kit. Used to replace existing motor on NA3/4 or NA5 wire feed head.
Order K2311-1

POWER WAVE AC/DC 1000 ORDER FORM

| PRODUCT DESCRIPTION | ORDER NUMBER | QUANTITY | PRICE |
|---|----------------|----------|-------|
| POWER WAVE AC/DC 1000™ (460/500/575/3/60) | K2344-1 | | |
| POWER WAVE AC/DC 1000™ (380/400/460/500/575/3/50/60) | K2344-2 | | |
| RECOMMENDED GENERAL OPTIONS | | | |
| System Interface | K2282-1 | | |
| Interface Control Cable (22-pin) | K1795-10 | | |
| ArcLink Cable (5-pin) | K1543-xx | | |
| Feeder Control Cable (14-pin) | K1785-xx | | |
| TC-3 Self-Propelled Travel Carriage | K325x | | |
| CE Filter ⁽¹⁾ | K2444-1 | | |
| RECOMMENDED WIRE FEEDER OPTIONS | | | |
| Power Feed 10A Controller | K2362-1 | | |
| Power Feed 10S Head | K2370-1 | | |
| Power Feed 10SF Wire Feed Head | K2312-1 | | |
| Power Feed 10SFM Motor Conversion Kit | K2311-1 | | |
| | TOTAL: | | |

⁽¹⁾The K2444-1 must be used with the K2344-2.

CUSTOMER ASSISTANCE POLICY

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

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

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