iQ Series
ULTRASONIC POWER SUPPLY
AL-E

Users Manual

Applicable System Models:
- 20AL060-1H
- 20AL060-2H
- 30AL060-1H
- 30AL060-2H
- 35AL060-1H
- 35AL060-2H
- 40AL060-1H
- 40AL060-2H

Dukane Part No. 403–607–00

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## Revision History

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Section 1 – Introduction

SECTION 1

Introduction

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Important User Information

Read This Manual First
Before operating the *iQ Series Ultrasonic Power Supply AL-E*, read this User’s Manual to become familiar with the system. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate this system. The examples given are chosen for their simplicity to illustrate basic setup procedures.

Notes and Tips
Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the system. A NOTE block is shown to the right.

Cautions and Warnings
In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. Different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a general condition or practice, an electrical safety issue, a hand protection issue or other condition.

Drawings and Tables
The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use Arabic sequence numbers (e.g. –1, –2, –3) while the tables use roman sequence numerals (e.g. –I, –II, –III). As an example, Figure 3–2 would be the second illustration in section three while Table 3–II would be the second table in section three.
System Overview

Your iQ Series Ultrasonic Power Supply AL-E, an ultrasonic generator, provides a versatile stand-alone workstation.

This product’s rugged internal circuitry ensures a continuous resonant frequency lock at the start of each weld.

Standard to this line of generators are time and energy control. The brightly lit display is easy to read. The menu structure makes programming simple, and the one-touch hot keys give the operator even more flexibility.

The generator also includes an RFI line filter that passes strict CE test specifications for global applications.

Key Features

• **Trigger by Power** is a Dukane patented feature that produces greater weld consistency by requiring that a sufficient amount of pressure/force is applied to the part before the actual weld begins. Trigger by Power is a cost effective alternative to trigger by force because it does not require additional, expensive components such as a load cell, amplifier board or cabling.

• **Compact Generator** is small and easily moved, and this allows your table or work bench to accommodate more of the items needed for your process.

• **Pulse Width Modulation** incorporates patented circuitry giving the power supply the ability to efficiently change the output amplitude. This makes it possible to start large horns with reduced power. It also provides more power efficient switch-mode generator operation and increased reliability.

• **Linear Ramp Soft Start** circuitry allows the acoustic stack to ramp up to operating amplitude smoothly, minimizing the start-up surges and abnormal stress to the stack and generator.

• **Digi-Trac Tuning** tracks the resonant frequency of the acoustic stack (horn, booster, transducer) and adjusts the generator output frequency to match it. This is done for every weld cycle and eliminates the need to manually tune the generator.

• **Line Voltage Regulation** automatically maintains constant amplitude regardless of line voltage deviation. The available output power is maintained with any voltage input within the specified range. This provides consistent system performance regardless of line voltage fluctuations. It also eliminates the need for bulky, external constant–voltage transformers.

• **Load Regulation** provides constant amplitude automatically regardless of power draw. The ultrasonic output amplitude level is held to within ±1% to provide weld process consistency and reduced weld cycle times.

• **Industrial Line–Power Source** means that standard systems will operate worldwide at all industrial high line voltage levels, whether it is 200VAC @60Hz in Japan, 240VAC @50Hz in Europe or 208VAC @60Hz in the United States. There are no internal transformer taps to change for worldwide operation. North American systems are optionally available to operate on the 120VAC line voltage level.

• **Multiple Electronic Overload** protection circuits prevent instantaneous component failure in the event of extreme output overload conditions, and rated overload power limit is based on the actual true RMS power output level.

• **CE Certification** means that the system meets the required European standards to be sold and used in Europe.

• **ISO 9001 : 2008 Certification** means that this system has been manufactured to high quality standards and assures you of manufacturing excellence.

• **TÜV Certification** - TÜV Rheinland certifies Dukane products comply with applicable UL (Underwriters Laboratories) and CSA (Canadian Standards Association) requirements.
SECTION 2

Health and Safety

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General Considerations

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your equipment. In this manual, the term system refers to a complete group of components associated with the welding of plastic or metal parts, also known as an ultrasonic assembly system. A typical system consists of a generator and/or ultrasonic process controller, start and stop switches, power controls, connecting cables, and the probe assembly which includes the transducer, booster, horn and replaceable horn tip.

Proper Installation - Operate system components only after they are properly installed and checked.

No Unauthorized Modifications - Do not modify your system in any way unless authorized to do so by the manufacturer. Unauthorized modifications may cause injury to the operator and/or equipment damage. In addition, unauthorized modifications will void the equipment warranty.

Keep the Cover On - Do not remove any equipment cover unless specifically directed to do so by the manufacturer. The generator produces hazardous electrical voltages which could cause injury.

Grounded Electrical Power - Operate this equipment only with a properly grounded electrical connection.

(See Page 8 for grounding information.)

Comply with Regulations - You may be required to add accessories to bring the system into compliance with applicable OSHA regulations for noise exposure.

Plastics Health Notice

Before using any ultrasonic welding system, be sure you are familiar with OSHA regulations from the U.S. Department of Labor about the particular type of plastic(s) you are using.

When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous. Make sure you have adequate ventilation whenever these plastics are processed.
Electrical Safety

Domestic Power Grounding

For safety, the power cords used on this product have a three-wire, grounding-type power cord. Figures 2-1 and 2-2 illustrate the appropriate electrical outlet to use with the power cords included with 100-120 volt and 200-240 volt systems respectively. This information applies to systems shipped to North America or Japan.

CAUTION

If you have a two-prong electrical receptacle, we strongly recommend that you replace it with a properly grounded three-prong type. Have a qualified electrician replace it following the National Electric Code and any local codes and ordinances that apply. See Figures 2–1 and 2–2 for suggested parts.

CAUTION

If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The cord should have an adequate power rating to do the job safely. It must be plugged into a grounded receptacle. Do not use a two-wire extension cord with this product.

International Power Grounding

The power cable normally provided for international use is compatible with the power outlet used in many Continental European countries. Refer to Figure 2–3. However, if your application requires another type of power cord, check with your equipment supplier, and follow local regulations concerning proper wiring and grounding.
SECTION 3

Installation

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Before Installation

As you plan for the installation of your generator, please consider these important subjects as listed below:

- When to use lockout / tagout devices

**When to Use Lockout / Tagout Devices**

The typical kind of LOTO device for this generator is a clam shell type device (with lockout capability). The LOTO device is placed over the plug end of the generator electrical cord. This effectively prevents access to the energy isolation point. See the example of one such device in the figure above.

The figure to the right shows the lockout device in the closed, locked position.

---

**WARNING**

Electrical safety hazards exist inside the generator chassis. Before making any internal adjustments to the generator, apply a lockout/tagout (LOTO) device to the generator chassis.

---

**Figure 3-1**  
Lockout Device In Open Position, Unlocked

**Figure 3-2**  
Bottom Lockout Device In Closed Position, Locked

Continued
Lockout/Tagout

Procedure to use BEFORE making any internal adjustments to the generator:
1. Push the generator’s AC power switch/breaker to the OFF position.
2. Unplug the generator’s electrical cord from its source.
3. Authorized personnel apply a lockout/tagout (LOTO) device to the plug end of the generator’s electrical cord. Using a typical clam shell type LOTO device:
   1) Open the clam shell.
   2) Place the electrical cord plug end inside the shell.
   3) Close the shell.
   4) Secure the shell with its lock, and lock it.
4. Wait a minimum of five minutes for the generator to discharge its electrical energy.
5. After taking these steps, make the necessary adjustments to the generator.

Assuming the generator is being put back into service. . .

Procedure to use AFTER making any internal adjustments to the generator:
1. Authorized personnel remove the lockout/tagout device from the plug end of the generator's electrical cord. Using a typical clam shell type LOTO device:
   1) Unlock the protective shell.
   2) Open the shell, exposing the electrical cord end.
   3) Remove the LOTO device, and set it aside.
2. Plug the generator's electrical cord into its AC power source.
3. Push the generator's AC power switch/breaker to the ON position.
Unpacking
Carefully open your shipping container, and make sure it contains the items shown on the shipping documents. Inspect all items, and report any missing items or damage immediately.

Placement
Make certain generator placement and cable routing do not interfere with normal operation. Maintain easy access to your equipment. The operator should have unobstructed access to cables and wiring.

RFI Grounding
Proper grounding for the generator chassis is essential for the effective suppression of electrical noise or RFI (Radio Frequency Interference). Every ultrasonic generator contains a RFI filter that blocks noise on the AC power line from entering the system control circuitry. This filter also prevents ultrasonic frequency noise from being fed back into the AC power line. For the RFI filter to operate effectively, it is necessary to correctly ground the system.

Connect a grounding wire from the grounding stud connection (see Figure 3-1) to the nearest grounded metal pipe or equivalent earth ground.

See Connecting Cables on the next page.
Connecting Cables - Quick Start Guide
Complete the basic connections as shown below:

- AC Line Input
- I/O (Input/Output) Connector
- Grounding Stud
- AC Power Cord Connection

Step 1. Connect the AC line. For the 100/120V model, plug the permanently attached power cord into a suitable receptacle.

For the 200/240V model, attach the female end of the power cord to the generator’s power inlet connector - A in Figure 3-3.

Step 2. Attach the I/O cable connector to the generator’s input/output connection. - B in Figure 3-3. Secure the connector to the system using the two jack screws attached to the connector hood.

Step 3. Ground the generator chassis with the supplied 14-Gauge wire. Attach one end to the grounding stud - C in Figure 3-2. Attach the other end to the nearest grounded metal pipe or equal earth ground.

Step 4. Attach the male end of the power cord to a suitable line receptacle.

Connector - See Page 19 for information about the rear panel CONFIGURATION connector E.

NOTE
AC Power Inlet
Depending on your generator model, line voltage required for the generator is either 100-120 VAC at 50/60 Hertz or 200-240 VAC at 50/60 Hertz. The unit has a power switch, and is powered ON whenever the AC line power is live and the switch is in the ON position as shown in Figure 3-4 below.

Figure 3-4 Rocker-style Power Switch/Circuit Breaker

[Diagram of Generator Detail - Rear View (100/120 Volt Model) and Generator Detail - Rear View (200/240 Volt Model)]
Power Cords

200/240 Volt Systems

The IEC AC power inlet connector mounted on the rear panel requires a properly configured IEC compliant power cord.

The 200/240 AC power cords supplied with the generators are matched to the ultrasonic output power rating and the continent of specified use. See Table 3-I.

Automation Controlled System

Step 1. Ground the generator chassis using the supplied 14-Gauge wire, and attach it to the grounding stud: C in Figure 3-3.

Step 2. Optional – Ground the probe support. This is a user-supplied 14-Gauge wire.

Step 3. Input/Output Cable - Attach the automation control cable from the user-supplied automation equipment to the system HD-15 connector, INPUTS/OUTPUTS on the rear panel: B in Figure 3-3.

Step 4. Attach the high voltage coaxial cable from the probe to the ultrasound output connector, D in Figure 3-3.

Step 5. Connect the AC power cord to the generator IEC power inlet connector, and plug the other end into an approved AC outlet: A in Figure 3-3.

<table>
<thead>
<tr>
<th>Continent of Use</th>
<th>Power Cord Part Number</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>200 - 1541</td>
<td>240V, 10A</td>
</tr>
<tr>
<td>Europe</td>
<td>200 - 1542</td>
<td>240V, 10A</td>
</tr>
<tr>
<td>India</td>
<td>200 - 1624</td>
<td>240V, 10A</td>
</tr>
</tbody>
</table>

Table 3-I Standard IEC AC Power Cord Part Numbers

100/120 Volt Systems (North America or Japan)

The power cord (including strain relief) supplied with the 100/120 AC systems is permanently attached to the rear of the generator. Units with this power cord are for use in North America or Japan.
System I/O Connector Pinout

Table 3-II lists the signal names and descriptions, with more detailed descriptions listed on the next page.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BLK</td>
<td>Enable Out</td>
</tr>
<tr>
<td>2</td>
<td>WHT</td>
<td>Enable In</td>
</tr>
<tr>
<td>3</td>
<td>RED</td>
<td>System Overload Status Output</td>
</tr>
<tr>
<td>4</td>
<td>GRN</td>
<td>Ultrasound Active Status Output</td>
</tr>
<tr>
<td>5</td>
<td>ORN</td>
<td>Any Fault Status Output</td>
</tr>
<tr>
<td>6</td>
<td>BLU</td>
<td>No Connection</td>
</tr>
<tr>
<td>7</td>
<td>WHT/BLK</td>
<td>Isolated Status Output Common</td>
</tr>
<tr>
<td>8</td>
<td>RED/BLK</td>
<td>System Ready Status Output</td>
</tr>
<tr>
<td>9</td>
<td>GRN/BLK</td>
<td>No Connection</td>
</tr>
<tr>
<td>10</td>
<td>ORN/BLK</td>
<td>No Connection</td>
</tr>
<tr>
<td>11</td>
<td>BLU/BLK</td>
<td>Fault Reset Input</td>
</tr>
<tr>
<td>12</td>
<td>BLK/WHT</td>
<td>Ultrasound Activate/Cycle Start Input</td>
</tr>
<tr>
<td>13</td>
<td>RED/WHT</td>
<td>Isolated Input Common (Sourcing or Sinking Inputs)</td>
</tr>
<tr>
<td>14</td>
<td>GRN/WHT</td>
<td>No Connection</td>
</tr>
<tr>
<td>15</td>
<td>BLU/WHT</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

Table 3-II Generator Input/Output Signals

**Pin 1 (Enable Out)**

This is a current limited voltage source output intended to connect to an E-Stop circuit. If an E-Stop circuit is not used, Pin 1 must be jumpered to Pin 2 for ultrasound operation to be enabled.

**Pin 2 (Enable In)**

The output from the E-Stop circuit is connected to this pin when an E-Stop circuit is used. Otherwise, this pin must be jumpered to Pin 1 for ultrasound operation to be enabled. See Figure A-1 in Appendix A for E-Stop circuit wiring examples.

**Pin 3 (System Overload Status Output)**

Pin 3 is an isolated digital NPN/PNP status output that activates when an output overload condition is tripped. This output will be an open circuit if an output overload condition is not tripped. This output will remain latched ON until the U/S Activate input is switched OFF and then ON again.

**Pin 4 (Ultrasound Active Status Output)**

Pin 4 is an isolated digital NPN/PNP status output that activates when the system is delivering ultrasonic power to the load attached to the ultrasound output connector. This output will be an open circuit when the ultrasound output is off.

**Pin 5 (Any Fault Status Output)**

Pin 5 is an isolated digital NPN/PNP status output that activates whenever any fault condition is detected that inhibits ultrasound output and normal system operation. This output will be an open circuit when no system fault conditions are active.

**Pin 6 (No Connection)**

**Pin 7 (Isolated Status Output Common)**

Pin 7 is electrically isolated from chassis ground. This common line should be connected to the negative output of a user-provided isolated 24VDC power supply for a PLC sourcing input card. For a PLC Sinking input card this line is connected to the positive output of the isolated 24VDC power supply.
Section 3 – Installation

Pin 8  (System Ready Status Output)
This status output signal will activate only when the system is ready to activate ultrasound or begin a weld cycle. Pin 8 is an isolated digital NPN/PNP status output that activates when a weld processing cycle is completed and the welding process control system is ready to start the next welding cycle. This output will be an open circuit when the welding process controller determines that the next welding cycle cannot be started. This includes system faults or E-Stop active, but not a process fault like Overload.

Pin 9  (No Connection)

Pin 10  (No Connection)

Pin 11  (Fault Reset Input)
Pin 11 is an isolated input control signal that will reset any output faults when it is activated. It can be used by the automation control system to simplify PLC programming.

Pin 12  (U/S Activate/Cycle Start Input)
Pin 12 is used to activate the generator ultrasound output. When welding in Automation mode, activating this isolated control input will switch the ultrasound output ON, and deactivating this signal will switch ultrasound OFF. When welding by Time or by Energy, this input functions as a cycle initiate. A momentary signal with a minimum duration of 50msec is required to initiate the cycle.

Pin 13  (Isolated Input Common)
[Electrically connected to Pin 5 on MPC I/O connector if MPC Interface option is installed.]
Pin 13 is electrically isolated from chassis ground. Using sourcing (PNP) output drivers, this common line would be connected to the automation system power supply common. Using sinking (NPN) output drivers, this common line would be connected to the automation system positive supply output. See Figure A-1 in Appendix A for E-Stop circuit wiring examples.

Pin 14  (No Connection)
Pin 15  (No Connection)

Configuration Port Connector
This connector - in Figure 3-3 - is a DB-9M (standard D-subminiature nine circuit, male) typically used for RS-232 serial communications. This serial port (DTE) connects to a serial port (DCE) on a computer via a standard 9-pin serial cable. If the computer does not have a serial port, you may use a USB-to-serial conversion cable.

This port is used for field updates to the generator firmware, without removing the enclosure cover. This port can also be used with a software application running on a Windows PC to modify the factory default system settings and hardware configurations. Contact your local sales representative for software availability information and access to documentation that will allow you to make use of the configuration port features.
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SECTION 4

Controls

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Controls Overview

This section gives an overview of the controls functions: powering the generator on/off; monitoring the process with the display; and programming with the control keys.

Figure 4-1 Controls

Power Switch/Circuit Breaker

The power switch/circuit breaker has a rocker-style actuator switch that will activate or deactivate the AC power to the system. The power ON position is marked with the internationally recognized I symbol, the power OFF position is marked with the 0 symbol. This power switch also integrates an appropriately sized over-current protection circuit breaker function in the generator.

If an over-current condition trips the circuit breaker, it will automatically switch to the OFF position. If the overload current that caused the circuit breaker to trip is due to a transient condition, the circuit breaker can be reset by switching the actuator back to the ON position.

CAUTION
If when resetting the circuit breaker after it has tripped, it immediately trips again, an internal system malfunction, is likely, and the generator will need service. Do NOT repeatedly try to reset the circuit breaker. If it trips, this will only cause more damage to the generator.

Control Keys

The control keys shown in Figure 4-1 and described below, are used to display information, and to program the generator.

INFO

Press this key to get system information or to modify the advanced settings.

System Information - Identifies the current version of system software.

Generator Settings - Weld Mode, Freerun, Ramp up, and Lock and Hold features.

Global Settings - Language, and Keyboard features.

SETUP

Use the SETUP key to Load, Store, or Delete as many as eight setups.

Continued
Control Keys

AMP
Set the ultrasound amplitude output level in the range of 20 to 100%. Typically amplitude is set to 100%.

TRIGGER
This key is use to enable trigger by power.

TIME
Use this key to select time as the method of welding. Set the weld time (seconds).

ENERGY
Use this key to select energy as the method of welding. Set the weld energy (joules).

HOLD
Hold is a time period beginning after the weld portion of the cycle is complete. The automation program holds the probe in place applying pressure to the weld, and an audible alarm indicates that the Hold time is finished. Hold can be set to a maximum of 30 seconds.

ENTER
Press the ENTER key to select a menu item, and move to the next level of the menu. Think of it as a “forward” key. When pressed, it also confirms and stores a selection in memory. It is also used to reset a latched condition.

Arrow Keys
Press the right and left arrow keys to move the cursor to the right or left.

+ and - Keys
Press these keys to increase or decrease the value of a selected digit.

CANCEL
Press CANCEL to return to the previous screen. Think of it as a “back” key. Press this key when you do not want to store the selection in memory.

System LCD Display
This high resolution, multi-line display provides a clear graphic interface to the operate and in-cycle screens needed to monitor and program the system.

Power Bar Graph
The Power Bar Graph appears at the bottom of the LCD display. It is a high resolution graph that represent readings from 0% to 100%. Above 80% power, the indication is yellow. Above 90%, the indication is red.

In the example below, 40% of the available power is used during the weld cycle. The display shows an In Cycle screen (while ultrasound [U/S] is active).

In the example below, 40% of the generator power was the maximum (peak) power delivered in the previous weld. The display shows an Operate screen (while U/S is inactive).

CAUTION
Make sure the stack is properly assembled before it is connected to the system. The horn should never come in direct contact with a metal fixture or anvil when ultrasound is activated.
Start-up Sequence

After all connections have been completed.

1. Push the Power Switch to ON (Figure 4-2).
   
   The generator performs a self-diagnostics sequence.

2. When the operate screen is displayed, the welder is ready to begin welding. the display shows:
   
   The weld method and part data for the last weld.

   Note: On power up, the display will read zeros. The previous weld data is not stored when the power is off.

   See Figure 4-3.

Starting a Weld Cycle

1. If the generator is not powered, press its Power Switch/Circuit Breaker to the ON position.

2. Select the setup you want to use, if appropriate.

3. The generator is ready to start a weld cycle when the Ultrasound Activate/Cycle Start Input (Pin 12) is activated.

Stopping a Weld Cycle

Normal Conditions

The cycle stops when the programmed welding cycle ends if the generator is configured to weld by time or energy. If it is configured to weld by automation, the cycle ends when the Ultrasound Activate/Cycle Start Input (Pin 12) is deactivated.

Emergency Conditions

Manual System

Push the Power Switch to OFF (See Figure 4-2.) to stop the ultrasound signal. This may be done under any conditions.

Automated System

Customer-supplied external controls provide the means to stop the cycle for an automated system.

Stopping the cycle is done by removing the ENABLE connection between pins 1 and 2. When this connection is removed, the screen turns red and the cycle is aborted.
LCD Display Overview

There are two basic kinds of screen displays:

**Operate** screens, and **In Cycle** screens.

An **Operate** screen tells the operator what happened in the last weld cycle.

![Figure 4-5 Example of an Operate Screen](image)

An **In Cycle** screen activates when the ultrasound signal has been activated.

![Figure 4-6 Example of an In Cycle Screen](image)
SECTION 5

Process Control Settings

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Process Controller Settings

This section of the manual helps the reader become familiar with the operating modes, and illustrates some typical programming steps.

There are three welding modes available. These correspond to the three ways in which the welder can be used: Automation, Time, and Energy.

Select the Welding Mode

**Automation** - In AUTOMATION mode the PLC controls the weld cycle. The cycle starts, and the ultrasonic signal (U/S) activates when Ultrasound Activate/Cycle Start Input (Pin 12) is activated. When the Ultrasound Activate/Cycle Start Input (Pin 12) is deactivated, the ultrasonic signal stops and the cycle is complete unless there is a hold time programmed.

**Time** - In TIME mode the operator sets a maximum time (seconds) that the ultrasonic signal will be active for each weld cycle. The cycle starts when the Ultrasound Activate/Cycle Start Input (Pin 12) is activated. The U/S stops when the programmed time is reached.

**Energy** - In ENERGY mode the operator sets a maximum energy (Joules) the generator will reach during the weld cycle. *A maximum weld time must be set when welding by energy. If the energy level is not reached, the preset for time will determine when the U/S is deactivated.* When the preset energy level is reached, the U/S will be deactivated. The cycle starts when the Ultrasound Activate/Cycle Start Input (Pin 12) is activated. When the programmed energy is reached, ultrasound stops.
Navigating the Modes

When the generator is first powered up, the default operating mode is Automation, and **Automation Weld** is shown at the top of the display as shown in Figure 5-1.

**Navigate to Time Mode**

1. Follow the sequence shown in the figures to the right to navigate from Automation mode to Time mode.
   
   In Automation mode, press the **TIME** key (Figure 5-2).

2. Set the time.
   
   Use the **← →** and the **+ -** keys to move the cursor and to set the digits for the weld time you want (See Figure 5-2).

3. Press the **ENTER** key to accept the time that has been set (Figure 5-3).
   
   Press the **CANCEL** key if you decide not to set the time.

**NOTE**

Navigating to Automation Mode

Set Time or Energy (depending on mode) to OFF, and press ENTER. This will put you back in Automation mode.

**Alternately:**

Press the info key, select Weld Mode, and then push ENTER. A pop up screen appears. Use the up arrow to select Automation and press enter.

![Figure 5-1 Automation Weld Mode](image1)

![Figure 5-2 Time Weld Mode - 1](image2)

![Figure 5-3 Time Weld Mode - 2](image3)
navigate to energy mode

1. Follow the sequence shown in the figures to the right to navigate from Time mode to Energy mode.

2. In Time mode (Figure 5-5), press the ENERGY key, and the screen as shown in Figure 5-6 appears.

3. Use the ← → and the + - keys to move the cursor and to set the digits for the energy you want. See Figure 5-7.

4. Press the ENTER key to accept the energy that has been set. Press the CANCEL key if you decide not to set the energy.

5. If you set the energy level, a maximum weld time needs to be set also. Set a time that is reasonable for your application. [The factory default for this time is 30 seconds (also the maximum).]
   The time can not be set below 0.001 second.
   Use the ← → and the + - keys to move the cursor and to set the digits for the time you want. See Figure 5-8.
**Hold**

HOLD is used more often with Time or Energy modes, but it can be used with the Automation mode.

HOLD does not allow the automation program to begin a new cycle until HOLD is finished.

To set a HOLD period:

1. Select the weld mode (Automation, Time, Energy).
2. Set the time and energy parameters as needed.
3. Press the HOLD key. The screen will appear as it does in Figure 5-9.
4. Set the time with the + - keys.
   (A maximum of 30 seconds.)
   Figure 5-9A shows a setting for 1 second.
5. Press the ENTER key to confirm your selection.

**Amplitude Adjustment**

Amplitude refers to the movement of the horn at its workface. The higher the amplitude setting, the higher the power output level will be at a particular pressure level.

Amplitude settings are given as a percent of the horn’s nominal amplitude in the range of 20% to 100%.

It is typical to leave the amplitude setting at 100% for maximum power output.

To adjust amplitude:

1. Press the AMP key. The screen will appear as in Figure 5-10.
2. Set the amplitude level using the ← → keys and the + - keys.
3. Press ENTER to confirm your amplitude setting.
Trigger by Power

Push ENTER to toggle from OFF to ON.
When Trigger by Power is selected, three additional settings are presented:

- **Trigger Amplitude** - This is the percentage of amplitude that the generator applies to the horn prior to reaching the Trigger Power setting (See Figure 5-11b).

- **Trigger Power** - This is the power level that must be reached at the Trigger Amplitude setting for the weld cycle to start (See Figure 5-12).

- **Trigger Timeout** - This is the maximum time the welder remains at the Trigger Amplitude setting before aborting the weld cycle (See Figure 5-13).

For a more detailed explanation of Trigger by Power, please refer to Application Note 506 found on our website at:


**NOTE**

Trigger by Power is only available when the weld mode is either Time or Energy.
System Information, Hardware Settings, Generator Settings

When the INFO key is pressed the display appears as seen in Figure 5-14a. From here System Information can be viewed, Hardware Settings can be updated, and Generator Settings can be updated.

1. System Information
   Push enter to display model type and firmware information.
   Figure 5-14b shows an example of this information.

2. Hardware Settings
   Weld Mode
   Displays the mode (See Figure 5-15). Push ENTER to change the mode.

3. Generator Settings
   Free Run Frequency
   Free run is the frequency at which the generator drives the ultrasound output pulses until a valid feedback signal is detected. Typically this value should be below the operating frequency of the probe.
   (See Figure 5-16a).
   Push ENTER to change the current value.

   Ramp Up Time
   This parameter increases the amplitude linearly in the programmed time period at the start of the weld from zero to the programmed amplitude level. This brings the probe up to operating amplitude smoothly preventing shock stress.
   Push ENTER to change the current value.

   Lock and Hold
   For an explanation of Frequency Lock and Hold, please refer to Application Note 505 found on our website at:
   Push ENTER to change the current value.
Language
This enables one to select which language is displayed. Press ENTER to select language (Figure 5-17).

Keyboard
Pushing the enter button enables the keyboard function. This facilitates entering weld time and energy values directly by number. Pushing the ENTER button will toggle the feature on and off. As shown in Figure 5-16.

When the TIME or ENERGY button is pushed, a numerical keypad will be displayed (Figure 5-18). Use the left and right arrows along with the up and down arrows to highlight the desired value and push ENTER. The value will be entered from left to right. (Figure 5-18) Highlight the displayed value and push ENTER to accept. (Figure 5-19).

Select “Weld Time” or “Energy” as shown in Figure 5-20. A pop-up screen will appear that will enable one to use the up and down arrows to select the weld method. Figure 5-21
Setup Maintenance

Introduction

The screens available in Setup Maintenance allow the operator to Load, Store, or Delete generator weld setups. The current program is stored automatically into the selected setup. Any time a setting is changed, the current setup is overwritten automatically. As many as eight (8) setups can be loaded and stored for your convenience.

Navigating

When the SETUP key is pressed, the screen will display the weld method and the value for each parameter for the current setup. Use the up and down arrow to select a setup.

- **Load** - (Load means to put data into the generator’s memory from a stored setup.)

  With the desired setup selected (Figure 5-17) press ENTER. A pop-up screen asks to confirm loading the selected setup (See Figure 5-17A).

  Select YES, and the display will change to an Operate Screen. The number of the selected setup will appear in the lower right corner of the screen (See Figure 4-4). This indicates that the desired setup has been loaded.

  Select NO, and the display will go back to the previous operate screen with the previous setup still loaded.

- **Delete** - To delete the setup, select Delete as shown in Figure 5-18, and press the ENTER key. A pop-up screen appears to ask you to confirm your choice (See Figure 5-18A). Select YES or NO, and press ENTER again.

Continued
Setup Maintenance

Changing the Current Setup

The following example will demonstrate how to change setups:

1. Follow the instructions on page 28 to set the mode to Weld By Time. Set the weld time to 1.520 seconds (See Figure 5-24).

2. The generator will automatically store this programmed value in the current setup location. Press the SETUP to confirm (See Figure 5-25).

3. To change setups, push the up arrow to a new setup. With LOAD selected, push enter. Push ENERGY and program for 200J, with a max weld time of 1 second. The generator will weld by energy to 200J (See Figure 5-26).

4. Press SETUP. The display will show the values for weld energy and time that you have just programmed. This confirms the generator has stored the new values you have entered (See Figure 5-27).

Selecting a Setup

1. Push the down arrow and with LOAD highlighted, select the setup number you first entered. The display will show the weld time of 1.520 seconds. The display will show values as displayed in Figure 5-25.

2. Press ENTER and the screen will return to the operate screen. The generator will weld for 1.520 seconds.

Deleting the Current Setup

1. Press SETUP.

2. With the + - arrows, select the second setup you previously programmed to weld by energy (See Figure 5-27). Highlight DELETE by pushing the right arrow.

3. Push ENTER. A pop up screen will ask you to confirm deletion of the selected setup. Press YES, and the setup will be deleted. You can confirm the setup has been deleted as the display will show Automation Weld. The Time and Energy values will display OFF (See Figure 5-28).
SECTION 6
Probes and Probe Stacks

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Ultrasonic Probe Overview

Theory of Operation
Plastic welding is the most common application of ultrasonic assembly. To perform ultrasonic plastic welding, the vibrating tip is brought into contact with one of the work pieces. Pressure is applied and ultrasonic motion travels through the material generating frictional heat at the contact point of the two parts. The frictional heat melts a molded ridge of plastic on one of the pieces and the molten material flows between the two surfaces. When the vibration stops, the material solidifies forming a permanent bond.

Probe Configuration
A basic ultrasonic probe package consists of:

1. A probe which houses the transducer to convert the electrical energy supplied by the generator into mechanical vibration.

2. A horn to transfer the mechanical vibration from the probe to the parts to be welded.

Optional components include special replaceable tips which can be threaded on to the tip of the horn, and a booster to amplify the mechanical vibration of the horn. A basic probe system is shown in Figure 6-1.

Normally a booster is not used with a probe as this increases the length and weight and reduces its versatility. The optional threaded titanium tip can be used when the application calls for a staking profile or a pointed spot weld. Replaceable tips are not commonly used in high-volume production environments.

NOTE
For automated systems we recommend that you use a booster with the probe as shown in Figure 6-2. Read Dukane’s Application Note #504 - Ultrasonic Acoustic Stack Mounting Guidelines - found on our website at: http://www.dukane.com/us/DL_ApplData.asp

CAUTION
Never use a probe if the cable insulating jacket is cut or damaged in any way.

CAUTION
The ultrasonic cable carries high electrical current when in operation. Do not nick or cut this cable. If cut, there would be a high potential for electric shock!

Figure 6–1 Probe, Horn and Tip
Ultrasonic Horn
The horn transfers the ultrasonic mechanical vibrations (originating at the transducer in the probe housing) to the plastic parts through direct physical contact. The horn is precision machined and designed to vibrate at either 20kHz, 30kHz, 40kHz, 50kHz or 70kHz. The tuning is accomplished using electronic frequency measurement. Inherent variations in material composition prevent tuning by dimensional machining alone.

There are many different horn profile styles depending upon the process requirements. Factors which affect the horn design are the materials to be welded and the method of assembly. Horns are usually constructed from aluminum, hardened steel or titanium. As the frequency increases, vibration amplitude typically decreases, but internal stress in the horn increases. Higher frequencies are used for delicate parts that cannot handle a lot of amplitude. Some factors to keep in mind for high–frequency (e.g. 40kHz) ultrasonic welding versus low–frequency (e.g. 20kHz) ultrasonic welding are listed here.

1. Stress in the horn is higher at high frequencies.
2. Wear on the horn is greater at high frequencies.
3. Clean and flat mating surfaces between the horn, booster and transducer are more critical at high frequencies.

Booster
The function of a booster is to alter the gain (i.e. output amplitude) of the probe. A booster is amplifying if its gain is greater than one and reducing if its gain is less than one. A neutral or coupling booster is used to provide an additional clamping location for added probe stack stability. A probe designed to be mounted in a fixture along with a booster and horn is shown in Figure 6–2. This is commonly referred to as a stack. As indicated, the components are secured with threaded studs.
Operating Notes

Cooling

The Dukane Probe is designed with a cooling port. Depending on the type of weld process, air cooling may be necessary. Low power and/or low duty cycle applications typically do not require cooling. However in a production environment, a determination will need to be made if external cooling is required. To make this determination, the surface temperature of the probe and horn will need to be monitored.

No part of the probe or horn surface should exceed 110 degrees F. If at any time, any part of the probe or horn exceeds 110 degrees, one should stop welding and allow the system to cool. Continuing to operate the system with component temperatures exceeding 110 degrees has the potential to damage the system. As a general guide, no part of the system should be too hot to touch, when monitoring the surface temperature in between cycles.

If it is determined that cooling is necessary, air should be supplied to the hand probe cooling port. The air must be clean and dry as the air is blowing directly on electrical components inside the probe. It may also be necessary to provide cooling air to the horn surface as well.

Note: The horn does not need to get hot to melt the plastic. High frequency motion at the horn tip creates friction at the point of contact, which results in heat that melts the plastic.
Stack Assembly

Attaching a Replaceable Tip to a Horn

1. Inspect all horn and tip surfaces for stress cracks, chips, or gouges. Any of these irregularities will affect operation and could lead to further equipment damage. Contact the Dukane Ultrasonics Tooling Department concerning damaged horn components.

2. Apply an extremely thin layer of a high temperature, high pressure silicon grease to the back surface that mates with the horn. The grease will allow both surfaces to intimately mate and become acoustically transparent which improves the energy transfer. Do not apply any grease to the threads. We recommend Dow–Corning #4 (or #111 as an alternate). A small packet of Dow–Corning #4 is supplied with the system. If you cannot use a silicon–based grease in your facility, a petroleum–based grease may be used. However, it is likely to leave carbonaceous deposits on the surface, and require more frequent joint maintenance. Failure to follow these instructions, may result in the mating surfaces bonding and difficulty removing the tip from the horn.

3. Thread the tip into the horn and tighten to the torque specifications below using an open end wrench of the correct size to fit the wrench flats of the tip. This is illustrated in Figure 6–3. If necessary, use a spanner wrench (on horns with spanner wrench holes) or an open end wrench (on horns with wrench flats) to keep the horn from turning in your hand. A canvas strap wrench is permissible if it does not gouge or scratch the horn.

```
<table>
<thead>
<tr>
<th>inch-lb</th>
<th>ft-lb</th>
<th>N-m</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>360</td>
<td>30</td>
<td>40.7</td>
<td>1/2” x 20 tpi tip threads</td>
</tr>
<tr>
<td>336</td>
<td>28</td>
<td>38</td>
<td>3/8” x 24 tpi tip threads</td>
</tr>
<tr>
<td>300</td>
<td>25</td>
<td>33.9</td>
<td>5/16” x 24 tpi tip threads</td>
</tr>
<tr>
<td>240</td>
<td>20</td>
<td>27.1</td>
<td>1/4” x 28 tpi tip threads</td>
</tr>
</tbody>
</table>
```

Table 6-I Tip Torque Unit Conversions

NOTE
Do not apply any grease to the threads of the replaceable tip. This may cause the tip to loosen from the horn resulting in inconsistent operation.

CAUTION
NEVER clamp the horn in a vise. The resulting scratches or gouges in the surface are stress risers which may result in cracks.

NOTE
Dukane Part No. for the 20kHz spanner wrenches is 721–68.
Dukane Part No. for the 40kHz spanner wrenches is 721–44.
Attaching the Mounting Stud to a Horn or a Booster

1. Inspect the stud for cracks or damaged threads. Replace the stud if it is cracked or otherwise damaged.

2. Remove any foreign matter from the threaded stud and the mating hole.

3. Thread the mounting stud into the input* end of the horn or the input* end of the booster and tighten to the following torque specifications using an Allen wrench in the socket head of the mounting stud. Table 6-II lists the torque specifications in units for both English and Metric systems of measurements.

DO NOT hold the booster by the mounting rings when tightening stud. The mounting rings have a shear pin which could snap under excessive torque. Use a spanner wrench (on horns with spanner wrench holes) or an open end wrench (on horns with wrench flats) to keep the horn or booster from turning in your hand.

<table>
<thead>
<tr>
<th>in-lb</th>
<th>ft-lb</th>
<th>N-m</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-18</td>
<td>1 - 1.5</td>
<td>1.4 - 2</td>
<td>1/2&quot; x 20 tpi studs</td>
</tr>
<tr>
<td>12-18</td>
<td>1 - 1.5</td>
<td>1.4 - 2</td>
<td>3/8&quot; X 20 tpi studs</td>
</tr>
<tr>
<td>12-18</td>
<td>1 - 1.5</td>
<td>1.4 - 2</td>
<td>8 mm studs</td>
</tr>
</tbody>
</table>

Table 6-II  Stud Torque Unit Conversions

* Always assemble the mounting studs that mate boosters, transducers and horns to the input end of the horn or the input end of the booster first. This is shown in Figure 6-5.

NEVER thread a stud into the transducer or the output end of the booster first. See Booster Notes in this section for correctly identifying the output end of a booster.

NOTE
Do not apply any grease to the stud threads or the tapped hole. This may cause the stud to loosen. If the stud wanders within the joint, it can vibrate, resulting in excessive heat. In some cases, this can melt the tooling material.

NOTE
Do not apply any grease to the stud threads or the tapped hole. This may cause the stud to loosen. If the stud wanders within the joint, it can vibrate, resulting in excessive heat. In some cases, this can melt the tooling material.

To convert inch-lbs to ft-lbs, divide by 12. To convert inch-lbs to Nm, divide by 8.852. To convert ft-lbs to Nm, multiply by 1.356. To convert Nm to ft-lbs, multiply by 0.7376.

Torque specifications have a tolerance of about ± 10%.

See Figure 10–4 for a handy conversion graph.
Attaching the Horn to a Booster, Booster to a Probe, or Horn to a Probe

1. Inspect all surfaces to be joined for stress cracks, chips, or gouges. Any of these irregularities will affect operation and could lead to further equipment damage. Contact the Dukane Ultrasonic Tooling Department concerning a damaged booster.

2. Ensure that the mating surfaces of the two components are clean and smooth. These surfaces must make intimate contact for the mechanical energy to pass from one component to the next. Pitting or a buildup of old grease and dirt on a mating surface will interfere with the energy transfer and reduce the power delivered.

3. Make sure that the stud in the horn or booster is tight. See the preceding mounting stud assembly instructions for torque specifications.

4. Remove any foreign matter from the threaded stud and mating hole.

5. Apply an extremely thin layer of a high temperature, high pressure silicon grease to the surface that mates with the horn. The grease will allow both surfaces to intimately mate and become acoustically transparent which improves the energy transfer. We recommend Dow–Corning #4 (or #111 as an alternate). A small packet of Dow–Corning #4 is supplied with the system. If you cannot use a silicon–based grease in your facility, a petroleum–based grease may be used. However, it is likely to leave carbonaceous deposits on the surface, and require more frequent joint maintenance. Grease may be omitted if mylar washers are preferred on systems that require frequent changes. Mylar is plastic and will creep under compression, so mylar is not recommended for systems that are not changed frequently. Failure to follow these instructions, may result in the mating surfaces bonding and difficulty removing the horn from the booster or the booster from the probe.

NOTE
Always remove a probe stack from the machine in which it is mounted before attaching or removing a horn.

CAUTION
Never leave a horn or booster assembly hand tight. Torque it to the proper specifications before proceeding. If the assembly is installed without being properly torqued down, the assembly may vibrate severely, damaging the mating surfaces and causing the generator to overload.

Figure 6–4 Stack Assembly Procedure

Continued
6. Thread the components together and tighten to the following torque specifications using only the correct size wrenches. Use spanner wrenches on components with spanner wrench holes or an open end wrench on components with wrench flats. See Figure 6–4 for the correct procedure. Refer to Table 6-III for torque unit conversions. Be careful not to overtighten.

<table>
<thead>
<tr>
<th>In-lb</th>
<th>Ft-lb</th>
<th>N-m</th>
<th>kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>540</td>
<td>45</td>
<td>61</td>
<td>15 kHz stack</td>
</tr>
<tr>
<td>420</td>
<td>35</td>
<td>47.5</td>
<td>20 kHz stack</td>
</tr>
<tr>
<td>216</td>
<td>18</td>
<td>24.4</td>
<td>30 kHz stack</td>
</tr>
<tr>
<td>216</td>
<td>18</td>
<td>24.4</td>
<td>40 kHz stack</td>
</tr>
</tbody>
</table>

**Table 6-III** Horn/Booster Torque Unit Conversions

**NOTE**
Horn and booster torque specifications are higher than stud torque specs. Be sure to tighten the horn or booster joints to the higher torque limits. Do not tighten the studs to these higher ratings as it may induce unnecessary stress in the assembly.
Stack Disassembly

Stack disassembly is required when changing the booster or horn, or for a thorough inspection of all stack components. In mounted systems, always remove the stack from its mounting to disassemble the stack components.

To establish a maintenance schedule, inspect the mating surfaces after the first 200–400 hours of operation. If they require cleaning, halve the time between inspections. If the surfaces do not require reconditioning, then double the time between inspections. Each system is different due to the large number of operational parameters and stress factors.

The assembly and disassembly procedures for a probe are shown in Figure 6–5. It makes no difference whether the horn is attached to the booster first, or the booster is attached to the probe first.

**Figure 6–5** Probe Assembly and Disassembly

---

**CAUTION**

Never hold a probe by the housing when tightening or loosening an adjoining component. The probe housing has anti-rotation devices to keep the transducer aligned. These could shear under excessive torque.
Separating the Horn from a Booster, Booster from a Probe, or Horn from a Probe

On all transducers and horns with spanner wrench holes, use only the correct size spanner wrench that came with your system to provide sufficient torque to loosen a joint. See Figure 6–6.

![Figure 6–6 Separating the Horn from the Booster](image)

On boosters and horns with wrench flats, use only the correct size wrench to provide sufficient torque to loosen a joint when necessary.

Removing the Mounting Stud from a Horn or Booster

Only use an Allen wrench of the correct size in the socket head’s stud to remove the stud from the horn or booster.

![Figure 6–7 Removing a Replaceable Tip from the Horn](image)

Removing Replaceable Tips from a Horn

Use an open end wrench of the correct size to fit the wrench flats of the detachable tip. Use a spanner wrench (on horns with spanner wrench holes) or an open wrench (on horns with wrench flats) to provide an opposite force to keep the horn from turning in your hand. Refer to Figure 6–7 for the correct tip removal procedure.

**NOTE**

Do not hold a booster by the mounting rings when removing the stud from the booster. Use a spanner or open-end wrench to provide opposite force and keep the horn or booster from turning in your hand when loosening the stud. Use a spanner wrench on horns and boosters with spanner wrench holes. Use an open end wrench on horns and boosters with wrench flats.
Booster Notes

How to Tell the Booster Input End from the Output

1. The depth of the threaded hole on the output end is always deeper than the threaded hole on the input end.

2. On an amplifying booster (gain > 1.0), the larger diameter end is the input end. On a reducing booster (gain < 1.0) the larger diameter end is the output end. On a neutral acting booster the diameters are equal.

3. The cap screws on the booster mounting rings are always inserted from the output end toward the input end.

How to Tell if the Booster Is Amplifying or Reducing

Boosters have a die-stamped number on their surface that indicates their gain or reduction. If the number is greater than 1.0 (e.g. 1.5), it is an amplifying booster. If the number is less than 1.0 (e.g. 0.6), it is a reducing or reverse booster. A neutral booster has no gain and has 1.0 stamped on it. A neutral or coupling booster is used to provide another probe stack clamping location for added stability.

CAUTION
NEVER install a booster upside down to change an amplifying system to a reducing system. The boosters are dimensionally asymmetric. They are tuned from input to output to act like an acoustic lens. Reversing them will not give the expected results and may cause damage to the system.
SECTION 7

Troubleshooting

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No Ultrasonic Output

Probe
Make sure that the probe cable is connected to the generator connector (PROBE) and secured to the rear panel. Also, make sure the probe stack is properly assembled.

System Power Output Level

Overload
When an overload occurs, it will automatically reset when the next ultrasound activation signal begins. If the condition persists:

Turn the generator OFF and:
1. Check the system. Change the probe to one that is known to be good.
2. Turn the generator ON, and see if the fault condition has been corrected.

Overtemperature
When the generator overheats, and its internal temperature exceeds 85°C (185°F) an overtemperature fault condition will trip.

When the system cools, the system automatically resets the overtemperature fault.

Generator Fault Does Not Reset
When a system fault condition does not automatically reset, the generator needs servicing.

System Power Diagnostic Procedures
Information regarding power diagnostic faults can be found by visiting: www.dukane.com/EasyAlarm

NOTE
The LCD screen displays a variety of pop-up status changes as they occur. Check Table 7-I - Pop-up Fault Status Screens - Page 53.

NOTE
When Latching Faults is enabled, ENTER must be pressed to clear a fault.
Welding Problems

Weak Welds
Weak welds, or underwelding, is caused by insufficient energy being transmitted to the part. You can increase the weld pressure, increase the weld duration (Time or Energy) or change to a higher gain booster to increase the amplitude to increase the energy delivered to the weld.

Inconsistent Welds
Variations in plastic due to filler materials and moisture absorption may lead to inconsistent welds. Fillers can be especially troublesome if they are not uniformly distributed, the content is too high or it contains too much or poor quality regrind or degraded plastic.

Try welding by energy. This eliminates many inconsistencies. There should be no unusual or loud noise from the acoustic stack. If there is, disassemble the stack and reassemble.

Exchange the probe with another unit to see if the problem disappears. If not, exchange the generator with another unit to try and isolate the problem.

The horn amplitude may not be uniform if it has been machined, altered or damaged. All of these will change the resonant frequency of the horn. You can have the horn analyzed.
Pop-up Fault Status Screens

<table>
<thead>
<tr>
<th>Process Alarms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pop-Up Alarm Displayed</strong></td>
</tr>
<tr>
<td>Process Alarm</td>
</tr>
<tr>
<td>Initiate Alarm</td>
</tr>
<tr>
<td>Process Alarm</td>
</tr>
</tbody>
</table>

Table 7-1 Pop-Up Process Alarms
Overload alarms
Many overload alarms can be the result of damage to the Ultrasonic stack assembly (probe and horn). More information regarding maintenance to the stack assembly can be found at:


<table>
<thead>
<tr>
<th>Pop-Up Alarm Displayed</th>
<th>Alarm Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Status</td>
<td>Generator was not able to find the resonant frequency of the probe and horn. This can be a result from applying too much force at startup, or the result of a damaged probe, or horn. Alarm will reset when the next cycle starts.</td>
</tr>
<tr>
<td>Alarm Status</td>
<td>Instantaneous current exceeds the rating of the internal generator components. Most often caused by a severe frequency mismatch. Alarm will reset when next cycle starts.</td>
</tr>
<tr>
<td>Alarm Status</td>
<td>Ultrasound voltage exceeded input voltage. Most often caused by a severe frequency mismatch between the generator and stack. Alarm will reset when next cycle starts.</td>
</tr>
<tr>
<td>Alarm Status</td>
<td>Output power exceeded the rated power of the generator. Reduce the power requirement by reducing force against the part. Alarm will reset when next weld cycle starts.</td>
</tr>
</tbody>
</table>

Table 7- II Pop-Up Overload Alarms
General Alarms

<table>
<thead>
<tr>
<th>Pop-Up Alarm Displayed</th>
<th>Alarm Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alarm Status</strong></td>
<td><strong>Alarm ID # U111</strong></td>
</tr>
<tr>
<td><strong>Over Temperature Alarm</strong></td>
<td>System over temperature fault detected in the output stage of the generator. Fault will reset when system cools down.</td>
</tr>
<tr>
<td><strong>Alarm Status</strong></td>
<td><strong>Alarm ID # U100</strong></td>
</tr>
<tr>
<td><strong>Configuration Alarm</strong></td>
<td>Generator model number does not match internal generator configuration. Cycle power. If fault persists, contact Dukane Technical Support.</td>
</tr>
<tr>
<td><strong>Alarm Status</strong></td>
<td><strong>Alarm ID # U110</strong></td>
</tr>
<tr>
<td><strong>Power not OK Alarm</strong></td>
<td>AC line voltage is not within the specified limits. Review incoming AC line voltage to insure it is correct. If AC line voltage measurement is correct, and alarm persists, contact Dukane Technical Support.</td>
</tr>
<tr>
<td><strong>Initiate Alarm</strong></td>
<td><strong>Alarm ID # U308</strong></td>
</tr>
<tr>
<td><strong>Not Ready</strong></td>
<td>If the cycle initiate signal was active during power up, the generator will be prevented from turning on ultrasound. Remove the cycle initiate signal and begin a new cycle. Make sure the cycle initiate signal is not active during power up.</td>
</tr>
</tbody>
</table>

Table 7-III Pop-Up General Alarms
SECTION 8
Specifications

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Operating Environment ............................................ 60
AC Power Requirements ......................................... 61
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Figure 8-1 Generator Outline Drawing

IN [mm]

- ALLOW 2" (50mm) FREE SPACE FOR COOLING AIR.
- ALLOW 5" (150mm) BEHIND GENERATOR FOR CABLE CONNECTIONS.
- HANDPROBE AND AUTOMATION CONNECTIONS ON BACK OF GENERATOR. REFER TO MANUAL FOR CONNECTION DIAGRAM.
Weights

<table>
<thead>
<tr>
<th></th>
<th>lb</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator Only</td>
<td>12</td>
<td>5.44</td>
</tr>
<tr>
<td>Generator + Packing Materials</td>
<td>17</td>
<td>7.71</td>
</tr>
</tbody>
</table>

Table 8–I  *iQ* Generator Weights

Operating Environment

Operate the equipment within these guidelines:

**Temperature:** 40°F to 100°F (+5°C to +38°C)

**Air Particulates:** Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

**Humidity:** 5% to 95% non-condensing @ +5°C to +30°C

Nonoperating storage guidelines:

**Temperature:** -4°F to 158°F (-20°C to +70°C)

**Air Particulates:** Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

**Humidity:** 5% to 95% non-condensing @ 0°C to +30°C
## AC Power Requirements

<table>
<thead>
<tr>
<th>Operating Frequency</th>
<th>Generator Model Number</th>
<th>Overload Power Rating (Watts)</th>
<th>Input AC Power Requirements Nominal AC Volt</th>
<th>North America/ Japan AC Outlet Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>20kHz</td>
<td>20AL060-1H</td>
<td>600</td>
<td>100-120 VAC, 50/60 Hz @ 9.0 Amps</td>
<td>15.0 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20AL060-2H</td>
<td></td>
<td>200-240 VAC, 50/60 Hz @ 4.5 Amps</td>
<td></td>
</tr>
<tr>
<td>30kHz</td>
<td>30AL060-1H</td>
<td></td>
<td>100-120 VAC, 50/60 Hz @ 9.0 Amps</td>
<td></td>
</tr>
<tr>
<td>30kHz</td>
<td>30AL060-2H</td>
<td></td>
<td>200-240 VAC, 50/60 Hz @ 4.5 Amps</td>
<td></td>
</tr>
<tr>
<td>35kHz</td>
<td>35AL060-1H</td>
<td></td>
<td>100-120 VAC, 50/60 Hz @ 9.0 Amps</td>
<td></td>
</tr>
<tr>
<td>35kHz</td>
<td>35AL060-2H</td>
<td></td>
<td>200-240 VAC, 50/60 Hz @ 4.5 Amps</td>
<td></td>
</tr>
<tr>
<td>40kHz</td>
<td>40AL060-1H</td>
<td></td>
<td>100-120 VAC, 50/60 Hz @ 9.0 Amps</td>
<td></td>
</tr>
<tr>
<td>40kHz</td>
<td>40AL060-2H</td>
<td></td>
<td>200-240 VAC, 50/60 Hz @ 4.5 Amps</td>
<td></td>
</tr>
</tbody>
</table>

**Table 8-II** AC Power Requirements

## Ultrasonic Pressure

<table>
<thead>
<tr>
<th>iQ Generator Models - kHz</th>
<th>15</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful Beam</td>
<td></td>
<td></td>
<td>360 degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasonic Pressure @ Operator’s Position - dB</td>
<td>125</td>
<td>140</td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>Ultrasonic Pressure 1 m from the Equipment - dB</td>
<td>110</td>
<td>130</td>
<td>110</td>
<td>105</td>
<td>110</td>
</tr>
</tbody>
</table>

**Table 8-III** iQ Generator Ultrasonic Pressure

**NOTE**
All measurements taken with Data Physics Dynamic 4-Channel Signal Analyzer with calibrated 377C01 Microphone and 426B02 Preamplifier.
Regulatory Agency Compliance

**FCC**
The *iQ* AL-E Power Supply complies with the following Federal Communications Commission regulations.

**CE Marking**
This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Européenne (European Conformity). The *iQ* AL-E Power Supply complies with the following CE requirements.
- The EMC Directive 2014/30/EU for Heavy Industrial —
  - EN 61000-6-4
  - EN 55011
  - EN 61000-6-2
    - EN61000–4–2
    - EN61000–4–3
    - EN61000–4–4
    - EN61000–4–5
    - EN61000–4–6
    - EN61000–4–8
    - EN61000–4–11
- The Low Voltage Directive 2014/35/EU
- The Machinery Directive 2006/42/EC
- EN ISO 12100: Safety of Machinery - General principles of design, risk assessment, and risk reduction.

**IP Rating**
The *iQ* AL-E Power Supply has an IP (International Protection) rating from the IEC (International Electrotechnical Commission).

The rating is IP2X, in compliance with finger-safe industry standards.

**UL & CSA**
The *iQ* AL-E Power Supply complies with these standards:

**Underwriters Laboratories (UL):**
- UL61010-1

**National Standards of Canada (CSA):**
- CAN/CSA C22.2 No. 61010-1

as verified by TÜV Rheinland.

**CAUTION**
DO NOT make any modifications to the *iQ* AL-E Power Supply or associated cables. The changes may result in violating one or more regulations under which this equipment is manufactured.
SECTION 9

Contacting Dukane
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Contacting Dukane

Equipment Identification and Problem Details
When contacting Dukane about a service related problem, be prepared to give the following information:

- *iQ* AL-E Power Supply model number and serial number.
- Any fault/error indicators from the LCD display.
- Software version. Press INFO, and with the pointer at System Information, press ENTER to get this data.
- Problem description and steps taken to resolve it

Some problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Ultrasonics Division

Mailing Address: Dukane
2900 Dukane Drive
St. Charles, IL 60174 USA

Main Phone: (630) 797–4900
Main Fax: (630) 797–4949
Service & Parts Fax: (630) 584–0796

Website
The website has information about our products, processes, solutions, and technical data (including 3D CAD models). Downloads are available for many kinds of literature.

Main page: www.dukane.com/us


You can locate your local representative at: www.dukane.com/us/SA_IntSales.htm
APPENDICES

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Appendix A  E-Stop Circuitry Examples

Dedicated E-Stop Switch Wiring Diagram

```
<table>
<thead>
<tr>
<th>System I/O Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Pin 1) Enable Out</td>
</tr>
<tr>
<td>(Pin 2) Enable In</td>
</tr>
</tbody>
</table>

User supplied E-stop switch
```

Automation System Safety Circuit Wiring Diagram

```
<table>
<thead>
<tr>
<th>System I/O Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Pin 1) Enable Out</td>
</tr>
<tr>
<td>(Pin 2) Enable In</td>
</tr>
</tbody>
</table>

Master control relay
User automation control hardware
```

Figure A-1 E-Stop Circuitry
## List of Figures

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</tr>
</thead>
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<td>Example of 240 Volt, Grounded, 3-prong Plug and Receptacle</td>
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<td>11</td>
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<tr>
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<td>Generator Settings - 1</td>
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<tr>
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<td>Generator Settings - 2</td>
<td>33</td>
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Please Refer To Our Website At:

www.dukane.com/us/SA_IntSales.htm

To Locate Your Local Representative