IQ Explorer 3

QUICK START GUIDE
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Specifications subject to change without notice.

This user’s manual documents product features, hardware, and controls software available at the time this user’s manual was published.

Dukane Part Number: 403-620-00

Dukane ultrasonic equipment is manufactured under one or more U.S. Patents.
Find the list of all the Ultrasonic Equipment Patents on our website below:
https://www.dukane.com/patents/
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SECTION 1

Introduction
Introduction

Press System Overview

The Infinity Series Servo Ultrasonic Press System is used for welding thermoplastics. A typical Infinity™ ultrasonic welding system is shipped completely with a press (thruster, base, and column), generator, an ultrasonic stack (transducer, booster, horn), fixturing, cables, and a HMI (with the IQ Explorer 3 software installed) for application setup and data acquisition.

General User Information

This Quick Start Guide provides information to set up and operate Dukane’s HMI and IQ Explorer 3 software. Please read it before using the system to become familiar with the equipment to ensure correct and safe operation.

Figure 1-1 Typical Press System
AC Power Requirements

Dukane HMI

AC line voltage - 90-260 VAC
AC line current - 1 Amp

**IQ Explorer 3 Overview**

The IQ Explorer 3 software comes standard on a Dukane HMI. This program connects with the Infinity™ generator/press through a user interface and is used for configuration and setup.

**Key Features**

*IQ Explorer 3 User Interface*

- **Windows 10 operating system** - Familiar file folder menu structure, requiring no special training.
- **Touch screen input** - Makes programming easier. All welder setup parameters are programmed from one menu page. (Applies to the HMI or PCs with touch screen, such as tablets.)
- **Ethernet connectivity** - For communications to the Infinity™ welder.
- **Control** - Control feature for locking out system controls that complies with FDA 21 CFR Part 11.
- **Remote connectivity** - Dukane hotline is available for system diagnostics and troubleshooting 24-hours a day. (VPN access to the welder’s network is required. Consult with your IT staff about availability.)
- **One screen operations page** - Most recent weld cycle and graph data with ability to modify commonly used process settings.
- **F1 Help command** - Instantly displays explanation of function.
- **IQ Explorer 3 User Interface** - It is a peripheral device. Operation is independent of the generator, and removal or malfunction of the IQ Explorer 3 does not affect machine functionality.
- **Eight user-selectable graph parameters** - Velocity, energy, power, distance, amplitude, frequency, force and pressure for viewing and storage of each weld.
- **Production analysis screen** - Displays eight-hour shift production statistics: good, bad, suspect quantities and percentages.
- **Advanced stack diagnostics** - Includes power and frequency graphs for stack (horn) documentation and future reference for troubleshooting.
- **Tool identification** - Uses barcode system to identify tooling.
- **Work cell** - A Dukane Lean Work Cell can be integrated with basic PLC managed operations.
- **Data Analysis for SPC** - Feature that aggregates and charts large quantities of cycle data results.
- **Barcodes** - Feature that allows scanned barcodes from parts to be attributed to cycle data.
SECTION 2

Cable Connections
HMI Cable Connections

AC POWER CONNECTION  ETHERNET PORTS  HMI POWER SWITCH

Figure 1-1  HMI Connections
System Cable Connections

Typical system components are:

- Ultrasonic Generator
- Press
- HMI

Make cable connections in the following order, referring to the Fig 1-2 and Table 1-1 on the next page:

1. Connect cables 1-5. Cables 3 and 4 are to be connected to an effectively grounded rod.
2. Connect cable 9 if optional automation equipment is used with the system.
3. Connect power cords 6-8.
4. Arrange cables as desired, but do not bundle the power cords (6-8) with any other cables.

CAUTION

Before connecting or disconnecting cables: Put power switches for the generator, press, and any user-supplied automation equipment in the OFF position. Turn off electrical power. Remove AC power cords from their receptacles.

**DO NOT** operate the generator unless the ultrasound coaxial cable is connected, and the transducer is installed in the thruster. Otherwise, an overload condition could occur, with possible damage to the generator.
### Table 1-1 Cable Connections

<table>
<thead>
<tr>
<th>Cable Number</th>
<th>Cable Description</th>
<th>Standard Length (Meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ultrasound</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Press Interface</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Press Grounding</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Generator Grounding</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>HMI Communications (CAT 5 / RJ45 Ethernet cable)</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Press Power Cord (line voltage: 90-240 VAC, 50/60 Hz, 10 A)</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Generator Power Cord (line voltage depends on generator model)</td>
<td>2.5</td>
</tr>
<tr>
<td>8</td>
<td>HMI Power Cord (line voltage: 90-240 VAC, 50/60 Hz, 10 A)</td>
<td>2.5</td>
</tr>
<tr>
<td>9</td>
<td>Automation I/O (optional)</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 1-2  Cable Connections
Getting Started Using IQ Explorer 3

STEP 1 - Getting Started

Ensure that a proper connection of the IQ Explorer 3 software and the servo press has been made. See Figure 3-1 below.

Names of active welders in the network appear when Show Welders tab is clicked.

STEP 2 - Select Unused Setup

Click on the Hardware tab. Click on the Setup File Name drop down box and select an unused setup as shown in Figure 3-2.

Names of the connected welder.

Hardware tab
STEP 3 - Set the Cycle Initiation Mode

Click on the Process Settings tab. Select Manual from the pull down menu as shown in Figure 3-3.

NOTE:
This Initiate Mode selection assumes there is a stand-alone, benchtop system with manual operate switches.

STEP 4 - Specify the Trigger Settings

Select Force from the TRIGGER type drop down box. Then, program the desired amount of force the press is to apply before ultrasound is activated. Next, enter the Max Trigger Time. This provides a measure of safety insuring the welder will terminate if the welder never achieves the programmed trigger force as shown in Figure 3-4.
STEP 5 - Program the Sensing Speed

The Sensing Speed is the speed (inches/millimeters per second) at which the horn will move during the approach just before reaching the trigger position. A typical starting value for Sensing Speed is 1.0 mm/s (0.040 in/s). The Sensing Speed can be set higher for shorter cycle times, or lower for greater trigger force detection accuracy.

STEP 6 - Program the Sensing Start Position

The Sensing Start Position is the actual position in the machine travel where the system begins to sense for the trigger force to be achieved. By the time the horn reaches the Sensing Start Position, it is already moving at the programmed Sensing Speed. It is critical to program the Sensing Start Position so that the horn is never in contact with the part at this position, taking into account the height variability of unwelded parts. Failure to do so may result in equipment damage. If you do not know the position where this contact is made, select the Teach button as shown in Figure 3-5.

Note:
The Sensing Start Position must be set such that the expected sensing distance, weld distance and hold distance do not exceed the Travel Limit.
The Travel Limit must be set to allow the full weld cycle to occur while also preventing the horn from contacting the fixture.

STEP 7 - Teach the Sensing Start Position

After clicking Teach, you will see a window similar to the one shown in Figure 3-6. Place an unwelded part into the fixture. Press both operate switches to jog the horn down to within 0.254 - 0.762 mm (0.010 - 0.030 inches) above the part. The stroke position of the thruster will be shown in the Current Position box. Once you are at the desired position, press Set to program that distance. Select Exit, and follow instructions to home the machine.

Figure 3-5  Sensing Speed and Position

Figure 3-6  Teach Sensing Start Position
**STEP 8 - Program Weld Characteristics**

**Primary Method**

On the Process Settings tab, find Weld > Primary Method, and select Distance.

Distance - This is the distance the welder advances once the programmed trigger force is reached. Usually this distance is the height of the energy director, or shear joint of the part being welded.

Max Time is a component of the weld method intended to offer a measure of safety. If the programmed weld method parameter is not achieved within this time window (2 seconds as shown in the example of Figure 3-7), the system will fault.

**Secondary Method**

Continue programming weld characteristics by selecting one of the Secondary Methods available: Position, Energy, Peak Power, Force Change, and Force Rate.

The purpose of the secondary method is to end the weld phase if the selected method parameter value is reached. If Disabled is chosen, there would be no secondary weld method.
STEP 9 - Enable Melt Detect™

This patented feature is found only on Dukane’s servo press systems. If the feature is selected, the system will stop motion once the desired Trigger Force is achieved. The ultrasound will be initiated at this moment. Once the programmed Melt-Detect™ force drop occurs, which indicates material softening or melting has begun, the motion will continue. This is the basis for Dukane’s exclusive Melt-Detect™ technology.

The value of the Melt-Detect™ Force Drop parameter is used to designate how much the force is to decrease relative to the Trigger Force before the horn will resume the programmed weld motion. For example, for a Trigger Force of 180 N and a value of 5% for Melt-Detect™ Force Drop, the press would stop once the Trigger Force is achieved, and resume motion after the force drops by 9 N (5% of 180 N) below the Trigger Force, or 171 N. A starting value of Melt-Detect™ is typically in the 5-10% range. The benefit of this option is significantly less stress on the parts and stronger weld bonds.

![Figure 3-9 Enable Melt-Match](image)

STEP 10 - Specify Weld Profile

Immediately after Trigger (or Melt-Detect™) occurs, the press changes the speed of motion to the Weld Speed. Enter the selections described below as shown in Figure 3-10.

Weld Profile - Select Segmented.

Click the Speed Profile button - Enter the desired weld profile speeds for segments 1 through 10.

![Figure 3-10 Weld Profile and Speeds](image)
STEP 11 - Set Ultrasound Amplitude

A typical initial ultrasound weld amplitude setting is 100%. The default amplitude setting is 90% as shown below in Figure 3-11. The range for this feature is between 20% and 100%.

![Weld Amplitude: 90%](image)

Figure 3-11  Default Weld Amplitude Setting

STEP 12 - Post Weld Settings

The post weld phase of the process is sometimes overlooked; however, it is important in achieving desired weld results. The Infinity™ servo welder has several exclusive post weld control parameters that can improve weld bond strength and process repeatability.

Hold Methods

There are two types of hold - Dynamic Hold and Static Hold. These types can be used together or separately.

Dynamic Hold Method

During Dynamic Hold, which occurs immediately after the weld phase, the press will continue to travel at the programmed hold speed with the ultrasound turned off.

This feature provides the ability to collapse the molten plastic after the ultrasonic signal is turned off, before material solidification. This feature can be beneficial in producing superior weld strength and appearance.

To program Dynamic Hold, find Post Weld > Dynamic Hold Method, and select Distance. Then enter the desired Hold Distance, Speed, and Max Time. The Max Time parameter is used to terminate the machine cycle if the dynamic hold distance is not reached within the allowable time window. See Figure 3-12 below.

![POST WELD](image)

Figure 3-12  Dynamic Hold Methods
**Static Hold Method**

After the completion of dynamic hold, if enabled, the press motion stops for a specified amount of time to allow for molten plastic to solidify. This phase is called static hold.

To program static hold, set the Static Hold Method to Time, and enter the desired Hold Time. Once the static hold phase is complete, the press retracts back to the Top-of-Stroke position.

This unique feature allows for superior consistency on overall part height. This is unlike a pneumatic press that continues to compress the part during the hold phase. In addition, Static Hold can contribute to stronger weld bonds. See Figure 3-13 below.

![Figure 3-13 Static Hold Method](image)

**STEP 13 - Specify Process Limits Behavior**

For each limit that is important to your application, use the drop down menu, and select Display. See Figure 3-14.

These parameters will be displayed on the Cycle Data screen, and may be important for subsequent analysis of the weld process.

Once the process settings are fully developed for the application, the Process Limits can be set to Suspect and/or Bad to identify part assemblies of inferior weld quality.

![Figure 3-14 Process Limits Tab](image)
**STEP 14 - Run Weld Cycle**

After all the parameters have been programmed, initiate the weld cycle.

**STEP 15 - View Weld Results**

View the results at the Cycle Data tab to insure all parameters have been achieved. See the example shown below in Figure 3-15. Detailed performance graphs for select parameters may also be reviewed by selecting the Graph tab.

![Cycle Data Tab](image)

*Figure 3-15* Cycle Data Tab
FCC
The Infinity™ generator 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 Europeéne (European Conformity). The equipment 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.
- EN ISO 12100: Safety of Machinery - General principles of design, risk assessment, and risk reduction.

IP Rating
The Infinity™ generator has an IP (International Protection) rating from the IEC (International Electrotechnical Commission).

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

The Infinity™ generator complies with these standards as verified by TÜV Rheinland.

UL
Tested to Underwriters Laboratories:
UL 61010–1, IEC 61010-1

CAN/CSA
National Standards of Canada: CAN/CSA C22.2 No. 61010–1–12
Identify Equipment

When contacting Dukane about a service–related problem, be prepared to give the following information:

- Model number, line voltage and serial number.
- Alarm/Fault indicators from the display.
- Software version (Press INFO. With selection indicators at System Information, press ENTER to get this data).
- Problem description and steps taken to resolve it.

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

Mailing Address:

Dukane IAS
2900 Dukane Drive
St. Charles, IL 60174 USA

Phone: (630) 797–4900
E-mail: ussales@dukane.com
Fax: Main (630) 797–4949
Service & Parts (630) 584–0796

Website

The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature.

This is the address for the main website:
www.dukane.com

Application Support

You can get application support at the following link below:
https://www.dukane.com/support/#application-support

Local Representative

You can locate your local representative at:
www.dukane.com/contact-us/
Dukane chose to become ISO certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well-defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane’s status as a quality vendor of technology and products.

To achieve ISO certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement

The ISO standards establish a minimum requirement for these requirements and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:

1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.

[ISO 9001:2015 CERTIFIED]

Dukane products are manufactured in ISO registered facilities.

View the Dukane ISO certificate of compliance at:
www.dukane.com/support/downloads/
Please refer to our website at:

www.dukane.com/contact-us
to locate your local representative.