## DPC-I User’s Manual

### Revision History

<table>
<thead>
<tr>
<th>Revision Number</th>
<th>Revision Summary</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 00</td>
<td>Original release.</td>
<td>2001-Aug-2</td>
</tr>
<tr>
<td>- 01</td>
<td>Text revision on Page 11; Add 30kHz model to Table 10-I and Figure 10-2</td>
<td>2001-Oct-09</td>
</tr>
<tr>
<td>- 02</td>
<td>RFI filter incorporated into chassis; New horizontal chassis benchtop model;</td>
<td>2003-Feb-28</td>
</tr>
<tr>
<td></td>
<td>Front access door; manual amplitude adjustment; New interface board option with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Remote Control Amplitude</td>
<td></td>
</tr>
<tr>
<td>- 03</td>
<td>Added warning regarding use of clean, dry, oil-free cooling air with sealed</td>
<td>2004-Sep-07</td>
</tr>
<tr>
<td></td>
<td>probes (see Page 51). Added probe cooling air warning to Figures 5-8 and 5-11.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Added probe cooling air entries to index. New consolidated North American and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>International Warranty</td>
<td></td>
</tr>
<tr>
<td>- 04</td>
<td>Removed “Do Not Clamp” on Figure 5-16 on Page 65.</td>
<td>2005-Nov-29</td>
</tr>
<tr>
<td></td>
<td>Updated website name, and Regulatory Compliance information</td>
<td>2010-May-18</td>
</tr>
<tr>
<td></td>
<td>Updated ISO Certification Notice, and patent numbers</td>
<td>2010-Nov-23</td>
</tr>
</tbody>
</table>
# Table of Contents

Section 1 – Introduction .......................................................... 1
Important User Information .......................................................... 3
  Read this Manual First .......................................................... 3
  Watch for Special Paragraphs .................................................. 3
  Drawings and Tables ............................................................ 3
Manual Organization ................................................................ 4
DPC I Overview ....................................................................... 5
Key DPC I Features .................................................................. 6

Section 2 – Health and Safety Tips ........................................... 7
Health and Safety Tips .................................................................. 9
  General Safety Considerations ................................................. 9
  Plastics Health Notice ............................................................. 10
Electrical Safety ........................................................................ 10
  Domestic Power Grounding ..................................................... 10
  International Power Grounding ................................................. 10

Section 3 – Unpacking and Installation ....................................... 13
Shipping Carton Contents .......................................................... 15
DPC Placement ......................................................................... 15
  Vertical Back–Panel Rack Mount ............................................... 15
  Horizontal Benchtop Chassis ................................................... 16
RFI Grounding .......................................................................... 17
Cable Connections ..................................................................... 18
  Manual Probe System .............................................................. 18
  Automation Probe System ........................................................ 20

Section 4 – Controls and Connectors ......................................... 23
Front & Rear Panel Layout ......................................................... 25
  Vertical Rack Chassis .............................................................. 27
  Horizontal Benchtop Chassis ................................................... 25
Status Panel ............................................................................... 29
  System Power Output Display ................................................ 29
  System Status Display ............................................................ 30
Control Keys ............................................................................. 31
Power Indicator .......................................................................... 31
Interface Board ......................................................................... 32
  Type 110–4004 Board .............................................................. 34
  Type 110–4061 Board .............................................................. 36
Remote Amplitude Control Connector ........................................... 38
System I/O Connector .............................................................. 40
  Connector Pinout (110–4004) ............................................. 40
  I/O Signal Description ....................................................... 41
  Connector Pinout (110–4061) ............................................. 40
  I/O Signal Description ....................................................... 41
Ultrasound Output Connector ............................................... 44
AC Power ........................................................................... 45
RFI Grounding Lug ............................................................ 45

Section 5 – Hand Probes/Probe Stacks ............................. 47
Ultrasonic Probes ............................................................... 49
  Theory of Operation ......................................................... 49
  Probe Configuration ........................................................ 49
  Ultrasonic Horn ............................................................... 50
  Booster ........................................................................... 50
  Probe Selection ............................................................... 61
  Probe Drawings ............................................................... 63
    41C26 20kHz Hand Probe ............................................. 63
    41C27 20kHz Mounted Probe ........................................ 64
    41C30 HD 20kHz Probe ................................................. 65
    41S30 Sealed 20kHz Probe ............................................ 66
    41A33 40kHz Hand Probe ............................................. 67
    41C28 40kHz Mounted Probe ......................................... 68
    41S28 40kHz Sealed Probe ............................................ 69
Stack Assembly ................................................................. 60
  Attaching the Replaceable Tip to a Horn ......................... 60
  Attaching the Mounting Stud to Horn/Booster ................. 61
  Attaching the Horn to a Booster ........................................ 62
  Attaching the Booster to a Probe ....................................... 62
  Attaching the Horn to a Probe ........................................... 62
Stack Disassembly ............................................................ 64
  Separating a Horn and Booster From a Probe ................ 66
  Removing a Mounting Stud From a Horn or Booster ........ 66
  Removing a Replaceable Tip From a Horn ......................... 66
Booster Notes ................................................................. 67
  How to Tell the Booster Input From the Output ............... 67
  How to Tell If a Booster Is Amplifying or Reducing ........... 67
Probe Stack Mounting ....................................................... 68

Section 6 – Checkout and Operations .............................. 69
Startup and Self–Test ......................................................... 71
System Test ....................................................................... 72
Probe Operation ............................................................... 73
Stopping the Weld Cycle ..................................................... 74
  Manual System ............................................................... 74
  Automated System ........................................................... 74
End of Day ....................................................................... 74
Section 7 – Troubleshooting ................................................................. 75
No Ultrasonic Output ........................................................................ 77
  Probe ......................................................................................... 77
  Cables ..................................................................................... 77
  Generator .................................................................................. 78
  Operate Input ........................................................................... 78
  Status Driver Output ................................................................. 78
Generator Faults ................................................................................ 79
  OVERLOAD Indicator ................................................................. 79
  OVERTEMP Indicator ................................................................. 79
  FAULT Indicator ...................................................................... 79
Generator Errors ............................................................................... 80
  INPUT TEST Indicator ............................................................... 80
  Steady Red .............................................................................. 80
  Does Not Flash ........................................................................ 80
  TEST Control Key ................................................................... 80
Welding Problems ........................................................................... 80
  Weak Welds ............................................................................ 80
  Excess Flash ........................................................................... 80
  Inconsistent Welds ................................................................. 80
Troubleshooting Flowchart ............................................................... 81

Section 8 – Maintenance ................................................................. 83
Front Panel .................................................................................... 85
  Cleaning ................................................................................. 85
  Display ................................................................................... 85
  Control Keys .......................................................................... 85
Chassis ........................................................................................... 85
  Sheet Metal Cover .................................................................... 85
  Air Ventilation Slots ............................................................... 86
  I/O Connector ......................................................................... 86
  AC Power Cord ..................................................................... 86
Probe ............................................................................................. 87
  Stack Maintenance ................................................................. 87
  Stack Inspection ..................................................................... 87
  Inspection Schedule ............................................................... 88
  Surface With Even Contact .................................................. 88
  Surface With Uneven Contact ............................................... 88
  Crowning .............................................................................. 89
  Center Depression ................................................................. 89
  Corrosion .............................................................................. 90
Reconditioning ............................................................................... 90
  Overview ............................................................................... 90
  Machining the Mating Surfaces ............................................. 90
  Manual Resurfacing .............................................................. 91
Introduction

- User Information
- Manual Organization
- DPC–I Overview
- Key DPC–I Features

Important User Information.................................3
Read The Manual First ......................................3
Caution and Warnings.......................................3
Drawings and Tables........................................3
Manual Organization ........................................4
DPC–I Overview ...............................................5
Key DPC–I Features ...........................................6
This page intentionally left blank
Important User Information

Read This Manual First
Before operating the DPC™ I, 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 an ultrasonic 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 product. 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. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or a hand protection issue.

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—I would be the second table in section three.
Manual Organization

Section 1 – Introduction covers the features of the Dukane Dynamic Process Controller™ (DPC) Probe System.

Section 2 – Safety Tips discusses health, operation and electrical safety.

Section 3 – Unpacking and Installation explains DPC placement, grounding and setup. It also shows the cable connections for quick-start operation.

Section 4 – Controls & Connectors describes the function of the front panel control keys, status display and the system I/O connector.

Section 5 – Hand Probes/Probe Stacks covers theory of operation. It also describes the assembly and mounting of both hand-held probe and probe stack assemblies.

Section 6 – Checkout & Operation describes basic system tests to ensure the DPC is functioning properly.

Section 7 – Troubleshooting provides helpful tips on solving the most common problems.

Section 8 – Maintenance provides a schedule of suggested preventive maintenance items.

Section 9 – Contacting Dukane provides information on obtaining support from the Dukane Ultrasonics factory team. It also contains the warranty information.

Section 10 – Specifications contains drawings with the DPC I dimensions, specifies the operating environment and AC power requirements.

Appendices
A – List of Figures.
B – List of Tables.
C – Switch Circuitry for user automation.
DPC Overview

The DPC—I OEM System is the lowest–cost model in Dukane’s Dynamic Process Controller™ (DPC) product family. It is designed for OEM applications and ultrasonic applications that utilize hand probes. Using the available system Input/Output status signals, it is easily integrated into automated machines.

The system design accepts a simple ultrasound operate signal, provides a status panel for displaying diagnostic messages and includes an amplitude adjustment control.

Like other DPC models, the OEM System includes the same rugged internal ultrasonic generator circuitry. The same Auto–Trac Tuning found in the DPC family ensures a continuous resonant lock at the start of each weld. An optional plug–in DPC Test/Setup module has a keyboard to change the factory default settings for the phase, frequency–shift and soft–start parameters. This enables users to modify the DPC’s performance to meet a wide variety of process requirements.

The OEM System is compact so that multiple units can be placed into an equipment cabinet, yet it features the same universal power supply with dual line voltage input* that is used in the other DPC generators. It also includes an RFI filter making the unit CE compliant for global applications.

* 90–130 VAC or 180–260 VAC at 50/60 Hz for units with a Peak Power Rating of 1200 Watts or less.
Units with a Peak Power rating of 1500 Watts or more, require 180–260 VAC at 50/60 Hz.
Key Features

- **Small Size** means very little space is required in the horizontal benchtop configuration. It is also available in a vertical back-plate mount configuration for incorporation into automated machine cabinets.

- **Pulse Width Modulation** is Dukane’s patented circuitry giving the DPC power supply the ability to efficiently change the output amplitude. This makes it possible to start large horns with reduced power. It also provides for cooler generator operation and increased reliability.

- **Linear Ramp Soft Start** circuitry allows the acoustic stack to be brought to operating amplitude smoothly, minimizing the startup surges and abnormal stress to the stack and generator.

- **Auto-Trac Tuning** automatically 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 output is held to within ±2% to provide consistency and reduced cycle time.

- **Dual Line–Voltage Universal Power Supply** means that the DPC I will operate worldwide. Auto-Ranging means that adjustments by the operator related to power input are unnecessary. There are no external step–up or step–down transformers and no internal transformer taps to change. Units with a rated output over 1200 Watts, require a 180-260V AC input.

- **Flow Through Cooling Tunnel** with a matched high–performance heatsink and thermostatically controlled fan reduces thermal gradients and increases component life.

- **AC Power Inrush** protection reduces electrical stress on the internal components by protecting them from AC power startup transients.

- **Electronic Overload** protection prevents component failure in the event of an output overload condition.

- **Transducer Protection** minimizes electrical damage to the ultrasonic transducer assembly.

- **CE Certification** means that the DPC I meets the required European standards to be sold and used in Europe.

- **ISO 9001 Certification** means that the DPC I is manufactured to very high quality standards and assures you of Dukane’s commitment to being a quality vendor and its goal of continuous improvement.

* Within specified ranges
Health and Safety Tips

- General Safety Considerations
- Plastics Health Notice
- Electrical Safety
Health and Safety Tips

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 Dukane Corporation. 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 Dukane Corporation. The generator produces hazardous electrical voltages which could cause injury.

Grounded Electrical Power - Operate this equipment only with a properly grounded electrical connection. (See Electrical Safety Grounding Instructions on the next page.)

Comply with Regulations - You may be required to add accessories to bring the system into compliance with applicable OSHA regulations for machine guarding and noise exposure.
**Plastics Health Notice**

Before using any Dukane 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 Ground**

For safety, the power cords used on all Dukane products have a three-prong, grounding-type plug.

![Image](Approved 2 pole, 3 wire grounding receptacle HUBBELL No. 5262 or equivalent to NEMA 5–15R or 5–20R)

*Figure 2–1 Example of 120 Volt, Grounded, 3-Prong Receptacle*

![Image](Approved 2 pole, 3 wire grounding receptacle HUBBELL No. 5652 or equivalent to NEMA 6–15R or 6–20R)

*Figure 2–2 Example of 220 Volt, Grounded, 3-Prong Receptacle*

**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.

**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 Ground**

The power cable normally provided for international use is compatible with many power outlets (refer to Figure 2–3.) However, if your application requires another type of cable, check with the local Dukane products representative, and follow local regulations concerning proper wiring and grounding.

![Figure 2–3 International 220/240V Grounding](image_url)
Unpacking and Installation

- Unpacking the DPC
- DPC Placement
- RFI Grounding
- Connecting the Cables

Shipping Carton Contents.................................................15
DPC Placement ....................................................................15
   Vertical Back–Panel Rack Mount ..................................15
   Horizontal Benchtop Chassis ..................................16
   Horizontal Rack Mount ........................................16
RFI Grounding ....................................................................17
Cable Connections ..................................................................18
   Manual Probe System ........................................18
   Automation Probe System ................................20
This page intentionally left blank
Shipping Contents

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DPC I Generator</td>
<td>**</td>
</tr>
<tr>
<td>1</td>
<td>DPC I User’s Manual</td>
<td>403–543–xx</td>
</tr>
</tbody>
</table>

** DPC Part Number depends upon Frequency and Power Rating
AC power cord and cables as specified. See your Packing List.
Compare with Table 3-II on Page 18

Table 3-I Contents of DPC Shipping Container

Carefully open the shipping container, and make sure it contains the items shown in Table 3—I. Inspect the DPC for damage. Report any damage immediately to Dukane.

DPC Placement

Vertical Back–Plate Mount

Attach the DPC back panel securely to the upper and lower rails of the rack with its front panel easily accessible as shown in Figure 3–1. Allow at least 2 inches (5 cm) of space on the top and bottom of the DPC chassis for air circulation. If the generator is installed in a rack with a front door, be sure to allow at least 3 inches (7.5cm) for the System I/O cable. The front access panel requires at least 5 inches (12.5cm) to open. Make certain the generator placement and cable routing allows for easy access and does not interfere with normal operation. The operator should be provided with a clear view of the power output and status displays.

CAUTION
Allow 2 inches for air ventilation by the cooling air intake and exhaust.
The fan draws in fresh air to cool the internal components, reduce thermal gradients and increase component life.
If excessive dust accumulates in the slots, wipe or vacuum them clean. Do not use compressed air as this may force the dust inside the chassis.
**Benchtop Placement**
Allow at least 2 inches (5 cm) of space on both side of the DPC chassis for air circulation. Allow a 4 inch space in the rear for the power cable. Allow at least 5 inches in the front to open the access panel. The placement of the generator and cable routing should permit easy access and not interfere with normal operation.

![Benchtop Placement of a DPC I](image)

**Figure 3–2** Benchtop Placement of a DPC I
RFI Grounding

In addition to the safety considerations, proper grounding at the generator power cord is essential for the effective suppression of RFI (Radio Frequency Interference). Every DPC contains an RFI filter which blocks noise on the AC power line from entering the DPC control circuitry. This filter also prevents ultrasonic RFI from being fed back into the AC power line. In order for the RFI filter to operate properly, it is necessary to adequately ground the DPC. Run a grounding wire from the rear grounding connection (see Figure 3-4) to the nearest grounded metal pipe or equivalent earth ground by means of a ground clamp. The grounding lug is also clearly identified in Figures 4–24 and 4–25. If you have multiple DPC generators, run a separate ground wire from each unit to ground. Use at least an 14 AWG wire for the connection to the DPC chassis. Stranded wire is more flexible and easier to work with than solid wire. However if you use stranded wire, securely crimp spade lugs on the both ends to ensure a good connection. If you have a color choice, green is the preferred color for an electrical ground connection.

NOTE

If you have troublesome RFI or ground currents, you will have to experiment to discover the best solution. Vertical Back–Plate mounted DPC I generators will be electrically grounded to the rack they are secured in. If the rack is also grounded, this may cause circulating ground currents if the rack ground and DPC’s RFI ground are at different potentials. The best solution is to have only one ground point. This requires the AC power ground to be the same as the DPC earth ground. Another possible solution is to electrically isolate the rack from the AC power ground and connect the rack to the DPC earth ground.
Cable Connections

The instructions here and the diagrams in Figures 3–4 through 3–7 are meant to serve as a quick–start guide. Both the benchtop and the vertical chassis are shown in the drawings. The connections are the same, but the physical location of the connectors differs between the two chassis layouts. The connectors and their pinouts are discussed in greater detail in Section 4.

Hand Probe System

Step 1. Ground the DPC I chassis. This is a user–supplied 14-Gauge wire in Figures 3–4 and 3–5.

Step 2. Attach one end of the adapter cable (① in Figure 3–4/3–5) to the HD–15 System I/O connector on the front panel.

Step 3. Attach the other end of the adapter cable ② to the 14-pin Amp connector ③ at the end of the hand probe cable.

Step 4. Attach high–voltage coaxial cable ④ to J1, the Ultrasonic output connector.

Step 5. Power cords with an IEC connector are only supplied with the benchtop chassis. Connect the AC power cord to the DPC I (⑤ in Figure 3–4) and plug the other end into an approved AC outlet.

Vertical back–plate mount units are equipped with a terminal strip to connect a user–supplied AC power cord. Secure the power cord to the terminal strip (⑥ in Figure 3–5) and plug the other end into an approved AC outlet.

CAUTION

The power cord is equipped with a three-prong, grounded-type plug for your safety. Whenever a two-slot receptacle is encountered, we strongly recommend that it is replaced with a properly grounded three-lead receptacle. Have a qualified electrician do the replacement in accordance with the National Electrical Code and local codes and ordinances. DO NOT cut off the power cord grounding prong or alter the plug in any way.

Table 3—Ⅱ  Benchtop AC Power Cord Part Numbers

The 3–prong AC Line cords supplied with the benchtop models are matched to the DPC I power rating and the continent of specified use.

The part numbers are —

200–1109 North America 110V
200–1110 North America 220V
200–1111 Continental Europe
Figure 3-4 Benchtop DPC I Hand Probe Cable Connections

Figure 3-5 Vertical Chassis DPC I Hand Probe Cable Connections
Automated Probe System

Step 1. Ground the DPC I chassis. This is ① a user–supplied 14-Gauge wire in Figures 3–6 and 3–7.

Step 2. Optional – Ground the probe support. This is ② a user–supplied 14-Gauge wire in Figures 3–6 and 3–7.


Step 4. Attach the high voltage coax cable from the probe to the bottom DPC connector J1 ④ in Figures 3–6/3–7.

Step 5. Power cords with an IEC connector are only supplied with the benchtop chassis. Connect the AC power cord to the DPC I ⑤ in Figure 3-6 and plug the other end into an approved AC outlet.

Vertical back–plate mount units are equipped with a terminal strip to connect a user–supplied AC power cord. Secure the power cord to the terminal strip ⑥ in Figure 3–7 and plug the other end into an approved AC outlet.

---

![Figure 3–6 Benchtop DPC I Automation Cable Connections](image-url)
Figure 3–7 Vertical Chassis DPC I Automation Cable Connections

NOTE
Systems may or may not have cables as shown. Compare your equipment order with the cables that were received. Notify Dukane Corporation of any discrepancies.
This page intentionally left blank
Controls and Connectors

- Power Output Display
- System Status Display
- Control Keys
- Interface Board
- System I/O Connector
- Ultrasound Output

Front & Rear Panel Layout ........................................ 25
Vertical Rack Chassis..................................................... 25
Horizontal Benchtop Chassis........................................... 27
Status Panel........................................................................ 29
System Power Output Display.......................................... 29
System Status Display...................................................... 30
Control Keys...................................................................... 31
Power Indicator................................................................. 31
Interface Board................................................................... 32
Type 110–4004 Board....................................................... 34
Type 110–4061 Board....................................................... 36
Remote Amplitude Control Connector................................. 38
System I/O Connector......................................................... 40
Connector Pinout (110–4004)............................................ 40
I/O Signal Description....................................................... 41
Connector Pinout (110–4061)............................................ 42
I/O Signal Description....................................................... 43
Ultrasound Output Connector................................................ 44
AC Power ........................................................................... 45
RFI Grounding Lug............................................................ 45
Panel Layouts

Vertical Rack Chassis – Front

This section introduces the DPC I front control panel, displays and connectors. The main operational controls, power and status displays and connectors on the DPC I vertical mount chassis are identified in Figure 4–1.

The Generator Status Panel contains —

A System Power Output Display

B System Status display

C Generator Control keys

Directly below the status panel is —

D System Power Indicator

The center of the chassis contains the —

E Access Panel to the Interface Board

At the top of the panel is the optional —

F Remote Amplitude Connector

At the bottom of the access panel is —

G HD–15 System I/O Connector

Located on the bottom of the chassis is —

H Ultrasound BNC Connector
**Vertical Rack Chassis – Bottom**

The bottom panel of the vertical mount chassis contains the AC power switch and the Ultrasound output. They are identified in Figure 4–2. Below the power switch is the RFI grounding lug and the AC power terminal connections. The front panel is on the left and the back mounting plate is on the right.

**Figure 4–2** Bottom Panel of Vertical Chassis DPC I
**Benchtop Chassis – Front**

The main operational controls, power and status displays and connectors on the DPC I horizontal benchtop chassis are identified in Figure 4–3.

The Generator Status Panel contains —

A System Power Output Display

B System Status display

C Generator Control keys

Next to the status panel is —

D System Power Indicator

The right half of the chassis contains the —

E Access Panel to the Interface Board

On the left side of the panel is the optional —

F Remote Amplitude Connector

On the right side of the access panel is —

G HD–15 System I/O Connector

Located on the far right of the chassis is —

H Ultrasound BNC Connector

---

**Figure 4–3** Front Control Panel of Benchtop DPC I
**Benchtop Chassis–Rear**
The rear panel of the horizontal benchtop chassis contains the AC power switch which is identified in Figure 4–4. Below the AC power switch is the IEC AC Power Cord socket. To the right of the AC socket is the RFI grounding lug.

1. AC Breaker/Switch

![Figure 4-4 Rear Panel of Benchtop DPC I](image_url)
**Status Panel**

### Power Output Display

The tricolor SYSTEM POWER OUTPUT display indicates the percentage of available ultrasonic power being drawn by the load.

**Green**

The first eight green light bars cover 10% to 80% power output, and indicate the normal operating range. Figure 4–5 shows the display indicating 80% power output.

**Yellow**

The two yellow bars for 90% and 100% power output warn that the generator is operating near its maximum rated output. Figure 4–6 shows the two yellow warning indicators.

**Red**

The last red bar indicates that the generator is in an overload condition (greater than 100%), delivering more than its rated output power. Figure 4–6 also shows the red overload indicator. The red lamp lights up during an overload condition. The ultrasonic output is shut off when an overload condition occurs.

---

**NOTE**

Available Power $= \text{Amplitude} \times \text{Power Rating}$
System Status Display

The Status Display indicates one of the six system states. If that state is active, the corresponding label is lit in the display. Figure 4–7 shows the System Status Display. The six status conditions are described beginning with the top row and proceeding from left to right.

**FAULT**  This indicator lights when out-of-tolerance voltage fluctuations occur that are related to one of the following conditions.
1. AC Line Voltage
2. Internal DC Power Supply (+5VDC, +12VDC, -12V DC or +24V DC.)

**INPUT TEST**  This indicator normally flashes red during a power-up test. If there is a problem, a steady red light appears. This means that either the input AC line voltage is out of tolerance, or an internal fault has occurred in the generator.

**OVERLOAD**  This red indicator lights when either of the following conditions occur.
1. An instantaneous overload caused by a mismatch between the ultrasonic signal and the resonant characteristics of the acoustic stack (transducer, booster and horn.)
2. Excessive power beyond the generator’s rated output is being drawn.

**ON LINE**  The generator is operational and capable of triggered ultrasonic operation. Depending on the mode when the generator was last powered down, it will return to that same mode when it is turned on again – either the ON LINE (operational) or the OFF LINE (standby) mode.

**OVERTEMP**  One of the power modules has overheated and the generator has shut down. The generator will automatically reset when the module temperature drops below the trip point which is 75°C (167°F).

**OFF LINE**  The generator is in a standby mode. It cannot be externally triggered, and the TEST key will not produce an output. Depending on the mode when the generator was last powered down, it will return to that same mode when it is turned on again – either the ON LINE (operational) or the OFF LINE (standby) mode.
Generator Control Keys

The Generator Control section consists of three keys as shown in Figure 4–8.

**ON LINE**
This makes the generator operational so that it will produce an ultrasonic output when triggered. When this key is pressed, the ON LINE status display will light.

**TEST**
This key momentary starts the generator to provide ultrasound output for test or setup purposes. The first green power output bar lights up when this key is pressed. TEST will work only in the ON LINE state.

**OFF LINE**
This key prevents the generator from producing an ultrasonic output signal when externally triggered. When the generator is in the OFF LINE state, the OFF LINE status display is lit and the TEST switch will not produce any output.

Power Indicator

The vertical chassis has a green system power indicator light below the status panel control keys as shown in Figure 4–9. The horizontal benchtop chassis has the power indicator positioned to the right of the power output display. This is shown in Figure 4–10. When the green power light is on, the AC power applied to the generator is within tolerance, the INPUT TEST has passed, the DC bus has been energized and the generator is capable of being placed ON LINE.
Access Panel Interface Board (Type 110–4004)
The hinged front panel opens to permit access to the DPC I interface board. There are two types of boards available. The standard model has a type 110–4004 board which contains a status relay. The optional 110–4061 board replaces the status output relay with a Remote Amplitude control circuit. The standard 110–4004 board is shown below in Figure 4–11.

There are eight test points on the left side of the board. The Amplitude Monitor, Status Driver and Ultrasonics Status output are also available through the HD–15 System I/O connector. These signals are described later in the section covering the System I/O Connector. The Frequency Monitor is only available at the test point. This signal is a sine wave at the actual output frequency with a maximum amplitude of 31Vrms.

The Status Relay is located at the right side of the board. The 2 Amp fuse next to the relay is wired in series with the relay output contacts to protect them from excessive loads.

A manual amplitude adjustment control is located on the left side of the access panel opening. This

![Figure 4–11 110–4004 Interface Board Test Points](image)
is shown in Figure 4–12. The adjustment range is from 40% to 100%, increasing going clockwise. Use the Amplitude Monitor test point while adjusting the level using a small screwdriver.

On the generator driver board, deeper inside the chassis, is located a connector for plugging in an optional DPC Setup/Test Module (Figure 4–13 Dukane Part Number 43A1570). This connector is referred to as P405 in the instructions included with the Setup/Test Module. As shown in Figure 4–12, the chassis has a rectangular cutout directly in front of the P405 connector to help locate the ribbon cable. The Setup/Test Module requires +24VDC power which is obtained from the DPC by the first two test points on the Interface board.

**NOTE** Do not adjust the trim potentiometer on the interface board (located directly behind the test points). This is for calibrating the gain of the Amplitude Signal buffer amplifier.
Jumper Blocks (Type 110–4004)
The DPC I may be customized to your specific requirements by means of internal jumpers located on the main printed circuit board. There are two versions of the interface board available for the DPC I. The standard DPC I model uses the type 110–4004 board with a status relay. The jumper block descriptions for the standard type 110–4004 board is listed here with its default factory settings and alternate positions. Figure 4–14 show the location of the jumper blocks. The factory default setting is indicated by an asterisk * or diamond ◊.

Status Driver Normal State Selection
Jumper Block – SH01
JU701 - Normally OFF (Factory Default)
JU702 - Normally ON

System Control Inputs
Jumper Block – SH02
JU724 - Non–Isolated Sink (Factory Default) – Dry contact between input and DPC ground.
JU725 - Non–Isolated Source – Dry contact between input and +22 VDC.
JU726 - Isolated Source – Input can be either sinking or sourcing. A signal of 5 to 24 VDC is required at the isolated inputs. The current is internally limited to 12.5mA.

Switch Debounce Filter Time Delay Selection
Jumper Block – SH03
JU717 - No Time Delay (used for electronic switches)
JU718 - 1 msec
JU719 - 10 msec (Factory Default)
JU720 - 22 msec

Status Output Driver Selection (Pin 4 on HD–15)
Jumper Block – SH04
JU703 - Ultrasound Active Status
JU704 - Overload Fault (Factory Default)
JU705 - Over Temperature Fault
JU706 - System Fault
JU707 - Any Fault

Status Relay Driver Selection (110–4004 Only; Pins 13 & 14/15 on HD–15)
Jumper Block – SH05
JU708 - Ultrasound Active Status
JU709 - Overload Fault (Factory Default)
JU710 - Over Temperature Fault
JU711 - System Fault
JU712 - Any Fault
Figure 4–14 Type 110–4004 Interface Board Layout and Jumper Blocks
**Interface Board (Type 110–4061)**

The optional 110–4061 board features a Remote Amplitude control circuit that replaces the status output relay and manual amplitude adjustment. This optional 110–4061 board is shown in Figure 4–15. Note that the test points and jumper blocks are in different locations than on the standard type 110–4004 board. There is an additional connector on the front panel (P704) to connect to a 4–20mA current loop for remotely controlling the output amplitude.

There are nine test points on the upper–right side of the board. The Amplitude Monitor, Status Driver, Loop Fault and Ultrasonics Status output are also available through the HD–15 System I/O connector. These signals are described later in the section covering the System I/O Connector. The Frequency Monitor is only available at the test point. This signal is a sine wave at the actual output frequency with a maximum amplitude of 31Vrms.

**Jumper Blocks**

**Status Driver Normal State Selection**

**Jumper Block – SH701**

JU701 - Normally OFF (Factory Default)  
JU702 - Normally ON

**System Control Inputs**

**Jumper Block – SH702**

JU724 - Non–Isolated Sink (Factory Default) – Dry contact between input and DPC ground.  
JU725 - Non–Isolated Source – Dry contact between input and +22 VDC.  
JU726 - Isolated Source – Input can be either sinking or sourcing. A signal of 5 to 24 VDC is required at the isolated inputs. The current is internally limited to 12.5mA.

**Switch Debounce Filter Time Delay Selection**

**Jumper Block – SH703**

JU717 - No Time Delay (used for electronic switches)  
JU718 - 1 msec  
JU719 - 10 msec (Factory Default)  
JU720 - 22 msec

**Status Output Driver Selection (Pin 4 on HD–15)**

**Jumper Block – SH704**

JU703 - Ultrasound Active Status  
JU704 - Overload Fault (Factory Default)  
JU705 - Over Temperature Fault  
JU706 - System Fault  
JU707 - Any Fault

**Current Loop Fault Option (110–4061 Only)**

**Jumper Block – SH706**

JU715 - Enable minimum level output (36% max) if a loop fault occurs (Factory Default)  
JU716 - Disable ultrasonic output if a loop fault occurs
Figure 4–15 Type 110–4061 Interface Board Layout and Jumper Blocks
Remote Amplitude

The output amplitude of the DPC I can be remotely controlled with a standard 4–20mA current loop. This requires the optional 110–4061 interface board. The current loop connector and fault indicator are shown in Figure 4–16. The output can be adjusted from 36% to 100%. The scale factor is $\Delta 16mA = \Delta 64\%$ or $\Delta 1mA = \Delta 4\%$. A graph of the output as function of loop current is shown in Figure 4–17. The current loop voltage compliance is 10 volts minimum at 20mA.

A fault is detected if the loop current is not maintained between 4mA and 20mA. The loop fault indicator is a bicolor LED. It is green when the current is between 4mA and 20mA. The indicator is red if the current is less than 4mA. The input is also polarity sensitive. If the loop is connected backwards, the loop status indicator will be red, the current loop status output (pin 15 on the System I/O connector) will be active low, and the output amplitude will be set to 36%. Jumper block SH706 permits the ultrasonic output to be disabled (JU716) if a loop fault occurs.

![Figure 4–16](image1)

![Figure 4–17](image2)

**EXAMPLES**

Out% = (20% + 4 $I_{\text{Loop}}$)%

- e.g. Determine the % Output delivered for an 8mA Loop Current
  
  $20 + (4 \times 8) = 52\%$

$I_{\text{Loop}} = \frac{\text{Out} - 20}{4}$

- e.g. Determine $I_{\text{Loop}}$ required for a 75% output
  
  $\frac{75 - 20}{4} = 13.75\text{mA}$

The equations for Out% and $I_{\text{Loop}}$ are only valid for normal operating conditions — 36% < Out% < 100% and 4mA < $I_{\text{Loop}}$ < 20mA

**NOTE**

The Manual Amplitude Adjustment shown in Figure 4–12 is not available when the Type 110–4061 Interface Board with Remote Amplitude Control is installed.
System I/O Connector

The DPC is capable of automation control by use of a Control Input signal and Status Output. The Input/Output connector is shown on the front panel drawings in Figures 4–1 and 4–3.

Connector Pinout (110–4004)

The System Input/Output is a HD-15 (high-density, 15 contact) female connector. Pin assignments are shown in Figure 4–18. The male cable end is a mirror image of the panel mount and is shown in Figure 4–19. Table 4—I lists the signal pinout for the standard 110–4004 Interface board. The signals and their use are described in more detail on the next page. Users of custom automation will also find a list of color code pinouts for the Automation Control Input cable (Dukane P/N 200–1203) in Table 4—II.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Signal Description (110 – 4004 Interface Board)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+22VDC</td>
<td>Current limited to 250 mA maximum</td>
</tr>
<tr>
<td>2</td>
<td>Gnd</td>
<td>22VDC Return (DPC Chassis Ground)</td>
</tr>
<tr>
<td>3</td>
<td>Gnd</td>
<td>Status Outputs/Driver/Monitor Return</td>
</tr>
<tr>
<td>4</td>
<td>Stat Driver</td>
<td>STATUS Driver Output (1 Amp max.)</td>
</tr>
<tr>
<td>5</td>
<td>U/S Active</td>
<td>Ultrasound Status Output (Active Low)</td>
</tr>
<tr>
<td>6</td>
<td>O L Fault</td>
<td>Overload Fault Output (Active Low)</td>
</tr>
<tr>
<td>7</td>
<td>Iso Com</td>
<td>Isolated Operate Input Common (7 &amp; 8) JU726</td>
</tr>
<tr>
<td>8</td>
<td>Oper Input</td>
<td>Sw Closure Operate Input (2 &amp; 8) JU724/725</td>
</tr>
<tr>
<td>9</td>
<td>O T Fault</td>
<td>Overtemperature Fault Output (Active Low)</td>
</tr>
<tr>
<td>10</td>
<td>Sys Fault</td>
<td>System Fault Output (Active Low)</td>
</tr>
<tr>
<td>11</td>
<td>Not Used</td>
<td>Reserved – HPPI Signal</td>
</tr>
<tr>
<td>12</td>
<td>Amp Setting</td>
<td>Amplitude Setting Monitor (10.0V = 100%)</td>
</tr>
<tr>
<td>13</td>
<td>Stat Relay Com</td>
<td>Status Relay Common</td>
</tr>
<tr>
<td>14</td>
<td>Stat Relay N.O.</td>
<td>Status Relay Normally Open (2 Amp max.)</td>
</tr>
<tr>
<td>15</td>
<td>Stat Relay N.C.</td>
<td>Status Relay Normally Closed (2 Amp max.)</td>
</tr>
</tbody>
</table>

Table 4—I System I/O Connector Signals for 110–4004 Interface Board

CAUTION

The System I/O port uses the same type of connector as a standard computer video monitor port, but it is electrically very different. DO NOT connect any video monitor devices to this connector. Doing so may result in damage to both the video device and the DPC.
Signal Description (110–4004)

Pin 1 (+22V)
This pin can supply +22VDC at up to 250mA to power the user’s automation controls.

Pin 2 (Power Gnd)
Pin 2 is the 22VDC return and is tied to the chassis ground.

Pin 3 (Signal Gnd)
Pin 3 is the Status Out and Operate return and is tied to the chassis ground.

Pin 4 Status Driver
An active low output on pin 4 indicates the condition set on Jumper Block SH704 has occurred (see Figures 4-14). The factory default is OVERLOAD.

Pin 5 (U/S Active)
An active low output on pin 5 indicates the ultrasound is activated and delivering power to the probe.

Pin 6 (OVERLOAD)
An active low output on pin 6 indicates that excessive power beyond the generators rated output is being drawn. The ultrasonic signal is shut down when an overload condition is detected. The front panel status display will indicate OVERLOAD. The overload signal resets when the operate input deactivates or the TEST switch is released.

Pin 7 (Isolated Common)
This pin is used as the isolated return common if jumper block SH702 is configured as a fully isolated input (position JU726). See Appendix C for further information on isolated switching.

Pin 8 (Isolated Operate In)
This pin is used to initiate the operate sequence. The factory default setting is a non-isolated sink requiring a dry contact closure to ground (pins 2 or 3). This input can be changed to a source or fully isolated input by jumper block SH702. For isolated operation, a voltage is applied between pins 7 and 8. See Appendix C for details.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Color</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>Red used by Belden may appear brown</td>
</tr>
<tr>
<td>2</td>
<td>Black</td>
<td>Also connected to connector metal shell</td>
</tr>
<tr>
<td>3</td>
<td>Blue/Blk</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Green/Wht</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Blue/Wht</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Red/Blk</td>
<td>Red used by Belden may appear brown</td>
</tr>
<tr>
<td>7</td>
<td>White/Blk</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Orange</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Blue</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Orange/Blk</td>
<td>Black may be faint – Don’t confuse with 9</td>
</tr>
<tr>
<td>12</td>
<td>Red/Wht</td>
<td>Red used by Belden may appear brown</td>
</tr>
<tr>
<td>13</td>
<td>Green/Blk</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Black/Wht</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Green</td>
<td></td>
</tr>
</tbody>
</table>

Table 4—II  System I/O Cable Color Code

Pin 9 (OVERTEMP)
An active low output on pin 9 indicates that one of the power modules in the generator has overheated and automatically shut down. The front panel status display will indicate OVERTEMP.

Pin 10 (System Fault)
An active low output on pin 10 indicates the generator has detected an out of tolerance voltage fluctuation. The front panel status display will indicate FAULT.

Pin 11 (Not Used)
Pin 11 is not used on the DPC I.

Pin 12 (Amp Setting)
The signal on pin 12 is proportional to the amplitude setting. The scale is 10.0V = 100%. This allows automation equipment to monitor the DPC amplitude setting.

Pin 13 (Status Relay Common)
This is the floating common of the relay contact that is not connected to chassis ground.
**Pin 14 (Status Relay N.O.)**
Pin 14 is a relay contact output that is normally open (N.O.). A contact closure between pin 14 and pin 13 (Common) indicates that the status relay has been activated. The fault selected depends upon the jumper selection in block SH705. The load current must be within the relay switching capacity. A 2–Amp fuse is installed on the interface board to protect the relay contacts. The relay may fail if it is connected to a DC source greater than 28VDC.

**Pin 15 (Status Relay N.C.)**
Pin 15 is a relay contact output that is normally closed (N.C.). A contact opening between pin 15 and pin 13 (Common) indicates that the status relay has been activated. The fault selected depends upon the jumper selection in block SH705. The load current must be within the relay switching capacity. A 2–Amp fuse is installed on the interface board to protect the relay contacts. The relay may fail if it is connected to a DC source greater than 28VDC.

**NOTE**
Active Low outputs are open collector Darlington transistors that sink current to ground (either chassis ground or isolated common @20mA maximum). Custom automation users must supply their own pullups. See Appendix C for sample circuits.
Connector Pinout (110–4061)
The System Input/Output is a HD-15 (high-density, 15 contact) female connector. Pin assignments are shown in Figure 4–20. The male cable end is a mirror image of the panel mount and is shown in Figure 4–21. These are the same as Figures 4–18 and 4–19, except rotated 90° as they would appear on a benchtop chassis Table 4—III below, gives the signal pinout for the Type 110–4061 Interface board. The only change from the 110–4004 board is the assignments of pins 13, 14 and 15 which replace the status relay outputs. The signals are described in more detail on the next page. Users of custom automation will find a list of color code pinouts for the Automation Control Input cable (Dukane P/N 200–1203) in Table 4—II on the previous page.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal Name</th>
<th>Signal Description (110 – 4061 Interface Board)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+22VDC</td>
<td>Current limited to 250 mA maximum</td>
</tr>
<tr>
<td>2</td>
<td>Gnd</td>
<td>22VDC Return (DPC Chassis Ground)</td>
</tr>
<tr>
<td>3</td>
<td>Gnd</td>
<td>Status Outputs/Driver/Monitor Return</td>
</tr>
<tr>
<td>4</td>
<td>Stat Driver</td>
<td>STATUS Driver Output (1 Amp max.)</td>
</tr>
<tr>
<td>5</td>
<td>U/S Active</td>
<td>Ultrasound Status Output (Active Low)</td>
</tr>
<tr>
<td>6</td>
<td>O L Fault</td>
<td>Overload Fault Output (Active Low)</td>
</tr>
<tr>
<td>7</td>
<td>Iso Com</td>
<td>Isolated Operate Input Common (7 &amp; 8) JU726</td>
</tr>
<tr>
<td>8</td>
<td>Oper Input</td>
<td>Sw Closure Operate Input (2 &amp; 8) JU724/725</td>
</tr>
<tr>
<td>9</td>
<td>O T Fault</td>
<td>Overtemperature Fault Output (Active Low)</td>
</tr>
<tr>
<td>10</td>
<td>Sys Fault</td>
<td>System Fault Output (Active Low)</td>
</tr>
<tr>
<td>11</td>
<td>Not Used</td>
<td>Reserved – HPPI Signal</td>
</tr>
<tr>
<td>12</td>
<td>Amp Setting</td>
<td>Amplitude Setting Monitor (10.0V = 100%)</td>
</tr>
<tr>
<td>13</td>
<td>Pwr Sig Com</td>
<td>Power Signal Common</td>
</tr>
<tr>
<td>14</td>
<td>Power Sig*</td>
<td>Power Signal Monitor Output* (1mV = 1 Watt)</td>
</tr>
<tr>
<td>15</td>
<td>Loop Fault</td>
<td>Current Loop Fault Output (Active Low)</td>
</tr>
</tbody>
</table>

* Power Signal Output Monitor (Pin 14) is available only if the generator is equipped with the optional Power Signal Board.

Table 4—III  System I/O Connector Signals for 110–4061 Interface Board

CAUTION
The System I/O port uses the same type of connector as a standard computer video monitor port, but it is electrically very different. DO NOT connect any video monitor devices to this connector. Doing so may result in damage to both the video device and the DPC.
**Signal Description (110–4061)**

**Pin 1 (+22V)**
This pin can supply +22VDC at up to 250mA to power the user’s automation controls.

**Pin 2 (Power Gnd)**
Pin 2 is the 22VDC return and is tied to the chassis ground.

**Pin 3 (Signal Gnd)**
Pin 3 is the Status Out and Operate return and is tied to the chassis ground.

**Pin 4 Status Driver**
An active low output on pin 4 indicates the condition set on Jumper Block SH704 has occurred (see Figures 4-15). The factory default is OVERLOAD.

**Pin 5 (U/S Active)**
An active low output on pin 5 indicates the ultrasound is being delivered to the probe.

**Pin 6 (OVERLOAD)**
An active low output on pin 6 indicates that excessive power beyond the generators rated output is being drawn. The ultrasonic signal is shut down when an overload condition is detected. The front panel status display will indicate OVERLOAD. The overload signal resets when the operate input deactivates or the TEST switch is released.

**Pin 7 (Isolated Common)**
This pin is used as the isolated return common if jumper block SH702 is configured as a fully isolated input (position JU726). See Appendix C for further information on isolated switching.

**Pin 8 (Isolated Operate In)**
This pin is used to initiate the operate sequence. The factory default setting is a non-isolated sink requiring a dry contact closure to ground (pins 2 or 3). This input can be changed to a source or fully isolated input by jumper block SH702. For isolated operation, a voltage is applied between pins 7 and 8. See Appendix C for details.

**Pin 9 (OVERTEMP)**
An active low output on pin 9 indicates that one of the power modules in the generator has overheated and automatically shut down. The front panel status display will indicate OVERTEMP.

**Pin 10 (System Fault)**
An active low output on pin 10 indicates the generator has detected an out of tolerance voltage fluctuation. The front panel status display will indicate FAULT.

**Pin 11 (Not Used)**
Pin 11 is not used on the DPC I.

**Pin 12 (Amp Setting)**
The signal on pin 12 is proportional to the amplitude setting. The scale is 10.0V = 100% (e.g. a loop current of 10mA yields 6V). This allows automation equipment to monitor the DPC amplitude setting.

**Pin 13 (Power Signal Common)**
This is the analog common return for the Power Signal Output on pin 14.

**Pin 14 (Power Signal Monitor Out)**
This output is only available when the optional Power Signal Output board is installed. The signal between pin 14 and 13 is proportional to the RMS ultrasonic output power being drawn from the DPC. The scale is 1mV = 1 Watt on the 20kHz, 30kHz and 40kHz models. The maximum full scale output is 4.095V (4095 Watts). On the 50kHz and 70kHz models, the scale factor is 10mV = 1 Watt with a maximum full scale output of 409.5 Watts.

**Pin 15 (Current Loop Fault)**
Remote Amplitude Control is adjusted by a current loop. Failure to provide between 4mA and 20mA of loop current is detected as a fault and produces an active low output on pin 15. The fault LED on the front panel (next to the current–loop connector) will also indicate red.

---

**NOTE**
Active Low outputs are open collector Darlington transistors that sink current to ground (either chassis ground or isolated common @20mA maximum). Custom automation users must supply their own pullups. See Appendix C for sample circuits.
Ultrasound Output

Vertical Chassis

The bottom panel of the vertical backpanel–mount DPC I chassis contains the AC power switch, power cord terminal block, RFI grounding lug and the Ultrasound output connector. The Ultrasound BNC output connector is located closest to the front panel and is shown in Figure 4–22. It can also be seen in Figure 4–2 as pointed to by callout 4.

Horizontal Benchtop Chassis

The Ultrasound output BNC connector is located on the far right side of the front panel of the DPC I benchtop chassis. This is shown in Figure 4–23.
AC Power

Vertical Chassis

The bottom panel of the vertical back-panel mount version of the DPC I generator contains the Ultra-sound output connector, the AC power switch, the AC power cord terminal block, and a RFI grounding lug. The last three items are located next to the back-panel mounting plate and are shown in Figure 4–24. The AC power switch is also a 15A circuit breaker. The switch must be in its ON position (marked by the I) to supply AC power to the generator. If the circuit breaker opens, it will flip the switch to its OFF position, marked by the O.

Horizontal Benchtop Chassis

The rear panel of the benchtop version of the DPC I generator contains the AC power switch, the IEC power cord receptacle and the RFI grounding lug. These are shown in Figure 4–25. The AC power switch is also a 15A circuit breaker. The switch must be in its ON position (marked by the I) to supply AC power to the generator. If the circuit breaker opens, it will flip the switch to its OFF position (marked by the O).

RFI Grounding Lug

The grounding lug used to connect the DPC to an earth ground for suppressing RFI (radio-frequency interference) is located next to the AC Power connection. The ground lug is identified in Figures 4–24 and 4–25 above. RFI suppression is discussed in Section 3, and the proper connection is shown in Figures 3–4 through 3–8.
This page intentionally left blank
Hand Probes/Probe Stacks

- Theory of Operation
- Probe Selection
- Probe Stack Assembly
- Torque Unit Conversion
- Probe Stack Mounting

Ultrasonic Probes .................................................49
  Theory of Operation ...........................................49
  Probe Configuration ..........................................49
  Ultrasonic Horn ................................................50
  Booster ..................................................................50
  Probe Selection ..................................................51
Probes Drawings ......................................................53
Stack Assembly ..........................................................60
  Installing Replaceable Tips ....................................60
  Mounting Stud to Horn/Booster ...............................61
  Horn to Booster ..................................................62
  Booster to Probe ................................................62
  Horn to Probe ....................................................62
Torque Unit Conversion Chart ....................................63
Stack Disassembly .....................................................64
Booster Notes ..........................................................67
Probe Stack Mounting .................................................68
This page intentionally left blank
Ultrasonic Probes

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 energy 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 vibrations.

2. A horn to transfer the mechanical vibrations 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 vibrations of the horn. A basic hand–held probe system is shown in Figure 5–1. The hand probe is easily identified by its trigger actuator and permanently attached cable. Normally a booster is not used with a hand 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 recommended for use in high–volume production environments.

A mounted probe lacks the trigger actuator and has a BNC connector for attaching the high voltage coaxial cable. A mounted probe may also have a booster to change the gain.

Figure 5–1 Hand Probe, Horn & Tip or Custom Horn
**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. Inherent variations in material composition prevent tuning by dimensional machining alone. The horn is machined close to its finished dimensions. The final tuning is accomplished using a combination of electronic frequency measurement and machining.

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. The flatness and cleanliness of the mating surfaces becomes more critical as frequency increases. Higher frequencies are used for delicate parts that cannot handle a lot of amplitude.

**Booster**

A booster has two functions. It can alter the gain of the probe and it provides an additional clamping location for increasing the stability of the probe stack. A booster is amplifying if its gain is greater than one and reducing if its gain is less than one. If no change in gain is required, a neutral or coupling booster is used to provide the additional clamping location for probe stack stability. It is highly desirable to have a booster in a mounted stack, but not mandatory. Contact your Dukane Representative if you have specific application questions. Hand probes are rarely fitted with a booster since it makes the probe awkward to use. A probe designed to be mounted in a fixture is shown in Figure 5–2 along with a booster and horn. As shown, the components are joined together with specially annealed threaded studs.
Probe Selection

The DPC I Generator is designed to be used with both hand–held ultrasonic probes and mounted probes in custom fixtures for automation control. Hand probes are used where maximum operator control or relatively low static forces are desirable. They are well suited for short production runs requiring spot welding or inserting. Hand probes are also used when assemblies are too large to be assembled in press systems or which have areas that are difficult to reach. Tapped horns with various types of replaceable titanium tips are available. When properly tuned, most of these tips are interchangeable. The most common hand–held 20kHz probe used with the DPC I is the 41D26 which consists of a 41C26 probe and a 14–pin Amphenol to HD–15 adapter cable for connection to the DPC I/O connector. A drawing of a 41C26 probe is shown in Figure 5–5.

Dukane offers an ergonomically designed pistol grip for the 20kHz hand probe (41C26/41D26). This lightweight housing (shown in Figure 5–3) ensures more accurate spot welding and reduces operator fatigue and the risk of repetitive stress injuries.

Probes can also be mounted in fixtures and are readily adaptable to custom actuator or automation installations. The common choices for machine automation application are the 41C27 or the 41C30 HD probes. These probes are shown in Figures 5–6 and 5–7 respectively. For specialized applications such as food processing, the 41C30 is offered in a sealed, air cooled, non–contaminating stainless steel package. This is the 41S30 probe and is shown in Figure 5–8. See the caution below regarding cooling of the sealed probes.

For custom automation systems, Dukane also has a support mount for the 41C30 HD 20kHz probe with machined aluminum transducer and booster clamps. Figure 5–8 shows the sealed HD 41S30 probe secured in this mount.

CAUTION

The cooling air for the sealed probes must be clean, dry and oil free. The air directly cools the transducer, and any moisture or oil will coat the transducer causing arcing of the high–voltage Ultrasonic input. This in turn leads to breakdown of the transducer insulation which results in premature failure of the probe.

![Figure 5–3 Pistol Grip For 20kHz Hand Probe](image-url)
For 40kHz applications, the standard hand probe is the 41B33 which consists of a 41A33 probe and a 14-pin Amphenol to HD-15 adaptor cable. A model 41A33 hand probe is illustrated in Figure 5–9. For machine automation applications, the 41C28 is the most common 40kHz mounted probe and is shown in Figure 5-10. This is also offered in a sealed package as a 41S28 and shown in Figure 5-11. The sealed probes have water and steam-proof cables with liquid-tight MIL-SPEC connectors. Sealed probes are also useful in areas which cannot tolerate the possibility of an electrical spark. See caution on the previous page regarding clean, dry cooling air.

Note that the probes do not include a horn or replaceable tip. The probe drawings show a generic horn attached to the probe. A list of the 20kHz and 40kHz probes is given in Table 5—I below. Standard 15kHz and 30kHz probes are also available. The horns are available in different materials and sizes because they are matched to the plastic material to be welded, the type of weld joint and the probe frequency. Contact Dukane or your local Dukane representative for specific information on horns, replaceable tips and 50kHz–70kHz probe applications.

<table>
<thead>
<tr>
<th>Model</th>
<th>Probe Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>41D26</td>
<td>41C26 20kHz DPC Hand Probe with Adapter Cable</td>
<td>5–5</td>
</tr>
<tr>
<td>41C27</td>
<td>Standard 20kHz Probe</td>
<td>5–6</td>
</tr>
<tr>
<td>41C30</td>
<td>Heavy Duty 20kHz Probe</td>
<td>5–7</td>
</tr>
<tr>
<td>41S30</td>
<td>Sealed HD 20kHz Probe with Stainless Steel Can &amp; Air Cooling</td>
<td>5–8</td>
</tr>
<tr>
<td>41B33</td>
<td>41A33  40kHz Hand Probe (350 &amp; 700 Watt) with Adapter Cable</td>
<td>5–9</td>
</tr>
<tr>
<td>41A39</td>
<td>40kHz Hand Probe (1000 Watt)</td>
<td>5–9**</td>
</tr>
<tr>
<td>41C28</td>
<td>Standard 40kHz Probe</td>
<td>5–10</td>
</tr>
<tr>
<td>41A38</td>
<td>40kHz Probe (1000 Watt)</td>
<td>5–10**</td>
</tr>
<tr>
<td>41S28</td>
<td>Sealed 40kHz Probe with Stainless Steel Can &amp; Air Cooling</td>
<td>5–11</td>
</tr>
</tbody>
</table>

** Same overall dimensions as probe illustrated. Front slug of probe housing is slightly different.

Table 5—I 20kHz and 40kHz DPC I Compatible Probes
Figure 5–5  41C26 20kHz Hand Probe
Figure 5–6  41C27 20kHz Mounted Probe
Figure 5–7  41C30 20kHz HD Mounted Probe

NOTE:
DIMENSIONS ARE FOR REFERENCE ONLY. HORN AND BOOSTER DIMENSIONS WILL VARY DEPENDING UPON HORN CONFIGURATION AND BOOSTER GAIN RATIO.
Figure 5–8  41S30 20kHz Sealed Probe in Mount
Figure 5–9  41A33 40kHz Hand Probe
Figure 5–10  41C28 40kHz Mounted Probe

NOTE:
DIMENSIONS ARE FOR REFERENCE ONLY. HORN AND
BOOSTER DIMENSIONS WILL VARY DEPENDING UPON HORN
CONFIGURATION AND BOOSTER GAIN RATIO (1:1 SHOWN).

DI A

NOTE:
DIMENSIONS ARE FOR REFERENCE ONLY. HORN AND
BOOSTER DIMENSIONS WILL VARY DEPENDING UPON HORN
CONFIGURATION AND BOOSTER GAIN RATIO (1:1 SHOWN).

DI A

NOTE:
DIMENSIONS ARE FOR REFERENCE ONLY. HORN AND
BOOSTER DIMENSIONS WILL VARY DEPENDING UPON HORN
CONFIGURATION AND BOOSTER GAIN RATIO (1:1 SHOWN).

DI A

NOTE:
DIMENSIONS ARE FOR REFERENCE ONLY. HORN AND
BOOSTER DIMENSIONS WILL VARY DEPENDING UPON HORN
CONFIGURATION AND BOOSTER GAIN RATIO (1:1 SHOWN).

DI A
Air Must Be Clean, Dry and Oil Free

Figure 5–11
41S28 40kHz Sealed Mounted Probe

- Booster Optional
- Horn & Booster Purchased Separately
- Cooling Fittings For 0.25 OD Tube On Rear
- Mates With 200-1234-XX Cable
- "XX" Denotes Length

Dukane Manual Part No. 403–543–04
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 surface of the tip 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. 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 5–12. 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.

   • 70 inch-lbs for an 8mm threaded tip
   • 100 inch-lbs for a 3/8” x 24 threaded tip
   • 160 inch-lbs for a 1/2” x 20 threaded tip

   **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**
   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.

   **NOTE**
   20kHz spanner wrenches have Dukane Part No. 721–68
   40kHz spanner wrenches have Dukane Part No. 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 5—II lists the torque specifications in units for both English and Metric systems of measurements. Figure 5–14 is a handy conversion graph if you require any intermediate values not listed.

**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.

- 70 inch-lbs for an 8mm threaded stud
- 100 inch-lbs for a 3/8” x 24 threaded stud
- 160 inch-lbs for a 1/2” x 20 threaded stud

<table>
<thead>
<tr>
<th>inch-lbs</th>
<th>ft-lbs</th>
<th>N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>5.8</td>
<td>7.9</td>
</tr>
<tr>
<td>100</td>
<td>8.3</td>
<td>11.3</td>
</tr>
<tr>
<td>160</td>
<td>13.3</td>
<td>18.1</td>
</tr>
</tbody>
</table>

**Table 5—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 5–16.

**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.

**CAUTION**

ALWAYS use Dukane stack studs. Ordinary steel set screws are not properly heat treated for use as stack studs. Too soft of a screw will gall the threads and too hard of a screw will break.

**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**

To convert inch-lbs to ft-lbs, divide by 12
To convert inch-lbs to N·m, divide by 8.852
To convert ft-lbs to N·m, multiply by 1.356
To convert N·m to ft-lbs, multiply by 0.7376

Torque specifications have a tolerance of about ± 10%.
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 build-up 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 of the tip 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 system 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.
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 5–13 for the correct procedure. Refer to Table 5—III for torque units conversions. Be careful not to overtighten.

- 40kHz Stacks - 130 inch-lbs

<table>
<thead>
<tr>
<th>inch–lbs</th>
<th>ft–lbs</th>
<th>N–m</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>10.8</td>
<td>14.7</td>
</tr>
<tr>
<td>200</td>
<td>16.7</td>
<td>22.6</td>
</tr>
</tbody>
</table>

Table 5—III Stack Torque Unit Conversions

NOTE
Stud torque specifications are lower than horn or booster torque specs. Be sure to tighten the horn or booster joints to the higher torque limits.
Stack Disassembly
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 (see Probe Maintenance in Section 8), 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.

CAUTION
Never hold a probe by the housing or a booster by the mounting rings when tightening or loosening an adjoining component. The probe housing and booster rings have anti-rotation devices to keep the transducer and booster aligned. These could shear under excessive torque.

Figure 5–15  Assembly and Disassembly of a Hand Probe
**CAUTION**

An improperly altered horn can cause destructive stress to the transducer, booster, generator and horn. The horn should only be modified by Dukane’s Horn Department.

**Figure 5–16** Assembly and Disassembly of Probe Stack with Booster
Separating A Horn From A Booster, Booster From A Probe Or Horn From A Probe

On all transducers and horns with spanner wrench holes (see Figures 5–17), use only the correct size spanner wrench that came with your system to provide sufficient torque to loosen a joint. This will prevent the booster from turning in your hand when loosening a stud. Do not hold the booster by the mounting rings.

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

Removing A Mounting Stud From A Horn Or Booster

Use the correct size Allen wrench (1/4” for 20kHz) in the socket head to remove the stud.

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 and keep the horn from turning in your hand. Refer to Figure 5–18 for the correct tip removal procedure.
Booster Notes

How To Tell The Booster Input End From The Output
1. The cap screws on the booster mounting rings are always inserted from the output end toward the input end (see Figure 5-16).

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 depth of the threaded hole on the output end is always deeper (by about 0.1”) than the threaded hole on 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. If no change in gain is required, a neutral or coupling booster is used to provide the additional clamping location for probe stack 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.
Probe Stack Mounting

A probe-horn assembly or probe-booster-horn assembly (stack) can be mounted into a customer-provided machine to ensure stability and proper alignment during operation or for automated operation. A stack is secured in a machine by clamping the probe (and booster, when present) at designated locations. Clamping at these designated locations provides stability to the stack and at the same time does not interfere with the transmission of ultrasonic vibrations of the stack components. The following rules apply when mounting a probe system stack.

1. A probe may be clamped anywhere along its body (except the 41S30). If it has a side mounted BNC, then it may require a thin mounting ring if it is to be clamped near the top. It may also be clamped below the BNC connector.

2. Secure a probe-horn stack by clamping the probe in two places.

3. Secure a probe-booster-horn stack by clamping the probe in one place and the booster in one place.

4. Never clamp the horn.

To mount the probe stack, see the drawings for help in determining the correct clamping locations. Figures 5–6, 5–7, 5–8, 5–10 and 5–11 all show suggested probe and booster clamp locations. Figure 5–8 shows a sealed HD 41S30 probe in a machined open probe mount. Note that the sealed probes have a raised area near the front. The 20kHz probes may be safely clamped here. However, the smaller 40kHz probes should not be clamped in this raised area since it may place stress on the transducer mount and seals. This no clamp area is marked in Figure 5–11.

**NOTE**

Never hold a probe by the housing or booster by the mounting rings when tightening or loosening from an adjoining component (see Figures 5–15 and 5–16 to identify these parts).

ALWAYS use the proper spanner wrenches when tightening or loosening the horn or booster.
Checkout and Operating

- Startup and Self–Test
- System Test
- Probe Stack Operation
- Stopping the Weld Cycle

Startup and Self–Test ..............................................71
System Test ..........................................................72
Probe Stack Operation .........................................73
Stopping the Weld Cycle .......................................74
  Manual Systems ...............................................74
  Automated System ..........................................74
  End of Day .......................................................74
This page intentionally left blank
Startup and Self–Test

1. Plug in the AC line cord to the correct AC power outlet. See Table 10—I for the model power requirements.

2. Turn on the AC Breaker/Switch (refer to Figures 4–24 and 4–25).

3. The INPUT TEST indicator in the Status Display should flash red for 5–10 seconds. This indicates the power–up self–test is running. When the test has successfully completed, the INPUT TEST indicator goes dark.

4. The green power indicator should then light up. This indicates the AC power applied to the generator is within tolerance, the INPUT TEST has passed, the DC bus has been energized and the generator is capable of being placed ON LINE.

5. Either the OFF LINE (standby) or ON LINE (operational) status display should be lit. Depending upon the mode when the generator was powered down, it will return to that same mode when powered up again.

6. If the yellow OFF LINE status indicator in Figure 6-1) is lit, press the ON LINE generator control key on the front panel (labeled 5 in Figure 6-1.) The green ON LINE indicator in the Status Display (labeled 5 in Figure 6-2) should now be lit.

NOTE
If the INPUT TEST indicator does not flash, check the AC line input. The DPC line cord must be properly connected to a live AC outlet with the proper rating.

If the INPUT TEST indicator flashes and then remains in a steady red state –
1. The AC line level may be out of specified operating range.
2. The DPC may have an internal fault preventing normal operation.

CAUTION
Always turn the AC power off and wait a few seconds, before disconnecting or connecting any cable to the DPC. Failure to turn off the AC power may result in damage to the generator or probe.
System Test

To test the system’s ultrasound operation, perform the following steps.

1. For the test, the generator must be ON LINE. If the green ON LINE status display is not lit up (F in Figure 6-2), press the ON LINE key (G in Figure 6-1).

2. Optional – Connect a probe to the generator ultrasonic output. This test will also work without a probe connected.

3. If you have a probe connected, place the probe so that the tip of horn is not in contact with anything. If you are using a hand probe, you may feel a slight vibration or sensation in your hand. This is normal. There should not be any loud or unusual noise.

4. Momentarily press the generator control TEST key (G in Figure 6-2).

5. The first green segment (10%) of the System Power Output bar display will light up indicating normal operation (E in Figure 6-2).

6. At the same time the green bar of the Power Output display lights, the ON LINE status indicator goes blank. This indicates the ultrasonic probe is activated. The probe should operate without any unusual noise. The probe will operate as long as the TEST key is pressed.

7. When the TEST key is released, the ON LINE status indicator lights up again and the Power Output display goes blank. This test cannot be performed with the generator OFF LINE.

---

**CAUTION**

Any unusually loud noise from the probe stack indicates that it has been improperly assembled. Check the probe stack for correct assembly and proper torque.
Probe Operation

1. If the generator is not online, press the ON LINE key. This is labeled C in Figure 6-1. The green ON LINE status should light up (تفكير) in Figure 6-2).

2. Hand Probe – Apply the probe tip to the components to be ultrasonically joined, and press the hand probe’s activation switch.
   Automation System – Press the automation system’s activation switch to trigger the generator. This will move the probe tip in contact with the components to be ultrasonically joined.

3. Hand Probe – Hold the probe’s activation switch for the appropriate amount of time to achieve the desired assembly results.
   Automation System – The weld time is controlled by the automation system.

4. The generator’s Power Output display will light up to indicate the percentage of power being delivered to the probe while the trigger is activated.

5. The display bars should be green or yellow. The Power Output display should never light the Red OVERLOAD indicator (>100%) during normal operation. Refer to Figure 4–5 and 4–6 for details on the power meter display.

6. After the weld trigger is terminated, the Power Output display should go blank indicating zero output power.

**NOTE**

A hand probe cannot trigger the generator to produce an ultrasound output if the DPC is OFF LINE.

An automation system cannot trigger the generator to produce an ultrasound output if the DPC is OFF LINE.
Stopping the Weld Cycle

Manual System
Release the switch on the hand probe to stop the welding cycle.

Automated System
The customer-supplied external controls provide the means to stop the welding cycle for an automated system. To override the U/S activation signal at any time, press the OFF LINE key (H in Figure 6-3) at any time.

End of Day
Push the OFF LINE generator control key on the front panel (I in Figure 6-3). The green ON LINE status indicator will go out and the yellow OFF LINE status indicator (I in Figure 6-3) will be illuminated.

Figure 6-3 Stopping the Weld Cycle
Troubleshooting

- No Ultrasonic Output
- OVERLOAD Indicator
- OVERTEMP Indicator
- FAULT Indicator
- INPUT TEST Indicator
- Troubleshooting Flowchart

No Ultrasonic Output ...........................................77
  Probe .....................................................................77
  Cable ....................................................................77
  Generator ................................................................77
  Operate Input .......................................................78
  Status Driver Output .............................................78
Generator Faults .......................................................79
  OVERLOAD Indicator .............................................79
  OVERTEMP Indicator .............................................79
  FAULT Indicator ....................................................79
INPUT TEST Indicator .............................................80
TEST Control Key ...................................................80
Troubleshooting Flowchart .................................81
This page intentionally left blank
No Ultrasonic Output

Probe
Make sure that the probe coaxial cable is connected to the generator Ultrasonic output connector J1. The benchtop chassis has the BNC connector on the front panel. The vertical chassis has the BNC output connector located on the bottom of the chassis (see Figure 7–1). Also, make sure the probe stack was properly assembled following the instructions in Section 5.

Cables
Make sure that both the U/S coaxial and System I/O cables are securely connected. You must have an operate trigger input to pin 8 on the System I/O HD-15 connector either by the hand probe’s control cable or by custom automation. Refer to Figures 3–4 and 3–5 for details. Place the generator OFF LINE, and check the coaxial cable for any signs of damage which may result in an open circuit preventing the cable from transmitting the signal from the generator to the probe. If you have a mounted probe, replace the coaxial cable with a known good cable. If you are using a hand probe, try a different known good probe to determine if the problem is related to the generator or the external cables and probe.

Figure 7-1 Bottom Ultrasonic Output Connector
Generator
The generator will not produce an output signal when triggered if it is OFF LINE. Make sure that the green power indicator C is lit. The status display should indicate ON LINE which is marked as A in Figure 7-2. If the generator is OFF LINE, press the ON LINE control key B.

![Figure 7–2 Generator ON LINE](image)

Operate Input
If you are using a hand probe, make sure the control cable and adapter cable is securely connected to the System I/O connector. The trigger switch on the hand probe activates the Ultrasonic output through the control cable.

NOTE
The cable end of the System I/O connector is a mirror image of the panel connector. Figure 7–3 below shows the cable pinout. Make sure you have correctly wired the connector if you are using custom automation signals.

Also refer to Table 4—II for the cable color pin assignment.

![Figure 7–3 Cable End of System I/O Connector](image)
Generator Faults

**OVERLOAD Indicator**
If the generator OVERLOAD light comes on, it indicates excessive power is being drawn. This could be caused by a mismatch between the ultrasonic signal and the resonant characteristics of the acoustic stack. Improperly assembled probes may draw excessive power if their components were not properly torqued to specifications. Make sure you have the correct probe and horn. A 40kHz probe and a 20kHz DPC may result in an instantaneous overload. The same is true for the reverse combination. Excessive power drawn by the load may result in damage to the probe and horn.

If there is an overload, the Status Driver output on pin 4 will become active low. This is the factory default setting for the Status Driver Output Selection jumper block. To reset a system which has overloaded, open the switch closure contacts between pins 2 and 8 (OPERATE Input) and verify that the Status Driver output has returned to its normally high state.

**OVERTEMP Indicator**
If the OVERTEMP indicator comes on, it indicates that one of the generator’s power modules has overheated. The module’s temperature sensor will automatically shut down the generator. The generator will automatically reset and turn off the OVERTEMP indicator when the module temperature drops below the 75°C (167°F) trip point.

**FAULT Indicator**
If the generator FAULT light comes on, it indicates an out-of-tolerance voltage condition. This could be related to one of two conditions.

1. AC line voltage out of tolerance
2. Internal DC power supply problems (+5VDC, +12VDC, –12VDC or +24VDC).

If the AC line voltage is within tolerance, then the DPC has an internal fault. Contact your local Dukane representative.

---

**NOTE**
The OVERLOAD, OVERTEMP and FAULT indicators are triggered by independent sensors. It is possible to get more than one error indicator. The ultrasonic output is disabled on any one of the errors. There are separate output signals for each of the faults. Overload fault on pin 6, Overtemp fault on pin 9 and System fault on pin 10. Refer to Tables 4—I and 4—III for more detailed information.
### Generator Errors

**INPUT TEST Indicator**

**Steady Red**

During power up, the INPUT TEST indicator should flash red for 5–10 seconds. This indicates the power-up test is running. When the test has successfully completed, the INPUT TEST indicator goes out. If the INPUT TEST indicator flashes and then remains in a steady red state, there are two possible causes.

1. The AC line level may be out of the specified operating range. Check the AC power to determine if it is within the limits specified in Section 10.
2. If the AC power is within specifications, the DPC has an internal circuit fault preventing normal operation. Contact your local Dukane representative.

**Does Not Flash**

If the INPUT TEST indicator does not flash during power up, check the AC power input. The DPC line cord must be plugged into a live AC outlet. The generator will not turn on if the line voltage is below the rated minimum. The INPUT TEST indicator should light up even without a probe connected.

**TEST Control Key**

The TEST control key will not trigger the INPUT TEST light. The TEST key should cause the first green bar on the power display to light even without a probe (see System Test in Section 6 and Figure 6-2).

### 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 time or change to a higher gain booster to increase the amplitude.

**Excess Flash**

The energy director may be too large. You can try and reduce the weld pressure and/or weld time. The parts may have too much shear interferences or a nonuniform joint dimension.

**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.

Check the horn and fixture alignment and parallelism. Check the alignment of the mating parts, shifting during welding or residual mold release on the parts.

There should be no unusual or loud noise from the acoustic stack. If there is, disassemble the stack and reassemble according to the guidelines and torque specifications in Section 5.

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 by Dukane.
Section 7 – Troubleshooting

INPUT TEST indicator lights up?

1. The AC breaker switch must be turned on.
2. Make sure the AC outlet has power.

INPUT TEST flashes for 5–10 sec?

Verify that the AC voltage is within specifications.

INPUT TEST indicator goes out?

Verify that the AC voltage is within specifications.

Green power light on?

1. Defective power indicator.
2. Internal fault – Contact Dukane Service.

FAULT status indicator off?

Verify that the AC voltage is within specifications.

A (Continued on next page)
1. Make sure correct probe is connected to generator.
2. Check the Ultrasonic coaxial cable for shorts.
3. Try changing the probe and/or cable.
4. Make sure probe stack is properly assembled.

Internal fault – Contact Dukane Service.

Disconnect the probe cables from DPC. The TEST key should work even without a probe or SYSTEM I/O cable.
Dukane Manual Part No. 403-543-04

Section 8

Maintenance

- Front Panel
- Chasis
- Stack Surfaces
- Inspection Schedule
- Reconditioning

Front Panel .................................................85
Chasis..........................................................86
Stack Surfaces..............................................87
  Stack Maintenance ......................................87
  Stack Inspection ........................................87
  Inspection Schedule ....................................87
  Surfaces With Even Contact .........................88
  Surfaces With Uneven Contact ......................88
  Crowning ..................................................89
  Center Depression ......................................89
  Corrosion ..................................................89
Reconditioning ............................................90
  Machining the Mating Surfaces .......................90
  Manual Resurfacing ....................................91
Front Panel

Cleaning
Do not use any solvents or abrasive cleaners on the front panel. Do not spray cleaner directly onto the front panel. Apply a small amount of computer cleaner to a soft towel first. Clean the panel with the moistened towel. Do not spray or apply the cleaner directly to the DPC. Do not allow any liquid to collect around the AC power switch.

Display
Do not use a sharp object on the display.

Control Keys
Use your finger to press the control keys. Do not use sharp objects on the keys. If your hands are greasy or contaminated with dirt, use a soft object like a pencil eraser.

Chassis

Sheet Metal Cover
The cover is preformed to also fit over the chassis and has protective grills over the cooling air vents. The cover is secured by 5 screws on the top and 5 screws on the bottom (left and right sides on the benchtop chassis). Keep the cover on at all times because there are high voltages present which could cause injury. The internal case also contains capacitors which continue to hold a high electrical charge, even after the power is shut off.

**IMPORTANT**

Never operate the DPC I with the cover off. This is an unsafe practice and the high voltage present may cause injury.
Air Ventilation Slots
Keep the top and bottom ventilation slots free from obstructions. If excessive dust or dirt collects on the slots, wipe or vacuum them clean. Do not use compressed air to clean them as this may force the dirt inside the chassis. On the vertical back–panel mount chassis, the top grill is the air intake as shown in Figures 8–1 and 3–1. The bottom grill is the hot air exhaust. Also see Figure 7–1 for a picture of the bottom air exhaust vent. Allow 2 inches (5 cm) on top and bottom for air circulation. On the horizontal benchtop chassis, the air intake is on the left, and the exhaust from the cooling tunnel is on the right. This is shown in Figure 3–2.

I/O Connector
The Input/Output connector has a pair of 4-40 threaded studs to secure the connector. Do not overtighten them.

AC Power Cord
The AC power cord should be kept in good condition and free from any cuts. The AC plug should be straight with no bent prongs.

Figure 8-1 Location of Air Cooling Vents
Probe

Stack Maintenance

It is essential that the mating surfaces of the acoustic stack components be flat and smooth. When the components are joined together and tightened, there must not be any air gap between the surfaces.

If there is any air gap, there will be a loss in power and efficiency. Air has much higher transmission losses than the metal horn. Whenever the wavefront encounters an air gap, the propagation velocity is significantly reduced and attenuated. This results in considerable loss. In some cases, the union between the mating surfaces could be so poor as to prevent the probe stack from operating. This could result in excessive power drawn from the generator and may damage the mating surfaces. Figure 8-2 shows the mating surfaces on a typical probe and booster assembly.

Stack Inspection

Examine the mating surfaces of the horn and probe (and booster if applicable). Look for a shiny, burnished area. This indicates where the surfaces have been in contact. It will indicate whether the surfaces are flat and making good contact, or if they are uneven and making poor contact.
**Inspection Schedule**

To establish a maintenance schedule, inspect the mating surfaces after the first 200–400 hours of operation. If they require cleaning, halve the next inspection time. If the surfaces do not require reconditioning, then double the next inspection time.

**Surfaces with Even Contact**

A flat surface will make even contact and its surface will be evenly burnished across the entire contact area. Figure 8-3 shows a surface that has made even contact.

![Burnished Area](image1)

*Figure 8-3  Flat Surface with Even Contact*

**Surfaces with Uneven Contact**

A surface that is not completely flat will make uneven contact. Its surface will be burnished only in the area where it has made contact. Figure 8-4 shows what such a surface would look like if only a portion of the surface were making contact. The inner and outer areas have no marks on it indicating there has been no contact in these areas.

![Burnished Area](image2)

*Figure 8-4  Surface with Uneven Contact*
Crowning
A surface which is burnished only in the inner ring area around the stud, indicates the surface is convex or crowned. An example of this is shown in figure 8-5. To get an idea of amount of deviation from a flat surface, place a straight edge along the stack element. Since its surface is higher at the center than at the edges, there will be a gap at the outer edge of the element.

![Crowned Surface](image)

Figure 8-5 Crowned Surface

Center Depression
A surface which is burnished only in the outer ring area around the edge, indicates the surface is concave or depressed. An example of this is shown in figure 8-6. To get an idea of amount of deviation from a flat surface, place a straight edge along the stack element. Since its surface is higher at the edge than at the center, there will be a visible gap near the center indicating the depth of the depression.

![Center Depression](image)

Figure 8-6 Center Depression
Corrosion
Corrosion is a factor to consider when determining the overall system performance. Over time, corrosion can build up on the mating surfaces of the acoustic stack. This build up interferes with the efficient transfer of ultrasonic energy to the parts to be welded. It may contribute to a loss in performance. Evidence of corrosion build up includes discolored mating surfaces or surfaces encrusted with hard deposits. To extend equipment life and maintain performance levels, minimize the system’s exposure to corrosive sources.

Reconditioning
Stack components require reconditioning when the mating surfaces become uneven or corroded. These conditions cause poor contact between the mating surfaces which wastes power. It also makes tuning the stack difficult, can cause heat damage to the transducer, and can contribute to a higher system noise level.

Machining the Mating Surfaces
Instructions on how to properly machine the stack components is beyond the scope of this manual. Please call Dukane’s Tooling Support Team for machining information. A list of Dukane contacts is provided in Section 9.

NOTE
Before deciding to recondition the mating surfaces yourself, consider calling Dukane Corporation’s Tooling Support team to discuss the situation. This is especially important if the mating surfaces are uneven, because machining of the component(s) may be required. Factory personnel can offer their skills and experience to help you determine the options for your particular needs. See Section 9 for a list of Dukane contacts.
Manual Resurfacing

To manually resurface the stack component mating surfaces, follow the steps given here.

1. Disassemble the acoustic stack and wipe all the mating surfaces clean. Use a clean cloth or a paper towel.

2. Examine all the surfaces. If any are corroded, discolored or coated with hard deposits, they should be reconditioned.

3. If the surfaces appear to be in good condition, proceed to step 11.

4. Remove the mounting stud(s) if any are installed.

5. Tape a clean sheet of #400 grit (or finer) emery cloth grit side up to a clean, flat surface such as a piece of plate glass or a granite inspection plate.

6. Hold the stack component with one hand near the bottom as shown in Figure 8-7. This view shows the thumb covering one of the three spanner wrench holes.

Without applying any downward pressure, carefully stroke the part in one direction across the emery cloth. The component’s weight alone is enough pressure as the part is moved across the emery cloth. Complete a second stroke across the cloth just like the first.

CAUTION
Use extreme care to keep the part level when moving it across the emery cloth. Be careful not to tilt the part. An uneven mating surface could leave the mating surface inoperative.

Surface flatness is more important than surface finish. Surfaces which are not flat make poor contact with each other. Poor contact wastes power, makes tuning difficult and can cause heat damage.
7. Keep the element’s surface flat against the emery cloth and turn it 120° (one-third of a complete rotation) so the thumb covers the next spanner wrench hole. Again move the part twice across the emery cloth as covered in the previous step.

8. Give the part a final one-third turn and repeat the two strokes described in Step 6.

9. Reexamine the mating surfaces. Repeat Steps 6 through 8 until the corrosion has been removed.

10. Clean any grit from the resurfaced element and the stud mounting threads using a clean cloth or paper towel.

11. If you had to remove the mounting studs, they need to be reinserted. Before they are reinserted, it is necessary to ensure proper thread engagement.
   a. Inspect and clean the stud.
   b. Clean the threaded hole with a clean cloth.
   c. Thread the stud into the hole. Tighten the stud to the torque specifications given in Table 5—I.

12. Reassemble the stack and install it using the procedure in Section 5 using Figures 5-12 and 5-16 as guides.

13. Complete the Operational Test in Section 6.

---

**CAUTION**

It is important to perform only two strokes each time the component is rotated. You are removing about 1/10,000 of an inch. Performing more than two strokes affects whether the surface remains flat. It is important for the mating surface to maintain its perpendicularity in relationship to the component’s centering axis. If this relationship between the surface and the axis is altered, the welding system may become inoperative.

**NOTE**

If the studs are overtightened, the threads may deform. Removing a stud that has been overtightened could damage the threads in the horn/booster. If this should happen, retap the horn/booster threads. Discard the old stud and replace it with a new heat-treated Dukane stud.
Contacting Dukane

- Identifying Equipment
- Main Office
- Website
- Warranty

Identify Equipment...............................................95
Main Office............................................................95
Website ...............................................................95
Warranty ..............................................................97
This page intentionally left blank
Contacting Dukane
Identify Equipment

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

• Model number, line voltage and serial number.
• Any fault indicators from the DPC status display.
• 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.

Intelligent Assembly Solutions

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

Phone: (630) 797–4900

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

Website www.dukane.com/us

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

You can locate your local representative at:

www.dukane.com/us/sales/intsales.htm
This page intentionally left blank


**DUKANE CORPORATION**

**NORTH AMERICAN WARRANTY POLICY**

Subject to the terms, limitations and exclusions set forth below, Dukane Corporation IAS Division (Dukane) warrants to the original Purchaser, unless otherwise expressly agreed to in writing by Dukane, that all equipment and tooling designed and built by Dukane will be free from defects in material or workmanship. Normal wear items are not covered by this warranty. Warranty duration shall be defined as documented herein and in conjunction with any exceptions or exclusions in the accompanying Dukane quotation to the Purchaser.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Equipment Warranty Duration</th>
<th>Other Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Systems</td>
<td>12 months on all Dukane designed and built content that is not part of our standard product.</td>
<td>Dukane standard product included in custom systems are covered by the applicable product warranty.</td>
</tr>
<tr>
<td>Hot Plate Welder</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>Laser Welder</td>
<td>For all laser sources, Original equipment manufacturer (OEM) warranty is applicable.</td>
<td>All internal laser optics and external beam delivery optics are warranted for only 30 days.</td>
</tr>
<tr>
<td>Spin Welder</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>Thermal Press</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>Ultrasonic Welder</td>
<td>36 months</td>
<td>See WARRANTY EXCLUSIONS OR EXCEPTIONS below.</td>
</tr>
<tr>
<td>Vibration Welder</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>All Production Tooling</td>
<td>12 months, one-time replacement. (6-month, one-time replacement for carbide tipped horns)</td>
<td>None</td>
</tr>
<tr>
<td>Prototype Tooling</td>
<td>• All tooling made from Renshape 460 (Renwood) are only warranted for 200 part-cycles. • All other prototype tooling is warranted as described in each specific proposal.</td>
<td>Prototype Renshape 460 (Renwood) tools employ reusable content, and therefore remain the property of Dukane.</td>
</tr>
</tbody>
</table>

All Dukane warranties commence on the date of the original shipment of the equipment or tooling, and duration is based upon a single shift per day, five day per week operation. The warranty period on rentals of new equipment that are converted to a purchase are deemed to have commenced on the initial date of rental.

These warranties are limited to equipment and tooling operated and maintained per Dukane’s written instructions, and used under normal operating conditions. These warranties do not include normal wear or normal wear items, and do not cover damage attributable to misuse, improper installation, faulty repair, unauthorized alteration or modification, neglect, or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or properly installed on the equipment.

The warranty on all Dukane equipment and tooling purchased and installed in North America is a parts and labor warranty only. Equipment installed outside of North America, regardless of where it was purchased, is covered by Dukane’s International Warranty Policy. In all cases, when on-site service is required, Travel & Living (T&L) expenses will be billed at cost. Warranty service labor (including travel time) at the customer’s site is provided on a Monday through Friday (excluding holidays), 7 a.m. to 7 p.m. basis. Any warranty service requested outside of these hours is available on a charge basis equal to 150% of Dukane’s prevailing rate for technical service work.

Any equipment or tooling that proves to be defective in material or workmanship during the stated warranty period will be repaired or replaced at the sole discretion of Dukane Corporation when Dukane is promptly notified in writing. During the warranty period, defective equipment, components, or tooling that are returned properly packed with all transportation charges prepaid will be repaired or replaced and returned to the end-user without charge. Shipments of warranty parts will be via standard, non-expedited delivery service. Expedited shipment requests are subject to freight charges to the Purchaser.

Computers, PLCs, CRTs, LCDs, touch screens, and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty from the date of shipment when used under normal operating conditions, and not subjected to misuse, abuse, or neglect. For all other equipment, components, or parts included in equipment or systems from Dukane, but not manufactured by Dukane or its affiliates, this warranty shall be limited in time and extent to the warranty given to Dukane by the OEM.

**EQUIPMENT WARRANTY EXCLUSIONS OR EXCEPTIONS:**

When specified in our quotation, a limited warranty may apply to certain components of the equipment, and/or for certain types of applications of the equipment, including those noted below.

- This warranty is void if the ultrasonic welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds 250 milliseconds.
- Ultrasonic Equipment and tooling used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2000 hours or 12 months from shipment, whichever occurs first.
- Any ultrasonic horn or tool quoted and sold as “Experimental” is not warranted.
- This warranty does not cover failures of equipment and components attributable to improper cooling or overheating of the transducer.
- Ultrasonic Horn Analyzers have a 12-month warranty.
- Ultrasonic Transducers have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

The forgoing warranty is the sole and exclusive warranty and is made in lieu of all other warranties, express, implied or statutory, including without limitation any warranties of merchantability, fitness for a particular purpose, description, quality, productiveness or any other warranty. The remedy set forth in this warranty policy is the sole and exclusive remedy of Purchaser and in no event shall Dukane be liable for any compensatory, consequential, special, punitive or contingent damages or for damages arising from any delay in performance by Dukane under this warranty.
Subject to the terms, limitations and exclusions set forth below, Dukane Corporation warrants to the original Purchaser, unless otherwise expressly agreed to in writing by Dukane, that all equipment and tooling designed and built by Dukane will be free from defects in material or workmanship. Normal wear items are not covered by this warranty. Warranty duration shall be defined as documented herein and in conjunction with any exceptions or exclusions in the accompanying Dukane quotation to the Purchaser.

### Equipment Warranty Duration

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Equipment Warranty Duration</th>
<th>Other Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Systems</td>
<td>12 months on all Dukane designed and built content that is not part of our standard product.</td>
<td>Dukane standard product included in custom systems are covered by the applicable product warranty.</td>
</tr>
<tr>
<td>Hot Plate Welder</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>Laser Welder</td>
<td>For all laser sources, Original equipment manufacturer (OEM) warranty is applicable.</td>
<td>All internal laser optics and external beam delivery optics are warranted for only 30 days.</td>
</tr>
<tr>
<td>Spin Welder</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>Thermal Press</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>Ultrasonic Welder</td>
<td>12 months</td>
<td>See WARRANTY EXCLUSIONS OR EXCEPTIONS below.</td>
</tr>
<tr>
<td>Vibration Welder</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>All Production Tooling</td>
<td>12 months, one-time replacement. (6-month, one-time replacement for carbide tipped horns)</td>
<td>Prototype Renshape 460 (Renwood) tools employ reusable content, and therefore remain the property of Dukane.</td>
</tr>
<tr>
<td>Prototype Tooling</td>
<td>• All tooling made from Renshape 460 (Renwood) are only warranted for 200 part-cycles.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All other prototype tooling is warranted as described in each specific proposal.</td>
<td></td>
</tr>
</tbody>
</table>

All Dukane warranties commence on the date of the original shipment of the equipment or tooling, and duration is based upon a single shift per day, five day per week operation. The warranty period on rentals of new equipment that are converted to a purchase are deemed to have commenced on the initial date of rental.

These warranties are limited to equipment and tooling operated and maintained per Dukane’s written instructions, and used under normal operating conditions. These warranties do not include normal wear or normal wear items, and do not cover damage attributable to misuse, improper installation, faulty repair, unauthorized alteration or modification, neglect, or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or properly installed on the equipment.

The warranty on all Dukane equipment and tooling purchased and installed in North America is a parts and labor warranty only. Equipment installed outside of North America, regardless of where it was purchased, is covered by Dukane’s International Warranty Policy. In all cases, when on-site service is required, Travel & Living (T&L) expenses will be billed at cost. Warranty service labor (including travel time) at the customer’s site is provided on a Monday through Friday (excluding holidays), 7 a.m. to 7 p.m. basis. Any warranty service requested outside of these hours is available on a charge basis equal to 150% of Dukane’s prevailing rate for technical service work.

Any equipment or tooling that proves to be defective in material or workmanship during the stated warranty period will be repaired or replaced at the sole discretion of Dukane Corporation when Dukane is promptly notified in writing. During the warranty period, defective equipment, components, or tooling that are returned properly packed with all transportation charges prepaid will be repaired or replaced and returned to the end-user without charge. Shipments of warranty parts will be via standard, non-expedited delivery service. Expedited shipment requests are subject to freight charges to the Purchaser.

Computers, PLCs, CRTs, LCDs, touch screens, and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty from the date of shipment when used under normal operating conditions, and not subjected to misuse, abuse, or neglect. For all other equipment, components, or parts included in equipment or systems from Dukane, but not manufactured by Dukane or its affiliates, this warranty shall be limited in time and extent to the warranty given to Dukane by the OEM.

### Equipment Warranty Exclusions or Exceptions:

When specified in our quotation, a limited warranty may apply to certain components of the equipment, and/or for certain types of applications of the equipment, including those noted below.

- This warranty is void if the ultrasonic welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds 250 milliseconds.
- Ultrasonic Equipment and tooling used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2000 hours or 12 months from shipment, whichever occurs first.
- Any ultrasonic horn or tool quoted and sold as “Experimental” is not warranted.
- This warranty does not cover failures of equipment and components attributable to improper cooling or overheating of the transducer.
- Ultrasonic Horn Analyzers have a 12-month warranty.
- Ultrasonic Transducers have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

The forgoing warranty is the sole and exclusive warranty and is made in lieu of all other warranties, express, implied or statutory, including without limitation any warranties of merchantability, fitness for a particular purpose, description, quality, productiveness or any other warranty. The remedy set forth in this warranty policy is the sole and exclusive remedy of Purchaser and in no event shall Dukane be liable for any compensatory, consequential, special, punitive or contingent damages or for damages arising from any delay in performance by Dukane under this warranty.
Specifications

- Regulatory Compliance
- Dimensions
- Operating Environment
- Model Power Ratings
- AC Power Requirements
- Model Number Coding

Regulatory Compliance.................................101
  Federal Communications Commission .......... 101
  CE Marking (Conformité Europeéne) ............. 101
Dimensions..................................................102
  Vertical Rack–Mount Chassis ...................... 102
  Horizontal Benchtop Chassis ..................... 103
Operating Environment...............................104
AC Power Requirements .........................105
Interpreting The DPC Model Number ..........106
Regulatory Agency Compliance

FCC
The equipment complies with the following Federal Communications Commission regulations.

• The limits for FCC measurement procedure MP-5, “Methods of Measurement of Radio Noise Emissions from ISM Equipment”, pursuant to FCC Title 47 Part 18 for Ultrasonic Equipment.

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 equipment complies with the following CE requirements.

• The EMC Directive 2004/108/EC for Heavy Industrial —
  EN 61000-6-4: 2001
  EN 55011: 2003
  EN 61000-6-2: 2001
  EN61000–4–2
  EN61000–4–3
  EN61000–4–4
  EN61000–4–5
  EN61000–4–6
  EN61000–4–8
  EN61000–4–11
  EN 60204: 2006

• The Low Voltage Directive 2006/95/EC.

• The Machinery Directive 2006/42/EC.
  EN 60204: 2006

CAUTION
DO NOT make any modifications to the DPC or associated cables as the changes may result in violating one or more regulations under which this equipment is manufactured.
Dimensions

Figure 10–1  DPC I  Vertical Back–Panel Mount Chassis Dimensions
Figure 10–2 DPC I Horizontal Benchtop Chassis Dimensions
Operating Environment

Operate the DPC I within these guidelines:

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

**Altitude:** 4570 m (15,000 ft)

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

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

**Vibration:**
- 10 minutes along each of the 3 major axis
- 10 Hz to 55 Hz in one minute cycles
- Hold for 5 minutes at 55 Hz
- Displacement (inches pk–pk) 0.015

**Shock:**
- 1.0 G, 1/2 sine, 11 msec duration
- 0.3 G rms from 5 to 500Hz, 5 minutes each axis

Nonoperating storage guidelines:

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

**Altitude:** 12,190 m (40,000 ft)

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

**Humidity:** 5% to 95% Non-condensing @ 0°C to +30°C

**Vibration:**
- 15 minutes along each of the 3 major axis
- 10 Hz to 55 Hz in one minute cycles
- Hold for 10 minutes at 55 Hz
- Displacement (inches pk–pk) 0.015

**Shock:**
- 5.0 G, 1/2 sine, 11 msec duration
- 2.0 G from 5 to 500Hz, 5 minutes each axis
AC Power Requirements

The AC input power requirements depend on the frequency and output power rating of the DPC I. Table 10—I below, lists both the AC requirements (maximum current drawn before overload) and the service rating of the AC outlet each DPC I model is designed for.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>DPC I Generator Model</th>
<th>Peak Power Rating (Watts)</th>
<th>Input Power Requirements (Min–Max Voltage @ Max Current)</th>
<th>AC Outlet Current Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 kHz</td>
<td>2050</td>
<td>500</td>
<td>90–130V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 4 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td>2120</td>
<td>1200</td>
<td>90–130V 50/60 Hz @ 15 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td>2170</td>
<td>1700</td>
<td>180–260V 50/60 Hz @ 12 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td>2220</td>
<td>2200</td>
<td>180–260V 50/60 Hz @ 15 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>30 kHz</td>
<td>3150</td>
<td>1500</td>
<td>180–260V 50/60 Hz @ 12 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 kHz</td>
<td>4035</td>
<td>350</td>
<td>90–130V 50/60 Hz @ 6 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 4 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td>4070</td>
<td>700</td>
<td>90–130V 50/60 Hz @ 12 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td>4100</td>
<td>1000</td>
<td>90–130V 50/60 Hz @ 15 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>50 kHz</td>
<td>5015</td>
<td>150</td>
<td>90–130V 50/60 Hz @ 6 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 4 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>70 kHz</td>
<td>7010</td>
<td>100</td>
<td>90–130V 50/60 Hz @ 6 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180–260V 50/60 Hz @ 4 Amps</td>
<td>15 Amps</td>
</tr>
</tbody>
</table>

Table 10—I  DPC I Generator Model and Power Requirements
Interpreting the DPC I Model Number

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Generator</th>
<th>Probe</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 = 20 kHz</td>
<td>2120LN4</td>
<td>-</td>
<td>VL1</td>
</tr>
<tr>
<td>3 = 30 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = 40 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = 50 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 = 70 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rated Power**
- L010 = 100 W
- L015 = 150 W
- L035 = 350 W
- L050 = 500 W
- L070 = 700 W
- 100 = 1000 W
- 120 = 1200 W
- 150 = 1500 W
- 170 = 1700 W
- 220 = 2200 W

**Input Power Module**
- L = Low Power Module
  - (All models except those listed below)
- H = High Power Module
  - (1700W & 2200W 20kHz
  - 1500W 30kHz
  - 1000W 40kHz)

**Probe Level**
- V = Vertical Backpanel Mount
- H = Horizontal Benchtop
- L1 = Level 1 Generator

**Transducers**
- 4 = 4 Ceramics
  - (All 20kHz and 30kHz units and the 1000W 40kHz)
- 2 = 2 Ceramics
  - (350W & 700W 40kHz, All 50kHz and 70kHz)

**NOTE**
Figure 10–3 is designed to help you determine which options your DPC has. It is not meant to suggest that all combinations of these options are possible.
## List of Figures

| Figure 2-1 | 120 Volt, Grounded, 3-Prong Receptacle | 10 |
| Figure 2-2 | 220 Volt, Grounded, 3-Prong Receptacle | 10 |
| Figure 2-3 | International 220/240V Grounding | 11 |
| Figure 3-1 | Vertical Back–Plate Installation of DPC I | 15 |
| Figure 3-2 | Benchtop Placement of DPC I | 16 |
| Figure 3-3 | RFI Grounding Arrangement | 17 |
| Figure 3-4 | Benchtop DPC I Hand Probe Cable Connections | 19 |
| Figure 3-5 | Vertical Chassis DPC I Hand Probe Cable Connections | 19 |
| Figure 3-6 | Benchtop DPC I Automation Cable Connections | 20 |
| Figure 3-7 | Vertical Chassis DPC I Automation Cable Connections | 21 |
| Figure 4-1 | Front Control Panel of Vertical Chassis DPC I | 25 |
| Figure 4-2 | Bottom Panel of Vertical Chassis DPC I | 26 |
| Figure 4-3 | Front Control Panel of Benchtop DPC I | 27 |
| Figure 4-4 | Rear Panel of Benchtop DPC I | 28 |
| Figure 4-5 | Normal Operation | 29 |
| Figure 4-6 | Warning Indicators | 29 |
| Figure 4-7 | System Status Display | 30 |
| Figure 4-8 | Generator Control Keys | 31 |
| Figure 4-9 | Vertical Chassis Power Indicator | 31 |
| Figure 4-10 | Horizontal Chassis Power Indicator | 31 |
| Figure 4-11 | 110–4004 Interface Board Test Points | 32 |
| Figure 4-12 | Internal Adjustment and Setup/Test Connector | 33 |
| Figure 4-13 | Setup/Test Module 43A1570 | 33 |
| Figure 4-14 | Type 110–4004 Interface Board Layout and Jumper Blocks | 35 |
| Figure 4-15 | Type 110–4061 Interface Board Layout and Jumper Blocks | 37 |
| Figure 4-16 | Current Loop Connector and Loop Status Indicator | 38 |
| Figure 4-17 | Current Loop Transfer Function Graph | 38 |
| Figure 4-18 | HD–15 System I/O Connector | 39 |
| Figure 4-19 | Cable End of System I/O Connector | 39 |
| Figure 4-20 | HD–15 System I/O Connector | 42 |
| Figure 4-21 | Cable End of System I/O Connector | 42 |
| Figure 4-22 | Ultrasound Output on Bottom of Vertical Chassis | 44 |
| Figure 4-23 | Ultrasound Output on Front of Benchtop Chassis | 44 |
| Figure 4-24 | Vertical Chassis AC Power Section | 45 |
| Figure 4-25 | Benchtop Rear Panel AC Power Section | 45 |
| Figure 5-1 | Hand Probe, Horn and Replaceable Tip | 49 |
| Figure 5-2 | Probe with Booster and Horn | 50 |
| Figure 5-3 | Pistol Grip For 20kHz Hand Probe | 51 |
| Figure 5-4 | Torque Reaction Arm and Hand Probe | 52 |
| Figure 5-5 | 41C26 20kHz DPC Hand Probe | 53 |
Figure 5-6  41C27  Standard 20kHz Probe ........................................... 54
Figure 5-7  41C30  Heavy Duty 20kHz Probe ...................................... 55
Figure 5-8  41S30  Sealed HD 20kHz Probe ........................................ 56
Figure 5-9  41A33  40kHz DPC Hand Probe ........................................ 57
Figure 5-10  41C28  Standard 40kHz Probe .......................................... 58
Figure 5-11  41S28  Sealed HD 40kHz Probe ....................................... 59
Figure 5-12  Replaceable Tip Installation .............................................. 60
Figure 5-13  Stack Assembly Procedure ............................................. 63
Figure 5-14  Torque Value Conversion Graph ....................................... 63
Figure 5-15  Assembly & Disassembly of Hand Probe ............................ 64
Figure 5-16  Assembly & Disassembly of Probe Stack with Booster ........... 65
Figure 5-17  Separating The Horn From The Booster .............................. 66
Figure 5-18  Removing A Replaceable Tip ............................................. 67

Figure 6-1  Front Panel Startup ................................................................. 71
Figure 6-2  System Tests ........................................................................ 72
Figure 6-3  Stopping the Weld Cycle ...................................................... 74

Figure 7-1  Bottom Ultrasonic Output Connector .................................... 77
Figure 7-2  Generator ON LINE ............................................................... 78
Figure 7-3  Cable End of System I/O Connector ....................................... 78
Figure 7-4  Troubleshooting Flowchart - Part 1 ...................................... 81
Figure 7-5  Troubleshooting Flowchart - Part 2 ...................................... 82

Figure 8-1  Location of Air Cooling Vents ............................................... 86
Figure 8-2  Location of Stack Mating Surfaces ....................................... 87
Figure 8-3  Flat Surface With Even Contact ......................................... 88
Figure 8-4  Surface With Uneven Contact ............................................. 88
Figure 8-5  Crowned Surface ................................................................. 89
Figure 8-6  Center Depression ................................................................. 89
Figure 8-7  Manual Resurfacing ............................................................. 91

Figure 10-1  Vertical Back–Panel Mount Dimensions .............................. 102
Figure 10-2  Horizontal Benchtop Dimensions ..................................... 103
Figure 10-3  Interpreting the DPC I Model Number ............................... 106

Figure C-1  Manual Control Switch ......................................................... 113
Figure C-2  Automation Control Switches ............................................. 114
Figure C-3  Non–Isolated Current Sink Switch ....................................... 115
Figure C-4  Non–Isolated Current Source Switch ................................... 116
Figure C-5  Isolated Power Source Switch ............................................. 117
APPENDIX B

List of Tables

Table 3—I Contents of DPC Shipping Container ........................................... 15
Table 3—II Benchtop AC Power Cord Part Numbers ...................................... 17

Table 4—I System I/O Connector Signals (110–4004) ...................................... 39
Table 4—II System I/O Cable Color Code ...................................................... 40
Table 4—III System I/O Connector Signals (110–4061) .................................... 42

Table 5—I 20kHz and 40kHz Compatible Probes ........................................... 52
Table 5—II Stud Torque Unit Conversions ...................................................... 61
Table 5—III Stack Torque Unit Conversions .................................................. 63

Table 10—I DPC I Generator Model and Power Requirements ...................... 105
This page intentionally left blank
User Supplied Circuitry

- Manual Control Switch
- Automation Control Switch
- Isolated Automation Control

Manual Switch Circuit........................................113
Automation Switch Circuits.................................114
Non–Isolated Switch Circuits.................................115
  Current Sink...............................................115
  Current Source............................................116
Isolated Switch Circuit......................................117
This page intentionally left blank
Manual Switch Circuit

Figure C–1 is an example of a typical, user supplied manual control circuit connected to the DPC Control Input connector. The switch contacts are connected to the Switch Closure Input at Pin #8 and DPC Ground at Pin #2.

NOTE
The drawings and circuits shown in this section are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Dukane does not assume responsibility or liability for actual use based upon the examples shown in this section.
Automation Switch Circuits

Figure C–2 shows examples of various types of user supplied automation control circuits connected to the DPC Input. These examples can be used in place of the low–side or high–side switches in Figure C–3 and Figure C–4.

---

**Figure C–2 Automation Control Switches**
Non–Isolated Switch Circuits

Current Sink Control Circuit

Figure C–3 illustrates an automation control circuit connected to the low side of one of the Isolated Automation Inputs. Even though the switch drives an Opto–Isolator, it is still connected to DPC ground and not isolated. Any of the examples in Figure C–2 can be used in place of the block labeled **Low Side Switch Sinks Current To Ground**.

To use a current sink switch, set the SH702 jumper block on the interface board to the JU724 position. Refer to Figures 4–14 and 4–15, depending on the type of interface board you have, for the jumper block location.

![Diagram of Non–Isolated Current Sink Switch](image)
Current Source Control Circuit

Figure C–4 illustrates an automation control circuit connected to the highside of one of the Isolated Automation Inputs. Even though the switch drives an Opto–Isolator, it is still connected to the DPC power source and not isolated. Any of the examples in Figure C–2 can be used in place of the block labeled **High Side Switch Sources Current**.

To use a current source switch, set the SH702 jumper block on the interface board to the JU725 position. Refer to Figures 4–14 and 4–15, depending on the type of interface board you have, for the jumper block location.
Isolated Switch Circuit

Isolated Power Source Circuit

Figure C–5 illustrates a fully isolated circuit connected to the Isolated Automation Inputs. This requires an external power supply to drive the switch.

To use an isolated power source, set the SH702 jumper block on the interface board to the JU726 position. Refer to Figures 4–14 and 4–15, depending on the type of interface board you have, for the jumper block location.
This page intentionally left blank
Current Loop Fault ................................................................. 38
Current Loop Transfer Function ........................................ 38
Current Sink Circuit ............................................................. 115
Current Source Circuit ......................................................... 116-117

D
Dimensions .......................................................................... 102-103
Disassembly, Probe Stack ................................................... 64-65
Display, Status ...................................................................... 25, 27, 30
Dow–Corning #4 Grease ....................................................... 60
DPC Test/Setup Module ........................................................ 33
Dukane Website ...................................................................... 95

E
Electrical Safety & Grounding ............................................. 10-11
Email Addresses, Dukane ..................................................... 95-96
Excess Flash During Welding ................................................ 80

F
FAULT Status Display .......................................................... 30, 79
FAULT Status Output ............................................................ 39-43
FCC Compliance .................................................................. 101
Features of DPC I ................................................................. 6
Flowchart, Troubleshooting .................................................. 81-82
Flow–Thru Cooling Tunnel .................................................... 6
Frequency Monitor Output .................................................... 32, 35, 36
Front Panel Displays ............................................................. 25, 27, 30, 71-74, 85
Front Panel Layout ............................................................... 25, 27
Front Panel Maintenance ..................................................... 85
Fuse, Status Relay ................................................................. 32

G
Ground Lug ........................................................................... 17, 45
Grounding ............................................................................ 10, 17

H
Hand Grip for Probe ............................................................ 51
Hand Probe Drawings .......................................................... 53-59
Hand Probe Selection .......................................................... 51-52
Hand Probe System Cabling ............................................... 18-19
HD–15 Connector (System I/O) .............................................. 25, 27, 39-43
Health and Safety Tips ........................................................ 9
Horn ..................................................................................... 50
Horn Contact Surfaces .......................................................... 88
Horn Corrosion ..................................................................... 90
Horn Crowning .................................................................... 89
Horn Disassembly ............................................................... 64-65
Horn Resurfacing ................................................................. 90-91
<table>
<thead>
<tr>
<th>Section</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Connector, System</td>
<td>25, 27</td>
</tr>
<tr>
<td>Inconsistent Welds</td>
<td>80</td>
</tr>
<tr>
<td>Indicator, Power</td>
<td>25, 27, 31, 71</td>
</tr>
<tr>
<td>Input Signal Description</td>
<td>40-43</td>
</tr>
<tr>
<td>INPUT TEST Status Display</td>
<td>30, 71, 80</td>
</tr>
<tr>
<td>Input, Isolated</td>
<td>39-43</td>
</tr>
<tr>
<td>Interface Board Differences</td>
<td>32</td>
</tr>
<tr>
<td>Interface Board Layout (110–4004)</td>
<td>32, 35</td>
</tr>
<tr>
<td>Interface Board Layout (110–4061)</td>
<td>37</td>
</tr>
<tr>
<td>Internet Site</td>
<td>95</td>
</tr>
<tr>
<td>ISO 9001 Certification</td>
<td>Inside Back Cover</td>
</tr>
<tr>
<td>Isolated Inputs</td>
<td>39-43</td>
</tr>
<tr>
<td>Jumper Blocks (110–4004)</td>
<td>34-35</td>
</tr>
<tr>
<td>Jumper Blocks (110–4061)</td>
<td>36-37</td>
</tr>
<tr>
<td>Key Features of DPC I</td>
<td>6</td>
</tr>
<tr>
<td>Keys, Generator Control</td>
<td>25, 27, 31</td>
</tr>
<tr>
<td>Line Voltage Regulation</td>
<td>6</td>
</tr>
<tr>
<td>Linear Ramp Soft Start</td>
<td>6</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>6</td>
</tr>
<tr>
<td>Loop Fault</td>
<td>38</td>
</tr>
<tr>
<td>Maintenance, Scheduled</td>
<td>88</td>
</tr>
<tr>
<td>Maintenance, Stack</td>
<td>87</td>
</tr>
<tr>
<td>Manual Amplitude Adjustment</td>
<td>33</td>
</tr>
<tr>
<td>Mating Surfaces (Horn)</td>
<td>88-90</td>
</tr>
<tr>
<td>Model Number Coding</td>
<td>106</td>
</tr>
<tr>
<td>Model Number Tag Location</td>
<td>45</td>
</tr>
<tr>
<td>Mount, Hand Probe</td>
<td>52</td>
</tr>
<tr>
<td>Mounting Stud, Horn &amp; Booster</td>
<td>61</td>
</tr>
<tr>
<td>Mounting the Probe Stack</td>
<td>68</td>
</tr>
<tr>
<td>OFF LINE Key</td>
<td>31, 74</td>
</tr>
<tr>
<td>OFF LINE Status Display</td>
<td>30, 74</td>
</tr>
<tr>
<td>ON LINE Key</td>
<td>31, 71</td>
</tr>
<tr>
<td>ON LINE Status Display</td>
<td>30, 72</td>
</tr>
<tr>
<td>Operating Environment</td>
<td>104</td>
</tr>
<tr>
<td>Operational Checkout</td>
<td>73</td>
</tr>
<tr>
<td>OSHA Compliance</td>
<td>10</td>
</tr>
<tr>
<td>Output Signal Description</td>
<td>39-43</td>
</tr>
<tr>
<td>OVERLOAD Status Display</td>
<td>30, 79</td>
</tr>
</tbody>
</table>
OVERLOAD Status Output .......................................................... 39-43
OVERTEMP Status Display ...................................................... 30, 79
OVERTEMP Status Output ...................................................... 39-43

P
Pistol Grip, Hand Probe ......................................................... 51
Placement of DPC .................................................................. 15-16
Plastics Health Notice ............................................................ 10
Power Indicator ...................................................................... 25, 27, 31, 71
Power Output Display ........................................................... 29
Power Requirements, AC ....................................................... 105
Power Signal Output .............................................................. 42-43
Power Switch, AC ................................................................. 26, 28, 45
Probe Cooling Air .................................................................. 51, 56, 59
Probe Configuration ............................................................... 49
Probe Noise, Unusual ............................................................ 72
Probe Selection ..................................................................... 51
Probe Stack Assembly ........................................................... 60
Probe Troubleshooting .......................................................... 77
Pulse Width Modulation ....................................................... 6

R
Rack Mounting DPC, Vertical Chassis ...................................... 15, 86
Rear Panel Layout (Benchtop) .................................................. 28
Remote Amplitude Control .................................................... 38
Replaceable Tips ................................................................... 60, 66
Resurfacing, Horn ................................................................. 91-92
RFI Considerations ............................................................... 17

S
Safety Tips .............................................................................. 9-10
Scheduled Maintenance ......................................................... 87-88
Self Test .................................................................................. 71
Serial Number Location ......................................................... 26, 28, 45
Setup/Test Module ................................................................. 33
Spanner Wrench, Probe Stack ............................................... 60
Specifications ........................................................................ 102-105
Stack Assembly ................................................................. 60-63
Stack Disassembly ............................................................... 64-65
Stack Inspection .................................................................... 88
Stack Maintenance ............................................................... 87
Status Control Keys .............................................................. 25, 27, 31
Status Display ................................................................. 25, 27, 30, 71-74, 85
Status Driver Normal State Selection Jumper ....................... 34-37
Status Driver Output Signal .................................................. 39-43
Status Driver Selection Jumper ............................................. 34-37
Status Panel ................................................................. 25, 27, 29-31
Status Relay ................................................................. 32
<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Relay Fuse</td>
</tr>
<tr>
<td>Status Relay State Selection Jumper</td>
</tr>
<tr>
<td>Stopping The Weld Cycle</td>
</tr>
<tr>
<td>Storage Conditions</td>
</tr>
<tr>
<td>Studs, Horn &amp; Booster</td>
</tr>
<tr>
<td>Switch Circuits, User Supplied</td>
</tr>
<tr>
<td>System Cabling</td>
</tr>
<tr>
<td>System Control Input Jumper</td>
</tr>
<tr>
<td>System Fault Status Output</td>
</tr>
<tr>
<td>System I/O Connector</td>
</tr>
<tr>
<td>System Input Signal Descriptions</td>
</tr>
<tr>
<td>System Output Signal Descriptions</td>
</tr>
<tr>
<td>System Power Output Display</td>
</tr>
<tr>
<td>System Test</td>
</tr>
</tbody>
</table>

**T**

| Telephone Numbers, Dukane | 95-96 |
| TEST Key | 31, 72, 80 |
| Test, Self | 71 |
| Test, System | 72 |
| Test/Setup Module | 33 |
| Theory of Operation, Ultrasonics | 49 |
| Tips, Replaceable | 60, 66 |
| Titanium | 50 |
| Torque Specifications | 60-63 |
| Torque Units Conversion | 61, 63 |
| Transducer Cooling | 51 |
| Troubleshooting, Equipment | 77-82 |
| Troubleshooting, Welds | 80 |

**U**

| Ultrasonic Active Status Output | 39-43 |
| Ultrasonic Output Connector | 26, 27, 44 |
| Ultrasonic Welding, Theory of | 49 |
| Universal Power Supply | 6 |

**V**

| Vents, Cooling Air | 15-16, 77, 86 |
| Vertical Mount Chassis | 15, 25 |
| Vise, Booster/Transducer Clamping | 66 |

**W**

| Warranty, Domestic | 97 |
| Warranty, International | 98 |
| Warranty, Tooling | 98 |
| Weak Welds | 80 |
| Website, Dukane | 95 |
| Weld Troubleshooting | 80 |
Dukane ISO

ISO CERTIFICATION

Dukane chose to become ISO 9001:2008 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 9001:2008 certification, you must prove to one of the quality system registrar groups that you meet three requirements:

1. Leadership
2. Involvement

The ISO 9001:2008 standard establishes 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.

Dukane products are manufactured in ISO registered facilities.
Please refer to our website at:
www.dukane.com/us/sales/intsales.htm
to locate your local representative.