Original Instructions
4000874 - REV. 00

EMERSON


# DCX 222 RM

## SIG Power Supply

# Operating Manual

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BRANSON

## Manual Change Information

At Branson, we strive to maintain our position as the leader in ultrasonics plastics joining, metal welding, cleaning and related technologies by continually improving our circuits and components in our equipment. These improvements are incorporated as soon as they are developed and thoroughly tested.

Information concerning any improvements will be added to the appropriate technical documentation at its next revision and printing. Therefore, when requesting service assistance for specific units, note the Revision information found on this document, and refer to the printing date which appears on this page.

## Copyright and Trademark Notice

## Foreword

Congratulations on your choice of a Branson Ultrasonics Corporation system!

The Branson DCX 222 RM SIG Power Supply system is process equipment for the joining of plastic parts using ultrasonic energy. It is the newest generation of product using this sophisticated technology for a variety of customer applications. This Operating Manual is part of the documentation set for this system, and must be kept with the equipment.

Thank you for choosing Branson!

## Introduction

This manual is arranged into several structured chapters which will help you find the information you may need to know to safely handle, install, set up, program, operate, and/or maintain this product. Please refer to the Table of Contents and/or the Index of this manual to find the information you may be looking for. In the event you require additional assistance or information, please contact our Product Support department (see 1.3 How to Contact Branson for information on how to contact them) or your local Branson representative.

# Table of Contents

# List of Figures

# List of Tables

**Chapter 7: Operation**



**Chapter 8: Maintenance**



**Appendix A: Signal Diagrams**

# Chapter 1: Safety and Support

## 1.1 Safety Requirements and Warnings

This chapter contains an explanation of the different Safety Notice symbols and icons found both in this manual and on the product itself and provides additional safety information for ultrasonic welding. This chapter also describes how to contact Branson for assistance.

### 1.1.1 Symbols Found in this Manual

These symbols used throughout this manual warrant special attention:

| WARNING | Indicates a possible danger |
|---|---|
|  | If these risks are not avoided, death or severe injury might result. |

| WARNING | High Voltage Hazard |
|---|---|
|  | High voltage. Turn power off before servicing. |

| WARNING | Corrosive Material Hazard |
|---|---|
|  | Corrosive material. Avoid contact with eyes and skin. Wear proper protection. |

| CAUTION | Indicates a possible danger |
|---|---|
|  | If these risks are not avoided, slight or minor injury might result. |

| CAUTION | Loud Noise Hazard |
|---|---|
|  | Loud Noise Hazard. Ear protection must be worn. |

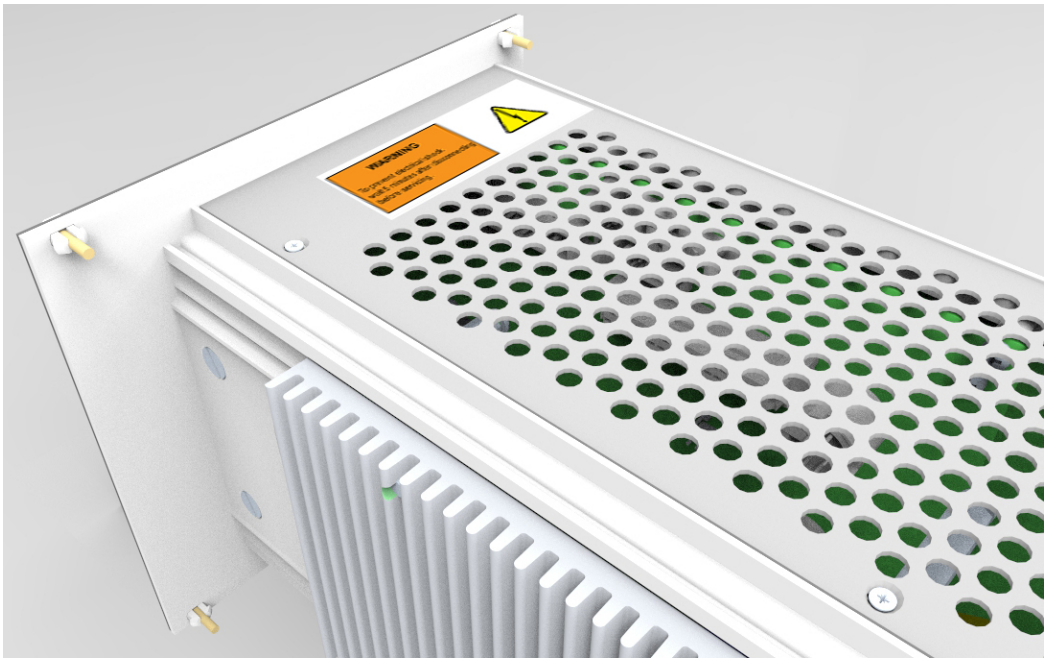
| CAUTION | Heavy Object |
|---|---|
|  | Heavy object. To avoid muscle strain or back injury, use lifting aids and proper lifting techniques. |

| NOTICE | Indicates a possible damaging situation |
|---|---|
|  | If this situation is not avoided, the system or something in its vicinity might get damaged.<br>Application types and other important or useful information are emphasized. |

### 1.1.2 Symbols Found on the Product

The DCX 222 RM SIG Power Supply has several safety-related labels on it to indicate the presence of hazardous voltages inside the unit.

**Figure 1.1** Safety-related Labels found on the DCX 222 RM SIG Power Supply



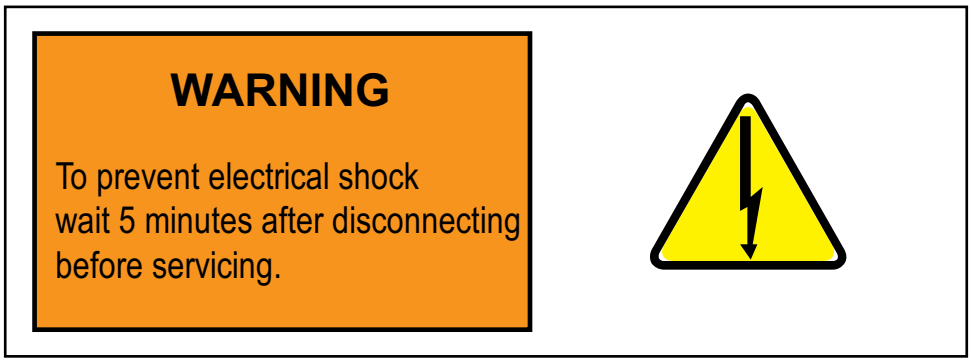
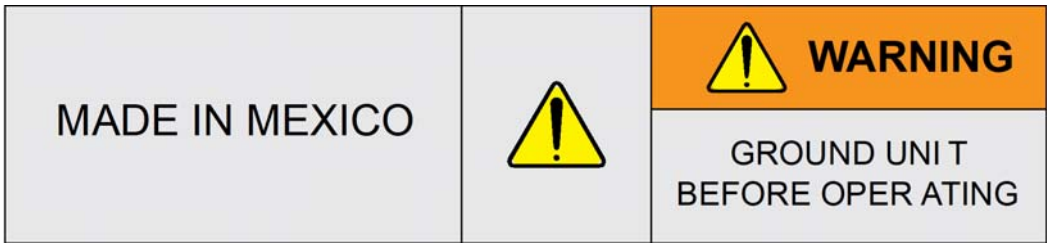


**Figure 1.2** Safety-related Labels found on the DCX 222 RM SIG Power Supply (back)

## 1.2 General Precautions

Take the following precautions before servicing the power supply:

- To prevent the possibility of an electrical shock, always plug the power supply into a grounded power source
- To prevent the possibility of an electrical shock, ground the power supply by securing an AWG #8 gauge grounded conductor to the ground screw located next to the air outlet
- Power supplies produce high voltage. Before working on the power supply assembly, do the following:

  Turn off the power supply

  Unplug main power

  Allow at least 5 minutes for capacitors to discharge
- High voltage is present in the power supply. Do not operate with the cover removed
- High line voltages exist in the ultrasonic power supply assembly. Common points are tied to circuit reference, not chassis ground. Therefore, use only non-grounded, battery-powered multimeters when testing the power supply assembly. Using other types of test equipment can present a shock hazard
- Keep hands from under the horn. Down force (pressure) and ultrasonic vibrations can cause injury
- Do not cycle the welding system if either the RF cable or converter is disconnected
- When using larger horns, avoid situations where fingers could be pinched between the horn and the fixture
- Ensure power supply installation is performed by qualified personnel and in accordance with local standards and regulations

| CAUTION | Loud Noise Hazard |
|---|---|
|  | Sound level and frequency of the noise emitted during the ultrasonic assembly process may depend upon a. type of application, b. size, shape and composition of the material being assembled, c. shape and material of the holding fixture, d. welder setup parameters and e. tool design.<br><br>Some parts vibrate at an audible frequency during the process. Some or all of these factors may result in an uncomfortable noise being emitted during the process.<br><br>In such cases operators may need to be provided with personal protective equipment. See 29 CFR (Code of Federal Regulations) 1910.95 Occupational Noise Exposure. |

### 1.2.1 Intended Use of the System

The DCX 222 RM SIG Power Supply and components are designed to be used as part of an ultrasonic welding system. These are designed for a wide variety of welding or processing applications.

If the equipment is used in a manner not specified by Branson, the protection provided by the equipment may be impaired.

Branson Ultrasonics Corp. designs and manufactures machines giving the first priority to safety precautions, to allow customers to use the machines safely and effectively. Only trained operators must run and service the equipment. Untrained operators can misuse the equipment or ignore safety instructions that can result in personal injury or equipment damage. It is most essential that all operators and service personnel pay attention to safety instructions when operating and servicing the equipment.

### 1.2.2 Emissions

Because of the various types of toxic or injurious gases that may be liberated during the welding based on the material being processed, sufficient ventilation must be provided to prevent a concentration of these gases in excess of 0.1 ppm. Check with your materials suppliers for recommended protection when processing their materials.

| CAUTION | Corrosive Material Hazard |
|---|---|
|  | Processing of many materials, such as PVC, can be hazardous to an operator's health and could cause corrosion/damage to the equipment. Use proper ventilation and take protective measures. |

### 1.2.3 Setting up the Workplace

Measures for setting up a workplace for safe operation of the ultrasonic welder are outlined in Chapter 5: Installation and Setup

### 1.2.4 Regulatory Compliance

This product meets electrical safety requirements and EMC (Electromagnetic Compliance) requirements for North America and the European Union.

## 1.3 How to Contact Branson

Branson is here to help you. We appreciate your business and are interested in helping you successfully use our products. To contact Branson for help, use the following telephone numbers, or contact the office nearest you.

### 1.3.1 Authorized Service Centers (Europe)

**Table 1.1** Authorized Service Centers (Europe)

| Name | Address | Tel/Fax Number |
|---|---|---|
| Branson Ultraschall<br>European Headquarters<br>Germany | Niederlassung der EMERSON Technologies GmbH & Co. OHG<br>Waldstraße 53-55<br>63128 Dietzenbach, Germany | Tel: 49 (0)6074/497-0<br>Tel: 49 (0)6074/497-784<br>Fax: 49 (0)6074/497-199<br>info@branson.de |

# Chapter 2: Introduction

## 2.1 Models Covered

This manual covers all models of the DCX 222 RM SIG Power Supply.

**Table 2.1** Models Covered in this manual

| Frequency | Power | EDP |
|---|---|---|
| 20 kHz | 2200 W | 159-132-2113 |

### 2.1.1 Overview of This Model

**Figure 2.1** The DCX 222 RM SIG Power Supply


The DCX 222 RM SIG Power Supply generates ultrasonic energy through an ultrasonic converter for welding plastics. One model is available, with a frequency of 20 kHz and a power range 2.2 kW. The power supply also contains a microprocessor-based controller module that provides for control and monitoring of welding operations.

The power supply provides the following features:

**End of Weld Store:** Allows the power supply to track and store the frequency of the last weld.

**Timed Seek:** Tracks and starts the stack on the correct frequency. It does this by running the horn at a low-level amplitude (10%) to find and lock on to the stack operating frequency. Seeks are timed from the moment sonics was last activated.

**Line Regulation:** Maintains converter amplitude by regulating for variances in the line voltages.

**Load Regulation:** Maintains converter amplitude over the full range of rated power.

**System Protection:** Protects the power supply by providing six levels of protection.

- Voltage
- Current
- Phase
- Temperature
- Power
- Frequency

**Web Page Interface:** Provides access, via Ethernet connection, to power supply information, diagnostics, and configuration web pages.

**Frequency Offset:** Provides for applying an external frequency offset to the operating frequency.

**Amplitude Control:** Provides complete control of amplitude throughout the weld cycle: programmable starting ramp, and digital setting of weld amplitude.

## 2.2 Compatibility with other Branson Products

**Table 2.2** Power Supply Compatibility with Branson Converters

| DCX 222 RM Models | Converter |
|---|---|
| 20 kHz | 932 AS |

## 2.3 Features

### 2.3.1 The Welding System

The welding system consists of a DCX 222 RM SIG Power Supply and a converter-booster-horn stack. The system can perform ultrasonic welding, inserting, staking, spot welding, swaging, degating, and continuous ultrasonic operations. It is designed for automated, semi-automated and/or manual production operations.

### 2.3.2 The Power Supply

The DCX 222 RM SIG Power Supply consists of an ultrasonic power supply assembly with a system controller and user interfaces. The ultrasonic power supply assembly converts conventional 50/60 Hz line current to 20 kHz, electrical energy. The system controller controls the welding system.

Listed below are the control features of the DCX 222 RM SIG Power Supply ultrasonic welding system:

**Table 2.3** Control Features

| Name | Description |
|---|---|
| Autotuning | Branson power supply tuning ensures that the system is running at peak efficiency. |
| Digital Amplitude Setting | This feature allows you to set the exact amplitude necessary for your application, allowing increased range and setting repeatability over analog systems. |
| Frequency Offset | This process feature allows a user to set an offset relative to the starting frequency, for certain specific applications, where the force imparted on the fixture or anvil causes a frequency shift in the stack's operation. You must only use this feature when advised to do so by Branson. |
| Horn Signature | Using the DCX 222 RM SIG Power Supply Web Page Interface, you may scan your ultrasonic stack to view its operating frequency on your computer, using digital readouts to give you the best picture of the stack's operation. |
| LCD (Liquid Crystal Display) | Provides a clear visual interface to monitor and configure the system. |
| Line Regulation | Maintains converter amplitude by regulating for variances in the line voltages. |
| Load Regulation | Maintains converter amplitude over the full range of rated power. |
| Membrane Keys | Front panel controls are designed for high reliability and immunity from factory dust and oils. |
| User ID and Passcodes | Allows for keeping track of user access to the DCX 222 RM SIG Power Supply Web Page Interface. |
| Ramp Starting | The starting of the DCX 222 RM SIG Power Supply and horn is done at a rate that helps reduce electrical and mechanical stress on the system. The horn start rate may be adjusted for some tough-to-start applications. |

**Table 2.3** Control Features

| Name | Description |
|---|---|
| Seek | Ensures operation at resonance; minimizes tuning errors; and operates the stack at low amplitude (10%), then provides a means of sensing and storing the resonant operating frequency value. |
| Start-up Diagnostics | At start-up, the controls test the major internal components. |
| System Protection | Protects the power supply by providing six levels of protection: voltage, current, phase, temperature, power, and frequency. |
| Timed Seek | When enabled, will do a Seek once every minute to update horn resonant frequency to memory. This is especially useful when the welding process affects the actual temperature of the horn, causing a resonant frequency shift. |
| True Watt-meter | The controls on the power supply include a true watt-meter for accurate measurement of power and energy. |
| Web Page Interface | Provides access, via Ethernet connection, to power supply information, diagnostics, and configuration web pages. |

### 2.3.3 The Actuator

The DCX 222 RM SIG Power Supply does not provide actuator control functions, and does not interface with actuator signals.

### 2.3.4 Converter/Booster/Horn Assembly

## The Converter

The ultrasonic electrical energy from the power supply is applied to the converter (sometimes called the transducer). This transforms the high frequency electrical oscillations into mechanical vibrations at the same frequency as the electrical oscillations. The heart of the converter is piezoelectric ceramic elements. When subjected to an alternating voltage, these elements alternately expand and contract, resulting in better than 90% conversion of electrical to mechanical energy.

## The Booster

Success in ultrasonic assembly depends on the right amplitude of movement at the horn face. Amplitude is a function of horn shape, which is largely determined by the size and form of the parts to be assembled. The booster can be used as a mechanical transformer to increase or decrease the amplitude of vibrations applied to the parts through the horn.

The booster is a resonant half-wave section of aluminum or titanium. It is mounted between the converter and the horn, as part of the ultrasonic stack. It also provides a clamping point for rigid stack mounting.

Boosters are designed to resonate at the same frequency as the converter with which they are used. Boosters are usually mounted at a nodal (minimum vibration) point of axial motion. This minimizes the loss of energy and prevents vibration from being transmitted to the stack supporting structure.

## The Horn

The horn is selected or designed for a specific application. Each horn is tuned typically as a half-wave section that applies the necessary force and vibration uniformly to the parts to be assembled. It transfers ultrasonic vibrations from the converter to the workpiece. The horn is mounted to the booster as part of the ultrasonic stack.

Depending on their profile, horns are referred to as stepped, conical, exponential, bar, or catenoidal. The shape of the horn determines the amplitude at the face of the horn. Depending on the application, horns can be made from titanium alloys, aluminum, or steel. Titanium alloys are the best materials for horn fabrication due to their high level of strength and low loss. Aluminum horns are usually chrome- or nickel-plated or hard-coated to reduce wear. Steel horns are for low amplitude requiring hardness, such as ultrasonic insertion applications.

## 2.4 Controls and Indicators

### 2.4.1 DCX 222 RM SIG Power Supply Front Panel

**Figure 2.2** DCX 222 RM SIG Power Supply Front Panel Controls and Indicators


**Table 2.4** DCX 222 RM SIG Power Supply Front Panel Controls and Indicators

| Reference | Description |
|---|---|
|  | **LCD**<br>For detailed information refer to Figure 2.3 LCD Description and Table 2.5 LCD Description. |
|  | **Up / Down Keys**<br>Use to adjust the amplitude of ultrasonic vibrations (10% to 100%). Also used to adjust weld mode parameters, select registers and edit register values. |
|  | **Alarm Reset Key**<br>Use the Reset key to reset alarms.<br>When changing system registers, use the Reset key to set a register back to its default value after entering the register and before editing the value. |

**Table 2.4** DCX 222 RM SIG Power Supply Front Panel Controls and Indicators

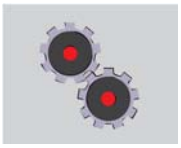
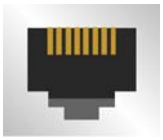
| Reference | Description |
|---|---|
|  | **Configuration Key**<br>Use the Configuration key to change system registers. Registers are used to change system parameters. For information on using the Configuration key to set system registers see 7.5 Configuring the Power Supply Registers. |
|  | **Ultrasonics Test Key**<br>Use the Test key to perform an ultrasonic test. Test performs a seek and then ramps the amplitude to the current setting. |
|  | **Ethernet Port**<br>Use the Ethernet Port to connect to the DCX 222 RM SIG Power Supply Web Page Interface. |
|  | **Power-On Indicator**<br>Lights when the power supply is connected to main power. |
|  | **24 V Indicator**<br>Lights when 24 V DC are supplied to the DCX 222 RM SIG Power Supply. |

**Figure 2.3** LCD Description

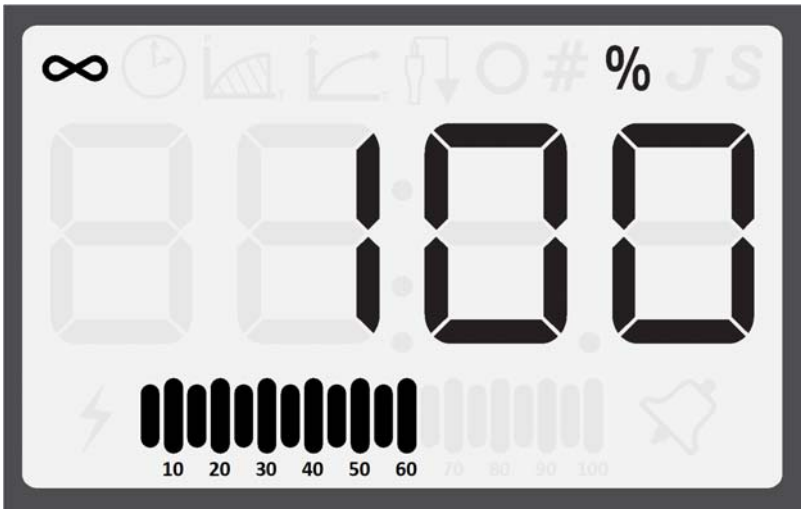
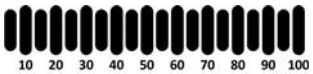



**Table 2.5** LCD Description

| Reference | Description |
|---|---|
|  | **Numeric Display**<br>Displays the Power Supply amplitude settings, register numbers, register values or alarm numbers. |
|  | **Continuous Mode Icon**<br>Indicates the power supply is running in Continuous mode. When in Continuous mode, the amplitude setting is shown on the numeric display in conjunction with the **%** icon. The amplitude setting may range from 10% to 100%. For more information see Chapter 7: Operation. |
|  | **Time Mode Icon**<br>Indicates the power supply is running in Continuous mode. When in Continuous mode, the amplitude setting is shown on the numeric display in conjunction with the **%** icon. The amplitude setting may range from 10% to 100%. For more information see 7.1.2 Selecting Time Mode. |
|  | **Energy Mode Icon**<br>Indicates the power supply is running in Energy mode. When in Energy mode, the weld energy setting is shown on the numeric display in conjunction with the **J** icon. The energy setting may range from 1 Joule to 9999 Joules. For more information see 7.1.3 Selecting Energy Mode. |
|  | **Circle Icon**<br>Indicates that the value shown on the numeric display is a register value. Use up and down keys to modify the register value. For more information see 7.5 Configuring the Power Supply Registers. |

**Table 2.5** LCD Description

| Reference | Description |
|---|---|
| # | **Number Sign Icon**<br>Indicates that the value shown on the numeric display is a register number. Use up and down keys to select a register. For more information see 7.5 Configuring the Power Supply Registers. |
| % | **Percentage Icon**<br>Indicates that the value shown on the numeric display represents a percentage. When in Peak Power mode, the value shown on the numeric display represents a percentage of the power supply rated power. If not in Peak Power mode, the value shown on the numeric represents the amplitude setting. |
| J | **Joule Icon**<br>Indicates that the value shown on the numeric display represents energy. |
| S | **Time Icon**<br>Indicates that the value shown on the numeric display represents time in seconds. |
|  | **Sonics Active Indicator**<br>Indicates ultrasonics is running. |
|  | **Power/Frequency Bar-Graph**<br>Shows the true percentage of ultrasonic power during a weld cycle. The bar-graph can be configured to show the peak power or the memory frequency at the end of each weld or test cycle. For instructions on how to modify this setting see 7.5 Configuring the Power Supply Registers.<br>For detailed bar-graph description and bar-graph reading examples, see 7.6.1 Power Bar-Graph Interpretation and 7.6.2 Frequency Bar-Graph Interpretation. |
|  | **Alarm Icon**<br>A flashing icon which indicates and alarm condition. |

## 2.4.2 DCX 222 RM SIG Power Supply Connections

**Figure 2.4** DCX 222 RM SIG Power Supply Front Panel

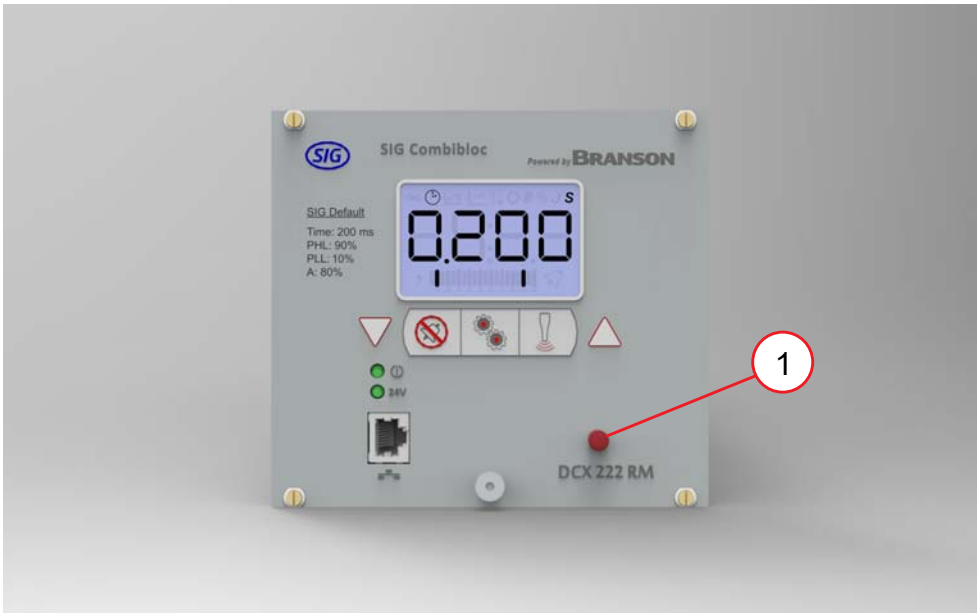



**Figure 2.5** DCX 222 RM SIG Power Supply Back Panel

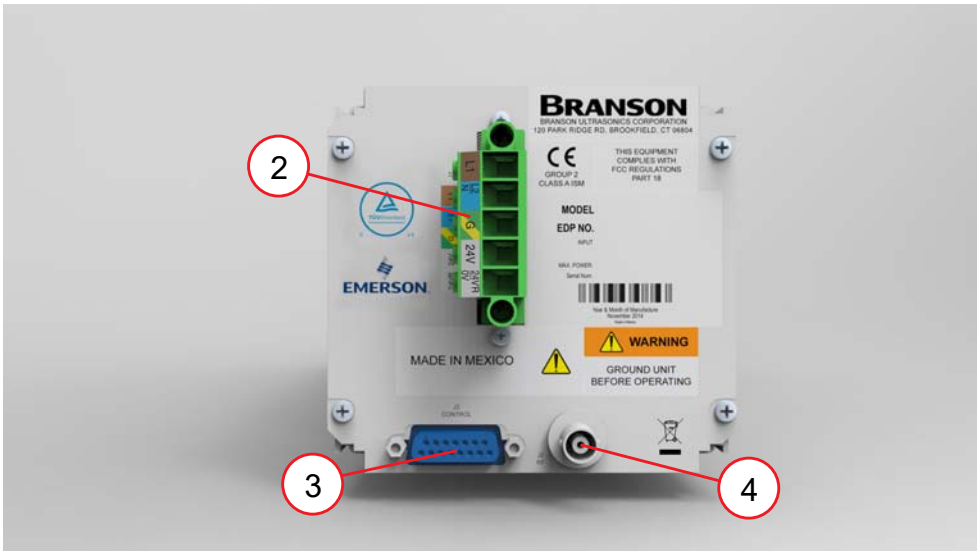



**Table 2.6** Connections to the DCX 222 RM SIG Power Supply

| Item | Name | Function |
|---|---|---|
| 1 | Power Out Connector | Binding post connector provides power out read-out.<br>0 V: 0% Power<br>10 V: 100% Power |
| 2 | Line Input Connector | Detachable connector block for connecting the input power. For wiring details refer to Chapter 5: Installation and Setup. |

**Table 2.6** Connections to the DCX 222 RM SIG Power Supply

| Item | Name | Function |
|---|---|---|
| 3 | User I/O Connector | Provides the necessary input/output signals to interface with user automation or control interfaces. For detailed information on interfacing with the DCX 222 RM SIG Power Supply refer to Chapter 5: Installation and Setup. |
| 4 | RF Connector | MHV connector for RF cable, which provides ultrasonic energy to the converter. |

## 2.5 Welding Systems

### 2.5.1 Principle of Operation

Thermoplastic parts are welded ultrasonically by applying high frequency vibrations to the parts being assembled. The vibrations, through surface and intermolecular friction, produce a sharp rise in temperature at the welding interface.

When the temperature is high enough to melt the plastic, there is a flow of material between the parts. When the vibrations stop, the material solidifies under pressure and a weld results.

### 2.5.2 Weld System Applications

DCX 222 RM SIG Power Supply weld systems can be used for the following applications:

- Ultrasonic welding
- Cutting and sealing thermoplastic fabric and film
- Staking, spot welding, swaging, and degating thermoplastic parts
- Other ultrasonic processing applications

DCX 222 RM SIG Power Supply weld systems typically consist of a power supply operated with a fixed converter-booster-horn stack.

## 2.6 Glossary

The following terminology may be encountered when using or operating a DCX 222 RM SIG Power Supply ultrasonic welding system:

**Table 2.7** Glossary

| Name | Description |
|---|---|
| Actuator | The unit which houses the converter/booster/horn stack assembly in a rigid mounting, allowing the stack to move up and down, either mechanically or pneumatically, applying force to the part at a user-adjustable force and velocity. |
| Alarm | Visual indication of error. |
| Amplitude Control | The ability to set amplitude digitally or by an external control. |
| Amplitude | The peak-to-peak movement at the horn face. Always expressed as a percentage of the maximum. |
| Booster | A one-half-wavelength-long resonant metal section mounted between the converter and horn, sometimes having a change in cross-sectional area between the input and output surfaces. The booster mechanically alters the amplitude of vibrations received from the converter, and imparts the new amplitude to the horn. |
| Clamping Force | The pounds or kilograms exerted by the horn onto the workpiece. |
| Cold Start | Restores the settings of the power supply back to its original condition. |
| Converter | The device that converts electrical energy into mechanical vibrations at a high frequency (an ultrasonic rate). |
| Counters | A record of the number of preset cycles recorded in the power supply. |
| Degating | Removing a molded part from its runner system |
| Energy Director | A triangular-shaped projection of plastic material which concentrates the ultrasonic energy at the joint interface of a plastic part. |
| External Amplitude Control | Enables you to access real-time amplitude control directly via the user I/O connector. |
| External Frequency Control | Enables you to access real-time frequency offset control directly via the user I/O connector. |
| Fixture | A device for holding a part in position for assembly. |
| Flash | Material displaced from the joint area. |
| Forming | Reshaping a section of thermoplastic. |
| Fretting Corrosion | A black surface condition, that results from friction between metal parts, that appears on the converter-booster-horn stack mating surfaces. |
| Frequency | The operating frequency of the ultrasonic stack. The frequency stored is measured at the end of the ultrasonic portion of the cycle (when ultrasonics are terminated). |

**Table 2.7** Glossary

| Name | Description |
|---|---|
| Frequency Offset | An offset factor applied to the ultrasonic frequency stored in the power supply. |
| Gain | The ratio of output to input amplitude of a horn or booster. |
| Horn | A bar or metal section, usually one half-wavelength-long which transfers vibratory energy to the workpiece. |
| Horn Amplitude | The peak-to-peak displacement of a horn at its work face. |
| Horn Signature | A scan to enhance selection of operating frequency and control parameters. |
| Insertion | The process of embedding a metal component in plastic. |
| Interface | 1. The contact surface of two mating parts.<br>2. The connection between two pieces of equipment. |
| Joint | The weld surfaces. |
| Parameter | A unique factor or element which affects the welding operation in a particular mode. |
| Parameter Range | Valid range of parameters accepted for a particular setup. |
| Power Supply | The electronic instrument in an ultrasonic assembly system which changes conventional 50/60 Hz electrical power into high frequency electrical power at 20 kHz, 30 kHz or 40 kHz. |
| Seek | The activation of ultrasonics at a low-level (10%) amplitude, for the purpose of finding the resonant frequency of the stack. |
| Staking | The process of melting and reforming a plastic stud to mechanically lock a dissimilar material in place. |
| Swaging | The process of capturing another component of an assembly by melting and reforming a ridge of plastic. |
| Thermoplastic | A polymer which undergoes a reversible change of state when subjected to heat. |
| Thermoset | A polymer which undergoes an irreversible change when subjected to heat. |
| Ultrasonic Power | Presence of ultrasonic power at the horn face. |
| Ultrasonic Welding | The use of ultrasonic vibrations to generate heat and subsequently melt the mating surfaces of two thermoplastic parts. When ultrasonic vibrations stop, the molten material resolidifies, and a weld occurs. |
| User ID | A unique 12 character long alphanumeric ID used to keep track of user access to the web page interface. |
| Weld System | A combination of components required to perform an ultrasonic operation. Usually consists of a power supply, converter, booster, and horn, with either an actuator or a handheld device, or in a fixed, mounted location. |

# Chapter 3: Delivery and Handling

## 3.1 Shipping and Handling

| CAUTION | Heavy Object |
|---|---|
|  | The power supply may be heavy. Handling, unpacking, and installation may require the assistance of a colleague or the use of lifting platforms or hoists. |

### 3.1.1 Environmental Specifications

The DCX 222 RM SIG Power Supply is an electronic unit that converts line voltage to ultrasonic energy and responds to user input for regulating the weld process. Its internal components are sensitive to static discharge, and many of its components can be harmed if the unit is dropped, shipped under improper conditions, or otherwise mishandled.

The following environmental guidelines must be respected in the shipping of the power supply.

**Table 3.1** Shipping Specifications

| Environmental Condition | Acceptable Range |
|---|---|
| Storage / Shipping Temperature | -25° C to +55° C (+70° C for 24 hours) |
| Shock / Vibration (transit) | 45 g shock / 0.5 g and (3 to 100 Hz) vibration per ASTM 3332-88 and 3580-90 |
| Drop Test | ISTA Procedure 1 & 2A (while packaged) |
| Humidity | Maximum 95%, non-condensing |

## 3.2 Receiving

The DCX 222 RM SIG Power Supply is a sensitive electronic device. Many of its components can be harmed if the unit is dropped or otherwise mishandled.

### Scope of Delivery

Branson equipment is carefully checked and packed before dispatch. It is recommended, however, that you follow the procedure below upon receiving your DCX 222 RM SIG Power Supply.

### Inspect the Power Supply when it is delivered, take the following steps:

**Table 3.2** Inspect the power supply

| Step | Action |
|---|---|
| 1 | Verify that all parts are complete according to the packing slip. |
| 2 | Check the packing and the unit for damage (visual inspection). |
| 3 | Report any damage claims to your carrier immediately. |
| 4 | Determine if any component has become loose during shipping and, if necessary, tighten screws. |

| NOTICE | |
|---|---|
|  | If the goods delivered have been damaged during shipping, please contact the forwarding agent immediately. Retain packing material (for possible inspection or for sending back the unit). |

## 3.3 Unpacking the Power Supply

| NOTICE | |
|---|---|
|  | If there are any visible signs of damage to the shipping containers or the product, or you later discover hidden damage, NOTIFY YOUR CARRIER IMMEDIATELY. Save the packing material. |

The power supply is fully assembled. It is shipped in a sturdy cardboard box. Some additional items are shipped in the box with the power supply. Note orientation of packaging material in case return/repack is necessary. When unpacking the power supply, take the following steps:

**Table 3.3** Unpacking the power supply

| Step | Action |
|---|---|
| 1 | Unpack the power supply as soon as it arrives. Save the packing material |
| 2 | Verify you have all of the equipment ordered. Some components are packed inside other boxes. |
| 3 | Inspect the controls, indicators, and surface for signs of damage. |
| 4 | Remove the cover of the power supply to check if any components became loose during shipping. |

## 3.4 Take Inventory of Small Parts

**Table 3.4** Small Parts included (=x): Power Supply Assemblies

| Part or Kit | 20 kHz |
|---|---|
| Mylar® plastic film Washer Kit | X |
| Spanners (2) | X |

* Mylar is a registered trademark of DuPont Teijin Films.

### 3.4.1 Cables

The RF cable connects the power supply to the converter. For automated systems you will also need a user I/O cable to monitor and control the power supply. Check your invoice for cable types and cable lengths.

## 3.5 Returning Equipment

If you are returning equipment to Branson Ultrasonic Corporation, please call your Customer Service Representative to receive approval to return the goods. Refer to 1.3 How to Contact Branson.

# Chapter 4: Technical Specifications

## 4.1 Technical Specifications

| NOTICE | |
|---|---|
|  | All specifications are subject to change without notice. |

### 4.1.1 Environmental Specifications

The DCX 222 RM SIG Power Supply has the following environmental specifications:

**Table 4.1** Environmental Specifications

| Environmental Condition | Acceptable Range |
|---|---|
| Ambient Operating Temperature | +5° C to +50° C |
| Storage / Shipping Temperature | -25° C to +55° C |
| Operating Altitude | 2000 m |
| Humidity | Maximum 95%, non-condensing |
| IP Rating | 2X |

### 4.1.2 Electrical Specifications

The following tables list input voltage and current requirements for the DCX 222 RM SIG Power Supply.

**Table 4.2** Electrical Input Operating Voltages

| Power Supply Rating | Input Operating Voltage |
|---|---|
| All Models | 200 V to 230 V Nominal (180 V Min. to 253 V Max.), 50 Hz or 60 Hz, Single Phase |
| | 24 VDC, 2.5 A |

**Table 4.3** Input Current and Fuse Specifications

| Model | Power | Current Rating |
|---|---|---|
| 20 kHz | 2200 W | 14 A Max. @ 200 V / 15 A Fuse |

| NOTICE | |
|---|---|
|  | High duty cycles require additional cooling for the converter. For information on converter cooling refer to 5.6 Converter Cooling in Chapter 5: Installation and Setup. |

| NOTICE | |
|---|---|
|  | System average power must be limited to the specified continuous maximum. Duty cycle for each power and frequency is 1 second on and 2.4 seconds off. |

## 4.2 Physical Description

This section describes the physical dimensions of the DCX 222 RM SIG Power Supply.

| NOTICE | |
|---|---|
|  | Dimensions are nominal. |

**Table 4.4** Dimensions and Weights of DCX 222 RM SIG Power Supply

| Size | Width | Height | Depth | Weight |
|---|---|---|---|---|
| Medium | 142 mm | 128 mm | 560 mm | 5.4 kg |

For detailed dimensional information refer to Chapter 5: Installation and Setup.

# 4.3 Declaration of Conformity

**Figure 4.1** Declaration of Conformity



**EU DECLARATION OF CONFORMITY**
According to Low Voltage Directive 2014/35/EU
and the EMC Directive 2014/30/EU

We, the manufacturer
**BRANSON ULTRASONICS CORPORATION**
120 Park Ridge Rd.
Brookfield, CT 06804
USA

Represented in the community by
BRANSON ULTRASONICS, a.s.
Piestanska 1202
91501 Nove Mesto nad Vahom
Slovak Republic

Expressly declare that the equipment, to which this declaration applies,
in the state in which it was placed on the market, fulfills all the relevant provisions of the Low Voltage Directive **2014/35/EU** and EMC Directive **2014/30/EU**. This declaration has been issued under the sole responsibility of the manufacturer. The object of this declaration is in conformity with relevant Union harmonization legislation.

Ultrasonic Assembly System consisting of a

Ultrasonic Power Supply, model:
0.80 DCX(S, A, f-EIP, or f-DP) 40 RACKMT
1.50 DCX(S, A, f-EIP, or f-DP) 30 RACKMT
1.25 DCX(S, A, f-EIP, or f-DP) 20 RACKMT
1.50 DCX(S, A, f-EIP, or f-DP) 20 RACKMT
4.00 DCX(S, A, f-EIP, or f-DP) 20 RACKMT
DCX RM 222 STD
DCX RM 240 STD
DCX RM 222 B
DCX RM 240 B
DCX RM 480 STD
DCX RM 315 STD
DCX RM 211 STD
DCX RM 480 B
DCX RM 315 B
DCX RM 211 B
P/S 2.20 DCX STD 20 SIG

used with converter model: **CR-20, CR-20S, CR-20C, CH-20C, CS-20S, CS-20C, CR-30, CR-30C, CH-30, CH-30C, CS-30S, CS-30C, CR-40C, 4TR, 4TH, 4TP or 932,**
and associated cables.

The equipment, to which this declaration relates, is in conformity with the following standards:
EN 61010-1:2010, EN 55011:2009/A1:2010, EN 61000-6-2:2005/AC:2005,
EN 60529:1991/AC:1993/A1:2000/A2:2013.

DocuSigned by:
Luis Benavides
018236BFCDE147C

Brookfield CT, USA
December 21, 2021

Luis Benavides
Product Safety Officer

# Chapter 5: Installation and Setup

## 5.1 About Installation

This chapter is intended to help the installer with the basic installation and setup of your new DCX 222 RM SIG Power Supply.

| CAUTION | Heavy Object |
|---|---|
|  | The power supply, and related components are heavy. Handling, unpacking, and installation may require the assistance of a colleague or the use of lifting platforms or hoists. |

International safety-related labels are found on the power supply. Those that are of importance during installation of the system are identified in Figure 1.1 Safety-related Labels found on the DCX 222 RM SIG Power Supply and Figure 1.2 Safety-related Labels found on the DCX 222 RM SIG Power Supply (back).

## 5.2 Installation Requirements

This section covers the location requirements, mounting options, power supply dimensions, environmental requirements, and electrical requirements, to help you plan and execute your installation successfully.

### 5.2.1 Installing the DCX 222 RM SIG Power Supply Drawers in a Customer Rack

The power supply units can be installed in any rack complying with the 19” industrial standard.

For successful installation in a rack, the respective demands on the electric and cooling system have to be met.

- If multiple drawers are to be installed in a rack we recommend to provide three phase power to the rack in order to provide each drawer with a dedicated supply and one phase to each drawer
- Particular care has to be taken that the heat generated during operation is dissipated. The heat generated depends on the power output by the module and the ambient conditions
- The heat sink of the module is mounted on the right. Make sure that the cooling device is mounted in a way allowing the cooling air to pass freely on this side
- For each group of four power supply modules installed one cooling drawer is required. The cooling drawers must be installed directly under the power supplies in order to ensure sufficient cooling
- In case a filter element is used to clean the intake air, regular inspection and cleaning of the filter depending on the ambient conditions is required to maintain the airflow volume
- To prevent thermal overload, the system is protected by thermoswitches which are reset automatically after cooling down

| NOTICE | |
|---|---|
|  | Three 105 CFM fans must be placed directly underneath each unit for cooling. |

### 5.2.2 Location

The power supply should be accessible for parameter changes and settings. The power supply should be located in an area away from radiators or heating vents.

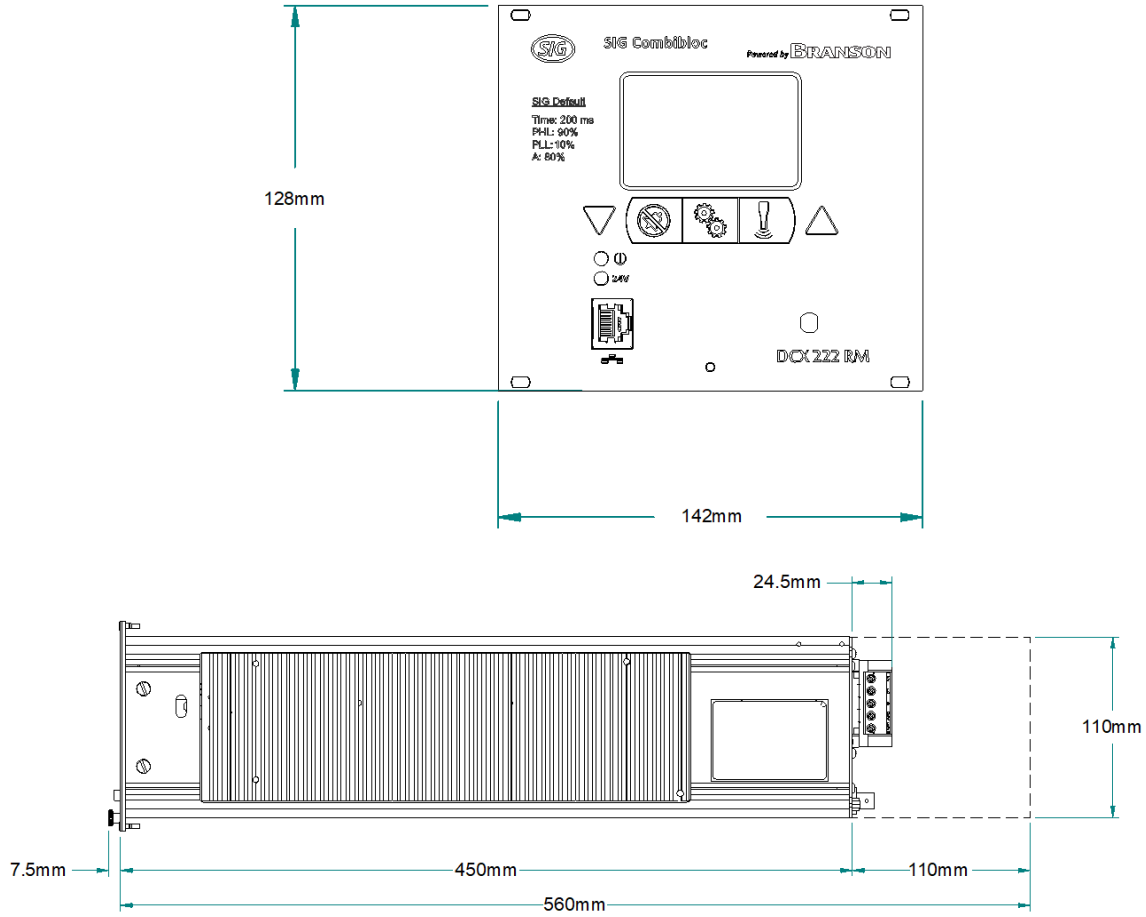
The DCX 222 RM SIG Power Supply must not be positioned so that is difficult to plug in or unplug the main power plug.

### 5.2.3 Dimensions

Refer to the illustrations on the pages that follow for dimensional drawings. All dimensions are approximate and may vary slightly:

Figure 5.1 DCX 222 RM SIG Power Supply Dimensional Drawing (Medium)

**Figure 5.1** DCX 222 RM SIG Power Supply Dimensional Drawing (Medium)



### 5.2.4 Environmental Requirements

Verify the DCX 222 RM SIG Power Supply is operated in an environment that meets the temperature and humidity requirements indicated in Table 5.1 Environmental Requirements.

**Table 5.1** Environmental Requirements

| Environmental Condition | Acceptable Range |
|---|---|
| Ambient Operating Temperature | +5° C to +50° C |
| Operating Altitude | 2000 m |
| Humidity | Maximum 95%, non-condensing |
| IP Rating | 2X |

### 5.2.5 Electrical Input Power Ratings

Connect the power supply to a single-phase, grounded, 3-wire, 50 Hz or 60 Hz 200 V to 230 V power source. Table 5.2 Input Current and Circuit Breaker Specifications lists the current and fuse ratings for the various models.

**Table 5.2** Input Current and Circuit Breaker Specifications

| Model | Power | Current Rating |
|---|---|---|
| 20 kHz | 2200 W | 14 A Max. @ 200 V / 15 A Breaker |

### 5.2.6 Pneumatic Requirements

Your welding system may require a cooling air stream for the converters. In continuous operations, or applications with longer duty cycles, it may be necessary to cool the horn as well as the converter.

Typically 80 cubic feet (2.26 $m^3$) per hour of clean, dry, compressed air are required to cool most welding operations.

To verify the 80 cubic feet (2.26 $m^3$) per hour cooling air stream required for your welding system, refer to 5.6 Converter Cooling.

## 5.3 Installation Steps

| WARNING | High Voltage Hazard |
|---|---|
|  | To prevent the possibility of an electrical shock:<br>• Ensure the power source is disconnected before beginning work on line connections<br>• Ensure the power switch on the back of the unit is in the OFF position before making any electrical connections<br>• Always plug the power supply into a grounded power source<br>• To prevent the possibility of an electrical shock, ground the power supply by securing an AWG #14 grounded conductor to the ground screw located next to the air outlet<br>• Ensure power supply installation is performed by qualified personnel and in accordance with local standards and regulations |

### Basic installation notes:

- To avoid problems associated with EMI, you should route high power lines (AC and Ultrasonic RF) away from low power lines (controls signals)
- You should consider future troubleshooting and repair when installing all wiring. All wiring should be either color coded or tagged with industrial wire tags
- The minimum cable bend radius is 5 times the cable outer diameter for RF cables
- The minimum cable bend radius is 10 times the cable outer diameter for user I/O & Ethernet cables
- Ground wires should not be shared with other equipment
- All inductive coils must be suppressed with appropriate devices, such as diodes or RC networks

### 5.3.1 Mount the Power Supply

The cable lengths are limited based on the operating frequency of the welding system. Performance and results can suffer if the RF cable is crushed, pinched, damaged or modified. Contact your Branson Representative if you have special cable requirements.

Do not place the power supply on the floor or in other locations that will allow dust, dirt or contaminants to be drawn into the power supply.

| NOTICE | |
|---|---|
| | Do not block exhaust and intake air circulation, which is needed to maintain a safe operating temperature. |

For dimensional drawings of the DCX 222 RM SIG Power Supply, see Figure 5.1 DCX 222 RM SIG Power Supply Dimensional Drawing (Medium).

### 5.3.2 Mounting Considerations

In addition to the considerations mentioned above, the LCD's viewing angle should be taken into account when selecting a location for your DCX 222 RM SIG Power Supply. The LCD is designed to be viewed from the top. Please refer to Figure 5.2 LCD Viewing Angle below when selecting a location for your DCX 222 RM SIG Power Supply.

**Figure 5.2** LCD Viewing Angle


| NOTICE | |
|---|---|
| | Optimal viewing angle is 25° above the normal to the display (indicated by 0°). |

### 5.3.3 Electrical Connections

**Figure 5.3** DCX 222 RM SIG Power Supply Connections

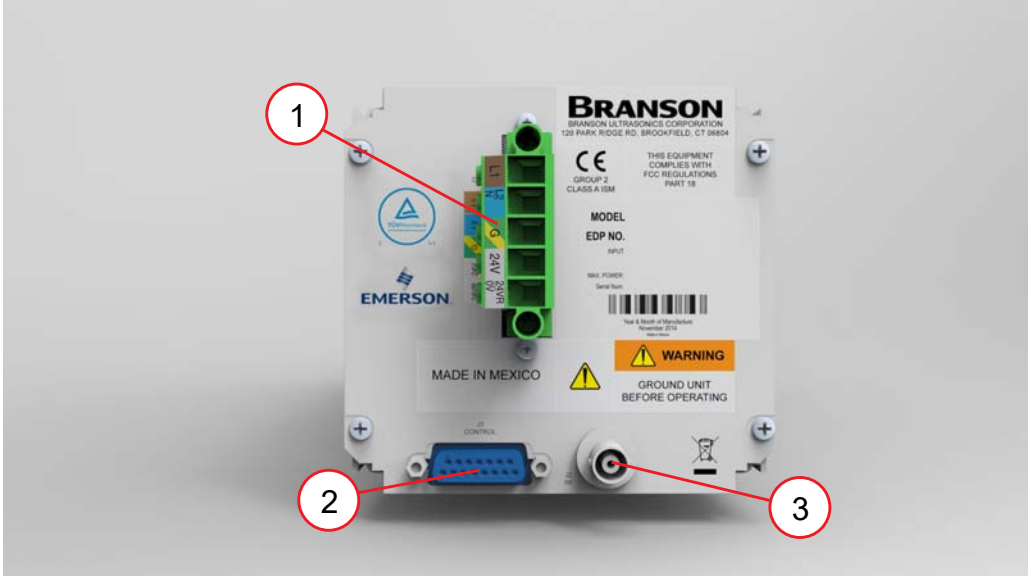



**Table 5.3** DCX 222 RM SIG Power Supply Connections

| Item | Description |
|---|---|
| 1 | Line Input Connector |
| 2 | User I/O Connector |
| 3 | RF Connector |

### 5.3.4 User I/O Connections

The user I/O is a standard interface for automation, provided on the power supply. It provides the ability to make your own interface for your automation, actuator interface, special control, or reporting needs. The interface cable has a DB15 male connector on one end, and wires on the other end. Pins are wired to ICEA standard color code (see Figure 5.4 User I/O Cable Identification and Wire Color Diagram and table Table 5.4 User I/O Cable Pin Assignments).

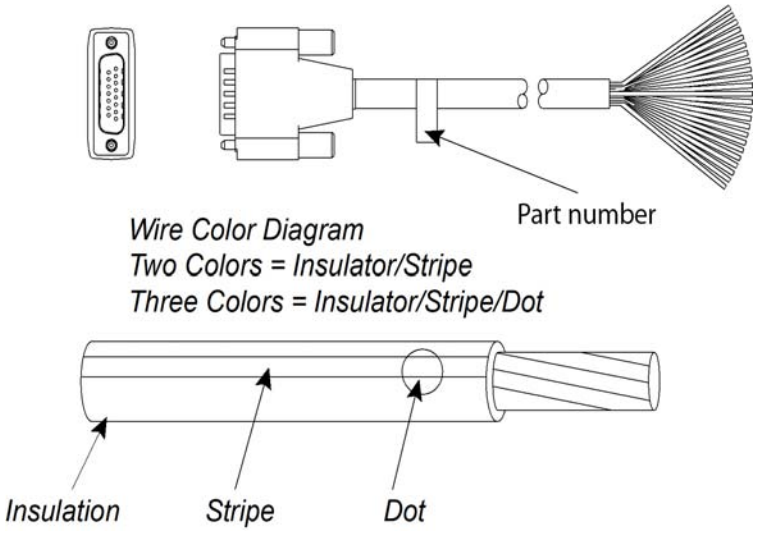
| NOTICE | |
|---|---|
| | Ensure all unused wires are properly isolated. Failure to do so may result in a power supply malfunction. |

Digital I/O functions can be configured to either active-high or active-low using the DCX 222 RM SIG Power Supply web page interface. Table 5.5 Available Digital Input Functions to Table 5.8 Available Analog Output Functions list the input and output functions available on the DCX 222 RM SIG Power Supply. See Table 5.4 User I/O Cable Pin Assignments for the user I/O pin assignments.

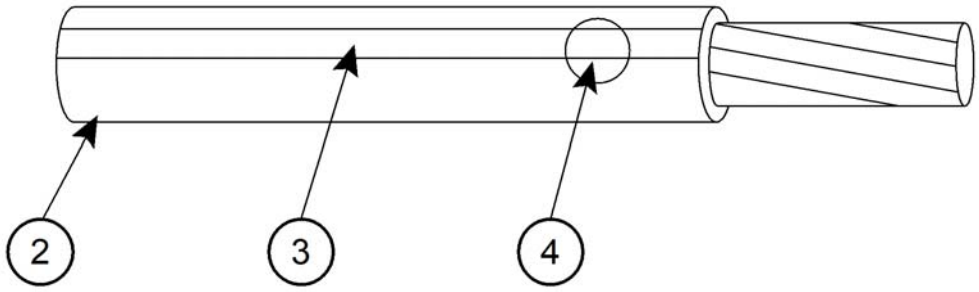
Figure 5.5 Typical Digital I/O Wiring Examples and Figure 5.6 Typical Analog I/O Wiring Examples show typical wiring examples.

**Figure 5.4** User I/O Cable Identification and Wire Color Diagram

User I/O Cable
Stripped Jacket one end,
DB15 male connector other end
(cable length as ordered)



Wire Color Diagram
Two Colors = Insulator/Stripe
Three Colors = Insulator/Stripe/Dot




| Item | Description |
|---|---|
| 1 | Part number |
| 2 | Insulation |
| 3 | Stripe |
| 4 | Dot |

### 5.3.5 User I/O Cable Pin Assignments

**Table 5.4** User I/O Cable Pin Assignments

| PIN | Input/Output Function | Signal Type | Signal Range | Color | |
|---|---|---|---|---|---|
| | | | | ISO | IEC |
| 1 | +Peak Power Limit | Digital Output | 24 V +/- 10%, 25 mA | White | Black |
| 2 | Overload Inverted (Ready) | Digital Output | 24 V +/- 10%, 25 mA | Brown | Brown |
| 3 | GND | 24 V Ground | 0 V External | Green | Red |
| 4 | Overload | Digital Output | 24 V +/- 10%, 25 mA | Yellow | Orange |
| 5 | External Start | Digital Input | 24 V +/- 10%, 25 mA | Gray | Yellow |
| 6 | External Seek | | | Pink | Green |
| 7 | +10 V | 10 V Reference | 10 V | Blue | Blue |
| 8 | GND | 24 V Ground | 0 V External | Red | Violet |
| 9 | Sonics Active | Digital Output | 24 V +/- 10%, 25 mA | Black | Gray |
| 10 | Power Out | Analog Output | 0 V to 10 V | Violet | White |
| 11 | +24 V | 24 V Source | 24 V External | Gray/ Pink | White/ Black |
| 12 | -Peak Power Limit | Digital Output | 24 V +/- 10%, 25 mA | Red/ Blue | White/ Brown |
| 13 | External Reset | Digital Input | 24 V +/- 10%, 25 mA | White/ Green | White/ Red |
| 14 | Amplitude Out | Analog Output | 0 V to 10 V | Brown /Green | White/ Orange |
| 15 | Amplitude In | Analog Input | -8 V to +10 V | White/ Yellow | White/ Yellow |

### 5.3.6 Available Digital Input Functions

**Table 5.5** Available Digital Input Functions

| Function | Description |
|---|---|
| External Reset | Resets alarm conditions. |
| External Seek | Activates ultrasonic energy at 10% amplitude for the purpose of finding the ultrasonic stack resonant frequency. |
| External Start | Activates ultrasonic energy at the currently set amplitude.<br>**NOTICE**<br>DCX 222 RM SIG Power Supply must be in ready mode before External Start. |

### 5.3.7 Available Digital Output Functions

**Table 5.6** Available Digital Output Functions

| Function | Description |
|---|---|
| Overload Inverted | Indicates the system is ready. |
| Sonics Active | Indicates sonics are active. |
| Overload | Indicates an overload alarm has occurred. |
| +Peak Power Limit | Indicates the weld has exceeded the maximum peak power set. |
| -Peak Power Limit | Indicates the weld has not reached the minimum peak power set. |

### 5.3.8 Available Analog Input Functions

**Table 5.7** Available Analog Input Functions

| Function | Description | Valid Range |
|---|---|---|
| Amplitude In | Controls the amplitude of ultrasonic energy that will be delivered by the power supply. | -8 V to +10 V<br>(10% to 100%) |

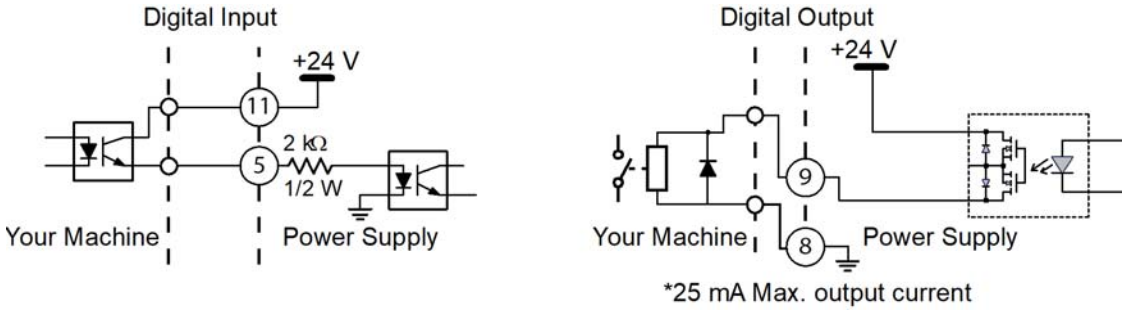
### 5.3.9 Available Analog Output Functions

**Table 5.8** Available Analog Output Functions

| Function | Description | Valid Range |
|---|---|---|
| Power Out | Provides a 0 V to 10 V output signal proportional to ultrasonic power output (0% to 100%). | 0 V to 10 V (0% to 100%) |
| Amplitude Out | Provides a 0 V to 10 V output signal proportional to amplitude (0% to 100%). | 0 V to 10 V (0% to 100%) |

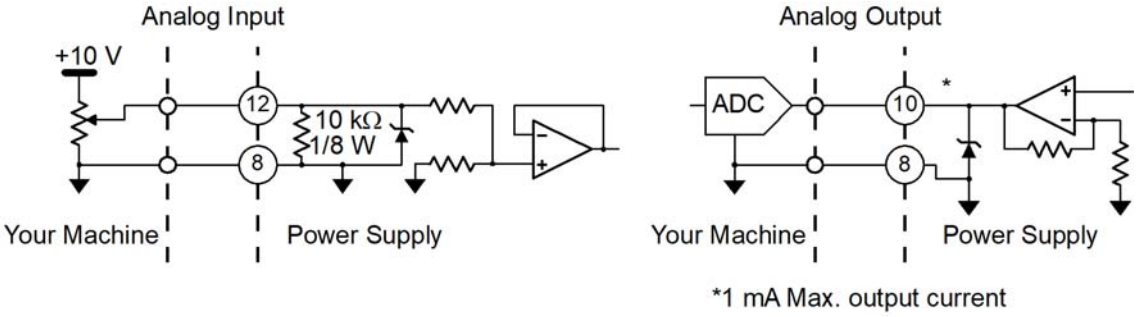
## 5.3.10 Typical Digital I/O Wiring Examples

**Figure 5.5** Typical Digital I/O Wiring Examples




## 5.3.11 Typical Analog I/O Wiring Examples

**Figure 5.6** Typical Analog I/O Wiring Examples



### 5.3.12 Output Power (RF Cable) Connection

Ultrasonic energy is delivered to the MHV connector on the power supply, which is then transmitted to the converter via the RF cable. The RF connector is located on the rear panel of the power supply.

To reduce electromagnetic interference (EMI), RF cables are equipped with a ferrite core (plastic case) on one end. This end is meant to be connected to the power supply.

| WARNING | High Voltage Hazard |
|---|---|
|  | Operating the System with the RF Cable disconnected or damaged can present an electrical shock hazard. |

| WARNING | High Voltage Hazard |
|---|---|
|  | To avoid the possibility of electrical shock. Converters need to be properly grounded. |

| NOTICE | |
|---|---|
|  | To avoid the possibility of EMI interference, ensure the RF connection to the power supply is made with the cable end that has the ferrite core box attached (see Figure 5.7 RF Cable Connection). |

**Figure 5.7** RF Cable Connection

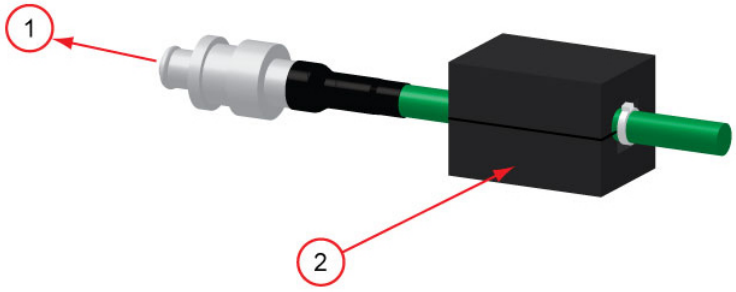



**Table 5.9** RF Cable Connection

| Item | Description |
|---|---|
| 1 | To Power Supply |
| 2 | Ferrite Core Box |

### 5.3.13 Input Power Connection

| WARNING | High Voltage Hazard |
|---|---|
|  | Ensure all electrical power is off when wiring input power to your DCX 222 RM SIG Power Supply power connector.<br>To prevent the possibility of an electrical shock, ground the power supply by securing an AWG #14 grounded conductor to the ground screw located next to the air outlet |

| WARNING | High Voltage Hazard |
|---|---|
|  | If miss-wired, the power supply can present an electrical shock hazard. |

| NOTICE | |
|---|---|
|  | The power supply can be permanently damaged if it is connected to the incorrect line voltage, or if the connection is mis-wired. |

Use the following procedure to connect the power supply to a 24 VDC 2.5A external power supply and to a single-phase, grounded 3-wire, 50 Hz or 60 Hz 200 V to 230 V power source. The 24 VDC power supply must be safety certified and agency approved.

**Table 5.10** Input Power Connection

| Step | Action |
|---|---|
| 1 | Detach the connector block on the back of the power supply. |
| 2 | Use two properly sized wires (according to local standards) to connect a 24 VDC 2.5A power supply as shown on Figure 5.3 DCX 222 RM SIG Power Supply Connections. |
| 3 | Use three properly sized wires (AWG #12, 2.5 mm or according to local standards) to connect the line 1, line 2, and ground to the connector block as shown on Figure 5.3 DCX 222 RM SIG Power Supply Connections. Choose wires according to the current rating as specified in Table 5.2 Input Current and Circuit Breaker Specifications and on the label located on the back of the unit. Be sure to use agency approved wiring and use sleeving or tubing on each wire for double insulation. |
| 4 | Secure an AWG #12 grounded conductor to the ground screw located next to the air outlet. |

**Table 5.10** Input Power Connection

| Step | Action |
|---|---|
| 5 | Connect the converter-booster-horn stack to the power supply using the RF cable. See 5.3.12 Output Power (RF Cable) Connection. |
| 6 | Ensure the power of the unit is disconnected. Plug the connector block back into the power supply. Tighten the two securing screws. |
| 7 | Connect the power supply to a single-phase, grounded, 3-wire, 50 Hz or 60 Hz 200 V to 230 V power source. |

# 5.4 Power Supply Configuration

## 5.4.1 Selecting the Alarm Mode

The DCX 222 RM SIG Power Supply activates ultrasonic power after receiving an External Start signal. Ultrasonic power remains on until you turn off the power supply or the External Start signal. The DCX 222 RM SIG Power Supply response to alarm conditions can be configured to operate in one of two modes:

**Table 5.11** Selecting the Alarm Mode

| Name | Description |
|---|---|
| Latching | In this mode the DCX 222 RM SIG Power Supply requires alarm conditions to be reset before a new weld cycle can begin. To reset alarm conditions while in this mode, either press the front panel Reset key or send an External Reset signal using the user I/O connector. |
| Non-Latching | In this mode the DCX 222 RM SIG Power Supply does not require alarm conditions to be reset, and new weld cycle can begin upon receiving an External Start signal. |

The alarm mode is factory-set to non-latching. For instruction on how to change the alarm mode refer to 7.5 Configuring the Power Supply Registers in Chapter 7: Operation and to your DCX Series Web Page Interface Instruction Manual (4000843).

## 5.4.2 Configuring the Power Supply

Certain power supply configurations can be modified from the factory setting if needed. Although not usually requiring modifications from the factory setting, the following features are selectable:

**Table 5.12** Configuring the Power Supply

| Name | Description |
|---|---|
| Amplitude control | Allows for varying the amplitude (10% to 100%) using the front panel LCD, the web page interface, or by way of external controls (analog signal applied though the user I/O analog input). |
| Latching Alarms: | Provides an option for selecting the power supply alarms to be latching (reset required) or non-latching (reset by reapplying the start signal). |
| Mode | Allows for selecting the weld mode from the different available options: Continuous, Time (s), and Energy (J). |
| Start Ramp Time | Provides a selection for different start ramp times. This controls how fast the amplitude of the horn rises from zero to the currently set amplitude. Long ramp times may be useful when using large horns or high gain stacks. |
| End of Weld Frequency Store | Provides an option for selecting if the stack frequency is stored at the end of each weld cycle. |
| Seek Ramp Time | Provides a selection for different power supply seek ramp times. |

**Table 5.12** Configuring the Power Supply

| Name | Description |
|---|---|
| Timed Seek | Provides an option for monitoring, and storing the operating frequency at timed intervals (60 seconds). Periodic frequency seeks may be helpful when welder is not used for long periods of time. Seeks are timed from the moment sonics was last activated. |
| Seek Time: | Provides an option for selecting seek duration. |
| Frequency Offset | Allows for varying the start frequency by way of external controls (analog signal applied though the user I/O analog input) or setting a fixed value using the web page interface. This is useful for certain applications, where the force imparted on the fixture or anvil causes a frequency shift in the stack's operation. |

For instruction on how to change the power supply settings refer to 7.5 Configuring the Power Supply Registers in Chapter 7: Operation and to your DCX 222 RM SIG Power Supply Web Page Interface Instruction Manual (4000843).

| NOTICE | |
|---|---|
|  | Consult with Branson before changing any default factory setting. |

## 5.5 Assembling the Acoustic Stack

| CAUTION | General Warning |
|---|---|
|  | The following procedure must be performed by a setup person. If necessary, secure the largest portion of a square or rectangular horn in a soft jawed vise. NEVER attempt to assemble or remove a horn by holding the converter housing or the booster clamp ring in a vise. |

| CAUTION | General Warning |
|---|---|
|  | Do not use silicone grease with Mylar plastic film washers. Use only 1 (one) Mylar plastic film washer of the correct inside and outside diameters at each interface. |

| NOTICE | |
|---|---|
|  | The use of a Branson torque wrench or the equivalent is recommended. EDP 101-063-787 for 20 kHz systems. |

**Figure 5.8** Assembling the Acoustic Stack

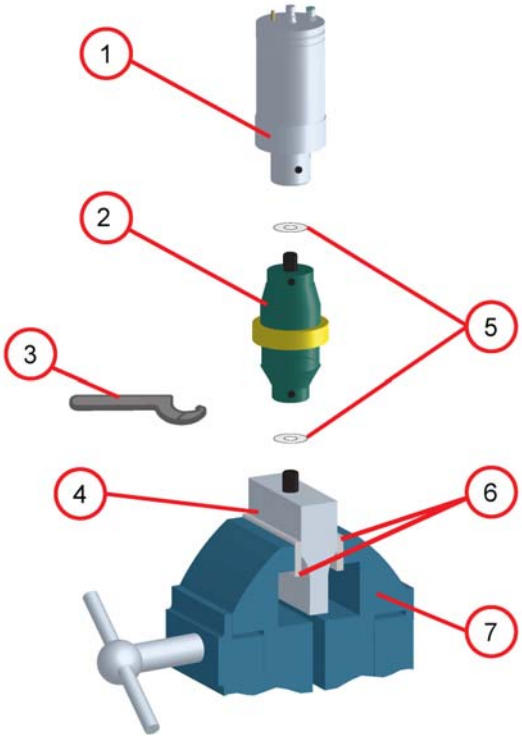



**Table 5.13** Acoustic Stack Description

| Item | Description |
|---|---|
| 1 | Converter |
| 2 | Booster |
| 3 | Spanner (provided) |
| 4 | Horn |
| 5 | See stack assembly procedure |
| 6 | Vise Jaw protectors (aluminum or soft metal) |
| 7 | Vise |

**Table 5.14** Stack Torque Values

| Frequency | Torque |
|---|---|
| 20 kHz | Converter–Booster: 50 N·m<br>Booster–Horn: 75 N·m |

**Table 5.15** Tools

| Tool | EDP Number |
|---|---|
| 20 kHz Torque Wrench Kit | 101-063-787 |
| 20 kHz Spanner Wrench | 101-118-039 |
| Mylar Plastic Film Washers (20 kHz) | 100-063-357 |

### 5.5.1 For a 20 kHz System

**Table 5.16** 20 kHz System

| Step | Action |
|---|---|
| 1 | Ensure that the mating surfaces of the converter, booster, and horn are clean, and that the threaded holes are free of foreign material. |
| 2 | Install a single Mylar plastic film washer (matching the size of the washer to the stud) to each interface. |
| 3 | Assemble the converter to the booster and the booster to the horn. |
| 4 | Torque to 50 N·m for the converter–booster and 75 N·m for the booster–horn. |

## 5.6 Converter Cooling

Converter performance and reliability can be adversely affected if the converter ceramics are subjected to temperatures above 140° F (60° C). The converter front driver temperature should not exceed 122° F (50° C).

To prolong converter life and maintain a high degree of system reliability, the converter should be cooled with clean, dry, compressed air, particularly if your application calls for continuous ultrasonic operation.

Use one of the following procedures to determine if a converter is operating close to the maximum allowable temperature. Check converter temperature immediately after substantial machine operation and without power applied to the horn.

- Press a pyrometer probe (or similar temperature measuring device) against the front driver of the converter assembly. Wait for the probe to reach the temperature of the shell. If the temperature is 120°F (49° C) or higher, the converter requires a cooling air stream
- If a temperature measuring device is unavailable, use your hand to feel the shell of the converter. If the converter is hot to touch, the converter requires a cooling air stream

High duty cycles require additional cooling for the converter. System average power must be limited to the specified continuous maximum. Higher peak power, up to the maximum acceptable power limit, with an on time of up to 10 seconds may be obtained, if appropriate off time ensures that, on average, the continuous duty maximum power is not exceeded.

**Table 5.17** Continuous Duty Max. Power & Full Power Duty Cycle

| Model | Power | Continuous Duty. Max. Power | Full Power Duty Cycles |
|---|---|---|---|
| 20 kHz | 2200 W | 660 W | 1 s on 2.4 s off (30% Duty Cycle) |

If converter cooling is required, use the following steps:

**Table 5.18** Converter Cooling Procedure

| Step | Action |
|---|---|
| 1 | Start with a 50 psi (345 kPa) air source or higher from a 0.06 in (1.5 mm) I.D. orifice |
| 2 | Perform a run of welding operations. |
| 3 | Immediately after completing the welding run, check the converter temperature. |
| 4 | If the converter is still too hot, increase the diameter of the orifice in small increments until the temperature falls within the ranges in the chart. |

A 0.06 in (1.5 mm) orifice at 50 psi (345 kPa) will result in a reading of 80 $ft^3$ (2.26 $m^3$) per hour. This should be sufficient to cool most operations requiring a cooling air stream. In continuous welding operations, or applications with longer duty cycles, it may be necessary to cool the horn as well as the converter. Horns may require cooling because of the heat transfer from contacting the work piece.

## 5.7 Testing the Installation

To test the power supply follow the procedure described in 7.8 Ultrasonics Test Procedure in Chapter 7: Operation.

## 5.8 Still Need Help?

Branson is pleased that you chose our product and we are here for you! If you need parts or technical assistance with your DCX 222 RM SIG Power Supply system, call your local Branson representative. Please refer to 1.3 How to Contact Branson for a list of Branson key contacts.

# Chapter 6: Converters and Boosters

## 6.1 Converters and Boosters

A variety of converters and boosters available for use with the DCX 222 RM SIG Power Supply are illustrated in the following pages.

| WARNING | High Voltage Hazard |
|---|---|
|  | To avoid the possibility of electrical shock. Converters need to be properly grounded. |

**Figure 6.1** 20 kHz 932 AS Converter Dimensions

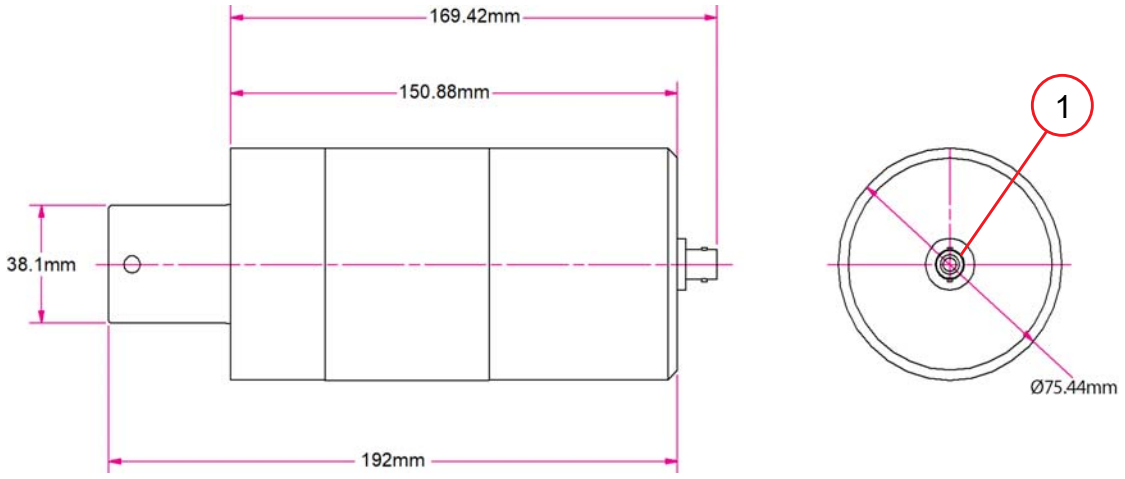



**Table 6.1** 20 kHz CH-20S Converter Dimensions

| Item | Description |
|---|---|
| 1 | MHV Connector |

**Figure 6.2** 20 kHz Booster Dimensions

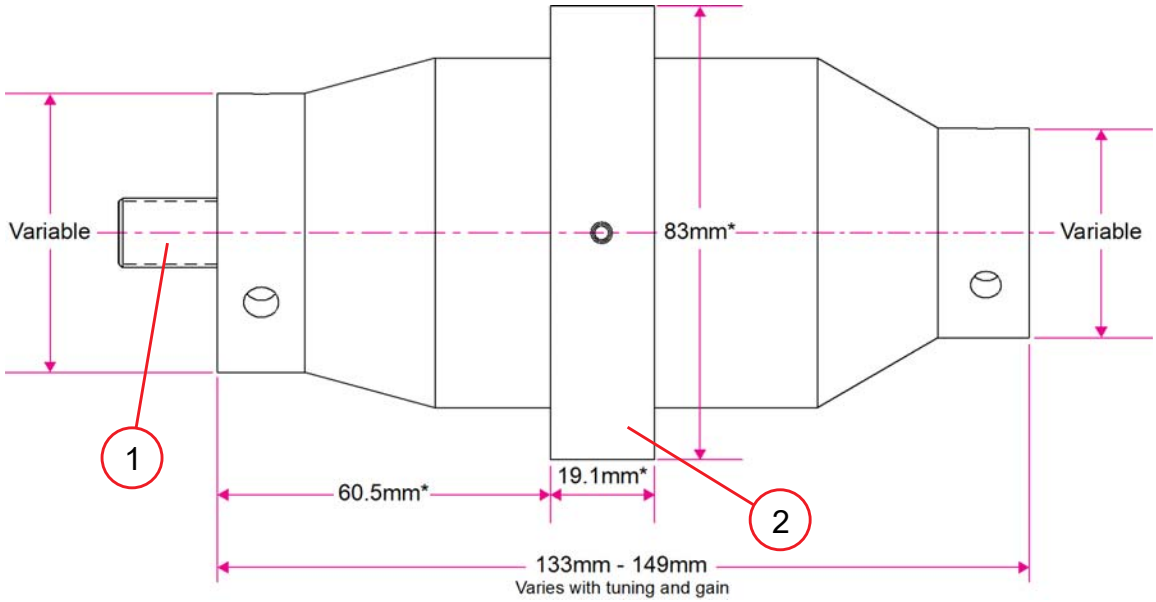



**Table 6.2** 20 kHz Booster Dimensions

| Item | Description |
|---|---|
| 1 | 1/2 - 20 x 1 - 1/4 stud (Ti boosters) |
| 2 | Grip Ring Diameter |

* These dimensions do not vary.

**Figure 6.3** 20 kHz Converter/Booster/Horn, Typical Dimensions

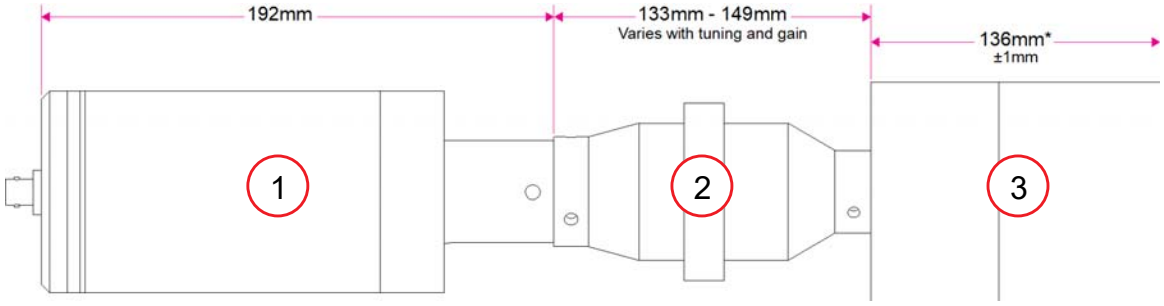



**Table 6.3** 20 kHz Converter/Booster/Horn, Typical Dimensions

| Item | Description |
|---|---|
| 1 | Converter |
| 2 | Booster |
| 3 | One-half wavelength horn |

* Overall horn length can vary beyond these typical dimensions depending on the application.

### 6.1.1 Component Functional Description

## Ultrasonic Stack

## Converter

The converter is mounted in the customer's automation as part of the ultrasonic stack. The ultrasonic electrical energy from the power supply is applied to the converter (sometimes called the transducer). This transforms the high frequency electrical oscillations into mechanical vibrations at the same frequency as the electrical oscillations. The heart of the converter are piezoelectric ceramic elements. When subjected to an alternating voltage, these elements alternately expand and contract, resulting in better than 90% conversion of electrical to mechanical energy.

## Booster

It is important to be able to modify the horn face amplitude for successful ultrasonic assembly. The booster provides a means to modify the amplitude. It is designed to couple different ratios of ultrasonic energy to the horn, which will in turn increase or decrease the amplitude at the face of the horn. This is accomplished by varying the ratios of the masses of the input and output half sections of the booster.

The booster is a resonant half-wave section of aluminum or titanium. It is mounted between the converter and the horn, as part of the ultrasonic stack. It also provides a clamping point for rigid stack mounting.

## Horn

The horn is selected or designed for a specific application. Each horn is tuned typically as a half-wave section that applies the necessary force and vibration uniformly to the parts to be assembled. It transfers ultrasonic vibrations from the converter to the workpiece. The horn is mounted to the booster as part of the ultrasonic stack.

Depending on their profile, horns are referred to as stepped, conical, exponential, bar, or catenoidal. The shape of the horn determines the amplitude at the face of the horn. Depending on the application, horns can be made from titanium alloys, aluminum, or steel. Titanium alloys are the best materials for horn fabrication due to their high level of strength and low loss. Aluminum horns are usually chrome- or nickel-plated or hard-coated to reduce wear. Steel horns are for low amplitude requiring hardness, such as ultrasonic insertion applications.

## Solid Mount Boosters

The solid mount booster is a one-half wave-length resonant section made exclusively of titanium. It is mounted between the converter and the horn, modifying the amplitude of vibration applied to the horn and providing a clamping point.

The solid mount booster is superior to prior versions in that deflection is minimized. This is the result of a redesigned clamp-ring which employs a metal-to-metal press fit rather than an O-ring assembly.

The advantage this booster offers is its improved rigidity. For continuous applications, this means more energy delivered to the product, while in plunge applications, improved alignment is possible. The solid mount provides improved positional alignment and will benefit continuous applications where high force, high side load, or high cycle rates are necessary. In plunge welding applications, overall deflection is reduced by an average of 0.0025 in. (0.064 mm) over a wide variety of materials, joint designs, and operating conditions. The results of this testing in combination with information drawn from field testing indicate that the solid mount will benefit plunge applications where precision alignment is necessary (such as staking, swaging, or insertion) or where concentricity/ parallelism is critical.

# Chapter 7: Operation

## 7.1 Setting Primary Parameters

| NOTICE | |
|---|---|
|  | There is a 2 seconds power-up delay before system is in ready mode. |

After analyzing your specific application, you can determine the Weld Mode to use to weld your parts. A Weld Mode is a set of parameters that governs the weld. (Contact the Branson Ultrasonics Applications Laboratory for more information on determining the best mode for welding your application). See 1.3 How to Contact Branson.

There are three Weld Modes to choose from Continuous, Time, and Energy modes. The following table describes each mode:

**Table 7.1** Summary of Weld Modes

| Weld Mode | Description |
|---|---|
| Continuous | On this mode, ultrasonic energy will be delivered continuously while the start signal is present. |
| Time | You select the length of time (in seconds) that ultrasonic energy will be transmitted to your parts. |
| Energy | You select the amount of energy (in Joules) that will be transmitted to your parts. (A Joule is one Watt-Second). |

| NOTICE | |
|---|---|
|  | In these modes, cutoffs can be used as secondary controls. |

### 7.1.1 Selecting Continuous Mode

In this mode, ultrasonic energy will be delivered continuously while the start signal is present. Within Continuous Mode, you can also select several other parameters, ranging from afterburst to limits and cutoffs. For more information on setting the optional parameters within Continuous Mode, or any other welding mode, refer to the DCX Web Page Instruction Manual.

**Table 7.2** Selecting Continuous Mode

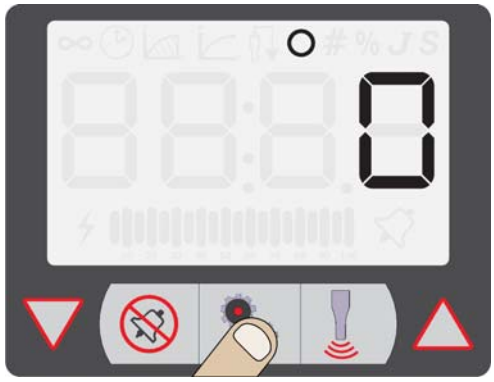
| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the number icon (#) appears on the LCD.<br>The power supply will display register 101 at every power up. |  |
| 2 | Press and release the Up/Down arrow keys to select register 138. For a detailed description of available registers refer to Table 7.18 Power Supply Registers. |  |
| 3 | Once you have reached register 138, press the Configuration key. The register value will be displayed; this is indicated by the circle icon. |  |

**Table 7.2** Selecting Continuous Mode

| Step | Action | Reference |
|---|---|---|
| 4 | Use the Up/Down arrow keys to select value 0 (Continuous mode), then press the Configuration key to confirm the selection. |  |
| 5 | Continuous mode icon and amplitude value will be displayed. |  |

### 7.1.2 Selecting Time Mode

You can use Time Mode to select the length of time that ultrasonic energy is applied to your parts. Within Time Mode, you can also select several other parameters, ranging from afterburst to limits and cutoffs. For more information on setting the optional parameters within Time Mode, or any other welding mode, refer to the DCX Web Page Instruction Manual.

**Table 7.3** Time Mode Parameters

| Parameter | Default | Max. Value | Min. Value |
|---|---|---|---|
| Time | 0.200 seconds | 30.00 seconds | 00.01 seconds |

**Table 7.4** Selecting Time Mode

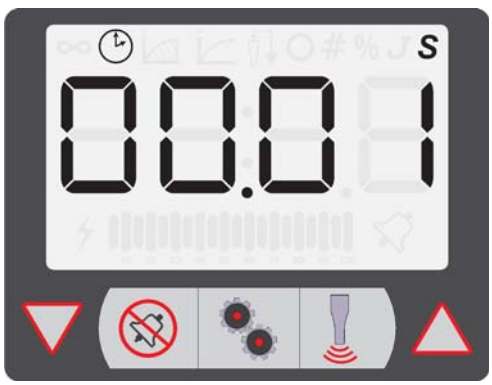
| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the number icon (#) appears on the LCD.<br>The power supply will display register 101 at every power up. |  |
| 2 | Press and release the Up/Down arrow keys to select register 138. For a detailed description of available registers refer to Table 7.18 Power Supply Registers. |  |

**Table 7.4** Selecting Time Mode

| Step | Action | Reference |
|---|---|---|
| 3 | Once you have reached register 138, press the Configuration key. The register value will be displayed; this is indicated by the circle icon. |  |
| 4 | Use the Up/Down arrow keys to select value 1 (Time mode), then press the Configuration key to confirm the selection. |  |

### 7.1.2.1 Setting Time Mode Parameters

**Table 7.5** Setting Time Mode Parameters

| Step | Action | Reference |
|---|---|---|
| 1 | Set the power supply to time mode. | See 7.1.2 Selecting Time Mode. |
| 2 | Time mode icon and parameter value will be displayed. Use the Up/Down keys to enter the desired parameter value.<br>Press the Configuration key once to confirm the selection, then press the key again to save the selection.<br>**NOTICE**<br>The value on the screen will blink X3, if the configuration button is not pressed again before the selection stops blinking, the value will not be saved and must be set again. |  |

### 7.1.3 Selecting Energy Mode

You can use Energy Mode to select the amount of ultrasonic energy that is applied to your parts. Within Energy Mode, you can also select several other parameters, ranging from afterburst to limits and cutoffs. For more information on setting the optional parameters within Energy Mode, or any other welding mode, refer to the DCX Web Page Instruction Manual.

**Table 7.6** Energy Mode Parameters

| Parameter | Default | Max. Value | Min. Value |
|---|---|---|---|
| Energy | 1 Joules | 9999 Joules | 0.1 Joules |

**Table 7.7** Selecting Energy Mode

| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the number icon (#) appears on the LCD.<br>The power supply will display register 101 at every power up. |  |
| 2 | Press and release the Up/Down arrow keys to select register 138. For a detailed description of available registers refer to Table 7.18 Power Supply Registers. |  |

**Table 7.7** Selecting Energy Mode

| Step | Action | Reference |
|---|---|---|
| 3 | Once you have reached register 138, press the Configuration key. The register value will be displayed; this is indicated by the circle icon. |  |
| 4 | Use the Up/Down arrow keys to select value 2 (Energy mode), then press the Configuration key to confirm the selection. |  |

### 7.1.3.1 Setting Energy Mode Parameters

**Table 7.8** Setting Energy Mode Parameters

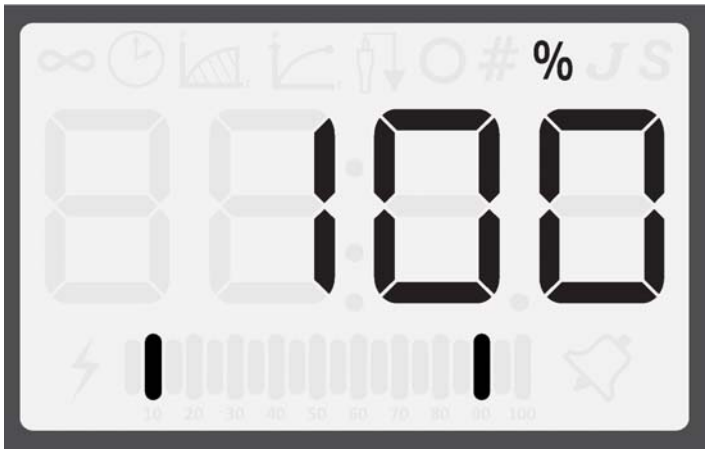
| Step | Action | Reference |
|---|---|---|
| 1 | Set the power supply to energy mode. | See 7.1.3 Selecting Energy Mode. |
| 2 | Energy mode icon and parameter value will be displayed. Use the Up/Down keys to enter the desired parameter value.<br>Press the Configuration key once to confirm the selection, then press the key again to save the selection.<br>**NOTICE**<br>The value on the screen will blink X3, if the configuration button is not pressed again before the selection stops blinking, the value will not be saved and must be set again. |  |

# 7.2 Setting Limits

## 7.2.1 Setting Peak Power Window Limits

If peak power window limits are enabled, it will display a single slowly blinking segment for the high limit (+power) and a single slowly blinking segment for the low limit (-power) in the bar-graph. In case of a window limit alarm, the respective segment will blink faster.

**Figure 7.1** Peak Power Window Limits




## 7.2.2 +Peak Power Window Limit (PHL)

**Table 7.9** +Peak Power Window Parameters

| Parameter | Default | Max. Value | Min. Value |
|---|---|---|---|
| +Peak Power Window Limit | 90% | 100% | 5% |

| NOTICE | |
|---|---|
| | Value must be higher than the -peak power window limit value. |

| NOTICE | |
|---|---|
| | Set value to 0 to set the +peak power window limit to off. |

| NOTICE | |
|---|---|
|  | Peak power window limits are set in multiples of 5. |

**Table 7.10** +Peak Power Window Limit Operational Sequence

| Step | Action | Reference |
|---|---|---|
| 1 | From the amplitude screen, press the Configuration key twice. |   |
| 2 | The power supply will display the +peak power window limit.<br>Use the Up/Down arrow keys to select the desired +peak power window limit value.<br>Press the Configuration key once to confirm the selection, then press the key again to save the selection.<br>**NOTICE**<br>The value on the screen will blink X3, if the configuration button is not pressed again before the selection stops blinking, the value will not be saved and must be set again. |   |

### 7.2.2.1 Using Registers

**Table 7.11** +Peak Power Window Limit Operational Sequence - Registers

| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the number icon (#) appears on the LCD.<br>The power supply will display register 101 at every power up. |  |
| 2 | Press and release the Up/Down arrow keys to select register 156. For a detailed description of available registers refer to Table 7.18 Power Supply Registers. |  |
| 3 | Once you have reached register 156, press the Configuration key. The register value will be displayed; this is indicated by the circle icon.<br>Use the Up/Down arrow keys to select the desired +peak power window limit value, then press the Configuration key to confirm the selection. |  |

### 7.2.3 -Peak Power Window Limit (PLL)

**Table 7.12** -Peak Power Window Limit Parameters

| Parameter | Default | Max. Value | Min. Value |
|---|---|---|---|
| -Peak Power Window Low Limit | 10% | 100% | 5% |

| NOTICE | |
|---|---|
|  | Value must be lower than the +peak power window limit value. |

| NOTICE | |
|---|---|
|  | Set value to 0 to set the -peak power window limit to off. |

| NOTICE | |
|---|---|
|  | Peak power window limits are set in multiples of 5. |

**Table 7.13** -Peak Power Window Limit Operational Sequence

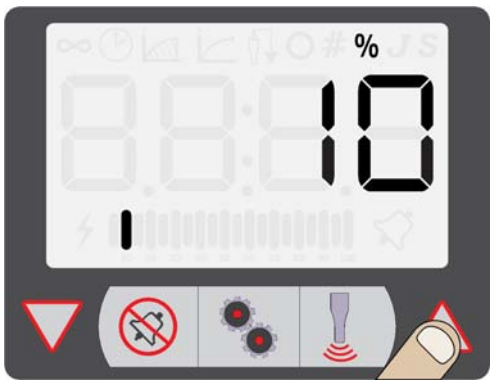
| Step | Action | Reference |
|---|---|---|
| 1 | From the amplitude screen, press the Configuration key once. |  |
| 2 | The power supply will display the -peak power window limit.<br>Use the Up/Down arrow keys to select the desired -peak power window limit value.<br>Press the Configuration key once to confirm the selection, then press the key again to save the selection.<br>**NOTICE**<br>The value on the screen will blink X3, if the configuration button is not pressed again before the selection stops blinking, the value will not be saved and must be set again. |  |

### 7.2.3.1 Using Registers

**Table 7.14** -Peak Power Window Limit Operational Sequence (Registers)

| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the number icon (#) appears on the LCD.<br>The power supply will display register 101 at every power up. |  |

**Table 7.14** -Peak Power Window Limit Operational Sequence (Registers)

| Step | Action | Reference |
|---|---|---|
| 2 | Press and release the Up/Down arrow keys to select register 155. For a detailed description of available registers refer to Table 7.18 Power Supply Registers. |  |
| 3 | Once you have reached register 155, press the Configuration key. The register value will be displayed; this is indicated by the circle icon.<br>Use the Up/Down arrow keys to select the desired -peak power window limit value, then press the Configuration key to confirm the selection. |  |

### 7.2.4 Using the Web Page Interface

Window limits can be set to a user specified value using the web page interface. For more information, refer to the DCX 222 RM SIG Rack Mount Series Web Page Interface Instruction Manual.

## 7.3 Setting the Amplitude

### 7.3.1 Using the Front Panel Controls

At power up the DCX 222 RM SIG Power Supply will display the last amplitude setting on the LCD. It can also be set to show weld mode.

| NOTICE | |
|---|---|
| | The amplitude value will be 80% only for the SIG special. |

**Figure 7.2** LCD at Power Up

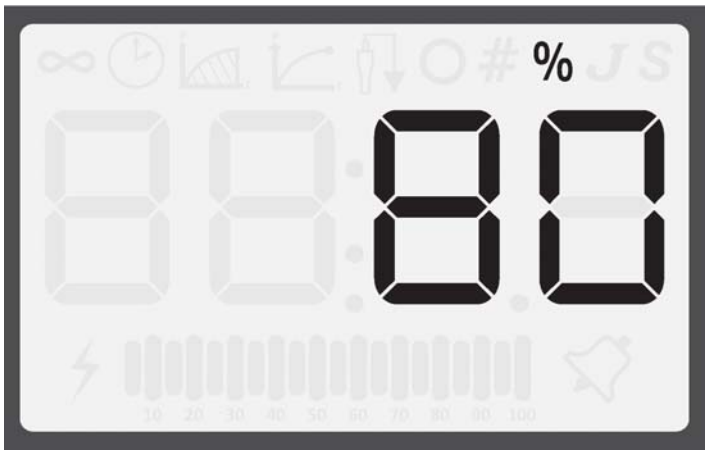



**Table 7.15** Setting the Amplitude Using the Front Panel Controls

| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the percentage icon (%) and no mode icons are displaying on the LCD. |  |

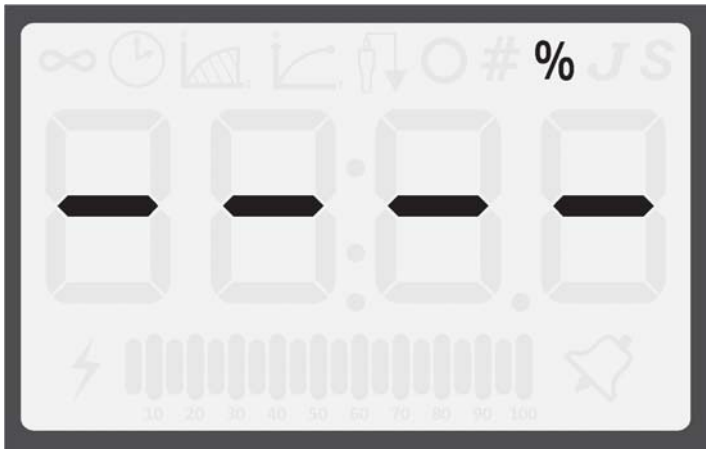
**Table 7.15** Setting the Amplitude Using the Front Panel Controls

| Step | Action | Reference |
|---|---|---|
| 2 | Press and release the Up or Down arrow keys to select the desired amplitude at 1% increments.<br><br>Press and hold down the Up or Down arrow keys and the Amplitude will auto increment at 1% increments every quarter of a second.<br><br>After holding down an arrow key for four straight seconds, the amplitude will auto increment at 5% increments every quarter of a second.<br><br>Press the Configuration key once to confirm the selection, then press the key again to save the selection.<br><br>**NOTICE**<br>The value on the screen will blink X3, if the configuration button is not pressed again before the selection stops blinking, the value will not be saved and must be set again. |  |

### 7.3.2 Using External Amplitude Control

When External Amplitude Control is enabled, the front panel amplitude control is disabled and the LCD displays four dashes (see Figure 7.3 LCD when in External Amplitude Control Mode below).

**Figure 7.3** LCD when in External Amplitude Control Mode




The ultrasonic amplitude can be controlled using one of the two analog input pins on the user I/O connector (pins 17 and 18).

### 7.3.3 Using the Web Page Interface

The ultrasonic amplitude can be set to a user specified value using the web page interface. For more information, refer to the DCX Series Web Page Interface Instruction Manual.

## 7.4 Resetting the Power Supply Alarms

You need to reset the weld system when you get an overload. When there is an overload, the alarm icon appears on the front panel LCD and the General Alarm output on the user I/O connector becomes active. The procedure for resetting the power supply depends on the power supply alarm settings. Refer to Table 7.16 Resetting the DCX 222 RM SIG Power Supply for reset procedures.

**Table 7.16** Resetting the DCX 222 RM SIG Power Supply

| Alarm Setting | Reset Procedure |
|---|---|
| Latching Alarms | Press the front panel Reset key. You can also send an External Reset signal. |
| Non-Latching Alarms | Remove and re-apply the start signal. |

| NOTICE | |
|---|---|
|  | Alarm circuitry requires at least 20 ms before restarting ultrasonic power. |

For more information on interfacing the DCX 222 RM SIG Power Supply using the user I/O connections refer to 5.3.4 User I/O Connections in Chapter 5: Installation and Setup.

## 7.5 Configuring the Power Supply Registers

At power up the DCX 222 RM SIG Power Supply will display the last amplitude setting, this is indicated by the percentage icon (%) on the LCD. Refer to Figure 7.2 LCD at Power Up.

**Table 7.17** Steps to Configure the Power Supply Registers

| Step | Action | Reference |
|---|---|---|
| 1 | Press the Configuration key until the number icon (#) appears on the LCD.<br>The power supply will display register 101 at every power up. |  |
| 2 | Press and release the Up or Down arrow keys to select the desired register. For a detailed description of available registers refer to Table 7.18 Power Supply Registers. |  |
| 3 | Once you have reached the desired register, press the Configuration key. The register value will be displayed, this is indicated by the circle icon. |  |

**Table 7.17** Steps to Configure the Power Supply Registers

| Step | Action | Reference |
|---|---|---|
| 4 | Press and release the Up or Down arrow keys to enter the desired value at 1 increments.<br>Press and hold down the Up and Down arrow keys and the value will auto increment at 1 increments every quarter of a second.<br>After holding down an arrow key for four straight seconds, the value will auto increment at 5 increments every quarter of a second.<br>Or press the Reset key to enter the default value. For detailed default values of available registers refer to Table 7.18 Power Supply Registers. |  |
| 5 | Press the Configuration key to save the value. The current amplitude setting will be displayed only for continuous mode. For all the other modes, it will display the primary parameter of that mode. |  |

### 7.5.1 Power Supply Registers

**Table 7.18** Power Supply Registers

| Register | Description | Default Value | Max. Value | Min. Value |
|---|---|---|---|---|
| 101 | System software version | 3.2 | N/A | N/A |
| 102 | Bar graph identification after weld complete<br>0: Power<br>1: Frequency | 0 | 1 | 0 |
| 104 | External amplitude control - user analog input<br>0: Off<br>1: On | 0 | 1 | 0 |
| 105 | Amplitude ramp time (ms) | 80 | 1000 | 10 |
| 106 | Store frequency at end of weld<br>0: Off<br>1: On | 1 | 1 | 0 |
| 107 | Power up seek/scan<br>0: Off<br>1: Seek<br>2: Scan | 2 | 2 | 0 |
| 108 | Seek ramp time (ms) | 80 | 1000 | 10 |
| 109 | Timed seek (every 60 seconds)<br>0: Off<br>1: On | 0 | 1 | 0 |
| 110 | Seek time (ms) | 500 | 1000 | 10 |
| 112 | Frequency offset value | | | |
| | 20 kHz | 0 | 500 | -500 |
| | 30 kHz | | 750 | -750 |
| | 40 kHz | | 1000 | -1000 |
| 115 | Restore defaults<br>0: Off<br>1: Just weld preset<br>2: System defaults | 0 | 2 | 0 |
| 116 | IP address - 1 | 192 | 255 | 0 |
| 117 | IP address - 2 | 168 | 255 | 0 |
| 118 | IP address - 3 | 10 | 255 | 0 |
| 119 | IP address - 4 | 100 | 255 | 0 |

**Table 7.18** Power Supply Registers

| Register | Description | Default Value | Max. Value | Min. Value |
|---|---|---|---|---|
| 120 | Gateway for IP address 1 | 192 | 255 | 0 |
| 121 | Gateway for IP address 2 | 168 | 255 | 0 |
| 122 | Gateway for IP address 3 | 10 | 255 | 0 |
| 123 | Gateway for IP address 4 | 1 | 255 | 0 |
| 124 | Subnet mask for IP address 1 | 255 | 255 | 0 |
| 125 | Subnet mask for IP address 2 | 255 | 255 | 0 |
| 126 | Subnet mask for IP address 3 | 255 | 255 | 0 |
| 127 | Subnet mask for IP address 4 | 0 | 255 | 0 |
| 128 | DHCP settings<br>0: Server<br>1: Client<br>2: Static<br>3: Restore registers 116-128 to default | 2 | 3 | 0 |
| 133 | Impulse start disable<br>0: Pulse start enabled<br>1: Input must be maintained | 0 | 1 | 0 |
| 134 | Backlight time-out (s)<br>0: Always on | 600 | 9999 | 0 |
| 135 | Auto scroll step size | 5 | 50 | 1 |
| 136 | Power on display<br>0: Weld mode<br>1: Amplitude | 1 | 1 | 0 |
| 137 | Power high and power low limit alarm will reset after 500 ms<br>0: Off<br>1: On | 1 | 1 | 0 |
| 138 | Weld Mode<br>0: Continuous<br>1: Time<br>2: Energy | 1 | 2 | 0 |
| 139 | MAC address 1 | * | FFFF | 0 |
| 140 | MAC address 2 | * | FFFF | 0 |
| 141 | MAC address 3 | * | FFFF | 0 |

**Table 7.18** Power Supply Registers

| Register | Description | Default Value | Max. Value | Min. Value |
|---|---|---|---|---|
| 155 | -Peak power window limit (PLL)<br>0: Off<br>1 to 100: Limit value (must be lower than register 156)<br>**NOTICE**<br>Peak power window limits are set in multiples of 5 | 10 | 100 | 0 |
| 156 | +Peak power window limit (PHL)<br>0: Off<br>1 to 100: Limit value (must be higher than register 155)<br>**NOTICE**<br>Peak power window limits are set in multiples of 5 | 90 | 100 | 0 |
| 157 | Memory clear when external reset through I/O<br>0: No memory clear<br>1: Memory clear | 1 | 1 | 0 |

*Value depends on each system.

## 7.6 LCD Bar-Graph

While ultrasonic power is active the LCD will always display the power value on the 20-segment LCD bar-graph as a percentage of the maximum output power.

At the end of a weld or test cycle, the bar-graph is factory set to represent the cycle's peak power as a percentage of the maximum output power.

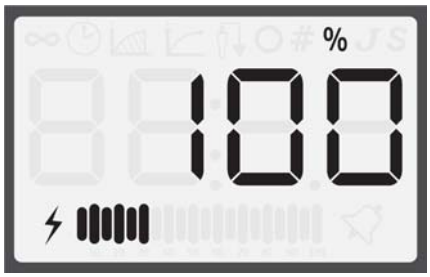
The power supply can also be configured to show a single bar on the LCD bar-graph to represent the stack operating frequency stored at the end of each weld or test cycle. This option can be used to troubleshoot operating frequency changes as a result of heating effects, coupling, tooling wear, etc.

For information on how to set the power supply registers see 7.5 Configuring the Power Supply Registers.

### 7.6.1 Power Bar-Graph Interpretation

The lightning bolt left of the bar-graph indicates ultrasonic power is running. Each of the segments represent 5% increments of the maximum output power. The segments will only appear if the output power has exceeded the value represented. For example if the power is 4% only the lightning bolt will be on. When it reaches 5% the first bar-graph segment will appear.

**Table 7.19** Power Bar-Graph Interpretation Examples

| Description | Reference |
|---|---|
| In this example only the lightning bolt appears left of the bar-graph. This means power is between 0% and 5%. If the power supply is 800 W the actual output power is between 0 W and 40 W. |  |
| In this example the first six segments appear on the bar-graph. This means power is between 30% and 35%. If the power supply is 800 W, the actual output power is between 240 W and 280 W. |  |

### 7.6.2 Frequency Bar-Graph Interpretation

The actual frequency depends on the power supply's operating frequency. Use Table 7.20 Frequency Bar-Graph Interpretation below to interpret frequency bar-graph readings.

| NOTICE | |
|---|---|
|  | If there is a test overload or an external memory reset signal is received, then the 50% segment will be displayed and blinking. |

**Table 7.20** Frequency Bar-Graph Interpretation

| 20 kHz (50 Hz/segment) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19,475–19,524 | 19,52–19,574 | 19,575–19,624 | 19,625–19,674 | 19,675–19,724 | 19,725–19,774 | 19,775–19,824 | 19,825–19,874 | 19,875–19,924 | 19,925–19,974 | 19,975–20,024 | 20,025–20,074 | 20,075–20,124 | 20,125–20,174 | 20,175–20,224 | 20,225–20,274 | 20,275–20,324 | 20,325–20,374 | 20,375–20,424 | 20,425–20,474 |
| 1 | 2 | 3 | 4 | 5 (25%) | 6 | 7 | 8 | 9 | 10 (50%) | 11 | 12 | 13 | 14 | 15 (75%) | 16 | 17 | 18 | 19 | 20 (100%) |

**Table 7.21** Frequency Bar-Graph Interpretation Examples

| Description | Reference |
|---|---|
| In this example the bar is located in the 11th segment. If the power supply is a 20 kHz unit, the stack is running in the frequency range of 19,975 Hz to 20,024 Hz. |  |
| In this example the bar is located in the 7th segment. If the power supply is a 20 kHz unit, the stack is running in the frequency range of 19,775 Hz to 19,824 Hz, |  |

## 7.7 Web Page Interface

The DCX 222 RM SIG Power Supply Power Supply Web Page Interface provides access, via Ethernet connection, to power supply information, diagnostics, and configuration web pages. Communication can be established point-to-point or through a local area network.

### 7.7.1 System Requirements

To connect to the DCX 222 RM SIG Power Supply Web Page Interface you will need a PC running a Windows® operating system with an Internet Explorer® web browser software (versions 7 and up).

### 7.7.2 Connecting to the Web Page Interface

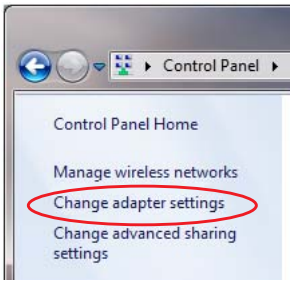
| NOTICE | |
|---|---|
|  | The DCX 222 RM SIG Power Supply is not compatible with network scanning software. If your local network uses these types of programs, the DCX 222 RM SIG Power Supply IP address must be placed in an exclusion list. |

| NOTICE | |
|---|---|
|  | A shielded Ethernet cable must be used to connect to the DCX 222 RM SIG Power Supply Web Page Interface to prevent possible EMI (Electromagnetic Interference) issues. |

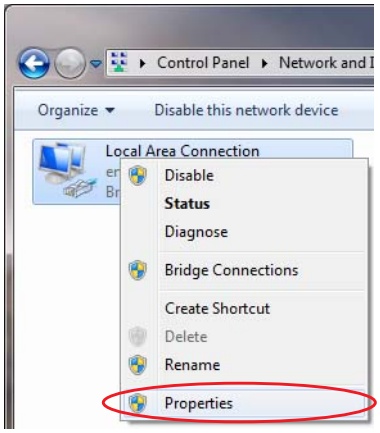
#### 7.7.2.1 Point to Point Connection (Windows Vista and Windows 7)

To connect directly to the DCX 222 RM SIG Power Supply Web Page Interface using a PC with Windows Vista® or Windows 7® operating system, complete the following steps:

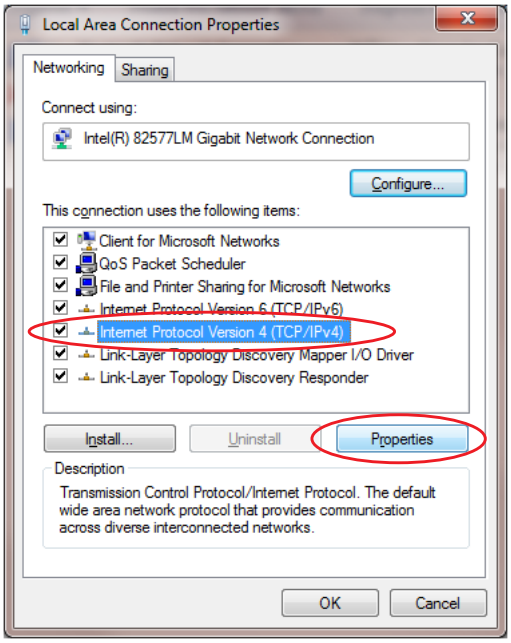
1. Connect the power supply to a computer via the Ethernet port
2. Turn on the power supply
3. On your PC, click on the Windows logo on the task bar and select **Control Panel**
4. Select **View Large Icons** on the top right corner
5. Select **Network and Sharing Center**
6. Select **Change adapter settings**



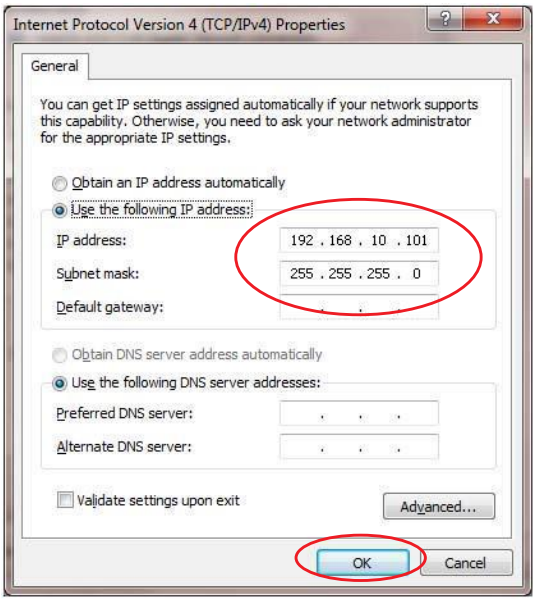
7. Right click on **Local Area Connection** and select **Properties** to bring up the **Networking** tab



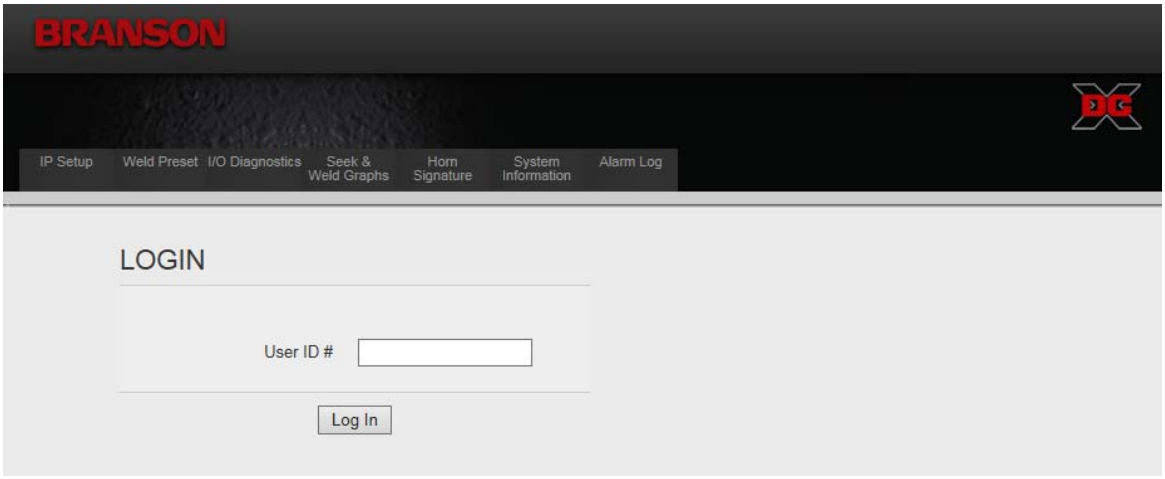

8. Highlight **Internet Protocol Version 4 (TCP/IPv4)** from the list and click on **Properties**



9. Use the following IP address:
   **IP address:** 192.168.10.101
   **Subnet mask:** 255.255.255.0

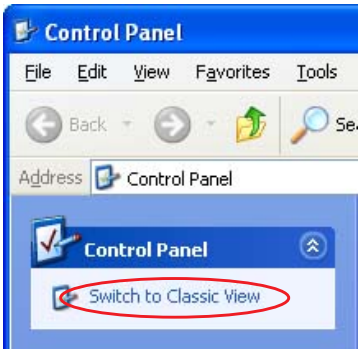



10. Click **OK**. Close the rest of the dialog boxes
11. Open the Internet Explorer web browser (version 7 and up)
12. In the address bar type the following address: http://192.168.10.100. Press Enter
13. This will bring up the DCX 222 RM SIG Power Supply Web Page interface
14. Enter a user ID number (any number up to 9 digits long)

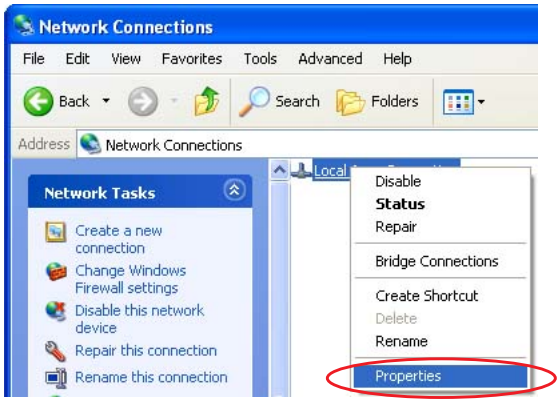


### 7.7.2.2 Point to Point Connection (Windows XP)

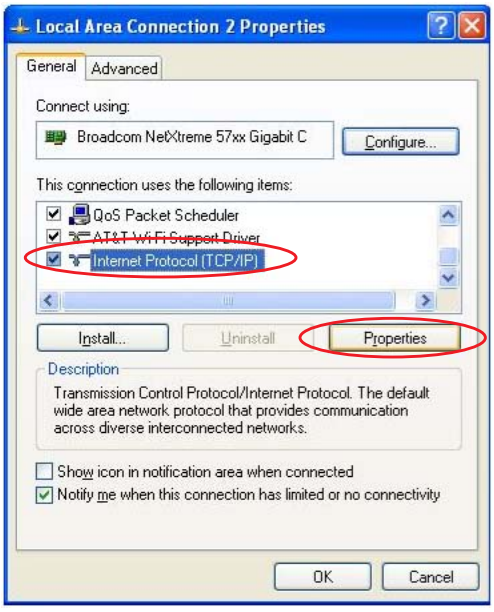
1. To connect directly to the DCX 222 RM SIG Power Supply Web Page Interface using a PC with Windows XP® operating system, complete the following steps:
2. Connect the power supply to a computer via the Ethernet port
3. Turn on the power supply
4. On your PC, select **Start > Control Panel**
5. Select **Switch to Classic View** on the top left corner




6. Select **Network Connections**
7. Right click on **Local Area Connection** and select **Properties** to bring up the **General** tab



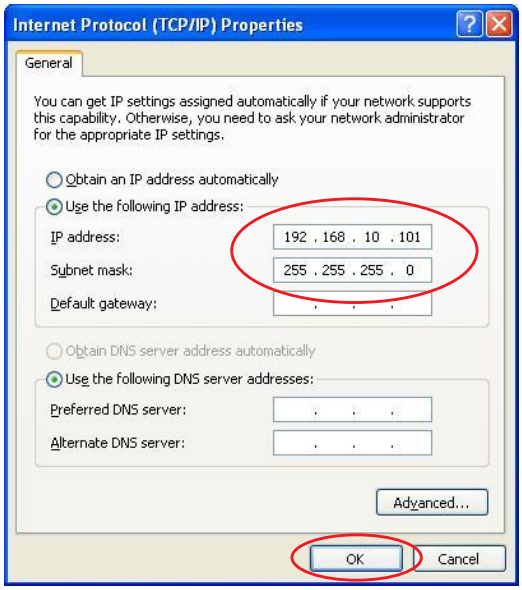

8. Highlight **Internet Protocol (TCP/IP)** from the list and click on **Properties**



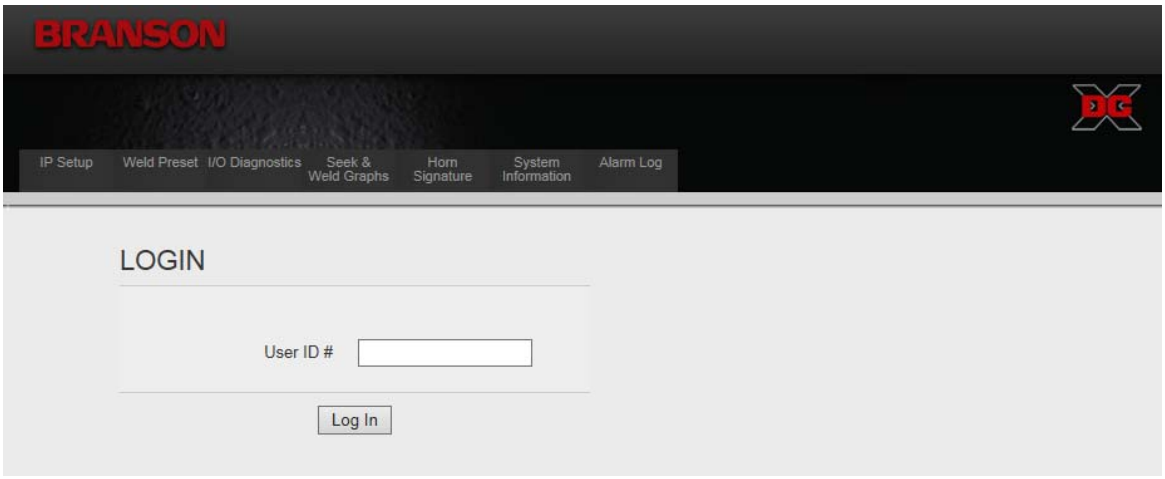
9. Use the following IP address:

   **IP address:**192.168.10.101

   **Subnet mask:** 255.255.255.0




10. Click **OK**. Close the rest of the dialog boxes
11. Open the Internet Explorer web browser (version 7 and up)
12. In the dress bar type the following address: http://192.168.10.100. Press Enter
13. This will bring up the DCX 222 RM SIG Power Supply Web Page interface
14. Enter a user ID number (any number up to 9 digits long)




## 7.7.3 Using the Web Page Interface

For complete instructions detailing the web page interface consult the DCX Series Web Page Interface Instruction Manual.

## 7.8 Ultrasonics Test Procedure

The Ultrasonics Test function measures ultrasonic power dissipated by the ultrasonic stack with no load. The ultrasonics test procedure involves an automatic matching of the frequency of the power supply to the frequency of the converter-booster-horn stack.

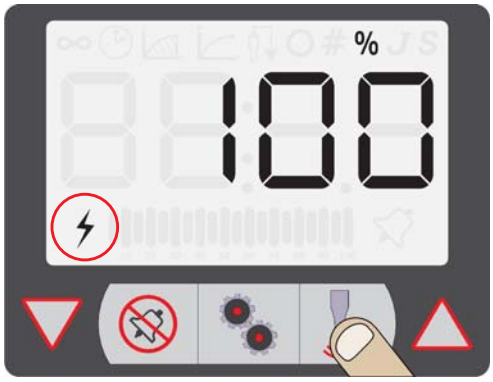
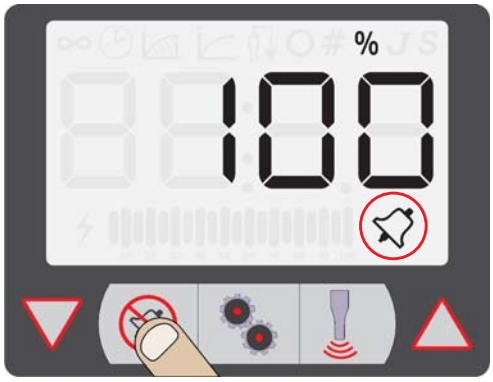
| WARNING | High Voltage Hazard |
|---|---|
|  | Ensure that no one is in contact with the horn when testing the power supply.<br>Do not cycle the welding system if either the RF cable or converter is disconnected. |

| WARNING | High Voltage Hazard |
|---|---|
|  | Ensure the power supply is properly connected, as indicated in 5.3 Installation Steps. |

### 7.8.1 Using the Front Panel Controls

| NOTICE | |
|---|---|
|  | To use the front panel controls, the DCX 222 RM SIG Power Supply unit must be in manual mode. |

**Table 7.22** Power Supply Ultrasonic Test Procedure (Front Panel)

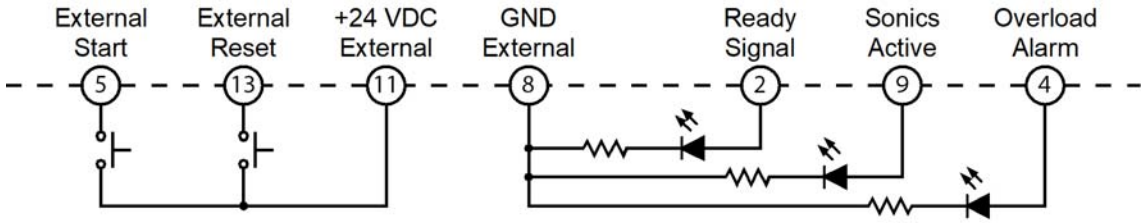
| Step | Action | Reference |
|---|---|---|
| 15 | Press the test key for 1-2 seconds, then release. The Sonics Active indicator appears while the test key is pressed. If the power supply alarm indicator does not appear, the test procedure is finished. |  |
| 16 | If the alarm indicator appears, press the alarm reset key and repeat step 2 one time only. If the alarm persists, refer to 8.5 Troubleshooting. |  |

## 7.8.2 Using the I/O Connections

**Table 7.23** Power Supply Ultrasonic Test Procedure (User I/O)

| Step | Action | Reference |
|---|---|---|
| 1 | Wire the necessary I/O signals as shown on Figure 7.4 Test Connections., or using a similar setup. | Refer to Figure 7.4 Test Connections. below. |
| 2 | Send an External Test signal for 1-2 seconds. The Sonics Active output will become active and the Sonics Active indicator appears while the External Start Signal is present. If the General Alarm output/ alarm indicator does not become active, the test procedure is finished. |   |
| 3 | If the General Alarm output/alarm indicator becomes active, send an External Reset signal and repeat step 2 one time only. If the alarm persists, refer to 8.5 Troubleshooting. |   |

**Figure 7.4** Test Connections.



# Chapter 8: Maintenance

## 8.1 General Maintenance Considerations

| WARNING | High Voltage Hazard |
|---|---|
|  | Power supplies produce high voltage. To avoid the possibility of an electrical shock, you must always power down your system prior to repairing any portion of it. |

| CAUTION | General Warning |
|---|---|
|  | When performing maintenance on the welder, make sure that no other automated systems are active. |

| NOTICE | |
|---|---|
|  | There are no customer replaceable components inside the power supply. Have all servicing done by a qualified Branson technician. |

| NOTICE | |
|---|---|
|  | When returning printed circuit boards, make sure to enclose them in an anti-static package. |

| NOTICE | |
|---|---|
|  | Connectors may not be keyed and wires may not be color-coded. Therefore, when disconnecting cables and wires, label them so you can reconnect them properly. |

| NOTICE | |
|---|---|
|  | To prevent circuit damage from electrostatic discharge, always service the power supply on a static-dissipative surface, while wearing a properly grounded wrist strap. |

## 8.2 Preventive Maintenance

The following preventive measures help assure long term operation of your Branson DCX 222 RM SIG Power Supply equipment.

### 8.2.1 Periodically Clean the Equipment

| NOTICE | |
|---|---|
|  | Use only anti-static vacuum cleaners to prevent damage from electrostatic discharge to your power supply. |

Air is continuously drawn into the power supply. Periodically disconnect the unit from power, remove the cover and vacuum out any accumulated dust and debris. Remove material adhering to:

- Power supply heat sink cooling fins
- Transformers
- Circuit boards
- Cooling intake vents
- Exhaust ports

External covers may be cleaned with a damp sponge or cloth using a solution of mild soap and water. Do not allow cleaning solution to enter the unit.

To prevent rust in areas of high humidity, exposed steel surfaces, may require a very light film of rust preventing oil, such as WD-40®.

### 8.2.2 Recondition the Stack (Converter, Booster, and Horn)

| NOTICE | |
|---|---|
|  | Never clean the converter-booster-horn stack mating surfaces by using a buffing wheel or by filing. |

Welding system components work most efficiently when the converter-booster-horn stack mating surfaces are flat, in solid contact, and free from fretting corrosion. Poor contact between mating surfaces wastes power output, makes tuning difficult, increases noise and heat, and may cause damage to the converter.

For standard 20 kHz, a Branson Mylar polyester film washer must be installed between the horn and booster, and horn and converter. Replace the washer if torn or perforated. Stacks using Mylar plastic film washers must be inspected every three months.

Stacks used with silicone grease, as with certain 20 kHz products, must be periodically reconditioned to eliminate fretting corrosion. A stack using silicone grease must be inspected every two weeks for corrosion. When experience is gained for specific stacks, the inspection interval can be adjusted to a longer or shorter period as required.

## Stack Reconditioning Procedure

To recondition stack mating surfaces, take the following steps:

**Table 8.1** Stack Reconditioning Procedure

| Step | Action |
|---|---|
| 1 | Disassemble the converter-booster-horn stack and wipe the mating surfaces with a clean cloth or paper towel. |
| 2 | Examine all mating surfaces. If any mating surface shows corrosion or a hard, dark deposit, recondition it. |
| 3 | If necessary, remove the threaded stud from the part. |
| 4 | Tape a clean sheet of #400 (or finer) grit emery cloth to a clean, smooth, flat surface (such as a sheet of plate glass), as in Figure 8.1 Reconditioning Stack Mating Surfaces. |
| 5 | Place the interface surface on the emery cloth. Grasp the part at the lower end, with your thumb over the spanner-wrench hole, and lap the part in a straight line across the emery cloth. Do not apply downward pressure — the weight of the part alone provides sufficient pressure. |
| 6 | Lap the part, two or three times, in the same direction against the emery cloth. (See Figure 8.1 Reconditioning Stack Mating Surfaces). |
| 7 | Rotate the part 120 degrees, placing your thumb over the spanner-wrench hole, and repeat the lapping procedure in step 6. |

**Table 8.1** Stack Reconditioning Procedure

| Step | Action |
|---|---|
| 8 | Rotate the part another 120 degrees to the next spanner-wrench hole, and repeat the lapping procedure in step 6. |
| 9 | Re-examine the mating surface. If necessary, repeat steps 2-5 until you remove most of the contaminant. Remember, this should not require more than two to three complete rotations for an aluminum horn or booster; a titanium component may require more rotations. |
| 10 | Before re-inserting a threaded stud in an aluminum booster or horn:<br>Using a file card or wire brush, clean any aluminum bits from the knurled end of the stud.<br>Using a clean cloth or towel, clean the threaded hole.<br>Examine the knurled end of the stud. If worn, replace the stud. Also, examine the stud and threaded hole for stripped threads.<br>**NOTICE**<br>Threaded studs cannot be reused in titanium horns or boosters. Replace all studs in these components. |
| 11 | Assemble and install the stack. |

**Figure 8.1** Reconditioning Stack Mating Surfaces

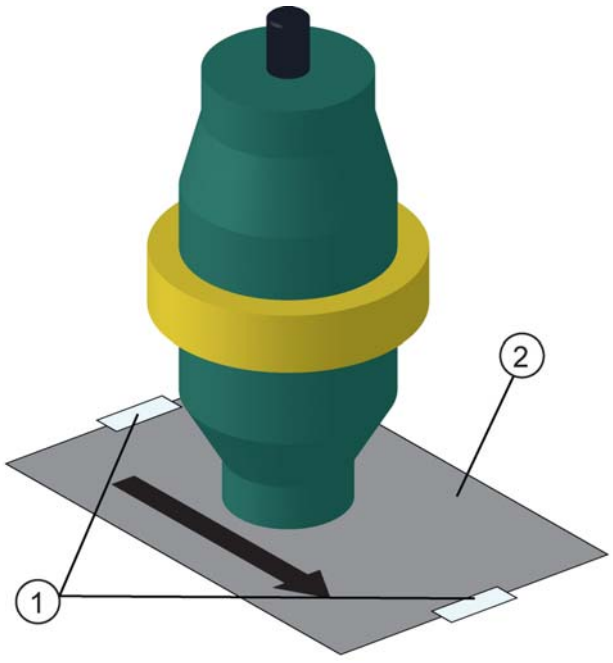



**Table 8.2** Reconditioning Stack Mating Surfaces

| Item | Description |
|---|---|
| 1 | Tape |
| 2 | #400 Emery Cloth |

#### 8.2.2.1 Stack Reassembly Process

**Table 8.3** Stack Torque Value

| Frequency | Torque |
|---|---|
| 20 kHz | Converter–Booster: 50 N·m<br>Booster–Horn: 75 N·m |

## For a 20 kHz System

**Table 8.4** Stack Reassembly for a 20 kHz System

| Step | Action |
|---|---|
| 1 | Clean the mating surfaces of the converter, booster, and horn. Remove any foreign material from the threaded holes. |
| 2 | Install the threaded stud into the top of the booster. Torque to 50 N·m. If the stud is dry, apply 1 or 2 drops of a light lubricating oil before installing. |
| 3 | Install the threaded stud into the top of the horn. Torque to 50 N·m. If the stud is dry, apply 1 or 2 drops of a light lubricating oil before installing. |
| 4 | Install a single Mylar plastic film washer (matching the size of the washer to the stud) to each interface. |
| 5 | Assemble the converter to the booster and the booster to the horn. |
| 6 | Torque to 50 N·m for the converter–booster and 75 N·m for the booster–horn. |

### 8.2.3 Stud Torque Values

**Table 8.5** Stud Torque Values

| Used on | Stud Size | Torque | EDP # |
|---|---|---|---|
| 20 kHz | 1/2 in x 20 x 1-1/4 in | 50 N·m | 100-098-370 |
| | 1/2 in x 20 x 1-1/2 in | | 100-098-123 |

### 8.2.4 Routine Component Replacement

The lifetime of certain parts is based on the number of cycles the unit has completed, or on hours of operation.

## 8.3 Calibration

This product does not normally require scheduled calibration. However, if you are operating under any type of regulatory requirements, you may need to calibrate the equipment according to that schedule and set of standards. Contact Branson for details.

## 8.4 Recommended Spare Stock

This section provides lists of replacement parts, system cables, and suggested spares.

### 8.4.1 Converters Compatible with the DCX 222 RM SIG Power Supply

**Table 8.6** Converters Compatible with the DCX 222 RM SIG Power Supply

| Where used | Model | Connector | Part Number |
|---|---|---|---|
| 20 kHz | 932 AS | MHV Connector | 159-135-077 |

### 8.4.2 DCX 222 RM SIG Power Supply Compatible Boosters

**Table 8.7** DCX 222 RM SIG Power Supply Compatible Boosters

| Type of Booster | Description | Part Number |
|---|---|---|
| Standard Series (1/2-20 horn stud) 20 kHz | Titanium, 1:1 (Green) | 101-149-056 |
| | Titanium, 1:1.5 (Gold) | 101-149-057 |

### 8.4.3 Other Items used with the DCX 222 RM SIG Power Supply

**Table 8.8** Other Items used with the DCX 222 RM SIG Power Supply

| Description | Part Number |
|---|---|
| Silicone Grease | 101-053-002 |

## 8.5 Troubleshooting

If you have a problem operating the DCX 222 RM SIG Power Supply, take the following steps:

**Table 8.9** Troubleshooting

| Step | Action |
|---|---|
| 1 | Make sure the converter-booster-horn stack is properly assembled and installed. |
| 2 | For instructions on reconditioning stack component surfaces, refer to 8.2.2 Recondition the Stack (Converter, Booster, and Horn). |
| 3 | If you need additional help, call your local Branson representative, refer to 1.3 How to Contact Branson. |

| NOTICE | |
|---|---|
|  | DCX 222 RM SIG Power Supply must be serviced only by qualified technicians using Branson-approved test and repair equipment, repair procedures, and replacement parts. Unauthorized attempts at repair or modification of the power supply will void the warranty. |

### 8.5.1 Common Electrical Problems

| NOTICE | |
|---|---|
|  | If the circuit breaker fails more than once, this usually indicates that another component has failed. Continue troubleshooting other components. |

**Table 8.10** Troubleshooting Common Electrical Problems

| Problem | Check | Solution |
|---|---|---|
| When touching a component of the weld system, you get a slight electrical shock. | Ensure the ground cable is connected properly. | N/A |
| | Inspect the line cables | If failed, repair or replace. |

### 8.5.2 Ultrasonic Power Problems

**Table 8.11** Troubleshooting Ultrasonic Power Problems

| Problem | Check | Solution |
|---|---|---|
| Ultrasonic power delivered to horn; no indication on bar graph. | Check connector cables, replace if failed. | Replace defective cables. |
| | Test power supply. | See Chapter 7: Operation 7.8 Ultrasonics Test Procedure |
| No ultrasonic power generated when Test key pressed; no Alarm indicator. | Failed or missing stack. | Replace. |
| | RF cable unplugged or failed; replace if failed. | Plug in or replace. |
| | Test power supply (Chapter 7: Operation 7.8 Ultrasonics Test Procedure). | If defective, send unit for repair. |
| Unable to adjust amplitude using the front panel keypad. | Register setting configured to “External Amplitude Control” | Reset if required, See Chapter 7: Operation 7.5 Configuring the Power Supply Registers |
| Unable to remote control. | User I/O cable | Repair or replace. |
| | Customer’s switching device | Test/inspect/repair/ replace. |

### 8.5.3 Weld Cycle Problems

**Table 8.12** Troubleshooting Weld Cycle Problems

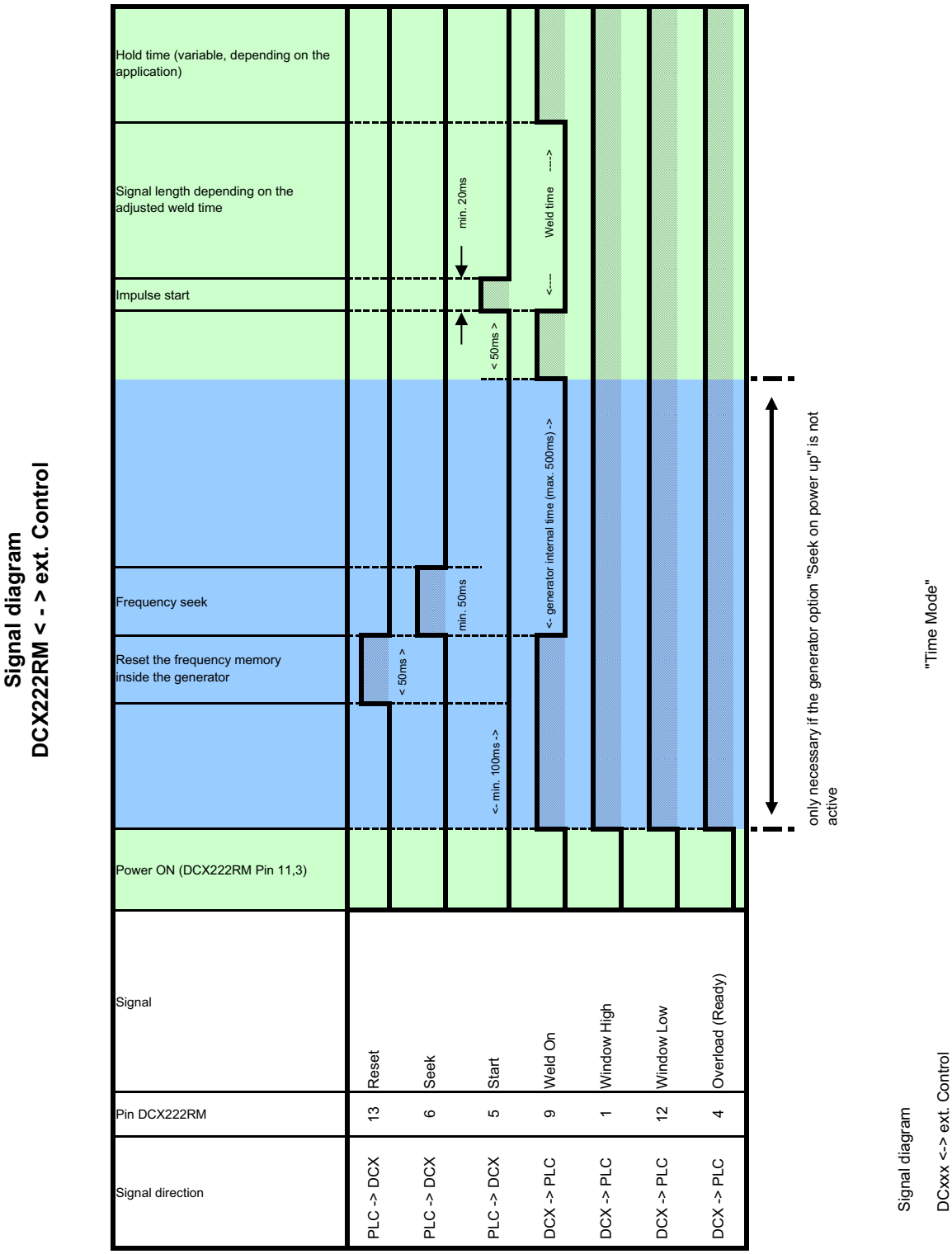
| Problem | Check | Solution |
|---|---|---|
| Full ultrasonic power not delivered. | Unsuitable horn or booster selection. | Contact Branson |
| | Plastic part material varies. | |
| | Mold release lubricant in weld area. | |
| | Unsuitable joint design. | |
| | Unsuitable or misaligned part fixture. | |
| | Amplitude setting | Adjust if required. |
| No ultrasonic power passed to horn. | Power supply overheating | Remove dust and debris. |
| Alarm indicator illuminates when you press the Test key or during the weld cycle. | Check converter-booster-horn stack interface for fretting corrosion. | See 8.2.2 Recondition the Stack (Converter, Booster, and Horn) |
| | Check for loose or failed horn converter or booster. | Tighten or replace as needed. |
| | Check for loose or failed horn or booster stud. | |
| | Failed RF cable | Replace if failed. |
| Excessively warm horn, booster, and converter; occasional overloads. | Check converter-booster-horn stack mating surfaces for fretting corrosion. | See 8.2.2 Recondition the Stack (Converter, Booster, and Horn). |
| | Be certain proper cooling has been provided. | See 5.2.1 Installing the DCX 222 RM SIG Power Supply Drawers in a Customer Rack. |

# Appendix A: Signal Diagrams

# A.1 Signal Diagrams

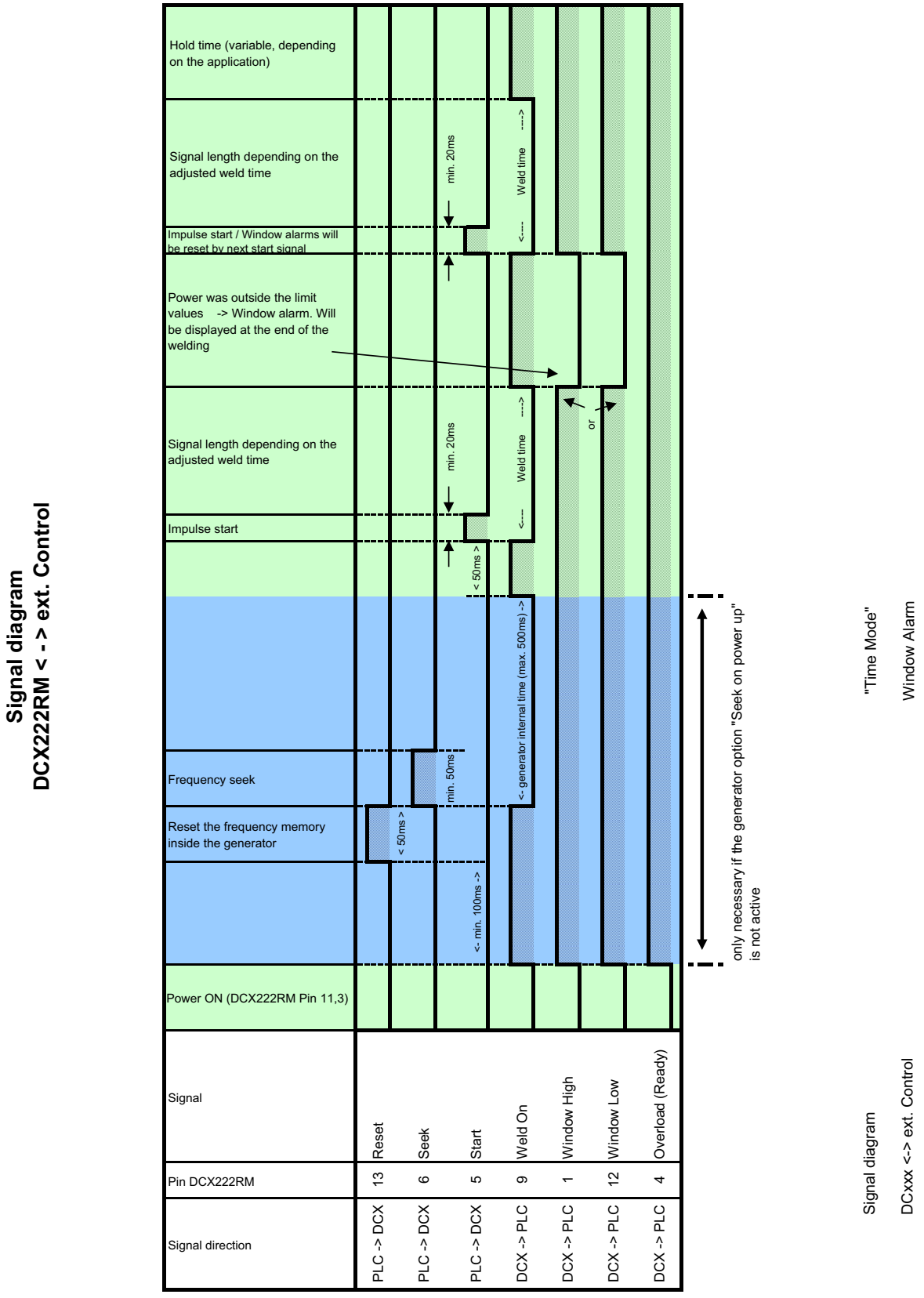
## A.1.1 Time Mode

**Figure A.1** Time



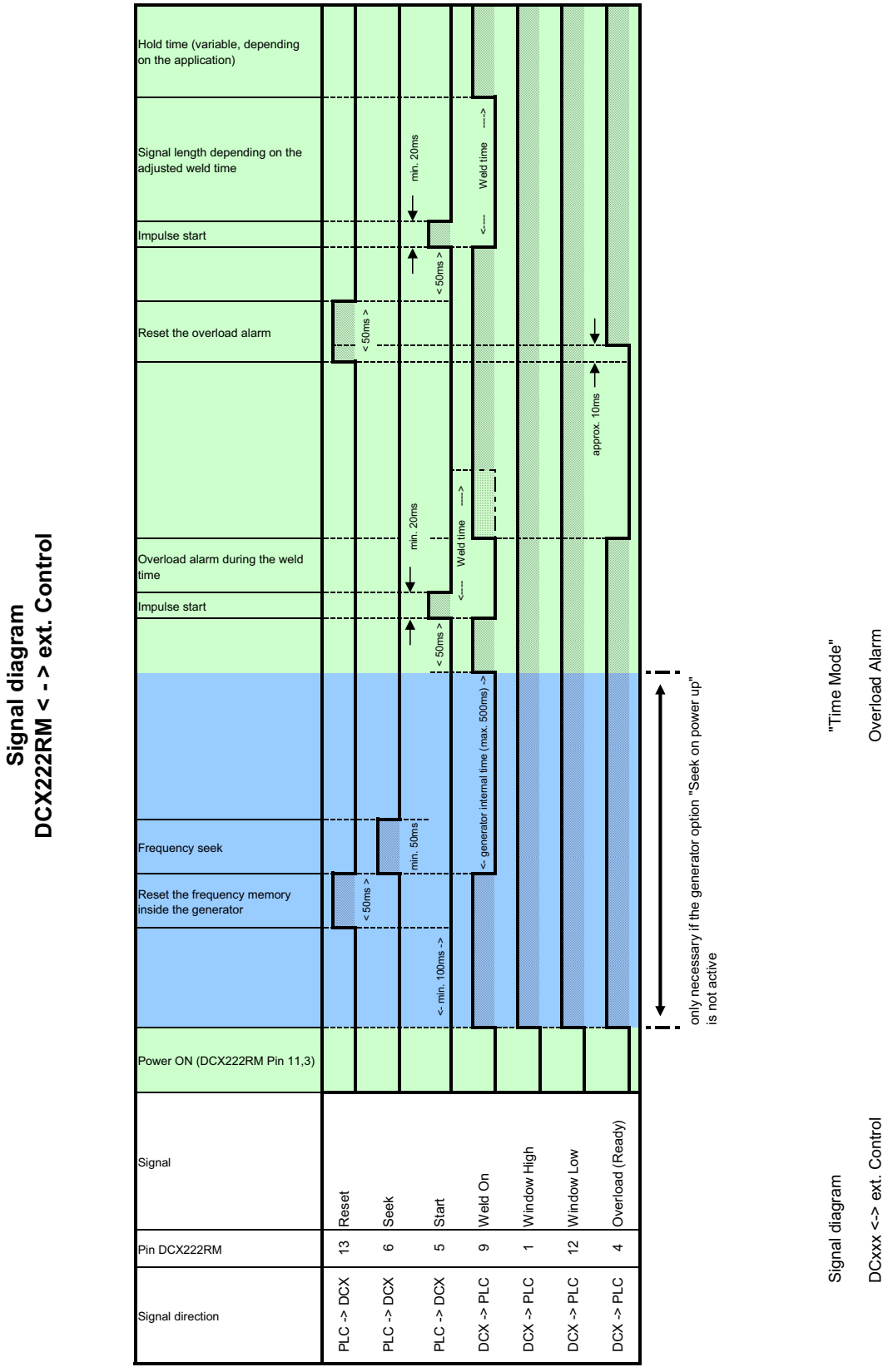
## A.1.2 Time Mode (Window Alarm)

**Figure A.2** Time Mode (Window Alarm)



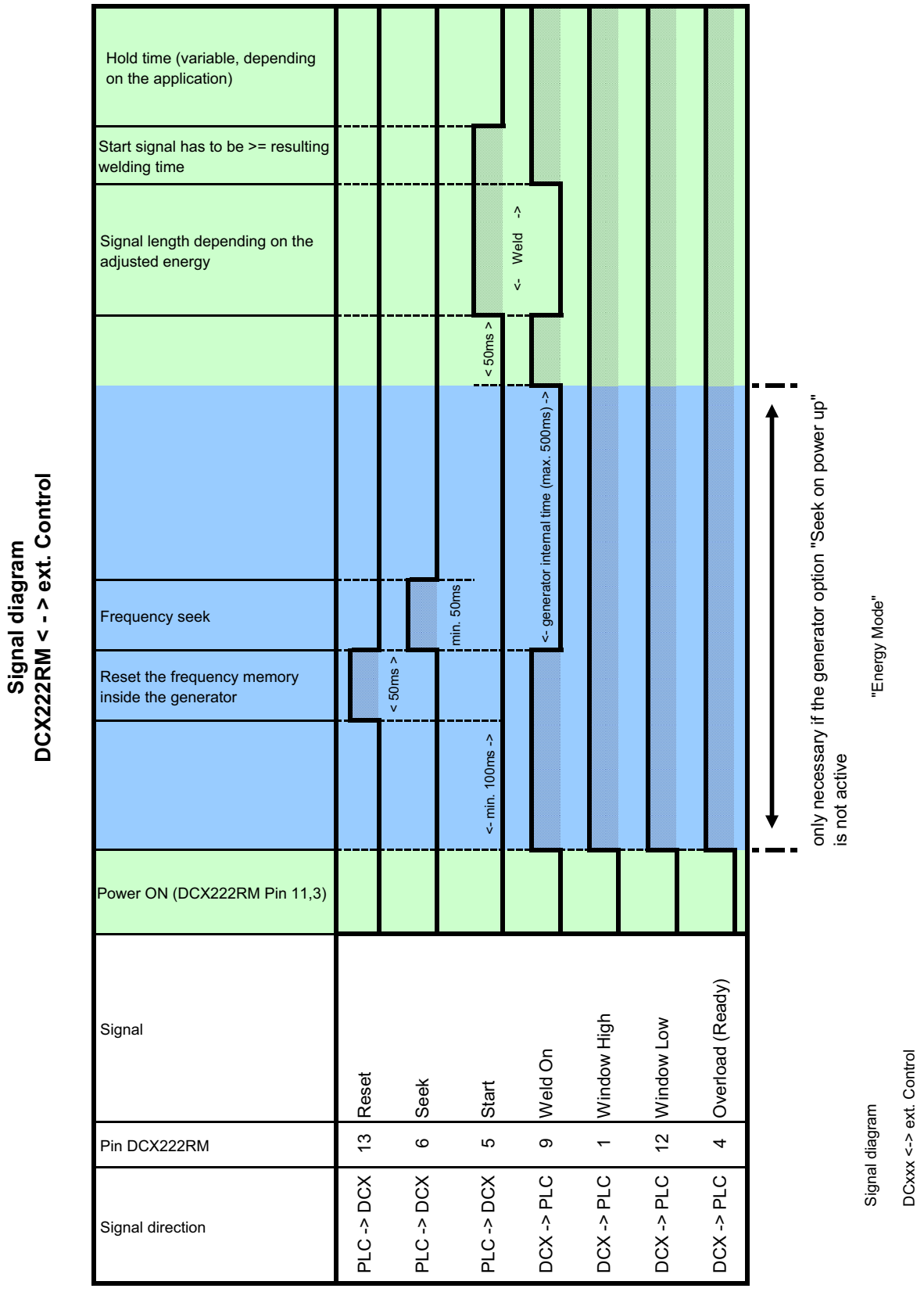
## A.1.3 Time Mode (Overload Alarm)

**Figure A.3** Time Mode (Overload Alarm)



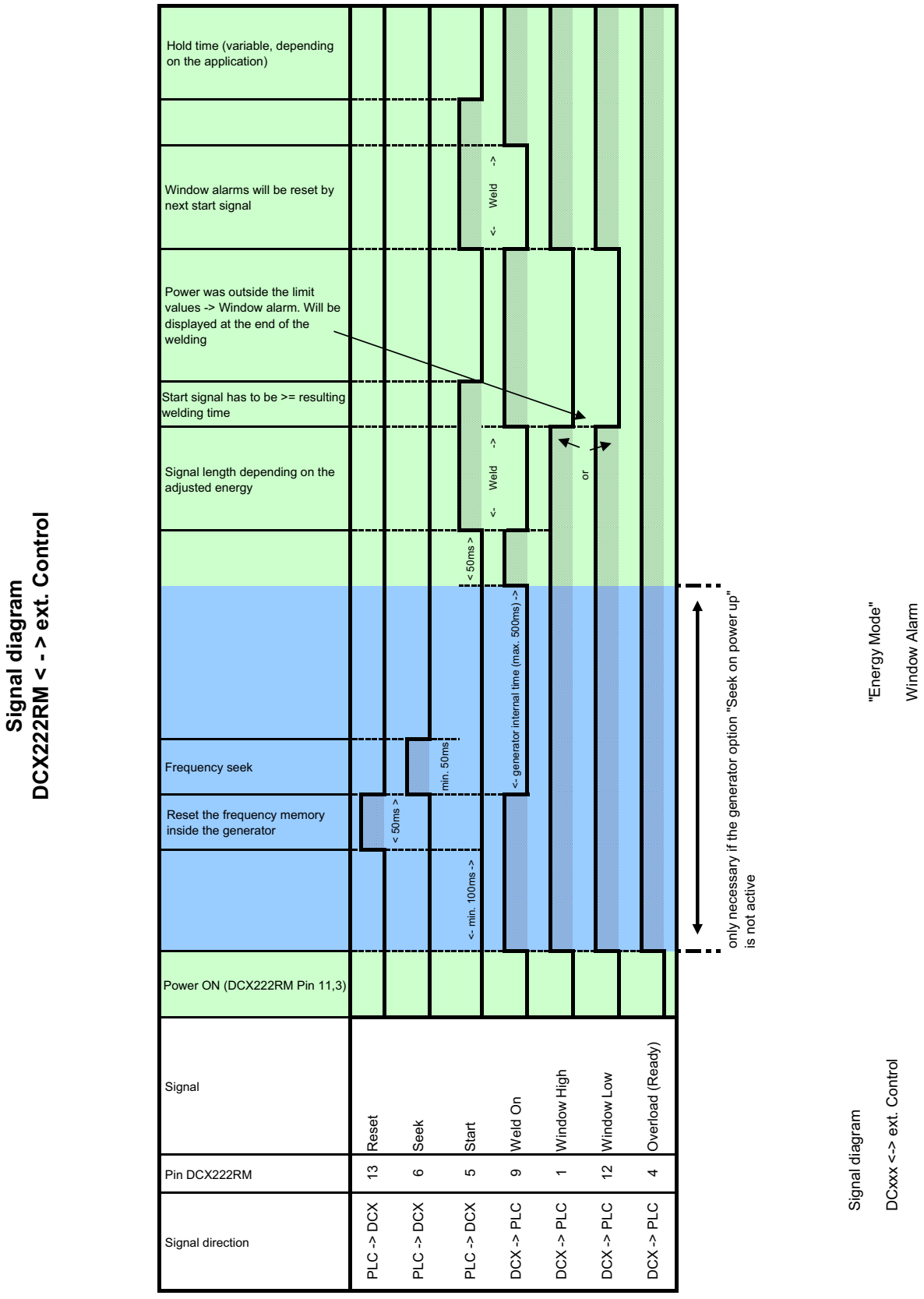
## A.1.4 Energy Mode

**Figure A.4** Energy Mode



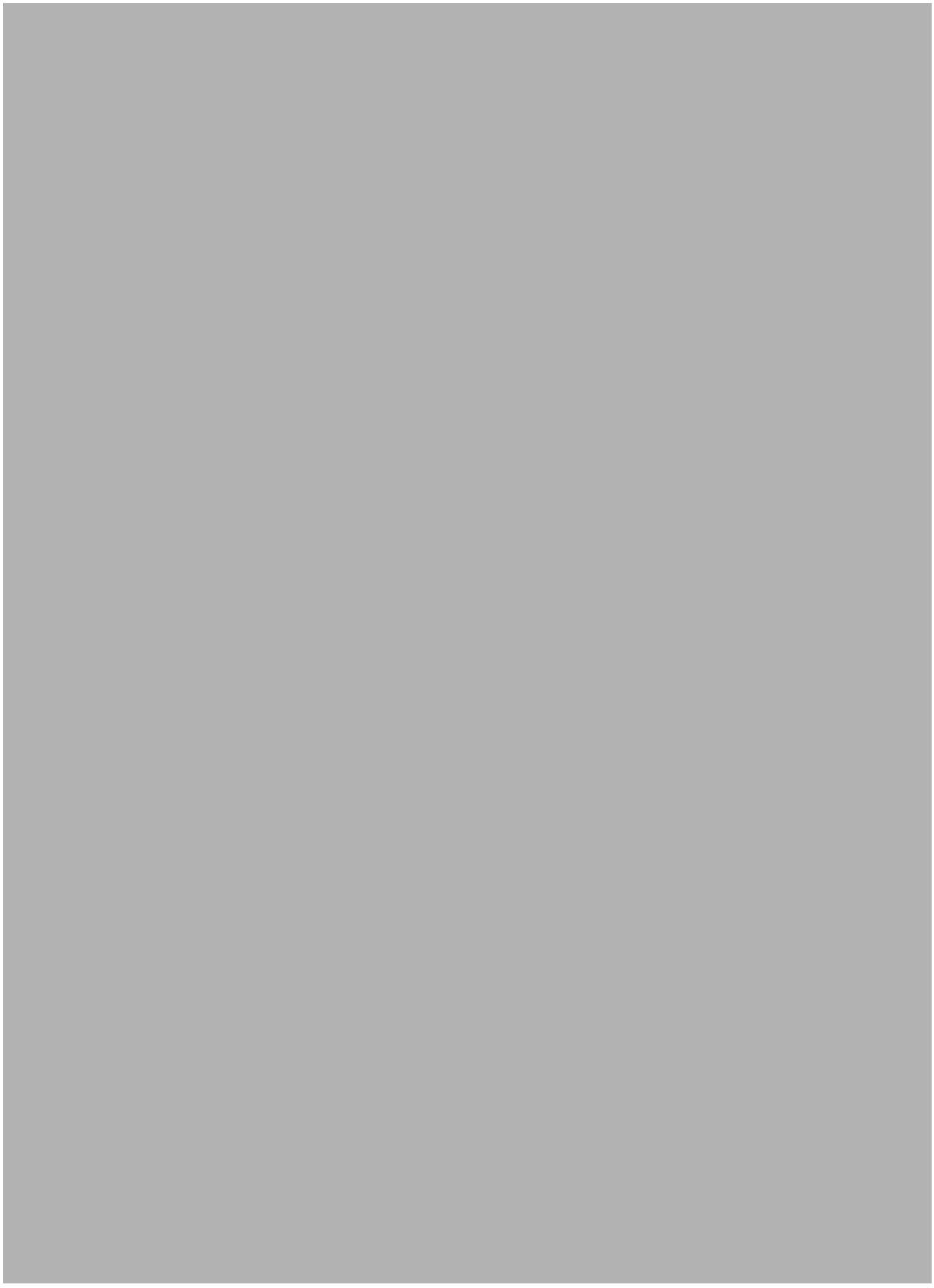
## A.1.5 Energy Mode (Window Alarm)

**Figure A.5** Energy Mode (Window Alarm)



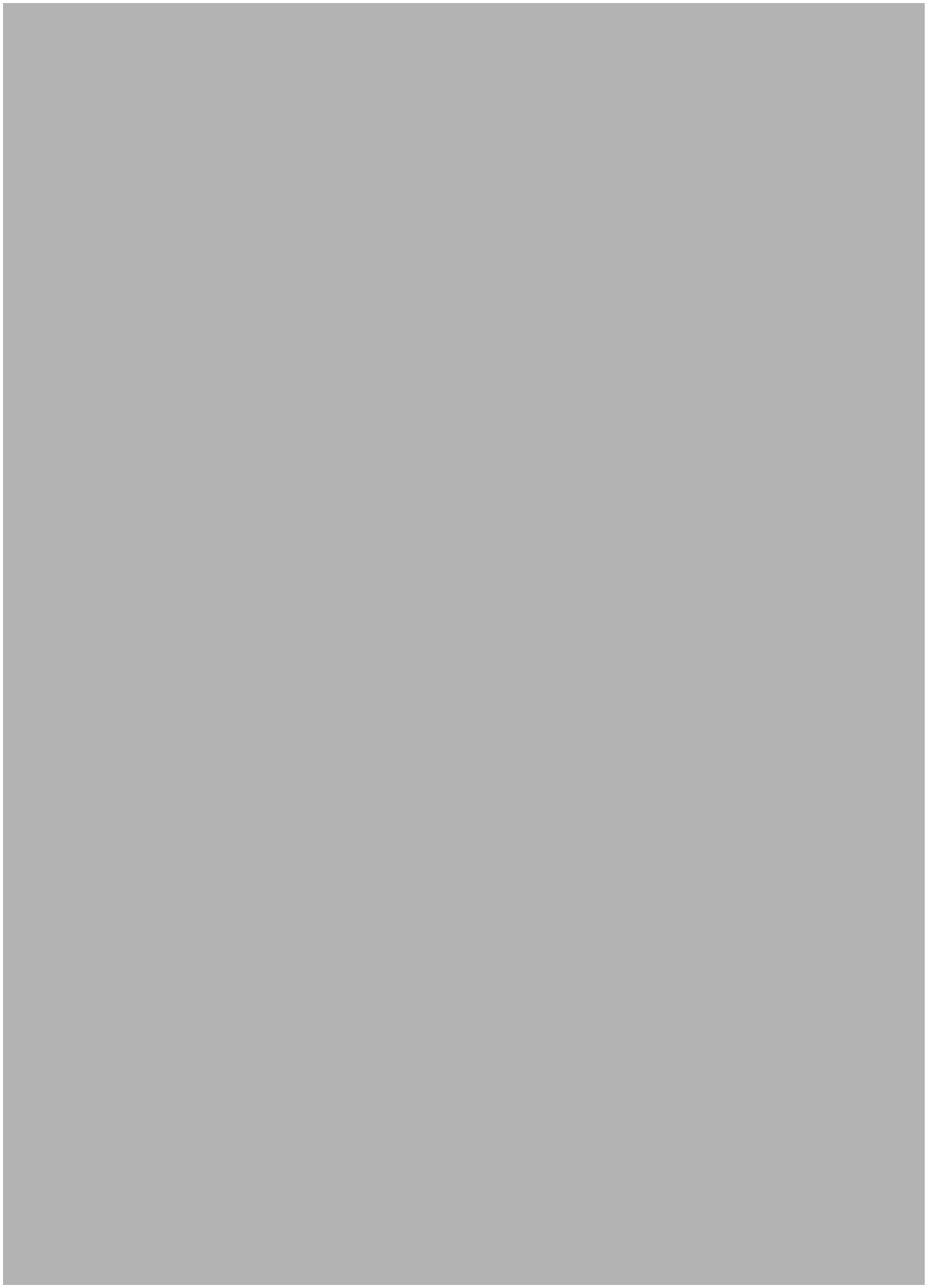
## A.1.6 Energy Mode (Start Signal Too Short)

**Figure A.6** Energy Mode (Window Low Alarm - Start Signal Too Short)



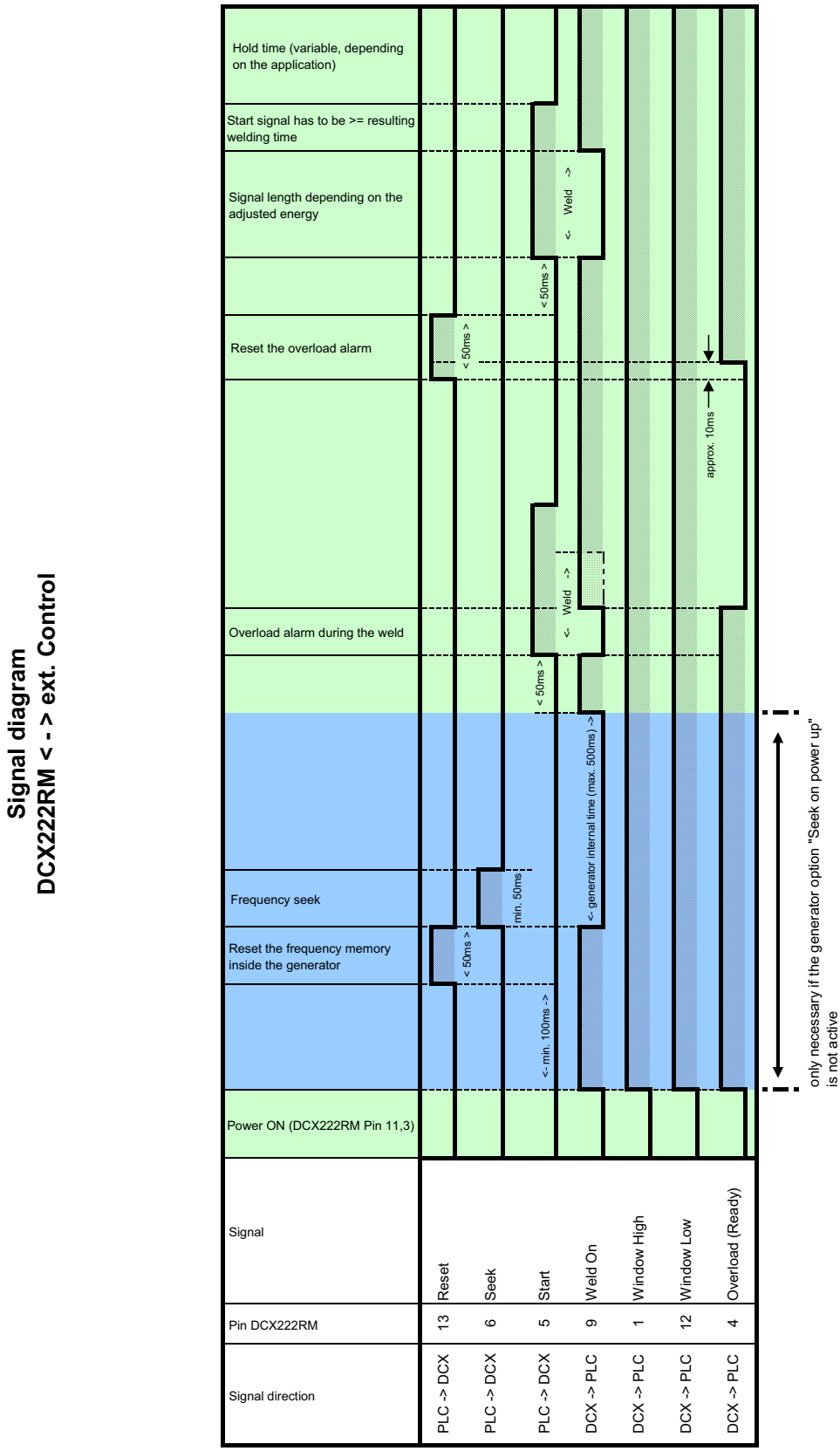
## A.1.7 Energy Mode (Max. Weld Time Reached)

**Figure A.7** Energy Mode (Window Low Alarm - Max. Weld Time Reached)



## A.1.8 Energy Mode (Overload Alarm)

**Figure A.8** Energy Mode (Overload Alarm)



# Index

**V**



**W**