

**STORED ENERGY POWER SUPPLY**

**CD-A**

# **USER MANUAL**



## Copyright © 2019 - 2024 AMADA WELD TECH

The engineering designs, drawings and data contained herein are the proprietary work of **AMADA WELD TECH** and may not be reproduced, copied, exhibited or otherwise used without the written authorization of **AMADA WELD TECH**.

Printed in the United States of America.

### Revision Record

Revision	EO	Date	Basis of Revision
A	45534	07/19	Original edition
B	45659	10/19	Model Number change + update weld parameters
C	45833	04/20	Update Company Name (Amada Weld Tech)
D	46051	10/20	Update CD-A1000A Specifications & Operation
E	46292	04/21	See ECO for details
F	46558	05/22	Update Error Message List & Communication Syntax
G	47127	10/23	Update Machine Directive Safety Standards
H	47206	01/24	Update Manual Title

The following CD-A Dual Pulse Resistance Welders are available:

**CD-A125A – 125 WS**

**CD-A300A – 300 WS**

**CD-A1000A – 1000 WS**

### Your New Welder Shipment Contains the Following Items:

1. The CD-A Control Unit (Power Supply)
2. Ship Kit # 4-81249-01
3. External current coil (CD-A1000A only)

**NOTE:** The **CD-A1000A** will also have an external transformer shipped on a separate pallet.

### Ship Kit Contents

Ship Kit Part Number 4-81249-01

AMADA WELD TECH Part Number	Description	Quantity
205-133	CE Power Cord, 115 VAC	1
245-162	Backshell, 37 pin D-sub	1
250-409	D-sub, 37 pin connector	1
4-40833-01	USB Assembly, CD-A Manuals	1

# CONTENTS

Revision Record .....	ii
Contact Us .....	vi
Safety Notes .....	vii
Limited Warranty .....	x

## Chapter 1. Description

Section I: Features .....	1-1
Features .....	1-1
Display Screens .....	1-2
Description .....	1-4
Section II: Major Components .....	1-5
Major Components .....	1-5
Front Panel Controls .....	1-5
UP/DOWN Buttons .....	1-6
Polarity Select .....	1-6
Pulse Select .....	1-6
RUN .....	1-6
MENU .....	1-6
LIMITS / COUNTERS .....	1-7
Pulse 1 & Pulse 2 .....	1-7
SQZ / HOLD .....	1-7
SAVE .....	1-7
CLEAR .....	1-7
CHARGE MONITOR Light .....	1-7
WELD / NO WELD Switch .....	1-7
Weld Disable Switch Operation .....	1-8

## Chapter 2. Installation and Setup

Section I: Installation .....	2-1
Unpacking .....	2-1
Space Requirements .....	2-1
Utilities .....	2-2
Power Input Specifications .....	2-2
Compressed Air and Cooling Water .....	2-2
Input Logic Configuration .....	2-2
Section II. CD-A125A & CD-A300A External Equipment Connections .....	2-3
Weld Disable Switch .....	2-3
Weld Head Connections to Power Supply Terminals (non-force fired Weld Head) .....	2-4
Mechanically Actuated Weld Head Connection (force fire Weld Head) .....	2-5
Pneumatic Actuated Weld Head Connection (non-force fired Weld Head) .....	2-6
EZ-AIR Weld Head Connections .....	2-7
24 VDC EZ-AIR™ .....	2-7
24 VAC EZ-AIR™ .....	2-8

## CONTENTS (Continued)

### Page

Section III. CD-A1000A External Equipment Connections .....	2-10
Overview .....	2-10
Connecting the CD-A1000A Transformer .....	2-11

### Chapter 3. Using Display Screens

Section I: RUN Screen .....	3-1
RUN Screen .....	3-1
Editing the RUN Screen .....	3-2
Pulse 1 .....	3-2
Pulse 2 .....	3-2
Squeeze Time .....	3-2
Hold Time .....	3-3
Section II: LIMITS / COUNTERS screen .....	3-4
LIMITS / COUNTERS Screen .....	3-4
Edit the LIMITS / COUNTERS Screen .....	3-4
Pulse 1 – Upper Limit.....	3-4
Pulse 1 – Lower Limit .....	3-4
Pulse 2 Limits .....	3-4
Pulse 1 – Action.....	3-5
Reset Weld Counter .....	3-5
Edit Counter Limit .....	3-5
Section III: MENU Screen .....	3-6
MENU Screen .....	3-6
Editing the MENU Screen .....	3-6
Buzzer .....	3-6
Baud Rate .....	3-7
Debounce .....	3-7
Chaining Start .....	3-7
Chaining End .....	3-8
Remote .....	3-8
Language .....	3-8
Reset Defaults .....	3-9
Repeat Mode .....	3-9
Repeat Time .....	3-10
Weld Mode .....	3-11

### Chapter 4. Operating Instructions

Section I: Introduction .....	4-1
Before You Start .....	4-1
Pre-Operational Checks .....	4-1
Connections .....	4-1
Power .....	4-1

## CONTENTS (Continued)

	Page
Compressed Air .....	4-1
Initial Setup .....	4-2
Section II. Operation .....	4-3
Start-Up .....	4-3
Using Existing Weld Schedules .....	4-3
Modifying Weld Schedules .....	4-3
Set Peak Current Monitor limits .....	4-4
Set Weld Counter Limit or Reset the Weld Counter. ....	4-5
Set MENU Entries .....	4-5
Dual Weldhead Operation .....	4-6
Programming Lock .....	4-6
Schedule Lock .....	4-6
Turning the Unit OFF .....	4-7
Section III: Operational Notes .....	4-8
Repetition Rate .....	4-8
Automatic Power Turn-Down .....	4-8
Extended Shut-down Procedure .....	4-8
<b>Chapter 5. Maintenance</b>	
Section I. Troubleshooting .....	5-1
Error Messages .....	5-2
Section II. Maintenance .....	5-4
Calibration .....	5-4
Electrode Maintenance .....	5-4
Parts Replacement .....	5-4
Section III. Repair Service .....	5-5
Appendix A. Technical Specifications .....	A-1
Appendix B. Electrical and Data Connections .....	B-1
Appendix C. System Timing .....	C-1
Appendix D. Communications .....	D-1
Appendix E. Machine Safety Compliance .....	E-1
Appendix F. The Basics of Resistance Welding .....	F-1
Appendix G. Quality Resistance Welding Solutions: Defining the Optimum Process .....	G-1

# CONTACT US

Thank you for purchasing an AMADA WELD TECH Resistance Welding System Control Unit.

Upon receipt of your equipment, please thoroughly inspect it for shipping damage prior to its installation. Should there be any damage, please immediately contact the shipping company to file a claim, and contact us at:

**AMADA WELD TECH INC.  
1820 South Myrtle Avenue  
Monrovia, CA 91016**

**TELEPHONE: (626) 303-5676**

**FAX: (626) 358-8048**

**e-mail: [info@amadaweldtech.com](mailto:info@amadaweldtech.com)**

The purpose of this manual is to provide the information required for proper and safe operation and maintenance of the AMADA WELD TECH CD-A125A, CD-A300A and CD-A1000A Dual Pulse Resistance Welding Power Supplies.

We have made every effort to ensure that information in this manual is both accurate and adequate. If you have any questions or suggestions to improve this manual, please contact us at the phone number or addresses above.

AMADA WELD TECH is not responsible for any loss or injury due to improper use of this product.

# SAFETY NOTES



## DANGER

- **DEATH ON CONTACT** may result if you fail to observe all safety precautions. *Lethal voltages* are present in the Power Supply.
- *Never* perform any welding operation without wearing protective safety glasses.

This instruction manual describes how to operate, maintain and service the CD-A125A, CD-A300A and CD-A1000A Dual Pulse Resistance Welding Power Supplies, and provides instructions relating to its *safe* use. A separate manual provides similar information for the weld head used in conjunction with the power supply. Procedures described in these manuals *must* be performed, as detailed, by *qualified* and *trained* personnel.

For *safety*, and to effectively take advantage of their full capabilities, please read these instruction manuals before attempting to operate weld heads and power supplies.

Procedures other than those described in these manuals or not performed as prescribed in them, may expose personnel to electrical shock or burn hazards.

After reading these manuals, keep them for future reference.

Please note the following conventions used in this manual:

**WARNING:** Comments marked this way warn the reader of conditions which might result in *immediate death or serious injury*.

**CAUTION:** Comments marked this way warn the reader of conditions which might result in damage to the equipment.



### Disposal

Properly handle and dispose of used materials.  
For the disposal of electronic waste please contact AMADA WELD TECH.

# ***Declaration of Conformity***

**Application of Council Directive:  
2014/35/EU, 2014/30/EU, 2011/65/EU**

**Standards To Which  
Conformity Is  
Declared:**

**EN62135-1:2015 (LVD)**

**EN62135-2:2015 (EMC)**

EN55011 Cls A Grp 1  
EN61000-3-2  
EN61000-3-3  
EN61000-4-2  
EN61000-4-3  
EN61000-4-4  
EN61000-4-5  
EN61000-4-6  
EN61000-4-8  
EN61000-4-11

**EN63000:2018 (EU RoHS)**

**Manufacturer:**

**AMADA WELD TECH INC.  
1820 South Myrtle Avenue, Monrovia, CA 91016, USA**

**European Representative:**

**AMADA WELD TECH GmbH  
Lindberghstrasse 1; 82178 Puchheim; Germany**

**Equipment Description:**

**CD WELDER**

**Equipment Class:**

**- Insulation Class I  
- Resistance Welding Equipment**

**Model Numbers:**

**CD-A125A & CD-A300A**

***I the undersigned, hereby declare that the equipment specified above,  
conforms to the above Directive(s) and Standard(s).***

**Place:**

Monrovia, CA, USA

**Signature:**

Thomas Houy

**Full Name:**

Thomas Houy

**Position:**

Mgr., Sustaining Engineering

**Date:**

June 30, 2023



# ***Declaration of Conformity***

**Application of Council Directive:  
2014/35/EU, 2014/30/EU, 2011/65/EU**

**Standards To Which  
Conformity Is  
Declared:**

**EN62135-1:2015 (LVD)**

**EN62135-2:2015 (EMC)**

EN55011 Cls A Grp 1  
EN61000-3-2  
EN61000-3-3  
EN61000-4-2  
EN61000-4-3  
EN61000-4-4  
EN61000-4-5  
EN61000-4-6  
EN61000-4-8  
EN61000-4-11

**EN63000:2018 (EU RoHS)**

**Manufacturer:**

**AMADA WELD TECH INC.  
1820 South Myrtle Avenue, Monrovia, CA 91016, USA**

**European Representative:**

**AMADA WELD TECH GmbH  
Lindberghstrasse 1; 82178 Puchheim; Germany**

**Equipment Description:**

**CD WELDER**

**Equipment Class:**

**- Insulation Class I  
- Resistance Welding Equipment**

**Model Numbers:**

**CD-A1000A**

***I the undersigned, hereby declare that the equipment specified above,  
conforms to the above Directive(s) and Standard(s).***

**Place:** Monrovia, CA, USA

**Signature:** Thomas Houy

**Full Name:** Thomas Houy

**Position:** Mgr., Sustaining Engineering

**Date:** June 30, 2023

**CD-A DUAL PULSE RESISTANCE WELDING POWER SUPPLY**

# LIMITED WARRANTY

## GENERAL TERMS AND CONDITIONS FOR THE SALE OF GOODS

### 1. Applicability.

(a) These terms and conditions of sale (these “**Terms**”) are the only terms which govern the sale of the goods (“**Goods**”) by Amada Weld Tech Inc. (“**Seller**”) to the buyer identified in the Sales Quotation and/or Acknowledgment (as each defined below) to which these Terms are attached or incorporated by reference (“**Buyer**”). Notwithstanding anything herein to the contrary, if a written contract signed by authorized representatives of both parties is in existence covering the sale of the Goods covered hereby, the terms and conditions of said contract shall prevail to the extent they are inconsistent with these Terms.

(b) The accompanying quotation of sale (the “**Sales Quotation**”) provided to Buyer, and/or sales order acknowledgement (“**Acknowledgement**”) and these Terms (collectively, this “**Agreement**”) comprise the entire agreement between the parties, and supersede all prior or contemporaneous understandings, agreements, negotiations, representations and warranties, and communications, both written and oral. For clarification, after the Acknowledgement is received by Buyer, the order for Goods is binding and cannot be cancelled by Buyer for any reason and the full purchase price amount set forth in the Acknowledgement shall be due and payable by Buyer to Seller pursuant to the payment schedule set forth in the Acknowledgement unless otherwise agreed to in writing by Seller. All terms and conditions contained in any prior or contemporaneous oral or written communication which are different from, or in addition to, the terms and conditions in this Agreement are hereby rejected and shall not be binding on Seller, whether or not they would materially alter this Agreement. These Terms prevail over any of Buyer’s terms and conditions of purchase regardless whether or when Buyer has submitted its purchase order or such terms. Fulfillment of Buyer’s order does not constitute acceptance of any of Buyer’s terms and conditions and does not serve to modify or amend these Terms. Notwithstanding anything herein to the contrary, all orders for Goods must be for a minimum purchase price of \$100 or such orders will be rejected by Seller.

### 2. Delivery.

(a) The Goods will be delivered within a reasonable time after Seller provides Buyer the Acknowledgment, subject to availability of finished Goods. Seller will endeavor to meet delivery schedules requested by Buyer, but in no event shall Seller incur any liability, consequential or otherwise, for any delays or failure to deliver as a result of ceasing to manufacture any product or any Force Majeure Event. Delivery schedules set forth in the Acknowledgment are Seller’s good faith estimate on the basis of current schedules. In no event shall Seller be liable for special or consequential damages resulting from failure to meet requested delivery schedules.

(b) Unless otherwise agreed in writing by the parties in the Acknowledgement, Seller shall deliver the Goods to the Seller’s plant in Monrovia, CA, USA (the “**Shipping Point**”) using Seller’s standard methods for packaging and shipping such Goods. Buyer shall take delivery of the Goods within three (3) days of Seller’s written notice that the Goods have been delivered to the Shipping Point. Buyer shall be responsible for all loading costs (including freight and insurance costs) and provide equipment and labor reasonably suited for receipt of the Goods at the Shipping Point. Seller shall not be liable for any delays, loss or damage in transit.

(c) Seller may, in its sole discretion, without liability or penalty, make partial shipments of Goods to Buyer, if applicable. Each shipment will constitute a separate sale, and Buyer shall pay for the units shipped whether such shipment is in whole or partial fulfillment of Buyer’s purchase order.

(d) If for any reason Buyer fails to accept delivery of any of the Goods on the date fixed pursuant to Seller’s notice that the Goods have been delivered at the Shipping Point, or if Seller is unable to deliver the Goods at the Shipping Point on such date because Buyer has not provided appropriate instructions, documents, licenses or authorizations: (i) risk of loss to the Goods shall pass to Buyer; (ii) the Goods shall be deemed to have been delivered; and (iii) Seller, at its option, may store the Goods until Buyer picks them up, whereupon Buyer shall be liable for all related costs and expenses (including, without limitation, storage and insurance).

### 3. Non-delivery.

(a) The quantity of any installment of Goods as recorded by Seller on dispatch from Seller’s place of business is conclusive evidence of the quantity received by Buyer on delivery unless Buyer can provide conclusive evidence proving the contrary.

(b) Seller shall not be liable for any non-delivery of Goods (even if caused by Seller’s negligence) unless Buyer gives written notice to Seller of the non-delivery within three (3) days of the date when the Goods would in the ordinary course of events have been received.

(c) Any liability of Seller for non-delivery of the Goods shall be limited to (in Seller’s sole discretion) replacing the Goods within a reasonable time or adjusting the invoice respecting such Goods to reflect the actual quantity delivered.

**4. Shipping Terms.** Unless indicated otherwise in the Acknowledgment, Delivery shall be made EXW (Incoterms 2010), Shipping Point, including without limitation, freight and insurance costs. If no delivery terms are specified on the Acknowledgement, the method of shipping will be in the sole discretion of Seller. Unless directed in writing otherwise by Buyer, full invoice value will be declared for all shipments.

**5. Title and Risk of Loss.** Title and risk of loss passes to Buyer upon delivery of the Goods at the Shipping Point. As collateral security for the payment of the purchase price of the Goods, Buyer hereby grants to Seller a lien on and security interest in and to all of the right, title and interest of Buyer in, to and under the Goods, wherever located, and whether now existing or hereafter arising or acquired from time to time, and in all accessions thereto and replacements or modifications thereof, as well as all proceeds (including insurance proceeds) of the foregoing. The security interest granted under this provision constitutes a purchase money security interest under the California Commercial Code.

**6. Amendment and Modification.** These Terms may only be amended or modified in a writing which specifically states that it amends these Terms and is signed by an authorized representative of each party.

---

## CD-A DUAL PULSE RESISTANCE WELDING POWER SUPPLY

## 7. Inspection and Rejection of Nonconforming Goods.

(a) Buyer shall inspect the Goods within two (2) days of receipt (“**Inspection Period**”). Buyer will be deemed to have accepted the Goods unless it notifies Seller in writing of any Nonconforming Goods during the Inspection Period and furnishes such written evidence or other documentation as required by Seller. “**Nonconforming Goods**” means only the following: (i) product shipped is different than identified in Buyer’s Acknowledgement; or (ii) product’s label or packaging incorrectly identifies its contents. Notwithstanding the foregoing, for shipped Goods that require field installation, the “re-verification” terms in the Acknowledgement shall apply and for custom installations, the inspection and verification shall take place at Buyer’s site immediately after the installation is completed.

(b) Seller will only accept Nonconforming Goods that are returned under Seller’s Return Material Authorization procedures then in effect (“**RMA**”). Buyer shall obtain a RMA number from Seller prior to returning any Nonconforming Goods and return the Nonconforming Goods prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016 or to such other location as designated in writing by Seller for the examination to take place there. If Seller reasonably verifies Buyer’s claim that the Goods are Nonconforming Goods and that the nonconformance did not developed by use from Buyer, Seller shall, in its sole discretion, (i) replace such Nonconforming Goods with conforming Goods, or (ii) credit or refund the Price for such Nonconforming Goods pursuant to the terms set forth herein. Notwithstanding the foregoing, the only remedy for Nonconforming Goods that are custom systems is repair (not refund or replacement). No returns for Nonconforming Goods are allowed after thirty (30) days from the original shipping date.

(c) Buyer acknowledges and agrees that the remedies set forth in Section 7(a) are Buyer’s exclusive remedies for the delivery of Nonconforming Goods. Except as provided under Section 7(a) and Section 14, all sales of Goods to Buyer are made on a one-way basis and Buyer has no right to return Goods purchased under this Agreement to Seller.

## 8. Price.

(a) Buyer shall purchase the Goods from Seller at the prices (the “**Prices**”) set forth in Seller’s published catalogue literature in force as of the date of the Sales Quotation. However, the Prices shown in such catalogue literature or any other publication are subject to change without notice. Unless specifically stated to the contrary in the Sales Quotation, quoted Prices and discounts are firm for thirty (30) days from the date of the Sales Quotation. Unless otherwise stated, prices are quoted EXW (Incoterms 2010), Shipping Point. Unless otherwise stated in the Acknowledgement, if the Prices should be increased by Seller before delivery of the Goods to a carrier for shipment to Buyer, then these Terms shall be construed as if the increased prices were originally inserted herein, and Buyer shall be billed by Seller on the basis of such increased prices.

(b) All Prices are exclusive of all sales, use and excise taxes, and any other similar taxes, duties and charges of any kind imposed by any governmental authority on any amounts payable by Buyer. Buyer shall be responsible for all such charges, costs and taxes (present or future); provided, that, Buyer shall not be responsible for any taxes imposed on, or with respect to, Seller’s income, revenues, gross receipts, personnel or real or personal property or other assets.

## 9. Payment Terms.

(a) Unless otherwise provided in the Acknowledgement, if Buyer has approved credit with Seller, Buyer shall pay all invoiced amounts due to Seller within thirty (30) days from the date of Seller’s invoice. If Seller does not have Buyer’s financial information and has not provided pre-approved credit terms for Buyer, the payment must be made in cash with order or C.O.D. in US dollars. If Buyer has approved credit terms, the payment may be made by cash with order, wire transfer of immediately available funds, or check in US dollars. Certain products require a down payment. Any payment terms other than set forth above will be identified in the Acknowledgement. Notwithstanding anything herein to the contrary, all prepaid deposits and down payments are non-refundable. If a deposit is not received when due, Seller reserves the right to postpone manufacturing of Goods until payment is received. Seller will not be responsible for shipment delays due to deposit payment delays.

(b) In Seller’s sole discretion, Seller may access Buyer interest on all late payments at the lesser of the rate of 1.5% per month or the highest rate permissible under applicable law, calculated daily and compounded monthly. Buyer shall reimburse Seller for all costs incurred in collecting any late payments, including, without limitation, attorneys’ fees. In addition to all other remedies available under these Terms or at law (which Seller does not waive by the exercise of any rights hereunder), Seller shall be entitled to suspend the delivery of any Goods if Buyer fails to pay any amounts when due hereunder and such failure continues for ten (10) days following written notice thereof.

(c) Buyer shall not withhold payment of any amounts due and payable by reason of any set-off of any claim or dispute with Seller, whether relating to Seller’s breach, bankruptcy or otherwise.

## 10. Intellectual Property; Software License.

(a) To the extent that any Goods provided under this Agreement contains software, whether pre-installed, embedded, in read only memory, or found on any other media or other form (“**Software**”), such Software and accompanying documentation are licensed to Buyer, not sold and shall remain the sole and exclusive property of Seller or third party licensors of Seller. Seller grants Buyer a non-exclusive license to use the Software solely as provided in and in connection with the use of the Goods in which such Software is contained and in accordance with any applicable user documentation provided with such Goods and subject to the provisions of this Agreement. Certain of Seller’s Goods may include third party software such as computer operating systems. Licenses to such third party software are subject to the terms and conditions of any applicable third party software license agreements. Unless identified in the Acknowledgement, no license is granted by Seller with respect to such third party software products that may be provided with the Goods (if any). Seller makes no warranties regarding any third party software that may accompany the Goods or otherwise and such software is explicitly included in the definition of Third Party Products below.

(b) Buyer shall not copy, modify, or disassemble, or permit others to copy, modify, or disassemble, the Software, nor may Buyer modify, adapt, translate, reverse assemble, decompile, or otherwise attempt to derive source code from the Software. Buyer shall not transfer possession of the Software except as part of, or with, the Goods, and each such transfer shall be subject to the restrictions contained herein. Buyer may not sublicense, rent, loan, assign or otherwise transfer the Software or documentation, and Buyer shall retain on all copies of the Software and documentation all copyright and other proprietary notices or legends appearing therein or thereon. Seller may terminate this license upon written notice for any violation of any of the terms of this license

or any material breach of any provision of this Agreement. Buyer shall immediately discontinue use of the Software upon any termination of this license or Agreement. This license shall terminate upon any termination of the Agreement.

(c) All patents, trademarks, copyrights or other intellectual property rights embodied in the Goods, including without limitation the Software, are owned by Seller and its licensors. Seller and its licensors retain all right, title and interest in such intellectual property rights. Except as expressly set forth herein, no license rights or ownership in or to any of the foregoing is granted or transferred hereunder, either directly or by implication. ALL RIGHTS RESERVED.

(d) If Buyer is the United States Government or any agency thereof, each of the components of the Software and user documentation are a “commercial item,” and “computer software” as those terms are defined at 48 C.F.R. 2.101, consisting of “commercial computer software” and “commercial computer software documentation,” as such terms are used in 48 C.F.R. 12.212. Consistent with 48 C.F.R. 12.212 and 48 C.F.R. 227.7202-1 through 227.7202-4, all United States government Buyers acquire only those rights in the Software and user documentation that are specified in this Agreement.

**11. Installation and Other Services.** Seller shall provide installation services (“**Installation Services**”) to Buyer if set forth in the Acknowledgment. If Installation Services are provided for in the Acknowledgment, Buyer will prepare the location for the installation consistent with Buyer’s written specifications and Buyer will install necessary system cable and assemble any necessary equipment or hardware not provided by Seller, unless agreed otherwise in writing by the parties. For Goods that will be operated on or in connection with Buyer supplied hardware or software, Buyer is responsible for ensuring that its hardware and software conform with Seller minimum hardware and software requirements as made available to Buyer. Seller shall provide other field services, such as maintenance visits and field repairs (the “**Other Services**” and together with the Installation Services, the “**Services**”) if set forth in the Acknowledgment.

## **12. Limited Warranty.**

(a) Subject to the exceptions and upon the conditions set forth herein, Seller warrants to Buyer that for a period of one (1) year from the date of shipment (“**Warranty Period**”), that such Goods will be free from material defects in material and workmanship.

(b) Notwithstanding the foregoing and anything herein to the contrary, the warranty set forth in this Section 12 shall be superseded and replaced in its entirety with the warranty set forth on **Exhibit A** hereto if the Goods being purchased are specialty products, which include, without limitation, laser products, fiber markers, custom systems, workstations, Seller-installed products, non-catalogue products and other custom-made items (each a “**Specialty Product**”).

(c) **EXCEPT FOR THE WARRANTY SET FORTH IN SECTION 12(A), SELLER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO THE GOODS (INCLUDING ANY SOFTWARE) OR SERVICES, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.**

(d) Products manufactured by a third party and third party software (“**Third Party Product**”) may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Goods. Third Party Products are not covered by the warranty in Section 12(a). For the avoidance of doubt, **SELLER MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO ANY THIRD PARTY PRODUCT, INCLUDING ANY (a) WARRANTY OF MERCHANTABILITY; (b) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; (c) WARRANTY OF TITLE; OR (d) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.** Notwithstanding the foregoing, in the event of the failure of any Third Party Product, Seller will assist (within reason) Buyer (at Buyer’s sole expense) in obtaining, from the respective third party, any (if any) adjustment that is available under such third party’s warranty.

(e) Seller shall not be liable for a breach of the warranty set forth in Section 12(a) unless: (i) Buyer gives written notice of the defect, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect and such notice is received by Seller during the Warranty Period; (ii) Seller is given a reasonable opportunity after receiving the notice to examine such Goods; (iii) Buyer (if requested to do so by Seller) returns such Goods (prepaid and insured to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016 or to such other location as designated in writing by Seller) to Seller pursuant to Seller’s RMA procedures and Buyer obtains a RMA number from Seller prior to returning such Goods for the examination to take place; and (iii) Seller reasonably verifies Buyer’s claim that the Goods are defective and that the defect developed under normal and proper use.

(f) Seller shall not be liable for a breach of the warranty set forth in Section 12(a) if: (i) Buyer makes any further use of such Goods after giving such notice; (ii) the defect arises because Buyer failed to follow Seller’s oral or written instructions as to the storage, installation, commissioning, use or maintenance of the Goods; (iii) Buyer alters or repairs such Goods without the prior written consent of Seller; or (iv) repairs or modifications are made by persons other than Seller’s own service personnel, or an authorized representative’s personnel, unless such repairs are made with the written consent of Seller in accordance with procedures outlined by Seller.

(g) All expendables such as electrodes are warranted only for defect in material and workmanship which are apparent upon receipt by Buyer. The foregoing warranty is negated after the initial use.

(h) Subject to Section 12(e) and Section 12(f) above, with respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: (i) repair or replace such Goods (or the defective part) or (ii) credit or refund the price of such Goods at the pro rata contract rate, provided that, if Seller so requests, Buyer shall, at Buyer’s expense, return such Goods to Seller.

(i) **THE REMEDIES SET FORTH IN SECTION 12(H) SHALL BE BUYER’S SOLE AND EXCLUSIVE REMEDY AND SELLER’S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN SECTION 12(A).** Representations and warranties made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty, as set forth above, shall not be binding upon Seller.

## **13. Limitation of Liability.**

(a) **IN NO EVENT SHALL SELLER BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR PUNITIVE DAMAGES, LOST PROFITS OR REVENUES OR DIMINUTION IN VALUE, LOSS OF INFORMATION OR DATA, OR PERSONAL INJURY OR DEATH ARISING IN ANY WAY OUT OF THE MANUFACTURE, SALE, USE, OR INABILITY TO USE ANY GOODS, SOFTWARE OR SERVICE, OR ARISING OUT OF OR RELATING TO ANY BREACH OF THESE TERMS, WHETHER OR NOT THE POSSIBILITY OF SUCH DAMAGES HAS BEEN DISCLOSED IN ADVANCE BY BUYER OR COULD HAVE BEEN REASONABLY**

FORESEEN BY BUYER, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE. (b) IN NO EVENT SHALL SELLER'S AGGREGATE LIABILITY ARISING OUT OF OR RELATED TO THIS AGREEMENT, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE TOTAL OF THE AMOUNTS PAID TO SELLER FOR THE GOODS SOLD HEREUNDER.

(c) ALL WARRANTIES SET FORTH HEREIN, DIRECT OR IMPLIED, ARE VOIDED IF THE INITIAL INSTALLATION AND START-UP OF THE SUBJECT GOOD IS NOT SUPERVISED BY AN AUTHORIZED REPRESENTATIVE OF SELLER. AFTER INSTALLATION, ANY RE-ALIGNMENT, RE-CLEANING, OR RE-CALIBRATION, PROVIDED THEY ARE NOT RELATED TO A PROVEN DEFECT IN MATERIALS OR WORKMANSHIP, SHALL BE PERFORMED BY AN AUTHORIZED REPRESENTATIVE OF SELLER AT THE CURRENT SERVICE RATES.

(d) WHERE GOODS ARE SUBJECT TO A MOVE TO ANOTHER LOCATION AFTER THE ORIGINAL INSTALLATION HAS BEEN MADE, THE WARRANTY MAY BE MAINTAINED ONLY IF SUPERVISED BY AN AUTHORIZED REPRESENTATIVE OF SELLER. SELLER, FOR A SERVICE CHARGE, WILL ARRANGE FOR AND SUPERVISE THE DISCONNECTION, TRANSPORTATION, REINSTALLATION AND START-UP OF THE EQUIPMENT. CLAIMS FOR DAMAGE IN SHIPMENT ARE THE RESPONSIBILITY OF BUYER AND SHALL BE FILED PROMPTLY WITH THE TRANSPORTATION COMPANY.

**14. Return Goods Policy.** Seller's products may be returned to Seller for credit within sixty (60) days of shipment subject to the following conditions.

(a) In order to return products for credit, Buyer must obtain a RMA number from Seller. Upon receipt, it must be executed by an authorized person and then returned with the Goods. Goods returned to Seller without a RMA will be returned at Buyer's expense.

(b) Goods are to be returned to Seller at 1820 South Myrtle Avenue, Monrovia, CA 91016 with Freight Prepaid. Seller will not accept collect shipments.

(c) Restocking fees will be assessed in accordance with the following schedules: (i) Goods returned within the first thirty (30) days from shipment date will be restocked less twenty percent (20%) of the amount billed on the original invoice. (ii) Goods returned over thirty (30) days of shipment but less than sixty (60) days will be restocked less thirty percent (30%) of the amount billed on the original invoice. (iii) No returns are allowed after sixty (60) days from the original shipping date.

(d) The restocking fees set forth above are the minimum fees. If a returned Good requires rework to restore it to a saleable condition, further charges will be assessed. Seller's quality assurance department will document the condition of the Goods when received by Seller and report their findings to Buyer.

(e) **Notwithstanding the foregoing provisions of this Section 14, the following Goods cannot be returned, are not eligible for any credit and cannot be restocked: (i) custom or modified products and (ii) any expendable product(s) that have been used.**

**15. Compliance with Law and Indemnification.** Buyer shall comply with all applicable laws, regulations and ordinances. Buyer shall maintain in effect all the licenses, permissions, authorizations, consents and permits that it needs to carry out its obligations under this Agreement. Buyer shall comply with all export and import laws of all countries involved in the sale of the Goods under this Agreement or any resale of the Goods by Buyer. Goods, Services and technical data delivered by Seller shall be subject to U.S. export controls. Buyer shall, and shall cause its customers to, obtain all licenses, permits and approvals required by any government and shall comply with all applicable laws, rules, policies and procedures of the applicable government and other competent authorities. Buyer will indemnify and hold Seller harmless for any violation or alleged violation by Buyer of such laws, rules, policies or procedures. Buyer shall not transmit, export or re-export, directly or indirectly, separately or as part of any system, the Goods or any technical data (including processes and Services) received from Seller, without first obtaining any license required by the applicable government, including without limitation, the U.S. government. Buyer also certifies that none of the Goods or technical data supplied by Seller under this Agreement will be sold or otherwise transferred to, or made available for use by or for, any entity that is engaged in the design, development, production or use of nuclear, biological or chemical weapons or missile technology. No Buyer information will be deemed "technical data" unless Buyer specifically identifies it to Seller as such. Buyer assumes all responsibility for shipments of Goods requiring any government import clearance. Seller may terminate this Agreement if any governmental authority imposes antidumping or countervailing duties or any other penalties on Goods. For all international shipments, Seller requires that all required Export Control documentations, including Form BIS-711 Statement by Ultimate Consignee and Purchases, are submitted by Buyer along with the purchase order. Seller reserves the right to postpone shipment until all documentations are completed and submitted to Seller. Seller will not be responsible for shipment delays due to non-compliance by Buyer of the foregoing two sentences.

**16. Termination.** In addition to any remedies that may be provided under these Terms, Seller may terminate this Agreement with immediate effect upon written notice to Buyer, if Buyer: (i) fails to pay any amount when due under this Agreement and such failure continues for ten (10) days after Buyer's receipt of written notice of nonpayment; (ii) has not otherwise performed or complied with any of these Terms, in whole or in part; or (iii) becomes insolvent, files a petition for bankruptcy or commences or has commenced against it proceedings relating to bankruptcy, receivership, reorganization or assignment for the benefit of creditors.

**17. Waiver.** No waiver by Seller of any of the provisions of this Agreement is effective unless explicitly set forth in writing and signed by Seller. No failure to exercise, or delay in exercising, any rights, remedy, power or privilege arising from this Agreement operates or may be construed as a waiver thereof. No single or partial exercise of any right, remedy, power or privilege hereunder precludes any other or further exercise thereof or the exercise of any other right, remedy, power or privilege.

**18. Confidential Information.** All non-public, confidential or proprietary information of Seller, including, but not limited to, specifications, samples, patterns, designs, plans, drawings, documents, data, business operations, customer lists, pricing, discounts or rebates, disclosed by Seller to Buyer, whether disclosed orally or disclosed or accessed in written, electronic or other form or media, and whether or not marked, designated or otherwise identified as "confidential," in connection with this Agreement is confidential, solely for the use of performing this Agreement and may not be disclosed or copied unless authorized in advance by Seller in writing. Upon Seller's request, Buyer shall promptly return all documents and other materials received from Seller. Seller shall be entitled to injunctive relief for any violation of this Section 18. This Section 18 does not apply to information that is: (a) in the public domain through no fault of Buyer; (b) known to Buyer at the time of disclosure without restriction as evidenced by its records; or (c) rightfully obtained by Buyer on a non-confidential basis from a third party.

**19. Force Majeure.** Seller shall not be liable or responsible to Buyer, nor be deemed to have defaulted or breached this Agreement, for any failure or delay in fulfilling or performing any term of this Agreement when and to the extent such failure or delay is caused by or results from acts or circumstances beyond the reasonable control of Seller including, without limitation, acts of God, flood, fire, earthquake, explosion, governmental actions, war, invasion or hostilities (whether war is declared or not), terrorist threats or acts, riot, or other civil unrest, national emergency, revolution, insurrection, epidemic, lock-outs, strikes or other labor disputes (whether or not relating to either party's workforce), or restraints or delays affecting carriers or inability or delay in obtaining supplies of adequate or suitable materials, materials or telecommunication breakdown or power outage (each a "**Force Majeure Event**"), provided that, if the event in question continues for a continuous period in excess of thirty (30) days, Buyer shall be entitled to give notice in writing to Seller to terminate this Agreement.

**20. Assignment.** Buyer shall not assign any of its rights or delegate any of its obligations under this Agreement without the prior written consent of Seller. Any purported assignment or delegation in violation of this Section 20 is null and void. No assignment or delegation relieves Buyer of any of its obligations under this Agreement.

**21. Relationship of the Parties.** The relationship between the parties is that of independent contractors. Nothing contained in this Agreement shall be construed as creating any agency, partnership, joint venture or other form of joint enterprise, employment or fiduciary relationship between the parties, and neither party shall have authority to contract for or bind the other party in any manner whatsoever.

**22. No Third-Party Beneficiaries.** This Agreement is for the sole benefit of the parties hereto and their respective successors and permitted assigns and nothing herein, express or implied, is intended to or shall confer upon any other person or entity any legal or equitable right, benefit or remedy of any nature whatsoever under or by reason of these Terms.

**23. Governing Law.** All matters arising out of or relating to this Agreement is governed by and construed in accordance with the internal laws of the State of California without giving effect to any choice or conflict of law provision or rule (whether of the State of California or any other jurisdiction) that would cause the application of the laws of any jurisdiction other than those of the State of California.

**24. Dispute Resolution.**

(a) If Buyer is an entity formed under the laws of the United States of America, or any of its states, districts or territories ("**U.S. Law**"), then any dispute, legal suit, action or proceeding arising out of or relating to this Agreement shall be adjudicated and decided in the federal courts of the United States of America or the courts of the State of California in each case located in the City of Los Angeles and County of Los Angeles, California and each party irrevocably submits to the exclusive and personal jurisdiction of such courts in any such dispute, suit, action or proceeding.

(b) If Buyer is an entity formed under the laws of any country, state, district or territory other than U.S. Law, then the parties irrevocably agree that any dispute, legal suit, action or proceeding arising out of or relating to this Agreement shall be submitted to the International Court of Arbitration of the International Chamber of Commerce ("**ICC**") and shall be finally settled under the Rules of Arbitration of the ICC. The place and location of the arbitration shall be in Los Angeles, California, pursuant to the ICC's Rules of Arbitration and shall be finally settled in accordance with said rules. The arbitration shall be conducted before a panel of three arbitrators. Each party shall select one arbitrator and the two arbitrators so selected shall select the third arbitrator, who shall act as presiding arbitrator. Notwithstanding the foregoing, if the matter under dispute is \$500,000 or less, there shall only be one arbitrator who shall be mutually selected by both parties. If the party-selected arbitrators are unable to agree upon the third arbitrator, if either party fails to select an arbitrator, or in the case that only one arbitrator is required and the parties are unable to agree, then the International Court of Arbitration shall choose the arbitrator. The language to be used in the arbitral proceeding shall be English. The arbitrator(s) shall have no authority to issue an award that is contrary to the express terms of this Agreement or the laws of the State of California or applicable US Federal Law, and the award may be vacated or corrected on appeal to a court of competent jurisdiction for any such error. The arbitrator(s) shall be specifically empowered to allocate between the parties the costs of arbitration, as well as reasonable attorneys' fees and costs, in such equitable manner as the arbitrator(s) may determine. The arbitrator(s) shall have the authority to determine issues of arbitrability and to award compensatory damages, but they shall not have authority to award punitive or exemplary damages. Judgment upon the award so rendered may be entered in any court having jurisdiction or application may be made to such court for judicial acceptance of any award and an order of enforcement, as the case may be. In no event shall a demand for arbitration be made after the date when institution of a legal or equitable proceeding based upon such claim, dispute or other matter in question would be barred by the applicable statute of limitations. Notwithstanding the foregoing, either party shall have the right, without waiving any right or remedy available to such party under this Agreement or otherwise, to seek and obtain from any court of competent jurisdiction any interim or provisional relief that is necessary or desirable to protect the rights or property of such party, pending the selection of the arbitrator(s) hereunder or pending the arbitrator(s)' determination of any dispute, controversy or claim hereunder.

**25. Notices.** All notices, request, consents, claims, demands, waivers and other communications hereunder (each, a "**Notice**") shall be in writing and addressed to the parties at the addresses set forth on the face of the Acknowledgement or to such other address that may be designated by the receiving party in writing. All Notices shall be delivered by personal delivery, nationally recognized overnight courier (with all fees pre-paid), facsimile (with confirmation of transmission) or certified or registered mail (in each case, return receipt requested, postage prepaid). Except as otherwise provided in this Agreement, a Notice is effective only (a) upon receipt of the receiving party, upon confirmation of delivery by nationally recognized overnight courier or upon forty-eight (48) hours after being sent by certified or registered mail (as applicable), and (b) if the party giving the Notice has complied with the requirements of this Section 25.

**26. Severability.** If any term or provision of this Agreement is invalid, illegal or unenforceable in any jurisdiction, such invalidity, illegality or unenforceability shall not affect any other term or provision of this Agreement or invalidate or render unenforceable such term or provision in any other jurisdiction.

**27. Survival.** Provisions of these Terms which by their nature should apply beyond their terms will remain in force after any termination or expiration of this Order including, but not limited to, the following provisions: Compliance with Laws, Confidentiality, Governing Law, Dispute Resolution, Survival, and the restrictions on Software in Sections 10(b), (c) and (d).

---

## CD-A DUAL PULSE RESISTANCE WELDING POWER SUPPLY

# CHAPTER 1

## Description

### Section I: Features

#### Features

AMADA WELD TECH **CD-A Dual Pulse Resistance Welding Power Supplies** precisely control welding energy and weld head timing. For the rest of this manual, the **CD-A Dual Pulse Resistance Welding Power Supply** will simply be called the *Power Supply*.

The CD-A125A and CD-A300A contain the same set of control features. The CD-A1000A has all of the features of the CD-A product family except; the polarity is fixed and upslope is not user settable in the weld schedules.

- Multi-function **microprocessor control** facilitates multiple applications at a single work-station and is compatible with both manual and air actuated weld heads. The Power Supply provides repeatable process control and protection from weld schedule changes by unauthorized personnel.
- **Dual pulse welding** can eliminate weld splash and improve weld quality, especially when welding plated materials.
- A **peak current monitor** displays actual peak current delivered to the weld on each pulse.
- User programmable **monitor limits** on each pulse can help to detect poor welding conditions. Programmable test pulses in conjunction with the **INHIBIT SECOND PULSE** feature can inhibit welding when conditions are out of limits on the test pulse.
- The **upslope** feature improves welding when parts are oxidized, surfaces are contaminated, or parts do not mate well (this feature is not present in the CD-A1000A).
- **Alternating polarity** allows the user to program pulse polarity changes each time the welder is fired. This allows the user to equalize the wear between two electrodes in many parallel gap welding processes (this feature is not present in the CD-A1000A).
- Five **relays** provide rear panel output signals for **UNIT READY TO WELD**, **WELD COMPLETED**, **WELD OUT OF LIMITS**, **ALARM**, and **WELD COUNTER PRESET LIMIT**.



## CHAPTER 1: DESCRIPTION

- Two **air valve drivers** are provided for sequential control of two separate air operated weld heads, when desired. As shipped, Air Valve Driver 2 is configured for 24 VAC weld head operation, but may be reconfigured for 24 VDC compatibility when required. See *Appendix B, Electrical & Data Connections* for details on how to select the drive voltage. Air Valve Driver 1 is **only** compatible with 24 VDC valve drivers.
- Remote schedule selection **simplifies use in automated systems**. The **CONTROL SIGNALS** connector provides remote control capability for **REMOTE WELD INHIBIT**, **REMOTE WELD SCHEDULE SELECTION**, and **REMOTE FIRING**.
- The **CHAIN SCHEDULE** feature allows consecutive schedules to be chained together.
- An **advanced charging circuit** provides rapid recharging and greater throughput.
- External **Weld Disable** function.

### Display Screens

Large, remarkably intuitive screens, allow the user to see everything at a glance. See *Chapter 3, Using Display Screens* for complete instructions. Briefly, the **RUN** screen is **BLUE**, welds within limits display **GREEN**, and welds out of limits display **RED** as indicated below.



Pulse 1 & Pulse 2 Limits OFF



Pulse 1 Out of Limits / Pulse 2 Within Limits

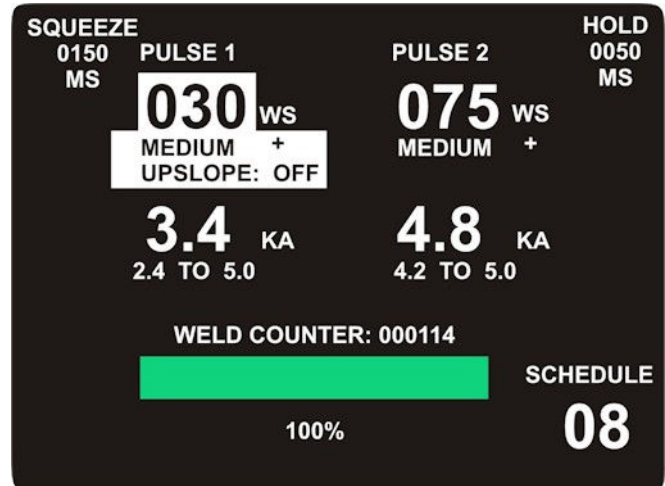


To “edit” **RUN**, **MENU**, or **LIMITS / COUNTERS** screens, press the appropriate **PULSE 1**, **PULSE 2**, **SQZ/HOLD**, **LIMITS/COUNTERS** or **MENU** button until the screen changes to **BLACK** indicating you’ve entered “edit” mode.

Highlight the item being edited in white as shown at the right. Edit values using the ▲▼ (up/down) arrows keys, then advance to the next field.

When finished, press the **SAVE** button, which will "save changes" and return the display to the **BLUE** run mode screen. You’re ready to weld!

**NOTE:** If you edited the limits screen, you will need to press **RUN** after **SAVE** to enable the weld mode.



See *Chapter 3, Using the Display Screens* for details on using these features.

- The schedule lock feature restricts welding to the one selected weld schedule and prevents changing that schedule.
- The program lock feature allows the use of all 63 schedules, but does *not* allow editing schedule values.
- The digital display allows operators to set welding energy accurately and quickly.
- The Power Supply is compatible with both manually and air actuated weld heads with 1-level or 2-level foot switches.
- The Power Supply is compatible with force fired and non-force fired weld heads. The **SQUEEZE** and **HOLD** delay times are adjustable from **20** to **2,999 ms** and **20** to **2,999 ms** respectively.
- A built-in weld counter allows controlling events based on the number of welds completed. The counter limit provides an output signal when the count equals or exceeds the user-programmable value.
- The firing circuit is compatible with single pole, double pole or optical firing switches.
- The energy monitor and lockout prevent poor welds caused by premature firing of the power supply before the capacitor bank has been properly charged or discharged.
- The line failure turndown safety feature discharges the capacitor bank when input power is interrupted.
- The Power Supply is protected from radio frequency and electromagnetic interference, resulting in reliable operation even in high electrical noise environments. Input switch debounce circuitry eliminates false triggering.

Detailed instructions on using these features are located in *Chapter 4, Operating Instructions*.

### Description

The 125, 300, and 1000 Watt-second, stored energy, capacitor discharge, dual pulse power supplies are versatile and can effectively solve most precision, small part resistance welding problems.

Up to 63 weld schedules can be programmed and saved into memory. A built-in schedule protection feature protects weld schedules from unauthorized or inadvertent changes. The exclusive charge monitor and firing lockout features guarantee accurate energy output independent of line voltage fluctuations and/or process speed.

*Dual pulse* welding improves weld quality and can eliminate weld splash. *Dual pulse* means each weld is performed with two pulses with independent energy levels and independent polarity. When welding parts with plating or contamination the first pulse can be used to consistently seat the electrodes onto the part surfaces. The second pulse welds the base metals.

The remote schedule feature allows the weld schedules to be selected in automated applications.

CD-A Power Supplies are designed to operate at either 110 – 120 VAC  $\pm$  10% or 200 – 240 VAC  $\pm$  10%, 50/60 Hz and can be used with manual, user actuated, or air actuated weld heads.

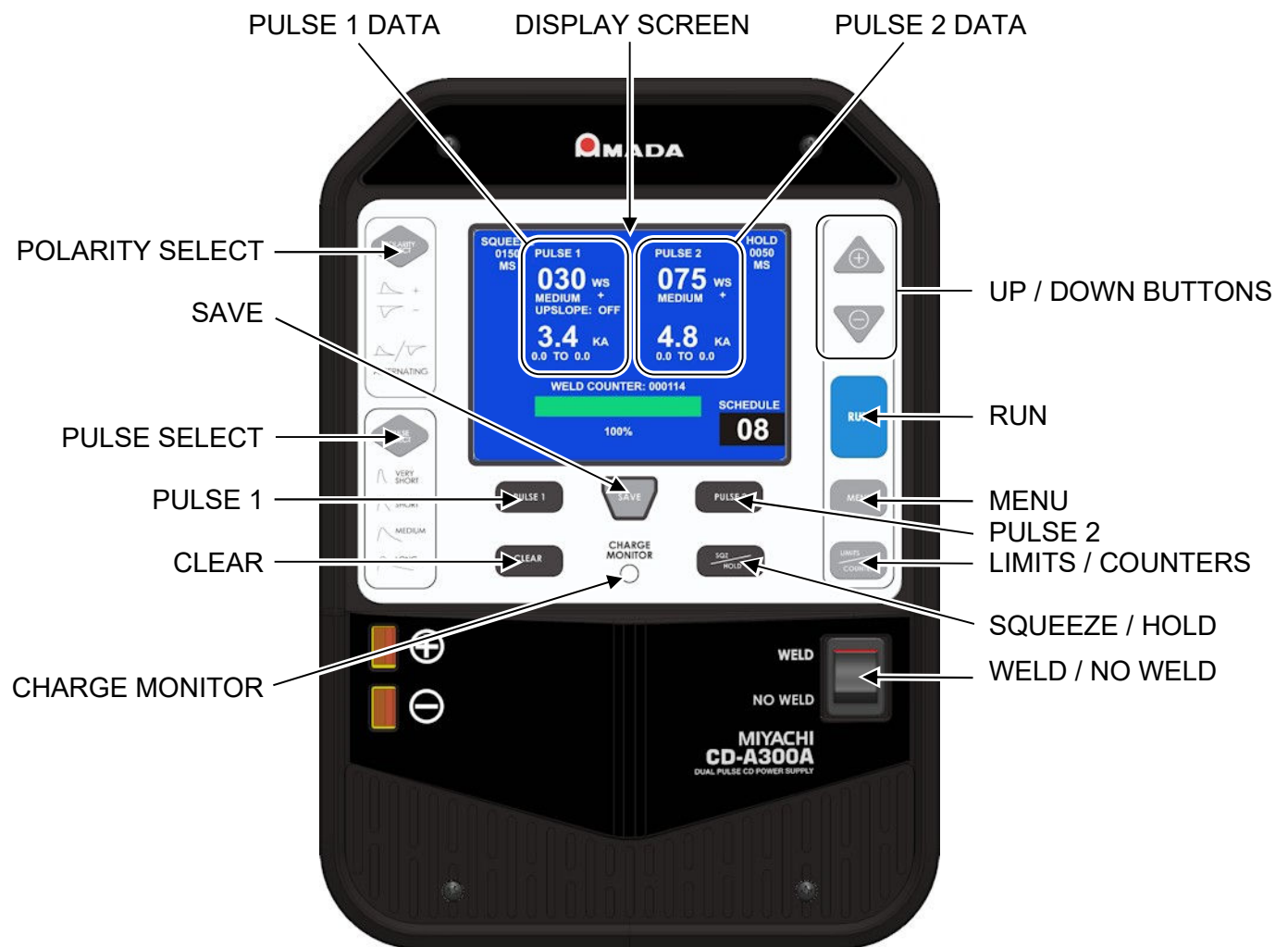
## Section II: Major Components

### Major Components

The major components are located on the front panel, which contain operator controls and indicators, and on the rear panel, which contain the circuit breaker, power and signal connectors. The rear panel connections are discussed in *Chapter 2, Installation and Setup*.

### Front Panel Controls

The function of each item is described on the following pages.



Front Panel Controls

### UP / DOWN Buttons

The UP (+) and DOWN (−) buttons have two functions.

- During “normal” operation, up and down buttons are used to scroll through the 63 schedules to select a desired schedule. The schedule number displays at the lower right corner of the front panel display screen.
- In “editing” mode, these buttons also are used to increase or decrease the highlighted values.

### Polarity Select

This button is **only** active when the Power Supply is in the “editing” mode. Press this button repeatedly until the polarity you want displays adjacent to the Pulse 1 or Pulse 2, 3-digit energy display.

For example, the front panel display screen shown on the previous page, indicates positive (+) polarity selected for both Pulse 1 and Pulse 2.

**NOTE:** This button is not active on the CD-A1000A

### Pulse Select

This button is **only** active when the Power Supply is in the “editing” mode. Press this button repeatedly until the pulse duration you want is indicated directly below the 3-digit energy display. The front panel display screen shown on the previous page, indicates **MEDIUM UPSLOPE** pulse duration selected for Pulse 1 and **MEDIUM UPSLOPE** pulse duration selected for Pulse 2.

**NOTE:** The **VERY SHORT** setting provides the shortest duration for a given energy setting. The **SHORT** setting will provide the highest peak current for a given energy setting. The **LONG** setting will provide the lowest peak current and longest duration for a given energy setting.

### RUN

Pressing the **RUN** button causes the **BLUE RUN** screen (shown on the previous page) to be displayed. Welding is allowed **only** when the **BLUE RUN** screen is displayed.

### MENU

Pressing this button momentarily causes the **Menu** screen to be displayed.

Press and hold this button for 1 second to display the **Menu** editing screen. Welding is **not** allowed when the **Menu** screens are displayed. Additional instructions for the **Menu** screen are in *Chapter 3, Using Display Screens*.

## **LIMITS / COUNTERS**

Press this button momentarily to display the **Limits / Counters** screen. Press and hold this button for 1 second to display the **Limits / Counters** editing screen. Welding is *not* allowed when these screens are displayed. Additional instructions on using the **LIMITS / COUNTERS** screen are in *Chapter 3, Using Display Screens*.

### **Pulse 1 & Pulse 2**

Press and hold either of these buttons for approximately 1 second to put the unit into “edit” mode which allows modification of weld schedule settings.

Press and hold the **Pulse 1** button, waiting for the screen background to change from **BLUE** to **BLACK**. Energy, pulse width, and Polarity for Pulse 1 may now be edited. To accept changes, press the **SAVE** button. To exit “editing” mode *without* accepting changes, press the front panel **RUN** button, then at the **SAVE** prompt, press the **CLEAR** button to discard.

To edit **Pulse 2** parameters, follow the same procedures described for Pulse 1.

### **SQZ / HOLD**

Pressing this button during edit mode causes the editing highlight to move to the **SQUEEZE** field.

Pressing this button again moves the highlight to the **HOLD** field.

### **SAVE**

Pressing this button saves changes made during editing.

### **CLEAR**

Press this button to clear the **WELD COUNTER**, **COUNTER LIMIT**, **PULSE 1 & PULSE 2 UPPER & LOWER LIMIT** fields. Pressing this button discards changes made during editing at the **SAVE** prompt: Press **SAVE** to save changes **CLEAR** to discard.

### **CHARGE MONITOR Light**

When the green **CHARGE MONITOR** light is lit, capacitors are fully-charged and ready to weld. The light will turn off for a short time during the weld discharge period and while the capacitor bank is recharging. Once capacitor charging has been completed, the **CHARGE MONITOR** light will again illuminate. When the **WELD/NO WELD** switch is in the **NO WELD** position, the **CHARGE MONITOR** light will *not* light because the system is not ready to weld.

### **WELD / NO WELD Switch**

With the **WELD** switch is in the **WELD** position, weld current is enabled and programmed weld sequences execute normally.

## CHAPTER 1: DESCRIPTION

---

With the **WELD** switch to the **NO WELD** position, weld current is **INHIBITED** and **output relays are disabled**; however, all other control functions execute in a normal manner. This feature allows adjustment of weld head and **SQUEEZE / HOLD** delay parameters prior to actual welding

### Weld Disable Switch Operation

If your workstation has a **WELD DISABLE SWITCH**, connect it to the cable provided at the rear panel of the unit. When pressed, the **WELD DISBALE SWITCH** will immediately halt the welding process and de-energize all air valves and power circuits. Additionally, a **WELD DISABLE** status display message will appear near the bottom of the display screen. To resume operation, reset the **WELD DISABLE SWITCH** to the normal position then press the **CLEAR** button on the keypad to return to normal operation. (If unit is in edit mode, press first **RUN**, then **CLEAR**). If unit does not return to normal operation, cycle power.

**NOTE:** During the 20-second startup period when the Power Supply is first turned ON, an activation of the Weld Disable will interrupt 24 V power to the Air Valve Driver output to ensure the weld head is *not* actuated. When the 20-second startup period is completed, the **WELD DISABLE** message will be displayed and the buzzer will sound.

If your work station is not equipped with an **WELD DISABLE SWITCH**, be sure that the conductors of the Weld Disable input cable are shorted together and insulated, as the system will not operate with this loop electrically open.

# CHAPTER 2

## Installation and Setup

### Section I: Installation

#### Unpacking

When you unpack the shipping container, be sure that the contents of the shipping kit match the list in the beginning of this manual (*Page ii*) and that you have also received the accessories you ordered.

If the Power Supply shows any signs of shipping damage, promptly contact both the carrier and AMADA WELD TECH Customer Service. See **CONTACT US** in the front of this manual to get in touch with us by e-mail, telephone, or regular mail.

#### Space Requirements

- Allow ample workspace around the Power Supply so that it will not be impacted during operation.
- Allow sufficient clearance around the sides and back of the Power Supply to allow for connecting cables.
- Allow enough ventilation space so the Power Supply does not overheat.
  - **CD-A125A / CD-A300A / CD-A1000A:** Allow a minimum of 1 inch space on each side and 2 inches in the rear.
  - **CD-A1000A Weld Transformer:** Allow a minimum of 1 inch on all sides of the transformer. See Appendix A for transformer dimensions.
- The work surface must be level, stable, free from vibration, and capable of supporting the combined weight of all system components. Weights are listed in *Appendix A, Technical Specifications*.
- Locate the Power Supply at a sufficient distance from weld heads so as to avoid weld splash.
- Locate the Power Supply at a sufficient distance from sources of high-frequency radiation to avoid electrical interference.
- The work area must be free of excessive dust, acids, corrosive gases, salt and moisture.



**NOTE:** Unlike the **CD-A125A** and **CD-A300A** Power Supplies which have internal transformers, the **CD-A1000A** has a large, external transformer that must be located within 2 meters of the power supply.

## CHAPTER 2: INSTALLATION AND SETUP

---

**NOTE:** Unlike the **CD-A125A** and **CD-A300A** Power Supplies which have internal transformers, the **CD-A1000A** has a large, external transformer that must be located within 2 meters of the power supply.

### Utilities

#### Power Input Specifications

The Power Supply is shipped with a harmonized NEMA 5-15P IEC Power cord compliant for North American 120 VAC power sources. For operation in countries with different A.C. mains requirements, replace the IEC power cord for an approved power cord for the country in which the unit is to be used. The required connections for your power cable connector are described in *Appendix B, Electrical and Data Connections*. Input power requirements for the Power Supply are as listed below.

Model	Input Voltage, 50 - 60 Hz, Single phase ( $V_{RMS}$ )	Circuit Breaker Current ( $A_{RMS}$ )	Copper Wire Gauge, 7 strands (AWG)	Wire Diameter (mm)
All CD-A Models	100-120 $\pm$ 10%	15	14	1.6
	200-240 $\pm$ 10%	10	14	1.6

**NOTE:** As an additional safety measure and to avoid the possibility of an electric shock, consider connecting a second grounding wire to the rear screw designated by the following symbol:



See Page 2-3 for grounding screw location (CD-A125A and CD-A300A).  
See Page 2-10 for grounding screw location (CD-A1000A).

#### Compressed Air and Cooling Water

If compressed air or cooling water service is required for the weld head, please refer to the weld head manufacturer's user manual for service specifications.

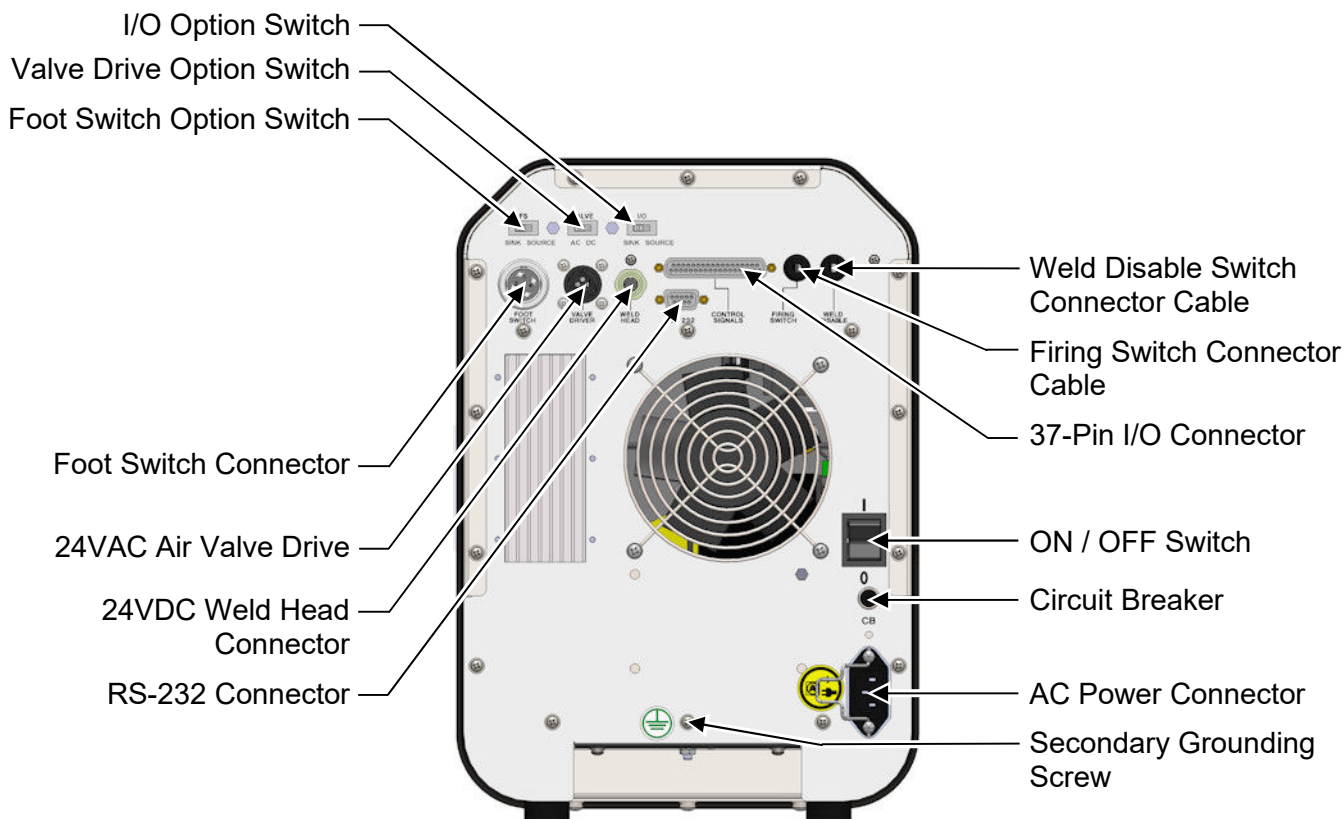
#### Input Logic Configuration

The unit is shipped from the factory configured for **SINK = TRUE INPUTS** which is compatible with switch closures to ground for activation (a "low" turns the function ON). The unit can also be configured for **SOURCE = TRUE INPUTS** which is commonly used with PLC's and other external devices which supply +24 VDC to activate (a "high" turns the inputs ON). This configuration can easily be changed with the use of the two selection switches located on the rear panel. (See Photo on following page)



### Section II: CD-A125A & CD-A300A External Equipment Connections

All connections between the Power Supply and external equipment other than the weld cable are made through the rear panel.



**Rear Panel Components and Connectors CD-A125A and CD-A300A**

**NOTE:** Weld cable connections are made on the front panel of the CD-A125A and CD-A300A and the external transformer for the CD-A1000A is hooked up in the back.

#### Weld Disable Switch

Connect a normally closed, **WELD DISABLE SWITCH** across the two leads of the Weld Disable switch connector cable. When this switch is opened, the weld cycle will immediately stop. See *Appendix B. Electrical and Data Connections* for circuit details.

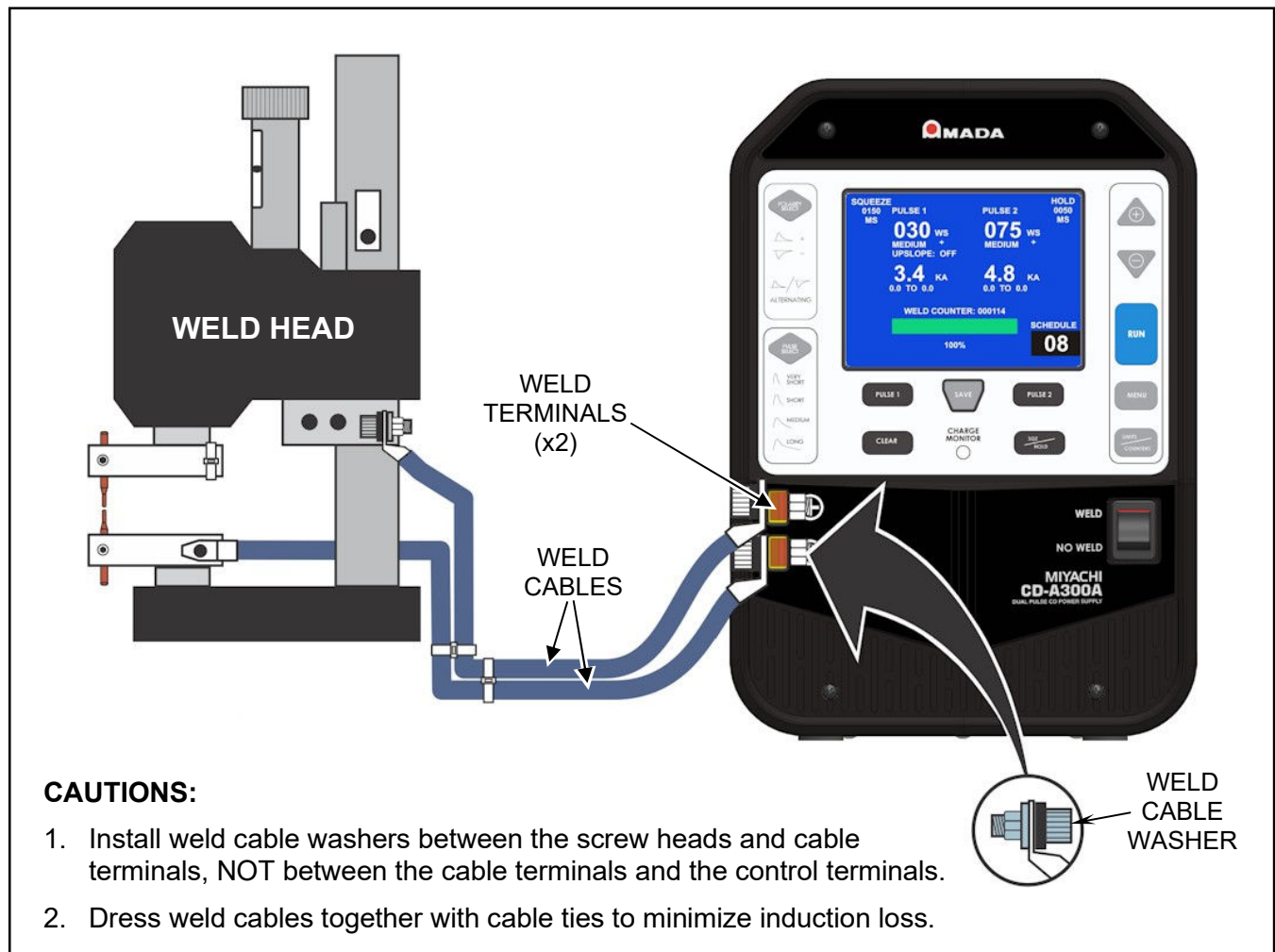
**NOTE:** For operation *without* a **WELD DISABLE SWITCH**, verify that the two conductors of the Weld Disable cable are shorted together as the system will not operate if this loop is electrically open.

## CHAPTER 2: INSTALLATION AND SETUP

### Weld Head Connections to Power Supply Terminals (non-force fired Weld Head)



The following set-up examples, incorporating Weld Heads, do not comply with CE or any Machine Safety Standards. Refer to Appendix E for an example of a CE Category 3 qualified connection diagram.



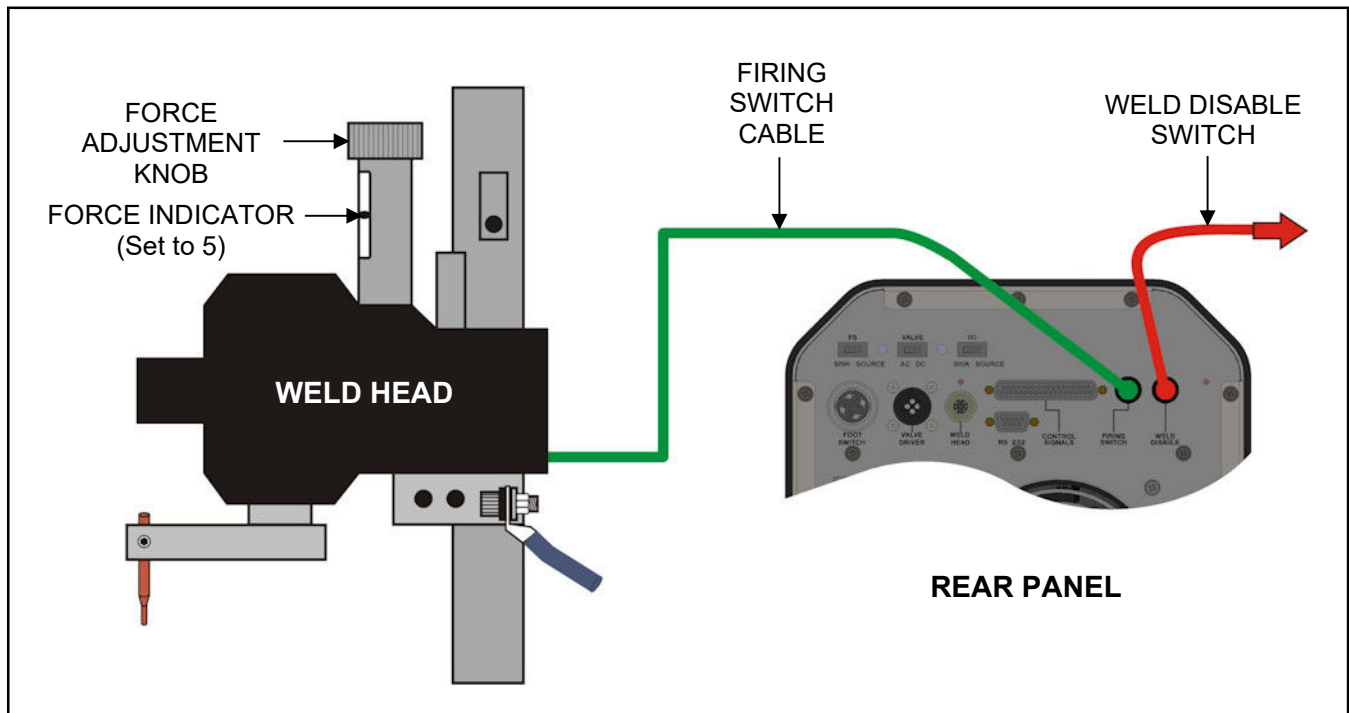
1. Turn the AC power OFF.
2. Connect one end of a weld cable to the negative (-) welding transformer terminal on the Power Supply (or external transformer for a CD-A1000A).
3. Connect one end of the second weld cable to the positive (+) welding transformer terminal on the Power Supply (or external transformer for a CD-A1000A).
4. Connect the other ends of the weld cables to the weld head.

### CD-A DUAL PULSE RESISTANCE WELDING POWER SUPPLY

5. Install electrodes in the weld head electrode holders.

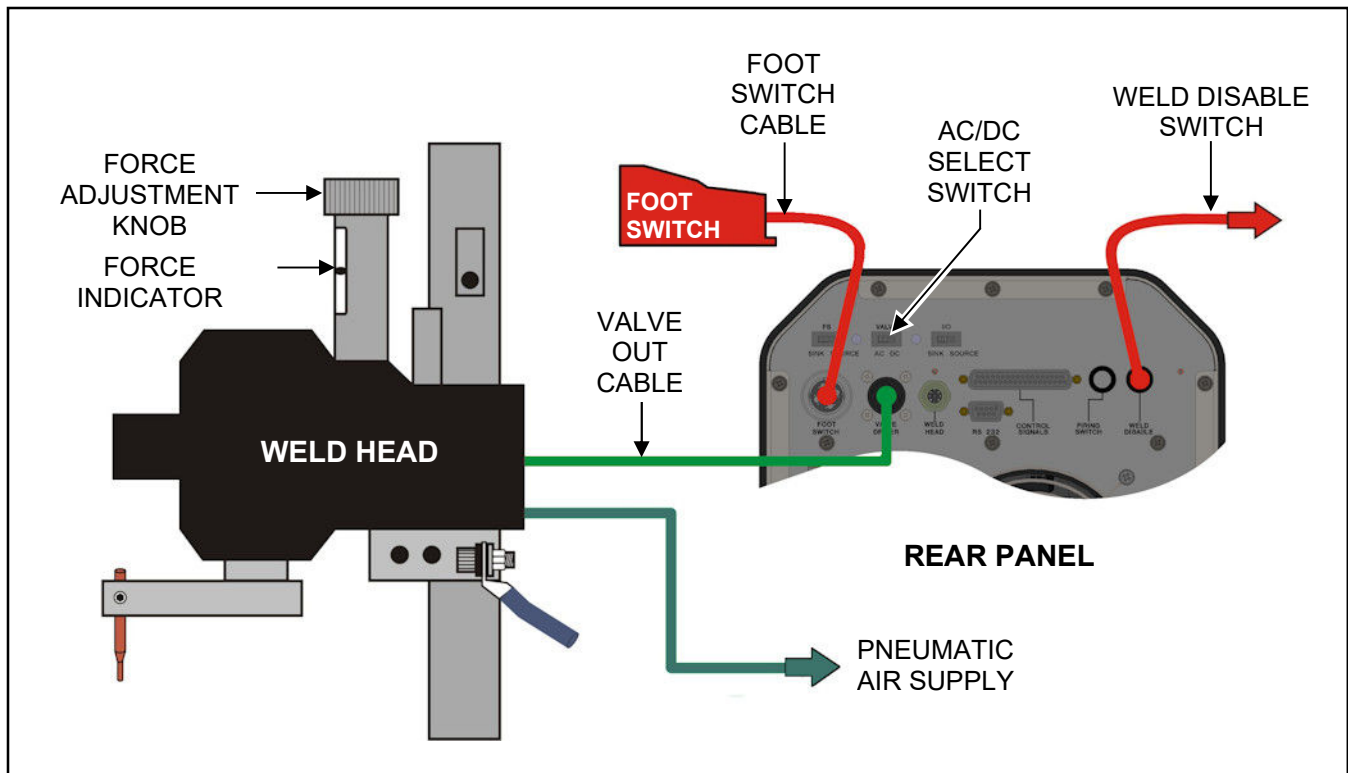
**NOTE:** If you need additional information about the weld heads, please refer to the manufacturer's user manuals.

### Mechanically Actuated Weld Head Connection (force fired Weld Head)



1. Connect the weld head cables as noted on the previous page (Steps 1-4).
2. Connect the weld head firing switch cable connector to the Power Supply firing switch cable connector.
3. Set the weld mode setting to the FSW selection.
4. Connect a normally closed **WELD DISABLE SWITCH** across the two leads of the Weld Disable switch connector cable. This switch, when operated (open), will immediately stop the weld cycle and retract the weld head. See *Appendix B. Electrical and Data Connections* for circuit details.
5. Set the **ON/OFF** switch on the rear panel of the Power Supply to the **ON** position.
6. Set the active schedule to the minimum energy level of the Power supply.
7. Set the weldhead force to 5 units of force (or greater, as displayed on the force indicator index).
8. Press the foot switch smoothly to close the weldhead. Verify that the power supply fires.

### Pneumatic Actuated Weld Head Connection (non-force fired Weld Head)

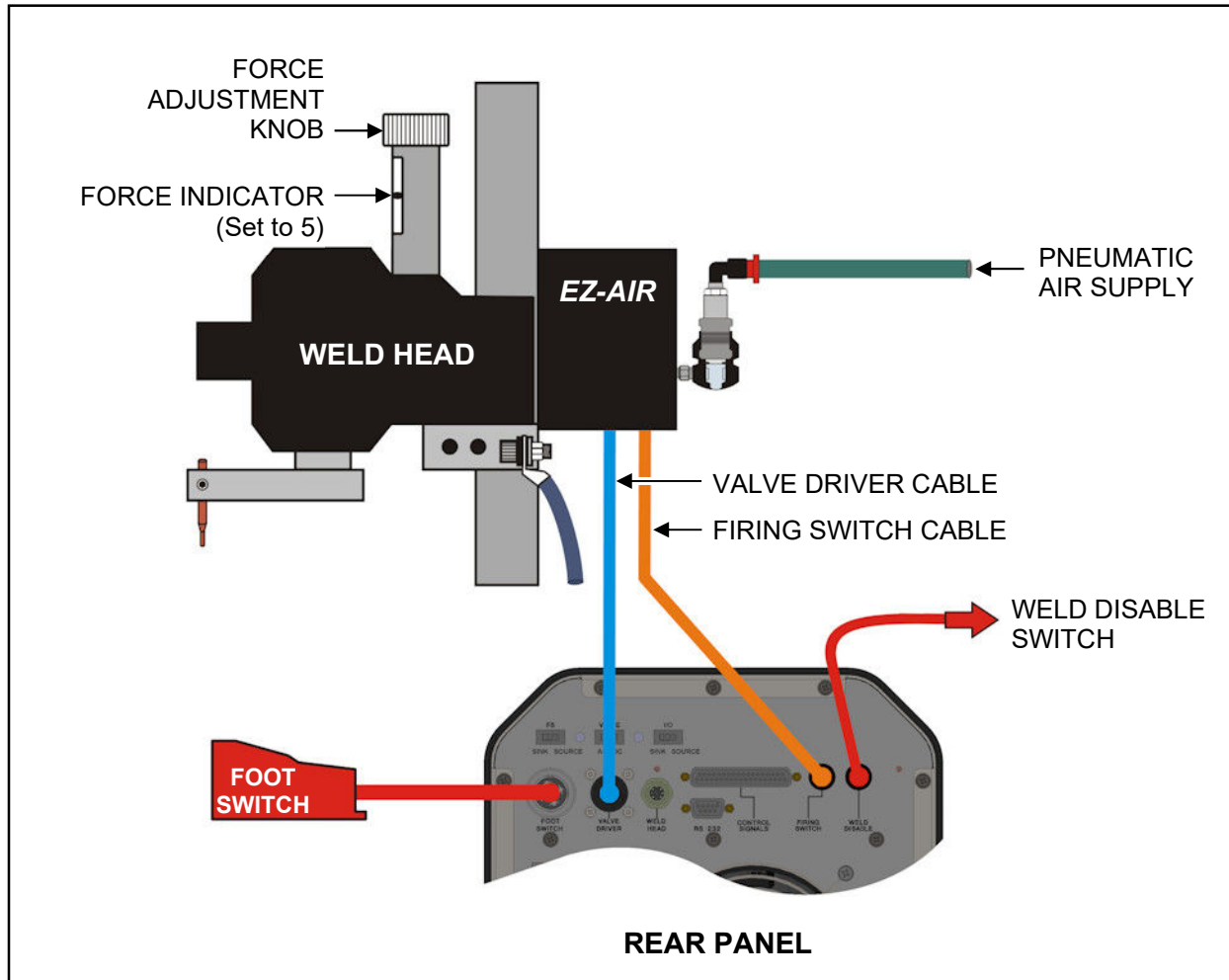


1. Connect the weld head cables as noted on the previous page (Steps 1-4).
2. Connect the weld head Pneumatic valve to the valve output as shown above.
3. Select AC or DC valve voltage by setting the AC/DC switch located above the valve connector.
4. Connect the two stage foot switch to the foot switch input.
5. Set the weld mode setting to the FS1 + FS2 selection.
6. Connect a normally closed **WELD DISABLE SWITCH** across the two leads of the Weld Disable switch connector cable. This switch, when operated (open), will immediately stop the weld cycle and retract the weld head. See *Appendix B. Electrical and Data Connections* for circuit details.
7. Set the **ON/OFF** switch on the rear panel of the Power Supply to the **ON** position.
8. Set the active schedule to the minimum energy level of the Power supply.
9. Set the weldhead force to 5 units of force (or greater, as displayed on the force indicator index).
10. Press the foot switch to position one (FS 1) the weld head should smoothly descend and the electrodes should make contact with the amount of force selected. Press the footswitch to the second position (F 2) and the unit should fire after the squeeze time then the head should retract after the hold time.



## CHAPTER 2: INSTALLATION AND SETUP

### 24 VAC EZ-AIR™



**NOTE:** These instructions are for both 24 VDC and 24 VAC EZ-AIR™ weld heads

1. Connect Weld Head Cables as noted on Page 2-4.
2. Adjust the weld head force adjustment knob to produce **5** units of force, as displayed on the force indicator index.
3. Connect the weld head firing switch cable connector to the Power Supply firing switch cable connector.
4. Connect a normally closed **WELD DISABLE SWITCH** across the two leads of the Weld Disable switch connector cable. This switch, when operated (open), will immediately stop the weld cycle and retract the weld head. See *Appendix B. Electrical and Data Connections* for circuit details.

5. Connect a Model FS2L or FS1L Foot Switch to the Power Supply **FOOT SWITCH** connector.
6. Set the Weld Mode setting to the FS1+FS2+FSW selection
7. Refer to the weld head manufacturer's User Manual for instructions on connecting the weld head air valve solenoid cable to the Power Supply **AIR VALVE DRIVER** connector.
8. Connect a properly filtered air line to the air inlet fitting on the weld head. Use 0.25 inch O.D. by 0.17 inch I.D. plastic hose with a rated burst pressure of 250 psi. Limit air line length to less than 40 in. (1 m) or electrode motion may be slow.

### NOTES:

- *EZ-AIR*<sup>™</sup> operates from 85 to 130 psi.
  - Use lubricators *only* with automated installations.
9. Turn air system ON and check for leaks.
  10. Set the **WELD/NO WELD** switch on the Power Supply front panel to the **NO WELD** position. In this position, the Power Supply cannot deliver weld energy, but it can activate the weld head.
  11. Set the ON/OFF switch on the rear panel of the Power Supply to the ON position.
  12. Press the foot switch part way to actuate the *first level* switch. The weld head upper electrode should descend smoothly to the DOWN position. When it reaches the down position, release the foot switch and proceed to Step 14. If the upper electrode does *not* operate smoothly, proceed to Step 13.
  13. Adjust the weld head down speed knob and repeat Step 12 until the upper electrode descends smoothly.
  14. Press the foot switch all the way down to close both level switches. The weld head upper electrode should descend smoothly to the DOWN position, and then send the firing switch signal back to the Power Supply when the preset electrode force is reached. After firing, the upper electrode should ascend smoothly back to the UP position.

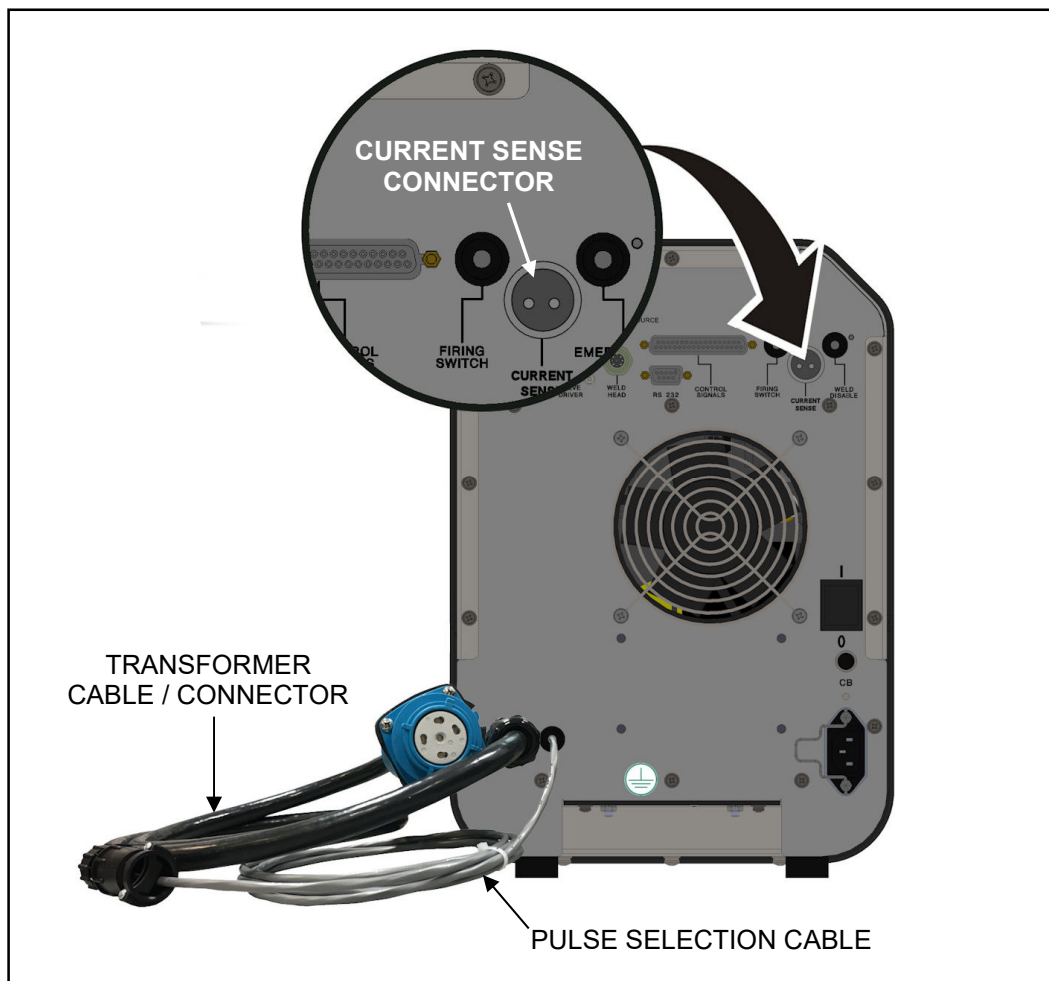
### Section III: CD-A1000A External Equipment Connections

#### Overview

Most of the external connections for the **CD-A1000A** are identical to those for the **CD-A125A** and **CD-A300A** described in *Section II*, *however* there are three notable exceptions:

- The **CD-A1000A** uses a separate, external **Weld Transformer**.
- The **CD-A1000A** uses a separate, external **Current Sense Coil**.
- The **CD-A1000A** uses an external **Pulse Selection Cable**.

All three of these must be connected to the Power Supply using the rear panel connectors shown below.

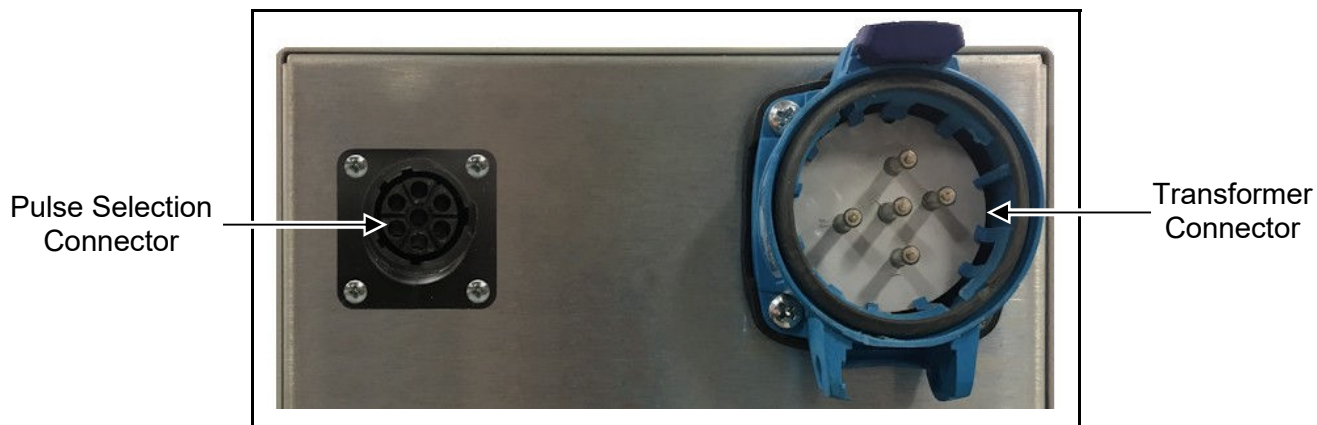


Rear Panel Connectors for the CD-A1000A



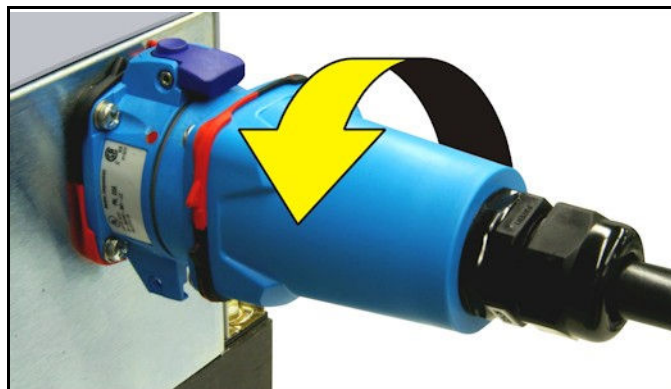
### Connecting the CD-A1000A Transformer

1. Locate the connectors at the top rear of the CD-A1000A external Weld Transformer.



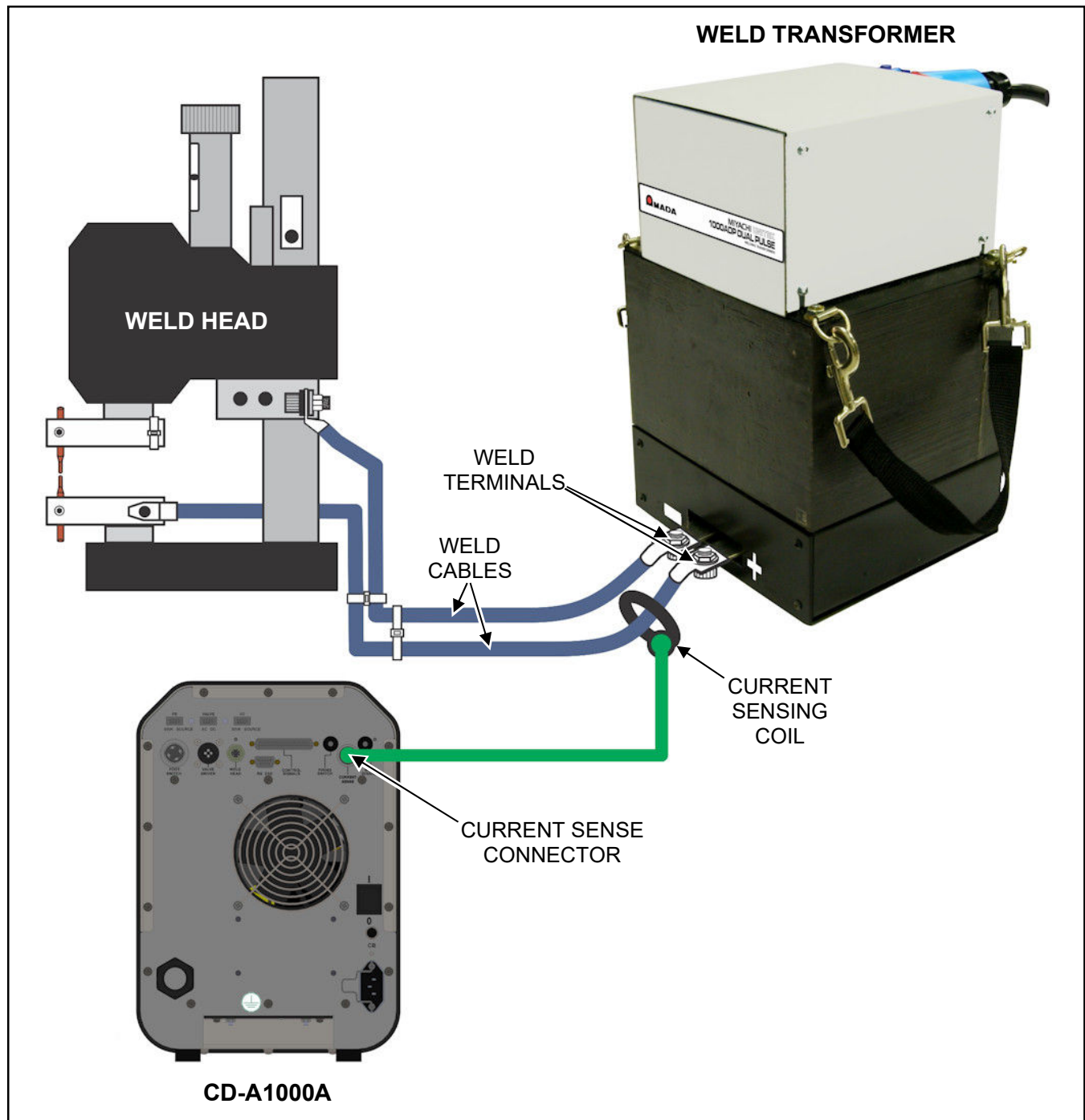
2. Connect the Pulse Selection Cable on to the Pulse Selection Connector.
3. Connect the Transformer Cable / Connector on to the Transformer Connector. Align the **RED** dot on the transformer cable connector to the **RED** dot on the transformer connector.

Once the **RED** dots are aligned, push the cable into the transformer connector until it stops, then twist *counterclockwise* until the connectors are secured together.



The following set-up example shown below, incorporating a Weld Head, does not comply with CE or any Machine Safety Standards. Refer to Appendix E for an example of a CE Category 3 qualified connection diagram.

## CHAPTER 2: INSTALLATION AND SETUP



4. Connect the current coil around **ONE** of the two weld cables (you can use either the **+** or **-** cable). For best weld monitoring accuracy, use tie-wraps to secure the loop end of the current coil (the end farthest from the opening secured by the Velcro strap) in a fixed position relative to the weld cable.
5. Plug the connector of the current coil cable to the **CURRENT SENSE** connector on the back of the power supply.

### CD-A DUAL PULSE RESISTANCE WELDING POWER SUPPLY

# CHAPTER 3

## Using Display Screens

### Section I: RUN Screen

#### RUN Screen

The **BLUE RUN** screen is displayed whenever the Power Supply is in **RUN** mode.

Squeeze and hold times are displayed in the upper left and right corners of the screen.

Programmed values for energy, pulse width, weld polarity and upslope are displayed in the upper middle of the screen.

Weld limits, if any, and the peak weld current monitor results for the last weld completed are displayed in the middle of the screen.

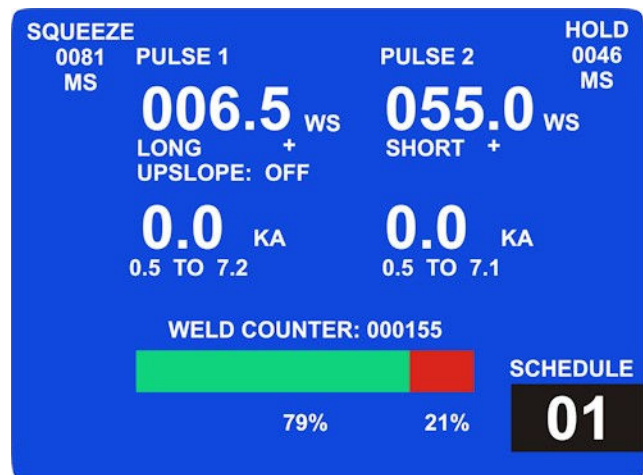
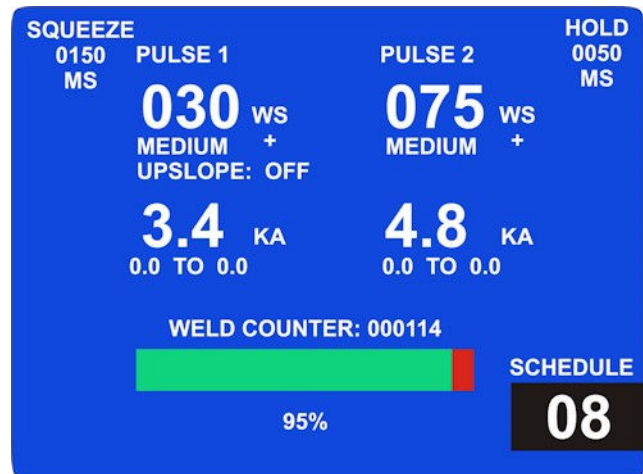
The number of the currently active weld schedule is displayed at the lower right corner.

In the lower middle of the screen the **WELD COUNTER** and process monitor indicate how many welds have been completed since the weld counter was reset and what percentage of those welds were within programmed limits, indicated both numerically and graphically. The **GREEN** bar on the screen above indicates 95% of welds are within limits, the **RED** portion of the bar shows 5% of welds are outside limits.

The CD-A125A allows programmed values for Energy in tenths of watt seconds for energy settings between 1.0 and 10.0 Ws. The energy settings for the CD-A125A between 10 and 125 Ws can **only** be set in whole number increments.

The energy settings for the CD-A300A and CD-A1000A can **only** be set in whole number increments.

The CD-A125A **RUN** screen is the same as the CD-A300A and CD-A1000A **RUN** screens **except** the Energy setting is shown with the tenths digit as shown in the screen shown on the right.



## CHAPTER 3. USING DISPLAY SCREENS

### Editing the Run Screen

#### PULSE 1

To edit Pulse 1, pulse width, polarity and upslope settings, press and hold the **PULSE 1** button for about 1 second to highlight the values in **WHITE** as shown on the right.

Use the **▲▼** arrows, **PULSE WIDTH** and **POLARITY SELECT** buttons to change the values for Pulse 1.

To change the energy value for Pulse 1, use the **▲▼** arrows.

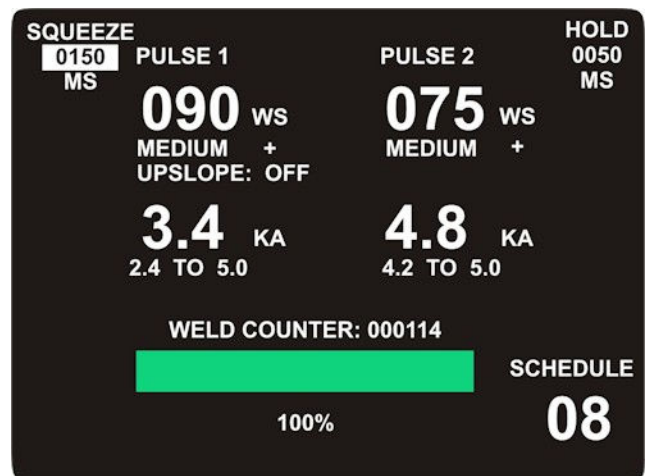
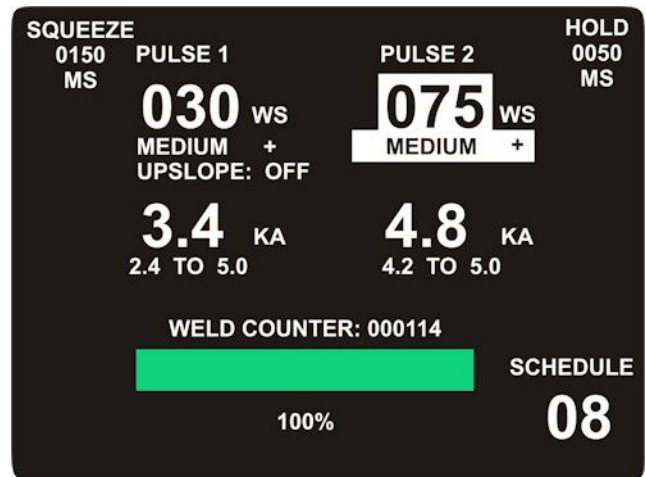
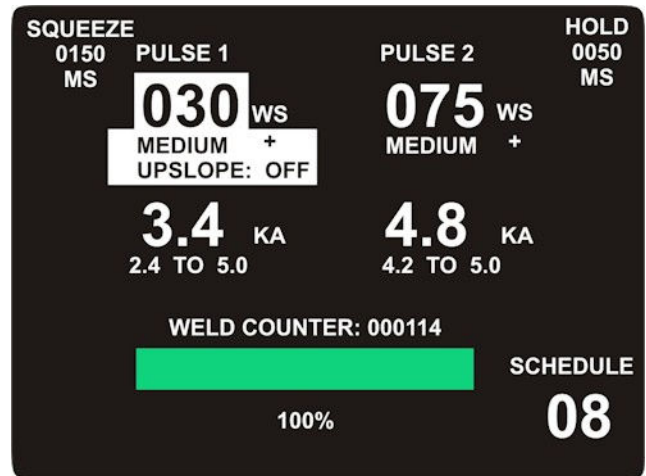
**NOTE:** Pulse Polarity and Upslope are *not* user settable in CD-A1000A.

#### PULSE 2

To edit the same values for Pulse 2, press the **PULSE 2** button and repeat the procedures for Pulse 1.

#### SQUEEZE TIME

To edit the squeeze time, press the **SQZ/HOLD** button. Use the **▲▼** arrows to change the time setting.

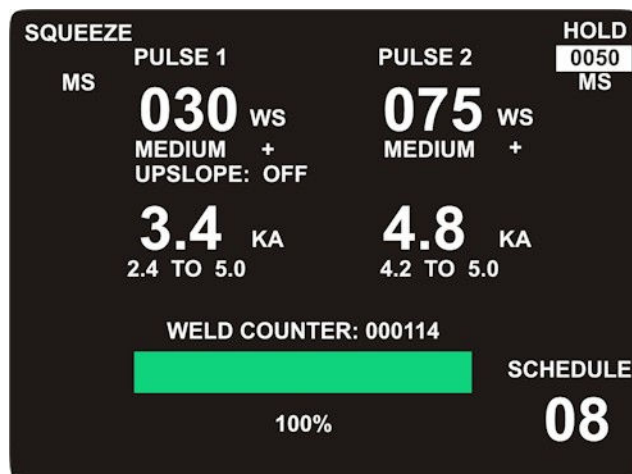


## HOLD TIME

To edit the hold time, press the **SQZ/HOLD** button again. Use the **▲▼** arrows to change the time setting.

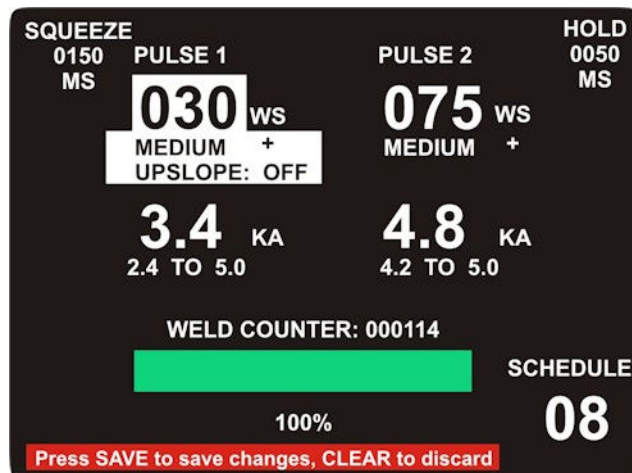
Press the **SAVE** button to save new values and return to the original screen.

**NOTE:** If you have *not* edited any values, press the **RUN** button to return to the blue **RUN** screen.



To discard edited values and restore previously saved values, press the **RUN** key. The system will respond with the **SAVE** prompt which appears at the bottom of the screen: "Press **SAVE** to save changes, **CLEAR** to discard." The system will revert to the original screen.

**NOTE:** Whenever the **RUN**, **MENU** or **LIMITS/COUNTERS** buttons are pressed *before* edited values are saved, the **SAVE** prompt will appear at the bottom of the screen.





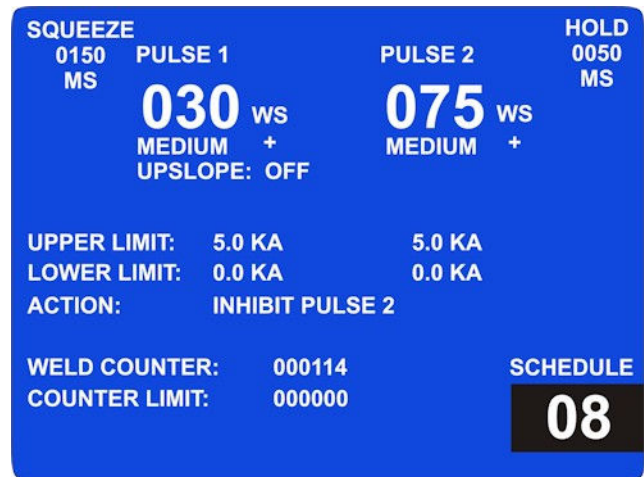
### Section II: LIMITS / COUNTERS Screen

#### LIMITS / COUNTERS Screen

Momentarily press the **LIMITS/COUNTERS** button to view the blue **LIMITS/COUNTERS** screen.

Peak current limits for Pulse 1 and Pulse 2 as well as **ACTION** to be taken when Pulse 1 peak current is out of limits are displayed at the middle of the screen.

Values for **WELD COUNTER** and **COUNTER LIMIT** are displayed at the bottom part of the screen.



#### Edit the Limits / Counters Screen

Press and hold the **LIMITS / COUNTERS** button for about 1 second to enter edit mode.

When editing on the **LIMITS / COUNTERS** screen, use the **▲▼** arrows to increment the values of a highlighted parameter.

#### PULSE 1 – Upper Limit

Press and release the **PULSE 1** button until the upper limit parameter is highlighted. Use the **▲▼** arrows to set the limit to the desired value. Use the **CLEAR** button to enter a value of zero.



#### PULSE 1 – Lower Limit

Press and release the **PULSE 1** button again until the lower limit parameter is highlighted. Use the **▲▼** arrows to set the desired value.

Use the **CLEAR** button to enter a value of zero.

**NOTE:** When **UPPER LIMIT** and **LOWER LIMIT** values are both set to zero, the limit function is disabled.

#### PULSE 2 - Limits

Limits for Pulse 2 are edited in the same manner as previously described for Pulse 1.



## PULSE 1 - ACTION

Press and release the **PULSE 1** button until the **ACTION** parameter is highlighted. Use the ▲ ▼ arrows to select the desired action.

If **ACTION** is set to **CONTINUE**, Pulse 2 will be enabled whether or not Pulse 1 is within limits.

If **ACTION** is set to **INHIBIT PULSE 2**, then Pulse 2 will be enabled *only* when Pulse 1 is within limits.

SQUEEZE 0150 MS	PULSE 1 <b>030</b> WS MEDIUM + UPSLOPE: OFF	PULSE 2 <b>075</b> WS MEDIUM +	HOLD 0050 MS
UPPER LIMIT: 5.0 KA		5.0 KA	
LOWER LIMIT: 0.0 KA		0.0 KA	
ACTION: <b>CONTINUE</b>			
WELD COUNTER: 000114		SCHEDULE	
COUNTER LIMIT: 000000		<b>08</b>	

## RESET WELD COUNTER

From the **LIMITS/COUNTERS** edit screen, press and release the **LIMITS/COUNTERS** button until the weld counter field is highlighted.

Press the **CLEAR** key to clear the weld counter to **000000**.

**NOTE:** The weld counter value can *not* be changed using the ▲ ▼ arrows.

SQUEEZE 0150 MS	PULSE 1 <b>030</b> WS MEDIUM + UPSLOPE: OFF	PULSE 2 <b>075</b> WS MEDIUM +	HOLD 0050 MS
UPPER LIMIT: 5.0 KA		5.0 KA	
LOWER LIMIT: 0.0 KA		0.0 KA	
ACTION: <b>INHIBIT PULSE 2</b>			
WELD COUNTER: <b>000114</b>		SCHEDULE	
COUNTER LIMIT: 000000		<b>08</b>	

## EDIT COUNTER LIMIT

From the **LIMITS/COUNTERS** edit screen, press and release the **LIMITS/COUNTERS** button until the **COUNTER LIMIT** field is highlighted.

Press the ▲ ▼ arrows to set a desired limit value or use the **CLEAR** key to reset to the limit to **000000**.

Setting the counter limit to **000000** will disable the **WELD COUNTER RELAY** output signal available at the rear panel **37-PIN I/O CONNECTOR**.

SQUEEZE 0150 MS	PULSE 1 <b>030</b> WS MEDIUM + UPSLOPE: OFF	PULSE 2 <b>075</b> WS MEDIUM +	HOLD 0050 MS
UPPER LIMIT: 5.0 KA		5.0 KA	
LOWER LIMIT: 0.0 KA		0.0 KA	
ACTION: <b>INHIBIT PULSE 2</b>			
WELD COUNTER: 000114		SCHEDULE	
COUNTER LIMIT: <b>000000</b>		<b>08</b>	

**NOTE:** At any time before you **SAVE** settings, you may recover original system settings (including the weld counter values) by pressing the **CLEAR** key at the **SAVE** prompt. To activate the **SAVE** prompt from the **EDIT** screen, press the **RUN** key and the **SAVE** prompt will now appear. To discard all new settings and values, and return the system to its previous settings, press the **CLEAR** button.

## Section III: MENU Screen

### MENU Screen

Press the **MENU** button momentarily to display the menu selection screen.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### Editing the MENU Screen

Press and hold the **MENU** button to enter the **MENU** edit mode. The screen will turn black when you are in edit mode.

Press the **MENU** button to sequence through all of the menu selections. When a menu option is highlighted it can be changed. To change the value, use the ▲ ▼ arrows.

The first menu item is **BUZZER**. This field sets the overall buzzer volume (1-4), where the value 4 is the loudest.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW



### BAUD RATE

Press the **MENU** button again the highlight the **BAUD RATE** field. This is the speed used for RS-232 communications.

BUZZER:	4
BAUD RATE:	<b>19200</b>
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### DEBOUNCE

Press the **MENU** button again for the debounce setting. Use the **0 MSEC** setting for applications where a PLC communicates with the unit.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	<b>30 MSEC</b>
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### CHAINING START

Press the **MENU** button again to edit the starting value for a weld chain.

In chaining, all schedules from **CHAINING START** to **CHAINING END** are welded one time and in numeric order. When the last schedule in the chain is completed, the system returns to the **CHAINING START** schedule.

Whenever a schedule within a chain is selected, the chain will start at that schedule. When the last schedule in the chain is completed, the system returns to the **CHAINING START** schedule.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	<b>03</b>
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

## CHAPTER 3. USING DISPLAY SCREENS

---

### CHAINING END

Press the **MENU** button again to edit the ending value for a weld chain.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	<b>05</b>
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### REMOTE

Press the **MENU** button again to highlight the **REMOTE** selection.

When this is set to **OFF**, serial communication commands to read data are active, but commands to change programs and settings are *not* active.

When **REMOTE** is set to **ON**, all serial communication commands are active.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	<b>OFF</b>
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### LANGUAGE

Press the **MENU** button again to select the language (**ENGLISH**, **ESPAÑOL**, **DEUTSCH**). The language on screen will change when this field is saved.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	<b>ENGLISH</b>
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### RESET DEFAULTS

Press the **MENU** button again to select the **RESET DEFAULTS**. The default selection is **OFF**.

To set all schedules, limits, weld counter, weld counter limits and all menu items back to their factory default values, select **ON**, then press **SAVE** to save changes.

To discard changes, press **RUN** to activate the **SAVE PROMPT** and at the prompt, press **CLEAR** to discard changes. After saving or discarding new settings, the display will revert to the original screen selected.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	<b>OFF</b>
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

### REPEAT MODE

Press the **MENU** button again to highlight the **REPEAT MODE** selection. When this is set to **ON**, the control provides an automatic repeat of the weld sequence for simple automated air actuated applications. This weld function is ideal for volume production which requires a single schedule.

**REPEAT MODE** can *only* be used with an Air Actuated Weld Head. On Force Fired Air Actuated Weld Heads, weld current begins when both levels of a two-level Foot Switch are closed and held down and then the Force Firing Switch in the Air-Actuated Weld Head closes sending a fire signal.

Note: Weld Mode set to FS1+FS2+FSW.

When **REPEAT MODE** is used with a Non-Force Fired Air Actuated Weld Head (Weld Mode set to FS1+FS2), the Squeeze (SQZ) Period must be used to allow sufficient time for the electrodes to close and apply the required weld force to the parts *before* the Weld Period begins. Weld current begins when the Squeeze Period ends and a fire signal is received. During this whole operation *both* levels of a two-level Foot Switch must remain closed to continue in **REPEAT MODE**.

When **REPEAT MODE** is used with any type of Air Actuated Weld Head, the Hold Period can be used to automatically keep the electrodes closed on the parts after weld current has terminated to provide additional heat sinking or parts cooling. **REPEAT TIME**, which is applicable only to **REPEAT MODE**, sets the cycling rate between welds by controlling how long the electrodes remain open.

When **REPEAT MODE** is set to **ON**, and the user keeps the footswitch depressed and firing switch closed, the control will repeatedly actuate the weldhead and perform the weld sequence. If set to **ON**, a **REPEAT TIME** other than **0** must also be set.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	<b>OFF</b>
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

# CHAPTER 3. USING DISPLAY SCREENS

## REPEAT TIME

You should specify the **REPEAT TIME** so that it is sufficient to allow the weld head to open the electrodes and to allow you to reposition the work piece before the entire welding sequence repeats.

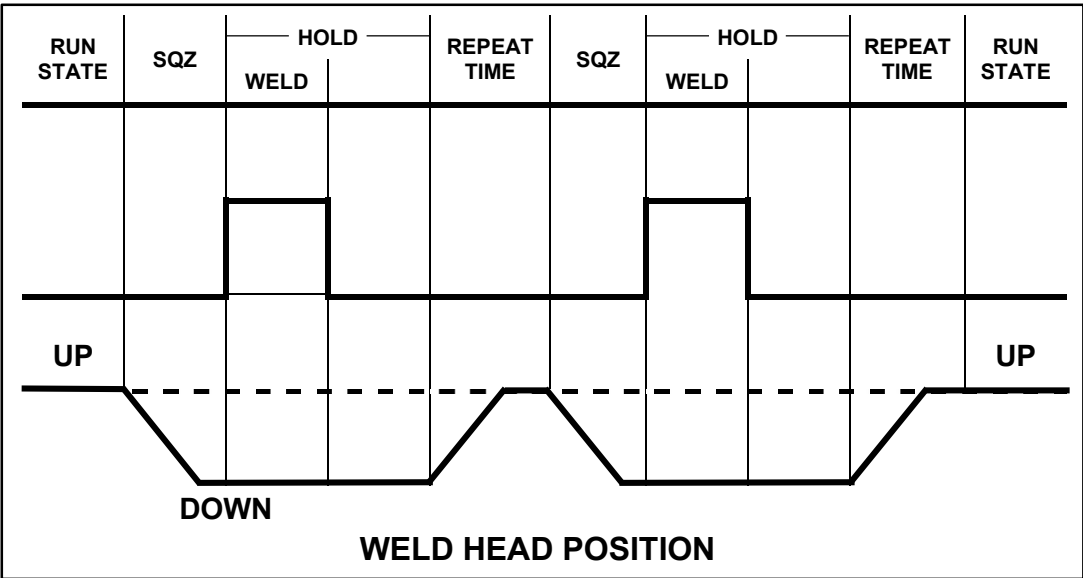
When **REPEAT MODE** is set to **OFF**, this function is deactivated.

**NOTE:** The actual REPEAT TIME will be the longer time of REPEAT TIME setting or charge/discharge time

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	FS1+FS2+FSW

## REPEAT MODE showing REPEAT TIME

Note: Weld Mode set to FS1+FS2 for the timing shown below.



### WELD MODE

Press the **MENU** button again to select the **WELD MODE** field. Use the ▲ or ▼ arrows to select between the three options; **FS1+FS2+FSW**, **FS1+FS2** and **FSW**.

Each of the options relate to what signals are required to initiate a weld. The first two selections incorporate valve control while the third does not activate the valves. Each option is defined below:



A screenshot of a dark grey menu screen with white text. The menu lists various settings and their values. The 'WELD MODE' setting at the bottom is highlighted with a white rectangular box.

BUZZER:	4
BAUD RATE:	19200
DEBOUNCE:	30 MSEC
CHAINING START:	03
CHAINING END:	05
REMOTE:	OFF
LANGUAGE:	ENGLISH
RESET DEFAULTS:	OFF
REPEAT MODE:	OFF
REPEAT TIME:	0.00 SEC
WELD MODE:	<b>FS1+FS2+FSW</b>

**FS1+FS2+FSW** – Foot Switch 1 and Foot Switch 2 and Firing.

Used with two-level foot switches and air actuated weld heads with force firing switch such as the AMADA Thinline series Weld Heads. Weld Head descends upon activation of FS1, weld begins when FS2 and FSW inputs are received.

**FS1+FS2** – FootSwitch 1 and Foot Switch 2

Used with two level foot switch and non-force pneumatic weld heads. Weld Head descends upon activation of FS1, weld begins when FS2 input is received.

**FSW** – Fire Switch only

Used with Manual Weld Heads or Hand Pieces, weld begins when FSW input is received.



# CHAPTER 4

## Operating Instructions

### Section I: Introduction

#### Before You Start

*Before* operating the Power Supply, you must be familiar with the following:

- The **location** and **function** of Controls and Indicators. For more information, see *Chapter 1, Description* of this manual.
- How to select and modify items on the Power Supply display screen. Make sure you have read *Chapter 3, Using Display Screens*.
- The principles of resistance welding and the use of programmed weld schedules. For more information, see *Appendix E, The Basics of Resistance Welding*. For additional information on the welding process, see *Appendix F, Quality Resistance Welding Solutions, Defining the Optimum Process*.

#### Pre-Operational Checks

Always perform these checks *before* attempting to operate the Power Supply.

##### Connections

Verify the Power Supply is connected to a manual or air-actuated weld head as described in *Chapter 2, Installation & Setup* in this manual. Verify the **WELD DISABLE SWITCH** connector cable, located on the rear panel, is connected properly.

##### Power

Verify AC input power is connected as described in *Chapter 2, Installation & Setup* in this manual.

##### Compressed Air

If you are using an air-actuated weld head, verify that compressed air is connected as described in the appropriate sections of your weld head manual. Turn the compressed air ON, and adjust it according to the instructions in your weld head manual.

### Initial Setup

1. Set the **WELD/NO WELD** switch on the Power Supply front panel to the **NO WELD** position. In this position, the Unit will operate the weld head *without* producing weld current.
2. Set the ON / OFF switch on the rear panel of the Power Supply to the ON position.
3. Adjust the weld head force adjustment knob for a force appropriate for your welding application. A good starting point is the mid-point in the range of the weld head force.
4. Press the foot switch to activate the first level switch and clamp the material. Check the head for suitable clamping pressure. Release the footswitch to release the material. Check the head for smooth operation of the electrodes.
5. When you are ready to perform a weld, be sure to set the **WELD/NO WELD** switch back to the **WELD** position.



## Section II. Operation

### Start-Up

Turn the Power Supply ON.

Verify that the Start-Up screen displays briefly then changes to the **RUN** screen.



**Start-Up Screen and Version Number**



**Normal RUN Screen**

The unit will take approximately 20 seconds to complete its internal startup routine. The **Charge Monitor** indicator on the front panel will turn green when the startup routine has been complete.

### Using Existing Weld Schedules

1. Use the ▲▼ arrows to select the weld schedule you desire.
2. Press the **WELD/NO WELD** switch to the **WELD** position.
3. Begin welding using your normal procedures.

**NOTE:** Welding will be performed using values of the schedule selected until you select a new schedule.

### Modifying Weld Schedules

1. Press the **WELD/NO WELD** switch to the **NO WELD** position.
2. Use the ▲▼ arrows to select the weld schedule you wish to modify.
3. Press the **PULSE 1** button to modify Pulse 1. Hold the button for about 1 second. When the screen changes to black, the Power Supply is in the “edit” mode.
4. To modify the **energy**, press the ▲ arrow to increase energy or press the ▼ arrow to decrease energy.

## CHAPTER 4: OPERATING INSTRUCTIONS

---

5. To modify **pulse duration**, press the **PULSE SELECT** button until the pulse length you want is indicated beneath the 3-digit energy display.

**NOTE:** The **Very Short** setting provides the shortest duration. The **Short** setting provides the highest peak current for a given energy setting. The **Long** setting provides the longest duration and lowest peak current for a given energy setting. The **Medium** setting provides an intermediate option between the **Short** and **Long** settings. Upslope applies to the **Short**, **Medium** and **Long** settings only, and is turned ON or OFF with the **PULSE SELECT** button.

6. To modify **POLARITY**, in edit mode, press the **POLARITY SELECT** button repeatedly until the polarity you want is indicated in the display.

**Note:** Polarity is not user settable on the CD-A1000A

7. To modify the **squeeze time**, press the **SQZ/HOLD** button. The **SQUEEZE** field will be highlighted. Press the ▲ arrow to increase squeeze time or press the ▼ arrow to decrease the squeeze time.
8. To modify the **hold time**, press the **SQZ/HOLD** button again. The **HOLD** field will be highlighted. Press the ▲ arrow to increase hold time or press the ▼ arrow to decrease hold time.
9. To modify the settings for Pulse 2, press and hold the **Pulse 2** button to enter edit mode.
10. Repeat steps 4 through 6 to program the settings for Pulse 2.
11. Press the **SAVE** button to save any changes made. To exit “editing” mode *without* accepting changes, press the RUN button on the front panel which will activate the **SAVE** prompt, then press **CLEAR** to discard changes.

### Set Peak Current Monitor Limits

Refer to Appendix A regarding repetition rates when limits are applied

Each of the 63 schedules has an associated set of **Monitor Limits**. To edit these limits, select the desired schedule, then:

1. Press the **LIMITS/COUNTERS** button to select this screen.
2. To edit the limits for Pulse 1, press and hold the **PULSE 1** button for about one second. The screen will turn black to indicate that the Power Supply is in edit mode. The upper limit for Pulse 1 will be highlighted. Press the ▲ arrow to increase limit or press the ▼ arrow to decrease the limit.
3. To edit the lower limit for Pulse 1, press the **PULSE 1** button again. The lower limit will be highlighted. Press the ▲ arrow to increase limit or press the ▼ arrow to decrease the limit.
4. To edit the Action for Pulse 1, press the Pulse 1 button again. Press the ▲ or ▼ arrow to select between **CONTINUE** or **INHIBIT PULSE 2**.

**NOTE:** When **CONTINUE** is selected, Pulse 2 is enabled whether or not Pulse 1 is within limits. When **INHIBIT PULSE 2** is selected, Pulse 2 is inhibited when Pulse 1 is out of limits.

5. Use the **PULSE 2** button to set the upper and lower limits for Pulse 2.

6. Press the **SAVE** button to save any changes made. To exit the “editing” mode *without* accepting changes, press the **RUN** button on the front panel, which will activate the **SAVE** prompt, then press **CLEAR** to discard changes.

### Set Weld Counter Limit or Reset the Weld Counter

The **WELD COUNTER** and **COUNTER LIMITS** apply to all weld schedules. There is not a separate counter or separate limit for each schedule. This feature is useful for counting welds made on a set of electrodes to determine when to change electrodes. This feature can also be used to count the number of welds during a particular shift or work day. After the limit is reached, the Power Supply will “beep” each time a weld is made. This signals the Operator to take action. To clear the counter or edit limit values:

1. Press the **LIMITS/COUNTERS** button to select this screen. Press and hold the **LIMITS/COUNTERS** button for about one second. The screen will turn black to indicate edit mode.
2. The **WELD COUNTER** field will be highlighted. Press the **CLEAR** button to reset this value to **000000**.  
**NOTE:** The ▲ or ▼ arrows do *not* change the Weld Counter value.
3. To change the **COUNTER LIMIT** field, press the **LIMITS/COUNTERS** button again. The **COUNTER LIMIT** field will be highlighted. Press the **CLEAR** button to set this to zero or use the ▲ or ▼ arrows to change the value.
4. Press the **SAVE** button to save changes. To exit “editing” mode *without* accepting changes, press **RUN** to activate the **SAVE PROMPT**; then press **CLEAR** on the front panel to discard changes.

### Set MENU Entries

The **MENU** screen contains set-up and configuration values that apply to all schedules.

1. Press the **MENU** button to select this screen. Press and hold the **MENU** button for about one second. The screen will turn black to indicate edit mode. The **BUZZER** field will be highlighted.
2. To adjust the buzzer volume, press the ▲ or ▼ arrows to go from 1 (quiet) to 4 (loud).
3. To set the RS-232 baud rate, press the **MENU** button again. The **BAUD** rate field will be highlighted. Press the ▲ or ▼ arrows to select the desired baud rate.
4. To set the input switch debounce time, press the **MENU** button again. Press the ▲ or ▼ arrows to select either **0** or **30 MSEC** debounce time.
5. To set the starting schedule for a weld chain, press the **MENU** button again. Press the ▲ or ▼ arrows to select the starting schedule.
6. To set the ending schedule for a weld chain, press the **MENU** button again. Press the ▲ or ▼ arrows to select the ending schedule.
7. Press the **MENU** button again to select the **REMOTE** field.
8. Press the ▲ or ▼ arrows to select **ON** or **OFF**. When this is set to **OFF**, the Power Supply will not accept RS-232 commands from a remote source to change schedule or control settings. When

## CHAPTER 4: OPERATING INSTRUCTIONS

---

this is set to **ON**, the unit will accept these commands. In either case the unit will accept and respond to RS-232 commands to send out weld data and information.

9. Press the **MENU** button again to select the **RESET DEFAULTS** field. Use the ▲ or ▼ arrows to select ON or OFF. If this value is set to ON and is saved, then all schedules, all weld limits, Pulse 1 actions, **WELD COUNTER**, **WELD COUNTER LIMIT** and all **MENU** screen entries are set back to factory defaults.
10. Press the **SAVE** button to save any changes made. To exit the “editing” mode *without* accepting changes, press RUN to activate the **SAVE** prompt; then press **CLEAR** on the front panel to discard changes.

### Dual Weldhead Operation

For dual weldhead operation, only schedules 1 and 2 are active. To set this feature, connect pin 13 of the 37 pin Control Signal connector to the I/O common (pin 28 or pin 32). See *Appendix B, Electrical & Data Connections* for connection details.

1. Connect Weldhead 2 to the 4 pin Standard Air Valve Driver Output Connector.
2. Connect Weldhead 1 to the 8 pin Weld Head Connector.
3. Connect the Dual Weldhead Input (pin 13 on the 37 pin connector) to the I/O common (pin 28 or 32 on the 37 pin connector).
4. Schedule 1 will then use Weldhead 1 and schedule 2 will use Weldhead 2. These two heads and schedules will fire alternately with the Footswitch input. Do not use the RS-232 commands or the Binary Schedule Select inputs to change weld schedules when Dual Weldhead operation is active.

### Programming Lock

The programmed values of the 63 schedules can be locked so that no changes are possible. To set this lock, connect pin 9 of the 37 pin Control Signal connector to the I/O common (pin 28 or pin 32). See *Appendix B, Electrical & Data Connections* for connection details.

**NOTE:** The schedule numbers can still be changed, but the values stored in each schedule *cannot* be changed.

### Schedule Lock

The programmed values of the 63 schedules and the schedule number itself can be locked so that no changes are possible. To set this lock, connect pin 27 of the 37 pin connector to the I/O common (pin 28 or pin 32). See *Appendix B, Electrical & Data Connections* for connection details.

### Turning the Unit OFF

The CD-A welders are capable of storing up to 9,860 welds. The welder will automatically save the weld data, Schedule data and Counter data into Non-Volatile memory whenever the input power is interrupted.

When cycling power from the ON to OFF to ON position, a 3 second pause should be observed when turning the power back on. If this pause is not incorporated the unit may come on with a white display. If a white display occurs at any time, perform the power cycle with the 3 second pause to correct the issue.

### Section III: Operational Notes

#### Repetition Rate

The repetition rates are different for full monitoring and no monitoring. See Appendix A for repetition rates.

#### Automatic Power Turn-Down

The user must limit the power dissipated in the automatic turn-down circuit to the 50 W limit listed in *Appendix A, Technical Specifications*. Rapid firing of different schedules with significantly different energy level can exceed this limit. To calculate the total power dissipated in this circuit:

1. Determine how many times in one minute the schedule will change from a higher energy to a lower energy.
2. Add up the total Watt-seconds of energy decrease in one minute.
3. Divide this number by 60 to determine the average Watts of power dissipated.

**Example:** If there are 12 schedule changes per minute where the programmed energy decreases from 300 Watt-seconds to 100 Watt-seconds, the total change is 2400 Watt-seconds per minute. Dividing by 60 gives a resultant value of 40 Watts (Watt-seconds per second equals Watts), which is within the capability of the unit.

#### Extended Shut-down Procedure

If the CD-A unit has been turned off and non-operational for a period of 3 months or longer, an extended warm-up sequence is recommended.

1. Turn the unit ON.
2. Set the energy to the maximum level. **Example:** set the CD-A1000A to 999 Watt Seconds.
3. Fire the unit once.
4. Leave the power ON and wait 15 minutes.
5. Program the desired schedule and resume normal operation.

# CHAPTER 5

## Maintenance

### Section I. Troubleshooting

Problem	Cause (in order of probability)	Problem	Cause (in order of probability)
Electrode Damage	<ol style="list-style-type: none"> <li>Excessive energy setting</li> <li>Excessive or insufficient weld head force</li> <li>Wrong electrode tip shape</li> <li>Contaminated weld piece surface / plating</li> <li>Excessively short pulse time setting</li> <li>Wrong electrode material</li> <li>Contaminated electrode surface</li> </ol>	Electrode Sparking	<ol style="list-style-type: none"> <li>Excessive energy setting</li> <li>Insufficient weld head force</li> <li>Slow weld head follow-up</li> <li>Incompatible weld piece projection design</li> <li>Contaminated weld piece surface/plating</li> <li>Wrong electrode tip shape</li> <li>Excessively short pulse time setting</li> <li>Wrong electrode material</li> <li>Contaminated electrode surface</li> </ol>
Electrode Sticking	<ol style="list-style-type: none"> <li>Contaminated weld piece surface / plating</li> <li>Wrong electrode material / tip shape</li> <li>Insufficient weld head force</li> <li>Excessive energy setting</li> <li>Contaminated electrode surface</li> <li>Slow weld head follow-up</li> </ol>	Weld Piece Warping	<ol style="list-style-type: none"> <li>Excessive weld time setting</li> <li>Excessive weld head force</li> <li>Incompatible weld piece projection design</li> <li>Incompatible weld piece materials</li> <li>Wrong electrode tip shape</li> <li>Excessive current/energy setting</li> </ol>
Insufficient Weld Nugget	<ol style="list-style-type: none"> <li>Insufficient energy setting</li> <li>Wrong electrode material / tip shape</li> <li>Worn / mushroomed electrodes</li> <li>Excessively long pulse time setting</li> <li>Incorrect weld head polarity</li> <li>Contaminated weld piece surface / plating</li> <li>Excessive weld head force</li> <li>Insufficient weld head force</li> <li>Contaminated electrode surface</li> <li>Incompatible weld piece projection design</li> <li>Slow weld head follow-up</li> <li>Incompatible weld piece materials</li> <li>No cover gas on weld piece</li> </ol>	Metal Expulsion	<ol style="list-style-type: none"> <li>Excessive current / energy setting</li> <li>Insufficient weld head force</li> <li>Slow weld head follow-up</li> <li>Incompatible weld piece projection design</li> <li>Contaminated weld piece surface / plating</li> <li>Incompatible weld piece materials</li> <li>Contaminated electrode surface</li> <li>Wrong electrode tip shape</li> <li>No cover gas on weld piece</li> <li>Excessively short weld time set at CD-A125A/CD-A300A</li> </ol>
Weld Piece Over-heating	<ol style="list-style-type: none"> <li>Excessive energy setting</li> <li>Insufficient weld head force</li> <li>Incompatible weld piece materials</li> <li>Wrong electrode material / tip shape</li> <li>Contaminated electrode surface</li> </ol>	Weld Piece Discoloration	<ol style="list-style-type: none"> <li>No cover gas on weld piece</li> <li>Excessive energy setting</li> <li>Insufficient weld head force</li> <li>Contaminated weld piece surface / plating</li> <li>Wrong electrode material / tip shape</li> <li>Contaminated electrode surface</li> </ol>

## CHAPTER 5: MAINTENANCE

### Error Messages

The Power Supply displays the following error messages in the bottom line of the display. To clear these error codes, press either the **RUN** or **CLEAR** buttons. If the error has gone away, the message will then be removed. If the error is still present, the message will remain on the display. In all cases, if the error persists, contact AMADA WELD TECH for service.

Error	Error Name	Description	Troubleshooting steps
0	Good Weld	“Good Weld” or “Weld with No Error”	
1	Discharge Problem	The energy setting in the weld schedule was reduced, or the schedule number was changed to a schedule with a lower energy setting. The unit did not reach this new, lower energy value within 15 seconds	Turn off the unit and wait 30 seconds. Turn the unit on and see if the error disappears.
2	Over Current	An Over Current condition has occurred and the unit has locked out the fire mode	Cycle the input power to restore.
3	Firing Switch not closed within 10 seconds	The firing switch did not close within 10 seconds of FS2 closing	Adjust the weldhead and/or parts to be welded so that the firing switch closes within 10 seconds of FS2 closing.
4	Calibration set out of Limits	The capacitor calibration values are out of the Limits	Cycle power to clear error. If error persists, contact AMADA WELD TECH
5	Memory Error	Internal Memory Error	
7	Memory Reset	Internal Memory Reset. Default values loaded.	
8	Weld Counter reached	Weld Counter limit has been reached	
9	Changes not saved	After setting changes are made, they must either be saved or discarded	Press SAVE to save changes, or CLEAR to discard.
10	Weld Disable	The Weld Disable input is open	Close the Weld Disable switch and press CLEAR to reset.
11	Chaining End < Chaining Start	Chaining Sequence Error. The chaining End is less than the Chaining Start	Reset the chaining sequence to the first schedule in the chain.
12	Open Load	There is not a load connected on the Output Terminals	Connect Load to Power Supply Output Terminals
13	Out of Limits	The weld settings exceed the limitations of the Power Supply	Change weld settings.



**Error Messages (cont.)**

<b>Error Number</b>	<b>Error Name</b>	<b>Description</b>	<b>Troubleshooting steps</b>
14	Over Temperature Error	The internal temperature of the unit has exceeded its limit.	1) Reduce output power or Repetition Rate and press RUN to restore. 2) Discontinue firing and allow Unit to cool.
15	Control Board Re-booted	The Control CPU has re-booted	Cycle power to clear error. If error persists, contact AMADA WELD TECH
16	Hamming Single Bit Error	Internal Communication Error	
17	No ECC Table found	Internal Communication Error	
18	No Memory Detected	Internal Communication Error	
19	No Good Flash Blocks	Internal Communication Error	
20	ECC Read Error	Internal Communication Error	
21	NAND Write Error	Internal Communication Error	
22	Check Input Switch Status	Input switch Active unexpectedly.	Resolve Switch Condition.
23	Check Weld Mode Setting	Weld Mode is not set for the input switch being used	Use correct switch or change the Weld Mode setting

### Section II. Maintenance

#### Calibration

Calibration must be performed by factory-trained and qualified personnel. If your Power Supply needs calibration, contact your local AMADA WELD TECH service representative, or contact our service department at the address, phone number, or e-mail address listed under **Contact Us** in the front of this manual.

#### Electrode Maintenance

When a welding schedule has been suitable for a particular welding application over many welds, but poor quality welds are now resulting, electrode deterioration could be the problem. If you need to increase welding current to maintain the same weld heat, the electrode tip has probably increased in surface area (mushroomed), effectively decreasing weld current density, thus cooling the weld. Try replacing the electrodes.

The rough surface of a worn electrode tip tends to stick to the work pieces. So, periodic tip resurfacing (dressing) is required to remove pitting, oxides and welding debris from the electrode. You should limit cleaning of an electrode on the production line to using a # 400-600 grit electrode polishing disk. If you must clean a badly damaged tip with a file, you must use a polishing disk after filing to ensure the electrode faces are smooth.

The best method of preventing electrode problems is to regularly re-grind electrode tip surfaces and shapes in a certified machine shop.

#### Parts Replacement

There are no user-serviceable parts inside the power Supply.

## **Section III. Repair Service**


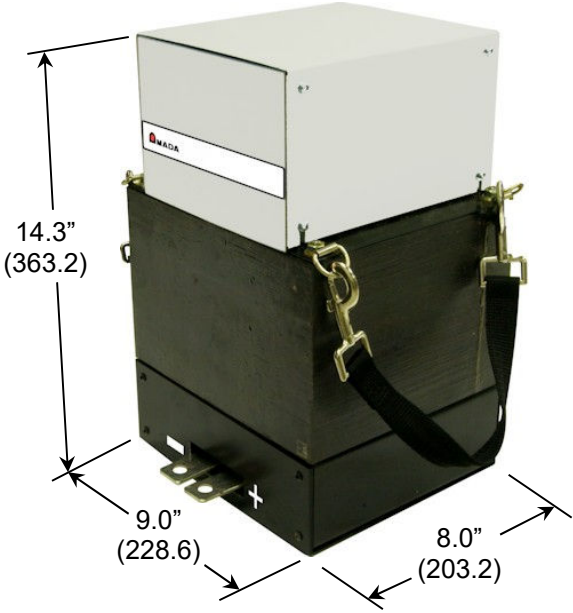
If you have problems with your power Supply that you cannot resolve, please contact our service department at the address, phone number, or e-mail address listed under **Contact Us** in the front of this manual.



# APPENDIX A

## Technical Specifications

**NOTE:** The specifications listed in this appendix may be changed without notice.

Item	Description
<b>Dimensions</b> CD-A125A (Power Supply) CD-A300A (Power Supply) CD-A1000A (Power Supply)	
<b>Weight (Power Supply)</b>	CD-A125A - 44 lb. (20kg) • CD-A300A - 69 lb. (31 kg) CD-A1000A control unit - 29 lb. (13kg)
<b>CD-A1000A Transformer Dimensions</b>	
<b>Weight (Transformer)</b>	135 lb (61 kg)

## APPENDIX A: TECHNICAL SPECIFICATIONS

Item	Description			
Input line voltage	90 - 132 VAC 180 - 264 VAC	50/60 Hz 50/60 Hz		
Overvoltage Detection	Internal switch			
Input VA (Max demand)	1300 VA			
Charge circuit type	Switched mode			
Weld Capacitor Charge Voltage	430 V max			
Weld Capacitance	As required to achieve Output Energy			
Output Energy Max per pulse	CD-A125A -- 125 Ws CD-A300A -- 300 Ws CD-A1000A -- 999 Ws			
Voltage turndown circuit	50 W average power. Automatic turndown upon power interruption.			
Weld schedules	63			
Weld pulses per Schedule	2			
Repetition Rate without monitoring (Pulses per minute)	Energy	CD-A125A	CD-A300A	CD-A1000A
	3 Ws	836/min		
	4 Ws		586/min	
	5 Ws	708/min		
	10 Ws	554/min	408/min	329/min
	20 Ws	425/min		
	25 Ws		281/min	
	40 Ws	313/min		
	50 Ws		204/min	164/min
	60 Ws	261/min		
	75 Ws		167/min	
	80 Ws	227/min		
	100 Ws	201/min	145/min	111/min
	125 Ws	173/min		
	150 Ws		118/min	
	200 Ws		100/min	
	225 Ws		94/min	
	250 Ws		87/min	60/min
	300 Ws		76/min	
	500 Ws			36/min
	750 Ws			25/min
1000 Ws			20/min*	
	NOTE: The Hit Rates for the CD-A300A and CD-A1000A are the same as their Repetition Rates.			
	*NOTE: room temperature repetition rate. If operating at ambient temperature of 40 °C or greater, reduce repetition rate by 25% to avoid thermal shut down. (Unit will reset after cool off)			

## APPENDIX A: TECHNICAL SPECIFICATIONS

Item	Description					
Repetition Rate with full monitoring (Pulses per minute)	Energy	CD-A125A	CD-A300A	CD-A1000A		
	1 Ws					
	2 Ws					
	3 Ws	180/min				
	4 Ws		168/min			
	5 Ws	174/min				
	7 Ws					
	10 Ws	161/min	156/min	150/min		
	13 Ws					
	17 Ws					
	20 Ws	146/min				
	25 Ws		134/min			
	35 Ws					
	40 Ws	131/min				
	50 Ws		113/min	100/min		
	60 Ws	113/min				
	75 Ws		103/min			
	80 Ws	95/min				
	100 Ws	87/min	95/min	77/min		
	125 Ws	86/min				
	150 Ws		84/min			
	200 Ws		84/min			
	225 Ws		72/min			
	250 Ws		66/min	48/min		
	300 Ws		52/min			
	500 Ws			31/min		
	750 Ws			23/min		
	1000 Ws			19/min*		
NOTE: The Hit Rates for the CD-A300A and CD-A1000A are the same as their Repetition Rates						
*NOTE: Room temperature repetition rate. If operating at ambient temperature of 40 °C or greater, reduce repetition rate by 25% to avoid thermal shut down. (Unit will reset after cool off)						
Rise Times at Max Energy into a 1 milliohm load with very low inductance		No Upslope			With Upslope	
		CD-A125A	CD-A300A	CD-A1000A	CD-A125A	CD-A300A
	Very Short (VS)	0.7 ms	0.9 ms	1.8 ms	Not Applicable	
	Short (S)	0.7 ms	0.9 ms	1.9 ms	0.9 ms	1.2 ms
	Medium (M)	0.85 ms	1.5 ms	2.7 ms	1.4 ms	2.8 ms
	Long (L)	1.25 ms	1.2 ms	3.4 ms	2.8 ms	3.3 ms

## APPENDIX A: TECHNICAL SPECIFICATIONS

Item	Description					
Typical Pulse duration times at Max Energy into a 1 milliohm load with very low inductance. Duration measured at 10% of peak currents.		No Upslope			With Upslope	
		CD-A125A	CD-A300A	CD-A1000A	CD-A125A	CD-A300A
	Very Short (VS)	2.1 ms	2.0 ms	4.3 ms	Not Applicable	
	Short (S)	2.3 ms	6.2 ms	8.6 ms	2.4 ms	6.0 ms
	Medium (M)	2.6 ms	8.0 ms	9.1 ms	2.8 ms	8.2 ms
	Long (L)	4.0 ms	11.2 ms	15.4 ms	4.7 ms	12.2 ms
Watt Second Adjustment Range	CD-A125A: 1 to 10 Watt Seconds (Ws), in 0.1 Ws increments, and 10 to 125 Watt Seconds (Ws), in 1 Ws increments. CD-A300A: 3 to 300 Watt Seconds (Ws), in 1 Ws increments. CD-A1000A: 10 to 999 Watt Seconds (Ws), in 1 Ws increments.					
Polarity Selection	Positive, Negative, or Alternating (on CD-A125A, CD-A300A only)					
Squeeze Time	20 – 2,999 msec +/-15% or +/-50 msec whichever is greater					
Hold Time	20 – 2,999 msec +/-15% or +/-50 msec whichever is greater					
Repeat Time	25 – 9999 msec +/-15% or +/-50 msec whichever is greater					
Weld Counter	0 - 999999					
Action Upon Reaching Limit	Buzzer sounds after each weld. Output relay activates					
Input Debounce Time	Approximately 30 msec					
Control Outputs (See Appendix B for details)	Weld ready (24 VAC or 30 VDC max, 500 mA max) Weld end (24 VAC or 30 VDC max, 500 mA max) Counter reached limit (24 VAC or 30 VDC max, 500 mA max) 24 VDC and return (for optical firing switch)					
Environmental Operating Humidity Operating Temperature	5% to 95% (Non-condensing) 5 °C to 40 °C (Ambient Temperature)					
Valve power	24 VAC, 0.5 A maximum					
	24 VDC 0.5 A maximum, including any current drawn from pins 1 and 19 of the 37 pin I/O connector					



# APPENDIX B

## Electrical and Data Connections

### Section I. Electrical Connection

#### Input Power

As described in *Chapter 2, Installation & Setup*, a NEMA 5-15P IEC Power Cord is supplied. The female end of the power cable is an IEC-320-C13 standard plug.

Connect the Power Supply power cable to a single-phase, 50/60 Hz power source. The nominal voltage can be either 100/120 V or 200/240 V.

#### Power Input Specifications

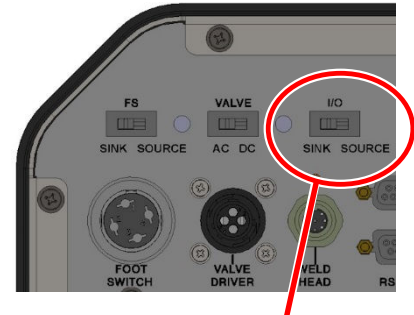
Model	Input Voltage, 50-60 Hz, Single phase ( $V_{RMS}$ )	Circuit Breaker Current ( $A_{RMS}$ )	Copper Wire Gauge, 7 strands (AWG)	Wire Diameter (mm)
All CD-A	100 – 120 $\pm$ 10%	15	14	1.6
	200 - 240 $\pm$ 10%	10	14	1.6

### Section II. External Input / Outputs

#### I/O Connector (D-Sub 37-pin)

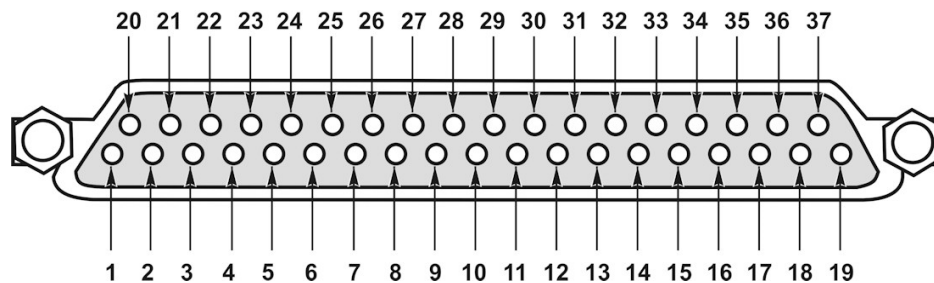
The CD-A Power Supply user Input and Output control signals can be found on the rear panel of the CD-A on the D-Sub 37-pin I/O Connector labeled **CONTROL SIGNALS**. For added I/O flexibility, the Input and Output 24 VDC logic inputs can be configured for either sink or source. The Inputs and Outputs are biased the same.

The Switch labeled **I/O** on the rear panel of the CD-A Power Supply is used to set the biasing of the inputs to either Sink (**LOW = True Inputs**) or Source (**HIGH = True Inputs**).



BIAS SWITCH

#### Signal Definitions



PIN	DESCRIPTION	
1	+24 VDC	The total current draw from pins 1 and 19 must not exceed 500 mA
2	Optical firing switch input	<b>Caution:</b> When connecting to these I/O pins. Damage may result from an improper connection. The optical firing switch input can only be used with AMADA WELD TECH heads that have this feature. In operation, an optical switch connects between pin 2 and pin 20 to initiate firing. Neither of these pins should be used for any other purpose since they connect to internal, non-isolated points in the unit.
3	<i>Not used</i>	
4	Firing switch input	Input must be held active for at least 50 ms
5	FS1 (Foot switch level 1) input	Input must be held active for at least 50 ms
6	<i>Not used</i>	
7	Weld inhibit input	Weld function is inhibited as long as this input is held active
8	Weld counter reset input	Input must be held active for at least 50 ms
9	Program lock input	Programming function is inhibited as long as this input is held active
10	Binary schedule select bit 1	Schedule 1 can be selected by activating this input for 50 ms. Must be held active to combine other schedule inputs.
11	Binary schedule select bit 4	Schedule 4 can be selected by activating this input for 50 ms. Must be held active to combine other schedule inputs.

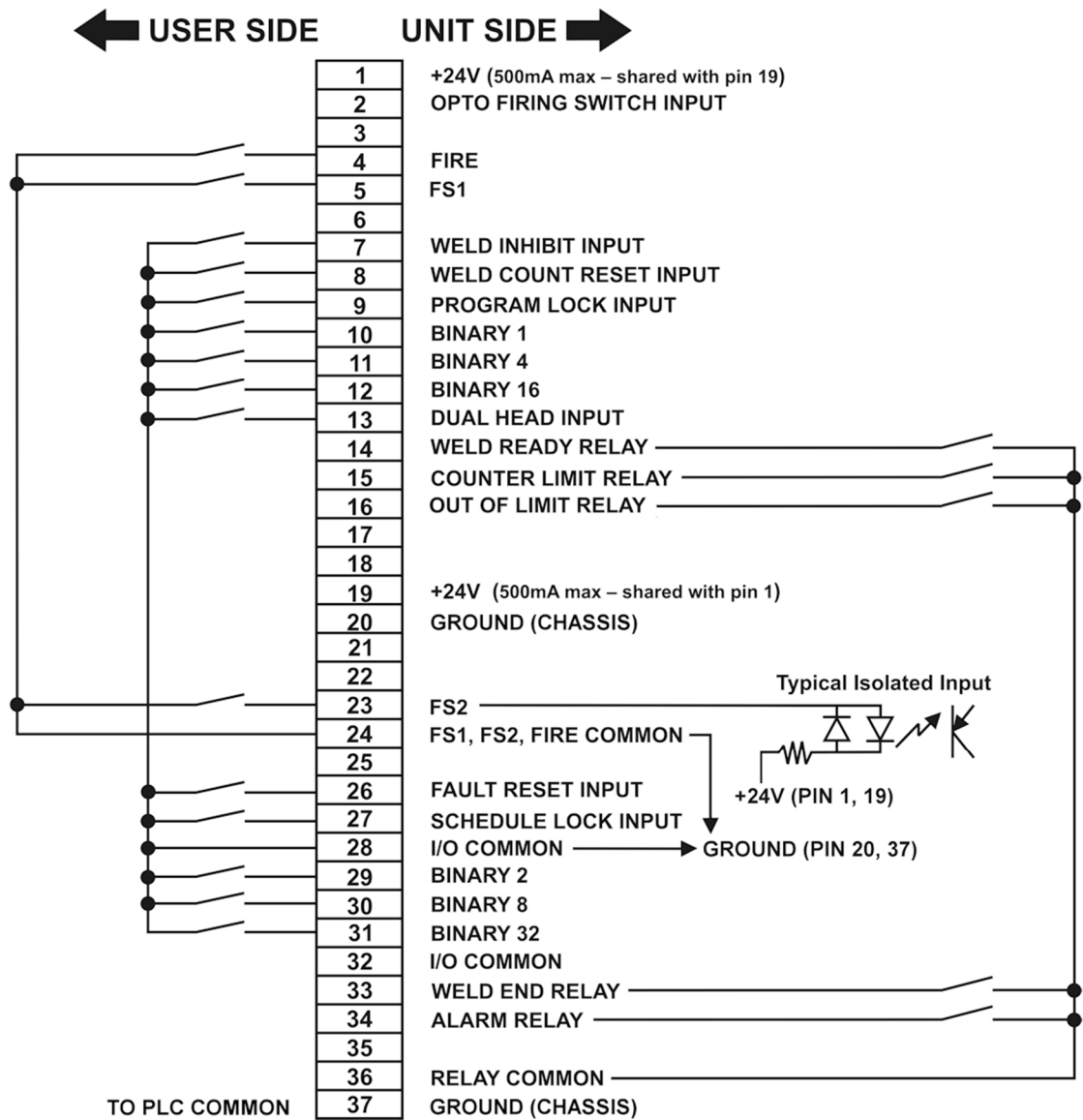
## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

### Signal Definitions (continued)

PIN	DESCRIPTION	
12	Binary schedule select bit 16	Schedule 16 can be selected by activating this input for 50 ms. Must be held active to combine other schedule inputs.
13	Dual weldhead input	Dual head function is enabled as long as this input is held active
14	Weld ready relay output	Relay closure to relay common when unit is ready to fire <i>NOTE:</i> The relay closure, may at times, extend for up to 30 milliseconds after the weld pulse has occurred.
15	Counter exceeds limit relay output	Relay closure to Relay common when Counter limit is exceeded. Can only be cleared by decreasing the counter limit to "0", by increasing the counter limit beyond the count or resetting the counter.
16	Weld out of limits relay	Relay closure to Relay common when Weld limit exceeded. Will reset when weld is within limits. If Monitoring this relay be sure to delay the reading of the status until weld end has occurred. This is to ensure that the prior weld does not cause an out of limit error of a good weld. It is also possible to Reset the relay using the Fault Relay input (Pin 26)
17, 18	<i>Not used</i>	
19	+24 VDC	The total current draw from pins 1 and 19 must not exceed 500 mA
20	Ground	
21, 22	<i>Not used</i>	
23	FS2 (Foot switch level 2)	Input must be held active for at least 50 ms
24	FSI, FS2, Fire Common	I/O common for FS1, FS2, FSW inputs
25	<i>Not used</i>	
26	Fault reset input	When activated for 50 ms, will reset any I/O relay fault (Except Counter). Must be activated for an additional 250 ms to clear the front panel error message.
27	Schedule lock input	Schedule change is disabled as long as this input is active
28	I/O Common	I/O common for non FS1, FS2, FSW inputs
29	Binary schedule select bit 2	Schedule 2 can be selected by activating this input for 50 ms. Must be held active to combine other schedule inputs.
30	Binary schedule select bit 8	Schedule 8 can be selected by activating this input for 50 ms. Must be held active to combine other schedule inputs.
31	Binary schedule select bit 32	Schedule 32 can be selected by activating this input for 50 ms. Must be held active to combine other schedule inputs.
32	I/O common	
33	Weld end relay output	Relay closure to Relay common when Weld has been completed
34	Alarm relay output	Relay closure to Relay common if a Weld Disable, Over-temperature, or Over current condition occurs.
35	<i>Not used</i>	
36	Relay common	
37	Ground	

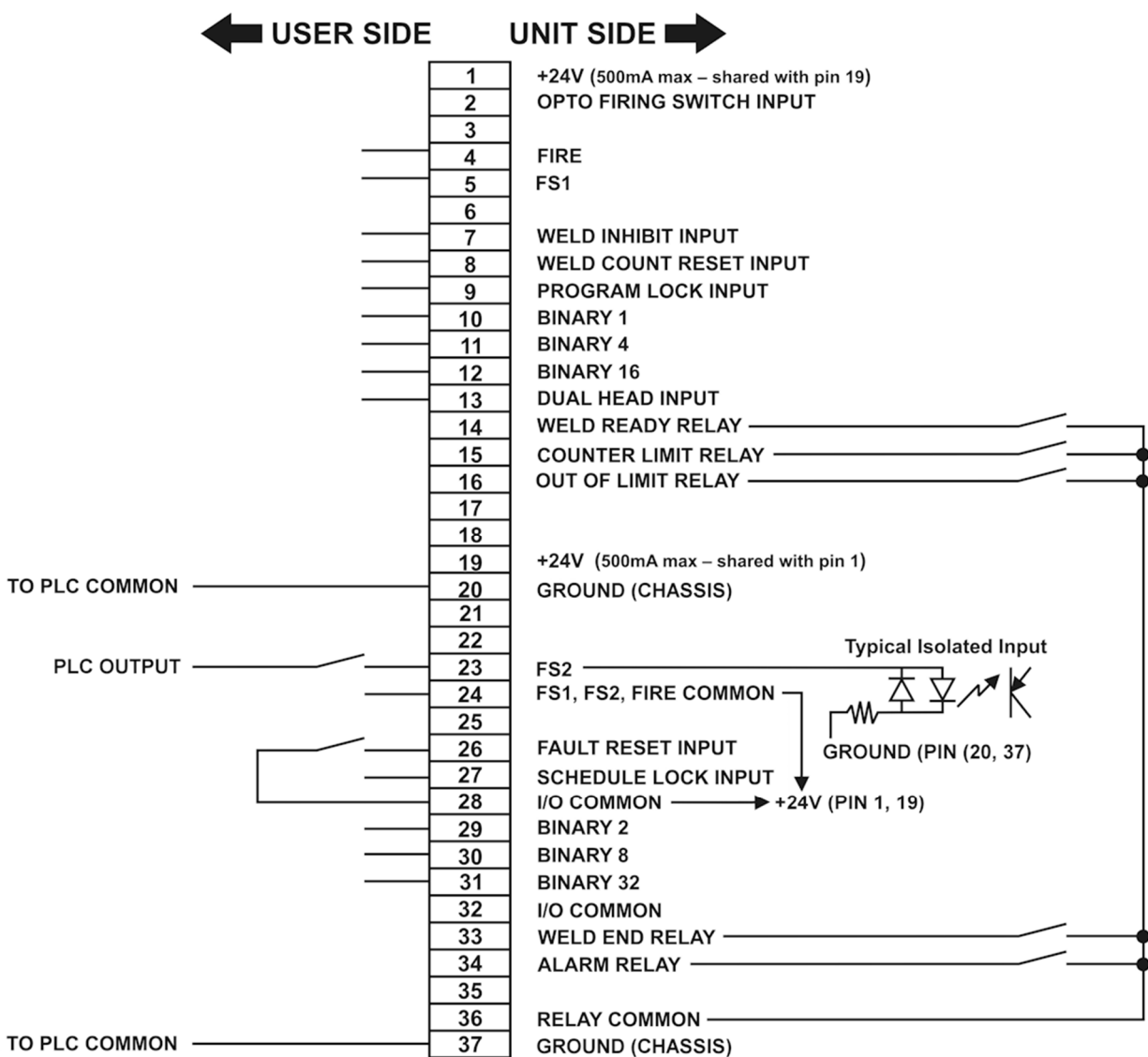
# APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

Connection Example – Inputs configured for sinking (Low = True Inputs)  
(Switch Closure to Activate Inputs – Default Configuration)



## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

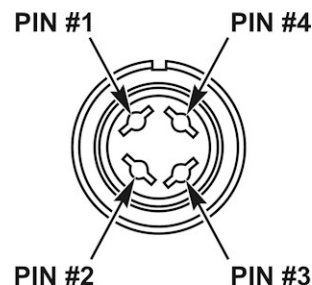
Connection Example – Inputs configured for sourcing (High = True Inputs)  
(Switch Closure to Activate Inputs)



## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

### Foot Switch Connector (signals also present on the 37-pin I/O Connector)

Foot Switch Input		
Function	Foot Switch Connector	37-pin I/O Connector
Chassis Ground	Pin # 1	---
Foot_1	Pin # 2	Pin # 5
Foot_2	Pin # 3	Pin # 23
Fire Common	Pin # 4	Pin # 24



The footswitch connector is located on the rear panel of the CD-A Power Supply and can accommodate both single-level and two-level footswitches or other 24 VDC logic inputs. In order to correctly bias the Foot Switch input for external 24 VDC logic inputs, the integrator can either set the Foot Switch input to either Sink (**LOW = True Inputs**) or Source (**HIGH = True Inputs**). The Sink/Source selection switch is located on the rear of the CD-A Power Supply just above the Footswitch Connector. In general the bias switch is only used when driving the Foot Switch input with an external 24 VDC logic input. The switch position does not matter when using a static footswitch.



### Single-Level Footswitch

When implementing a single-level footswitch, connect the footswitch leads between the **Foot\_2** and **Fire Common** inputs. In addition, terminate the **Foot\_1** signal by connecting it to **Fire Common**. When the footswitch is depressed, the weld head moves into position and applies force to the weld pieces. After the Squeeze delay, the Weld Current will flow and the Power Supply will automatically return the upper electrode to its UP position when the weld schedule is complete.

### Two-Level Footswitch

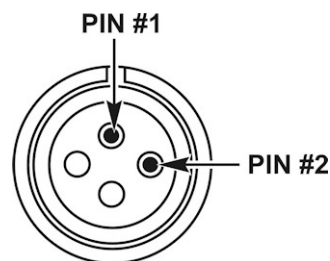
When using a two-level footswitch, connect position 1 (1<sup>st</sup> position) between **Foot\_1** and **Fire Common** and position 2 (2<sup>nd</sup> position) between **Foot\_2** and **Fire Common**. When the footswitch is depressed, the Power Supply energizes the air actuated weld head. This causes the upper electrode to descend and apply force to the weld pieces. If you release the foot switch before pressing it to the second level, the Power Supply will automatically return the upper electrode to its UP position so that you may re-position the weld pieces. If you continue pressing the footswitch down to the second level, the force-firing switch in the weld head will close. Weld current will flow and the Power Supply will automatically return the upper electrode to its UP position when the weld schedule is complete.

### 24 VDC Logic Input

If connecting a PLC or other digital device to emulate the footswitch operation, select the appropriate sink/source logic as defined above. Refer to *Appendix C, System Timing* for correct implementation of the external Logic Source.

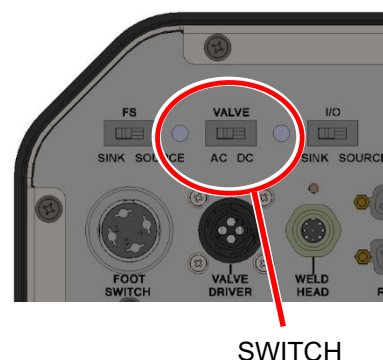
## Standard Air Valve Driver Output Connector

Air Valve Driver 24 V Connector	
Pin	Description
1	24 VAC (for solenoid) or 24 VDC
2	HEAD_2 (Switched 24VDC common)



The Air Valve Driver Output is located on the rear panel of the CD-A Power Supply and can accommodate both 24 VAC and 24 VDC (Solenoid) Valves. The voltage is set via a switch located on the rear of the CD-A Power Supply just above the Valve Driver connector. The switch can be set to **AC** (for 24 VAC valves) or **DC** (for 24 VDC valves).

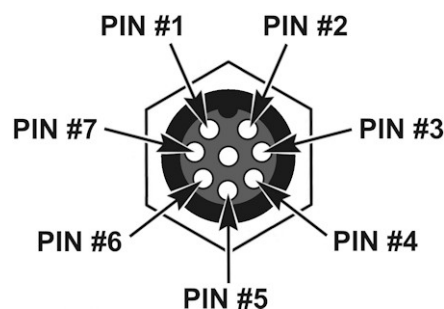
The air valve driver output is initiated when the footswitch is depressed during the 1<sup>st</sup> position. At this time the upper electrode on the Weld Head will descend and apply force to the weld pieces.



The Valve Driver mating connector is a TE Connectivity 206429-1 connector (Pt # 520-107) + 206358-5 backshell (Pt # 245-084) + 1-66103-8 terminals (Pt # 253-001).

## Weld Head Connector

Weld Head Connector	
Pin	Description
1	HEAD_1 (switched 24V common for solenoid)
2	24V_OUT (24VDC for solenoid)
3	FIRE COMMON (Pin 24 on 37-pin I/O Connector)
4	FIRE (Pin 4 on 37-pin I/O Connector)
5	VOLT_IN (not used)
6	VOLT_COM (not used)
7	AIRHEAD (not used)
8	Not used



The Weld Head Connector is located on the rear panel of the CD-A Power Supply and it combines all of the inputs and outputs necessary to connect an optional plug-and-play AMADA WELD TECH EZ-AIR weld head.

## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

---

### Force Firing Switch Input Cable

#### Function

The force firing switch input cable originates from the rear panel of the CD-A Power Supply and is connected to the weld head. This signal provides feedback to the CD-A Power Supply to indicate that the selected pressure has been applied to the weld piece.

Note that a mechanical firing switch is subject to contact bounce, which can cause false weld starts. The effects of switch bounce can be avoided at low weld speeds ( $\leq 1.5$  welds/second) by using the switch debounce function in the CD-A Power Supply. *See Chapter 3, Using Display Screens, Section II: Menu Screen* for more information. If welding speeds are expected to exceed 1.5 welds/second, AMADA WELD TECH highly recommends using a Focus Head with an optical firing switch. Contact AMADA WELD TECH for more details.

#### Connections

The firing switch cable is 5 feet long and is a Type 2/C, 600 volt cable containing two shielded 22 awg twisted wires and is terminated with a 2-pin Amphenol Type 80-MC2F connector (Pt # 520-011). This connector mates with the weld head firing switch connector (Pt # 520-001).

Firing Switch Connector	
Pin	Description
1	FIRE COMMON (Pin 24 of the 37-pin I/O Connector)
2	FIRE (Pin 4 of the 37-pin I/O Connector)



### Operator Weld Disable Cable Switch Input

#### Function

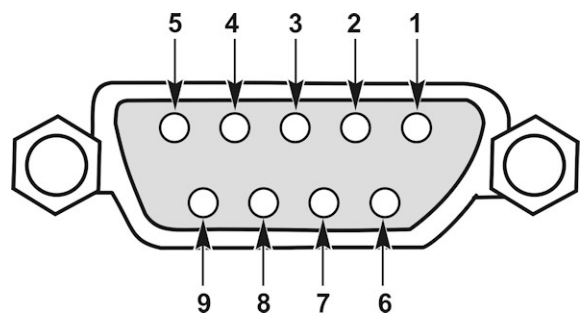
The Weld Disable Cable Switch Input originates from the rear panel of the CD-A Power Supply and is designed to be connected to an external **Weld Disable Switch** in case an emergency develops during the weld process. The **Weld Disable-Switch** should only be used in *emergencies*.

#### Connections

You must connect the **Weld Disable-Switch** cable leads, otherwise the CD-A Power Supply will not operate. Connect the wires from the 2 foot (61 cm) Weld Disable cable to a normally closed switch. If the switch is activated (opened), it will immediately halt the weld process and de-energize all CD-A Power Supply outputs. If you choose not use an external **Weld Disable Switch**, an electrical short is required between the Weld Disable cable leads from the Power Supply to be functional.



RS-232 Connections



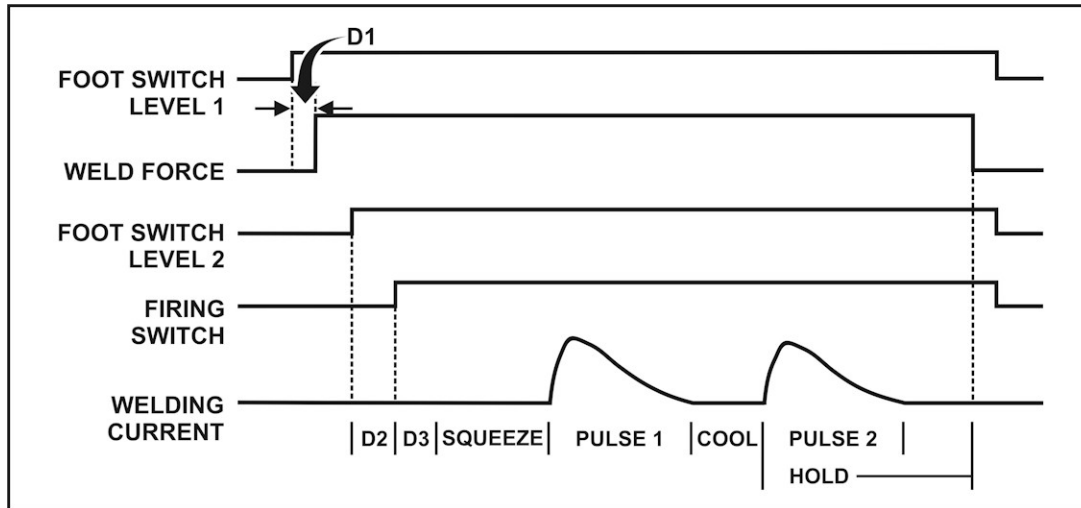
PIN	DESCRIPTION
1	No Connection
2	RS-232 Transmit
3	RS-232 Receive
4	No Connection
5	Signal Ground
6	No Connection
7	No Connection
8	No Connection
9	No Connection



# APPENDIX C

## System Timing

### Basic Weld Operation: Air Head System with Two-Level Foot Switch



#### Definitions

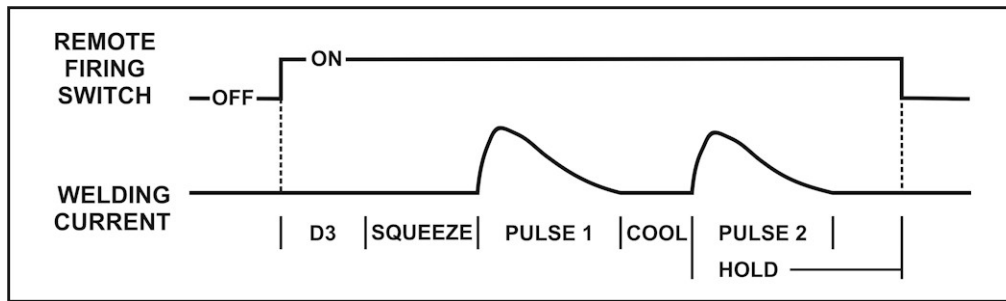
- D1** Delay time from Foot Switch Level 1 closure to Weld Force start. This time ranges from 10 to 70 ms depending upon the debounce setting.
- D2** Delay time from Weld Force start to Firing Switch closure. Maximum D2 time is 10 seconds. If the firing switch does not close within approximately 10 seconds, the message **FIRING SWITCH DIDN'T CLOSE IN 10 SECONDS** will display.
- D3** Delay time from Firing Switch closure and Foot Switch Level 2 closure to squeeze time (**SQZ**). Maximum D3 time is 60 ms.
- SQZ** Squeeze time. Selectable range is 20 to 2,999 ms. Typical accuracy is +/- 15% or +/- 50 ms (whichever is greater)
- Pulse 1** The timing of this weld pulse depends upon the pulse length programmed, the energy setting and the impedance of the secondary circuit.
- COOL** This time is not programmable by the user. It depends upon the energy level of the second pulse, and ranges from 20 to 670 ms on the CD-A125A and CD-A300A or up to 3,000 ms on the CD-A1000A. If no second pulse is programmed, this time period is skipped. Changing pulse widths or polarities may result in longer cool times.
- Pulse 2** The timing of this weld pulse depends upon the pulse length programmed, the energy setting and the impedance of the secondary circuit.
- HOLD** Hold time. The Hold Time is measured from the start of the last weld pulse. Selectable range is 20 to 2,999 ms. Typical accuracy is +/- 15% or +/- 50 ms (whichever is greater).

**NOTE:** The inputs signals (FS1, FS2 and firing switch) need to be activated for *at least 50 ms* for the Power Supply to recognize the signals.

## APPENDIX C: SYSTEM TIMING

---

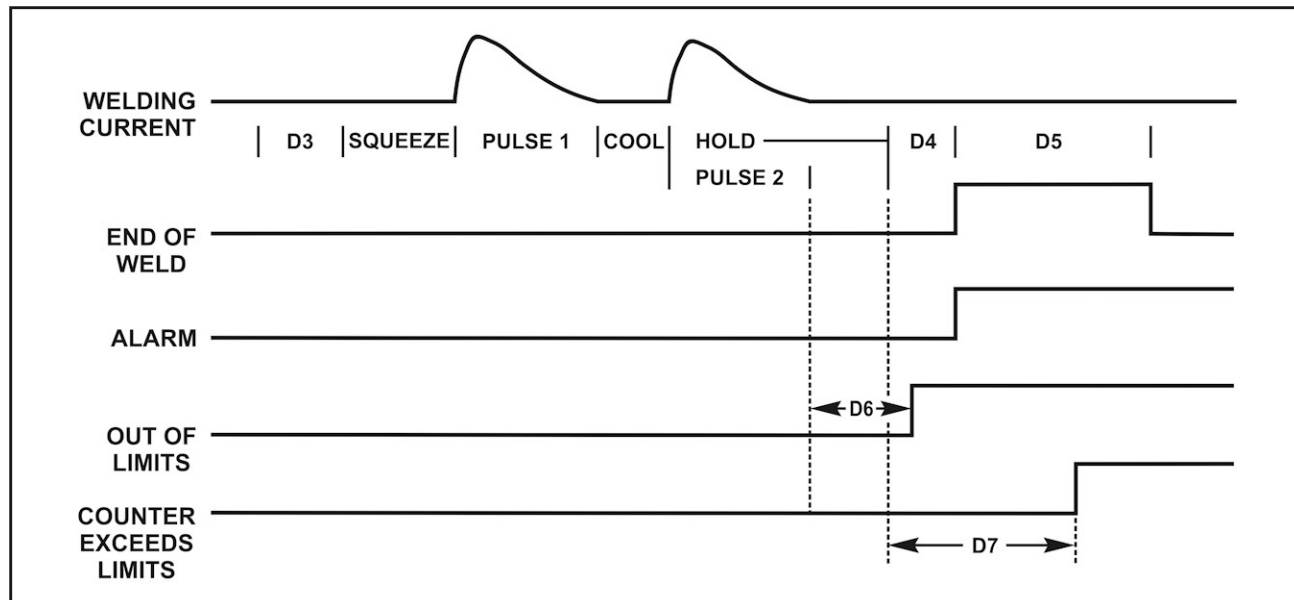
### Basic Weld Operation: Manual Head System with Firing Switch Operation



#### Definitions

- D3** Delay time from firing switch closure to the start of the weld sequence (that is, start of **SQZ**). This time ranges from 10 to 70 ms depending upon the debounce setting and pulse selection.
- SQZ** Squeeze time. Selectable range is 20 to 2,999 ms. Typical accuracy is +/- 15% or +/- 50 ms (whichever is greater).
- Pulse 1** The timing of this weld pulse depends upon the pulse length programmed, the energy setting and the impedance of the secondary circuit.
- COOL** This time is not programmable by the user. It depends upon the energy level of the second pulse, and ranges from 20 to 670 ms on the CD-A125A and CD-A300A. It can range up to 3,000 ms on the CD-A1000A. If no second pulse is programmed, this time period is skipped. Changing pulse widths or polarities may result in longer cool times than if no changes are made to these parameters.
- Pulse 2** The timing of this weld pulse depends upon the pulse length programmed, the energy setting and the impedance of the secondary circuit.
- HOLD** Hold time. The Hold Time is measured from the start of the last weld pulse. Selectable range is 20 to 2,999 ms. Typical accuracy is +/- 15% or +/- 50 ms (whichever is greater).
- NOTE:** The firing switch signal needs to be activated for *at least 50 ms* for the Power Supply to recognize the signal.

## Relay Timing



## Definitions

- D4** Delay time from the end of **HOLD** time until the **END OF WELD** or **ALARM** relay turns on. This time is 50 ms or less in most cases. However, if the energy remaining in the capacitor bank at the end of pulse 2 is greater than the energy required for Pulse 1 of the next weld, the unit will discharge the capacitor bank to the proper energy level. The end of weld relay will be delayed until the proper energy level is reached.
- D5** Duration of the **END OF WELD** relay. This is from 100 to 125 ms.
- D6** Delay time from the end of the weld pulse until the **OUT OF LIMITS** relay turns on. This time can be up to 300 ms.
- D7** Delay time from the end of **HOLD** time until the **COUNTER EXCEEDS LIMIT** relay turns On. This time is from 100 to 500 ms.



# APPENDIX D

## Communications

### Section I. Introduction

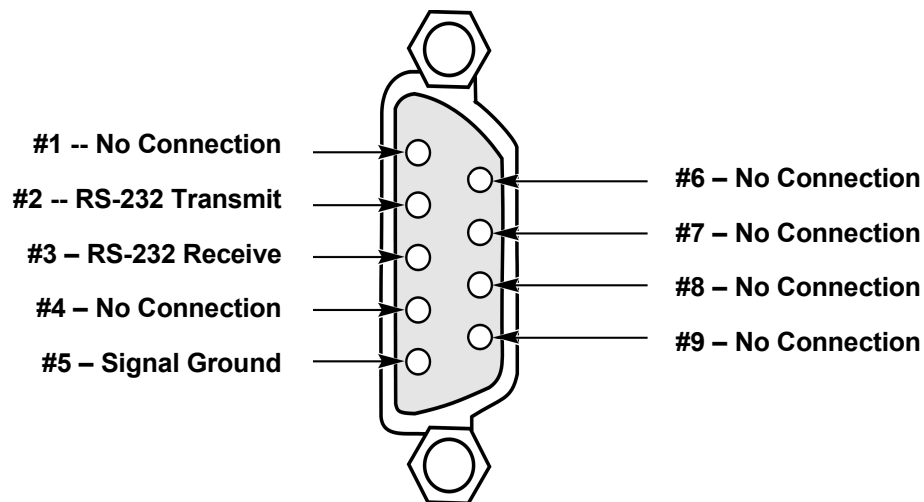
#### Overview

The Power Supply has the ability to communicate with a host computer or with automation control system. The communications option uses RS-232 to connect one control to one host.

#### Remote Programming

The codes needed to perform remote programming are listed in *Section II, Communications Protocol and Commands*. Using these codes, users can write customized software for controlling all functions of the welding control and interfacing the unit to automation control systems.

#### RS-232 Serial Connector Information



#### RS-232 settings

Baud Rate	9600, 19.2 k, and 38.4 k Baud
Data bits	8
Stop bit	1
Parity	None

#### NOTES:

- The host must be set to the same baud rate as the unit.
- For a microprocessor-based conversion (such as the Edgeport USB converter from Inside Outside Networks), the host computer should be running the Windows operating system.

**Section II. Communications Protocol and Commands**

**Command Format**

Each external command will be formatted as follows:

<stx> <cmd> <cnt> <data> <cksum> <etx>.

**Definition of a Command:**

<stx>	1 byte	The data packet will start with a STX (start of text 0x02) character.
<cmd>	2 bytes	This is a two character ASCII string denoting the command. (i.e. “TY”)
<cnt>	2 bytes	This is a count of data bytes to follow, converted into a decimal ASCII number. (“00” to “99”)
<data>	<i>n</i> bytes	This is ASCII numbers or ASCII data and may or may not be required by the command. See the individual command. Multiple byte ordering is: [MSB][...][LSB]
<cksum>	2 bytes	This is a two character ASCII HEX string calculated from the sum of all bytes except <stx>, <cksum>, and <etx>. Then masked with 255 (0xFF)
<etx>	1 byte	This terminates the transmission. (End of text 0x03)

The CD-A will respond with a Negative Acknowledge Command (“NK”) when an error is encountered in response to a command. The format and reasons follow.

<stx> “NK” <cnt> <err> <cksum> <etx>

Where <err> =	‘1’	NO<SOH>	‘4’	Timeout
	‘2’	BAD checksum	‘5’	In Local
	‘3’	Unrecognized command	‘6’	Data Bad

A valid command will return EITHER DATA OR “AK”.

The <ACK> format is: <stx> “AK” <cnt> <data> <cksum> <etx>

The **DATA** format is: <stx> <cmd> <cnt> <ascii data> <cksum> <etx>

When you issue a command to the CD-A, you need to wait for the response before you issue the next command. This waiting period should be at least 250 ms. The CD-A should respond within this timeout.

**VARIABLE:** *italics*.

**RANGE OF PARAMETERS:** *low\_end* - *high\_end* (separated by hyphen).



## Host Originated Command Set

These are commands sent by the host computer, via the RS-232 port to the CD-A.

NAME	COMMAND	DATA	SIZE
TYPE	“TY” Read	None. Returns Type of Welder	0 Bytes
STATUS	“TS” Read	None. Returns status of last weld	0 Bytes
REAR	“TR” Read	None. Returns the rear panel status	0 Bytes
RESET	“RX” Set	None. Reset an Error	0 Bytes
WELD	“TC” Read	None. Returns the current weld counter	0 Bytes
COUNTER	“TG” Read	None. Returns Good and Bad Weld counts	0 Bytes
LIMITS	“TL” Read	None. Returns Weld count Limit	0 Bytes
COUNT	“RC” Read	None. Returns # of stored welds	0 Bytes
REPORT	“RR” Read	Request # (1 – 6 or Retransmission = ‘F’) READ ORDER, (N = New, O = Old)	1 Byte 1 Byte (2 Bytes Total)
REMOTE	“RM” Set	0 = Local, 1 = Remote	1 Byte
WELD ZERO	“CR” Set	Reset Weld Counter (zero = 1)	1 Byte
WELD LIMIT	“CS” Set	Weld Limit Value	6 Bytes
LOAD	“LR” Read	None, Returns current schedule number	0 Bytes
	“LS” Set	01 – 63 = Sets active schedule	2 Bytes
SCHEDULE	“SR” Read	Reads current schedule data	0 Bytes

## APPENDIX D: COMMUNICATIONS

				<u>CD-A125A</u>	<u>CD-A300A</u>
SCHEDULE	“SS”	Set	SCHEDULE #,	2 Bytes	2 Bytes
			SQZ #, (Squeeze Time),	4 Bytes	4 Bytes
			WS #1, (Energy in Watt Seconds),	4 Bytes	4 Bytes
			WS #2, (Energy in Watt Seconds),	4 Bytes	3 Bytes
			HOLD #, (Hold Time),	4 Bytes	3 Bytes
			PULSE1, ( <i>weld length</i> ),	1 Byte	1 Byte
			PULSE2, ( <i>weld length</i> ),	1 Byte	1 Byte
			POLARITY1, ( <i>weld polarity</i> ),	1 Byte	1 Byte
			POLARITY2, ( <i>weld polarity</i> ),	1 Byte	1 Byte
			UP #, (Up Slope, 0 = Off, 1 = On),	1 Byte	1 Byte
				23 Bytes Total	21 Bytes Total

where *weld length* 0 = Very short, 1 = Short, 2 = Medium, 3 = Long

where *weld polarity* 0 = Positive, 1 = Negative, 2 = Alternating

**Note 1:** The “SS” Set commands for PULSE1, PULSE2, POLARITY1 and POLARITY 2 do not apply to the CD-A1000A.

**Note 2:** If the schedule being modified using the SS command was displayed on the CD-A, then the CD-A display needs to be updated after sending the SS command by recalling the same schedule manually or with LS command. If the schedule was not updated or recalled the weld output will be incorrect and the weld will be whatever the previous setting was.

LIMITS	“MR”	Read	Schedule #	2 Bytes
LIMITS	“MS”	Set	SCHEDULE #,	2 Bytes
			P1 Upper Limit,	4 Bytes
			P1 Lower Limit,	4 Bytes
			P1 Action ( <i>Action</i> )	1 Byte
			P2 Upper Limit	4 Bytes
			P2 Lower Limit	4 Bytes
				19 Bytes Total

where *Action* 0 = NONE, 1 = INHIBIT P2

SYSTEM	“YR”	Read	none	0 Bytes
SYSTEM	“YS”	Set	BAUD RATE ( <i>Rate</i> )	1 Byte
			DEBOUNCE (0 = None, 1 = 30 ms)	1 Byte
			BUZZER (0 = OFF, 1, 2, 3 = loud)	1 Byte
			FAST WELDING MODE (0 = OFF, 1 = ON)	1 Byte
			(0=FS1FS2FSW, 1= FS1FS2, 2 = FSW)	1 Byte
			REMOTE (0 = OFF, 1 = ON)	1 Byte
			CHAINING START, (0 = OFF, 01 – 63)	2 Bytes
			CHAINING END (0 = OFF, 01 – 63)	2 Bytes
				10 Bytes Total

where *Rate:* 0 = 9,600 baud, 1 = 19.2 k baud, 2 = 38.4 k baud

### CD-A Originated Command Set

These are commands returned by the CD-A to the host computer via the RS-232 port.

NAME	COMMAND		DATA	SIZE
TYPE	"TY"	Read	"CD-A", Release # and Revision #. Example: "CD-A300A 1.02 C".	14 Bytes
RESET	"RX"	Set	Reset an Error, Returns STATUS "TS"	1 Byte
WELD	"TC"	Read	The current weld counter	6 Bytes
COUNTER	"TG"	Read	Good (6 bytes) and Bad (6 bytes) counters	12 Bytes
LIMITS	"TL"	Read	Weld count Limit	6 Bytes
COUNT	"RC"	Read	Returns # of stored welds	4 Bytes
REMOTE	"RM"	Set	<ACK <b>OR</b> NAK>	1 Byte
WELD ZERO	"CR"	Set	<ACK <b>OR</b> NAK>	1 Byte
WELD LIMIT	"CS"	Set	<ACK <b>OR</b> NAK>	1 Byte
LOAD	"LS"	Set	<ACK <b>OR</b> NAK>	1 Byte
	"LR"	Read	The active schedule #	2 Bytes
REPORT	"RR"	Read	Schedule #, (1 to 63)	2 Bytes
			Weld Status, (0 = Good, 1 = Out of Limits)	1 Byte
			1st pulse Current,	3 Bytes
			2nd pulse Current,	3 Bytes
			Weld Number	6 Bytes
				15 Bytes Total
REAR	"TR"	Read	Returns the rear panel status in HEX	1 Byte
			Dual Weld Head (0 <sup>th</sup> )	1 Bit
			Weld Inhibit (1 <sup>st</sup> )	1 Bit
			Schedule Lock (2 <sup>nd</sup> )	1 Bit
			Program Lock (3 <sup>rd</sup> )	1 Bit
			Weld Disable (4 <sup>th</sup> )	1 Bit
			FS2 (5 <sup>th</sup> )	1 Bit
			FS1 (6 <sup>th</sup> )	1 Bit
			Fire Switch (7 <sup>th</sup> )	1 Bit

## APPENDIX D: COMMUNICATIONS

---

STATUS	"TS"	Read	Status of unit or the last weld. <i>Note: Refer to Chapter 5 for detailed error code descriptions</i> 0 = GOOD, No Error 1 = Discharge Error 2 = Overcurrent Error 3 = Firing switch does not close within 10 seconds of FS2 closing 4 = The capacitor calibration value is outside of limits 5 = Memory Error 7 = Memory Reset, default values loaded 8 = Weld Counter reached 9 = Exiting Edit mode, press Save or Clear 10 = Weld Disable input is open 11 = Invalid Chaining start or end value 12 = Open Load 13 = Last Weld was out of Limits 14 = Over Temperature, Press Run to restore 15 = Control Board has re-booted 16 = Hamming Single Bit Error 17 = No ECC Table found 18 = No Memory Detected 19 = No Good Flash Blocks 20 = ECC Read Error 21 = NAND Write Error 22 = Check Input Switch Status 23 = Check Weld Mode Settings	2 Bytes
SYSTEM	"YS"	Set	<ACK <b>OR</b> NAK>	1 Byte
SYSTEM	"YR"	Read	BAUD RATE ( <i>Rate</i> ) DEBOUNCE (0 = None, 1 = 30 ms) BUZZER (0 = OFF, 1, 2, 3, 4 = loud) FAST WELD MODE (0 = OFF, 1 = ON) (0=FS1FS2FSW, 1= FS1FS2, 2=FSW) REMOTE (0 = OFF, 1 = On) CHAINING START (0 = OFF, 01 – 63) CHAINING END (0 = OFF, 01 – 63) REPEAT MODE (0 = OFF, 1 = ON) REPEAT TIME	1 Byte 1 Byte 1 Byte 1 Byte 1 Byte 2 Bytes 2 Bytes 1 Byte 3 Bytes 14 Bytes Total

where *Rate*      0 = 9,600 baud, 1 = 19.2 k baud, 2 = 38.4 k baud

## APPENDIX D: COMMUNICATIONS

SCHEDULE	“SS”	Set	<ACK <b>OR</b> NAK>	1 Byte	
				<b>CD-A125A</b>	<b>CD-A300A</b>
SCHEDULE	“SR”	Read	SCHEDULE # ,	2 Bytes	2 Bytes
			SQZ # (Squeeze Time),	4 Bytes	4 Bytes
			WS #1 (Energy in Watt Seconds),	4 Bytes	3 Bytes
			WS #2 (Energy in Watt Seconds),	4 Bytes	3 Bytes
			HOLD # (Hold Time),	4 Bytes	4 Bytes
			PULSE1 ( <i>weld length</i> ),	1 Byte	1 Byte
			PULSE2 ( <i>weld length</i> ),	1 Byte	1 Byte
			POLARITY1 ( <i>weld polarity</i> ),	1 Byte	1 Byte
			POLARITY2 ( <i>weld polarity</i> ),	1 Byte	1 Byte
			UP # (Up Slope, 0 = OFF, 1 = ON)	1 Byte	1 Byte

where *weld length* 0 = Very Short, 1 = Short, 2 = Medium, 3 = Long

where *weld polarity* 0 = Positive, 1 = Negative, 2 = Alternating

MONITOR	“MS”	Set	<ACK <b>OR</b> NAK>	1 Byte
MONITOR	“MR”	Read	SCHEDULE #,	2 Bytes
			P1 Upper Limit,	4 Bytes
			P1 Lower Limit,	4 Bytes
			P1 Action	( <i>action</i> ) 1 Byte
			P2 Upper Limit	4 Bytes
			P2 Lower Limit	4 Bytes

where *action* 0 = NONE, 1 = INHIBIT P2

## APPENDIX D: COMMUNICATIONS

---

### EXAMPLE #1

An example of sending a TYPE command to the CD-A: <STX>“TY000D”<ETX>

The command: “TY”

The Count is: “00”

The check sum is “0D”. Which is calculated from the ASCII (American Standard Code for Information Interchange) and is a two character ASCII HEX string calculated from the sum of all bytes except <stx>, <cksum>, and <etx>. ‘T’ + ‘Y’ + ‘0’ + ‘0’

Looking up the value for each character, We get  $0x54 + 0x59 + 0x30 + 0x30 = 0x10D$  HEX

In decimal  $84 + 89 + 48 + 48 = 269$  decimal.

The check sum is a value between 0 and 255; Therefore,  $269 - 255 * n = 14$  decimal = 0D hex.

Where  $n = (\text{check sum} / 255)$ . Here it is only 1.

If the check sum was 9C4 hex = 2500 decimal. Then  $n = 2500 / 256 = 9.7$ .

Using only the hole number  $n = 9$

The final check sum is  $(2500 - (256 * 9)) = 196$  decimal or 0xC4 hex

A better way is to take the final check sum and AND it with 255 (0xFF).

In hex, taking the final check sum 0x9C4 and ANDing it with 0xFF = 0xC4, or in decimal  $2500 \text{ AND } 255 = 196$ .

### EXAMPLE #2

Now we wish to find out how many welds are stored in the CD-A weld buffer.

The total command is: <STX>“TC00F7”<ETX>. “TC” is the command, “00” is the count, and “F7” is the check sum.

If the CD-A sends back: <STX>”TC0600000522”<ETX>, then the command is “TC” (or current weld counter), the data count is 6 (“06”), and the number of welds stored is 5 (“000005”). The check sum is 22 hex (in decimal  $84 + 67 + 48 + 54 + 48 + 48 + 48 + 48 + 48 + 53 = 546$ ).

$546 / 256 = 2.13$ . Therefore the check sum is  $546 - (256 * 2) = 34$  decimal or 22 hex.

**CD-A Commands Alphabetically:**

CR	Reset Weld Counter
CS	Set Weld Limit
LR	Read current schedule
LS	Set active schedule
MR	Monitor Limits (Read)
MS	Monitor Limits (Set)
RC	Number of reports stored
RM	Set Remote
RR	Read Report
RX	Reset an Error
SR	Schedule (Read)
SS	Schedule (Set)
TC	Read Weld Counter
TG	Read Good & Bad Counters
TL	Read Weld Count Limit
TR	Rear Panel Status
TS	Read Status of last weld
TY	Read the Type
YR	System (Read)
YS	System (Set)

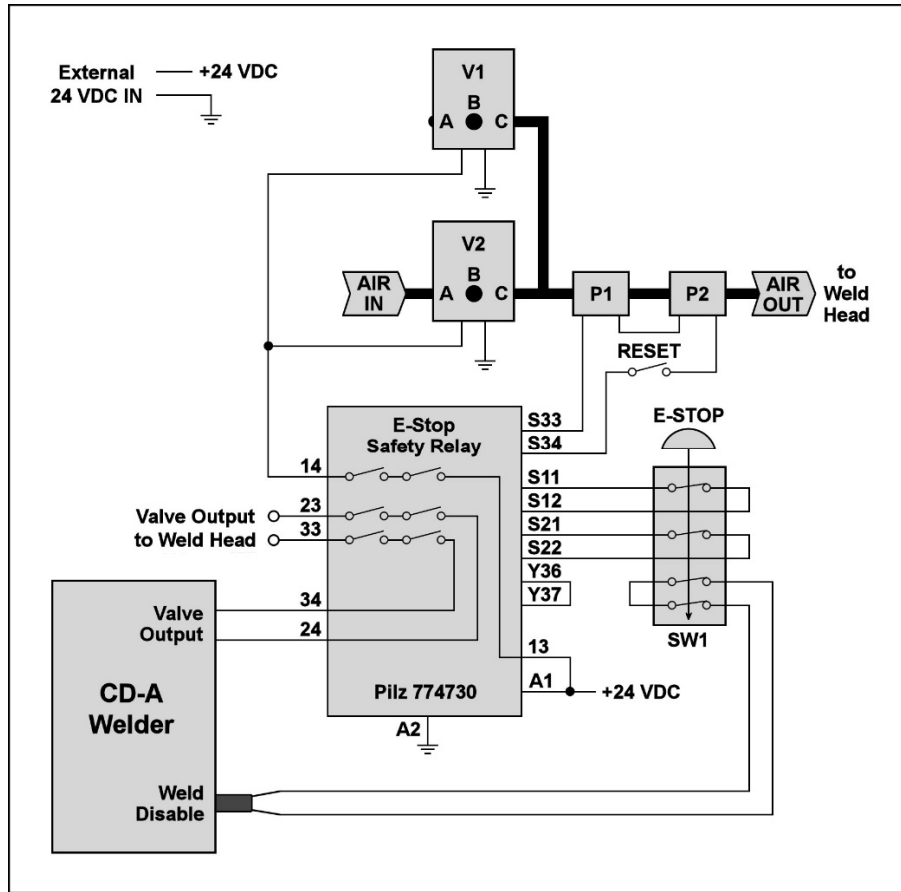




# APPENDIX E

## Machine Safety Compliance

The following diagram is an example of the necessary additions required to meet a Category 3 Machine Safety Standard. This diagram is designed to meet the current CE standards. This is only one method of achieving a Category 3 level of safety. The customer should evaluate their safety needs and configure their machine accordingly.



**Category 3 Machine Safety Standard Example**

<b>V1, V2</b>	SMC # VT307Y-5G1-01N – 3-Way Valve Operation: POWER ON – “B” BLOCKED, “A” to “C” OPEN POWER OFF – “A” BLOCKED, “B” to “C” OPEN
<b>P1, P2</b>	Honeywell # 76577-00000040-1 – Normally-Closed Pressure Switch, 4 PSI
<b>SW1</b>	IDEC # XW1E-8V404M-R – Quad Channel E-Stop Switch



# APPENDIX F

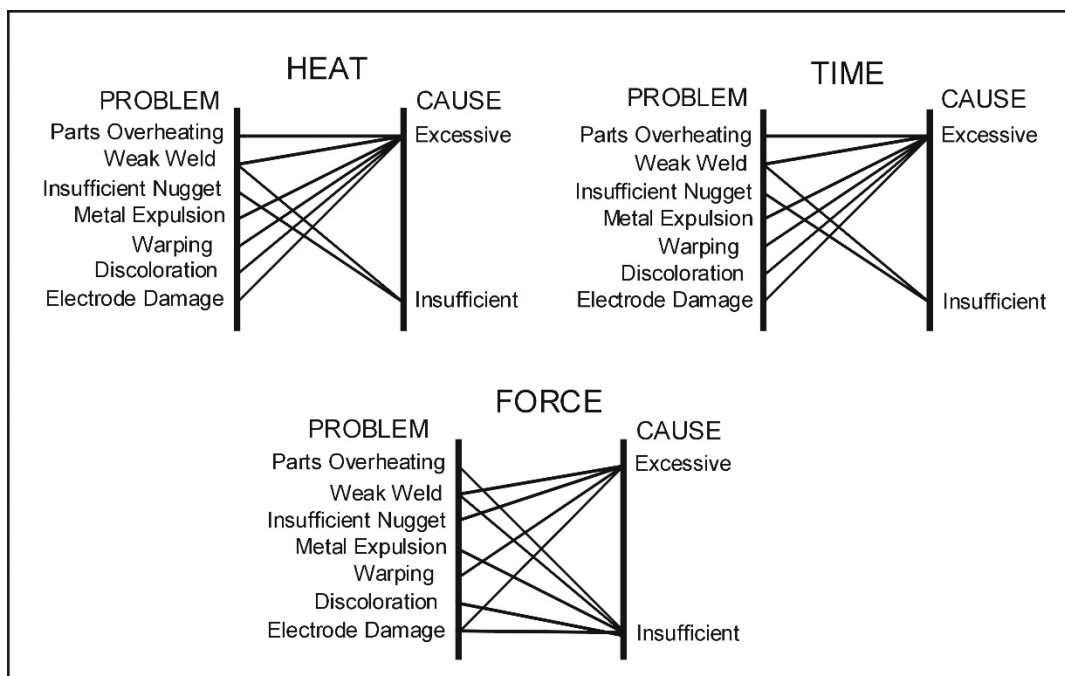
## The Basics Of Resistance Welding

### Resistance Welding Parameters

Resistance welding heat is produced by passing electrical current through the parts for a fixed time period. The welding heat generated is a function of the magnitude of the weld current, the electrical resistance of the parts, the contact resistance between the parts, and the weld force applied to the parts. Sufficient weld force is required to contain the molten material produced during the weld. However, as the force is increased, the contact resistance decreases. Lower contact resistance requires additional weld current, voltage, or power to produce the heat required to form a weld.

The higher the weld force, the greater the weld **current**, **voltage**, **power**, or **time** required to produce a given weld. The formula for amount of heat generated is  $I^2RT$  -- the square of the weld current [ **I** ] times the workpiece resistance [ **R** ] times the weld time [ **T** ].

### Welding Parameter Interaction



Interaction of Welding Parameters

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

### Electrode Selection

Correct electrode selection strongly influences how weld heat is generated in the weld area. In general, use conductive electrodes such as a RWMA-2 (Copper alloy) when welding electrically resistive parts such as nickel or steel so that the weld heat is generated by the electrical resistance of the parts and the contact resistance between the parts. Use resistive electrodes such as RWMA-13 (Tungsten) and RWMA-14 (Molybdenum) to weld conductive parts such as copper and gold because conductive parts do not generate much internal heat so the electrodes must provide external heat. Use the following Electrode Selection Table for selecting the proper electrode materials.

MATERIAL	ELECT RWMA TYPE	MATERIAL	ELECT RWMA TYPE
Alumel	-2	Alumel	-2
Alumel	-2	Chromel	-2
Alumel	-2	Dumet	-2
Aluminum	-1	Aluminum	-1
Aluminum	-1	Aluminum Alloys	-1
Aluminum	-1	Cadmium Plating	-1
Aluminum	-1	Tinned Brass	-14
Aluminum	-1	Tinned Copper	-14
Aluminum	-1	Gold Plated Dumet	-2
Aluminum	-1	Gold Plated Kovar	-2
Aluminum	-1	Kovar	-2
Aluminum	-1	Magnesium	-1
Aluminum	-1	Cold Rolled Steel	-2
Aluminum	-1	Stainless Steel	-2
Beryllium Copper	-2	Beryllium Copper	-2
Beryllium Copper	-2	Brass	-2, -14
Beryllium Copper	-2	Copper	-14
Beryllium Copper	-2	Tinned Copper	-14
Beryllium Copper	-2	Nickel	-2

MATERIAL	ELECT RWMA TYPE	MATERIAL	ELECT RWMA TYPE
Beryllium Copper	-2	Cold Rolled Steel	-2
Beryllium Copper	-2	Stainless Steel	-2
Brass	-2, -14	Brass	-2, -14
Brass	-2, -14	Tinned Brass	-14
Brass	-2, -14	Consil	-2
Brass	-2, -14	Constantan	-2
Brass	-2, -14	Copper	-14
Brass	-2, -14	Tinned Copper	-14
Brass	-2, -14	Dumet	-2
Brass	-2, -14	Nichrome	-2
Brass	-2, -14	Nickel	-2
Brass	-2, -14	NiSpan C	-2
Brass	-2, -14	Paliney 7	-2
Brass	-2, -14	Silver	-11, -14
Brass	-2, -14	Cold Rolled Steel	-2
Brass	-2, -14	Stainless Steel	-2
Bronze	-2, -11	Bronze	-2, -11
Bronze	-2, -11	Tinned Copper	-14
Bronze	-2, -11	Iron	-2

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

MATERIAL	ELECT RWMA TYPE	MATERIAL	ELECT RWMA TYPE
Bronze	-2, -11	Nichrome	-2
Bronze	-2, -11	Nickel	-2
Chromel	-2	Chromel	-2
Chromel	-2	Constantan	-2
Chromel	-2	Copel	-2
Chromel	-2	Copper	-14
Chromel	-2	Tinned Copper	-14
Chromel	-2	Dumet	-2
Chromel	-2	Nichrome	-2
Chromel	-2	Cold Rolled Steel	-2
Consil	-2	Consil	-2
Consil	-2	Tinned Copper	-14
Consil	-2	Dumet	-2
Constantan	-2	Constantan	
Constantan	-2	Copper	-14
Constantan	-2	Tinned Copper	-14
Constantan	-2	Iron	-2
Constantan	-2	Nichrome	-2
Constantan	-2	Nickel	-2
Copper	-14	Copper	-14
Copper	-14	Dumet	-2
Copper	-14	Invar	-2
Copper	-14	Karme	-2
Copper	-14	Manganin	-2
Copper	-14	Nichrome	-2
Copper	-14	Nickel	-2
Copper	-14	Paliney 7	-2

MATERIAL	ELECT RWMA TYPE	MATERIAL	ELECT RWMA TYPE
Copper	-14	Silver	-11, -14
Copper	-14	Cold Rolled Steel	-2
Copper	-14	Stainless Steel	-2
Dumet	-2	Dumet	-2
Dumet	-2	Nichrome	-2
Dumet	-2	Nickel	-2
Dumet	-2	Platinum	-2
Dumet	-2	Cold Rolled Steel	-2
Evanohm	-14	Copper	-14
Gold	-14	Gold	-14
Gold	-14	Kovar	-2
Hastalloy	-2	Titanium	-2
Inconel	-2	Inconel	-2
Inconel	-2	Kulgrid	-2
Invar	-2	Invar	-2
Iridium	-2	Iridium	-2
Iridium	-2	Platinum	-2
Iron	-2	Iron	-2
Karma	-2	Karma	-2
Karma	-2	Nickel	-2
Karma	-2	Platinum	-2
Kovar, Gold Plate	-2	Kovar, Gold Plate	-2
Kovar, Gold Plate	-2	Kulgrid	-2
Kovar, Gold Plate	-2	Nickel	-2
Kovar, Gold Plate	-2	Silver	-11, -14
Kovar, Gold Plate	-2	Stainless Steel	-2
Magnesium	-1	Magnesium	-1

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

MATERIAL	ELECT RWMA TYPE	MATERIAL	ELECT RWMA TYPE
Molybdenum	-2	Nickel	-2
Molybdenum	-2	Tungsten	-2
Nichrome	-2	Nichrome	-2
Nichrome	-2	Nickel	-2
Nichrome	-2	Cold Rolled Steel	-2
Nichrome	-2	Stainless Steel	-2
Nickel	-2	Nickel	-2
Nickel	-2	Cold Rolled Steel	-2
Nickel	-2	Stainless Steel	-2
Nickel	-2	Tantalum	-2
Nickel	-2	Tungsten	-2
Nickel Alloy	-2	Nickel Alloy	-2
Nickel Alloy	-2	Tinned Brass	-14
Nickel Alloy	-2	Beryllium Copper	-2
Nickel Alloy	-2	Consil	-2
Nickel Alloy	-2	Tinned Copper	-14
Nickel Alloy	-2	Nichrome	-2
Nickel Alloy	-2	Nickel	-2
Nickel Alloy	-2	Cold Rolled Steel	-2

MATERIAL	ELECT RWMA TYPE	MATERIAL	ELECT RWMA TYPE
NiSpan C	-2	NiSpan C	-2
NiSpan C	-2	Cold Rolled Steel	-2
NiSpan C	-2	Stainless Steel	-2
Niobium	-2	Niobium	-2
Platinum	-2	Platinum	-2
Paliney 7	-2	Paliney 7	-2
Silver	-11, -14	Silver	-11, -14
Silver	-11, -14	Cadmium	-13
Cold Rolled Steel	-2	Cold Rolled Steel	-2
Cold Rolled Steel	-2	Stainless Steel	-2
Cold Rolled Steel	-2	Tantalum	-2
Stainless Steel	-2	Stainless Steel	-2
Stainless Steel	-2	Tungsten	-2
Tantalum	-2	Tantalum	-2
Titanium	-2	Titanium	-2
Tungsten	-2	Tungsten	-2
Tungsten	-2	henium	-2
Zinc	-14	Zinc	-14

### Electrode Maintenance

Depending on use, periodic tip resurfacing is required to remove oxides and welding debris from electrodes. Cleaning of electrodes on production line should be limited to use of # 400-600 grit electrode polishing disks. For less critical applications, a file can be used to clean a badly damaged tip. However, after filing, polishing disks should then be used to ensure that the electrode faces are smooth. If this is not done, the rough surface of the electrode face will have a tendency to stick to the work piece.

### Weld Schedule Development

Developing a weld schedule is a methodical procedure, which consists of making sample welds and evaluating the results. The first weld should be made at low energy settings. Adjustments are then made to each of the welding parameters **one at a time** until a successful weld is made.

- 1 Install the correct electrodes in the electrode holders on the Weld Head. See the preceding Table for electrode material recommendations.
- 2 Use a flat electrode face for most applications. Use a "domed" face if surface oxides are a problem. If either of the parts is a wire, the diameter of the electrode face should be equal to or greater than the diameter of the wire. If both parts are flat, the face should be at least one-half the diameter of the electrodes. Pencil point electrodes cause severe electrode sticking to the parts, unexplained explosions, and increase the weld heat substantially because of the reduced electrode-to-part contact area.
- 3 Use the Force Adjustment Knob on the Weld Head to set the Firing Force and adjust an Air Actuated Weld Head.
- 4 Program a weld schedule, then make your first weld. Always observe safety precautions when welding and wear safety glasses. For a complete procedure on making welds, refer to *Operating Instructions*.
- 5 Use pliers to peel the welded materials apart. A satisfactory weld will show residual material pulled from one material to the other. Tearing of base material around the weld nugget indicates a material failure NOT a weld failure. Excessive electrode sticking and/or "spitting" should define a weld as unsatisfactory and indicates that too much weld current, voltage, power, or time has been used.
- 6 If the parts pull apart easily or there is little or no residual material pulled, the weld is weak. Increase the weld time in 1ms increments. Increase weld current, voltage, or power if a satisfactory weld achieved using 10 ms of weld time.

**NOTE:** Actual weld strength is a user-defined specification.

- 7 Polarity, as determined by the direction of weld current flow, can have a marked effect on the weld characteristics of some material combinations. This effect occurs when welding materials with large differences in resistivity, such as copper and nickel or when welding identical materials with thickness ratios greater than 4 to 1. The general rule is that the more resistive material or the thinner material should be placed against the negative (-) electrode. Polarity on the Control can be changed by either changing the setting in the Edit mode on the RUN screen (See polarity select in chapter 1) or by reversing the Weld Cables.

### Weld Strength Testing

Destructive tests should be performed on a random basis using actual manufacturing parts. Destructive tests made on spot welds include tension, tension-shear, peel, impact, twist, hardness, and macro-etch tests. Fatigue tests and radiography have also been used. Of these methods torsional shear is preferred for round wire and a 45-degree peel test for sheet stock.

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

### Weld Strength Profiles

Creating a weld strength profile offers the user a scientific approach to determining the optimum set of welding parameters and then displaying these parameters in a graphical form.

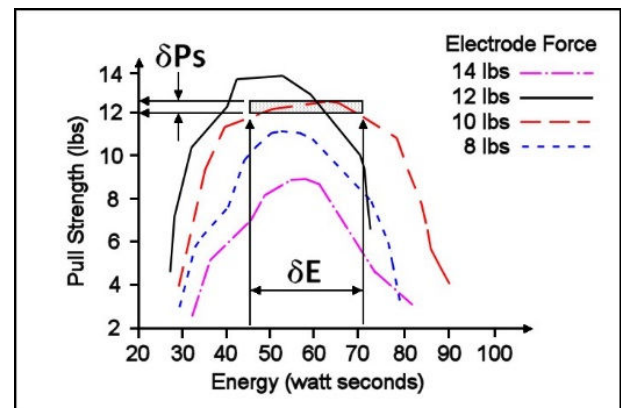
- 1 Start at a low weld current, voltage, or power, making five or more welds, then perform pull tests for each weld. Calculate the average pull strength. Increase weld current, voltage, or power and repeat this procedure. Do not change the weld time, weld force, or electrode area.
- 2 Continue increasing weld current, voltage, or power until any unfavorable characteristic occurs, such as sticking or spitting.
- 3 Repeat steps 1 through 3 for different weld forces, then create a plot of part pull strength versus weld current, voltage, or power for different weld forces as shown in the illustration on the next page, *Typical Weld Strength Profile*.
- 4 Repeat steps 1 through 3 using a different but fixed weld time.

### Typical Weld Strength Profile

The picture on the right illustrates a typical weld strength profile. The 14 lb electrode force curve shows the highest pull strengths but the lowest tolerance to changes in weld current, voltage, or power. The 12 lb electrode force curve shows a small reduction in pull strength, but considerably more tolerance to changes in weld energy. Weld heat will vary as a result of material variations and electrode wear.

The 12 lb electrode force curve is preferred. It shows more tolerance to changes in weld current, voltage, or power and has nearly the same bond strength as the 14 lb electrode force curve.

A comparison of weld schedules for several different applications might show that they could be consolidated into one or two weld schedules. This would have obvious manufacturing advantages.



Typical Weld Strength Profile



# APPENDIX G

## Quality Resistance Welding Solutions: Defining the Optimum Process

### Introduction

A quality resistance welding solution both meets the application objectives and produces stable, repeatable results in a production environment. In defining the optimum process, the user must approach the application methodically and consider many variables. In this article we will look at the following key stages and principles to be considered when defining the optimum resistance welding process:

- Materials and their properties
- Basic resistance welding
- principles
- Weld profiles
- Approach to development
- Common problems
- Use of screening DOE's
- Use of factorial DOE's

### Resistance Welding - A Material World

The first consideration in designing a quality welding solution is the properties of the materials to be joined and the quality requirements of the desired welded joint. At this stage, it is worthwhile to review the way the resistance welding process works and the likely outcome when the parts are resistance welded.

There are four main types of structural materials:

- Metals (silver, steel, platinum)
- Ceramic (alumina, sand)
- Plastics/polymers (PVC, teflon)
- Semiconductors (silicon, germanium)

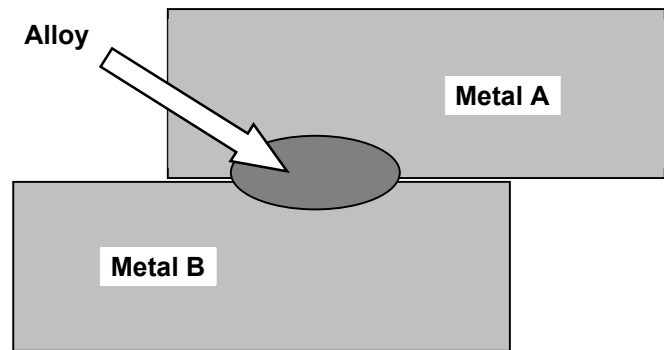
Of these, only metals can be resistance welded because they are electrically conductive, soften on heating, and can be forged together without breaking.

## APPENDIX G: DEFINING THE OPTIMUM PROCESS

---

Alloys are a mixture of two or more metals. An alloy is normally harder, less conductive, and more brittle than the parent metal which has bearing on the type of joint one can expect when resistance welding a combination of different metals.

Metals atoms are naturally attracted to other metal atoms even in different parent materials. Metals and alloys will bond together once surface contaminants such as dirt, grease, and oxides removed. Resistance welding generates heat at the material interface, which decomposes the dirt and grease and helps to break up the oxide film. The resultant heat softens or melts the metal and the applied force brings the atoms on either side into close contact to form the bond. The strength of the joint develops as it cools and a new structure is formed.



There are three main types of bonds that can be formed using the resistance welding process:

- **Solder or Braze Joint**

A filler material such as a solder or braze compound is either added during the process or present as a plating or coating. Soldered joints are typically achieved at temperatures less than 400 °C and brazed joints such as Sil-Phos materials melt at temperatures above 400 °C.

- **Solid-State Joint**

A solid state joint can be formed when the materials are heated to between 70 - 80% of their melting point.

- **Fusion Joint**

A fusion joint can be formed when both metals are heated to their melting point and their atoms mix.

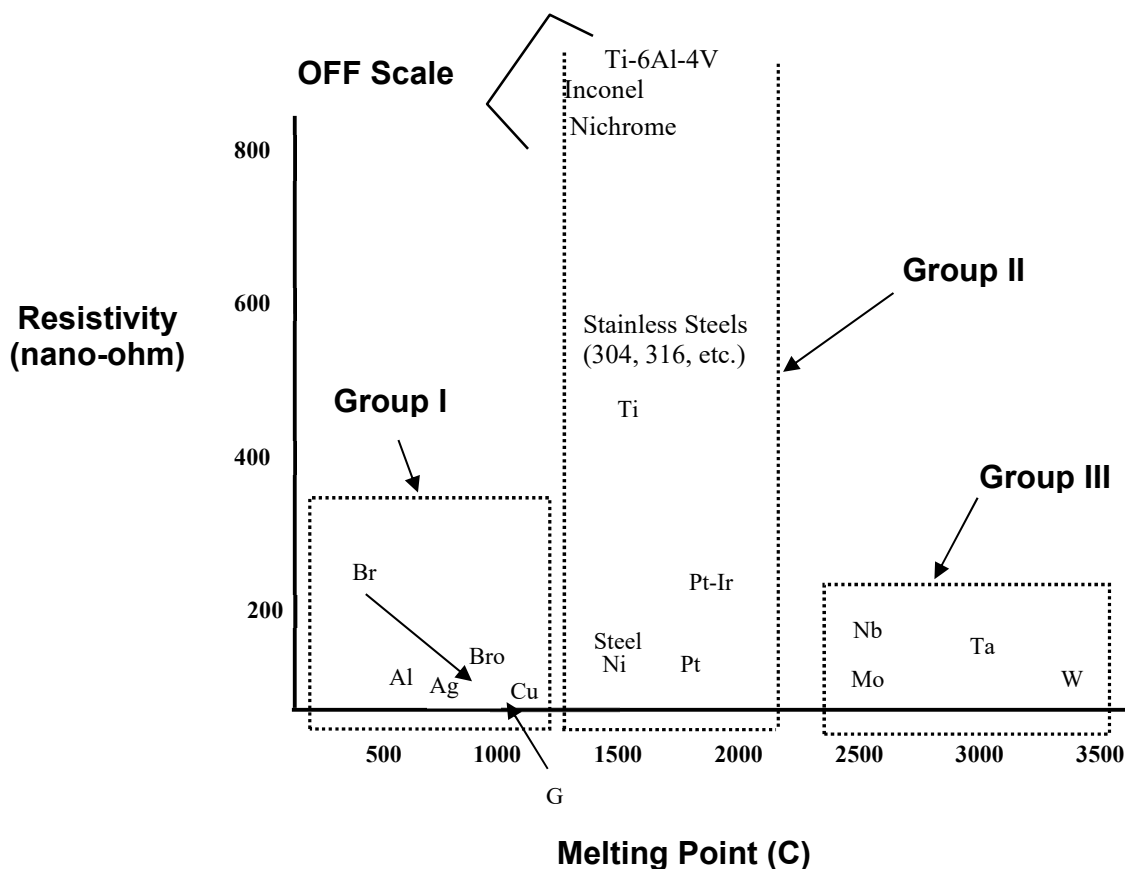
Many micro-resistance welding challenges involve joining dissimilar metals in terms of their melting points, electrical conductivity, and hardness. A solid-state joint can be an ideal solution for these difficult applications; there is no direct mixing of the two materials across the weld interface thus preventing the formation of harmful alloys that could form brittle compounds that are easily fractured. Remember that in a solid-state joint, the metals are only heated to 70 - 80% of their respective melting points, resulting in less thermal stress during heating and subsequent joint cooling in comparison to a fusion weld. As there is no real melting of the materials in a solid-state joint, there is less chance of weld splash or material expulsion. A weld nugget can still be achieved with a solid-state joint.

### Consider the Material Properties

The important material properties to be considered in the resistance welding process are:

- *Electrical and thermal conductivity*
- *Plating and coating*
- *Hardness*
- *Melting point*
- *Oxides*

The figure below illustrates the variance in resistivity and melting points for some of the more common materials used in micro resistance welding today.



The materials can be grouped into three common categories. The types of joints achievable within each of the main groups are detailed below:

- **Group I – Conductive Metals**

Conductive metals dissipate heat and it can be difficult to focus heat at the interface. A solid-state joint is therefore preferred. Typically, resistive electrode materials are used to provide additional heating.

# APPENDIX G: DEFINING THE OPTIMUM PROCESS

- Group II – Resistive Metals**

It is easier to generate and trap heat at the interface of resistive metals and therefore it is possible to form both solid state and fusion welds depending on time and temperature. Upslope can reduce contact resistances and provide heating in the bulk material resistance.

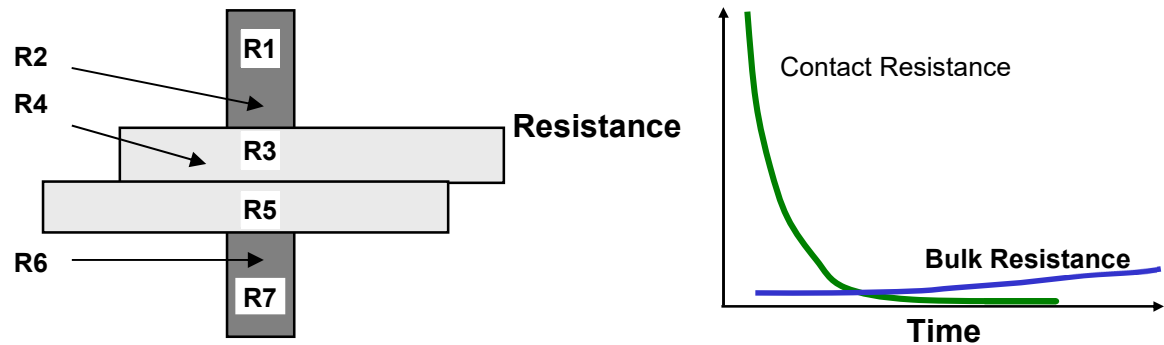
- Group III – Refractory Metals**

Refractory metals have very high melting points and excess heating can cause micro-structural damage. A solid-state joint is therefore preferred.

The chart below gives some guidance on the type of joint that can be expected and design considerations required when joining materials from the different groups.

	Group I	Group II	Group III
Group I (Copper)	<ul style="list-style-type: none"><li>• Solid-State</li><li>• W/Mo electrodes</li></ul>	<ul style="list-style-type: none"><li>• Solid-State</li><li>• Projection on Group I</li></ul>	<ul style="list-style-type: none"><li>• Solid-State</li><li>• Fine projections on Group III</li></ul>
Group II (Steel)		<ul style="list-style-type: none"><li>• Solid-State or Fusion</li></ul>	<ul style="list-style-type: none"><li>• Solid-state or braze of II on III</li><li>• Projection on III</li></ul>
Group III (Moly)			<ul style="list-style-type: none"><li>• Solid-State</li></ul>

## Basic Principles



The figure above shows the key resistances in a typical opposed resistance weld and the relationship between contact resistances and bulk resistances over time, during a typical resistance weld:

---

## APPENDIX G: DEFINING THE OPTIMUM PROCESS

---

- R1 & R7**      The electrode resistances affect the conduction of energy and weld heat to the parts and the rate of heat sinking from the parts at the end of the weld.
- R2, R4 & R6**      The electrode-to-part and part-to-part “Contact Resistances” determine the amount of heat generation in these areas. The contact resistances decline over time as the parts achieve better fit up.
- R3 & R5**      The metal “Bulk Resistances” become higher during the weld as the parts are heated.

If a weld is initiated when the contact resistances are still high, the heat generated is in relation to the level and location of the contact resistances, as the materials have not had a chance to fit up correctly. It is common for the heat generated at the electrode-to-part and part-to-part resistances to cause multiple welding problems when welding resistive materials including:

- Part marking and surface heating
- Weld splash or expulsion
- Electrode sticking
- Weak welds

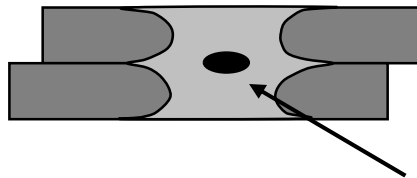
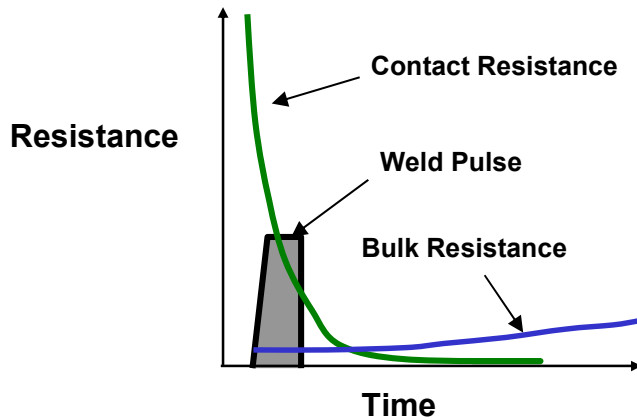
Alternately, conductive materials can be welded by using high contact resistance and fast heating because their bulk resistance is not high and cannot be relied upon for heat generation.

If a weld is initiated when both parts and electrodes are fitted up correctly, the contact resistance is lower and bulk resistance now controls the heat generation. This type of weld is achieved with a slower heating rate and normally longer time is preferred for welding resistive materials, which can generate heat through their bulk resistance.

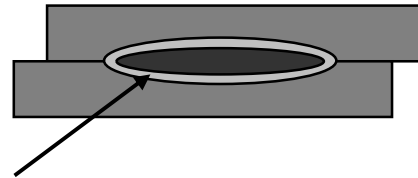
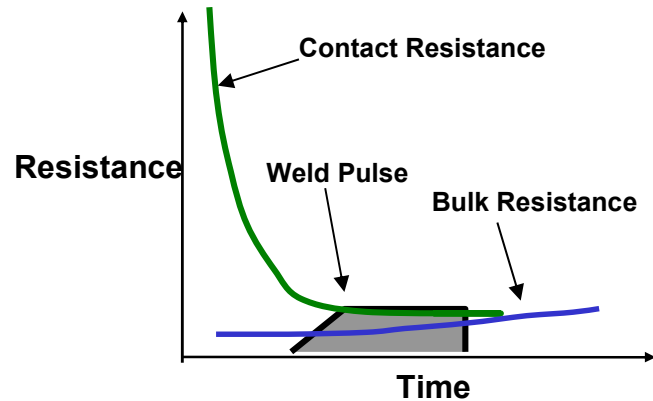
The contact resistances present at the weld when the power supply is fired have a great impact on the heat balance of a weld and, therefore, the heat affected zone.

## APPENDIX G: DEFINING THE OPTIMUM PROCESS

The figure below shows a weld that is fired early on in the weld sequence when the contact resistance is still quite high.



The figure shows a weld that is initiated when the contact resistance is lower; in this example, we are using bulk resistance to generate our weld heat.

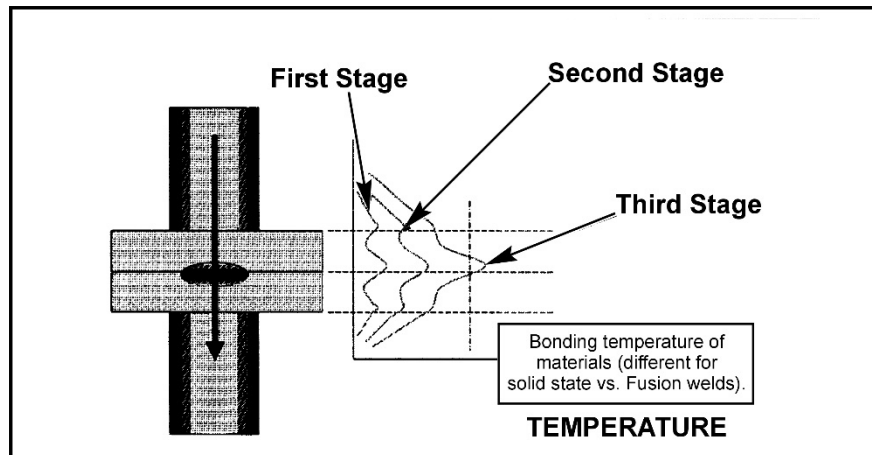


**Heat Affected Zone**

**(NOTE: Larger nuggets are possible with longer weld times when using bulk resistance.)**

In general, conductive materials benefit from a faster heating rate, as the higher contact resistances assist heat generation in the weld. Resistive materials benefit from slower heating rates which allow the contact resistances to reduce significantly. Bulk resistances, therefore, become the major source for heat generation. The heat-affected zone is also much smaller in this case producing a weld with less variation.

The following figure shows the three stages of heat generation for resistive materials in a fusion weld. In the first stage, the heat is focused in the part-to-part and electrode-to-part contact areas, since contact resistance is high relative to bulk resistance. In the second stage, contact resistance decreases as the electrodes seat better to the parts. Less heat is generated in the electrode-to-part contact areas, and a greater amount of heat is generated in the parts as the bulk resistance increases. In the third stage, the bulk resistance becomes the dominant heat-generating factor and the parts can reach their bonding temperature at the part-to-part interface. The stages of heat generation for conductive materials will be similar to that of resistive materials, but there will be less heat generated in the bulk resistance due to the conductivity of the materials.

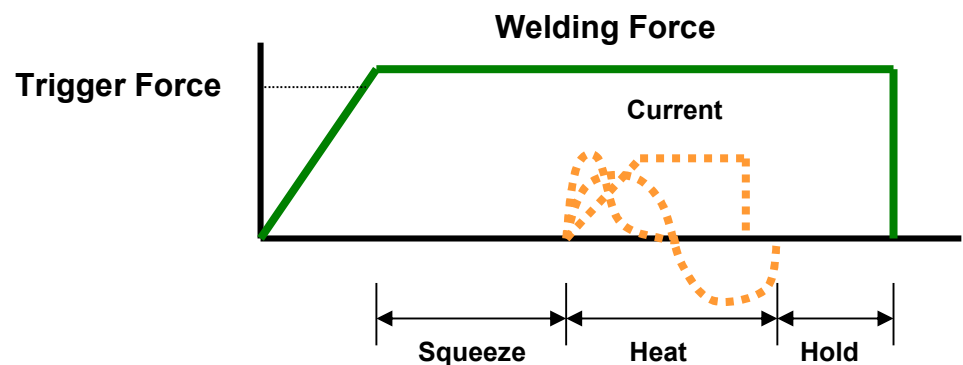


### Weld Profiles

The basic welding profile (or schedule) consists of a controlled application of energy and force over time. Precision power supplies control the energy and time and therefore heating rate of the parts. The weld head applies force from the start to finish of the welding process.

The figure on the right shows a typical welding sequence where the force is applied to the parts; a squeeze time is initiated which allows the force to stabilize before the current is fired. Squeeze time also allows time for the contact resistances to reduce as the materials start to come into

closer contact at their interface. A hold time is initiated after current flows to allow the parts to cool under pressure before the electrodes are retracted from the parts. Hold time is important as weld strength develops in this period. This basic form of weld profile is sufficient for the majority of small part resistance welding applications.



Power supply technology selection is based on the requirements of both the application and process. In general, closed loop power supply technologies are the best choice for consistent, controlled output and fast response to changes in resistance during the weld.

### Approach to Weld Development

The first stage in developing a quality welding process is to fix as many of the variables as possible in the welding equipment set up. The welding variables can be grouped in the following categories:

- **Material Variables**
  - Base material
  - Plating
  - Size
  - Shape
- **Weld Head & Mechanical Variables**
  - Force, squeeze, hold
  - Actuation method
  - Electrode material and shape
- **Power Supply Variables**
  - Energy
  - Time (squeeze, weld, hold)
- **Process Variables**
  - Tooling, level of automation
  - Repetition rate
  - Part positioning
  - Maintenance, electrode cleaning
- **Quality Requirements**
  - Pull strength
  - Visual criteria
  - Test method, other weld joint requirements

The first stage in developing a quality welding process is to fix as many of the variables as possible in the welding equipment set up. Welding variables can be grouped in the following categories:

### Initial Welding Trials -- The “Look See” Tests

“Look see” welding tests are a series of mini welding experiments designed to provide a starting point for further statistical development of the welding parameters. The user should adjust the key welding variables (energy, force, time) in order to identify the likely good “weld window.” Close visual inspection of the weld parts will promote better understanding of the heating characteristics of the application.

The mini-experiments should also be used to understand the weld characteristics from both application and process perspective. Key factors in this understanding are as follows:

#### Application Perspective

- Materials: Resistivity, melting point, thermal mass, shape, hardness, surface properties.
- Heat balance: Electrode materials, shape, Polarity, heating rate (upslope).
- Observation: visual criteria, cross section, and impact of variables on heat balance.



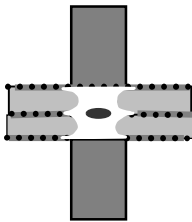
### Process Perspective

- What are the likely variables in a production process?
- How will operators handle and align the parts?
- What tooling or automation will be required?
- How will operators maintain and change the electrodes?
- What other parameters will operators be able to adjust?
- What are the quality and inspection requirements?
- What are the relevant production testing methods and test equipment?
- Do we have adequate control over the quality of the materials?

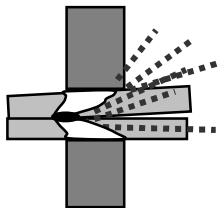
### Common Problems

During this stage of process development, it is important to understand that the majority of process problems are related to either materials variation, or part-to-electrode positioning. Some examples are shown below.

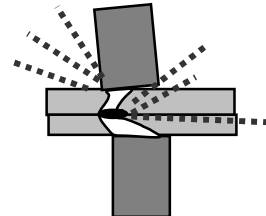
**Material Control**



**Part-To-Part Positioning**



**Electrode-To-Part Positioning**

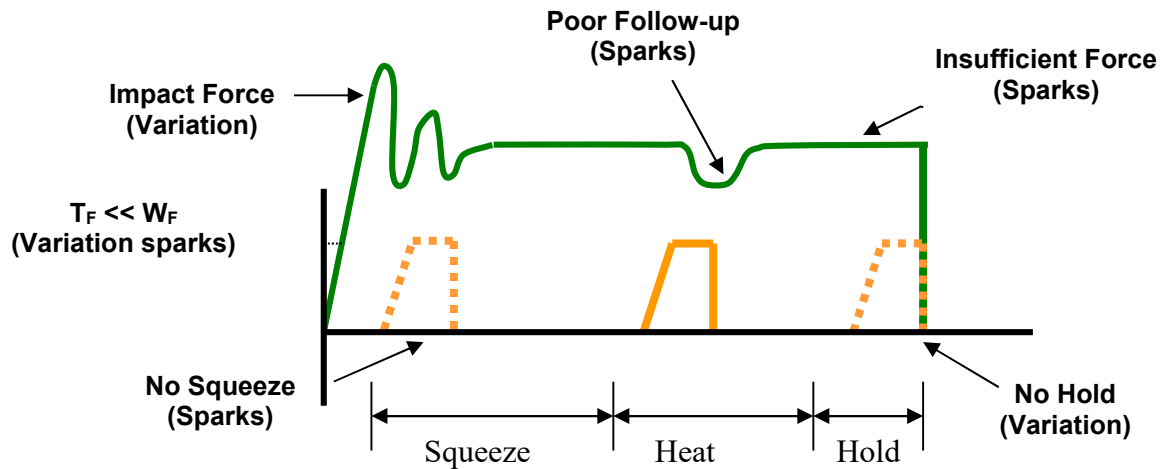


The changes detailed above generally result in a change in contact resistance and always affect the heat balance of the weld. During weld development these common problems must be carefully monitored so as not to mislead the course and productivity of the welding experiments.

In summary, the “look see” welding experiments should be used to fix further variables from an application and process perspective and also to establish a “weld window” for energy, time and force. This part of weld development is critical in order to proceed to a statistical method of evaluation (Design of Experiments or “DOEs”). Random explosions or unexpected variables will skew statistical data and waste valuable time.

## APPENDIX G: DEFINING THE OPTIMUM PROCESS

---



Common welding problems can often be identified in the basic set up of the force, energy, and time welding profile shown above. These problems can lead to weld splash, inconsistency, and variation (contact AMADA WELD TECH for further information and support).

### What are Screening DOE'S?

The purpose of a Screening DOE is to establish the impact that welding and process parameters have on the quality of the weld. Quality measurement criteria should be selected based on the requirements of the application. A Screening DOE will establish a relative quality measurement for the parameters tested and the variation in the welded result. This is important, as identifying variation in process is critical in establishing the best production settings. Typically, welded assemblies are assessed for strength of joint and variation in strength.

A Screening DOE tests the high, low settings of a parameter, and will help establish the impact of a parameter on the process. A Screening DOE is a tool that allows the user to establish the impact of a particular parameter by carrying out the minimum number of experiments to gain the information. A five-factor screening DOE can be accomplished in as few as 24 welds, with three welds completed for each of 8 tests. By comparison, it would take 96 welds to test every combination. The DOE promotes understanding of many variables in a single experiment and allows the user to interpret results, thus narrowing the variables for the next level of statistical analysis. If many variables are still not understood, multiple Screening DOE's may be required. AMADA WELD TECH provides a simple Screening DOE tool that is run in *Excel*® and is sufficient for the majority of possible applications (contact AMADA WELD TECH for details). Sophisticated software is also available from other vendors designed specifically for this purpose.

### Criteria for Success

Before running the series of experiments, the user must establish an acceptable window for energy, time, and force, thus preventing voided results. It is common practice to include one or all of the above variables in a Screening DOE. This is only recommended if sufficient understanding has been established for the other application and process variables that can impact quality. Users should first try to screen out all common application and process variables that require further exploration from the results of the “look see” mini experiments and then include the three key welding variables (energy, force and time). Several Screening DOE’s may be required.

Results should be interpreted carefully. Typically, one would look for the highest result in terms of quality with the least variation. A Screening DOE provides only a measurement that indicates the relative importance of a parameter and not the ideal setting. Factorial DOE’s should be used to establish the correct or best setting for a parameter once many of the other variables have been screened and fixed. This is also the time to assess the measurement accuracy and consistency of the test method and procedure. Variation in test method can invalidate the test and lead to misinterpretation of results.

### What are Factorial DOE’s?

The purpose of a Factorial DOE is to narrow in on the optimal setting for a particular parameter. This method is generally used when the critical or main key variables have been identified, and we need to establish the best settings for the process. A factorial DOE may also give an indication as to how wide the acceptable weld window is in relation to quality requirements. We recommend data be gathered from a monitoring perspective so that this can provide a starting point for establishing a relationship between quality and the monitored measurement parameter.

### Criteria for Success

Critical parameters should be identified from the list of unfixed variables left from the Screening DOE’s. A mini-experiment may be required establishing reasonable bounds for the combination of parameters to be tested. This will prevent void data and wasted time. At this stage, it is useful to record multiple relevant quality measurement or inspection criteria so that a balanced decision can be reached. For example, if part marking and pull strength are the relevant criteria, a compromise in ideal setting may be required.

As with all experiments, the test method should be carefully assessed as a potential source of variation and inconsistency. Once the optimum parameters have been established in this series of experiments, a validation study can be run which looks at the consistency of results over time. It is good practice to build in variables such as electrode changes and cleaning, as well as equipment set up by different personnel. This will ensure that the solution is one that can run in a real production environment. Welded assemblies should be tested over time and under real use conditions to ensure that all functional criteria will be met. Validation testing is usually required to prove the robustness of the process under production conditions.

### **Conclusion**

The resistance welding process can deliver a reliable and repeatable joining solution for a wide range of metal joining applications. Defining the optimum welding process and best production settings can be achieved through a methodical and statistical approach. Time spent up front in weld development will ensure a stable welding process and provide a substantial return in quality and long term consistency. Welding problems can more easily be identified and solved if sufficient experimental work is carried out to identify the impact of common variables on the quality and variation of the welded assembly. AMADA WELD TECH frequently uses the Screening DOE tool to establish the impact of key variables and to assist customers with troubleshooting. Often, the testing described above will provide the information and understanding to predict common failure modes and causes.

# AMADA WELD TECH INC.

---

<http://www.amadaweldtech.com>

## **AMADA WELD TECH INC.**

1820 South Myrtle Ave., Monrovia, CA 91016, U.S.A.

TEL. +1-626-303-5676 FAX, +1-626-358-8048

<http://www.amadaweldtech.com>

## **AMADA WELD TECH CO., LTD.**

200, Ishida, Isehara-shi, Kanagawa 259-1196, Japan

## **AMADA WELD TECH KOREA CO., LTD.**

28, Dongtanhana 1-gil, Hwaseong-si, Gyeonggi-do, 18423, Korea

TEL. +82-31-8015-6810 FAX. +82-31-8003-5995

## **AMADA WELD TECH SHANGHAI CO., LTD.**

Unit 401, A206(C8), No. 77, Hongcao Road, Xuhui District, Shanghai, China

TEL. +86-21-6448-6000 FAX. +86-21-6448-6550

## **AMADA WELD TECH GmbH**

Lindberghstrasse 1, DE-82178 Puchheim, Germany

TEL. +49-89-839403-0 FAX. +49-89-839403-68

## **AMADA WELD TECH TAIWAN CO., LTD.**

Rm. 5, 2F., No. 9, Dehui St., Zhongshan Dist., Taipei 10461, Taiwan (R.O.C.)

TEL. +886-2-2585-0161 FAX. +886-2-2585-0162

## **AMADA VIETNAM CO., LTD.**

469 Ha Huy Tap Road, Yen Vien, Gia Lam, Ha Noi, Vietnam

TEL. +84-4-6261-4583 FAX. +84-4-6261-4584

## **AMADA (THAILAND) CO., LTD.**

Asia Industrial Estate Suvarnabhumi (AIES) 88/41 Moo 4, Khlongsuan, Bangbo, Samutprakarn 10560, Thailand

TEL. +66 2170-5900 FAX. +66 2170-5909

## **AMADA WELD TECH INDIA PVT. LTD.**

G-A Ground Floor, 5C-409, 5th Cross, Kammanahalli Main Road, HRBR Layout, Kalyan Nagar, Bengaluru, - 560043, India

TEL. +91-80-4092-1749 FAX. +91-80-4091-0592

## **AMADA WELD TECH LTDA.**

Av. Tamboré, 965/973, Salas P22e F11, bairro Tamboré, 06460-000-Barueri-SP, Brazil

TEL. +55-11-4193-1187

**AMADA WELD TECH INC.**

1820 South Myrtle Ave., Monrovia, CA 91016, U.S.A.

TEL. +1-626-303-5676 FAX. +1-626-358-8048