

**ELECTRONIC WELD HEAD CONTROL**

**SL-300A**

**USER MANUAL**



990-115 REV T

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S	45789	04/20	Update Company Name (Amada Weld Tech) + Model Names
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# FOREWORD

Thank you for purchasing an Amada Weld Tech SL-300A Fast Response Weld Head System.

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 notify us at:

**Amada Weld Tech Inc.**  
**1820 South Myrtle Avenue**  
**Monrovia, California 91016**  
**Phone: (626) 303-5676**  
**FAX: (626) 358-8048**  
**E-mail: info@amadaweldtech.com**

The purpose of this manual is to supply operating and maintenance personnel with the information needed to properly and safely operate and maintain the SL-300A Fast Response Weld Head System.

We have made every effort to ensure that the information in this manual is accurate and adequate.

Should questions arise, or if you have suggestions for improvement of this manual, please contact us at the above location/numbers.

Amada Weld Tech is not responsible for any loss due to improper use of this product.

This manual covers the following models:

Original Model Name	Original P/N		Current Model Name	Current P/N
301H, 115VAC Inline WH	2-301-04	→	SL-301A/115 Inline WH	2-301-05
301H, 100VAC Inline WH	2-301-04-01	→	SL-301A/100 Inline WH	2-301-05-01
301H, 230VAC Inline WH	2-301-04-02	→	SL-301A/230 Inline WH	2-301-05-02
301H, 208VAC Inline WH	2-301-04-03	→	SL-301A/208 Inline WH	2-301-05-03
302H, 115VAC Offset WH	2-302-04	→	SL-302A/115 Offset WH	2-302-05
302H, 230VAC Offset WH	2-302-04-02	→	SL-302A/230 Offset WH	2-302-05-02
350C/115 WH Controller	2-350-01	→	SL-300A WH Controller	
350C/115 WH Controller	2-350-02	→		
350C/230 WH Controller	2-350-02-02	→		
350C/208 WH Controller	2-350-02-03	→		

# SAFETY NOTES

This instruction manual describes how to operate, maintain and service the SL-300A Fast Response Weld Head System, and provides instructions relating to its SAFE use. Procedures described in this manual MUST be performed, as detailed, by QUALIFIED and TRAINED personnel.

For SAFETY, and to effectively take advantage of the full capabilities of the tester, please read these instruction manuals before attempting to use the workstation.

Procedures other than those described in this manual or not performed as prescribed in it, may expose personnel to electrical hazards.

After reading this manual, retain it for future reference when any questions arise regarding the proper and SAFE operation of the tester.

Please note the following conventions used in this manual:

**WARNING:** Comments marked this way warn the reader of actions which, if not followed, might result in immediate death or serious injury.

**CAUTION:** Comments marked this way warn the reader of actions which, if not followed, might result in either damage to the equipment, or injury to the individual if subject to long-term exposure to the indicated hazard.

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# SAFETY PRECAUTIONS

*Before* using this equipment, read the **SAFETY PRECAUTIONS** carefully to understand the correct usage of the equipment.

- These precautions are given for safe use of the Inverter Weld Head and for prevention of injury to operators or others.
- Be sure to read each of the instructions, as they are all important for safe operation.
- The meanings of the words and symbols are as follows:



## WARNING

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.






## WARNING

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.



## CAUTION

Denotes operations and practices that may result in personal injury or damage to the equipment if not correctly followed.

	<p>These symbols denote <b>PROHIBITION</b>. They are warnings about actions that should <i>not</i> be performed because they can damage the equipment and will void the warranty.</p>
	<p>These symbols denote actions which operators <i>must</i> take.</p>
	<p>Each symbol with a triangle denotes that the contents gives notice of <b>DANGER, WARNING, or CAUTION</b> to the operator.</p>



## DANGER



**NEVER DISASSEMBLE, REPAIR, OR MODIFY THE WELD HEAD.**  
 These actions can cause electric shock and fire. **NEVER** do anything other than the maintenance described in this manual.





# WARNING



**Do NOT put your hands or fingers between the electrodes.**

When welding, keep your hands and fingers away from the electrodes.



**Do NOT touch any welded part or electrode during, or just after welding.**

The welded parts and electrodes are very *hot*. If you touch them you will be burned.



**Only use specified cables.**

A cable with insufficient capacity or loose connections can cause electric shock or fire.



**Only apply the specified power.**

Application of a voltage or current out of the specified range can cause electric shock or fire.



**Do NOT use a damaged connecting cables, or plugs.**

Do *not* step on, twist, or tense any cable. Connecting cables may be damaged which can cause electric shock, short circuit, or fire. If any part needs to be repaired or replaced, consult Amada Weld Tech or your distributor.



**Stop operation if any trouble occurs.**

If you detect a burning smell, abnormal sounds, abnormal heat, smoke, etc., turn power OFF immediately to prevent fire or electric shock. Contact Amada Weld Tech or your distributor for help.



**People with pacemakers MUST stay away from the Weld Head.**

When the Weld Head is operating, it generates a magnetic field, which adversely affects pacemakers. People who use a pacemaker must *not* approach the Weld Head, or walk around the welding shop while the Weld Head is operating, *unless* their medical doctor has deemed it safe to do so.



**Wear protective gear.**

Put on protective gear such as protective gloves, long sleeved jacket, and leather apron to avoid being burned.



## CAUTION



**Keep water and water containers away from the Weld Head.**

Water spilled on the Weld Head can cause a short circuit, electrical shock, or fire.



**Use proper tools (wire strippers, pressure wire connectors, etc.) for terminations of the connecting cables.**

Do **not** nick the wire conductor. Doing so can cause a short circuit, electric shock, or fire.



**Do NOT damage connecting cables or connectors during use.**

Do **not** step on, twist, or tense any cable. Connecting cables may be damaged which can cause electric shock, short circuit, or fire. If any part needs to be repaired or replaced, consult Amada Weld Tech or your distributor.



**Install the Weld Head on a firm, level surface.**

Injury may result if the Weld Head falls over or drops from an uneven surface.



**Keep combustible matter away from the Weld Head.**

Spatter can ignite combustible materials. If you cannot remove all combustible materials, cover them with a non-combustible material.



**Do NOT cover the Weld Head with a blanket, cloth, etc.**

Heat generated by the operating Weld Head may ignite a blanket or cover.



**Wear ear protectors.**

Loud noises can damage hearing.



**Keep a fire extinguisher nearby.**

Make sure there is a fire extinguisher in or near the welding shop in case of fire.



**Regularly inspect and maintain the Weld Head.**

Regular inspection and maintenance is essential to safe operation and long life of the equipment. If you see any damage, make necessary repairs before operation.

# 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.

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## SL-300A FAST RESPONSE WELD HEAD SYSTEM

## **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 develop 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.

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(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.**

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# **SL-300A FAST RESPONSE WELD HEAD SYSTEM**

(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

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## SL-300A FAST RESPONSE WELD HEAD SYSTEM

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).

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## SL-300A FAST RESPONSE WELD HEAD SYSTEM





# CHAPTER 1 DESCRIPTION

## Section I: Features

### Overview

The SL-300A Fast Response Weld Head System is designed for any bench-top, semi or fully automated resistance welding applications. It provides programmable, highly-controlled weld force and extremely fast follow-up response required by precision resistance welding applications. The system consists of either an on-line or offset weld head, called the Actuator, and a control. An optional stand assembly is also available. This manual covers the following models:

Model	Original Stock No.
SL-301A/115	2-301-XX
SL-301A/100	2-301-XX-01
SL-301A/230	2-301-XX-02
SL-301A/208	2-301-XX-03
SL-302A/115	2-302-XX
SL-302A/230	2-302-XX-02

For the rest of this manual any of the Linear Actuator Modules will simply be referred to as *the Actuator*, and any model Electronic Weld Head Control will simply be referred to as *the Control*, unless unique descriptions for specific models are required.

### Performance Features

Through two unique features – programmable follow-up force and weld-to-displacement – the Weld Head System solves critical problems in conventional pneumatic or cam-driven welding systems.

### Programmable Follow-Up Force

Through programmable follow-up force, the Weld Head System is able to quickly and repeatedly position the electrode during the molten or plastic phase of the welding process. This unique feature prevents workpiece expulsion during the welding operation. Maximum strength welds result, and previously difficult-to-weld material combinations, such as tungsten wire to tungsten wire and tungsten wire to molybdenum foil, are easily made. Furthermore, due to the absence of sparking, electrode life is dramatically increased.

## **CHAPTER 1: DESCRIPTION**

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### **Weld-to-Displacement**

This feature ensures consistent nugget size by regulating the energy cutoff point of the power supply, thus controlling the amount of material collapse or set-down.

### **Weld Head Dynamics**

The dynamics of the Actuator during the weld operation are detailed in Appendix C. The information will be useful in installing, setting up and operating the Weld Head System.

### **Other Important Features**

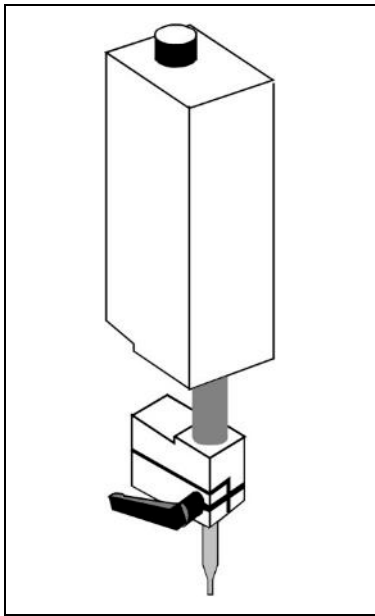
Other important performance features of the Weld Head System are:

- Precise measurement of setdown displacement for each weld provides an indication of weld quality.
- Weld-to-displacement feature shuts off the power supply when a programmed setdown displacement is reached.
- Over force and “hammering” are eliminated, even at high weld repetition rates.
- Real time graphical display of programmed and actual weld force and setdown displacement for each weld.
- Storage of up to 128 welding schedules allows rapid setups for applications that require different force and setdown control.
- Unique electrode dress mode that minimizes electrode maintenance down time.

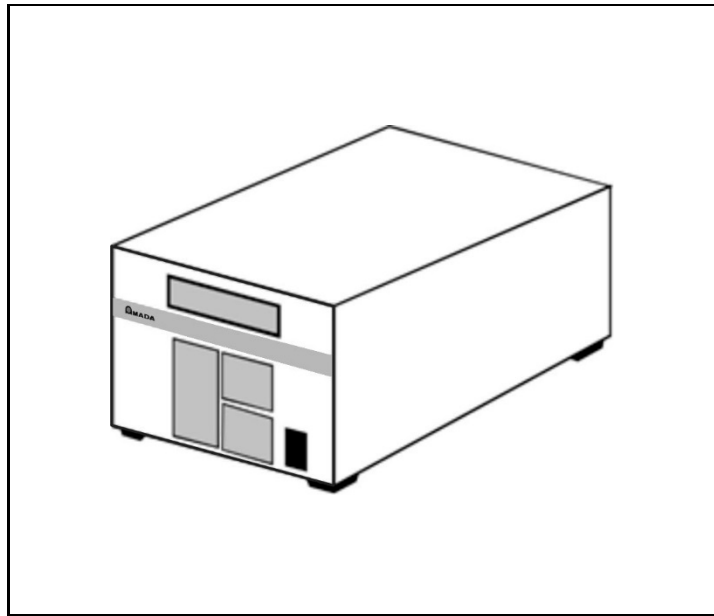
## Section II: Components

### Equipment Description

The SL-300A Fast Response Weld Head System consists of either the SL-301A or SL-302A Linear Actuator Module (figure 1-1) and the SL-300A Electronic Weld Head Control (figure 1-2). The SL-301A Actuator (shown) has an in-line electrode. The SL-302A Actuator has an offset electrode. Additional equipment required but not supplied, includes the appropriate welding transformer model, high-frequency resistance welding power supply, and a two-level foot switch. The system equipment is listed in table 1-1. In addition, an MK301 (in-line) or MK302 (offset) stand is available for mounting the Actuator.



**Figure 1-1. SL-301A  
Linear Actuator  
Module (Typical)**



**Figure 1-2. SL-300A Electronic  
Weld Head Control**

**NOTE:** For clarity of communication throughout this manual, it is assumed you are using the HF2 Welding Transformer, HF2 Power Supply (with appropriate transformer), HF-2500A Power Supply, or UB25 Power Supply, and the FS2L Foot Switch with your Weld Head System. If you are using equivalent equipment, please refer to the manufacturer's manuals for information about that equipment.

## CHAPTER 1: DESCRIPTION

**Table 1-1. SL-300A System Equipment List**

Equipment	Amada Weld Tech Part Number	Application	Notes
SL-301A Linear Actuator	4-34858-01	In-line welding	Only one weld head provided with system, depending on which is ordered.
SL-302A Linear Actuator	4-34857-01	Offset welding	
SL-300A Electronic Weld Head Control	4-34831-01	Weld Head Control	---

Other Required Items (Not Supplied)			
Welding Power Supply	---	---	Model HF2 (with transformer), UB25, HF-2500A, or equivalent.
Two-level Foot Switch	Equivalent to Amada Weld Tech 4-28945-01	---	Equivalent to Amada Weld Tech FS2L

Optional Items			
Weld Head Stand	4-34165-01	In-line weld head (SL-301A)	---
Weld Head Stand	4-33713-01	Offset weld head (SL-302A)	---

The Linear Actuator Module (Weld Head) is electro-magnetically controlled by the Weld Head Control according to the travel and force profile program that you select. Through the program, electrode position can be controlled to within 0.001 in. (25 $\mu$ m) but measured to within 0.0001 in (2.5 $\mu$ m). The weld force and duration can be set to between 1 lb (0.45 kg) and 20 lbs (9 kg) at a 15% duty cycle.

Depending on the travel and force profile that you select, weld rate can be as high as four per second with no impact force on the weld parts.

The Weld Head Control will interface with any programmable power supply that will initiate weld energy through a dry-contact closure. However, the Weld Head Control is particularly effective when used with a power supply that can be programmed to turn on weld energy in 1 millisecond increments.

Communication with external, user-supplied equipment is handled by the Weld Head Control through a control signal input port, control signal output port, and a serial port for RS-485 data communications. The addressable RS-485 serial port permits on-line logging of weld dynamics data and alarm conditions on your data logger or PC. An accessories port is present for future communications needs.

### System Controls

The front control panel of the SL-300A Weld Head Control is illustrated in Figure 1-3. The only other system controls are the POWER switch on the rear panel of the Weld Head Control, and the power circuit breaker on the power supply.



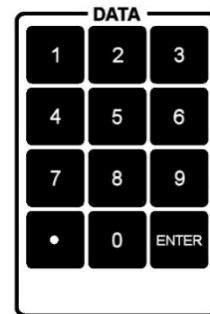
Figure 1-3. Weld Head Control Front Panel Controls

The eight-line liquid crystal displays provide essentially the same functions on the Weld Head Control and the Power Supply. Alphanumeric screens allow you to program up to 128 different weld force profiles and monitor alarm conditions. Graphic screens allow you to fine-tune the time, follow-up force and weld energy relationships. Additionally, on-line help screens allow you to interrogate the system for quick look-up information about installation and operation issues.

**NOTE:** The functions of the key clusters on the HF2 Power Supply and the Weld Head Control are identical. So, the following descriptions of the key clusters apply to them both. The UB25 and HF-2500A Power Supplies are slightly different; you should refer to the user manual for your power supply.

#### Data Keypad

This cluster of twelve numerical keys enters numerical information. Use the keys to enter values directly to the screens instead of incrementally with the ▲▼ keys. Use [.] to key in decimal values. Press [ENTER] after keying in data to complete the entry.



## CHAPTER 1: DESCRIPTION

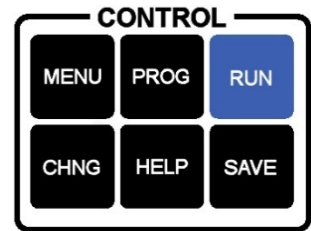
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### Control Keypad

This cluster of six keys allows you to access the various control screens on the display and control the editing (changing) of data on the screens.

[MENU] Provides a screen (display) menu listing of user options that are common to all weld schedules.

[PROG] Each time you press [PROG], it accesses the next programming screen in a sequence of programming screens. It also disables the RUN state.



[RUN] Pressing [RUN] exits the PROGRAM state (the state in which the Weld Head Control is to be programmed) or the MENU (user options) state, and enters the RUN state. In the RUN state, you can view the screens while you make a weld and analyze weld force, weld current, and electrode position (follow-up) relationships dynamically.

[CHNG] Pressing [CHNG] allows you to either:

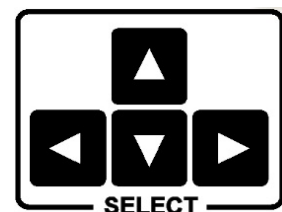
- Select different screen menu options, or
- Restore the previous contents of a screen programmable field, or
- Toggle through the series of screen of the RUN state.

[HELP] Accesses detailed on-line help screens for any program variables or alarm messages. The screens provide helpful information about any menu option or flashing programmable field. Pressing [HELP] a second time returns you to the original screen state.

[SAVE] This key is active only in the PROGRAM state. Pressing [SAVE] saves the changes to the weld schedule that you just entered to the program screen, then automatically selects the RUN state.

### Select Keypad

This is a cluster of four arrow keys. In the RUN state, you actuate them to increment or decrement weld schedules. In the alphanumeric PROGRAM or MENU states, you actuate them to move the cursor up, down and sideways on the screens to select value field for editing. In the graphical PROGRAM state, you can increment or decrement programmed values.



**WELD/NO WELD Switch (Power Supply).** Placing this switch in the NO WELD position cuts off weld current. It is the position that is required to adjust the weld head. Note that a complete electrode positioning sequence can be executed without weld current flowing. You must place the switch in the WELD position to make a weld.

**RUN/DRESS Switch (Weld Head Control).** Placing this switch in the RUN position allows normal execution of the weld cycle. In the DRESS position, it allows you to dress (clean) the electrodes by executing a setdown on cleaning material that you insert between the electrodes. Setdown force for dressing is programmable.

# CHAPTER 2

## GETTING STARTED

### Section I: Planning for Installation

#### Space Requirements

We recommend that you install the SL-300A Fast Response Weld Head System in a well-ventilated area that is free from excessive dirt and moisture. Allow sufficient clearance around both sides and back of the SL-300A Electronics Weld Head Control, the welding power supply, and the welding transformer so that cooling air can flow properly.

#### SL-300A Installation Dimensions

The dimensions and weight for a complete welding system are listed in table 2-1.

**Table 2-1. System Installation Dimensions**

<b>Equipment</b>	<b>Width (in/cm)</b>	<b>Height (in/cm)</b>	<b>Depth (in/cm)</b>	<b>Weight (lbs/kg)</b>
SL-300A Weld Head Controller	10.5 / 26.7	8.5 / 21.6	15.1 / 38.4	68.0 / 30.8
SL-301A/302A Linear Actuator Module (Weld Head)	2.0 / 5.1	10.4 / 26.4	4.0 / 10.2	13.0 / 5.9
Weld Head Stand (optional)	2.4 / 6.0	20.5 / 52.0	10.2 / 26.0	8.2 / 3.7

### Linear Actuator Installation

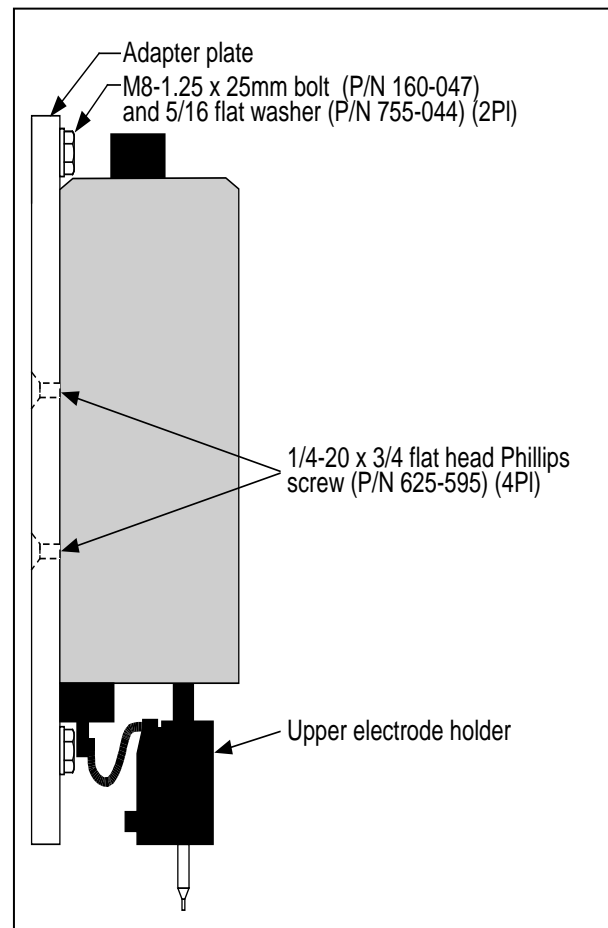
All units of the SL-300A System are stand-alone except the Linear Actuator (weld head), which must be mounted on a stable, vibration-proof work surface. If you purchase the optional L-Stand Assembly, which provides a flexible method of installing the actuator for non-automated applications, refer to that specific paragraph, below.

#### Basic Installation

**NOTE:** The Linear Actuator has three sets of mounting holes, with identical hole patterns, so the unit can be mounted on its back or either side. An optional adapter plate (P/N 4-33273-01) is available from Amada Weld Tech and is already included in the optional L-Stand Assembly.

Referring to figure 2-1 and the Installation Drawing (included in the Ship Kit), perform the following steps.

- 1 Secure the actuator to an adapter plate with four 1/4-20 screws. If you are using the above-mentioned adapter plate, these should be 1/4-20 x 3/4" flat head Phillips screws (P/N 625-595).
- 2 Secure the adapter plate to a vertical mounting surface using two machine bolts and flat washers. The height of the upper electrode holder above the lower electrode holder (to be installed in step 3) should allow for no more than 1.06 in. (27mm) of upper electrode travel.
- 3 Secure the lower electrode holder (user furnished, but included in the optional L-Stand Assembly) to the horizontal work surface, in alignment with the upper electrode holder. The misalignment between the upper and lower electrode center lines should be less than 10% of the *smallest* electrode diameter or width dimensions.



**Figure 2-1. Typical Linear Actuator Installation**

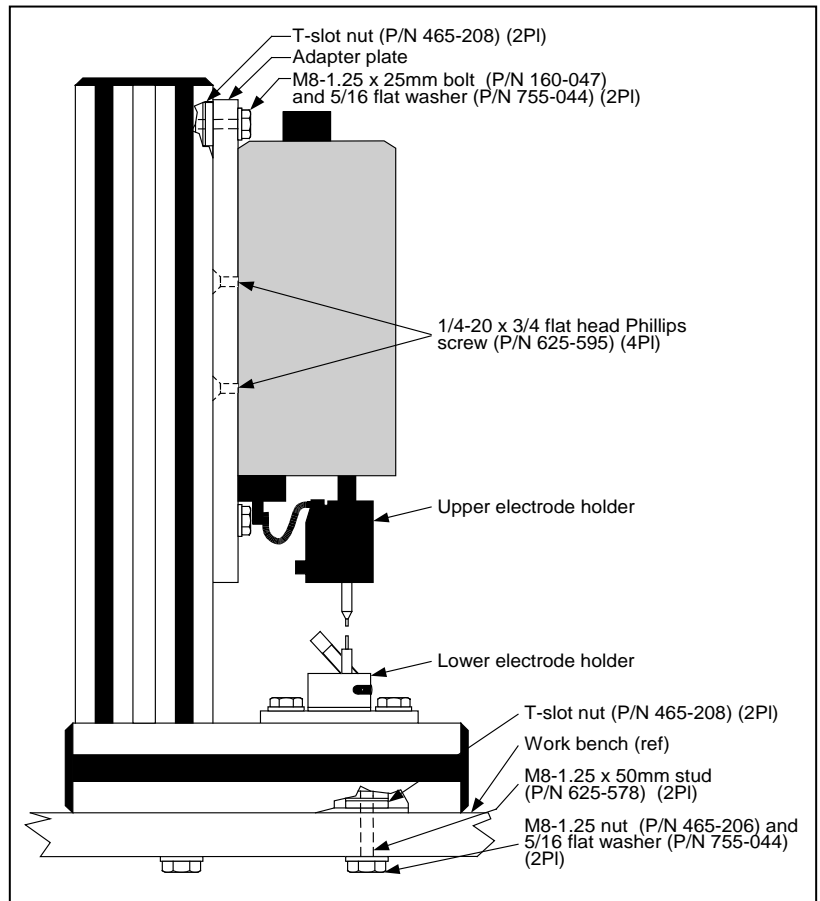


**Optional L-Stand Installation**

**NOTE:** The L-Stand Adapter contains a completely-assembled L-stand, lower electrode holder and adapter plate (P/N 4-33273-01). The Ship Kit contains the necessary mounting hardware.

Referring to figure 2-2, perform the following steps.

- 1 Lay the L-stand on its back. This will prevent the T-nuts (P/N 465-208) from moving during the next few steps.
- 2 Remove the two M8-1.25 x 25mm bolts (P/N 160-047) and 5/16 flat washers (P/N 755-044) securing the adapter plate to the L-stand.
- 3 Secure the actuator to the adapter plate with four 1/4-20 x 3/4 flat head Phillips screws (P/N 625-595).
- 4 Re-install the adapter plate to the T-slot nuts in the L-stand with the bolts and washers removed in Step 2.
- 5 Install the assembly to a horizontal work surface that provides firm (non-deflectional) support using two T-slot nuts (P/N 465-208), M8-1.25 x 50mm studs (P/N 625-578), 5/16 flat washers (P/N 755-044), and M8 nuts (P/N 465-208), contained in the Ship Kit.
- 6 Adjust the height of the upper electrode holder above the lower electrode holder to allow for no more than 1.06 in. (27mm) of upper electrode travel.



**Figure 2-2. Optional L-Stand and Lower Electrode Holder Installation**

- 7 Adjust the lower electrode holder so that any misalignment between the upper and lower electrodes is less than 10% of the *smallest* electrode diameter or width dimensions.

### Section II: Power Supply Connections

#### Power Line Voltage, Current, and Wire Size Requirements

Use the values listed in table 2-2 to select the correct power line circuit breaker and wire gauge sizes for installing the SL-300A Weld Head Controller.

**CAUTION:** The SL-300A Weld Head Controller is assembled at the factory for operation at a specific input power line voltage. *Serious damage can result if an input voltage is used other than the voltage for which the Weld Head Control is wired.*

**Table 2-2. Input Power Circuit Breaker and Wire Size Recommendations**

Service Voltage (RMS)	Circuit Breaker Current (RMS)	Copper AWG Wire Gauge	Outside Wire Dia.(in./mm)
115	15 Amps	12	0.083/2
208 to 230	6 Amps	12	0.083/2

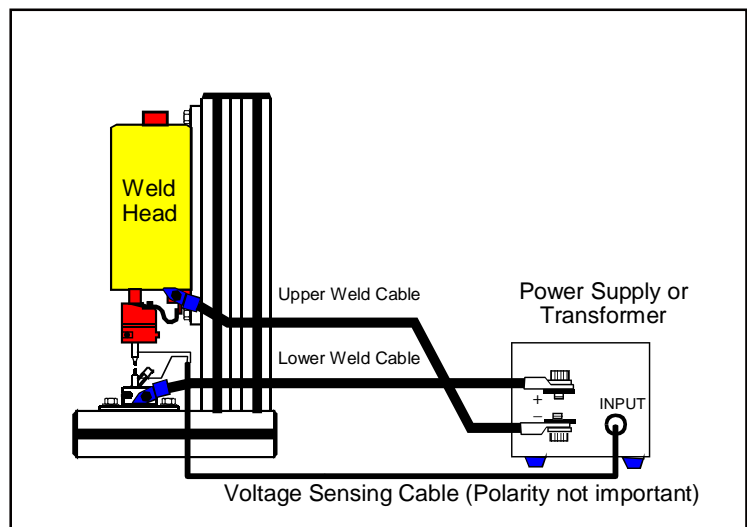
#### Connector Functions

The functions and pin assignments of the connector on the rear panel of the SL-300A Weld Head Controller are described in Appendix B.

#### Welding Transformer to Weld Head Connections

Refer to figure 2-3.

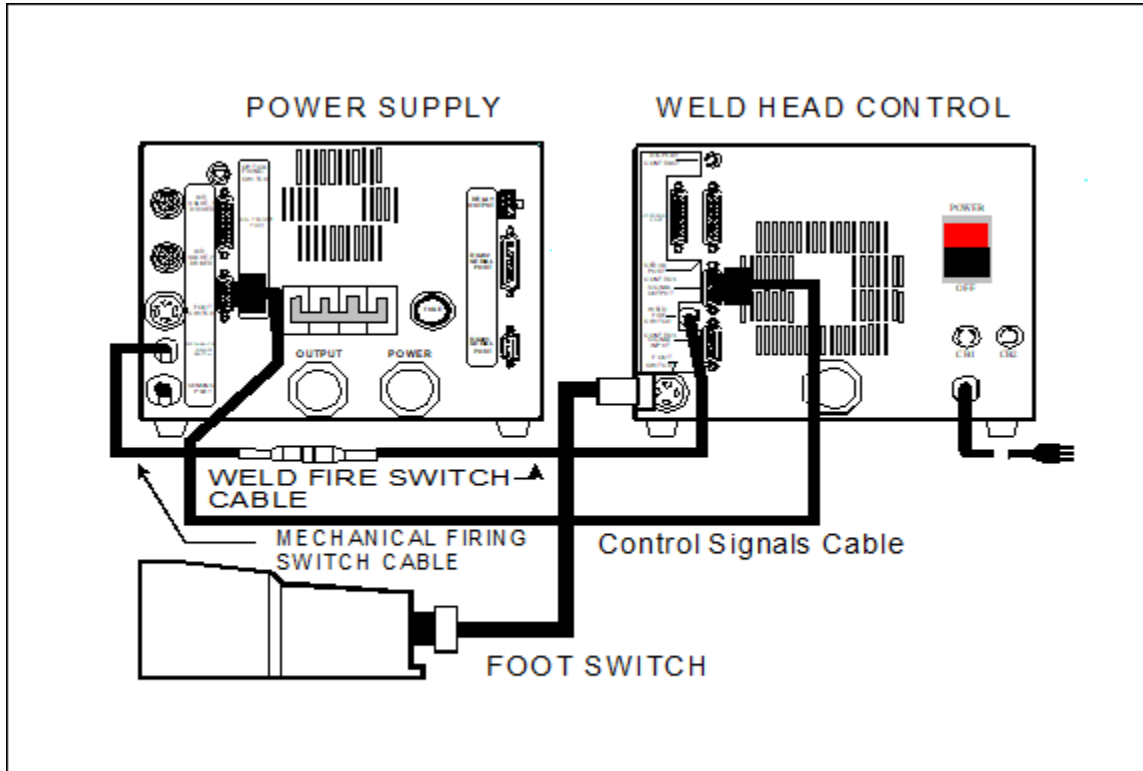
- 1 Connect the upper weld cable to the negative (-) terminal on the power supply or transformer.
- 2 Connect the lower weld cable to the positive (+) terminal on the power supply or transformer.



**Figure 2-3. Weld Head Connections to Power Supply or Transformer**

**Power Supply and Foot Switch to Weld Head Controller Connections**

Refer to figure 2-4.



**Figure 2-4. Power Supply Connections**

- 1 Connect the MECHANICAL FIRING SWITCH cable from the power supply to the SL-300A Weld Head Controller WELD FIRE SWITCH cable.
- 2 Connect the power supply CONTROL SIGNALS cable to the SL-300A Weld Head Controller CONTROL SIGNAL OUTPUT connector.
- 3 Connect the Foot Switch cable to the SL-300A Weld Head Controller FOOT SWITCH connector.

### Section III: Making the First Weld

**NOTE:** The information in this section gives you a ‘quick start’ method for starting to weld with minimal programming. For more detailed information regarding the screens and their functions see Chapter 3, Operating Instructions.

#### Nomenclature and Symbols

The following nomenclature, symbols, and conventions are used in this manual for expressing control and key actuations, and display readings, on the Weld Head System (both the SL-300A Weld Head Controller and the HF2 Power Supply). If you are not using an HF2 Power Supply, refer to your user's manual for appropriate nomenclature:

- Press and release front panel keys that are enclosed by [ ] symbols.
- To select (highlight) a requested menu option, press the vertical cursor keys [▲▼] in conjunction with the horizontal cursor keys [◀▶]. Then press the [ENTER] key.
- The words shown in *UPPER CASE ITALIC* letters or overlaid with shading indicate *flashing* menu options on the display (screens).

#### Electrode Installation

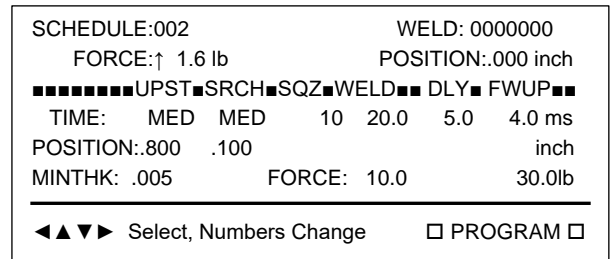
Install the appropriate electrodes in the Weld Head electrode holders. Your choice of electrodes depends on your specific welding applications, but keep in mind the following considerations:

- 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.
- Pencil point electrodes cause severe electrode sticking to the parts and unexplained explosions. They also increase the required weld heat substantially because of the reduced electrode-to-part contact area.

### Weld Head Controller Power Up and Initialization

To turn on the SL-300A Weld Head Controller power and set initial conditions, proceed as follows:

- 1 Set the RUN/DRESS switch on the Weld Head Control front panel to the RUN position. (The screen will prompt you to do so if the switch is in the DRESS position).
- 2 Set the POWER switch on the Weld Head Control rear panel to the ON (up) position. The Weld Head Control will automatically run a self-test cycle, during which it:
  - Determines the downstop position (DNST) of the opposing electrode. It then resets the DNST so that it is calibrated as 0.000. The upstop (UPST) and search (SRCH) positions are then referenced to DNST.
  - Verifies the calibration of the position and force control systems.
  - Determines the location of the inward-most position of the Linear Actuator output shaft relative to DNST. The location is the maximum UPST to which the Weld Head System can be programmed for the current length and placement of the electrode.
  - Determines the location of the inward-most position of the Linear Actuator output shaft relative to DNST. The location is the maximum UPST to which the Weld Head System can be programmed for the current length and placement of the electrodes.
- 3 At the end of the self-test, the alphanumerical RUN screen appears. The first time it appears, it will show the factory default settings, as shown here.



If the space between the top and bottom electrodes is substantially less than 1 inch (25 mm), the default settings for the UPST and SRCH positions will be different than those shown.

Also, the Linear Actuator head moves to the upstop position (UPST) specified by the initial positioning schedule.

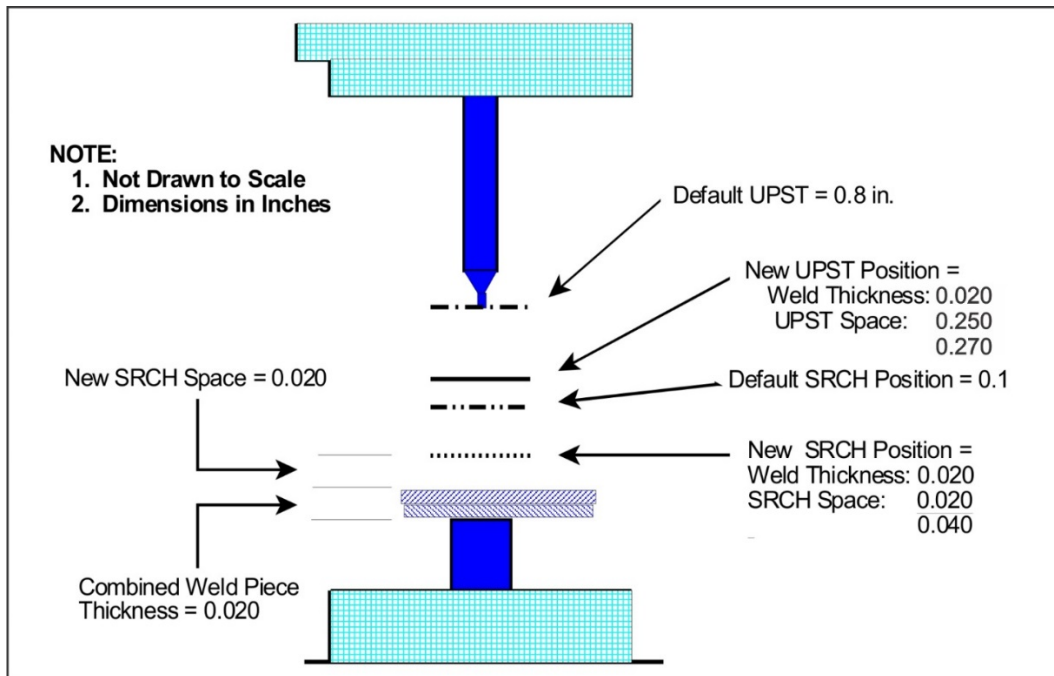
**NOTE:** The head may run into the limits of inward travel, as determined during the automatic self-test cycle. If it does, a message appears on the lowest (alarm) line of the screen. It is safe to continue operation and correct the electrode settings later.

## CHAPTER 2: GETTING STARTED

### Setting the Upstop and Search Positions

Note on the alphanumeric RUN screen that the default positions for electrode upstop (UPST) and electrode search (SRCH) are .800 inch (20.3 mm) and .100 inch (2.5 mm) respectively. These positions are with respect to the position of the lower electrode, which the Weld Head Control senses during its power up calibration cycle. You will now need to reset these values to accommodate the combined thickness of the workpieces that you will be welding.

Figure 2-5 shows an example of setting new UPST and SRCH positions that are suitable for a typical combined workpiece thickness of 0.020 inch (0.51 mm). A space of 0.25 inch (6 mm) between the upper electrode tip and the workpieces will set the UPST position at 0.270 inch (6.8 mm). A nominal space of 0.25 inch (6 mm) reduces the travel time for the upper electrodes to reach the workpieces. Enter the UPST value of 0.27 inch as follows.

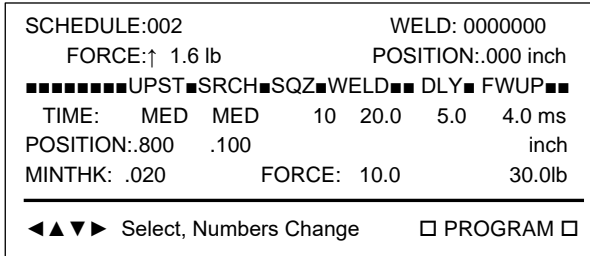


- Assuming that the default alphanumeric RUN screen is still accessed (Step 2 of the power up Weld Head Control procedure in the previous section), press the [PROG] key to access the alphanumeric PROGRAM screen.

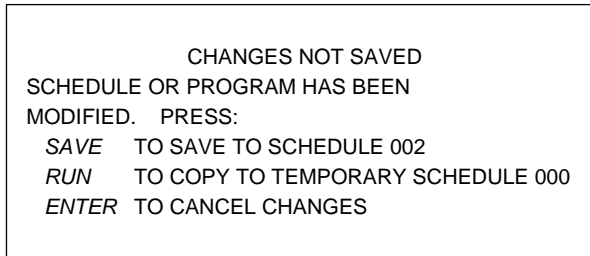
**NOTE:** Instructions for selecting parameters on the screen and entering values are annotated on the instruction (bottom) line of the screen.

SCHEDULE:002	WELD: 000000
FORCE:↑ 1.6 lb	POSITION:.000 inch
■■■■■■■■UPST■SRCH■SQZ■WELD■■ DLY■ FWUP■■	
TIME: MED MED 10 20.0 5.0 4.0 ms	
POSITION:.270 .040	inch
MINTHK: .020	FORCE: 10.0 30.0lb
◀▲▼▶ Select, Numbers Change □ PROGRAM □	

2. With the [▲▼] keys, select (highlight with the cursor) the UPST position, which now reads the default value of .800.
3. Enter the new UPST position value directly with the DATA keypad. In this example, key in .270 on the DATA keypad and press [ENTER].



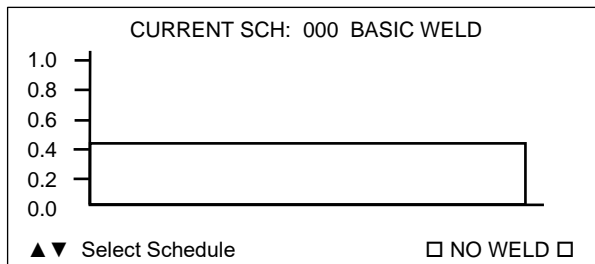
4. Press [▶] to select the default SRCH position value of .100. A SRCH space that is 0.020 inch (0.5mm) greater than the combined workpiece thickness helps to visually align the upper electrode with the workpieces (see figure 2-5). For this example, key in .040 inch.
5. At this point, you have entered the new SRCH position, but you have not yet saved it. Press [SAVE] to save both the UPST and SRCH positions to the weld schedule.
6. If you forget to save in Step 5 and press [RUN] to go to the run mode, the Weld Head Control puts up the CHANGES NOT SAVED screen. The three highlighted options allow you to save the new UPST and SRCH positions to the weld schedule (SAVE), go to the run mode and save the new UPST and SRCH positions to Schedule 000 (RUN), or cancel the changes (ENTER).



**Power Supply Power Up and Initialization**

To turn on the Power Supply and set initial conditions, proceed as follows:

1. Set the Power Supply front panel WELD/NO WELD switch to NO WELD.
2. Set the circuit breaker located on the Power Supply rear panel to the ON (up) position. The default (factory set) graphical weld RUN screen for the BASIC WELD function (SCHEDULE 000) appears after a series of power up screens. This is the default screen for the Power Supply at power up.

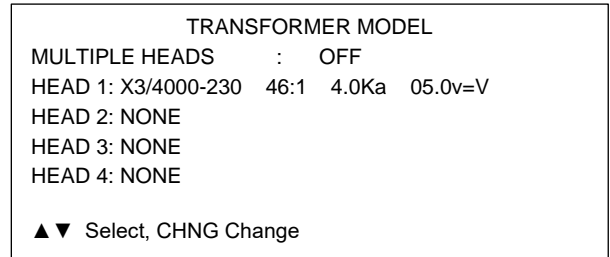
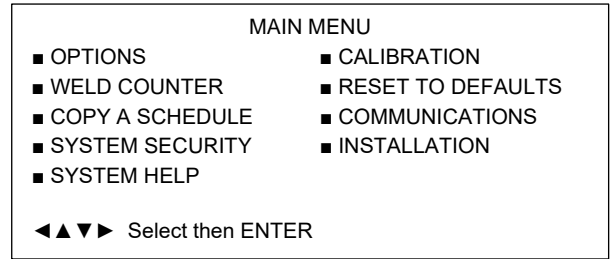


**Note:** the NO WELD notice at the bottom right-hand corner. It is a reminder that the WELD/NO WELD switch is in the NO WELD position.

## CHAPTER 2: GETTING STARTED

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- 3 Press the [MENU] key. The MAIN MENU screen for the Power Supply appears.
- 4 Select ■ TRANSFORMER MODEL with the [◀▲▼▶] keys and press [ENTER]. The TRANSFORMER MODEL screen appears.
- 5 Select MULTIPLE HEADS: *OFF*. If the display reads *ON*, press [CHNG] until *OFF* is displayed.
- 6 Select HEAD 1: X3/4000-230. X3/4000-230 is the default transformer model number. Press [CHNG] until the correct transformer model is displayed.
- 7 Press [MENU] to return to the MAIN MENU screen.
- 8 Select ■ OPTIONS and press [ENTER]. Press [▶] as many times as is necessary to access the OPTIONS 2 screen. If not already set, change WELD HEAD TYPE to MANUAL and SWITCH DEBOUNCE TIME to 0ms.
- 9 Press [RUN] to return to the graphical RUN screen (Step 2).



### Making Test Welds with Round-to-Round or Round-to-Flat Stock

To arrive at the point where you make a successful first weld will require you to make several test welds, using identical weld pieces each time for true process control.

You should make the first test welds with low energy settings. You can then adjust each of the welding parameters *one at a time* until you can make a successful weld.

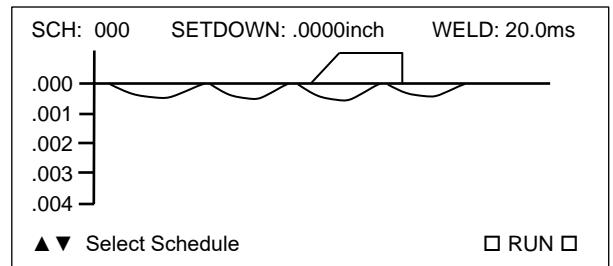
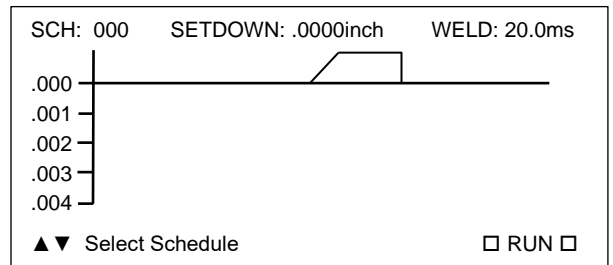
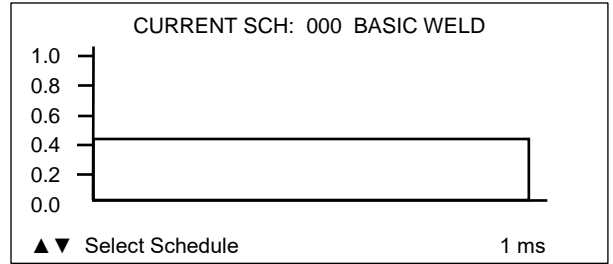
You will be adjusting weld energy (current over time) with the Power Supply, and weld force (WELD), follow-up force (FWUP), and follow-up force delay (DLY) with the Weld Head Control.

**WARNING:** Always wear safety glasses when welding.

**The first test weld:  
default settings**



- 1 At the Power Supply, set the WELD/NO WELD switch to WELD to go to the run state. Note that the NO WELD legend on the Power Supply graphical RUN screen is replaced by the weld time.
- 2 At the Weld Head Control, press [CHNG] twice to access the Weld Head Control graphical setdown RUN screen.
- 3 Make a test weld by placing the weld pieces on the lower electrode and pressing on the Weld Head foot switch. The first level press of the foot switch will send the upper electrodes to the SRCH position that you programmed, 0.020 inch above the workpieces. The second level pressing of the foot switch will send the upper electrode to the weld piece surface and trigger the weld cycle.
- 4 If a partial weld has taken place, peel the welded materials apart. A satisfactory weld will show residual material pulled from one material to the other. The default WELD time of 1ms and the default CURRENT of 0.5kA, as shown on the Power Supply graphical RUN screen, will probably not be sufficient to make a good weld, or any weld. Also, weld force will need to be adjusted at the Weld Head Control.



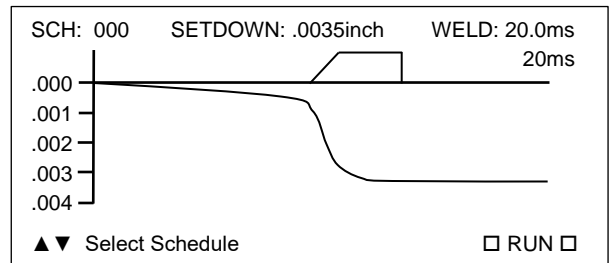
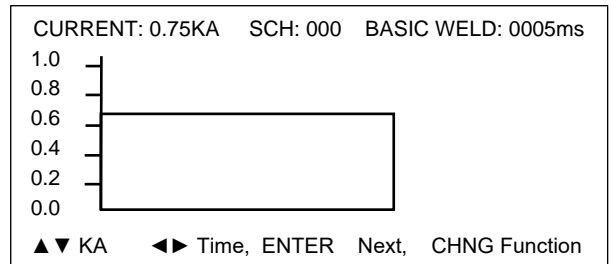
**NOTE:** When insufficient weld energy is supplied, oscillations just below the .000 setdown line are typical for round-to-round or round-to-flat welding applications. When sufficient weld energy is applied, a negative (downward) swing of the setdown trace is typical.

**The second test weld:  
increasing Power Supply weld  
current and weld time**

- 5 Press [PROG] on the Power Supply front panel. Use the [▶] key to increase the WELD TIME. Use the [▲] key to increase WELD CURRENT. In this example, WELD CURRENT has been increased to 0.75kA and WELD TIME has been increased to 0005ms.
- 6 Press [SAVE] on the Power Supply front panel to save your program to Schedule 000. The Power Supply is now back in the weld run state.

**NOTE:** Use the minimum time and current necessary to make a good weld so that the weld joint heat affected zone will be minimized.

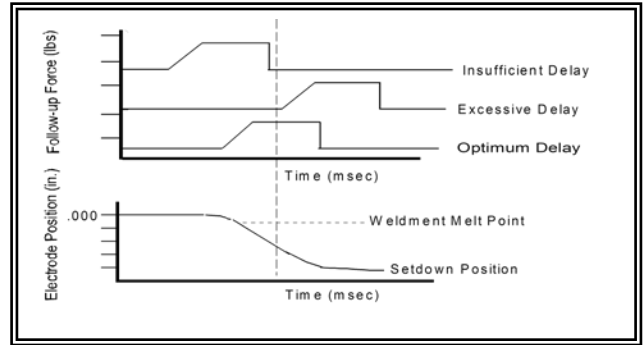
- 7 Keep increasing the weld time and weld current for each test weld until the setdown trace on the graphical setdown RUN screen is swinging negatively below the .000 setdown reference line *and* a weld nugget has formed between the two workpieces.



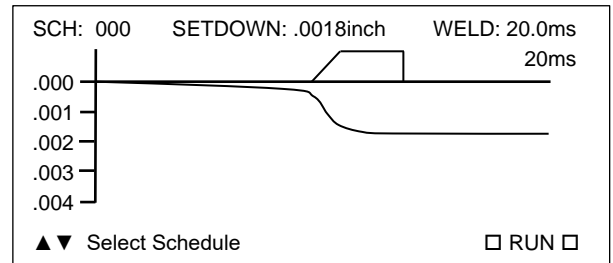
**The optimum test weld:  
adjusting the weld head  
delay time**

The relationship of the follow-up force profile and the electrode setdown trace is important. Its center must be fairly well aligned with the center of the setdown curve. If there is misalignment, you can adjust the delay of the follow-up force profile with the actual setdown curve.

- 8 Press [PROG] to access the Weld Head Control alphanumeric PROGRAM screen.
- 9 Select DLY TIME with the [▲▼◀▶] keys. The screen now shows a delay (DLY) time of 5.0ms.
- 10 Increase or decrease DLY time by 1.0ms.
- 11 Press [SAVE] and press [CHNG] twice to display the graphical setdown RUN screen.
- 12 Make another test weld.
- 13 Repeat Steps 10 through 12 to achieve co-incidence between the centers of the follow-up profile and the setdown trace.
- 14 If you get sparking between the electrodes and the workpieces, or within the workpieces, you need to adjust the Weld Head Control weld force and follow-up force. As before, use the Weld Head Control alphanumeric PROGRAM screen to make these adjustments until the sparking ceases.
- 15 Repeat Steps 10 through 14 to optimize the weld.

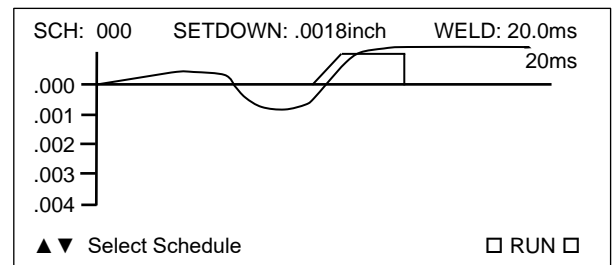


**Follow-up Delay Relationship with Setdown for Round-to-Round or Round-to-Flat Workpieces**



### Making Test Welds with Flat-to-Flat Stock

The approach to selecting weld values for this type of stock is the same as for round-to-flat or round-to-round stock. The only difference is in the appearance of the setdown trace in the Weld Head Control graphical setdown screen, where the setdown trace will always be initially in the positive direction (above the .0000 setdown line). This is because, when weld energy is first applied to flat stock, expansion of the stock forces the electrode upward until melting and electrode penetration occurs.

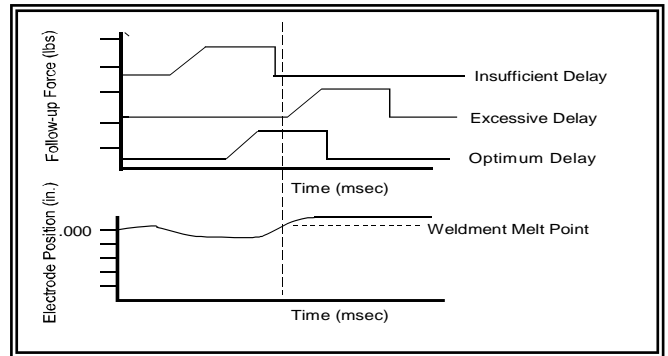


## CHAPTER 2: GETTING STARTED

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**NOTE:** When insufficient weld energy is applied, an oscillation of the setdown trace about the .000 setdown line is typical.

Just as for round stock welding applications, the relationship of the follow-up force profile to the electrode setdown trace is important. Their centers should be aligned as closely as possible.

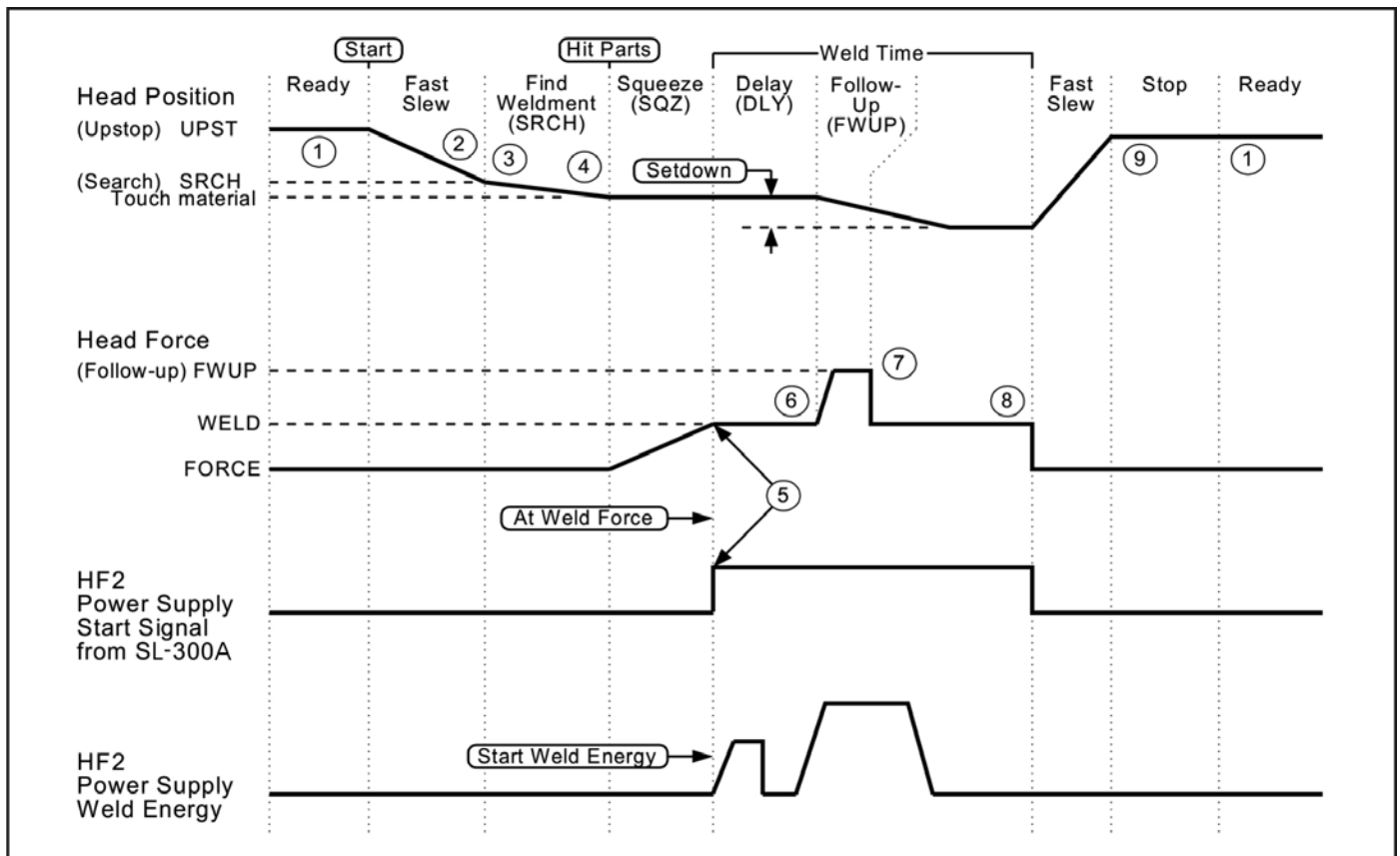


# CHAPTER 3 OPERATING INSTRUCTIONS

## Overview of the SL-300A Weld Head Operation

An understanding of the processes involved in the weld cycle will be helpful in following the programming instructions for the Weld Head Control. The Weld Head Control, in conjunction with the Power Supply, executes the sequence of actions shown in figure 3-1 during the weld cycle. The circled numbers refer you to the step numbers in weld head cycle table 3-1.

When doing manual welding, the two-level Foot Switch FS2L allows you to move the electrode between the upstop (UPST) position and the search (SRCH) position as often as you need before completing the weld with setdown (STDN). This way, you can carefully align the materials to be welded during the first downstroke of the electrode (first level of the foot switch), then commit to the weld with the final downstroke of the electrode (second level of the foot switch).



## CHAPTER 3: OPERATING INSTRUCTIONS

**Table 3-1. The Complete Weld Cycle**

Step	Event	Linear Actuator Action	Comments
1	Ready	At UPST position.	Run state. Ready to make a weld.
2	First level of the foot switch is actuated	Moves to SRCH position.	Slew rate is programmable: FAST, MED, SLOW. If the foot switch is released, the head moves back to the UPST position. By activating and releasing the first level of the foot switch, the head moves between the UPST and SRCH positions.
3	Second level of the foot switch is actuated	Moves toward weld material.	Slew rate is programmable: FAST, MED, SLOW.
4	Electrode touches weld material	Force builds up to WELD force.	The time required to reach the WELD force is programmable. This is called the squeeze (SQZ) time.
5	WELD force is reached	Start signal (contact closure) to Power Supply is initiated and follow-up force delay timer (DLY) is started.	You <i>must</i> set the switch debounce time in the Power Supply to 0 msec.
6	DLY time is expired	Force rapidly increases from the WELD force to the follow-up (FWUP) force.	Force change occurs in about 1 millisecond and remains at the FWUP force level for the programmed FWUP time duration. Round-to-round or round-to-flat parts collapse (set down) during the FWUP period. Flat-to-flat parts expand.
7	End of FWUP time	Force rapidly decreases back to the WELD force.	WELD force is applied for the remaining WELD time.
8	End of WELD time	Head retracts to the UPST position.	Slew rate is the same as in step 2.
9	UPST position is reached	Head remains at the UPST position for the duration of a hidden STOP time, which is automatically determined from the programmed and actual force and time information.	New weld cannot be initiated until the end of the STOP time. Also, the foot switch must be released and reactivated to start the next weld cycle. The STOP time ensures that the head will not overheat.

**The HELP Screens**

The Weld Head Control offers you context-sensitive, on-line help screens. They are available when the system is either running or is being programmed. To access the related help screen, all you need to do is press the [HELP] key; an on-line screen will appear with narrative explaining the function that is currently in effect.

For example, if you are setting up the electrode upstop position, the upstop program screen will be accessed.

From the alphanumerical RUN screen, press [PROG] twice. The SET THE UP-STOP POSITION screen appears.

Now, press the [HELP] key. The related on-line help screen will appear to give you more information about setting the upstop position. To return to the set upstop screen, press [HELP] again.

Press [RUN] to return to the alphanumerical RUN screen.

SET THE UP-STOP POSITION  
 SET THE UP-STOP POSITION WHERE THE HEAD NORMALLY STAYS.  
 USE ▲ TO MOVE THE HEAD UP  
 USE ▼ TO MOVE THE HEAD DOWN.  
 CURRENT UP-STOP POSITION: .300 inch  
 ▲▼ Adjust, PROGRAM SEARCH POSITION

[HELP] -- [SET UP-STOP POSITION]  
 USE ▲/▼ TO MOVE THE HEAD UP/DOWN TO THE DESIRED UP-STOP POSITION. PRESS ► TO GO TO THE NEXT STEP.  
 MAX RANGE: .006 - .99 IN (.2 - 25.4mm)  
 HELP to return

**A Closer Look at the PROGRAM Screens**

Press the [PROG] key to enter the program mode. Repeatedly pressing the [PROG] key cycles the display through five programming screens. Each screen is updated with the programming changes, regardless of which screen is used to enter the schedule information.

**Alphanumerical PROGRAM Screen**

This screen allows you to set all force, time and position fields using the numerical keys. Use all four [►◀▲▼] keys to select the various fields. The setdown displacement alarms and the weld-to-displacement feature are not programmed on this screen; they are programmed in the setdown PROGRAM screen.

SCHEDULE:002 WELD: 000000  
 FORCE:↑ 2.0 lb POSITION:.000 inch  
 ■■■■■■UPST■SRCH■SQZ■WELD■ DLY■ FWUP■  
 TIME: MED MED 10 20.0 5.0 4.0 ms  
 POSITION:.800 .100 inch  
 MINTHK: .020 FORCE: 10.0 30.0lb  
 ◀▲▼▶ Select, Numbers Change □ PROGRAM □

## CHAPTER 3: OPERATING INSTRUCTIONS

### UPST Position PROGRAM Screen

This screen provides an alternative way of programming the upstop position. The UPST position is where the head is located while the SL-300A System is ready (in the run state).

Upon entering this screen, the head is positioned at the UPST position. You use the [▲▼] keys to raise or lower the head, or program the UPST position directly using the numerical keys. Since the head responds immediately to your actions, this screen is particularly helpful for fine tuning the UPST position.

SET THE UP-STOP POSITION  
SET THE UP-STOP POSITION WHERE THE HEAD NORMALLY STAYS.

USE ▲ TO MOVE THE HEAD UP

USE ▼ TO MOVE THE HEAD DOWN.

CURRENT UP-STOP POSITION: .300 inch

▲▼ Adjust, PROGRAM SEARCH POSITION

### SRCH Position PROGRAM Screen

The search (SRCH) position is the location where the head stops on its way down to allow the user to accurately align the materials to be welded. Typically, this position is set up so the electrodes are just above the weld material.

Upon entering this screen, the head is positioned in the SRCH position. You use the [▲▼] keys to lower the head, or program the SRCH position directly using the numerical keys. Since the head responds immediately to your actions, this screen is particularly helpful for fine-tuning the SRCH position.

SET THE SEARCH POSITION

SET THE SEARCH POSITION TO BE SLIGHTLY ABOVE THE WELD MATERIALS.

USE ▲ TO MOVE THE HEAD UP

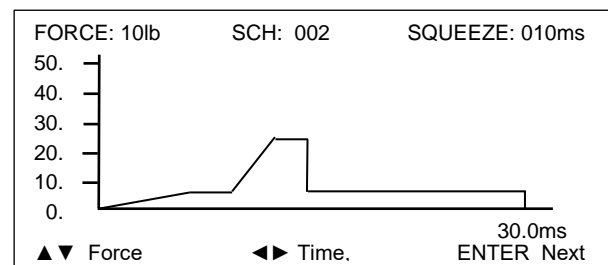
USE ▼ TO MOVE THE HEAD DOWN.

CURRENT UP-STOP POSITION: .060 inch

▲▼ Adjust, PROGRAM FORCE PROFILE

### Graphical Force PROGRAM Screen

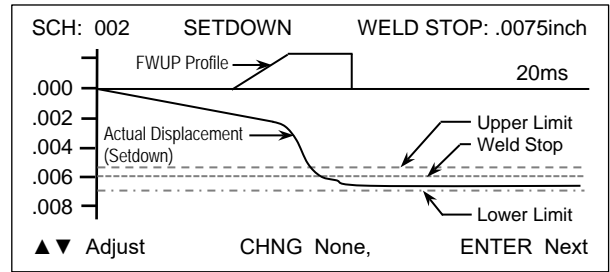
This screen allows you to program the weld force magnitude and duration using a graphical screen. Pressing the [ENTER] key selects the next segment of the graph to program. The segment is indicated by the horizontal window located on the horizontal time line. Pressing the [▲▼] keys adjusts the force of selected segment. Pressing the [◀▶] keys increases or decreases the time duration of the selected segment.





**Setdown PROGRAM Screen**

The term ‘setdown’ (STDN) is the small electrode position displacement that occurs during the weld. This screen shows the actual setdown versus time graph of the last weld, and allows you to superimpose upper and lower setdown displacement limits. In addition, the weld-to-displacement feature is programmed on this screen (refer to *Weld-to-Displacement Feature* at the end of this chapter).



Press [ENTER] to select the UPPER or LOWER setdown limit alarms, or the WELD STOP displacement for the weld-to-displacement feature. Set the limit and stop line values with the [▲▼] keys. Note that the LOWER setdown limit must be programmed before the UPPER limit.

Press the [CHNG] key to remove either limit lines or weld-stop displacement.

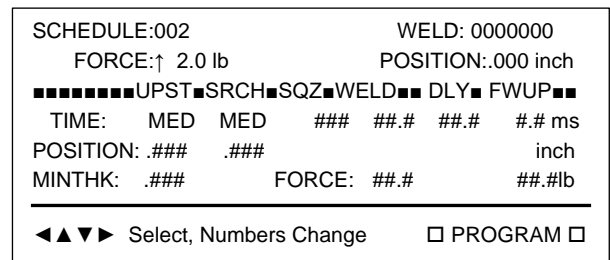
**A Closer Look at the RUN Screens**

Press the [RUN] key to ensure that the Weld Head Control is in the RUN state. Now press the [CHNG] key a few times. Notice that the display changes screens each time you press the [CHNG] key. The [CHNG] key alternates the display among three RUN screens:

- Alphanumerical (text and numbers)
- Graphical Force (force over time)
- Graphical Setdown (electrode position over time)

**Alphanumerical RUN Screen**

This screen displays the schedule number and all the programmed schedule information. (The # characters define user-programmable values.) Other information such as SCHEDULE number, tare FORCE 8, and cumulative WELD count are also displayed. The fields are defined in table 3-2.

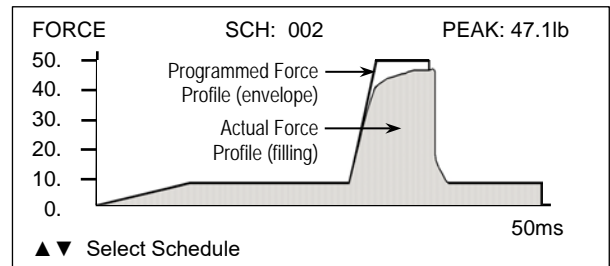


## CHAPTER 3: OPERATING INSTRUCTIONS

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### Graphical Force RUN Screen

The graphical force RUN screen relates the programmed and actual force (vertical axis) with time (horizontal axis). The force profile shows the complete WELD time interval, including the SQZ time (force ramp-up) and the FWUP force impulse. The programmed force is shown as a line graph, and the actual force is shown as a 'filled-in' graph after the weld cycle is repeated.



The force is shown on the vertical axis, and the time is shown on the horizontal axis. The total time duration of the SQZ and WELD periods is indicated in the lower right corner. After a weld cycle is completed, the peak FWUP force is indicated in the upper right corner.

Cycle the weld head a few times. Notice that the actual force graph is redrawn each time.

Field	Function
SCHEDULE: 000	Schedule number from 000 - 127. Use the [▲▼] keys or numerical keys to select a different schedule number when in the RUN state.
WELD: 0000000	Weld counter. Increments each time a weld is completed.
FORCE: 2.0 lbs.	Tare force. Force required to keep the weld head electrode holder in the UPST position. Tare force is not programmable.
POSITION: .000 inch	Current position of the weld head.
TIME: UPST	Rate at which the head moves toward or away from the upstop position: FAST: 30 inches (76.2 cm)/second MED: 8 inches (20.3 cm)/second SLOW: 1 inch (2.5 cm)/second
POSITION: UPST	Upstop position is relative to 0.000, where the electrodes touch each other.
TIME: SRCH	Rate at which the head moves between search position and where the electrode touches the weld material: FAST: 0.5 inches (12.7 mm)/second MED: 0.1 inches (2.5 mm)/second SLOW: 0.05 inches (1.3 mm)/second
POSITION: SRCH	Search height position is relative to 000.0, where the electrodes touch each other.
TIME: SQZ	Time duration for force to build up to the WELD force.(50ms recommended)
TIME: WELD	Time duration for WELD. The start signal to the Power Supply is asserted for this time period.
FORCE: WELD *	Force maintained for the duration of the WELD time, except for the interval during which the follow-up force is applied.
TIME: DLY	Time interval from the start of the WELD period to application of follow-up force. The optimal programming of this parameter to achieve good welds is important. Refer to <i>The Importance of Follow-Up Force</i> in this chapter.
TIME: FWUP	Time duration of follow-up force. The optimal programming of this parameter to achieve good welds is important. Refer to <i>The Importance of Follow-Up Force</i> in this chapter.
FORCE: FWUP *	Follow-up force must be greater than or equal to WELD force.

**Table 3-2. Alphanumerical Screen Field Definitions**

\* Note: Force accuracy of unit is only maintained if the head is calibrated in the same position as it is used. Head is factory calibrated in horizontal position. This does not affect force repeatability.

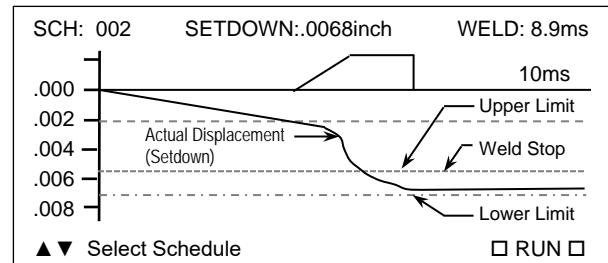
## CHAPTER 3: OPERATING INSTRUCTIONS

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### Graphical Setdown RUN Screen

The graphical setdown RUN screen shows five categories of information:

- Follow-up (FWUP) time profile
- Actual electrode setdown into the workpieces
- User programmed weld stop (setdown limit)
- User programmed lower limit
- User programmed upper limit



The upper and lower limits are shown on the graph by the dashed lines only if you have programmed them. If you have programmed the weld-to-displacement (weld stop) feature, the weld stop horizontal dotted line is shown intersecting the actual displacement graph at the exact displacement at which the Power Supply start signal is terminated. The displayed time is normally less than the programmed WELD time period.

If the weld-to-displacement feature is not programmed, the displayed time is equal to the programmed WELD time period. Refer to *Weld-to-Displacement Feature* toward the end of this chapter for details of the weld-to-displacement feature.

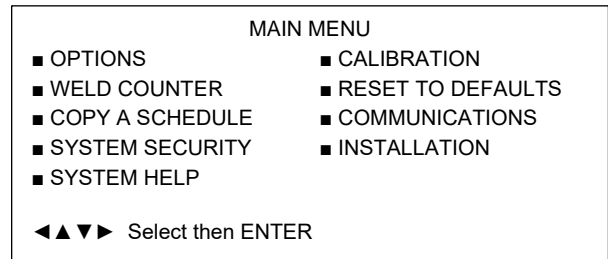
The final setdown displacement is listed alphanumerically at the top center of the screen; in this weld schedule, it is shown as SETDOWN: .0068 inch. The total duration of the weld time (8.9ms) is indicated in the upper right corner of the screen.

Select each of these screens and exercise the weld head to see how the fields and graphs update during and after each weld cycle.

## The MAIN MENU Screen

You set up the program options for the Weld Head Control through a menu system, as presented on the MAIN MENU screen. The options are normally set up during installation, and they affect the operation of the system regardless of which schedule you select.

Like a tree with many branches, there are multiple menu levels. You access each new menu level by selecting an option and pressing the [ENTER] key. To return to a menu level, you press the [MENU] key.

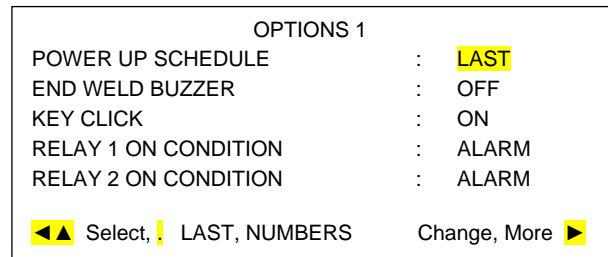


Press the [MENU] key on the Weld head Control front panel to access the MAIN MENU. Use the [▶◀▲▼] keys to select a topic (for example, #OPTIONS or #CALIBRATION), then press [ENTER] to go to the menu screen of the selected topic.

## The ■OPTIONS Selection

The Weld head Control makes twelve different system options available to you through three screens: OPTION 1, OPTION 2, and OPTION 3. Most of these programmed options allow you to modify how an external input, such as a foot switch, interfaces with the Weld Head Control. Output relay options allow you to interface the Weld Head Control with an external computer or Programmable Logic Control (PLC).

- 1 From the MAIN MENU screen, select #OPTIONS. The OPTIONS 1 screen appears. Five option items appear as shown.



- **POWER UP SCHEDULE:** This option determines which weld schedule will be used when the Weld Head Control is switched ON: either (a) Schedule Number 0-127, or (b) the weld schedule that was selected just before the power was switched OFF. To select (a) or (b):
  - (a) Press [CHNG] to select 000, then key in the weld schedule number that you want the Weld Head Control to display on power up, or
  - (b) Press [.] to change a specific weld schedule to *LAST*.
- **END WELD BUZZER:** ON means that an audible signal will be given at the end of each weld process as your signal to release the foot pedal. Press [CHNG] to select *ON* or *OFF*.

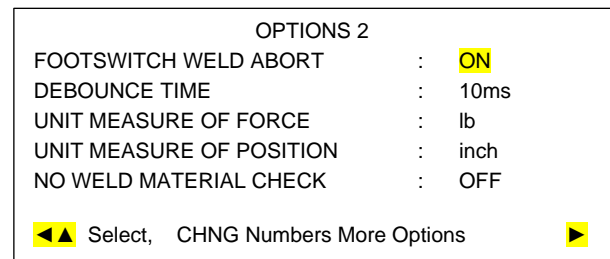
## CHAPTER 3: OPERATING INSTRUCTIONS

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- **KEY CLICK:** This option provides a ‘click’ sound when you press any front panel key. Press [CHNG] to select *ON* or *OFF*.
- **RELAY 1 ON CONDITION:** This feature has four options that allow you to select when RELAY 1 will activate. RELAY 1 is a contact closure terminating at the CONTROL SIGNAL INPUT connector (see Appendix B) that you can use as an event monitor. The options for contact closure are:
  - > ALARM                                      When an alarm condition exists
  - > RUN STATE                                During the RUN state
  - > WELD PERIOD                              During the weld period
  - > ENTIRE                                      During the entire weld cycle
- **RELAY 2 ON CONDITION:** This feature is identical to the RELAY 1 ON CONDITION.

2 Press [▶] (More Options) to access the submenu of options on the OPTIONS 2 screen.

- **FOOTSWITCH WELD ABORT:** Select ON or OFF with the [CHNG] key. This option controls how the Weld Head Control interfaces with a foot switch or a force firing switch. Either or both switches may be defined as the ‘initiation switch.



The ON selection means the welding process is initiated by the closure of the initiation switch(es) and continues to its conclusion as long as the initiation switch(es) remain closed. If the initiation switch(es) open during the welding process, the welding process will terminate.

The ON selection is preferred for human operators since it allows you to abort the welding process by releasing the foot switch or foot pedal. Use OFF when controlling the Weld Head Control with a host computer or PLC.

- **DEBOUNCE TIME:** Single pole mechanical firing switch contacts ‘bounce’ when they close. The debounce time feature allows you to specify that the firing switch must remain closed for 0, 10, 20, or 30 milliseconds before the weld period can be initiated, to minimize false weld cycle initiation due to contact ‘noise’ on the foot switch signal. The Weld Head Control automatically sets the debounce time to 0.0 milliseconds whenever a 3-wire or optical coupling switch is selected. Press [CHNG] to select 0, 10, 20, or 30 msec.
- **UNITS MEASURE OF FORCE:** Press the [CHNG] key to select pounds, kilograms or newtons as units of force measurement.

- **UNITS MEASURE OF POSITION:** Press the [CHNG] key to select inches or millimeters as units of position measurement.
  - **NO WELD MATERIAL CHECK:** Press the [CHNG] key to select ON or OFF. When you select ON, the weld head will expect material thickness of at least 0.005 inch. If the weld head does not sense material by the time the electrodes are 0.005 inch apart, the weld cycle aborts and a warning message appears on the alphanumeric RUN screen. Press [MENU] to return to the MAIN MENU screen or press (RUN) to return to the weld graphical RUN screen.
- 3 Press [▶] (More Options) to access the submenu of options on the OPTIONS 3 screen.

OPTIONS 3	
SELF-CHECK DURING BOOT-UP	: ON
SELF-CHECK FORCE LIMIT	: 10 lb
EMERGENCY STOP OPERATION	: NO
MATERIAL SEARCH FORCE	: 3.0 lb
OBJECT DETECTION FORCE	: 10 lb
◀ Select, NUMBERS Change, More ▶	

- **SELF-CHECK DURING BOOT-UP:** When you set this option to OFF, the self-checking procedure will be skipped during boot-up. When the head is retracting to the upstop position, a SKIPPING SELF-CHECK OPERATION message will be displayed.

SKIPPING SELF-CHECK OPERATION

When you set it to ON, the self-checking procedure will be executed. Regardless of the option state, the self-checking procedure will always be executed when returning from the dress mode.

- **SELF-CHECK FORCE LIMIT:** With this option, you may limit the amount of force applied by the electrodes during calibration (self-check) so that the force will not bend miniature or angled electrodes.

**NOTE:** This option does not apply to weld force or follow-up force.

You should set the self-check force to 10 pounds for directly opposed electrodes, as noted on the HELP screen. For angled electrodes, select the maximum force the electrodes can tolerate without bending.

[HELP] -- [FORCE LIMIT]  
DURING INITIAL POWER UP AND SWITCHING FROM DRESS MODE TO RUN MODE, THE HEAD CHECKS ITS CALIBRATION. ENTER MAXIMUM FORCE THE HEAD CAN USE. UNLESS THE HEAD IS SET UP TO USE WITH ANGLED ELECTRODES, LEAVE SELF-CHECK FORCE LIMIT TO 10 LB.  
[HELP] to return

- **EMERGENCY STOP OPERATION:** You can configure the Emergency Stop switch input at the CONTROL SIGNAL INPUT connector to operate either in the normally open or normally closed mode. Note that the OPTION 3 screen is showing a selection of normally open (NO). You toggle the selection to normally closed (NC) with the CHNG key.

## CHAPTER 3: OPERATING INSTRUCTIONS

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Refer to Appendix B under *CONTROL SIGNAL INPUT Connector, Emergency Shutdown Input*, for Emergency Stop signal input details. When you configure the Emergency Stop switch on the OPTIONS 3 screen, you must change the wiring to the emergency stop input on the CONTROL SIGNALS connector. For normal operation, the circuit must be open in the NO case and shorted in the NC case.

- **MATERIAL SEARCH FORCE:** This is the force used to detect the weld material. You can set it from 2 to 10 lbs., or to AUTO, by pressing the CHNG key. AUTO is the default setting. When set to AUTO, the material search force will change according to the search (SRCH) rate setting of the selected weld schedule (see table 3-2). With the SRCH rate set to FAST or MED, the force will be 3 lbs. When SRCH is set to SLOW, the force will be 2 lbs.

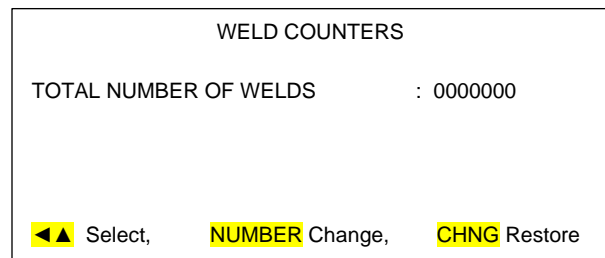
**NOTE:** You will not be able to set a weld force lower than the MATERIAL SEARCH FORCE setting.

- **OBJECT DETECTION FORCE:** This is the maximum force to be used during the approach mode (from upstop to search position). Referring to table 3-2, the object detection force is 10 lbs. for FAST rate and 3 lbs. for MED and SLOW rate.

You can set the force from 3 to 10 lbs., or to AUTO, by pressing the CHNG key. AUTO is the default setting. In the AUTO state, the object detection force will change according to the search (SRCH) rate of the selected weld schedule. With the search rate set to FAST, the object detection force will be 10 lbs. With the search rate set to MED or SLOW, the object detection force will be 3 lbs.

### The ■WELD COUNTER Selection

The Weld Head Control contains one standard weld counter and three additional weld counters if the built-in Weld sentry is installed in the Power Supply. These counters increment each time a weld is made in any weld schedule.



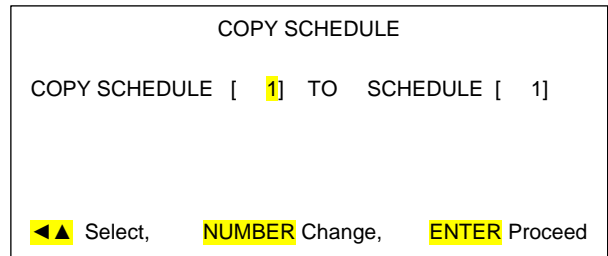
- 1 From the MAIN MENU screen, select #WELD COUNTER. The WELD COUNTER screen appears.
- 2 Select the weld count number for TOTAL NUMBER OF WELDS. To set the counter:
  - To zero, select the count number and press the [0] numerical key. If you change your mind, press [CHNG] before leaving the WELD COUNTER screen; the original count will appear.
  - To another number, select the count number, key in the change with the numerical keys, and press [ENTER].
- 3 Press [MENU] to return to the MAIN MENU screen, or press [RUN] to return to the weld graphical RUN screen.



## The ■COPY a SCHEDULE Selection

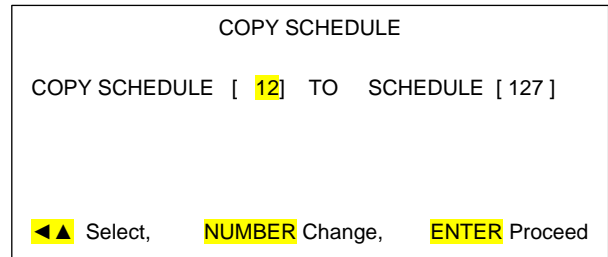
All Weld Head Control weld schedules can be easily copied from one weld schedule to another by using the COPY A SCHEDULE option listed under the MAIN MENU.

- 1 From the MAIN MENU, select #COPY A SCHEDULE. The COPY SCHEDULE Screen will appear with the TO SCHEDULE field selected as a default.
- 2 With the numerical keys, key in the number of the destination schedule to the TO SCHEDULE field; for example, key in 127 to copy a schedule to be selected to Schedule 127.



**NOTE:** Schedule information previously stored in Schedule 127 will be overwritten by the new information coming from the source schedule.

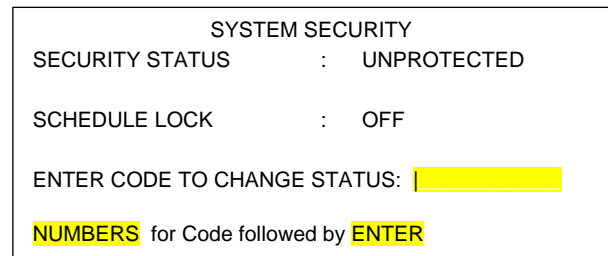
- 3 Press [◀] to select the COPY SCHEDULE FIELD. With the numerical keys, key in the number of the source schedule. For example, key in 12 as the source schedule.
- 4 Press [ENTER] to complete the schedule copy process and to automatically return to the weld graphical RUN screen.



## The ■SYSTEM SECURITY Selection

All Weld Head Control weld schedules can be protected from operator changes by programming the Weld Head Control with a user defined protection code.

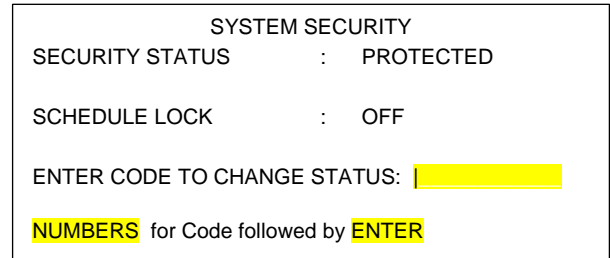
- 1 From the MAIN MENU screen, select #SYSTEM SECURITY. The SYSTEM SECURITY screen will appear. The first character position of the code status line should be flashing.
- 2 Enter a seven-digit number from 1 to 9999999.
- 3 If unauthorized operators are to be kept from changing weld schedules, select SCHEDULE LOCK: OFF and use [CHNG] to select ON. When ON is selected, all other weld schedules are locked out and cannot be used for welding.



## CHAPTER 3: OPERATING INSTRUCTIONS

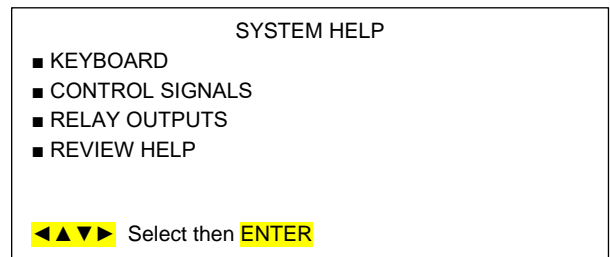
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- 4 Press [ENTER] to enable System Security. SECURITY STATUS: will now display PROTECTED.
- 5 Press [MENU] to return to the MAIN MENU screen or press [RUN] to return to the weld graphical RUN screen.
- 6 To unlock the Weld Head Control, return to the SYSTEM SECURITY screen and re-enter the security code. The SECURITY STATUS: will now display UNPROTECTED.
- 7 If you forget or misplace the security code:
  - a Return to the SYSTEM SECURITY screen.
  - b Press and hold [◀].
  - c Press [SAVE] and release [◀]. SECURITY STATUS: will now display UNPROTECTED.



### The ■SYSTEM HELP Selection

System Help provides detailed descriptions of all hardware features on the Weld Head Control. From the MAIN MENU screen, select #SYSTEM HELP. The SYSTEM HELP screen will appear. Select the desired topic, then press [ENTER]. Use the [◀▲▼▶] keys to review each page.



### The ■CALIBRATION Selection

Please observe the **NOTE**, **CAUTIONS** and **WARNINGS** in this section.

**NOTE:** The Weld Head and Weld Head Control are calibrated together at the factory and are not interchangeable. If they are interchanged, calibration will be nullified.

**CAUTION:** The Weld Head Control can be calibrated only by a qualified electronics technician since the Weld Head Control cover must be removed to provide access to the adjustments while AC power is ON.

- 1 Set the POWER switch on the rear panel of the Weld Head Control to OFF.

**WARNING:** Be sure to observe the instructions given in Step 2. If you do not perform Step 2, or you perform it improperly, you could be seriously injured. Up to 230 VAC could be present in the chassis area.

- 2 Disconnect the AC input power to the Weld Head Control.
- 3 Remove the Weld Head Control Cover.

**WARNING:** Be extremely careful when reconnecting the input power. Up to 230 VAC could be present in the chassis area.

- 4 Reconnect input power to the Weld Head Control and set the POWER switch to ON.
- 5 From the MAIN MENU screen, select #CALIBRATION and press [ENTER]. This accesses the PRE-CALIBRATION screen. Disregard the password message. See the HELP screen for further instructions.
- 6 Locate the Weld Head Control printed circuit board, positioned on the right-hand side of the Weld Head Control. Follow the calibration instructions listed on each screen page. The only tools you will need are a flat-bladed screwdriver and voltmeter for making the potentiometer adjustments.

**CAUTION:** Do not attempt to re-adjust the factory-adjusted LVDT position.



### WARNING

Be sure to observe the instructions given in the next step. If you do not perform it, or you perform it improperly, you could be seriously injured. Up to 230 VAC could be present within the chassis area.

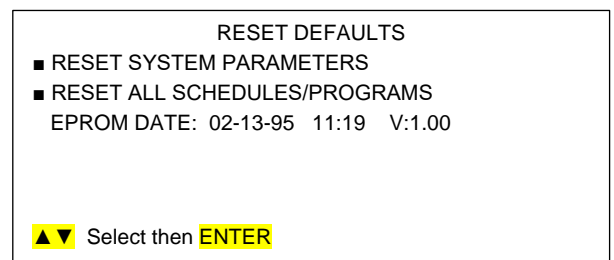
- 7 Set the POWER switch on the rear panel of the Weld Head Control to OFF and disconnect the AC input power.
- 8 Replace the Weld Head Control cover.

### The ■RESET to DEFAULTS Selection

The Reset To Defaults feature allows you to reset all system parameters or all weld schedules to their original factory default settings.

**NOTE:** You will not reset the weld counter.

- 1 From the MAIN MENU screen, select #RESET TO DEFAULTS. The RESET DEFAULTS screen will appear.
- 2 Select #RESET SYSTEM PARAMETERS and press [ENTER]. The RESET SYSTEM PARAMETERS PROCEED? Option line appears.
- 3 Press [CHNG] to change NO to YES to reset all system parameters to their factory default settings, then press [ENTER]. Table 3-3 lists the factory default settings. When the reset process is complete, the bottom of the screen will display the message SYSTEM PARAMETERS ARE RESET.



System Parameters	Default	System Parameters	Default
Power Up Schedule	Last	Footswitch Weld Abort	On
End Weld Buzzer	Off	Debounce Time	10ms
Key Click	On	Unit Measure of Force	lb.
Relay 1 ON Condition	Alarm	Unit Measure of Distance	inch
Relay 2 ON Condition	Alarm	No Weld Material Check	Off

**Table 3-3. Default System Parameters**

- 4 Select #RESET ALL SCHEDULES/PROGRAMS and press [ENTER]. The RESET ALL SCHEDULES/ PROGRAMS PROCEED? Option line appears.
- 5 Press [CHNG] to change NO to YES to reset all weld schedules to their factory default settings. Then press [ENTER]. When the reset process is complete, the bottom of the screen will display the message SCHEDULES/PROGRAMS ARE RESET.
- 6 Press [MENU] to return to the MAIN MENU screen or press [RUN] to return to the weld graphical RUN screen.

```

RESET DEFAULTS
■ RESET SYSTEM PARAMETERS
■ RESET ALL SCHEDULES/PROGRAMS
  EPROM DATE: 02-13-95 11:19 V:1.00

RESET ALL SCHEDULES/PROGRAMS
PROCEED? : NO
CHNG Change, ENTER accept
    
```

### The ■INSTALLATION Selection

The installation option provides narrative (no illustrations) instructions about how to set up the Weld Head Control. At the MAIN MENU screen, press [ENTER] to select this option. Then, press [▶] for each new page of instructions. The best procedure is to follow the instructions in *Chapter 2: Getting Started* in this manual.

### The Weld-to-Displacement Feature

Successfully using the weld-to-displacement feature requires some understanding of the timing relationship between the Power Supply and the Weld head Control. The discussion below assumes that the Weld Head Control is connected to an Amada Weld Tech power supply. If you are not using an Amada Weld Tech power supply, refer to your power supply user's manual for specific instructions.

When the weld head reaches the WELD force, the firing switch solid state relay closes. This is the 'start' signal to the Power Supply. The Power Supply starts within a couple of milliseconds, and the FWUP force occurs later, exactly at the time set for DLY milliseconds. You must set up the Power Supply properly so that the FWUP force occurs at the right point in the weld cycle. Here is a check-list to ensure that the Power Supply and the Weld Head Control are synchronized for the weld-to-displacement function (it assumes that the units are interconnected as described in Chapter 2):

#### On the Power Supply

Program the weld function and weld energy as follows:

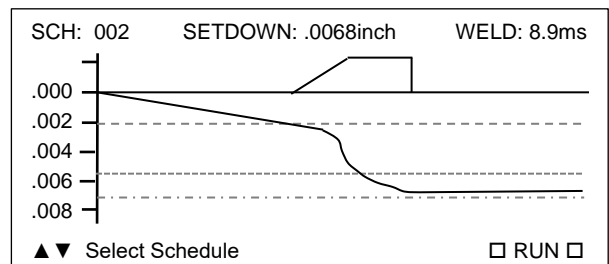
- 1 Set the switch debounce option to 0ms. This eliminates the time delay between receipt of the start signal to the time when the Power Supply actually delivers energy to the weld.
- 2 Set the weld head type to MANUAL. This allows the Power Supply to be activated through the force firing switch input.
- 3 Set the footswitch abort option to ON. This allows the Weld Head Control to shut off the Power Supply by disabling the start signal when the programmed displacement is reached.
- 4 Program the Power Supply for the desired weld function (BASIC, PRE/POST HEAT, etc.) to properly perform the weld.
- 5 Set the weld current to a low value. For example, try 1 kA.

#### On the Weld Head Control

Program the profile for the weld as follows:

- 1 Access the graphical setdown RUN screen.
- 2 Try a weld.

**NOTE:** The weld time that you program into the Weld Head Control is the total time that the Power Supply energy will be supplied to the weld materials. Start out with short weld times and work up to the minimum time that a weld requires.

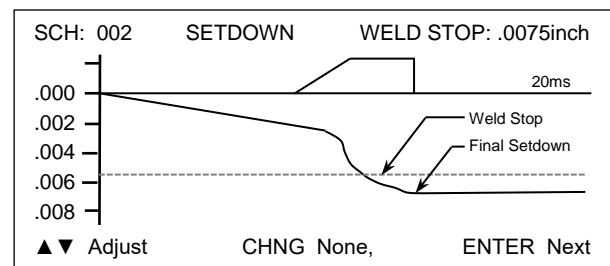


## CHAPTER 3: OPERATING INSTRUCTIONS

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- 3 Gradually increase the WELD time and/or the Power Supply weld energy until you produce a satisfactory weld.
- 4 Note the appearance of the SETDOWN graph on the setdown RUN screen. The graph should not have abrupt changes in it, but rather a 'sideways S' shape as shown.
- 5 Set the DLY time so that the FWUP force impulse (the trapezoid on the top line) occurs just when the SETDOWN graph shows the welding materials just starting to melt (that is, the SETDOWN displacement just starts to change rapidly).
- 6 Experiment with WELD time, WELD force, FWUP time, FWUP force DLY time, and Power Supply energy until you achieve the desired weld and setdown displacement.

**NOTE:** Do not experiment with Power Supply time.



- 7 Access the graphical setdown PROGRAM screen and select the WELD STOP feature. Using the [▲▼] keys, move the weld stop line to just above the final setdown line.
- 8 Increase the WELD time by 20 milliseconds. Now, the weld-to-displacement programming will shut off the Power Supply when the programmed setdown displacement is achieved.
- 9 Repeat the weld. The Power Supply should now shut off prior to the end of the WELD time programmed on the Weld Head Control.
- 10 Experiment with the WELD STOP program to achieve consistently good welds with the desired setdown displacement.

### The Importance of Follow-Up Force

The programmable follow-up force is the key to high performance and consistent weld quality achievable with the Weld Head System. Depending on the type of weld, the weld material melts or becomes plastic as the weld progresses, causing the force between the electrodes to diminish. Unless the weld head can quickly accelerate the electrode into the weld material during this crucial time period, material will be expelled from the weldment, producing a poor weld. The small movement of the electrodes during the course of the weld is called 'follow-up.' The ability to rapidly accelerate the electrodes during follow-up, thus maintaining force on the weld material and preventing expulsion, is a key performance measure of a weld head.

Conventional weld heads – whether pneumatic, pedal, hand, or cam operated – typically use a mechanical spring or pneumatic cylinder to develop the weld force. The maximum follow-up acceleration is limited by the moving weld head mass (including electrode, electrode holder, and output shaft) and the weld force. The relationship between follow-up acceleration, weld force, and moving mass follows Newton's first law of motion:  $Acceleration = force/mass$ . Since the moving mass is constant for a given weld head, the maximum follow-up acceleration is proportional to the weld head force. This means that for low force welds, or for welds that require a lot of follow-up acceleration (such as wire-to-foil or cross-wire welds), conventional weld heads have a fundamental limit to their follow-up performance.

The SL-300A Weld Head System, however, uses an electromagnetic linear actuator to develop the weld force. A user-programmed force impulse (FWUP) accelerates the electrode into the material during the follow-up period. The resulting precise head movement outperforms any other weld head technology.

Use the following procedure as a starting point to set up the FWUP force:

- 1 Start with default WELD, FWUP force, DLY and FWUP time settings.
- 2 Use the graphical setdown RUN screen and PROGRAM screen to assist in fine-tuning the programming of the timing and magnitude of the follow-up force.
- 3 Make a few welds. Notice where the setdown displacement starts to change rapidly. This is the point where the weld materials start to melt. Adjust the DLY to position the FWUP impulse at this point.
- 4 If sparking or splashing occurs, increase both the WELD and FWUP forces. To calculate the new FWUP force, multiply 2.5 lbs./0.001 inch (44.6 kg/0.0254 mm) by the measured electrode displacement. Add this new constant to the weld force value. Use the combined total as the new FWUP force.
- 5 For large WELD and FWUP force operations, increase the FWUP time to match the actual melting or setdown period as indicated by the 'S' shaped portion of the actual setdown graph.
- 6 Experiment with the FWUP force, time duration, and delay time to optimize the weld.





# CHAPTER 4

## Maintenance

### Section I: Service Precautions

#### General Operator Safety

**Warning:** Always wear safety glasses any time you are operating the Weld Head.

Never wear loose clothing or jewelry when operating the weld head. It could be caught in the mechanism.

Before operating the Weld Head, read this manual and the power supply manual. Particularly note the specific hazards associated with those components.

### Section II: Operation Troubleshooting

Your SL-300A Fast Response Weld Head system is designed with reliability as a top user priority. But, occasionally, you will run into a problem and need some help to get back to normal operation. Reading this chapter will speed up the process.

#### General Kinds of Problems

**NOTE:** It has been our experience that 99% of all weld head and resistance welding power supply ‘problems’ are caused by lack of material control, process control and electrode tip surface maintenance.

The problems that you might encounter fall into two groups:

- **Soft** – The problem is transient, and you can correct it by re-calibrating the system or re-setting limits, for example.
- **Hard** – The problem is imbedded in the system and some form of repair or upgrade will be needed.

In either case, built-in automatic self-test and self-calibration routines will bring up alarm messages on the display screen. These messages will usually let you know what action is required of you to correct the reason for the alarm. For a complete listing of the alarm messages, what they mean, and what to do about them, please refer to table 4-1.

**Table 4-1. Alarm Message Listing**

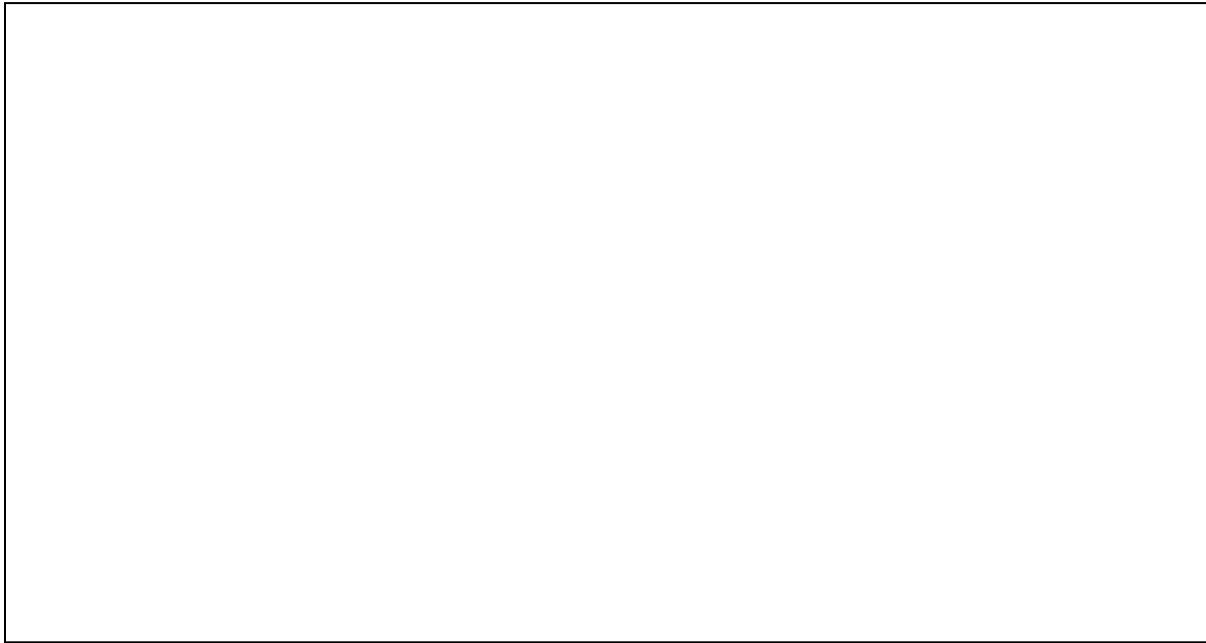
<b>Alarm Message</b>	<b>Description</b>	<b>Corrective Actions</b>
ALARM EMERGENCY STOP	An Emergency Stop signal was received on the CONTROL SIGNALS connector. The Weld Head Control cannot operate in the RUN state.	Remove the Emergency Stop signal.
ALARM SEARCH POSITION	Electrode encountered an obstacle before it reached the programmed search position.	Remove the obstacle.
CALIBRATION SELECTED	The CALIBRATION switch has been actuated.	Press the CALIBRATION switch.
DOWNSTOP OUT OF RANGE	Weld Head output shaft bottoms out before the upper electrode reaches the lower electrode.	Adjust the position of the lower electrode, using the centering bar displayed in the DRESS mode. Set the RUN/DRESS switch to RUN. The Weld Head Control will automatically recalibrate the downstop position.
ERROR. TOO LITTLE SETDOWN	Measured setdown is less than the programmed upper limit.	<ol style="list-style-type: none"> <li>1. Reprogram a higher upper setdown limit.</li> <li>2. Replace the weld material.</li> <li>3. Troubleshoot the Welding Power Supply.</li> </ol>
ERROR. TOO MUCH SETDOWN	Measured setdown is greater than the programmed lower limit.	<ol style="list-style-type: none"> <li>1. Reprogram a lower lower setdown limit.</li> <li>2. Replace the weld material.</li> <li>3. Troubleshoot the Welding Power Supply.</li> </ol>
ERROR. WELD ABORTED	Foot switch did not stay actuated during the weld cycle.	Actuate the foot switch again.
FOLLOW-UP TIME TOO SMALL	Time entered was below the minimum value allowed.	Reprogram the follow-up time to be at least the 1ms minimum.
FOLLOW-UP TOO LOW	Follow-up force entered is less than the weld force.	Reprogram a higher follow-up force or lower weld force.
FORCE CALIBRATION IS OFF	Force setting and force reading differ by more than 0.3 lbs.	Recalibrate force with the CALIBRATION selection on the MAIN MENU.
INPUT TOO LARGE	Value entered is too large for the field.	Enter a value within the field upper limit.
INPUT TOO SMALL	Value entered is too small for the field.	Enter a value within the field lower limit.
HEAD NOT READY	Foot switch was actuated before the end of the OFF time calculated by the Weld Head Control for the weld schedule.	Reactuate the foot switch at the end of the OFF time.
POSITION CALIBRATION IS OFF	The position setting and position reading differ by more than 0.015 in. (0.38 mm).	Recalibrate position with the CALIBRATE selection on the MAIN MENU.

<b>Alarm Message</b>	<b>Description</b>	<b>Corrective Actions</b>
ILLEGAL CODE ENTERED	The system is security-protected against unauthorized entry and you have attempted to enter an unauthorized security code.	Enter the original code used to protect the system. If you do not know it, change the system to unprotected status as follows: 1. Set the WELD/NO WELD switch to NO WELD. 2. Access the SYSTEM SECURITY screen. 3. Press and hold [□]. 4. Press [SAVE] and release [□]. SECURITY STATUS: will now read UNPROTECTED.
NO RESPONSE FROM THE HEAD	Weld Head is not responding to the Weld Head Control.	1. Tighten the weld head to Weld Head Control cable. 2. Contact your authorized service agent for technical assistance.
NO SAMPLE DATA EXISTS	No setdown displacement data is available to display because the last weld schedule used is not the current weld schedule.	To display the setdown data graph, make a weld with the current weld schedule.
NO WELD MATERIAL	The upper electrode has traveled to 0.005 in. (0.12 mm) above the lower electrode and has not encountered weld material.	1. Insert weld material. 2. Reposition the electrodes.
SAVE ERROR	Weld Head Control could not save the weld schedule.	Contact your authorized service agent for technical assistance.
SCHEDULE LOCKED	System is protected and the schedule is locked.	Unlock the schedule as follows: 1. At the MAIN MENU, access the SYSTEM SECURITY selection. 2. Enter your security code and change SCHEDULE LOCK to OFF.
SEARCH POSITION TOO LOW	Specified search position is lower than the lower limit of 0.005 in. (0.12 mm).	Reset the search position above the lower limit.
STANDBY REMOTE SCHEDULE	The Weld Head Control is waiting for external equipment to input a weld schedule number code via the CONTROL SIGNAL INPUT connector (see Appendix B).	Refer to the user's manual for the external equipment.
UPSTOP POSITION TOO HIGH	Specified upstop position cannot be reached.	Enter a smaller upstop position value.
UPSTOP POSITION TOO LOW	Specified upstop position is lower than or equal to the search position.	Enter an upstop position value that is higher than the search position value.
WELD TIME TOO SMALL	Specified weld time is less than the combined delay time and follow-up time.	Enter a weld time that is longer than the sum of the delay time and the follow-up time.

### Section III: Operator Service Procedures

#### 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 are needing to increase weld current to maintain the same welding quality, the electrode tip has probably increased in surface area (that is, mushroomed), effectively increasing weld resistance. Try replacing the electrode.



**Figure 4-1. Electrode Tip Surface Maintenance**

The rough surface of a worn electrode tip tends to stick to the workpieces. So, periodic tip resurfacing (dressing) is required to remove pitting, oxides and welding debris from the electrode. You should limit cleaning of an electrode tip on the production line to using a # 400-600 grit electrode polishing disk.

If you must clean a badly damaged tip with a file, be sure that the electrode surfaces are maintained parallel, and use a polishing disk after filing to ensure that the electrode tip 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.

## Section IV: Repair Service

### Parts Replacement

**CAUTION:** Only authorized repair personnel should replace parts. Removal of the unit covers by unauthorized personnel could be hazardous and may void the warranty.

If you need to replace a part, table 4-2 lists the repair parts for the SL-301A and SL-302A Linear Actuators.

**Table 4-2. SL-301A and SL-302A Linear Actuator Module Repair Parts List**

Amada Weld Tech P/N	Description	Application
4-33274-01	Flexure	SL-301A and SL-302A
4-33967-02	Electrode Holder (Upper)	SL-301A
4-33474-01	Electrode Holder Handle Clamp	SL-301A
4-33712-02	Electrode Holder	SL-302A

### Technical Assistance

If you need further technical assistance, please contact either your authorized service agent or Amada Weld Tech Customer Service at the number provided in the Foreword of this manual.

### Section V. Calibration

#### SL-300A Weld Head System with the SL-300A Weld Head Controller

##### Applicable Models

2-350-xx-xx

##### Equipment Required

- An NIST traceable force gauge in the 20lb range.
- A calibrated, 4+ digit voltmeter, accurate to at least  $\pm 0.1\%$

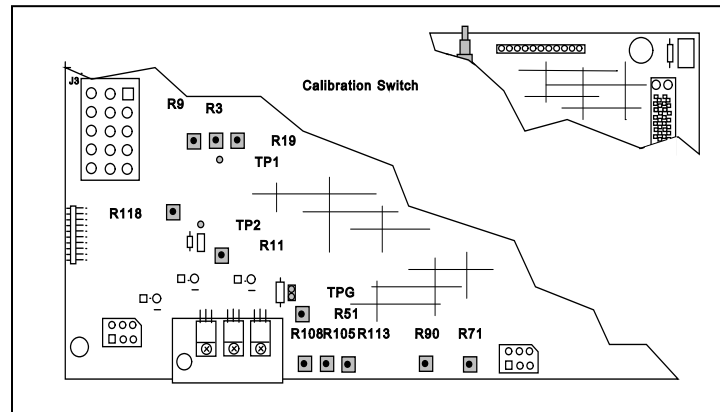
**WARNING:** Calibration should be performed only by a qualified electronics technician since the cover must be removed to provide access to the adjustment potentiometers. Contact with voltages present in the control may cause serious injuries.

##### Preliminary Setup

Set the POWER switch to the ON position and allow the Weld Head Control and all test equipment to warm up for 15 minutes prior to calibrating the system.

##### Procedure

- 1 Set the POWER switch on the rear panel of the Weld Head Control to the OFF position.
- 2 Disconnect the AC input power to the Weld Head Control.
- 3 Remove the Weld Head Control cover.
- 4 Reconnect the AC input power to the Weld Head Control and set the POWER switch to the ON position.
- 5 From the MAIN MENU screen, select CALIBRATION and press [ENTER]. This accesses the PRE-CALIBRATION screen. A series of screens will be displayed that will guide you through the calibration procedure. You may soon find it more convenient to follow only the calibration screens as you become more familiar with the process. You will need a small, flat blade screwdriver for making potentiometer adjustments.
- 6 Locate the Control Board, which is on the right hand side of the Weld Head Control. All of the test points and adjustment potentiometers are located on the Control Board. Refer to figure 1-1 on the last page of this procedure to locate the test and adjustment points.



**Figure 1-1. Control Board Test and Adjustment Points**

- 7 Set the Calibration pushbutton switch on the top edge of the Control Board to the Calibration (UP) position.
- 8 Connect the voltmeter to test point TP1 and ground it at test point TPG. Adjust potentiometer R19 for a reading of 0.00 VDC,  $\pm 1\text{mV}$ , on the voltmeter.
- 9 Press right arrow key [▶]. The voltmeter should now read approximately 5 volts. Adjust potentiometer R9 for a reading of 5.786 VDC,  $\pm 3\text{mV}$ , on the voltmeter.
- 10 Press right arrow key [▶]. Adjust potentiometer R51 to set the indicator bar to center scale, or zero. Notice there is a 4-digit number just to the right of the word “Calibrate.” For best accuracy, adjust this reading to 0000,  $\pm 2$ .
- 11 Press right arrow key [▶]. Move the voltmeter lead to test point TP2. Adjust potentiometer R11 for a reading of 0.00 VDC,  $\pm 1\text{mV}$  on the voltmeter.
- 12 Press right arrow key [▶]. Adjust potentiometer R3 for a reading of -2.014 VDC,  $\pm 1\text{mV}$ , on the voltmeter.
- 13 Remove the voltmeter from the circuit. Press right arrow key [▶]. Adjust potentiometer R71 to set the indicator bar to center scale, and the 4-digit reading to 0000,  $\pm 3$ .
- 14 Press right arrow key [▶]. Adjust potentiometer R105 to set the indicator bar to center scale, and the 4-digit reading to 0000,  $\pm 3$ .
- 15 Press right arrow key [▶]. Adjust potentiometer R90 to set the indicator bar to center scale, and the 4-digit reading to 0000,  $\pm 3$ .
- 16 Press right arrow key [▶]. Set the Calibration switch to the normal (DOWN) position. Adjust potentiometer R108 to set the indicator bar to center scale, and the 4-digit reading to 0000,  $\pm 3$ .
- 17 Insert the force gauge between the two electrodes. Press right arrow key [▶]. Adjust potentiometer R118 for a reading of 10lb,  $\pm 0.1\text{lb}$  (4.54 kg,  $\pm 0.04$  kg) on the force gauge.

## CHAPTER 4: SERVICE

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**Note:** Make certain that the force gauge is absolutely perpendicular to the electrodes. A holding fixture installed in the lower electrode holder is recommended.

- 18 Press right arrow key [▶]. Adjust potentiometer R113 to zero the indicator bar to center scale, and the 4-digit reading to 0000,  $\pm 3$ .
- 19 Press right arrow key [▶]. Verify that the reading on the force gauge is 2lb,  $\pm 0.3$ lb (0.91 kg,  $\pm 0.14$  kg). If the force gauge reading is out of tolerance, press [RUN] to exit and restart calibration from step 5 of this procedure. If the reading is within tolerance, press right arrow key [▶] and continue.
- 20 Use the up and down arrow keys to adjust the force gauge reading to 2lb,  $\pm 0.2$ lb (0.91 kg,  $\pm 0.09$  kg).
- 21 Press right arrow key [▶]. No more adjustments are necessary. Remove the force gauge from between the electrodes. Press [RUN] to exit the calibration screens and save the calibration settings in memory. The head will go through its start-up routine.
- 22 After the Weld Head Control screen has reached the MAIN MENU, set the POWER switch to the OFF position and disconnect the AC input power.
- 23 Apply Glyptol to all of the adjustment potentiometers, and replace the Weld Head Control cover. The calibration procedure is now complete.



# APPENDIX A

## TECHNICAL SPECIFICATIONS

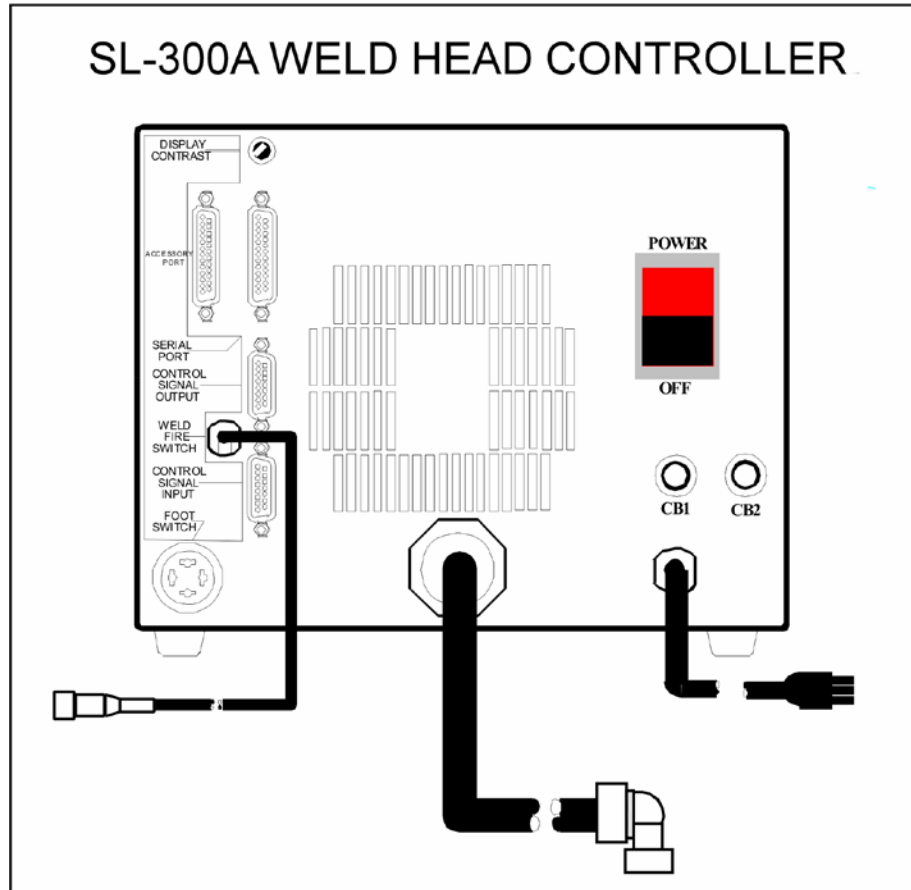
ITEM	SPECIFICATIONS
<b>Physical Dimensions:</b> <b>SL-301A / SL-302A</b> <b>Linear Actuator Module</b>  <b>SL-300A Electronic Weld Head Control</b>	<b>Dimensions:</b> 14 in. (H) x 2 in. (W) x 4 in.(D) 35.56 cm (H) x 5.08 cm (W) x 10.16 cm (D) <b>Weight:</b> 13 lbs. (5.9 kg) excluding electrode holder  <b>Dimensions:</b> 8 ½ in. (H) x 10 ½ in. (W) x 15 ⅛ in. (D) 21.59 cm (H) x 26.67 cm (W) x 38.42 cm (D) <b>Weight:</b> 45 to 48 lbs. (20.41 to 21.77 kg)
<b>Electrical</b> <b>Line Voltage:</b> <b>Line Current:</b> <b>Weld Current Input (max):</b> <b>Control Signals:</b>	100 / 115 / 208 / 230 VAC, single phase, 50/60 Hz 10A rms @ 100 / 115 VAC, 5A rms @ 208 / 230 VAC 5 kA Refer to Appendix B
<b>Operational</b> <b>Force:</b>  <b>Displacement (Setdown):</b>  <b>Position Overshoot:</b>  <b>Rate:</b>  <b>Stroke (max):</b>  <b>Electrode Holders</b> <b>SL-301A</b>  <b>SL-302A</b>	Response Rate: 50,000 lbs./sec (22,680 kg/sec) Rating (RMS) 7.8 lbs. (3.53 kg) Weld and Hold 20lbs. (0 to 9.07 kg) Impulse 50 lbs. (0 to 22.68 kg) Resolution 0.1 lb. (45 g)  Resolution 0.001 in. (25 microns) Measurement Resolution 0.0001 in. (2.5 microns)  None  Slew (max) 30 in. (76.2 cm)/sec Weld Repetition (self-limiting) (max) 4/sec  0.999" in. (2.54 cm)  In Line, Quick Change, 0.204 in. (6 mm) to 0.25 in. (6.35 mm) O.D. electrodes  1/8-inch offset electrodes



## APPENDIX B

# WELD HEAD CONTROL INPUT/OUTPUT SIGNALS

### Weld Head Control Connector Functions



**Figure B-1. Weld Head Control Connectors**

The connectors on the rear panel of the SL-300A Weld Head Controller are shown in figure B-1. The functions of the connectors are as follows:

- **ACCESSORY PORT:** 25-pin D-type connector to accommodate future expansion.
- **SERIAL PORT:** 25-pin D-type connector transmits weld force and weld displacement data, using RS-485 protocol, to a user data logging device or host computer. Refer to Appendix D and the SL-300A Serial Communications Interface Manual, No. 990-116, for pin assignments.

## APPENDIX B: WELD HEAD CONTROL INPUT/OUTPUT SIGNALS

- **CONTROL SIGNAL INPUT:** 15-pin D-type connector that receives control signals from external automation equipment for schedule selection, emergency shutdown, process inhibit and alarm relay control.
- **CONTROL SIGNAL OUTPUT:** 15-pin D-type connector that furnishes remote schedule selection signals to the power supply.
- **WELD FIRE SWITCH:** Initiates the power supply weld current.
- **FOOT SWITCH:** Initiates the weld cycle.
- Lower central cable with right-angle connector: Conducts command signals to, and feedback signals from, the Linear Actuator.
- Right bottom corner cable: Power mains input.

### CONTROL SIGNAL INPUT Connector

The CONTROL SIGNAL INPUT connector interfaces with a Programmable Logic Control (PLC) or host computer for operation in an automated environment. As shown in figure B-2, the connector accommodates three functional groups of signals: remote schedule selection, relay contact outputs, and process stop external inputs. The signal functions and pin assignments are listed in table B-1. Typical control signal input circuits are shown in figure B-3.

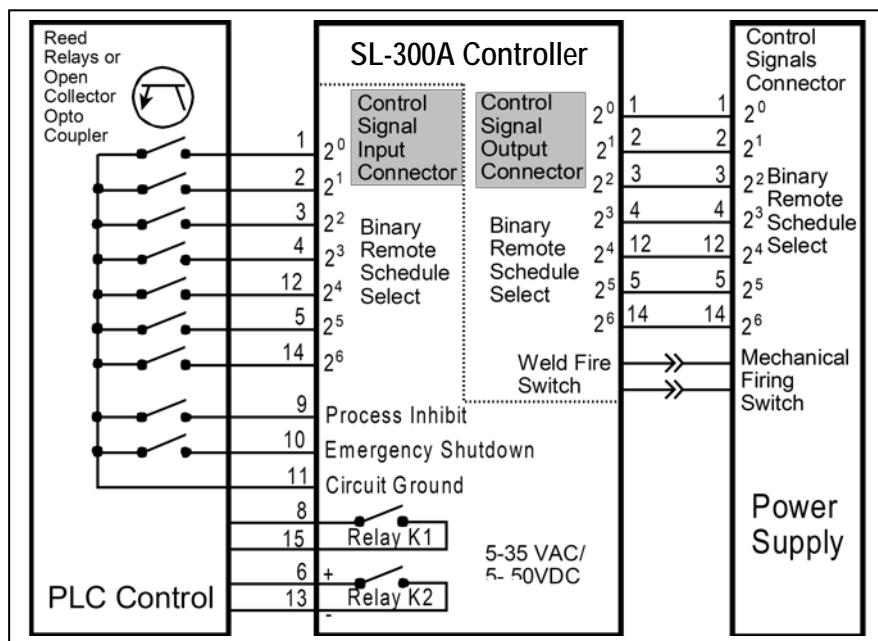


Figure B-2. PLC Interface Schematic Diagram

## APPENDIX B: WELD HEAD CONTROL INPUT/OUTPUT SIGNALS

### Remote Schedule Selection

These signals allow schedule selection via a binary parallel interface. The controlling device — a PLC or host computer, for example — should provide isolated dry relay contacts or open collectors from opto-couplers to activate these signals.

**Table B-1. CONTROL SIGNAL INPUT Connector Pin Assignments**

Pin No.	Signal Name	Function
<b>PARALLEL REMOTE SCHEDULE SELECTION INPUTS.</b> May be set up at any time during operation. Next first-level foot switch contact closure selects the next schedule. All lines have internal 1k ohm pull up to +5V and are active low. See figure B-3.		
1	$2^0$	Binary remote schedule select bit 1 (input 1)
2	$2^1$	Binary remote schedule select bit 2 (input 2)
3	$2^2$	Binary remote schedule select bit 3 (input 4)
4	$2^3$	Binary remote schedule select bit 4 (input 8)
12	$2^4$	Binary remote schedule select bit 5 (input 16)
5	$2^5$	Binary remote schedule select bit 6 (input 32)
14	$2^6$	Binary remote schedule select bit 7 (input 64)
<b>ISOLATED SOLID STATE RELAY CONTACT OUTPUTS</b>		
6	Relay K2 Output	+5-50 VDC (from user supplied power)
8	Relay K1 Output	5-35 VAC (from user supplied power)
13	Relay K2 Return	+5-50 VDC return
15	Relay K1 Return	5-35 VAC return
<b>PROCESS STOP EXTERNAL INPUTS.</b> All lines have internal 10 k ohm pull up to +5V and are active low.		
9	Process Inhibit	Process stop input
10	Emergency Shutdown	Emergency stop input
11	Circuit Ground	DC common

## APPENDIX B: WELD HEAD CONTROL INPUT/OUTPUT SIGNALS

### Emergency Shutdown Input

Connect a switch, reed relay or the collector of an opto-coupler to Pin 10 of the CONTROL SIGNAL INPUT connector to immediately terminate the welding process. No welding process can be initiated until the inhibit status of the input has been removed. The emitter of the opto-coupler must be connected to pin 11.

You can select the state of the input (normally open or normally closed) with the OPTIONS 1 screen. Refer to Chapter 3 under *Options Selection*.

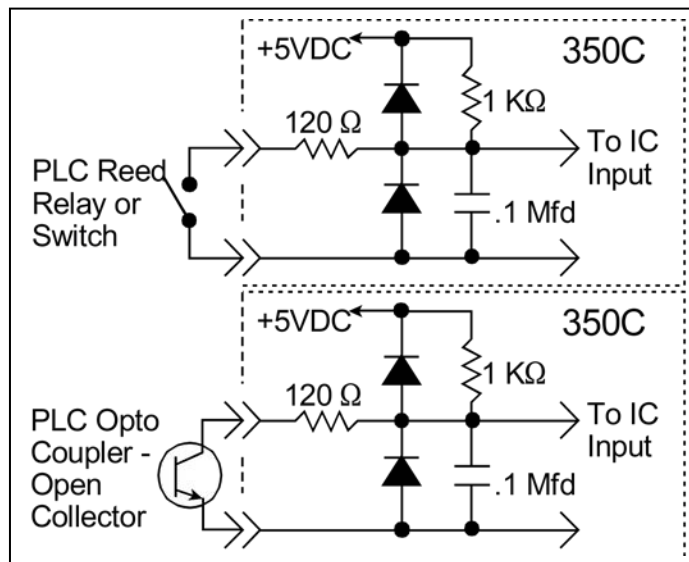


Figure B-3. Typical Control Signal Input Circuit

### Process Inhibit Input

Connect a reed relay or the open collector of an opto-coupler to pin 9 of the CONTROL SIGNAL INPUT connector to prevent a new welding process from beginning. No welding process can be initiated until the switch closure has been removed. The emitter of the opto-coupler must be connected to pin 11.

### Output Relays

Output relays K1 and K2 (see figure B-4) can be used to provide status or timing signals to a Programmable Logic Control (PLC) or host computer. When used for status signals, the relays can be independently programmed to close:

- when an alarm condition exists
- during the RUN state
- during the weld period, or
- during the entire welding cycle.

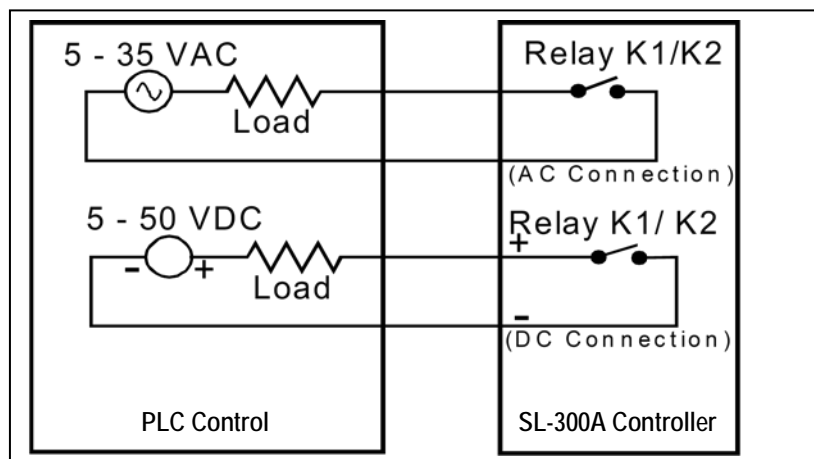


Figure B-4. Relay K1 and K2 Connections

As shipped, either relay can switch either AC or DC current. AC signals are limited to from 5 to 35 volts RMS at 0.5 amps maximum. DC signals are limited to from 5 to 50 volts at 0.7 amps. Polarity does not have to be observed.

To switch higher DC currents, either relay can be removed from its socket and reinserted two positions to the right. Maximum relay current is limited to 1.0 amps. Polarity must now be observed.

**CONTROL SIGNAL OUTPUT Connector**

When the control signal output cable is connected between this connector and the CONTROL SIGNALS connector on the HF2 or HF-2500A Power Supply, selecting a new schedule on the Weld Head Control automatically selects the identical schedule number on the power supply. On the UB25 Power Supply, the schedule must be separately set on the power supply. See table B-2 for the connector pin assignments.

**Table B-2. CONTROL SIGNAL OUTPUT Connector Pin Assignments**

<b>Pin</b>	<b>Signal Name</b>	<b>Function</b>
1	$2^0$	Binary remote schedule select bit 1 (input 1)
2	$2^1$	Binary remote schedule select bit 2 (input 2)
3	$2^2$	Binary remote schedule select bit 3 (input 4)
4	$2^3$	Binary remote schedule select bit 4 (input 8)
12	$2^4$	Binary remote schedule select bit 5 (input 16)
5	$2^5$	Binary remote schedule select bit 6 (input 32)
14	$2^6$	Binary remote schedule select bit 7 (input 64)
7	Logic Out	Not implemented
6	Logic In	Not implemented
11, 13	Circuit Ground	DC Common
Shroud	Chassis Ground	Power return
8, 9, 10, 15	None	Not used

**Weld Fire Switch Cable**

The 5-foot weld fire switch cable is terminated with an Amphenol 80-MC2M connector (Amada Weld Tech P/N 520-001) to connect to the power supply weld fire switch cable. Pin 1 is signal and pin 2 is digital ground. The weld fire switch signal initiates the power supply weld current when the SL-301A Linear Actuator (weld head) reaches the programmed weld force.

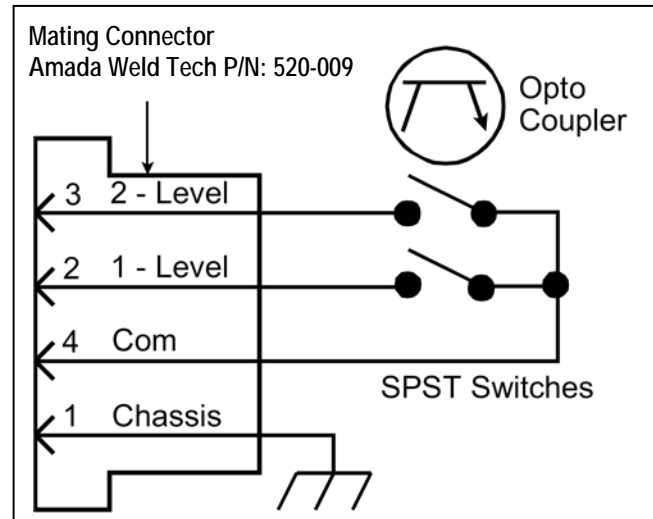
## APPENDIX B: WELD HEAD CONTROL INPUT/OUTPUT SIGNALS

### FOOT SWITCH Connector

The FOOT SWITCH connector uses a 4-pin Amphenol 91-PC4F (Amada Weld Tech P/N 550-006) bulkhead connector that mates with an Amphenol 91-MC4M (Amada Weld Tech P/N 520-009). The connections for the two-level FS2L Foot Switch are shown schematically in figure B-5. The pin assignments are listed in table B-3.

When the foot switch is pressed to the first level, the Weld Head Control energizes the weld head, causing the Upper Electrode to descend to the search position. If you release the foot switch before you press the foot switch to the second level, the Weld Head Control will automatically return the upper electrode to its up position so that you can re-position the parts. Once the second level has been reached and the programmed weld force has been reached, weld current will flow and the Weld Head Control will automatically return the upper electrode to its up position.

The FOOT SWITCH connector also accommodates a reed relay or an opto-coupler to initiate the weld operation. The emitter of an opto-coupler must be connected to pin 4.



**Figure B-5. Two-Level Foot Switch Connections**

**Table B-3. FOOT SWITCH Connector Pin Assignments**

Pin No.	Signal	Function
1	Chassis	Chassis ground
2	1-Level	Foot switch level-1 input. Internal 10 k ohm pull up to +5V. When grounded, head moves to SRCH position.
3	2-Level	Foot switch level-2 input. Internal 10 k ohm pull up to +5V. When grounded, head completes weld cycle.
4	Com	DC common



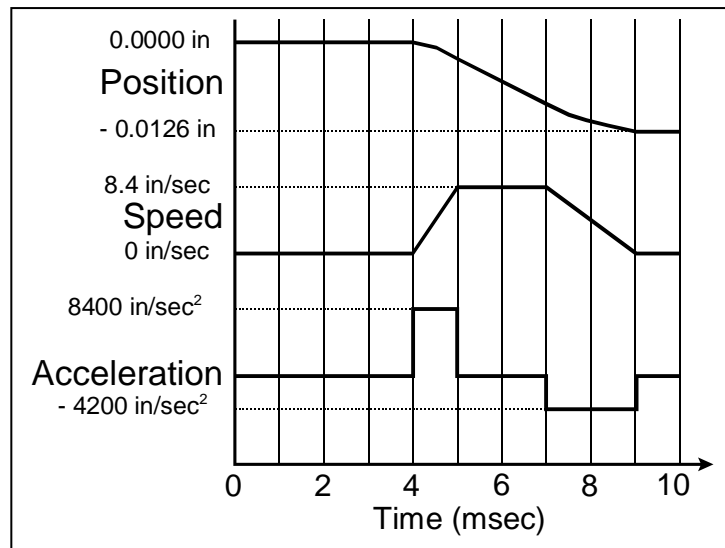
# APPENDIX C

## WELD HEAD DYNAMICS

This appendix describes graphically and textually the dynamics of the SL-300A Actuator during a weld cycle. The explanation should be useful to those who are tasked to install, set up and operate the system.

The following narrative steps describe the electrode status or action at each stage of the weld cycle.

- 1 The electrodes are brought into contact with the weld material.
- 2 The electrode force is increased to the programmed weld force. When the electrode stops moving and the weld force is established, the net force acting on the electrode is 0 (zero). That is, the weld force supplied by the linear actuator (or spring) is balanced by the reaction force of the weld material.
- 3 The resistance welding power supply is turned on.
- 4 Weld current flows through the electrodes and the weld material.
- 5 After a short period, the weld material softens or melts.
- 6 The net force on the electrodes is now no longer 0 (zero). The reaction force provided by the weld material decreases because the material has softened. Now, the electrodes start to move into the weld material. This movement, called 'follow-up,' compresses the weld material until the reaction force builds up again and exactly balances the applied weld force.
- 7 During the follow-up movement, the electrodes move from a dead stop to a certain speed throughout the follow-up period. Then, they stop when the reaction force builds up again. The time that is most crucial to weld quality is when the electrodes just start to move. They must accelerate rapidly to maintain force on the weld material to prevent expulsion.



## APPENDIX C: WELD HEAD DYNAMICS

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The above graph shows the relationship between the follow-up displacement (position), speed and acceleration over follow-up time during a typical cross-wire weld cycle. Note that the amount of acceleration needed to follow the deformation of the weld material is 8,400 inches (213 meters)/second<sup>2</sup>, or about a 22 g acceleration. That means that the weld force during the follow-up acceleration period must be at least equal to the applied weld force, plus 22 times the weight of the moving head mass (the electrode, flexures, weld head shaft, and so on).

Suppose the moving mass of the weld head weighs 1.4 lbs. (636 grams). In order for the weld head to execute the required motion shown in the diagram while maintaining a weld force of 4 lbs. (1.81 kilograms) on the weld material, the applied force must be increased to:

$$1.81 + (22 \times 0.63) = 15.7 \text{ kg, or}$$

$$4 + (22 \times 1.4) = 34.8 \text{ lbs}$$

A spring-driven weld head is adjusted to provide the weld force needed to create the right heat balance at the weld joint. If a spring drive were adjusted to provide 4.0 pounds of weld force for the above-describe weld, the electrode could not possibly accelerate fast enough to follow the deformation of the weld material and so avoid expulsion. This means that, with a spring-driven weld head, a compromise must be reached between proper heat balance and follow-up performance.

The SL-301A Linear Actuator, on the other hand, has the unique feature of a programmable follow-up force that is independent of the weld force. You can optimize both the weld force and the follow-up movement to get the best possible weld head dynamic behavior by:

- Setting the follow-up delay time (DLY) to cause the follow-up force to occur when the electrode should be accelerating into the weld material during follow-up, and
- Adjusting the follow-up force magnitude and duration (FWUP) to maintain the proper force on the weld material while the electrode is moving.

As a general guide for programming FWUP, multiply 2.5 lbs per each 0.001 inch (44.6 Kg/millimeter) of electrode displacement, then add this new constant to the weld force value. Use the combined total as the new programmed follow-up force. For example:

**Given:**

Existing weld force	10 lbs (4.54 kg)
Electrode displacement	0.004 in. (0.10 mm)

**New Constant:**

$$(2.5/0.001) \times 0.004 = 10$$

**New FWUP Force:**

$$\text{New constant} + \text{existing weld force} = 10 + 10 = 20 \text{ lbs. (9 kg)}$$

This degree of control and flexibility allows the SL-300A Fast Response Weld Head System to execute consistently high quality welds.

# APPENDIX D

## RS-232 Serial Communications

### Overview

The SL-300A Weld Head Controller has a single RS-232/485 SERIAL PORT connector for transmitting weld data to a serial data collecting device such as a Personal Computer (PC) or host computer. Multiple Weld Head Controls can be placed on a multi-drop RS-485 communications line for weld data collection by a host computer using the ASCII command language and protocol listed in the *SL-300A User's Manual*, Amada Weld Tech P/N 990-116.

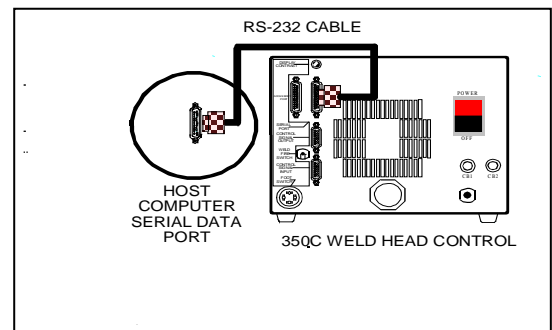
**Table D-1. Interface Protocol**

Parameter	Description
Baud Rate	1.2k, 2.4k, 4.8k, 9.6k, 14.4k, 19.2k or 28.8k bits/second
Stop Bits	1
Data Bits	8
Parity	None
Duplex	Half

### RS-232 SERIAL PORT Connections

Refer to figure D-1. The RS-232 SERIAL PORT connector is a standard 25-pin female D-Sub connector. This connector will mate with any standard 25-pin male D-Sub connector, such as the Amada Weld Tech P/N 250-479 connector (+ 250-027 connector shell).

Connect an RS-232 cable between your host computer COM1 or COM2 ports and the Weld Head Control serial data port.



**Figure D-1. RS-232C Serial Data Port Connections**

### RS-232 Serial Printer Operation

You can send weld data from the Weld Head Control directly to an RS-232 serial printer or host computer. To send weld data directly to a printer or PC, proceed as follows:

- 1 On the Weld Head Control, press [MENU] to access the MAIN MENU screen.
- 2 On the MAIN MENU screen, select ■COMMUNICATIONS to access the COMMUNICATIONS screen.

## APPENDIX D: RS-232 SERIAL COMMUNICATIONS

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- 3 On the COMMUNICATIONS screen, select ROLE: SLAVE.
- 4 Press [CHNG] to change the role to ROLE: MASTER.
- 5 Press [RUN] to return the Weld Head Control to the run state.
- 6 Connect a serial printer or PC using a straight-through RS-232 cable to the Weld Head Control **SERIAL PORT** connector.
- 7 Set the printer or PC communication parameters in accordance with the parameters listed in table D-1.
- 8 The Weld Head Control will now automatically send out weld data for each weld.

### Weld Data Output Format

The data fields in the weld data report packet are organized as follows:

*weld\_count,schedule\_number,thickness,setdown,weld\_time,weld\_status*

The fields are separated with commas and all fields are in integer format. The six fields in a report packet are as follows:

<i>weld_count:</i>	Weld count of the weld (0 - 9999999)
<i>schedule_number:</i>	Schedule number of the weld (0 - 127)
<i>thickness:</i>	Thickness of the weld material before the weld starts, in inches or millimeters. Resolution is 0.001 inch.
<i>setdown:</i>	Reading of the final setdown, in inches or millimeters. Resolution is 0.001 inch.
<i>weld_time:</i>	Duration of the weld signal. Resolution is 0.1 milliseconds.
<i>weld_status:</i>	Status of the weld.

An example of a weld data print out is:

17,0,0.005,-0.0004,10,0

where:

- 17 = weld count
- 0 = weld schedule number
- 0.005 = material thickness of 0.005 inch
- 0.0004 = setdown of -0.0004 inch
- 10 = weld time of 10.0 milliseconds
- 0 = weld status of 0, which is good.

# AMADA WELD TECH INC.

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