WSI WELD SYSTEMS INTEGRATORS, INC.

RESISTANCE WELDING. SOLVED.

### AC WELDER

# ST-100A
# ST-200A

# OPERATION MANUAL

990-351 Rev K

AMADA

AMADA WELD TECH

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## Revision Record

| Revision | EO | Date | Basis of Revision |
|---|---|---|---|
| A | 19123 | 12/01 | Initial Release |
| B | 19373 | 07/02 | Addition of technical upgrades and features and inclusion of other STA models. |
| C | 19557 | 11/02 | Inclusion of all STA Controls, and software upgrade to version 3.0. |
| D | 20369 | 03/05 | Updated technical information. |
| E | 21467 | 07/07 | Updated Schematics. |
| F | 42840 | 10/13 | Updated to Miyachi America name and logo. |
| G | 43479 | 11/14 | Updated to Amada Miyachi America name and logo. |
| H | 43808 | 08/15 | Updated to Amada Miyachi format, deleted obsolete models. |
| J | 45836 | 04/20 | Update Company Name (Amada Weld Tech), Update Model Numbers + Update Input Voltage Requirement |
| K | 46317 | 05/21 | See ECO for Details |

# FOREWORD

Thank you for purchasing an AMADA WELD TECH, ST-100A / ST-200A - AC Control / Power Supply. This unit is a component of a larger resistance welding system. Upon receipt, please inspect it thoroughly for shipping damage ***before*** you install it. If there is any damage, contact the shipping company immediately to file a claim, and notify us at:

**AMADA WELD TECH INC.**
**1820 South Myrtle Avenue**
**Monrovia, CA 91016-7133**
**Telephone: (626) 303-5676**
**FAX: (626) 358-8048**
**e-mail: info@amadaweldtech.com**

We have made every effort to ensure that the information in this manual is accurate and adequate. The contents of this manual are subject to change without notice. If you have any questions, find any errors/omissions, or if you have suggestions for improving this manual, please contact us.

## About This Equipment

The ST-100A / 200A consists of a cabinet which contains; (1) an AC Main Timer Board, (2) SCR Driver Board, (3) Control Panel Assembly, (4) valve + power transformers, (5) SCR assemblies + snubbers and (6) surge resistors. Unless ordered otherwise, ST-200A also contains a circuit breaker that disconnects when the front panel is opened. Four tabs on the rear panel provide convenient mounting of the unit. The ST-100A / 200A provides the user with all of the controls for establishing all weld modes and timing.

Control options include a Valve Expansion Board, communication capability, voltage monitoring, electronic pressure regulator control, force monitoring and either primary current sensor or input connector(s) for secondary current sensor(s).

AMADA WELD TECH is not responsible for any loss or injury 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 |
|---|---|---|---|---|
| STA-100A | 1-1-xxxx-xx-01 | → | ST-100A | 1-1-xxxx-xx-01 |
| STA-200A | 1-2-xxxx-xx-01 | → | ST-200A | 1-2-xxxx-xx-01 |

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# SAFETY NOTES

This instruction manual describes how to operate, maintain and service the ST-100A / ST-200A AC Control / Power Supply, and provides instructions relating to its SAFE use.

For SAFETY, and to effectively take advantage of the full capabilities of this Power Supply, please read these instructions before attempting to use the equipment.

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 unit.

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.

## WARNINGS

**HIGH VOLTAGE** is used in the operation of this equipment.

**DEATH ON CONTACT** may result if personnel fail to observe the safety precautions labeled on the equipment and noted in this manual.

**WHEN WELDING always** wear safety glasses.

**Disposal**

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

# 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).

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(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.

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**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.

**7. Inspection and Rejection of Nonconforming Goods.**

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

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

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

**8. Price.**

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

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

**9. Payment Terms.**

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

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

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

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**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 Acknowledgement, 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 Acknowledgement.

**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 91016or 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, ORARISING OUT OF OR RELATING TO ANY BREACH OF THESE TERMS, WHETHER OR NOT THE POSSIBILITY OF SUCH DAMAGES HAS BEEN DISCLOSED IN ADVANCE BY BUYER OR COULD HAVE BEEN REASONABLY FORESEEN BY BUYER, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE.**

(b) **IN NO EVENT SHALL SELLER'S AGGREGATE LIABILITY ARISING OUT OF OR RELATED TO THIS AGREEMENT, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, EXCEED THE TOTAL OF THE AMOUNTS PAID TO SELLER FOR THE GOODS SOLD HEREUNDER.**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**24. Dispute Resolution.**

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

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

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

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

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

# Chapter 1

# SYSTEM DESCRIPTION

## Section I: Features

### Overview

For the rest of this manual, **ST-100A / ST-200A Single-Phase AC Welding Control** will simply be referred to as the "***Power Supply,***" except in specific instances where unique descriptions are required such as specifications, connections, etc. In those instances ST-100A or ST-200A will be specified. The Power Supply has a wide variety of options, some are installed at the time of purchase and some may be added later. In addition, the operating controls and LCD display screen on the ST-200A may be installed on the front or side of the Power Supply enclosure, depending on your space requirements. As a result, each Power Supply is essentially "custom-built" to your specifications even though it is assembled using standard AMADA WELD TECH components.

This manual describes the most common or "typical" components and options. If you have questions about custom items in your Power Supply that are not covered in this manual, contact AMADA WELD TECH using the phone, e-mail, or mailing information in the front of this manual.

## CHAPTER 1: DESCRIPTION

### Standard Features

- Operates on 50 Hz or 60 Hz, self-detecting, no adjustments needed.
- Multiple pulse capability.
- Controlled current ramps.
- 300, 600, 1200, 1800, or 2200 amp SCRs with constant current control.
- Water-cooling of the 600 A and larger SCR assemblies.
- Programming features with LCD display.
- Programmable for spot, repeat, successive, or chaining modes.
- Continuous seam weld and roll spot seam welding capabilities.
- Programmable for 64 welding schedules.
- Valve drivers for up to four user-programmable valves are included in the basic unit.
- Supports air-actuated Retraction Valves.

### Optional Features

- A circuit breaker that removes power to the Power Supply when the door is opened (ST-200A).
- A Communications card that allows remote data collection and remote programming of the Power Supply.
- A Cascade Board Option that allows a Power Supply to operate multiple SCRs. Depending upon the model, up to 8 SCRs can be cascade fired.
- A Valve Expansion Option to increase user-programmable valve-driver capability to 12 valves.
- A Voltage Monitor Option that allows you to compare results against high and low limits, and monitor either peak or average voltage. This feature allows you to select when the voltage is monitored, either during both weld periods (excluding up/downslope) or during the last cycle of each weld only, which is useful for welding to a specific resistance.
- A Force Control (Force Output) Option that can control up to 8 separate (user supplied) electronic pressure regulators. Force is programmed in pounds using front panel controls. The Power Supply makes calculations to create accurate air pressure. Calibration is a simple 2-step procedure using front panel controls.
- A Pressure Control Option (Force Input) that uses differential pressure sensors is available for up to eight channels. You may use this feature in a Force-Firing function (welds only when correct pressure is reached), or as a pressure monitor to see if air pressure is in the desired range. Force firing can reduce cycle time by eliminating the need to program squeeze time, and it assures that every weld is made at the optimum force.

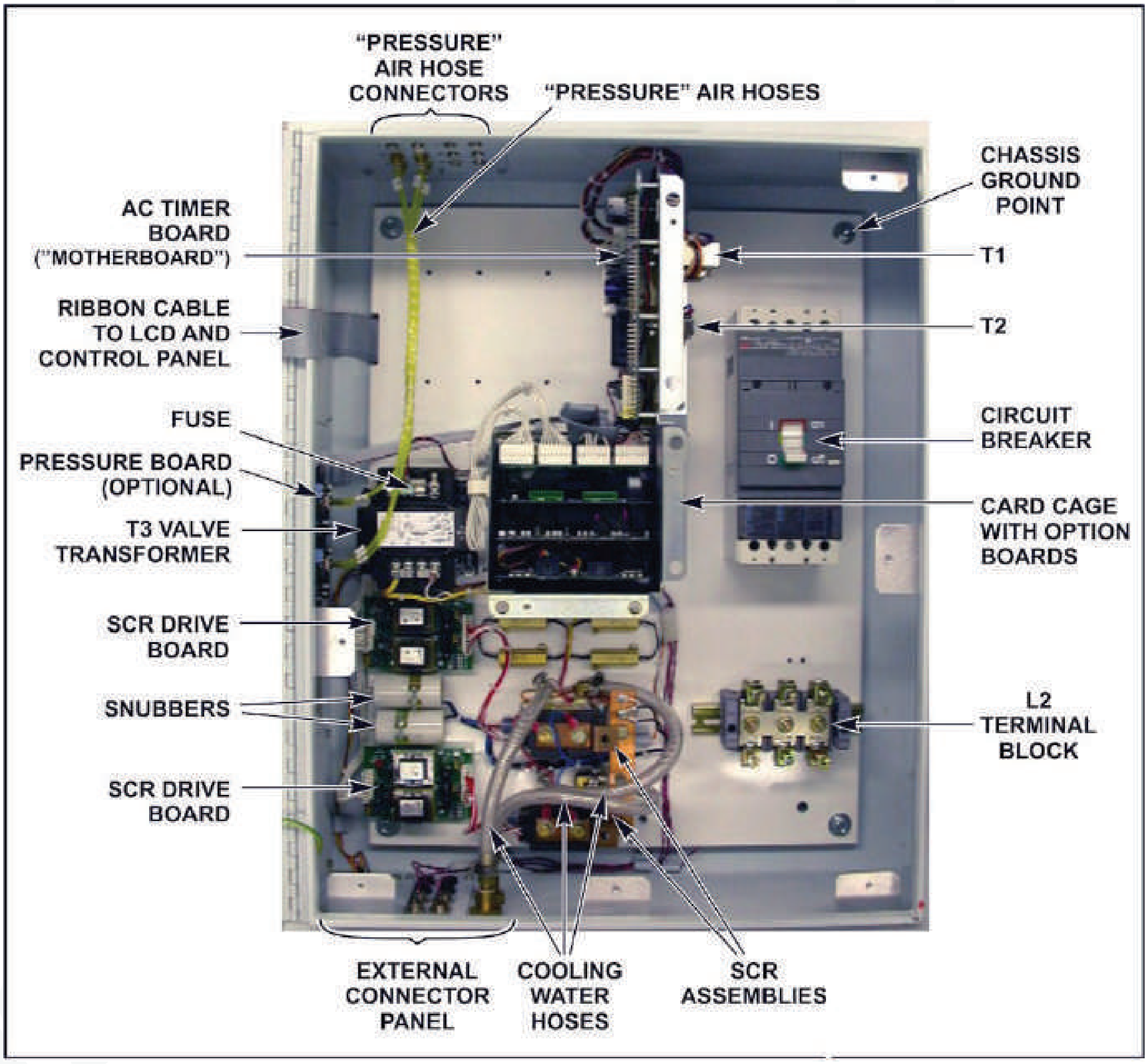
  **High**, **low** and **Firing Force** limits are programmed in pounds using front panel controls. Calibration is a simple 2-step procedure using front panel controls. Calibration correlates the pounds desired to the equivalent air pressure. This feature will check the air pressure for up to 5 seconds at the start of the squeeze delay period. If the force is within limits, the weld will continue. Otherwise, the weld will be aborted and an alarm will be triggered. If the pressure was out of limits at the end of a weld an alarm will be triggered.

  **NOTE:** This feature ***requires*** presence of the Force Control (Force Output) board, but does not require usage of the Force Output feature in order for Force Input to be functional.

# Section II: Major Components

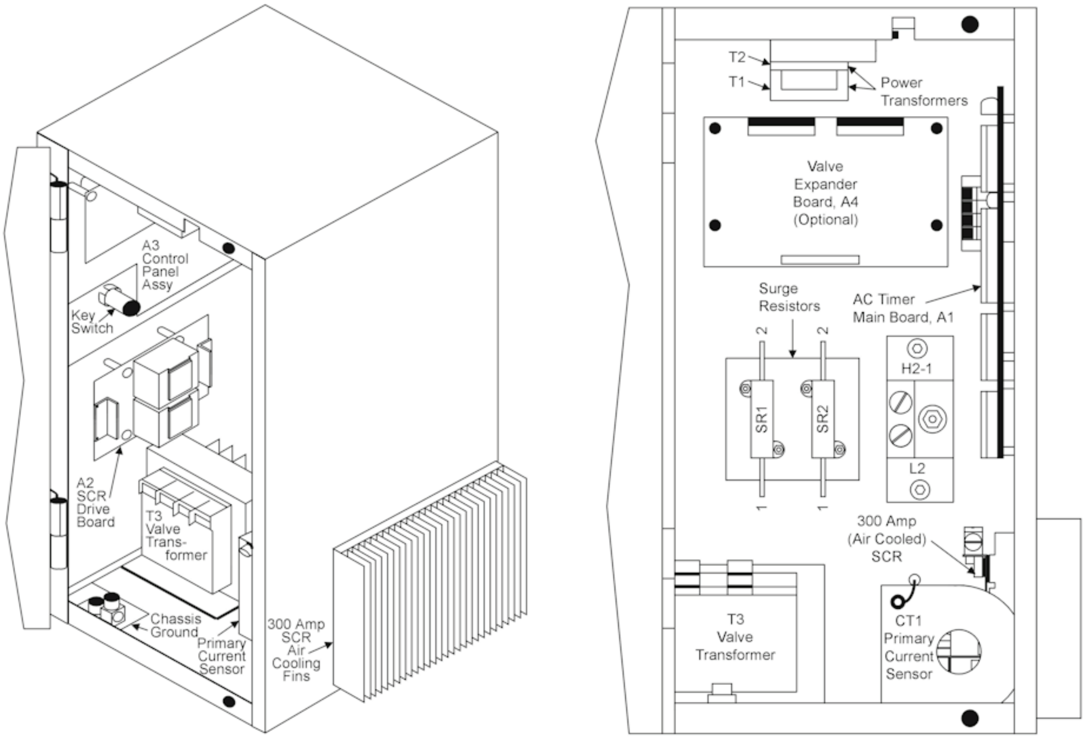
## Major Components

The following illustrations show a "typical" Power Supply. Your Power Supply may be different due to options that have been installed or to the physical configuration. For example, the LCD Display and operating controls can be factory-installed on the front or on the side of the Power Supply. Dimensions and weight for each model are listed in *Appendix A, Technical Specifications*.


"PRESSURE" AIR HOSE CONNECTORS
"PRESSURE" AIR HOSES
CHASSIS GROUND POINT
AC TIMER BOARD ("MOTHERBOARD")
T1
RIBBON CABLE TO LCD AND CONTROL PANEL
T2
CIRCUIT BREAKER
FUSE
PRESSURE BOARD (OPTIONAL)
CARD CAGE WITH OPTION BOARDS
T3 VALVE TRANSFORMER
SCR DRIVE BOARD
SNUBBERS
L2 TERMINAL BLOCK
SCR DRIVE BOARD
EXTERNAL CONNECTOR PANEL
COOLING WATER HOSES
SCR ASSEMBLIES

ST-200A Major Components (Typical)

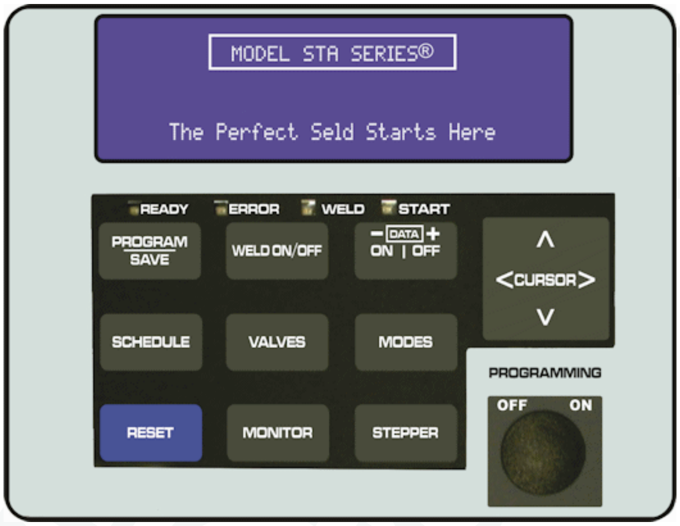
## CHAPTER 1: DESCRIPTION


A3
Control
Panel
Assy
Key
Switch
A2
SCR
Drive
Board
T3
Valve
Trans-
former
Chassis
Ground
Primary
Current
Sensor
300 Amp
SCR
Air
Cooling
Fins
T2
T1
Power
Transformers
Valve
Expander
Board, A4
(Optional)
Surge
Resistors
AC Timer
Main Board, A1
2
2
SR1
SR2
1
1
H2-1
L2
300 Amp
(Air Cooled)
SCR
T3
Valve
Transformer
CT1
Primary
Current
Sensor

ST-100A Major Components (Typical)

## Front Panel Controls and Indicators

All controls and indicators are located on the control panel shown below. The Control Panel Assembly is normally mounted on the access panel, but can also be mounted on the left-hand side of the box on ST-200A Power Supply.


MODEL STA SERIES®
The Perfect Seld Starts Here
READY
ERROR
WELD
START
PROGRAM SAVE
WELD ON/OFF
− DATA +
ON | OFF
^
<CURSOR>
V
SCHEDULE
VALVES
MODES
PROGRAMMING
OFF
ON
RESET
MONITOR
STEPPER

**ST-100A / ST-200A Controls and Indicators**

| | |
|---|---|
| **LCD Display** | White on blue 40 x 8 LCD display provides information for programming and monitoring the unit. |
| **Ready** | Red LED indicator lights when the Power Supply is ready to weld. |
| **Error** | Red LED indicator lights when a control error or weld error has occurred. |
| **Weld** | Green LED indicator lights when weld is occurring. |
| **Start** | Red LED indicator lights to indicate receipt of a start signal. |
| **Program/Save** | Pressing this pushbutton switch toggles the Power Supply between Program Mode and Run Mode. (In the Run Mode, entered data is saved; hence the name on the switch.) When in the Program Mode, the green LED on the pushbutton switch lights and the operator may enter program information using the **DATA** and **CURSOR** pushbutton switches. When in this mode, the Power Supply will not accept a Start signal.<br>At the completion of making Schedule Program changes, pressing the **PROGRAM/SAVE** switch again, saves all program changes and places the Power Supply into Run mode. During **Run Mode**, the **DATA ON/OFF** pushbutton switch will be disabled, preventing the operator from modifying programs. |

## CHAPTER 1: DESCRIPTION

**Weld ON/OFF** When the **WELD ON/OFF** entry (in the **Extended System Values** screen) is set to **LOCAL**, pressing this pushbutton switch will enable or disable the flow of weld current. The green LED lights when current is enabled. When current is disabled, the Power Supply can still sequence through its program and fire valves, but current will not flow.

**- Data +**
**ON | OFF** This is a two-position pushbutton switch. When the Power Supply is in the **Program** Mode, pressing this pushbutton switch will allow the operator to change the program settings. Holding the switch down (in either position) will scroll the values in the selected direction.

When the Power Supply is in the Run mode, the **WELD ON/OFF** switch is set to **OFF**, and the cursor is at the schedule number position, the operator can use this key to scroll through the schedules.

**Schedule** When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the current Schedule number's screen to be displayed. The cursor shall be at the unit digit of the Schedule #. If the Schedule # is changed, that specific schedule will be displayed. See Chapter 3 for details of this screen.

**Valves** When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the Valve screen to appear on the display. See Chapter 3 for details of this screen.

**Modes** When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the Mode screen to appear on the display. See Chapter 3 for details of this screen.

**Reset** Pressing this pushbutton switch will reset the Power Supply after a major error signal is received. (Major errors are **Emergency Stop, Over-temperature, No Current, Mode Change Error, End of Stepper Function, Weld1 or Weld2 Conduction High, Weld1 or Weld2 Current High, Full Wave Conduction, Illegal Schedule Number,** or **SCR shorted**.) Pressing this pushbutton also resets minor errors if auto reset is turned **OFF**. See *Chapter 3, Section VIII, Using ST-100A / ST-200A Control Functions*.

**Monitor** When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the Monitor screen to appear on the display. See *Chapter 3* for details of this screen.

**Stepper** When the **WELD ON/OFF** pushbutton switch is set to **OFF**, pressing this pushbutton switch will cause the **Stepper** screen to appear on the display. See *Chapter 3* for details of this screen.

This screen allows information to be programmed to compensate for gradual degradation of the weld electrodes by adjusting power to compensate for that degradation. Power can be adjusted either up or down.

**Cursor**

This is a four-position, momentary-action pushbutton switch. Pressing this pushbutton switch will allow the operator to move the cursor around the display.

**Left and Right Arrows ◄ ►** – In general, the right arrow will move the cursor from left to right, then to the left-hand field of the next line down, across that line, and so on. Upon reaching the bottom, right-hand field, the cursor will “roll over” to the top, left-hand field. The left arrow works in the reverse direction. Whichever arrow is pressed, when the cursor enters a field, it will automatically position itself at the rightmost position of a numeric field or the leftmost position of an **ON/OFF** or alphabetic field.

When in a numeric field, successively pressing the left arrow will move the cursor successively to the next higher order digit or, when the highest order number for that field is reached, to the previous field.

**Up and Down Arrows ▼ ▲** – These arrows will move the cursor to the field above or below the current field whose rightmost digit is closest to the current position of the cursor. Holding any cursor pushbutton down will cause the cursor to rapidly move in the appropriate direction, eventually rolling over from the last field to the first, or vice-versa.

While in Program Mode, when the cursor is in any position of a digit field, pressing the + or – key of the **DATA** pushbutton will cause the digit in that position to increment or decrement by one digit.

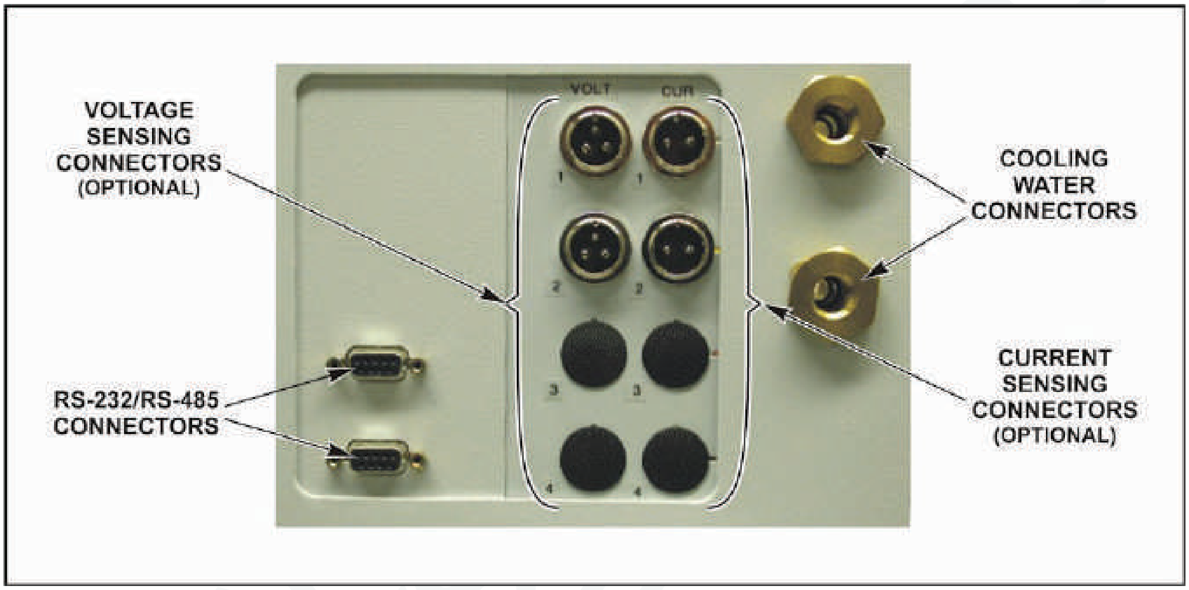
**Programming Lock**

This optional key lock prevents any change in the program when it is locked.

# CHAPTER 1: DESCRIPTION

## External Connectors

External connectors for Voltage Sensing, Current Sensing, Data & Communications (RS-232 or RS-485), and cooling water for the SCRs are on a panel that can be mounted on the top, bottom, or sides of the Power Supply.

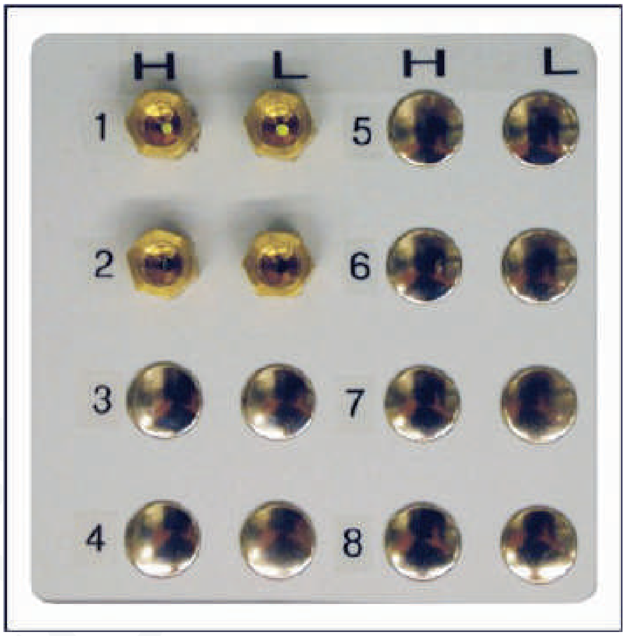

VOLTAGE SENSING CONNECTORS (OPTIONAL)
RS-232/RS-485 CONNECTORS
VOLT
CUR
1
1
2
2
3
3
4
4
COOLING WATER CONNECTORS
CURRENT SENSING CONNECTORS (OPTIONAL)

## Cylinder Air Hose Connections

If your Power supply uses Force Control, the air hoses for the Differential Pressure Sensors are located on a panel on the top of the Power Supply.

In the example on the right, this Power Supply is equipped with HIGH and LOW fittings for channels 1 and 2.

Standard ¼ NPT female fittings are supplied by the factory, but the customer must supply air connections and hoses in order to connect the Power Supply to the HIGH and LOW connections on the weld head(s). The HIGH fitting should be connected to the top (high-pressure side) of the cylinder that supplies welding force. The LOW fitting is connected to the bottom (low-pressure side) of that same cylinder. Make the connection to the weld head as close to the cylinder as possible in order to get accurate readings.



## Internal Access

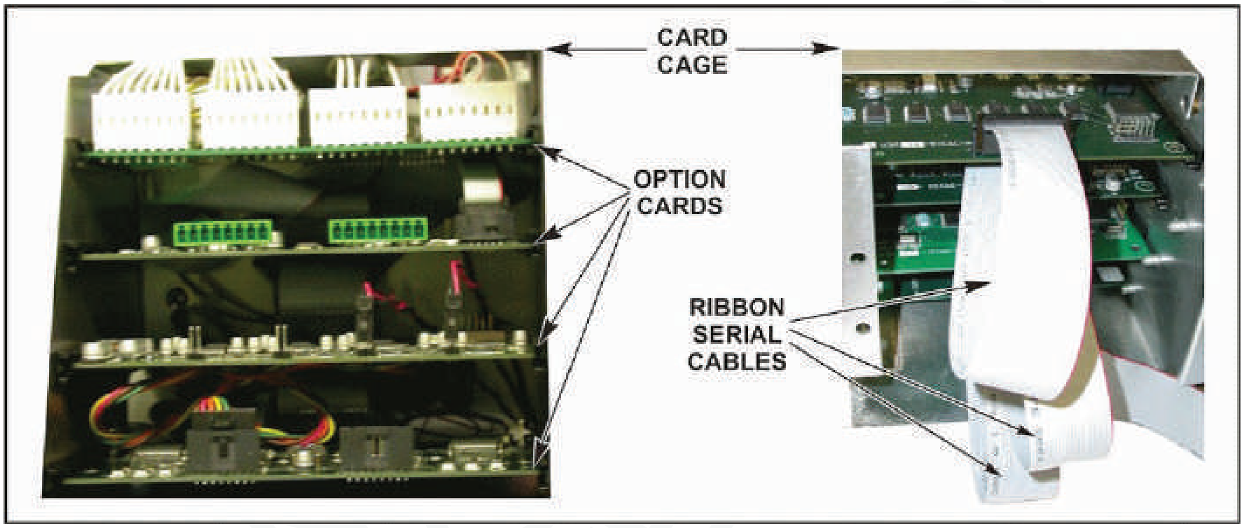
Access to the internal components is obtained by opening the door, which is secured with a screw-operated latch. There are no operator adjustments inside of the unit, so the door should not need to be opened except for initial installation (electrical connections) and for repair of components.

**NOTE:** If your unit is equipped with a circuit breaker, that breaker ***must*** be de-energized to open the door and access the components.

# CHAPTER 1: DESCRIPTION

## Option Cards

Printed circuit boards ("cards") for the ST-100A / ST-200A options can be installed in each Power Supply. The ST-100A has a card cage that can accept three option cards. The larger ST-200A models each have a card cage that can accept four option cards. Option boards can be inserted into a card cage in any order. No installation hardware is required, the cards merely slide into slots. A ribbon cable connects each of the option cards together, with the last output cable connected to the buss connector on the motherboard.



## Electrical Connections

The user must provide access holes for electrical connections (power and control). If the optional secondary current sensing has been ordered, the Power Supply will have the appropriate input connector(s) are factory-installed in the bottom of the Power Supply cabinet.

# CHAPTER 2

# INSTALLATION

## Section I: Installation

### Environmental Factors

We recommend that you install the Power Supply in a well-ventilated area that is free from excessive dust, weld expulsion, acids, corrosive gasses, salt, moisture, oil, coolant, and contaminants. Allow adequate space around the unit for power and signal cabling runs, water-cooling hose connections, and full length of open front door. Electrical and signal connections may be made from either the top or bottom of the Power supply.

The Power Supply is designed to work in the following ambient conditions:

| | |
|---|---|
| Temperature: | 32 °F – 104 °F (0°C – 40 °C) |
| Humidity: | 0% to 95%, non-condensing |
| Maximum altitude | 9,800 ft. (3,000 m) |

### Space and Mounting Requirements

Outline drawings of the ST-100A / ST-200A Power Supplies, including dimensions for the mounting holes, are included in *Appendix A, Technical Specifications.*

### Power Requirements

Power requirements are: 230 or 460 VAC (nominal), single phase, 50/60 Hz. (See Appendix A, Technical Specifications, for exact ranges.) Other voltages are available upon request.

**NOTE:** The Power Supply is a component of a larger resistance welding system. Please review the complete system requirements in order to install this component in compliance with all applicable codes and requirements. The external disconnect device must be rated no less than 115 percent of the full load current. If the Power Supply does not have an internal circuit breaker, an external power control (ON/OFF switch or contactor) must be provided at the junction box that feeds power to the Power Supply.

### Cooling Water Requirements

See *Appendix A, Technical Specifications*, for SCR cooling water requirements. The connections to the SCR are made with ¼-18 NPT fittings through the bottom of the Power Supply cabinet.

# Section II: Power Supply Set-up

## Unpacking

Unpack the Power Supply from its shipping box. The box also contains a Ship Kit with the components itemized on a packing list within the kit.

**NOTE:** Carefully save and store packing materials for future storage or shipment of the Power Supply.

## Installation

Installation consists of mounting the unit, making power and signal connections, and making cooling water connections.

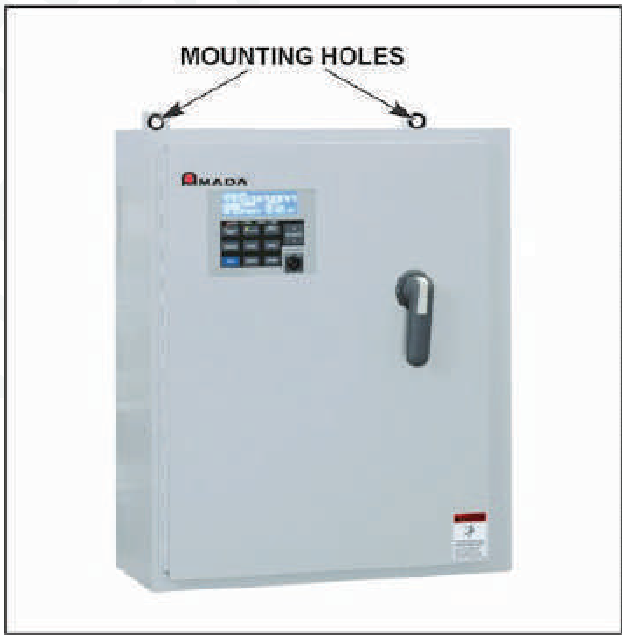
**CAUTION:** Protect electronic components from metal shards when drilling pilot holes and punching holes. Be sure all metallic shards are removed from the Power Supply after punching holes.

## Mounting the Power Supply

The ST-100A is small and is commonly used standing on a bench, but can be machine-mounted using the detachable mounting tabs shipped with the Power Supply. The ST-200A is designed for wall or machine mounting using the four mounting tabs, two with mounting holes (top) and two with mounting slots (bottom). Mount the unit with the display towards the top.

As each installation is different, no mounting hardware is provided for the cabinet. The holes on the mounting tabs are 0.44 inch diameter, and are designed for 7/16” screws or bolts. You will need to provide the appropriate screws or bolts, flat and lock washers, and nuts.

Loosely install the two lower mounting screws. Slide the Power Supply bottom (slotted) tabs into the two lower mounting screws. With one person holding the Power Supply in place, have a second person install the two upper mounting screws then tighten the two lower mounting screws.



Mounting Holes

## Connecting Electrical Power

For installation instructions, see *Appendix B, Electrical and Data Connections*.

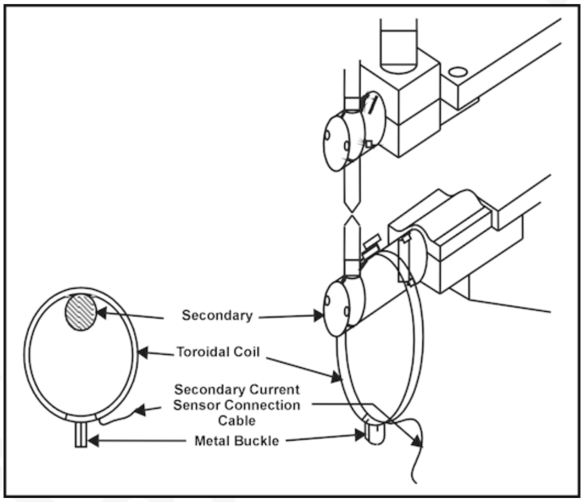
## CHAPTER 2: INSTALLATION AND SETUP

### Secondary Current Sensing

If you ordered Secondary Current sensing, toroidal coil(s), it will be shipped with the Power Supply, along with cable(s) that attach to the connector(s) on the bottom of the Power Supply. Place the toroidal coil(s) on the secondary of each weld transformer.

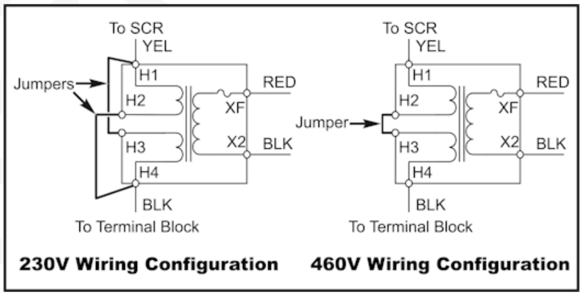
**NOTES For MB-400K and MB-800K Coils:**

- Make sure that the metal buckle on the toroidal coil is as far away from the secondary as possible.
- For most accurate measurement, do not distort the shape of the toroidal coil.


Secondary
Toroidal Coil
Secondary Current Sensor Connection Cable
Metal Buckle

Placement of Secondary Current Coils

**NOTE:** Unless otherwise ordered, Power supplies are shipped with the Valve Transformer T3 connected for 460 V configuration. If you reconfigure the unit for 230 V, you must change the jumpers as shown on the right.


To SCR
YEL
Jumpers
H1
H2
H3
H4
XF
X2
RED
BLK
BLK
To Terminal Block
230V Wiring Configuration
To SCR
YEL
Jumper
H1
H2
H3
H4
XF
X2
RED
BLK
BLK
To Terminal Block
460V Wiring Configuration

Valve Transformer Wiring Connections

### Cooling Water Hose Connections

Connect the water, specified in *Appendix A, Technical Specifications*, using water hoses and ¼-18 NPT fittings. The installation site should be free of sudden temperature fluctuations and the humidity should be ≤ 95% (non-condensing).

> **CAUTION:**
> Verify that the cooling water lines do not condense with moisture. If necessary, increase the external cooling water temperature to raise the dew point and prevent condensation.

### Input / Output Signal Connections

Connect the input/output (I/O) signals as shown in the *Appendix B, Electrical and Data Connections*.

## CHAPTER 3

# USING ST-100A / ST-200A CONTROL FUNCTIONS

## Section I: Overview

To ensure accurate, consistent welds, the Power Supply delivers extremely precise pulses of energy to the weld head. Each pulse is comprised of weld-time and weld-energy values pre-programmed by the user. The Power Supply with optional primary or secondary current coils is a closed-loop welding control using internal or external sensors to measure the weld-energy delivered to the weld head. Weld-energy feedback instantly goes to the Power Supplies logic circuits that actively correct the pulse to compensate for any variation in part resistance. The Power Supply also has several monitor functions that give you remarkable control over the welding and production process. Together, these features ensure precise, consistent welds, higher productivity, a lower rejection rate, and longer electrode life.

The Power Supply contains internal software that gives you a great deal of flexibility in the setup and use of your welding system. The Power Supply software displays various menu screens on the LCD, each containing prompts telling you which of the Power Supplies front panel controls to use in order to customize operating parameters, set the Power Supply for use in an automated welding system, and program communication settings if you are using the optional Communication capability.

This chapter describes Power Supply functions in the following sections based on the LCD screens:

- Schedule Screen
- Valves Screen
- Monitor Screen
- Monitor Counts Screen
- Mode Screen
- Linked Schedules Screen
- System Wide Values Screens (3)
- System Valve Status Screen
- Force Calibration Screen
- Stepper Screen

***Before*** programming the Power Supply, you must be familiar with the **location** and **function** of the LCD and front panel controls. If you need more information on these controls, see *Chapter 1, Description*.

*Chapter 4, Operating Instructions*, contains the step-by-step instructions on how to program each of the functions above.

## CHAPTER 3: USING ST CONTROL FUNCTIONS

# Section II: Schedule Screen

The **SCHEDULE** screen consists of the following settings shown on the right.

```
SCHEDULE # 01
SQD  SQZ  UP1  W1  DN1  CO  UP2  W2  DN2  HLD OFF
 00   00   00  00   00  00   00  00   00   00  00
                060%                000%
CH=F1    FORCE=0150Lb    ElecValve=01    SCR=1
IMPULSE=01        COPY TO # 00    PLUS 00 ↵
SCR          1
VALVES 1   2   3   4
```

**SCHEDULE # -** The schedule number is programmable from **00** to **63**; the default is **00** on initial operation. Changing the schedule number will automatically display that schedule on the screen.

Pressing the **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run** Modes. Placing the system in the **Run Mode** automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:

```
MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
   MODIFICATIONS, THEN PRESS DESIRED
   SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
   MODIFICATIONS
```

**Links** – If the schedule is part of a linked sequence, the upper-right corner of the screen will show the links as a set of three 2-digit numbers.

1) First number: **Previous** schedule
2) Second number: **Current** schedule being used (shown in brackets ◄ ►).
3) Third number: **Subsequent** schedules in the link.

```
SCHEDULE # 01                             07<03>05
SQD  SQZ  UP1  W1  DN1  CO  UP2  W2  DN2  HLD OFF
 00   00   00  00   00  00   00  00   00   00  00
                 60%                000%
CH=F1    FORCE=0150Lb    ElecValve=01    SCR=1
IMPULSE=01        COPY TO # 00    PLUS 00 ↵
SCR          1
VALVES 1   2   3   4
```

In the example shown above ( **07<03>05** ), **07** is the previous schedule used, **03** is the current schedule being used, and **05** will be the next schedule used. If the current schedule is the *first* of the link, the first 2-digits will be " – – ". Similarly, if it is the last of the link, the last 2-digits will be " – – ".

**NOTE:** Each of the following weld sequence settings are programmable from **00** to **99** cycles. The default is **00** for all values except **W1** and **W2**, whose defaults are **01**.

**SQD** – Squeeze delay is that period between receipt of the start signal (FS1 or FS1/FS2) and the start of the SQZ (squeeze) time. It allows the electrodes to move to the parts and build up force.

**SQZ** – The squeeze time is the delay from the receipt of the start signal (or the end of SQD) until UP times begin (weld power is not necessarily applied). It allows the system to settle and any mechanical motion or ringing to stop before welding begins.

**UP1** – This is the upslope time for weld 1 of the sequence.

**W1** – This is the weld 1 time of the sequence.

**DN1** – This is the downslope time for weld 1 of the sequence.

**CO** – This is the cool time between weld 1 downslope and weld 2 upslope in the sequence.

**UP2** – This is the upslope time for weld 2 of the sequence. (See **IMPULSE**)

**W2** – This is the weld 2 time of the sequence.

**DN2** – This is the downslope time for final weld 2 of the sequence. (See **IMPULSE**)

**HLD** – This is the hold time (the time the valve is held on) after the **DN2** ends. (See **IMPULSE**)

**OFF** – This is the off time at the end of the weld cycle. The electrode valve is turned off at the beginning of hold (**HLD**) time. All other valves are turned off at the conclusion of **OFF** time.

**NOTE:** Some of the items in the **SCHEDULE** screen will differ depending on the Power Supplies operating **MODE** (described in *Section VI, Mode Screen*).

**CURRENT SETTING** – The current settings are presented directly below the **W1** and **W2** settings. When **CONTROL MODE** is set to **%HEAT**, the percentage of the available power is programmable from **000%** to **100%**. The minimum conduction angle is 20 degrees of power at a power factor of 1.0. As the power factor decreases, the minimum conduction angle may increase. When **CONTROL MODE** is set to **PRI C.C.** or **SEC. C.C.**, the current setting is programmable from **00.0 kA** to **80.0 kA** for best results, this value should be between 20% and 95% of the full current. (Power Supply may operate beyond this range, but not within accuracy and regulation specifications.)

**CH** – Force Output Channel selected. Settings include **NONE** (the Force option is not installed), and **F1-F8** (The output for SCR 1 goes through F1, SCR 2 through F2 and so on). The **F1-F8** option allows the Power Supply to operate up to 8 independent electronic pressure regulators.

**FORCE** – Force output (in lb.) for the Force Output Board (electronic pressure regulator). See the appendix for details on how to calibrate this option. This is the electronic pressure regulator output only. This valve should be set to match the **FIRE =** firing force in the Monitor Screen. See Section IV: Monitor Screen for programming limits on the force input option.

**NOTE:** The following six functions are identical for all three operational modes.

**ElecValve** – This number indicates the valve that is associated with the welding electrode in the selected schedule. Its associated SCR appears to the right.

**SCR # –** When there are multiple SCRs, the number presented represents the SCR that will be fired for that schedule. It is programmable in the **System Wide Values** screen (below) from 1 to the number of SCRs in the control (maximum of 8); the default is 1.

**IMPULSE** – This number is the quantity of Weld 2 operations. It is generally used in applications such as stitch welding, which involves a series of spaced spot welds, similar to a sewing stitch. Impulse is programmable from **01** to **25** times, with a default of **01**. If there are more than one Weld 2 operations, the programmed **UP2** time applies only to the first pulse and the programmed **DN2** time applies only to the last pulse, after which the **HLD** and **OFF** times occur. The time between each Weld 2 pulse is determined by the programmed **CO** time.

## CHAPTER 3: USING ST CONTROL FUNCTIONS

**COPY TO #** – Copying a schedule —this includes all functions such as valves, etc.—to another schedule is done by changing the schedule number to the (new) desired schedule number. (It is assumed that the new schedule is not already in use). By placing the cursor on the ↵ symbol next to **COPY TO #,** entering the number of schedules beyond this **COPY TO #,** and pressing the **DATA +** pushbutton, the original schedule will be copied to the new schedule(s).

For example**, COPY TO 10 PLUS 02** will copy the current schedule to schedules **10, 11** and **12**. The following message will be displayed:

**SCHEDULES HAVE BEEN COPIED**
**PRESS ANY SCREEN KEY TO CONTINUE**
**I.E. SCHEDULE, VALVES, MODES,**
**OR MONITOR**

# Section III: Valves Screen

```
SCHEDULE #01       VALVE

ELECTRODE VALVE  01
STATUS COUNT
1=ON   00200
2=OFF  00000
3=OFF  00000
4=OFF  00000
```

The Valve screen is used to program which valves will turn on during a welding schedule. (See *Appendix D, System Timing* for details.) The standard unit has four valves, and an additional eight valves can be added for a total of twelve. The screen will show entries for the correct number of valves in that particular unit. The **Valves** screen consists of the settings shown above.

**SCHEDULE # -** The schedule number is used to select the program number that will control the valves. Entering a schedule number will automatically display the associated valve data for that schedule. The schedule is programmable from **00** to **63**.

Pressing the **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run Modes**. Placing the system in the Run Mode automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:

```
MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
MODIFICATIONS, THEN PRESS DESIRED
SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
MODIFICATIONS
```

**ELECTRODE VALVE** – This item displays the electrode valve number which is used with this schedule. The valve is selected using the Schedule screen.

**STATUS –** Valves are scheduled either **ON** or **OFF**. If set to **ON**, a valve will turn on at the start of the squeeze delay (**SQD**). (See *Appendix D, System Timing* for details.)

**COUNT –**This is a display-only field and allows the operator to view the weld count used in the **Stepper** function.

## CHAPTER 3: USING ST CONTROL FUNCTIONS

# Section IV: Monitor Screen

Press the **MONITOR** button on the Control Panel to get the **MONITOR** Screen.

**NOTES:**

- These **W1** and **W2** values are the results of the weld.
- These **W1** and **W2** values are the limits that were programmed ***before*** the weld.

```
SCHEDULE  #00        MONITOR
      CURR(KA)     COND     VOLTS          FORCE (LB.)
W1    00.0         000°     0.00           START  END
W2    00.0         000°     0.00           0000      0000
       LO     HI    HI       LO     HI     LO        HI
W1    N/A    N/A   N/A      0.00   0.00    0000      0000
W2    N/A    N/A   N/A     0.00    0.00    FIRE =   0000
                                                Counts ↲
```

**CURR –** Displays the average weld current for **Weld 1 (W1)** and **Weld 2 (W2)** during the previous weld. This data is not programmable. A primary or secondary current coil is required to collect this data.

**COND -** Displays the conduction (**COND**) angle for **Weld 1 (W1)** and **Weld 2 (W2).** This data is not programmable.

**VOLTS –** Displays the voltage measured from the last weld if the optional voltage card has been installed. See Section VIII details on System Valves Screen 3 for instruction on how to program this reading for peak or RMS readings over the whole weld period or for the last cycle only.

**FORCE (LB.) -** Displays the force in lb. at the start of the squeeze period and at the end of the weld. This reading and the associated limits require the optional force input card to be installed.

**LO –** This field sets the low limit for the associated parameter. Current is programmable from **50%** to **100%** for W1 and W2. A setting of **100%** is equivalent to the low monitor being **OFF**. This limit is not applicable in **Percent Heat Primary** and **Percent Heat Secondary** modes. The Voltage is programmable from 0.1 to 9.9 V. A setting of 0.00 is equivalent to the low monitor being off. Force is programmable from 1 to 9999 lb. This setting is a programmable force-firing switch. When the force reaches this limit (and stays within a HI limit if programmed) the weld will continue (e.g. Squeeze Delay and Squeeze could both be set to 1 cycle and the lower force limit will trigger the weld, thus shortening cycle times). A setting of 0000 is equivalent to the low monitor being off. See Chapter 4 Section V for a list of associated error messages.

**HI –** This field sets the high limit for the associated parameter. Current is programmable from **100%** to **150%**. A setting of **100%** is equivalent to the high monitor being **OFF**. This limit is not applicable in **Percent Heat Primary** and **Percent Heat Secondary** modes. The conduction angle limit is programmable from **000** to **180** (degrees) in primary constant current and secondary constant current modes. This limit is not applicable in **Percent Heat Primary** and **Percent Heat Secondary** modes. Setting the limit to **180** degrees turns this limit **OFF.** Voltage is programmable from 0.1 to 9.9 V. A setting of 0.00 is equivalent to the high monitor being off. Force is programmable from 1 to 9999 lb. A setting of 0000 is equivalent to the high monitor being off. See Chapter 4 Section V for a list of associated error messages.

**FIRE = This field requires installation of the differential pressure input. When this option is installed,** this field sets the force at which the weld head will fire. The weld force setting in the schedule screen should match this value. The actual weld force measured by the control must be greater than this value and less that a **HI** limit (if programmed) for the weld to proceed. In order to prevent pressure spikes from inadvertently triggering the weld, an initial good reading is followed by a 4 cycle delay after which the pressure is again checked against the limits. If both readings are within the acceptable range, the weld will proceed. If not, the Power Supply will wait for about 5 seconds for acceptable pressure readings. If acceptable readings are not reached within that period, a minor error will be recorded.

**Counts ↲ --** This control takes you to the **MONITOR COUNTS** screen.

## CHAPTER 3: USING ST CONTROL FUNCTIONS

# Section V: Monitor Counts Screen

To get the **MONITOR COUNTS** Screen, press the **MONITOR** button on the Control Panel, go to COUNTS at the bottom of the screen, highlight the ↵ symbol and press the Data + key.

The **MONITOR COUNTS** screen consists of the following settings and readouts shown on the right.

```
SCHEDULE  #00          MONITOR COUNTS

WELD COUNT → 0001           STEP # → 01
WELD COUNT LIMIT=2990       STEP COUNT → 0001
SET WELD COUNT=0↵           ELECT.VALVE → 01

                                              Back ↵
```

**SCHEDULE # -** The schedule number is used to select a particular schedule whose associated monitor data is to be displayed. The schedule is programmable from **00** to **63**, the default being the last schedule saved. Pressing the **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run Modes**. Placing the system in the **Run Mode** automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:

```
MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
MODIFICATIONS, THEN PRESS DESIRED
SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
```

If no data field has been changed, the software will allow control buttons on the panel to function. Entering a new **SCHEDULE #** shall cause the Power Supply to switch to that new schedule and display it on the screen.

**WELD COUNT** – Displays the total number of welds for the schedule. This data is not programmable.

**WELD COUNT LIMIT** – Programmable from **0000** to **9999** with the default being **0000**, which sets the weld count limit to **OFF**. When the **WELD COUNT** reaches this user programmed number, an error signal is transmitted from the Fault output and a fault message screen **WELD COUNT REACHED WELD COUNT LIMIT** is displayed. (See Error Messages in Chapter 4.)

**SET WELD COUNT = 0** – Placing the cursor at the ↵ symbol and pressing the plus key, sets the weld count of a schedule to zero.

**STEP # --** Displays what step the schedule is on. This data is not programmable. When the Stepper is off, **00** is displayed. When the **Stepper** is reset, this value updates after the following weld.

**STEP COUNT** – Displays the current weld count of the step. This data is not programmable. When the Stepper is off, **0000** is displayed.

**ELECT. VALVE** – This item displays the electrode valve number used with this schedule. The valve is selected using the **Schedule** screen.

## Section VI: Mode Screen

Press the **MODE** button on the Control Panel to get this screen.

The **MODE** screen is used to set up various parameters used in welding. The **Weld Mode** screen consists of the settings shown on the right.

```
SCHEDULE  # 01                 MODE

START=MAINTAINED
WELD MODE=SPOT WELD
LINKED SCHED ↵
GO TO SYSTEM VALUES SCREEN       1   ↵
GO TO SYSTEM VALUES SCREEN       2   ↵
GO TO SYSTEM VALUES SCREEN       3   ↵
```

**SCHEDULE # -** The schedule number is used to select the schedule for making parameter settings. Entering a particular schedule number will cause the previously selected parameters for that schedule to be displayed. The schedule is programmable from **00** to **63**.

The **PROGRAM/SAVE** pushbutton toggles between the **Program** and **Run Modes**. Placing the system in the **Run Mode** automatically saves the currently displayed values for the schedule.

If any changes have been made in any data field, the system will prevent the operator from changing to a different schedule until the changes have been accepted or rejected. The operator will get the following message:

```
MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
MODIFICATIONS, THEN PRESS DESIRED
SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
MODIFICATIONS
```

If no data field has been changed, the software shall allow control buttons on the panel to function. Entering a new **SCHEDULE #** shall cause the Power Supply to switch to that new schedule and display it on the screen.

**START** – This control determines how the Power Supply reacts to an external **Start** signal. A different type of start signal can be set for each schedule. It can be set for **PULSED, LATCHED, MAINTAINED**, or will appear as **SEAM** if the unit is a seam welder.

- If set for **PULSED**, the **Start** signal need only be held until **Squeeze Delay** (**SQD**) is completed.
- If set for **LATCHED**, the **Start** signal need only be held until **Squeeze** (**SQZ**) is completed. If **SQZ** is used, and the **Start** signal is interrupted before **W1** or **W2** begins, the control will abort the schedule being fired.
- If set for **MAINTAINED**, the **Start** signal must be maintained throughout the entire process from **SQZ** to **Hold** (**HO**) or the process will abort. When in **SEAM START** mode, the weld can be aborted during **SQD** time by releasing the **Start** signal. If the **Start** signal is held beyond the end of **SQD** time, the seam schedule will begin by initiating **SQZ, UP1**, and **W1**, (if so programmed). The **CO, UP2**, and **W2** sequence will then be repeated until the **Start** signal is released. When the **Start** signal is released, **CO, UP2**, and **W2** will run to completion and the schedule will conclude with **HO** and **OFF** times. (See *Appendix D, System Timing* for details.)

## CHAPTER 3: USING ST CONTROL FUNCTIONS

**WELD MODE** – This control selects one of six welding modes:

- **Spot Weld Mode** – This is the basic default weld.
- **Repeat Mode** – When this mode is being used, the entire weld cycle from **Squeeze** through **OFF** is repeated as long as the start signal is present. **Squeeze Delay** occurs only for the first weld cycle. The **OFF** time between repetitions is set by the program, but it will be a minimum of one cycle (even if "**0**" cycle is selected).
- **Successive Mode –** This mode sequences through a series of previously selected and linked weld schedules. Each schedule begins with the presence of a separate Start signal. There is a pause between each schedule until a new Start signal is received. To set up a succession, select the first desired schedule, then turn Successive Mode ON at the Mode screen. Repeat the procedure for subsequent schedules in the succession. Then link the schedules together in the correct sequence. (See Section VII: Linked Schedules Screen for this procedure.)

  The **Successive Mode** can be started at any schedule in the linked sequence. To start in any schedule in a link, press the **DATA+/-** keys to select the first schedule to be fired. Press the **PROGRAM/SAVE** key to save this schedule as the beginning of the sequence. Each subsequent **Start** signal will then cause the next schedule in the linked sequence to be selected. At the end of the sequence, the weld sequence stops and awaits another start signal. The Power Supply returns to the *first schedule fired in that succession* whether or not that schedule is the first one in the **link**. For instance, if schedules **01** through **06** are set up in the link, but the weld operation is started with schedule **03**, after completing schedule **06**, the Power Supply will return to schedule **03** rather than schedule **01**.

  During welding in **Successive Mode**, the screen displays the currently active schedule.
- **Chaining Mode –** When in the Chaining Mode the operation sequences through a series of linked weld schedules with the presence of only a single Start signal. Unlike the Successive Mode, it does not pause between schedules.

  To set up a sequence, select the first desired schedule, then turn **Chaining Mode ON**. Repeat the procedure for subsequent schedules in the sequence. Then link the schedules together in the correct sequence. (See Section VII: Linked Schedules Screen for this procedure.).

  The **Chaining Mode** can be started at any schedule in the link sequence by selecting that schedule with the display (using the **DATA +/–** key followed by the **Program/Save** key) and applying a **Start** signal. The Power Supply returns to the *first schedule fired in that chain* (whether or not that schedule is the first one in the link.). For instance, if schedules **01** through **06** are set up in the chain, but the **Program/Save** key is pressed and the weld operation is started with schedule **03**, after the completing schedule **06**, the Power Supply will return to schedule **03** rather than schedule **01**.

  **NOTE:** During welding in **Chaining Mode**, the **Monitor** screen does not display monitoring results. At the completion of the chain, monitor results may be viewed for each weld **if WELD ON/OFF** is turned **OFF** and the **DATA +/-** key is used to increment / decrement the schedule number.

- **CONT SEAM MODE** (optional) **-** The continuous seam mode repeats the weld cycle from **COOL** through **WELD2** as long as the start signal is present. See Appendix D for a graphical representation of this weld mode.
- **ROLL SPOT MODE** (optional) - The roll spot seam mode repeats the weld cycle from **SQUEEZE** through **OFF** as long as the start signal is present. See Appendix D for a graphical representation of this weld mode.

**LINKED SCHED ↲ --** Placing the cursor at the ↲ symbol, and pressing the **DATA+** key will cause the Linked Schedule screen to be displayed.

## CHAPTER 3: USING ST CONTROL FUNCTIONS

# Section VII: Linked Schedules Screen

To get this screen, go to the **MODE** screen, highlight **LINKED SCHED. ↵**, and press the **DATA +** button on the Control Panel.

This screen shows all linked schedules, their current weld counts, weld modes, and an error notification if the same schedule is used more than once. It allows changes and additions to be made as shown on the right.

```
SCHD  CURR WELD CNT  WELD MODE
01. 02      0025          SUCC    ERROR
02. --
03. 05      0300          REPT
04. 08      0010          SPOT
05. 10      0045          CHAIN
06. --
07. 02      0025          SUCC    ERROR
```

**NOTE:** Linking is not enabled when binary schedule select is enabled or when **Continuous Seam** or **Roll Spot Weld** modes are selected at the **System Wide Value Screen #1.**

Each link shall be a series of schedule numbers separated by a schedule number of **--** ***before*** the first number in the link and ***after*** the last number. In the example above, schedule **05** is linked to **08**, which is linked to **10**.

If a schedule number is used more than once, it shall have a **ERROR** printed to the right. In the above example schedule **02** has been entered twice. The reason for this is that if this schedule number starts a linked sequence, the system will not know which link to use.

**Reference Number** – This left-hand column of figures, labeled **01., 02., 03.,** and so on up to **64.,** provides a reference for the operator's convenience. Pressing the up or down key shall scroll through all reference numbers, rolling over from largest to smallest and vice versa.

**SCHD** – This column represents the schedule number linked in this reference position. It is programmable from **00** to **63**.

**CURR WELD CNT** – This column shall be non-programmable. It displays the current number of weld counts for the schedule.

**WELD MODE** – This column shall be non-programmable. It displays the weld mode for the last saved schedule set up in the **WELD MODE** field of the **Mode** screen.

**ERROR** – This notification shall be displayed when a schedule number is repeated in the list. If it is desirable to use the same schedule in two different link sequences, copy the schedule and assign it a different schedule number.

# Section VIII: System Values Screens

## System Values Screen 1

To get this screen, go to the **MODE** screen, highlight **System Values Screen 1 ↵,** and press the **DATA +** button on the Control Panel.

**NOTE:** Some values are detected and displayed by the Power Supply. They cannot be changed by the operator.

```
               SYSTEM VALUES SCREEN 1

FULL CURR=10KA                COIL=01X
MAX  #  OF SCR=1              CONTRAST +/-
TURNS RATIO=053: 1            NUM VALVES=04
CNTRL MODE=%HEAT SEC.         VALVES STATUS ↵
BIN. SCHED. SELECT=OFF        MODE=SPOT
FIRING SWITCH=ONE STAGE                 More ↵
```

**FULL CURR.** – The full current (**FULL CURR.)** is programmable from **05 kA** to **80 kA**. For proper operation, this value must be at the current obtained when the unit is fired with a 180E conduction angle into the secondary circuit that will be used for welding. If the transformer taps are changed, this value must be adjusted.

**MAX # OF SCR** – Denotes the number of SCRs available in the Power Supply. The factory-set default is **4**, so this must be changed to the appropriate number.

**TURNS RATIO** – This adjusts the transformer turns ratio for the constant current, and is programmable from **001:1** to **200:1**.

**CNTRL MODE** – Control Mode (**CNTRL MODE**) allows the operator to set the control mode of operation. Selections are pre-set by the factory and depend on the type of current sensing coil (if any) installed.

- **%HEAT SEC –** Percent Heat Secondary
- **SEC. C.C.** – Secondary Constant Current

*OR*

- **%HEAT PRI –** Percent Heat Primary
- **PRI. C.C.** – Primary Constant Current

By placing the cursor at the first character of the **CNTRL MODE** selection and using the **DATA +/–** pushbutton, the operator can toggle between the modes that are applicable to that machine. %HEAT works for all machines. SEC. CC requires a secondary current coil. PRI CC requires a primary current coil. Selecting any one of these modes will automatically turn the other modes off. The Power Supply is shipped in the **% HEAT** mode as the default.

**BIN. SCHED. SELECT** – Binary Schedule Select (**BIN. SCHED. SELECT**) determines whether or not the binary schedule select input is active. That is, it enables or disables the ability for the Power Supply to be a client to a separate Programmable Logic Controller (PLC) or other device with BCD capability. There are only two options, **OFF** or **ON**; the default is **OFF**. If **OFF**, the binary inputs are ignored and the Power Supply defaults to that which is presented on the control panel. If **ON**, the binary select input is active and an external device controls which schedule is used. Linking is disabled if Binary Schedule Select is ON.

**FIRING SWITCH** – Selects either two stage or single stage firing switch.

**COIL** – This Power Supply has no option; it is set for **1X**.

**CONTRAST+/–** – By placing the cursor at the first character of this field and using the **DATA +/–** pushbutton, the operator can increase or decrease the contrast of the LCD screen.

# CHAPTER 3: USING ST CONTROL FUNCTIONS

**NUM VALVES** – This control will select the number of valves in the system. It is pre-set to either 4 or 12, depending on the valve option implemented in this unit.

**VALVES STATUS –** This control allows the operator to select the **Valve Status** screen, discussed in Section IX.

**MODE –** This control allows the selection of weld modes - Spot Weld and the optional Roll Spot or Continuous Seam Weld Functions. The unit is shipped as ordered.

**MORE** – Brings up **System Values Screen 2**.

## System Values Screen 2

**87° DELAY -** This control turns the **87° Delay** Mode ON or OFF. This mode is used with Hypersil transformers to limit the firing of the SCR to 87° on the first half cycle thereby preventing saturation of the transformer. The default setting is ON.

```
                SYSTEM VALUES SCREEN 2
87° DELAY=ON                   AUTO RESET=OFF
END OUTPUT=ON                  ERROR OUTPUT=ON
STEP END OUTPUT=ON             SET DEFAULTS ↵
WELD ON/OFF=LOCAL              HOST CNTL=LOCAL
LOW LINE ALARM=ON              UNIT ADDRESS=01
                             Screen 1 ↵        More ↵
```

**END OUTPUT** – This control turns on and off the **End Output** signal (that signal that indicates the completion of the weld cycle). It is programmable as either **ON** or **OFF** by placing the cursor at the first character of the parameter's value and using the **DATA +/–** key to toggle between the two states.

**STEP END OUTPUT** – This control turns on and off the **Step End Output** signal (that signal that indicates the completion of a stepper). It is programmable as either **ON** or **OFF** by placing the cursor at the first character of the parameter's value and using the **DATA +/–** key to toggle between the two states. In the **ON** state, the **Step End Output** signal remains active until a **Reset** signal is received, the operator presses the **RESET** button, or the **Step Reset** signal is received. In the **OFF** state the **Step End Output** signal remains inactive. If the **Reset** key is pressed on the front panel or an external **Reset** is received, the error will return after the next weld. If the unit receives an external **Step Reset** signal, the step counters are cleared and the error does not occur until the step counts are again reached.

**WELD ON/OFF** – This control determines whether the **WELD ON/OFF** button on the Control Panel or the remote **NW1** signal will control the flow of welding current. The default is **LOCAL**, which places control on the pushbutton switch. If **REMOTE** is selected, control is placed under the **NW1** signal. In either case, the control NOT selected is locked out.

When set to **REMOTE**, saving any changes to the schedule or settings on the front panel will set the Power Supply to the **Weld Off** state. This input must then be opened and re-closed to set the **Weld On** state.

**LOW LINE ALARM –** this control determines whether the **Low Line Voltage Alarm** is active.

**AUTO RESET –** This control determines how the Power Supply reacts to an internal minor error signal. When **AUTO RESET** is **OFF**, an error signal will prevent the Power Supply from reacting to the next **Start** signal and will inhibit an **End** signal output from the Power Supply.

- When **AUTO RESET** is **ON**, the error signal will light the Error LED indicator but this error signal will be reset by the next **Start** signal. If the **ERROR OUTPUT** function is turned on, a Fault output will occur.
- If **AUTO RESET** is **OFF,** the error signal must be overridden by the operator pressing the **RESET** button on the control panel, or by the application of an **Error Reset** signal to the I/O connector. If **ERROR OUTPUT** function is turned on, a Fault output will occur. This is the default setting.

**ERROR OUTPUT** – This control turns on and off the **Error Output** signal. It is programmable as either **ON** or **OFF** by placing the cursor at the first character of the parameter's value and using the **DATA +/–** key to toggle between the two states. The default is **ON**. In the **ON** state, the **Error Output** signal remains on either until an **Error Reset** signal occurs or, in the case of a minor error, until the next **Start** signal or an **Error Reset** signal occurs. In the **OFF** state the **Error Output** signal remains **OFF**.

**SET DEFAULTS** – Placing the cursor over the ↵ symbol next to **SET DEFAULTS** and pressing the **DATA +** pushbutton will cause the factory-set defaults to be restored to the software.

**HOST CNTL** – This selects the device that will be able to change the programming on the unit. If **LOCAL** is selected, (the default) the operator will be able to program the unit normally through the buttons on the unit's panel. If **HOST** is set, the buttons on the panel will be able to display but not change any values; only the host device will have the ability to program the unit, through the communications software. The only exception is that **HOST CNTL** itself may be changed to **LOCAL** using the panel buttons, even though it has been previously set to **HOST**.

**UNIT ADDRESS** – This sets the unit's RS-485 address. Each control on a single RS-485 loop must have a unique unit address. Allowable values are **01 – 30**, default is **01**.

**Screen 1** ↵ – Highlight Screen 1 and push the **DATA +** button to return to **System Values Screen 1**.

**More** ↵ – Highlight **MORE** to go to **System Values Screen 3.**

## System Values Screen 3

```
            SYSTEM VALUES SCREEN 3

RETRACTION=MAINTAINED       DIFF.PRESSURE=ON
PRESSURE SWITCH=OFF         BACK PRESSURE=10
FORCE CALIBRATION ↵
OUTPUT FORCE=F1
MONITORED VOLTS=RMS
MONITORED TIME=W1/W2                  Screen 2 ↵
```

**RETRACTION** – This switches the Electrode Retraction mode between **MAINTAINED** and **PULSED**. The **MAINTAINED** mode causes the retraction output to follow the input switch. When the switch is closed, power is supplied to the retraction output. This is the non-retracted state. Welding is allowed in this state. Welding is not allowed when the weld head is retracted. The **PULSED** mode requires the input switch to be toggled before the output changes state. Welding is not allowed when the weld head is retracted.

## CHAPTER 3: USING ST CONTROL FUNCTIONS

**Pressure Switch** = This turns the **Pressure Switch** function **ON** and **OFF**. When this function is turned ON, a weld will not proceed until both the footswitch input and the pressure switch inputs are closed. If this input does not close in approximately 5 seconds, the unit gives a "Pressure Switch Alarm" on the screen and a fault output.

**NOTE:** This is for an external pressure switch on the weld head. Normally this is **OFF**. Turn **ON** only when using an external pressure switch on the weld head.

**Force Calibration** = This accesses the **Force Calibration** screen. Instructions for using this screen are in *Appendix H, Force Control Option.*

**Output Force** = This turns the Output Force function to Channels **F1-F8**, or **OFF**. **F1-F8** means the output for SCR 1 goes through F1, SCR 2 is associated with F2 and so on. The **F1-F8** option allows the control to operate up to 8 independent electronic pressure regulators.

**Monitored Volts** = This switches the voltage monitoring mode between **PEAK** and **RMS** (Average).

**Monitored Time** = This switches the weld monitoring time between **W1/W2** (Weld 1 and Weld 2) or **Last Cycle Only**. This setting applies to the voltage monitoring option only. Selecting **W1/W2** causes the unit to monitor the voltage during the **W1** period and the **W2** period, ignoring any upslope and downslope. Selecting **Last Cycle Only** causes the control to look only at the last cycle in the **W1** and **W2** periods.

**DIFF PRESSURE =** This turns the force input functions (differential pressure) **ON** and **OFF.** When this function is turned on, actual force readings from each weld will be displayed on the monitor screen. High, low and firing force limits can be programmed in the monitor screen, and welding will not proceed until the actual value is within those limits.

**Back Pressure** = Using the ▲ ▼ keys, you can increment/decrement the Back Pressure (in psi). Back Pressure is the pressure that is sent by the electronic pressure regulator to the bottom of a weld head's air cylinder when a schedule is not operating. The psi setting for this parameter will only be accurate if the electronic pressure regulator has the association of 0 – 10 VDC = 0 – 100 psi.

**Screen 2 ↲ --** Returns you to **SYSTEM VALUES SCREEN2.**

# Section IX: System Valve Status Screen

To get this screen, go to the **SYSTEM VALUES SCREEN 1**, highlight **VALVES STATUS. ↵**, and press the **DATA +** button on the Control Panel.

The **System Valve Status** screen allows the operator to view the weld count used in the **Stepper** function. The number displayed is the total count of welds performed on each valve by all schedules. The operator can set this count to zero by placing the cursor at the ↵ symbol and pressing the **DATA +** key. The operator can also select the SCR to be associated with each valve for the weld count used in the Stepper function. Note that this setting does not control which SCR is to be fired in a weld schedule; that is done on the **Schedule** screen.

The number of valves displayed on the screen will be either **4** or **12**, depending on the option selected in **System Wide Values** screen 1.

**SYSTEM VALVE STATUS**

| VALVE | CNT | RESET | SCR |
|---|---|---|---|
| 1 | 00200 | ↵ | 1 |
| 2 | 00000 | ↵ | N/A |
| 3 | 00000 | ↵ | N/A |
| 4 | 00000 | ↵ | N/A |

**VALVE** – This column displays the valve numbers. These numbers are non-programmable.

**CNT** – This column displays the total count of welding operations associated with the electrode valve / SCR combination.

**RESET -** Placing the cursor at the ↵ symbol and pressing the **DATA +** key will cause the **CNT** number to reset to zero.

**SCR** – This column indicates the SCR used with each valve. It can be programmed from 1 to the maximum number of SCRs selected at the **System Wide Values** screen. If desired, it can also be programmed to **N/A** (not applicable).

## CHAPTER 3: USING ST CONTROL FUNCTIONS

# Section X: Force Calibration Screen

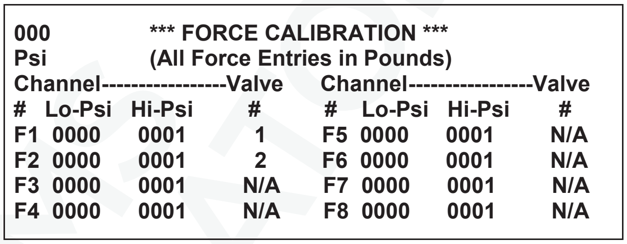
To get to this screen, go to the **SYSTEM VALUES SCREEN 3**, highlight **FORCE CALIBRATION ↵**, and press the **DATA +** button on the Control Panel.

The **FORCE CALIBRATION** screen allows the operator to calibrate the pressure used in both the **FORCE** and **PRESSURE** (Differential Pressure) functions. Complete Calibration instructions are in *Appendix H, Force Control Option.*

**F1** through **F8** are the Channels (**F** = "Force") to calibrate. **F1** is associated with SCR 1, **F2** with SCR 2 and so on.

**Lo-Psi** is highlighted to calibrate Low Pressure.

**Hi-Psi** is highlighted to calibrate High Pressure.



```
000            *** FORCE CALIBRATION ***
Psi            (All Force Entries in Pounds)
Channel-----------------Valve   Channel-----------------Valve
#  Lo-Psi  Hi-Psi      #       #  Lo-Psi  Hi-Psi      #
F1  0000    0001       1       F5  0000    0001      N/A
F2  0000    0001       2       F6  0000    0001      N/A
F3  0000    0001      N/A      F7  0000    0001      N/A
F4  0000    0001      N/A      F8  0000    0001      N/A
```

The Valve # must be programmed with the valve that is being turned on to create the weld force.

The PSI value at the top left of the screen indicates the actual differential pressure across the weld head cylinder for the active channel if the force input option is installed.

# Section XI. Stepper Screen

The **Stepper** screen allows information to be programmed to maintain weld results despite gradual degradation of the weld electrodes. This is done by adjusting power to compensate for the electrode degradation. The **Stepper** screen is shown on the right.

```
VALVE NUM=01
SCR #1      STEPPER=OFF
    COUNT       HEAT%       COUNT       HEAT%
1   0000        FIXED       6   0000     100%
2   0200        105%        7   0000     100%
3   0500        110%        8   0000     100%
4   0750        120%        9   0000     100%
5   0850        130%        10  0000     100%
```

Note: This screen cannot be accessed if the control's weld mode is set to **%HEAT PRIMARY** or **%HEAT SECONDARY.**

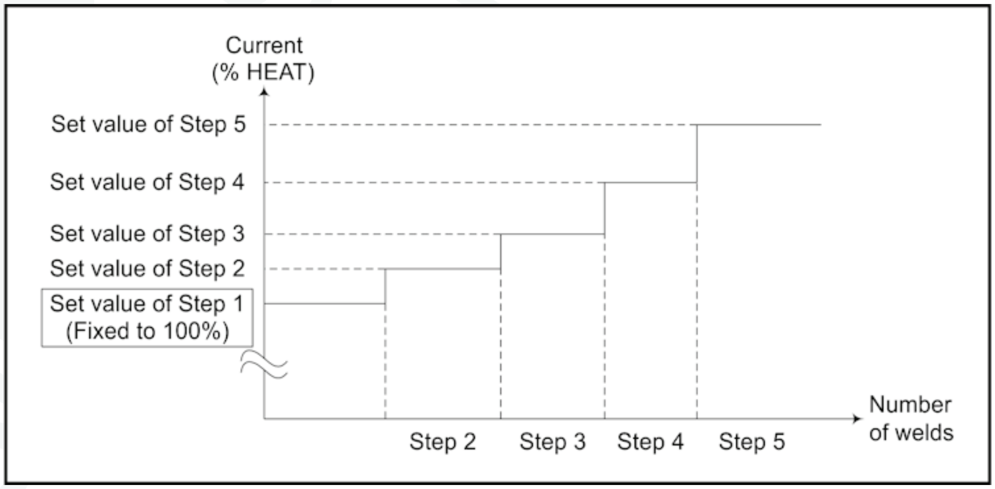
**VALVE NUM -** The **Valve Number (VALVE NUM)** is used to select a particular valve stepper schedule to be displayed. The schedule is programmable from **01** to **04** or **01** to **12** depending on the valve option selected on the **System Wide Values** screen.

**SCR# –** This display-only field shows the SCR number associated with the selected valve. The association is programmed on the **System Valve Status** screen.

**STEPPER** – This control turns the **Stepper ON** or **OFF**. The default is **OFF**.

**COUNT** - This control sets the weld count for each step, and is programmable from **0000** to **9999**. When the count is set to **0000** the step is considered off or at the end of a step. There are 10 steps available to increment/decrement **Heat%.**

**HEAT%** -- This control sets the percent of heat change for each step relative to the base weld current set in the schedule. The first field is non-programmable and its value is displayed as "FIXED," representing 100% of the weld current set in the schedule. All other fields are programmable from 50% to 200%. If the setting is 100%, the weld current will be that set in the schedule.



**Example of Stepper Function**

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# Chapter 4
# OPERATING INSTRUCTIONS

## Section I: Introduction

### Overview

This Chapter tells you how to turn the Power Supply ON, use menu screens to customize operating parameters, match the Power Supply to your welding system, and how to operate the Power Supply. This chapter is divided into the following sections:

- Introduction
- Preparing for Operation
- Setup Messages
- Operation
- Programming Weld Schedules
- Operational Messages
- Shutdown

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

- The principles of resistance welding and the use of programmed weld schedules.
- The **location** and **function** of Controls and Indicators. For more information, see *Chapter 1* of this manual.
- How to **select** and **use** the Power Supply functions for your specific welding applications. For more information, see *Chapter 3, Using ST-100A / ST-200A Control Functions*.

### General Operator Safety

**WARNINGS**

- To prevent blindness or eye injury, ***wear safety goggles at all times during welding***.
- ***Be careful of moving parts.*** You can be injured by moving parts during welding.
- Do ***not*** wear loose clothing or jewelry around moving parts. They could get caught and cause injury.

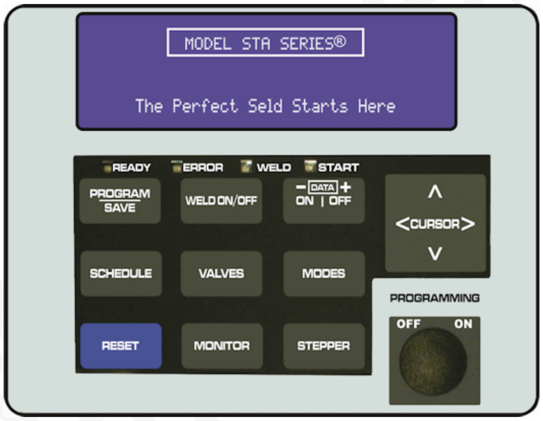
## CHAPTER 4: OPERATING INSTRUCTIONS

# Section II: Preparing for Operation

## Turning the Equipment ON

Depending on the customer's purchase, the Power Supply may have an internal circuit breaker or power may be applied from the junction box that feeds power to the Power Supply.

When power is first applied, the system performs an internal self-test. At the completion of that test, all LEDs are turned on briefly and introductory screens appear on the Control Panel for several seconds, beginning with the screen on the right.



Control Panel with Introductory Screen and Indicators

During the power-up cycle, the Power Supply will briefly display the version of the software installed in the Power Supply. If you ever need to contact AMADA WELD TECH for technical assistance, Customer Support will need to know which version ("Release") number of the software is installed.

**ST RESISTANCE WELDING SYSTEM**

**AMADA WELD TECH**
**MONROVIA, CALIFORNIA**

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**RELEASE 3.0 Rev G**

The Power Supply will then display which Option cards are installed in the Power Supply as shown on the right.

***** INSTALLED BOARDS *****

**DETECTED SINGLE CASCADE CARD**
**DETECTED SINGLE COMMUNICATION CARD**
**DETECTED SINGLE VOLTAGE CARD**
**DETECTED PRESSURE MONITOR CARD**

If an unknown card is present, the system will stop, prevent further operation, and display the following message:

**ERROR! DETECTED UNKNOWN OPTION CARD**

After the startup screens, the **Schedule** screen appears. All values on the screen will be the values on the Power Supply at time of last power-off.

# CHAPTER 4: OPERATING INSTRUCTIONS

## Pre-Operational Setup

**NOTES:**

- If your unit is equipped with a **PROGRAMMING** lock, the key must be inserted and turned to the ON position before any program changes can be made.
- If your weldhead does not have a retraction switch to control this function, a jumper must be installed between RETR and RETC inputs on the main board.
- During set-up, the following symbols indicate which values are controllable, and which are presented for information only. The symbols are screen-specific; a value that can be controlled on one screen may be informational on another screen.
- **=** are values that can be set by the operator.
- → are values provided for information only and cannot be changed by the operator
- Following this section is a display of information and error screens, which you might encounter during set-up.

# Section III: Setup Messages

You may receive one of the following messages during set-up of the Power Supply. The message tells you what corrective action should be taken. If you cannot correct the action by performing these instructions, contact your AMADA WELD TECH representative.

**SCHEDULE 01 WELD 1 CURRENT LESS THAN**
**20% OF SYSTEM FULL CURRENT.**
**TO ACCEPT, PRESS PROGRAM/SAVE KEY, THEN.**
**DESIRED SCREEN BUTTON AFTER SAVING.**
**OR ENTER THE SYSTEM VALUES SCREEN AND**
**CHECK FULL CURR. W1 CURRENT MUST BE**
**MORE THAN 20% OF THIS. ADJUST W1 ON**
**THE SCHEDULE SCREEN ACCORDINGLY.**

**SYSTEM VALUE FOR FULL CURRENT FAILS**
**VALIDITY CHECK.**
**FULL CURRENT DIVIDED BY TURNS RATIO MUST**
**FALL WITHIN A 50 TO 1500 AMP RANGE.**
**ON SYSTEM VALUES SCREEN, CHECK THAT THE**
**TURNS RATIO IS VALID. IF SO, THE**
**FULL CURR VALUE MUST BE BROUGHT**
**WITHIN ACCEPTABLE LIMITS.**

**SCHEDULE 01 WELD 1 CURRENT GREATER THAN**
**SYSTEM FULL CURRENT.**

**ENTER THE SYSTEM VALUES SCREEN AND CHECK**
**FULL CURR. WELD 1 CURRENT MUST BE LESS**
**THAN THIS. ADJUST W1 ON THE SCHEDULE**
**SCREEN ACCORDINGLY.**

**SCHEDULE 01 WELD 1 CURR. PLUS STEP CURR.**
**GREATER THAN SYSTEM FULL CURRENT**

**ENTER THE SYSTEM VALUES SCREEN AND CHECK**
**FULL CURR. WELD 1 STEP CURRENT MUST BE**
**LESS THAN THIS.**
**STEP CURRENT IS THE PRESENT STEP NUM'S**
**HEAT % TIMES WELD 1 CURRENT.**

**SCHEDULE 01 WELD 2 CURRENT LESS THAN**
**20% OF SYSTEM FULL CURRENT.**
**TO ACCEPT, PRESS PROGRAM/SAVE KEY, THEN**
**DESIRED SCREEN BUTTON AFTER SAVING.**
**OR ENTER THE SYSTEM VALUES SCREEN AND**
**CHECK FULL CURR. W2 CURRENT MUST BE**
**MORE THAN 20% OF THIS. ADJUST W2 ON**
**THE SCHEDULE SCREEN ACCORDINGLY.**

**SCHEDULE 01 W1 AND W2 TIMES ARE SET TO ZERO**

**PRESS PROGRAM/SAVE KEY TO ACCEPT, THEN
DESIRED SCREEN BUTTON AFTER SAVING.
OR PRESS SCHEDULE KEY TO VIEW OR CHANGE
THESE TIMES**

---

**MODIFIED SCHEDULE NOT SAVED.
PRESSING THE PROGRAM/SAVE KEY SAVES
MODIFICATIONS, THEN PRESS DESIRED
SCREEN BUTTON AFTER SAVING.
OR PRESS PLUS OR MINUS KEY TO LOSE
MODIFICATIONS**

---

**SCHEDULE 01 WELD 2 CURRENT GREATER THAN
SYSTEM FULL CURRENT.**

**ENTER THE SYSTEM VALUES SCREEN AND CHECK
FULL CURR. WELD 2 CURRENT MUST BE
LESS THAN THIS. ADJUST W2 ON THE
SCHEDULE SCREEN ACCORDINGLY.**

---

**SCHEDULE 01 WELD 2 CURR. PLUS STEP CURR.
GREATER THAN SYSTEM FULL CURRENT**

**ENTER THE SYSTEM VALUES SCREEN AND CHECK
FULL CURR. WELD 2 STEP CURRENT MUST BE LESS
THAN THIS.
STEP CURRENT IS THE PRESENT STEP NUM'S
HEAT % TIMES WELD 2 CURRENT.**

---

**SCHEDULE 01
BAD SCR NUMBER IN SCHEDULE TO BE
WELDED.**

**SELECT CORRECT SCR NUMBER ON SCHEDULE
SCREEN AND PRESS RESET TO CONTINUE.**

---

**Programmed value for FORCE fails a
validity check.
The FORCE value on the SCHEDULE screen
Must be greater than the FORCE LO and
less than the FORCE HI values on the
MONITOR screen. Also, FORCE must be
equal to or greater than the MONITOR
screen FORCE FIRING value**.

# Section IV: Operation

1 Turn power ON, either from the internal circuit breaker or the external, customer-supplied circuit breaker or power contactor.

2 After waiting for the internal self-test, and presentation of the introductory screens, the Control Panel will present the Schedule Screen. During this period, all LEDs will light briefly as an indication that they are working.

3 Select the appropriate schedule for your welding procedure.

4 During welding operation, you may monitor the operation of the Power Supply through the various screens described in *Chapter 3, Using ST-100A / ST-200A Controls*, but you cannot modify the schedules. If your unit has a PROGRAMMING lock, you will be unable to change the schedules unless programming is turned ON.

5 In **Roll Spot Mode** (optional), the motor (connected to the valve designated as **the Motormove Valve** in the schedule) moves only during **OFF** time. All other valves are held through the **OFF** time. If **OFF** time is set to 0, the motor will not move.

**NOTE:** Some motors require several cycles before motion begins.

6 In Continuous **Seam Weld Mode** (optional), changing the **Binary Schedule** inputs (with **Binary Select Enabled**) will cause the Power Supply to change schedules. There is a delay of up to 70 milliseconds for switch debounce and 5 cycles for the Power Supply to re-compute the parameters of the new schedule. During this time, the previous schedule will continue to operate. The Power Supply will then start at the beginning of **COOL** time in the second schedule.

7 In **% Heat Mode**, the conduction angle depends on both the user-programmed **% Heat** and the power factor of the secondary circuit. Changes in that power factor can result in changes of the measured conduction angle even though there are no programmed changes to the **% Heat**.

## Spot Welds

1 To change the information in the schedule screen, the Power Supply must be in **PROGRAM** mode. From the schedule screen press the **PROGRAM/SAVE** button so that the red **READY** indicator is off and the green **PROGRAM** indicator is on.

2 To select the schedule you desire, press the schedule button, then select the schedule number using the **DATA +** or **–** buttons.

3 To change weld schedule data, press ► to scroll through and enter the time (in cycles) desired for **SQD, SQZ, UP1, W1, DN1, CO, UP2, W2, DN2, HO** and **OFF**. As described above, in each field, use the + or – keys to change the time desired. See *Appendix D, System Timing* for a graphical representation of each of these periods.

4 Press ► again and enter the weld current or percent heat desired for **W1**. See the description of the system wide values screen for more information on the %heat and constant current weld modes.

5 Press ► and enter the weld current or percent heat desired for **W2**.

6 Press ► to move to the **ELECTRODE VALVE** and **SCR** selection. Use the + or – keys to select the desired electrode valve and SCR. See the description of the system valve status screen for more information on assigning electrode valves to SCRs.

7 To select the valve on/off settings, press the **VALVES** button located below the main screen, to go to the valves screen.

8 Press ▼ to toggle through the available valves. Use the + or – keys to turn each valve **ON** or **OFF** in that schedule.

9 Use the **MONITOR** screen to set welding limits (see *Chapter 3, Section IV*).

10 To save the information that was just modified press the **PROGRAM/SAVE** button. The message *****SAVING***** will flash briefly on the top of the screen.

11 If operating in **LOCAL MODE**, press the **WELD ON/OFF** button to put the Power Supply into the ready to weld mode. The green LED in the **WELD ON/OFF** button will turn ON.

12 Actuate the Start signal to begin welding.

## CHAPTER 4: OPERATING INSTRUCTIONS

### Continuous Seam Weld (ST-100A and ST-200A Option)

1 To change the information in the schedule screen, the Power Supply must be in **PROGRAM** mode. From the schedule screen, press the **PROGRAM / SAVE** button so that the red **READY** indicator is off and the green **PROGRAM** indicator is on.

2 From the schedule screen press ▲ once to select the **SHOW SYSTEM VALUES** field. Press the + button to show the system wide values screen.

3 Press ▲ to go to the **MODE** field. Press the + key as needed to select **CONT SEAM.**

4 To select the schedule you desire, press the **SCHEDULE** button, then select the schedule number using the **DATA+/-** buttons.

5 To change weld schedule data, press ► to scroll through and enter the time (in cycles) desired for **SQD, SQZ, UP1, W1, CO, UP2, W2, HO** and **OFF**. In each field, use the **+** or **–** keys to change the time desired. See *Appendix D, System Timing* for a graphical representation of each of these periods.

6 Press ► again and enter the weld current or percent heat desired for **W1**. See the description of the system wide values screen for more information on the % heat and constant current weld modes.

7 Press ► and enter the weld current or percent heat desired for **W2**.

8 Press ► to move to the **MOTORMOVE VALVE** and **SCR** selection. Use the **+** or **–** keys to select the desired motormove valve and SCR. See the description of the system valve status screen for more information on assigning electrode valves to SCRs.

9 Press ▼ to toggle through the available valves. Use the **+** or **–** keys to turn each valve on or off in that schedule.

10 To select the valve ON/OFF settings, press the **VALVES** button located below the main screen, to go to the valves screen.

11 Use the **MONITOR** screen to set welding limits (see *Chapter 3, Section IV*).

12 To save the information that was just modified, press the **PROGRAM/SAVE** button. The message *****SAVING***** will flash briefly on the top of the screen.

13 If operating in **LOCAL MODE**, press the **WELD ON/OFF** button to put the Power Supply into the ready mode.

14 Actuate the **START** signal to begin welding.

## Cascading (Requires Multiple SCRs)

1 To change the information in the schedule screen the Power Supply must be in **PROGRAM** mode. From the schedule screen press the **PROGRAM / SAVE** button so that the red **READY** indicator is OFF and the green **PROGRAM** indicator is ON.

2 From the **MODE** screen, highlight the **SYSTEM VALUES 1** screen, then press the **DATA +/-** key.

3 Press ▼ to select the **MAX # OF SCR=** field. Use the **+** key to input the number of SCRs in the Power Supply.

4 Use ◄ ► to select the **VALVES STATUS** field. Press the + key to display the **System Valve Status** screen. Use ► to select the **SCR** field for the first valve. Use the + or – key to select which SCR should be tied to this electrode valve. Use ▼ to select the SCR field for each of the remaining electrode valves. Use the + or – keys to select the SCR that is associated with each electrode valve. You may also select **N/A**.

5 To select the schedule you desire, return back to the main schedule screen by pressing the **Schedule** button then select the schedule number using the **+** or **–** (**ON** or **OFF**) keys.

6 To change the weld schedule data, press ► to scroll through and enter the time (in cycles) desired for **SQD, SQZ, UP1, W1, DN1, CO, UP2, W2, DN2, HO** and **OFF**. In each field, use the + or – keys to change the time desired. See *Appendix D, System Timing* for a graphical representation of each of these periods.

7 Press ► again and enter the weld current or percent heat desired for **W1**. See the description of the **SYSTEM VALUES SCREEN 1** for more information on the %heat and constant current weld modes.

8 Press ► and enter the weld current or percent heat desired for **W2**.

9 Press ► to move to the **ElectroValve** and **SCR** selection. Use the **+** or **–** keys to select the desired electrode valve and SCR.

10 To select the valve **ON/OFF** position, press the **VALVES** button located below the main screen, to go to the valve screen.

11 Press ▼ to toggle through the available valves. Use the **+** or **–** keys to turn each valve on or off in that schedule.

12 Use the **MONITOR** screen to set welding limits (see *Chapter 3, Using ST-100A / ST-200A Control Functions, Section IV*).

13 Press the **MODES** button to display the modes screen. Push ▼ twice to select the **WELD MODE** field. Press the **DATA +/-** key as required to select the **SUCCESSIVE** or **CHAINING** weld mode. Use **SUCCESSIVE** when the intention is to stop welding between each schedule, remove, and reactivate the **Start** signal to resume welding with the next schedule in the sequence. Use **CHAINING** when the intention is to fire all the linked schedules in sequence with one input of the Start signal.

14 Press the **SCHEDULE** button to redisplay the schedule screen.

15 If you desire multiple copies of a specific schedule to be included in the Linked program, press ▼ to go to the **COPY TO # xx PLUS yy** field. Enter the number of the schedule you want to copy to in place of the **XX** above. If you want to make more than one copy, enter the number of additional copies in the **PLUS yy** field above. (For example, **COPY TO 10 PLUS 02** will copy the current schedule to schedules **10, 11** and **12**). Move the cursor to the ( ↵ ) field. Press the + button to make the copies. **SCHEDULES HAVE BEEN COPIED** …will be displayed.

16 Press the **SCHEDULE** button to redisplay the schedule screen. Press the **PROGRAM/SAVE** button to save the schedule. The message ***** SAVING ***** will flash briefly on the top of the screen. Go to each of the schedules copied above, and in each of those schedules, press ▼ as required to select the **ELECTRODE VALVE=XX AND SCR # Y** field. Then use the + or – keys to enter the number of SCR that you wish to fire in that schedule. The valve status can be changed in each schedule by pressing the **VALVE** button and making the desired changes. Press the **PROGRAM/SAVE** button after each schedule to save the data in that schedule.

17 Press the **MODES** button to select the modes screen. Press ▼ to select the **LINKED SCHED** field. Press the + key to select the linked schedule screen.

18 In the linked schedule screen, use the **+** or **–** keys to select the first schedule you wish to fire in this cascade.

19 Press ▼ to select the **SCHD** field in the next line. Use the **+** or **–** keys to select the second schedule that will be fired in this cascade. Repeat this process until all schedules for this cascade have been entered. Push the **PROGRAM/SAVE** button to save the schedule. The message ***** SAVING ***** will flash briefly on the top of the screen.

20 Press the **SCHEDULE** button to go to the schedule screen. Use the **+** or **–** keys to select the first schedule that will be fired in this cascade. Press **PROGRAM/SAVE** to put the unit into program mode. Press **PROGRAM/SAVE** again. This sets the first schedule in the chain. To help the user follow which schedules are Linked together, AMADA WELD TECH has provided an easy to understand Help-Link. The **Help**-Link is located in the upper right-hand corner of the **SCHEDULE** screen and displays the schedules that are Linked to the schedule that is displayed. In the upper right hand corner of the screen you will notice that the schedule you are in will be displayed in the center, between the schedules that are Linked both prior and after your displayed schedule. For example: **01 < 02 > 03**

21 If operating in **Local Mode**, press the **WELD ON/OFF** button to put the Power Supply into the ready to weld mode. The green LED on the **WELD ON/OFF** button will be on if the unit is ready to fire.

22 Actuate the **Start** signal to begin welding.

# Section V: Operational Messages

You may receive one of the following error messages during set-up or operation of the Power Supply. The message tells you what corrective action should be taken. If you cannot correct the action by performing these instructions, contact your AMADA WELD TECH representative. Major errors require pressing the **RESET** button or giving a signal to the **RESET** input to clear the error. If **AUTO RESET** is turned **ON**, minor errors can be cleared by the next **START** signal. If **AUTO RESET** is turned **OFF**, minor errors must be cleared by pressing the **RESET** button or giving a signal to the **RESET** input. See Chapter 3, Section VIII for more information on **AUTO RESET.**

## Major Run-Time Error Messages

```
          ************ EMERGENCY STOP ************

THE SYSTEM HAS ENCOUNTERED A SERIOUS
CONDITION, POSSIBLY INVOLVING A
SAFETY HAZARD.  CLEAR THE CONDITION
AND PRESS THE RESET BUTTON TO REBOOT.
```

```
                  OVERTEMP ALARM:

CHECK THERMOSTAT CIRCUIT

PRESS RESET TO RESUME WELDING
```

**NOTE:** If an external weld transformer thermostat is connected into the circuit **OVERTEMP ALARM** will be displayed if the external transformer thermostat opens. as shown in *Appendix K, Circuit Modification for External Transformer Thermostat,*

```
NO CURRENT. VERIFY THAT THERE IS:
1.  ENOUGH WELD FORCE          6.    FULL CURR SET
2.  NO COIL BREAKAGE IN RANGE
3.  INTACT COIL CABLE          7.    CORRECT SCR
4.  GOOD COIL CABLE UNIT POWER
      CONNECTION
5.  ENOUGH SQZ TIME
PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 2 CURRENT EXCEEDED HIGH LIMIT.
     1. REPROGRAM WELD 2 CURRENT.
     2. INCREASE WELD TRANSFORMER RATIO.
     3. INCREASE W2 HIGH LIMIT AT THE
        MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

## CHAPTER 4: OPERATING INSTRUCTIONS

```
SCHEDULE 01
WELD 1 CURRENT EXCEEDED HIGH LIMIT.
     1. REPROGRAM WELD 1 CURRENT.
     2. INCREASE WELD TRANSFORMER RATIO.
     3. INCREASE W1 HIGH LIMIT AT THE
        MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 1 CONDUCTION ANGLE EXCEEDED LIMIT.
     PRESS RESET BUTTON TO RESUME WELDING.
     IF PROBLEM CONTINUES, INCREASE THE W1
        COND. LIMIT AT THE MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
WELD 2 CONDUCTION ANGLE EXCEEDED LIMIT.
     PRESS RESET BUTTON TO RESUME WELDING.
     IF PROBLEM CONTINUES, INCREASE THE W2
        COND. LIMIT AT THE MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.
```

```
CONDUCTION ANGLE REACHED FULL PHASE
     (180 DEGREES)

     REDUCE % HEAT SETTING

     PRESS RESET BUTTON TO RESUME WELDING.
```

```
SCHEDULE 01
     EXCEEDED STEPPER SCHEDULE LIMIT.
     1. SERVICE ELECTRODES, RESET VALVE
          COUNT FOR THE ASSOCIATED VALVE.
     2. CHANGE TO A SCHEDULE WITH GREATER
          STEPPER COUNTS.
     3. PUSH RESET TO CONTINUE WITH THIS
            SCHEDULE (AND REDISPLAY THIS MSG).
```

```
   ** IMPROPER SCHEDULE NUMBER DETECTED **

FOUND AN OUT OF RANGE SCHEDULE NUMBER.
  VALID NUMBERS ARE 00 – 63.


PRESS THE RESET KEY AND CONTINUE.
```

CHANGED FROM RUN MODE TO PROGRAM MODE IN THE MIDDLE OF A WELD, OR TURNED OFF WELD CURRENT DURING A WELD. WELD WAS ABORTED.

PRESS RESET BUTTON, THEN RESTART THE WELD FROM THE BEGINNING.

## Minor Run-Time Error Messages

SCHEDULE 01
WELD 1 CURRENT BELOW LOW LIMIT.
1. REPROGRAM WELD 1 CURRENT.
2. DECREASE WELD TRANSFORMER RATIO.
3. DECREASE W1 LOW LIMIT AT THE MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING

SCHEDULE 01
WELD 2 CURRENT BELOW LOW LIMIT.
1. REPROGRAM WELD 2 CURRENT.
2. DECREASE WELD TRANSFORMER RATIO.
3. DECREASE W2 LOW LIMIT AT THE MONITOR SCREEN.

PRESS RESET BUTTON TO RESUME WELDING.

SCHEDULE 01
REACHED THE LAST STEP COUNT FOR CURRENT STEP. THE NEXT WELD WILL MODIFY WELDING CURRENT USING THE PERCENTAGE FACTOR SPECIFIED IN THE NEXT STEP OF THE CURRENT STEPPER SCHEDULE.
PRESS RESET BUTTON TO RESUME WELDING.

WELD COUNT REACHED WELD COUNT LIMIT. IMPLEMENT USER DEFINED PROCEDURE FOR THIS CONDITION.

AT THE MONITOR SCREEN:
1. SET WELD COUNT=0 OR
2. INCREASE WELD COUNT LIMIT.

## CHAPTER 4: OPERATING INSTRUCTIONS

*** LOW LINE VOLTAGE ***

*** ADVISORY MESSAGE ONLY ***

LOW LINE VOLTAGE WAS DETECTED. CHECK LINE VOLTAGE AND PRESS RESET KEY TO CONTINUE.

---

*** HIGH LINE VOLTAGE ***

*** ADVISORY MESSAGE ONLY ***

HIGH LINE VOLTAGE WAS DETECTED. CHECK LINE VOLTAGE AND PRESS RESET KEY TO CONTINUE

---

*** SCALE CURRENT ERROR ***

SCALED CURRENT WAS GREATER THAN MAX.

PRESS RESET KEY TO CONTINUE

# Section VI: Shutdown

## Emergency Shutdown

In an emergency, you may perform an emergency shutdown by hitting the **Emergency Stop Switch**. Weld power will be immediately shut down, the valve outputs will turn off, and you will get the emergency shutdown message on the Power Supply.

```
************ EMERGENCY STOP ************

THE SYSTEM HAS ENCOUNTERED A SERIOUS
CONDITION, POSSIBLY INVOLVING A
SAFETY HAZARD.  CLEAR THE CONDITION
AND PRESS THE RESET BUTTON TO REBOOT.
```

After clearing the emergency condition, you ***must***:

- Assure that **FS1** and **FS2** signals are open,
- Reset the emergency shutdown switch.
- Rest the Power Supply either by pressing the front panel **RESET** switch or providing an external reset signal.
- The Power Supply will re-boot following the **RESET** signal. Set the Power Supply to the desired schedule.

## Normal Shutdown

Turn off power from the external, customer-supplied circuit breaker or power contactor.

# Chapter 5

# MAINTENANCE

## Section I: Precautions

### WARNING

***Never*** attempt to repair the Power Supply with power applied. ***DEATH may result from contact with lethal voltages inside the Power Supply***.

Turn power to the unit OFF ***before*** starting maintenance work. Tag (and preferably lock) the switch so that power is ***not*** accidentally restored.

### Precautions

- Read through the entire specific instructions, including all caution and warning messages, ***before*** starting any maintenance procedure.
- Other than as indicated in *Appendix K, Circuit Modification for External Transformer Thermostat,* do ***not*** modify the unit without prior written approval from AMADA WELD TECH.
- Use the appropriate tools for terminating the connecting cables, being careful not to nick the wire conductors.
- ***Never*** use paint thinner, benzene or acetone to clean the exterior of the Power Supply. Use a dry cloth or, if it is heavily soiled, use a cloth moistened with a mild detergent or alcohol.

## Section II: General Information

### General Maintenance Procedures

1 Open the door by rotating (CCW) the front panel screw securing the door.

2 Rotate or pull the circuit breaker handle and open the door.

3 Repair is by replacement of components. Find the specific item(s) you want to repair or upgrade in *Section III, Standard Components Replacement* or *Section IV, Optional Components Replacement*, then follow the procedures listed.

### Cooling Maintenance-Water Draining

**CAUTION**: To protect the equipment (SCR and hoses) the water should be drained at any time when there is a chance that it might freeze. The water should also be drained and the hoses and SCR cooling chamber flushed any time you believe that there is a build-up of sediment that might decrease the water flow and cause the unit to overheat.

# CHAPTER 5: MAINTENANCE

## Fuse Replacement

The Power Supply contains a fuse, mounted on the load side of the Valve Transformer. Before replacing the fuse, determine what caused it to fail and make appropriate repairs. The fuse size will depend on which transformer has been ordered. See table 4-1 for appropriate fuse selection.

**Valve Transformer Fuse Selection**

| Transformer Rating | Fuse Size | AMADA WELD TECH Part Number |
|---|---|---|
| 115 VAC, 150 VA | 2 A | FNM-2 |
| 115 VAC, 250 VA | 3 A | FNM-3 |
| 115 VAC, 500 VA | 6 A | FNM-6 |
| 24 VAC, 150 VA | 10 A | FNM-10 |
| 24 VAC, 250 VA | 15 A | FNM-150 |
| 24 VAC, 500 VA | 30 A | FNM-30 |

## Principles of Operation

Input power (L1 and L2) enters the Power Supply. L1 is applied through the (optional) circuit breaker and (optional) primary current sensor to the SCRs and the valve transformer.

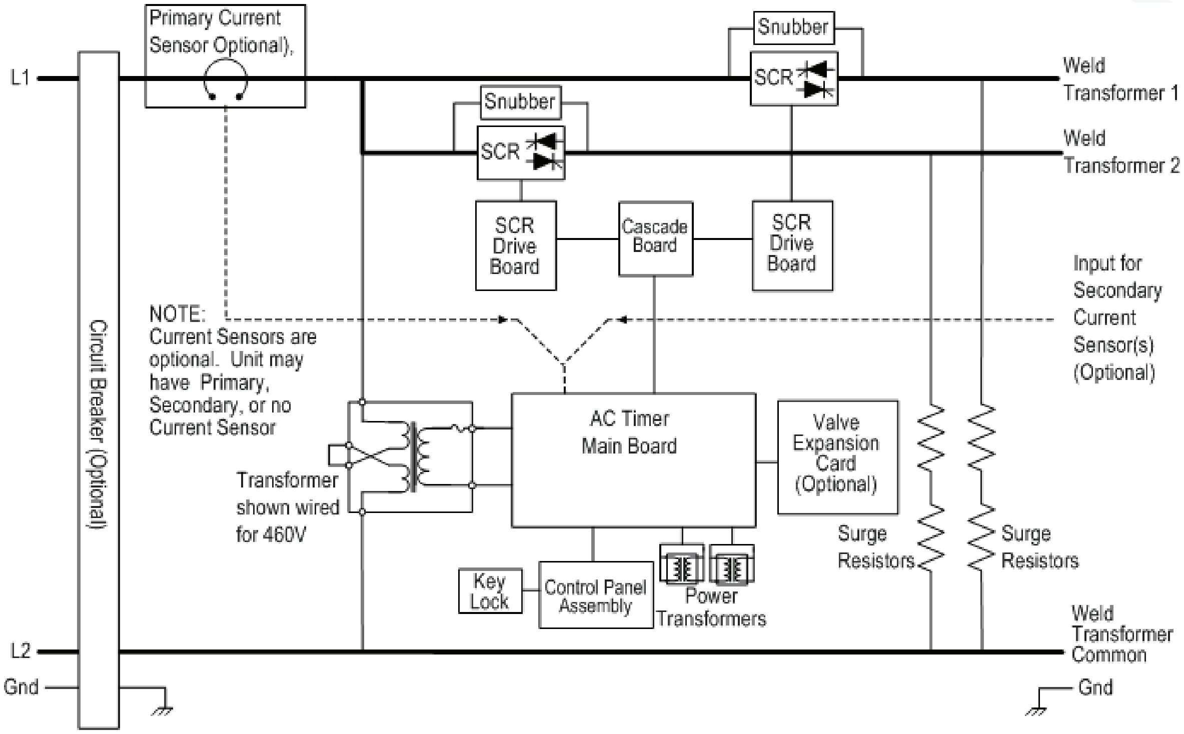
Your Power Supply may have Primary Current sensing, Secondary Current sensing, or no current sensing. The valve transformer is wired and jumpered based on the input voltage. The output of the transformer is applied to the AC Timer Main Board for application to the valves.

Two chassis-mounted power transformers break down the input voltage to the various voltages required in the main board and the Power Supply.

The main board receives signals from the Control Panel Assembly and/or external input signals, applied directly to the main board through the I/O connectors. These signals, along with various feedback signals from the primary or secondary current sensor(s), control the entire operation of the unit. This board has the basic controls for the operation of four user-programmable valves. If more valves are required, an optional Valve Expansion Card can be added to control the additional valves.

An optional key lock, mounted on the front panel, can be used to prevent programming changes.

At the appropriate timing, as determined by the control and feedback signals, the main board provides a control signal to the Cascade Board, which at the appropriate time passes the signal to SCR Drive Boards. If there is only one SCR, the signal goes directly from the Main Board to the SCR Driver. The SCR Driver Board, in turn, causes the SCRs to switch the input voltage (L1) across the two surge resistors to the weld transformers. The snubber across the SCR assembly cancels inductive-kickback from the weld transformers.

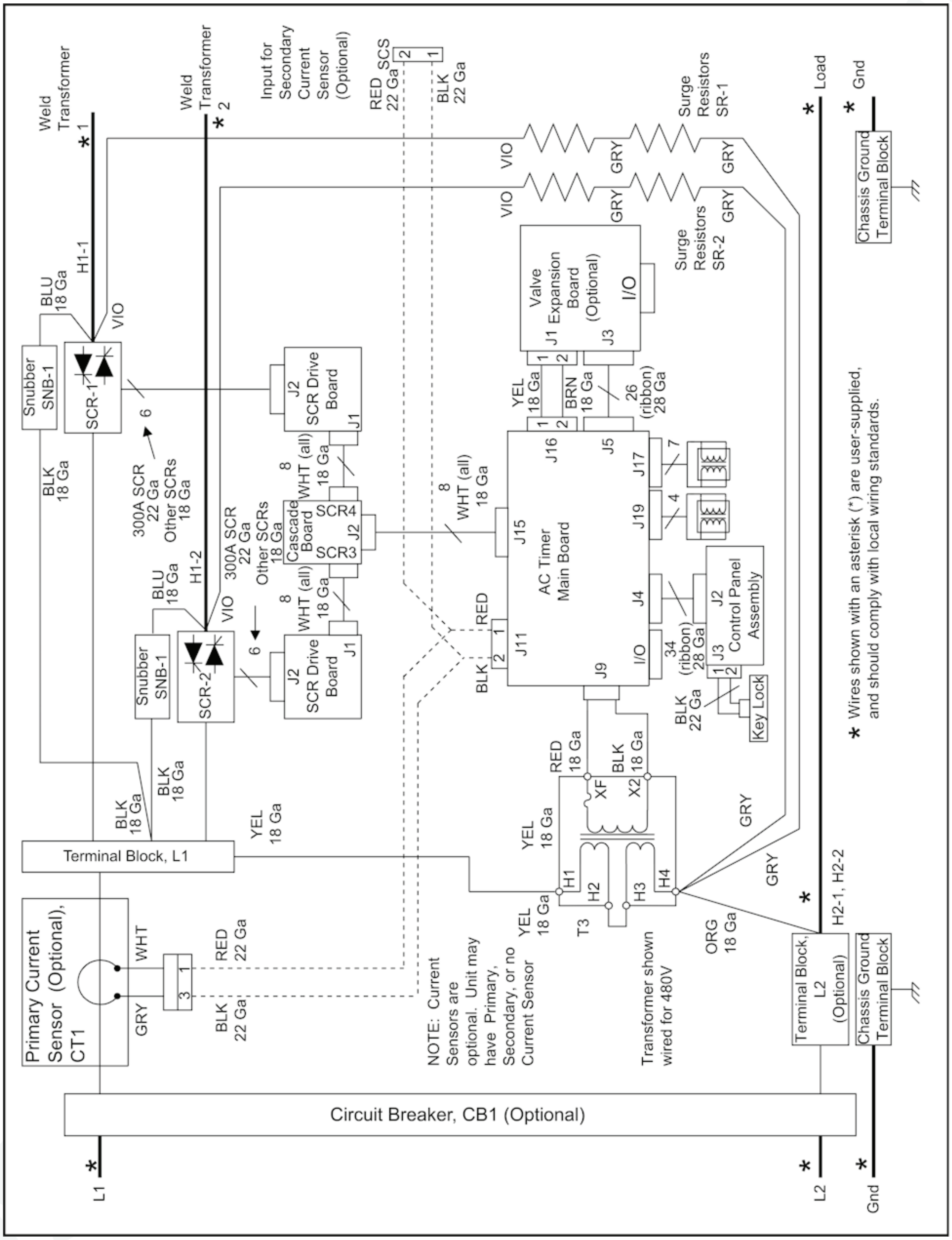

Primary Current
Sensor Optional),
L1
L2
Gnd
Circuit Breaker (Optional)
Snubber
SCR
Snubber
SCR
Weld
Transformer 1
Weld
Transformer 2
SCR
Drive
Board
Cascade
Board
SCR
Drive
Board
Input for
Secondary
Current
Sensor(s)
(Optional)
NOTE:
Current Sensors are
optional. Unit may
have Primary,
Secondary, or no
Current Sensor
Transformer
shown wired
for 460V
AC Timer
Main Board
Valve
Expansion
Card
(Optional)
Surge
Resistors
Surge
Resistors
Key
Lock
Control Panel
Assembly
Power
Transformers
Weld
Transformer
Common
Gnd

Simplified Block Diagram

## Wiring Diagram

The diagram on page 5-4 shows the point-to-point wiring, which will assist you in performing continuity checks on the Power Supply or rewiring it after a repair.

## CHAPTER 5: MAINTENANCE


Weld Transformer 1
Weld Transformer 2
Input for Secondary Current Sensor (Optional)
SCS
RED 22 Ga
BLK 22 Ga
Load
Gnd
Surge Resistors SR-1
Surge Resistors SR-2
VIO
GRY
Chassis Ground Terminal Block
H1-1
BLU 18 Ga
Snubber SNB-1
SCR-1
6
J2 SCR Drive Board J1
300A SCR 22 Ga Other SCRs 18 Ga
8 WHT (all) 18 Ga
Cascade Board
SCR4
SCR3
J2
Valve Expansion Board (Optional)
J1
J3
I/O
YEL 18 Ga
BRN 18 Ga
26 (ribbon) 28 Ga
J16
J5
J17
J19
7
4
J15
AC Timer Main Board
J4
J11
J9
RED
BLK
J2 Control Panel Assembly
J3
34 (ribbon) 28 Ga
BLK 22 Ga
Key Lock
H1-2
SCR-2
BLK 18 Ga
Terminal Block, L1
RED 18 Ga
XF
X2
H1
H2
H3
H4
T3
ORG 18 Ga
H2-1, H2-2
Terminal Block, L2 (Optional)
Primary Current Sensor (Optional), CT1
WHT
GRY
1
3
NOTE: Current Sensors are optional. Unit may have Primary, Secondary, or no Current Sensor
Transformer shown wired for 480V
Circuit Breaker, CB1 (Optional)
L1
L2
*
* Wires shown with an asterisk (*) are user-supplied, and should comply with local wiring standards.

Control Wiring Diagram

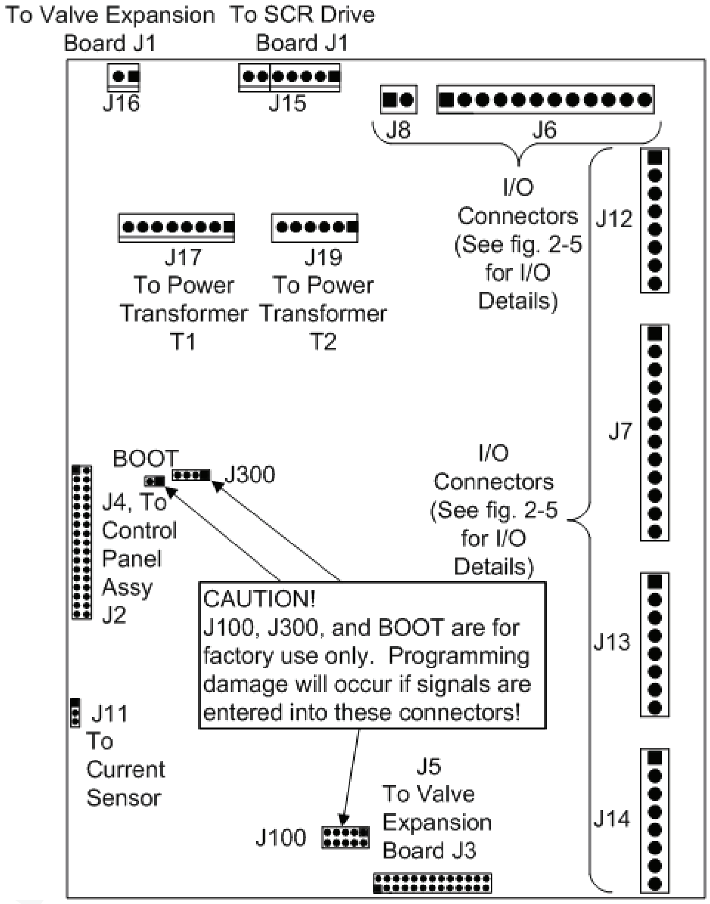
# Section III. Standard Components Replacement

## AC Timer Main Board

1 Disconnect the following cable connectors from the indicated headers on the circuit board:

- Two wire cable from the valve transformer T3 connected to J9.
- Eight wire connector from SCR Drive Board or Cascade Board connected to J15.
- Thirty-four wire ribbon cable connector from Control Panel Assembly connected to J4.
- Seven-wire cable (eight-pin connector) from power transformer to J17 and four-wire cable (six pin connector) from power transformer to J19.

2 Disconnect the six, I/O plugable terminal strips from the board (J6, J7, J8, J12, J13, and J14). See *Appendix B, Electrical and Data Connections* for a detailed listing of I/O signals.


To Valve Expansion Board J1
To SCR Drive Board J1
J16
J15
J8
J6
I/O Connectors (See fig. 2-5 for I/O Details)
J12
J17 To Power Transformer T1
J19 To Power Transformer T2
J7
BOOT
J300
J4, To Control Panel Assy J2
I/O Connectors (See fig. 2-5 for I/O Details)
CAUTION! J100, J300, and BOOT are for factory use only. Programming damage will occur if signals are entered into these connectors!
J13
J11 To Current Sensor
J5 To Valve Expansion Board J3
J100
J14

**AC Timer Main Board Connector Locations**

3 If present, disconnect the following optional cable connectors from the indicated headers on the circuit board:

- Two-wire cable from the primary current sensor or the secondary current sensor connector connected to J11.
- Two-wire cable from the Valve Expansion Card connected to J16 and the 26-wire ribbon cable from the same circuit board connected to J5.

4 Remove the nine 6-32 x 3/8” Phillips head screws and nine # 6 flat nylon washers that secure the circuit board to the Power Supply chassis and remove the board.

5 Install or re-install the circuit board with nine 6-32 x 3/8” Phillips head screws and nine #6 flat nylon washers, being careful not to over-tighten the screws and damage the circuit board.

6 If present, reconnect the following optional cable connectors to the indicated headers on the circuit board:

- Two-wire cable from the primary current sensor or secondary current sensor connector connected to J11.
- Two-wire cable from the Valve Expansion Card to J16 and the 26-wire ribbon cable from the same circuit board to J5.

7 Reconnect the six I/O pluggable terminal strips to the board (J6, J7, J8, J12, J13, and J14). See *Appendix B, Electrical and Data Connections* for a detailed listing of I/O signals.

**NOTE:** If you are installing a new circuit board, be sure to connect the pullup connector to the +24 V connector or to whatever other power source it had been previously connected.

8 Reconnect the following cable connectors to the indicated headers on the circuit board:

- Two-wire cable from the valve transformer T3, connected to J9.
- Eight-wire connector from SCR Drive Board or Cascade Board to J15.
- Thirty-four-wire ribbon cable from Control Panel Assembly to J4.
- Four-wire cable (six-pin connector) from power transformer to J19 and seven-wire cable (eight pin connector) from power transformer to J17.

## Power Transformer T1

1 Disconnect the transformer cable connector from AC Timer Main Board connector J17.

2 While supporting the transformer with one hand, remove the two screws and lock washers.

3 Install re-install the transformer by supporting it with one hand while attaching it to the side of the card cage with two screws and lock washers.

4 Reconnect the transformer cable connector to AC Timer Main Board connector J17.

## Power Transformer T2

1 Disconnect the transformer cable connector from AC Timer Main Board connector J19.

2 While supporting the transformer with one hand, remove the two screws and internal tooth lock washers.

3 Install or re-install the transformer by supporting it with one hand while attaching it to the side of the card cage with the two screws and internal tooth lock washers.

4 Reconnect the transformer cable connector to AC Timer Main Board connector J19.

## Valve Transformer, T3

1 Remove the following four wires from the transformer terminals: H1 (yellow), H4 (orange and gray), XF (red), and X2 (black).

2 While supporting the transformer, remove the four 10-32 x 3/8” Phillips head screws, # 10 split lock washers, and # 10 flat washers that secure the transformer to the Power Supply chassis and remove it.

3 Install or re-install the transformer with four 10-32 x 3/8” Phillips head screws, # 10 split lock washers, and # 10 flat washers.

**NOTE:** If you are installing a new transformer, be sure to reconnect the jumper(s) in the same configuration as previously connected. See the **Wiring Diagram** on page 5-4 for specific connections for different voltage inputs.

4 Connect the following wires to the indicated terminals and tighten the screws: yellow to H1, orange and gray to H4, red to XF, and black to X2. Be sure to install the proper fuse, as shown in *Section V, Parts List*.

## Surge Resistors

1 To replace a surge resistor assembly, disconnect the violet wire from the SCR and the gray wire from Valve Transformer terminal H4.

2 Remove the four screws and lock washers that attach the surge resistor assembly to the Power Supply chassis.

## CHAPTER 5: MAINTENANCE

3 Install or re-install the surge resistor assembly by attaching the assembly to the Power Supply chassis with four screws and lock washers.

4 Reconnect the violet wire to the SCR and the gray wire to Valve Transformer terminal H4.

### Snubber

1 Disconnect the blue wire from the SCR and the black wire from copper bus bar L1.

2 Loosen the clamp screw that secures the snubber and remove it.

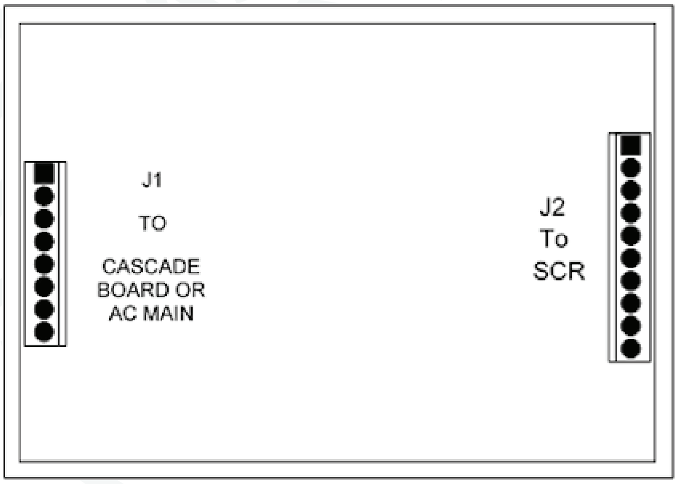
3 Install or re-install the snubber by slipping it into the clamp and tightening the clamp screw.

4 Reconnect the black wire to copper bus bar L1 and the blue wire to the SCR.

### SCR Drive Board

1 To replace the SCR Drive Board, disconnect the following cable connectors from the indicated headers on the circuit:

- Six-wire cable (ten-pin connector) from the SCR connected to J2.
- Eight-wire cable connector from AC Timer Main Board or Cascade Board to J1.



**SCR Drive Board Connector Locations**

4 Remove the four 6-32 x 3/8” Phillips head screws, spring lock washers, and flat washers that secure the circuit board to the Power Supply chassis and remove the board.

5 Install or re-install the circuit board with the four 6-32 x 3/8” socket head screws, spring lock washers, and flat washers, being careful not to over-tighten the screws and damage the circuit board.

6 Reconnect the following cable connectors to the indicated headers on the circuit board:

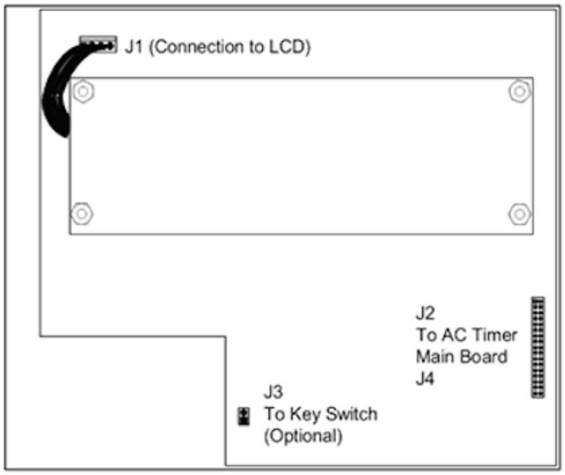
- Six-wire cable (ten pin connector) from the SCR to J2.
- Eight-wire cable from AC Timer Main Board to J1 or Cascade Board.

## Control Panel Assembly

1 To replace the Control Panel Assembly remove the four screws securing the protective cover plate over the Control Panel Assembly and remove the plate.

2 Disconnect the following cable connectors from the indicated headers on the circuit board:

- Thirty-four wire ribbon cable connector from the AC Timer Main Board, connected to J2.
- (Optional) 2-wire cable connector from the control panel key switch to J3.



**Control Panel Assembly Connector Locations**

3 Install or re-install the circuit board with four 4-40 hex nuts and standoffs.

4 Reconnect the following cable connectors to the indicated headers on the assembly:

   a Thirty-four-wire ribbon cable connector from the AC Timer Main Board to J2.

   b (Optional) two-wire cable connector from control panel key switch to J3.

5 Install the protective cover plate over the Control Panel Assembly with four screws.

# Section IV. Optional Components Replacement

**NOTE:** Each of the following options is described in a separate *Appendix*. Each *Appendix* contains descriptions, maintenance procedures, and other information. (See *Table of Contents*.)

## Optional Primary Current Sensor

1 To replace the primary current sensor, disconnect the two-wire (white and gray) connector from the mating connector of the two-wire (black and red) jumper cable (which is connected to the AC Timer Main Board connector J1).

2 Disconnect the orange cable from the circuit breaker by loosening the Allen head screw in the circuit breaker.

3 While holding the current sensor, remove the 10-32 screws and size 10 lock washers that secure it to the back plate.

4 Slide the current sensor from the orange cable.

5 Install or re-install the primary current sensor by sliding the sensor onto the orange cable from L1 bus bar.

6 Connect the orange cable to the circuit breaker (if equipped).

7 Attach the current sensor to the Power Supply chassis with 10-32 screws and number 10 washers.

8 Reconnect the two-wire (white and gray) connector from the mating connector of the two-wire (black and red) cable.

## Optional Secondary Current Sensor Connector

1 To replace the secondary current sensor connector, disconnect the two-wire (black and red) cable connector from the AC Timer Main Board connector J11.

2 Remove the attaching hardware (nut and washer) from the inside bottom of the Power Supply chassis.

3 Install or re-install the connector assembly by attaching it to the bottom of the Power Supply with the attaching hardware (nut and washer) supplied with the assembly.

4 Reconnect the two-wire (black and red) cable connector to the AC Timer Main Board connector J11.

## Optional Key Lock

1 To replace the key lock, disconnect the two-wire cable from connector J3 of the Control Panel Assembly.

2 Unscrew the nut on the rear of the switch.

3 Install a new key lock (or re-install the old one if it is being used) by sliding it into the double “D” hole in the Power Supply chassis and securing from inside with the nut that comes with the switch.

4 Reconnect the two-wire cable to connector J3 of the Control Panel Assembly.

## Optional SCR Assembly, 600,1200, 1800, and 2200 Amp

**NOTE:** The only difference in the removal/replacement instructions for the 600 A and 1200 A SCR assemblies is the attaching hardware. The 600 A requires two 10-32 x 1.5” Phillips pan head mounting screws and # 10 internal tooth washers; the 1,200 A and 1,800 A SCRs each require four 10-32 x 1.0” Phillips pan head mounting screws and # 10 internal tooth washers.

1 Turn the water supply to the cooling water hoses going to the SCR assembly OFF.

**NOTE:** Place a container beneath the Power Supply chassis to catch water draining from the SCR assembly and the cooling water hoses.

2 Disconnect the cooling water hoses from the SCR assembly on the bottom of the Power Supply chassis. Allow all of the water to drain from the SCR assembly.

**CAUTION**: In the following steps, be careful not to damage the wires attached to the L1 terminal.

3 Remove the bolts, lock washers and flat washers securing L1 bus bar to the SCRs (or SCR and insulator), and remove L1.

4 Disconnect the cable connector from the SCR Drive Board connector J2.

5 Remove the screws and lock washers attaching the assembly to the Power Supply chassis.

6 Install or re-install the SCR by attaching it to the Power Supply chassis with the screws and lock washers.

7 Reconnect the cable connector to the SCR Drive Board connector J2.

8 Reinstall L1 to the SCRs (or SCR and insulator) with the bolts lock washers and flat washers removed in step 3.

9 Reconnect the cooling water hoses to the SCR assembly on the bottom of the Power Supply chassis.

10 Turn on the water supply to the cooling hoses going to the SCR assembly. Check for leaks.

## CHAPTER 5: MAINTENANCE

# Section V. Spare Parts

Below is a list of frequently required spare parts, which can be obtained by contacting your AMADA WELD TECH representative. Additional parts are available by contacting AMADA WELD TECH using the phone, e-mail, or mailing information in the Foreword of this manual.

**Spare Parts Kit # 4-35732-01**

| Item | AMADA WELD TECH Part Number |
|---|---|
| AC Timer Main Board A1 | 4-35255-01 |
| Control Panel Assembly, A3 | 4-35259-01 |
| Fuse, 2 A, SB (FNM-2) | 330-130 |
| Fuse, 3 A, SB (FNM-3) | 330-141 |
| Fuse, 10 A, SB (FNM-10) | 330-142 |
| Fuse, 15 A, SB (FNM-15) | 330-117 |
| Cascade Board | 4-35858-01 |
| Valve Expansion Board | 4-35268-01 |
| Snubber | These part numbers will vary, depending on your Model and Serial Number. Please be sure to have those numbers handy when you call us. |
| SCR Drive Board | |
| SCR | |
| Primary Coil | |
| Secondary Coil | |
| Circuit Breaker | |
| Transformers T1, T2, T3 | |
| Water Hose | |

**NOTE:** Contact AMADA WELD TECH for replacement cooling hose. Use of other hoses may result in damage to the Power Supply.

# Section VI. Repair

If you have problems with your unit that you cannot resolve, please contact our service department at the address, phone number, or e-mail address indicated in the Foreword of this manual.

# Section VII. Storage and Shipment

## Preparation for Storage or Shipment

**WARNING:** Be sure ***all*** power is removed from the Power Supply before disconnecting input (LINE) cables.

1 Open the Power Supply door and disconnect all line and load wires.

2 Disconnect all signal wires

3 If a secondary current sensor is used, disconnect the signal cable from the connector(s) on the bottom of the Power Supply.

4 If SCR is water-cooled, turn off water source and disconnect the water hoses to the Power Supply. Using shop air, dry out the water-cooling chamber of the SCR.

5 Remove the Power Supply from its mounting location.

## Packing for Storage or Shipment

Repack the Power Supply into the original packing materials and packing box in which you originally received the unit.

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# APPENDIX A
# TECHNICAL SPECIFICATIONS

## Specifications

| Model | Size | Weight | Maximum Number of SCRs |
|---|---|---|---|
| **ST-100A** | 18” H x 10” W x 10” D<br>(457 mm x 254 mm x 25.4 mm) | 35 – 50 lb. (depends on options) | 1 |
| **ST-200A** | 30” H x 25.4” W x 12” D<br>(762 mm x 645 mm x 305 mm) | 110 – 140 lb. (depends on options) | 2 |

| ITEMS | SPECIFICATIONS |
|---|---|
| **Environmental** | |
| Ambient Temperature | 32 ºF – 104 ºF (0 ºC – 40 ºC) |
| Relative Humidity | 0% to 95% non-condensing |
| Maximum altitude | 9,800 ft. (3,000 m) |
| **Electrical Requirements** | 201 to 270 VAC or 402 to 540 VAC, 50/60 Hz, single-phase.<br>External disconnected device shall be rated no less than 115% of full-current load. |
| **Cooling Water Requirements** | In accordance with RWMA Bulletin 5-005.04: 1.2 gallons/minute (4.5 liter/minute), minimum; 90 psi (621 kPa) maximum; 104 °F (40 °C) maximum.<br>In addition:<br>▪ Water temperature should be no less than existing dew point for ambient air (approximately 70°F (21°C)), see Caution on page 2-3;<br>▪ Water shall have a pH of 7.0 – 8.0;<br>▪ Maximum impurity contents shall be:<br>▪ Chloride 20 ppm;<br>▪ Nitrate 10 ppm;<br>▪ Sulfate 100 ppm;<br>▪ Solids 250 ppm;<br>▪ Calcium carbonate ppm.<br>In addition, for the 2,200 A SCR, the cooling water must always be flowing when voltage is supplied to the SCR. |
| **Output Power** | |
| Valve power | Four user-programmable valve outputs (standard);<br>Eight additional user-programmable valve outputs (optional).<br>115 VAC (24 VAC optional) at 150 VA (standard) or 250 VA or 500 VA (optional) |
| Output Signals | Five outputs, triac, 1 A, 125 VAC max.<br>Functions are under program control. |
| **Conditions for all Modes** | |
| Load Power Factor | 30 – 70%, fixed impedance |
| Applicable Set Point Ranges | 20 – 95% of current at 180° conduction angle. (Unit will operate outside these ranges, but accuracy and regulation specifications will not apply.) |

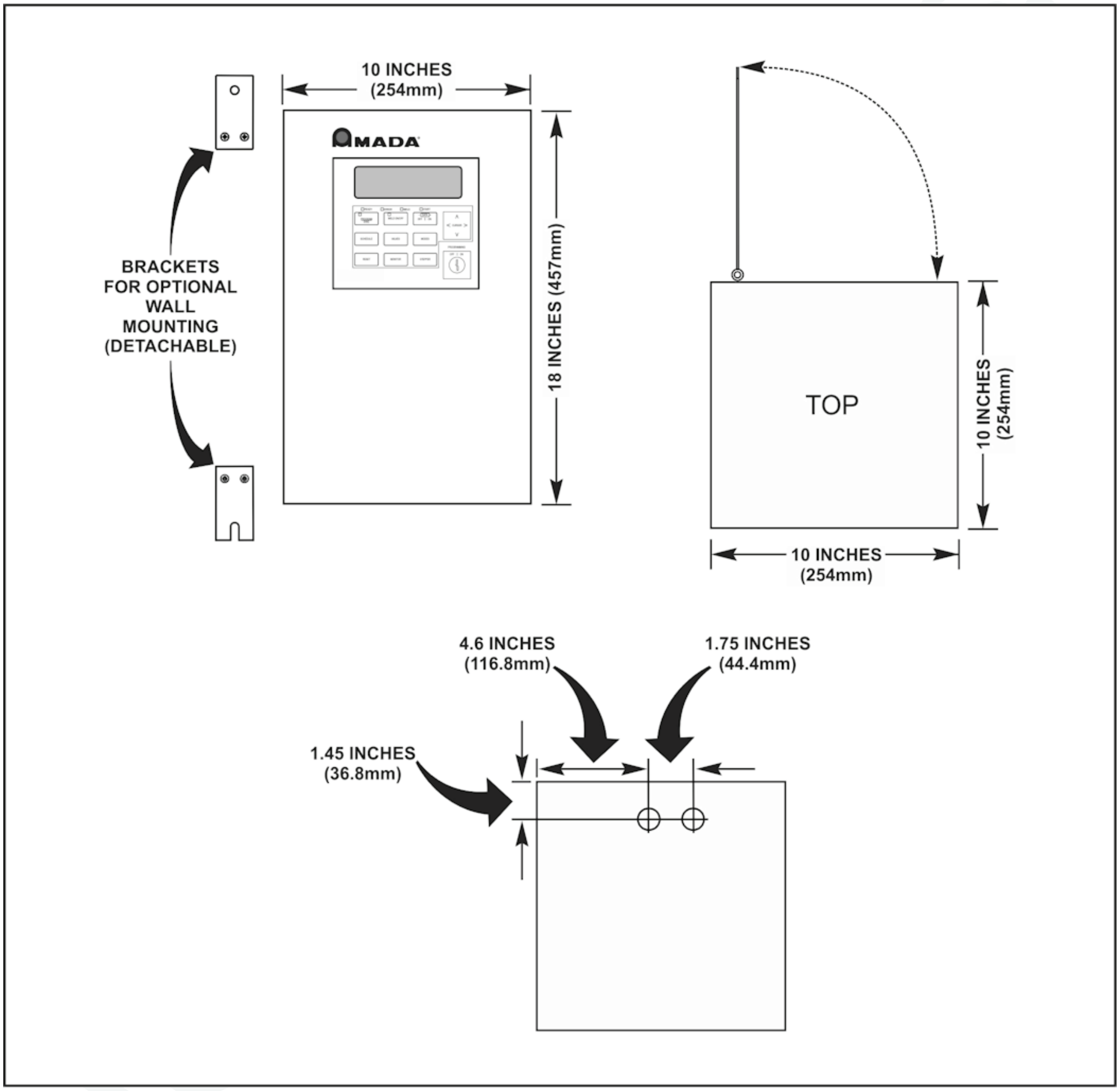
## APPENDIX A: TECHNICAL SPECIFICATIONS

| ITEMS | SPECIFICATIONS |
|---|---|
| **Regulation** | |
| Percent Heat Mode | |
| Control Speed | Responds by end of second cycle to input voltage fluctuations. |
| Accuracy | ± 3% of set point for fluctuation of ± 10% of power source voltage |
| Constant Current – Primary Monitor | Internal current transformer |
| Control Algorithm | Whole cycle (symmetrical) by cycle |
| *Initial Responding Speed | Set point current ± 10% after 4 cycles |
| *Voltage regulation | ± 2% of set point for +10 / –15% AC voltage fluctuation |
| *Resistive load regulation | ± 2% of set point for ± 15% load resistance fluctuation |
| *Inductive load regulation | ± 2% of set point for ± 15% load induction fluctuation |
| Constant Current – Secondary Monitor | External Rowgowski Coil (Torroidal Coil) |
| Control Algorithm | Half cycle by half cycle |
| *Initial Responding Speed | Set point current ± 10% after 2 cycles |
| *Voltage regulation | ± 2% of set point for + 10, –15% AC voltage fluctuation |
| *Resistive load regulation | ± 2% of set point for ± 15% load resistance fluctuation |
| *Inductive load regulation | ± 2% of set point for ± 15% load induction fluctuation |
| *Average Current Accuracy | ± 1% of set point of full scale after initial response |
| *For welds between 20% and 95% of full current | |

# APPENDIX A: TECHNICAL SPECIFICATIONS

## Outline Drawings

**NOTE:** Measurements are in inches (mm).


10 INCHES (254mm)
AMADA
BRACKETS FOR OPTIONAL WALL MOUNTING (DETACHABLE)
18 INCHES (457mm)
TOP
10 INCHES (254mm)
10 INCHES (254mm)
4.6 INCHES (116.8mm)
1.75 INCHES (44.4mm)
1.45 INCHES (36.8mm)

ST-100A AC Control

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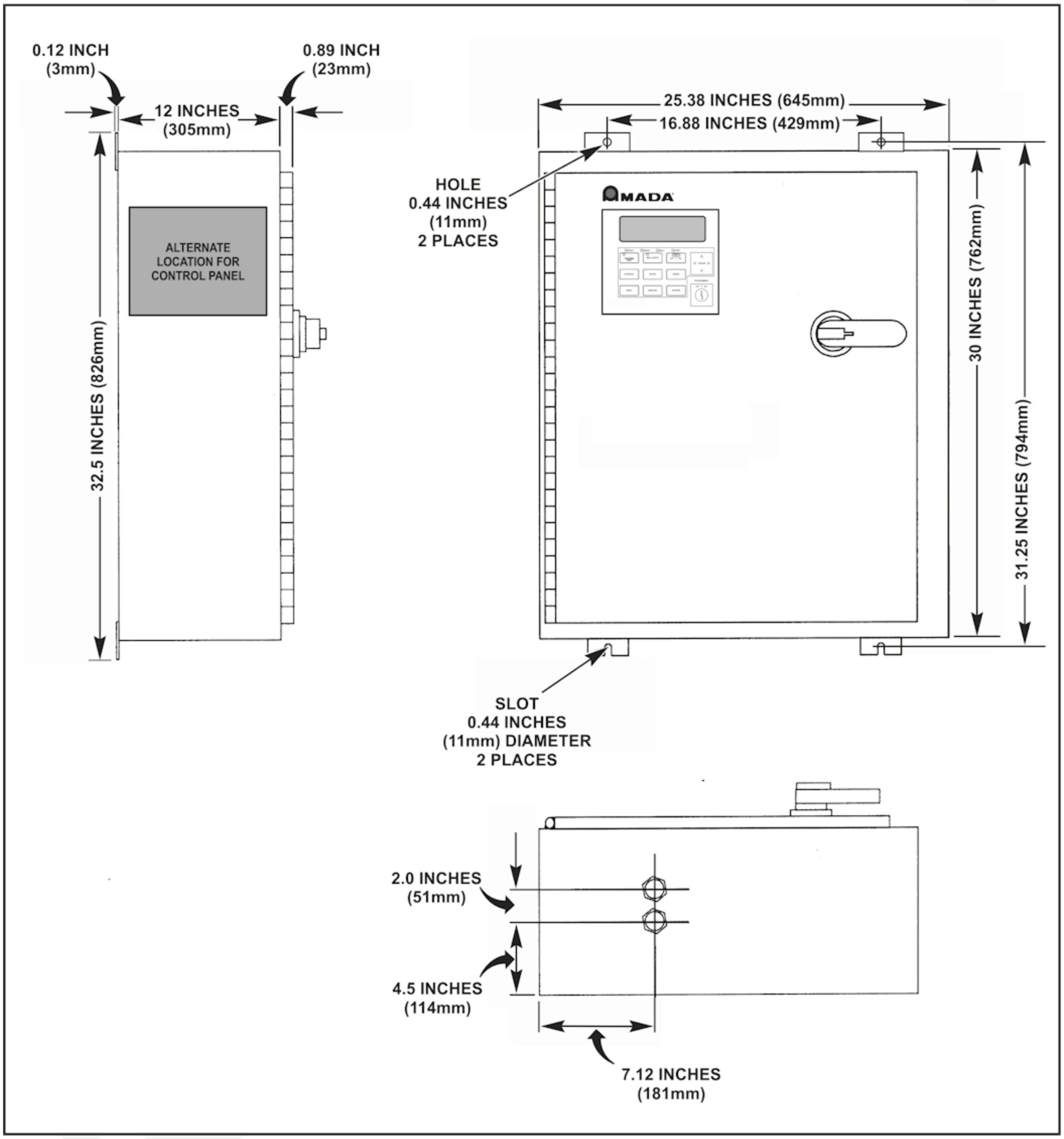
## APPENDIX A: TECHNICAL SPECIFICATIONS


0.12 INCH (3mm)
0.89 INCH (23mm)
12 INCHES (305mm)
32.5 INCHES (826mm)
ALTERNATE LOCATION FOR CONTROL PANEL
25.38 INCHES (645mm)
16.88 INCHES (429mm)
HOLE 0.44 INCHES (11mm) 2 PLACES
AMADA
30 INCHES (762mm)
31.25 INCHES (794mm)
SLOT 0.44 INCHES (11mm) DIAMETER 2 PLACES
2.0 INCHES (51mm)
4.5 INCHES (114mm)
7.12 INCHES (181mm)

ST-200A AC Control

WSI INC.

# APPENDIX B
# ELECTRICAL AND DATA CONNECTIONS

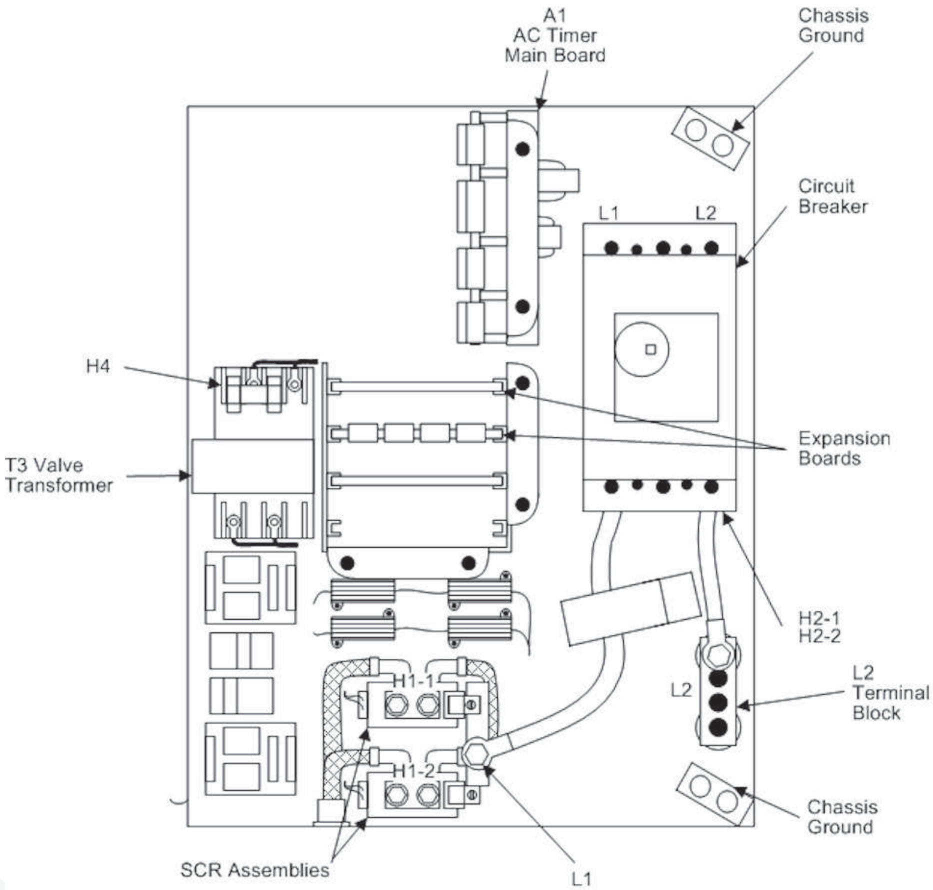
## Section I. Electrical Connections

**WARNING**: The installer must make electrical connections in accordance to all applicable codes.

**NOTES:**

- Make sure you are familiar with the Power Supplies internal components and where they are located (see *Chapter 1, Description*).
- Make sure you know where the power connection points are. (See Page B-2*, Electrical Power Connections*.)
- Make sure you know the appropriate circuit breaker rating for your Power Supply. (See *Appendix C, SCR, Wire Gauge, and Circuit Breaker Selection*.)
- Make sure you know how to make the **Emergency Stop** connections.
- Power and signal connections are made through the customer-provided punch-out holes in the Power Supply.

## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS


A1
AC Timer
Main Board
Chassis
Ground
Circuit
Breaker
L1
L2
H4
T3 Valve
Transformer
Expansion
Boards
H2-1
H2-2
L2
L2
Terminal
Block
H1-1
H1-2
Chassis
Ground
SCR Assemblies
L1

Typical Electrical Power Connections

1 Connect the Power Supply to the weld transformer using the appropriate wire gauge for your requirements.

2 Connect one side of each weld transformer primary to H1-1 and H1-2, respectively.

3 Connect the other side of each weld transformer primary together and to H2-1 and H2-2 or the optional Terminal Block L2.

**NOTE:** If the Power Supply is not equipped with an L2 terminal block, connect H2-1 and H2-2 to the incoming L2 line and connect an 18 gauge wire from there to H4 of the valve transformer.

4 Connect the Power Supply to the appropriate power source (230 V or 460 V) using the appropriate wire gauge for your power requirements. (See Appendix C.)

5 Connect the power source wires to L1 and L2 of the circuit breaker and to chassis ground.

**NOTE:** If your unit was ordered without a circuit breaker, connect the wires to L1 of the SCR assemblies, optional terminal block L2, and ground. If you do *not* have terminal block L2, connect the incoming L2 wire to H2-1 and H2-2, and connect an 18-gauge wire from there to H4 of the valve transformer.

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# Section II. Input / Output Signal Connections

Connect the input/output (I/O) signals as shown in the connection diagram on the following page (B-4), *Input / Output Control Signals*.

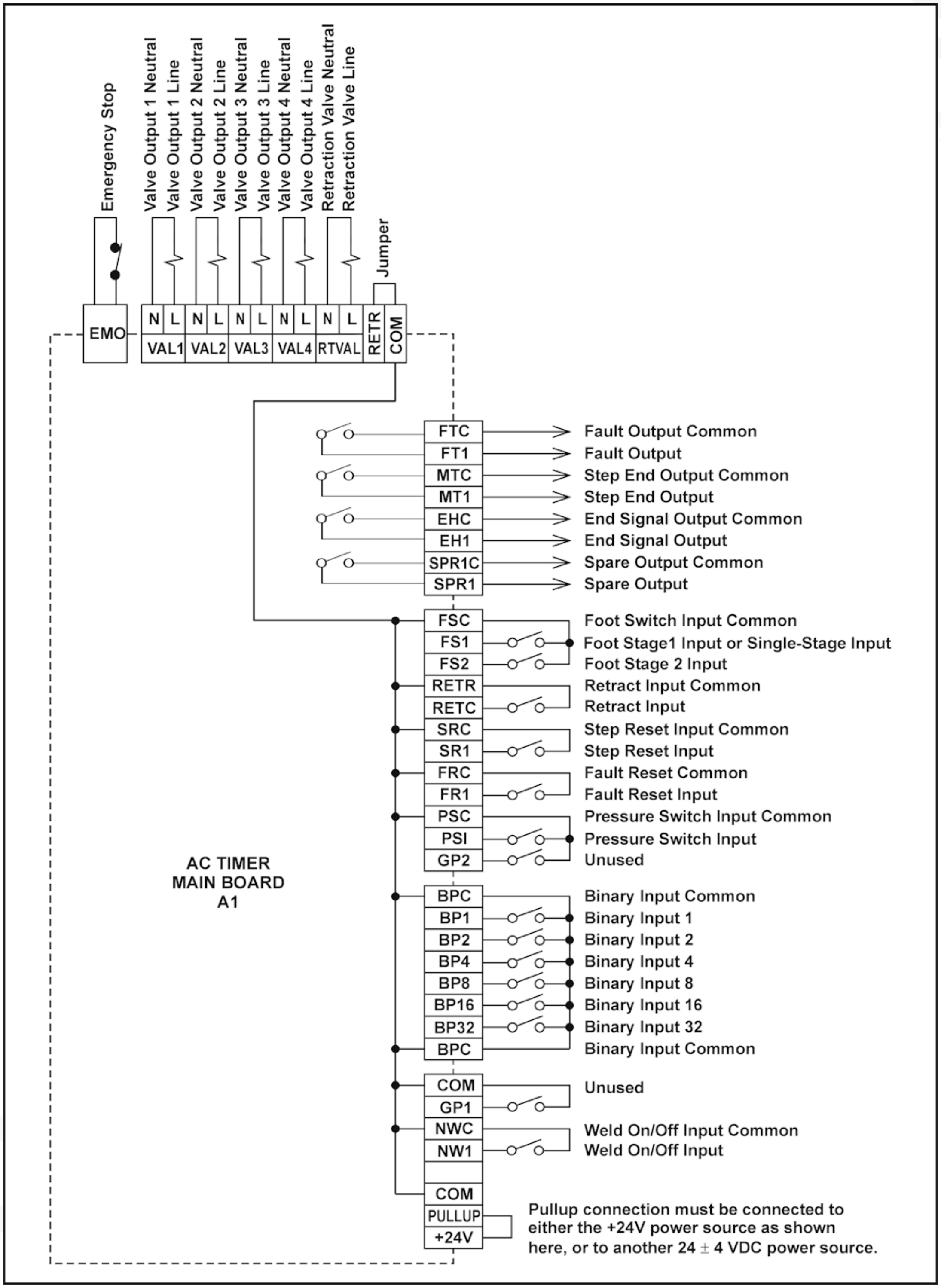
With the exception of the valve outputs, all output signals are isolated contact relays. Valve outputs may be either 115 VAC (standard) or 24 VAC.

Input signals are referenced to either an internal or external 24 VDC power supply.

**NOTES:**

- If you have an optional Valve Expansion Board, also make the output connections to that board, as shown on page B-7.
- Descriptions of these signals follow each diagram.

# APPENDIX B: ELECTRICAL AND DATA CONNECTIONS


Emergency Stop
Valve Output 1 Neutral
Valve Output 1 Line
Valve Output 2 Neutral
Valve Output 2 Line
Valve Output 3 Neutral
Valve Output 3 Line
Valve Output 4 Neutral
Valve Output 4 Line
Retraction Valve Neutral
Retraction Valve Line
Jumper
EMO
N L N L N L N L N L
VAL1 VAL2 VAL3 VAL4 RTVAL
RETR
COM
FTC
FT1
MTC
MT1
EHC
EH1
SPR1C
SPR1
Fault Output Common
Fault Output
Step End Output Common
Step End Output
End Signal Output Common
End Signal Output
Spare Output Common
Spare Output
FSC
FS1
FS2
RETR
RETC
SRC
SR1
FRC
FR1
PSC
PSI
GP2
Foot Switch Input Common
Foot Stage1 Input or Single-Stage Input
Foot Stage 2 Input
Retract Input Common
Retract Input
Step Reset Input Common
Step Reset Input
Fault Reset Common
Fault Reset Input
Pressure Switch Input Common
Pressure Switch Input
Unused
AC TIMER
MAIN BOARD
A1
BPC
BP1
BP2
BP4
BP8
BP16
BP32
BPC
Binary Input Common
Binary Input 1
Binary Input 2
Binary Input 4
Binary Input 8
Binary Input 16
Binary Input 32
Binary Input Common
COM
GP1
NWC
NW1
Unused
Weld On/Off Input Common
Weld On/Off Input
COM
PULLUP
+24V
Pullup connection must be connected to either the +24V power source as shown here, or to another 24 ± 4 VDC power source.

Input / Output Control Signals

## Input / Output Signal Descriptions

### EMO – Emergency Stop

A disconnect signal from an external Emergency Stop switch, across these two pins will cause an immediate termination of the welding operation. Power Supply power remains on. When the emergency stop switch is released and the reset button is pressed, the Power Supply will automatically re-boot and then be ready for operation.

### VAL1, N & L through VAL4, N & L – Valve Output 1 Neutral and Line through Valve Output 4 Neutral and Line

Output signals to drive up to four valves. (If more valves are needed, a Valve Expander Board is required.) Each set of connections provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections.

### RTVAL, N & L – Retraction Valve Output Neutral and Line

Output signals to drive the retraction valve. Provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections.

### RETR – Retraction Input

The input to control the status of the retraction valve output. This may be either a fixed or pulsed input. See Chapter 3 for the software selection of how this input operates. If a retraction input is not supplied, a jumper should be installed between **RETR** and **RETC**.

### FT1/FTC – Fault Output

An output signal indicating an error has occurred. The **ERROR OUTPUT** setting, set on the **Weld Mode** screen, determines whether this signal will be sent.

### MT1/MTC – Step End Output

Output signal indication stepper is completed. Once this output is on, the unit can no longer be fired and the error must be cleared. If the front panel **RESET** button or external **Fault Reset** is initiated at the end of the stepper, the fault will clear and the unit may be fired one more time. After firing one more time, the fault will re-appear. To clear the step counters, use the **Step Reset** input. After clearing with **Step Reset**, the unit will once again start counting at the first programmed step count.

### EH1/EHC – End Signal Output

Output signal indicating completion of the weld schedule sequence. In **Chain Sequence**, **EH1** occurs after all schedules have fired. **EH1** is 40 – 70 ms in duration. If the Start signal is held beyond the end of the schedule, **EH1** will stay on until either **Start** switch (**FS1** or **FS2**) is turned off.

### SPR1/SPR1C – Weld On/Off Status

This output indicates the NW1 status. (See **NW1**) When the output is closed, the unit is ready to weld.

**NOTE:** These outputs are isolated contact relays that are closed when active.

# APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

### FS1 – Foot Switch Stage 1 Input

The first level of a two-level foot switch or a single level foot switch is connected to this connector. (A single level foot switch MUST also be connected to FS2) This signal will switch the valve driver on, causing the electrode(s) of the weld head to apply force to the work pieces and start the squeeze delay period. In the case of a single level footswitch, the weld schedule will continue to its completion; no further input is required. In the case of a two-level footswitch, the valves will be activated on the first level, and the schedule will commence from the beginning on the second level.

### FS2 – Foot Switch Stage 2 Input

This signal starts the weld schedule. **FS1** turns on selected valves only.

### SR1 – Step Reset Input

Input signal that, with the presence of a step end signal, will set the stepper back to **0000** and the step number back to **01**. This input will also clear the fault output when step end occurs.

### FR1 – Fault Reset Input

Input signal that resets a fault condition and clears the fault output. After an **EMO** (**Emergency Stop**), a fault reset input will re-boot the system.

### IN1 – General Purpose Input 1

Unused

### PS1 – Pressure switch input

When the pressure switch input is enabled in software (see Chapter 3) this input must close for the schedule to progress from squeeze delay to squeeze. If this input does not close within approximately 5 seconds, the error message **PRESSURE SWITCH ALARM** appears on the display and a fault output occurs.

### IN2 – General Purpose Input 2

Unused

### BP1, BP2, BP4, BP8, BP16, BP32 – Binary Input 1, 2, 4, 8, 16, 32

These are the binary inputs for weld schedule selection. See *Appendix D* for the I/O Binary Input schedule. There are two **Binary Input Common** (**BPC**) connections associated with these signals.

### TT1 – Unused

Unused

### NW1 – Weld On/Off Input

When the **WELD ON/OFF** control (in the **Extended System Values** screen) is set to **LOCAL**, this signal locks out the **WELD ON/OFF** input and enables the pushbutton switch on the Control Panel.

When the **WELD ON/OFF** control is set to **REMOTE**, the following occurs: If the input is closed, the Power Supply will function normally. If the input is open, the Power Supply will operate through the programmed sequence, but will not activate the SCR; no weld will occur.

When set to **REMOTE**, saving any changes to the schedule or settings on the front panel will set the Power Supply to the **Weld Off** state. This input must then be opened and re-closed to set the **Weld On** state.

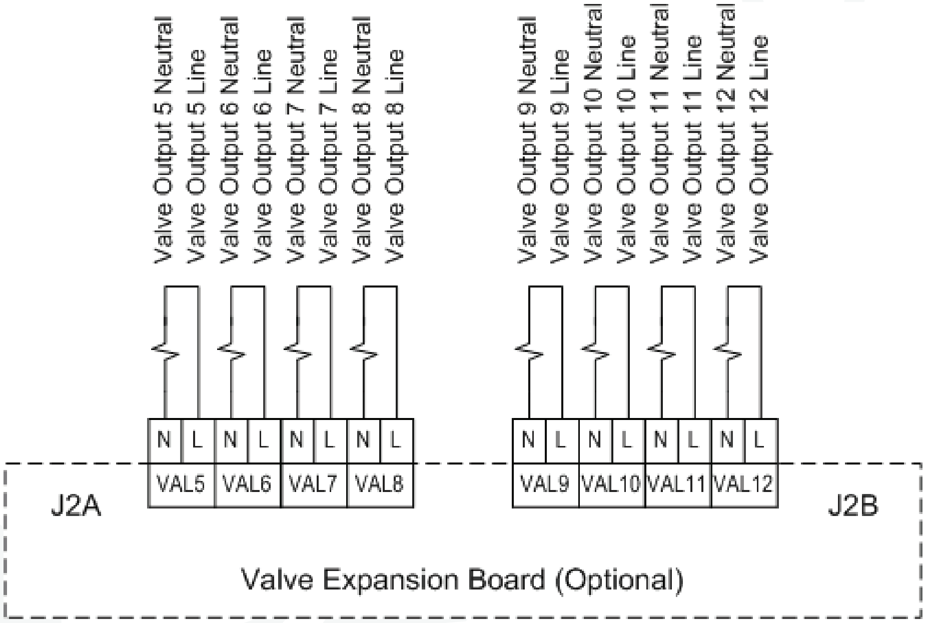
## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

### PULLUP – Pullup Voltage

This input provides the pull-up voltage for the I/O bus. It is normally connected to the adjacent +24 V source (see **+24 V**, below), but can be connected to any power source between +20 V and +28 V.

**+24 V –** Provides output source of **+24 V** power that may be used for the pull-up voltage. Do ***not*** use this voltage to power external devices or the Power Supply may be damaged.

## Optional Valve Expansion Board


Valve Output 5 Neutral
Valve Output 5 Line
Valve Output 6 Neutral
Valve Output 6 Line
Valve Output 7 Neutral
Valve Output 7 Line
Valve Output 8 Neutral
Valve Output 8 Line
Valve Output 9 Neutral
Valve Output 9 Line
Valve Output 10 Neutral
Valve Output 10 Line
Valve Output 11 Neutral
Valve Output 11 Line
Valve Output 12 Neutral
Valve Output 12 Line
N
L
VAL5
VAL6
VAL7
VAL8
VAL9
VAL10
VAL11
VAL12
J2A
J2B
Valve Expansion Board (Optional)

Valve Expansion Board Output Signals

### VAL5, N & L through VAL12, N & L – Valve Output 5 Neutral and Line through Valve Output 12 Neutral and Line

Output signals to drive up to eight additional valves. Each set of connections provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections. Output is limited to 1 amp per channel.

WSI INTEGRATORS, INC.

# APPENDIX C

# SCR, WIRE GAUGE, AND CIRCUIT BREAKER SELECTION

## Basis for SCR, Wire Gauge, and Circuit Breaker Selection

- SCR size is determined as the larger size needed to support
  a) machine rated kVA
  b) machine demand kVA
- The maximum demand current an SCR can handle is conservatively assumed equal to 2.5 x rated current (at the 50% duty cycle).
- Maximum machine kVA ratings (50% duty cycle) for a given SCR allows for a 300% safety factor.
- Input wire gauge must meet two criteria:
  a) Less than or equal to 5% of the voltage drop with 100 feet of mains wiring at maximum demand current, and
  b) Ampacity must be larger than effective 100% RMS current based on NEC table.
- Circuit breaker is determined by
  a) Trip current being the lowest specified unit at least 1.25 times the maximum RMS current, normalized to 100% of the duty cycle.
  b) Trip characteristics are determined by maximum demand current and weld duration.
- Wire gauge determination assumes 90 °C, 600 V insulation.

**SCR Selection**

| SCR Current Rating | | 240 V | | | | 480 V | | | |
|---|---|---|---|---|---|---|---|---|---|
| SCR 100% DC Current Rating | SCR 50% DC 30-Cycle Weld Current Rating (A) | Max kVA 50% | Equivalent Continuous Current (A) | Max kVA Demand | Max Current Demand (A) | Max kVA 50% | Equivalent Continuous Current (A) | Max kVA Demand | Max Current Demand (A) |
| 300 | 470 | 35 | 103 | 85 | 354 | 70 | 103 | 170 | 354 |
| 600 | 1,100 | 85 | 250 | 220 | 916 | 170 | 250 | 440 | 916 |
| 1,200 | 1,800 | 130 | 383 | 300 | 1,250 | 250 | 383 | 600 | 1,250 |
| 1,800 | 2,500 | 200 | 590 | 500 | 2,083 | 400 | 590 | 1,000 | 2,083 |
| 2,200 | 3,200 | 250 | 736 | 583 | 2,430 | 500 | 736 | 1,166 | 2,430 |

# APPENDIX C: SCR, WIRE GAUGE, AND CIRCUIT BREAKER SELECTION

## Wire Gauge

For specific wire gauge needed to support ampacity, use the Equivalent Continuous Current and refer to NFPA 70 National Electric Code table 310-16. The table for 90 °C insulated copper wire at 30 °C ambient temperature is reproduced here for reference only.

### Wire Gauge Requirements

| Ampacity | AWG Wire Gauge |
|---|---|
| 55 | 8 |
| 75 | 6 |
| 95 | 4 |
| 110 | 3 |
| 130 | 2 |
| 150 | 1 |
| 170 | 0 |

| Ampacity | AWG Wire Gauge |
|---|---|
| 195 | 2/0 |
| 225 | 3/0 |
| 260 | 4/0 |
| 290 | 250 |
| 320 | 300 |
| 350 | 350 |
| 380 | 400 |

| Ampacity | AWG Wire Gauge |
|---|---|
| 430 | 500 |
| 475 | 600 |
| 520 | 700 |
| 535 | 750 |
| 555 | 800 |
| 585 | 900 |
| 615 | 1000 |

Table C-3. Wire Gauge Based on Ampacity.

### 240 VAC Mains

| Rated kVA | 240 | AWG |
|---|---|---|
| 10 | 29 | 8 |
| 15 | 44 | 8 |
| 20 | 59 | 6 |
| 30 | 88 | 6 |
| 50 | 147 | 1 |
| 75 | 221 | 3/0 |
| 100 | 295 | 250 |
| 150 | 442 | 2 x 4/0 |
| 175 | 516 | 2 x 250 |
| 200 | 589 | 2 x 300 |
| 250 | 737 | 2 x 500 |
| 300 | 884 | * |
| 350 | 1,031 | * |
| 400 | 1,179 | * |
| 500 | 1,473 | * |

### 480 VAC Mains

| Rated kVA | 240 | AWG |
|---|---|---|
| 10 | 15 | 8 |
| 15 | 22 | 8 |
| 20 | 29 | 8 |
| 30 | 44 | 8 |
| 50 | 74 | 6 |
| 75 | 110 | 2 |
| 100 | 147 | 1 |
| 125 | 184 | 2/0 |
| 150 | 221 | 3/0 |
| 160 | 236 | 4/0 |
| 175 | 258 | 250 |
| 200 | 295 | 300 |
| 250 | 368 | 400 |
| 300 | 442 | 2 x 4/0 |
| 350 | 516 | 2 x 250 |
| 400 | 589 | 2 x 300 |
| 500 | 737 | 2 x 400 |
| 600 | 884 | 2 x 500 |
| 700 | 1,031 | * |
| 800 | 1,179 | * |
| 900 | 1,326 | * |
| 1000 | 1,473 | * |
| 1200 | 1,768 | * |

# APPENDIX C: SCR, WIRE GAUGE, AND CIRCUIT BREAKER SELECTION

## Wire Gauges Based on Demand (kVA)

For wire gauge needed to support a maximum of 5% voltage drop, consult table C-4. The information herein is based on NFPA70 National Electric Code table 9 in Chapter 9. The calculations are based on a 30% power factor and 100 foot power cable run.

**Wire Gauge Based on Demand 240 VAC Mains**

| Demand kVA | 240 | Max Zw | Max Rw | Max XLw | AWG (Cu) |
|---|---|---|---|---|---|
| 10 | 42 | $2.880 \times 10^{-01}$ | $8.640 \times 10^{-01}$ | 2.758 | 8 |
| 15 | 63 | $1.920 \times 10^{-01}$ | $5.760 \times 10^{-01}$ | 1.839 | 6 |
| 20 | 83 | $1.440 \times 10^{-01}$ | $4.320 \times 10^{-01}$ | 1.379 | 4 |
| 30 | 125 | $9.600 \times 10^{-02}$ | $2.880 \times 10^{-01}$ | $9.195 \times 10^{-01}$ | 3 |
| 50 | 208 | $5.760 \times 10^{-02}$ | $1.728 \times 10^{-01}$ | $5.517 \times 10^{-01}$ | 1 |
| 75 | 313 | $3.840 \times 10^{-02}$ | $1.152 \times 10^{-01}$ | $3.678 \times 10^{-01}$ | 2/0 |
| 100 | 417 | $2.880 \times 10^{-02}$ | $8.640 \times 10^{-02}$ | $2.758 \times 10^{-01}$ | 3/0 |
| 150 | 625 | $1.920 \times 10^{-02}$ | $5.760 \times 10^{-02}$ | $1.839 \times 10^{-01}$ | 250 |
| 175 | 729 | $1.646 \times 10^{-02}$ | $4.937 \times 10^{-02}$ | $1.576 \times 10^{-01}$ | 300 |
| 200 | 833 | $1.440 \times 10^{-02}$ | $4.320 \times 10^{-02}$ | $1.379 \times 10^{-01}$ | 350 |
| 250 | 1,042 | $1.152 \times 10^{-02}$ | $3.456 \times 10^{-02}$ | $1.103 \times 10^{-01}$ | 400 |
| 300 | 1,250 | $9.600 \times 10^{-03}$ | $2.880 \times 10^{-02}$ | $9.195 \times 10^{-02}$ | 2 x 250 |
| 350 | 1,458 | $8.229 \times 10^{-03}$ | $2.469 \times 10^{-02}$ | $7.881 \times 10^{-02}$ | 2 x 300 |
| 400 | 1,667 | $7.200 \times 10^{-03}$ | $2.160 \times 10^{-02}$ | $6.896 \times 10^{-02}$ | 2 x 350 |
| 500 | 2,083 | $5.760 \times 10^{-03}$ | $1.728 \times 10^{-02}$ | $5.517 \times 10^{-02}$ | 2 x 500 |

# APPENDIX C: SCR, WIRE GAUGE, AND CIRCUIT BREAKER SELECTION

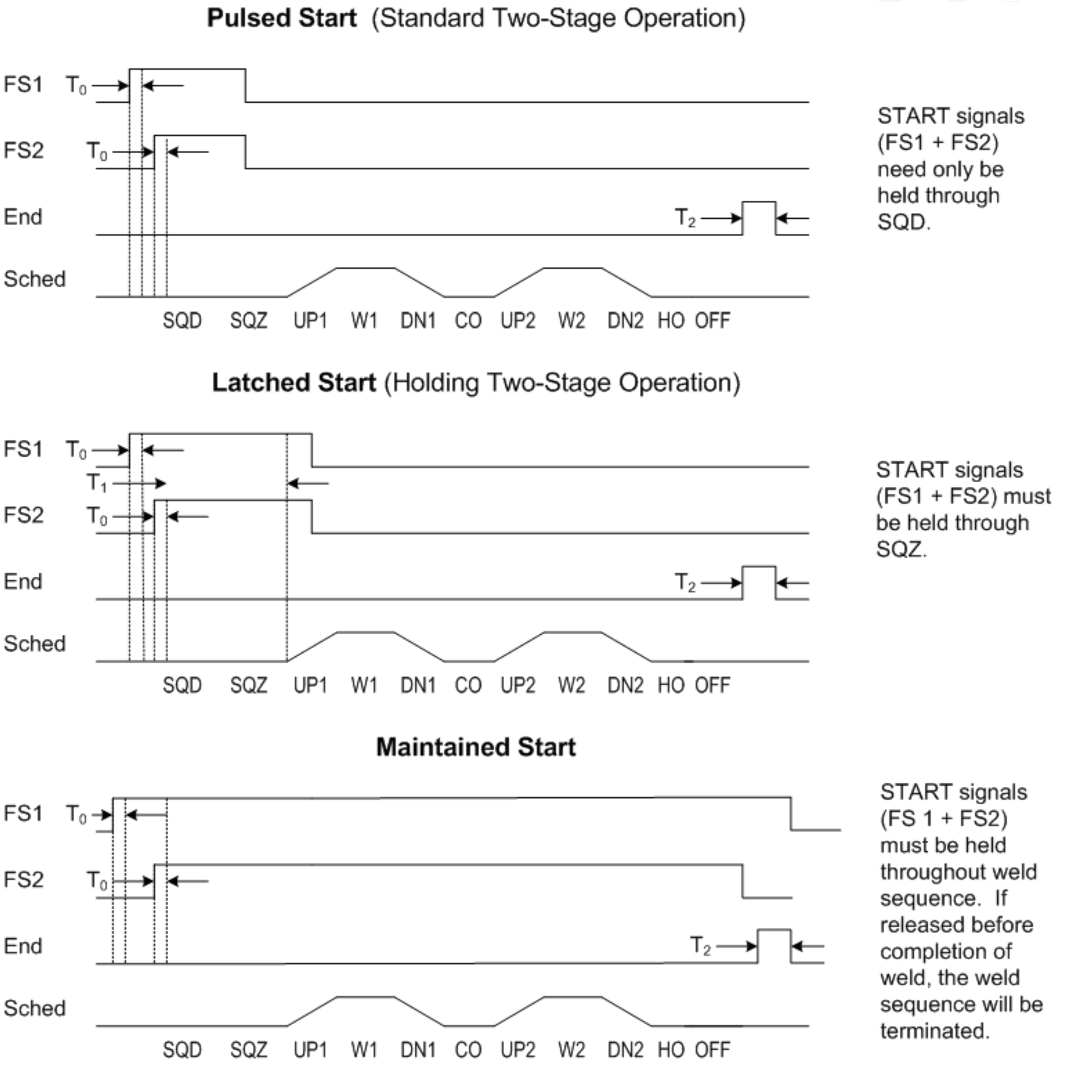
### Wire Gauge Based on Demand 480 VAC Mains

| Demand kVA | 480 | Max Z | R | XL | AWG (Cu) |
|---|---|---|---|---|---|
| 10 | 21 | 1.152 | 3.456 | 11.03 | 14 |
| 15 | 31 | $7.680 \times 10^{-01}$ | 2.304 | 7.356 | 12 |
| 20 | 42 | $5.760 \times 10^{-01}$ | 1.728 | 5.517 | 10 |
| 30 | 63 | $3.840 \times 10^{-01}$ | 1.152 | 3.678 | 8 |
| 50 | 104 | $2.304 \times 10^{-01}$ | $6.912 \times 10^{-01}$ | 2.207 | 6 |
| 75 | 156 | $1.536 \times 10^{-01}$ | $4.608 \times 10^{-01}$ | 1.471 | 4 |
| 100 | 208 | $1.152 \times 10^{-01}$ | $3.456 \times 10^{-01}$ | 1.103 | 4 |
| 150 | 313 | $7.680 \times 10^{-02}$ | $2.304 \times 10^{-01}$ | $7.356 \times 10^{-01}$ | 2 |
| 160 | 333 | $7.200 \times 10^{-02}$ | $2.160 \times 10^{-01}$ | $6.896 \times 10^{-01}$ | 2 |
| 175 | 365 | $6.583 \times 10^{-02}$ | $1.975 \times 10^{-01}$ | $6.305 \times 10^{-01}$ | 1 |
| 200 | 417 | $5.760 \times 10^{-02}$ | $1.728 \times 10^{-01}$ | $5.517 \times 10^{-01}$ | 1 |
| 250 | 521 | $4.608 \times 10^{-02}$ | $1.382 \times 10^{-01}$ | $4.414 \times 10^{-01}$ | 1/0 |
| 300 | 625 | $3.840 \times 10^{-02}$ | $1.152 \times 10^{-01}$ | $3.678 \times 10^{-01}$ | 2/0 |
| 350 | 729 | $3.291 \times 10^{-02}$ | $9.874 \times 10^{-02}$ | $3.153 \times 10^{-01}$ | 3/0 |
| 400 | 833 | $2.880 \times 10^{-02}$ | $8.640 \times 10^{-02}$ | $2.758 \times 10^{-01}$ | 3/0 |
| 500 | 1,042 | $2.304 \times 10^{-02}$ | $6.912 \times 10^{-02}$ | $2.207 \times 10^{-01}$ | 4/0 |
| 600 | 1,250 | $1.920 \times 10^{-02}$ | $5.760 \times 10^{-02}$ | $1.839 \times 10^{-01}$ | 250 |
| 700 | 1,458 | $1.646 \times 10^{-02}$ | $4.937 \times 10^{-02}$ | $1.576 \times 10^{-01}$ | 350 |
| 800 | 1,667 | $1.440 \times 10^{-02}$ | $4.320 \times 10^{-02}$ | $1.379 \times 10^{-01}$ | 400 |
| 900 | 1,875 | $1.280 \times 10^{-02}$ | $3.840 \times 10^{-02}$ | $1.226 \times 10^{-01}$ | 500 |
| 1000 | 2,083 | $1.152 \times 10^{-02}$ | $3.456 \times 10^{-02}$ | $1.103 \times 10^{-01}$ | 2 x 250 |
| 1200 | 2,500 | $9.600 \times 10^{-03}$ | $2.880 \times 10^{-02}$ | $9.195 \times 10^{-02}$ | 2 x 300 |

# APPENDIX D
# SYSTEM TIMING

## Input and Output Timing Signals

Figure D-1 shows the timing signals for the pulsed, latched, and maintained start signals. Table D-1 is the binary input for the schedules.



**Pulsed Start** (Standard Two-Stage Operation)

START signals (FS1 + FS2) need only be held through SQD.

**Latched Start** (Holding Two-Stage Operation)

START signals (FS1 + FS2) must be held through SQZ.

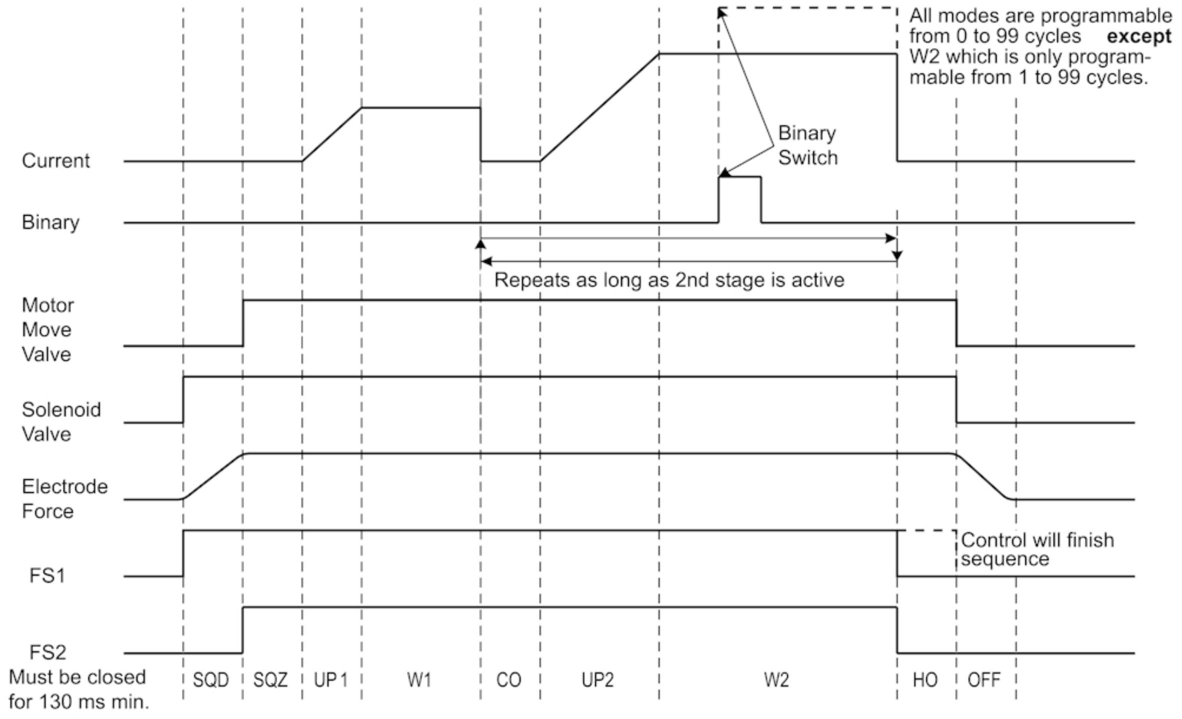
**Maintained Start**

START signals (FS 1 + FS2) must be held throughout weld sequence. If released before completion of weld, the weld sequence will be terminated.

$T_0$ = Debounce Period (30-70 ms)
$T_1$ = Hold Period (SQD + SQZ)
$T_2$ = End of Weld Signal (40-70 ms, minimum). Signal will be held until Start signal(s) are removed.

**Pulsed, Latched, and Maintained Start Signals**

# APPENDIX D: SYSTEM TIMING


All modes are programmable from 0 to 99 cycles **except** W2 which is only programmable from 1 to 99 cycles.
Binary Switch
Current
Binary
Repeats as long as 2nd stage is active
Motor Move Valve
Solenoid Valve
Electrode Force
FS1
Control will finish sequence
FS2
Must be closed for 130 ms min.
SQD
SQZ
UP1
W1
CO
UP2
W2
HO
OFF

Notes:

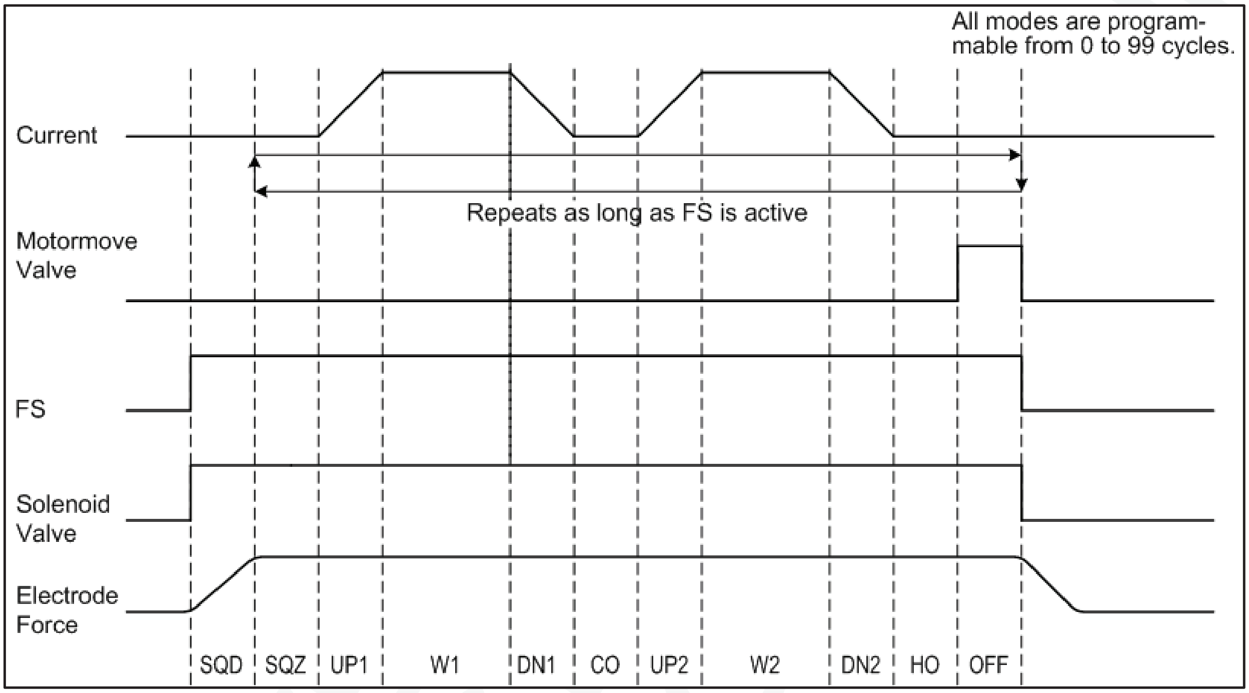
1 FS1 and FS2 are debounced for 30-70 ms upon opening and closing.

2 The microprocessor requires up to 70 ms of calculation time upon closure of FS1 and 50 ms of calculation of FS2. Valves and current may have a different calculation time.

3 Calculation of weld results may require 15-35 ms at the end of each weld period.

**Continuous Seam Weld**

# APPENDIX D: SYSTEM TIMING


All modes are programmable from 0 to 99 cycles.
Current
Repeats as long as FS is active
Motormove Valve
FS
Solenoid Valve
Electrode Force
SQD
SQZ
UP1
W1
DN1
CO
UP2
W2
DN2
HO
OFF

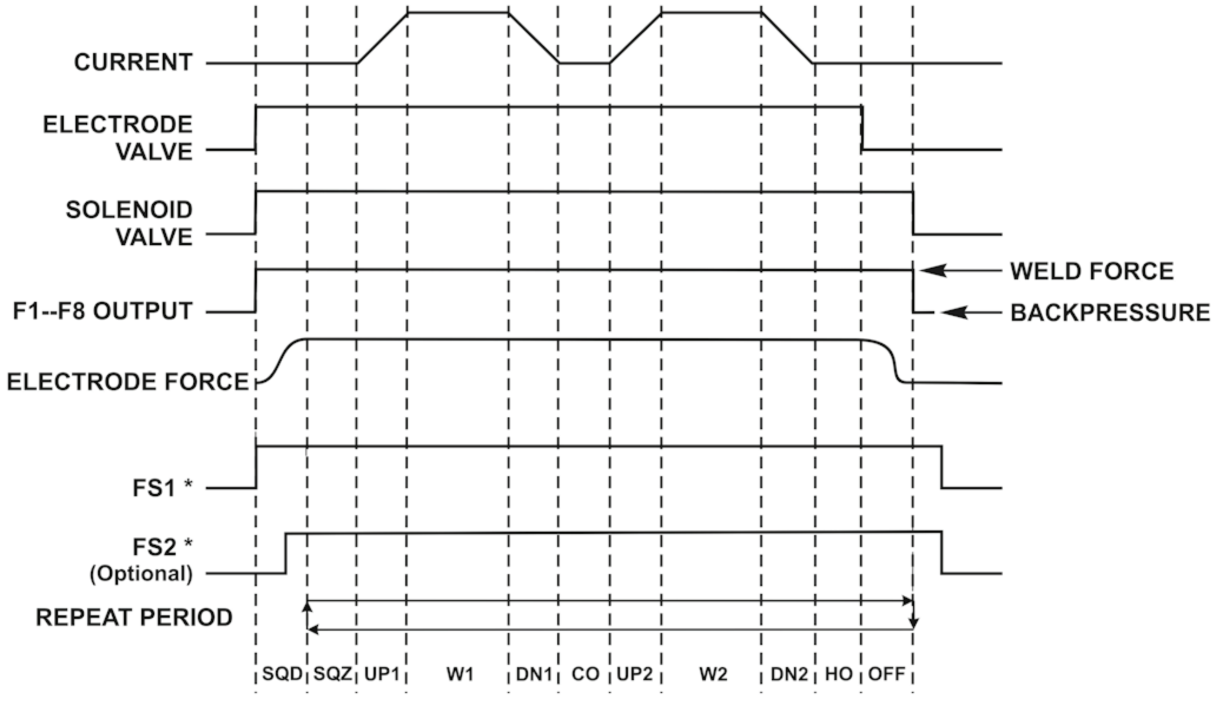
Notes:

1. FS1 and FS2 are debounced for 30 – 70 ms upon opening and closing.
2. The microprocessor requires up to 70 ms of calculation time upon closure of FS1 and 50 ms of calculation of FS2. Valves and current may have a different calculation time.

**Roll Spot Seam Weld**

WSI

## APPENDIX D: SYSTEM TIMING


CURRENT
ELECTRODE VALVE
SOLENOID VALVE
F1--F8 OUTPUT
WELD FORCE
BACKPRESSURE
ELECTRODE FORCE
FS1 *
FS2 *
(Optional)
REPEAT PERIOD
SQD
SQZ
UP1
W1
DN1
CO
UP2
W2
DN2
HO
OFF

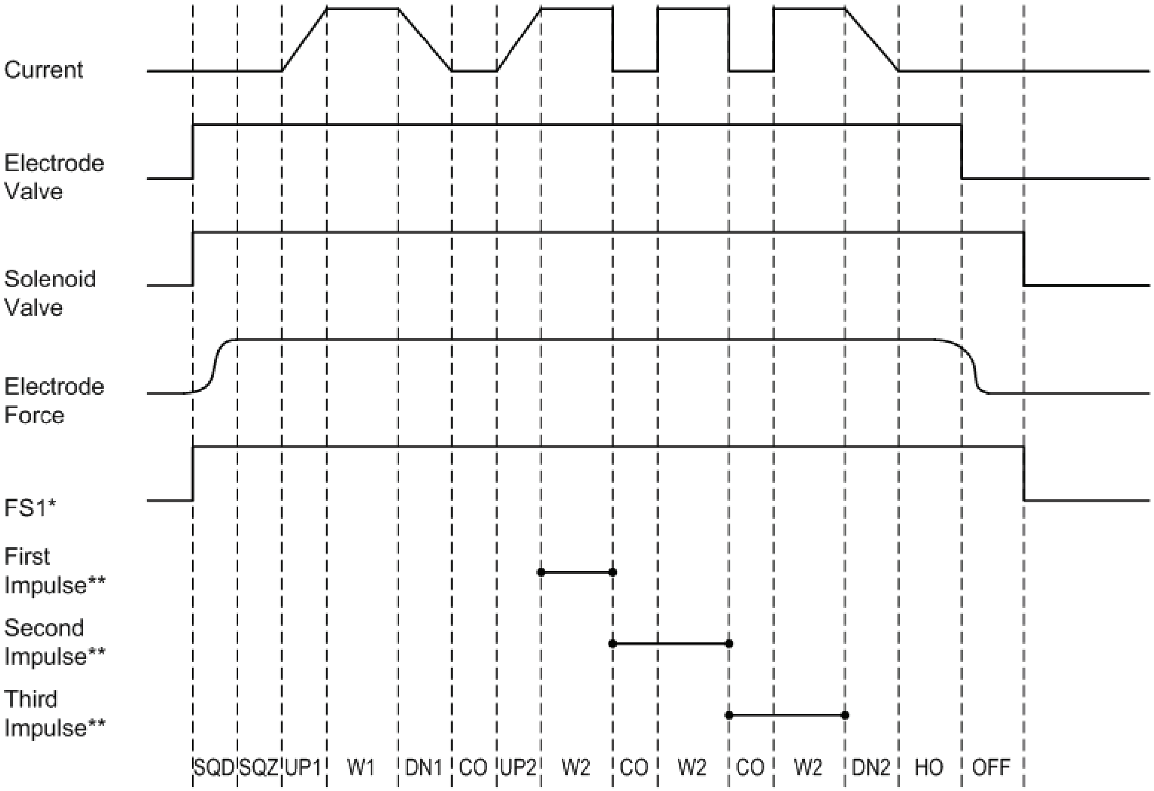
* Maintained mode shown. See Chapter 3 for description of Pulsed, Latched, and Maintained.
** The user can select one- or two-stage footswitches in software. See Chapter 3.

NOTES:

1. FS1 and FS2 are debounced for 30-70 ms upon opening and closing.
2. The microprocessor requires up to 70ms of calculation time upon closure of FS1 and 50ms of calculation of FS2. Valves and current may have a different calculation time.
3. Calculation of weld results may require 15-35 ms at the end of each repeat period.

Spot Welding

# APPENDIX D: SYSTEM TIMING


Current
Electrode Valve
Solenoid Valve
Electrode Force
FS1*
First Impulse**
Second Impulse**
Third Impulse**
SQD
SQZ
UP1
W1
DN1
CO
UP2
W2
CO
W2
CO
W2
DN2
HO
OFF

*See Chapter 3 for description of Maintained, Pulsed, and Latched modes. One-stage footswitch shown.
**The first impulse is a W2 period only. The second and following impulses are a CO period followed by a W2 period.

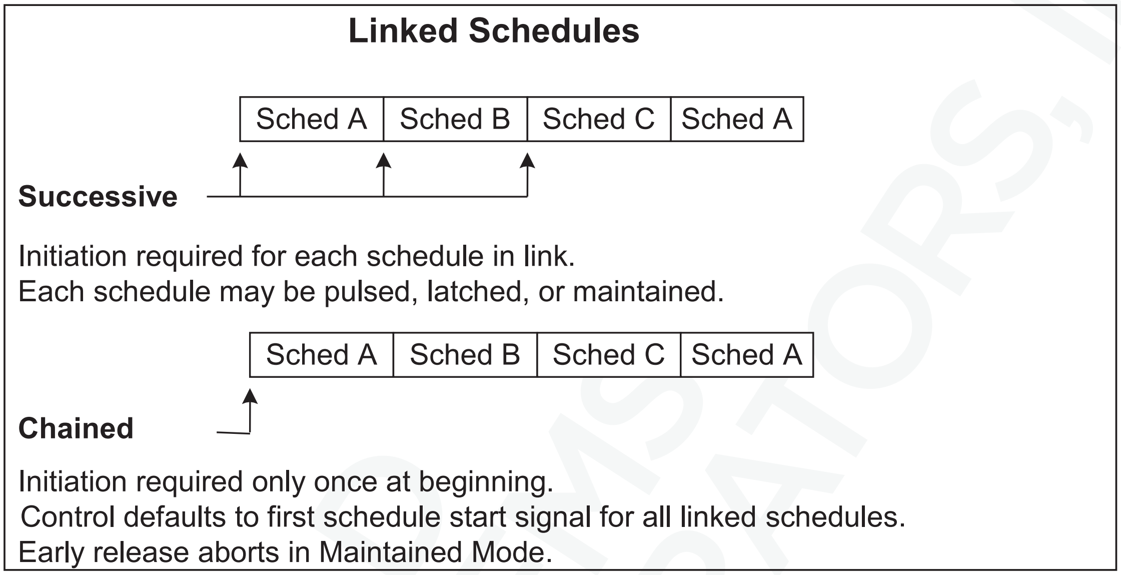
Notes:

1. FS1 and FS2 are debounced for 30 – 70 ms upon opening and closing.
2. The microprocessor requires up to 70 ms of calculation time upon closure of FS1 and 50 ms of calculation of FS2. Valves and current may have a different calculation time.

Spot Welding with 3 Impulses

WSI INC.

# APPENDIX D: SYSTEM TIMING


Linked Schedules
Sched A
Sched B
Sched C
Sched A
Successive
Sched A
Sched B
Sched C
Sched A
Chained

Initiation required for each schedule in link.
Each schedule may be pulsed, latched, or maintained.

Initiation required only once at beginning.
Control defaults to first schedule start signal for all linked schedules.
Early release aborts in Maintained Mode.

**Linked Schedules**

## APPENDIX D: SYSTEM TIMING

### Table B-1. I/O Binary Input

| Weld Schedule | I/O Binary Input | | | | | |
|---|---|---|---|---|---|---|
| | **Schedule 1** | **Schedule 2** | **Schedule 4** | **Schedule 8** | **Schedule 16** | **Schedule 32** |
| Schedule 00 | | | | | | |
| Schedule 01 | • | | | | | |
| Schedule 02 | | • | | | | |
| Schedule 03 | • | • | | | | |
| Schedule 04 | | | • | | | |
| Schedule 05 | • | | • | | | |
| Schedule 06 | | • | • | | | |
| Schedule 07 | • | • | • | | | |
| Schedule 08 | | | | • | | |
| Schedule 09 | • | | | • | | |
| Schedule 10 | | • | | • | | |
| Schedule 11 | • | • | | • | | |
| Schedule 12 | | | • | • | | |
| Schedule 13 | • | | • | • | | |
| Schedule 14 | | • | • | • | | |
| Schedule 15 | • | • | • | • | | |
| Schedule 16 | | | | | • | |
| Schedule 17 | • | | | | • | |
| Schedule 18 | | • | | | • | |
| Schedule 19 | • | • | | | • | |
| Schedule 20 | | | • | | • | |
| Schedule 21 | • | | • | | • | |
| Schedule 22 | | • | • | | • | |
| Schedule 23 | • | • | • | | • | |
| Schedule 24 | | | | • | • | |
| Schedule 25 | • | | | • | • | |
| Schedule 26 | | • | | • | • | |
| Schedule 27 | • | • | | • | • | |
| Schedule 28 | | | • | • | • | |
| Schedule 29 | • | | • | • | • | |
| Schedule 30 | | • | • | • | • | |
| Schedule 31 | • | • | • | • | • | |
| Schedule 32 | | | | | | • |
| Schedule 33 | • | | | | | • |
| Schedule 34 | | • | | | | • |
| Schedule 35 | • | • | | | | • |
| Schedule 36 | | | • | | | • |
| Schedule 37 | • | | • | | | • |
| Schedule 38 | | • | • | | | • |
| Schedule 39 | • | • | • | | | • |
| Schedule 40 | | | | • | | • |
| Schedule 41 | • | | | • | | • |
| Schedule 42 | | • | | • | | • |
| Schedule 43 | • | • | | • | | • |
| Schedule 44 | | | • | • | | • |
| Schedule 45 | • | | • | • | | • |
| Schedule 46 | | • | • | • | | • |
| Schedule 47 | • | • | • | • | | • |
| Schedule 48 | | | | | • | • |
| Schedule 49 | • | | | | • | • |
| Schedule 50 | | • | | | • | • |
| Schedule 51 | • | • | | | • | • |
| Schedule 52 | | | • | | • | • |
| Schedule 53 | • | | • | | • | • |
| Schedule 54 | | • | • | | • | • |
| Schedule 55 | • | • | • | | • | • |
| Schedule 56 | | | | • | • | • |
| Schedule 57 | • | | | • | • | • |
| Schedule 58 | | • | | • | • | • |
| Schedule 59 | • | • | | • | • | • |
| Schedule 60 | | | • | • | • | • |
| Schedule 61 | • | | • | • | • | • |
| Schedule 62 | | • | • | • | • | • |
| Schedule 63 | • | • | • | • | • | • |

WELD SYSTEMS INTEGRATORS, INC.

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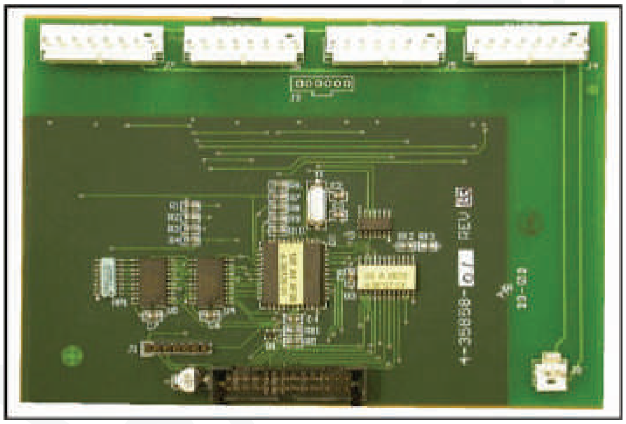
# APPENDIX E
# CASCADE BOARD OPTION

## Description

The Cascade Board gives the Power Supply the ability to operate up to four SCRs instead of just one.



Cascade Board

## Maintenance/Replacement

1 Disconnect the 26-pin ribbon cable connector from the AC Timer Main Board connected to J2.

2 Disconnect the 8-wire cable connector from each of the SCR Driver Boards connected to J4 (SCR1) through J7 (SCR4) as required.

3 Disconnect the 2-wire power connector from J8.

4 Slide the card out of the card cage.

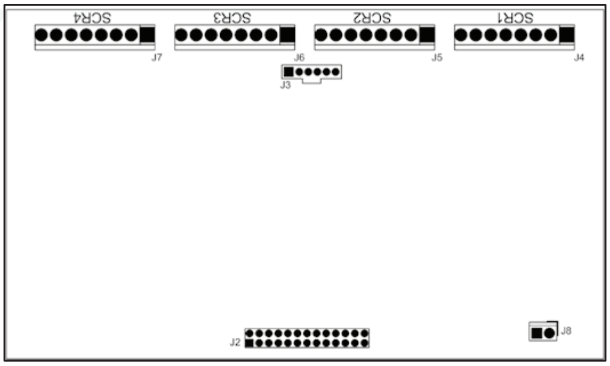
5 Install or re-install the circuit board by sliding it into the card cage.

6 Reconnect the 26-pin ribbon cable connector from the AC Timer Main Board to J2

7 Reconnect the 8-wire cable connectors from each of the SCR Driver Boards to J4 through J7 as required.

8 Reconnect the 2-wire power connector to J8.

9 Slide the board into the card cage.

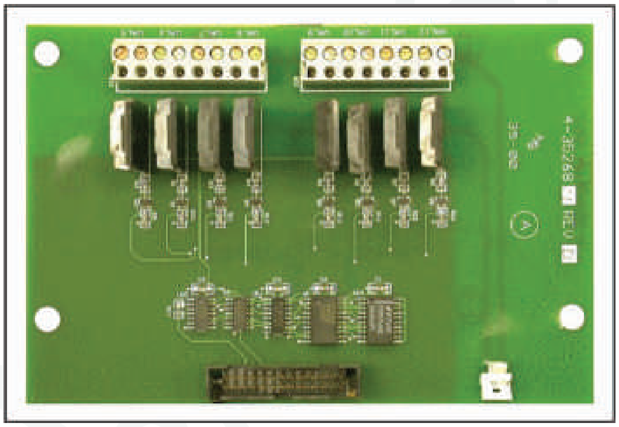


Cascade Board Connector Locations

# APPENDIX F
# VALVE EXPANSION BOARD OPTION

## Description

The Valve Expansion Board gives the Power Supply the ability to drive up to eight additional valves. Each set of connections provides 115 VAC (standard) or 24 VAC (optional) power to the valve solenoid connected across those connections.



Valve Expansion Board

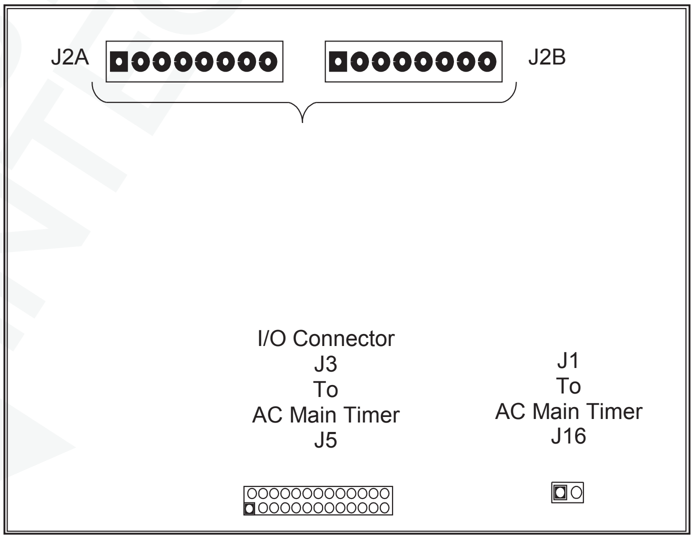
## Maintenance/Replacement

1 Disconnect the 26-pin ribbon cable connector from the AC Timer Main Board connected to J3.

2 Disconnect the 2-wire cable connector from the AC Timer Main Board connected to J1.

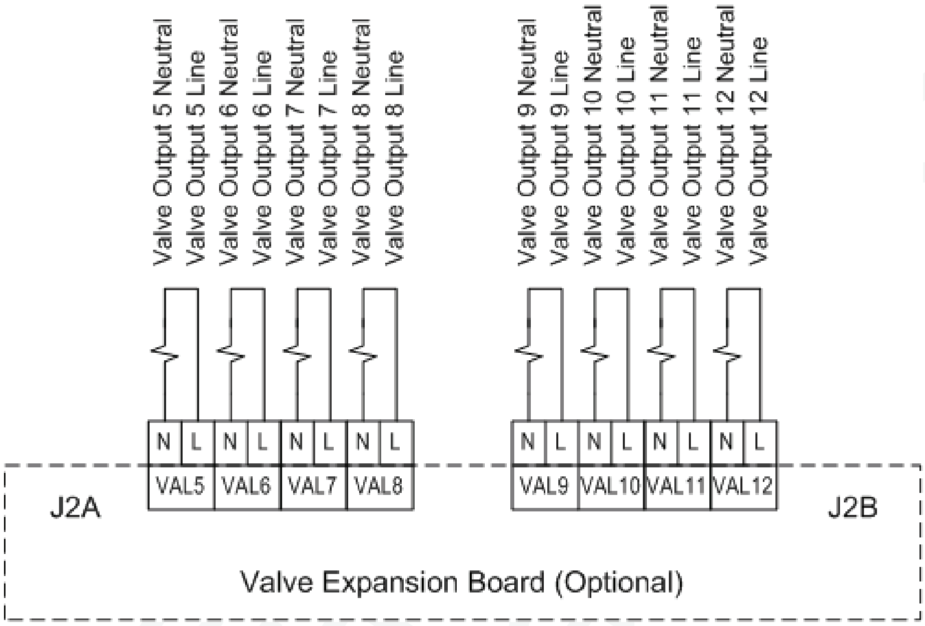
3 Mark and disconnect the I/O pluggable terminal strips from the board (J2A and J2B). See the next illustration (Valve Expansion Board Output Signals) for a detailed listing of signals.

4 Slide the card out of the card cage.



Valve Expansion Board Connector Locations

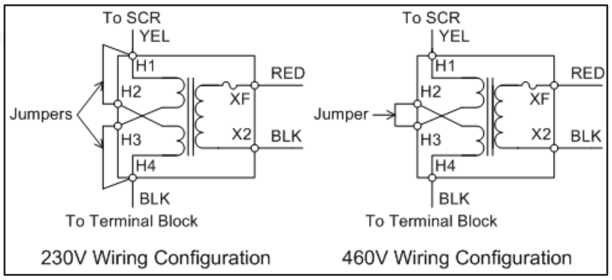
# APPENDIX F: VALVE EXPANSION BOARD OPTION


Valve Output 5 Neutral
Valve Output 5 Line
Valve Output 6 Neutral
Valve Output 6 Line
Valve Output 7 Neutral
Valve Output 7 Line
Valve Output 8 Neutral
Valve Output 8 Line
Valve Output 9 Neutral
Valve Output 9 Line
Valve Output 10 Neutral
Valve Output 10 Line
Valve Output 11 Neutral
Valve Output 11 Line
Valve Output 12 Neutral
Valve Output 12 Line
N L N L N L N L
VAL5 VAL6 VAL7 VAL8
N L N L N L N L
VAL9 VAL10 VAL11 VAL12
J2A
J2B
Valve Expansion Board (Optional)

**Valve Expansion Board Output Signals**

**NOTES:**

- VAL5, N & L through VAL12, N & L – Valve Output 5 Neutral and Line through Valve Output 12 Neutral and Line.
- Unless otherwise ordered, the Power supplies are shipped with the Valve Transformer T3 connected for 460 V configuration. If you re-configure the unit for 230 V, you must change the jumpers as shown on the right.


To SCR
YEL
H1
H2
H3
H4
XF
X2
RED
BLK
Jumpers
BLK
To Terminal Block
230V Wiring Configuration
To SCR
YEL
H1
H2
H3
H4
XF
X2
RED
BLK
Jumper
BLK
To Terminal Block
460V Wiring Configuration

**Valve Transformer Wiring Connections**

5 Reconnect the 26-wire ribbon cable connector from the AC Timer Main Board to J3

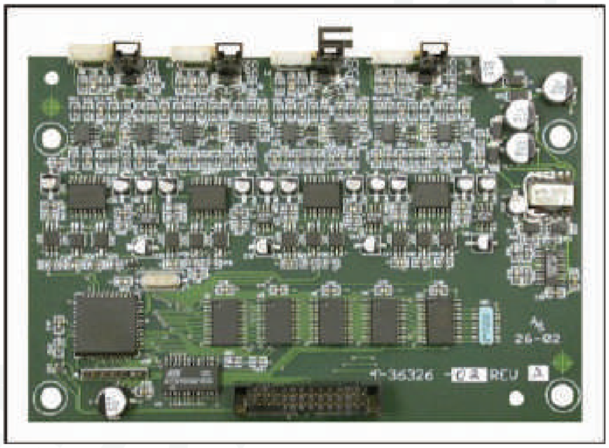
6 Reconnect the 2-wire cable connector from the AC Timer Main Board to J1.

7 Reconnect the I/O pluggable terminal strips to the board (J2A and J2B).

8 Slide the card into the card cage.

# APPENDIX G
# VOLTAGE MONITOR BOARD OPTION

## Description



Voltage Monitor Board

The Voltage Board gives the Control the ability to compare weld voltage against pre-programmed high and low limits. This board allows you to monitor either peak or average (RMS) voltage.

You can also select *when* the voltage is monitored, either during both weld periods (excluding up/downslope) or during the last cycle only. When doing a constant current weld, the last cycle voltage monitoring is useful for calculating the specific resistance of the part at the end of the weld.

## Specifications

| | |
|---|---|
| **Voltage Measurement Range:** | 0.10 to 9.99 volts |
| **Accuracy:** | +/- 2% of full scale |

## Operation

Voltage Monitor functions are described in *Chapter 3,Using ST-100A / ST-200A Control Functions.*

## Maintenance/Replacement

1 Disconnect the serial cable connector (26-pin ribbon cable) connected to J10 on the Voltage Board.
2 Disconnect the voltage sensing cables from V1 through V4 on the Voltage Board as required.
3 Slide the card out of the card cage.
4 Reconnect the voltage sensing cables to V1 through V4 on the Voltage Board as required.
5 Reconnect the serial cable connector (26-pin ribbon cable) to J10 on the Voltage Board.
6 Install or re-install the circuit board by sliding it into the card cage.

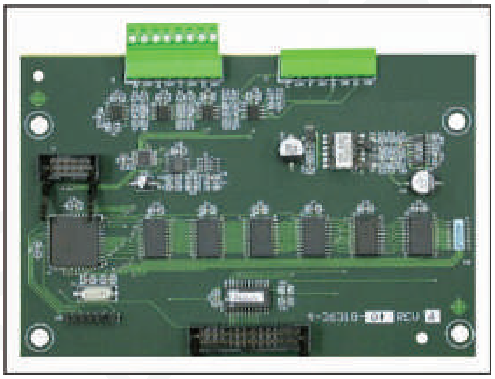
# APPENDIX H
# FORCE CONTROL OPTION

## Description

The Force Control (Force Output) Option can control up to 8 electronic pressure regulators.

Output Force is programmed in lb. using front panel controls. Once the Operator programs the Output Force, the Power Supply converts this to the correct voltage to be sent to the electronic pressure regulator in order to get the desired force.

Calibration is a simple 2-step procedure using front panel controls.



**Force Board**

## Operation

Descriptions of how to program and use the Force Control functions are located in *Chapter 3, Using ST-100A / ST-200A Control Functions.* For accurate back pressure readings, the electronic pressure regulator attached to this board must be set to have an association of 0 – 10 V = 0 – 100 psi.

## Calibration

CAUTION: If the electronic pressure regulator is set to have an association of 0 – 10 V = 0 – 100 psi, Lo psi during calibration will be about 30 psi and Hi psi will be about 80 psi. Make sure the force gauge used can withstand the force of the weld head at 80 psi.

```
            SYSTEM VALUES SCREEN 3
RETRACTION=MAINTAINEDDIFF.PRESSURE=ON
PRESSURE SWITCH=OFFBACK PRESSURE=10
FORCE CALIBRATION ↵
OUTPUT FORCE=F1
MONITORED VOLTS=RMS
MONITORED TIME=W1/W2SCREEN 2 ↵
```

1 From the **SYSTEM VALUES SCREEN 3**, set **OUTPUT FORCE = F1-F8**.

2 Go to **FORCE CALIBRATION**, highlight the ↲ symbol and press **DATA +** to enter the screen.

## Operation

1 Use the ▲ ▼ ◀ ▶ buttons on the Control panel to highlight the valve number for the channel to be calibrated. Press **PROGRAM/SAVE** to put the unit into program mode. Input the valve number that supplies air to the head to be calibrated.

```
000         *** FORCE CALIBRATION ***
Psi         (All Force Entries in Pounds)
Channel-----------------Valve     Channel-----------------Valve
#  Lo-Psi   Hi-Psi      #         #  Lo-Psi   Hi-Psi      #
F1  0000    0001        1         F5  0000    0001       N/A
F2  0000    0001        2         F6  0000    0001       N/A
F3  0000    0001       N/A        F7  0000    0001       N/A
F4  0000    0001       N/A        F8  0000    0001       N/A
```

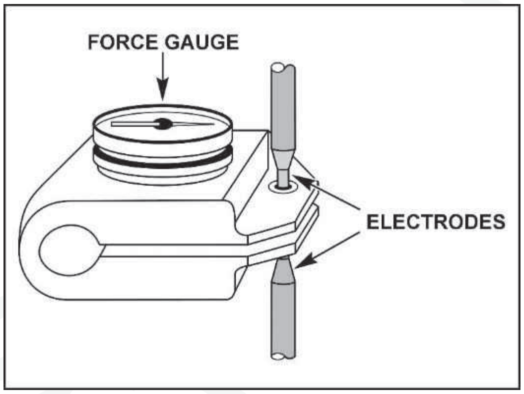
## APPENDIX H: FORCE CONTROL OPTION

2 Move the cursor to “Lo-Psi.”

3 Place a force gauge between the electrodes.

4 Press the **WELD ON** button on the Control Panel to close the electrodes.

**NOTE:** In **FORCE CALIBRATION** mode, the Power Supply will ***not*** send weld current to the electrodes.



5 Let the force stabilize, then check the force on the force gauge. Press the **WELD ON** button to release the weld head. Enter the number of pounds under **Lo-Psi** on the LCD screen.

6 Select “Hi-Psi” on the control.

7 Place a force gauge between the electrodes.

8 Press the **WELD ON** button on the Control Panel to close the electrodes.

9 Let the force stabilize, then check the force on the force gauge. Press the **WELD ON** button to release the weld head. Enter the number of pounds under **Hi-Psi** on the LCD screen. Press the Program/Save button to save this information. Calibration for this Channel is now complete.

```
000          *** FORCE CALIBRATION ***
Psi          (All Force Entries in Pounds)
Channel                 Valve   Channel----------------Valve
 #  Lo-Psi  Hi-Psi        #      #  Lo-Psi  Hi-Psi     #
F1  0119    0364          1     F5  0000    0001      N/A
F2  0000    0001          2     F6  0000    0001      N/A
F3  0000    0001         N/A    F7  0000    0001      N/A
F4  0000    0001         N/A    F8  0000    0001      N/A
```

**Example:** As shown on the right, Low Pressure was **119 lb.**, High Pressure was **364 lb.**

10 Repeat Steps 3-10 to calibrate other channels.

## Maintenance/Replacement

1 Disconnect the serial cable connector (26-pin ribbon cable) connected to J10 on the Force Board.

2 Disconnect the force input cables from J1 and the force output cables from J2 and J3 on the Force Output Board as required.

3 Slide the card out of the card cage.

4 Reconnect the force input cables from J1 and the force output cables from J2 and J3 on the Force Output Board as required.

5 Reconnect the serial cable connector (26-pin ribbon cable) to J10 on the Force Board.

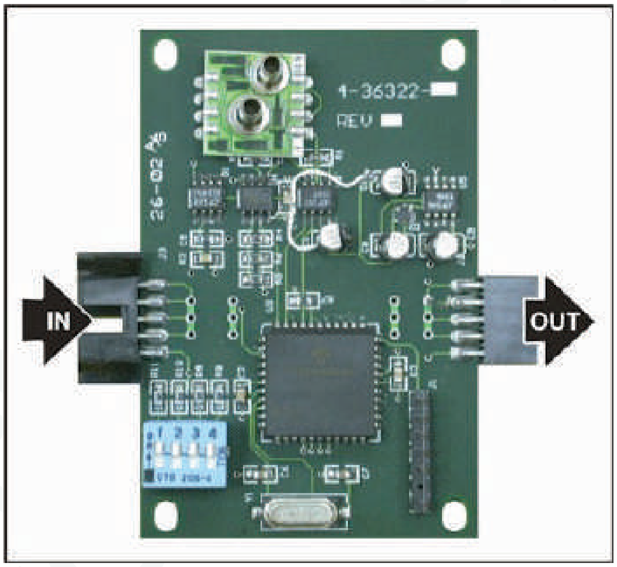
6 Install or re-install the circuit board by sliding it into the card cage.

# APPENDIX I
# PRESSURE MONITORING OPTION

## Description

The Pressure Control Option (Force Input) uses differential pressure sensors on up to eight channels. You may use this feature in a Force-Firing function (welds only when correct pressure is reached), or as a pressure monitor to see if air pressure reached (or exceeded) the desired range. Setting high and low limits can reduce cycle time by reducing the programmed squeeze time to 1 cycle.

**NOTE:** Some configurations of pneumatic components produce pressure spikes when the solenoids are energized. This is most common when there is significant friction in the cylinder. The control has a 4 cycle delay to catch this condition. The weld proceeds only if the pressure is within limits at the start and end of this period. This is sufficient for most weld heads. In some extreme cases, a few cycles of squeeze delay time may be needed in order to prevent premature triggering due to the pressure spikes.



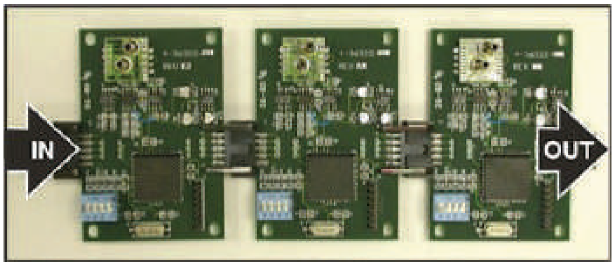
**Pressure Board**

The Pressure Control Option will trigger an alarm if correct pressure is ***not*** reached within 5 seconds. If there is too much or too little pressure at the ***start*** of a weld, the Power Supply will prevent welding until the problem is fixed.

If the pressure was too high at the ***end*** of a weld, the Power Supply will give an alarm. High and low pressure limits are programmed in lb. using front panel controls. Calibration is a simple 2-step procedure using front panel controls.

**NOTE:** This feature comes with the Force Control (Force Output) Board because the Pressure Boards plug into the Force Board. The Force Output features may or may not be used in conjunction with Pressure Monitoring features.

Pressure Boards are plugged into J1 on the Force Board using a ribbon cable. As shown on the right, multiple Pressure Boards may be plugged into each other, *then* plugged into the ribbon cable because the signal passes through all the boards.



**Linked Pressure Boards**

# APPENDIX I: PRESSURE CONTROL OPTION

## Channel Number Setup

Each Pressure Board is manually assigned to a specific channel at the factory using the dipswitch on each board. If you are replacing a Pressure Board(s), you will have to set each one to a different channel. Find the **CHANNEL** you want in the table below, then turn the dipswitches ON or OFF as indicated.

**NOTE:** It's easier to tag the board with the new channel number until you install it than it is to remember the new channel number solely by dipswitch settings.

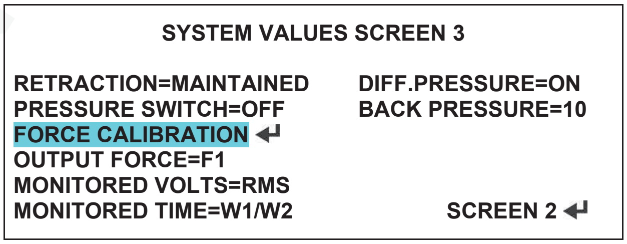
| CHANNEL | DIPSWITCH | | | |
|---|---|---|---|---|
| | #1 | #2 | #3 | #4 |
| 1 | ON | ON | ON | ON |
| 2 | OFF | ON | ON | ON |
| 3 | ON | OFF | ON | ON |
| 4 | OFF | OFF | ON | ON |
| 5 | ON | ON | OFF | ON |
| 6 | OFF | ON | OFF | ON |
| 7 | ON | OFF | OFF | ON |
| 8 | OFF | OFF | OFF | ON |

After the channel number is set, you may plug the board into other Pressure Boards ***in any sequence.*** The channel number is fixed and will not change until it is reprogrammed.

## Calibration

1 From the **SYSTEM VALUES SCREEN 3**, turn **DIFF. PRESSURE ON.**

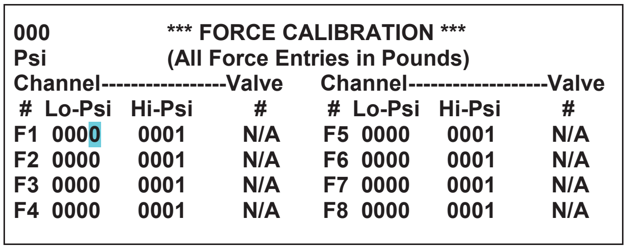
2 Go to **FORCE CALIBRATION**, highlight the ↵ symbol and press **DATA +** to enter the screen.



```
                SYSTEM VALUES SCREEN 3

RETRACTION=MAINTAINED        DIFF.PRESSURE=ON
PRESSURE SWITCH=OFF          BACK PRESSURE=10
FORCE CALIBRATION ↵
OUTPUT FORCE=F1
MONITORED VOLTS=RMS
MONITORED TIME=W1/W2                  SCREEN 2 ↵
```

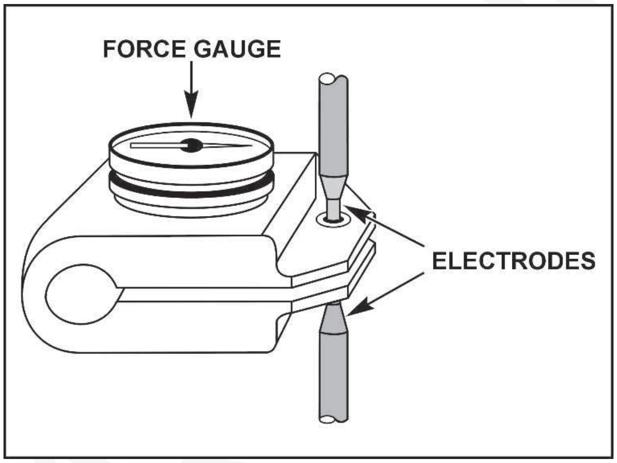
3 Use the ▲ ▼ ◄ ► buttons on the Control panel to highlight the valve number for the channel to be calibrated. Press **PROGRAM/SAVE** to put the unit into program mode. Input the valve number that supplies air to the head to be calibrated.



```
000            *** FORCE CALIBRATION ***
Psi            (All Force Entries in Pounds)
Channel-----------------Valve   Channel------------------Valve
 #  Lo-Psi  Hi-Psi     #         #  Lo-Psi  Hi-Psi       #
F1  0000    0001      N/A       F5  0000    0001        N/A
F2  0000    0001      N/A       F6  0000    0001        N/A
F3  0000    0001      N/A       F7  0000    0001        N/A
F4  0000    0001      N/A       F8  0000    0001        N/A
```

4 Move the cursor to **Lo-Psi.**

## APPENDIX I: PRESSURE CONTROL OPTION



5 Place a force gauge between the electrodes.

6 If the force output option is installed, press the **WELD ON** button on the Control Panel to close the electrodes.

**NOTE:** In **FORCE CALIBRATION** mode, the Power Supply will ***not*** send weld current to the electrodes.

7 If the force output option is not installed, press the **WELD ON** button to close the electrodes. Set the air pressure to approximately 30 psi. Use the psi of the screen to adjust the air pressure.

8 Let the force stabilize, then check the force on the force gauge.

9 Press the **WELD ON** button to release the weld head. Enter the number of pounds under **Lo-Psi** on the LCD screen.

10 Select **Hi-Psi** on the control.

11 Place a force gauge between the electrodes.

12 If the Force Output Option is installed, press the **WELD ON** button on the Control Panel to close the electrodes.

If the force output option is not installed, press the WELD On button to close the electrodes. Set the air pressure to approximately 80 psi. Use the psi indicator in the upper left corner of the screen to adjust the air pressure.

13 Let the force stabilize, then check the force on the force gauge.

14 Press the **WELD ON** button to release the weld head. Enter the number of pounds under **Hi-Psi** on the LCD screen.

```
000              *** FORCE CALIBRATION ***
Psi              (All Force Entries in Pounds)
Channel-----------------Valve    Channel-----------------Valve
#   Lo-Psi   Hi-Psi     #        #   Lo-Psi   Hi-Psi     #
F1  0119     0364       N/A      F5  0000     0001       N/A
F2  0000     0001       N/A      F6  0000     0001       N/A
F3  0000     0001       N/A      F7  0000     0001       N/A
F4  0000     0001       N/A      F8  0000     0001       N/A
```

15 Press the **PROGRAM/SAVE** button to save this information. Calibration for this Channel is now complete.

16 **Example:** As shown above on the right, Low Pressure was **119 lb.**, High Pressure was **364 lb**. Repeat Steps 3-13 to calibrate other channels.

# APPENDIX I: PRESSURE CONTROL OPTION

## Maintenance/Replacement

1 Label the air hoses from the Pressure Board(s) you want to remove. Note the location on the board and label them appropriately. Hoses cannot be switched! Remove the hoses.

2 Unplug the Pressure Board(s) from the Force Board. If you are using multiple Pressure Boards, disconnect them in order to remove/replace/install specific boards.

**NOTE**: If you are using a ***new*** board, verify that it has been set for the correct channel.

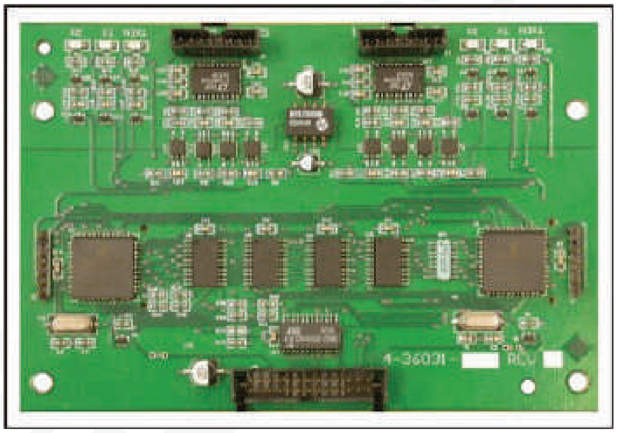
3 Install the air hoses on the Pressure Board that were removed in Step 1.

4 Install the new Pressure Board(s) either by plugging into the Force Board, or mounted separately and connected with a ribbon cable.

# Appendix J
# Communications Option

## Section I. Description

An optional circuit card gives the Power Supply the ability to communicate with a host computer or with automation control systems. The communications option uses either RS-232 to connect one control to one host or RS-485 multi-drop architecture to connect up to 30 controls to one host on a single channel.



Serial Communications Board

### Remote Programming

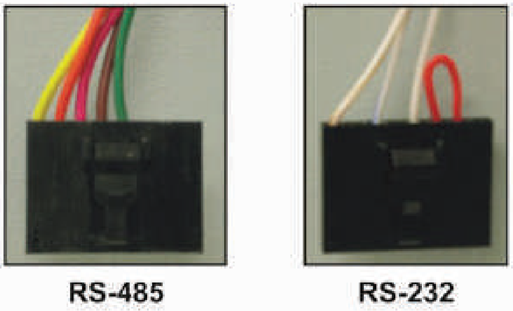
Advanced users may wish to perform additional programming for custom welding applications. The codes needed to perform remote programming are listed in *Section II. Communications Protocol and Commands*. Using these codes, users can write customized software for controlling all functions of the Power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

# APPENDIX J: COMMUNICATION OPTION

## RS-485 / RS-232 Operation

The Communications Option card can be used for RS-232 or RS-485 protocol. The wiring of the external 9-pin connector is determined by the internal serial connector supplied at time of purchase. The connectors shown on the right are from the cables that go between the external 9-pin connector on the Power Supply and the Communications Board.

When the 5-pin cable is used, the external 9-pin connector is set for RS-485 operation. When the 3-pin + jumper cable is used, the 9-pin connector is set for RS-232 operation.



COMMUNICATIONS CARD
SERIAL CABLE CONNECTORS

## Host settings

| | |
|---|---|
| Baud Rate | 38.4 k |
| Data bits | 8 |
| Stop bit | 1 |
| Parity | None |

**NOTE:** The host must be able to support 38.4 k baud communications without interruptions or dropped bits. The computer hardware and operating system needed to achieve that level of performance depends upon the RS-485 adapter (or converter box) used. For a microprocessor-based conversion (such as the Edgeport USB converter from Inside Outside Networks), the host computer should be at least a Pentium II-233 running Windows 98, Windows ME, Windows 2000, Windows XP or Windows NT 4.0. For a hardware-based converter without an internal microprocessor (such as the Telebyte model 285), the host computer should be at least a Pentium III-550 running Windows 98, Windows ME, Windows 2000, Windows XP or Windows NT 4.0.

For RS-485 communication, care must be taken not to exceed the capacity of each channel. The product of:

(total number welds per second on all welders on that channel)
x (times)
(total number of bytes exchanged per weld)
x (times)
(8 bits per byte)

must in all cases remain less than the theoretical maximum capacity of the channel – 38,400 bits per second. This capacity is not an issue on RS-232 channels.

## APPENDIX J: COMMUNICATION OPTION

A good guideline is that on a line free of electrical noise, the number calculated above must remain less that 70% of the theoretical maximum capacity (26,880 bytes per second). Electrical noise on the communications lines will further reduce this capacity. Shielded cables are recommended.

Several commands require the Power Supply to be in **HOST** mode for the Power Supply to accept them. Those commands include the **REPORT** command and all **SET** commands. See the **HOST CNTL** command in *Chapter 3, Using ST-100A / ST-200A Control Functions* and the **REMOTE** command in the next Section for more information.

## APPENDIX J: COMMUNICATION OPTION

# Section II. Communications Protocol and Commands

## Communication External Protocol

Each external command will be formatted as follows:

<soh> <@> <cmd> <cnt> <data> <cksum> <eot>.

## Definition of Command Elements

| | | |
|---|---|---|
| <soh> | 1 BYTE | The data packet will start with a **SOH** (start of header **0x01**) character. |
| <@> | 2 BYTES | This is the address of the unit to which data is requested converted into ASCII decimal numbers. **("01" - "30").** |
| <cmd> | 2 BYTES | This is a two character ASCII string denoting the command.<br>**(i.e. "IA")**. |
| <cnt> | 2 BYTES | This is a count of data bytes to follow, converted into an ASCII HEX number. **("00" - "FF").** |
| <data> | n BYTES | his is optional **BINARY** data.<br>Multiple binary byte ordering **[MSB][…][LSB]**. |
| <cksum> | 2 BYTES | This is a two charter ASCII HEX string calculated from the sum of all fields except **<soh>, <cksum>,** and **<eot>**. Then masked with **0xFF.** |
| <eot> | 1 BYTE | This terminates the transmission. (End transmit **0x04**). |

## Unit Responses to External Commands

### Errors or Unsupported Commands

The Power Supply will respond with a Negative Acknowledge <**NAK**> (0x15) when an error in checksum is encountered. The host will return a Negative Acknowledge <**NAK**> in response to any command that is not supported.

<soh> <@> <**NAK**> <err> <cksum> <eot>

Where <err> =
'1' NO <SOH>
'2' BAD checksum
'3' Unrecognized command
'4' Timeout
'5' HC16 is Busy
'6' Data Bad
'7' Input timeout
'8' Output timeout

### Valid Commands

A valid command will return ***either*** data ***or*** **<ACK> (0x06)**.

**<soh> <@> <ACK> <cksum> <eot>**

Data will be returned with the following structure:

**<soh> <@> <cmd> <cnt> <data> <cksum> <eot>**

## APPENDIX J: COMMUNICATION OPTION

### Host Originated Command Set

These are commands sent by the host computer, via the RS-485/RS-232 port to the Power Supply.

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| TYPE | "TY" Read | none | | 0 Bytes |
| REPORT | "RR" Read | Retransmission = 0x0FF | | 1 Byte |
| RESET | "RX" Set | Reset an Error and Returns | STATUS | 0 Bytes |
| REMOTE | "RM" Set | 0=Local, 1=Remote | | 1 Byte |
| LOAD | "LR" Read | none | | 0 Bytes |
| | "LS" Set | The schedule # to become active | | 1 Byte |
| COUNTER | "CS" Set | Schedule # to Reset the Counter | | 1 Byte |
| COPY | "CP" Set | Source schedule # | | 1 Byte |
| | | Destination schedule # | | 1 Byte |
| | | Count past | | 1 Byte |
| | | | | 3 Bytes Total |
| TIME CLK | "RT" Set | <data>=0 Reset Time Clock | | 1 Byte |
| | "RT" Read | <data>=1 Read Time Offset | | 1 Byte |
| LINK | "KR" Read | none | | 0 Bytes |
| | "KS" Set | SCHEDULE #, SCHEDULE #,… | | 64 Bytes |

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| SCHEDULE | "DR" Read | Schedule # | | 1 Byte |
| SCHEDULE | "DS" Set | SCHEDULE # | | 1 Byte |
| | | SQD # | (Squeeze Delay) | 2 Bytes |
| | | SQZ # | (Squeeze Time) | 2 Bytes |
| | | UP1 # | (Up Slope Time) | 2 Bytes |
| | | WELD1 # | (Weld Time), | 2 Bytes |
| | | DOWN1 # | (Down Slope Time) | 2 Bytes |
| | | COOL # | (Cool Time) | 2 Bytes |
| | | UP2 # | (Up Slope Time) | 2 Bytes |
| | | DOWN2 # | (Down Slope Time) | 2 Bytes |
| | | HOLD # | (Hold Time) | 2 Bytes |
| | | OFF # | (Off Time) | 2 Bytes |
| | | % HEAT #1 | (0 - 100%) | 2 Bytes |
| | | % HEAT #2 | (0 - 100%) | 2 Bytes |
| | | CURRENT #1 | (Energy 0 - 80.0 kA), See **NOTE [1]** | 2 Bytes |
| | | CURRENT #2 | (Energy 0 - 80.0 kA), See **NOTE [1]** | 2 Bytes |
| | | IMPULSE | (0 - 25) | 1 Byte |
| | | FORCE, | (0 - 9999) | 2 Bytes |
| | | FORCE CHANNEL | (1 - 8) | 1 Byte |
| | | | | 35 Bytes Total |

**NOTE [1]:** 1,000 = 10.0 kA

## APPENDIX J: COMMUNICATION OPTION

| **NAME** | **COMMAND** | **DATA** | | | **SIZE** |
|---|---|---|---|---|---|
| MONITOR | "MR" Read | Read Schedule # | | | 1 Byte |
| MONITOR | "MS" Set | Set SCHEDULE # | | | 1 Bytes |
| | | HIGH1C # | High current #1% | | 2 Bytes |
| | | HIGH2C # | High current #2% | | 2 Bytes |
| | | LOW1C # | Low current #1% | | 2 Bytes |
| | | LOW2C # | Low current #2% | | 2 Bytes |
| | | ANGLE LIMIT 1 | Conduction limit #1 | | 1 Byte |
| | | ANGLE LIMIT 2 | Conduction limit #2 | | 1 Byte |
| | | LIMIT # | Weld Count limit | | 2 Bytes |
| | | START | start value | | 1 Byte |
| | | MODE | weld mode | | 1 Byte |
| | | LOP | Low Pressure Limit | (0 - 9999) | 2 Bytes |
| | | HIP | High Pressure Limit | | 2 Bytes |
| | | VOLTHIW1 | W1 High Volt Limit | (0.00 - 9.99) | 2 Bytes |
| | | VOLTLOW1 | W1 Low Volt Limit | | 2 Bytes |
| | | VOLTHIW2 | W2 High Volt Limit | | 2 Bytes |
| | | VOLTLOW2 | W2 Low Volt Limit | | 2 Bytes |
| | | | | | 27 Bytes Total |

----------------------------------------------------------------------

start value: MAINTAINED = 0
or PULSED = 1
or LATCHED = 2
or SEAM = 3

----------------------------------------------------------------------

weld mode: SPOT = 0
or REPEAT = 1
or SUCCESSIVE = 2
or CHAINING = 3

----------------------------------------------------------------------

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | SIZE | | |
|---|---|---|---|---|---|
| STEPPER | "ER" Read | Valve # | | | 1 Byte |
| STEPPER | "ES" Set | VALVE # | | | 1 Byte |
| | | STEPPER | {ON=1 \| OFF=0} | | 1 Byte |
| | | STEP 1 COUNT # | 100% | | 3 Bytes |
| | | STEP 2 COUNT # | #% | | 3 Bytes |
| | | STEP 3 COUNT # | #% | | 3 Bytes |
| | | STEP 4 COUNT # | #% | | 3 Bytes |
| | | STEP 5 COUNT # | #% | | 3 Bytes |
| | | STEP 6 COUNT # | #% | | 3 Bytes |
| | | STEP 7 COUNT # | #% | | 3 Bytes |
| | | STEP 8 COUNT # | #% | | 3 Bytes |
| | | STEP 9 COUNT # | #% | | 3 Bytes |
| | | STEP 10 COUNT # | #% | | 3 Bytes |
| | | | (0 - 9999) | (50 - 200) | 32 Bytes Total |

**NOTE:** COUNT# = 2 Bytes
#% = 1 Byte

| NAME | COMMAND | DATA | SIZE | | |
|---|---|---|---|---|---|
| VALVE | "VR" Read | Schedule # | | | 1 Byte |
| VALVE | "VS" Set | SCHEDULE # | | | 1 Byte |
| | | ELECTRODE VALVE # | | | 1 Byte |
| | | VALVE 1 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 2 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 3 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 4 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 5 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 6 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 7 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 8 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 9 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 10 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 11 | {ON=1 \| OFF=0} | | 1 Byte |
| | | VALVE 12 | {ON=1 \| OFF=0} | | 1 Byte |
| | | | | | 14 Bytes Total |

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | | | SIZE |
|---|---|---|---|---|---|
| SCR's | "UR" Read | none | | | 0 Bytes |
| SCR's | "US" Set | Valve 1 | SCR# | Count | 5 Bytes |
| | | Valve 2 | SCR# | Count | 5 Bytes |
| | | Valve 3 | SCR# | Count | 5 Bytes |
| | | Valve 4 | SCR# | Count | 5 Bytes |
| | | Valve 5 | SCR# | Count | 5 Bytes |
| | | Valve 6 | SCR# | Count | 5 Bytes |
| | | Valve 7 | SCR# | Count | 5 Bytes |
| | | Valve 8 | SCR# | Count | 5 Bytes |
| | | Valve 9 | SCR# | Count | 5 Bytes |
| | | Valve 10 | SCR# | Count | 5 Bytes |
| | | Valve 11 | SCR# | Count | 5 Bytes |
| | | Valve 12 | SCR# | Count | 5 Bytes |
| | | | (1 - 8) | (0 - 99999) | 60 Bytes Total |

**NOTE:** SCR# = 1 Byte
COUNT = 4 Bytes

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | SIZE |
|---|---|---|---|
| SYSTEM | "YR" Read | none | 0 Bytes |
| SYSTEM | "YS" Set | MAX VALVES # | 1 Byte |
| | | MAX SCRS | 1 Byte |
| | | TURNS RATIO (1:1 - 200:1) | 1 Byte |
| | | 87 DEGREE DELAY {ON=1 \| OFF=0} | 1 Byte |
| | | RESET {ON=1 \| OFF=0} | 1 Byte |
| | | END OUTPUT {ON=1 \| OFF=0} | 1 Byte |
| | | ERROR OUTPUT {ON=1 \| OFF=0} | 1 Byte |
| | | STEP END OUTPUT {ON=1 \| OFF=0} | 1 Byte |
| | | BINARY SCHEDULE {ON=1 \| OFF=0} | 1 Byte |
| | | FULL CURRENT # (5 kA – 80 kA), See **NOTE [1]** | 1 Byte |
| | | CONTROL MODE control mode | 1 Byte |
| | | FIRING SWITCH {0=2Stage, 1= 1Stage} | 1 Byte |
| | | SEAM WELD seam mode | 1 Byte |
| | | WELD ON/OFF { LOCAL=0 \| REMOTE=1} | 1 Byte |
| | | LOW LINE ALARM {ON=1 \| OFF=0} | 1 Byte |
| | | Host Control {0=Local, 1=Host} | 1 Byte |
| | | RETRACTION (0=MAINTAINED, 1=PULSED) | 1 Byte |
| | | DIFF. PRESSURE {ON \| OFF} | 1 Byte |
| | | PRESSURE SWITCH {ON \| OFF} | 1 Byte |
| | | OUTPUT FORCE (0=OFF, 1=F1, 2=F1-F8) | 1 Byte |
| | | MONITORED VOLTS (0=PEAK, 1=RMS) | 1 Byte |
| | | MONITORED TIME (0=W1/W2, 1=LAST CYCLE) | 1 Byte |
| | | BACK PRESSURE (0 - 30) | 1 Byte |
| | | Always 0 | 1 Byte |
| | | Always 0 | 1 Byte |
| | | | 25 Bytes Total |

control mode: Primary C. Current = 0
or Secondary C. Current = 1
or % Heat = 2
or % Heat Secondary = 3

seam mode: Spot = 0
or Continuous Seam = 1
or Roll Spot = 2 (Seam welding is an optional feature)

**NOTE [1]:** 1,000 = 10.0 kA

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| FORCE | "PR" Read | None | | 0 Bytes |
| FORCE | "PS" Set | P1 MIN CALIBRATE #, | (0 - 9999) | 2 Bytes |
| | | P1 MAX CALIBRATE #, | | 2 Bytes |
| | | P2 MIN CALIBRATE #, | | 2 Bytes |
| | | P2 MAX CALIBRATE #, | | 2 Bytes |
| | | P3 MIN CALIBRATE #, | | 2 Bytes |
| | | P3 MAX CALIBRATE #, | | 2 Bytes |
| | | P4 MIN CALIBRATE #, | | 2 Bytes |
| | | P4 MAX CALIBRATE #, | | 2 Bytes |
| | | P5 MIN CALIBRATE #, | | 2 Bytes |
| | | P5 MAX CALIBRATE #, | | 2 Bytes |
| | | P6 MIN CALIBRATE #, | | 2 Bytes |
| | | P6 MAX CALIBRATE #, | | 2 Bytes |
| | | P7 MIN CALIBRATE #, | | 2 Bytes |
| | | P7 MAX CALIBRATE #, | | 2 Bytes |
| | | P8 MIN CALIBRATE #, | | 2 Bytes |
| | | P8 MAX CALIBRATE #, | | 2 Bytes |
| | | P1 ASSOCIATED VALVE #, | (0 = n/a, 1 - 12) | 1 Byte |
| | | P2 ASSOCIATED VALVE #, | | 1 Byte |
| | | P3 ASSOCIATED VALVE #, | | 1 Byte |
| | | P4 ASSOCIATED VALVE #, | | 1 Byte |
| | | P5 ASSOCIATED VALVE #, | | 1 Byte |
| | | P6 ASSOCIATED VALVE #, | | 1 Byte |
| | | P7 ASSOCIATED VALVE #, | | 1 Byte |
| | | P8 ASSOCIATED VALVE #, | | 1 Byte |
| | | | | 40 Bytes Total |

## APPENDIX J: COMMUNICATION OPTION

### Power Supply Originated Response Command Set

These are commands returned by the Power Supply, via the RS-485/RS-232 port.

| NAME | COMMAND | DATA | SIZE |
|---|---|---|---|
| TYPE | “TY” Read | "STA", Release # and Revision #<br>Example: "STA 01.21 AB" | 12 Bytes |
| COUNT | “CT” Read | #Reports Stored | 1 Byte |
| COUNTER | “CS” Set | <ACK> **OR** <NAK> | 0 Bytes |
| COPY | “CP” Set | <ACK> **OR** <NAK> | 0 Bytes |
| LOAD | “LR” Read | The active schedule # | 1 Byte |
| | “LS” Set | <ACK> **OR** <NAK> | 0 Byte |
| TIME CLK | “RT” Read | Read Time Offset in cycles since power-up or reset | 4 Bytes |
| | “RT” Set | <ACK> **OR** <NAK> | 0 Bytes |
| LINK | “KS” Set | <ACK> **OR** <NAK> | 0 Bytes |
| | “KR” Read | SCHEDULE #, SCHEDULE #,… | 64 Bytes |

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| REPORT | "RR" Read | Schedule # | | 1 Byte |
| | | Status | | 4 Bytes |
| | | 1st pulse Current | | 2 Bytes |
| | | 1st pulse Pressure | | 2 Bytes |
| | | 1st pulse Angle | | 2 Bytes |
| | | 2nd pulse Current | | 2 Bytes |
| | | 2nd pulse Voltage | | 2 Bytes |
| | | 2nd pulse Pressure | | 2 Bytes |
| | | 2nd pulse Angle | | 2 Bytes |
| | | Weld Number | | 2 Bytes |
| | | On Step number | | 1 Bytes |
| | | Stepper Count | | 2 Bytes |
| | | Time Count Offset | (in cycles since power-up or reset) | 4 Bytes |
| | | Total number of reports = <cnt> / | | 30 Bytes Total |
| SCHEDULE | "DS" Set | <ACK> **OR** <NAK> | | 0 Bytes |
| SCHEDULE | "DR" Read | SCHEDULE # | | 1 Byte |
| | | SQD # | (Squeeze Delay) | 2 Bytes |
| | | SQZ # | (Squeeze Time) | 2 Bytes |
| | | UP1 # | (Up Slope Time) | 2 Bytes |
| | | WELD1 # | (Weld Time) | 2 Bytes |
| | | DOWN1 # | (Down Slope Time) | 2 Bytes |
| | | COOL # | (Cool Time) | 2 Bytes |
| | | UP2 # | (Up Slope Time) | 2 Bytes |
| | | WELD2 # | (Weld Time) | 2 Bytes |
| | | DOWN2 # | (Down Slope Time) | 2 Bytes |
| | | HOLD # | (Hold Time) | 2 Bytes |
| | | OFF # | (Off Time) | 2 Bytes |
| | | % HEAT #1 | (0 - 100%) | 2 Bytes |
| | | % HEAT #2 | (0 - 100%) | 2 Bytes |
| | | CURRENT #1 | (Energy 0 - 80.0 kA), See **NOTE [1]** | 2 Bytes |
| | | CURRENT #2 | (Energy 0 - 80.0 kA), See **NOTE [1]** | 2 Bytes |
| | | IMPULSE | (0 - 25) | 1 Byte |
| | | FORCE, | (0 - 9999) | 2 Bytes |
| | | FORCE CHANNEL | (1 - 8) | 1 Byte |
| | | | | 35 Bytes Total |

**NOTE [1]:** 8,000 = 80.0 kA

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | | | SIZE |
|---|---|---|---|---|---|
| MONITOR | “MS” Set | <ACK> **OR** <NAK> | | | 0 Bytes |
| MONITOR | “MR” Read | SCHEDULE # | | | 1 Byte |
| | | HIGH1C # | High current #1 % | | 2 Bytes |
| | | LOW1C # | Low current #1 % | | 2 Bytes |
| | | HIGH2C # | High current #1 % | | 2 Bytes |
| | | LOW2C # | Low current #1 % | | 2 Bytes |
| | | ANGLE LIMIT 1 | Conduction limit #1 | | 1 Byte |
| | | ANGLE LIMIT 2 | Conduction limit #2 | | 1 Byte |
| | | LIMIT # | Weld count limit | | 2 Bytes |
| | | START | Start value | | 1 Byte |
| | | MODE | Weld mode | | 1 Byte |
| | | LOP, | Low Pressure Limit | (0 - 9999) | 2 Bytes |
| | | HIP, | High Pressure Limit | | 2 Bytes |
| | | VOLTHIW1 | W1 High Volt Limit | (0.00 - 9.99) | 2 Bytes |
| | | VOLTLOW1 | W1 Low Volt Limit | | 2 Bytes |
| | | VOLTHIW2 | W2 High Volt Limit | | 2 Bytes |
| | | VOLTLOW2 | W2 Low Volt Limit | | 2 Bytes |
| | | | | | 27 Bytes Total |

weld mode: SPOT = 0
or REPEAT = 1
or SUCCESSIVE = 2
or CHANING = 3

start value: MAINTAINED = 0
or PULSED = 1
or LATCHED = 2
or SEAM = 3

| NAME | COMMAND | DATA | SIZE |
|---|---|---|---|
| STATUS | “TS” Read | Last Major Error (see below) | 2 Byte |
| | | Last Minor Error (see below) | 2 Byte |
| | | Schedule, Monitor, or Valve changed<br>0 = No Change, Schedule #+1 if changed | 1 Byte |
| | | Stepper, 0 = No change, Valve # if changed | 1 Byte |
| | | Link Array 0 = No change, 1=change | 1 Byte |
| | | Active screen number | 1 Byte |
| | | Active screen value | 1 Byte |
| | | | 9 Bytes Total |

## APPENDIX J: COMMUNICATION OPTION

**Major Error Bit Pattern** – the following bits are set to 1 when their associated error condition exists.

| | |
|---|---|
| Bit 0 | Emergency Stop |
| Bit 1 | Over temperature |
| Bit 2 | No current |
| Bit 3 | Mode change error |
| Bit 4 | Shorted SCR |
| Bit 5 | Weld 1 current high |
| Bit 6 | Weld 2 current high |
| Bit 7 | Weld 1 conduction angle high |
| Bit 8 | Weld 2 conduction angle high |
| Bit 9 | Step end reached |
| Bit 10 | Full conduction angle reached |
| Bit 11 | Schedule number error |

**Minor Error Bit Pattern** - the following bits are set to 1 when their associated error condition exists.

| | |
|---|---|
| Bit 0 | Weld 1 current low |
| Bit 1 | Weld 2 current low |
| Bit 2 | Step count too high |
| Bit 3 | Setup error |
| Bit 4 | Weld end reached |
| Bit 6 | Low line voltage |
| Bit 7 | High line voltage |
| Bit 8 | Current scaling incorrect |
| Bit 9 | Initial force too high |
| Bit 10 | Initial force too low |
| Bit 11 | Final force too high |
| Bit 12 | Final force too low |

**Active Screen Number**

| | |
|---|---|
| 1. | Run screen |
| 2. | Stepper screen |
| 3. | Weld mode screen |
| 4. | % heat monitor screen |
| 5. | Valve screen for 12 valves |
| 6. | Not used |
| 7. | Program screen for constant current modes |
| 8. | System values screen |
| 9. | Linked schedules screen |
| 10. | Not used |
| 11. | Not used |

## APPENDIX J: COMMUNICATION OPTION

**Active Screen Number (continued)**

12. Duplicate starting schedules in link lists screen
13. Schedule programming screen
14. Not used
15. Hidden screen
16. Copy schedule screen
17. System valve screen – 4 valve option
18. System valve screen – 12 valve option
19. Full current error screen
20. Weld 1 current greater than full current error screen
21. Weld 2 current greater than full current error screen
22. Weld 1 current less than 20% of full current screen
23. Weld 2 current less than 20% of full current screen
24. Weld monitor screen – constant current modes
25. Valve screen – 4 valves
26. Weld monitor programming screen
27. Weld 1 current plus stepper value exceeds full current screen
28. Weld 2 current plus stepper value exceeds full current screen
29. Emergency Stop screen
30. Thermostat over temperature screen
31. No current error screen
32. Full wave conduction angles reached error screen
33. Mode change error screen
34. Weld 1 current too high
35. Weld 2 current too high
36. Weld 1 current too low
37. Weld 2 current too low
38. Weld 1 conduction angle too high
39. Weld 2 conduction angle too high
40. Step count too high error screen
41. Modified schedule not saved error screen
42. Duplicate SCR number assigned error screen
43. Weld count reached limit error screen
44. Stepper end reached error screen
45. Not used
46. Simplified schedule screen
47. Simple % heat screen
48. Not used
49. Seam weld in primary current control screen
50. Seam weld in % heat mode screen

**Active Screen Number (Continued)**

| | |
|---|---|
| 51. | Seam weld simplified schedule screen – constant current modes |
| 52. | Seam weld simplified schedule screen – % heat modes |
| 53. | SCR shorted screen |
| 54. | List of boards installed screen |
| 55. | Low line voltage screen |
| 56. | High line voltage screen |
| 57. | Current scaling error |
| 58. | Not used |
| 59. | Continuous seam weld enabled mode screen |
| 60. | Roll spot weld enabled mode screen |
| 61. | Schedule number error screen |
| 62. | System values continuation screen |
| 63. | Schedule W1 and W2 times set to 0 error screen |
| 64. | Pixel test info screen |
| 65. | Not used |
| 66. | Not used |
| 67. | Second hidden screen |
| 68. | Incorrect SCR number detected screen |
| 69. | Pressure switch error |
| 70. | Force calibration screen |
| 71. | System boot-up screen |

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| STEPPER | “ES” Set | <ACK> **OR** <NAK> | | 0 Bytes |
| STEPPER | “ER” Read | VALVE # | | 1 Byte |
| | | STEPPER | {ON=1 \| OFF=0} | 1 Byte |
| | | STEP 1 COUNT # 100% | | 3 Bytes |
| | | STEP 2 COUNT # #% | | 3 Bytes |
| | | STEP 3 COUNT # #% | | 3 Bytes |
| | | STEP 4 COUNT # #% | | 3 Bytes |
| | | STEP 5 COUNT # #% | | 3 Bytes |
| | | STEP 6 COUNT # #% | | 3 Bytes |
| | | STEP 7 COUNT # #% | | 3 Bytes |
| | | STEP 8 COUNT # #% | | 3 Bytes |
| | | STEP 9 COUNT # #% | | 3 Bytes |
| | | STEP 10 COUNT # #% | | 3 Bytes |
| | | (0 - 9999) | (50 - 200) | 33 Bytes Total |

**NOTE:** COUNT# = 2 Bytes
#% = 1 Byte

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| VALVE | “VS” Set | <ACK> **OR** <NAK> | | 0 Bytes |
| VALVE | “VR” Read | SCHEDULE # | | 1 Byte |
| | | ELECTRODE VALVE # | | 1 Byte |
| | | VALVE 1 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 2 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 3 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 4 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 5 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 6 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 7 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 8 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 9 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 10 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 11 | {ON=1 \| OFF=0} | 1 Byte |
| | | VALVE 12 | {ON=1 \| OFF=0} | 1 Byte |
| | | | | 14 Bytes Total |
| SCR's | “UR” Read | <ACK> **OR** <NAK> | | 0 Bytes |

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| SCR's | "US" Set | Valve 1 | SCR # Count | 5 Bytes |
| | | Valve 2 | SCR # Count | 5 Bytes |
| | | Valve 3 | SCR # Count | 5 Bytes |
| | | Valve 4 | SCR # Count | 5 Bytes |
| | | Valve 5 | SCR # Count | 5 Bytes |
| | | Valve 6 | SCR # Count | 5 Bytes |
| | | Valve 7 | SCR # Count | 5 Bytes |
| | | Valve 8 | SCR # Count | 5 Bytes |
| | | Valve 9 | SCR # Count | 5 Bytes |
| | | Valve 10 | SCR # Count | 5 Bytes |
| | | Valve 11 | SCR # Count | 5 Bytes |
| | | Valve 12 | SCR # Count | 5 Bytes |
| | | (1 - 8) | (0 - 99999) | 60 Bytes Total |

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| SYSTEM | “YS” Set | <ACK> **OR** <NAK> | | 0 Bytes |
| SYSTEM | “YR” Read | MAX VALVES # | | 1 Byte |
| | | MAX SCRS | | 1 Byte |
| | | TURNS RATIO (1:1 - 200:1) | | 1 Byte |
| | | 87 DEGREE DELAY | {ON=1 \| OFF=0} | 1 Byte |
| | | RESET | {ON=1 \| OFF=0} | 1 Byte |
| | | END OUTPUT | {ON=1 \| OFF=0} | 1 Byte |
| | | ERROR OUTPUT | {ON=1 \| OFF=0} | 1 Byte |
| | | STEP END OUTPUT | {ON=1 \| OFF=0} | 1 Byte |
| | | BINARY SCHEDULE | {ON=1 \| OFF=0} | 1 Byte |
| | | FULL CURRENT # (5 kA – 80 kA) | | 1 Byte |
| | | CONTROL MODE control mode | | 1 Byte |
| | | FIRING SWITCH | {0 = 2 Stage, 1 = 1Stage} | 1 Byte |
| | | SEAM WELD seam mode | | 1 Byte |
| | | WELD ON/OFF | {LOCAL=0 \| REMOTE=1} | 1 Byte |
| | | LOW LINE ALARM | {ON=1 \| OFF=0} | 1 Byte |
| | | HOST CONTROL | {0=Local, 1=Host} | 1 Byte |
| | | RETRACTION (0=MAINTAINED, 1=PULSED) | | 1 Byte |
| | | DIFF. PRESSURE | {ON \| OFF} | 1 Byte |
| | | PRESSURE SWITCH | {ON \| OFF} | 1 Byte |
| | | OUTPUT FORCE (0=OFF, 1=F1, 2=F1 - F8) | | 1 Byte |
| | | MONITORED VOLTS (0=PEAK, 1=RMS) | | 1 Byte |
| | | MONITORED TIME (0=W1/W2, 1=LAST CYCLE) | | 1 Byte |
| | | BACK PRESSURE (0 - 30) | | 1 Byte |
| | | COIL TYPE (0=NONE, 1=PRI, 2=SEC) | | 1 Byte |
| | | FREQ | {0 = 60 hz, 1 = 50 hz} | 1 Byte |
| | | | | 17 Bytes Total |

---

control mode: Primary C. Current = 0
or % Heat Primary = 1,
or Secondary C. Current = 2
or % Heat Secondary = 3
or % Heat = 4

---

seam mode: Spot = 0
or Continuous Seam = 1
or Roll Spot = 2

---

## APPENDIX J: COMMUNICATION OPTION

| NAME | COMMAND | DATA | | SIZE |
|---|---|---|---|---|
| FORCE | "PS" Set | <ACK **OR** NAK> | | 0 Bytes |
| FORCE | "PR" Read | P1 MIN CALIBRATE #, | (0 - 9999) | 2 Bytes |
| | | P1 MAX CALIBRATE #, | | 2 Bytes |
| | | P2 MIN CALIBRATE #, | | 2 Bytes |
| | | P2 MAX CALIBRATE #, | | 2 Bytes |
| | | P3 MIN CALIBRATE #, | | 2 Bytes |
| | | P3 MAX CALIBRATE #, | | 2 Bytes |
| | | P4 MIN CALIBRATE #, | | 2 Bytes |
| | | P4 MAX CALIBRATE #, | | 2 Bytes |
| | | P5 MIN CALIBRATE #, | | 2 Bytes |
| | | P5 MAX CALIBRATE #, | | 2 Bytes |
| | | P6 MIN CALIBRATE #, | | 2 Bytes |
| | | P6 MAX CALIBRATE #, | | 2 Bytes |
| | | P7 MIN CALIBRATE #, | | 2 Bytes |
| | | P7 MAX CALIBRATE #, | | 2 Bytes |
| | | P8 MIN CALIBRATE #, | | 2 Bytes |
| | | P8 MAX CALIBRATE #, | | 2 Bytes |
| | | P1 ASSOCIATED VALVE #, | (0 = n/a, 1 - 12) | 1 Byte |
| | | P2 ASSOCIATED VALVE #, | | 1 Byte |
| | | P3 ASSOCIATED VALVE #, | | 1 Byte |
| | | P4 ASSOCIATED VALVE #, | | 1 Byte |
| | | P5 ASSOCIATED VALVE #, | | 1 Byte |
| | | P6 ASSOCIATED VALVE #, | | 1 Byte |
| | | P7 ASSOCIATED VALVE #, | | 1 Byte |
| | | P8 ASSOCIATED VALVE #, | | 1 Byte |
| | | | | 40 Bytes Total |

# Section III. Maintenance

## Remove/Replace the Communications Board

1 Disconnect the twenty-six pin ribbon cable connector from the AC Timer Main Board connected to J2.

2 Disconnect the serial cable connector (coming from the external 9-pin connector) from J3.

3 Slide the card out of the card cage.

4 Install or re-install the circuit board by sliding it into the card cage.

5 Reconnect the 26-pin ribbon cable connector from the AC Timer Main Board to (coming from the external 9-pin connector)

6 Reconnect the serial cable connector (coming from the external 9-pin connector) to J3.

7 Slide the board into the card cage.

# APPENDIX K
# CIRCUIT MODIFICATION FOR EXTERNAL TRANSFORMER THERMOSTAT

## External Transformer Thermostat Connection

The following procedure will enable you to connect an external transformer thermostat to the Power Supply such that it will monitor that thermostat the same as the SCR thermostat.

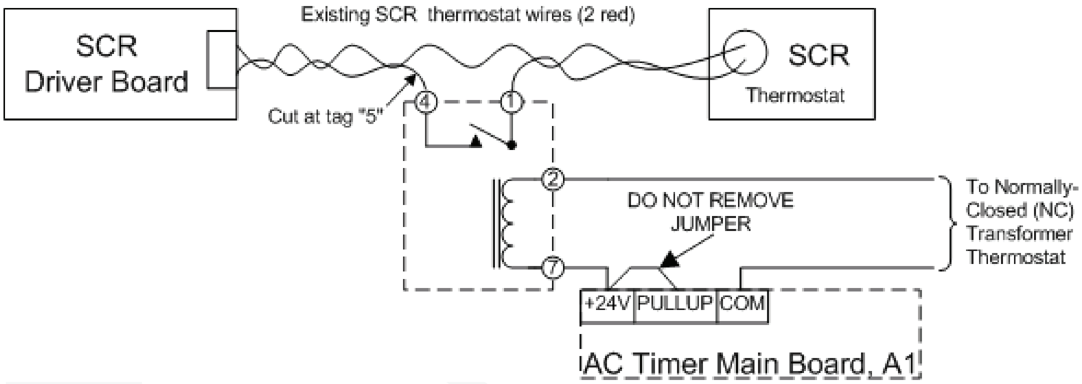
**WARNING:** Lethal voltages are present in the unit. Disconnect power before making this modification.

**Required Parts:**

- 1 relay, 24 VDC, 75 mA maximum coil current, octal base (Recommended: *Grainger* 1A485)
- 1 octal relay socket (Recommended: *Grainger* 5X852)
- Miscellaneous wire, tape, insulation, and mounting hardware, as needed

1 Determine a location in the Power Supply cabinet for mounting the relay. This location should be away from the high voltage terminals.

2 Mount the relay socket and perform the following wiring procedure:


Existing SCR thermostat wires (2 red)
SCR Driver Board
SCR Thermostat
Cut at tag "5"
4
1
2
7
DO NOT REMOVE JUMPER
To Normally-Closed (NC) Transformer Thermostat
+24V
PULLUP
COM
AC Timer Main Board, A1

a) On one of the SCR thermostats, locate the red wire tagged "**5**."

b) Cut the wire and splice on two extension wires long enough to reach the relay socket. Connect these wires to the socket terminals for the **NO** and **COM** terminals of the relay.

c) Connect a wire from one of the socket terminals for the relay coil to the **+24 VDC** terminal on connector **J14** of the **AC Timer Main Board, A1**. Do not remove the existing jumper already on this terminal.

d) Connect the external transformer thermostat to the **COM** terminal on connector **J14** of the **AC Timer Main Board, A1**, and the socket terminal for the other side of the relay coil.

3 Carefully check all wiring and plug the relay into the relay socket.

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# APPENDIX L
# DEFAULT INITIALIZATIONS

The Table below lists the settings that are initially loaded into the Control software. Note that some of these settings may not still be so set when you receive your equipment. During final testing in our Quality Assurance department certain settings, such as **Control Mode**, may be altered to test the equipment with the options you have ordered.

**NOTE:** Selecting **SET DEFAULTS** in the **Extended System Wide Values** screen, ***will*** set all settings to those shown in table E-1. This may require you to reset certain settings, such as **Control Mode**, to allow the Power Supply to operate as you ordered it.

### Default Initializations

| Setting Name | Screen Indication (May vary between screens) | Default |
|---|---|---|
| Current Schedule Number | SCHEDULE # | 00 |
| Linking | | All schedules are unlinked |
| **SCHEDULE Initialization** | | |
| Squeeze Delay Time | SQD | 0 |
| Squeeze Time | SQZ | 0 |
| UP 1 Time | UP1 | 0 |
| Weld 1 Time | W1 | 1 |
| Down 1 Time | DN1 | 0 |
| Cool Time | CO | 0 |
| Up 2 Time | UP2 | 0 |
| Weld 2 Time | W2 | 1 |
| Down 2 Time | DN2 | 0 |
| Hold Time | HLD | 0 |
| OFF Time | OFF | 0 |
| Weld 1 Current | | 00.0 |
| Weld 2 Current | | 00.0 |
| Weld Valve | ELECTRODE VALVE | 01 |
| SCR Number | SCR # | 1 |
| Impulse | IMPULSE | 01 |
| Detailed Schedule Screen | | Detailed |

# APPENDIX L. DEFAULT INITIALIZATIONS

| Setting Name | Screen Indication (May vary between screens) | Default |
|---|---|---|
| **SYSTEM WIDE VALUES Initialization** | | |
| Full Current | FULL CURR. | 10 |
| Maximum Number of SCRs | MAX # OF SCR | 1 |
| Turns Ratio | TURNS RATIO | 053:1 |
| Control Mode | CNTRL MODE | %HEAT |
| Binary Schedule Selected | BIN. SCHED. SELECT | OFF |
| Firing Switch | FIRING SWITCH | TWO STAGE |
| Coil | COIL | 01 |
| Contrast | CONTRAST | 0X3C00<br>(Value not seen by user) |
| Number of Valves | NUM VALVES | 04 |
| Weld Mode Status | MODE | SPOT |
| 87° Delay | 87° DELAY | ON |
| End Output | END OUTPUT | ON |
| Step End | STEP END | ON |
| Weld On/Off | WELD ON/OFF | LOCAL |
| Low Line Alarm | LOW LINE VOLTAGE ALARM | ON |
| Auto Reset | AUTO RESET | OFF |
| Error Output | ERROR OUTPUT | ON |
| **MONITOR Initialization** | | |
| Weld Count Limit | WELD COUNT LIMIT | 99999 |
| Weld Count | SET WELD COUNT | 0 |
| Weld 1 Current | W1 – CURR | 00.0 |
| Weld 1 High Current Limit | W1 – HIGH | 150 |
| Weld 1 Low Current Limit | W1 – LOW | 50 |
| Weld 1 Conduction Angle Limit | W1 – COND. LIMIT | 180 |
| Weld 2 Current | W2 – CURR | 00.0 |
| Weld 2 High Current Limit | W2 – HIGH | 150 |
| Weld 2 Low Current Limit | W2 – LOW | 50 |
| Weld 2 Conduction Angle Limit | W2 – COND. LIMIT | 180 |

# APPENDIX L: DEFAULT INITIALIZATIONS

| Setting Name | Screen Indication (May vary between screens) | Default |
|---|---|---|
| **SYSTEM VALVE STATUS Initialization** | | |
| Valve Count (All) | Valve Count (All) | Valve Count (All) |
| Valve 1 SCR | Valve 1 SCR | Valve 1 SCR |
| All Others Valves | All Others Valves | All Others Valves |
| **MODE Initialization** | | |
| Weld Mode | Weld Mode | Weld Mode |
| **STEPPER Initialization** | | |
| Stepper | STEPPER | OFF |
| Step 1 Count | COUNT | 250 |
| Step 2 Count | COUNT | 400 |
| Step 3 Count | COUNT | 600 |
| Step 4 Count | COUNT | 800 |
| Step 5 Count | COUNT | 1000 |
| Step 6 Count | COUNT | 1200 |
| Step 7 Count | COUNT | 1400 |
| Step 8 Count | COUNT | 1600 |
| Step 9 Count | COUNT | 1800 |
| Step 10 Count | COUNT | 2000 |
| Step 1 Heat % | HEAT% | FIXED (100%) |
| Step 2 Heat % | HEAT% | 90% |
| Step 3 Heat % | HEAT% | 100% |
| Step 4 Heat % | HEAT% | 105% |
| Step 5 Heat % | HEAT% | 110% |
| Step 6 Heat % | HEAT% | 120% |
| Step 7 Heat % | HEAT% | 125% |
| Step 8 Heat % | HEAT% | 125% |
| Step 9 Heat % | HEAT% | 125% |
| Step 10 Heat % | HEAT% | 125% |

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