

WELD HEAD

**SR-071A**

**SR-072A**

**SR-073A**

# **USER MANUAL**



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### Revision Record

Revision	EO	Date	Basis of Revision
A	20183	11/04	None. Original edition.
B	21776	05/08	Update to Miyachi Unitek logo, and added new <b>CAUTION</b> information.
C	40496	07/10	Addition of Series 73 models.
D	41398	09/11	Correction of Model 73 electrode force on page A-2. Addition of 73-Z Pincer Weld head.
E	42860	11/13	Updated to Miyachi America name and logo.
F	43087	02/14	Removal of CE Certification.
G	43481	11/14	Update to Amada Miyachi America name and logo.
H	43866	08/15	Updated to Amada Miyachi America format.
J	44244	05/16	Update contact information
K	45853	04/20	Update Company Name (Amada Weld Tech) + Model Names. Update Technical info. See body of ECO for changes.
L	47210	01/24	Update Manual Title

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# FOREWORD

Thank you for purchasing an Amada Weld Tech SR-070A Series Weld Head.

Upon receipt of your equipment, please thoroughly inspect it for shipping damage ***before*** installing it. If there is any damage, please contact the shipping company immediately to file a claim, ***and*** notify us at:

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

The purpose of this manual is to provide the information required for proper and safe operation and maintenance of the SR-071A / SR-072A / SR-073A / SR-073A-Z Weld Heads.

We have made every effort to ensure that information in this manual is both accurate and adequate. If you have any questions or suggestions to improve this manual, please contact us at the phone number or addresses above. The contents of this manual are subject to change without notice.

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		Current Model Name	Current P/N
Model 71	→	SR-071A	2-240-xx
Model 72	→	SR-072A	2-241-xx
Model 73	→	SR-073A	2-244-xx
Model 73Z	→	SR-073A-Z	2-244-0x-xx

# SAFETY PRECAUTIONS

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

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



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





## WARNING



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

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



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

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



**Only use specified cables.**

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



**Only apply the specified power.**

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



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

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



**Stop operation if any trouble occurs.**

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



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

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



**Wear protective gear.**

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



## CAUTION



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

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



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

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



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

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



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

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



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

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



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

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



**Wear ear protectors.**

Loud noises can damage hearing.



**Keep a fire extinguisher nearby.**

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



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

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



## Installation Precautions

Do **not** install this Welding Head in **any** of the following:

- Damp places where humidity is 90% or higher.
- Dusty places.
- Places where chemicals are handled.
- Places near a high-frequency noise source.
- Hot or cold places where temperatures are above 40°C or below 0°C, or places where water will condense.



### CAUTION

Do **not** modify the electrode holders or attach additional mechanisms to the moving parts of the head. Doing so may hurt welding performance, damage the head, and **void the warranty**.

## Operating Precautions

- Do **not** put anything other than a workpiece (tool, screw, coin, etc.) between the electrodes or on the Weld Head or you may damage the Weld Head or cause a short circuit or fire.
- Operate the Welding Head **only** according to the instructions in this manual.
- Operate the button carefully **by hand**. If it is operated roughly or with the tip of a tool you may damage the Weld Head.

## Disposal Precaution

The Motor Controller photo-coupler contains **GaAs** (Gallium Arsenide). Follow **all** local environmental regulations for disposal.

# LIMITED WARRANTY

## GENERAL TERMS AND CONDITIONS FOR THE SALE OF GOODS

### 1. Applicability.

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

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

### 2. Delivery.

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

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

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

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

### 3. Non-delivery.

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

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

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

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

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

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

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**SR-071A / SR-072A / SR-073A WELD HEADS**

## 7. Inspection and Rejection of Nonconforming Goods.

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

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

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

## 8. Price.

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

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

## 9. Payment Terms.

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

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

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

## 10. Intellectual Property; Software License.

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

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

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

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

## **12. Limited Warranty.**

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

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

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

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

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

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

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

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

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

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

(a) **IN NO EVENT SHALL SELLER BE LIABLE FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR PUNITIVE DAMAGES, LOST PROFITS OR REVENUES OR DIMINUTION IN VALUE, LOSS OF INFORMATION OR DATA, OR PERSONAL INJURY OR DEATH ARISING IN ANY WAY OUT OF THE MANUFACTURE, SALE, USE, OR INABILITY TO USE ANY GOODS, SOFTWARE OR SERVICE, OR ARISING OUT OF OR RELATING TO ANY BREACH OF THESE TERMS, WHETHER OR NOT THE POSSIBILITY OF SUCH DAMAGES HAS BEEN DISCLOSED IN ADVANCE BY BUYER OR COULD HAVE BEEN REASONABLY FORESEEN BY BUYER, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY (CONTRACT, TORT OR OTHERWISE) UPON WHICH THE CLAIM IS BASED, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER REMEDY OF ITS ESSENTIAL PURPOSE.**

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

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

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

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

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

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

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

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

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

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

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

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

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

**19. Force Majeure.** Seller shall not be liable or responsible to Buyer, nor be deemed to have defaulted or breached this Agreement, for any failure or delay

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## SR-071A / SR-072A / SR-073A WELD HEADS

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

## DESCRIPTION

### Section I: Features

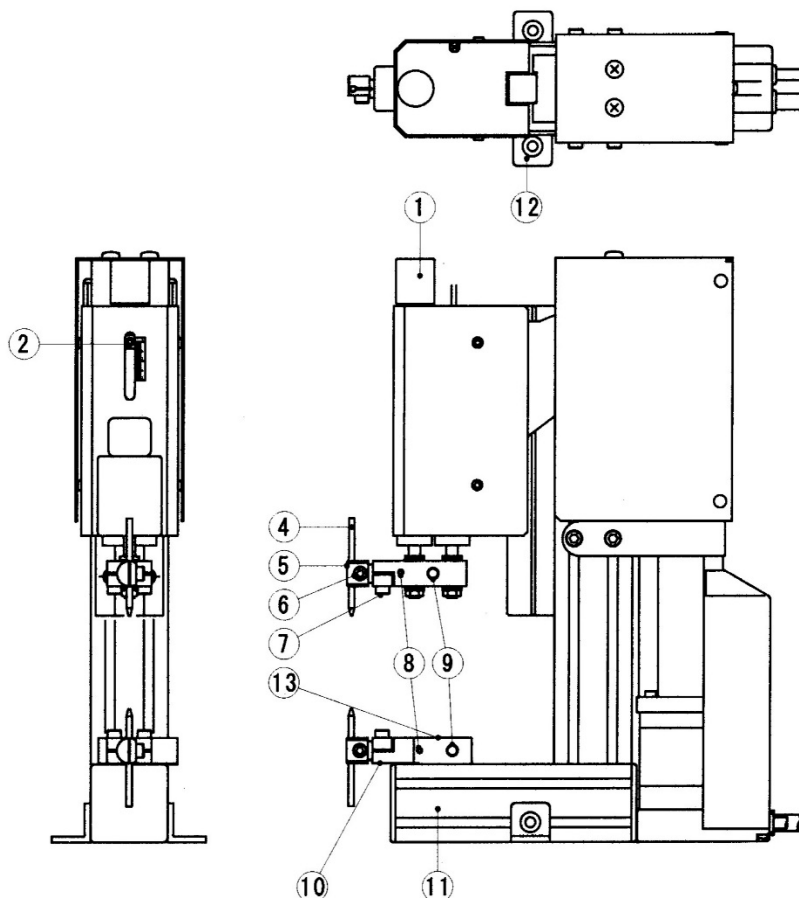
For the rest of this manual, **SR-071A / SR-072A / SR-073A / SR-073A-Z Weld Heads** will simply be referred to as the ***Weld Head***. The **Motor Control Unit** will simply be referred to as ***The Controller***.

The Weld Head has the following features:

- Owing to motor-driven mechanism, the electrode force is always stable, even if the part thickness changes. No fine gap adjustment is necessary when replacing electrodes.
- The electrode force is 1-8 lbs per electrode for the SR-071A and SR-072A Weld Heads.
- The electrode force is 15-110 lbs per electrode for the Model SR-073A Weld Head.
- The electrode force is 15-110 lbs. per electrode for the Model SR-073A-Z Weld Head.
- You can adjust the electrode speed to suit your welding needs. The force is adjustable in four steps; the electrode-up/down speed, in eight steps.
- You can manually or externally select thirty-one different weld schedules.
- The electrode moves down quickly from the start point (stand-by position) to the mid-point (middle-stop position); then slowly to contact the workpiece.
- The speed of the electrode can be programmed so as not to cause excessive impact to the parts.
- The start point and the mid-point are adjustable arbitrarily.
- The electrode moves up and down between the mid-point and workpiece for continuous welding. This reduces the weld cycle time as the electrode doesn't need to return to the start point every time it welds. This can be useful in automation.
- During welding, the workpiece can expand and shrink. This Weld Head employs a spring so that the electrode can follow-up the deformation of the workpiece quickly which reduces splash.
- The dedicated Controller easily sets the electrode position and speed.
- Since this Welding Head is motor driven, the piping for air actuation is not needed, enabling an easy installation.

### Section II: Major Components

#### Model SR-071A Weld Head

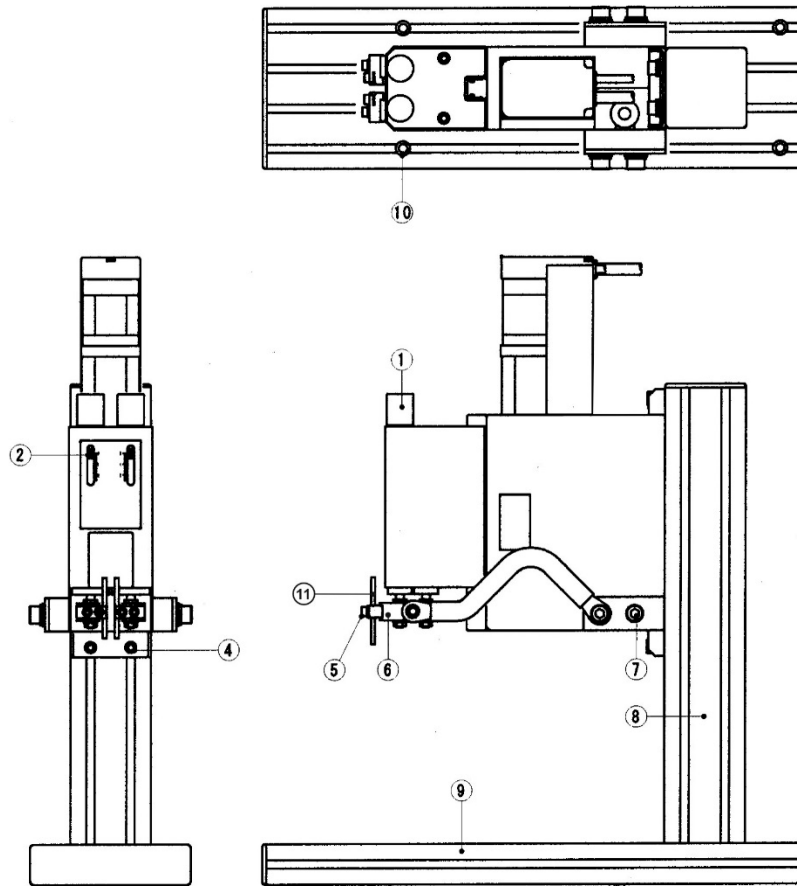


Item	Name	Description
1	Weld Force Adjustment Knob	Adjusts the electrode force.
2	Lock Screw	Locks the Weld Force Adjustment Knob.
4	Electrode	For spot welding.
5	Electrode Holder	Holds the electrode.
6	Electrode Screw	Secures the Electrode to the Electrode Holder.
7	Holder Clamping Screw	Clamps the Electrode Holder in place.
8	Voltage Sensing Cable Screw	Connects the Voltage Sensing Cable.
9	Weld Cable Screw	Secures the Weld Cable to the Electrode Holder Adapter.
10	Electrode Holder Adapter	Connects the Electrode Holder to the head.
11	Base	Supports the Mounting Post.
12	Head Bracket	For mounting the Weld Head to the work bench. Two brackets are provided, each with 2/10" (5.5mm) mounting holes.
13	Adapter Mounting Screws	Secures the bottom Electrode Adapter to the Base.

#### SR-071A / SR-072A / SR-073A WELD HEADS



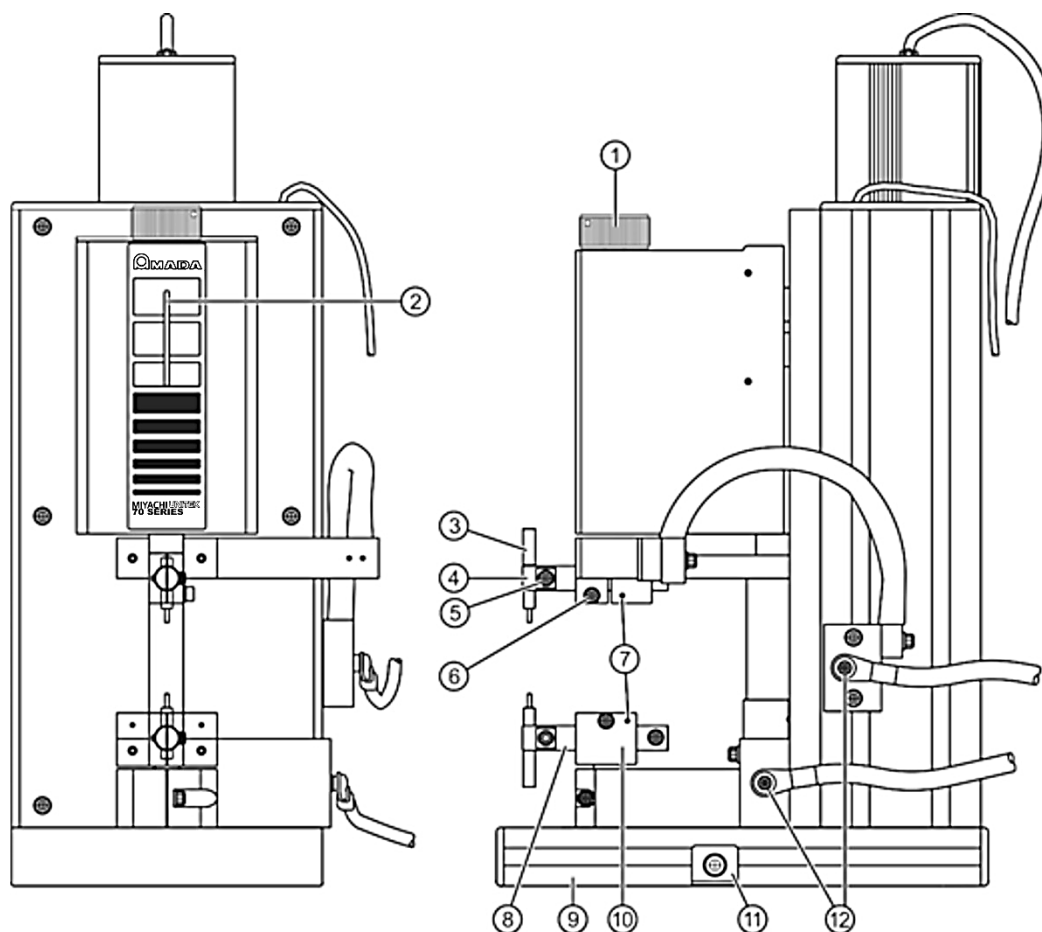
## Model SR-072A Weld Head



Item	Name	Description
1	Weld Force Adjustment Knob	Adjusts the electrode force.
2	Lock Screw	Locks the Weld Force Adjustment Knob.
3	N/A	N/A
4	Mounting Screw	Secures the Head to the Mounting Post
5	Electrode Screws	Secures the Electrodes to the Holders.
6	Voltage Sensing Cable Screw	Connects the Voltage Sensing Cable.
7	Weld Cable Screw	Secures the Weld Cable to the Power Bar.
8	Mounting Post	Attaches to the Base and supports the Weld Head.
9	Base	Supports the Mounting Post.
10	Base Mounting Holes.	For mounting the Welding Head on the workbench. Six (6) holes are provided. Each hole is 1/4-inch (6.5mm), with Ø.43-inch (11mm) spot facing, and Ø.4-inches (10mm) deep.
11	Electrodes	For spot welding.

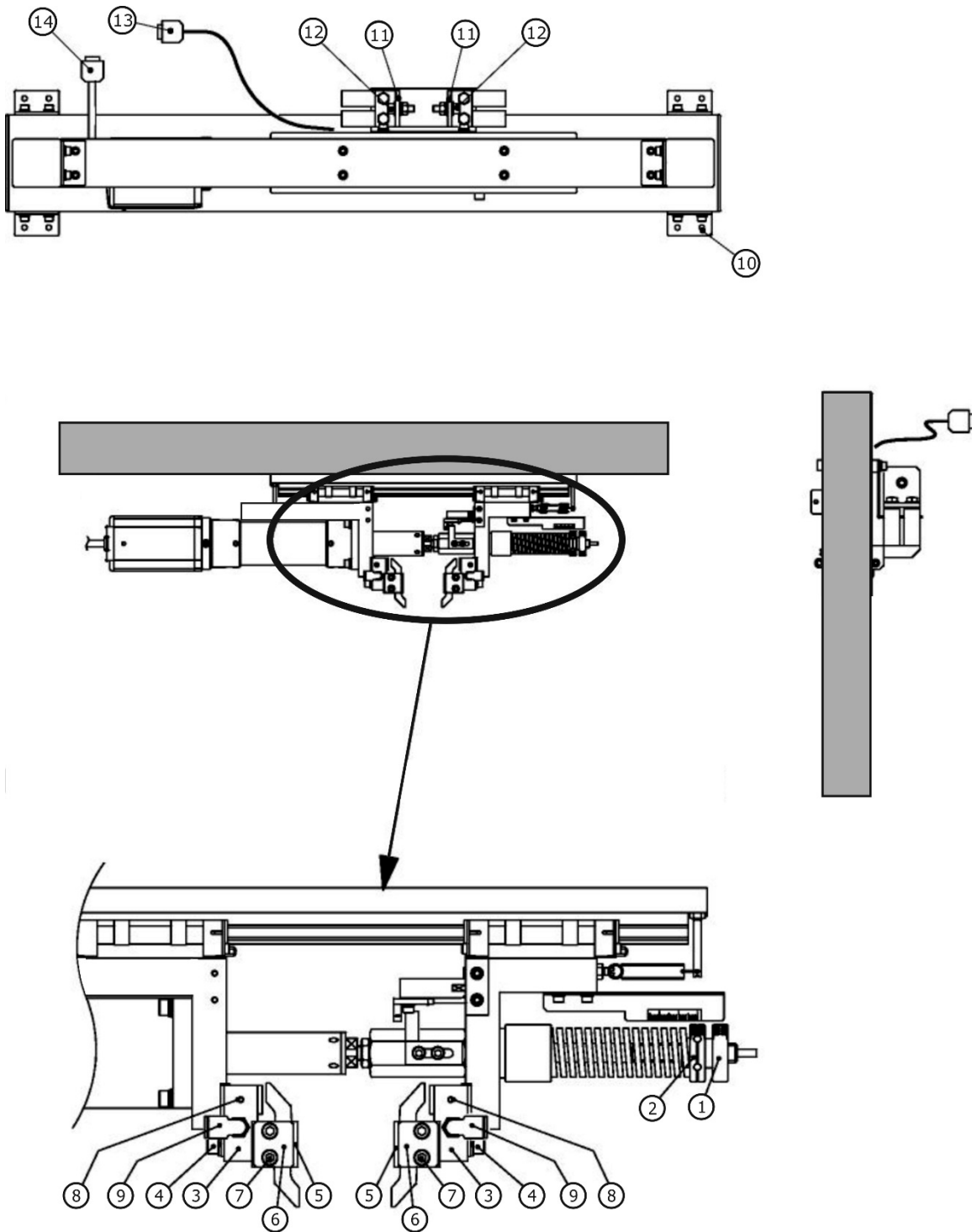
## CHAPTER 1: DESCRIPTION

### Model SR-073A Weld Head



Item	Name	Description
1	Weld Force Adjustment Knob	Adjusts the electrode force.
2	Lock Screw	Locks the Weld Force Adjustment Knob.
3	Electrode	For spot welding.
4	Electrode Holder	Holds the electrode.
5	Electrode Screw	Secures the Electrode to the Electrode Holder.
6	Holder Clamping Screw	Clamps the Electrode Holder in place.
7	Voltage Sensing Cable Screw	Connects the Voltage Sensing Cable.
8	Electrode Holder	Holds the electrode.
9	Base	Supports the Mounting Post.
10	Electrode Holder Adapter	Connects the Electrode Holder to the head.
11	Head Bracket	For mounting the Weld Head to the work bench. Two brackets are provided, each with 2/10" (5.5mm) mounting holes.
12	Weld Cable Screw	Secures the Weld Cable to the Electrode Holder Adapter.

**Model SR-073A-Z Weld Head**



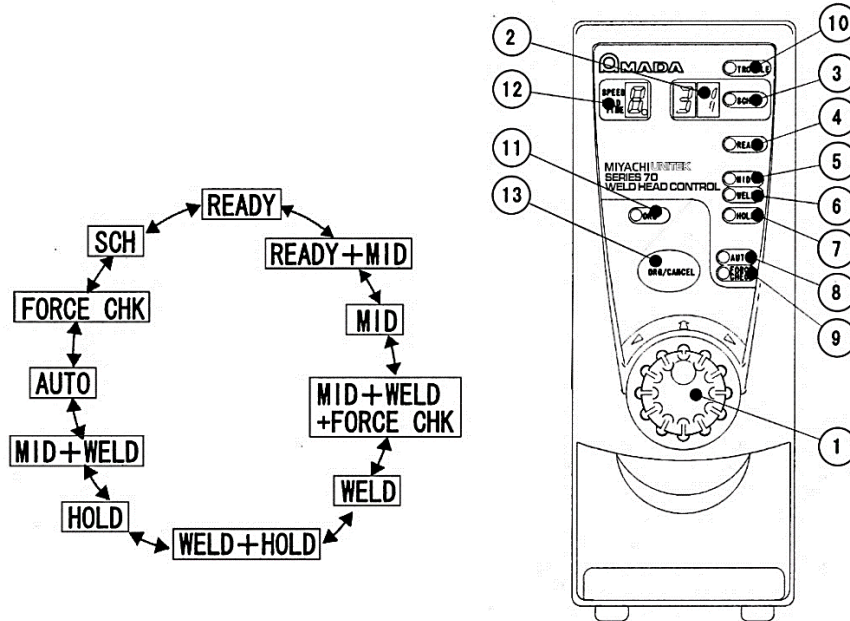
## CHAPTER 1: DESCRIPTION

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Item	Name	Description
1	Weld Force Adjustment	Adjusts the electrode force.
2	Lock Screw	Locks the Weld Force Adjustment Knob.
3	Holder	Fixes Electrode Holder.
4	M6 Screw for mounting Electrode Holder	Mounts the electrode Holder to the Holder.
5	Electrode Holder	Fixes the electrodes (separately sold).
6	Holder Cover	Fixes the electrodes (separately sold).
7	M5 Screw for mounting Holder Cover	Mounts Holder Covers to Electrode Holders.
8	Screw for connecting Voltage Sensing Cable	Connects the volt sensing cable. Use the cables which your welding power supply designates.
9	Joint	Connects the water inlet and outlet tubes.
10	Installation Holes in Base	For attaching the Welding Head to a worktable. The size of the holes (8 places) is 6.5 mm diameter.
11	Plate for supplying Power	Mounts a secondary cable.
12	M8 Screws for fixing Secondary Cable	Fixes a secondary cable.
13	Cable for Weld Force Detecting Sensor	Connects firing sensor to controller
14	Motor Cable	Connects motor to controller

## Controller (Front Panel)

**Operation Button.** You operate the Weld Head by turning the button clockwise/counterclockwise and by pressing it. By turning the button, the lamp illumination changes as shown below.



Lamp	When Illuminated	When blinking
<b>AUTO Lamp</b>	Operation button is selecting a function.	Auto-function will set electrode position and movement.
<b>FORCE CHK Lamp</b>	Operation button is selecting a function.	Weld force can be measured.
<b>HOLD Lamp</b>	Operation button is selecting a function.	Hold Time can be changed.
<b>MID Lamp</b>	Electrode is at Mid-Point. Operation button is selecting a function.	Mid-Point can be changed.
<b>ORG Lamp</b>	The <b>ORG</b> Lamp is not used.	---
<b>READY Lamp</b>	Electrode is at Start Point and completed for work. Operation button is selecting a function.	Start Point can be changed.
<b>SCH (Schedule) Display</b>	Schedule Nos. are displayed. (There are 31 combinations of Electrode position, Speed and Hold Time that can be registered as Schedules).	When power supply is applied, zero "0" blinks. When trouble occurs, fault code is displayed. Weld force can be measured
<b>SCH (Schedule) Lamp</b>	Operation button is selecting a function.	Schedule No. can be changed
<b>TROUBLE Lamp</b>	Trouble is occurring.	---
<b>WELD Lamp</b>	Electrode is at Weld Point. Operation button is selecting a function.	Lowest point (Downstop Point) is being changed.

## CHAPTER 1: DESCRIPTION

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### SPEED HOLD TIME Display

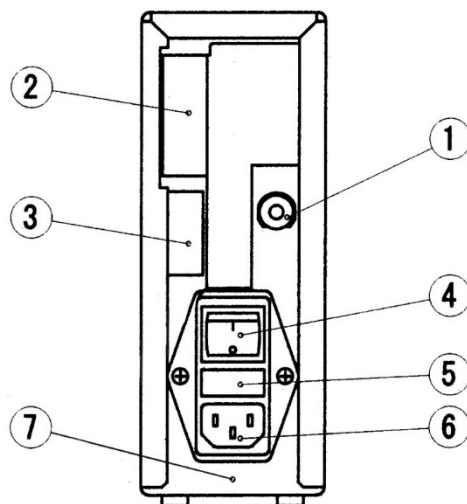
Indicates the “electrode speed” and “**HOLD** Time after the application of weld force is completed.” The larger number indicates the faster electrode speed and the longer **HOLD** time.

The lamp lights up simultaneously with other lamps as shown below.

Lamp	When illuminated,	When blinking,
<b>READY Lamp and MID Lamp and SPEED HOLD TIME Display</b>	Operation button is selecting a function. ( <b>SPEED HOLD TIME</b> Display does <i>not</i> light up.) Electrode is moving between Start Point and Mid-Point.	Electrode speed between Start Point and Mid-Point can be set.
<b>MID Lamp and WELD Lamp and SPEED HOLD TIME Display</b>	Operation button is selecting a function. ( <b>SPEED HOLD TIME</b> Display does <i>not</i> light up.) Electrode is moving from Weld Point to Mid-Point.	Electrode speed from Weld Point to Mid-Point can be set.
<b>MID Lamp and WELD Lamp and FORCE CHK Lamp and SPEED HOLD TIME Display</b>	Operation button is selecting a function. ( <b>SPEED HOLD TIME</b> Display does <i>not</i> light up.) Electrode is moving from Mid-Point to Weld Point.	Electrode speed from Mid-Point to Weld Point can be set.
<b>WELD Lamp and HOLD Lamp and SPEED HOLD TIME Display</b>	Operation button is selecting a function. ( <b>SPEED HOLD TIME</b> Display does <i>not</i> light up.)	The desired time for which the additional weld force is exerted on after applying the weld force at Weld Point is being set.
<b>HOLD Lamp and SPEED HOLD TIME Display</b>	Operation button is selecting a function. ( <b>SPEED HOLD TIME</b> Display does <i>not</i> light up.)	Hold Time can be set.
<b>SPEED HOLD TIME Display</b>	In case of Movement Mode 1, electrode position is at Start Point and the Display shows “A” when setting is not performed.	---

**ORG/CANCEL Button.** This button interrupts the programming changes in progress.

## Controller (Rear Panel)



Number	Name	Description
1	<b>MOTOR CONTROL Connector</b>	Connects the control motor to drive the electrode.
2	<b>I/O Connector</b>	Used for input/output signal connections.
3	<b>Weld Force Detecting Sensor Connector</b>	Connects the Weld Force signal from the welding head.
4	<b>Power Switch</b>	Turns the Controller ON/OFF.
5	<b>Fuse Holder</b>	Fuse Rating 250V, 1A, 5mm diameter, 20mm length (Slow Blow melting and high breaking capacity type).
6	<b>Power Supply Connector</b>	Used for connecting a power supply cable (separately sold) to 100 to 240 VAC power supply.
7	<b>Ground Terminal</b>	Used as a ground terminal when you are <i>not</i> using a power supply cable with a ground wire (sold separately).





# CHAPTER 2

## INSTALLATION AND SETUP

### Section I: Installation

#### Unpacking

The Weld Head comes fully assembled from the shipping box. The only installation requirements are planning the workspace, installing the electrodes, and connecting the unit to the appropriate Power Supply/Welding Control with the cables provided in the Ship Kit.

Unpack the Weld Head from its shipping box and verify that all components of the Ship Kit are present. The Weld Head comes from the shipping box completely assembled except for the electrodes.

**NOTE:** Carefully put the packing materials back in the packing boxes and store for future shipping.

#### Space Requirements

Allow enough space so the Operator may safely perform the welding operation and have sufficient space for the welding Power Supply.

#### Power Requirements

The Weld Head 100-240 VAC,  $\pm 10\%$ , 50/60 Hz, 70VA which may be available from the Power Supply/Welding Control.

In addition, the weld head requires welding current from the Power Supply/Welding Control. Refer to the Power Supply/Welding Control *Operator Manual* for power requirements of that unit.

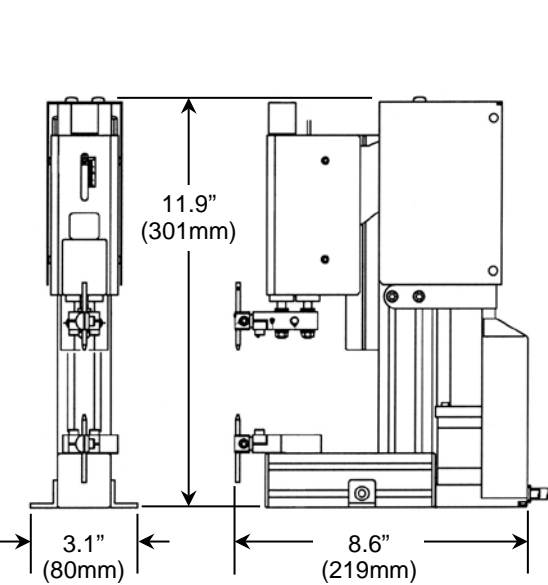
**NOTE:** The Weld Head is motor-driven, therefore it does *not* require any compressed air to operate.

#### Installation on a Workbench

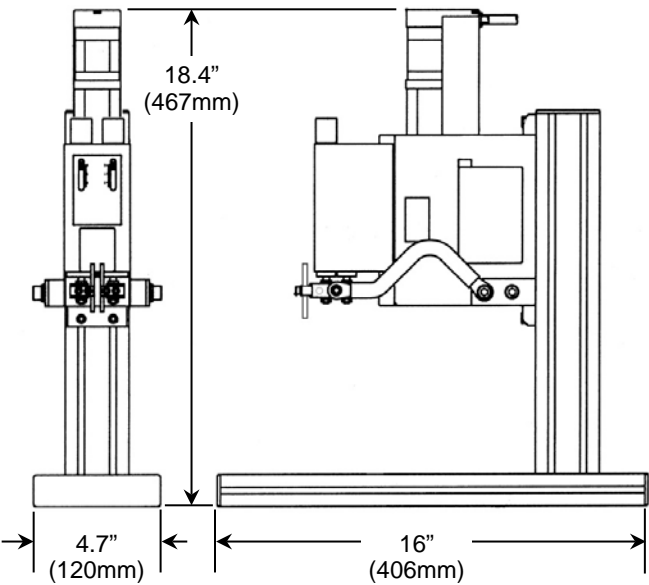
The Welding Head base has six (6) holes so that it may be installed onto a work bench. Each hole is 1/4-inch (6.5mm) in diameter, with Ø.43-inch (11mm) spot facing, and is Ø.4-inches (10mm) deep.

**CHAPTER 2: INSTALLATION AND SETUP**

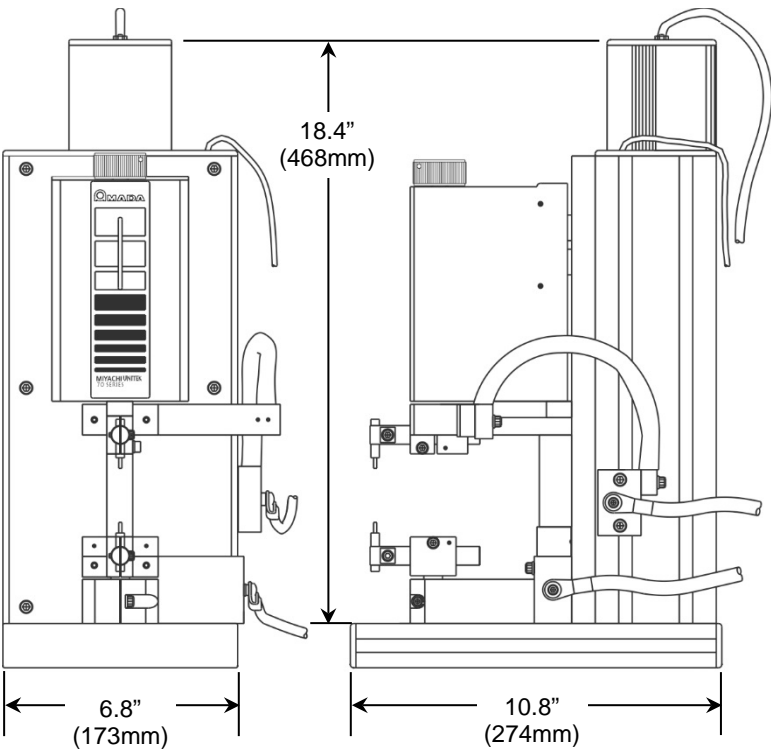
**Space Requirements *(not to scale)***



**Model SR-071A Weld Head**

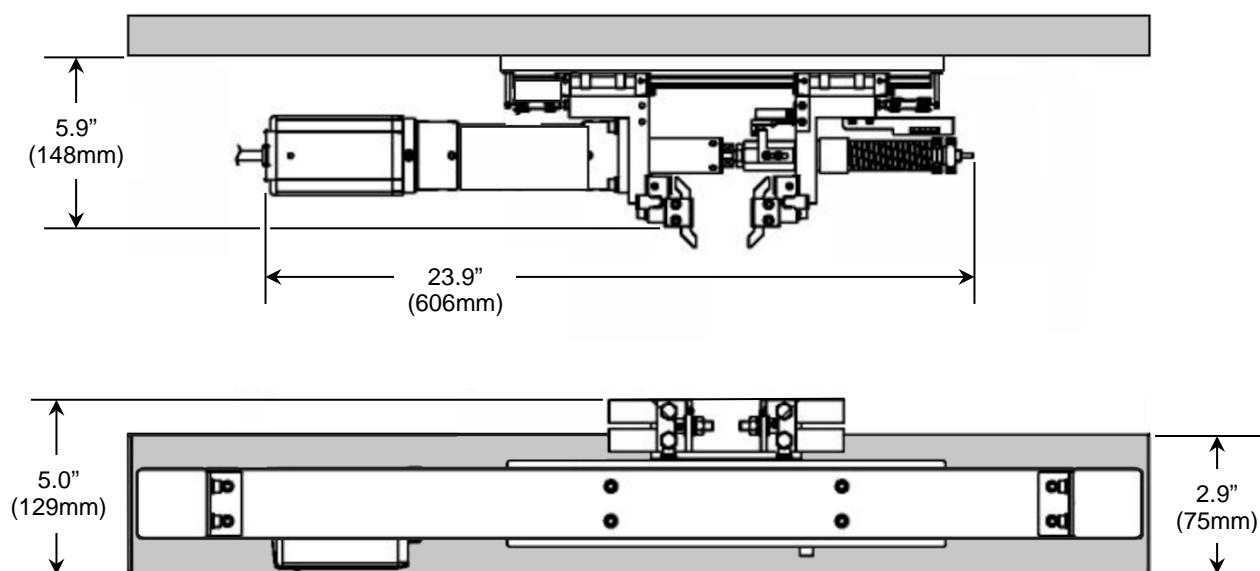


**Model SR-072A Weld Head**



**Model SR-073A Weld Head**

**SR-071A / SR-072A / SR-073A WELD HEADS**



**Model SR-073A-Z Weld Head**

### Install Electrodes

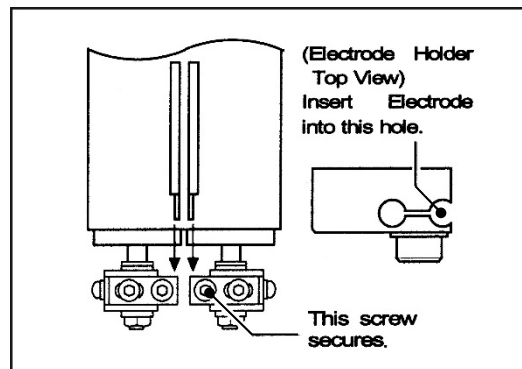


#### CAUTION

Do **not** modify the electrode holders or attach additional mechanisms to the moving parts of the head. Doing so may hurt welding performance, damage the head, and **void the warranty**.

Installing and replacing electrodes is essentially the same for all weld heads. The example shown on the right shows the **Model SR-072A** for reference.

1. Loosen the Electrode Screw.
2. Insert the Electrode into the Electrode Holder.
3. Tighten the Electrode Screw to secure the Electrode in place.



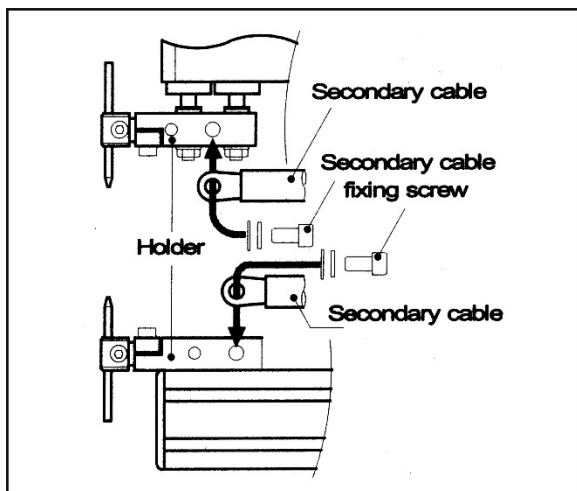
## CHAPTER 2: INSTALLATION AND SETUP

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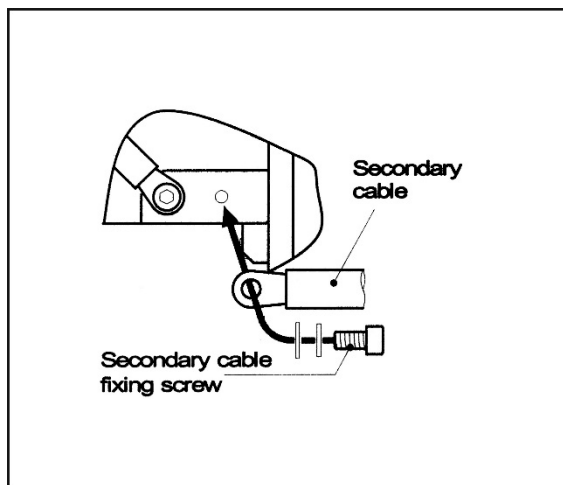
### Connect Weld Cables

After installing the Weld Head on the work bench, connect the Weld Cables, also known as “secondary cables,” to the head as shown below.

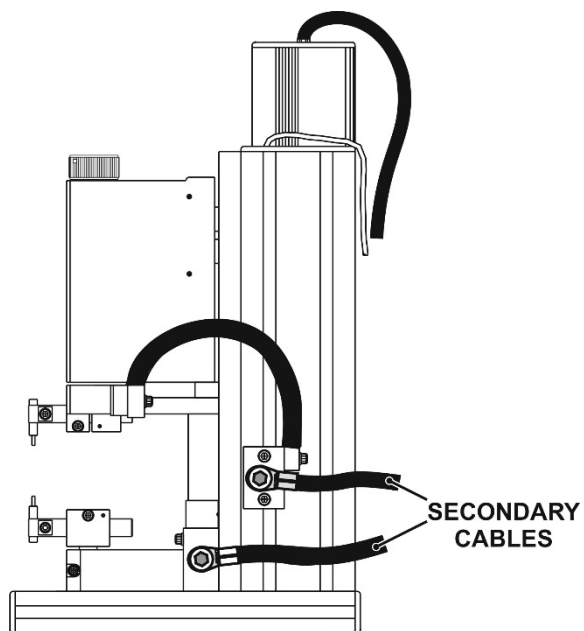
**Model SR-071A**



**Model SR-072A**



**Model SR-071A**



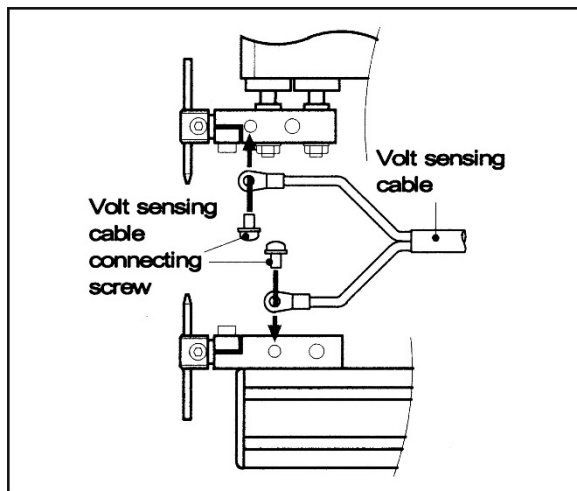
#### NOTES:

- These cables are *not* polarized.
- The connecting screws on **Model SR-072A** are on both the left and right sides of the head.

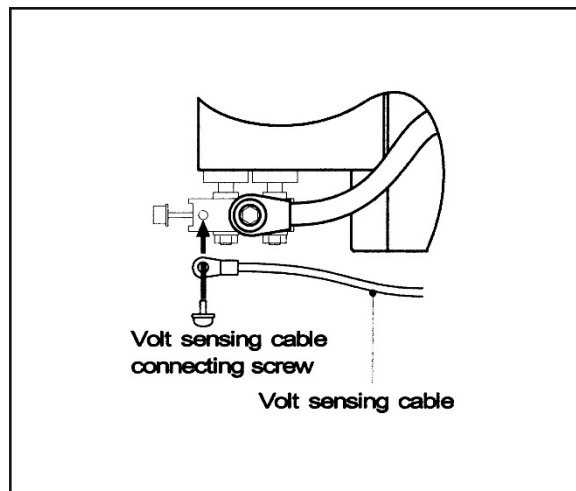
### Connect Controller and Power Supply Cables

1. **Connect the Volt-Sensing Cable.** When employing the voltage-detecting function of a Power Supply, Weld Checker, etc., connect the Volt-Sensing Cables to the Electrode Holders as shown below.

**Model SR-071A & SR-073A**



**Model SR-072A**



**NOTE:** On the Model SR-072A, connect the Volt-Sensing Cables on both the right and left Holders.

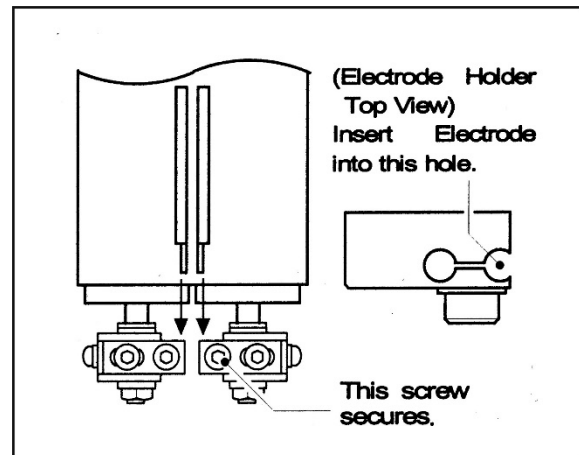
2. **Connect the Weld Force Detecting Sensor Cable.** Connect the Weld Force Detecting Sensor Cable to the Motor Controller.
3. **Connect the I/O Connector.** Connect the I/O Connector to the Motor Controller. Connect the operation switch for an emergency stop of the motor to Pins 21 and 22 of the I/O connector. Use the operation switch whose capacity is more than 24VDC, 20 mA.
4. **Connect the AC Cable.** Finally, connect the AC Cable to the 100—240VAC, 50/60 Hz outlet.

### Section II: Set-up

#### Adjust Electrode Height

Adjust the electrode height in advance to allow  $L1 = L2$  when welding a stepped workpiece.

If the distances to the work pieces are different, two built-in photo-micro switches do *not* turn on simultaneously, resulting in inferior welding. This could also damage the equipment.



#### Adjust Weld Force

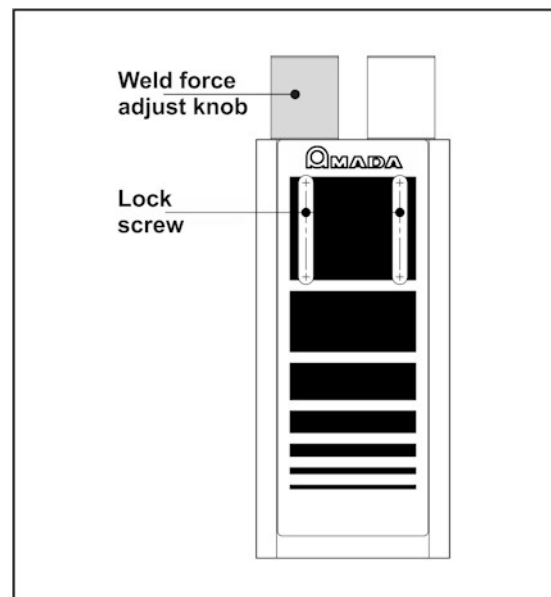


#### CAUTION

- *Always* stop operation *before* starting adjustment.
- The weld force conversion graph represents theoretical values. To measure the actual weld force, use a force gauge.

**NOTE:** Weld Force adjustment is the same procedure for both models. The Model SR-072A Weld Head is shown for reference.

1. Loosen the Lock Screw using the supplied M2.5 hex wrench.
2. The scale represents the weld force. Turn the Weld Force Adjust Knob to adjust the center of the Lock Screw to the desired weld force scale.
3. Tighten the lock screw to lock the Weld Force Adjust Knob.
4. After adjusting, measure the weld force using a pressure force gauge.



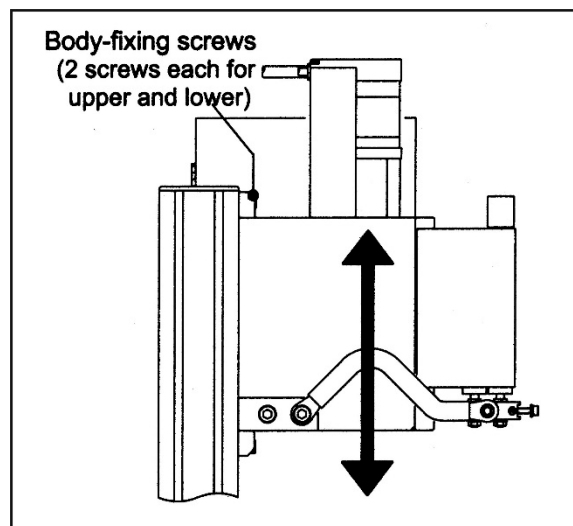
### Adjust Weld Head Position



#### WARNING

*Always* support the Weld Head when you loosen the screws. If you loosen the head without support it could fall causing injury to the Operator and/or damage to the equipment.

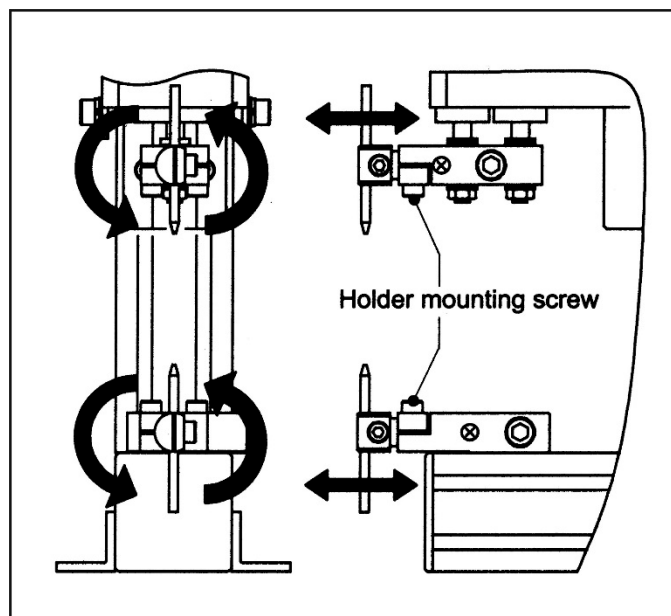
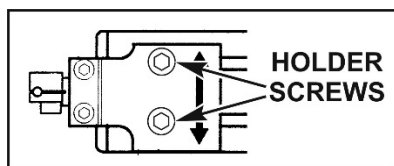
1. Unplug the AC Cable from the electrical outlet.
2. Loosen the Weld Head Screw.
3. Move the Weld Head up and down to adjust the mounting height.
4. When the head is in the desired position, tighten the Weld Head Screw firmly.



### Aligning the Electrodes

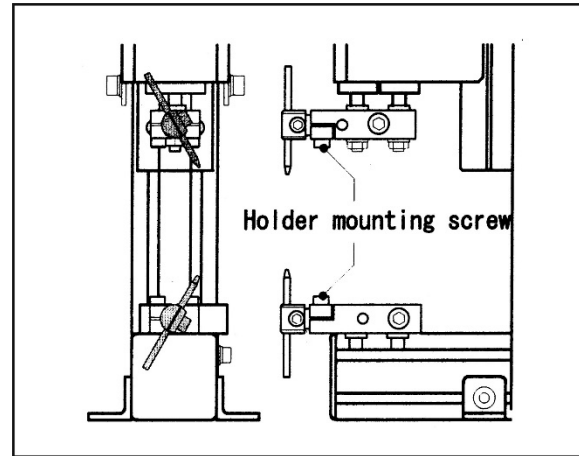
1. Unplug the AC Cable from the outlet to turn off the power supply.
2. Loosen the Holder-Mounting Screws.
3. Rotate or move back and forth the Electrode Holders to align the upper and lower electrodes as shown at lower right.

**NOTE:** If you can't align the electrodes, loosen the Holder Screw to move the Electrode Holder up, down, left, or right as needed.



### Adjust the Electrode Mounting Angle

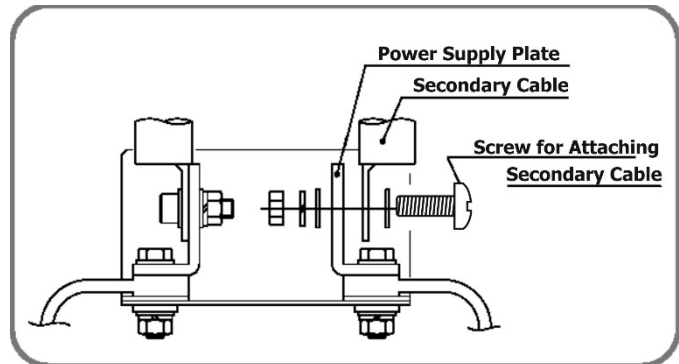
1. Unplug the AC Cable from the outlet to turn off the power supply.
2. Loosen the Holder-Mounting Screws and turn the Electrode Holders to adjust the mounting angle of the electrode.
3. After the adjustment, tighten the Holder-Mounting Screw securely.



### Model SR-073A-Z Weld Head

#### Connect the Secondary Cable

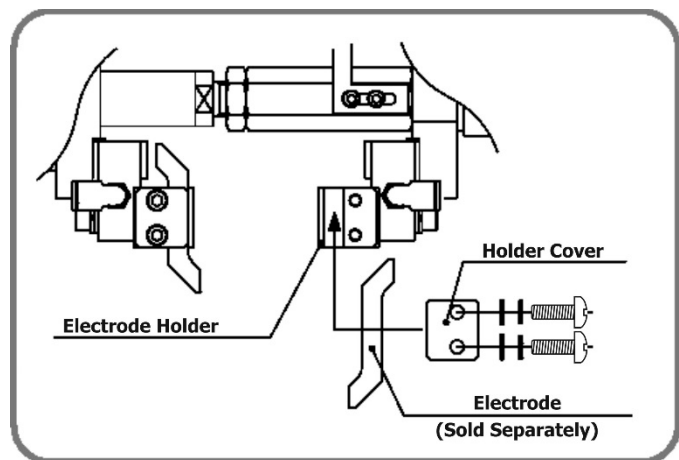
1. Verify that the weld head is attached to the work table or support mechanism securely.
2. After installing, connect the **Secondary Cable** to the weld head.
3. Tighten the screws securely to avoid shaking or other unwanted movement during operation



#### Install or Replace Electrodes

**NOTE:** **Electrodes** are sold separately.

1. Remove the **Electrode Holder Cover**.
2. Insert the electrode into the slot of **Electrode Holder** and adjust to desired height.
3. Reinstall the **Electrode Holder Covers**.
4. When the **Electrodes** are in place tighten the screws securely.



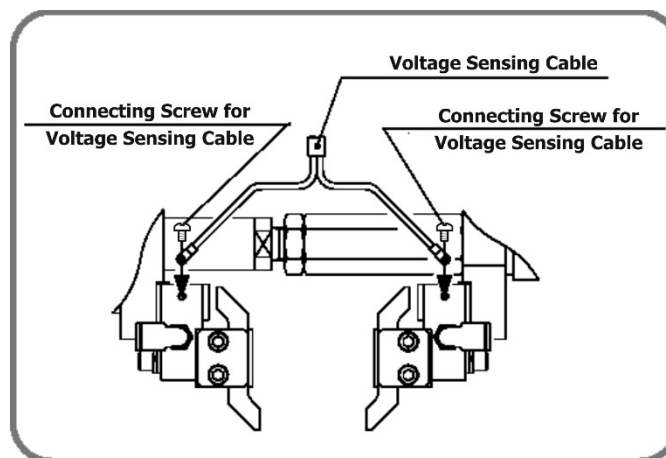


### Connect Voltage Sensing Cable

Connect **Voltage Sensing Cables** when using the Voltage feedback mode or using Voltage monitoring with Amada Weld Tech Inverters or Weld Monitors.

#### NOTES:

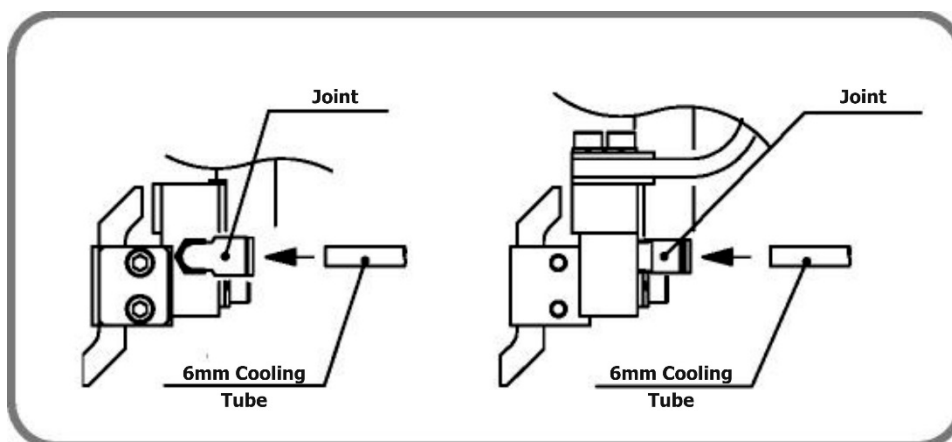
- Be sure to use the **Voltage Sensing Cables** which your welding power supply designates.
- Tighten the screws securely to prevent the cables from coming loose during operation.



### Attach Water Cooling Tubes

Attach the tubes as shown below.

**NOTE:** 6mm water cooling tubes are *not* supplied with the weld head.





# CHAPTER 3

## OPERATING INSTRUCTIONS

### Section I: Before You Start


#### Preparation

*Before* operating the Weld Head, read both this manual *and* the *Operator Manual* that came with your Power Supply/Welding control. Particularly note the specific hazards associated with those components. You *must* be familiar with the general principles of welding, programming weld schedules, and the operating procedures of your Power Supply/Welding Control.

Use the checklist below to make sure that all connections and settings are correct to ensure that you will achieve the highest quality welds possible.

PRE-WELD CHECKLIST	
✓	Confirm that a qualified Engineer or Technician has properly installed and setup the equipment according to the instructions in <i>Chapter 2, Installation and Setup</i> .
✓	Set the <b>WELD/NO WELD</b> Switch, located on the front of the Power Supply/Welding Control to the <b>NO WELD</b> position.
✓	Check that the weld power cables are correctly attached at both ends.
✓	Verify that the Firing Switch Cable is attached to the welding power supply.
✓	Verify that the Power Supply/Welding Control is connected to the appropriate power source and that the power source is turned <b>ON</b> .
✓	Verify that the Power Supply/Welding Control is turned <b>ON</b> .

#### Operator Safety

 <b>DANGER</b>
<ul style="list-style-type: none"><li>• <i>Always</i> wear protective safety glasses when performing any welding operation.</li><li>• <i>Always</i> wear appropriate personal protective gear when welding.</li></ul>

### Section II: Operation

#### Overview

Welding consists of:

- Adjusting the electrodes and Weld Head height to match the pieces being welded.
- Adjusting the welding force if necessary.
- Using the Controller to program the motor drive settings.
- Welding using normal shop procedures.



#### CAUTION

*Before* performing the procedures below, make sure the **WELD-/NO-WELD** switch is in the **NO-WELD** position to avoid unexpected sparking or weld current discharge that could damage equipment.

#### 2-level Footswitch

It is of 2-level type. The first level switch is External Input 1 **STI**. The second level switch is External Input **2NDJ**. These two switches allow a variety of operations.

#### Electrode Position

Model SR-072A electrodes have five stop positions.

Position	Description
<b>Original Point</b>	The position where the electrode has completely returned.
<b>Start Point</b>	A little bit farther position from Original Point. It can be set arbitrarily. The <b>READY</b> Lamp lights up when the electrode is at this position.
<b>Mid-Point</b>	Just before the position where the electrode contacts workpiece. It can be set arbitrarily. MID Lamp lights up when the electrode is at this position.
<b>Weld Point</b>	The position where the electrode contacts workpiece. The <b>WELD</b> Lamp lights up when the electrode is at this position and causes the welding current to flow.
<b>Downstop Point</b>	A little bit beyond the position from Weld Point. It can be set arbitrarily.

## Electrode Working Mode

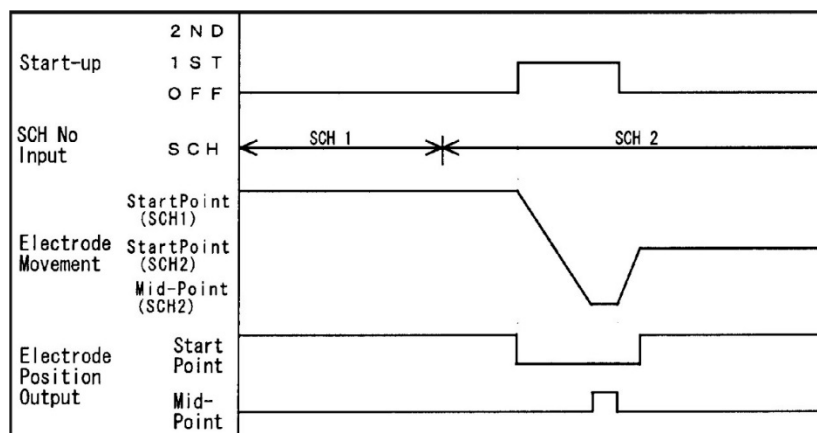
Model SR-072A has two working modes.

Movement	Mode 0	Mode I
For setting Position or measuring Weld Force	Performed by External Input <b>1ST</b> or <b>2ND</b>	Performed by External Input <b>1ST</b> or <b>2ND</b> or pressing the <b>Operation</b> button.
For resuming Start Point of motor	Performed by External Input <b>1ST</b> or <b>ORG</b>	Performed by External Input <b>1ST</b> or <b>ORG</b> or pressing <b>ORG/CANCEL</b> button.
Electrode is pressed on the way other than from Mid-Point to Weld Point.	Error indicated	Error indicated and the power supply to motor turned off.

In **Mode 1**, when the electrode is at **Start Point** and no setting is performed, then **A** is shown on **SPEED HOLD TIME Display**.

## Change of Schedule Number

Changing the **Schedule No.** does not cause the electrode to move. The electrode's **START POINT** stays at the position of the previous schedule. In case that Start Point of the new **Schedule No.** differs from the one of the last **Schedule No.**, move the electrode to the Mid-Point and back to get the new Start Point.



- In case of continuous operations across several Schedule Numbers, set each Start Point the same.
- When the weld force is exerted on the electrode on the way other than moving from Mid-Point to Weld Point, then the fault code “E” is displayed.

## In Case of Mode 0

When a problem occurs between Mid-Point and Start Point, open External Input **1ST** to make the electrode move to Start Point.

## CHAPTER 3: OPERATING INSTRUCTIONS

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When a problem occurs between Start Point and Original Point, open External Input **1ST** to make the electrode move to Original Point. At the Original Point, External Output **START POINT** is output.

### In case of Mode 1

Power to the motor is turned OFF to stop.

## Mode Setting

### Setting

1. Turn on the power while pushing the Operation button. The character of **Set** blinks on the **SCH** (Schedule) display and **SPEED HOLD TIME** Display.
2. Continue to press the button until blinking changes stays on.
3. Depress the Operation button, and “0” blinks on **SPEED HOLD TIME** Display. Rotate the Operation button to choose one of the following settings.
  - **0** means “Change of **Mode**.”
  - **1** means “Change of **ERROR** signal output.”
  - **E** means “**End**.”

### Changing Mode

1. Press the Operation button while **0** blinks on **SPEED HOLD TIME** Display.
2. **Mode No.** blinks on **SCH** (Schedule) display. Rotate the **Operation** button to select “0” or “1.”
3. Press the **Operation** button to set the **Mode No**.
4. Finally, be sure to perform the **End of Setting** operation below.

### Change of ERROR Signal Output

5. Press the **Operation** button while **1** blinks on **SPEED HOLD TIME** Display.
6. **Mode No.** blinks on **SCH** (SCHEDULE) Display. Rotate the **Operation** button to select **0** or **1**.
  - **0** means circuit opened in case of error”
  - **1** means “circuit closed in case of error”
7. Press the **Operation** button to set the **ERROR** signal output.
8. Finally, be sure to perform the End of Setting operation below.

### End of Setting

9. Rotate the **Operation** button to select “**E**”. Press the **Operation** button to fix.
10. Confirm **End** on **SCH** (SCHEDULE) and **SPEED HOLD TIME** Display, which means the completion of setting.
11. Turn the power OFF.

### Applying Power and Moving to Start Point

1. Turn the power ON.
2. Zero **0** blinks on **SCH** Display of the front panel.
3. Close the circuit of **External Input (1ST or ORG)**, and the electrode, after it once returns back to **Original Point**, moves to **Start Point**.
4. If the circuit of **External Input** is opened while electrode is moving, the electrode stops there.
5. When the circuit of **External Input** is closed again, the electrode begins to move.
6. When the electrode reaches **Start Point**, the **READY** lamp lights up and the preparation is completed.

#### NOTES:

- The Original Point and Start Point are at the same position when the shipping package is opened and the power is supplied for the first time.
- In case of **Mode 1**, it works by pressing **ORG/CANCEL** button in addition to **1** the use of External Input.

### Auto-Set the Electrode Position

1. The electrode position can be set automatically by means of the auto-setting function. Turn the **Operation** button to light up the **AUTO** Lamp.
2. Press the **Operation** button for 1 second, and the **AUTO** lamp will blink.
3. Close the External Input (**1ST**), and the electrode moves to Original Point.
4. Open External Input when electrode stops and the Controller beeps.  
**NOTE:** The Controller beeps when the package is opened and the power is supplied for the first time, because Original Point and Start Point are at the same position.
5. A numeral blinks on **SCH** Display. Turn the **Operation** button to change **Schedule No.**
6. When **Schedule No.** is determined, press the **Operation** button.
7. The blinking numeral on **SCH** Display changes to the illuminated one.
8. Position the workpiece to be welded.
9. Close External Input **1ST** and **2ND** to make the electrode move forward. Hold the External Input **1ST** and **2ND** closed. The electrode presses the workpiece and the Controller beeps.
10. When the application of the electrode force is completed, the electrode returns to the position before Original Point and the Controller beeps.
11. Open External Input **1ST** and **2ND** to complete the auto-setting with a beep. The position where the electrode stops is Start Point.

## CHAPTER 3: OPERATING INSTRUCTIONS

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12. The electrode positions determined by the auto-setting are as follows:

Electrode Position	Description
Original Point	Position where the electrode has completely returned.
Start Point	Between Weld Point and Original Point.
Mid-Point	2mm before Weld Point.
Downstop Point	5mm beyond Weld Point.

**NOTE:** The electrode speed and **Hold Time** are *not* set automatically. The previous settings are valid. Change these settings manually.

In case of **Mode 1**, it works by pressing the **Operation** button in addition to the use of External Input. When using the **Operation** button, press the **Operation** button again, because the electrode stops after pressing the workpiece.

### Manually Set the Electrode Position

#### Selecting Schedule No.

1. Turn the **Operation** button to light up **SCH** lamp.
2. Press the **Operation** button for 1 second. **SCH** Lamp and **SCH** Display blink.
3. Turn the **Operation** button clockwise and counterclockwise to select a numeral (**1** to **31**) on the **SCH** Display.
4. After selecting **Schedule No.**, press the **Operation** button.
5. Press **ORG/CANCEL** button to interrupt the operation.
6. Setting Start Point
7. Turn the **Operation** button to light up **READY** Lamp.
8. Press the **Operation** button for 1 second, and **READY** Lamp lights up.
9. Close the **External Input (1ST)**.
10. The electrode moves to Start Point with and the Controller beeps. (When the electrode has been at Start Point, only beeps are given. No motion is observed)
11. Open the External Input (**1<sup>ST</sup>**).
12. Turn the **Operation** button clockwise and counterclockwise to make the electrode move forward and backward in 0.1 mm-increment/decrement.
13. Press the **Operation** button until the electrode reaches the desired position. The **READY** lamp will blink fast.
14. Close the External Input (**1<sup>ST</sup>**). The Start Point setting is completed and the Controller beeps.



## CHAPTER 3: OPERATING INSTRUCTIONS

**NOTE:** When you want to interrupt the operation, press the **ORG/CANCEL** button, and the **READY** lamp blinks fast.

15. Close the External Input (**1<sup>ST</sup>**). The electrode returns to the previous position with beeps.  
In case of **Mode 1**, it works by pressing the **Operation** button in addition to the External Input (**1<sup>ST</sup>**).

### Changing Moving Speed between Start Point and Mid-Point

1. Turn the operation button to light up both **READY** and **MID** Lamp.
2. Press the **Operation** button for 1 second. The **READY** and **MID** lamps will blink.
3. The number of blinking **SPEED HOLD TIME** Lamp indicates the current speed setting. Turn the **Operation** button clockwise and counterclockwise to change the number of the blinking lamp. Select your desired speed.

Number	Start Point to Mid-Point Moving Speed (mm/sec)	Note
1	20	<div>Minimum</div> <div>↑</div> <div>↓</div> <div>Maximum</div>
2	60	
3	100	
4	140	
5	180	
6	220	
7	260	
8	300	

4. After setting the speed, close and thereafter open External Input **1<sup>ST</sup>**. Check the speed of the electrode that moves forward and backward.
5. Press the **Operation** button when your desired speed is determined.

**NOTE:** Press **ORG/CANCEL** button to interrupt.

### Setting Mid-Point

1. Turn the **Operation** button to light up **MID** Lamp.
2. Press the **Operation** button for 1 second. **MID** Lamp blinks.
3. Close External Input **1<sup>ST</sup>** to make the electrode move to Mid-Point with beeps.
4. Open the External Input **1<sup>ST</sup>**.
5. Turn the **Operation** button clockwise and counterclockwise to make the electrode move forward and backward in 0.1 mm-increment/decrement.
6. Press the **Operation** button when the electrode reaches the desired position and the **MID** Lamp will blink quickly.

## CHAPTER 3: OPERATING INSTRUCTIONS

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7. Close External Input **1ST**. The electrode moves to Start Point with beeps to complete Mid-Point setting.
8. When you want to interrupt the operation, press the **ORG/CANCEL** button, and the **MID** Lamp blinks fast.
9. Close External Input **1ST**. The electrode returns to the previous position with beeps.
10. In case of **Mode 1**, it works by pressing the **Operation** button in addition to External Input.

### Setting Moving Speed from Mid-Point to Weld Point

1. Turn the **Operation** button to light up all of the **MID**, **WELD** and **FORCE CHK** Lamps.
2. Press the **Operation** button for 1 second. The **MID**, **WELD** and **FORCE CHK** Lamps blink.
3. The number of the blinking **SPEED HOLD TIME** Lamp indicates the current speed setting. Turn the **Operation** button clockwise and counterclockwise to change the number of the blinking lamp. Select your desired speed.

Number	Mid-Point to Weld Point Moving Speed (mm/sec)	Note
1	7.5	Minimum ↑ ↓ Maximum
2	15	
3	25	
4	30	

4. After setting the speed, close and thereafter open External Input both **1ST** and **2ND**. Check the speed of the electrode that moves forward and backward.
5. Press the **Operation** button when your desired speed is determined. Press the **ORG/CANCEL** button to interrupt.

### Setting Downstop Point

1. Turn the **Operation** button to light up **WELD** Lamp.
2. Press the **Operation** button for 1 second. The **WELD** Lamp will blink.
3. Close External Input **2ND** to make the electrode move to Downstop Point with beeps.
4. Open External Input **2ND** and **1ST**.
5. Turn the **Operation** button clockwise and counterclockwise to make the electrode move forward and backward in 0.1 mm-increment/decrement.
6. Press the **Operation** button when the electrode reaches the desired position. The **WELD** Lamp will blink quickly.

### In Case the Electrode Cannot Move Beyond the Weld Point Because of a Workpiece

1. Turn the **Operation** button until the electrode stops, then press the **Operation** button again.
2. Downstop Point is set 5mm beyond Weld Point and the **WELD** Lamp blinks fast.
3. Close External Input **1ST**. The electrode moves to Start Point with beeps to complete Weld Point setting.

### When you want to interrupt the operation

1. Press **ORG/CANCEL** button, and the **WELD** Lamp blinks fast.
2. Close External Input **1ST**. The electrode returns to the previous position with beeps.
3. In case of **Mode 1**, it works by pressing the operation button in addition to External Input.

### Setting Additional Squeeze time at Weld Point

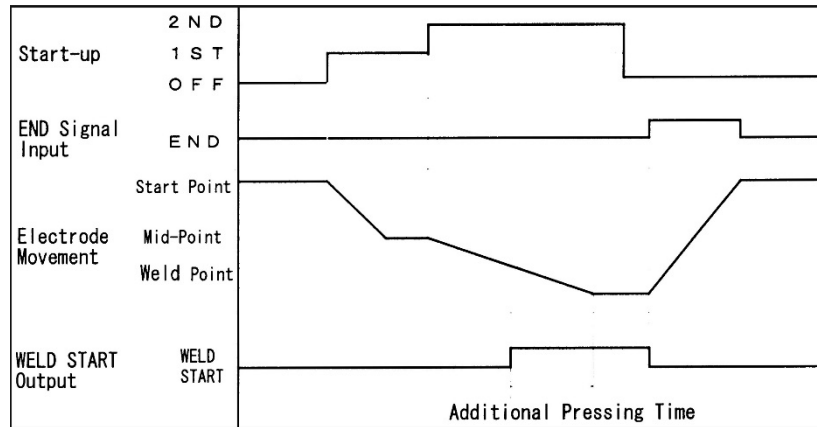
1. By the function of setting the additional squeeze time, the additional electrode force can be exerted on the electrode for desired period without stopping the motor.
2. Turn the **Operation** button to light up both **WELD** and **HOLD** Lamp.
3. Press the **Operation** button for 1 second and the **WELD** and the **HOLD** Lamps will blink.
4. The number of the blinking **SPEED HOLD TIME** Lamp indicates the additional squeeze time setting. Turn the **Operation** button clockwise and counterclockwise to change the number of the blinking lamp. Select your desired period.

Setting	Additional Squeeze Time (ms)
0	None (0)
1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
A	100

4. Press the **Operation** button when your desired period is indicated.

**NOTE:** Press the **ORG/CANCEL** button to interrupt.

## CHAPTER 3: OPERATING INSTRUCTIONS



### Setting Hold Time

1. Turn the **Operation** button to light up **HOLD** Lamp.
2. Press the **Operation** button for 1 second and the **HOLD** Lamp will blink.
3. The number of the blinking **SPEED HOLD TIME** Lamp indicates the present Hold Time setting. Turn the **Operation** button clockwise and counterclockwise to change the number of the blinking lamp. Select your desired speed.

Number	Hold Time (ms)	Note
1	100	<div>Minimum</div> <div>↕</div> <div>Maximum</div>
2	200	
3	300	
4	400	
5	500	
6	1000	
7	2000	
8	Waits for input.	

4. After selecting the number, close and thereafter open External Input both **1ST** and **2ND**. Check the Hold Time, observing the electrode that moves up and down.
5. Press the **Operation** button when your desired Hold Time is determined.

**NOTE:** Press **ORG/CANCEL** button to interrupt.

### Setting Moving Speed from Weld Point to Mid-Point

1. Turn the **Operation** button to light up both **MID** and **WELD** Lamp.
2. Press the **Operation** button for 1 second. The **MID** and **WELD** Lamps will blink.
3. The number of the blinking **SPEED HOLD TIME** Lamp indicates the current speed setting.
4. Turn the **Operation** button clockwise and counterclockwise to change the number of the blinking lamp. Select your desired speed.

Number	Weld Point to Mid-Point Moving Speed (mm/sec)	Note
1	20	<div>Minimum</div> <div>↑</div> <div>↓</div> <div>Maximum</div>
2	60	
3	100	
4	140	
5	180	
6	220	
7	260	
8	300	

### Section III. Welding

#### Operation

1. Close External Input **2ND**. Then the electrode moves forward to Weld Point.
  - When the electrode contacts the workpiece and the weld force reaches the setting value, then the electrode stops. Weld Start Signal is output and the welding starts.
  - When Weld Start Signal is once output, the weld force of the electrode is maintained although the footswitch is released.
  - When Hold Time has elapsed or End Signal is output from the welding power supply, the weld force is released.

**NOTE:** In case that End Signal *cannot* be input although Hold Time is set to “8,” press **ORG/CANCEL** button while pressing the footswitch. The electrode returns to Start Point or Mid-Point.

2. After the weld force of the electrode is released, open External Input both **1ST** and **2ND**. Then, the electrode returns to Start Point. In case that External Input **1ST** is closed, the electrode returns to and stops at the Mid-Point.

**NOTE:** When External Input **2ND** is closed while the electrode is at Mid-Point, the electrode starts to apply the weld force again. Be sure *not* to release the electrode while welding current is being applied.

#### Measuring Weld Force

1. Turn the **Operation** button until the **FORCE CHK** lamp turns ON.
2. Press the **Operation** button for 1 second. The **FORCE CHK** lamp will blink and a dash or vertical bar will appear on the **SCH** Display, see explanation below.

Model SR-071A & SR-073A: A horizontal bar “—” will light on the **SPEED HOLD TIME** display.

Model SR-072A: A vertical bar “|” will light on the **SPEED HOLD TIME** display.

3. Rotate the **Operation** button to change **Schedule No.** The **FORCE CHK** lamp will blink.

Model SR-071A & SR-073A: A horizontal bar “—” will blink on **SPEED HOLD TIME** display.

Model SR-072A: A vertical bar “|” will blink on **SPEED HOLD TIME** display.

Note: On the Model SR-072A, you can rotate the **Operation** button to select either the right or left electrode to measure. The blinking “|” indicates which electrode is selected.

4. Insert a force gauge between the electrodes.
5. Press on the foot switch and the electrode will move forward.
6. When the electrode contacts the force gauge, the electrode will stop with multiple beeps.
7. Measure the weld force.
8. Release the footswitch and the weld head will return to the Start Point.
9. After the electrode has returned to Start Point, press **ORG/CANCEL** button to exit the force measurement.

# CHAPTER 4 MAINTENANCE

## Section I. Troubleshooting

When a problem occurs, the **TROUBLE** Lamp lights up and a fault message is shown on the **SCH** Display. Closing the External Input **RESET** or continuing to press the operation button can reset the fault signal.

Message	Fault	Corrective Action
<b>E (Mode 0)</b>	Electrode force is applied on the way to return to Start Point	Close External Input <b>1ST</b> again to make the electrode move to Original Point. Rectify the cause of the problem. Thereafter, reset the fault signal and close External Input <b>1ST</b> . The <b>TROUBLE</b> output is released.
	Electrode force is applied before Mid-Point	Close External Input <b>1ST</b> and <b>2ND</b> to make the electrode return to Start Point. Rectify the cause of a trouble. Thereafter, reset the fault signal and close External Input <b>1ST</b> . The <b>TROUBLE</b> output is released.
<b>E (Mode 1)</b>	Electrode force is applied on the way to return to Start Point or applied before Mid-Point	After rectifying the cause of a trouble, reset the fault signal and resume Start Point.
<b>1</b>	Fault occurred in controller memory	Some settings have been lost. You must re-set again. Turn on the power while pressing <b>ORG/CANCEL</b> button to clear all the settings.
<b>2</b>	Fault occurred in memory's R/W-function in controller	Turn off the power and thereafter, turn it on again. If the problem continues, contact Amada Weld Tech for repair.
<b>3</b>	Fault occurred in controller CPU	After turning off the power or resetting the fault signal, resume Start Point. If the problem continues, contact Amada Weld Tech for repair.
<b>4</b>	Fault occurred in electrode-driving motor	After turning off the power or resetting the fault signal, resume Start Point. If the problem continues, contact Amada Weld Tech for repair.
<b>5</b>	Fault occurred in the control signal of electrode-driving motor	After turning off the power, check the connector conduction between the controller and motor. If the problem continues, contact Amada Weld Tech for repair.
<b>6</b>	STOP-Pin circuit is opened	Close the circuit of <b>STOP-Pin</b> . After turning off the power or resetting the fault signal, resume Start Point.

### Section II. Maintenance



#### WARNING

To avoid electric shock or injury, turn the welding current and power to the motor controller OFF *before* performing maintenance.



#### CAUTION

- Use the appropriate tools for the size of screws for maintenance.
- After adjustment, tighten the screws securely to avoid shaking or other unwanted movement during operation.

### Service

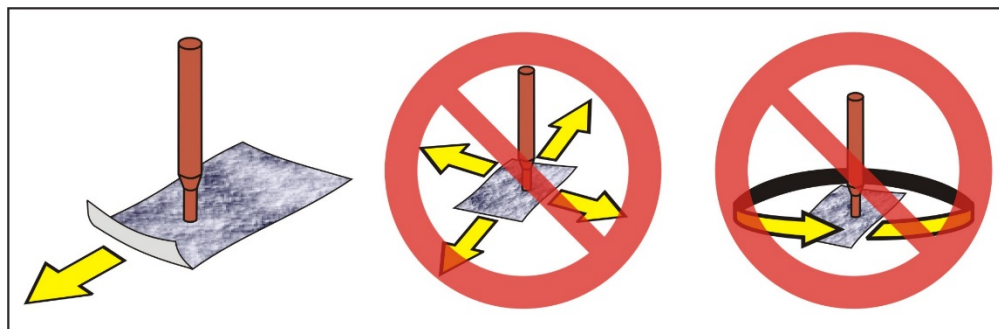
There are *no* User-serviceable parts in the Weld Head or Controller. If they need service, or if you have problems you cannot resolve, contact us at the address, e-mail, or phone number listed in **CONTACT US** in the front of this book. The *only* maintenance the User can perform is to routinely clean and replace the electrodes.

### Electrode Cleaning

Clean the electrode tips periodically to remove oxides and welding debris.

1. Use 600 grit sandpaper or finer to clean the electrodes.
2. Place the sandpaper beneath electrodes. The electrodes should contact with paper with a force low enough to allow the paper to be moved without damaging the electrodes.
3. Gently pull the sandpaper forward one or two inches *in a straight line only*.

**CAUTION:** Do *not* move the paper from side-to-side or in a circular motion or you may damage the electrodes.



4. Clean the electrode face with a small cotton swab saturated in alcohol.

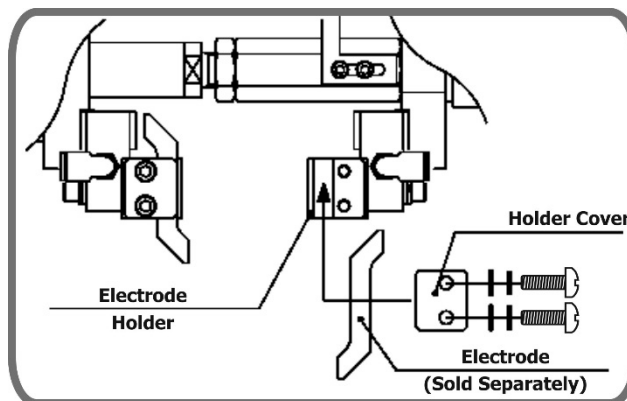


## CHAPTER 4: MAINTENANCE

### Model SR-073A-Z Maintenance

#### Install Electrodes

1. Verify that the power switches of the motor controller and the welding power supply are OFF.
2. Remove the **Electrode Holder Covers**.
3. Insert electrodes into the slot of electrode holders.
4. Install the **Electrode Holder Covers** and tighten the holder screws.



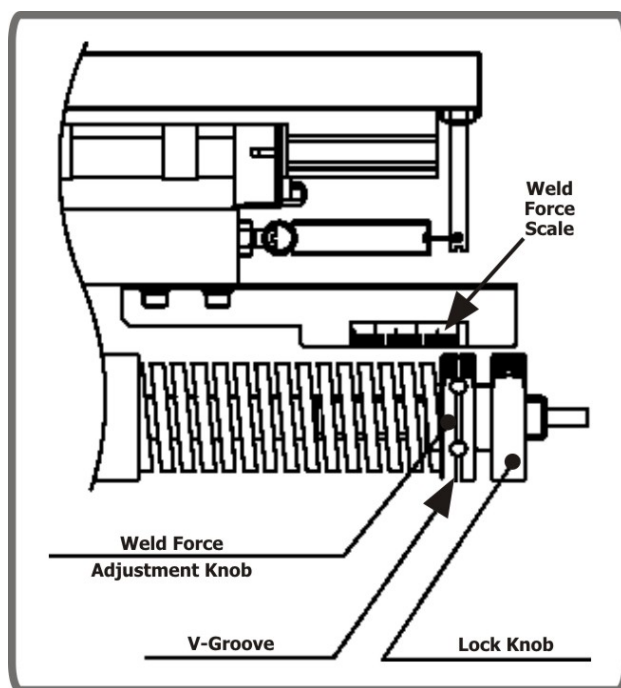
#### Adjust the Weld Force



### WARNING

To avoid injury, *stop* the apparatus *before* adjusting the weld force.

1. Loosen the lock screw.
- Note:** The **Weld Force Scale** is for reference only.
2. Turn the **Weld Force Adjustment Knob** to make the center of the **V-Groove** in the center of the knob lines up with the desired weld force on the scale.
  3. Tighten the lock screw to secure the **Weld Force Adjustment Knob**.
  4. After adjusting, measure the weld force by using a force gauge or spring balance.

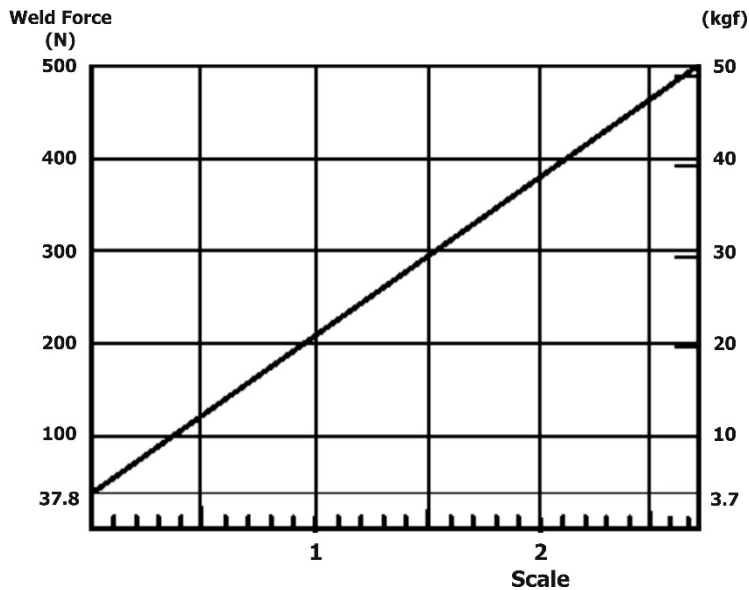


# CHAPTER 4: MAINTENANCE

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## Weld Force Conversion Graph

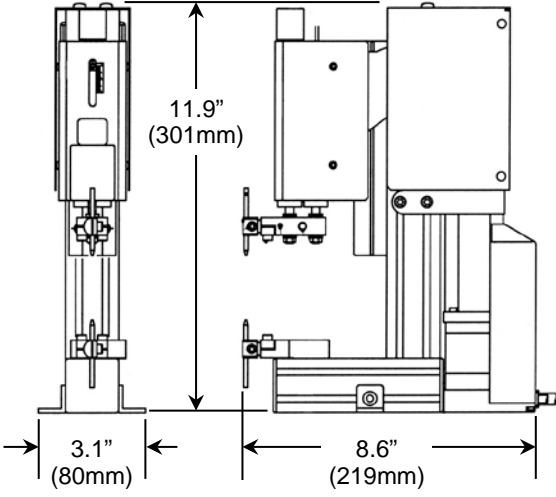
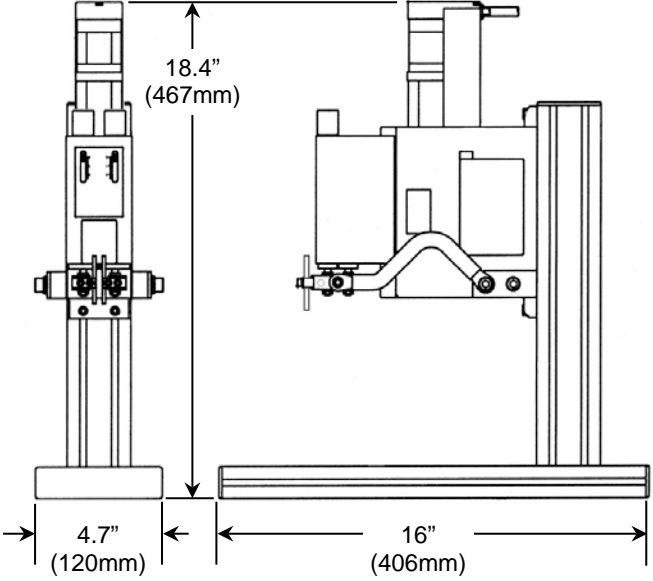
This graph represents theoretical values. To measure the actual weld force, use a pressing force gauge or spring balance.



# APPENDIX A

## TECHNICAL SPECIFICATIONS

### Specifications

Item	Description
<p><b>MODEL SR-071A</b> Dimensions</p>	 <p>Technical drawing of Model SR-071A showing dimensions: height 11.9" (301mm), width 3.1" (80mm), and depth 8.6" (219mm).</p>
<p><b>MODEL SR-072A</b> Dimensions</p>	 <p>Technical drawing of Model SR-072A showing dimensions: height 18.4" (467mm), width 4.7" (120mm), and depth 16" (406mm).</p>

Item	Description
<b>MODEL SR-073A</b> Dimensions	<p>18.4" (468mm)</p> <p>6.8" (173mm)</p> <p>10.8" (274mm)</p>
<b>MODEL SR-073A-Z</b> Dimensions	<p>5.9" (148mm)</p> <p>23.9" (606mm)</p> <p>5.0" (129mm)</p> <p>2.9" (75mm)</p>

## APPENDIX A: SPECIFICATIONS

Head Type	Model SR-071A	Model SR-072A	Model SR-073A	Model SR-073A-Z
	For Opposed Welding	For Series Welding	For Series Welding	For Opposed Welding
Electrode Force	1 – 8 lbs. (0.45 – 3.6 kgf)	1 – 8 lbs. (0.45 – 3.6 kgf) per electrode	15-110 lbs. (6.8 – 49.9 kgf)	15-110 lbs. (6.8 – 49.9 kgf)
Weld Force Method	Spring-Forced	Spring-Forced	Spring-Forced	Spring-Forced
Electrodes	ES0400 Series (0.125 inch dia)	Unibond Electrodes	ES0800 Series (0.250 inch dia)	13-200-01-01
Weight	Head: 15 lbs (6.8 kg) (with Baseplate)  Controller: 4.6 lbs (2.1 kg)	Head: 17 lbs (7.7 kg) (with Baseplate)  Controller: 4.6 lbs (2.1 kg)	Head: 35.2 lbs (16 kg) (with Baseplate)  Controller: 4.6 lbs (2.1 kg)	Head: 19.25 lbs (8.7 kg)  Controller: 4.6 lbs (2.1 kg)
Throat Depth	8.5 inches (216 mm)	8.5 inches (216 mm)	5.25 inches (133.3 mm)	2.75 inches (69.85mm)
Maximum Current Rating	3,000A (@ 2% duty cycle)	3,000A (@ 2% duty cycle)	7,500A (@ 2% duty cycle)	7,500A (@ 2% duty cycle)
Electrode Speed	8 Speeds between Start Point - Mid-Point and Weld Point - Mid-Point. 4 Speeds between Mid-Point - Weld Point. (All speeds are selectable for each Schedule)			
Electrode Drive Method	Servo Motor			
Electrode Stroke	1.7 inches (43 mm) Maximum			
Hold Time Setting	7 Settings			
Number of Weld Schedules	31 Schedules (Externally Selectable)			
Operating conditions	Temperature: 0° - 40°C, Humidity: 90% or less (No condensation)			
Power Supply Voltage	100-240 VAC, $\pm 10\%$ , 50/60 Hz, 70VA			

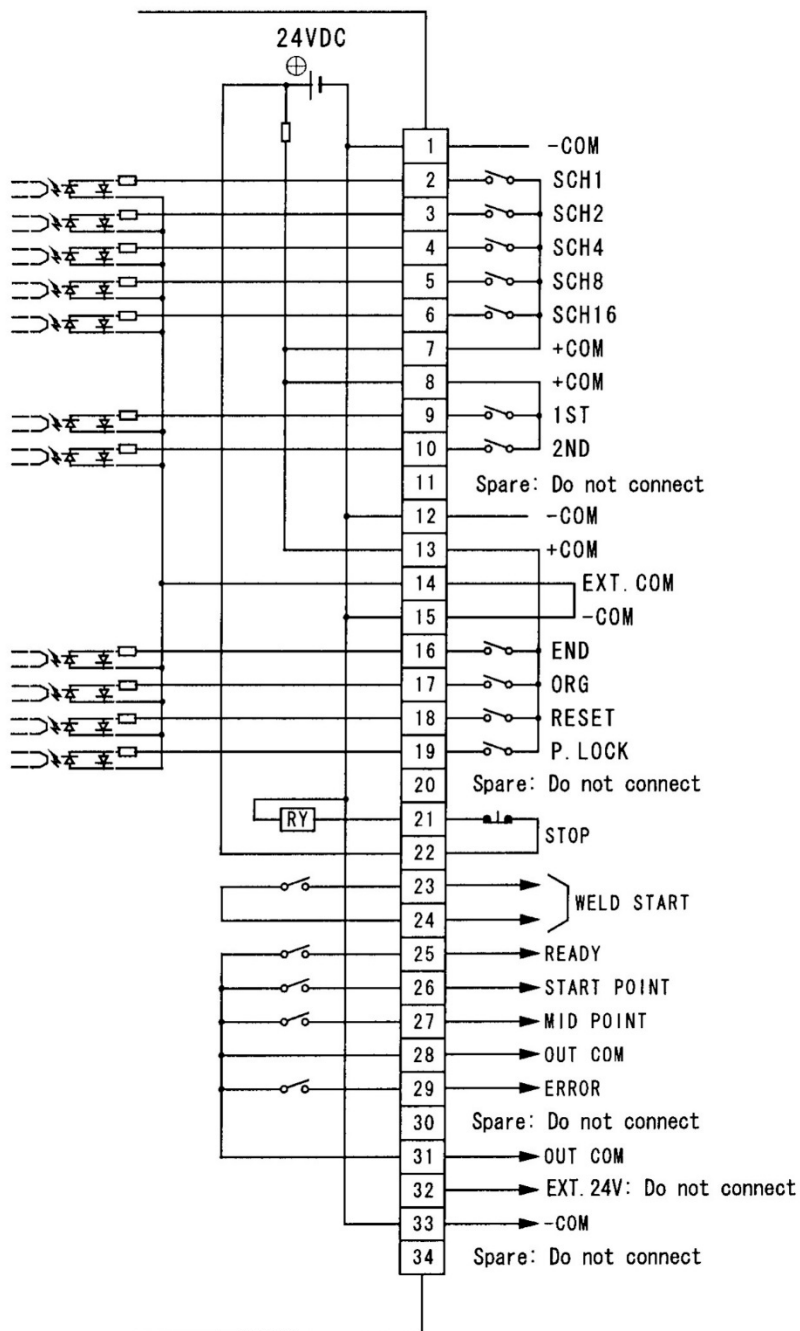
### SR-071A / SR-072A / SR-073A WELD HEADS



# APPENDIX B

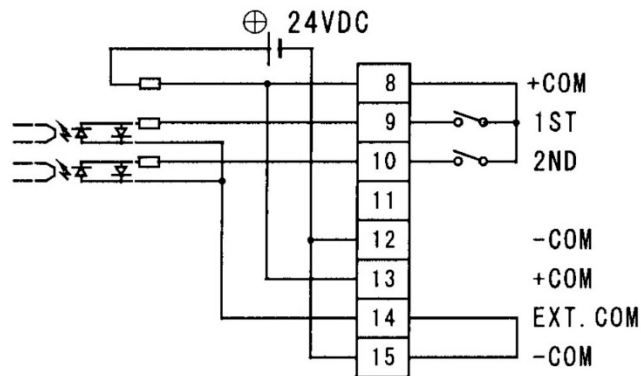
## ELECTRICAL AND DATA CONNECTIONS

### External Input / Output Signal Connections

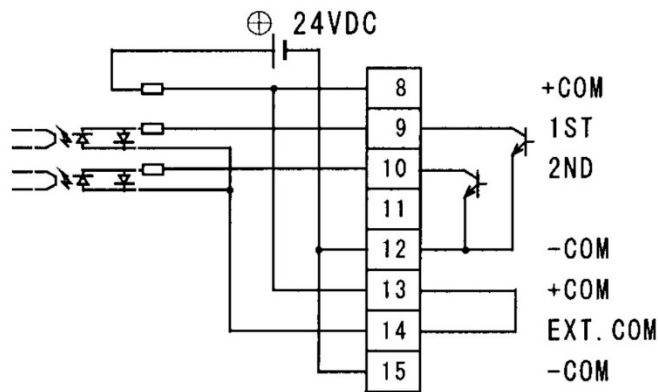


## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

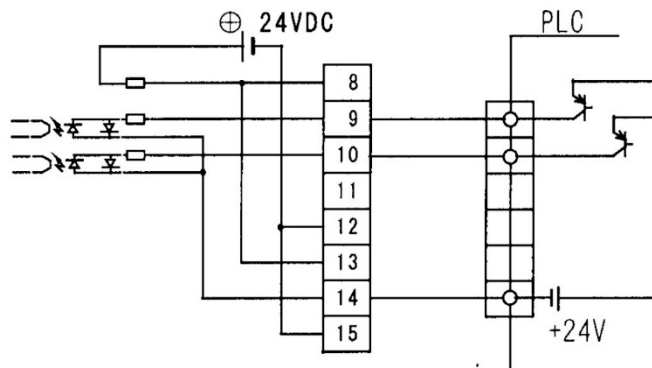
**EXAMPLE:** When contacts are used as the Input Terminal of the I/O Connector.



**EXAMPLE:** When an NPN transistor (sink type) on a PLC is used as the input terminal of the I/O Connector.



**EXAMPLE:** When a PNP transistor (source type) on a PLC is used as the input terminal of the I/O Connector.





## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

### I/O Connector

Pin #	I/O	Description
1	Input	Internally connected to GND ( 0V ).
2		<p>Select a schedule number, referred to as <b>SCH No.</b> below, indicating a combination of the circuit-closed pins among Pins, No. 2, 3, 4, 5 and 6 (See table below.).</p> <p>The schedule number selected by I/O Connector has priority over the schedule number set on the Controller. Before selecting the schedule number by the <b>Operation</b> button on the Controller, open the circuits of all the Pins of No. 2, 3, 4, 5 and 6 in I/O Connector.</p> <p>Input <b>SCH</b> signal at least 2ms before the welding current flows. During in operation, the schedule number cannot be changed.</p>
3		
4		
5		
6		

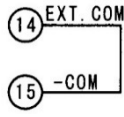
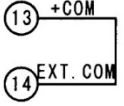
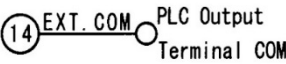
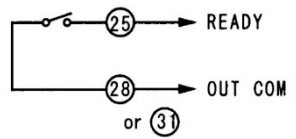
SCH No. \ Pin No.	6	5	4	3	2
1					●
2				●	
3				●	●
4			●		
5			●		●
6			●	●	
7			●	●	●
8		●			
9		●			●
10		●		●	
11		●		●	●
12		●	●		
13		●	●		●
14		●	●	●	
15		●	●	●	●
16	●				

SCH No. \ Pin No.	6	5	4	3	2
17	●				●
18	●			●	
19	●			●	●
20	●		●		
21	●		●		●
22	●		●	●	
23	●		●	●	●
24	●	●			
25	●	●			●
26	●	●		●	
27	●	●		●	●
28	●	●	●		
29	●	●	●		●
30	●	●	●	●	
31	●	●	●	●	●

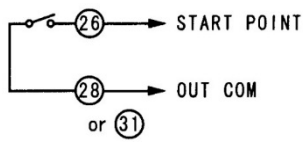
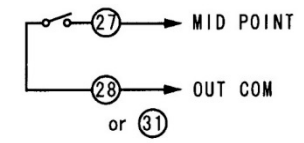
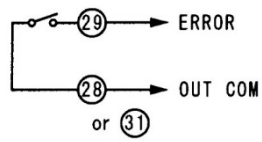
7	Output	Output pins for 24 VDC through 100Ω internal resistor.
8		
9	Input	Input pin for start-up signal. When 1 <sup>st</sup> is closed, electrode moves from <b>Start Point</b> to <b>Mid-Point</b> .
10		When 2 <sup>nd</sup> is closed after 1 <sup>st</sup> was closed, electrode moves from <b>Mid-Point</b> to <b>Weld Point</b> . Although only 2 <sup>nd</sup> is closed, electrode does not move.
11	---	Spare pin: Do <b>not</b> connect.
12	Input	Internally connected to GND ( 0V ).
13	Output	Output pins for 24 VDC through 100Ω internal resistor.

### SR-071A / SR-072A / SR-073A WELD HEADS

## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

Pin #	I/O	Description
14	---	<p>According to the usage, connect pins as follows.</p> <ul style="list-style-type: none"> <li>When a contact is used as the input signal of the I/O Connector, connect pins 14 and 15.  </li> <li>When an NPN transistor (sink type) on a PLC is used as the input signal of the I/O Connector, connect Pins 13 and 14. The <b>COM</b> terminal of a PLC connects to <b>COM</b> Pins 1, 12, and 15.  </li> <li>When a PNP transistor (source type) on a PLC is used as the input signal of the I/O Connector, connect Pins 14 to the <b>COM</b> terminal of the PLC.  </li> </ul>
15	Input	Internally connected to GND ( 0V ).
16	Input	Input pin for the <b>END</b> signal from welding power supply. If Pin 16 is closed, the input signal of 2 <sup>nd</sup> cannot be accepted.
17	Input	Input pin for Start Point resuming signal. When the circuit of Pin 17 becomes closed, the electrode resumes <b>Start Point</b> . (In case that the motor finishes moving back to <b>Original Point</b> , the electrode does not move.)
18		Input pin for the <b>RESET</b> signal. If a trouble occurs, rectify the trouble and close the circuit of the Pin to turnoff <b>NG</b> signal. (See Chapter 7 for fault codes.) Close at least for 2ms. Pin 18 does not work while the circuit of Pin 18 is closed.
19		Input pin for prohibiting changing the program When Pin 19 is closed, the program of <b>MH-P20A/D20A</b> cannot be modified.
20	---	Spare pin: Do <b>not</b> connect.
21	Output	Output pin for an emergency stop of the motor. When the circuit between Pins 21 and 22 is opened, the motor carries out emergency stop.
22		Connect the operation switch for an emergency stop of the motor to Pins 21 and 22 of the I/O connector. Use the operation switch whose capacity is more than 24VDC, 20 mA.
23		Output pin for current-supplying start signal to the welding power supply. When the weld force is completed, the circuit between Pins 23 and 24 becomes closed.
24		Contact capacity is 24 VDC, 20 mA.
25		Output pin for completion signal of being ready for work. When the resumption of <b>Start Point</b> is Output completed, the Pin becomes closed. If the Controller has an emergency, the Pin becomes opened. 

## APPENDIX B: ELECTRICAL AND DATA CONNECTIONS

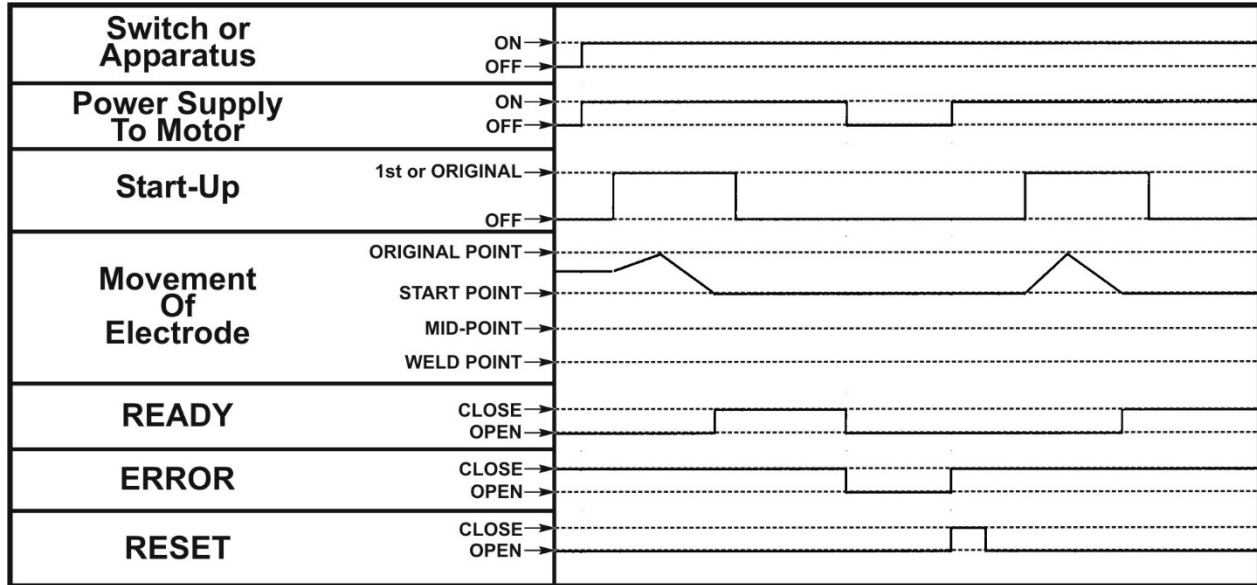
26	Output	Output pin for completion signal of arriving at <b>Start Point</b> . When the electrode is at Start Point, the Pin becomes closed.	
27	Output	Output pin for completion <b>MID POINT</b> signal arriving at the Mid-Point. When the electrode is at <b>Mid-Point</b> , the <b>COM</b> Pin becomes closed.	
28	---	Common terminal to <b>READY, START POINT, MID POINT</b> and <b>ERROR</b> .	
29	Output	Output pin for a trouble signal. When trouble occurs in <b>MH-P20AJD20A</b> , the Pin becomes opened until it is reset.	
30	---	Spare pin: Do <b>not</b> connect.	
31	---	Common terminal to <b>READY, START POINT, MID POINT</b> and <b>ERROR</b> .	
32	---	Do <b>not</b> connect to the Pin for <b>EXT. 24 V</b> .	
33	Input	Internally connected to GND ( 0V ).	
34	---	Spare pin: Do <b>not</b> connect.	



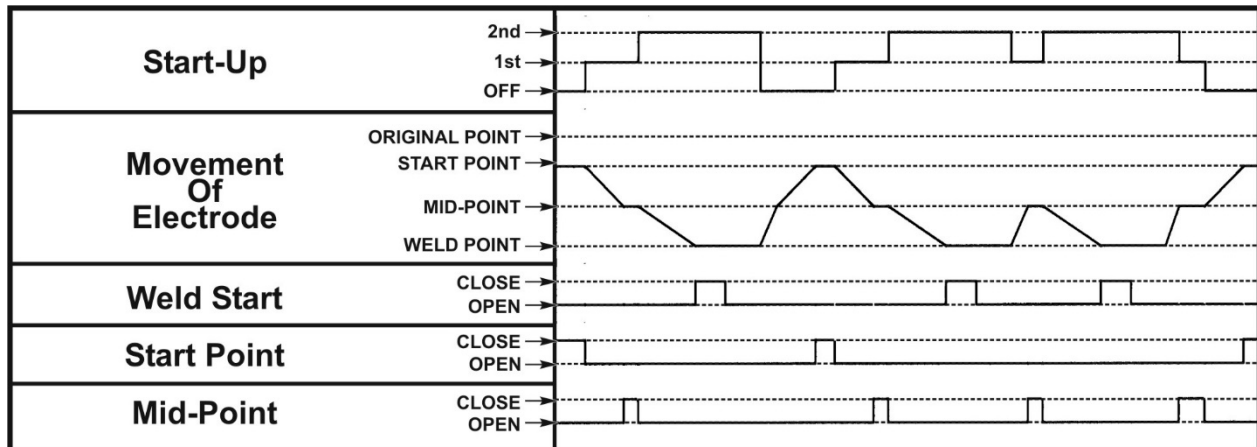
# APPENDIX C

## TIMING

### Power ON and ERROR Indication



### Operation





# APPENDIX D

## COMMUNICATIONS

### Specifications

<b>Method</b>	RS-232C - Asynchronous, Teletype procedure RS-485 - Asynchronous, Half-duplex
<b>Transmission Rate</b>	9600 bps
<b>Data Type</b>	Start bit: ----- 1 Data bit: ----- 8 Stop bit: ----- 1 Parity bit: ----- 1 (Even parity)
<b>Character Code</b>	ASCII (CR code is indicated as “ $C_R$ ” and LF code as “ $L_F$ ”)

### Connections

#### RS-232C

RS-232C signals use **TXD**, **RXD**, and **GND**. The communication connector is inside the external connector cover.

#### Controller

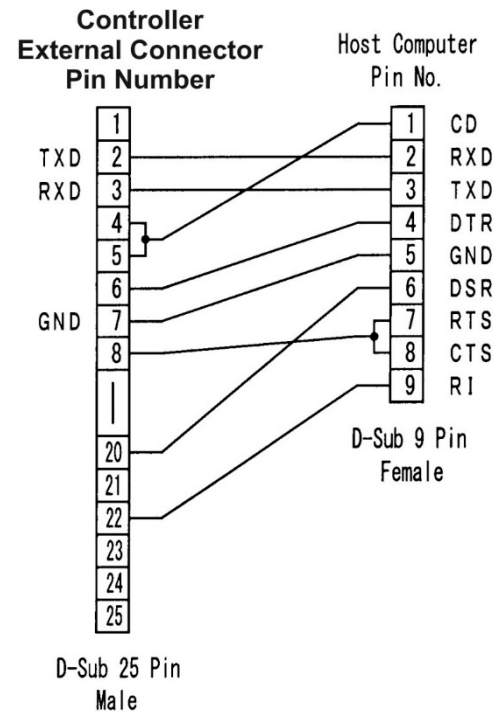


#### Host Computer



RS-232C

#### External Connector Cover



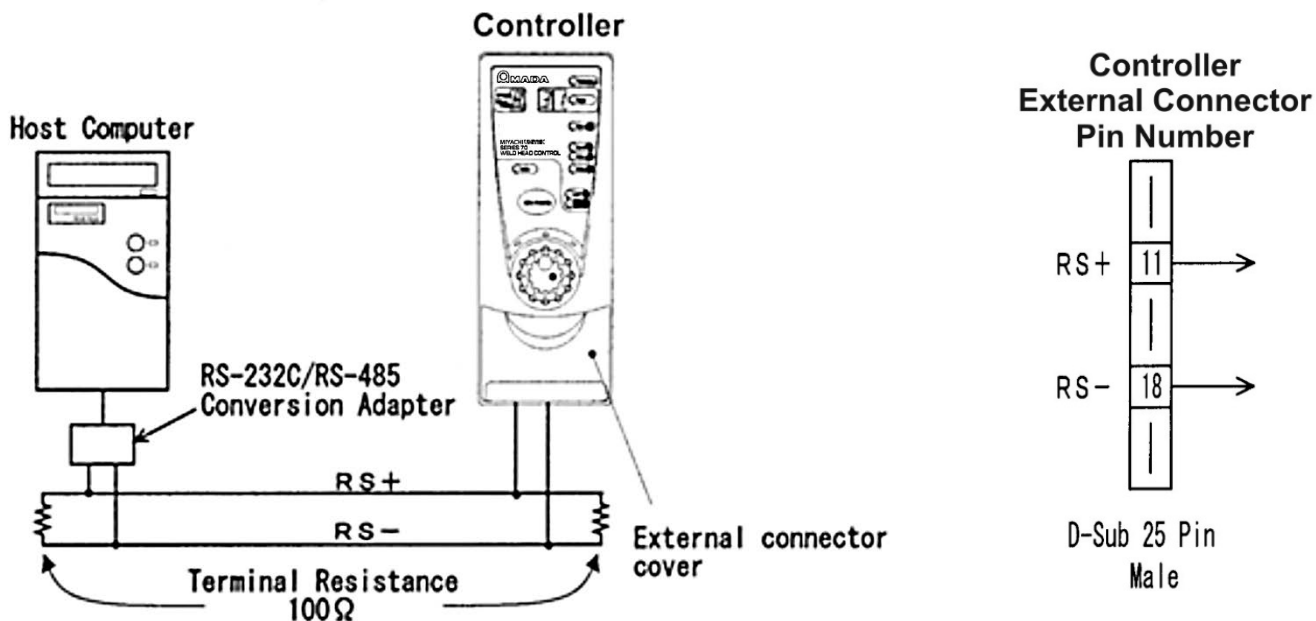
**NOTE:** **DTR** and **DSR** are *not* used with the **Controller**. **CTS** is *not* checked at the beginning of communication.

## APPENDIX D: COMMUNICATIONS

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### RS-485

RS-485 signals use **RS+** and **RS-**. The communication connector is inside the external connector cover.



#### NOTES:

- RS-485 operation requires a user-provided RS-232C-to-RS-485 converter/adaptor.
- Mount a 100Ω terminal resistor at both ends of the RS-485 cable as shown above.



## Bidirectional Communication

The **Schedule** data can be read and written by a command on the host computer side. When the electrode is at a **Start Point**, the schedule data can be read or written.

When the readout/overwrite command is sent from the host computer, the **MH-P20A/D20A** sends back an response. When sending a command, do **not** send the next command until you either receive a response from the controller or the timeout time elapses.

When using the overwrite command, compare the **Schedule** of the overwrite command with that of the data response to confirm whether or not it has been changed.

Then, if the comparison is done at **Start Point**, **Mid-Point** and **Downstop Point**, confirm the first 4-digit number eliminating the last digit.

**Example:** In case of 12345” (123.45mm) at **Start Point**, eliminate the last digit 5” to confirm “1234” (123.4 mm).

## Readout Command

Item	ORDER	CHACTER TRAIN	DESCRIPTION	RANGE
<b>01</b>	01-01	#	Communication start from host	Fixed
<b>02</b>	02-03	01	Communication ID	Fixed
<b>03</b>	04-04	R	Readout request	Fixed
<b>04</b>	05-07	nnn	Schedule Number	001 to 031
<b>05</b>	08-08	*	All contents	Fixed
<b>06</b>	09-09	$C_R$	CR code ( 0 x 0D )	Fixed
<b>07</b>	10-10	$L_F$	LF code ( 0 x 0A )	Fixed

## APPENDIX D: COMMUNICATIONS

---

### Readout Command – (Controller → Host Computer)

Item	ORDER	CHACTER TRAIN	DESCRIPTION	RANGE
01	01-01	!	Communication start to host	Fixed
02	02-03	01	Communication ID	Fixed
03	04-06	nnn	Schedule Number	001 to 031
04	05-07	:	Data Start	Fixed
05	08-13	nnnnn,	Start Point	00000 - 05000 (nnn.nn dimensions in mm)
06	14-19	nnnnn,	Mid-Point	00000 - 05000 (nnn.nn dimensions in mm)
07	20-25	nnnnn,	Downstop Point	00000 - 05000 (nnn.nn dimensions in mm)
08	26-27	n,	Moving Speed between Start Point and Mid-Point	1 - 8
09	28-29	n,	Moving Speed between Weld Point and Mid-Point	1 - 8
10	30-32	n,	Hold Time	1 - 8
11	32-33	n,	Moving Speed between Mid- Point and Weld Point	1 - 4
12	34-34	n,	Additional Squeeze Time at Weld Point	1 - A
13	35-35	C <sub>R</sub>	CR code ( 0 x 0D )	Fixed
14	36-36	L <sub>F</sub>	LF code ( 0 x 0A )	Fixed

**Overwrite Command – (Controller → Host Computer)**

Item	ORDER	CHACTER TRAIN	DESCRIPTION	RANGE
01	01-01	#	Communication start from host	Fixed
02	02-03	01	Communication ID	Fixed
03	04-04	w	Overwrite request	Fixed
04	05-07	nnn	Schedule Number	001 to 031
05	08-08	:	Data Start	Fixed
06	09-14	nnnnn,	Start Point	00000 - 05000 (nnn.nn dimensions in mm)
07	15-20	nnnnn,	Mid-Point	00000 - 05000 (nnn.nn dimensions in mm)
08	21-26	nnnnn,	Downstop Point	00000 - 05000 (nnn.nn dimensions in mm)
09	27-28	n,	Moving Speed between Start Point and Mid-Point	1 - 8
10	29-30	n,	Moving Speed between Weld Point and Mid-Point	1 - 8
11	31-32	n,	Hold Time	1 - 8
12	33-34	n,	Moving Speed between Mid- Point and Weld Point	1 - 4
13	35-35	n,	Additional Squeeze Time at Weld Point	1 - A
14	36-36	C <sub>R</sub>	CR code ( 0 x 0D )	Fixed
15	37-37	L <sub>F</sub>	LF code ( 0 x 0A )	Fixed

## APPENDIX D: COMMUNICATIONS

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### Response – (Controller → Host Computer)

Used to verify schedule changes after an overwrite command is issued.

Item	ORDER	CHACTER TRAIN	DESCRIPTION	RANGE
01	01-01	!	Communication start to host	Fixed
02	02-03	01	Communication ID	Fixed
03	04-06	nnn	Schedule Number	001 to 031
04	05-07	:	Data Start	Fixed
05	08-13	nnnnn,	Start Point	00000 - 05000 (nnn.nn dimensions in mm)
06	14-19	nnnnn,	Mid-Point	00000 - 05000 (nnn.nn dimensions in mm)
07	20-25	nnnnn,	Downstop Point	00000 - 05000 (nnn.nn dimensions in mm)
08	26-27	n,	Moving Speed between Start Point and Mid-Point	1 - 8
09	28-29	n,	Moving Speed between Weld Point and Mid-Point	1 - 8
10	30-32	n,	Hold Time	1 - 8
11	32-33	n,	Moving Speed between Mid- Point and Weld Point	1 - 4
12	34-34	n,	Additional Squeeze Time at Weld Point	1 - A
13	35-35	$C_R$	CR code ( 0 x 0D )	Fixed
14	36-36	$L_F$	LF code ( 0 x 0A )	Fixed

# APPENDIX E

## ACCESSORIES

### Accessories

Description	Model SR-071A	Model SR-072A	Model SR-073A	Model SR-073A-Z
<b>Electrodes</b>	ES0402	EU1000	ES0850	13-200-01-01
<b>AMYA Part Number</b>	13-003-04-02	11-008-10-02		
<b>Operator Manual</b>	<i>Operator Manual for the SR-071A / SR-072A / SR-073A Weld Heads (990-143)</i>			



# APPENDIX F

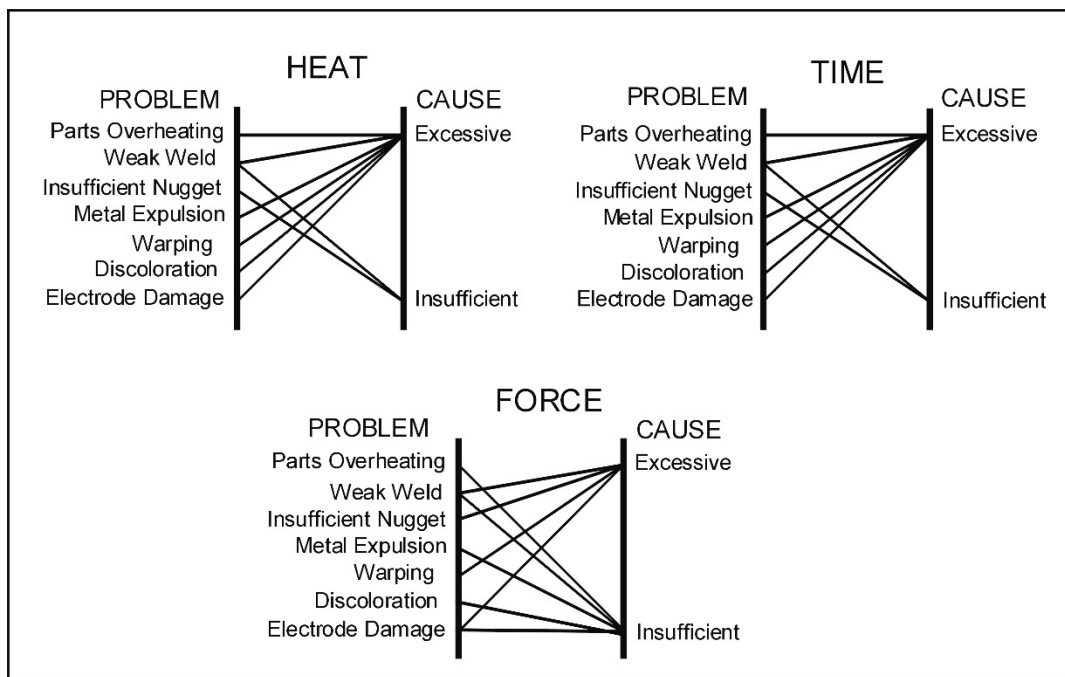
## The Basics Of Resistance Welding

### Resistance Welding Parameters

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

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

### Welding Parameter Interaction



Interaction of Welding Parameters

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

### Electrode Selection

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

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

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

### SR-071A / SR-072A / SR-073A WELD HEADS



## APPENDIX F: THE BASICS OF RESISTANCE WELDING

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

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

### SR-071A / SR-072A / SR-073A WELD HEADS

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

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

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

### Electrode Maintenance

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

### Weld Schedule Development

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

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

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

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

### Weld Strength Testing

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

## APPENDIX F: THE BASICS OF RESISTANCE WELDING

### Weld Strength Profiles

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

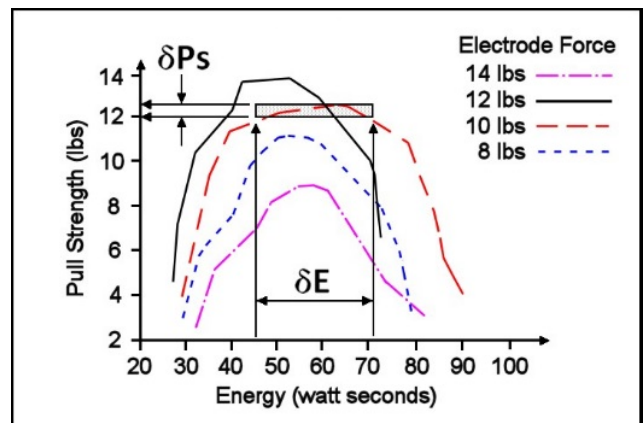
- 1 Start at a low weld current, voltage, or power, making five or more welds, then perform pull tests for each weld. Calculate the average pull strength. Increase weld current, voltage, or power and repeat this procedure. Do not change the weld time, weld force, or electrode area.
- 2 Continue increasing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

### Typical Weld Strength Profile

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

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

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



Typical Weld Strength Profile

# APPENDIX G

## Quality Resistance Welding Solutions

### Defining the Optimum Process

#### Introduction

A quality resistance welding solution can be defined as one that meets the application objectives and produces stable, repeatable results in a production environment. In order to define the optimum process the user must approach the application in a methodical way and many variables must be considered. In this article we will look at the following key stages and principles to be considered when defining the optimum resistance welding process:

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

#### Resistance Welding - A Material World

The first stage in designing a quality welding solution is to consider the properties of the materials to be joined and also the quality requirements of the desired welded joint. When considering these properties it is worthwhile to review the way the resistance welding process works and the likely outcome when the parts are resistance welded.

There are four main types of structural materials:

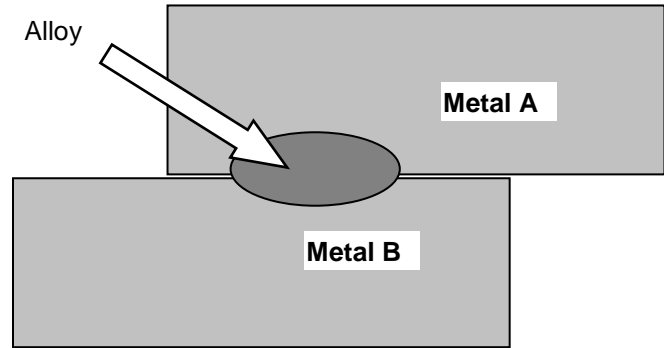
- Metals: silver, steel, platinum
- Ceramic: alumina, sand
- Plastics / polymers: PVC, Teflon
- Semiconductors: silicon, germanium

Metals can be resistance-welded because they are electrically conductive, soften on heating, and can be forged together without breaking.

## APPENDIX G: DEFINING THE OPTIMUM PROCESS

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Alloys are a mixture of two or more metals as shown on the right. Alloys are normally harder, less conductive, and more brittle than the parent metal. This has bearing on the type of joint one can expect when resistance-welding a combination of different metals.



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

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

- **A Solder or Braze Joint**

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

- **A Solid-State Joint**

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

- **A Fusion Joint**

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

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

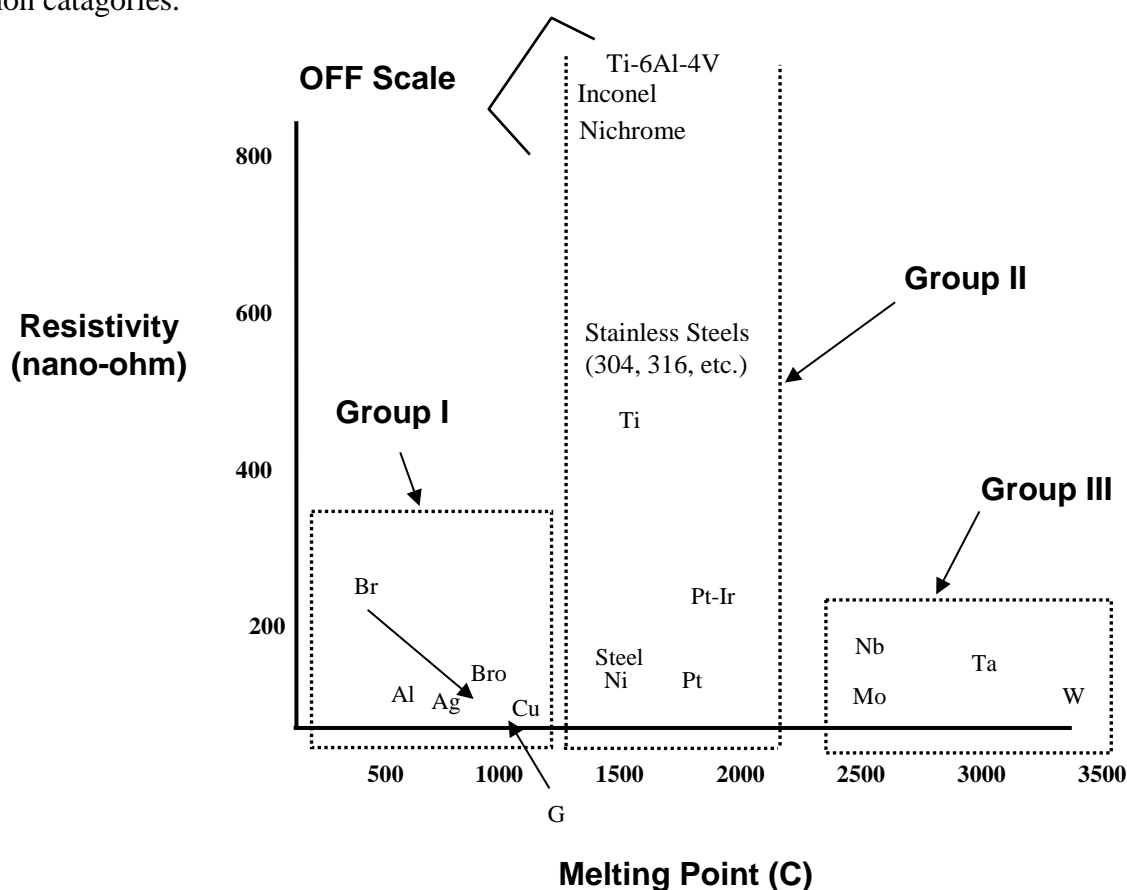
### Consider the Material Properties

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

- Electrical and thermal conductivity
- Melting point
- Hardness

It is also important to consider the surface properties of each material such as plating, coatings, and oxides.

The figure below gives an idea of the variance in resistivity and melting point for some of the more common materials used today in micro resistance welding. The materials can be grouped into three common categories.



The types of joints achievable within each of the main groups are as follows:

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

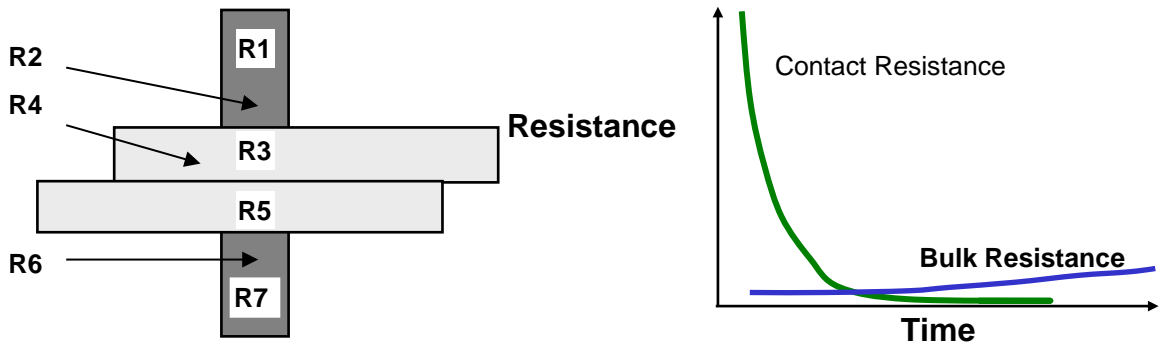
# APPENDIX G: DEFINING THE OPTIMUM PROCESS

- **Group II – Resistive Metals**
  - It is easier to generate heat and trap heat at the interface of resistive metals and therefore it is possible to form both solid state and fusion welds depending on the time and temperature. Upslope can reduce contact resistances and provide heating in the bulk material resistance.
- **Group III – Refractory Metals**
  - Refractory metals have very high melting points and excess heating can cause micro-structural damage. A solid-state joint is therefore preferred.

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

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

## Basic Principles



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



## APPENDIX G: DEFINING THE OPTIMUM PROCESS

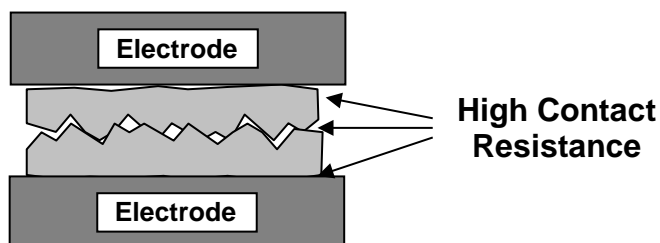
**R1 & R7** The electrode resistances affect the conduction of energy and weld heat to the parts and also the rate of heat sinking from the parts at the end of the weld.

**R2, R4 & R 6** The electrode to part and part to part “**Contact Resistances**” determine the amount of heat generation in these areas. The contact resistances decline over time as the parts achieve better fit up.

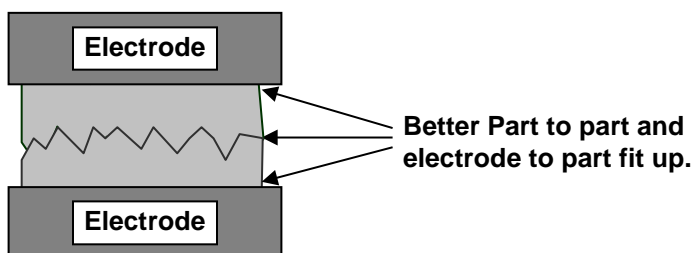
**R3 & R5** The metal “**Bulk Resistances**” become higher during the weld as the parts are heated.

If a weld is initiated when the contact resistances are still high, the heat generated is in relation to the level and location of the contact resistances, as the materials have not had a chance to fit up correctly. It is common for the heat generated at the electrode to part and part to part resistances to cause multiple welding problems when welding resistive materials (see below). Conductive materials can be welded by using high contact resistance and fast heating as their bulk resistance is not high and cannot be relied upon for heat generation.

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



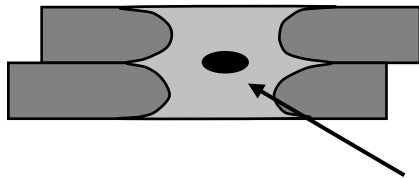
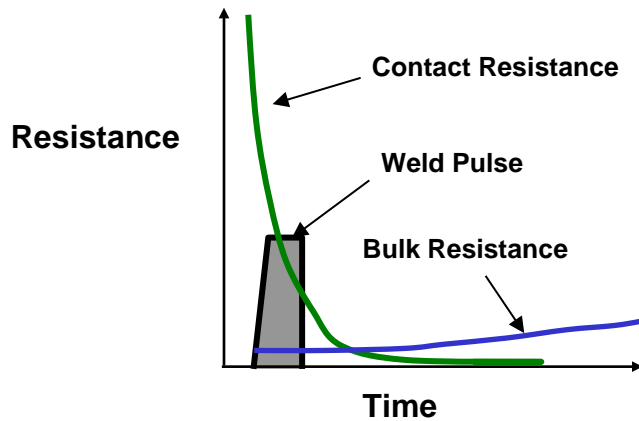
If a weld is initiated when both parts and electrodes are fitted up correctly as show on the right, the contact resistance is lower and bulk resistance now controls the heat generation. This type of weld is achieved with a slower heating rate and normally longer time is preferred for welding resistive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



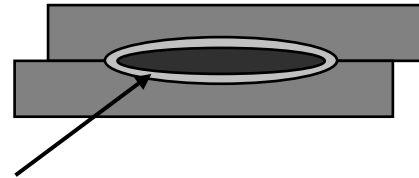
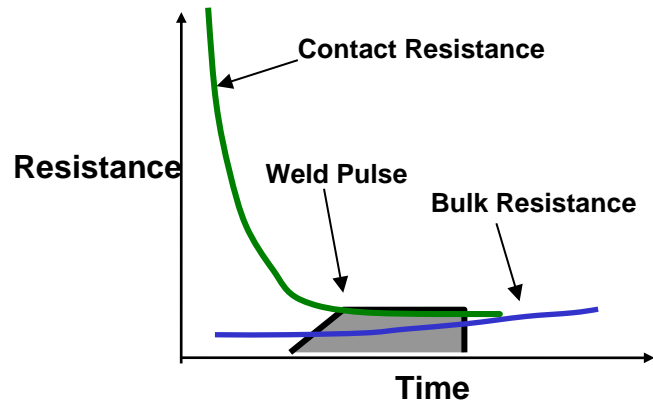
The contact resistance present at the weld when the power supply is fired has a great impact on the heat balance of a weld and therefore also the heat affected zone.

## APPENDIX G: DEFINING THE OPTIMUM PROCESS

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



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



**Heat Affected Zone**

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

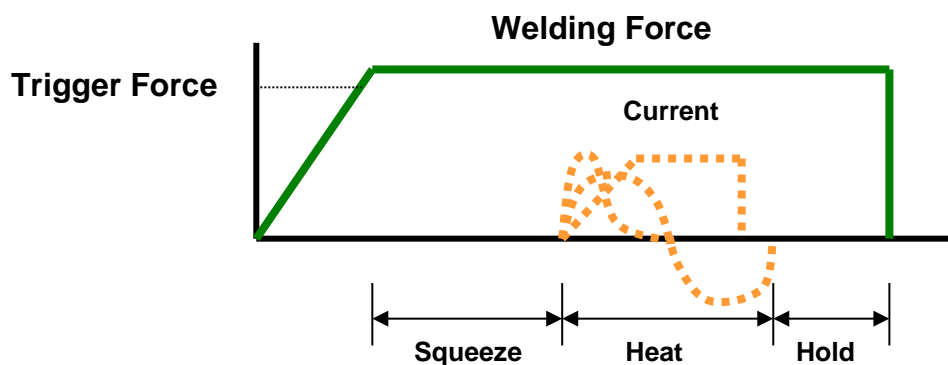
In general conductive materials benefit from a faster heating rate, as the higher contact resistances assist heat generation in the weld. Resistive materials benefit from slower heating rates that allow the contact resistances to reduce significantly thus bulk resistances become the major source for heat generation.

### Weld Profiles

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

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

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



### Approach to Weld Development

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

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

At this stage, it is good practice to document the welding set up so that it can be referred to later. Once the equipment set up has been documented the next stage is to fix as many of the process and material variables as possible to reduce variation in the subsequent welding trials. The main welding parameters such as energy, force, and time cannot be fixed at this stage but many of the other variables such as repeatable part positioning should be fixed.

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

“Look see” welding tests are a series of mini welding experiments designed to provide a starting point for further statistical development of the welding parameters. The user should adjust the key welding variables (energy, force, time) in order to identify the likely good “weld window”.

The mini experiments should also be used to understand the weld characteristics from both application and process perspective. Key factors in this understanding are listed on the next page.

#### **Application Perspective**

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

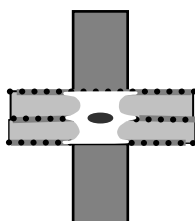
#### **Process Perspective**

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

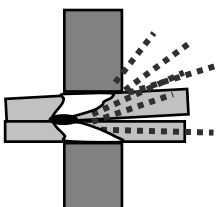
### Common Problems

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

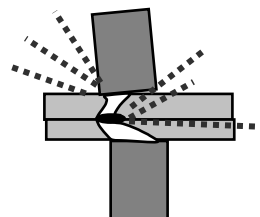
**Material Control**



**Part-To-Part Positioning**

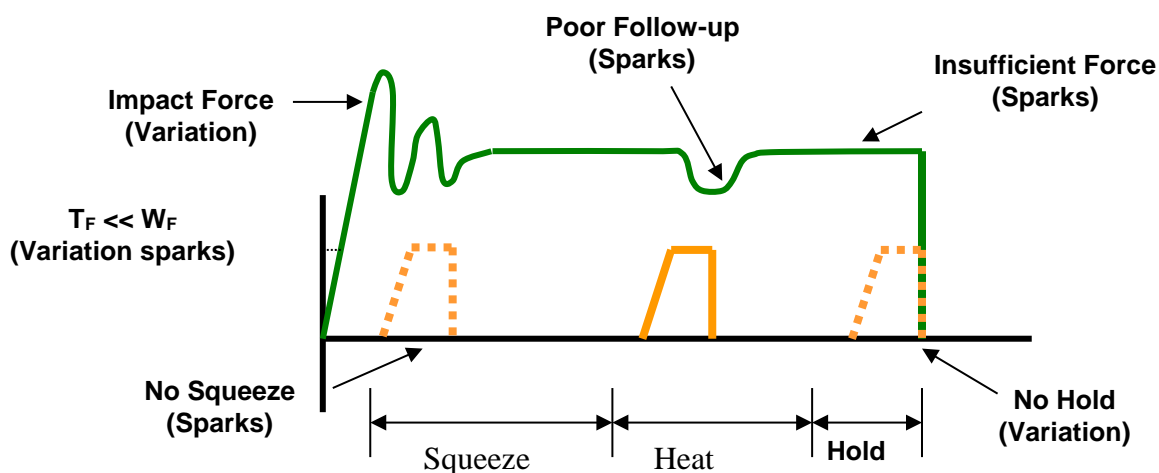


**Electrode-To-Part Positioning**



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

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



The figure above shows common welding problems that can often be identified in the basic set up of the force, energy and time welding profile. These problems can lead to weld splash and inconsistency and variation (contact Amada Weld Tech for further information and support).

### **What are Screening DOE'S?**

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

Typical welded assemblies are assessed for strength of joint and variation in strength. A Screening DOE tests the high and low settings for a parameter, and will help establish the impact of a parameter on the process. A Screening DOE is a tool that allows the user to establish the impact of a particular parameter by carrying out the minimum number of experiments to gain the information.

A five-factor screening DOE can be accomplished in as few as 24 welds with three welds completed for each of 8 tests. By comparison, it would take 96 welds to test every combination. It promotes understanding of many variables in a single experiment and allows the user to interpret results and thus narrow the variables for the next level of statistical analysis. If many variables are still not understood, multiple Screening DOE'S may be required. Amada Weld Tech provides a simple Screening DOE tool that is run in excel and is sufficient for the majority of applications (contact us for details). Bespoke sophisticated software is also available from other vendors designed specifically for this purpose.

### **Criteria for Success**

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

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

### What are Factorial DOE'S?

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

### Criteria for Success

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

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

### Conclusion

The resistance welding process can deliver a reliable and repeatable joining solution for a wide range of metal joining applications. Defining the optimum welding process and best production settings is not a “black art” and can be achieved through a methodical and statistical approach. Time spent up-front in weld development will ensure a stable welding process and provide a substantial return in quality and long term consistency. Welding problems can more easily be identified and solved if sufficient experimental work is carried out to identify the impact of common variables on the quality and variation of the welded assembly. Amada Weld Tech will frequently use the Screening DOE tool to establish the impact of key variables and also to assist customers with troubleshooting. Often the testing as described above will provide the information and understanding to predict common failure modes and causes.





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