HERMETIC SEALING SYSTEM

AF-8500A
AF-1250A

OPERATION MANUAL

990-451 REV F

Revision Record

Rev	ECO	Date	Basis of Revision
001	None	09/09	Initial Release
002	None	03/10	Add buttons in Jog Mode for Auer Boat elevator options.
003	None	06/10	Add Lid Pickup Options in Jog Mode, Add Seal Ring size option, Add large part support.
004	None	08/10	Add support for AF8500.
A	40530	01/11	Incorporated into Miyachi Unitek documents.
B	42840	01/11	Updated to Miyachi America name and logo.
C	43480	12/14	Updated to Amada Miyachi America name and logo.
D	43838	08/15	Updated to Amada Miyachi format.
E	44060	10/16	Updated Screen Images to Windows 7 (64-bit) + added functions.
F	45916	06/20	Updated Screen shots to new GUI

FOREWORD

The purpose of this manual is to supply operating, maintenance and service personnel with the information needed to operate the AF-8500A / AF-1250A, Autoflow Welding System.

Should questions arise, or if you have suggestions for improving this manual, please contact:

Amada Weld Tech Inc.
1820 South Myrtle Avenue
Monrovia, CA 91016
Telephone: (626) 303-5676
FAX: (626) 358-8048
E-Mail: info@amadaweldtech.com

NOTICE

Amada Weld Tech may be released from all warranty obligations if repairs or modifications are made by persons other than its own service personnel, or its authorized representatives, unless such repairs or modifications are specifically authorized in writing by Amada Weld Tech Inc.

This manual covers the following models:

Original P/N	Original Model		Current P/N	Current Model
AF-85-07-01	AF8500/240VAC	→	AF-85-08-01	AF-8500A/240VAC
AF-85-07-01-P	AF8500/240VAC, P	→	AF-85-08-01-P	AF-8500A/240VAC, P
AF-85-07-01-VP	AF8500/240VAC, VP	→	AF-85-08-01-VP	AF-8500A/240VAC, VP
AF-85-07-02	AF8500/400VAC	→	AF-85-08-02	AF-8500A/400VAC
AF-85-07-02-P	AF8500/400VAC, P	→	AF-85-08-02-P	AF-8500A/400VAC, P
AF-85-07-02-VP	AF8500/400VAC, VP	→	AF-85-08-02-VP	AF-8500A/400VAC, VP
AF-85-07-02-VPR	AF8500/400VAC, VPR	→	AF-85-08-02-VPR	AF-8500A/400VAC, VPR

AF-125-07-01	AF1250/240VAC	→	AF-125-08-01	AF-1250A/240VAC
AF-125-07-01-VP	AF1250/240VAC	→	AF-125-08-01-VP	AF-1250A/240VAC
AF-125-07-02	AF1250/240VAC	→	AF-125-08-02	AF-1250A/240VAC
AF-125-07-02-VP	AF1250/240VAC	→	AF-125-08-02-VP	AF-1250A/240VAC

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 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.

7. Inspection and Rejection of Nonconforming Goods.

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

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

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

8. Price.

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

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

9. Payment Terms.

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

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

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

10. Intellectual Property; Software License.

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

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

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

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

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

12. Limited Warranty.

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

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

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

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

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

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

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

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

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

13. Limitation of Liability.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

24. Dispute Resolution.

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

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

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

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

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

Table of Contents

Introduction

This users guide will help operators and setup personnel gain knowledge and skills for efficiently and effectively using the AF-8500A / AF-1250A system.

Autoflow Component Features

A. The AF-8500A / AF-1250A will inspect, pick, place, tack and weld lids to parts in a matrix configuration.

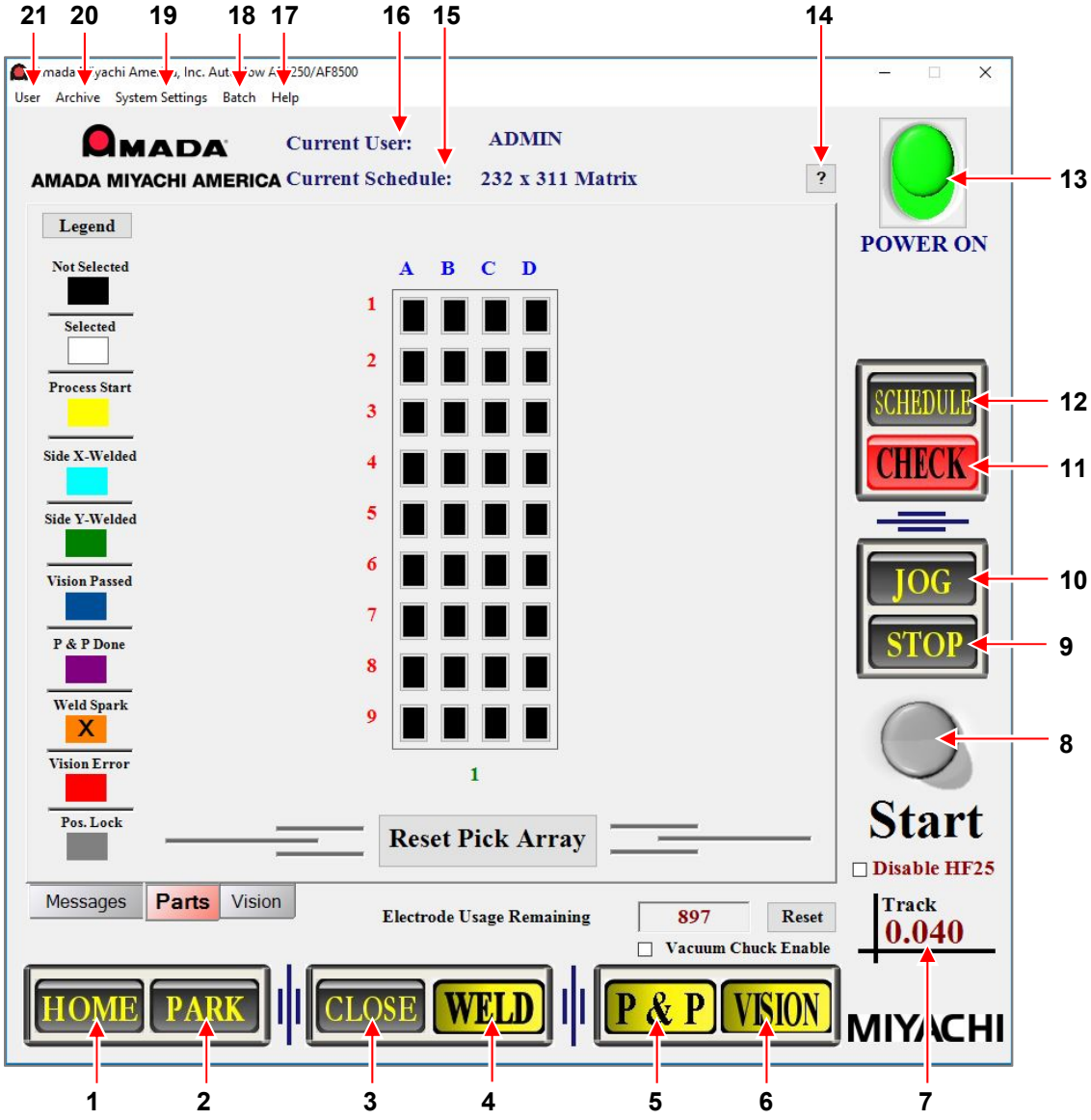
B. The HF-2500A inverter power supply can deliver the energy needed for welding.

C. The base configuration of the product does not have pick and place capability. Lids can manually be placed on the parts and tacked with the weld electrodes.

D. The Placement option can be added to the base configuration. The added pick and place head allows lids to be automatically picked up and placed on the base parts. The Vision option can be added to the placement option to achieve higher accuracy in placing the lids. The addition of the camera assembly allows automatic compensation for all variance of part, nesting conditions and machine positioning.

Autoflow Software Functions

Main Control Screen

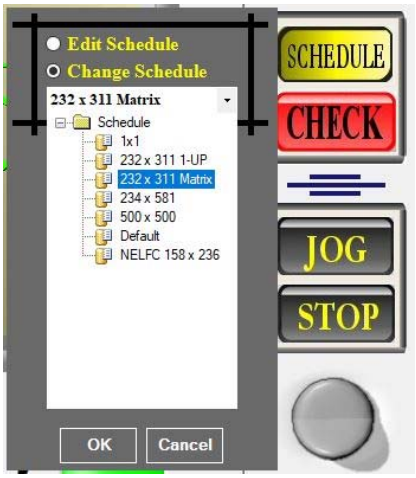


The Main Control Screen is divided into three tabs; **Messages**, **Parts** and **Vision** that can be switched by a single "mouse click" on any one of the tabs (located above the Home / Park buttons). See the **Messages Tab**, **Parts Tab** and **Vision Tab** sections for more information about each function. The selected tab will be "red".

The Main Control Screen contains the following Options (counter-clockwise from the lower left):

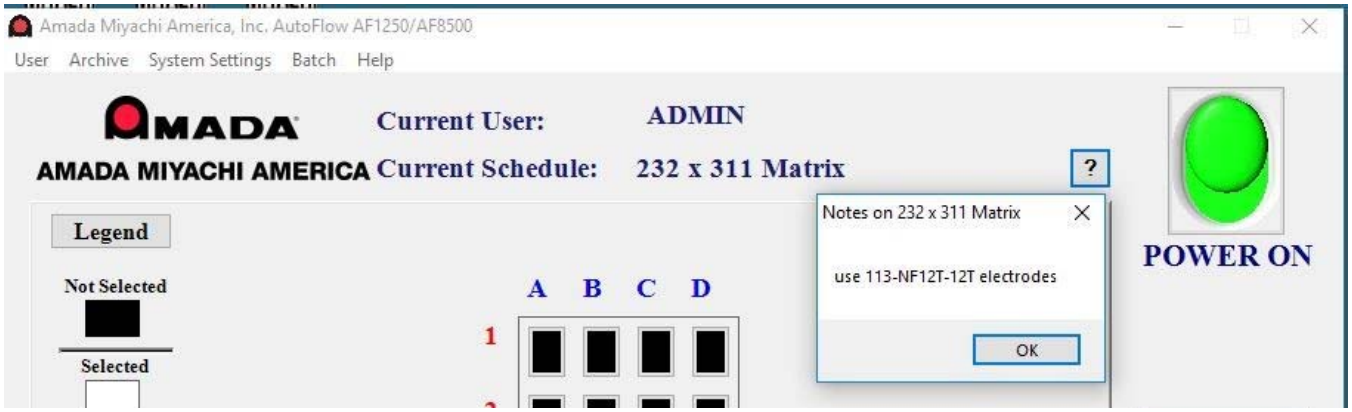
1. **Home** command button moves all mechanisms of the machine to their predefined starting positions.
2. **Park** command button moves all of the machine axes to their predefined park positions. This feature prevents interference with the operator as parts are inserted or removed from the welder table.
3. **Close** button shuts down the Autoflow software and return to Windows.
4. **Weld** mode button enables or disables the welding process. Welding is enabled when the background of the button is "yellow" and disabled when the background is "red".

5. **P&P** mode button enables or disables the Pick and Place process. Pick & Place is enabled when the background of the button is “yellow” and disabled when the background is “red”.
6. **Vision** mode button enables or disables the vision process. Vision is enabled when the background of the button is “yellow” and disabled when the background is “red”.
7. **Track** number displays the distance from the outer edge of the weld electrode (track 0) to a position on the electrode that is in contact with the part during welding.
8. **Start** command button is used to Start the current welding schedule from the beginning, or to restart from the current position after a Stop command or error has occurred.
9. **Stop** command button stops the motion anytime during the process. To stop running the process **immediately**, use the Emergency Stop button located on the front baseplate of the Autoflow system.
10. **Jog** button brings up the jog screen. See the **Jog Mode** section for more information.
11. **Check** button allows the operator to run the motion of the process schedule without performing a weld and vacuum to ensure proper setup without the risk of improperly welding parts. Check mode is enabled when the background of the button is “yellow” and disabled when the background is “red”.
12. **Schedule** button brings up two options; *Edit Schedule* and *Change Schedule*. Selecting *Edit Schedule* will bring up a new edit schedule window (see the **Schedule Edit** section for more information). To change a schedule without going into *Edit Schedule* window, simply select *Change Schedule* and select the schedule from the pull-down option box. Select the schedule by double clicking the schedule name



13. The **Power** button turns the software functionality of the system **ON** and **OFF**.

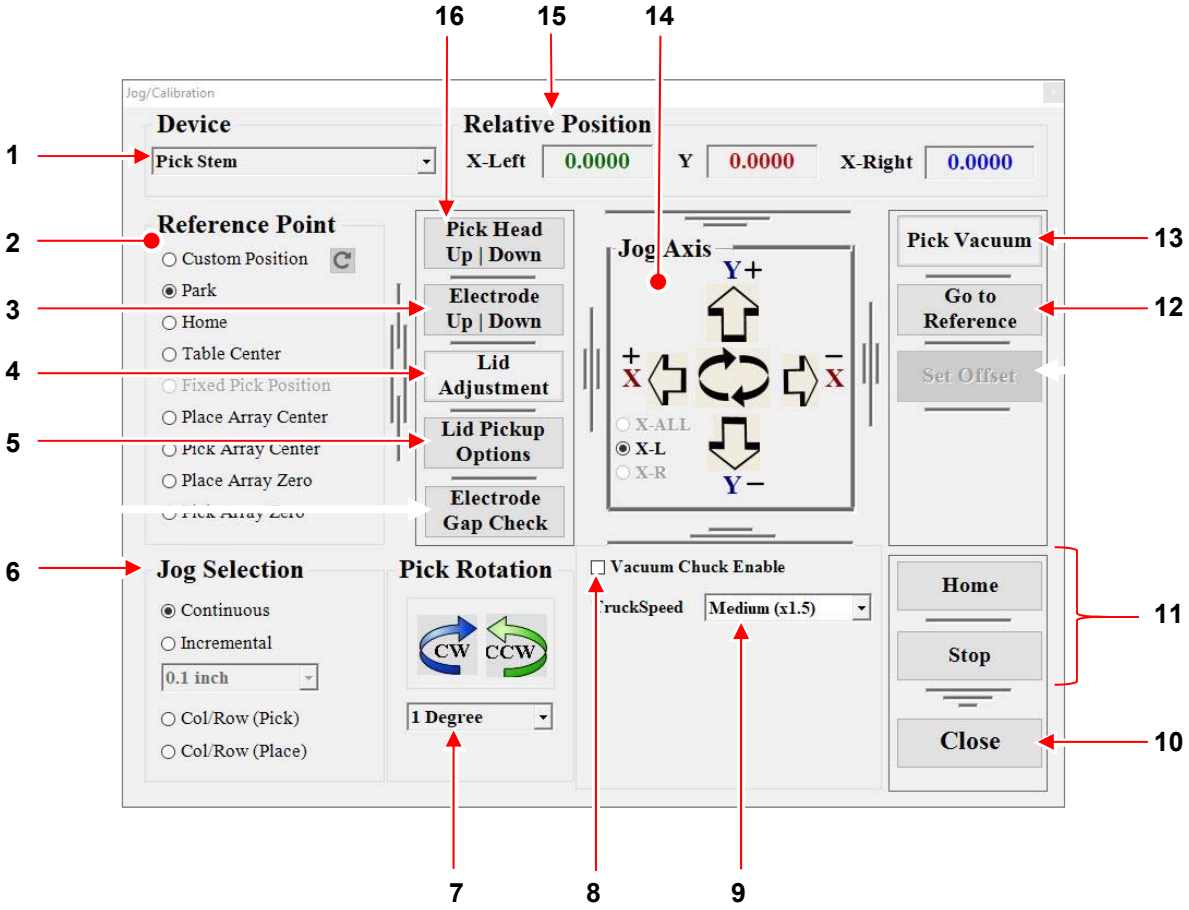
14. The **?** button is used to display processing notes for the weld process. This field is editable.



15. The **Current Schedule** displays the schedule name that is currently selected.
16. The **Current User** displays the user name logged in to the software interface.
17. The **Help** pull-down menu provides links to the manuals and information about the software revision.
18. The **Batch** pull-down menu provides the welding process reports.
19. The **System Settings** pull-down menu should only be used by qualified and trained personnel to calibrate, align and troubleshoot the system.
20. The **Archive** pull-down menu displays previous schedule information.
21. The **User** pull-down menu set the log on user for the system.

Jog/Calibration Mode

The Jog/Calibration Mode function is only available to users logged in as Administrator. From the Main Control Screen, select the **Jog** button and the Jog/Calibration Mode **Calibration** window will appear.



The Jog/Calibration mode is being used primarily for manually performing motion on the system. This mode is also being used for calibration and alignment.

1. **Device** selection allows 4 options to be selected:
   - Selecting the **Pick Stem** and any four arrows on the **Jog Axis** will move the left arm (where the pick stem is mounted) and the table. Selecting **Go to Reference (14)** will move the pick stem to the reference point selected.
   - Selecting the **Camera** and any four arrows on the **Jog Axis** will move the left arm (where the camera is mounted) and the table. Selecting **Go to Reference (14)** will move the camera to the reference point selected.
   - Selecting the **Weld Electrode .5 inch spacing** button and **Go to Reference (14)** will move each weld electrode 0.25 inch from the table center in the outward direction. The distance between the two electrodes will be 0.5 inch. This is useful to make sure the table center reference is accurate. The **Jog Axis** will not work with this option selected.
   - Selecting the **Weld Electrode track zero** provides an option of X-L, X-R and X-ALL. X-L jogs the left arm only while X-R jogs the right arm only. X-ALL jogs both arms at the same time. Selecting **Go to Reference (14)** will move the left or right arm to the reference point selected.

2. **Reference Point** is used to set where the selected device will go when the **Go to Reference (14)** button is selected.

   - **Custom Position** will enable a customizable position.
   - **Park** will drive all devices to the Park position.
   - **Home** will drive all devices to the Home position.
   - **Table Center** will drive the selected device to the center of the table. If the selected devices are off from table center, it means that the system is not aligned yet. To align the system, use the **Jog Axis** to move the device to the table center and select **Set Offset** to save the setting.

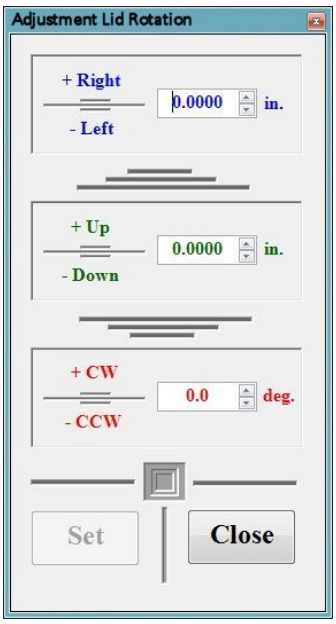
     Note: **Set Offset** is available when *Weld Electrode Track Zero*, *Pick Stem* or *Camera* option is selected.

     WARNING: User must be very cautious when setting offset for the table center reference because improper adjustment may cause the system to lose alignment.

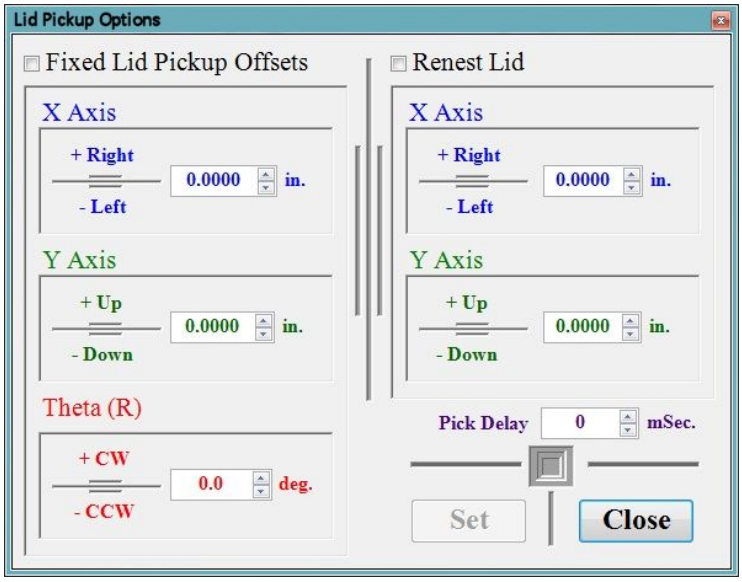
   - **Fixed Pick Position** will drive the pick stem to the lid centering device (if available) on the system.
   - **Place Array Center** will drive all devices to the center of the parts layout (0, 0 reference).
   - **Pick Array Center** will drive all devices to the center of the parts layout (0, 0 reference).
   - **Place Array Zero** will drive all devices to the upper left corner of the parts array.
   - **Pick Array Zero** will drive all devices to the upper left corner of the parts array (first part of the array).

3. **Electrode Up | Down** button will move both weld electrodes up and down.

4. **Lid Adjustment** button will bring up a window where the lid placement can be adjusted in addition to the error correction. Adjustments are available in X-axis, Y-axis and Rotation (R).



5. **Lid Pickup Options** will bring up a window where the lid pick options can be selected and adjusted.



- ☐ **Fixed Lid Pickup Offsets**
  If Fixed Lid Pickup Offsets is checked, the system will use vision to detect existence of the lid, but the calculated vision result will be overridden by **X**, **Y** and **Theta (R)**.
- ☐ **Renest Lid**
  To eliminate error due to tolerance within the nest, the lid can be pushed to the top-left corner using the pick stem. To use this option, check Renest Lid and define a distance X and Y to move while the pick stem is down.

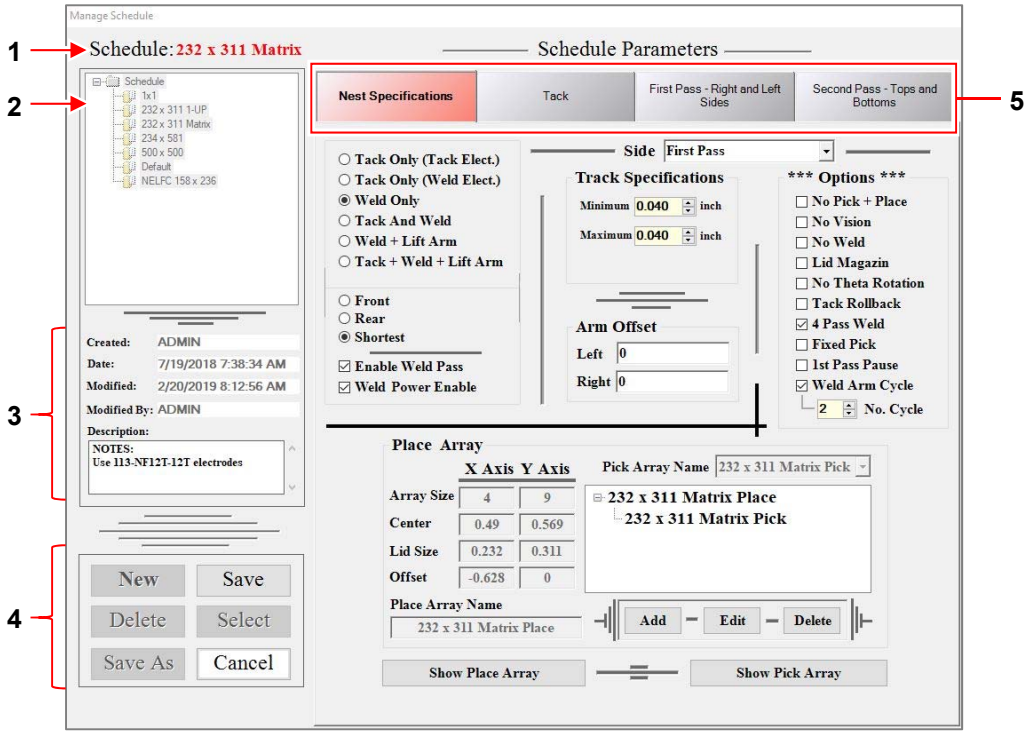
Note: If ☑ **Fixed Lid Pickup Offsets** is selected, re-nesting will be done after system performs vision inspection to check for lid existence. If the **Fixed Lid Pickup Offsets** is not selected, re-nesting will be done prior to the vision inspection.

6. **Jog Selection** determines the "distance of motion" of the table and arms when using the **Jog Axis** buttons. In addition to continuous and specific incremental distances, there are 2 other options; **Col/Row (Pick)**, **Col/Row (Place)**.
   - **Col/Row (Pick)** allows jog movement from lid to lid. Each time the Jog Axis button is selected, it will jump to the next lid in the direction you selected.
   - **Col/Row (Place)** allows jog movement from base to base. Each time the Jog Axis button is selected, it will jump to the next base in the direction you selected.
7. **Pick Rotation** determines the angular rotation of the pick stem in degrees. Select the rotation angle from the pull-down options and then select **CW** (clockwise) or **CCW** (counter-clockwise) rotation.
8. ☐ **Vacuum Chuck Enable** is used to enable/disable the vacuum when testing the Pick Head Up/Down.
9. **Truck Speed** is the stage speed setting and is related to the current Jog Screen. The Truck Speed does not affect the schedule runtime speed.
10. **Close** exits the jog mode and returns to the Main Screen.
11. **Home** and **Stop** have the same functionality as the main screen.
12. **Go to Reference** drives the motion to the selected reference point.
13. **Pick Vacuum** turns the vacuum on the pick stem ON and OFF.

14. **Jog Axis** has four arrows indicating the direction the mechanism can be moved. The **Y+** (up) and **Y-** (down) control the table moving forward and backward. The **X-** and **X+** control the arm moving left and right. The arm being controlled depends on the selection of ⊙ **X-L** and ⊙ **X-R** which indicates left arm and right arm. ⊙ **X-ALL** moves both arms at the same time. In some device selection options, these radio buttons will be unavailable.
15. **Relative Position** represents the distance from current position to the reference point of the left arm (**X-Left**), table (**Y**) and right arm (**X-Right**)
16. **Pick Head Up | Down** button will move the pick stem up and down.

Schedule Edit – Common Functions

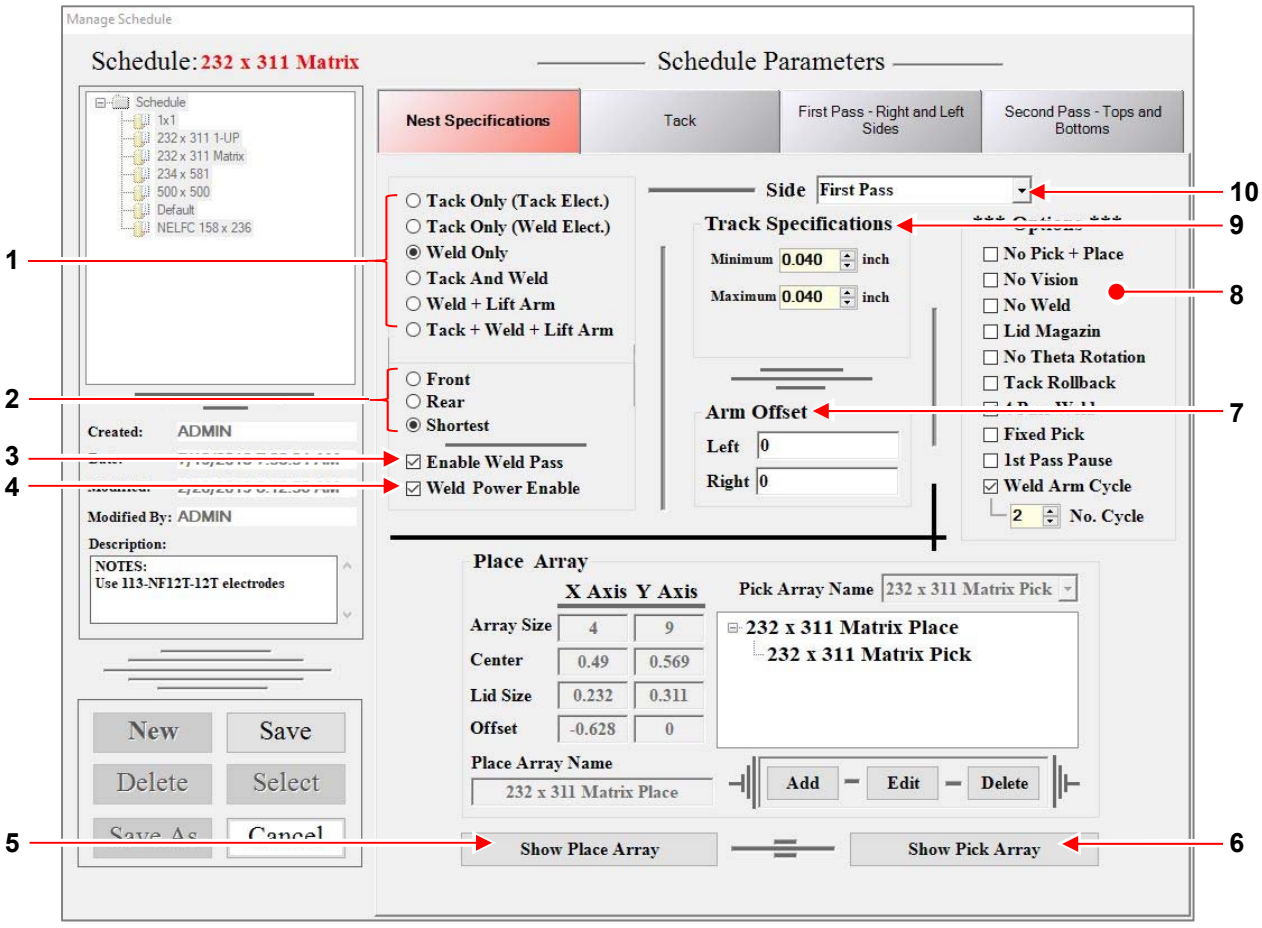
From the Main Control Screen, select the **Schedule** button, followed by **Edit Schedule** and the **Manage Schedule** window will appear. Use this screen to adjust the schedules and process parameters.



1. **Schedule:** displays the name of the schedule that is currently selected.
2. Under the **Schedule** Name field is a list of all schedules. To edit, select any schedule from the list.
   - Select the right mouse button to create a new folder.
   - User can drag and drop schedules in between folders for better organization.
   - User can drag a schedule into another schedule for schedule linking. When two schedules are linked, selecting **Start** will process the first schedule, followed by the second schedule. This is useful when the same part has a second weld schedule on a different section without having to change schedule after every pallet. The number of linked schedules can be more than two.
3. Below the Schedule selection window is the information and user description of the selected schedule.
4. The six buttons are described as follows.
   - **New** creates a new schedule.
   - **Delete** will delete currently selected schedule.
   - **Save As** will save the current schedule as a different schedule name.
   - **Save** completes modification of the current schedule.
   - **Select** will select the current schedule to be used in the process
   - **Cancel** will close the schedule window and return to the Main Control Screen.
5. **Nest Specifications**, **Tack**, **First Pass – Right and Left Sides**, **Second Pass – Tops and Bottoms** are schedule specific functions. Refer to the following pages below for detailed screen information.

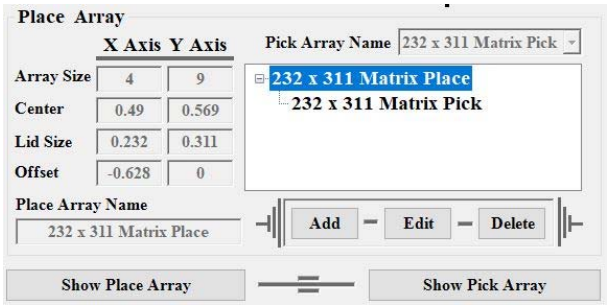
Schedule Edit – Nest Specifications

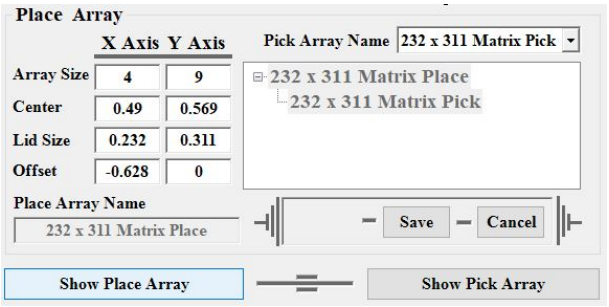
The Nest Specifications are used to define the pallet measurements; lid size, pitch, array size and offset. In addition, is also contains the tacking and welding options. When the Nest Specifications tab is selected it will turn "red".



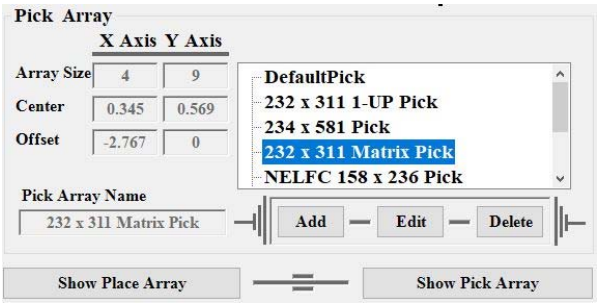
1. Weld Options
   - ○ **Tack Only (Tack Elect.)** – Weld electrodes will only perform tack on parts.
   - ○ **Tack Only (Weld Elect.)** – Weld electrodes will only perform weld on parts.
   - ○ **Weld Only** – Weld electrodes will perform tack and weld on parts.
   - ○ **Tack & Weld** – Weld electrodes will perform tack and weld on parts.
   - ○ **Weld + Lift Arm** – Weld electrodes will lift up in between parts and will only perform weld on parts.
   - ○ **Tack + Weld + Lift Arm** – Weld electrodes will lift up in between parts and will perform tack and weld on parts.
2. Weld Direction:
   - ○ **Front** – Will process parts from front to rear.
   - ○ **Rear** – Will process parts from rear to front.
   - ○ **Shortest** – Will process parts in serpentine motion for the shortest possible process time.

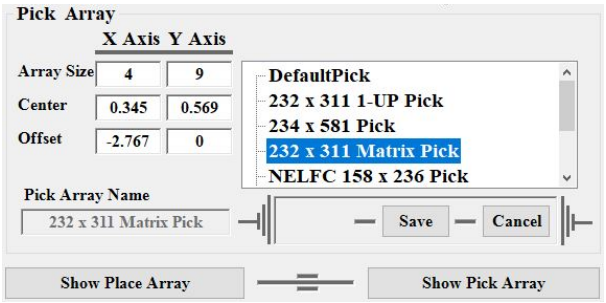
3. Checking the ☑ **Enable Weld Pass** checkbox will enable the weld pass. If unchecked, the current weld pass will not be processed.
4. When ☑ **Weld Power Enable** is checked, the lid will be welded to the base during runtime. Uncheck this box when you are testing the pick and place consistency and repeatability to avoid welding.
5. When **Show Place Array** is selected, the Place Array data fields will display. The Place Array stores numbers being used by the system to determine the location of the parts on the pallet. These numbers are usually obtained from a mechanical drawing of the pallet.
   - **Array Size** determines the number of parts in the X and Y axis.
   - **Center** determines the pitch or the distance between the center of a part to the center of the next part in the pallet.
   - **Lid Size** determines the size of the lid in inches.
   - **Offset** is the distance from the table center to the center of the place array.
   - **Pick Array Name** associates a pick array with the current placed array.
     The current place array name is displayed in the box below the **Pick Array Name**. Selecting the "plus" icon next to it will display the pick array name.
   - Select **Add** to add a place array and **Delete** to delete a place array.
   - Select **Edit** to edit the numbers on the place array. Selecting **Edit** will change the options to **Save** and **Cancel**.





6. When **Pick Array** is selected, the Pick Array data fields will display. The Pick Array stores numbers being used by the system to determine the location of the lids on the pallet. These numbers are usually obtained from a mechanical drawing of the pallet.
   - **Array Size** determines the number of lids in the X and Y axis.
   - **Center** determines the pitch or the distance between the center of a lid to the center of the next lid in the pallet.
   - **Offset** is the distance from the table center to the center of the pick array.
     The box next to it displays the list of the pick array that can be selected from the Place Array setting.
   - Select **Add** to add a pick array and **Delete** to delete a pick array.
   - Select **Edit** to edit the numbers on the pick array. Selecting **Edit** will change the options into **Save** and **Cancel**.





7. **Arm Offset** enables the user to adjust the arm in both the left and right directions. By default, this option should be 0. Use negative and positive numbers for the left arm to offset left and right respectively. The polarity of the right arm is reversed; use negative and positive numbers for the right arm to offset right and left respectively.

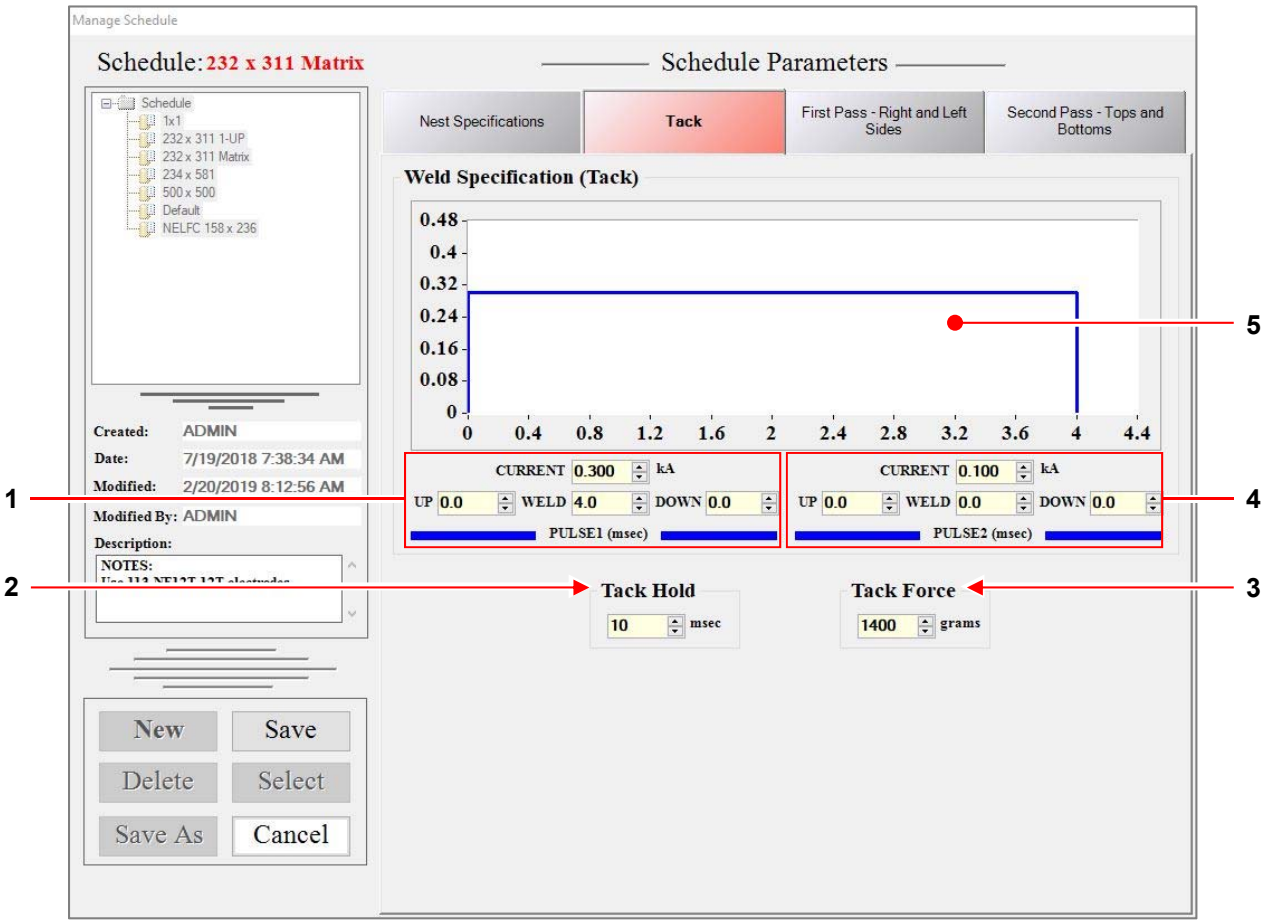
8. The **Options** menu has several options that can be enabled or disabled. Option enabled when selected.
   - **No Pick + Place** will disable the pick and place button on the Main Control Screen.
   - **No Vision** will disable the vision button in the Main Control Screen.
   - **No Weld** will disable the weld button in the Main Control Screen.
   - **Lid Magazine** will enable the add-on lid elevator system.
   - **No Theta Rotation** will disable the rotation correction being done by the pick stem.
   - **Tack Rollback** will enable the system to move the table slightly after tacking to prevent electrode from sticking onto the part. This is useful especially for smaller part geometries.
   - **4 Pass Weld** will enable the 4 pass weld mode where it starts from the center and weld the top half of the part before moving back to the center and weld the bottom half.
   - **Fixed Pick** will enable the add-on lid centering device.
   - **Weld Arm Cycle** will only cycle the weld arm down and up before the welding process at the indicated number of cycles two (2) hours from the most recent weld arm operation. This two (2) hour interval can be changed in the AFLOW.ini file. Cycling the pneumatic cylinders (which the electrodes are mounted on), will break static freeze between the O-rings and the cylinder walls after the cylinder is not being used for a few hours.

9. **Track Specifications** determines the minimum and maximum electrode track, which is the distance from the edge to the surface of the electrode being used to where the parts are processed.

10. **Side** determines which pass is being edited. The Options are *First Pass* and *Second Pass*. First pass edits the process when the table is at 0 degrees. Second pass edits the process when the table is at 90 degrees.

Schedule Edit – Tack

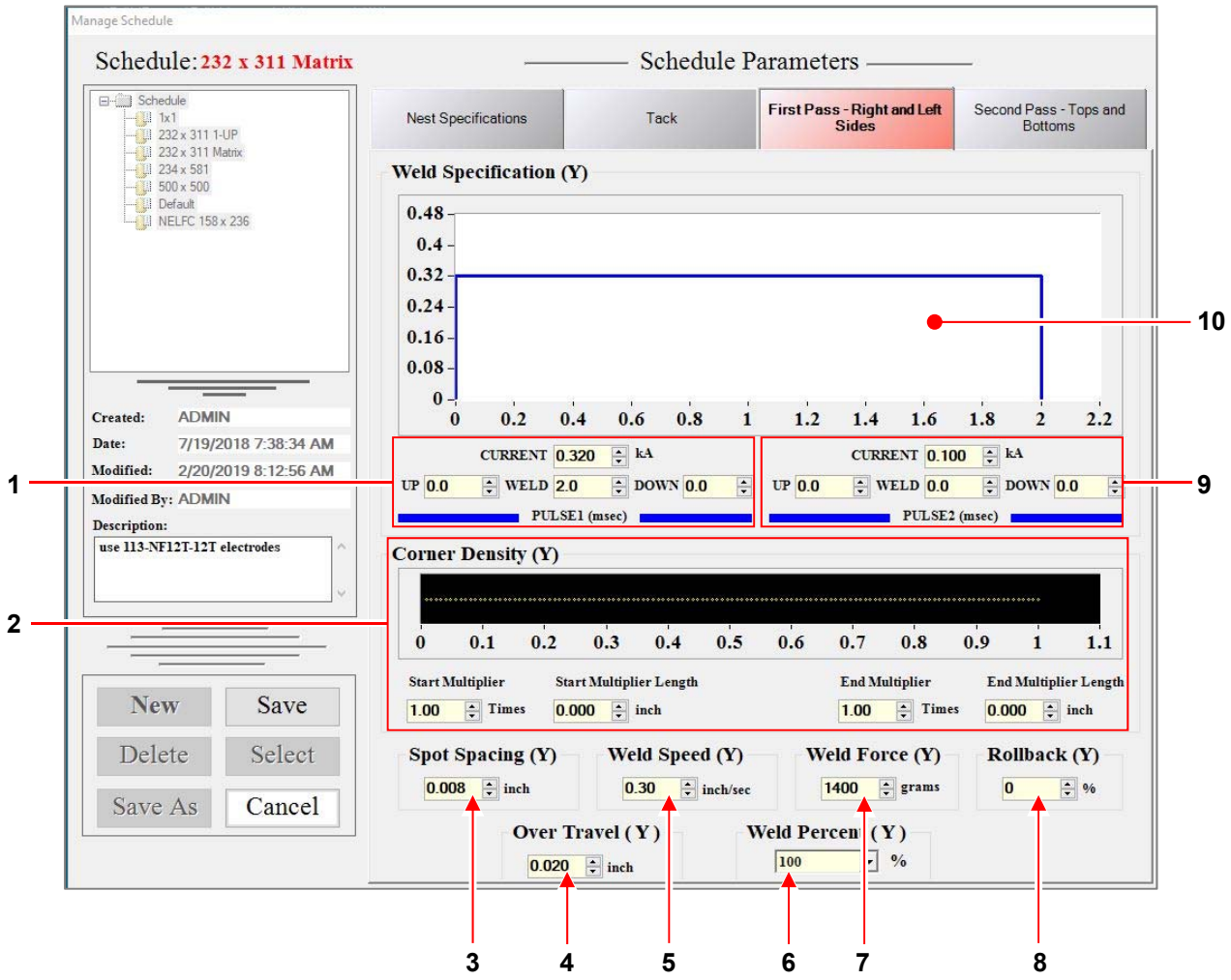
The Tack window is used to define the tack schedule parameters; pulse setting, tack force and hold time. The pulse specification sets the parameters on the dual pulse HF-2500A inverter. When the Tack tab is selected it will turn "red".



1. **Pulse 1 (msec)** contains the parameters for the first pulse; current in kA, weld time (in msec), up slope time and down slope time.
2. **Tack Hold** is the time (msec) between the tacking pulse and when the electrode lifts up.
3. **Tack Force** is the amount of force (grams) exerted by the cylinder during tacking.
4. **Pulse 2 (msec)** contains the parameters for the second pulse; current in kA, weld time (in msec), up slope time and down slope time. To disable the second pulse, enter zero for all the weld times.
5. The *Graph* displays the current Weld Tack pulse settings.

Schedule Edit – First Pass – Right and Left Sides

The First Pass window is used to define the first pass weld schedule parameters for the Right and Left sides; pulse setting, corner density, spot spacing, speed, force, rollback and over travel. The pulse specification sets the parameters on the dual pulse HF-2500A inverter. When the First Pass – Right and Left Sides tab is selected it will turn "red".



1) **Pulse 1 (msec)** contains the parameters for the first pulse; current in kA, weld time (in msec), up slope time and down slope time.

2) **Corner Density (Y)** allows the user to adjust the amount of pulse applied to the part during the portions of the weld near the corners. By entering a **Start Multiplier** value greater than 1, more pulse will be applied by way of decreasing the spot spacing by an amount equal to the inverse of the start multiplier. The length is specified in the **Start Multiplier Length** field. **End multiplier** works the same way except **Start Multiplier** starts at the beginning of the part while **End Multiplier** starts before the end of the part.

3) **Spot Spacing (Y)** is the distance in inches from center to center between each weld pulse. The initial weld pulse for each package starts from the corner plus the *Over Travel* for the quad mode or the center plus the overlap for the 4 pass mode. Each subsequent weld pulse is spaced evenly based upon the spot spacing value. The AF-8500A / AF-1250A uses precision encoders and high accuracy servo motors to deliver this weld spot spacing with high accuracy. While setting the spot spacing in conjunction with the weld speed, it is important to keep in mind the repetition rate of the HF-2500A power supply. It is possible

to program the system so that the weld pulses are closer and faster than the HF-2500A can accommodate. In this situation, although the electrodes will travel at the requested speed and the power supply will be triggered to send a weld pulse, the requested energy will not be delivered to the weld site.

4) **Over Travel (Y)** parameter determines the distance of travel before and after the length or width of the part. This parameter accounts for the radiuses in the corners as it causes the welder to fire pulses as it rolls beyond the corner of the part.

5) **Weld Speed (Y)** is set in inches per second. It determines how fast the electrodes move over the surface of the lid package during welding. As noted above, it is important to keep in mind the repetition rate of the HF-2500A power supply.

6) **Weld Percent (Y)** defines how much of a side needs to be welded. For example, if Weld Percent is 90% for a 1" x 1" part, only 0.9" of the part will be welded and the remaining 0.1" will be unwelded.

7) **Weld Force** value is the force in grams that will be applied to the contact area between the electrodes and the part being welded. Typical force applied to the ceramic package is 1400 grams.

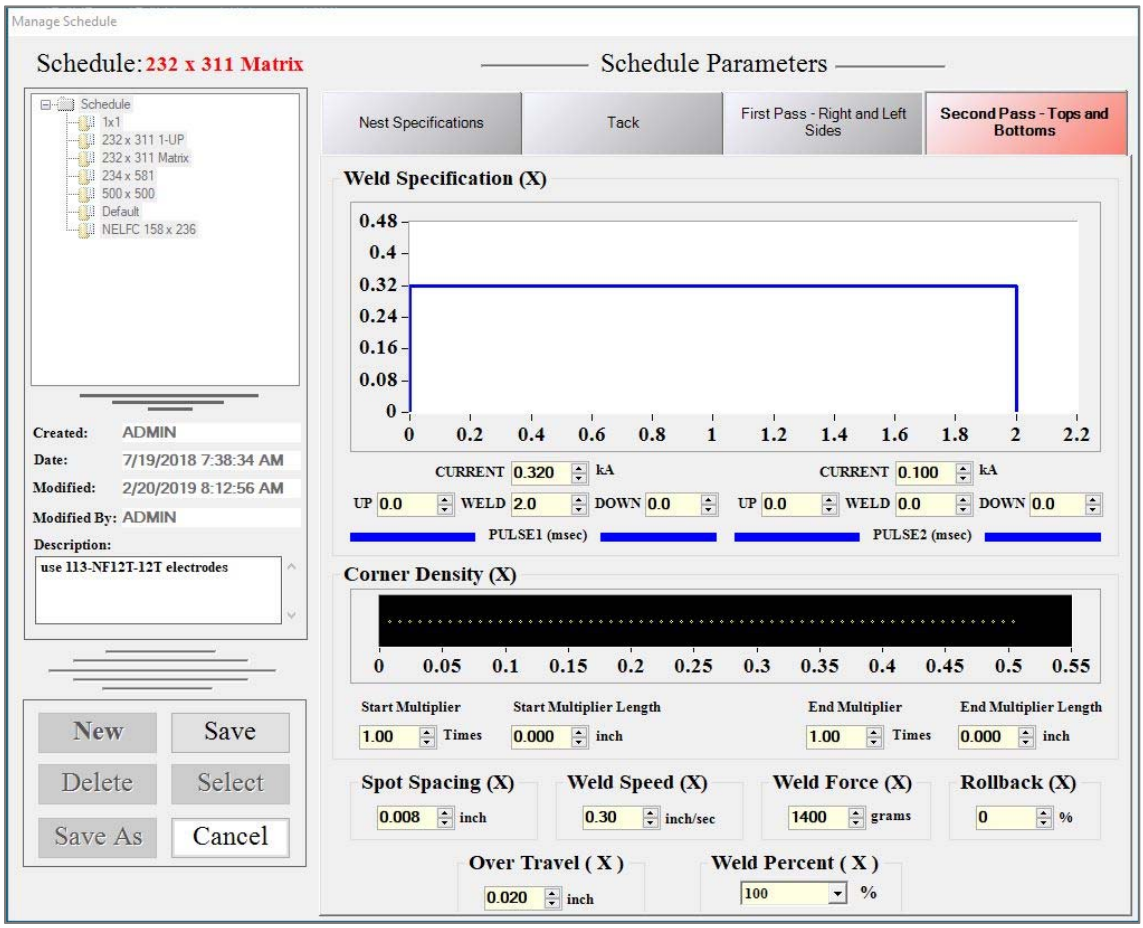
8) **Rollback** is a unique feature where the electrodes move in reverse direction of the welding. This motion is done right after the last pulse is being fired during welding. This feature keeps the parts (especially low mass) from sticking to the electrodes after the final weld pulse. The rollback is set as a percentage of the total distance along the edge of the part.

9) **Pulse 2 (msec)** contains the parameters for the first pulse; current in kA, weld time (in msec), up slope time and down slope time. To disable the second pulse, enter zero for all the weld times.

10) The *Graph* displays the current Weld Tack pulse settings.

Schedule Edit – Second Pass – Tops and Bottoms

The Second Pass window is used to define the second pass weld schedule parameters for the Tops and Bottoms; pulse setting, corner density, spot spacing, speed, force, rollback and overtravel. The pulse specification sets the parameters on the dual pulse HF-2500A inverter. When the Second Pass – Tops and Bottoms tab is selected it will turn "red".



Refer to the previous section ***Schedule Edit – First Pass – Right and Left Sides*** for details on the parameters shown in this window.

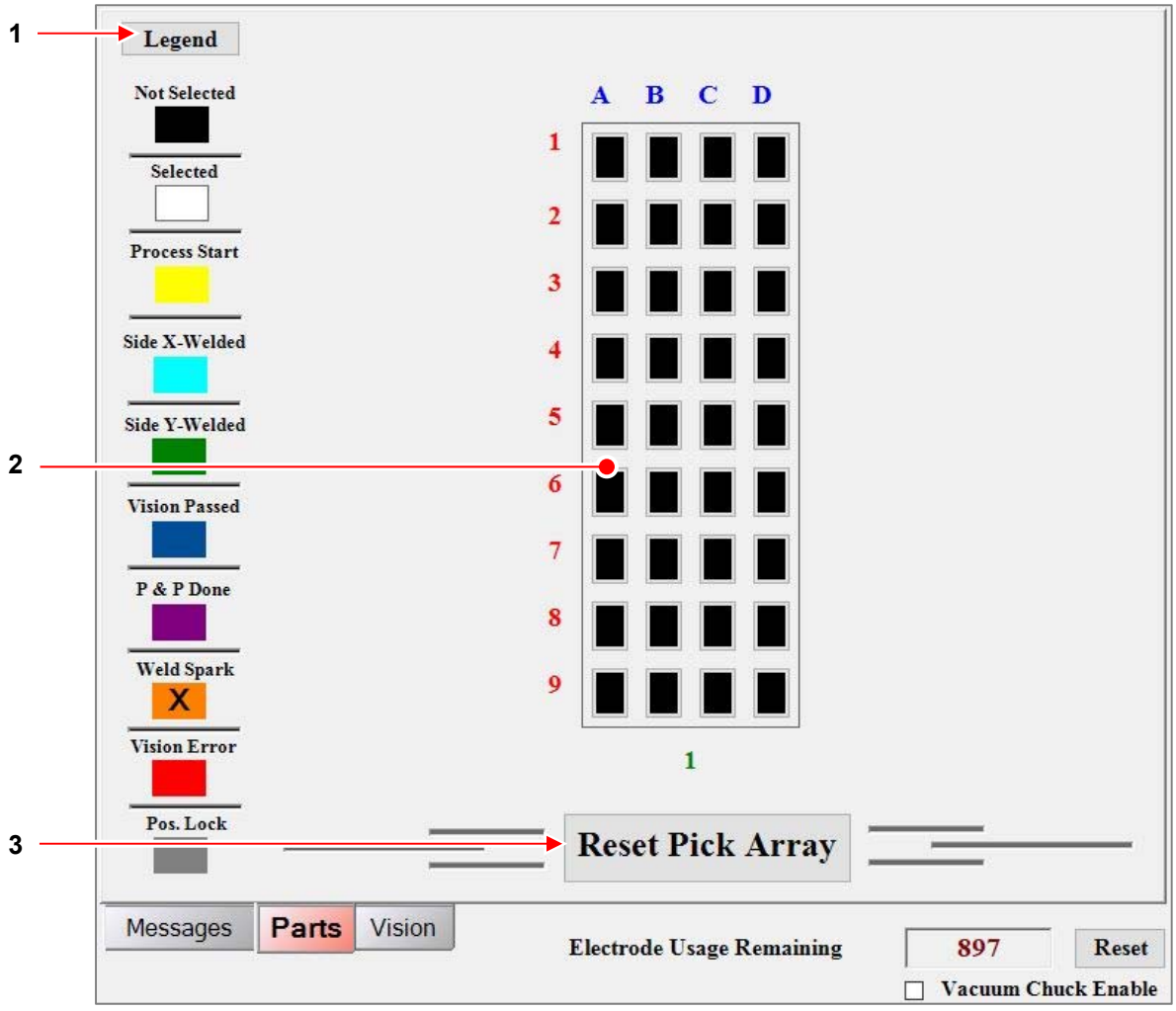
Messages Tab

The Messages Tab display AF-8500A / AF-1250A Messages and set some global settings.

1. Message box displays the status of the AF-8500A / AF-1250A system.
2. Selecting the **Auto**, **Manual** or **Step** mode:
   - **Auto** mode runs the schedule from the first selected part to the last selected part without stopping.
   - **Manual** mode runs the schedule one part at a time, stopping after each part. Pressing the Start button continues the process.
   - **Step** mode runs the schedule one step at a time, stopping after each step. Pressing the Start button continues the step process.
3. ☐ **Vacuum Chuck Enable** is used to enable/disable the vacuum when testing the Pick Head Up/Down.
4. The **Row** and **Column** fields display the row and column number of the current part being processed. In addition, the adjacent rectangle displays a color to indicate the current process. The process colors are defined on the Parts Tab (see below).
5. The **?** button is used to display processing notes for the weld process. This field is editable.

Parts Tab

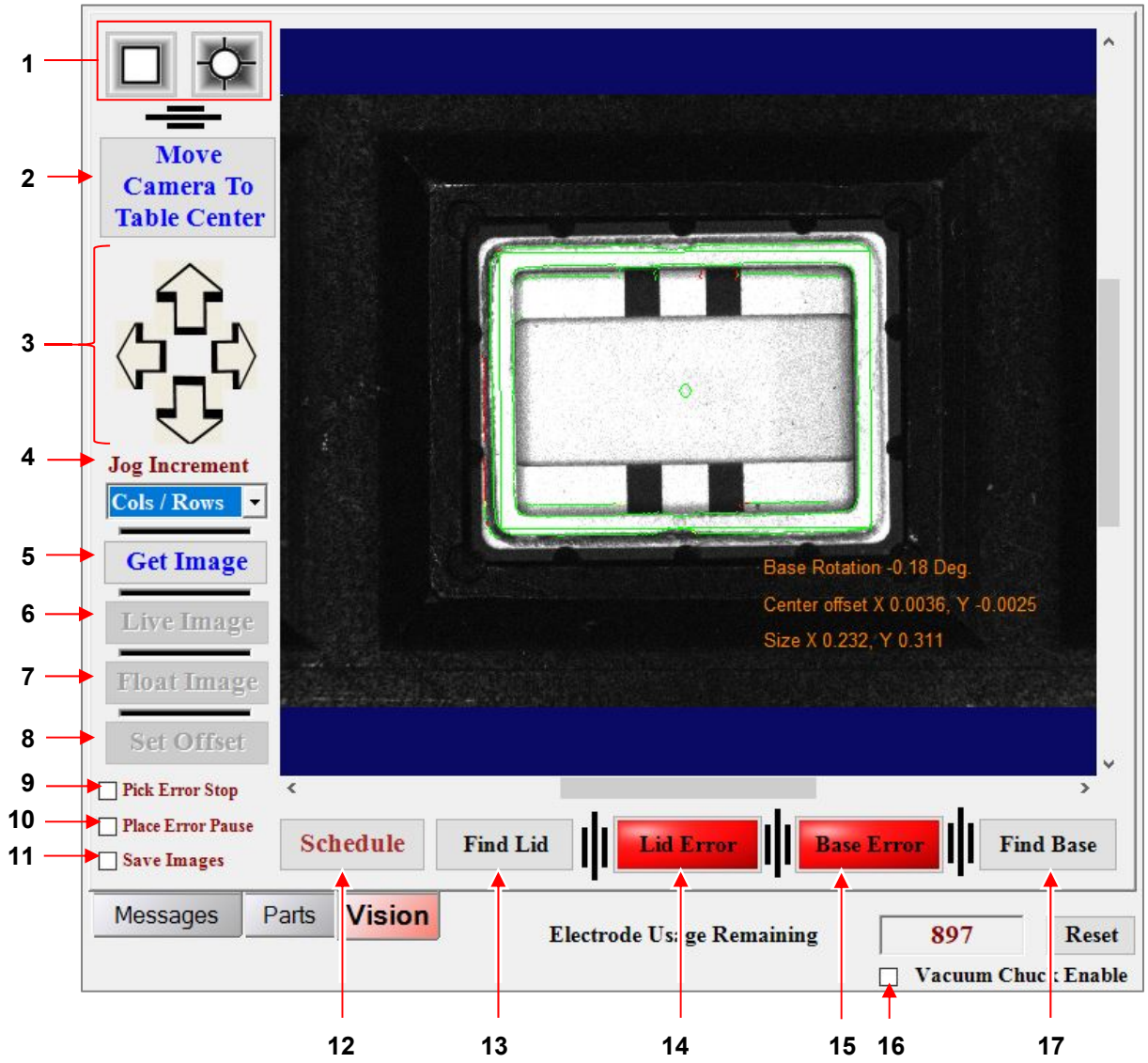
The Parts tab displays the array of parts to be welded.



1. **Legend** displays the description of each color and its associated process. When viewing the Messages Tab, these colors can be used to indicate the current process.
2. Display of part arrays of the currently selected schedule. Parts can be selected or deselected by clicking on the part. Selected parts are displayed as white while parts not selected are displayed as black.
3. **Reset Pick Array** will reset the pick stem motion so that it processes the lid from the beginning of the array. If this button is not pressed prior to process, the pick stem will continue processing from the last pick array location of the previous process.

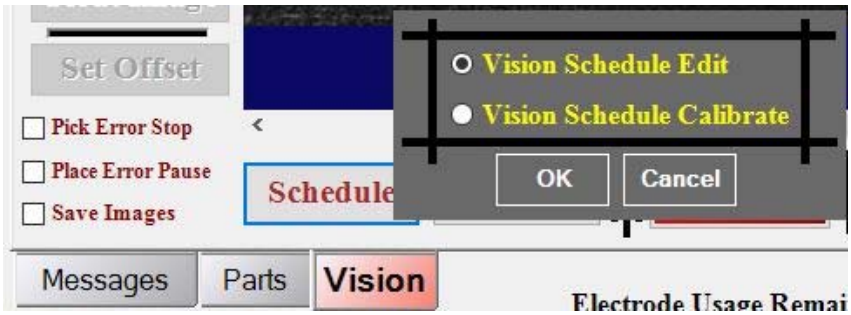
Vision Tab

The Vision tab is used to control image processing. The main portion of the window displays the camera view, which can either display a live view or a snapshot of the parts. During processing a live image can be enabled or disabled. If the live image option is disabled, the camera will take snapshots of the lids and parts and calculate a correction based on the captured image. The correction will be displayed on the lower right of the display.



1. The *Reticle* and *Rectangular* buttons on the top left are used to superimpose a reticle and/or a rectangular box on to a live image. These buttons can be used to help the user calibrate and align the system. These buttons are only available during live image.
2. **Move Camera To Table Center** positions the camera to the center of the table.
3. The *Four Arrows* (⇧⇨⇩⇦) are used for jogging the left arm and the table.
4. **Jog increment** determines the "distance of motion" of the table and arms when using the **Jog Axis** buttons. The available settings are the same as the Jog Increment settings on the Jog screen.

5. **Get Image** captures a snapshot at the current position.
6. **Live Image** sets the camera to view a live image.
7. **Float Image** opens a new window with a live image of the camera.
8. **Set Offset** sets the table center reference of the camera.
9. When the ☐ **Pick Error Stop** option is selected, the system will stop when the vision cannot find the part. In order to resume process, the user must replace the part or adjust the part until the camera finds it.
10. When the ☐ **Place Error Pause** option is selected, the system will stop.
11. When the ☐ **Save Images** option is selected, the software will capture and archive the images of the found lid and base for each part when performing the pick/place welding process. All captured images will include graphical overlays to indicate how the vision system saw the orientation of the part and will provide the (x,y) location and angle of orientation data.
12. **Schedule** opens up two options whether to calibrate the vision or edit the vision schedule. Please refer to section *Vision Schedule Calibrate* or *Vision Schedule Edit* for more information.



13. **Find Lid** will drive the camera to browse through all of the lids available in the lid arrays. The camera will capture a snapshot of each lid and calculate the error. Find Lid will have to be clicked again to browse to the next lid. Select any part in Parts Tab then select this button to start the motion.
14. **Lid Found / Lid Error** is an indicator that displays the status of the vision when browsing through a lid array. If the vision finds a lid, a *Lid Found* message with green background will be displayed. If the vision fails to find a lid, a *Lid Error* message with red background is displayed.
15. **Base Found / Base Error** is an indicator that displays the status of the vision when browsing through the part array. If the vision finds a part, a *Base Found* message with green background is displayed. If the vision fails to find a part, a *Base Error* message with red background is displayed.
16. ☐ **Vacuum Chuck Enable** is used to enable/disable the vacuum when testing the Pick Head Up/Down.
17. **Find Base** will drive the camera to browse through the part(s) that are selected in the Parts tab. The camera will capture a snapshot of each part and calculate the error. Find Base will have to be selected again to browse to the next part unless only one part is selected from the part array. Select any part in Parts Tab then select this button to start the motion. The camera will only browse through the parts selected in the Parts Tab.

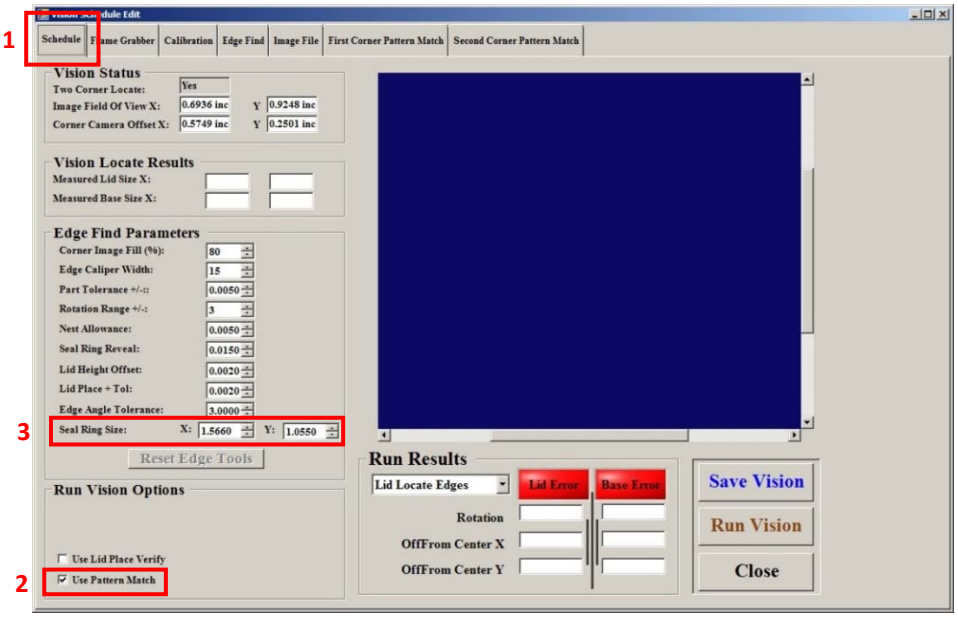
AF Software Modification
Vision Pattern Match (Vision Calibration)

The Vision System in the AF-8500A / AF-1250A can be calibrated to aid in producing package welds for any given base/lid package through the use of Vision Pattern Match. Vision Pattern Match (also known as Vision Calibration) is a process by which the AF-8500A / AF-1250A can be programmed to recognize the boundaries of the lid and Base/Part seal ring through the use of its camera system, which enables perfect package welds each time. The steps below instruct the user how to set-up their AF-8500A / AF-1250A for Vision Pattern Match.

Initial Setup

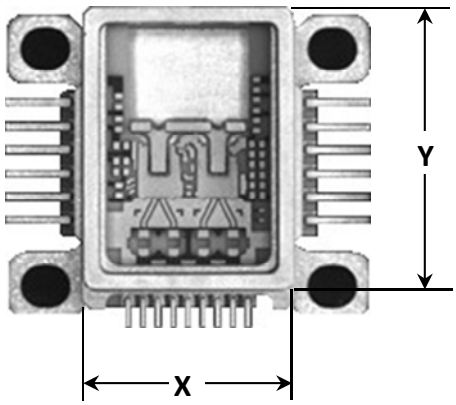
The Vision system can use Cognex Pattern Recognition feature to process parts and lids.

1. On the *Vision Schedule Edit* screen, select the **Schedule** tab.

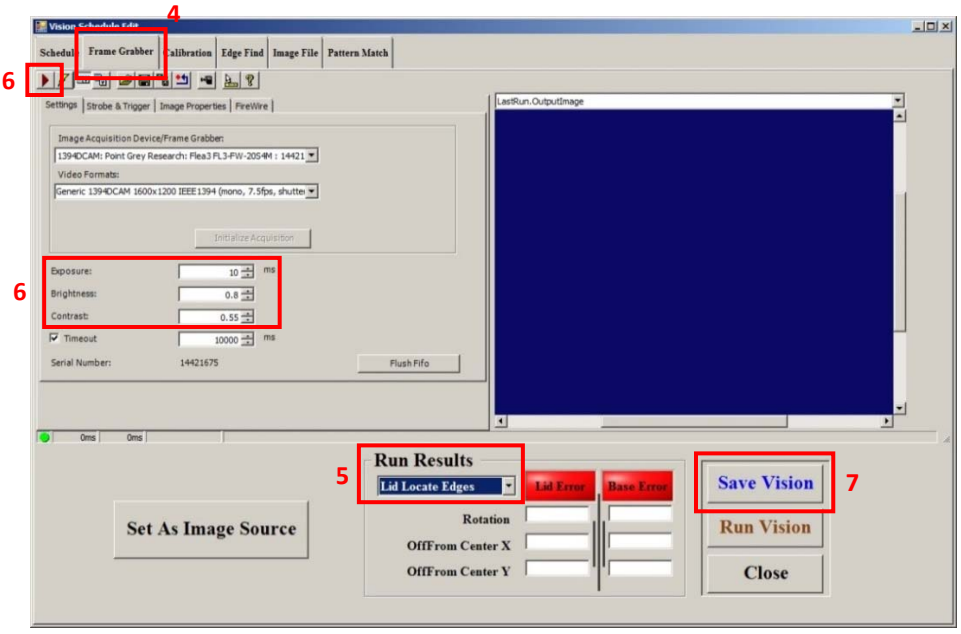


2. Select the ☑ **Use Pattern Match** option, located on the bottom left corner of the screen
3. Specify the **X** and **Y** parameters of the part in the **Seal Ring Size:** field.

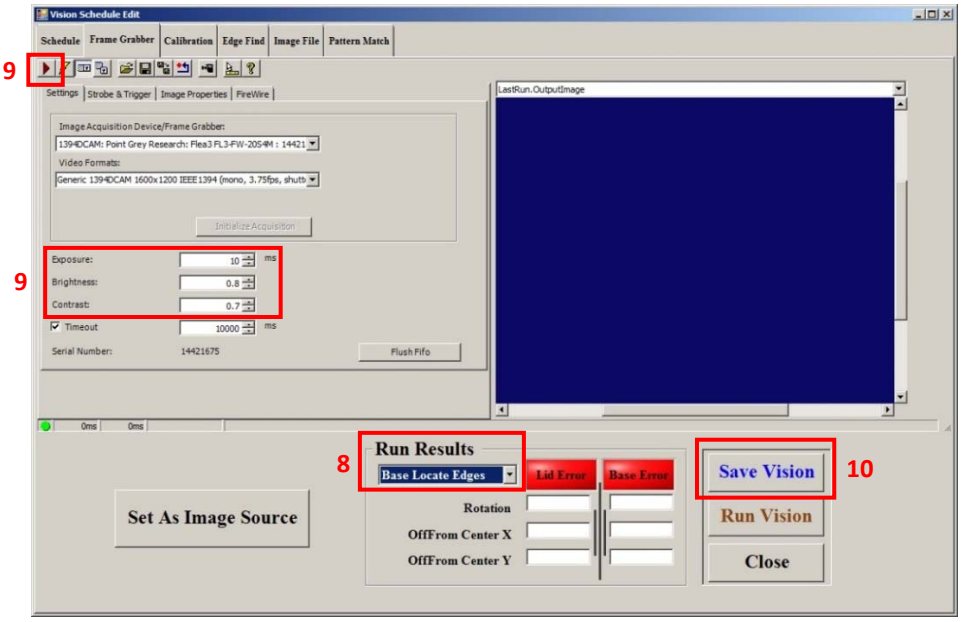
Seal Ring Size:
Base/Part shown



4. From the *Vision Schedule Edit* screen, select the **Frame Grabber** tab.



5. Select the **Lid Locate Edges** option under *Run Results*.
6. Select the **Run Vision** button. Once the lid image is displayed, modify the **Exposure**, **Brightness** and **Contrast** to achieve a bright clean image. A good starting point is Exposure 5, Brightness 0.5 and Contrast 0.5.
7. Select **Save Vision** once the Lid image adjustment is complete.
8. Select the **Base Locate Edges** option under *Run Results*.

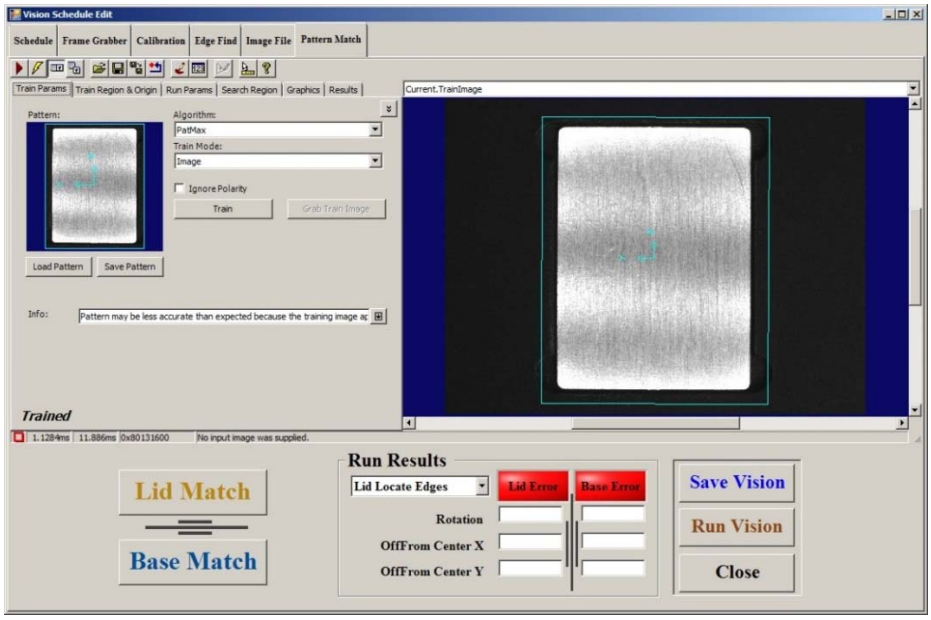


9. Select the **Run Vision** button. The Base/Part has different settings than the lid. Once the Base/Part image is displayed, modify the **Exposure**, **Brightness** and **Contrast** to achieve a bright clean image. A good starting point is exposure 5, brightness 0.5 and contrast 0.5.
10. Select **Save Vision** once the Base adjustment is complete.

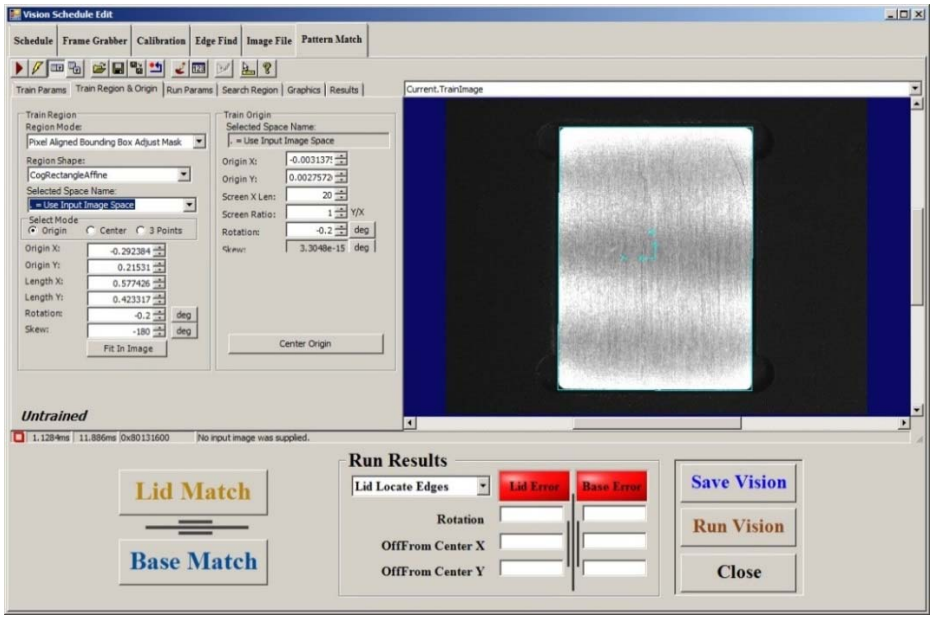
NOTE: Pattern match works best with flawless lid and Base/Part with no scratches and nicks. If a flawless lid/base is not available, use the best lid and Base/Part.

Training Lid Single Capture (Lid Calibration)

1. On the *Vision Schedule Edit* screen, select the **Pattern Match** tab, followed by the **Trans Params** tab.

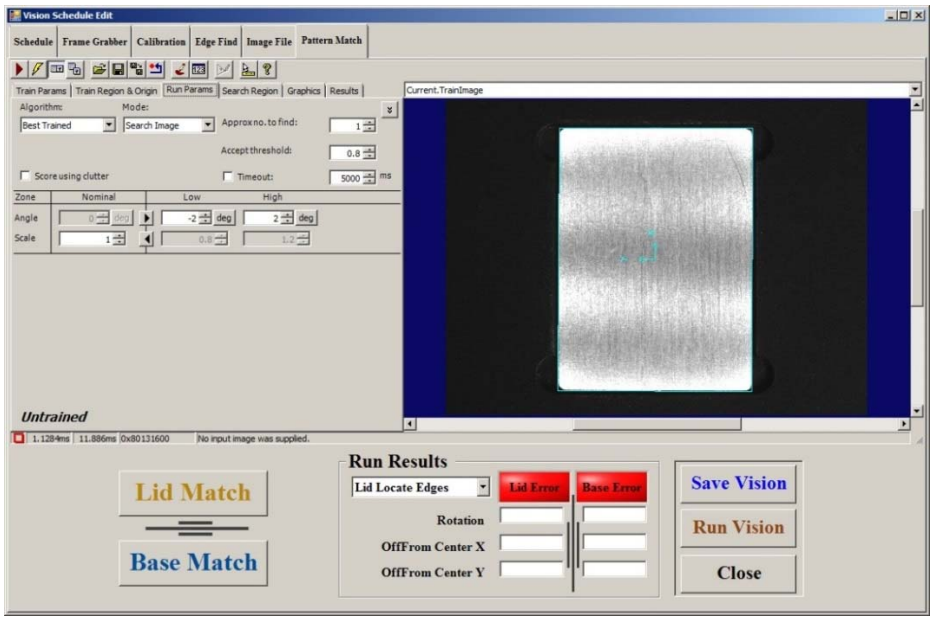


2. Select the **PatMax** option under *Algorithm* and the **Image** option under *Train Mode*.
3. Select the **Lid Locate Edges** option under *Run Results*.
4. Select the **Run Vision** button to obtain an image of the Lid.
5. Select the **Train** button to grab an image of the Lid for training.
6. On the *Vision Schedule Edit* screen, select the **Train Region & Origin** tab.

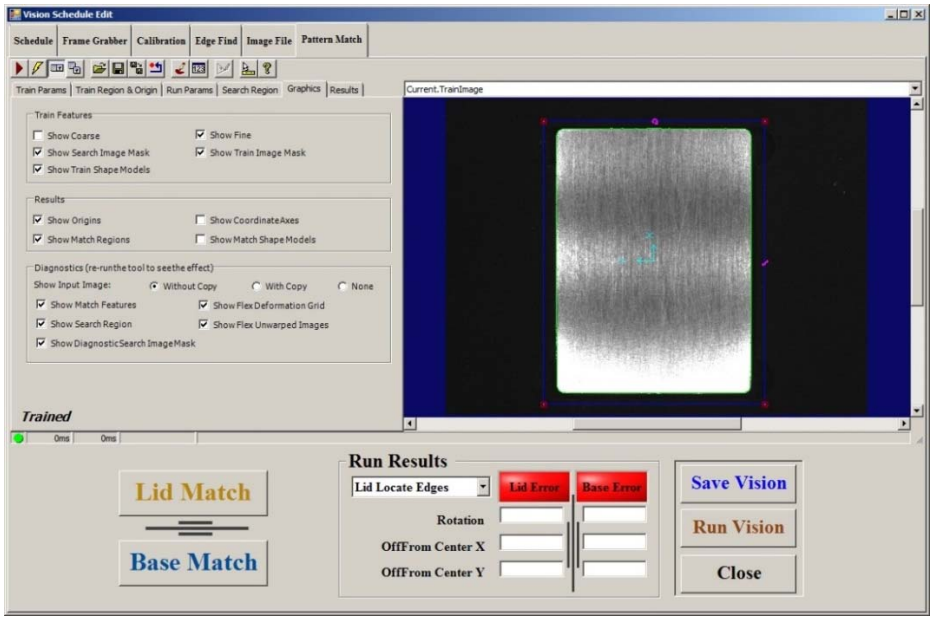


7. Place your mouse cursor over the Lid image and select the right-mouse button. Select the **Fit Image** option.
8. Select the **Fit In Image** button under the *Train Region* section (left side) to move the light blue box within the image.
9. Set the **Rotation** field value (left side) under the *Train Region* to 0 degrees.

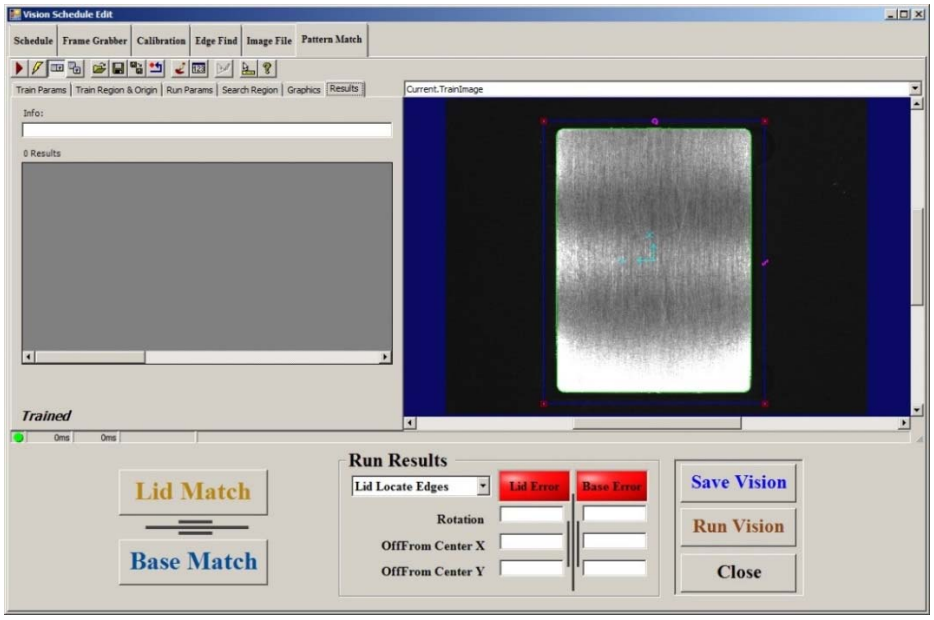
10. Adjust the light blue box so that it encloses the edge of the lid as shown in the picture above. The **Rotation** field value may need to be adjusted (using the up/down arrows) if the Lid is at an angle.
11. After the region adjustment is complete, select the **Center Origin** button. Modify the **Rotation** angle field above the *Center Origin* button to match the **Rotation** value obtained in the previous step.
12. On the *Vision Schedule Edit* screen, select the **Run Params** tab.



13. Set the **Accept threshold** value so that it will reject lids with lower pattern match scores. A value of 0.8 is recommended but this value can be raised until the rejection rate is acceptable.
14. The **Low** and **High** *Angle* values must be set to **Low** = -2 deg and **High** = 2 deg. Use the up/down arrows next to the Low/High fields to adjust these values.
15. Select the **Run** button on the top left corner. The pattern match scoring result should be displayed on the **Results** tab. Scores of **1** or greater than **0.95** should be obtained.
16. On the *Vision Schedule Edit* screen, select the **Graphics** tab to see the scoring results. Verify the **Results** options are selected as shown below.

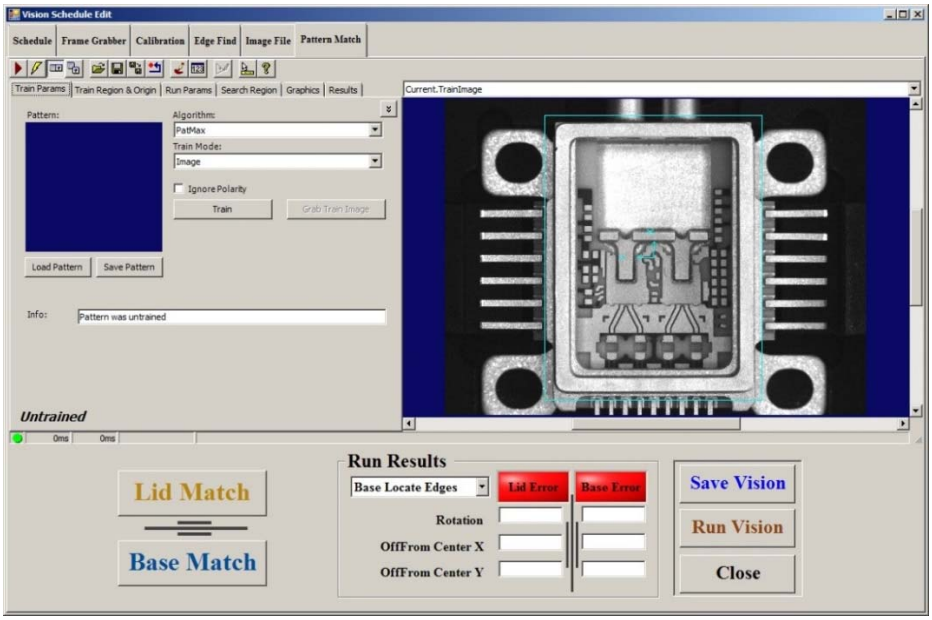


17. On the *Vision Schedule Edit* screen, select the **Results** tab to view the Pattern Match results.

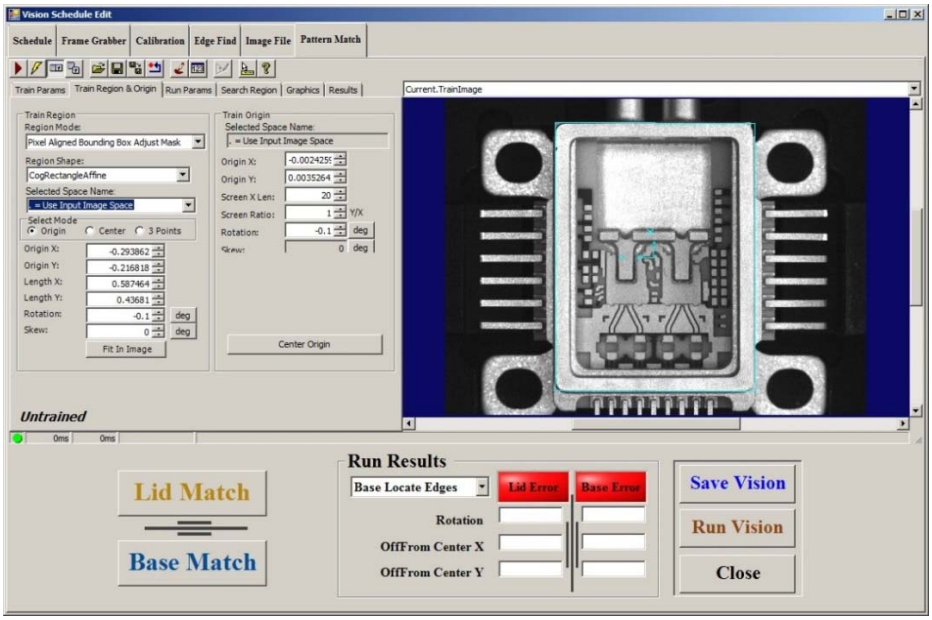


18. On the *Vision Schedule Edit* screen, select the **Train Params** tab once again.
19. Select the **Train** button to complete the pattern match process for the Lid. An image of the lid will be displayed in the **Pattern:** field.
20. Select the **Save Vision** button to save the Lid pattern match. The pattern match training can also be saved into a file by selecting the **Save Pattern** button and can be recalled in the future by selecting the **Load Pattern** button.

Training Base Single Capture (Base Calibration)

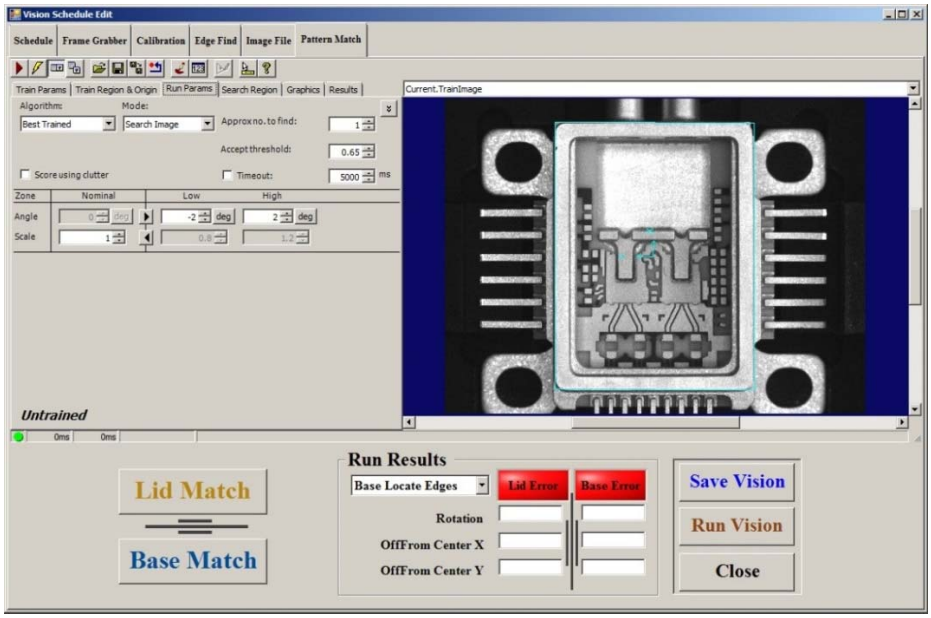


1. Select the **PatMax** option under *Algorithm* and the **Image** option under *Train Mode*.
2. Select the **Base Locate Edges** option under *Run Results*.
3. Select the **Run Vision** button to obtain an image of the Base/Part.
4. Select the **Train** button to grab and image of the Base/Part.
5. On the *Vision Schedule Edit* screen, select the **Train Region & Origin** tab.



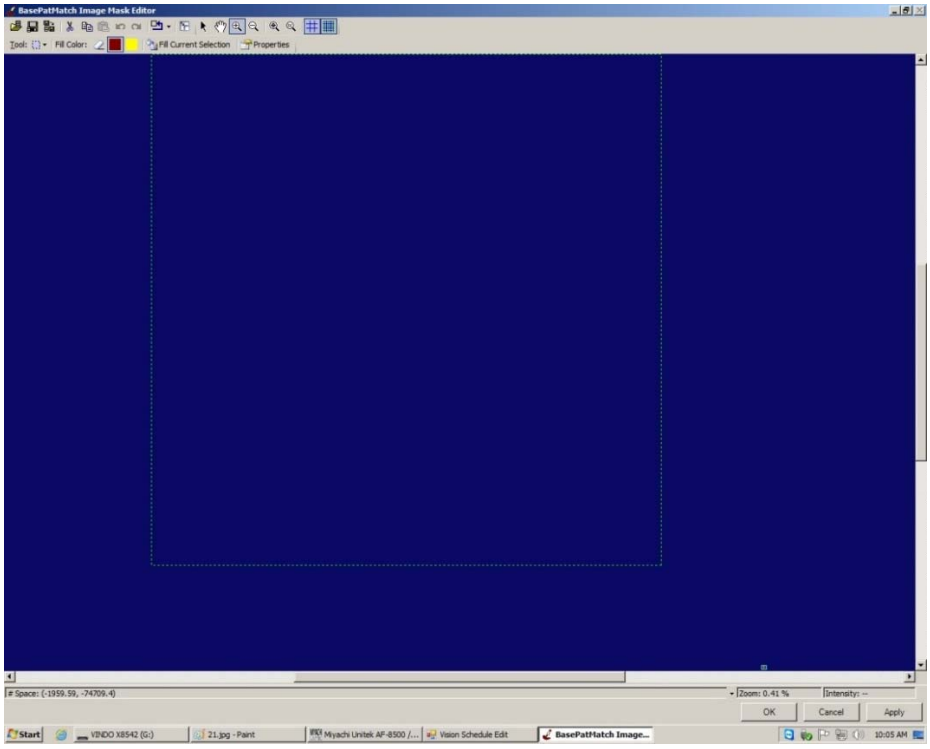
6. Place your mouse cursor over the Base/Part image and select the right-mouse button. Select the **Fit Image** option.
7. Select the **Fit In Image** button under the *Train Region* section to move the light blue box within the image.
8. Set the **Rotation** field value (left side) under the *Train Region* to 0 degrees.

9. Adjust the light blue box so that it encloses the edge of the seal ring of the Base/Part as shown in the picture above. The **Rotation** field value may need to be adjusted (using the up/down arrows) if the Base/Part is at an angle.
10. After the region adjustment is complete, select the **Center Origin** button. Modify the **Rotation** angle field above the *Center Origin* button to match the **Rotation** value obtained in the previous step.
11. On the *Vision Schedule Edit* screen, select the **Run Params** tab.



12. Set the **Accept threshold** value so that it will reject Base/Parts with lower scores. A value of 0.8 is recommended but this value can be raised until the rejection rate is acceptable.
13. The **Low** and **High** *Angle* values must be set to **Low** = -2 deg and **High** = 2 deg. Use the up/down arrows to adjust these values.
14. An extra step is required for training the Base/Part. This extra step is called ***masking***. Pattern match is most accurate when only the seal ring pattern is used as the source pattern. Everything else will be ignored or masked including the radius on the seal ring corners. Select the Masking button above the **Run Params** tab.

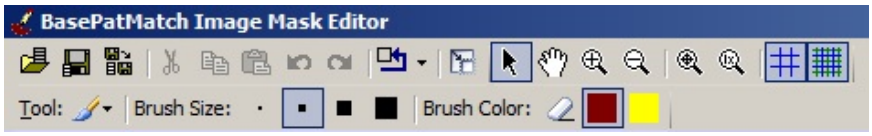
    Note: The *Vision Schedule Edit* window may have to be minimized to view the **BasePatMatch Image Mask Editor** window.

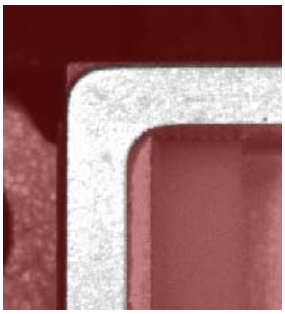


15. Select the drop down arrow next to the **Tool** options and select the **Rectangle Tool**.
16. Place your mouse cursor over the workspace and select the right-mouse button. Select the **Fit Image and Graphics** option. The green rectangle will appear much larger than the image. Reduce this rectangle to the size of the image. Start masking everything except the seal ring. First, position the rectangle so that it contains the outer part of the seal ring. From the toolbar select the **Fill Color** option (the red square) and then select the **Fill Current Selection** button. Every area that is highlighted in red will be ignored. Adjust the green rectangle a few more times to mask all areas outside the seal ring. Once this is complete, the area inside the seal ring will need to be masked as well. Do not worry about the radius in the corners at this time. That will be taken care of in the fine tuning.

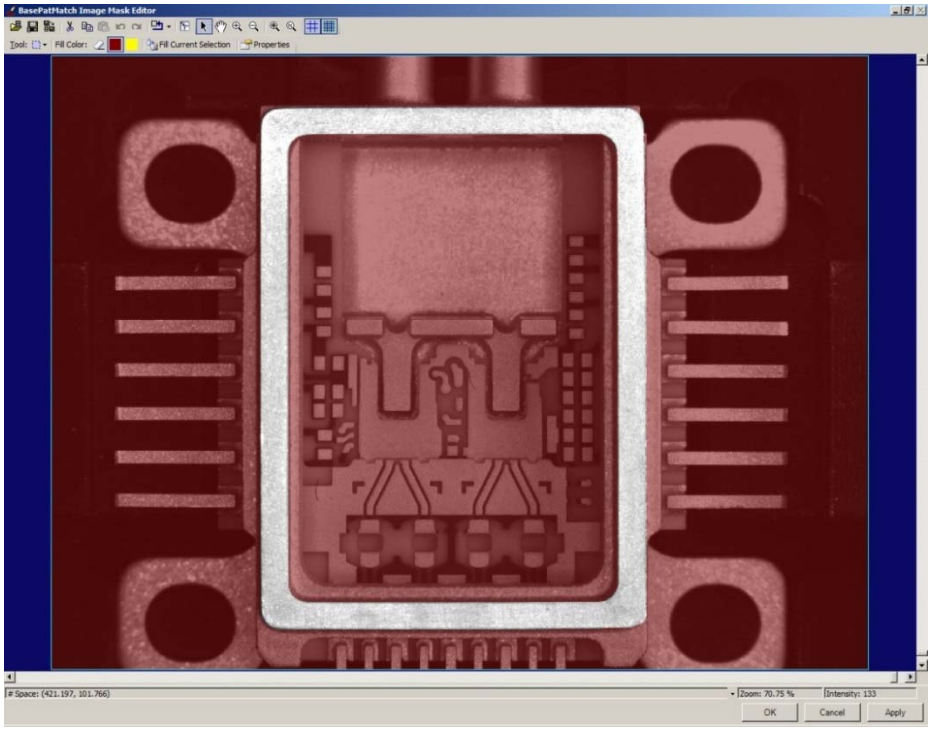
    Note: If the seal ring is accidentally masked, select the eraser (next to the red square). Highlight the masked seal ring and then select **Fill Current Selection** to delete the mask.

17. To fine tune the radius of the seal ring, select the drop down arrow next to the **Tool** options and select **Brush**. The brush size can be changed to accommodate smaller parts. Start erasing the masking that overlaps the seal ring and mask the edges that are not the seal ring. Place your mouse cursor over the part image and select the right-mouse button. Select the **Zoom In** option as necessary for easier adjustment. Alternate masking between the eraser and the red square mask until everything is masked except for the seal ring. The Pencil tool can also be used as required.

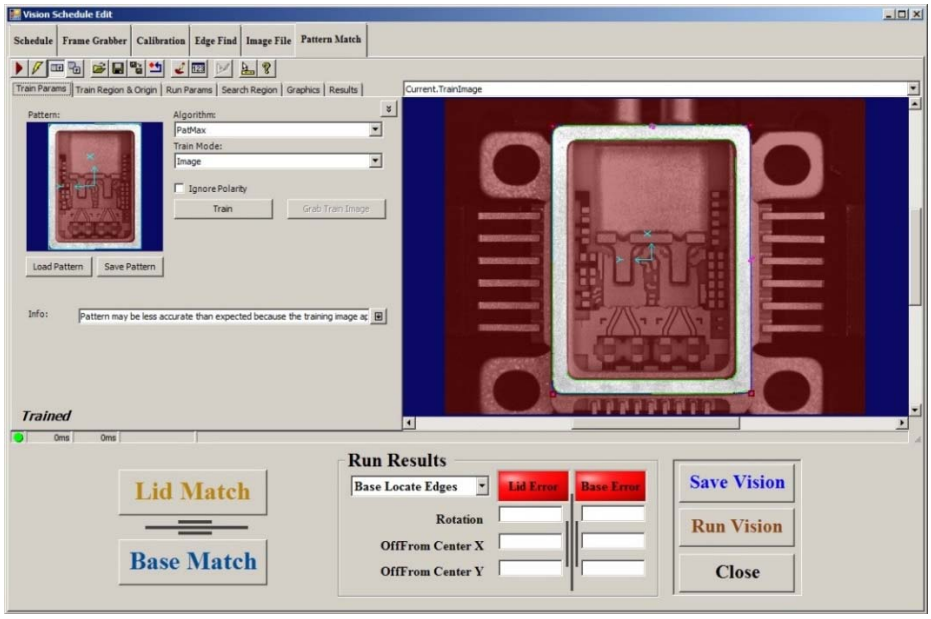




Once all masking is complete, the image will appear as shown below.



18. Once masking is complete, select the **Apply** button, followed by **OK**.
19. Select the *Vision Schedule Edit* tab on the taskbar to bring up the *Vision Schedule Edit* window.
20. Select the **Run** button on the top left corner. The scoring results should be displayed on the **Results** tab. Scores of **1** or greater than **0.95** should be obtained.
21. On the *Vision Schedule Edit* screen, select the **Graphics** tab to see the results. Some option checkboxes may have to be checked to view the result.
22. On the *Vision Schedule Edit* screen, select the **Train Params** tab once again.

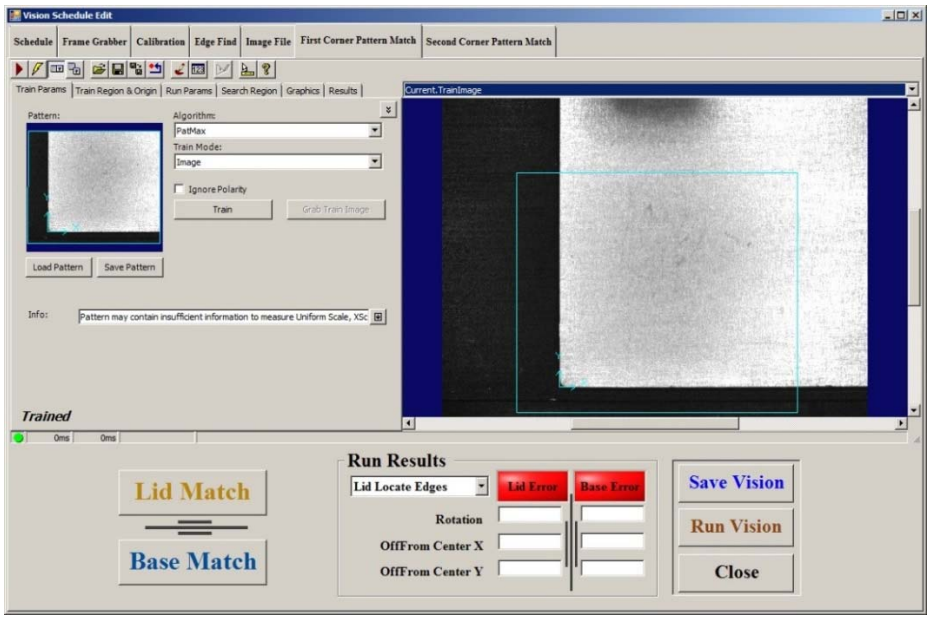


23. Select the **Train** button to complete the pattern match process for the Base/Part. An image of the Base/Part will be displayed in the **Pattern:** field.
24. Select the **Save Vision** button to save the Base/Part pattern match. The pattern match training can also be saved into a file by selecting the **Save Pattern** button and can be recalled in the future by selecting the **Load Pattern** button.

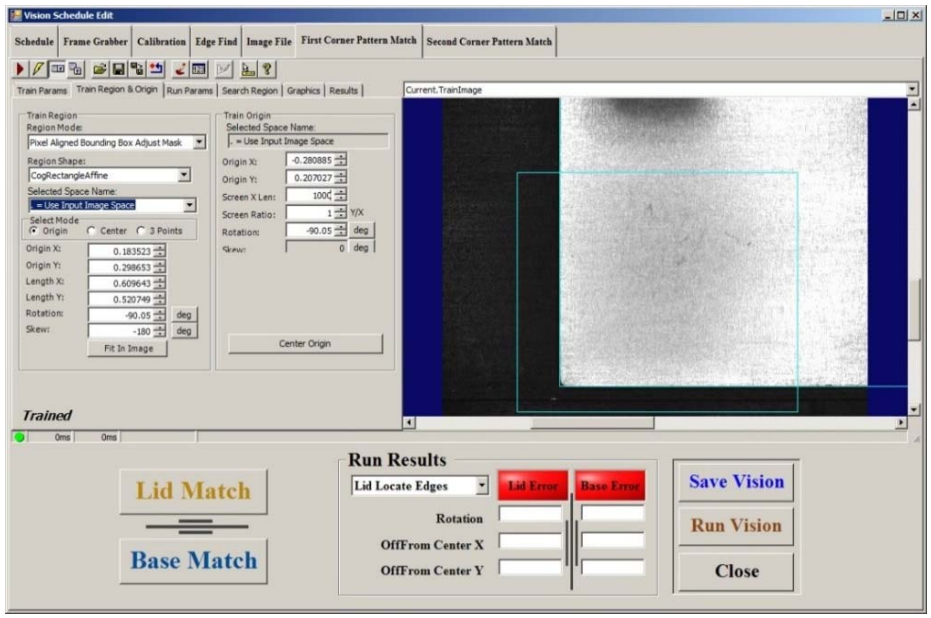
Training Lid Double Capture (Large Lid Calibration)

Training Lid on Double Capture Vision happens automatically when the Lid and Base/Part is larger than the field of view of the camera. As a result, the camera will capture 2 opposite corners of the lid and Base/Part.

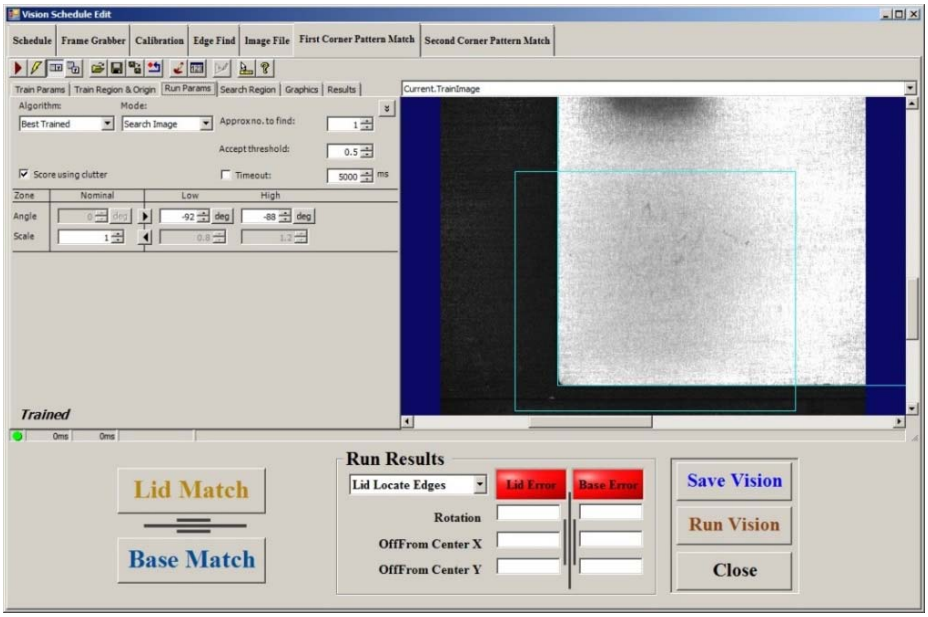
1. On the *Vision Schedule Edit* screen, select the **First Corner Pattern Match** tab followed by the **Train Params** tab.



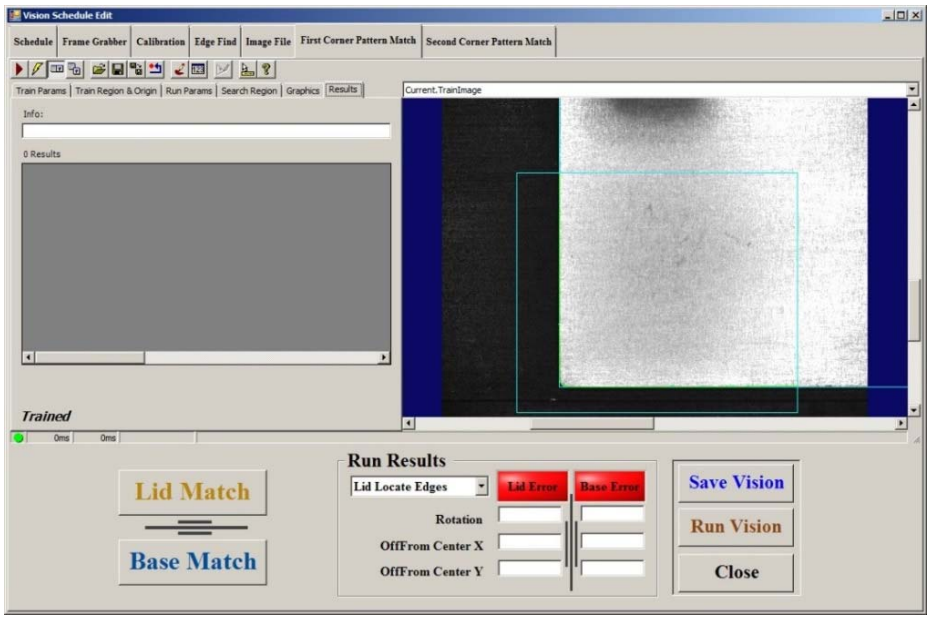
2. Select the **PatMax** option under *Algorithm* and the **Image** option under *Train Mode*.
3. Select the **Lid Locate Edges** option under *Run Results* to grab the actual lid image if not available.
4. Select the **Train** button to grab an image of the Lid for training.
5. On the *Vision Schedule Edit* screen, select the **Train Region & Origin** tab.



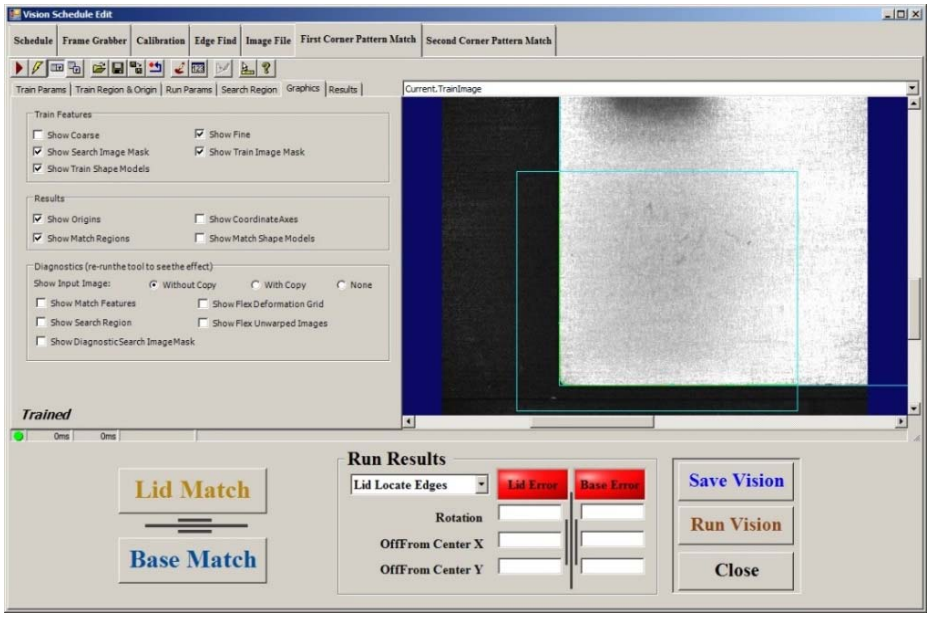
6. Place your mouse cursor over the corner of the Lid image and select the right-mouse button. Select the **Fit Image** option.
7. Select the **Fit In Image** button to move the light blue box within the image.
8. Select the **Center Origin** button under the *Train Origin* section to center the origin to the region.
9. Set the **Rotation** field value (left side) under the *Train Origin* section to -90 degrees and the **Screen X Len** field value to 1000.
10. Adjust the origin so that the X and Y lines are on the edge of the lid as shown in the picture above. The **Rotation** field value may need to be adjusted (using the up/down arrows) if the Lid is at an angle.
11. After the region adjustment is complete and was adjusted to a value other than -90, then make sure to modify the **Rotation** angle field above the *Center Region* button to match the **Rotation** value obtained in the previous step.
12. On the *Vision Schedule Edit* screen, select the **Run Params** tab.



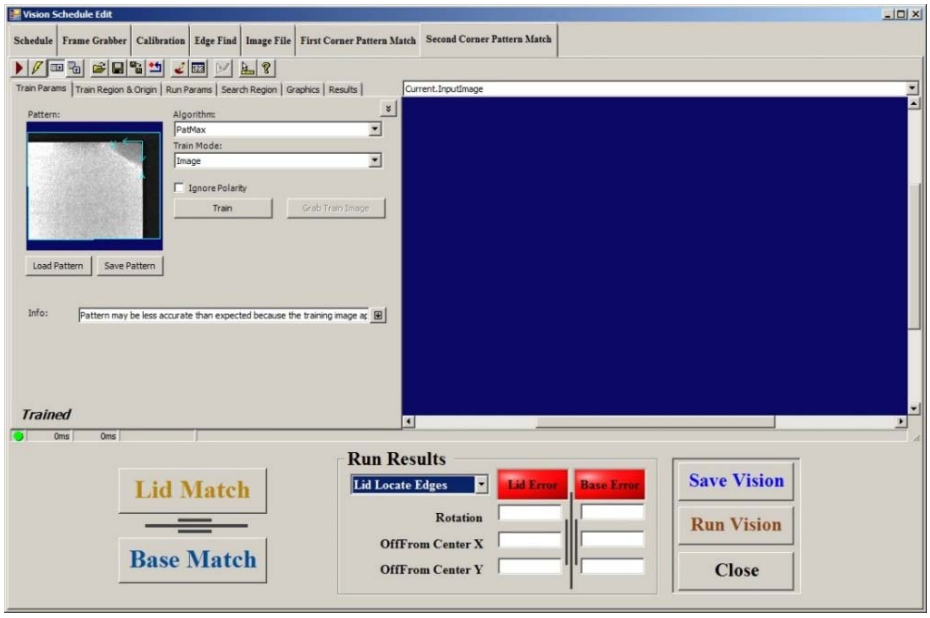
13. Set the **Accept threshold** value so that it will reject Lids with lower pattern match scores. A value of 0.8 is recommended but this value can be raised until the rejection rate is acceptable.
14. The **Low** and **High** *Angle* values must be set to **Low** = -92 deg and **High** = -88 deg. Use the up/down arrows next to the Low/High fields to adjust these values.
15. Select the Run button on the top left corner. The pattern match scoring result should be displayed on the **Results** tab. Scores of **1** or greater than **0.95** should be obtained.



16. On the *Vision Schedule Edit* screen, select the **Graphics** tab to see the scoring results. Verify the **Results** options are selected as shown below.



17. On the *Vision Schedule Edit* screen, select the **Train Params** tab once again.

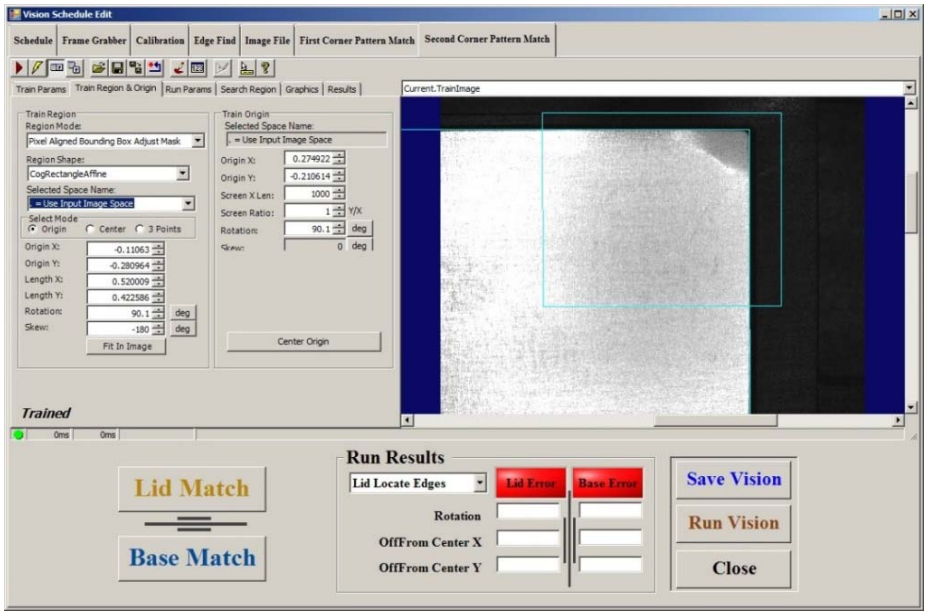


18. Select the **Train** button to complete the pattern match training for one corner of the Lid. An image of the Lid will be displayed in the **Pattern:** field.
19. Select the **Save Vision** button to save the Lid pattern match. The pattern match training can also be saved into a file by selecting the **Save Pattern** button and can be recalled in the future by selecting the **Load Pattern** button.

The lid pattern match training is not complete yet because there is another corner that needs to be trained (calibrated).

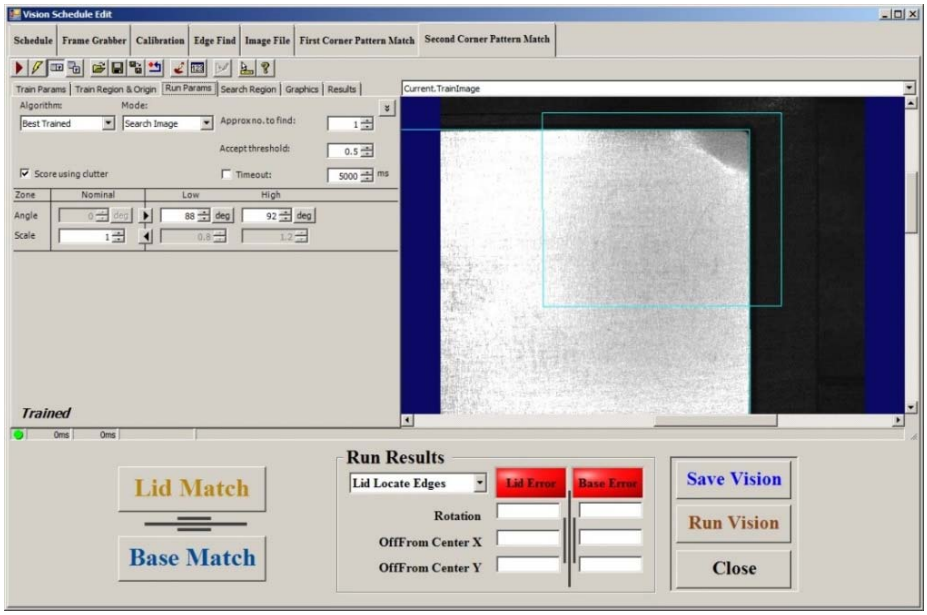
20. On the *Vision Schedule Edit* screen, select the **Second Corner Pattern Match** tab followed by the **Train Params** tab.
21. Select the **PatMax** option under *Algorithm* and the **Image** option under *Train Mode*.
22. Select the **Lid Locate Edges** option under *Run Results* to grab the actual Lid image if not available.
23. Select the **Train** button to grab an image of the Lid.

24. On the Vision Schedule Edit screen, select the **Train Region & Origin** tab.

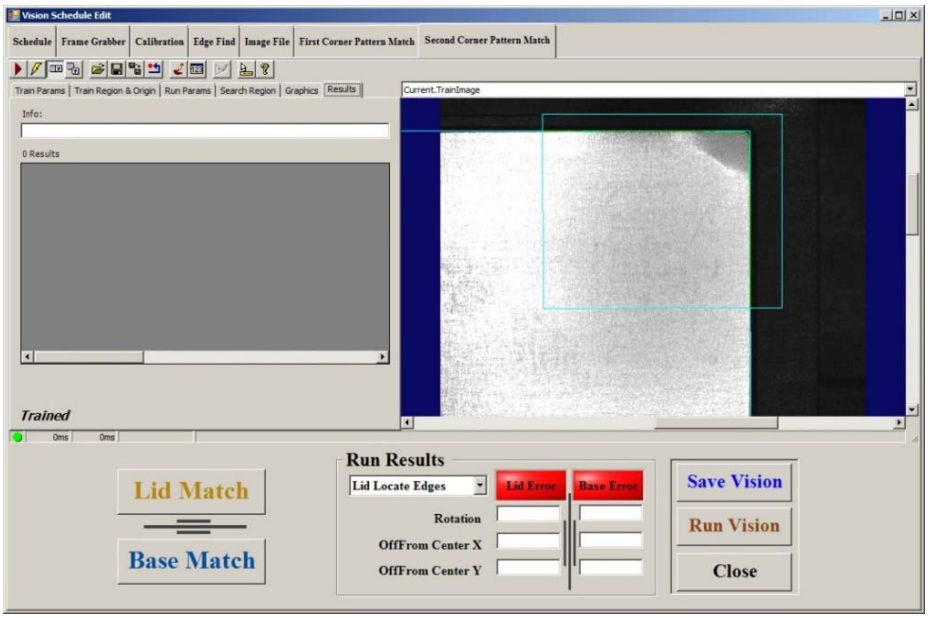


25. Place your mouse cursor over the corner of the Lid image and select the right-mouse button. Select the **Fit Image** option.
26. Select the **Fit In Image** button to move the light blue box within the image.
27. Select the **Center Origin** button under the *Train Origin* section to center the origin to the region.
28. Set the **Rotation** field value (left side) under the *Train Origin* section to 90 degrees and **Screen X Len** field value to 1000.
29. Adjust the origin so that the X and Y lines are on the edge of the lid as shown on the picture above. The **Rotation** field value may need to be adjusted (using the up/down arrows) if the Lid is at an angle. After the region adjustment is complete, modify the **Rotation** field above the *Center Origin* button to match the **Rotation** value obtained in the previous step.

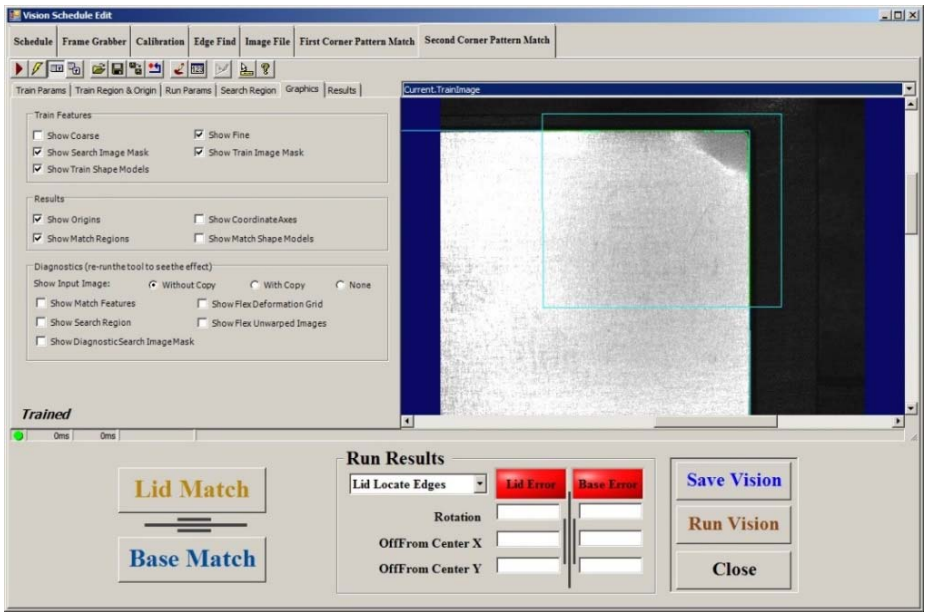
30. Select the **Run Params** tab.



31. Set the **Accept threshold** value so that it will reject Lids with lower pattern match scores. A value of 0.8 is recommended but this value can be raised until the rejection rate is acceptable.
32. The **Low** and **High** *Angle* values must be set to **Low** = 88 deg and **High** = 92 deg. Use the up/down arrows next to the Low/High fields to adjust these values.
33. Select the **Run** button  on the top left corner. The pattern match scoring result should be displayed on the **Results** tab. Scores of **1** or greater than **0.95** should be obtained.



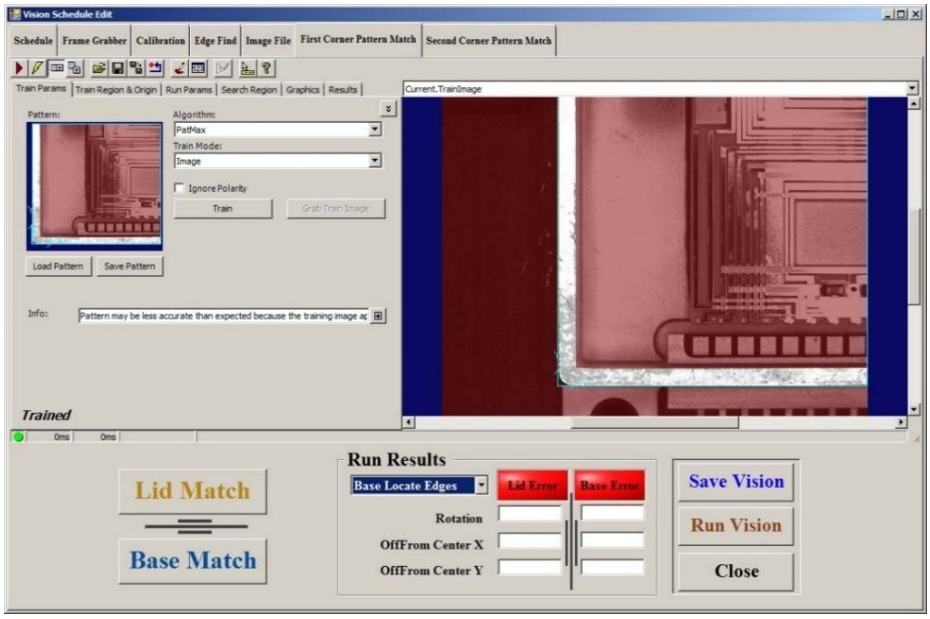
34. On the *Vision Schedule Edit* screen, select the **Graphics** tab to see the scoring results. Verify the **Results** options are selected as shown below.



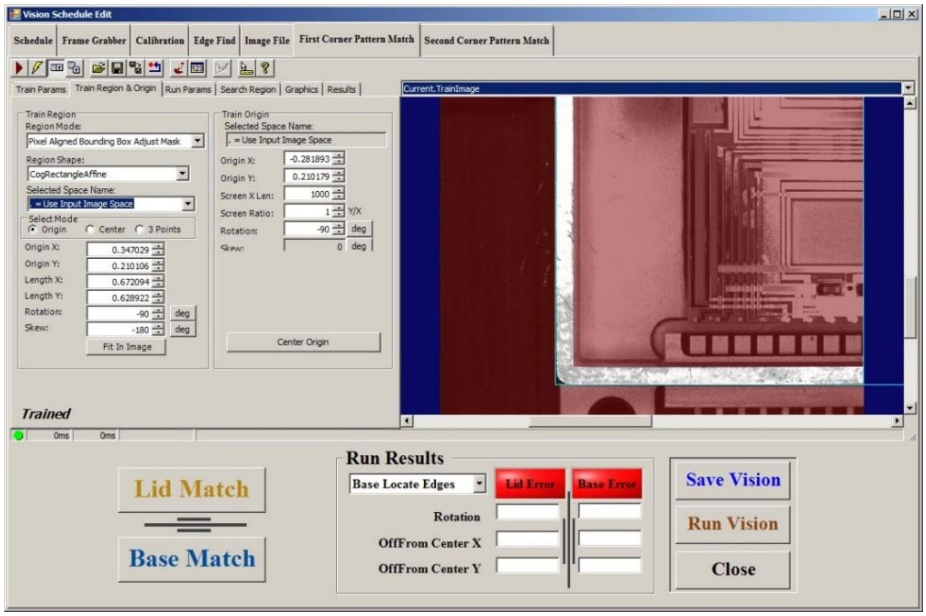
35. On the *Vision Schedule Edit* screen, select the **Train Params** tab once again.
36. Select the **Train** button to complete the pattern match training for the Lid. An image of the Lid will be displayed in the **Pattern:** field.
37. Select the **Save Vision** button to save the Lid pattern match. The pattern match training can also be saved into a file by selecting the **Save Pattern** button and can be recalled in the future by selecting the **Load Pattern** button.

Training Base Double Capture

1. On the *Vision Schedule Edit* screen, select the **First Corner Pattern Match** tab followed by the **Train Params** tab.

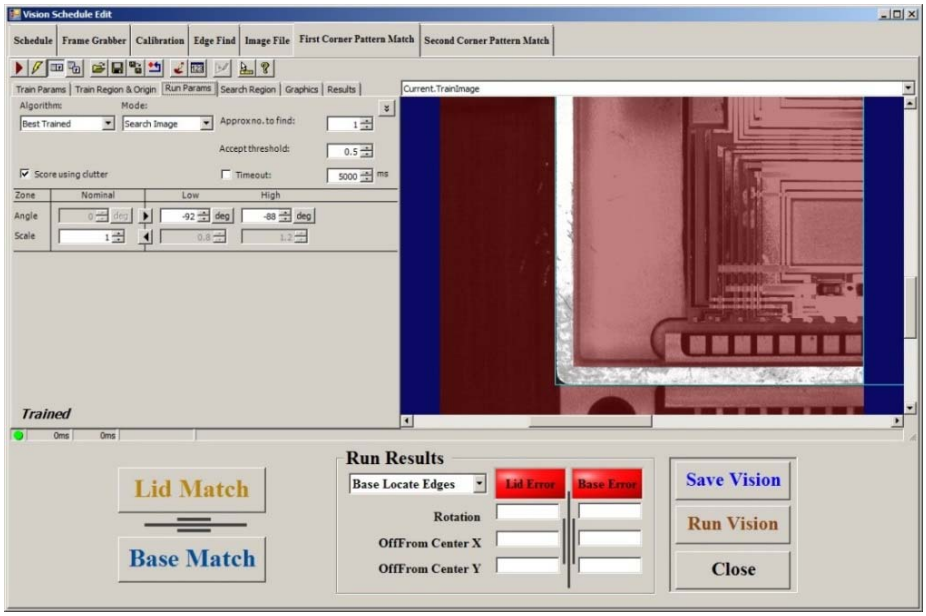


2. Select the **PatMax** option under *Algorithm* and the **Image** option under *Train Mode.*
3. Select the **Base Locate Edges** option under *Run Results*.
4. Select the **Run Vision** button to obtain the image of the Base/Part.
5. Select the **Train** button to grab an image of the Base/Part.
6. On the *Vision Schedule Edit* Screen, select the **Train Region & Origin** tab.



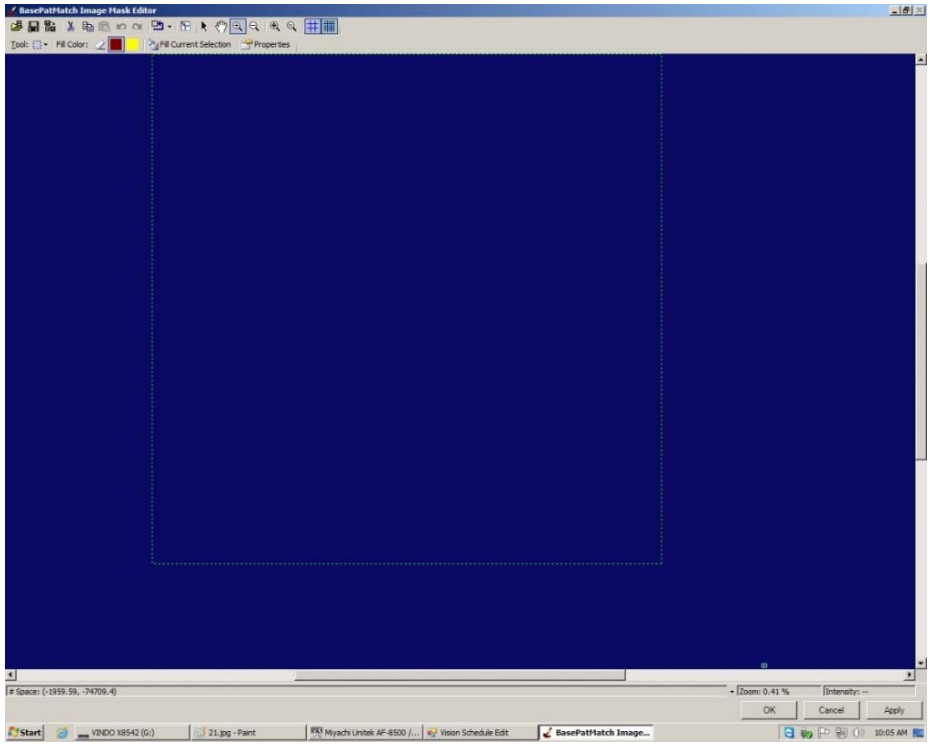
7. Place your mouse cursor over the corner of the Base image and select the right-mouse button. Select the **Fit Image** option.

8. Select the **Fit In Image** button under the *Train Region* section to move the light blue box within the image.
9. Select the **Center Origin** button under the *Train Origin* section to center the origin to the region.
10. Set the **Rotation** field value under Train Origin section to -90 degrees.
11. Adjust the origin so that the X and Y lines are on the edge of the Base/Part as shown in the picture above. The **Rotation** value set in the previous step may need to be adjusted if the actual Base/Part is at an angle. If the **Rotation** value is adjusted to a value other than -90, then make sure to modify the **Rotation** value under the *Train Region* section to match this value.
12. Select the **Run Params** tab



13. The **Accept threshold** can be adjusted higher so that it will reject bases with lower scores. A value of 0.8 is recommended but is user adjustable.
14. Verify the **Angle** – **Low** and **High** values are set to -92 deg (Low) and -88 deg (High). Use the up/down arrows to adjust the values.
15. An extra step is required for training the Base/Part. This extra step is called ***masking***. Pattern match is most accurate when only the seal ring pattern is used as the source pattern. Everything else will be ignored or masked including the radius on the seal ring corners. Select the masking button above the **Run Params** tab.

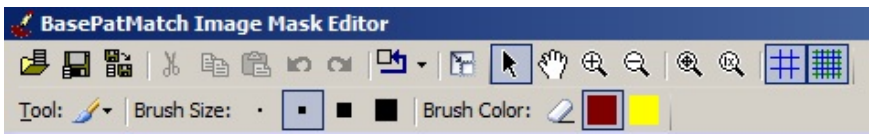
    Note: The Vision Schedule Edit window may have to be minimized to view the **BasePatMatch Image Mask Editor** window.

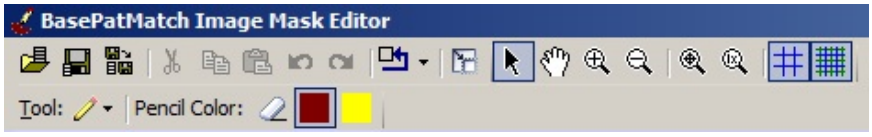


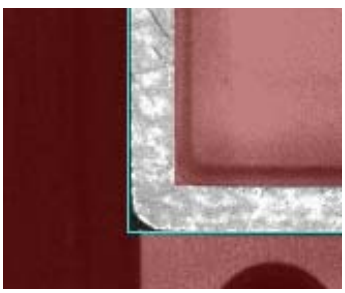
16. Select the drop down arrow next to the **Tool** options and select the **Rectangle Tool**.
17. Place your mouse cursor over the workspace and select the right-mouse button. Select the **Fit Image and Graphics** option. The green rectangle will appear much larger than the image. Reduce this rectangle to the size of the image. Start masking everything except the seal ring. First, position the rectangle so that it contains the outer part of the seal ring. From the toolbar select the **Fill Color** option (the red square) and then select the **Fill Current Selection** button. Every area that is highlighted in red will be ignored. Adjust the green rectangle a few more times to mask all areas outside the seal ring. Once this is complete, the area inside the seal ring will need to be masked as well. Do not worry about the radius in the corners at this time. That will be taken care of in the fine tuning.

    Note: If the seal ring is accidentally masked, select the eraser (next to the red square). Highlight the masked seal ring and then select **Fill Current Selection** to delete the mask.

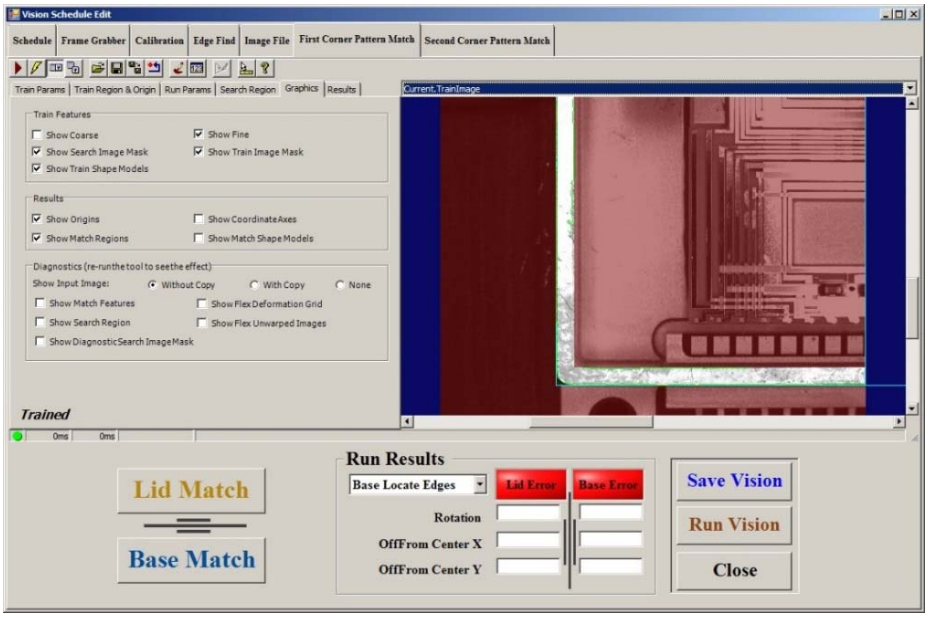
18. To fine tune the radius of the seal ring, select the drop down arrow next to the Tool options and select **Brush**. The brush size can be changed to accommodate smaller parts. Start erasing the masking that overlaps the seal ring and mask the edges that are not the seal ring. Place your mouse cursor over the part image and select the right-mouse button. Select the **Zoom In** option as necessary for easier adjustment. Alternate masking between the eraser and the red square mask until everything is masked except for the seal ring. The Pencil tool can also be used as required.



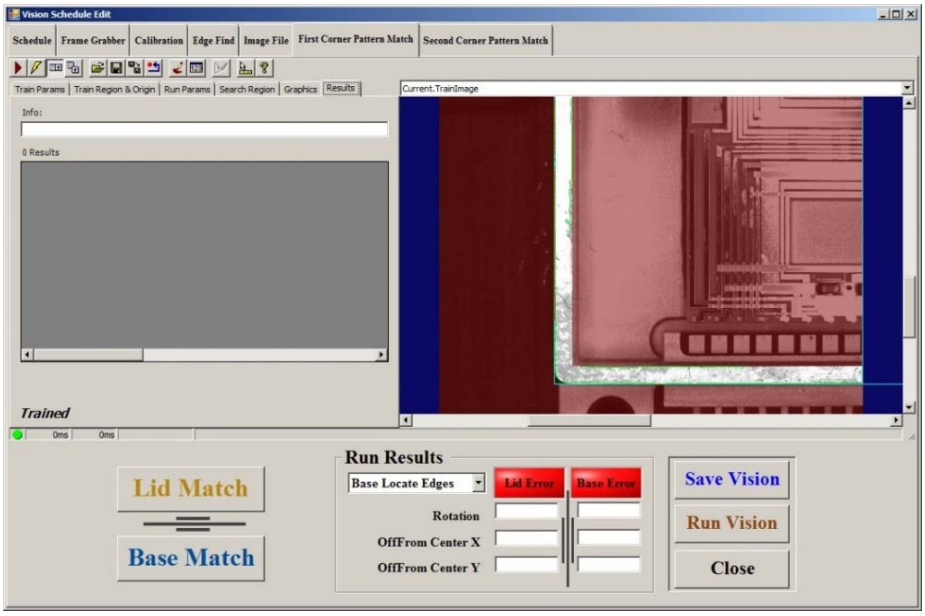




Once all masking is complete, the image will appear as shown below.



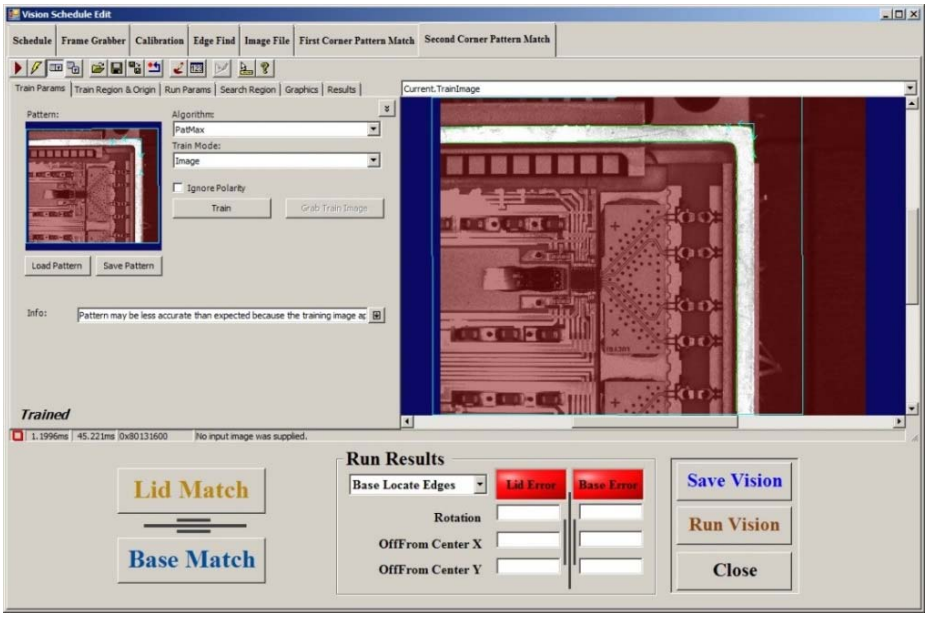
19. Once masking is complete, select the **Apply** button, followed by **OK**.
20. Select the *Vision Schedule Edit* tab on the taskbar to bring up the *Vision Schedule Edit* window.
21. Select the **Run** button ▶ on the top left corner. The scoring result should be displayed on the **Results** tab. Scores of **1** or greater than **0.95** should be obtained.
22. On the *Vision Schedule Edit* screen, select the **Graphics** tab to see the results. Some option checkboxes may have to be checked to view the result.
23. On the *Vision Schedule Edit* screen, select the **Train Params** tab once again.



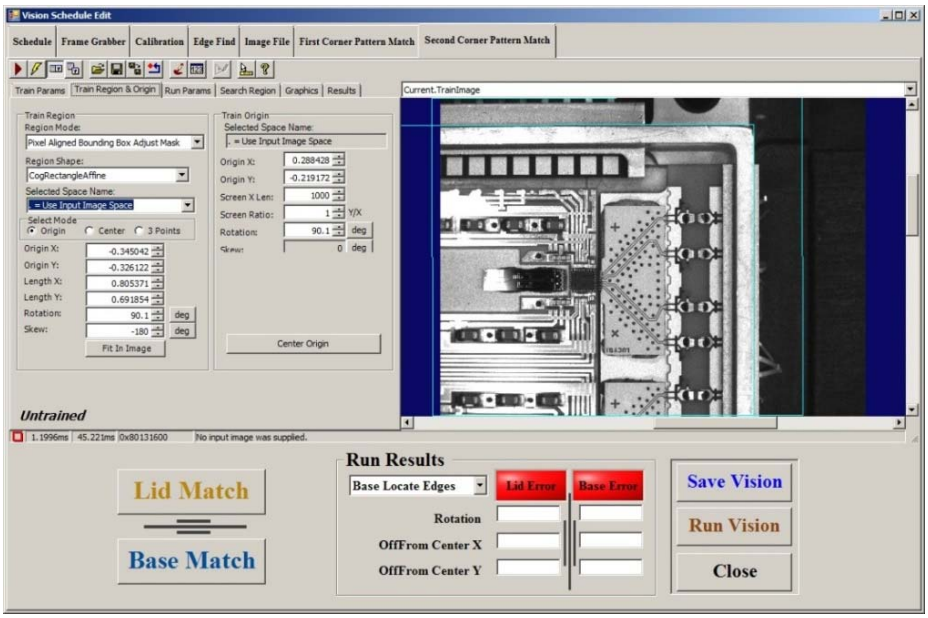
24. Select the **Train** button to complete training of the pattern match for one corner of the Base/Part. An image of the Base/Part will be displayed in the **Pattern:** field.
25. Select the **Save Vision** button to save the Base/Part pattern match. The pattern match training can also be saved into a file by selecting the **Save Pattern** button and can be recalled in the future by selecting the **Load Pattern** button.

The Base/Part pattern match training is not complete yet because there is another corner that needs to be trained (calibrated).

26. On the *Vision Schedule Edit* screen, select the **Second Corner Pattern Match** tab followed by the **Train Params** tab.

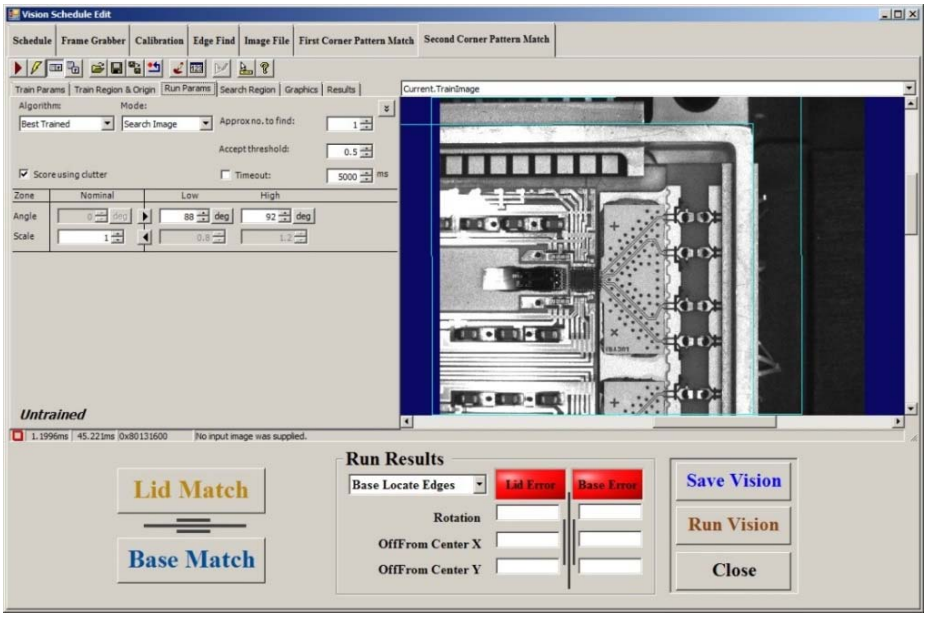


27. Select the **PatMax** option under *Algorithm* and the **Image** option under *Train Mode*.
28. Select the **Base Locate Edges** option under *Run Results* to grab the actual Base image if not available.
29. Select the **Train** button to grab an image of the Base/Part.
30. On the *Vision Schedule Edit* screen, select the **Train Region & Origin** tab.



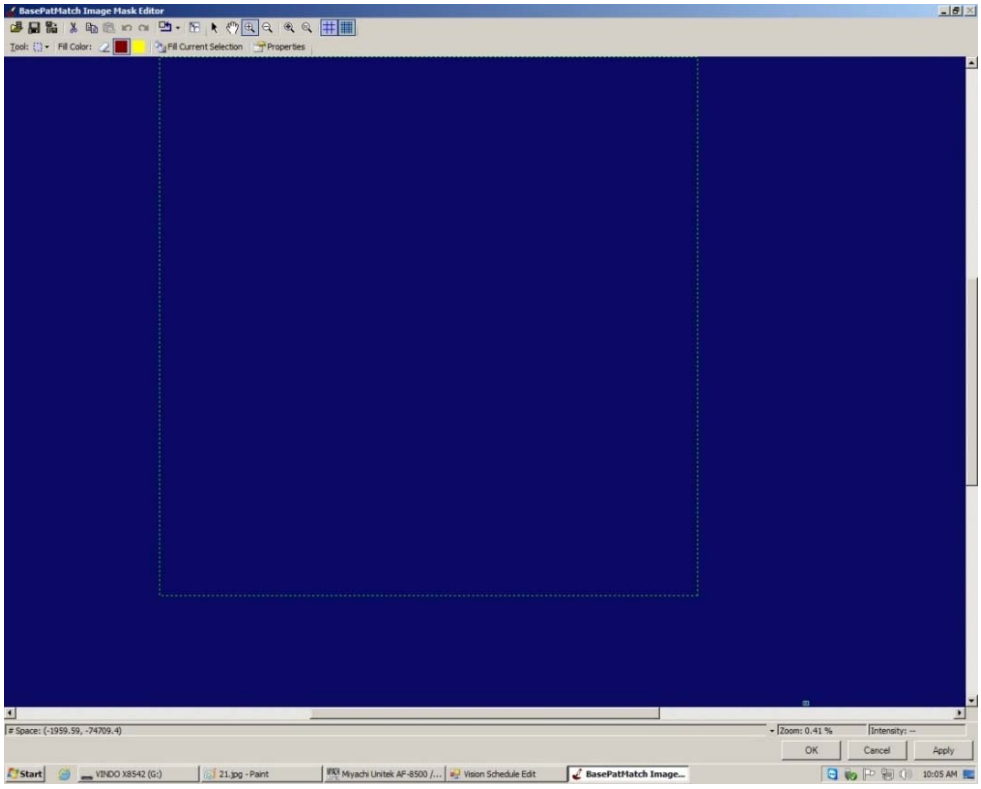
31. Place your mouse cursor over the corner of the Base/Part image and select the right-mouse button. Select the **Fit Image** option.
32. Select the **Fit In Image** button under the *Train Region* section to move the light blue box within the image.
33. Select the **Center Origin** button under *Train Origin* section to center the origin to the region.

34. Set the **Rotation** field value under the *Train Origin* section to 90 degrees and the **Screen X Len** field value to 1000.
35. Adjust the origin so that the X and Y lines are on the edge of the Base/Part as shown on the picture above. The **Rotation** value set in the previous step may need to be adjusted if the actual Base/Part is at an angle. If the **Rotation** value is adjusted to a value other than 90, then make sure to modify the **Rotation** value under the *Train Region* section to match this value.
36. Select the **Run Params** tab.



37. The **Accept threshold** value can be adjusted higher so that it will reject bases with lower scores. A value of 0.8 is recommended but is user adjustable.
38. Verify the **Angle** – **Low** and **High** values are set to 88 deg (Low) and 92 deg (High). Use the up/down arrows to adjust these values.
39. An extra step is required for training the Base/Part. This extra step is called ***masking***. Pattern match is most accurate when only the seal ring pattern is used as the source pattern. Everything else will be ignored or masked including the radius on the seal ring corners. Select the Masking button above the **Run Params** tab.

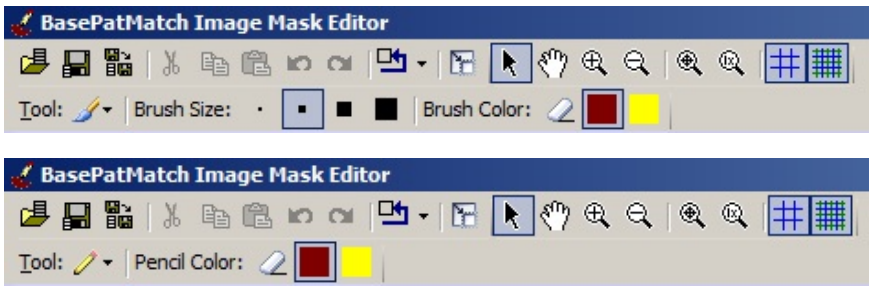
    Note: The *Vision Schedule Edit* window may have to be minimized to view the **BasePatMatch Image Mask Editor** window.

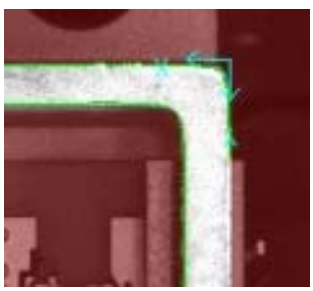


40. Select the drop down arrow next to the Tool options and select the **Rectangle Tool**.
41. Place your mouse cursor over the workspace and select the right-mouse button. Select the **Fit Image and Graphics**. The green rectangle will appear much larger than the image. Reduce this rectangle to the size of the image. Start masking everything except the seal ring. First, position the rectangle so that it contains the outer part of the seal ring. From the toolbar select the **Fill Color** option (the red square) and then select the **Fill Current Selection** button. Every area that is highlighted in red will be ignored. Adjust the green rectangle a few more times to mask all areas outside the seal ring. Once this is complete, the area inside the seal ring will need to be masked as well. Do not worry about the radius in the corners at this time. That will be taken care of in the fine tuning.

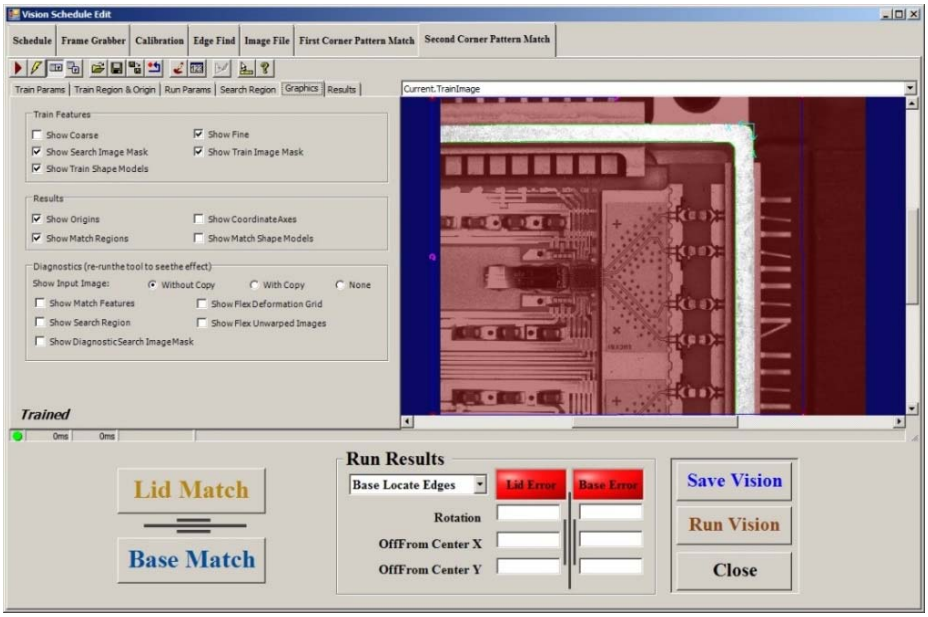
    Note: If the seal ring is accidentally masked, select the eraser (next to the red square). Highlight the masked seal ring and then select **Fill Current Selection** to delete the mask.

42. To fine tune the radius of the seal ring, select the drop down arrow next to the **Tool** options and select **Brush**. The brush size can be changed to accommodate smaller parts. Start erasing the masking that overlaps the seal ring and mask the edges that are not the seal ring. Place your mouse cursor over the part image and select the right-mouse button. Select the **Zoom In** option as necessary for easier adjustment. Alternate masking between the eraser and red square mask until everything is masked except for the seal ring. The Pencil tool can also be used as required.

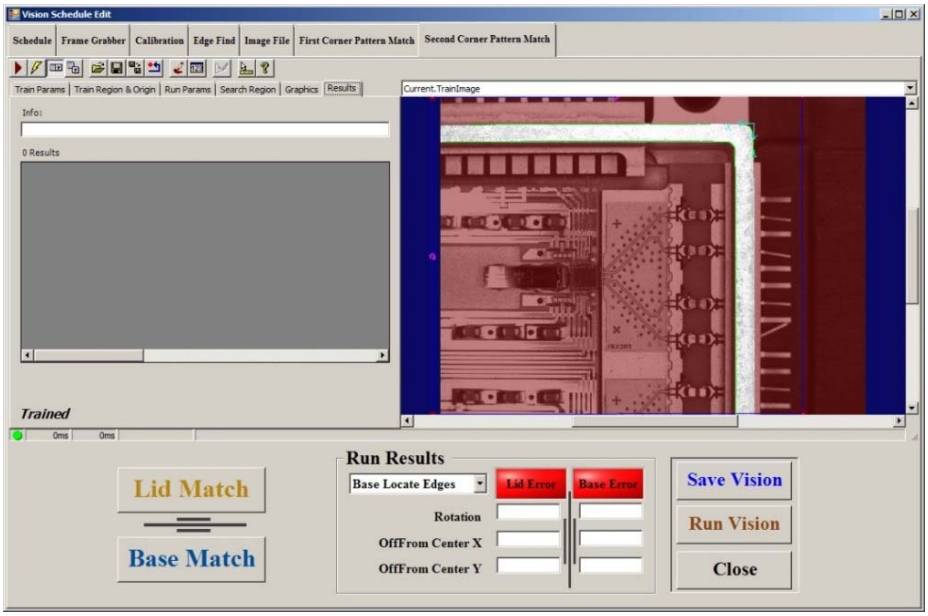




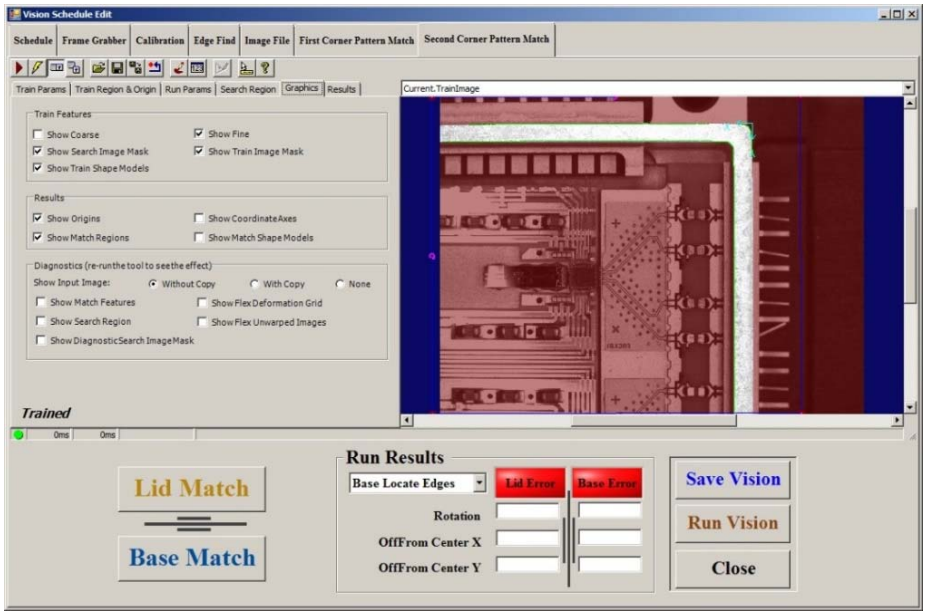
Once masking is complete, the image will appear as shown below.



43. Once masking is complete, select the **Apply** button, followed by **OK**.
44. Select the *Vision Schedule Edit* tab on the taskbar to bring up the *Vision Schedule Edi*t window.
45. Select the **Run** button ▶ on the top left corner. The scoring result should be displayed on the **Results** tab. Scores of **1** or greater than **0.95** should be obtained.



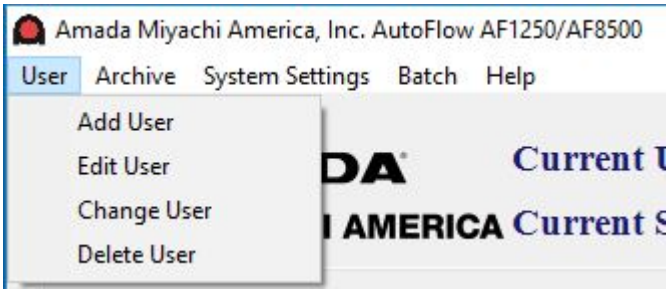
46. On the *Vision Schedule Edit* screen, select the **Graphics** tab to see the scoring results. Verify the **Results** options are selected as shown below.



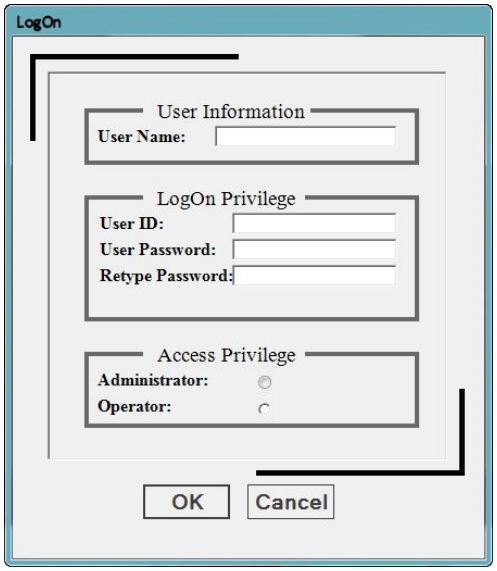
47. On the *Vision Schedule Edit* screen, select the **Train Params** tab once again.
48. Select the **Train** button to complete the pattern match process for the Base/Part. An image of the Base/Part will be displayed in the **Pattern:** field.
49. Select the **Save Vision** button to save the Base/Part pattern match. The pattern match training can also be saved into a file by selecting the **Save Pattern** button and can be recalled in the future by selecting the **Load Pattern** button.

Pull-Down Menus

User Menu

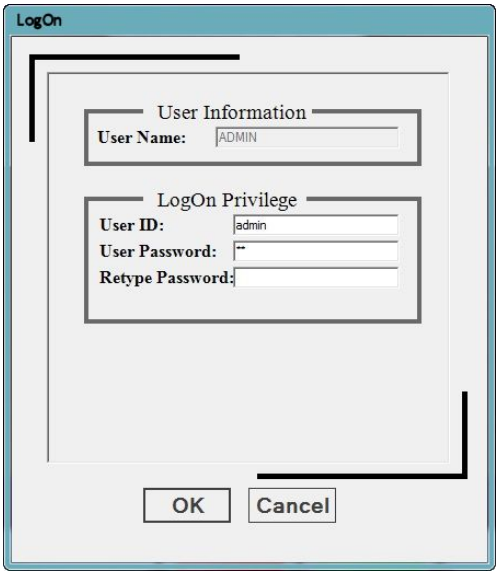


The **User** menu is used to control who can access the AF system. The options include; Add User, Edit User, Change User and Delete User.



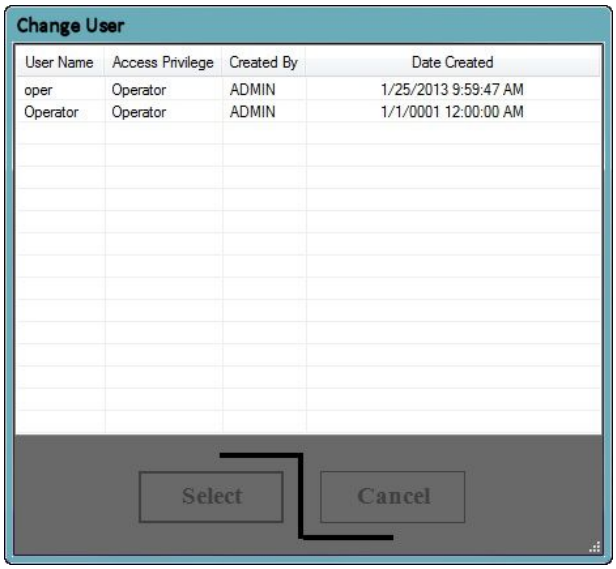
Add User – Allows Administrator to add a User. An Operator without Administrator privileges cannot add a user.

- Enter displayed user name
- Enter User ID and Password (twice)
- Select access privileges for the user
- Select **OK** to add new User



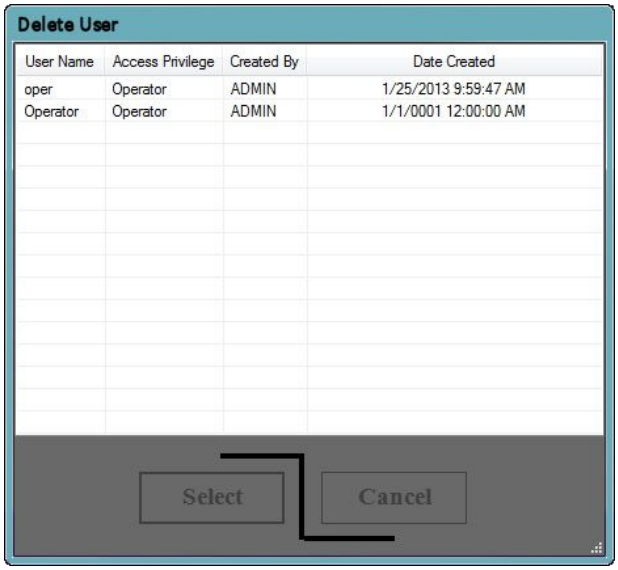
Edit User – Allows either a User or Administrator to change their password.

- Type in a new Password (twice)
- Select **OK** to register new password



Change User – Allows the current User to change to another User.

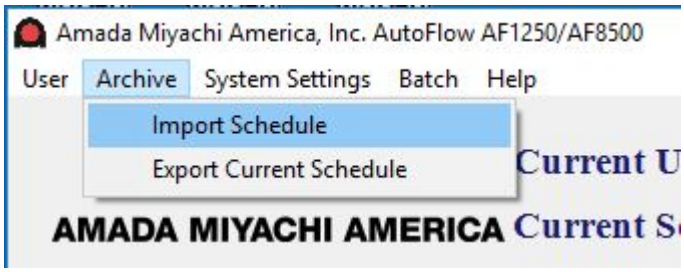
- Select a different User from the window.
- Log-in using the new User's ID and Password



Delete User – Allows the Administrator to delete a User. Users without Administrator privileges cannot delete a User.

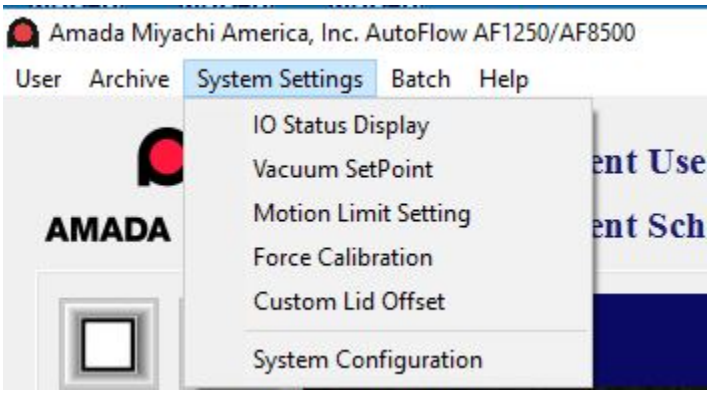
- Select the User that you want to delete.

Archive Menu



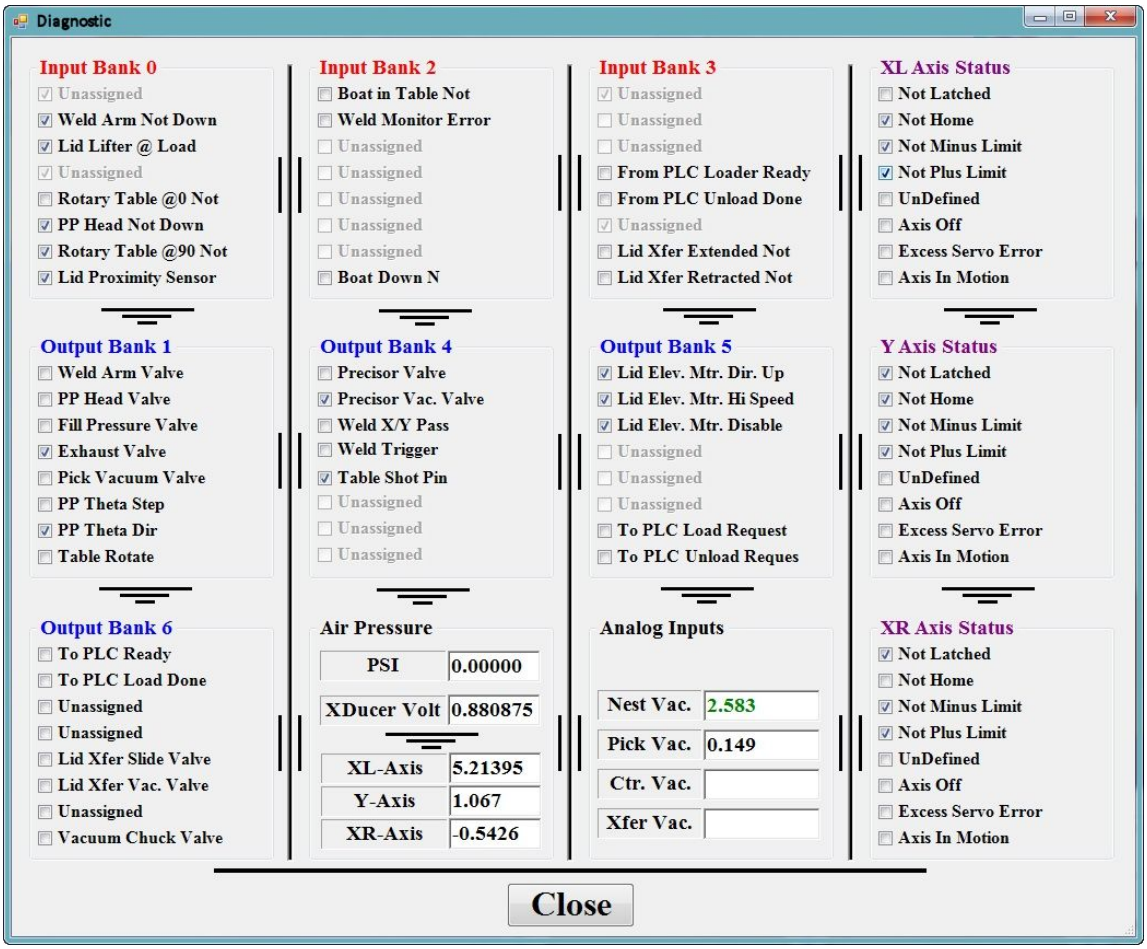
The **Archive** menu allows for Weld Schedule import and export functions. During import, make sure receiving system does not have the same weld schedule name.

System Settings Menu



The System Settings menu consists of global system settings and status. The options include; IO Status, Vacuum Set-Point, Motion Limit Setting, Force Calibration and System Configuration.

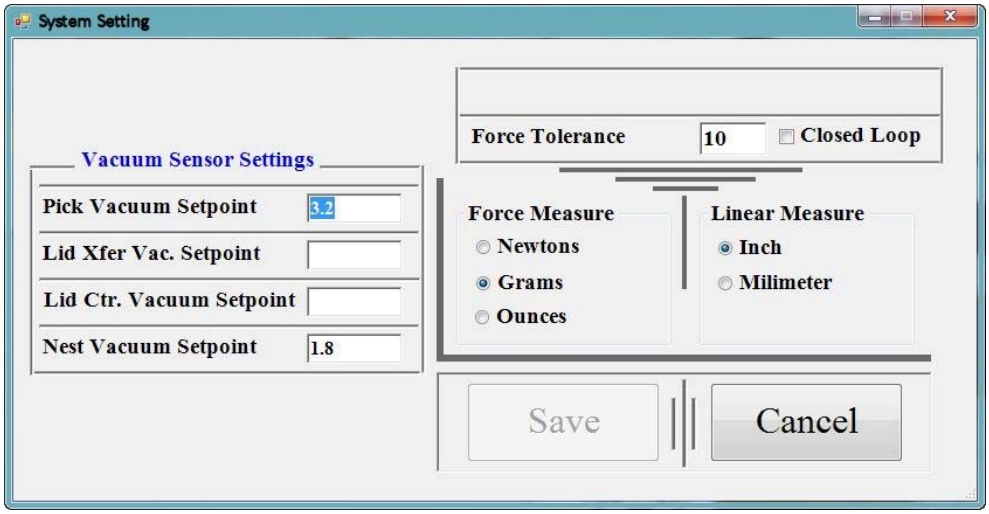
1) IO Status Display



The IO screen displays the status of the motion controller, digital and analog inputs and all three axes. In addition the Digital outputs can also be triggered.

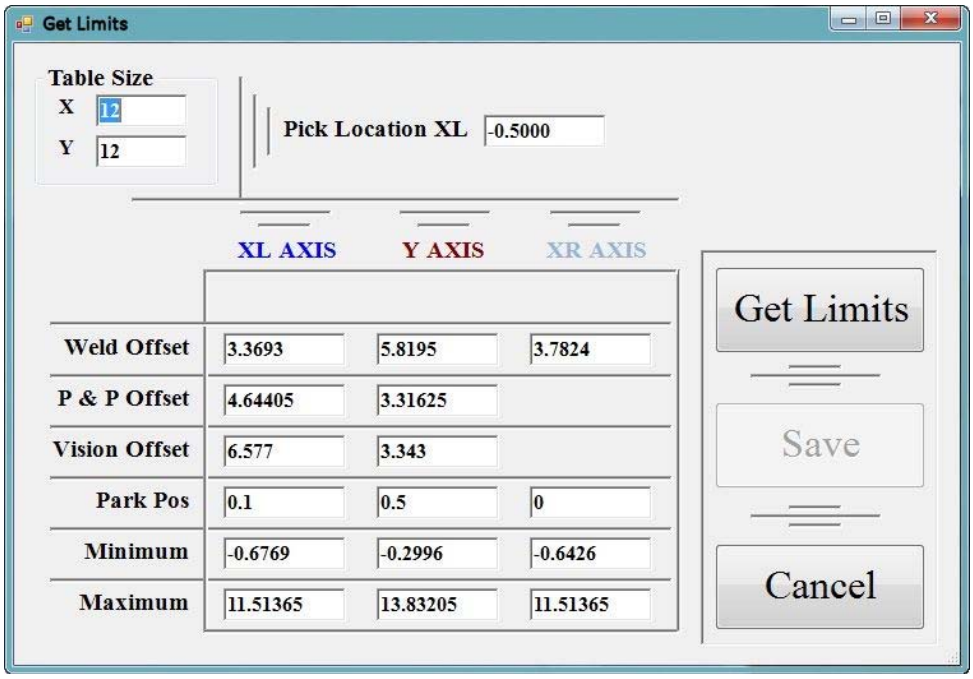
The IO screen is very useful for troubleshooting and calibrating the system.

2) Vacuum Setpoint



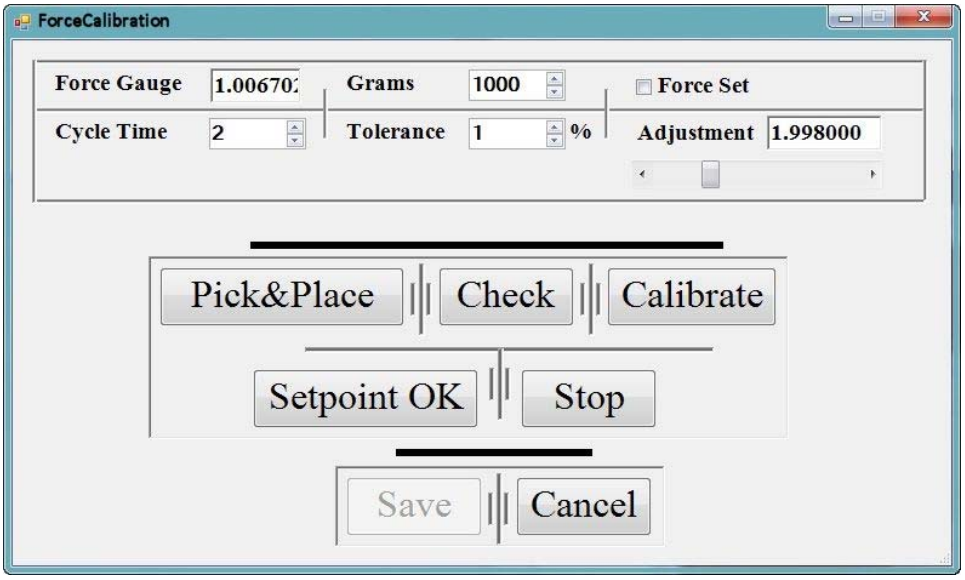
The motion controller reads the vacuum level as an analog input. All vacuum setpoints for the vacuum system are set on this screen. The default **Pick Vacuum Setpoint** is 3.2. This value defines the minimum acceptable vacuum level. If the motion controller reads the vacuum level and its value is below 3.2, then the system will report no vacuum.

3) **Motion Limit Setting**



Get Limits is performed during system calibration. The main purpose of the **Get Limits** test is to determine the maximum travel distance for all axes. The values are stored in the settings file and displayed on the *Motion Limit Setting* screen. When **Get Limits** is selected, the system will perform a motions test that will calculate the travel limits. Select **Save** once the motion test is complete.

4) Force Calibration

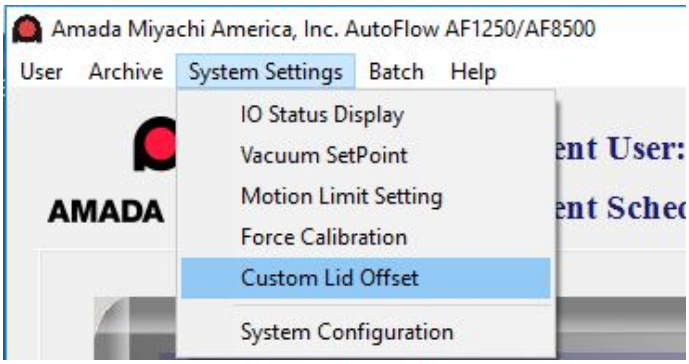


Force calibration sets the force coefficients for the tack and weld electrode. A force gauge is required to perform this calibration procedure.

When **Pick & Place** is selected, the tack electrodes will be calibrated. Procedure:

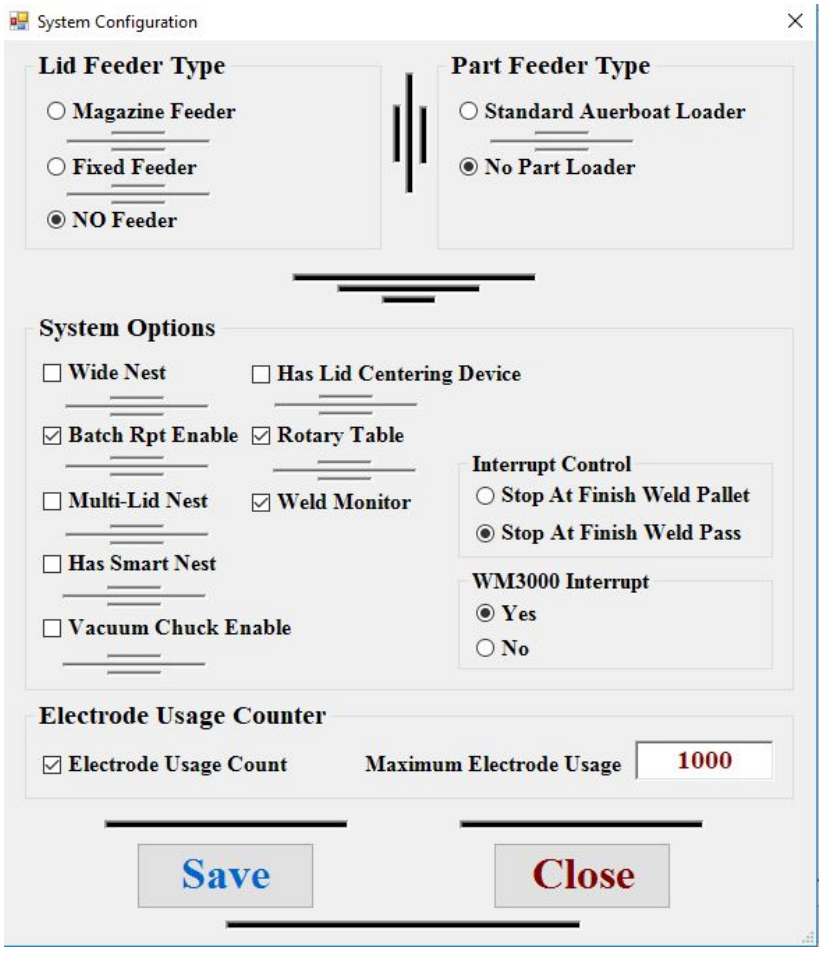
- Select **Pick & Place** to change it to **Weld** where the weld electrodes will be calibrated.
- **Cycle Time** is usually set to 5 seconds and **Tolerance** set to 5 %.
- Select **Check** to make sure the electrodes extend down and triggers the force gauge to preset force.
- Select **Calibrate** to initiate 2 point force calibration routine.
- The 2 point force calibration set points are 1000 and 2500 grams.
- To calibrate force at 1000 grams, adjust the slide bar under the adjustment field to lower or raise the force coefficient until external force gauge reads 1000 grams ± 5% then select **Setpoint OK**. At this point the GRAMS field set-point will automatically display 2500 grams. Adjust the slide bar under the adjustment field to lower or raise the force coefficient until external force gauge reads 2500 grams ± 5% then select **Setpoint OK**.
- Select **Save** once the process is finished. Make sure to calibrate both the tack and weld electrodes.

5) Custom Lid Offset



This function allows lid placement correction prior to tacking when a consistent lid placement misalignment is seen at specific locations in the matrix fixture. This can be achieved by creating a data table consisting of a matrix of X, Y, and R values separated with commas which corresponds to a specific location in the matrix fixture.
A positive "X" distance value will move the lid to the right and a negative value to the left.
A positive "Y" distance value move the lid upwards and a negative value downwards.
A positive "R" value will rotate the lid clockwise and a negative value counter clockwise

6) **System Configuration**



The system configuration windows consists of:

Lid Feeder Type

a) ○ **Magazine Feeder** – Lids are being fed using a lid magazine.
b) ○ **Fixed Feeder** – Lids are being fed with a fixed mechanical fixture.
c) ○ **No Feeder** – Lid feeder is not available.

Part Feeder Type

a) ○ **Standard Auer Boat Loader** – Parts are loaded on an Auer Boat magazine.
b) ○ **No Part Loader** – Part loader is not available.

System Options

a) ☐ **Wide Nest**
b) ☐ **Batch Rpt Enable**
c) ☐ **Multi-Lid Nest**
d) ☐ **Has Smart Nest** – Smart Nest loads Auer Boats and has vacuum chuck that holds down parts before they are being processed.
e) ☐ **Vacuum Chuck Enable** – Vacuum chuck holds down parts seated in the nest to ensure parts do not move during motion.
f) ☐ **Has Lid Centering Device** – Lid Centering Device is available to hold the lid where it will be picked by the pick head.
g) ☐ **Rotary Table** – Adds a table rotate option for seamsealing both the horizontal and vertical sides of the part.
h) ☐ **Weld Monitor** – Add a weld monitor option. This option includes interrupting the motion when the weld monitor detects sparks during the seamsealing process.

Interrupt Control

a) ○ **Stop at Finish Weld Pallet**
b) ○ **Stop at Finish Weld Pass**

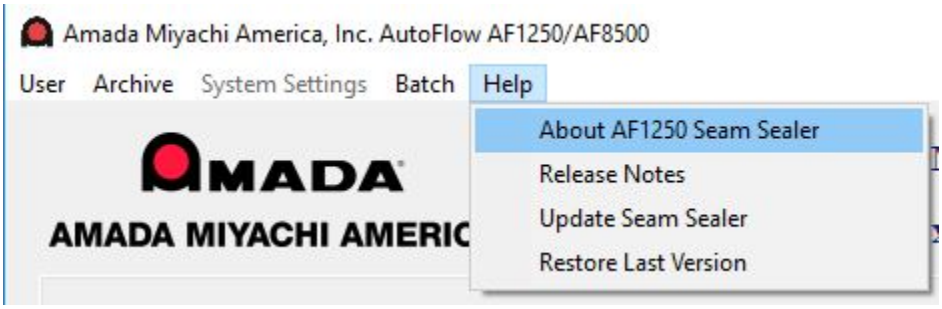
WM3000 Interrupt

a) ○ **Yes**
b) ○ **No**

Electrode Usage Counter

a) ☐ **Electrode Usage Count**
b) **Maximum Electrode Usage**

Help Menu



About AF-1250A (or AF-8500A) Seam Sealer gives information about the current version of the software.

Release Notes provides a list of software changes for each revision (web based).

Update Seam Sealer provides an automatic way to update the software (Internet access required).

Restore last version provides a way to restore the previous Software version.

Troubleshooting – Commonly Encountered Difficulties

The following is a list of common situations and solutions that will solve most problems encountered by operators in the course of normal Autoflow operation. If other problems occur that require further assistance, please call your Amada Miyachi America service technician.

PROBLEM	SOLUTION
No buttons can be selected during software start-up	Home the System
System will not perform motion. Pick head and weld electrodes extend down.	Check process gas supply connection. Leak check hoses and connections. Minimum supply pressure is 55-60psi.
System does not tack or weld	Check the HF-2500A Power Supply. Make sure the switch is at the Weld position.
No lid detected by the vacuum switch	Make sure lids are loaded and vacuum is on
System loses power by power outage or emergency stop	Restore the power (E-Stop button must be in reset position) and restart the application software.
Error message: Lid on pickstem	Remove lid from the pick stem or select start to use the lid on the pick stem for the next part.

Safety Factors

Because the Autoflow designers have done everything to make the Autoflow system as safe as possible, Autoflow has a remarkable history of safe operation. The following suggestions are offered to remind operators of common procedures that promote safety for the operator and for the Autoflow system.

A. Operator Safety
   (1) Always keep hands and clothing securely away from the part nest, the rotary table and the welding and tacking arms when operating the system.
   (2) Turn OFF the power at the main control panel when not in use for long periods of time or during maintenance.
   (3) Log off when leaving the system unattended.

B. Equipment Safety
   (1) Replace worn electrical cords and hoses at the first appearance of wear.
   (2) Regularly inspect the Autoflow electrodes to maintain quality performance.
   (3) Regularly back-up the Autoflow database files.

Autoflow Operating Instructions

(1) At the logon screen, enter your username and password and select OK.
(2) On the main screen, select the **Home** button to place all elements in their starting positions. This may take about 30 seconds.
(3) Select the **Schedule** button followed by **Change Schedule** to pick from a list of schedules in the drop down box. Choose a schedule followed by **OK**.
(4) Place the part nest on the welding table. Be sure that the nest is level and securely in place.
(5) View the part array display to confirm that the display matches the actual part layout.
(6) Load the lids so that they are available for the Pick and Place head.
(7) Select the **Check** button to confirm that alignment and set up parameters are correct. (This step only needs to be done once before each new schedule runs.)
(8) Select the appropriate choices from the welder controls: **P&P**, **Vision** and **Weld**. When selected, each control button will have a yellow background. Selecting the selection again turns off the function (red background).
(9) Select **Start** to run the schedule from beginning to end.
(10) Remove the parts when the schedule is complete.
(11) To run the same schedule again, reload the lids and parts on the nest and select **Start**. To switch to a new schedule, repeat steps 3 through 9.

Inputs and Outputs

I/O for AF-8500A

The AF-8500A input and output assignments are as follows:

Input	Type	High	Low
1	N/A	N/A	N/A
2	Weld Arms Sensor	Weld Arms Up	Weld Arms Down
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	Table Not at 0°	Not at 0°	At 0°
6	Pick Head Sensor	Pick Head Up	Pick Head Down
7	Table Not at 90°	Not at 90°	At 90°
8	N/A	N/A	N/A

Analog Input	Pin	Type
1	3	Pick Up Vacuum
2	4	Transducer Output

Output	Type	High	Low	Solenoid
1	Weld Arms	Arms Down	Arms Up	1 & 8
2	Pick Head	Head Down	Head Up	2 & 3
3	Fill Valve	On	Off	4
4	Exhaust Valve	On	Off	5
5	Pick Vacuum	On	Off	6
6	Theta Step	Not Step	Step	N/A
7	Theta Direction	Clockwise	Counterclockwise	N/A
8	Table Rotate Valve	Rotate to 90°	Rotate to 0°	7

I/O for AF-1250A

The AF-1250A inputs assignment are as follows:

Input	Type	High	Low
1	N/A	N/A	N/A
2	Weld Arms Not Down	Weld Arms Up	Weld Arms Down
3	Lid Lifter @ Load	N/A	N/A
4	N/A	N/A	N/A
5	Rotary Table not @ 0°	Not at 0°	At 0°
6	Pick Head Not Down	Pick Head Up	Pick Head Down
7	Rotary Table not @ 90°	Not at 90°	At 90°
8	Lid Proximity Sensor	N/A	N/A
17	Boat On Table Not	Not on Table	On Table
18	Weld Monitor Error	No Error	Error
19	N/A	N/A	N/A
20	N/A	N/A	N/A
21	N/A	N/A	N/A
22	N/A	N/A	N/A
23	N/A	N/A	N/A
24	Boat Not Down	Not Down	Down
25	N/A	N/A	N/A
26	N/A	N/A	N/A
27	N/A	N/A	N/A
28	From PLC Loader Ready	N/A	N/A
29	From PLC Unload Done	N/A	N/A
30	N/A	N/A	N/A
31	Lid Xfer Extended	N/A	N/A
32	Lid Xfr Retracted	N/A	N/A

Analog Input	Pin	Type
1	3	Pick Up Vacuum
2	4	Transducer Output
3	5	Vacuum Chuck
5	7	Precisor Vacuum
6	8	Transfer Vacuum

The AF-1250A outputs assignment are as follows:

Output	Type	High	Low	Solenoid
1	Weld Arms Valve	Arms Down	Arms Up	1 & 8
2	Pick Head Valve	Head Down	Head Up	2 & 3
3	Fill Valve	On	Off	4
4	Exhaust Valve	On	Off	5
5	Pick Vacuum Valve	On	Off	6
6	Theta Step	Not Step	Step	N/A
7	Theta Direction	Clockwise	Counterclockwise	N/A
8	Table Rotate Valve	Rotate to 90°	Rotate to 0°	7
33	Precisor Valve	N/A	N/A	16
34	Precisor Vacuum Valve	N/A	N/A	17
35	Weld X/Y Pass	2nd Pass	1st Pass	N/A
36	Weld Trigger	Weld	No Weld	N/A
37	Table Shot Pin	Pin Up	Pin Down	13
38	N/A	N/A	N/A	N/A
39	N/A	N/A	N/A	N/A
40	N/A	N/A	N/A	N/A
41	Lid Elev. Mtr. Dir. Up	N/A	N/A	N/A
42	Lid Elev. Mtr. Hi-Speed	N/A	N/A	N/A
43	Lid Elev. Mtr. Disable	N/A	N/A	N/A
44	N/A	N/A	N/A	N/A
45	N/A	N/A	N/A	N/A
46	N/A	N/A	N/A	N/A
47	To PLC Load Request	N/A	N/A	N/A
48	To PLC Unload Request	N/A	N/A	N/A
49	To PLC Ready	N/A	N/A	N/A
50	To PLC Load Done	N/A	N/A	N/A
51	N/A	N/A	N/A	N/A
52	N/A	N/A	N/A	N/A
53	Lid Xfer Slide Valve	N/A	N/A	14
54	Lid Xfer Vacuum Valve	N/A	N/A	15
55	N/A	N/A	N/A	N/A
56	Vacuum Chuck Valve	Vacuum On	Vacuum Off	12

Appendix – Schedule Development

Principles of Seam Sealing

- Resistance Welding
- Contact Resistance Generated By Placing An Electrode Into Contact With Part Lid
- Electrode Angle
  - Shallower Angle
    - Decreased Contact Resistance
    - Distribute Heat More Evenly In Lid
    - Increased Stitch Width
    - More Energy Required To Maintain Metals At Molten Level
- Electrode Force
  - Force Increased
    - Range Of Temperatures At Which The Metals Remains Molten Becomes Wider
    - Temperature Less Critical
  - Contact Resistance Is Decreased
    - Less Energy Available At The Weld
  - More Intimate Contact Between Lid, Seal Ring, And Electrode Surface
    - Decreased Heat In Lid
    - Increased Heat In Package
    - Increased Stitch Width
    - Appearance Of Stitches Appear Smoother
- Speed
  - Speed Increased
    - Distance Between Stitch Stays The Same
    - HF Spot Spacing Remains Constant Within Speed Range
    - Increased Stitch Width, But Only If The Energy Delivered By Each Pulse Is Enough To Melt The Metals
- Power
  - Power Increased
    - Increases Radius Of Weld Nugget
    - Increases Weld Penetration Through Lid And Seal Ring
  - Schedule development requires a general knowledge of seam sealing prior to schedule development with the high frequency inverter system
- Tools
  - Microscope
  - Log sheet
  - Parts and nesting / tooling
- Procedure
  - Tack lid with minimal setting
  - ‘Standard Weld Pass’
  - Identify physical dimensions of part and enter into schedule
  - Spot spacing 0.010 inches
  - Halving the spot spacing doubles the power delivered to the package

AMADA WELD TECH INC.

http://www.amadaweldtech.com

AMADA WELD TECH INC.

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

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

http://www.amadaweldtech.com

AMADA WELD TECH CO., LTD.

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

AMADA WELD TECH KOREA CO., LTD.

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

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

AMADA WELD TECH SHANGHAI CO., LTD.

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

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

AMADA WELD TECH GmbH

Lindberghstrasse 1, DE-82178 Puchheim, Germany

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

AMADA WELD TECH TAIWAN CO., LTD.

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

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

AMADA VIETNAM CO., LTD.

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

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

AMADA (THAILAND) CO., LTD.

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

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

AMADA WELD TECH INDIA PVT. LTD.

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

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

AMADA WELD TECH LTDA.

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

TEL. +55-11-4193-1187

AMADA WELD TECH INC.
1820 South Myrtle Ave., Monrovia, CA 91016, U.S.A.
TEL. +1-626-303-5676 FAX. +1-626-358-8048