

LASER FOCUS HEAD

50mm FX SERIES

USED WITH A-SERIES Nd:YAG LASER WELDERS

USER MANUAL



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REVISION RECORD

Revision	EO	Date	Basis of Revision
A	19399	08/02	Production Release
C	19501	10/02	Revised Manual
D	19686	03/03	Revised Manual
E	19796	08/03	Revised Manual
F	41182	06/11	Revised Manual
G	41254	07/11	Revised Manual
H	41513	11/11	Added Kowa Video Lens
J	42506	11/13	Update to Miyachi America name and logo.
K	43483	12/14	Updated to Amada Miyachi America name and logo.
L	43879	09/15	Updated to Amada Miyachi America format.
M	46110	05/21	Update to Amada Weld Tech format + manual changes
N	47212	01/24	Update Manual Title

Models Described In This Manual

This manual covers the following standard AMADA WELD TECH 50mm Focus Head Models:

Model ¹	Collimator Focal Length (mm)	Output Focal Length (mm)	CCTV FX Focus Head	Straight FX Focus Head
FX100/70H	100	70	8-660-01-01	8-661-01-08
FX100/75S	100	75	8-660-01-02	8-661-01-02
FX100/100H	100	100	8-660-01-08	8-661-01-05
FX120/50H	120	50	8-660-01-03	8-661-01-01
FX120/70H	120	70	8-660-01-04	8-661-01-04
FX120/100H	120	100	8-660-01-06	8-661-01-06
FX120/120H	120	120	8-660-01-07	8-661-01-07
FX200/50H	200	50	8-660-01-05	8-661-01-03

¹ Other Focus Head combinations are also available by Special Order.

50mm FX FOCUS HEAD

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CONTACT US

Thank you for purchasing the AMADA WELD TECH 50mm FX Laser Focus Head. Upon receipt of the Focus Head, please thoroughly inspect it for shipping damage *before* you install it. If there is any damage, contact the shipping company immediately to file a claim and notify us at:

AMADA WELD TECH, INC.
1820 South Myrtle Avenue
Monrovia, California 91016
Phone: (626) 303-5676
FAX: (626) 358-8048
E-mail: info@amadaweldtech.com

The contents of this Manual are subject to change without notice. If you have any questions about the contents of this manual, or find any errors or omissions, please contact us. AMADA WELD TECH is not responsible for any losses due to improper use of this product or the procedures contained herein.

SAFETY PRECAUTIONS



WARNING

This Instruction Manual describes how to perform procedures on Laser Focus Heads. These procedures are intended for AMADA WELD TECH field personnel and properly trained end users.

All procedures contained in this Manual must be performed as explicitly written. Failure to perform a correct procedure may cause damage or expose personnel to laser radiation hazards. If your product becomes damaged due to an improper procedure, you will need to arrange for repair or a field service visit. AMADA WELD TECH assumes no responsibility for improper procedures.

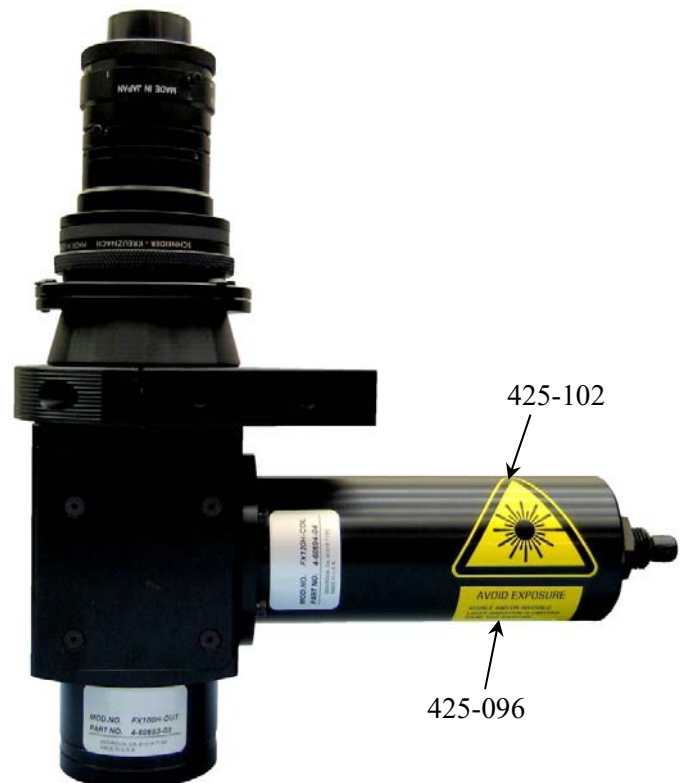
Be sure to wear Laser Protective Goggles having an optical density of at least 5+ at the output wavelength of the Laser Welder you are working with.

The 50mm FX Laser Focus Heads (hereinafter referred to as ***FX Focus Heads***) are designed for use with AMADA WELD TECH A-Series Lasers ***only***.

Warning Labels



Straight Focus Heads
8-661-01-0x

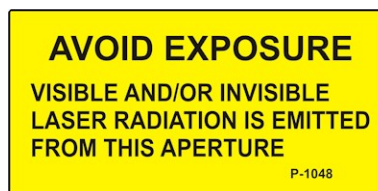


CCTV Focus Heads (Kowa & Pentax)
8-660-01-0x

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Triangle Warning Label (AWTA # 425-102)



Avoid Exposure Label (AWTA # 425-096)

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.

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7. Inspection and Rejection of Nonconforming Goods.

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

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

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

8. Price.

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

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

9. Payment Terms.

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

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

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

10. Intellectual Property; Software License.

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

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

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

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

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

12. Limited Warranty.

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

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

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

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

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

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

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

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

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

13. Limitation of Liability.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

50mm FX FOCUS HEAD

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).

50mm FX FOCUS HEAD

Exhibit A
Warranty For "Specialty Products"
LIMITED WARRANTY

EXCEPT FOR THE WARRANTY SET FORTH BELOW IN THIS EXHIBIT 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.

Warranty Period: The Warranty Period for Specialty Products is for one (1) year, and the Warranty Period for laser welders and laser markers is two (2) years (unlimited hours), and the Warranty Period for the laser pump diodes or modules is two (2) years or 10,000 clock hours, whichever occurs first (as applicable, the "**Warranty Period**"). The Warranty Period begins as follows: (i) on orders for Goods purchased directly by Buyer, upon installation at Buyer's site or thirty (30) days after the date of shipment, whichever occurs first; or (ii) on equipment purchased by a Buyer that is an OEM or systems integrators, upon installation at the end user's site or six (6) months after the date of shipment, whichever occurs first.

Acceptance Tests: Acceptance Tests (when required) shall be conducted at Sellers, Monrovia, CA, USA (the "**Testing Site**") unless otherwise mutually agreed in writing prior to issuance or acceptance of the Acknowledgement. Acceptance Tests shall consist of a final visual inspection and a functional test of all laser, workstation, enclosure, motion and accessory hardware. Acceptance Tests shall include electrical, mechanical, optical, beam delivery, and software items deliverable under the terms of the Acknowledgement. Terms and conditions for Additional Acceptance Tests either at Seller's or Buyer's facility shall be mutually agreed in writing prior to issuance or acceptance of the Acknowledgement.

Performance Warranty: The system is warranted to pass the identical performance criteria at Buyer's site as demonstrated during final Acceptance Testing at the Testing Site during the Warranty Period, as provided in the Acknowledgement. Seller explicitly disclaims any responsibility for the process results of the laser processing (welding, marking, drilling, cutting, etc.) operations.

Exclusions: Seller makes no warranty, express or implied, with respect to the design or operation of any system in which any Seller's product sold hereunder is a component.

Limitations: The limited warranty set forth on this Exhibit A does not cover loss, damage, or defects resulting from transportation to Buyer's facility, improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the equipment, or improper site preparation and maintenance. This warranty also does not cover damage from misuse, accident, fire or other casualties of failures caused by modifications to any part of the equipment or unauthorized entry to those portions of the laser which are stated. Furthermore, Seller shall not be liable for a breach of the warranty set forth in this Exhibit 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.

Seller further warrants that all Services performed by Seller's employees will be performed in a good and workmanlike manner. Seller's sole liability under the foregoing warranty is limited to the obligation to re-perform, at Seller's cost, any such Services not so performed, within a reasonable amount of time following receipt of written notice from Buyer of such breach, provided that Buyer must inform Seller of any such breach within ten (10) days of the date of performance of such Services.

Seller shall not be liable for a breach of the warranty set forth in this Exhibit A unless: (i) Buyer gives written notice of the defect or non-compliance covered by the warranty, reasonably described, to Seller within five (5) days of the time when Buyer discovers or ought to have discovered the defect or non-compliance 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 and (a) Buyer returns such Goods to Seller's place of business at Buyer's cost (prepaid and insured); or (b) in the case of custom systems, Seller dispatches a field service provider to Buyer's location at Buyer's expense, for the examination to take place there; and (iii) Seller reasonably verifies Buyer's claim that the Goods are defective or non-compliant and the defect or non-compliance developed under normal and proper use.

All consumable, optical fibers, and 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.

No warranty made hereunder shall extend to any product whose serial number is altered, defaced, or removed.

Remedies. With respect to any such Goods during the Warranty Period, Seller shall, in its sole discretion, either: repair such Goods (or the defective part). **THE REMEDIES SET FORTH IN THE FOREGOING SENTENCE SHALL BE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH IN THIS EXHIBIT 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. 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 this Exhibit 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.

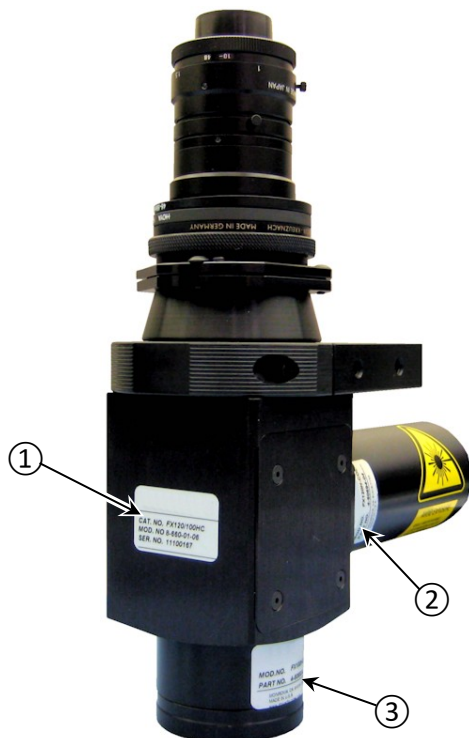
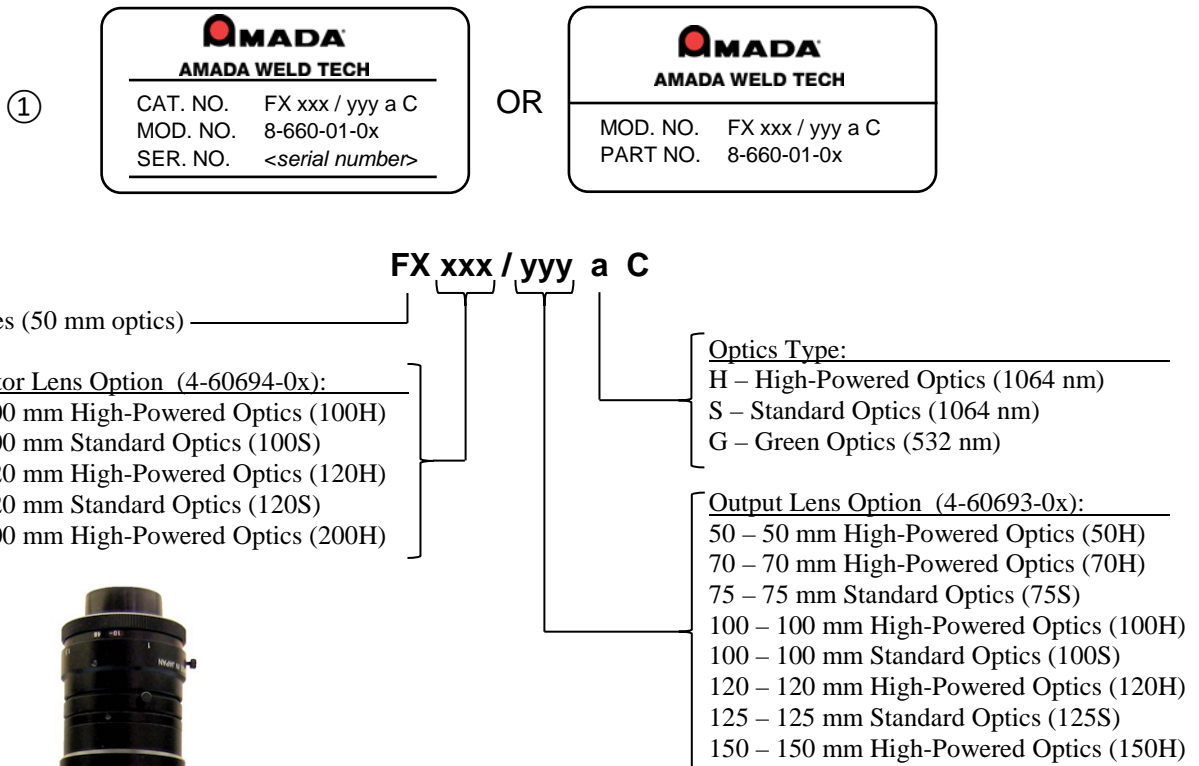
50mm FX FOCUS HEAD

CHAPTER 1

SYSTEM DESCRIPTION

Section I. Model Number Identification

Focus Head Model Number Labels – CCTV with Kowa Video Lens (8-660-01-0x)



② Collimator Lens Assembly Label

AMADA AMADA WELD TECH		
CAT #	FX xxx a –COL	REV
PRT #	4-60694-0x	

③ Output Lens Assembly Label

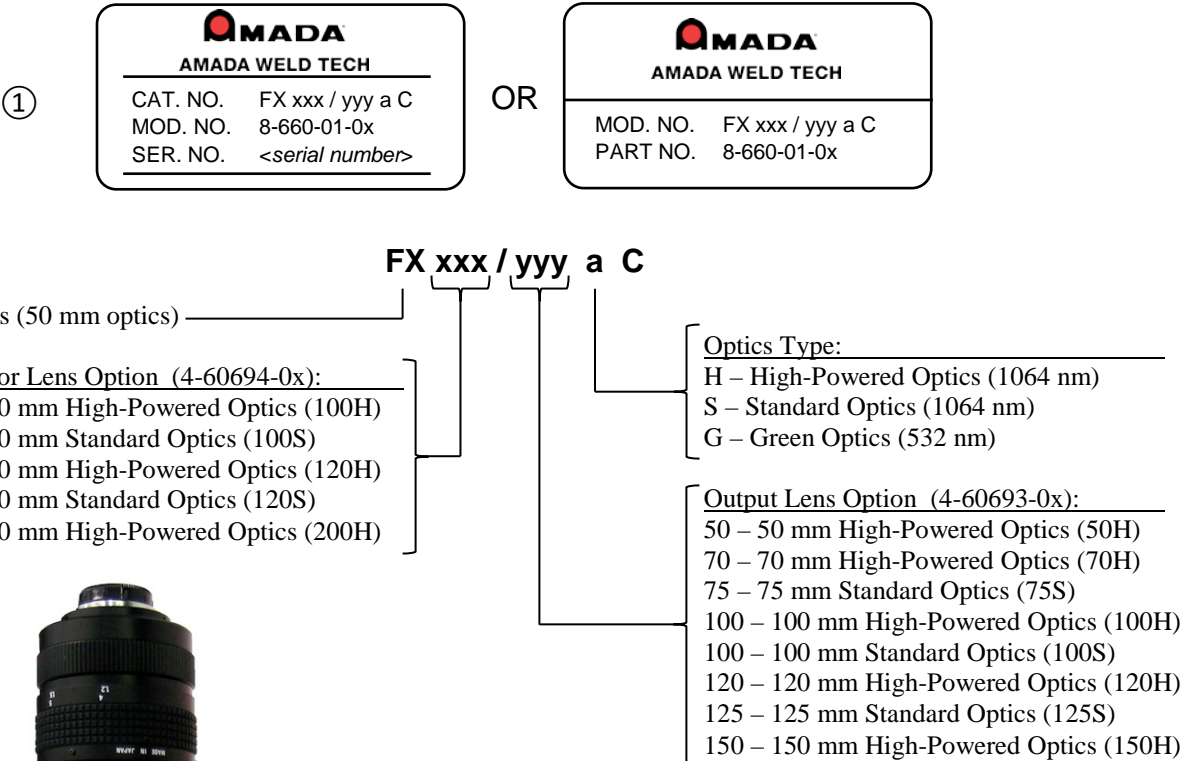
AMADA AMADA WELD TECH		
CAT #	FX xxx a –OUT	REV
PRT #	4-60693-0x	

50mm FX FOCUS HEAD

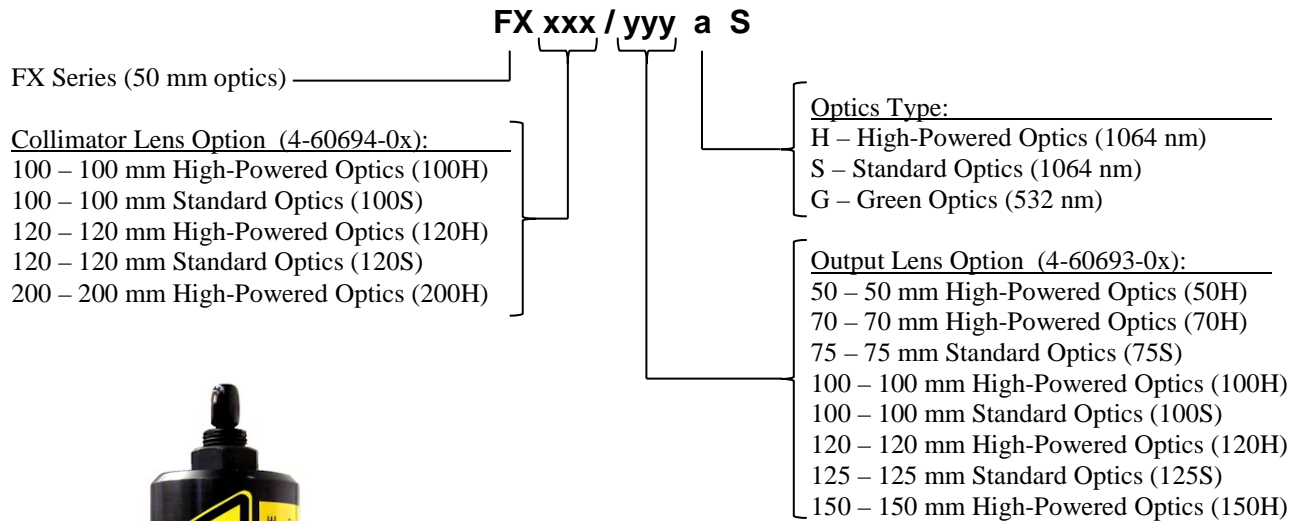
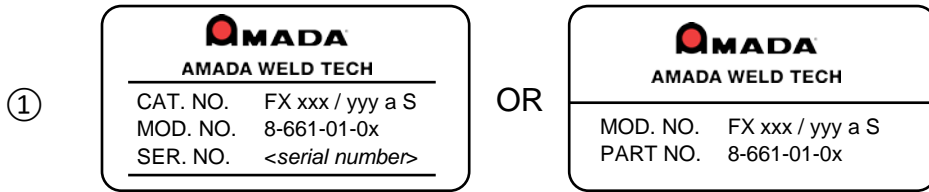
CHAPTER 1: DESCRIPTION

Focus Head Model Number Labels – CCTV with Pentax Video Lens (8-660-01-0x)

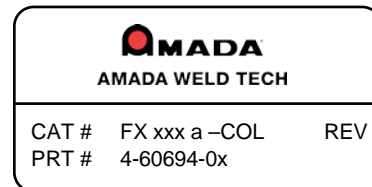
Note: The Pentax Video Lens is no longer manufactured. Information below is for historical purposes.



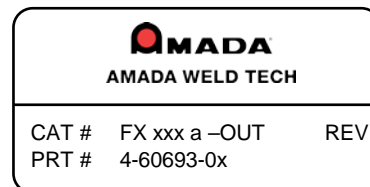
Focus Head Model Number Labels – Straight Focus Head (8-661-01-0x)



② Collimator Lens Assembly Label



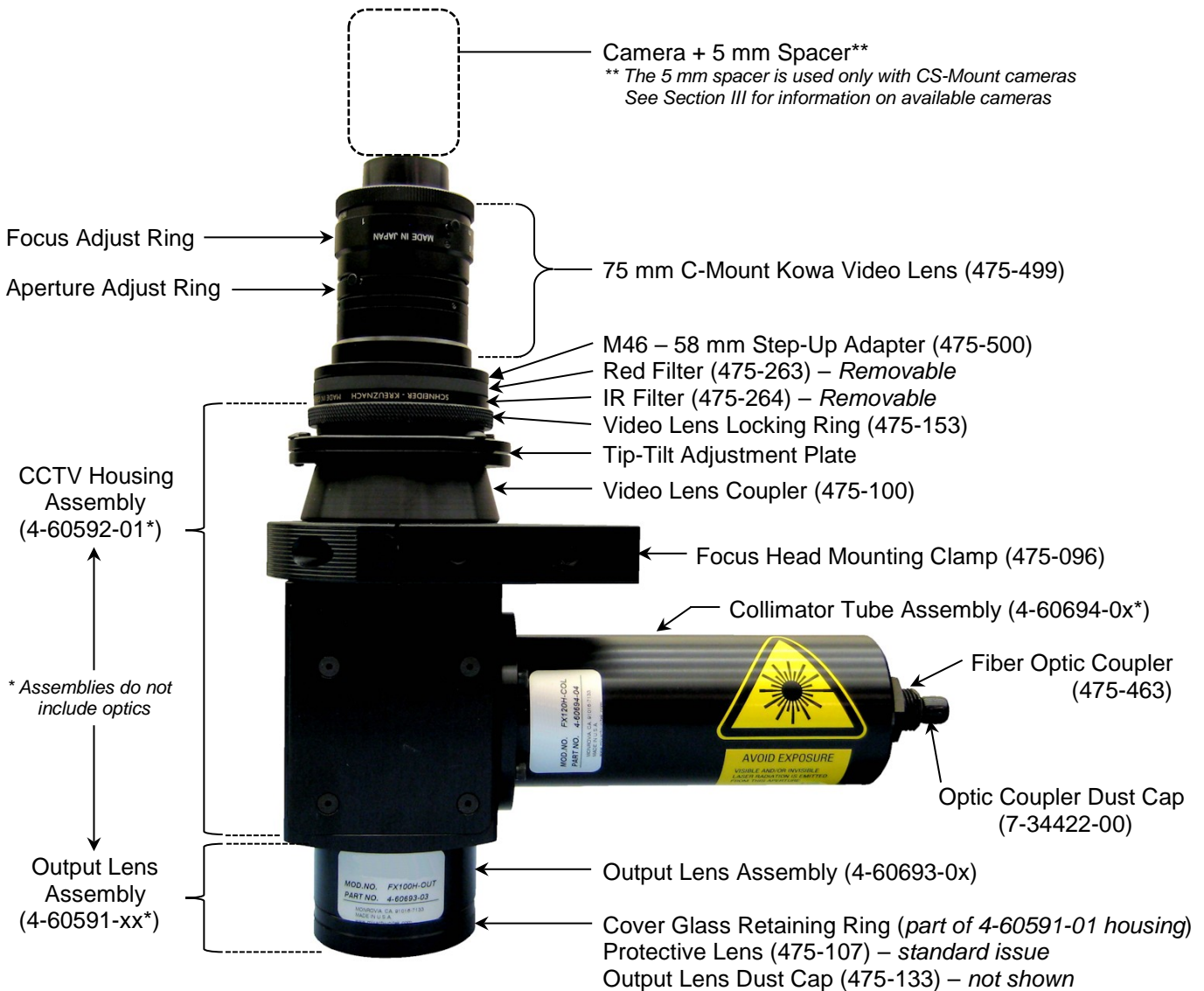
③ Output Lens Assembly Label



50mm FX FOCUS HEAD

Section II. Parts Identification

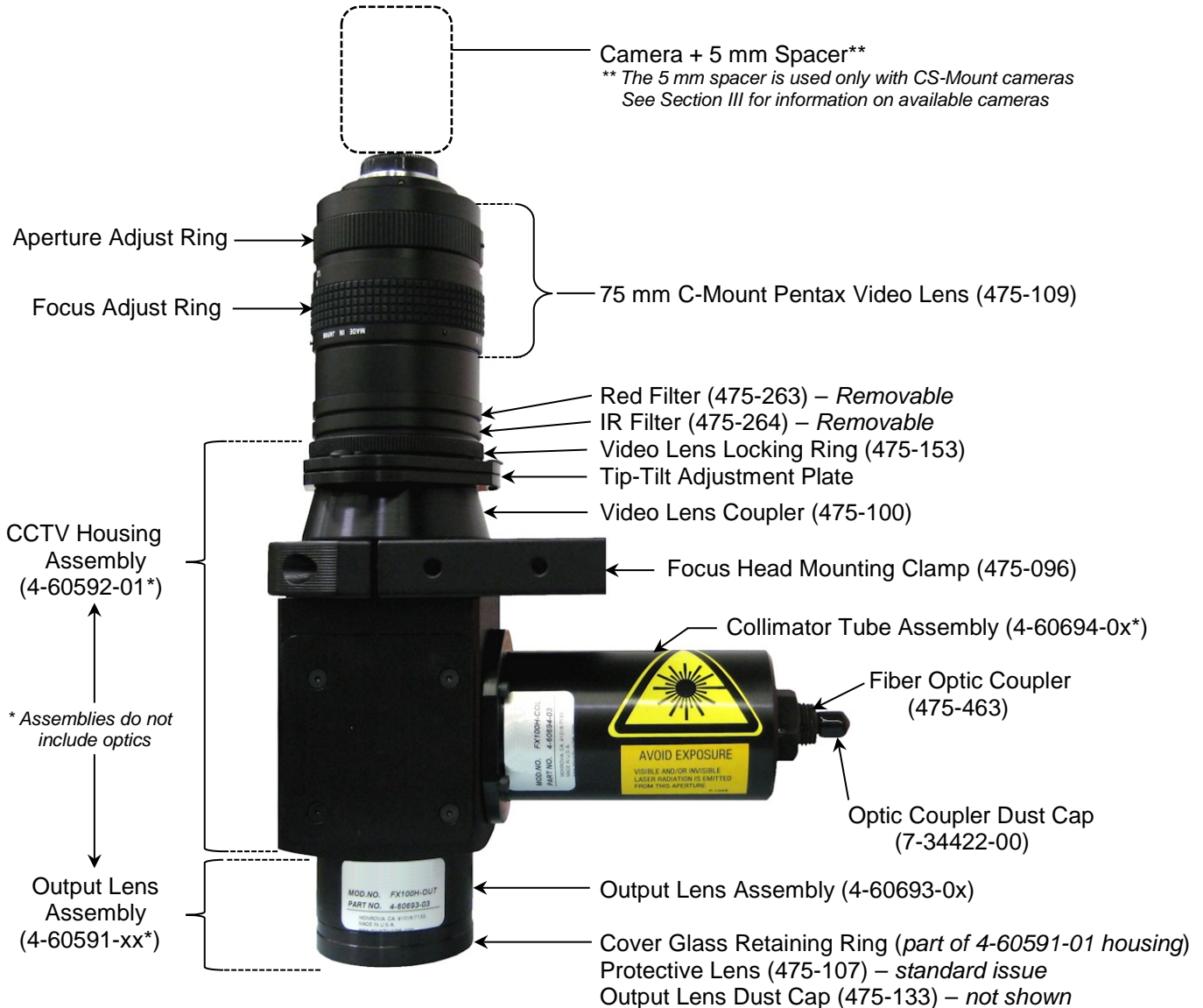
CCTV Focus Heads with Kowa Video Lens (8-660-01-0x)



* Assembly does not include optics.

CCTV Focus Heads with Pentax Video Lens (8-660-01-0x)

Note: The Pentax Video Lens is no longer manufactured. Information below is for historical purposes.



*** Assembly does not include optics.**

50mm FX FOCUS HEAD

CHAPTER 1: DESCRIPTION

Straight Focus Heads (8-661-01-0x)



* Assembly does not include optics.

50mm FX FOCUS HEAD

Section III. Focus Head Options

Video Camera Options

The Video Lens used on the CCTV Focus Head has a C-Mount interface. Therefore all CS-Mount cameras must use the included 5 mm spacer. The spacer is included with all cameras and is also available separately (AWTA # 475-084). The available camera options constantly change in industry. Therefore some of the cameras listed below may no longer be available. Contact AMADA WELD TECH for more information and suitable replacement cameras.

AWTA #	Type	Color	Mount	Interface	Note
4-90739-02	Digital	B&W	C	RJ45	1/2.9" Progressive CMOS Sensor, PoE (270-823)
4-76301-02 ¹		B&W	C	RJ45	1/3" Progressive CCD Sensor, PoE (270-630)
4-90739-01		Color	C	RJ45	1/2.9" Progressive CMOS Sensor, PoE (270-822)
4-76301-01 ¹		Color	C	RJ45	1/3" Progressive CCD Sensor, PoE (270-629)
270-829 ²	Analog	B&W	CS	BNC	1/2" CCD Sensor (uses 270-331 – +12v P.S.)
270-330 ^{1,2}		B&W	CS	BNC	1/3" CCD Sensor (uses 270-331 – +12v P.S.)
270-363 ^{1,2}		Color	CS	BNC	1/3" CCD Sensor (uses 270-331 – +12v P.S.)

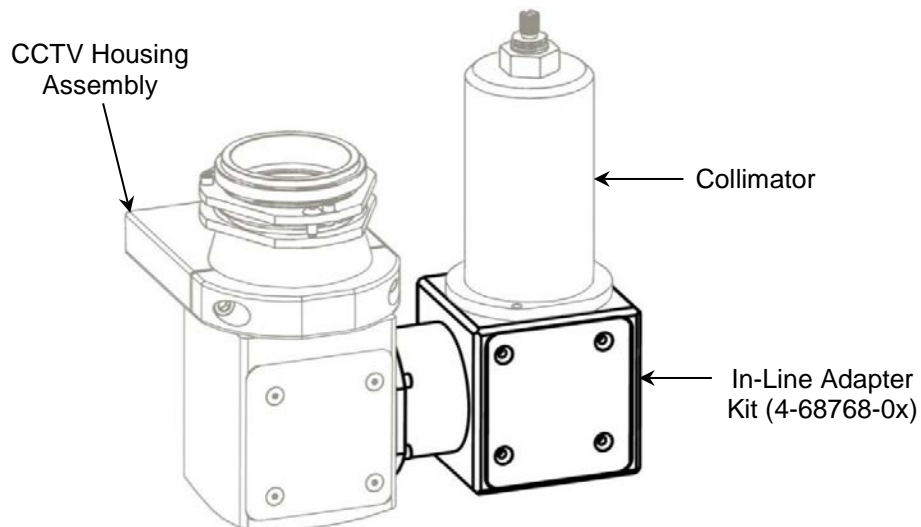
1. Not recommended for new designs, set for obsolescence.
2. Camera requires a 5 mm spacer between the camera and video lens.

In-Line Collimator Adapter (4-68768-0x)

The In-Line Collimator Adapter changes the direction of the collimator tube, such that it is positioned parallel with the focus head body. This option can be added or removed at any time to any FX Focus Head. The 4-68768-0x In-Line Adapter Kit includes; the Adapter, 100% Mirror and 6-32 x 3/8" screws.

4-68768-01 – is used with IR ($\lambda = 1064 \text{ nm}$) Nd:YAG Laser Welders

4-68768-02 – is used with SHG ($\lambda = 532 \text{ nm}$) Nd:YAG Laser Welders



CHAPTER 1: DESCRIPTION

Fiber Breakage Detection (8-620-xxxx-xx)

The Fiber Breakage Detection option can be added to any IR equipped Focus Head that is being used with an A-Series Nd:YAG Laser (50 W – 600 W). The purpose of this option is to detect when the optical fiber that connects between the A-Series Laser and the Focus Head is cut, severed or not connected. A pulse modulated photoelectric transmitter ($\lambda = 700 \text{ nm}$) is mounted inside the Laser and a matching photo-electric receiver is mounted on the Focus Head. The modulated pulse is transmitted through the optical fiber. When the light between transmitter/receiver is broken, the Laser is rendered inoperative. Only focus heads that contain the

Fiber Breakage access hole can be fitted with Fiber Breakage Detection. To install, remove the Fiber Breakage Cover Plate (4-67402-01) and fasten the Fiber Breakage Receiver to the focus head body using two M3 x 10 mm screws (AWTA # 625-827). The Fiber Breakage Detection option is configurable. Contact AMADA WELD TECH AMERICA for more information.

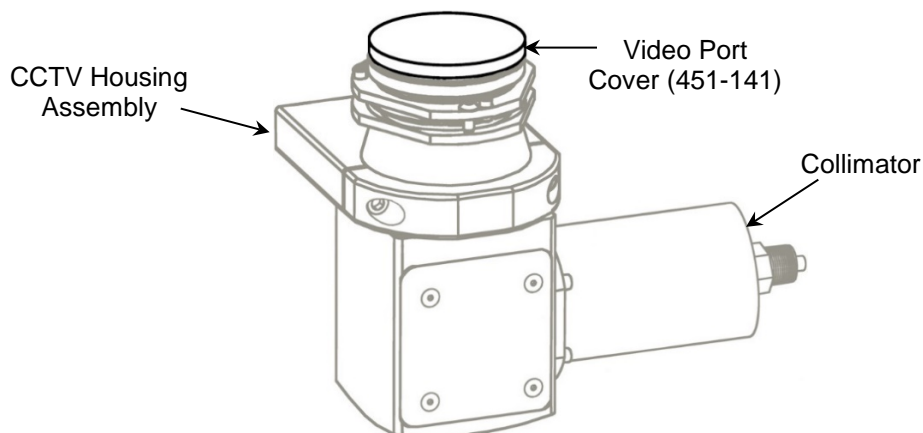


Cover Gas Nozzle Kit (4-61088-0x)

The Cover Gas Nozzle Kit is an accessory for applications where cover gas is used in a welding process. Any FX Focus Head can be fitted with the Cover Gas Nozzle Kit using the existing mounting holes on the focus head. There are two options available; a single hose nozzle (-01) or a dual hose nozzle (-02). The hoses are constructed with hose segments that can be positioned in any configuration and are compatible with all cover gases used. The Cover Gas Nozzle Assembly bolts to the side of the FX Focus Head using two M6 x 14 mm screws (AWTA # 625-853) and connects to the cover gas delivery system using standard 1/4" OD tubing.

Video Port Cover (451-141)

If a weld set-up uses a CCTV Focus Head but does not use a Video Camera, a Video Port Cover is available. The Video Port Cover screws on to the top of the CCTV Housing Assembly.



50mm FX FOCUS HEAD

CHAPTER 2

FX FOCUS HEAD ADJUSTMENTS

The purpose of a focus head is to “focus” all Laser energy on to a work area for welding, brazing or soldering. Instructions on how to integrate the Focus Head(s) with a Laser System can be found in the *Installation and Set-up* chapter of the Laser Welder that is being used. There are two basic types of Focus Heads; Straight and CCTV. The Straight Focus Heads (8-661-xx-xx) use a fixed optical set-up and require no adjustment. The CCTV Focus Heads (8-660-xx-xx) have some adjustability features and can be used with a Camera, so the Laser Operator can view the welding process in real-time.

Straight Focus Head Adjustment

The Straight Focus Heads (8-661-xx-xx) do not need any adjustments.

CCTV Focus Head Adjustment

The CCTV Focus Heads (8-660-xx-xx) shipped from AMADA WELD TECH are pre-adjusted for immediate use. In the event a Focus Head is repaired or does not perform to original specification, it may need to be adjusted. The scope of the adjustment procedure is to make the “Visual Focus” coincident with the “Laser Focus” such that both are focused at the same point on the work piece. At “Laser Focus”, the spot diameter (or beam waist) will contain the highest energy density. The basic procedure will be to establish visual focus first and then adjust the laser focus to maximize the energy density at the workpiece.

The adjustment procedure below is comprehensive, and covers all FX Focus Heads that are used with the AMADA WELD TECH A-Series Nd:YAG Laser Welders. Depending on the focus head set-up, some portions may not be applicable to that specific adjustment and may be skipped. Likewise, if a focus head parameter is known to be adjusted correctly, that portion of the procedure may be skipped as well.

Two of the typical variations in the FX Focus Head build are the available Video Cameras and the use of IR/Red Filters. An understanding of each option and how it affects the adjustment are noted below:

Video Cameras

There are two types of video camera mounts, C-Mount and CS-Mount. All video lenses used with the FX Focus Heads have a C-Mount interface. If a CS-Mount Camera is used, an additional 5mm spacer (shipped with the camera) must be used to properly set the focal length of the camera. If a C-Mount Camera is used, the additional spacer is not required. See *Chapter 1, Section III* for a list of available Video Cameras.

IR/Red Filters

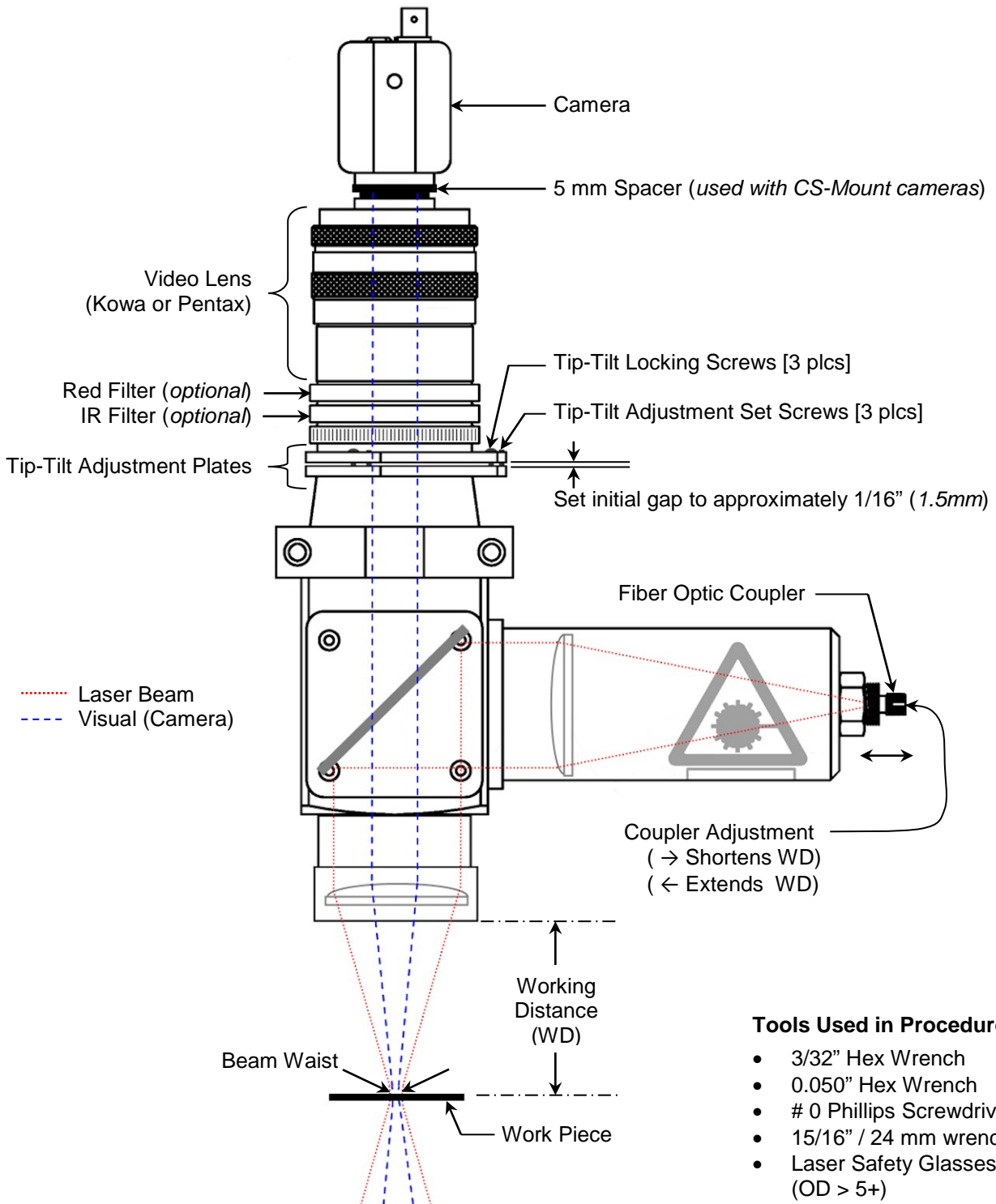
Depending on the CCTV Focus Head configuration, the Focus Head may or may not contain an IR Filter and/or Red Filter. The IR Filter is used to protect the camera from damage due to high Laser IR energy pulses. Some cameras have a built-in filter and do not require an external IR filter. Since the Camera is sensitive to a broad spectrum of wavelengths, the Red Filter is used to reduce the received wavelengths to the “red” spectrum of light which helps to minimize chromatic aberrations and sharpen the focused image in Black & White Camera Systems. The Red Filter is not used with Color Camera Systems.

50mm FX FOCUS HEAD

CHAPTER 2: FOCUS HEAD ADJUSTMENTS

CCTV Adjustment Points

Refer to the illustration below for the adjustments points notated in the CCTV Focus Head Adjustment Procedure.



CCTV Focus Head Adjustment Procedure:

1. Connect Focus Head to Laser. Connect the optical fiber between the A-Series Laser Welder and the CCTV Focus Head. Hand tighten the optical fiber until snug.
2. Connect Camera Output. Connect the video output of the Camera to a video monitor or video capture system.
3. Tighten all Optical Components. Make sure all optical components (video lens, filters, etc.) are securely tightened before making any adjustments. Loose optical components will affect focus, centering, orientation, etc.
4. If setting up a new focus head, make sure there is at least a $1/16$ " (1.5 mm) gap between the Tip-Tilt Adjustment Plates. To adjust, loosen the three **Tip-Tilt Locking Screws** ($3/32$ " hex), and adjust the **Tip-Tilt Adjustment Set-Screws** ($3/32$ " hex) until the proper space between plates is achieved. Failure to start with a $1/16$ " gap may not allow for enough "centering" adjustability.
5. Loosen the **Aperture Adjust Locking Screw** and rotate the **Aperture Adjust Ring** to the smallest f -stop number (see figures below). Tighten the **Aperture Adjust Locking Screw** when finished.
6. Loosen the **Focus Adjust Locking Screw** and rotate the **Focus Adjust Ring** to approximately $1/8$ " from (∞) infinity as shown below. Tighten the **Focus Adjust Locking Screw** when finished.



7. Set Visual Focus / Working Distance

Place a piece of non-reflective metal (aluminum or stainless-steel) under the focus head and vary the position of the metal (towards / away from the Focus Head) until the metal surface is in focus on the video monitor. This will be the operating Working Distance (WD) and the visual focus point.

Alternately, if the Focus Head is inside a fixed tooling fixture or the WD is already established, adjust the Focus on the Video Lens until the weld area is focused and clear at the set WD.

*Note: The Working Distances listed in Appendix A are **nominal** values **NOT absolute** values.*

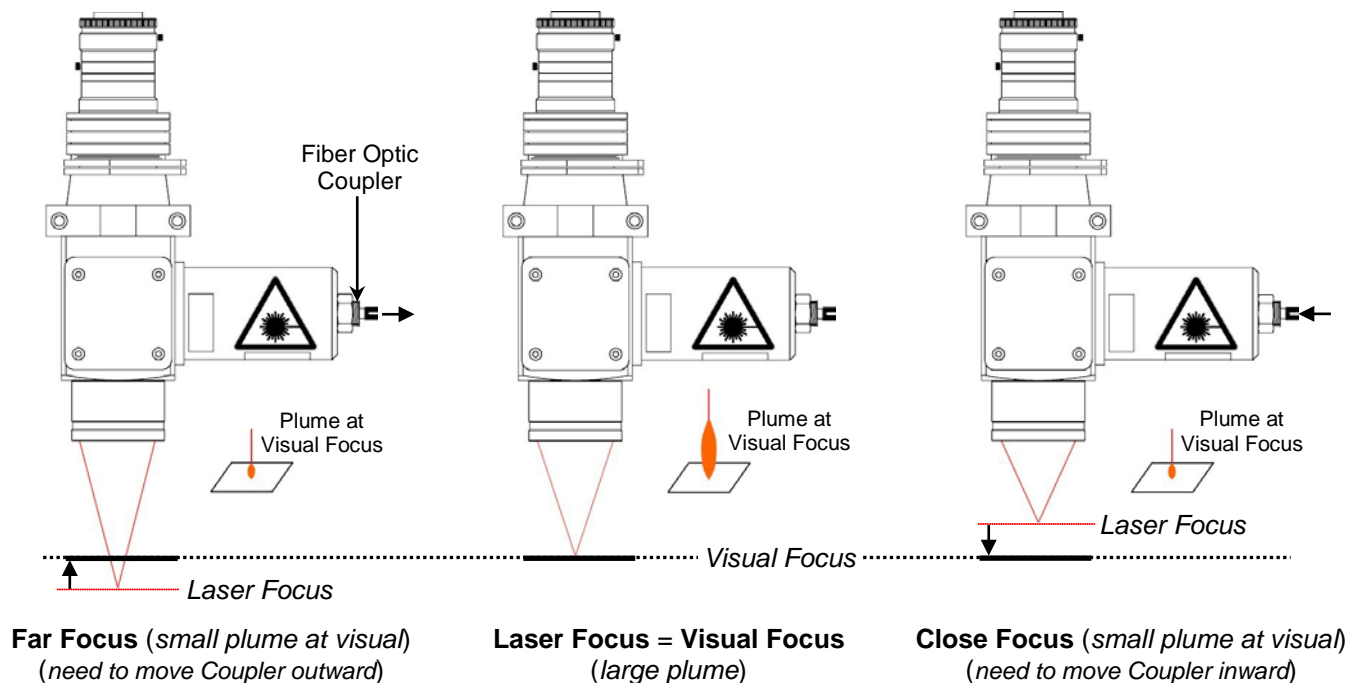
CHAPTER 2: FOCUS HEAD ADJUSTMENTS

8. (Optional) Rotate the **Aperture Adjustment** for the clearest / best image, then hand-tighten the **Aperture Adjust Locking Screw**. A small aperture number (*default aperture f-stop*) results in more light but less the depth of field (*narrow range of focus*). Likewise a large aperture number (*aperture f-stop*) results in less light but more depth of field (*large range of focus*).
9. Wear Laser Safety Glasses (OD > 5+ @ wavelength of Laser) before continuing with the next step. Secure the area around the Laser set-up and remove unnecessary personnel from the work area. Contact your facility LSO (Laser Safety Officer) for more information.
10. Fire a single-shot from the Laser into a piece of non-reflective metal (aluminum, steel, etc.). Set the Laser to produce $E_{OUT} \approx 1 \text{ J}$ (1 kW @ 1 mS) to 2 J (1 kW @ 2 mS), and fire the laser to locate the center of the optical axis (*Note: adjust laser settings accordingly for different materials*).
11. **Center Visual Field**
Loosen the **Tip-Tilt Locking Screws** and adjust the **Tip-Tilt Adjustment Set Screws** accordingly. Adjust the Tip-Tilt Plates until the laser spot becomes centered in the Video Monitor. Once the center position is located and set, tighten the **Tip-Tilt Locking Screws** to secure its position.

12. Adjust Laser Focus

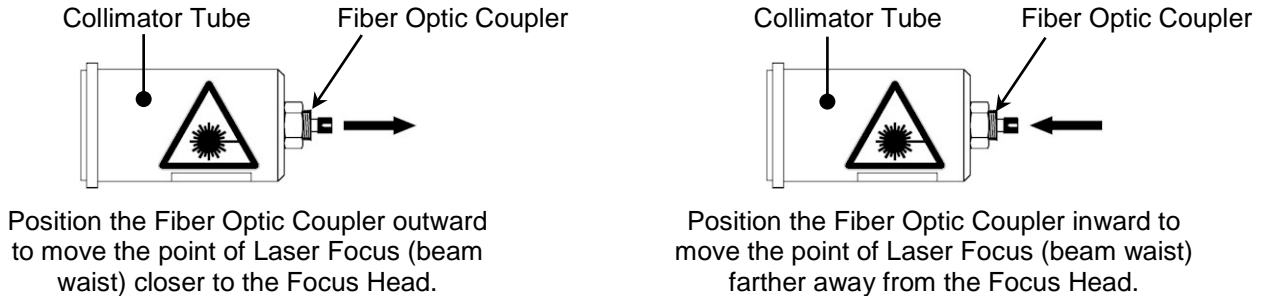
Adjust the *Laser Focus* to be coincident with the *Visual Focus*. The laser focus is set by the overall length of the collimator tube, more specifically the position of the **Fiber Optic Coupler**. Fire the Laser, then adjust the work piece up and down by 0.25mm steps to / from the output lens in order to find the smallest spot size (i.e. beam waist). Be sure to reposition the metal each time before firing the laser so that the laser fires on to a clean spot. The weld plume will physically be biggest when the spot size is at laser focus. Determine whether the laser focus needs to be moved up or down to match the visual focus determined in *Step 7*. The collimator tube length will be correctly adjusted when the smallest beam waist (spot size) occurs at the same point as visual focus.

Relationship between Visual Focus and laser Focus:

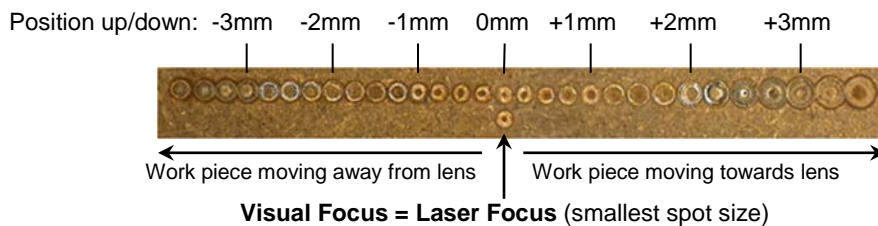


50mm FX FOCUS HEAD

Loosen the nut that secures the Fiber Optic Coupler to the Collimator Tube using a 15/16" (24 mm) or adjustable wrench. Adjust the position of the Fiber Optic Coupler by turning the **Fiber Optic Coupler** into (CW) or out of (CCW) the Collimator tube until the *Laser Focus* is coincident with the *Visual Focus*.



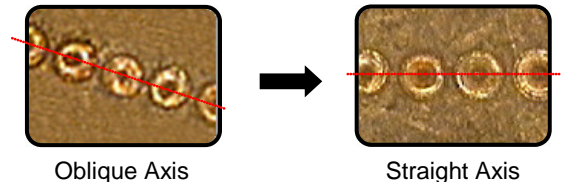
Example: In the example shown below, the working distance in a focus head was adjusted towards and away from the output lens in 0.25 mm increments. When adjusted properly, the smallest spot size is the point of focus:



13. Adjust Axis Orientation

Fire multiple shots from the Laser into a piece of non-reflective metal (aluminum, steel, etc.). Fire shots in a straight line along a given axis. Set the Laser parameters the same as in *Step 10*.

If the line of weld spots forms an oblique (or crooked) axis in the video monitor, then the axis orientation will need to be adjusted.



The pictures shown on the right represent a typical series of weld pulses that were fired along the x-axis.

Prior to adjustment, the x-axis was crooked in the video monitor. After adjustment the orientation of the x-axis was adjusted to move horizontally from left to right to form a straight x-axis.

If the Optical set-up includes a Watec Analog Camera, the axis orientation can be changed by loosening the three screws that secure the camera ring mount.

To adjust, simply loosen the three set-screws (0.050" hex) and rotate the camera into the desired orientation. Re-tighten the set-screws to secure the camera in to position.



CHAPTER 2: FOCUS HEAD ADJUSTMENTS

If the focus head does not include a Watec camera, the **Video Lens Locking Ring** will need adjustment. Before adjusting the Axis Orientation, it is important to know how the **Video Lens Locking Ring** functions. For the purposes of this step, we will call the *Video Lens Assembly* the section of the focus head that includes; the IR Filter (if applicable), Red Filter (if applicable), Adapter (if applicable), Video Lens, 5 mm Spacer (if applicable) and Camera, basically all of the optics connected to the top portion of the Focus Head Body. Initially the *Video Lens Assembly* is secured to the top of the Focus Head Body until snug (hand-tightened). The **Video Lens Locking Ring** is then tightened up against the *Video Lens Assembly* to secure it into position.

To change the axis orientation of the *Video Lens Assembly*, loosen the **Video Lens Locking Ring**. Since the **Video Lens Locking Ring** sits flush against the *Video Lens Assembly*, it may be necessary to loosen the *Video Lens Assembly* first before turning the **Video Lens Locking Ring** to prevent thread binding.

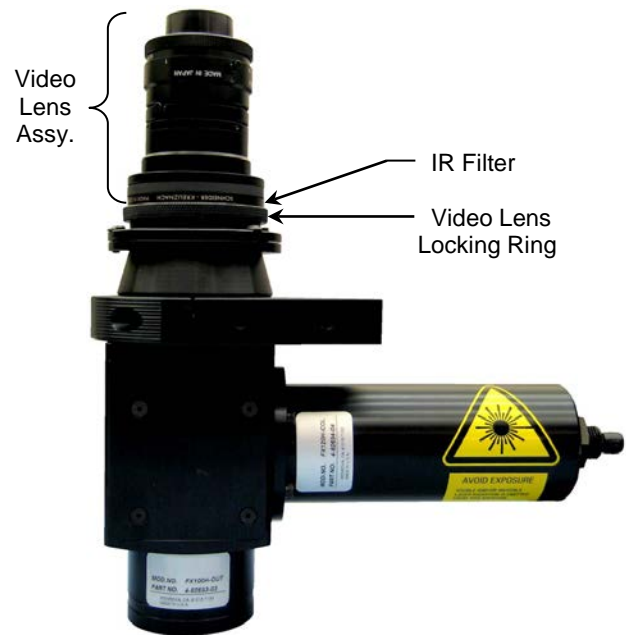


If the **Video Lens Locking Ring** and/or *Video Lens Assembly* are hard to loosen, a Filter Wrench may be used:

- IR Filter: 2.36" (60 mm) outer diameter
- Locking Ring: 2.49" (63.3 mm) outer diameter



With the **Video Lens Locking Ring** loosened, start with the *Video Lens Assembly* tightened against the Focus Head body, rotate the *Video Lens Assembly* counter-clockwise (CCW) until the desired axis orientation is achieved, then tighten the **Video Lens Locking Ring** up against the *Video Lens Assembly*. Verify all optical components are snug once orientation is achieved.



14. If necessary, repeat any of the previous Focus Head adjustments as necessary until the Focus Head is set-up in the desired way.
15. Repeat the process for any other Focus Heads used in the application.

End of Procedure

CHAPTER 3

USER MAINTENANCE

Section I. FX Focus Head Spare Parts

AWTA PART NUMBER	PART DESCRIPTION
475-107	FX Cover Glass (Protective Lens), uncoated, (<i>standard issue</i>)
475-108	FX Cover Glass (Protective Lens), AR (anti-reflective) Coated, $\lambda = 532/1064$ nm, Pyrex
475-334	FX Cover Glass (Protective Lens), AR (anti-reflective) Coated, $\lambda = 1064$ nm, Fused Silica
7-34422-00	Protective Dust Cap, Optical Fiber Input Coupler (Fiber Input)
475-133	Protective Dust Cap, Output Lens Assembly

Focus Head Parts (for CCTV Focus Heads):

475-499	Kowa Video Lens, M46, 75 mm, C-Mount
475-500	M58 to M46 Adapter (Step-up) Ring (used with Kowa Lens)
475-264	IR cut-off Filter (option for some CCTV focus heads)
475-263	Hoya R-60 Red Filter (option for some CCTV focus heads)

Lens Cleaning Supplies:

900-314	Lens Cleaning Tissue
900-342	Lens Cleaner, RoHS Compliant

Video Camera Supplies (see *Chapter 1, Section III* for a list of Video Camera options):

475-084	CS-Mount to C-Mount Adapter Ring, 5 mm
205-445	RJ45, CAT6 Ethernet Cable, 14 ft. (used with digital cameras)
205-157	BNC Cable, 6 foot, 50 Ω (used with analog cameras)
520-142	BNC “In-Line” Coupler (couples 2 BNC cables together)
250-486	BNC “Tee” Connector
475-159	Image Multiplier (x2)

Focus Head Options:

4-68768-0x	In-Line Collimator Adapter (-01 for $\lambda = 1064$ nm, -02 for $\lambda = 532$ nm)
451-141	Video Port Cover (cover used when video lens assembly is removed from Focus Head body)

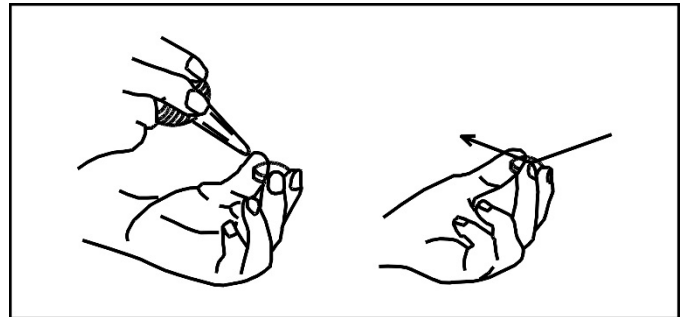
Section II. How to Clean a Focus Head

In order to maintain optimal performance, the Focus Head must be kept clean. This is especially true for the optical components. When a Focus Head is not being used and is not hooked up in a system, the protective dust caps should ***always*** be used. These dust caps prevent dirt and debris from contaminating the internal optical components. In general these internal optical components will not need to be cleaned unless the Focus Head is taken apart, repaired or exposed to contamination. AMADA WELD TECH recommends daily inspection of the Focus Head to ensure that it is free of contamination and operating at optimal performance.

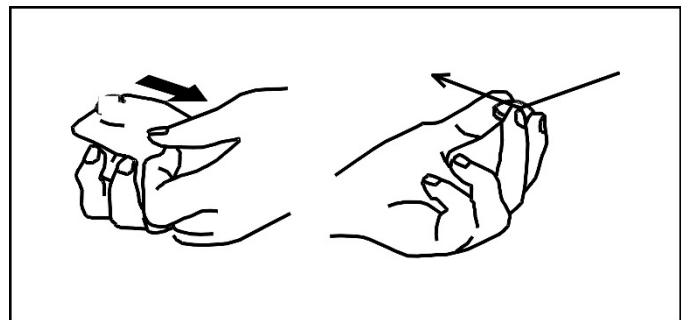
All Focus Heads shipped from AMADA WELD TECH are equipped with a replaceable Cover Glass (Protective Glass). The Cover Glass is positioned between the Output Lens and the work piece and is used to protect the output lens from weld splatter. Never operate the Focus Head without the Cover Glass in place. The cost of the output lens is significantly more than the Cover Glass.

The outside of the Focus Head can be cleaned by simply wiping it with clean cloth. For heavily soiled conditions, isopropyl alcohol may also be used. Avoid using alcohol on or near the Video Lens. For a soiled Cover Glass (or internal optical component), use the following cleaning procedure:

1. Wear powder free Latex Gloves (or similar) to prevent getting finger oils on the optical components.
2. Hold the optical part horizontally by the sides.
3. Blow off any dirt and dust using an air blower.
4. Check that no dirt or dust remains. If the optic still appears to be dirty, stained or foggy, continue with the next step.



5. Place a drop of Lens Cleaner or acetone on the center of the lens cleaning paper.
6. Lay the wet part of the cleaning paper onto the top surface of the optical part.
7. Holding one end of the cleaning paper, move the wet part of the lens cleaning paper across the optical part by pulling the cleaning paper across it at a constant speed from one side to the other. This method prevents scratching.



8. Repeat as necessary until the optical component is clean and free from contamination, dirt and debris.

NOTE: If an optical component can ***not*** be cleaned, it should be ***replaced***. Operating a Focus Head with a dirty optical component can cause further damage to the Focus Head. Refer to the list of **FX Focus Head Spare Parts** on the previous page for a list of cleaning supplies and spare parts.

APPENDIX A

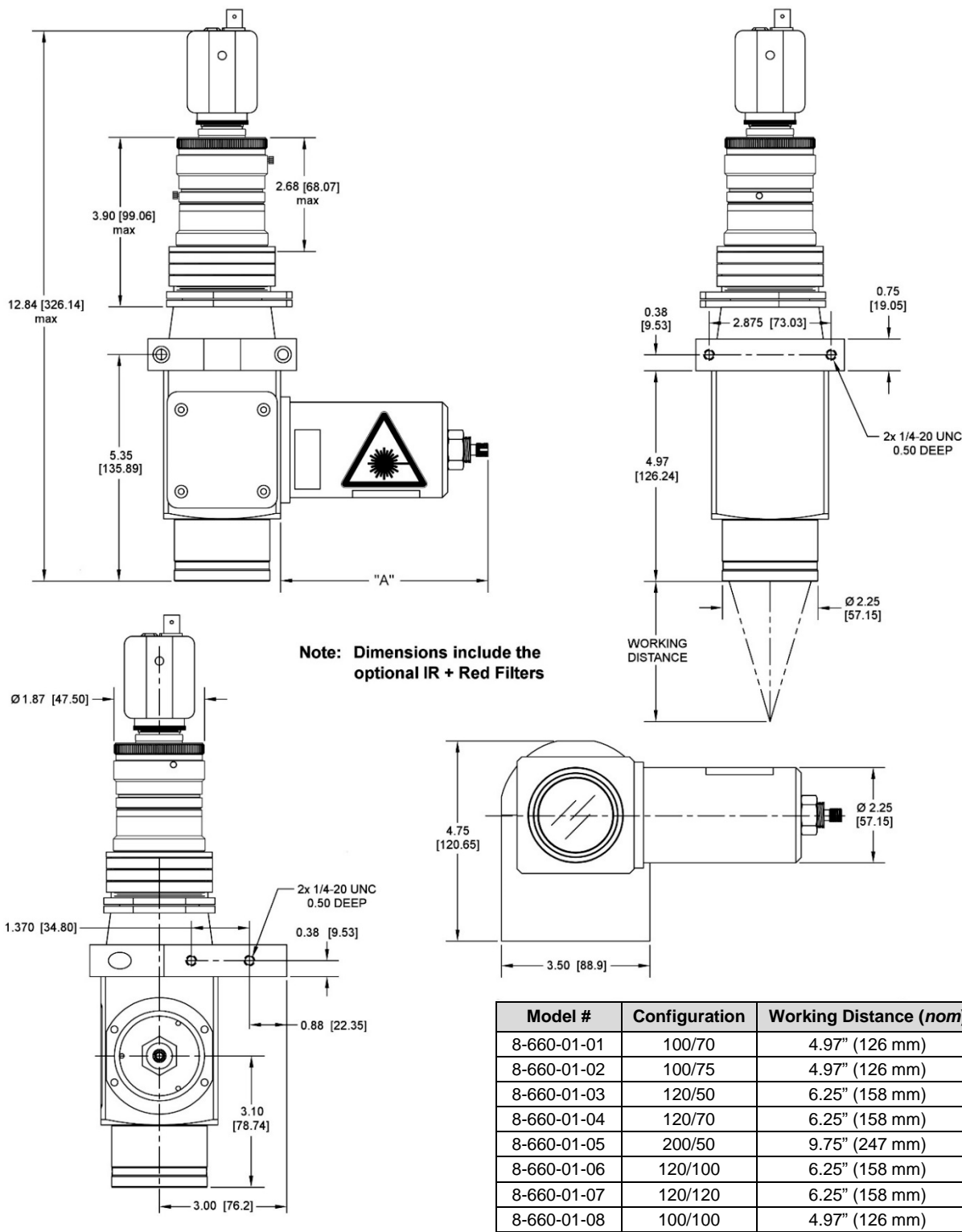
PHYSICAL SPECIFICATIONS

Section I. Technical Specifications

Dimensions	CCTV	See Dimensional Data starting on Page A-2
	Straight	See Dimensional Data starting on Page A-4
Working Distance (nominal)	CCTV	See Table data on Page B-2
	Straight	See Table data on Page B-2
Mass	CCTV	6.75 lb. (3.06 kg) – heaviest CCTV Focus Head with Camera
	Straight	2.86 lb. (1.30 kg) – heaviest Straight Focus Head
Operating: Temperature Range		32 °F – 122 °F (0 °C – 50 °C)
Operating: Relative Humidity		10% - 95% (non-condensing)

Section II. Dimensional Data

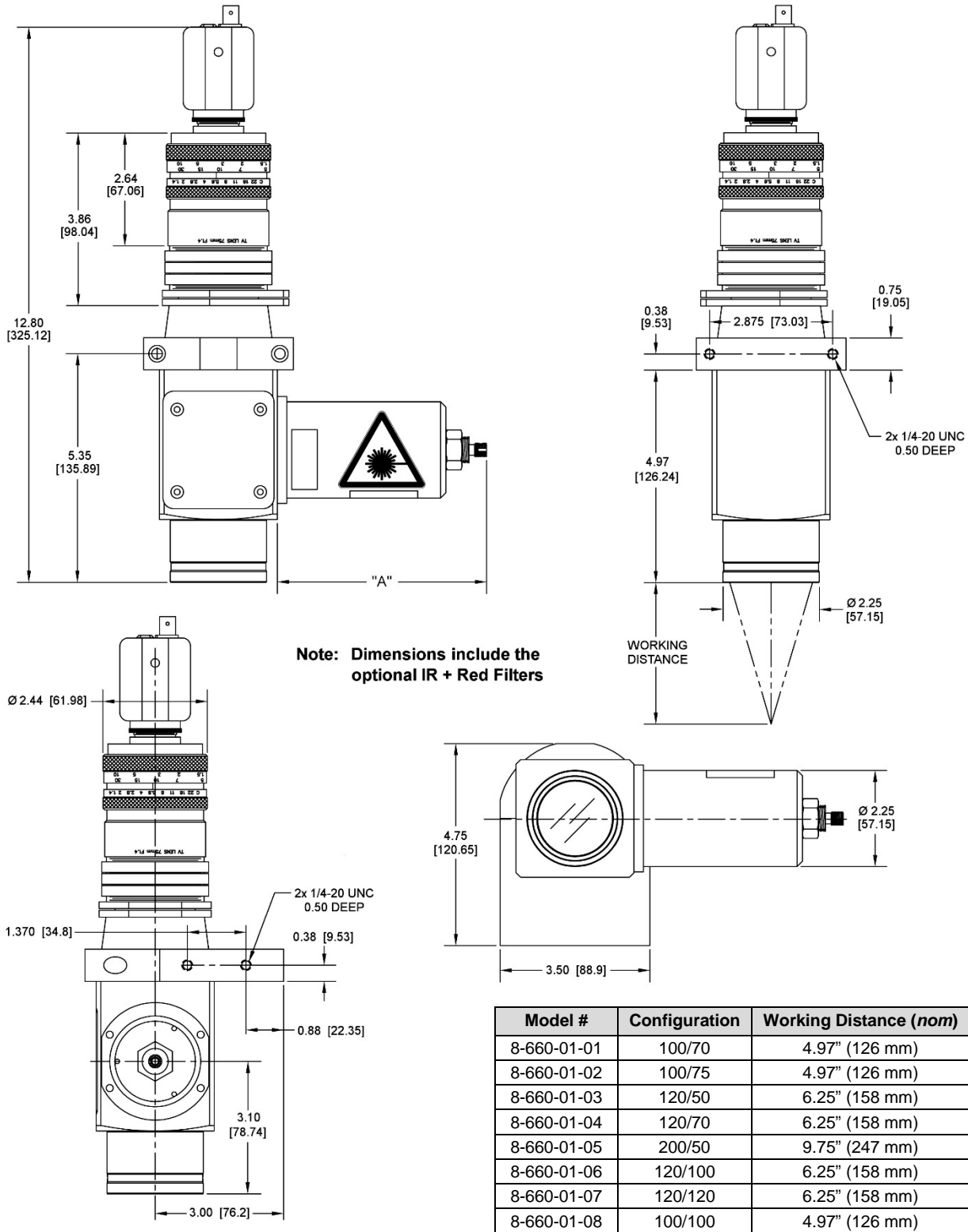
Dimensional Data -- CCTV Focus Head (8-660-01-0x) With Kowa Lens



APPENDIX A: PHYSICAL SPECIFICATIONS

Dimensional Data -- CCTV Focus Head (8-660-01-0x) With Pentax Lens

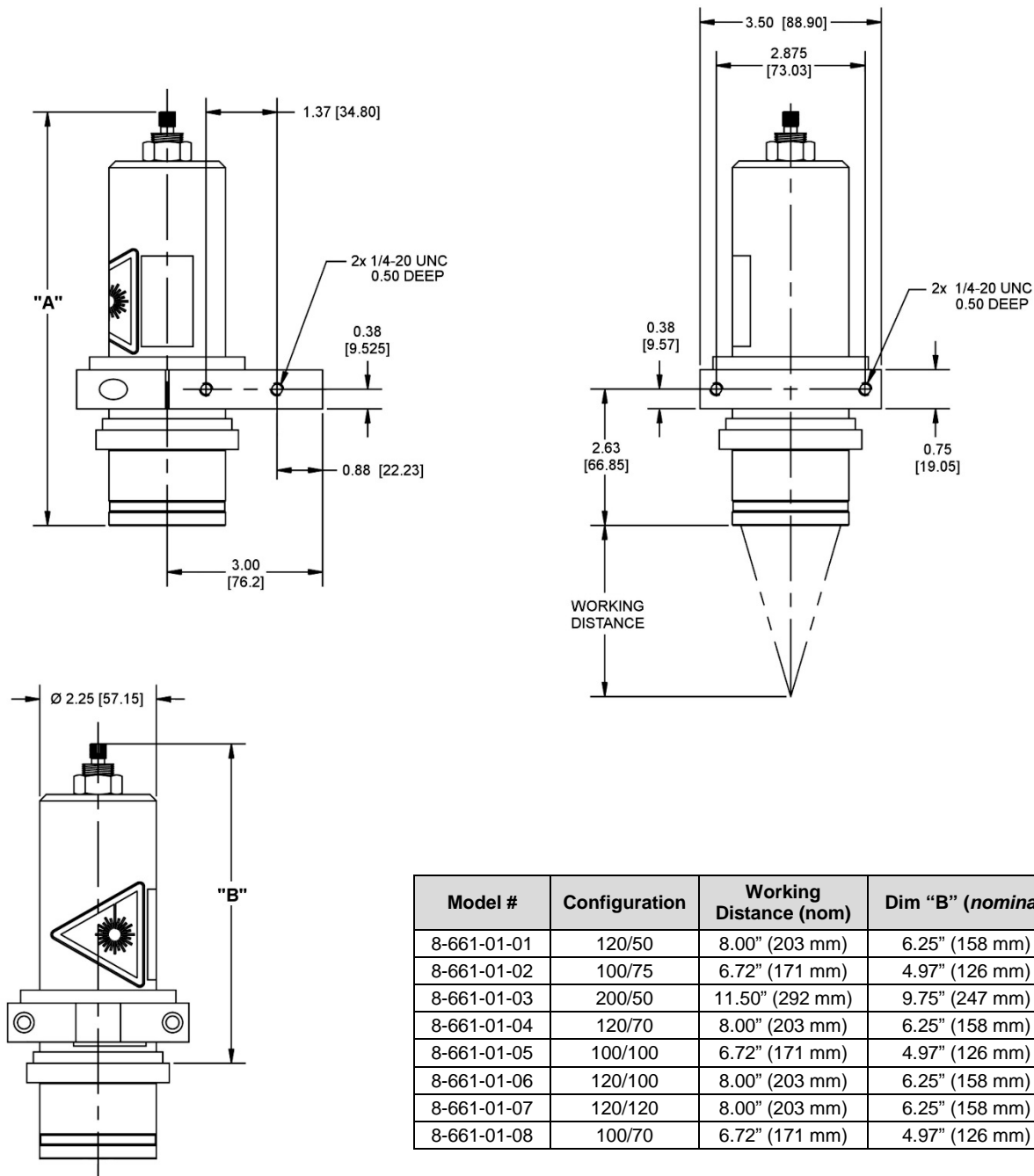
Obsolete Model. Information provided for reference.



50mm FX FOCUS HEAD

APPENDIX A: PHYSICAL SPECIFICATIONS

Dimensional Data -- Straight Focus Head (8-661-01-0x)



APPENDIX B

OPTICAL SPECIFICATIONS

Laser Focused Spot Diameter Table (microns \pm 10%)

The following tables list the theoretical spot diameters (in microns) for the different Focus Head combinations that are available. The first table lists the Spot Diameters for “Standard” Focus Heads followed by the “Special Order” Focus Heads. Note that these Spot Diameters are theoretical and do not take into account the heat affected zone where the imaged Laser light impinges on the surface of the welded material. The actual spot diameter may be significantly larger than the values in these tables. Use these values as a “relative measurement” when trying to achieve the desired Spot Size.

“Standard” Focus Head Combinations (8-660-01-0x and 8-661-01-0x) – $\lambda = 1064$ nm:

Lens combination		Fiber Core Diameter (μm)						
Collimator	Output	100	200	300	400	600	800	1000
100 H/S	70 H	70	140	210	280	420	560	700
100 H/S	75 S	75	150	225	300	450	600	750
100 H/S	100 H/S	100	200	300	400	600	800	1000
120 H/S	50 H	42	83	125	167	250	333	417
120 H/S	70 H	58	117	175	233	350	467	583
120 H/S	100 H/S	83	167	250	333	500	667	833
120 H/S	120 H	100	200	300	400	600	800	1000
200 H	50 H	25	50	75	100	150	200	250

“Special Order” Focus Head Combinations – $\lambda = 1064$ nm:

Lens combination		Fiber Core Diameter (μm)						
Collimator	Output	100	200	300	400	600	800	1000
100 H/S	50 H	50	100	150	200	300	400	500
100 H/S	120 H	120	240	360	480	720	960	1200
100 H/S	125 S	125	250	375	500	750	1000	1250
100 H/S	150 H	150	300	450	600	900	1200	1500
120 H/S	75 S	63	125	188	250	375	500	625
120 H/S	125 S	104	208	313	417	625	833	1042
120 H/S	150 H	125	250	375	500	750	1000	1250
200 H	70 H	35	70	105	140	210	280	350
200 H	75 S	38	75	113	150	225	300	375
200 H	100 H/S	50	100	150	200	300	400	500
200 H	120 H	60	120	180	240	360	480	600
200 H	125 S	63	125	188	250	375	500	625
200 H	150 H	75	150	225	300	450	600	750

“Special Order” Focus Head Combinations – $\lambda = 532$ nm:

Lens combination		Fiber Core Diameter (μm)						
Collimator	Output	100	200	300	400	600	800	1000
120.2	100.5	84	167	251	334	502	669	836
200.1	100.5	50	100	151	201	301	402	502

50mm FX FOCUS HEAD

APPENDIX A: OPTICAL SPECIFICATIONS

Optical Specifications – Standard Focus Head combinations (8-660-01-0x and 8-661-01-0x)

Lens combination ¹		Working Distance ²	Focus Head Laser Mag. ³	Focus Head Optical Mag. ⁴	Video Monitor Magnification ⁵	Nominal Loss ⁶	Cone Angle ⁷
Collimator	Output						
100 H/S	70 H	51 mm	0.70x	1.07x	54.6x	22%	53°
100 H/S	75 S	52 mm	0.75x	1.00x	51.0x	17%	52°
100 H/S	100 H/S	73 mm	1.00x	0.75x	38.3x	22%	37°
120 H/S	50 H	25 mm	0.42x	1.50x	76.5x	24%	88°
120 H/S	70 H	51 mm	0.58x	1.07x	54.6x	26%	50°
120 H/S	100 H/S	72 mm	0.83x	0.75x	38.3x	26%	37°
120 H/S	120 H	106 mm	1.00x	0.63x	31.9x	24%	26°
200 H	50 H	25 mm	0.25x	1.50x	76.5x	52%	88°

NOTES:

1. Refer to **Page ii** for information on determining the AMADA WELD TECH AMERICA Part Number.
2. The nominal **Working Distance** is measured from the bottom of the cover glass holder to the work piece. This data value has a tolerance of $\pm 10\%$ and should be used as a typical value, rather than absolute value. The actual working distance occurs where the energy density of the impinging beam is the greatest (i.e. smallest spot size).
3. The Focus Head Laser Magnification is the ratio of the Output Lens Focal Length to Collimator Lens Focal Length.
4. The Focus Head Optical Magnification is the ratio of the Video Lens Focal Length to Output Lens Focal Length. This value only applies to CCTV Focus Head models. Video Lens focal length = 75 mm
5. The Video Monitor Magnification is the overall magnification of the work piece as viewed on a 17" Monitor. This value only applies to CCTV Focus Head models.

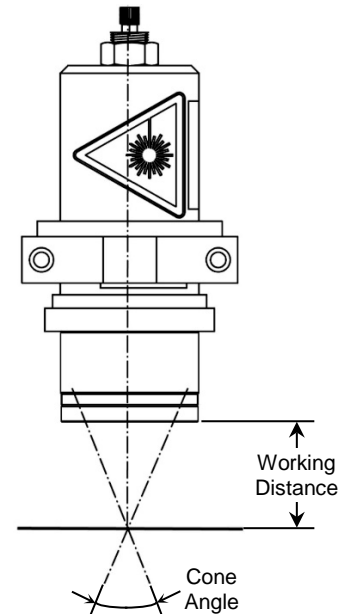
Video Monitor (4:3 diagonal) = 17"

Camera chip size = 1/3"

6. The Nominal Loss is the typical amount of optical loss that can be expected in the Focus Head. The values shown in the table above are nominal losses when used with the ML-2551A (LW300A), ML-2550A (LW400A), ML-2651B (LW500A) and ML-2650B (LW600A) Laser Welders.

The nominal loss is typically less than 10% when used with the ML-2052A (LW5AM), ML-2051A (LW5A), ML-2050A (LW15A), ML-2150A (LW25A), ML-2351A (LW50A), ML-2350A (LW70A) and ML-2450A (LW150A) Laser Welders.

7. The approximate Cone Angle is shown in the figure to the right.



50mm FX FOCUS HEAD

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