Claymount Americas Corporation
2545 Curtiss St.
Downers Grove, IL 60515 U.S.A.
Phone: (630) 271-9729 www.aidxray.com; www.claymount.com Fax: (630) 271-9995

Three-field Ionization Chamber Calibration Procedure for The 61154 Pre-Amplifier Board Assemblies

INTENDED USE:

An CLAYMOUNT Ionization Chamber is a device that is placed between the patient and an x-ray image receptor to assist the Automatic Exposure Control (AEC) in delivering the proper x-ray dose in medical radiography.

An Ionization Chamber's function is to give an output signal proportional to the amount of radiation that is transmitted through the subject to the image receptor and to provide the output signal in a compatible form to the Automatic Exposure Control (AEC) circuitry of an x-ray generator/control.

General Ionization Chamber Technical Data	
Specification	Description
Minimum Response Time	Less than 1mS.
Output Sensitivity (Gain Range)	Adjustable from 0.046V/µGy to 0.91V/µGy @76kV. Additional output sensitivities available upon request.
Ionization Chamber Potential	+75VDC ±10V (internally generated).
Output Reproducibility	Less than ±0.045 Coefficient of Variation.
Integrator Drift	No more than 50mV/8 seconds at standard CLAYMOUNT gain setting.
Output	Linear ramp with no more than ±5% deflection in full output scale.
Field Matching	Outputs of multi-field chambers are individually adjustable to within 5% of one another.
X-ray % Transmission	No less than 85% from 50kV to 150kV with 2.5mm to 3.0mm total aluminum equivalent beam filtration from the x-ray tube and collimator.
Internal Structure Imaging	Images caused by internal structures will result in an optical density variation no greater than 0.01 O.D. for exposures at 50kV using a 2 inch Plexiglas phantom, 2.5mm to 3.0mm aluminum equivalent beam filtration and a film density of 1.2 ± 0.1 O.D. with 400 ASA or equivalent screen-film combination.
Power Supply Requirement	± 11.4VDC to ±15.75 VDC @ 0.1A unless specified otherwise.
Operating Temperature	+10°C to +40°C
Operating Humidity	10% to 60% relative humidity non-condensing
Operating Atmospheric Pressure	860hPA to 1060hPA
Transport and Storage Temperature Range	-40°C to +70°C
Transport and Storage Humidity Range	10% to 95% relative humidity non-condensing
Transport and Storage Atmospheric pressure	860hPA to 1060hPA
Cable Connection	Shielded 24AWG cable. Standard cable length is 45 feet (13.7 meters).

WARNING: If this equipment is modified, appropriate inspection and testing must be conducted to ensure continued safe use of this equipment.

Only properly trained and qualified personnel should conduct the initial installation, calibration, or be permitted access any internal parts.

The ionization chamber may be isolated from the mains by shutting off the Automatic Exposure Control. (See the manual for the x-ray system)

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The following adjustments apply to the calibration of a 61154A pre-amplifier board for a stationary 3-field ionization chamber, e.g. for chest or table use. (Also valid for 61154B, 61154C, 61154G, 61154J, 61154L, 61154N, 61154S, 61154T and 61154Y)

Pre-amp Assembly	Description	Difference from 61154A
61154A	Calculated Gain Range = 1.0 to 21.0	None
61154B	Calculated Gain Range = 1.46 to 37.8	R24 = 560 ohm, R31 = 820 ohm Low-Profile Side-Turn Pots
61154C	Calculated Gain Range = 1.47 to 34.8	R24 = 1500 ohm, R31 = 2200 ohm R4 = 50K ohm
61154G	Calculated Gain Range = 1.22 to 29.0	R1, R2, R3, R4 = 50K ohm R24 = 1800 ohm, R31 = 2200 ohm
61154J	Calculated Gain Range = 1.47 to 34.8	R24 = 1500 ohm, R31 = 2200 ohm R4 = 50K ohm, Side-Turn Pots
61154L	Calculated Gain Range = 0.83 to 11.94	R24 = 1800 ohm, R31 = 1500 ohm Side-Turn Pots
61154N	Calculated Gain Range = 2.2 to 52.2	R31 = 2200 ohm R4 = 50K ohm
61154S	Calculated Gain Range = 2.68 to 63.7	R 4 = 50K ohm, R24 = 820 ohm R31 = 2200 ohm, Top-Turn Pots
61154T	Calculated Gain Range = 2.68 to 63.7	R 4 = 50K ohm, R24 = 820 ohm R31 = 2200 ohm, Side-Turn Pots
61154Y	Calculated Gain Range = 1.69 to 40.2	R 4 = 50K ohm, R24 = 1300 ohm R31 = 2200 ohm C1, C4, C7 =470 pF

WARNING:

- Do not attempt to service the equipment unless this service manual has been consulted and is understood.
- Failure to heed this warning may result in injury to the service provider, operator or patient from electric shock and mechanical or other hazards.

Note: When working with the pre-amplifier assembly it is important that electrostatic discharge (ESD) prevention techniques be observed. Before touching the pre-amp assembly, attach an ESD wrist strap to yourself. Be sure to ground yourself and the ionization chamber frame to dissipate static charges.

Note: The pre-amp assembly is a very delicate and sensitive device. It is important to keep it as clean as possible. Wash and dry your hands thoroughly before working with it and, when possible, use unpowdered latex or cotton gloves. Take care to touch the pre-amp board as little as possible. Take extra care to avoid touching the three air-mounted field inputs. Oils from your fingers on the air-mounts or their components can cause performance degradation.

The 61154A pre-amplifier board can be configured to operate with several different AEC systems. If specified at the time of purchase, the ionization chamber will be delivered with the pre-amplifier board already configured for a particular application. To reconfigure an ionization chamber for a different configuration, see the section on Ionization Chamber Inputs and Output and the section on Specific Configurations at the end of this document.

The procedure assumes that the installation of the Automatic Exposure Control (AEC) is complete and that the AEC and x-ray generator are in proper working condition. After making the necessary interconnections between the ionization chamber and the AEC, power up the system.

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Master Gain Adjustment:

Typically, the master gain adjustment is the only adjustment needed when installing ICX series ionization chambers. Use the master gain adjustment to match the overall chamber sensitivity to that of the other stationary chambers connected to the system. Note that the master gain adjustment is a multi-turn potentiometer. A clockwise adjustment to the master gain potentiometer will increase the sensitivity of the chamber, causing the length of the exposure (mAs) to decrease.
Make exposures and process the films. Adjust the master gain for the desired optical density. Make the master gain adjustment for each stationary chamber being installed.
Field Balance Check:

Using the AEC post-exposure mAs display or other calibrated mAs meter check the individual fields to see that they are balanced, that is, that they produce the same mAs reading. If mAs readings are not stable from exposure to exposure for an individual field, then it will be necessary to expose films and make these adjustments based upon optical density.

If necessary, adjust the individual gain potentiometers to balance the outputs to give the same mAs reading for each field selected individually. Note that individual gain adjustments are multi-turn potentiometers. A clockwise adjustment to a field gain potentiometer will increase the sensitivity of that field, causing the length of the exposure (mAs) to decrease.

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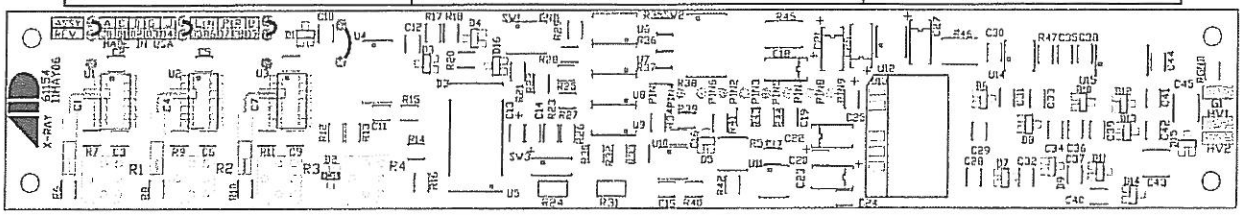
Ionization Chamber Pin-outs:

61154A Pre-amp Board Pin-out	Function	9-Pin Sub-D Pin-Out
1	NONE	1
2	FIELD 2 SELECT	2
3	FIELD 1 SELECT	3
4	RESET	4
5	OUTPUT	5
6	FIELD 3 SELECT	6
7	NEGATIVE SUPPLY	7
8	POSITIVE SUPPLY	8
9	GROUND	9

Acceptable Power Supply Ranges for 61154A Pre-amp:

Supply Voltage	Measurement Point	Acceptable Range
External +12VDC	61154A pin 8 (referenced to 61154A pin 9)	+11.4VDC to +15.8VDC
External -12VDC	61154A pin 7 (referenced to 61154A pin 9)	-11.4VDC to -15.8VDC
Internal +12VDC	Measure across 61154A C23	+10.8VDC to +12.5VDC
Internal -12VDC	Measure across 61154A C22	-10.8VDC to -12.5VDC
Internal +5VDC	Measure across 61154A C17	+4.7VDC to +5.3VDC
Internal +75VDC	Measure across 61154A C45 (HV1 to G1)	+65VDC to +85.0VDC



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Ionization Chamber Inputs and Output:

Signal	Switch	Comments
Positive Supply +12VDC	None	+11.4VDC to +15.75VDC less than 85 mA.
Negative Supply -12VDC	None	-11.4VDC to -15.75VDC less than 15 mA.
Low-Active Commands Reset & Field Selects	SW1-3 OFF SW1-4 ON	Pulling the Reset line to ground (≤6VDC) beginning at exposure start and lasting for the entire duration of the exposure allows the integrator to operate. Pulling the field select lines to ground (≤6VDC) will select the field.
High-Active Commands Reset & Field Selects	SW1-3 ON SW1-4 OFF	Driving the Reset line high (≥8VDC) beginning at exposure start and lasting for the entire duration of the exposure allows the integrator to operate. Driving the field select lines high (≥8VDC) will select the field.
Field Configuration A=1, B=2, C=3	SW2-1,5 & 8: ON SW2-2,3,4, 6 & 7: OFF	Field selects 1, 2 and 3 select left (A), center (B) and right (C), respectively, as viewed from the x-ray tube-side of the ionization chamber.
Field Configuration A=2, B=1, C=3	SW2-2,4 & 8: ON SW2-1,3,5, 6 & 7: OFF	Field selects 2, 1 and 3 select left (A), center (B) and right (C), respectively, as viewed from the x-ray tube-side of the ionization chamber.
Field Configuration A=3, B=1, C=2	SW2-3,4 & 7: ON SW2-1,2,5, 6 & 8: OFF	Field selects 3, 1 and 2 select left (A), center (B) and right (C), respectively, as viewed from the x-ray tube-side of the ionization chamber.
Field Configuration A=3, B=2, C=1	SW2-3,5 & 6: ON SW2-1,2,4, 7 & 8: OFF	Field selects 3, 2 and 1 select left (A), center (B) and right (C), respectively, as viewed from the x-ray tube-side of the ionization chamber.
Positive Output	SW3-1 ON SW3-2 OFF	Time integrated signal ramping from 0VDC to a maximum of at least 80% of the supply voltage (+9.6VDC for +12VDC supply). The slope of this signal is directly proportional to the amount of x-ray flux received.
Negative Output	SW3-1 OFF SW3-2 ON	Time integrated signal ramping from 0VDC to a maximum of at least 80% of the supply voltage (-9.6VDC for -12VDC supply). The slope of this signal is directly proportional to the amount of x-ray flux received.

Power Supply Isolation:

Signal	Switch	Comments
Power Supply Isolation Defeated	SW1-1 ON	Connects external ground (61154A Pin-9) to pre-amp chassis and ionization chamber frame. Default Setting.
Power Supply Isolation Enabled	SW1-1 OFF	Separates external ground (61154A Pin-9) from pre-amp chassis and ionization chamber frame to prevent ground loop.

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Specific Configurations:

Unless specified otherwise, ICX ionization chambers are delivered with an AID compatible jumper configuration. AID compatible means that the input and output signals will interface with Advanced Instrument Development, Inc's Expos-AID™ Automatic Exposure Control. This same configuration will also interface with Acoma, Control-X, CPI, Del Medical (Gendex), Electromed (EMD, Triton), OEC, Quantum Medical Imaging, Sedecal (Innerscan), Summit Industries, etc.

AID Compatible jumper configuration:

Function	Switch Setting
Defeat: Power Supply Isolation	SW1-1 ON
Enable: Alternate Field Selection	SW1-2 OFF
Low-Active Commands: Start Integrate & Field Selects	SW1-3 OFF SW1-4 ON
Field Configuration: A=2, B=1, C=3	SW2-2,4 & 8 ON SW2-1,3,5, 6 & 7 OFF
Positive Output	SW3-1 ON SW3-2 OFF

Alternate configurations are listed below.

GE, Fischer, Varian Compatible jumper configuration:

Function	Switch Setting
Defeat: Power Supply Isolation	SW1-1 ON
Enable: Alternate Field Selection	SW1-2 OFF
High-Active Commands: Start Integrate & Field Selects	SW1-3 ON SW1-4 OFF
Field Configuration: A=1, B=2, C=3	SW2-1,5 & 8 ON SW2-2,3,4, 6 & 7 OFF
Positive Output	SW3-1 ON SW3-2 OFF

GTR Labs Compatible jumper configuration:

Function	Switch Setting
Defeat: Power Supply Isolation	SW1-1 ON
Enable: Alternate Field Selection	SW1-2 OFF
Low-Active Commands: Start Integrate & Field Selects	SW1-3 OFF SW1-4 ON
Field Configuration A=3, B=1, C=2 (= GTR Labs fields 1-2-3)	SW2-3,4 & 7 ON SW2-1,2,5, 6 & 8 OFF
Positive Output	SW3-1 ON SW3-2 OFF

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Trex Medical - Continental, Keithley, Ratheon, Xonics Compatible jumper configuration:

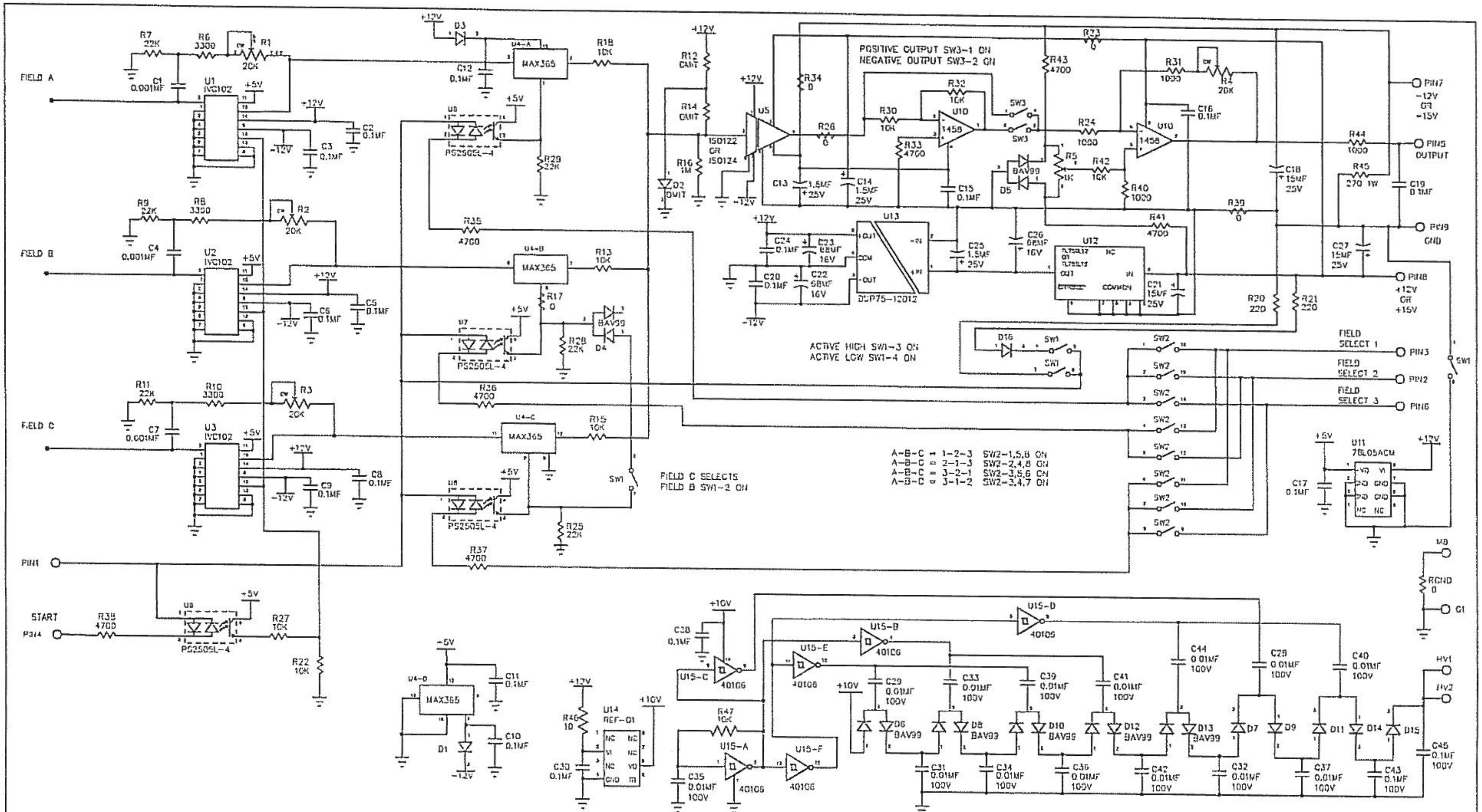
Function	Switch Setting
Defeat: Power Supply Isolation	SW1-1 ON
Enable: Alternate Field Selection	SW1-2 OFF
Low-Active Commands: Start Integrate & Field Selects	SW1-3 OFF SW1-4 ON
Field Configuration: A=1, B=2, C=3	SW2-1,5 & 8 ON SW2-2,3,4, 6 & 7 OFF
Positive Output	SW3-1 ON SW3-2 OFF

Trex Medical - Bennett, Health Care Manufacturing Compatible jumper configuration:

Function	Switch Setting
Defeat: Power Supply Isolation	SW1-1 ON
Enable: Alternate Field Selection	SW1-2 OFF
Low-Active Commands: Start Integrate & Field Selects	SW1-3 OFF SW1-4 ON
Field Configuration: A=1, B=2, C=3	SW2-1,5 & 8 ON SW2-2,3,4, 6 & 7 OFF
Negative Output	SW3-1 OFF SW3-2 ON

Picker Compatible jumper configuration:

Function	Switch Setting
Defeat: Power Supply Isolation	SW1-1 ON
Enable: Alternate Field Selection	SW1-2 OFF
Low-Active Commands: Start Integrate & Field Selects	SW1-3 OFF SW1-4 ON
Field Configuration: A=2, B=1, C=3	SW2-2,4 & 8 ON SW2-1,3,5, 6 & 7 OFF
Negative Output	SW3-1 OFF SW3-2 ON



REV	ECN NO.	DATE	REVISIONS	BY
04	2583	30JUL08	SEE COMPONENT LAYOUT	SO
04	2504	28DEC07	C26 WAS 15MF 20V	C.L.
03	2429	07NOV06	COPPER DATE [illegible]	SO
02	2291	10MAR05	COPPER DATE [illegible] ADDED R5, R41, R42, R43 & D5	SO
01	2238	17DEC04	COPPER DATE [illegible]	TRW
00	2045	01MAY02	[illegible]	TRW

NOTES:

1. * MANUFACTURER MAY USE ALTERNATE COMPONENTS UNLESS NOTED OTHERWISE.
2. ALL SWITCHES OFF UNLESS OTHERWISE NOTED.
3. U6,U7,U8, AND U9 MAY BE (4) SINGLE, (2) DUAL, OR (1) QUAD DEVICES.

DO NOT SCALE

SCALE: NONE | DRAWN BY: TRW | DATE: 01MAY02

ADVANCED INSTRUMENT DEVELOPMENT, INC.
2545 CURTISS ST.
DOWNERS GROVE, IL 60515

3-FIELD ISOLATED PRE-AMP
CALCULATED GAIN RANGE 1 TO 21
12T TOP-TURN POTS

USED ON: ICX SERIES | DRAWING NO.: 61154A | REV: 04

Claymount Assemblies B.V.
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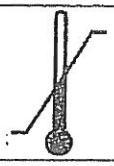
CE
0120
Ionization Chamber
model number beginning with
prefix 'ICX' or 'INX'

The Table below defines the meaning of various symbols found on the device labels and accompanying documents.

REF	Reference number symbol used to identify the model number
SN	Serial number symbol
EC REP	EC Representative in the European Community symbol
	Date of manufacture symbol
	Date of manufacture symbol Manufacturer symbol
	Warning symbol. Refer to accompanying documents for details.
c UL us	UL Recognized Component Marks for Canada and the United States
CE 0120	Conformité Européenne symbol with notified body identification number. Indicates product meets European Conformity standards.
	Keep product dry symbol
	Handle with care symbol
	Temperature limitation symbol. The upper and lower temperature limits will be indicated on either side of the symbol.

- For operating instructions, refer to the manual for the x-ray system. A translation of the installation and calibration instructions is available on request.
- Pour obtenir des instructions de fonctionnement, se reporter au manuel de l'appareil radiographique. Une traduction des instructions d'installation et d'étalonnage du préamplificateur de la chambre d'ionisation est disponible sur demande auprès du fabricant.
- 有关操作说明，请参阅 X 光系统手册

  电离室前置放大器的安装和校准说明书的翻译可向制造商索取。
- For betjeningsvejledning se manualen til røntgensystemet.
  De kan anmode fabrikanten om en oversættelse af installations- og kalibreringsvejledningen til ionisationskammerpreforstærkeren.
- Raadpleeg voor gebruiksinstructies de handleiding bij het röntgensysteem.
  Op verzoek kunt u van de fabrikant een vertaling van de installatie- en kalibratie-instructies voor de voorversterker van de ionisatiekamer krijgen.
- Für die Betriebsanweisung verweisen wir auf das Handbuch über das Röntgensystem.
  Eine Übersetzung der Installierungs- und Justierungsanweisungen für den Ionenkammer-Vorverstärker steht Ihnen auf Anfrage beim Hersteller zur Verfügung.
- Per le istruzioni d'uso, fare riferimento al manuale del sistema a raggi X.
  Su richiesta, è disponibile presso il produttore una traduzione delle istruzioni di installazione e di taratura per il pre-amplificatore della camera di ionizzazione.
- 操作手順については、X線システムのマニュアルを参照してください。

  イオンチェンバー前置増幅器の取り付けおよび校正手順の翻訳版は、ご要望があれば製造会社よりご入手いただけます。
- Para obtener las instrucciones de funcionamiento, consulte el manual del sistema radiográfico.
  El fabricante puede proporcionar, a petición una traducción de las instrucciones de instalación y calibración para el amplificador previo de la cámara de ionización.
- Se handboken till röntgensystemet för driftanvisningar.
  En översättning av installations- och kalibreringsanvisningarna för joniseringskammarens förförstärkare finns tillgänglig på begäran från tillverkaren.
- Az üzemeltetési utasításokat a röntgenrendszer leírásában találja. A telepítési és kalibrációs utasítások fordítása igény szerint rendelkezésre áll.
- Para as instruções operacionais, consulte o sistema de raios X. Uma tradução das instruções de instalação e calibração está disponível a pedido.

RETURNS POLICY

All material returns require a Return Authorization number (RA#). This number is obtained from the Service Department of Claymount Americas Corp. (630) 271-9729, FAX (630) 271-9995 or us.service@claymount.com

Please be prepared to supply the serial number, model number and as complete a description of the problem as possible.

Material being returned must be packaged to prevent damage during shipping (and we suggest that you insure the package). Mark the RA# on the outside of the package and ship the package, shipping prepaid to:

Claymount Americas Corp.
2545 Curtiss Street
Downers Grove, Illinois 60515, USA

Material returned for credit must be in original condition with no damage and is subject to a 15% restocking fee or $200.00 minimum. Material must be returned within sixty days of shipment from CAU.

Warranty returns

Warranty period:

New Ionization Chambers:	Two years from date of shipment.
New Equipment:	One year from date of shipment
Parts:	90 days from date of shipment.
Repairs:	Balance of equipment warranty or 90 days, whichever is longer.

Equipment is defined as having a CAU serial number label attached.

Parts are defined as individual components, cables or circuit boards.

Returned equipment found to have no problem is subject to a minimum labor charge.

TWO YEAR LIMITED WARRANTY

CLAYMOUNT AMERICAS CORP. (CAU) warrants each product manufactured by CAU to be free from defect in material and workmanship, for a period of two (2) years from the date of shipment from CAU.

If any defect in material or workmanship appears within the period of time specified above, the Purchaser shall notify CAU immediately and CAU shall thereupon correct the defect by repairing the defective part or product, or by supplying a replacement therefor at CAU's expense, if CAU finds the part or product was defective. At CAU's sole discretion and direction, the defective part or product shall either be returned to CAU for examination and repair with all transportation charges prepCAU by the Purchaser or, at CAU's discretion, the defective part or product shall be repaired or replaced in the field by an CAU representative.

This warranty does not extend to any CAU product which has been subject to misuse, neglect, accident, shipping damage, incorrect wiring by others, improper installation, or to use in violation of instructions furnished by CAU, nor to products on which the serial number or identifying numbers or date code have been removed, defaced or changed, nor to accessories used therewith not of CAU manufacture.

RoHS compliant products contain lead-free solder which is known to cause dendritic growth and can result in shorts between fine pitch electrical connections. This warranty does not cover failures due to dendritic growth from lead-free solder.

The conditions of any test to be made by the Purchaser shall be mutually agreed upon and CAU shall be notified of, and may be represented at, all such tests. The liability of CAU, except as to title, arising out of the supplying of sCAU part or product, or its use, whether on warranties or otherwise, shall be limited to the correction of defects as aforesCAU, and upon the expiration of the respective warranty periods all such liability shall terminate. In no event shall CAU be liable for special or consequential damages.

Adjustments will not be allowed on returned parts or products which meet CAU inspection standards, nor on parts or products which were sold more than two (2) years prior to return.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES SET FORTH ABOVE, AND SUCH WARRANTIES SHALL CONSTITUTE THE SOLE AND EXCLUSIVE LIABILITY OF CAU AND ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING THE WARRANTY OF MERCHANTABILITY, OR FITNESS FOR PURPOSE, AND ALL OTHER OBLIGATIONS OR LIABILITIES, EITHER IN CONTRACT OR IN TORT, OF CAU. CAU NEITHER ASSUMES, NOR AUTHORIZES ANY REPRESENTATIVE OF CAU OR ANY OTHER PERSON TO ASSUME FOR IT, ANY OTHER OBLIGATION OR LIABILITY IN CONNECTION WITH THE SALE OF ITS PRODUCTS. THE FOREGOING SHALL CONSTITUTE THE SOLE REMEDY OF THE PURCHASER.

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