

Three-field Ionization Chamber Calibration Procedure for  
 Pre-Amplifier board assemblies 61170A  
 (Also valid for the pre-amp assemblies listed below)

The following adjustments apply to the calibration of a 61170A pre-amplifier board for a stationary 3-field ion chamber, e.g. for chest or table use.

| Pre-amp Assembly | Description                          | Difference from 61170A                                                             |
|------------------|--------------------------------------|------------------------------------------------------------------------------------|
| 61170A           | Calculated Gain Range = 1 to 21      | None                                                                               |
| 61170C           | Calculated Gain Range = 1.47 to 34.8 | R24 = 1500 ohm<br>R31 = 2200 ohm<br>R4 = 50K ohm                                   |
| 61170J           | Calculated Gain Range = 1.47 to 34.8 | R24 = 1500 ohm<br>R31 = 2200 ohm<br>R4 = 50K ohm<br>Side-Turn Pots                 |
| 61170N           | Calculated Gain Range = 2.2 to 52.2  | R24 = 1000 ohm<br>R31 = 2200 ohm<br>R4 = 50K ohm                                   |
| 61170S           | Calculated Gain Range = 2.68 to 63.7 | R24 = 820 ohm<br>R31 = 2200 ohm<br>R40 = 680 ohm<br>R4 = 50K ohm                   |
| 61170T           | Calculated Gain Range = 2.68 to 63.7 | R24 = 820 ohm<br>R31 = 2200 ohm<br>R40 = 680 ohm<br>R4 = 50K ohm<br>Side-Turn Pots |

**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 ion 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.

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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 ion chamber and the AEC, power up the system.

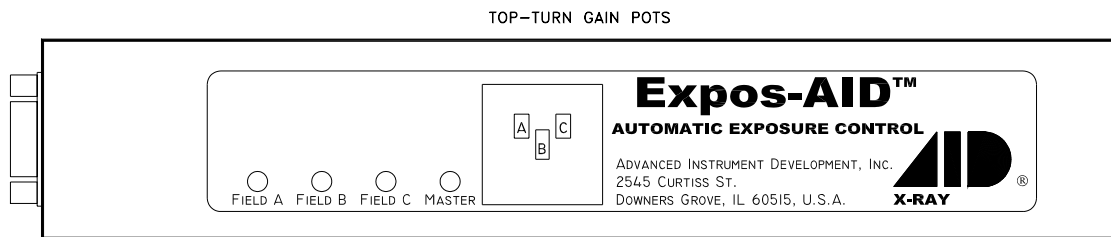
The 61170A pre-amplifier board can be configured to operate with several different AEC systems. If specified at the time of purchase, the ion chamber will be delivered with the pre-amplifier board already configured for a particular application. To reconfigure an ion chamber for a different configuration, see the section on Ion Chamber Inputs and Output and the section on Specific Configurations at the end of this document.

#### Calibration/Test Set Up:

Your X-Ray Generator/AEC Manual should cover this subject. Calibration procedures are specific to the X-Ray Generator/AEC. The Following is provided as additional information only.

Select the center field of the ion chamber. Set the generator for 100 kVp and maximum backup time. For 100 kVp use 8 to 10 inches (20 to 25 cm) of water or plastic for a phantom. Metals such as copper, aluminum or lead are not suitable for use as phantoms. Make sure the phantom is homogeneous and completely covers all fields equally. Center the x-ray beam on the center field. Collimate the x-ray beam so that it completely covers all three fields but does not extend beyond the limits of the phantom.

#### Adjustment Potentiometers:



All necessary adjustment potentiometers are accessible through the pre-amp chassis cover. There is no need to open the pre-amp cover during normal calibration procedures.

#### Master Gain Adjustment:

The master gain adjustment should be used to adjust the ion chamber to produce the correct optical density (OD) while only the Center Field (Field B) is selected. A replacement ion chamber's film optical density should usually be matched to that of other stationary ion 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 an exposure and record the post exposure mAs reading. Process the film. Measure and record the film optical density. Adjust the master gain for the desired optical density (normally between 1.1 and 1.8 OD, depending upon the user). Make the master gain adjustment using this formula:

$$\text{Desired mAs} = (\text{Desired OD} / \text{Measured OD}) \times \text{Measured mAs}$$

Note: Make sure that a film cassette is present while making all exposures. Cassette backscatter affects AEC operation.

Field Balance Check:

Using the AEC post-exposure mAs display or other calibrated mAs meter check the Left Field (Field A) and Right Field (Field C) individually to see that they each produce the same mAs reading as the Center Field (Field B).

If necessary, adjust the individual gain potentiometers to balance the outputs to give the same mAs reading for each field selected individually. Do not adjust Field B unless you run out of gain range on the Left and Right Field adjustments. If Field B requires readjustment, be certain to repeat the Master Gain adjustment.

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.

Ionization Chamber Pin-outs:

| 61170A Pre-amp Board Pin-out | Function        | 9-Pin Sub-D Pin-Out | 15-Pin Sub-D Pin-Out |
|------------------------------|-----------------|---------------------|----------------------|
| 1                            | NONE            | 1                   | 1                    |
| 2                            | FIELD 2 SELECT  | 2                   | 2                    |
| 3                            | FIELD 1 SELECT  | 3                   | 3                    |
| 4                            | RESET           | 4                   | 4                    |
| 5                            | OUTPUT          | 5                   | 5                    |
| 6                            | FIELD 3 SELECT  | 6                   | 6                    |
| 7                            | NEGATIVE SUPPLY | 7                   | 7                    |
| 8                            | POSITIVE SUPPLY | 8                   | 8                    |
| 9                            | GROUND          | 9                   | 9                    |
| N/C                          | NONE            | N/A                 | 10-15                |

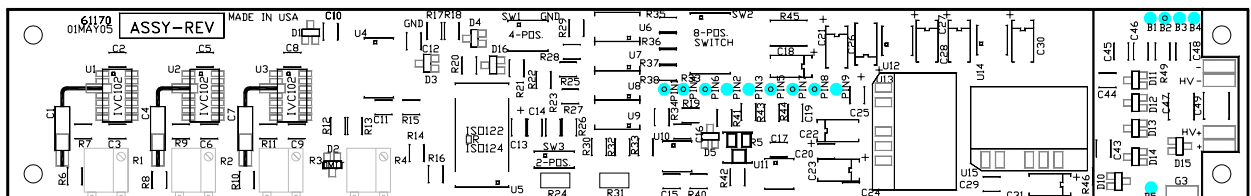
**NOTE:** Cable wire colors do not match those inside the pre-amp chassis. Cable pin-out details are available on-line at <http://www.aidxray.com> or by contacting Advanced Instrument Development, Inc.

Acceptable Power Supply Ranges for 61170A Pre-amp:

| Supply Voltage           | Measurement Point                         | Acceptable Range     |
|--------------------------|-------------------------------------------|----------------------|
| External +12VDC          | 61170A pin 8 (Referenced to 61170A pin 9) | +11.4VDC to +15.8VDC |
| External -12VDC          | 61170A pin 7 (Referenced to 61170A pin 9) | -11.4VDC to -15.8VDC |
| Internal +12VDC Isolated | Measure across 61170A C23                 | +10.8VDC to +12.5VDC |
| Internal -12VDC Isolated | Measure across 61170A C22                 | -10.8VDC to -12.5VDC |
| Internal +5VDC           | Measure across 61170A C17                 | +4.7VDC to +5.3VDC   |
| Internal +75VDC          | Measure across 61170A C49 (HV+ to HV-)    | +65VDC to +85.0VDC   |

Ionization Chamber Inputs and Output:

| Signal                                              | Switch                                         | Comments                                                                                                                                                                                                                                              |
|-----------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Positive Supply<br>+12VDC                           | None                                           | +11.4VDC to +15.75VDC less than 85 mA.                                                                                                                                                                                                                |
| Negative Supply<br>-12VDC                           | None                                           | -11.4VDC to -15.75VDC less than 15 mA.                                                                                                                                                                                                                |
| Low-Active<br>Commands<br>Reset<br>& Field Selects  | SW1-3 OFF<br>SW1-4 ON                          | Pulling the Reset line to ground ( $\leq 6VDC$ ) beginning at exposure start and lasting for the entire duration of the exposure allows the integrator to operate.<br>Pulling the field select lines to ground ( $\leq 6VDC$ ) will select the field. |
| High-Active<br>Commands<br>Reset<br>& Field Selects | SW1-3 ON<br>SW1-4 OFF                          | Driving the Reset line high ( $\geq 8VDC$ ) beginning at exposure start and lasting for the entire duration of the exposure allows the integrator to operate.<br>Driving the field select lines high ( $\geq 8VDC$ ) will select the field.           |
| Field<br>Configuration<br>A=1, B=2, C=3             | SW2-1,5 & 8:<br>ON<br>SW2-2,3,4, 6 & 7:<br>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 ion chamber.                                                                                                              |
| Field<br>Configuration<br>A=2, B=1, C=3             | SW2-2,4 & 8:<br>ON<br>SW2-1,3,5, 6 & 7:<br>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 ion chamber.                                                                                                              |
| Field<br>Configuration<br>A=3, B=1, C=2             | SW2-3,4 & 7:<br>ON<br>SW2-1,2,5, 6 & 8:<br>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 ion chamber.                                                                                                              |
| Field<br>Configuration<br>A=3, B=2, C=1             | SW2-3,5 & 6:<br>ON<br>SW2-1,2,4, 7 & 8:<br>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 ion chamber.                                                                                                              |
| Positive<br>Output                                  | SW3-1 ON<br>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<br>Output                                  | SW3-1 OFF<br>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.                                      |



Specific Configurations:

Unless specified otherwise, ICX ion 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                         |
|---------------------------------------------------------|----------------------------------------|
| Enable: Alternate Field Selection                       | SW1-2 OFF                              |
| Low-Active Commands:<br>Start Integrate & Field Selects | SW1-3 OFF<br>SW1-4 ON                  |
| Field Configuration:<br>A=2, B=1, C=3                   | SW2-2,4 & 8 ON<br>SW2-1,3,5, 6 & 7 OFF |
| Positive Output                                         | SW3-1 ON<br>SW3-2 OFF                  |

NOTES:

Switch SW1-1 must be off at all times.

When changing switch settings, the switches for selecting low-active and high-active signals, SW1-3 and SW1-4, must never be ON simultaneously.

Alternate configurations are listed below.

GE, Fischer, Varian Compatible jumper configuration:

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

GTR Labs Compatible jumper configuration:

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

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

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

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

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

Picker Compatible jumper configuration:

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

