Instruction Manual

SEB Electron Beam Control System

Thermionics Laboratory, Inc.

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Rev. C, February 2011

WARRANTY STATEMENT

Thermionics warrants each item it manufactures to be free from defects in workmanship and material for a period of one year from date of shipment. HM^2 e-Gun evaporation sources are warranted for a period of five years from date of shipment. Minor deviations which do not affect the performance of the equipment shall not be deemed to constitute defects of workmanship or materials, or failure to comply with the specifications.

Not withstanding the foregoing, Thermionics shall have no warranty responsibility for expendable items such as vacuum tubes, diodes, transistors, batteries, lamps, mechanical pump shaft seals and oil, diffusion pump oil, gaskets, or filaments. In addition, all vacuum gauge sensing devices such as thermocouple tubes, Pirani tubes, ionization gauge tubes, etc. are warranted against defects in manufacture in normal use, as determined be sellers inspection, for a period of ninety(90) days from date of shipment, provided the defective gauge tube is returned to the seller's plant for inspection.

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This warranty does not extend to Thermionics products which have been subject to misuse, neglect, accident, or improper application, nor shall it extend to units which have been substantially altered outside the Seller's plant except by a Thermionic's service engineer.

This warranty is expressly in lieu of all other obligations or liabilities on the part of Thermionics unless such additional warranty is either agreed to in writing, appears in a separate warranty statement provided to the customer, or appears in a warranty statement accompanying the product shipped to the customer. Under no circumstance will Thermionics be liable for consequential or resulting loss or damage, whether of or due to causes covered by Thermionics' warranty. Thermionics neither assumes nor authorizes any other person to make any other representation or warranty on its behalf, or assume for it any liability in connect with the sale of its products.

WARRANTY REPAIR

Notice of any claim that a product is in any way defective shall be given to Thermionics immediately upon discovery. Before any items are returned for repair and/or adjustment, approval of Thermionics must be obtained by the customer. Written authorization for the return and instructions as to how these times should be shipped will be provided. If any Thermionics products must be returned to the factory, they must be sent prepaid via the means of transportation indicated as being acceptable in the written authorization. Thermionics reserves the right to reject any warranty claim on any product that has been shipped by a non-acceptable means of transportation.

When Thermionics products are returned for examination and inspection, it is important that they be properly packed for shipment. Use the original packing material or equivalent. The sender and the shipping agency must assume the responsibility for damage resulting from improper packing or handling. And for loss of transit.

When products are returned, it is very important that the customer provide Thermionics with the data on the operating conditions and any other pertinent information which will enable us to determine the cause of failure. In all cases, Thermionics has sole responsibility for determining the cause of failure, and sole discretion in determining the nature and extent of adjustment, if any, to which a customer may be entitled.

If it is found that our product has been returned without cause and is still serviceable, the customer will be notified and the product be returned. All shipping costs on products returned for warranty repair shall be the customer's responsibility. Thermionic's sole liability hereunder shall be the correction and/or replacement of defective materials and workmanship.

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DANGER - HIGH VOLTAGE!!!

HIGH VOLTAGE IS PRESENT WITHIN THIS EQUIPMENT. CARE SHOULD BE EXERCISED AT ALL TIMES WHEN OPERATING OR TROUBLESHOOTING.

HUMAN CONTACT WITH THE VOLTAGES INSIDE THIS UNIT CAN BE FATAL.

Be certain to turn off the input power before opening the doors or panels. Short all capacitors with a grounding hook. Avoid testing live circuits.

If, in the process of troubleshooting, it becomes necessary to energize portions of the circuitry, extreme caution should be observed. All test meter connections should be made with power off. The test leads should be in good repair and have sufficient insulation for at least twice that to be measured. The test meter should not be touched after the power is turned on. Do not work in cramped spaces or cluttered areas. Troubleshooting of this nature should be carried out only by experienced personnel using standard approved safety procedures.

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SECTION 1

1.1 INTRODUCTION

The Thermionics Laboratory, Inc. Source 1 Controller provides the interlock system and emission regulation for the models SEB-06 and SEB-15 switching high voltage power supplies. Everything required for the control and monitoring of one electron beam gun is provided. If multiple gun operation is desired, additional source controllers can be added up to a total of 3 each per power supply.

1.2 DESCRIPTION/SPECIFICATIONS

One 19” rack mountable high voltage power supply provides the accelerating high voltage for up to 3 electron beam guns. See High Voltage power supply manual for specifications.

One half rack mountable Source 1 control chassis: 9.5”W x 21.0” D x 5.25”H.

Input: 85 - 264 VAC 50/60 Hz. 2 Amperes.

Output: 24 VDC to safety/process interlock strings.

0 – 10 VDC control signal to the SCR inside the filament transformer enclosure

One filament transformer enclosure: 11.0”W x 18.0”D x 11.0”H.

Input: 208 – 240 VAC 50/60 Hz. Single Phase. 5 Amperes

Output: 10 KV Negative (Maximum SEB Output).

10 VAC, 70 Amps (Maximum filament power).

All connecting cables.

SECTION 2

INSTALLATION

2.1 ELECTRICAL REQUIREMENTS

Refer to diagram 3-2 on page 22 for an example of the electrical connections for a single e-Gun system.

NOTE: Care MUST be taken when routing all cables. For example, high voltage, AC input, ground and sweep control cables should not be bundled together but take separate routes to their destinations. Ground cables should be straight runs not coiled and be as short as possible. Avoid running high voltage cables near sensitive instruments such as vacuum gauges and microprocessor controlled devices.

Three input power circuits are required for operation. See section 1.2 and the high voltage power supply manual for detailed information.

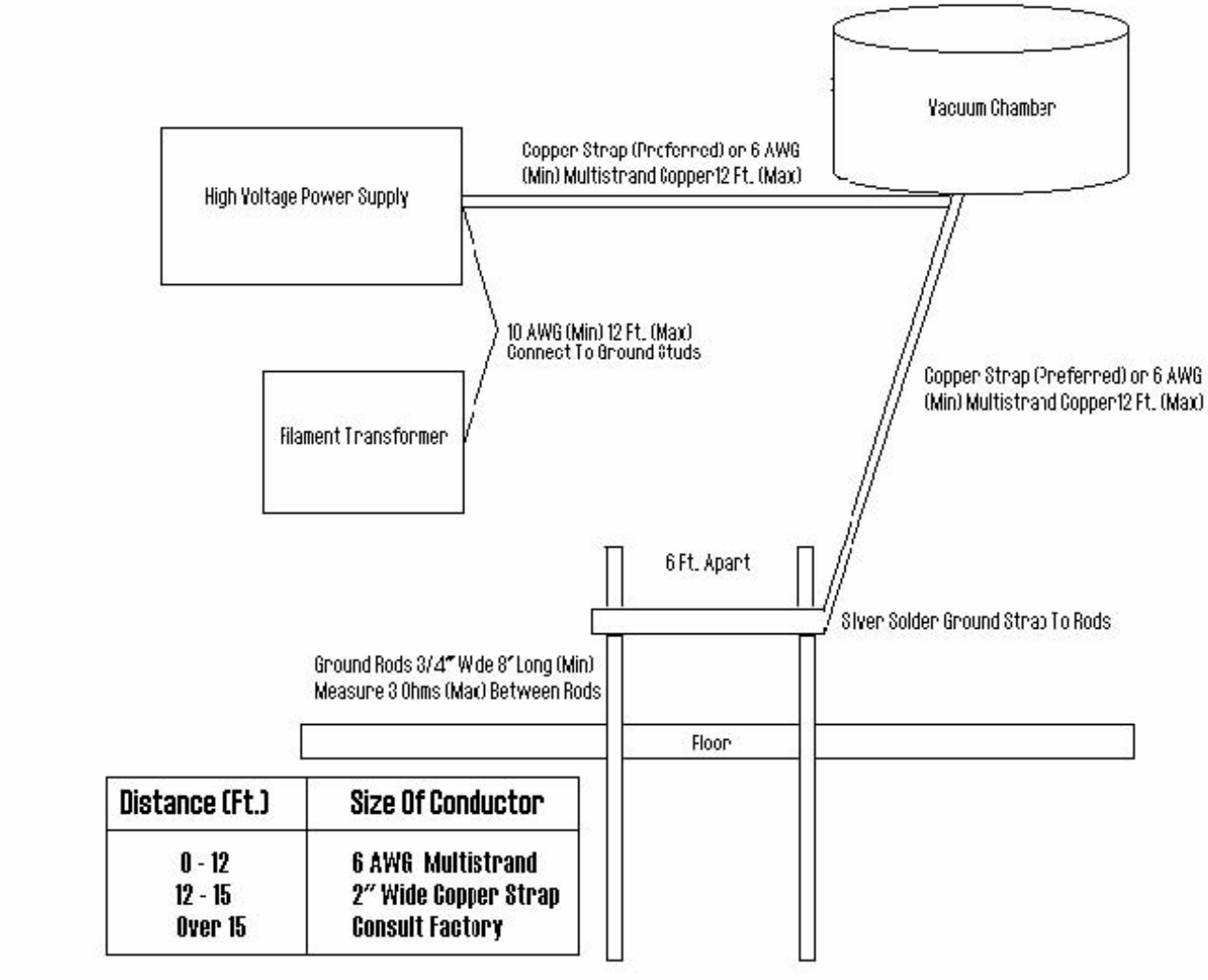
Each power circuit has overload protection. The HV Interlock/Source 1 Controller has a fuse within the AC line cord receptacle located on the rear panel. The high voltage power supply has a 3 pole circuit breaker located on the front panel and the Gun #1 filament transformer has a 2 pole 15 A circuit breaker located at the input end of the enclosure.

2.2 SYSTEM GROUND

The ground system is a VERY important aspect of electron beam equipment installation. The vacuum chamber, high voltage power supply and filament transformer must be connected to a GOOD earth ground.

Under normal conditions, a good earth ground will consist of two ¾ inch diameter copper clad rods 8 feet long (min) driven through the floor and into the earth 6 feet apart as close as possible to the vacuum chamber location. These rods should be connected to the vacuum chamber by 2” wide 0.05” thick copper strap. The strap should be silver soldered to the ground rods after ensuring there is 3 ohm (max) resistance between them. Braided cable is not recommended and care should be taken to ensure connections are tight and to clean bare metal surfaces rather than coated or painted ones.

Keep in mind this is a high frequency as well as a DC ground. RF generation during evaporation varies with a number of parameters including vacuum level, chamber shape and material, evaporant material and high voltage level. As impedance is the important factor, measuring DC resistance from point to point on the system or between the system and earth ground will not represent actual RF ground capability. For this reason Thermionics recommends the physical ground specifications in figure 1 on page 6.



Distance (Ft.)	Size Of Conductor
0 - 12	6 AWG Multistrand
12 - 15	2" Wide Copper Strap
Over 15	Consult Factory

Figure 1

If the equipment is installed on upper floors, the system ground may be accomplished by connecting to the steel structure of the building. This should be done only after insuring the steel structure itself has a good earth ground. Do not depend on water pipes for the system ground connection. Because of the many joints and sealing compounds used in water pipe installation, no assumption should be made as to the impedance of the pipe to earth ground.

2.3 SOURCE CONTROLLERS

The Source 1 Controller is provided with the purchase of an SEB High Voltage power supply. If more than one e-Gun (up to a total of 3) operation is desired, optional Source 2 and Source 3 Controllers can be provided.

The Source 1 Controller is the master controller for both single and multiple e-Gun operation. Primary AC input power (115VAC 2A domestic U.S. or 220VAC 1A International) is connected to the fused input located on the rear panel. All high voltage interlocks originate and end at the Source 1 Controller. Main power on/off and emission control crossover from "Manual" (potentiometer) to "Auto" (optional deposition rate controller) is done with the key switch. The output of the rate controller connects to a BNC connector located on the rear panel of each source controller. The selected key switch mode applies to all source controllers connected in the system.

A 6 foot cable is provided for connecting the Source 1 Controller interlock string to the SEB HV power supply. This cable is connected to the rear panel of the Source 1 Controller connector labeled " HV Pwr Supply I/O" and to the SEB HV power supply rear panel connectors labeled J4 and J5.

A black 14 pin circular connector serves as a jumper for terminating the connection to additional source controllers if only one e-Gun is in operation. This jumper is to be located at the Source 1 Controller rear panel connector labeled "To: Gun 2 Control" and must be removed to connect a Source 2 Controller. A 3 ft. cable is connected between here and the Source 2 Controller rear panel connector labeled "To: Gun 2 Control". The jumper is then moved to the Source 2 controller rear panel connector labeled "To: Gun 3 Control". The same connection procedure is used for connecting a Source 3 Controller. As these controllers are connected in series, the last controller must have the jumper installed.

Hand Held Remote Control is available. These (optional) remote control boxes allow emission and beam sweep control at the vacuum chamber location. There is also an emergency high voltage off mushroom switch on each HHRC. Where these remote controls are not used, a 25 pin jumper plug must be installed on each source controller rear panel connector labeled "Remote".

2.4 FILAMENT TRANSFORMER ENCLOSURES

One filament transformer is provided with each source controller. This filament transformer is mounted inside an enclosure that must be located near the vacuum tank. Ten foot filament cables terminated with high voltage connector(s) are designed to plug onto Thermionics high voltage feedthroughs. The dual high voltage connector has an interlock switch positioned such that the connector must be plugged all the way onto the feedthrough to satisfy the interlock circuitry.

There are three high voltage output connectors on the rear panel of each SEB HV power supply for connecting up to three filament transformer high voltage coaxial cables.

Primary AC power (208 – 240 VAC) is connected to the gun 1 enclosure connector labeled “Input”. If a second e-gun is to be operated a 3 ft. cable is connected to the gun 1 enclosure connector labeled “Output” and to the gun 2 enclosure labeled “Input”. An additional 3 ft. cable is provided for operating a third e-gun.

Each filament transformer enclosure is connected to the associated source controller via a control cable. This control cable also serves to complete the DC current feedback loop. Each filament transformer has a 16 pin connector labeled To: Source 1, 2 or 3 Controller and each source controller has a 14 pin connector labeled To: Fil. Transformer 1, 2 or 3 for connection of these cables.

The High Voltage interlock string is connected from the Source 1 Controller rear panel TB901 pins 5,6 to the Gun 1 Filament Transformer Enclosure with the cable provided. A black 4 pin circular connector serves as a jumper for completing the interlock string. If a Gun 2 Filament Transformer is used the jumper is removed and a 3 ft. cable is provided to connect the interlock string between the Gun 1 transformer and the Gun 2 transformer. The jumper is then moved to the Gun 2 transformer.

The same connection procedure is used for connecting a Gun 3 transformer. As these transformer enclosure interlocks are connected in series, the last enclosure must have the jumper installed for the interlock circuitry to be satisfied. The last transformer jumper can also be broken for the purpose of connecting an external safety interlock such as a switch connected to a door or access panel. If the interlock circuitry is not connected properly or each dual high voltage connector is not plugged all the way onto the chamber high voltage feedthrough, the Source 1 Controller LED labeled External will not light and the SEB HV power supply will not turn on.

2.5 MAIN POWER CONNECTIONS

After installing all connecting cables, grounds and high voltage feedthrough connectors, the sources of main power can be connected to the system.

The SEB high voltage power supply is provided with a 12 foot 4 conductor cable for connecting main three phase power to the unit. One end, stripped and tinned, is connected to the screw terminals in on the rear panel. The other end is for connection to a user provided service disconnect.

The Source controllers are provided with computer grade power cord for connecting 115 or 220 VAC to the rear of the Source 1 controller. This cable provides power for all additional source controllers connected in the system.

The Gun 1 filament transformer enclosure is provided with a 12 foot 3 conductor cable for connection to 208 – 240 VAC single phase power. One end is connected to the Gun 1 filament transformer connector labeled input. This cable provides power for all additional filament transformers in the system.

Where a second filament transformer is used, a three foot three conductor cable is connected between the Gun 1 filament transformer connector labeled output and the Gun 2 filament transformer connector labeled input.

The same connection procedure is used for connecting primary power to a Gun 3 filament transformer.

SECTION 3 THERORY OF OPERATION

3.1 INTERLOCKS

The first LED indicator in the interlock string is labeled “KEY”. It is provided to give an indication that the control power is on or off. When the key is switched into either the “Manual” or “Auto” mode, two DC power supplies are turned on inside the Source 1 Controller. 24 VDC supplies power to the interlock circuits. +/- 15 VDC supplies power to the closed loop current feedback systems.

The second LED indicator is labeled “VACUUM”. It is energized by providing a closure to terminals 1 and 2 of TB901, located on the rear panel of the Source 1 Controller. This is a point for connecting the relay output of vacuum gauge controller for the purpose of ensuring there is sufficient vacuum in the chamber before High Voltage can be turned on.

The third LED indicator is labeled “WATER”. It is energized by providing a closure to terminals 3 and 4 of TB901, located on the rear panel of the Source 1 Controller. This is a point for connecting the relay output of a water flow switch for the purpose of ensuring there is sufficient cooling water to the e-Gun in the chamber before High Voltage can be turned on.

The forth LED indicator is labeled “EXTERNAL”. It is energized by providing a closure to terminals 5 and 6 of TB901, located on the rear panel of the Source 1 Controller. This is a point for connecting the filament transformer interlocks for the purpose of ensuring that all High Voltage Connectors are installed properly before high voltage can be turned on.

The fifth LED indicator is labeled “REMOTE”. It is energized when all emergency mushroom switches on the Hand Held Remote Control boxes are in the up position. Where the HHRC boxes are not used, jumper plugs must be installed on the rear panels of the source controllers at the 25 pin connectors labeled “REMOTE”.

When all of the interlock conditions are satisfied, a green LED indicator labeled “READY” will light. This will also enable the OFF pushbutton on the front panel of the SEB High Voltage power supply. The system is now ready for operation.

Additional Source Controllers connected in the system have operational interlocks for protection of the source as well.

The first LED indicator is labeled “VACUUM”. It is energized by providing a closure to terminals 1 and 2 of TB1001, located on the rear panels of the Source 2 and 3 Controllers. This is a point for connecting the relay output of vacuum gauge controller for the purpose of ensuring there is sufficient vacuum in the chamber before High Voltage can be turned on.

The second LED indicator is labeled “WATER”. It is energized by providing a closure to terminals 3 and 4 of TB1001, located on the rear panels of the Source 2 and 3 Controllers. This is a point for connecting the relay output of a water flow switch for the purpose of ensuring there is

sufficient cooling water to the e-Gun in the chamber before High Voltage can be turned on.

When all of the interlock conditions are satisfied, a green LED indicator labeled “READY” will light. This will also enable the OFF pushbutton on the front panels of the additional Source Controllers. These controllers are now ready for operation.

3.2 CLOSED LOOP FEEDBACK SYSTEM

The emission current of the electron beam gun is determined by the power applied to the filament and this current must be tightly controlled to keep the emission current constant. A closed loop feedback system is used to drive an SCR located in the Filament Transformer enclosure. This SCR controls the primary (208-240VAC) input to a filament transformer.

A transducer whose output is proportional to the e-Gun emission current generates the feedback signal. This device also drives the current meter on the front panel of the associated source controller. The feedback signal is compared to a DC signal developed by the Emission potentiometer (in “Manual” mode) or the input signal from an optional deposition rate controller (in the “Auto” mode). The resultant error signal is applied to the SCR controlling the input to the filament transformer. An increase of the error signal results in increased filament current to the e-Gun.

During an arc or over current situation as is common in e-Gun operation, the filament current is reduced to the level set by the Bias potentiometer located on the rear panel of the Source controllers. When the arc is extinguished, emission current regulation resumes.

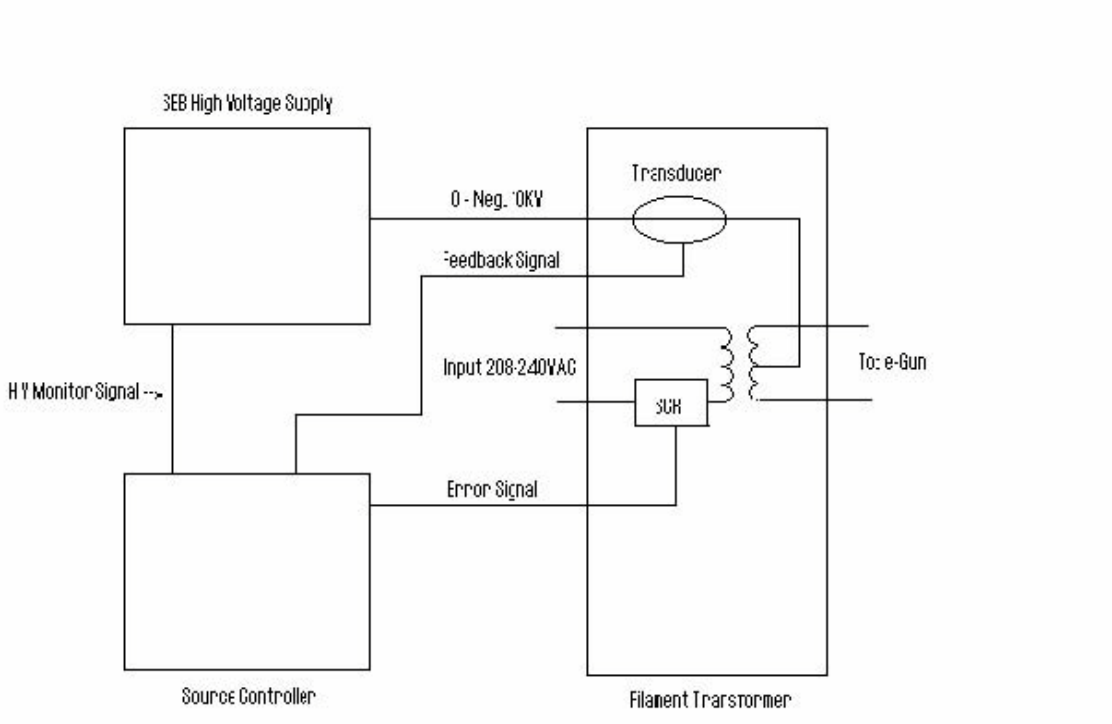


Figure 2

Simplified diagram of the closed loop feedback system.

3.3 FILAMENT CHECK

The Filament Check circuit is provided to allow the user to check the operation and or the condition of the e-gun filament without high voltage. A momentary rocker switch and indicator LED are located on the Source controller front panels for this purpose.

When the Filament Check switch is depressed with the key in the “Manual” or “Auto” mode, the “Filament Check LED” and the “Emission On” pushbutton will illuminate indicating the filament circuits are in operation. As Filament Check is a test of the e-Gun filament only, the high voltage if on will turn off. An upscale reading of 0.250 to 0.500 Amps by the emission meter indicates current is passing through the e-gun filament. It is a good idea to hold the Filament Check switch down for a few seconds to ensure the filament can maintain a steady flow of current. When the Filament Check switch is released, the meter and filament circuits will return to their “Ready” states.

If there is no upscale reading indicated by the emission meter or the reading cannot be maintained while holding the switch depressed, it may be necessary to replace the e-gun filament.

SECTION 4

START UP / SHUT DOWN

4.1 INTRODUCTION

As Hand Held Remote Control options are available with the SEB series systems, “Manual” mode will refer to filament operation control by either the front panel of a Source Controller or a HHRC connected to a Source Controller. The “Auto” mode refers to filament operation control by means of an external signal. Thermionics Laboratory , Inc. Source Controllers are designed to accept the zero to negative 10 Volt DC output of many commercially available Deposition Rate Controllers.

4.2 MANUAL MODE

Insert key into the switch on the Source 1 Controller and rotate counterclockwise to the “Manual” position. Observe the interlock LED’s. If all interlock conditions are satisfied, the green “Ready” indicator will be on. The green lamp on the emission off pushbutton will also be on. Turn on the circuit breaker on the filament transformer enclosure

NOTE: The SEB series high voltage power supplies are configured for manual operation See the SEB instruction manual for additional information about remote operation.

Turn on the circuit breaker on the SEB High Voltage power supply front panel. The yellow “Mains” and green “Interlock” LEDs should be on and the “HV Off” pushbutton should be illuminated indicating all safety, process interlocks are satisfied and the high voltage is ready to be turned on. Press the “HV On” pushbutton. The “HV Off” lamp should go out and the “HV On” indicator should stay lit.

Rotate the “Output Adjust” potentiometer clockwise observing the “HV Output” meter until the desired high voltage level is obtained. The Source Controllers are interlocked such that emission cannot begin until the high voltage is set above 3.8 Kilovolts. Thermionics e-Guns will run from 4KV to 10KV. See the e-Gun instruction manual for appropriate high voltage operating level.

From this point either Source Controller front panel or Hand Held Remote Control will be used to control emission. Press the “Emission On” pushbutton. The red indicator should remain illuminated. Rotate the “Emission Adjust” potentiometer clockwise observing the “Emission” meter until the desired level of emission current is obtained.

When deposition is complete, rotate “Emission Adjust” potentiometer fully counterclockwise and press the “Emission Off” pushbutton.
Rotate “Output Adjust” potentiometer on the SEB power supply fully counterclockwise and press the “HV Off” pushbutton.

Return the key on the Source 1 Controller to the “Safe” position. Allow several minutes for the SEB High Voltage power supply to cool and turn off the main circuit breaker.

4.3 AUTO MODE

Insert key into the switch on the Source 1 Controller and rotate counterclockwise to the “Auto” position. Observe the interlock LED’s. If all interlock conditions are satisfied, the green “Ready” indicator will be on. The green lamp on the emission off pushbutton will also be on. Turn on the circuit breaker on the filament transformer enclosure.

NOTE: The SEB series high voltage power supplies are configured for manual operation See the SEB instruction manual for additional information about remote operation.

Turn on the circuit breaker on the SEB High Voltage power supply front panel. The yellow “Mains” and green “Interlock” Leds should be on and the “HV Off” pushbutton should be illuminated indicating all safety interlocks are satisfied and the high voltage is ready to be turned on. Press the “HV On” pushbutton. The “HV Off” lamp should go out and the “HV On” indicator should stay lit.

Rotate “Output Adjust” potentiometer clockwise observing the “HV Output” meter until the desired high voltage level is obtained. The Source Controllers are interlocked such that emission will not begin until the high voltage is set above 3.8 Kilovolts. Thermionics e-Guns will run from 4KV to 10KV. See the e-Gun instruction manual for appropriate high voltage level.

From this point only a closure at the source 1 rear panel I/O connector pins 5 and 6 will turn on the emission contactor. The red indicator should remain illuminated. Start the program on the Deposition Rate Controller. After the desired rate has been obtained, press the “Emission Off” pushbutton.

Rotate “Output Adjust” potentiometer on the SEB power supply fully counterclockwise and press the “HV Off” pushbutton. Return the key on the Source 1 Controller to the “Safe” position. Allow several minutes for the SEB High Voltage power supply to cool and turn off the main circuit breaker.

4.4 FIRST TIME EVAPORATION

Before initial operation of an electron beam source is attempted several items should be checked first.

Cooling water should be supplied to the electron beam source as recommended in the evaporation source manual.

Crucible loaded to approximately 80 % with evaporant material.

Electrical connections can be checked with an ohm meter at the high voltage feedthroughs. Check between the two conductors for continuity less than 1 ohm. Check between each conductor and the chamber wall (ground) for an open circuit.

Verify the power supply and vacuum chamber are properly grounded in accordance with section 2.2 of this manual. Connect the high voltage connector(s) to the feedthrough conductors. Ensure the connections are tight.

If an optional XY axis beam sweep controller is used, verify the current at both axis' is at zero.

Once becoming familiar with the power supply control features, the system is ready to be operated.

A vacuum of 5×10^{-5} torr (mm of Hg) or better is recommended. At higher pressures interaction with residual gasses can result in causing defects and impurities in the deposited film. Increased arcing and a more diffused beam concentration result as well as the formation of glow discharge regions at higher pressures.

The high voltage is then turned on and after a stable voltage is present, the filament power can be applied (emission current). This current should be brought up slowly until a slight bluish glow is observed. The emission meter will be at a small value at this point (under 50 mA). If an emission current in excess of 50 mA is measured and no visible indication of the beam is observed the system will need to be shut off and opened for investigation of the problem. Improper magnetic field orientation or strength and/or incorrect acceleration voltage can cause the beam to be emitted in such a fashion as not to reach the evaporant material. If the electron beam is run at high power under such a condition, damage to the area of the beam impact will result.

Once the beam has been located use the optional X-Y axis sweep coil system to position the beam on the center of the evaporant material. If the material is capable of melting bring up the power until the material begins to melt. If the material is in a pellet or chunk form, sweeping of the beam can be used to speed up the melting process. Some materials transfer heat readily to adjacent material resulting in a constant flow of material back into the melt, however some materials do not act as well in this respect and require sweeping to maintain a constant molten pool of material. Tunneling of the beam into the material should be avoided. The beam sweep should be used in all situations where a constant flat vapor emitting surface area can not otherwise be maintained.

It is always best to increase the power slowly as this will result in a more stable increase in temperature. Most materials require a period of outgassing of impurities. During this period a shutter system is normally utilized to prevent the deposit of these impurities onto the substrate. After the material has been melted and degassed, the power can again be increased gradually to the desired point of evaporation. The evaporant material should be allowed a brief period to achieve thermal equilibrium and then the shutter can be opened and the desired film can be deposited. After the film has been deposited, the shutter can again be closed and the electron beam source turned off.

Adequate time should be provided after shutting off the source to allow the filament cool down before releasing the system to atmosphere. If the air is introduced too soon the filament will be destroyed. After a few minutes the system can be released to air (the use of dry nitrogen will

result in improved filament life).

SECTION 5 MAINTENANCE

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Be certain to turn off the input power before opening the doors or panels. Short all capacitors with a grounding hook. Avoid testing live circuits.

If, in the process of troubleshooting, it becomes necessary to energize portions of the circuitry, extreme caution should be observed. All test meter connections should be made with power off. The test leads should be in good repair and have sufficient insulation for at least twice that to be measured. The test meter should not be touched after the power is turned on. Do not work in cramped spaces or cluttered areas. Troubleshooting of this nature should be carried out only by experienced personnel using standard approved safety procedures.

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5.1 CALIBRATION

This section describes the procedure for calibrating the emission current meter. A calibrated precision power supply capable of displaying current is required for this procedure.

With the circuit breaker on the SEB high voltage power supply in the off position and input power removed, DISCONNECT THE COAXIAL CABLE FROM THE REAR OF THE POWER SUPPLY. Disconnect the connector(s) from the vacuum chamber feedthroughs. This leaves only the input (208 – 240 VAC) cable and the control cable connected to the filament transformer enclosure.

Connect the coaxial cable from the filament transformer enclosure to the ground terminal on the precision power supply. The positive output of the supply connects to one of the filament power leads at the vacuum chamber feedthrough connector(s). Remove the top cover of the source controller under test. Care should be taken due to the presence of input voltage (115 or 220 VAC) inside this controller. Observe the location of the calibration potentiometer behind the emission current meter.

Turn the key switch on the source 1 controller to the “On” position. Allow a minute for the circuitry to energize and observe the emission current meter. The meter should display a reading of zero amps. Plus or minus adjustments can be made with a potentiometer located behind the digital meter.

Set the output of the precision power supply to 0.5 amps. Observe the emission current meter. If a reading of 500 milli amps is present , no further action is required. Plus or minus adjustments can be made by turning the calibration potentiometer located behind the emission current meter inside the source controller.

5.2 TROUBLESHOOTING

One of the most common problems associated with electron beam equipment is the loss of or absence of emission current. This is in most cases due to problems with the e-Gun filament. At the end of service lifetime a filament will open breaking the connection to the filament transformer.

The condition of the filament can be checked in two ways. First use the Fil Chek feature on the associated source controller. When the Filament Check switch is depressed with the key in the “Manual” or “Auto” mode, the “Filament Check LED” and the “Emission On” pushbutton will illuminate indicating the filament circuits are in operation. An upscale reading of 0.250 to 0.500 Amps by the emission meter indicates current is passing through the e-gun filament. It is a good idea to hold the Filament Check switch down for a few seconds to ensure the filament can maintain a steady flow of current. When the Filament Check switch is released, the meter and filament circuits will return to their “Ready” or “Off” states.

If no reading is observed on the meter, the vacuum chamber feedthrough connector(s) should be removed and the e-Gun filament resistance checked With an ohm meter, check between the two conductors for continuity less than 1 ohm. Check between each conductor and the chamber wall (ground) for an open circuit. If an “open” circuit is measured between the two feedthrough

connectors, the system must be vented and opened to inspect and or replace the e-Gun filament.

If no reading is observed on the emission meter when the Filament Check switch is pressed and the e-Gun filament measures the correct resistances, the filament control circuitry may need to be checked for proper operation.

Two test power supplies are required for checking the operation of the filament control circuitry. A precision power supply capable of displaying current as in section 5.1 and a source of greater than 4 VDC but not more than 10 VDC. A 9 volt battery will work for this test.

Place the source 1 controller key switch in the “Off” mode. Remove the 15 pin connector located on the rear panel of the source 1 controller labeled “HV PS I/O”. Connect the output of a nine volt battery (or test power supply) to pins 3(+) and 4(-) at the open rear panel connector. Connect the leads from a volt meter to both filament cables removed from the vacuum chamber feedthroughs. Set the volt meter to measure volts AC.

If the chamber is not currently under vacuum and the water is not flowing to the e-Gun, these two interlocks must be shorted at the rear panel of the source controller under test. Jumper positions 1, 2 and 3, 4 on the interlock terminal block.

Turn the source 1 controller key switch to the “Manual” mode. Press the filament “On” pushbutton on the source controller under test and rotate the emission potentiometer clockwise. Observe the meter voltage increase from zero to approximately 10.5 VAC. Rotate the potentiometer counterclockwise and observe the voltage decrease to nearly zero.
If there is no increase and or decrease of this AC voltage, this would indicate a problem with filament control amplifier PCB located inside the associated source controller. Contact Thermionics for information regarding replacement parts or additional testing procedures.

5.3 SCHEMATICS/DATA SHEETS

1. SEB Power Supply Source 1 Controller/Transformer Connection Pg. 22

2. SEB Power Supply Source 1 Controller/Transformer Connection Pg. 23

3. Wiring Diagram, HV Interlock Source 1 Controller Pg. 24

4. Schematic, Digital Metering Rev 1 Pg. 25

5. Component Layout, Filament Control Amplifier PCB Pg. 26

6. Wiring Diagram, Filament Transformer Enclosure Rev C Pg. 27

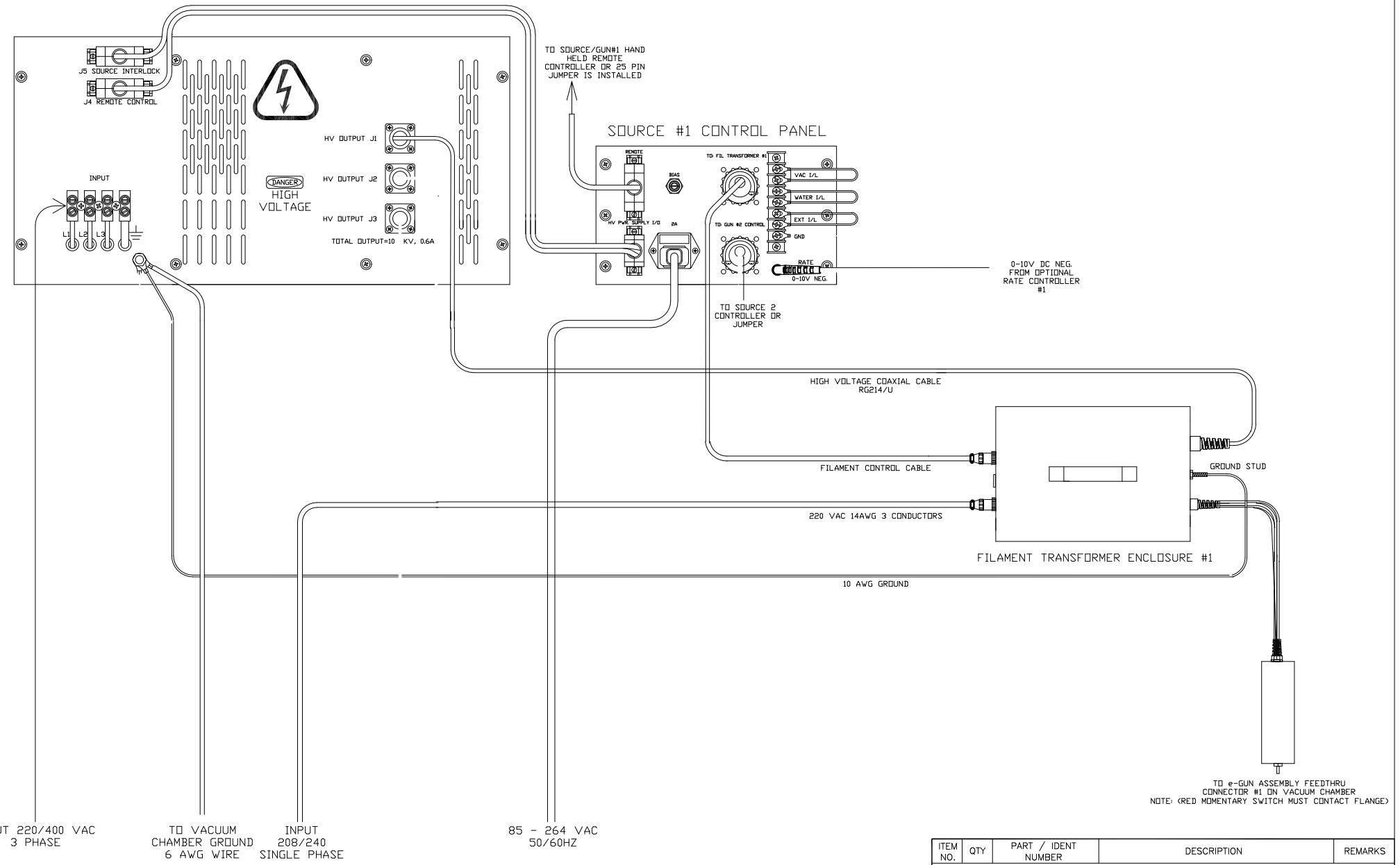
7. Schematic, Filament Control Amplifier PCB Rev B Pg. 28

8. Data Sheet Current Sensor 700-S218-903 Pg. 29

9. Wiring Diagram, Hand Held Remote Control Rev. B Pg. 30

10. Data Sheet, Control Concepts Model 1022 SCR Module Pg. 31

11. Data Sheet GLC-75 Power Supply Pg. 37



ITEM NO.	QTY	PART / IDENT NUMBER	DESCRIPTION	REMARKS

LIST OF MATERIALS

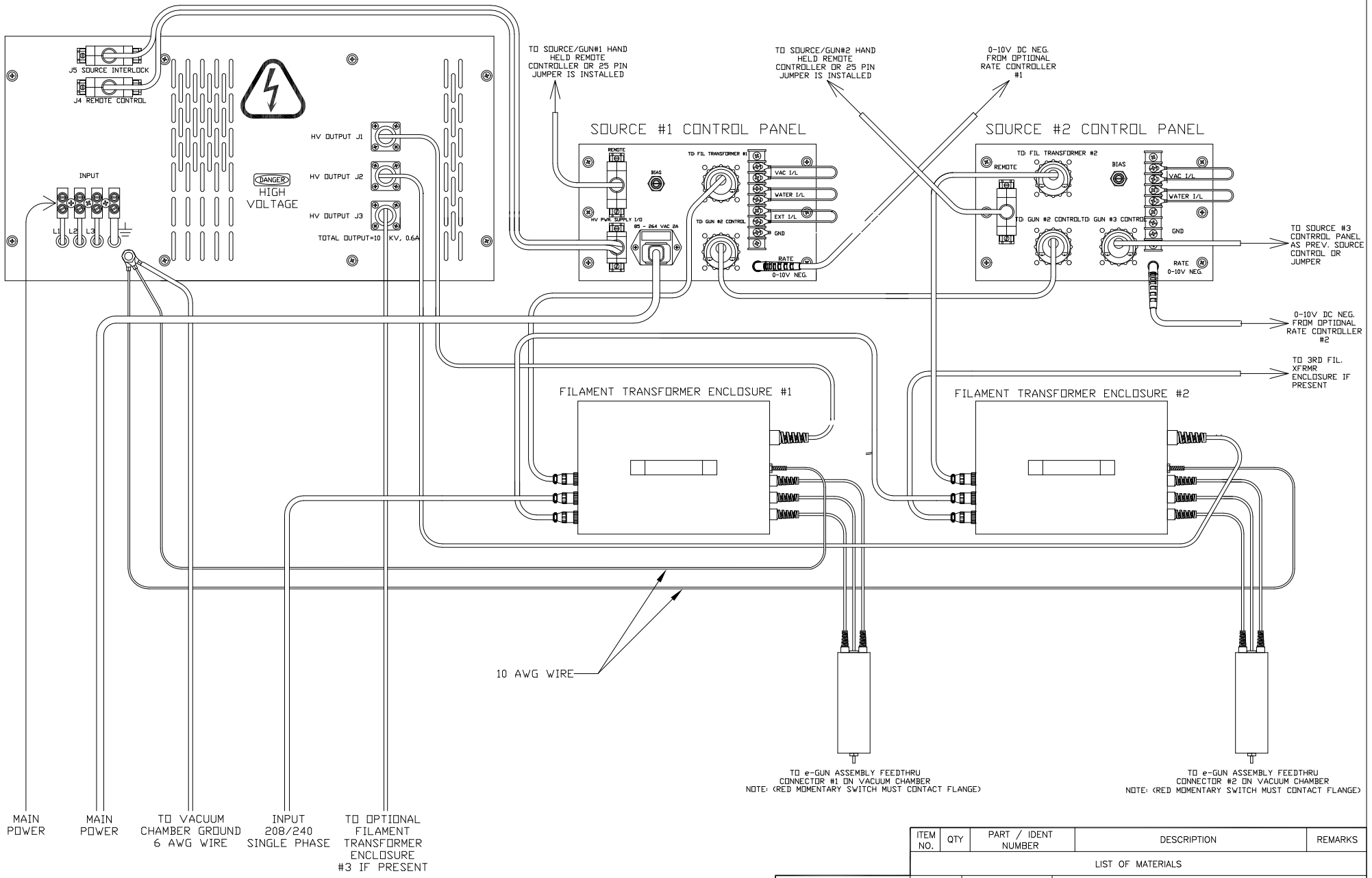
	DRAWN	C.MALONEY
	DESIGNER	
	CHECKED	
	APPROVED	
NEXT ASSEMBLY	RELEASED	
UNLESS OTHERWISE SPECIFIED	MATERIAL:	
SURFACE FINISH 123 /	.X ±.1 .XX ±.01 .XXX±.005 FRAC±	ANGLES ± 1/2°
DO NOT SCALE DRAWING	FINISH:	

thermionics laboratory, inc.
999 Beecher Street San Leandro, Ca. 94577

SEB POWER SUPPLY - SOURCE 1 CONTROLLER - TRANSFORMER CONNECTIONS

A	3-2	REV	A
Scale X	Sheet 1 OF 1		

CAD FILE= X



ITEM NO.	QTY	PART / IDENT NUMBER	DESCRIPTION	REMARKS

LIST OF MATERIALS

	DRAWN	C.MALONEY
	DESIGNER	
	CHECKED	
	APPROVED	
NEXT ASSEMBLY	RELEASED	
UNLESS OTHERWISE SPECIFIED	MATERIAL:	
SURFACE FINISH 123 /	.X ±.1 .XX ±.01 .XXX±.005 FRAC±	ANGLES ± 1/2°
DO NOT SCALE DRAWING	FINISH:	

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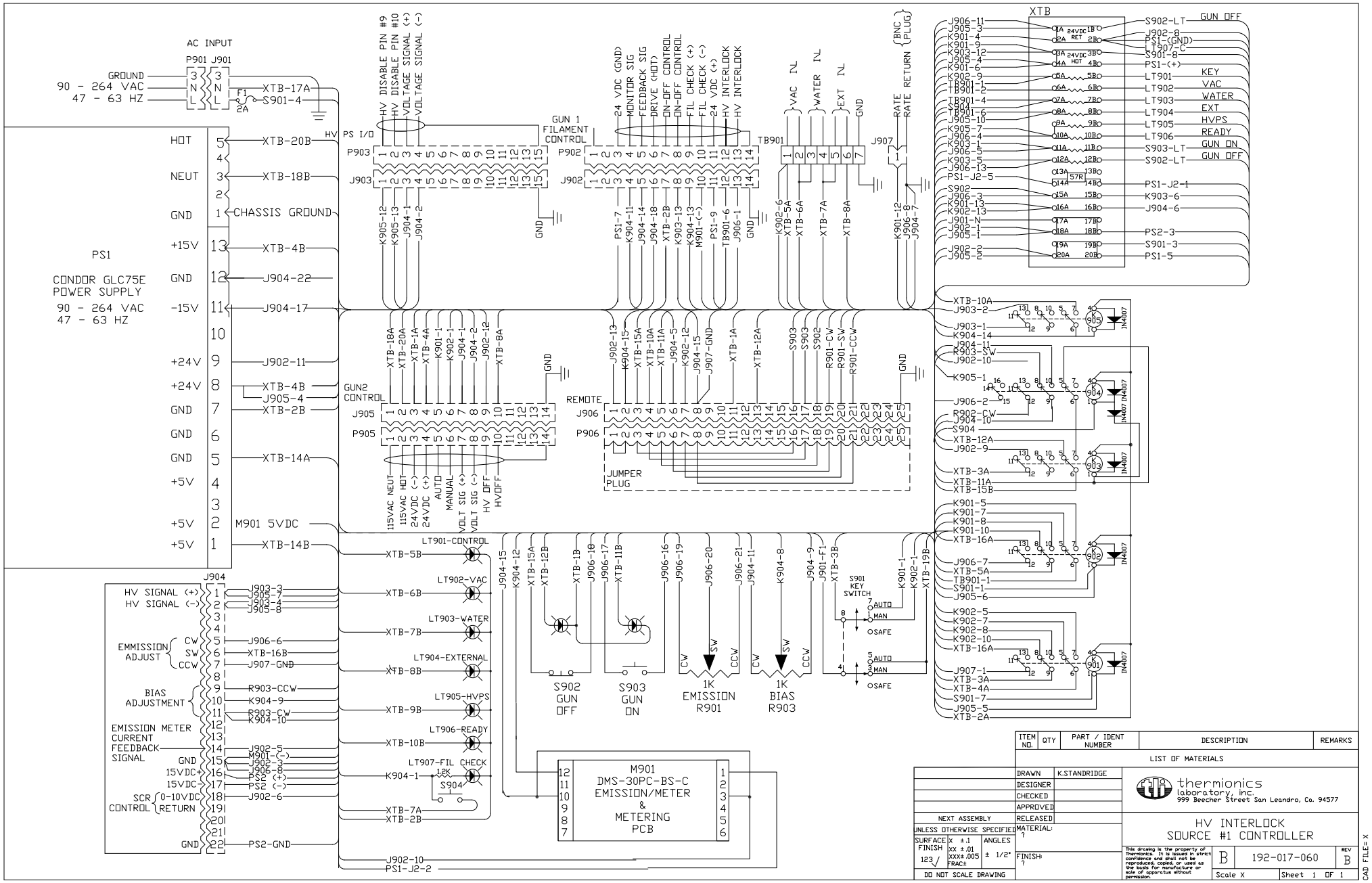
SEB ADDITIONAL CONTROLLER/TRANSFORMER CONNECTION

A	3-2B	REV	B
Scale X	Sheet 1 OF 1		

CAD FILE= X



ITEM NO.	QTY	PART / IDENT NUMBER	DESCRIPTION	REMARKS

LIST OF MATERIALS

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	DESIGNER	
	CHECKED	
	APPROVED	
NEXT ASSEMBLY	RELEASED	

UNLESS OTHERWISE SPECIFIED
SURFACE FINISH 123
X ±.1 XX ±.01 XXX±.005 FRAC±
ANGLES ± 1/2°
MATERIAL: ?
FINISH: ?
DO NOT SCALE DRAWING

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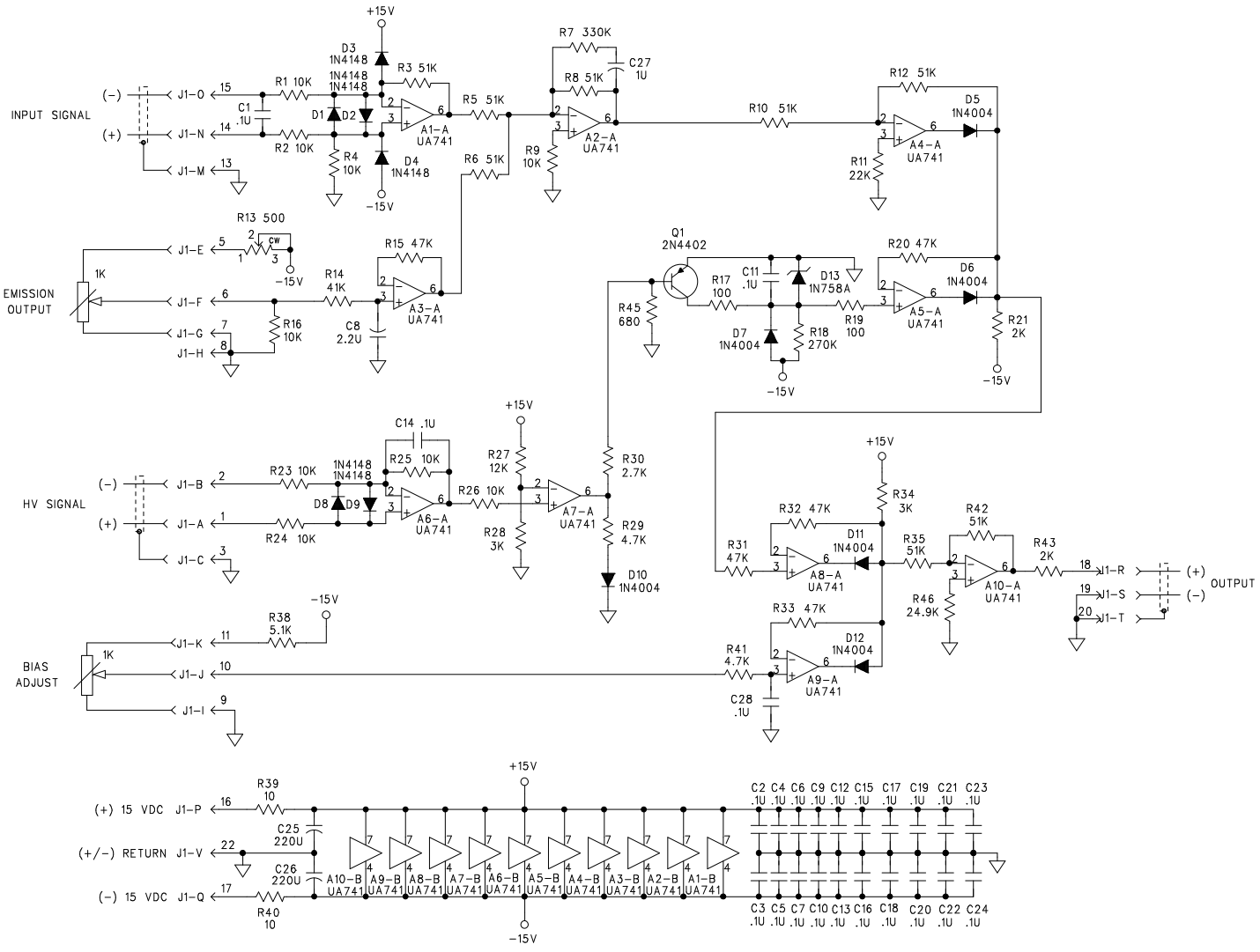
HV INTERLOCK SOURCE #1 CONTROLLER

B | 192-017-060 | REV B

Scale X | Sheet 1 OF 1

CAD FILE= X

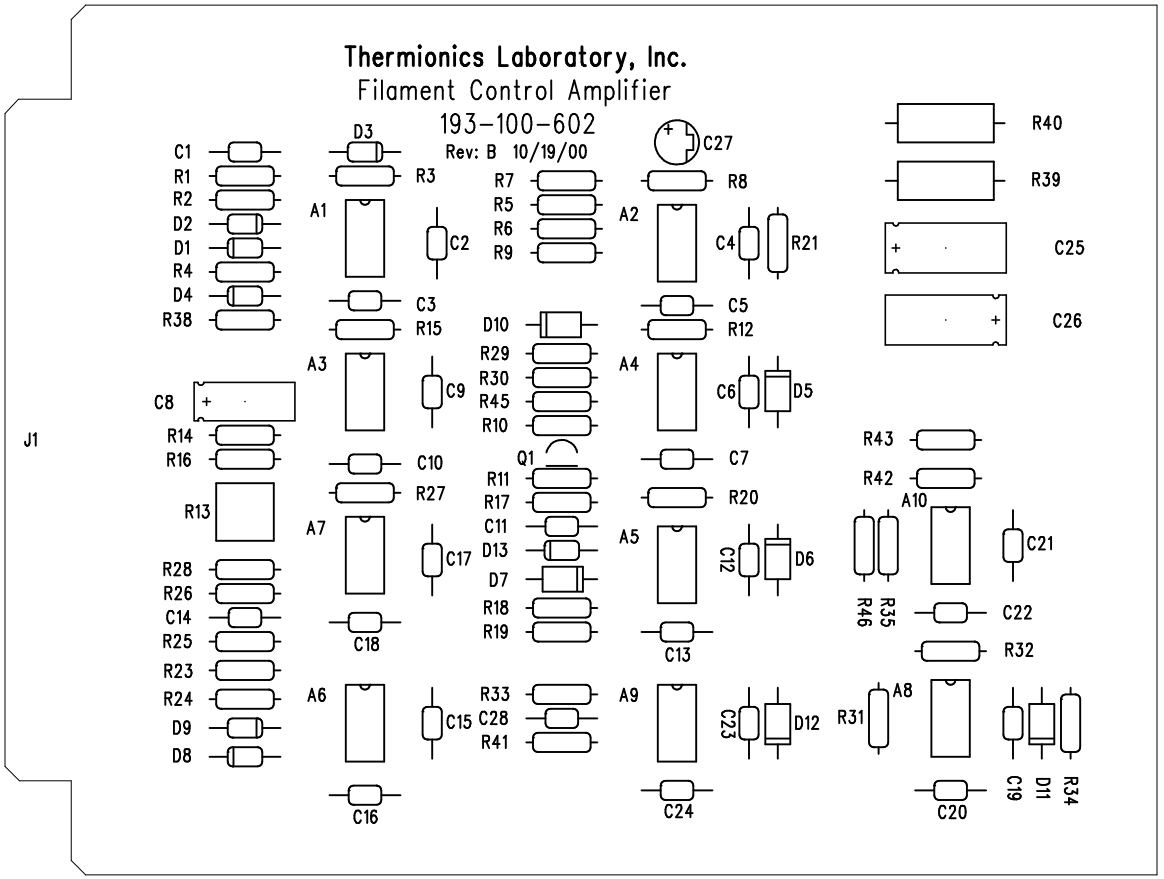


REVISION RECORD	
DERSCRIPTION	DATE:
UPDATED PCB LAYOUT - REV: A	9/8/00
FIXED BIAS ADJ R38 TO -15V - REV: B	10/19/00

DRAWN:	DATED:	COMPANY: Thermionics Laboratory, Inc.
CHECKED:	DATED:	TITLE: Filament Control Amplifier
QUALITY CONTROL:	DATED:	CODE: / SIZE: / DRAWING NO: 193-100-602 / REV: B
RELEASED:	DATED:	SCALE: / SHEET: 1 OF 1

Bill Of Materials for filament Control Amplifier Rev: B 10\19\00

Item	Qty	Reference	Part Name	Manufacturer	Description
1	6	D5-7 D10-12	1N4004	1N4004	Diode Axial DO-41 1A 400V
2	6	D1-4 D8-9	1N4148	1N4148	Diode Axial DO-35 150mA 100V
3	1	D13	1N758A		Diode Axial DO35 10V 500mA Zener
4	1	Q1	2N4402	2N4402	EBC TO-92 PNP Small signal Transistor
5	24	C1-7 C9-24 C28	CAP-.1U-AXIAL		CAP U1 50V 5% AXIAL
6	1	C27	CAP-1U-50		CAP ALECT 1U 50V 20% 5Dx11Hx2LS
7	1	C8	CAP-2.2U-50-AXIAL		CAP Alect Axial 85C 2.2UF 50V 5Dx13.5L
8	2	C25-26	CAP-220U-25-AXIAL		CAP Alect Axial 85C 220UF 25V 6.5Dx16L
9	1	J1	CON156\22PIN\EDGE		22 pin .156 ctr PCB edge connector
10	1	R18	R1/4W-270K		RESISTOR 1/4W 5% 270K
11	2	R17 R19	R1/4W5%-100		RESISTOR 1/4W 5% 100 OHM
12	1	R45	R1/4W5%-680		RESISTOR 1/4W 5% 680 OHM
13	9	R1-2 R4 R9 R16 R23-26	R1/4W5%-10K		RESISTOR 1/4W 5% 10K
14	1	R27	R1/4W5%-12K		RESISTOR 1/4W 5% 12K
15	1	R30	R1/4W5%-2.7K		RESISTOR 1/4W 5% 2.7K
16	1	R11	R1/4W5%-22K		RESISTOR 1/4W 5% 22K
17	1	R46	R1/4W5%-24.9K		RESISTOR 1/4W 5% 24.9K
18	2	R21 R43	R1/4W5%-2K		RESISTOR 1/4W 5% 2K
19	1	R7	R1/4W5%-330K		RESISTOR 1/4W 5% 330K
20	2	R28 R34	R1/4W5%-3K		RESISTOR 1/4W 5% 3K
21	2	R29 R41	R1/4W5%-4.7K		RESISTOR 1/4W 5% 4.7K
22	1	R14	R1/4W5%-41K		RESISTOR 1/4W 5% 41K
23	5	R15 R20 R31-33	R1/4W5%-47K		RESISTOR 1/4W 5% 47K
24	1	R38	R1/4W5%-5.1K		RESISTOR 1/4W 5% 5.1K
25	8	R3 R5-6 R8 R10 R12 R35 R42	R1/4W5%-51K		RESISTOR 1/4W 5% 51K
26	2	R39-40	R2W-10		RESISTOR 2 WATT 5% 10 OHM
28	1	R13	TRIM-6-VERT-500	VIMEX #CA6V 500ohm	TRIM POT 6mm SQ 500 OHM VERT ADJ
28	10	A1-10	UA741	SGS UA741CN	General Purpose Single Op Amp DIP-8


Thermionics Laboratory, Inc.
Filament Control Amplifier
193-100-602
Rev: B 10/19/00
J1
C1
R1
R2
D2
D1
R4
D4
R38
C8
R14
R16
R13
R28
R26
C14
R25
R23
R24
D9
D8
D3
R3
A1
C2
C3
R15
A3
C9
C10
R27
A7
C17
C18
A6
C15
C16
R7
R5
R6
R9
D10
R29
R30
R45
R10
Q1
R11
R17
C11
D13
D7
R18
R19
R33
C28
R41
C27
R8
A2
C4
R21
C5
R12
A4
C6
D5
C7
R20
A5
C12
D6
C13
A9
C23
D12
C24
R40
R39
C25
C26
R43
R42
A10
C21
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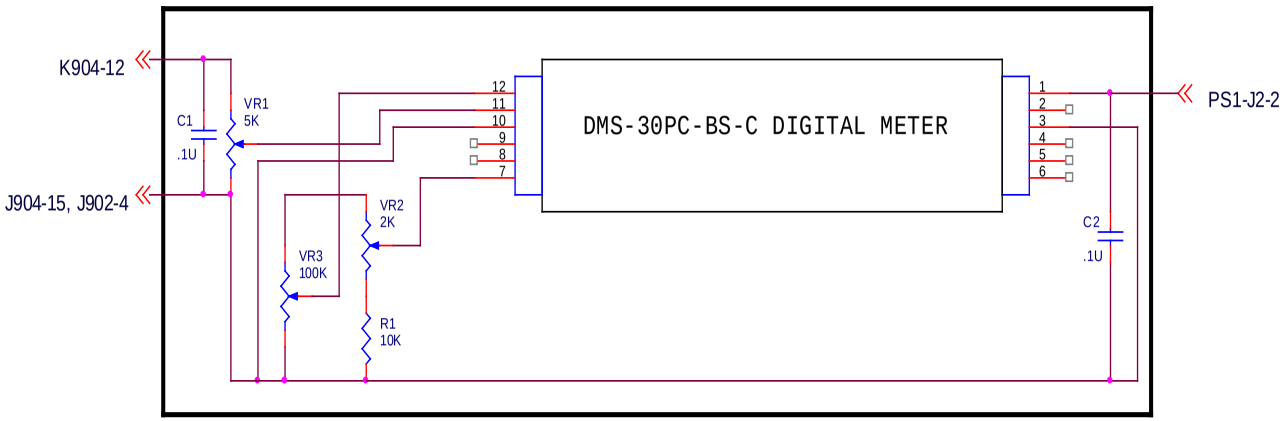
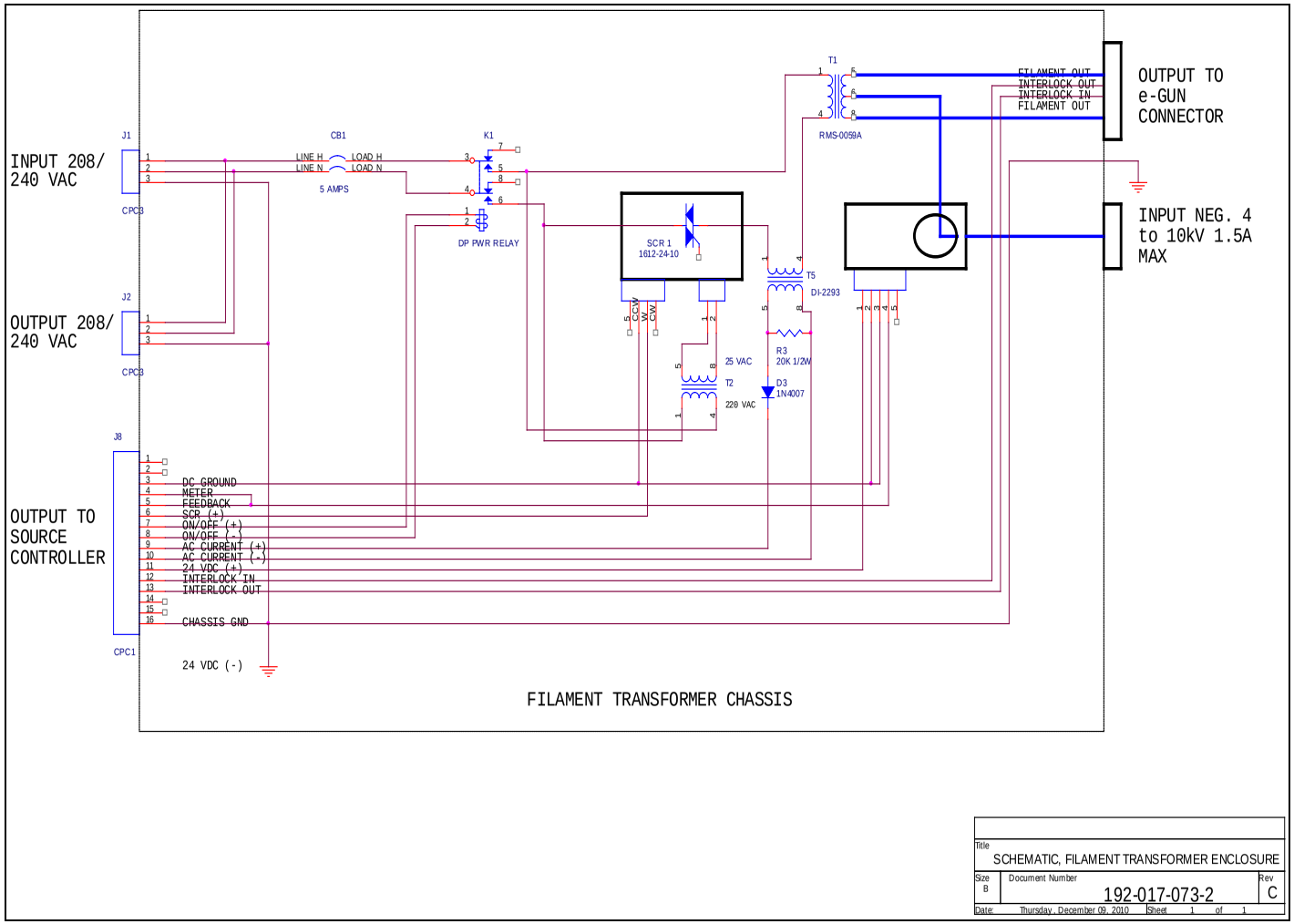
R32
R31
A8
C19
D11
R34
C20



Title: SCHEMATIC DIGITAL METERING PCB		
Size: B	Document Number: 192-017-061	Rev: 1
Date: Monday, December 20, 2010	Sheet 1 of 1	

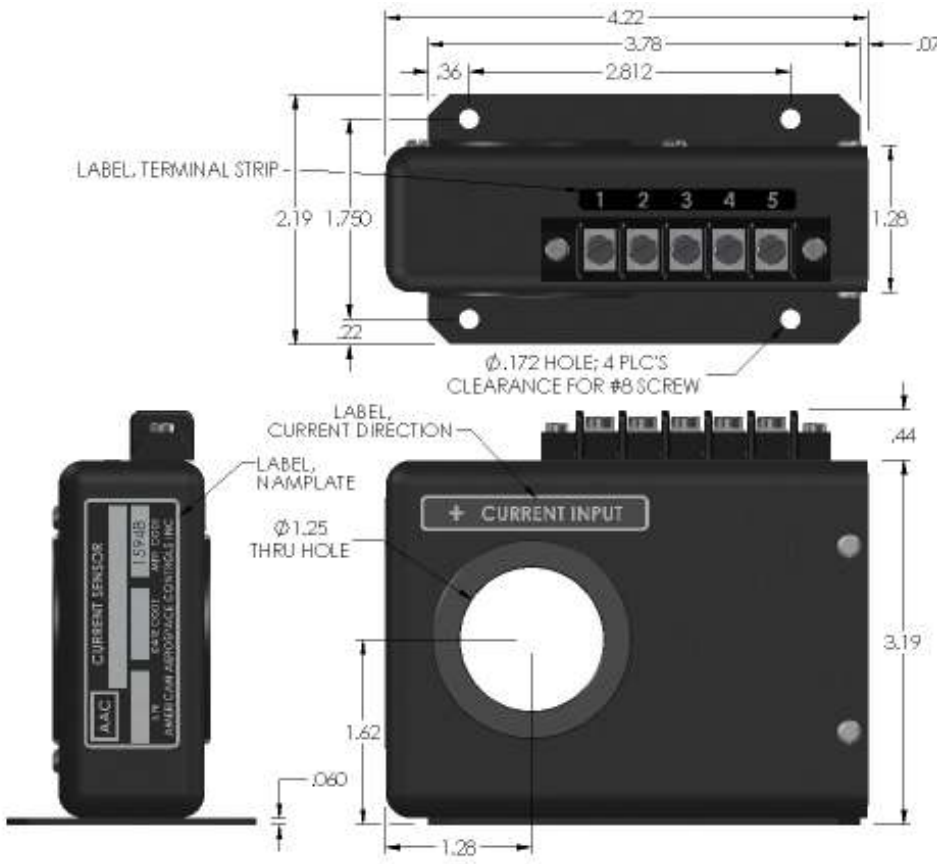


Title: SCHEMATIC, FILAMENT TRANSFORMER ENCLOSURE		
Size: B	Document Number: 192-017-073-2	Rev: C
Date: Thursday, December 09, 2010	Sheet 1 of 1	

Dimensions in Inches, Tolerances: .XX ± .03 .XXX ± .010

DC CURRENT SENSOR
SERIES S218

PART NO.	INPUT CURRENT RANGE	PART NO.	INPUT CURRENT RANGE
S218-100	0 TO 100mA	S218-1A	0 TO 1A
S218-200	0 TO 200mA	S218-2A	0 TO 2A
S218-500	0 TO 500mA	S218-5A	0 TO 5A



OUTPUT

VOLTAGE SIGNAL	0 to +5Vdc FS (Full Scale)
ACCURACY	±1% FS (±50mV)
RIPPLE	2% FS RMS max.
IMPEDANCE	1000 Ohms ±5%, 100mA to 1A range 500 Ohms ±5%, 2A 200 Ohms ±5%, 5A
RESPONSE	50 m-sec max. (10 to 90%)
TEMPERATURE COEFFICIENT	± .04%/°C max.

POWER SUPPLY

SUPPLY VOLTAGE	28Vdc ±4Vdc
CURRENT DRAIN	65mAdc max.
REVERSE POLARITY PROTECTION	10μA max. Current Drain- no damage

ENVIRONMENTAL AND PHYSICAL CHARACTERISTICS

OPERATING TEMPERATURE RANGE	-55°C to +85°C
STORAGE TEMPERATURE RANGE	-60°C to +100°C
INSULATION RESISTANCE	100 M-Ohms (terminals 1,2,3,&4 to case)
DIELECTRIC STRENGTH	350V RMS (terminals 1,2,3,&4 to case)
ALTITUDE	Operating sea level to 60,000 ft.
VIBRATION	Operating - 0.06 in. D.A., 10 to 55Hz Method 201 of MIL-STD-202.
SHOCK	Operating 50g, 11 m-sec half sine pulse Method 213 Condition A of MIL-STD-202.
MOISTURE RESISTANCE	Will meet Method 106 of MIL-STD-202 and Method 507.1 Proc. 1 of MIL-STD-810
OPERATING HUMIDITY	0 to 95% RH
ATTITUDE	Meets spec. for any mounting position.
RIPPLE	40mV reflected onto pass-thru line.
WEIGHT	1.5 lbs. Max.

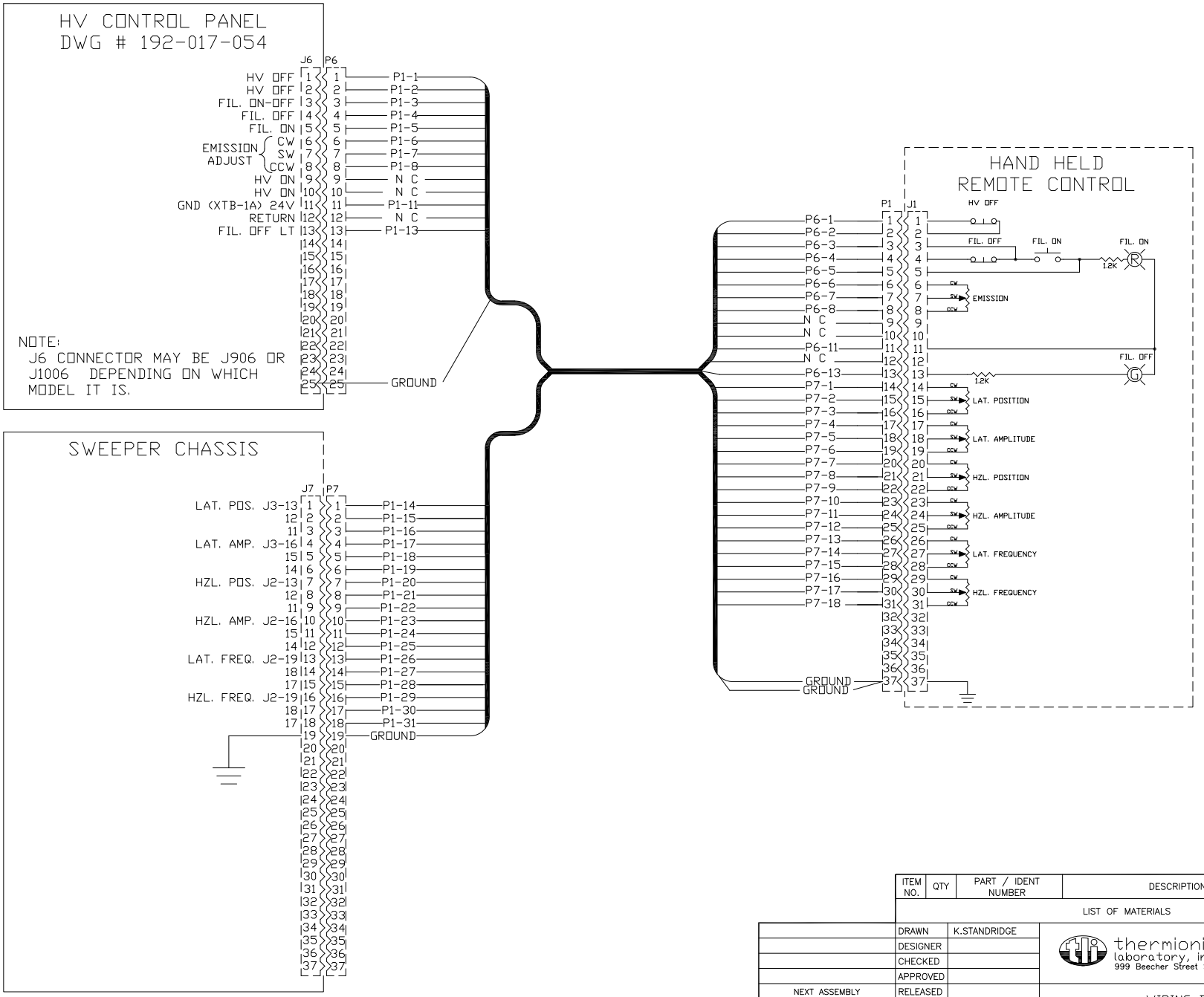
NOTE:
MOLDED TERMINAL BARRIER WITH 5-40 TERMINAL SCREWS
3/8 IN. CENTER TO CENTER SPACING.
ACCEPTS WIRE SIZES TO 14 AWG AND WIRE LUGS UP TO 9/32 IN. WIDE

TERMINAL IDENTIFICATION

1. SUPPLY VOLTAGE (+)
2. SUPPLY VOLTAGE (RTN)
3. OUTPUT SIGNAL (RTN)
4. OUTPUT SIGNAL (+)
5. CASE GROUND

AAC	Drawing Number	Rev.
	700-S218-903	H

Code Ident. No. 15948 **AAC** American Aerospace Controls Inc., 570 Smith Street, Farmingdale, New York 11735 Tel:(631) 694-5100 Fax:(631) 694-6739



ITEM NO.	QTY	PART / IDENT NUMBER	DESCRIPTION	REMARKS

LIST OF MATERIALS

	DRAWN	K.STANDRIDGE
	DESIGNER	
	CHECKED	
	APPROVED	
NEXT ASSEMBLY	RELEASED	
UNLESS OTHERWISE SPECIFIED	MATERIAL: ?	
SURFACE FINISH 123 /	.X ±.1 .XX ±.01 .XXX±.005 FRAC±	ANGLES ± 1/2°
DO NOT SCALE DRAWING	FINISH: ?	

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999 Beecher Street San Leandro, Ca. 94577

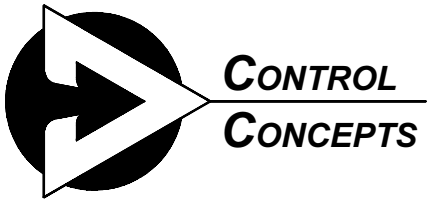
WIRING DIAGRAM
REMOTE CONTROL SYSTEM

A	193-100-053	REV B
Scale X	Sheet 1 OF 1	

CAD FILE= X

CONTROL CONCEPTS INC.

INSTRUCTION MANUAL
MODEL 1022 & 1025



Distributed Worldwide By
www.mcgoff-bethune.com
1-800-303-4705
+1-770-840-9811

DESCRIPTION:

The models 1022 and 1025 are single-phase phase-angle SCR power controllers. The controllers are the same except the 1022 accepts command signals of 0-5Vdc, 0-10Vdc or a potentiometer signal. The model 1025 accepts a 4-20mA command signal.

Both controllers control the RMS voltage to the load proportional to the command signal, independent of line voltage changes. The controllers include soft-start and missing cycle detection which on power interruptions of one half cycle or more sets the load voltage to zero and then increases the load voltage to the desired voltage at a predetermined rate. This eliminates inrush currents that can occur due to loads with a low cold resistance or because of saturation when a transformer is used between the controller and the load.

The command signal is electrically isolated from the line and load voltages and all are electrically isolated from the heat sink.

THEORY OF OPERATION:

The model 1022 and 1025 are phase-angle controllers therefore, the load voltage is controlled by turning the appropriate SCR on for a portion of each electrical half cycle as shown in figure 1.0. The waveform shown as E_L represents the “ON” time of the SCRs in each half cycle and therefore represents the voltage waveform applied to the load. As the load voltage is increased the SCRs are turned ON earlier in the cycle. As the load voltage is decreased the SCRs are turned on later in cycle. The load voltage can be varied with infinite resolution from 0 to 100 percent of the line voltage. Circuit tolerances may limit the maximum load voltage to about 97% of the supply voltage.

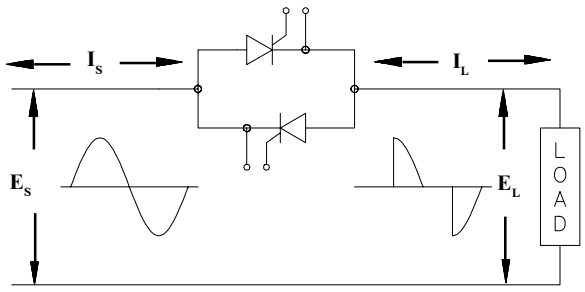


Figure 1.0. Phase angle control at 50% power

MODEL No. IDENTIFICATION:

MODEL NUMBER: 102X-VV-AA
[-SCXXX] [-MOXX]

X = **2** for 1022, **5** for 1025
1022 (0-5Vdc, 0-10Vdc or potentiometer control)
1025 (4-20mA input)

VV = Rated voltage:
12=120;
24=240;
48= 480;
57=570Vac.

AA = rated amps: **10**, **20**, **30**, **40**, or **70** amps

Note:

The addition of **"-SCXXX"** implies that the controller has been modified to have a different input command. For example, a "**-SC1/5Vdc**" implies the controller has been modified to operate with a 1-5Vdc control signal.

The addition of "-MOXX" implies a special mounting or assembly of the controller.

INSTALLATION:

The controller must be mounted on a vertical surface such that the heat radiating fins are vertical and located in an environment that will not exceed 135°F and that is protected from dirt and dust.

The wiring must be per local electrical codes. The supply and load terminals will accept up to # 6 wire. The terminals for the circuit transformer and control signals accept wire up to # 14. The terminals for the control signals and circuit transformer are plug-in and may be removed by pulling perpendicular to the circuit card.

CAUTION:

1. The circuit transformer must be connected to the same supply as the controller and the load. A common installation error has been that of the circuit transformer being powered from a different phase or being connected across the SCR module rather than from the supply.
2. Do not over tighten the wire connections.

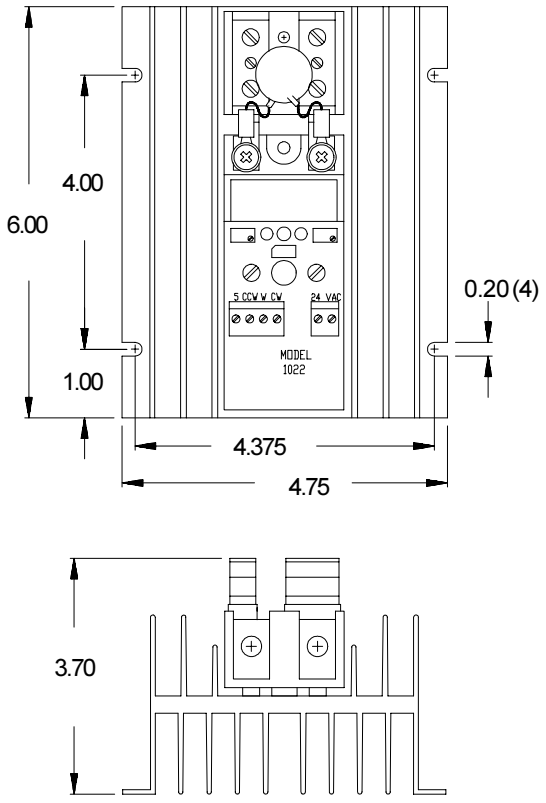
NOTE: It is recommended that the controller and the load be protected with fast acting class "T" fuses such as described in the specification portion or this instruction manual.

SPECIFICATIONS:

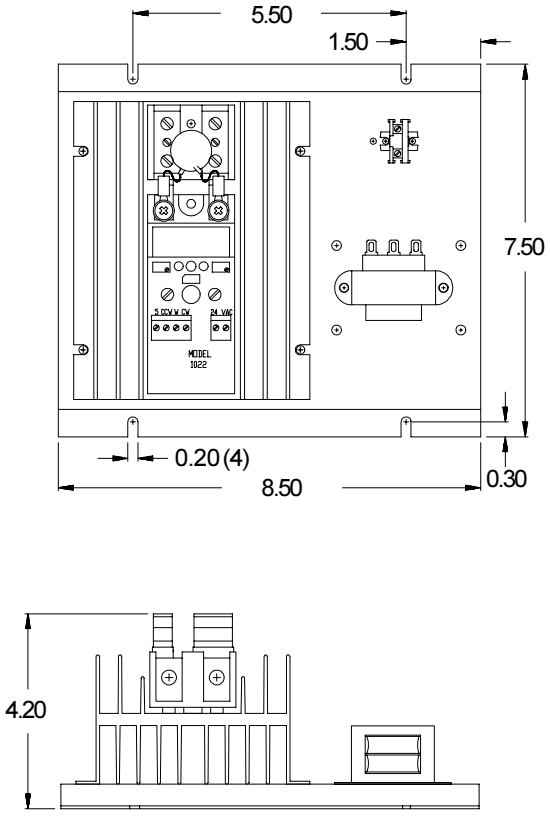
Control Mode	Single-phase; Phase-angle; RMS value of the voltage applied to the load
Command Signal	SIGNAL — INPUT IMPEDANCE Model 1022: 0-5Vdc — 100K 0-10VDC & Pot — 200K (1K pot recommended, 20K permissible) Model 1025: 4-20mA; — 200 ohms
Control Range	6 to 97% of line voltage typical.
Linearity	RMS load voltage is linear within 2% of span of the command signal.
Zero and Span Adjustment	User adjustable over range of ±20% of span.
Isolation	Dielectric strength input/line & load voltage/heatsink 4000V(RMS). Insulation resistance input/line & load voltage/heatsink 10^{10} ohms. Maximum capacitance input to output 8pf.
Cooling	Convection
Mounting	Must be mounted on vertical surface with fins vertical. Units may be mounted adjacent to each other. Heat sink is electrically isolated.
Line voltage	120, 240, 480 or 575Vac +10%,-20% 50/60 Hertz
Diagnostic Indicator	The intensity of an LED varies as a function of the command signal. Feature provides a quick and safe means to check controller operation.
Physical	Weight: 10 thru 40 amp 2 lbs , 70 amp 6 lbs Dimensions: Refer to installation drawing
Environment	Operating: 0 to 55°C (32 to 131°F) Storage: -40 to 80°C (-40 to 176°F) Humidity: 0 to 95% Non-condensing
dv/dt & Transient Voltage	200 volts/usec minimum A dv/dt snubber and a metal oxide varistor (MOV) are provided to protect against high frequency transients (dv/dt) and voltage spikes.
Dissipation	1.5 watt per amp of controlled current
Recommended Fusing	Special semiconductor fuses are not required. It is recommended that the controller and load be protected with fast acting class "T" fuses such as Bussmann type JJS or JJN fuses. Control Concepts maintains an inventory of fuses and fuse holders for your convience.

SURGE CURRENT RATINGS				KW				
Continuous RMS rating	RMS 1 Second	Peak 1 cycle (Non-Repetive)	I^2t rating	120Vac	240Vac	277Vac	480Vac	575Vac
10	22	140	81	1.20	2.40	2.77	4.80	5.75
20	40	250	260	2.40	4.80	5.54	9.60	11.50
30	80	625	1620	3.60	7.20	8.31	14.40	17.25
40	150	1000	4150	4.80	9.60	11.08	19.20	23.00
70	150	1000	4150	8.40	16.80	19.39	33.60	40.25

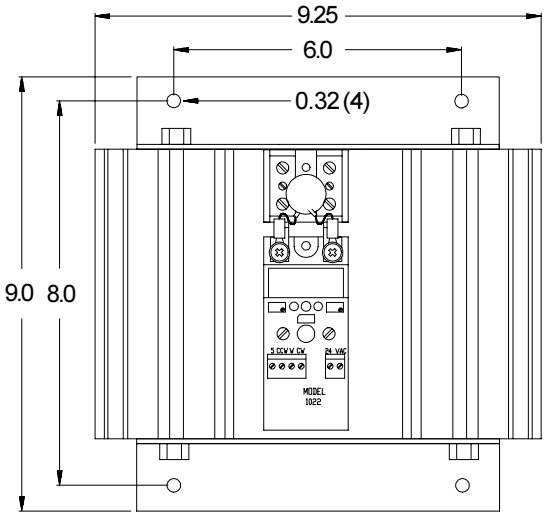
INSTALLATION DRAWINGS:

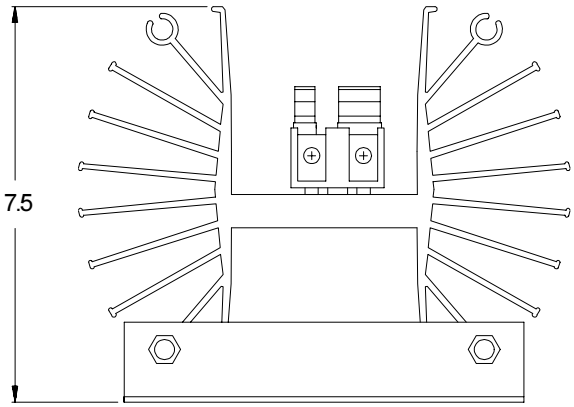


10, 20, 30 & 40 AMP



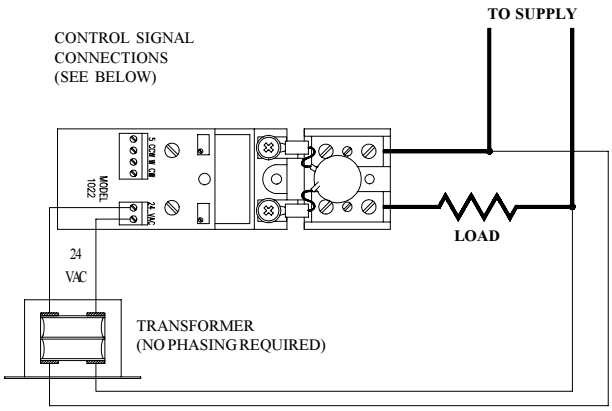
"-MO1" Mounting Option

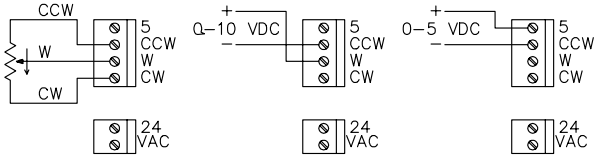




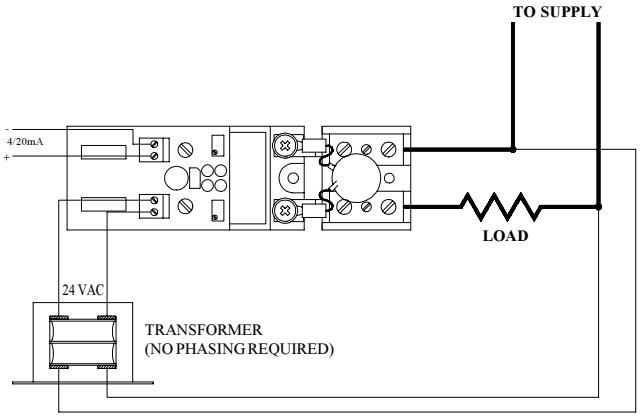
70 AMP

MODEL 1022 CONNECTIONS:





MODEL 1025 CONNECTIONS:



RECOMMENDED SPARE PARTS AND FUSES

MODEL:	SCR MODULE (ASSEMBLY) CCI PART #	FUSES FOR RESISTIVE AND TRANSFORMER COUPLED LOADS	
		CCI PART #	BUSSMAN #
1022-12-10	1652-12-10	42110-0430-315	JJN-15
1022-12-20	1652-12-20	42110-0430-325	JJN-25
1022-12-30	1652-12-30	42110-0430-335	JJN-35
1022-12-40	1652-12-40	42110-0430-350	JJN-50
1022-12-70	1652-12-70	42110-0430-390	JJN-90
1022-24-10	1652-24-10	42110-0430-315	JJN-15
1022-24-20	1652-24-20	42110-0430-325	JJN-25
1022-24-30	1652-24-30	42110-0430-335	JJN-35
1022-24-40	1652-24-40	42110-0430-350	JJN-50
1022-24-70	1652-24-70	42110-0430-390	JJN-90
1022-48-10	1652-48-10	42110-0460-315	JJS-15
1022-48-20	1652-48-20	42110-0460-325	JJS-25
1022-48-30	1652-48-30	42110-0460-335	JJS-35
1022-48-40	1652-48-40	42110-0460-350	JJS-50
1022-48-70	1652-48-70	42110-0460-390	JJS-90
1022-57-10	1652-57-10	42110-0460-315	JJS-15
1022-57-20	1652-57-20	42110-0460-325	JJS-25
1022-57-30	1652-57-30	42110-0460-335	JJS-35
1022-57-40	1652-57-40	42110-0460-350	JJS-50
1022-57-70	1652-57-70	42110-0460-390	JJS-90

TROUBLE SHOOTING:

CAUTION: High voltage exists on the supply and load terminals of this controller and may exist on other equipment located near the controller. Use extreme caution to avoid electrical shock.

The LED located on the controller circuit can be used to aid in determining problems. This LED varies in intensity proportional to the command signal and therefore should be proportional to the load voltage.

THE FOLLOWING ARE SYMPTOMS AND POSSIBLE CAUSES:

NO LOAD POWER: LED not ON:

Determine that the command sigal is applied to the controller. Determine that 24 volts is applied to the circuit.

NO LOAD POWER: LED intensity can be varied:

Determine that all fuses are "OK". If the voltage across the SCR module is equal to the line voltage the SCR module has probably failed. NOTE: If a replacement SCR module is ordered specify the voltage and current rating of the controller and the serial number of the failed unit.

LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED: LED is ON:

Determine that the command signal can be adjusted to zero. Also remove the green plug-in connector to remove the command signal. If the LED is not off, the circuit card has failed.

LOAD POWER IS MAXIMUM AND CANNOT BE REDUCED: LED is OFF:

Remove the 24Vac plug in connector. If the load still has power the SCR module has probably failed as a short allowing full power at be applied to the load. To determine if the SCR module has shorted remove power and then the line and load connections and measure the resistance across the line and load terminals on the SCR module. If the resistance is less than 10000 ohms the modual has failed. NOTE: If a replacement SCR module is ordered specify the voltage and current rating of the controller and the serial number of the failed unit.

LOAD VOLTAGE SNAPS ON:

Determine that the primary of the circuit transformer is connected to the same supply as the controller and load.

MAXIMUM LOAD VOLTAGE CANNOT BE OBTAINED:

Determine that the primary of the circuit transformer is connected to the same supply as the controller and load. Typically this problem is caused by the primary being connected across the load and line connection at the controller.

ZERO AND SPAN ADJUSTMENTS:

The zero and span adjustments have been factory adjusted to provide zero load voltage when the minimum command signal is applied and to provide rated output voltage to the load when the maximum command signal is applied. Further adjustment of these settings should not be required. If it is desired to readjust the zero and span settings the following procedures should be followed. **NOTE** Voltage and/or current measurements should be taken with meters that provide true RMS readings due to the chopped waveforms provided by the SCR controller. Adjust the zero potentiometer with the minimum command signal applied such that the load voltage is just zero. (Clockwise rotation of both the span and zero potentiometer increase the load voltage) Adjust the span potentiometer with the maximum command signal applied such that load voltage equals the rated voltage of the controller. It may be necessary to repeat these steps due to interaction that can occur. The 1022 and 1025 controllers have line voltage compensation therefore if the supply voltage is above the nominal rating the controller will supply the nominal rated voltage to the load. For example, if a controller rated for 240 volt operation is supplied from a 260 volt supply and the maximum command signal is applied the controller will supply only 240 volts to the load thereby eliminating the effects of line voltage changes.

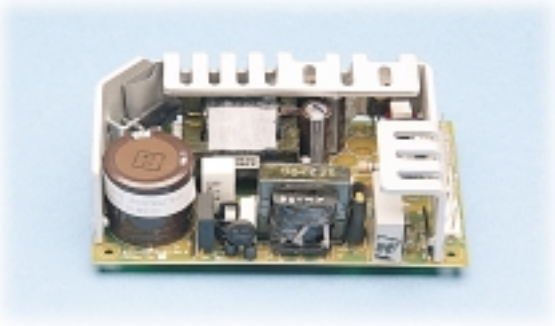
REFERENCE DRAWINGS:

Model 1022: Schematic	B1000466
Model 1025: Schematic	B1000324
Transformer Inst. Dwg.	AS1401

MANUFACTURED BY:

CONTROL CONCEPTS

GLC75 Commercial/GLM75 Medical
75 Watt Single Output Global Performance Switchers



FEATURES:

- Cost-effective single-output power source
- 3.4" x 5.75" x 1.56" (meets 1U applications)
- Universal input 90-264 Vac
- 2-year warranty
- Complies with EN61000-3-2 Class A
- Also available in multiple output versions
- Conducted EMI exceeds FCC Class B and CISPR 22 Class B (Commercial models) and CISPR 11 Class B (Medical models)
- Commercial Approved to UL1950, CSA22.2 No. 234 and IEC950, EN60950
- Medical Approved to UL2601-1, IEC601-1 and CSA22.2 No. 601
- CE marked to LVD

SPECIFICATIONS:

Ac Input
90-264 Vac, 47-63 Hz single phase.

Input Current
Maximum input current at 120 Vac, 60 Hz with full rated output load not to exceed 2.3 A.

Output Power
Normal continuous output power is 75 W for unrestricted natural convection cooling; 110 W with 26 cfm airflow.

Output Regulation
Regulation measured by changing from 5% to 50% load or 50% load to full load in either direction.

Overload Protection
Factory set to begin power limiting at approximately 120 W (GLC 75-5 is set at approximately 100 W). Fully protected against short circuit and output overload. Short circuit protection is cycling type power limit.

Output Noise
0.5% rms, 1% pk-pk, 20 MHz bandwidth, differential mode. Measured with noise probe directly across output terminals of the power supply.

Transient Response
Main Output: 500 µs typical response time for return to within 0.5% of final value for a 50% load step change, $\Delta i/\Delta t<0.2$ A/µs. Maximum voltage deviation is 3.5%. Startup/shutdown overshoot less than 3%.

Overvoltage Protection
Standard on all models.

Voltage Adjust
Factory set on standard unit; however, potentiometer adjusts voltage ±5% minimum. Consult factory for application assistance.

Efficiency
72-85% depending on model.

Input Protection
Internal ac fuse provided. Designed to blow only if a catastrophic failure occurs in the unit—fuse does not blow on overload or short circuit.

Inrush Current
Inrush limited by internal thermistors. Inrush at 240 Vac, averaged over the first ac half-cycle under cold start conditions will not exceed 37 A.

Temperature Coefficient
0.03%/°C typical on all outputs.

Power Fail
A standard TTL or CMOS compatible output goes low (< 0.5 V) 5ms before output voltage drops more than 4% below nominal voltage upon loss of ac power. Signal is factory set to trip on 84 to 94 Vac brown-out depending upon incoming line impedance and distortion. Other settings are available through adjustment of built-in potentiometer (consult factory for assistance). Output will stay low for 20 ms minimum.

EMI/EMC Compliance
All models include built-in EMI filtering to meet the following emissions requirements:

EMI SPECIFICATIONS	COMPLIANCE LEVEL
Conducted Emissions GLC75	EN55022 Class B; FCC Class B
Conducted Emissions GLM75	EN55011 Class B; FCC Class B
Static Discharge	EN61000-4-2, 6 kV contact, 8 kV air
RF Field Susceptibility	EN61000-4-3, 3 V/meter
Fast Transients/Bursts	EN61000-4-4, 2 kV, 5 kHz
Surge Susceptibility	EN61000-4-5, 1 kV diff., 2 kV com.
Line Frequency Harmonics	EN61000-3-2 Class A

Commercial Safety
All GLC models are approved to UL1950, CSA22.2 No. 234 Level 3, IEC950 and EN60950. Consult factory for approval status.

Medical Leakage Current
70 µA 264 V @ 50 Hz (normal conditions).

Medical Safety
All GLM models are approved to UL2601-1, CSA-C22.2 No. 601.1, IEC601-1 and EN60601-1. Consult factory for approval status.

GLC75 Commercial/GLM75 Medical 75 Watt Single Output

Commercial Model	Medical Model	Output	Output Minimum	Output Maximum (A)	Output Maximum (B)	Output Peak	V1 OVP Set	Noise P-P	Total Regulation
GLC75-5	GLM75-5	5.1 V	0 A	13.7 A	19.6 A	21 A	6.2 ± 0.6 V	50 mV	1%
GLC75-12	GLM75-12	12 V	0 A	6.3 A	9.1 A	9.5 A	15.6 ± 1.1 V	120 mV	1%
GLC75-15	GLM75-15	15 V	0 A	5 A	7.3 A	7.7 A	18.5 ± 1.5 V	150 mV	1%
GLC75-24	GLM75-24	24 V	0 A	3.1 A	4.6 A	5 A	28 ± 2.5 V	240 mV	1%
GLC75-28	GLM75-28	28 V	0 A	2.7 A	4 A	4.4 A	34 ± 2.8 V	280 mV	1%

A. Rating with unrestricted convection cooling. Total power not to exceed 75 W.
B. Rating with 26 cfm forced-air cooling. Total power not to exceed 110 W.

GLC75/GLM75 MECHANICAL SPECIFICATIONS

INPUT: J1
AMP P/N: 643495-2
0.312 CTRS CONNECTOR, 3 CIRCUIT
PIN 1 AC GROUND
PIN 3 AC NEUTRAL
PIN 5 AC LINE

OUTPUT: J2
AMP P/N: 640445-9
0.156 CTR HEADER

PIN #	SINGLE OUTPUT MODELS
1	OUTPUT#1
2	OUTPUT #1
3	OUTPUT #1
4	OUTPUT #1
5	COMMON
6	COMMON
7	COMMON
8	COMMON
9	POWER FAIL

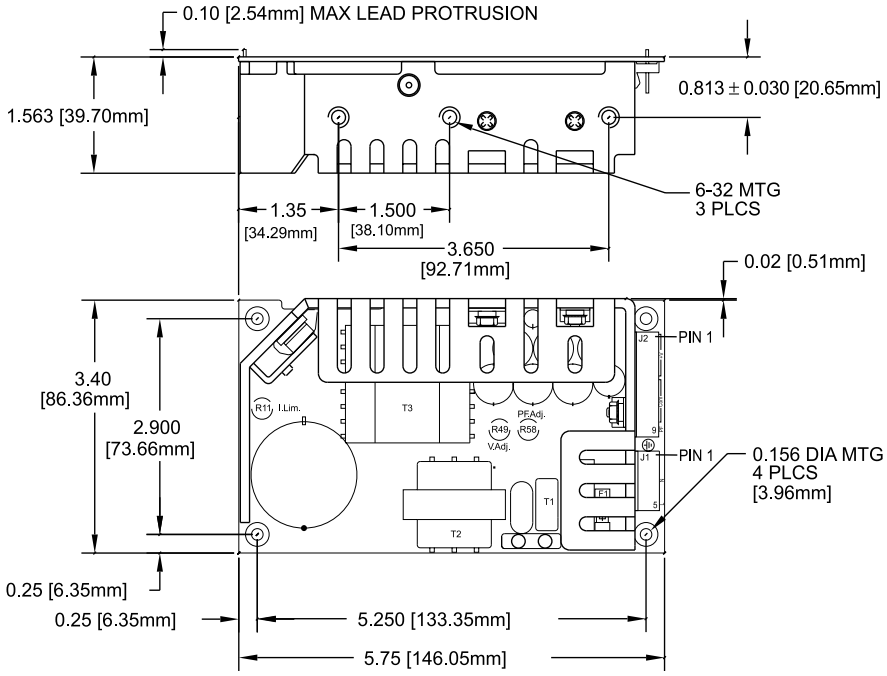
MATING CONNECTOR AMP P/N'S

	HOUSING
INPUT:	640250-5
OUTPUT:	640250-9
	CONTACT
INPUT:	770476-1
OUTPUT:	770476-1

NOTE: 5A MAXIMUM RECOMMENDED CURRENT PER CONNECTOR PIN.

WEIGHT: 1.0 LBS. MAX. [0.45 kg]

TOLERANCES: X.XX=0.030 [0.76mm]
X.XXX=0.010 [0.25mm]



Environmental Specification	Operating	Non-operating
Temperature (A)	0 to 50°C	-40 to +85°C
Humidity (A)	0 to 95% RH	0 to 95% RH
Shock (B)	20 g_{pk}	40 g_{pk}
Altitude	-500 to 10,000 ft	-500 to 40,000 ft
Vibration (C)	1.5 g_{rms}, 0.003 g^2/Hz	5 g_{rms}, 0.026 g^2/Hz

A. Units should be allowed to warm up/operate under non-condensing conditions before application of power.
B. Random vibration—10 to 2000Hz, 6dB/octave roll-off from 350 to 2000Hz, 3 orthogonal axes. Tested for 10 min./axis operating and 1 hr./axis non-operating.
C. Shock testing—half-sinusoidal, 10 ± 3 ms duration, ± direction, 3 orthogonal axes, total 6 shocks.