MODEL TT-10/15 (T2)
ELECTRON BEAM SOURCE
POWER SUPPLY

INSTRUCTION MANUAL

Part Number 108-0100-2

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www.telemrk.com

SAFETY WARNING

HIGH (POTENTIALLY LETHAL) VOLTAGES ARE PRESENT WITHIN THESE MODULES. GREAT CARE MUST BE EXERCISED WHEN PERFORMING MAINTENANCE. HUMAN CONTACT WITH THE VOLTAGES CAN BE FATAL.

Make sure that the input power is turned off before removing covers. Short all capacitors with a grounding hook. Do not test live circuits unless absolutely necessary.

If it becomes necessary to test live circuits, all test meter connections must be made with the power OFF. Test leads should be in good repair and have sufficient insulation for a test voltage of at least twice that to be measured. The test meters should be securely mounted and should not be touched after power is turned on. Do not work in cramped spaces or cluttered areas. TROUBLESHOOTING OF THIS NATURE SHOULD BE CARRIED OUT ONLY BY QUALIFIED PERSONNEL UTILIZING STANDARD SAFETY PROCEDURES.

DANGER - HIGH VOLTAGE

WARRANTY

The TT-10/15 Electron Beam Source Power Supplies are guaranteed against faulty materials, function, and workmanship for a period of 12 months after shipment from the Telemark factory. This warranty is valid only for normal use when regular maintenance is performed as instructed. This warranty shall not apply if repairs have been performed or alterations made by anyone other than an authorized Telemark representative, or if damage occurs through abuse, misuse, negligence, or accident. No charge will be made for repairs made at a Telemark service facility during the warranty period. Simply return the malfunctioning module, freight prepaid. Telemark reserves the right to determine the appropriate warranty adjustment.

USER RESPONSIBILITY

The user is responsible for proper installation, operation and ordinary maintenance of the equipment, following procedures described in this manual. If the user has a doubt about use or installation of a component, your Telemark representative or the factory should be called.

It is vitally important that the user properly installs the equipment, with particular attention to correct grounding methods, as described in Chapter 3 (Installation) of this manual. The Warranty will be void if the equipment is improperly installed and/or improperly grounded.

Alteration of the design or any function of the equipment voids the warranty and is entirely the responsibility of the user.

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GENERAL DESCRIPTION

Functional Description

The Telemark Model TT-10/15 Power supply is a direct current, regulated high voltage power supply. It is intended for use with high volume production EB (electron beam) sources as used in the vacuum evaporation industry. The TT-10/15 can be operated from the controller or a remote station.

The TT-10/15 is compatible with EB sources that use electromagnetic deflection or combinations of electromagnetic deflection and permanent magnet focusing. Emission current regulated filament power is supplied to the EB sources.

The High Voltage/Power Cabinet is produced to accommodate one, two or three sources. The number of Source Filament Control modules determines the number of sources that can be driven.

There are two versions of the TT-10/15 control modules: Source 1 Control and source 2/3 Control.

The **Source 1 Control** contains:

1. *High Voltage Control and digital indicators(There is only one HV control for the main Power supply.)*
2. *Source 1 Control*

Note: **Source 1 Control** may be used stand-alone or with a **Source 2/3 Contro**l.

The **Source 2/3 Control** contains:

1. *Source Control*

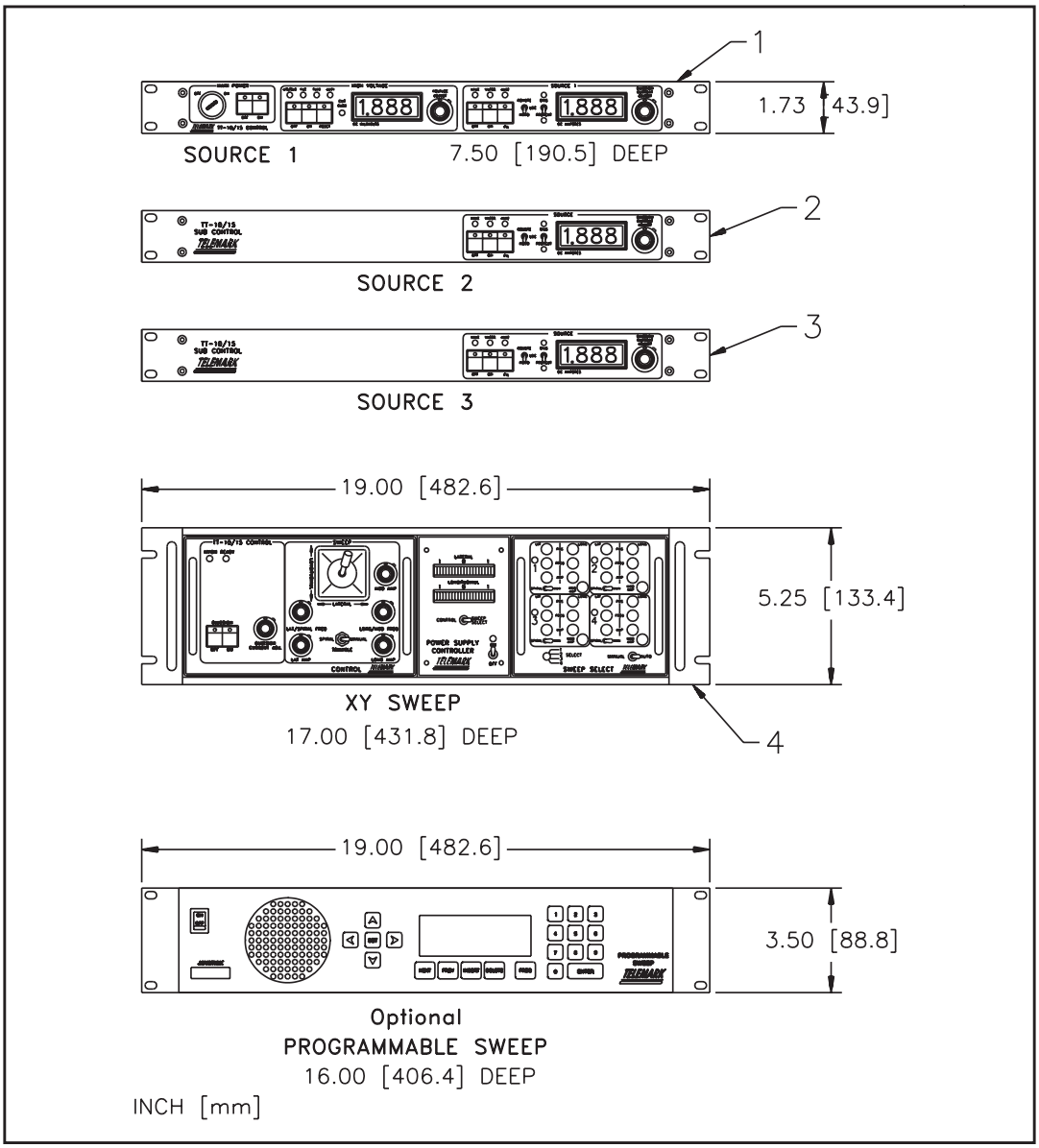
A system of safety interlocks with the vacuum system is provided to protect both the operator and the equipment.

System Components

The **TT-10/15 Electron Beam Power Supply** consists of the following:

1. *HV Control / Source 1 Control Module*
2. *Source 2 Control Module - 2 and 3 source systems only*
3. *Source 3 Control Module - three source systems only*
4. *Sweep Module - one per EB source is also needed in standard operation*
5. *High Voltage / Power Cabinet*
6. *Filament transformer - one per EB source)*

Figure 1-A Control General View



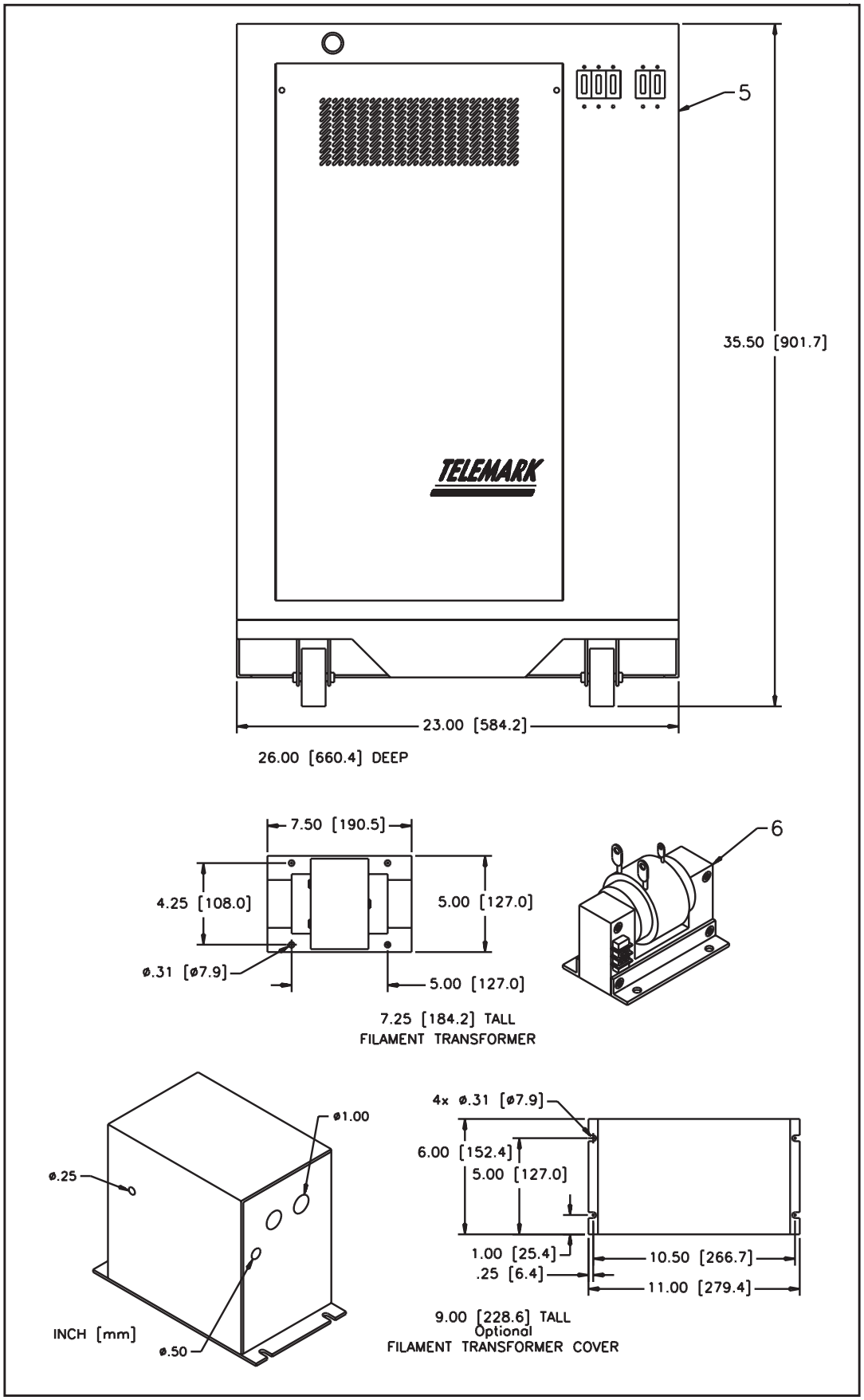


Figure 1-B
Cabinet
General
View

2

SPECIFICATIONS

Control Module

- Input Power

  208/240 volts, 3-phase, 60 Hz.

- High Voltage Regulation

  Less than 2% of max.

- High Voltage Ripple

  Less than 100 volts pk-pk

- Current cutback level

  TT-10: 0.2 to 1.0 amps, adjustable.
  TT-15: 0.2 to 1.5 amps, adjustable.

- Current cutback response

  Less than 100 microseconds

HV/Power Cabinet

- Input Power

  D models: 208/240 volts, 3-phase, 60 Hz. (plus 15A for control circuitry) — TT-10: 50 amps. TT-15: 60 amps.

  E models: 380/415 volts, 3-phase, 50 Hz. — TT-10: 40 amps. TT-15: 50 amps.

- Output voltage range

  1 to 10 kilovolts DC (negative)

- Output current (maximum)

  TT-10: 1.0 amp.
  TT-15: 1.5 amps.

Filament Transformer

- Primary voltage

  0 to 220 volts, 1-phase, 50/60 Hz

- Secondary Power

  8 volts at 50 Amps

- Insulation rating, secondary to primary and core

  22 kV DC

Note: Other transformer voltages are available upon special request.

Standard XY Sweep with Memory Module

- Input Power

  switchable ranges of 110—120VAC @ 2A, or
  208—240V @ 1A; single-phase, 50/60Hz.

- Output power

  Dual Channel (longitudinal and lateral): plus or minus 1.5 amps. (mfg. adjustable) maximum, into a load with impedance of less than 15Ω.

- Frequency range

  Triangle Pattern mode: 6 to 50Hz;
  Circle/Spiral mode: circling at 5Hz, but can collapse into spiral at rates of 0.5 to 6Hz.

- LED Bargraphs

  Lateral and Longitudinal LED bargraphs indicating amplitude/position changes

SWEEP SELECT MODULE (Memory Module)

- Four (identical) Output Module pattern-bank selections
- Pattern Banks are selectable manually or remotely

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INSTALLATION

Introduction

Please see Figure 1-A, General View, Power Supply

The TT Electron Beam Power Supply Control and Sweep are designed to be mounted in a standard 19 inch electronic instrument cabinet. Any suitable place on a vacuum system that has a standard 19 inch wide opening may be used. The control module could, for example, be set directly on a system cabinet top for easy access. The High Voltage/Power Cabinet is a free-standing cabinet. The installation procedures are described below.

Mechanical

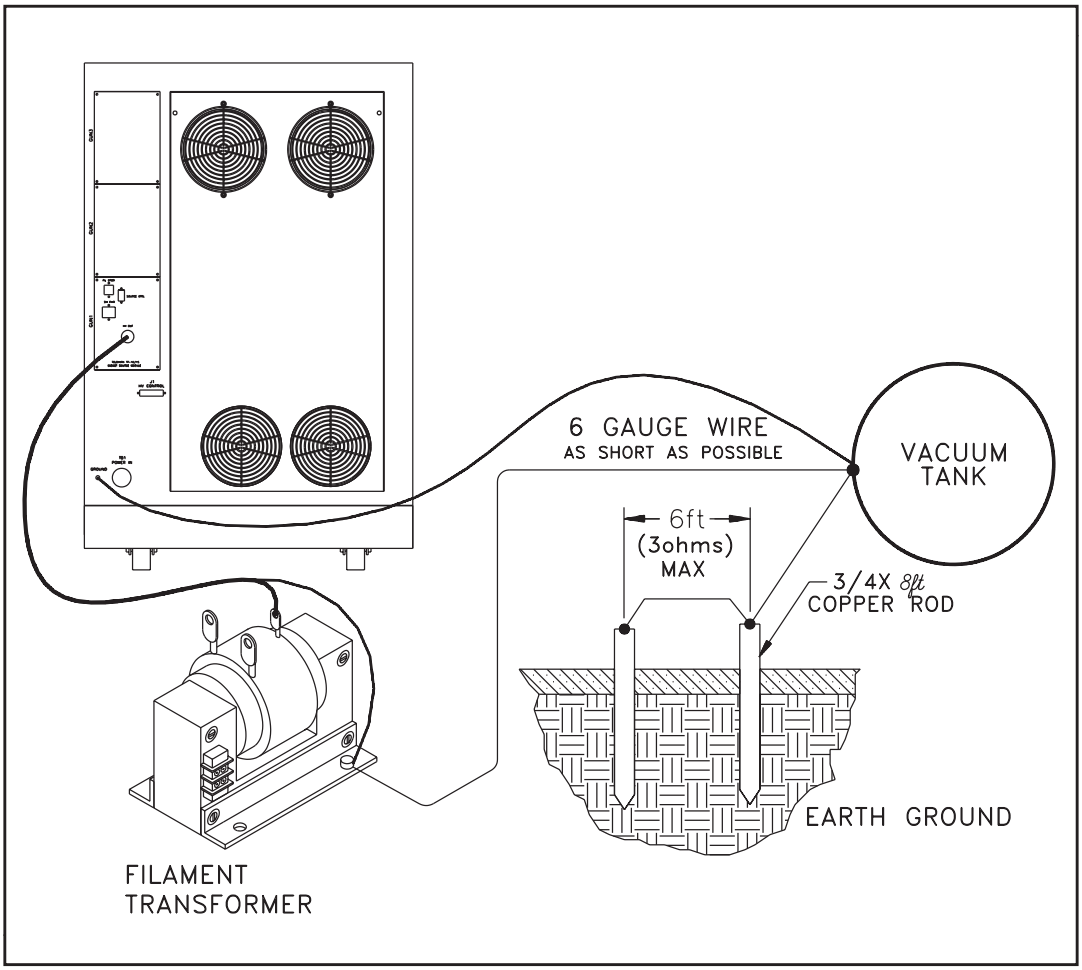
The Control and Sweep modules must be placed in a level 19 inch rack or other suitable cabinet that is capable of supporting a minimum of 25 pounds. The High Voltage/Power Cabinet must be placed in a level foundation capable of supporting a minimum of 500 pounds. There should be ample clearance at the back to allow proper air flow. All modules must be secured in the cabinet before electrical connections are made.

System Grounding Practice

See Figure 3-A or 3-B, Vacuum Tank Grounding Installation

A good ground is necessary to assure safe and proper operation of the power supply. The following practices are recommended to assure a good ground.

Figure 3-A
Single Source
Vacuum Tank
Grounding
Installation



NOTE - THE POWER SUPPLY MUST BE CONNECTED TO AN ISOLATED EARTH GROUND AS SHOWN IN FIG. 3-A AND 3-B, FAILURE TO CONNECT THE POWER SUPPLY TO AN ISOLATED EARTH GROUND COULD CAUSE SEVERE DAMAGE TO THE POWER SUPPLY AND/OR AUXILIARY ELECTRONIC CONTROL EQUIPMENT AND WILL VOID THE WARRANTY.

Vacuum Tank Ground

The vacuum tank and power supply cabinet must be connected to a good earth ground. Under normal conditions, a good earth ground will consist of two 3/4 inch diameter copper clad steel rods driven through the floor and into the earth near the tank location.

The ground rods should be connected to the vacuum tank and the filament transformer by a #6 or larger gauge copper cable. If the distance from the grounding rods to the tank is more than 10 feet, but less than 20 feet, increase the size of the copper cable to #4 gauge. For distances of 20 to 60 feet, use 2 inch by .035 inch copper strap. For distances over 60 feet, consult the factory. Do not use braided wire and be sure that the connection is made to clean metal. The rods

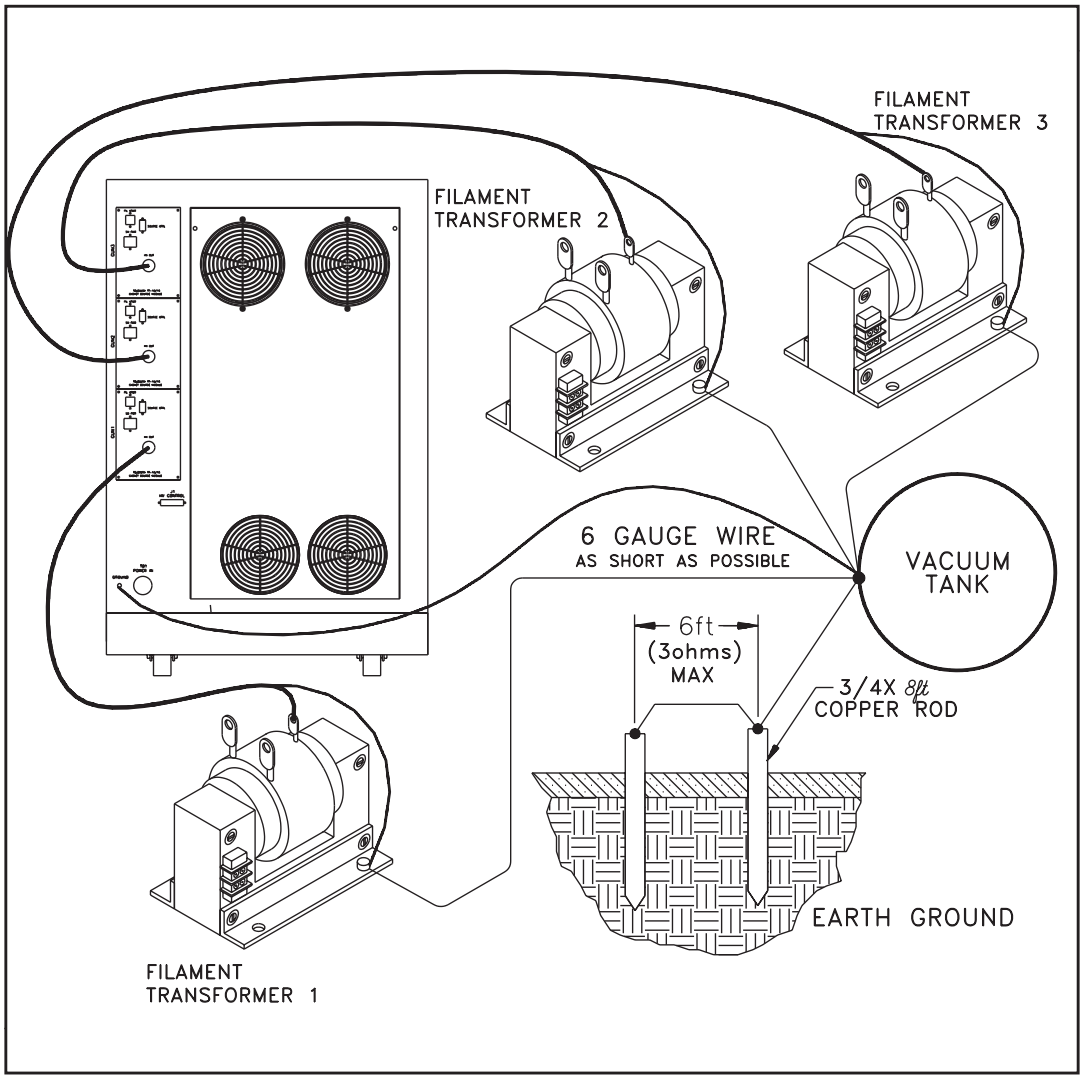


Figure 3-B
Multi Source
Vacuum Tank
Grounding
Installation

must be approximately 6 feet apart and the resistance between the rods (without the cable connection) should be 3 ohms or less. The resistance of the soil can be reduced by adding copper sulfate or salt water around the rods. A drip system may be required to insure maintenance of a proper ground.

NOTE - BE SURE THAT THE POWER SUPPLY CANNOT BE TURNED ON DURING THE FOLLOWING TEST.

At least once a year the wire between the two rods should be disconnected and the soil resistance checked. The resistance should never be over 3 ohms. The climate and soil conditions in your area may dictate performing this test more often. After this test has been completed, reconnect the cable to both rods before returning the power supply to service.

If the equipment is to be installed in the upper floors of a building where the installation described above is not feasible, the system may be grounded by connecting the vacuum chamber to the steel structure of the building. This should be done only after verifying that the building structure itself has a good earth

ground. If no building ground exists, rods must be driven in sufficient number and connected to the building structure to assure a suitable ground.

Do not depend on water pipes for the system ground connection. It is safe to assume that, because of multiple joints and sealing compounds, water pipes will not be an earth ground. Keep in mind that this is RF as well as DC ground. Do not make a ground loop by connecting the low impedance ground cable to the power supply incorrectly. As shown in Fig. 3-A and 3-B, the ground cable runs from the ground source to the tank first. Then connect the cable from the tank to the source filament transformer.

The power supply is connected to ground using the HV cable's shield connection. The power supply may sustain major damage if power is applied before the ground is connected. Connect cabinet ground to vacuum tank.

Filament Transformer

The mounting base of the filament transformer must be connected to the tank ground. This is best done by connecting a #6 wire from the tank to the ground stud on the transformer. If the filament transformer has no stud at the bottom of the core, connect ground to the transformer base bracket. Be sure to scrape away the paint at the mounting bolt if it has not been done. This insures that the transformer core does not rise above ground potential during operation.

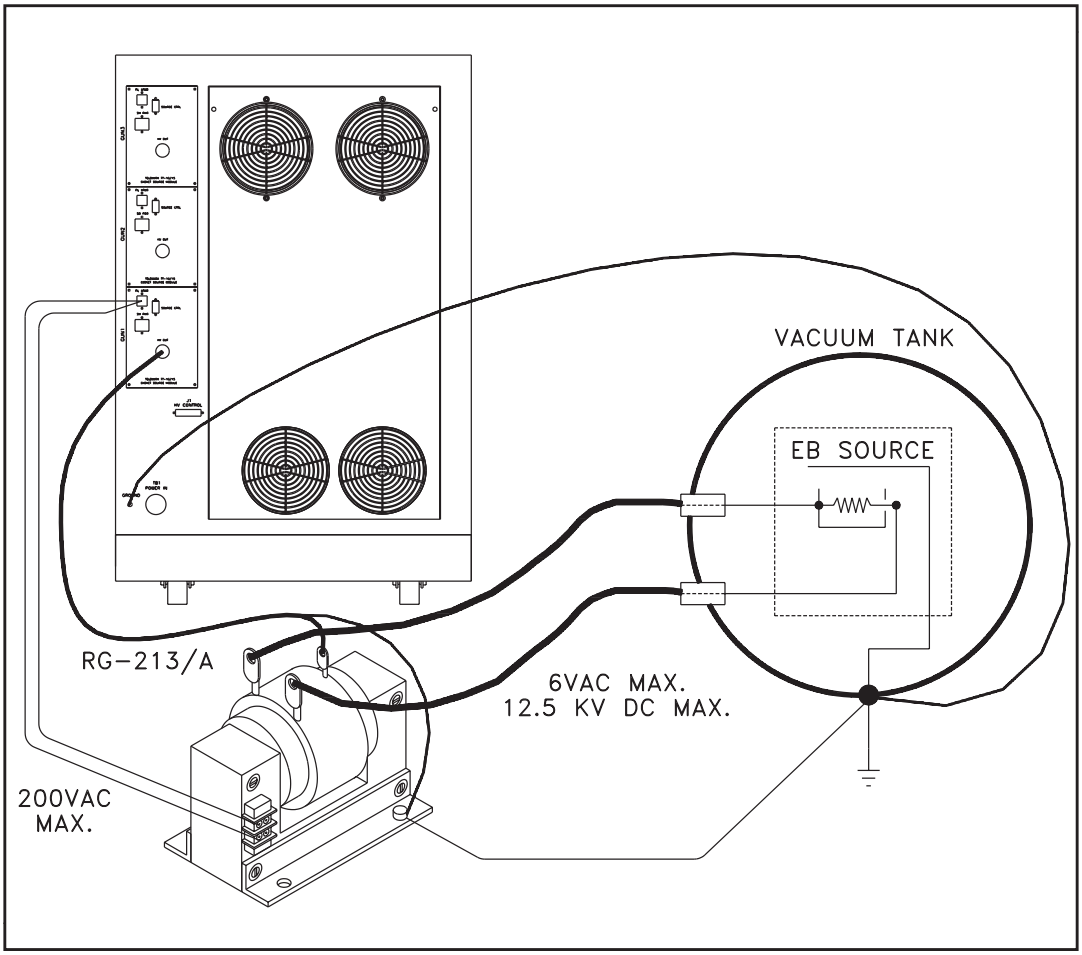


Figure 3-C
Source
Filament
Transformer
Connections

High Voltage Shielded Cable

See Figure 3-C

Approximately 20 feet of RG-213/U high voltage coaxial cable is provided for connection of the power supply output to the source transformer and is shipped connected to emission control module.

Approximately 5 inches of outer covering should be removed, and the shield stripped back so the insulated center conductor is exposed. The shield should then be connected to the tank ground at the transformer. The same care should be taken in making these connections as that taken in connecting earth ground to the tank and transformer.

The center conductor should be attached to the secondary center-tap on the top of Source Filament transformer. The cable is supplied with appropriate connections.

You must have a HV cable for each source from the power supply.

In addition, you have been supplied two 3 foot lengths of special coaxial cable (#6 AWG with 40KVDC dielectric insulation) to be used from the filament transformer output to the vacuum tank high voltage feedthrus. If a different length is desired, please contact the factory.

Inter-module Connections

See Figure 3-D or 3-E

Control to HV/Power

- J4 of Controller to Power Supply “HV Control”

J4 is a 25-pin D-sub connector located on the rear panel of the HV module. The 25 wires carry many signals both for commands and feedback information in analog form.

HV Power Supply Source Module to Sweep

- Rectangle plug, 2-pin plus ground

This line carries single phase line voltage (220V) to the Sweeper Module.

Control Module

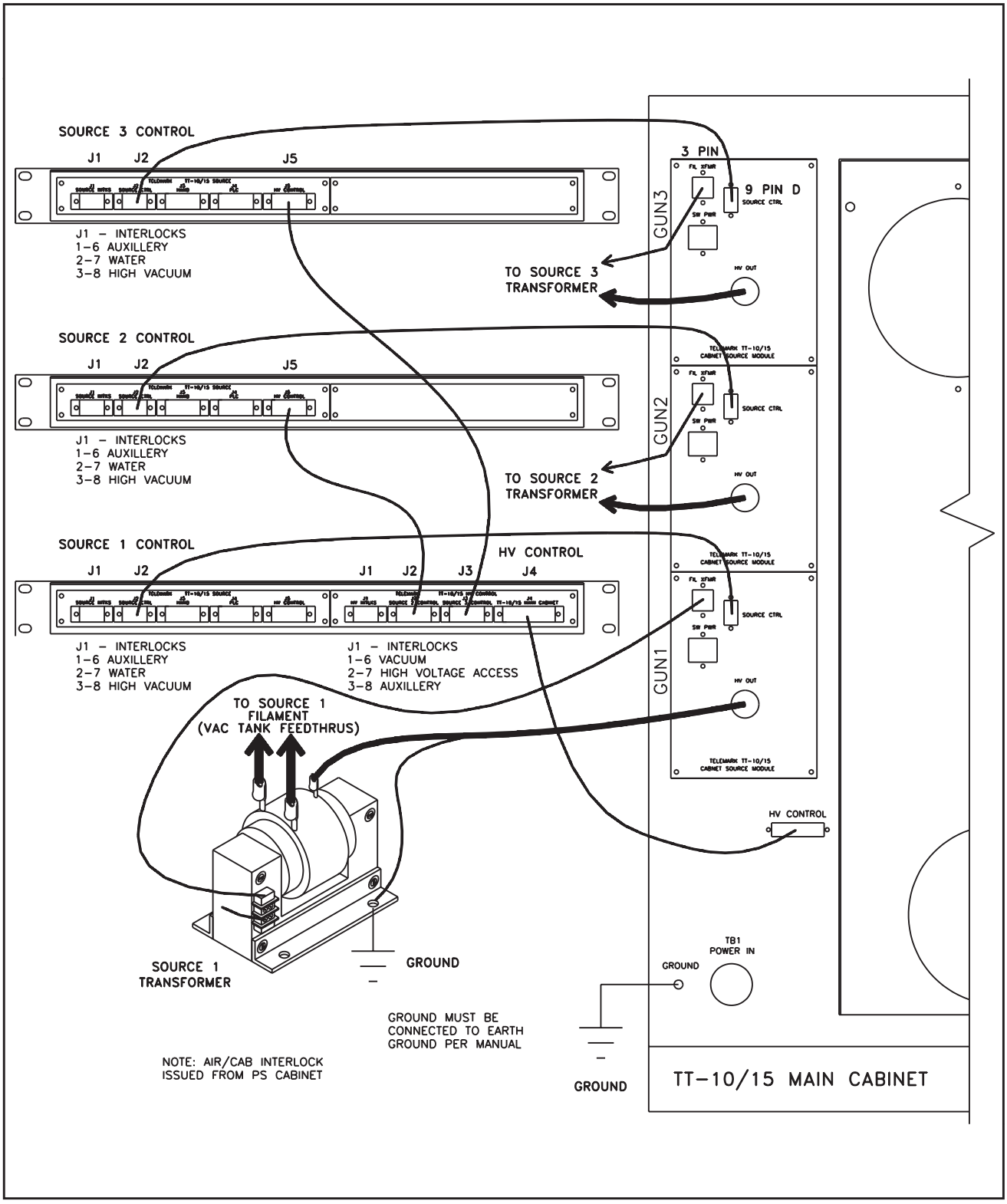
This section applies to all Control Modules, (Single or Multi-gun)

Interlock Connections - J1

The external interlocks are connected to the power supply through J1 (9 pin D-sub), which is located on the rear of the control module. Each controller (HV Control/Source 1 and Source 2/3) has an independent interlock circuit. See Figure 3-D or 3-E, Control Module Connections for details. 22 gauge ribbon cable or round cable should be used for the interlock installation that is described below.

- Auxiliary Interlock 2 - Source 1, 2 and 3

Figure 3-D
Source
Inter-Module
Connections



WARNING - ALL STATEMENTS REGARDING OPERATOR AND EQUIPMENT SAFETY ARE VOID IF THE EXTERNAL INTERLOCKS ARE NOT INSTALLED AS REQUIRED.

This interlock is provided for the insertion of additional interlocks that the user may require to turn the source off. These may include crucible rotation interlocks, etc. The normally open contacts of each interlock should be connected in series and terminated through pins 1 and 6 of J1 should be closed for normal operation.

- Source Water Interlock - Source 1, 2 and 3

Install a water flow switch in the return line of the cooling system for the electron beam source. This switch should close when there is sufficient water flow to cool the source and associated shields. Connect the switch to pins 2 and 7 of J1.

- High Vacuum Interlock -Source

This interlock insures that there is sufficient vacuum within the tank before the source can be energized. This level of vacuum normally coincides with that required for the energizing of the vacuum gauge filaments and most units have auxiliary contacts for this purpose. Their connection should be such that pins 3 and 8 of J1 are shorted when the filaments of the vacuum gauge are energized.

- Auxiliary Interlock 1 - HV

This interlock is provided for the insertion of additional interlocks that the user may require to turn the HV off. These may include emergency off push buttons, etc. The normally open contacts of each interlock should be connected in series and terminated through pins 3 and 8 of J1 should be shorted or closed during normal operation.

- Tank/High Voltage Access - HV

These interlocks are to be connected to pins 2 and 7 of J1. Install series connected, normally open switches on the doors and high voltage panels so that they are closed only when the doors of the chamber and all panels are in place.

This interlock should be closed only when there is no possible chance of coming into contact with high voltage.

- Vacuum Interlock - HV

A vacuum switch should be installed on the tank so that it is closed when there is a slight vacuum within the tank. This switch is connected to pins 1 and 6 of J1.

Remote Emission Adjust - J4

J4 is a 15 pin D-sub connector. Remote Emission Adjust is a differential input. Install the rate signal (zero to -10 volts) to pin 14 and ground to pin 6 of J4. The amplitude of this signal should increase when it is desired to increase the evaporation rate. Also, pins 9 and 4 must be jumpered for proper operation.

The three position Emission Current Mode switch selects which signal controls the source current value. Remote control adjust is through J4 from a PLC (Programmable Logic Control). Hand held control using the optional hand held current control unit that plugs into J4.

Filament Transformer Primary Connection - J1005

The filament transformer primary must be connected to pins 1 and 3, square connector of source control module(s) on back of power supply. The phase angle controlled line voltage sets the source current. The source current cannot be turned on if any of the interlock LEDs are off.

25' Cables are supplied for each EB Source ordered.

HV/Power Cabinet

See Fig 3-C, Source Filament Transformer Connections

Electrical, interlock and control connections are outlined in the following sections. Installation should only be performed by qualified personnel.

High Voltage Connection - C1

See figure 3-D

The high voltage connection is made with RG-213/U cable and the shield should be connected as described in the previous section, High Voltage Shielded cable. The tank end of the cable should be connected to the filament transformer. Care must be taken to install the shield away from high voltage. A minimum of one inch of air clearance is required.

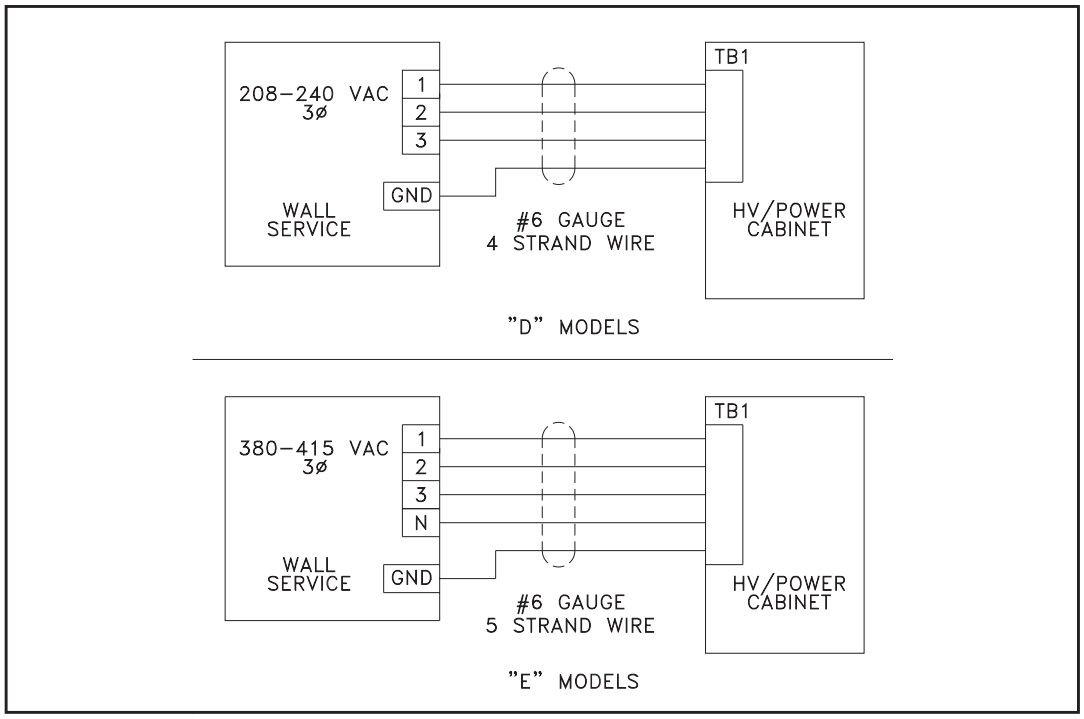
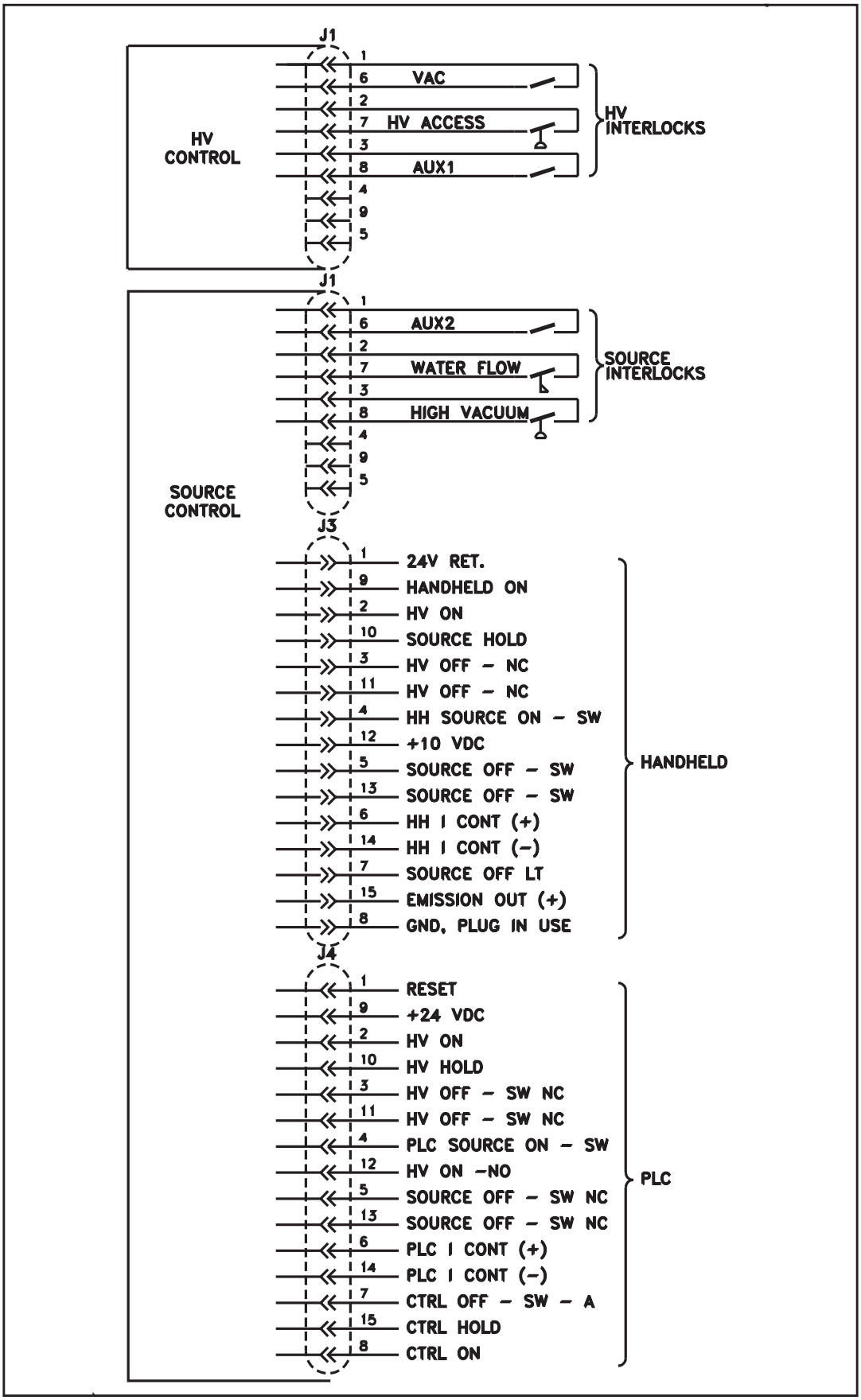


Figure 3-F HV/Power Cabinet Connections

Figure 3-E
Control
Module
Connections



POWER IN - TB1

When the power supply has been installed as described in the preceding sections, the primary power should be the last connection made, with the power off. See Figure 3-F, HV/Power Cabinet Connections.

The power cord (AWG-6) is connected to TB1 on the HV/Power Cabinet. “D” models are to be connected to a 3Ø 208/240V, 4 wire, 60Hz source. “E” models are to be connected to a 3Ø 380/415V, 5 wire, 50Hz source. (“D” models; TT-10: 40A, TT-15: 50A. “E” models; TT-10: 40A, TT-15: 50A), each hot line is protected by circuit breakers, located on the front panel of HV/Power cabinet. The electronic control circuitry and fans are protected by single phase 15A circuit breakers.

**CAUTION - GREEN OR GREEN/YELLOW WIRE MUST BE CONNECTED TO UTILITY GROUND.
IT MUST NOT BE DISCONNECTED
OR BE CONNECTED TO ANY OF THE HOT LINES.**

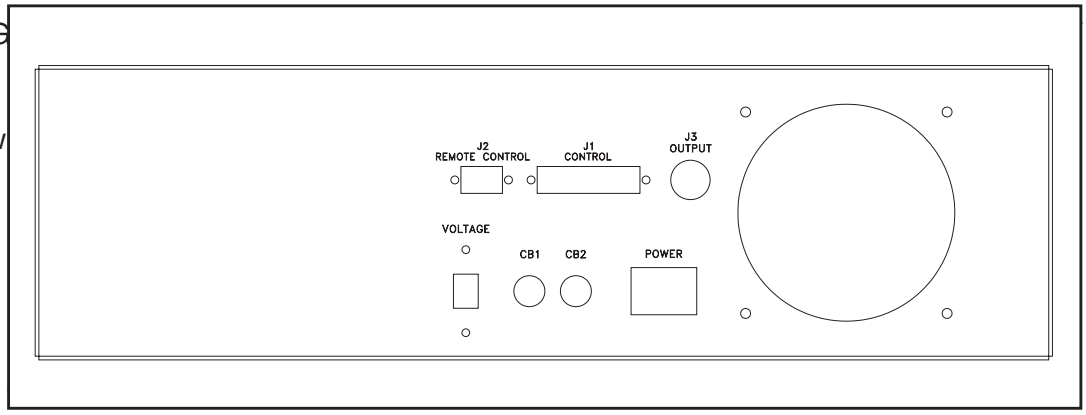
Sweep Module - Rear Panel

See Figure 3-H

INPUT V.A.C. CONNECTION - Power

The VAC input connector (on the back panel) is a standard 3-pin plastic domestic male computer-style (there is a choice of input cable for either standard domestic outlet use, or the 208V single-phase jack on the back of a TT-10/15 power supply).

Figure 3-G Sweep Module Rear View



This Sweep allows the customer to select the input-voltage range, with a switch (on the back panel) for running on either 105—120 VAC or 208—240VAC. Switched to the lower range, it can plug into domestic wall outlets, ~115VAC.

WARNING: Care should be used to set the switch to a range appropriate for the available line power. Note if the switch is set at 230 but powered by 115, no damage results, but full power cannot be achieved. Conversely, if the switch is set at 115 but powered by 230, damage will likely result.

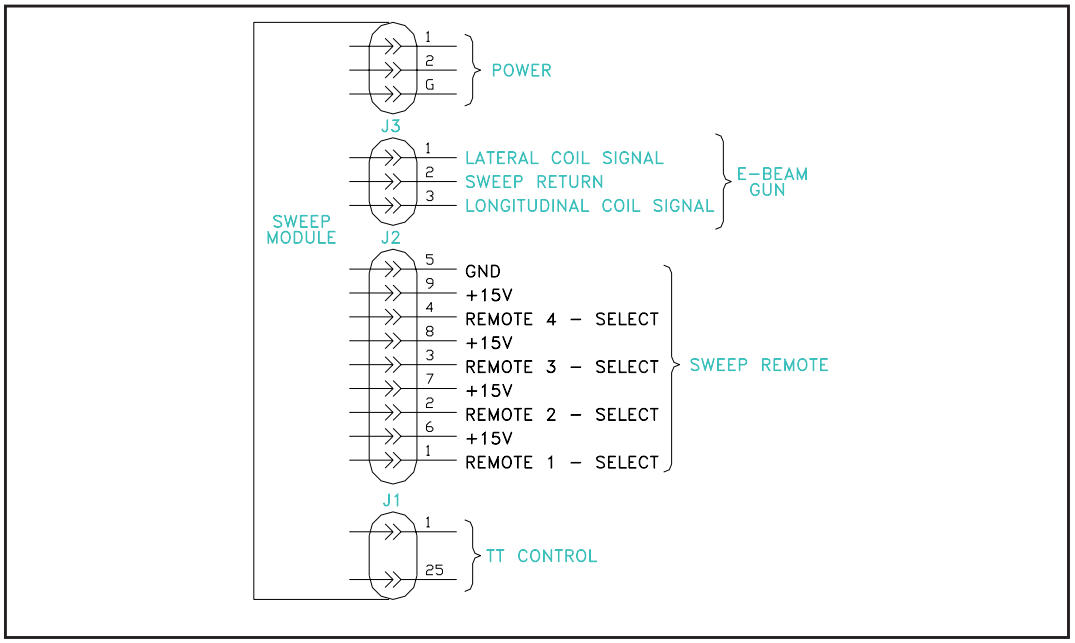


Figure 3-H
Sweep Module Connections

WARNING: Care should be used to set the switch to a range appropriate for the available line power. Note if the switch is set at 230 but powered by 115, no damage results, but full power cannot be achieved. Conversely, if the switch is set at 115 but powered by 230, damage will likely result.

SWEEP OUTPUT CONNECTION - J3

Connection of the Sweep generator to an EB gun coils is accomplished by bringing the Longitudinal and Lateral coil leads out of the vacuum tank by way of a feed-through. In the vacuum tank, take care to dress these leads away from the EB gun filament assembly and filament conductors. (This is further discussed in EB gun manuals.)

Outside the tank, still keep the coil leads away from the high-voltage feed-throughs. These leads are then connected to pins 1, 2, & 3 of the Sweep's J3. The Sweep Output connector provided is a round metal 3-pin male Philmore. Pin 1 is the Lateral output, pin 3 the Longitudinal, and pin 2 is the common ground-return; BOTH coils return to pin 2—-the common is shared. The cable must be capable of passing a minimum of two amperes. Note the common return is not grounded inside the Sweep, but must be grounded at the EB gun tank.

WARNING: Leaving the common ungrounded at the tank could damage the Sweep.

TT-10/15 POWER SUPPLY CONNECTION - J1

The interface between the Controller and the supply is the special 15-P Male D-Sub to 25-P female D-Sub. The Controller option allows Electron-Beam Power Supply operation via the Sweeper's special Controller/Joystick Module.

REMOTE PATTERN-SELECTION CONNECTION - J2

The customer may control external selection of the Sweep Select Module's pattern banks, accomplished through this male 9-pin D-sub. An indexer or computer may be used in conjunction with the Sweep Select Module to choose which of its four pattern-banks is active. Connect the indexer or computer interface to J2 such that the appropriate pins are shorted for selection of the desired bank.

Sweep Module - Front Panel

Hand-held remotes (Removable Modules) which control beam Position; and Sweep Amplitude, Frequency, and Pattern can be plugged into the 37-pin D-sub connectors on the inner-front of the Sweep.

Connection of the Sweep to its Removable Modules is shown in Fig 4-C, Sweep Chassis.

CONTROLLER/ JOYSTICK CONTROL - J4 & J5

The left module bay on the front of the chassis has 37-pin female D-subs for the Controller/Joystick Module. The bottom connector allows the Module to plug straight in; the top allows optional cable attachment to use the Module remotely. The connectors are electrically identical, but have different mounting hardware (jack-bolts on the upper connector).

SWEEP SELECT CONTROL - J6 & J7

The right module bay on the front of the chassis has 37-pin male D-subs for the Sweep Select Module. The bottom connector allows the Module to plug straight in; the top allows optional cable attachment to use the Module remotely. The connectors are electrically identical, but have different mounting hardware (jack-bolts on the upper connector).

4

CONTROLS AND INDICATORS

Control Module

Please refer to Fig. 4-A, Control Module Front View.

The front panel controls are grouped according to the three basic functions to be controlled. Lines on the panel enclose the controls and indicators associated with each group. High Voltage controls are in the middle; Source controls are on the right, and Main Power controls are at the left.

Main Power Controls

1. *KEYLOCK - Main power is controlled first by a keylock to prevent unauthorized operation of the equipment. The key, when turned to the ON position, cannot be removed.*
2. *MAIN POWER, OFF - The on/off function is provided by a pair of push-buttons on the panel at the middle of the labeled Main Power functional group. The off button lights when the Main Power is ready for turn on.*
3. *MAIN POWER, ON - The on button lights when the main power is on. When the button is pushed the sound of fans should be heard. Also the back light of the digital displays should be seen.*

WARNING - THE POWER SUPPLY MUST BE OFF FOR MORE THAN 15 SECONDS PRIOR TO RESTART. TURNING THE POWER SUPPLY OFF AND ON QUICKLY MAY CAUSE DAMAGE TO THE POWER SUPPLY.

High Voltage Controls and Interlock Indicators

4 *HIGH VOLTAGE, OFF - The on/off function is provided by a pair of push-buttons on the main control panel High Voltage group. The off button lights when High Voltage power is off.*

5 *HIGH VOLTAGE, ON - The on button lights when High Voltage is on.*

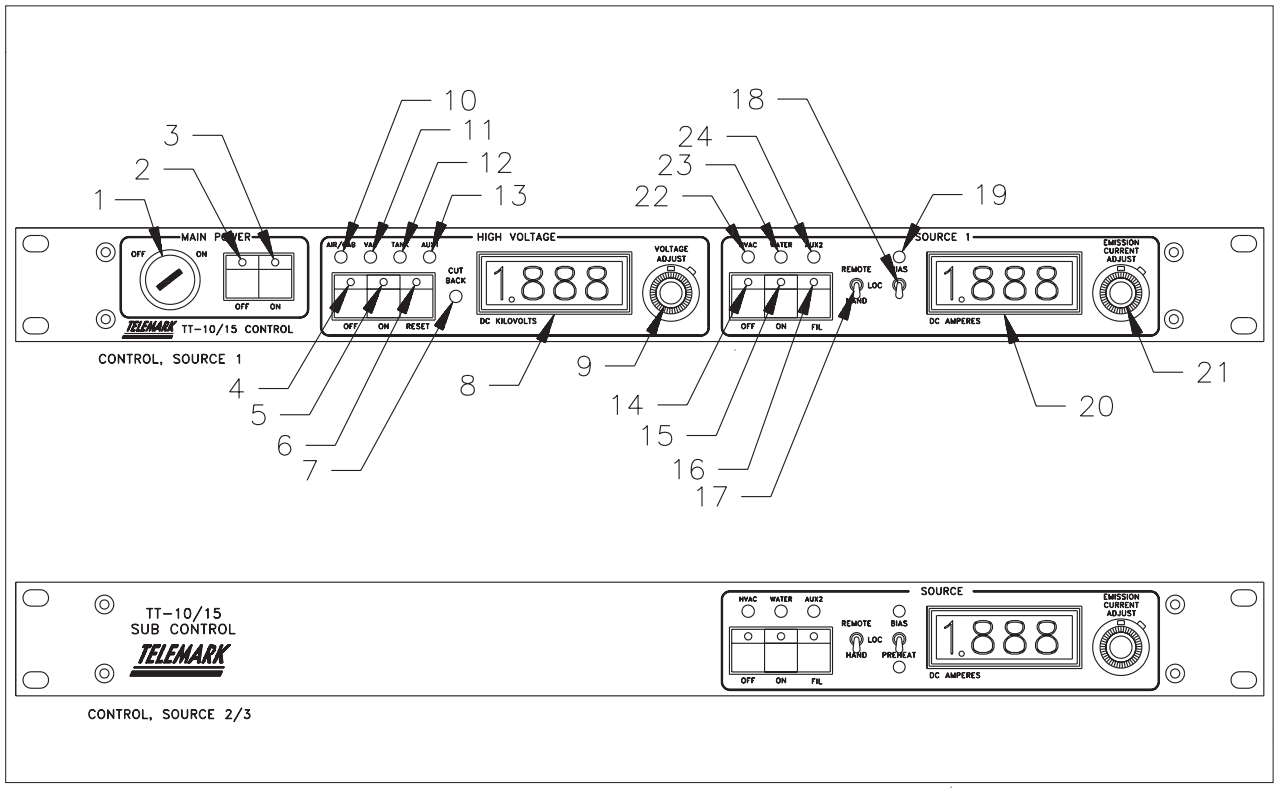
6 *RESET - Turns on HV Off and emission off lamps when all interlocks are satisfied.*

7 *CUT BACK - This light illuminates when the power supply is in cut back. Arcing in tank is sensed or max current limit has been reached*

8 *HIGH VOLTAGE METER - A digital display of the power supply's output voltage, from 0 to 10kV.* ***The output is a negative DC voltage****.*

9 *HIGH VOLTAGE ADJUST - The multi-turn precision variable resistor adjusts from 0 to more than 10kV to set the output voltage. The power supply is designed to run EB sources between 2kV and 10kV. However it is recommended that you utilize at least 6kV.*

Figure 4-A
Control Module
Front View



The state of the High Voltage interlocks is continuously checked. If any condition is not correct, the corresponding indicator will not be lit. The High Voltage Indicator lights are (left to right):

10 *AIR/CAB - A pressure sensor is used to insure proper airflow in the tube box. The HV cabinet interlocks are in-line with the air switch. All covers must be in place and there must be good air flow though the box before the light will come on. Push the Reset button to reset the circuit.*

11 *VACUUM - With a vacuum switch on the tank it indicates that there is the minimum vacuum in the tank necessary to start the HV.*

12 *TANK HIGH VOLTAGE ACCESS - With interlocks (on all doors and panels that permit HV access) closed, This indicates that accidental contact with HV is not likely.*

13 *AUXILIARY 1 EXTERNAL INTERLOCKS - This is used for additional interlocks that may require the HV to be turned off, such as another emergency off push-button.*

Source Controls and Interlock Indicators

14 *SOURCE, OFF - The on/off function is provided by a pair of push-buttons on the panel at the lower left of the labeled Source functional group. The off button lights when Source Filament is off. This button only controls the Source current. The reset button can be used to reset the breaker indicator.*

15 *SOURCE, ON - The on button lights when Source Filament is on. It only operates when the High Voltage is on and @ minimum kV and all interlocks are satisfied.*

16 *FILAMENT VERIFICATION - Pushing this button will forward a meter reading indication of current to the primary of the source filament transformer. This does not read actual emission current.*

17 *EMISSION CURRENT MODE - The three position Emission Current Mode switch selects which signal controls the source current value:*

Remote - Remote control adjust through J4, pins 6 and 14, from a PLC (Programmable Logic Control).

Local - Control by the EMISSION CURRENT ADJUST [21] potentiometer on the panel.

Hand - Control using the optional hand held current control unit that plugs into J3, pins 6 and 14.

18 *BIAS ON/OFF SWITCH - With bias on, adjust bias trimpot for minimum beam. Primarily used to position beam and sweep pattern, before beginning operation.*

19 *BIAS - The Bias adjustment is located at the center of the Source Control group. The Bias potentiometer is recessed. The resistor is used to adjust the "bias" set point (the minimum source current). Turning counter-clockwise with a small flat head screwdriver increases the filament current. With the source current on and the emission current set at "0" the bias should be adjusted to the point that the beam just begins to appear. Line voltage changes may affect this setting.*

20 *SOURCE CURRENT DISPLAY - Source current is displayed by the digital meter at the top of the Source control group.*

21 *EMISSION CURRENT ADJUST - The Emission Current potentiometer is located at the right center of the Source control group and is used to set the desired value of source current. Adjustment between the bias setting level and the current limit can be made. Special circuitry protects the power supply, and may cause interruption of the power supply at a setting exceeding the maximum rated current (1 Amp for TT-10, 1.5 Amp for TT-15) cutback.*

The state of all Source interlocks is continuously checked. If any condition is not correct, the corresponding indicator will not be lit. The Source Group Indicator Lights are (left to right):

22 *HIGH VACUUM - With a high vacuum gauge utilized in the system, the minimum vacuum level set on the gauge must be present before the source can be energized.*

23 *WATER - A water flow switch on the water return line from the source assures that there is sufficient water flow to cool the source.*

24 *AUXILIARY 2 EXTERNAL INTERLOCKS - This interlock is used for additional interlocks that may require the source be turned off, such as an interlock that prevents emission while the crucible rotates.*

HV/Power Cabinet

See Fig. 4-B

25 *POWER RESET - The front panel of the HV/Power Cabinet contains circuit breakers. They protect the power supply from*

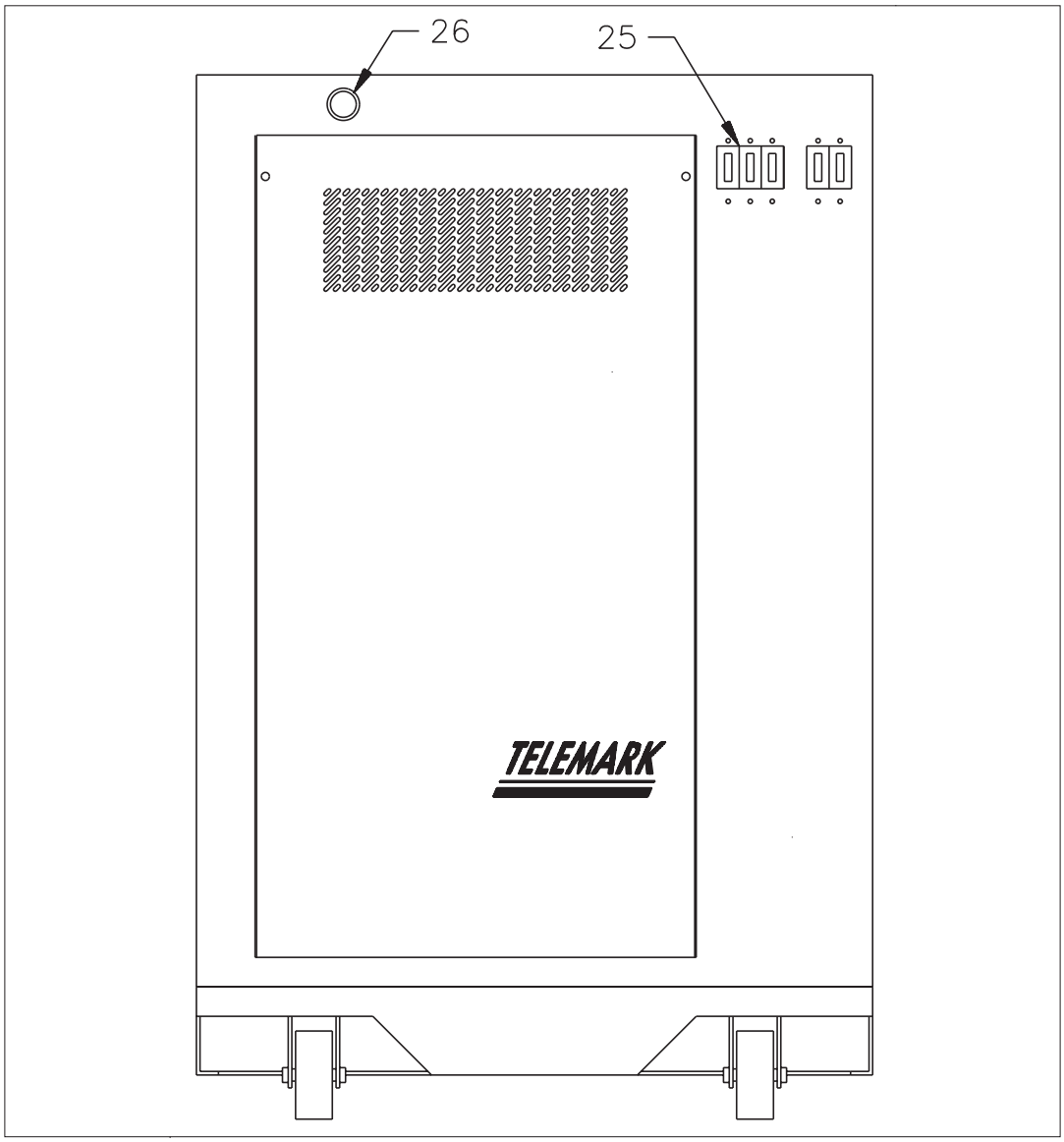


Figure 4-B
HV/Power
Cabinet Front
View

overload or line surges. If any of them have been tripped the power supply will not turn on.

26 *OFF - This off button will shut off all power contactors and HV circuit. Reset must be pressed on control unit to restart system.*

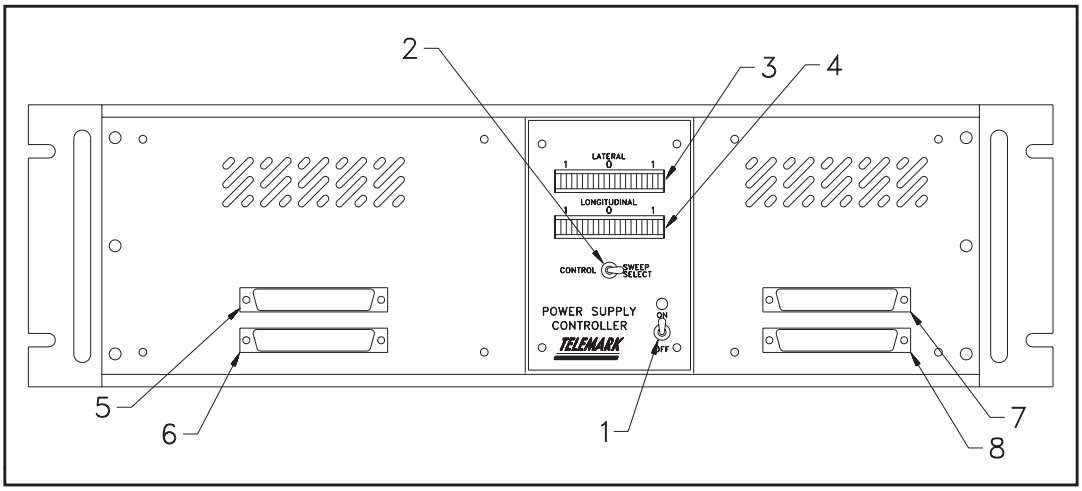
Standard Sweep Control Module Chassis

See figure 4-C

1 *ON/OFF SWITCH—-Provides Sweeper power, not TT-10/15 Controller power.*

2 *MODE (CONTROL / SWEEP SELECT) SWITCH—-selects between Control on the left and Sweep Select on the right. Note: when no Memory Module is connected, operation defaults to the Controller (Joystick) Module.*

Figure 4-C Control Module Chassis, Front View



3 & 4 *POSITION L.E.D.s—-show the relative position of the beam (in two axis—Lateral [left & right] and Longitudinal [near & far]) in the pocket.*

NOTE: DIRECT OBSERVATION OF BEAM POSITION SHOULD BE MADE. LED INDICATORS ARE FOR REACTIVE POSITION AND FUNCTION.

5 & 6 *CONTROL CONNECTORS—-used to attach the Controller Module: the bottom one allows the module to plug on, the top is for attaching a remote cable. Note: the two connectors are electrically identical, with different hardwares.*

7 & 8 *SWEEP SELECT CONNECTORS—-used similarly to the Control Connectors.*

XY Sweep Controller (with Memory Module) (Optional)

See figure 4-D

The Removable Module may be used plugged into the chassis, or as a Handheld Remote on an extension cable.

1 *PATTERN MODE SWITCH - The three-position MODE switch is used to select between SPIRAL, MANUAL beam position, and TRIANGLE pattern.*

With the MODE switch in the SPIRAL condition, the Longitudinal/Modulation Frequency knob controls the spiral-collapse frequency, while both Lateral and Longitudinal Amplitude knobs control the overall size (in two axis). The Joystick is used to position the beam. The Modulation Amp knob controls the depth of spiraling collapse (how close the beam moves towards the center of the pattern).

With the MODE switch in the MANUAL beam position setting, the Joystick is used to position the beam; there is no sweeping.

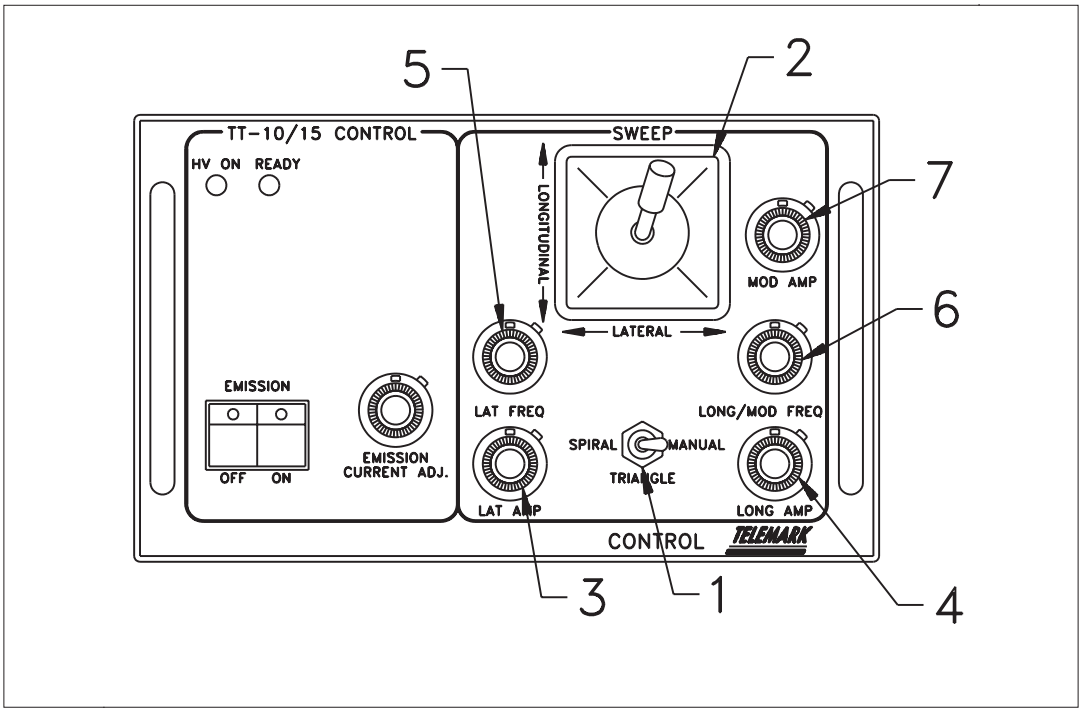


Figure 4-D Sweep Module, Front View

With the MODE switch in the TRIANGLE setting, the Lateral and Longitudinal Amplitudes and Frequencies of the beam are set with the corresponding knobs. The Joystick is used to position the beam. The resulting beam movement is in a diamond(s) pattern.

2 *JOYSTICK - Moves the beam position (in two axis —Lateral [left & right] and Longitudinal [near & far]), or the center position of patterns.*

3 & 4 *AMPLITUDE - Adjusts the overall pattern size (in two axis).*

5 & 6 *FREQUENCY - Adjusts the sweeping speed(s). When in Triangle mode, the Lateral and Longitudinal Frequency knobs operate independently (in two axis). When in Spiral mode, only the Longitudinal/Mod.Freq. pot (6) controls the spiral-collapse frequency.*

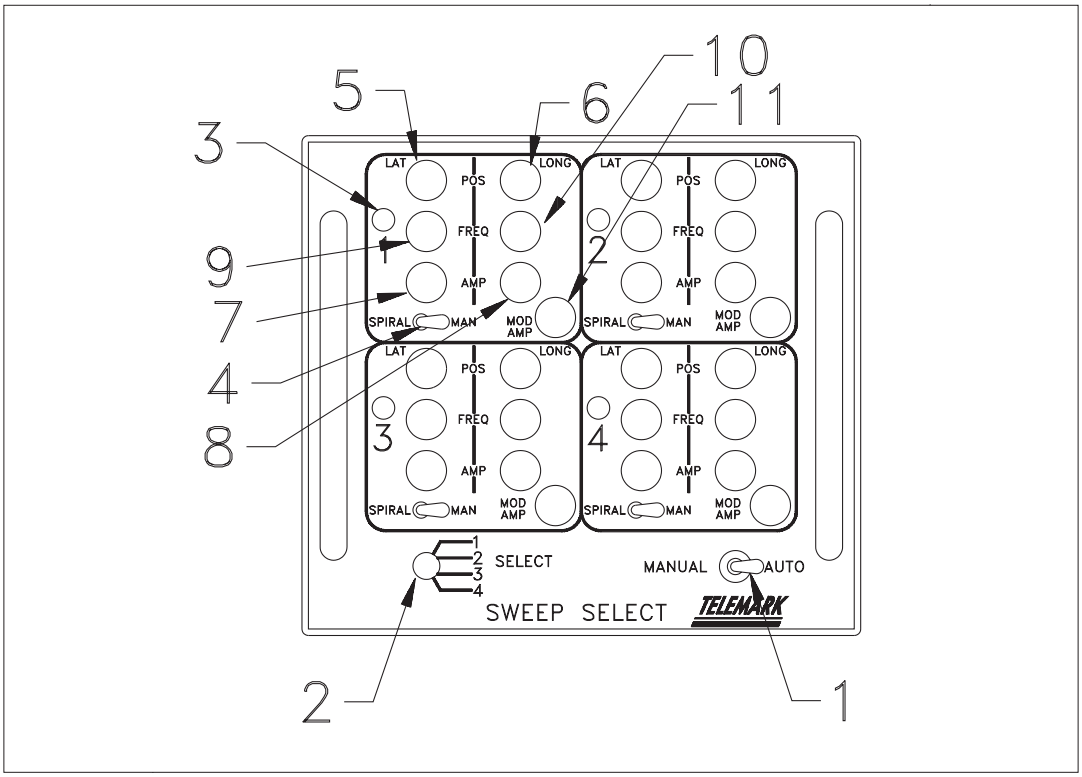
7 *MOD AMP - The modulation amplifier knob adjusts the depth of the spiral's collapse.*

Standard Sweep Select Module (Memory Module)

See figure 4-E

The Removable Module may be used plugged into the chassis, or as a Handheld Remote on an extension cable. Each Channel (1—4) operates similarly to the Controller (Joystick) Module.

Figure 4-E
Sweep Select
Module, Front
View



1 *MANUAL/AUTO SWITCH - Changes the control of the Sweep Select module from the knob on the front panel (2) to the remote input from J2 on the back panel. Note: in AUTO mode, if J2 has no input, operation defaults to Sweep Select Channel 1.*

2 *SELECT PATTERN - Rotates to select the active pattern for manual mode.*

3 *ACTIVE PATTERN L.E.D. - Indicates which one of the four patterns is active.*

4 *PATTERN MODE SWITCH - The three-position MODE switch is used to select between SPIRAL, MANUAL beam position, and TRIANGLE pattern. Note: Triangle is not silkscreened on the panel, but it is the middle position, similar to the Joystick Controller Module.*

With the MODE switch in the SPIRAL condition, the Longitudinal/Modulation Frequency knob controls the spiral-collapse frequency, while both Lateral and Longitudinal Amplitude and Position knobs control the overall size and placement (in two axis). The Modulation Amp knob controls the depth of spiraling collapse (how close the beam moves towards the center of the pattern).

With the MODE switch in the MANUAL beam position setting, the Lateral and Longitudinal Position knobs are used to position the beam; there is no sweeping.

With the MODE switch in the TRIANGLE setting, the Lateral and Longitudinal Positions, Amplitudes, and Frequencies of the beam are set with the corresponding knobs. The resulting beam movement is in a diamond(s) pattern.

5 & 6 *POSITION - Moves the beam (in two axis—Lateral [left & right] and Longitudinal [near & far]), or the center position of patterns.*

7 & 8 *AMPLITUDE - Adjusts the overall pattern size (in two axis).*

9 & 10 *FREQUENCY - Adjusts the sweeping speed(s). When in Triangle mode, the Lateral and Longitudinal Frequency knobs operate independently (in two axis). When in Spiral mode, only the Longitudinal/Mod.Freq. pot (10) controls the spiral-collapse frequency.*

11 *MOD AMP - The modulation amplifier knob adjusts the depth of the spiral's collapse.*

5 OPERATION

Introduction

This section describes the normal operating procedures for the Telemark TT Power Supplies.

Preliminary Precautions

Before turning on the system for the first time, it is essential that the following conditions are observed:

1. *The ground system is correctly installed as described in detail in Chapter 3 (Installation), System Grounding Practice.*
2. *The external interlocks are correctly installed as described in detail in Chapter 4, Interlock Connections under Control Modules.*
3. *The vacuum tank is operational.*
4. *The filament assembly is assembled to specifications and not shorted to ground, and the E-beam source has material in its crucible.*

Startup

1. *Turn ON the primary source of VAC power to the system. Make sure that the main cabinet circuit breakers are on.*
2. *Turn on controller KEYLOCK.*
3. *Push Main Power on.*

4 *Depress the Controller Reset, to reset interlocks. It will take about 30 seconds for the HV/Power Cabinet fans to reach normal speed. Once the fans have reached normal speed the air switch will close, then the AIR/CAB interlock can be reset.*

5 *Observe the interlock lights. All should be on. If any of these lights are not illuminated, the corresponding open interlock must be located and the condition causing the open interlock corrected. The high voltage and source filament are ready to be turned on.*

6 *Turn on the high voltage by depressing the HV ON push-button.*

NOTE: ALLOW APPROXIMATELY 1-5 MINUTES WARM-UP BEFORE TURNING HV ON. FAILURE TO WAIT MAY CAUSE DAMAGE AND VOID WARRANTY.

7 *High voltage will now be applied to the electron beam source and HV level will be indicated by the HIGH VOLTAGE meter.*

8 *Increase the VOLTAGE ADJUST potentiometer until the meter reads the required operating voltage (normally 6-10 kV). This affects the longitudinal beam position.*

9 *Turn the electron beam source on by depressing the SOURCE ON push-button.*

10 *Turn on BIAS. If this is the first time or if the EB Source has been cleaned or rebuilt then slowly increase BIAS ADJUST trimmer until you see a small amount of emission current. Check the EB source for a beam. Decrease this setting to slightly below the point at which emission occurs. Leave the trimmer at this setting.*

11 *Adjust kV to place beam in center of crucible pocket.*

12 *Increase the SOURCE EMISSION ADJUST to the required operating level. Be sure the electron beam is in the center of the pocket with the sweep turned off.*

Operation

The system is now operational. The position of the beam in the crucible can be moved or swept by adjustment of the sweeper controls.

XY Sweep (with Memory Module) Setup

The following is the procedure to set the Sweep Module Controller/Joystick Module for initializing operating levels. (This may be done with the Module plugged into the front panel or extended by cable.)

1. *With the HV/Emission off, place the front-panel switch "control/sweep select" in the "control" position.*
2. *Turn on the "power" switch.*
3. *Set the joystick to its midpoint, and switch the module's mode switch to "manual."*
4. *Note the LED bargraph displays are approximately mid-scale. Slight adjustment of the joystick may be necessary.*
5. *Turn on the E-Beam Power Supply's high voltage.*
6. *Slowly move the joystick and observe movement of the beam in the crucible. This ensures connection of the deflection coils and Sweep output. With the beam in the center of the pocket, turn Emission down.*
7. *Place the front-panel switch "control/sweep select" in the "sweep select" position.*
8. *Switch the Sweep Select Module's control-select toggle-switch (labeled "manual/auto") to 'manual.' Turn the rotary switch labeled "select" to pattern-bank channel 1.*
9. *Switch the channel's mode switch to "man" (manual).*
10. *Bring the E-beam Power Supply's Emission up slowly and use the Sweep Select's channel 1 position knobs to center the beam in the crucible pocket. Turn the Emission down.*
11. *Repeat the last three steps for each of the other pattern-bank channels.*
12. *If more than one Sweep Select Module is to be used (for additional pattern storage), it is advisable to center the channels at this time.*

XY Sweep with Memory Module Operation

The system is now operational. The position of the E-beam in the crucible can be moved or swept by adjustment of the Sweeper removable module controls.

Patterns are determined using the Controller/Joystick Module while watching the E-beam in the vacuum tank's EB gun crucible. Once setup and positioned, they can be copied to Sweep Select Module pattern-bank channels even with Emission off: visually match front-panel LED bargraph-display motions controlled by the joystick system with those controlled by the Sweep Select channels. Once patterns are complete, it is best to check them with low Emission into the tank. Note E-beam shape may be affected somewhat as Emission output is later increased to high levels. If the E-beam spreads, the pattern may end up sweeping wider areas than previously calibrated.

CAUTION: always keep the E-beam in the crucible pocket.

Shutdown

1. *Reduce the EMISSION ADJUST potentiometer to zero. The indicated emission current should go to near zero. If it does not, the bias setting is too high and should be reduced.*
2. *Turn off the source filament power supply by depressing the SOURCE OFF push-button.*
3. *Turn off the high voltage by depressing the HV OFF push-button. The indicated voltage level will go to zero.*

NOTE: ALLOW 2-5 MINUTES FOR COOL DOWN. FAILURE TO COMPLY MAY CAUSE DAMAGE AND VOID WARRANTY.

4. *Turn the KEYLOCK to off or depress the MAIN POWER OFF push-button.*
5. *Turn off the primary source of VAC power to the system.*
6. *The system is now totally de-energized.*
7. *Do not touch any HV sources until properly grounded with safety probe. Can cause injury if HV charge is held.*