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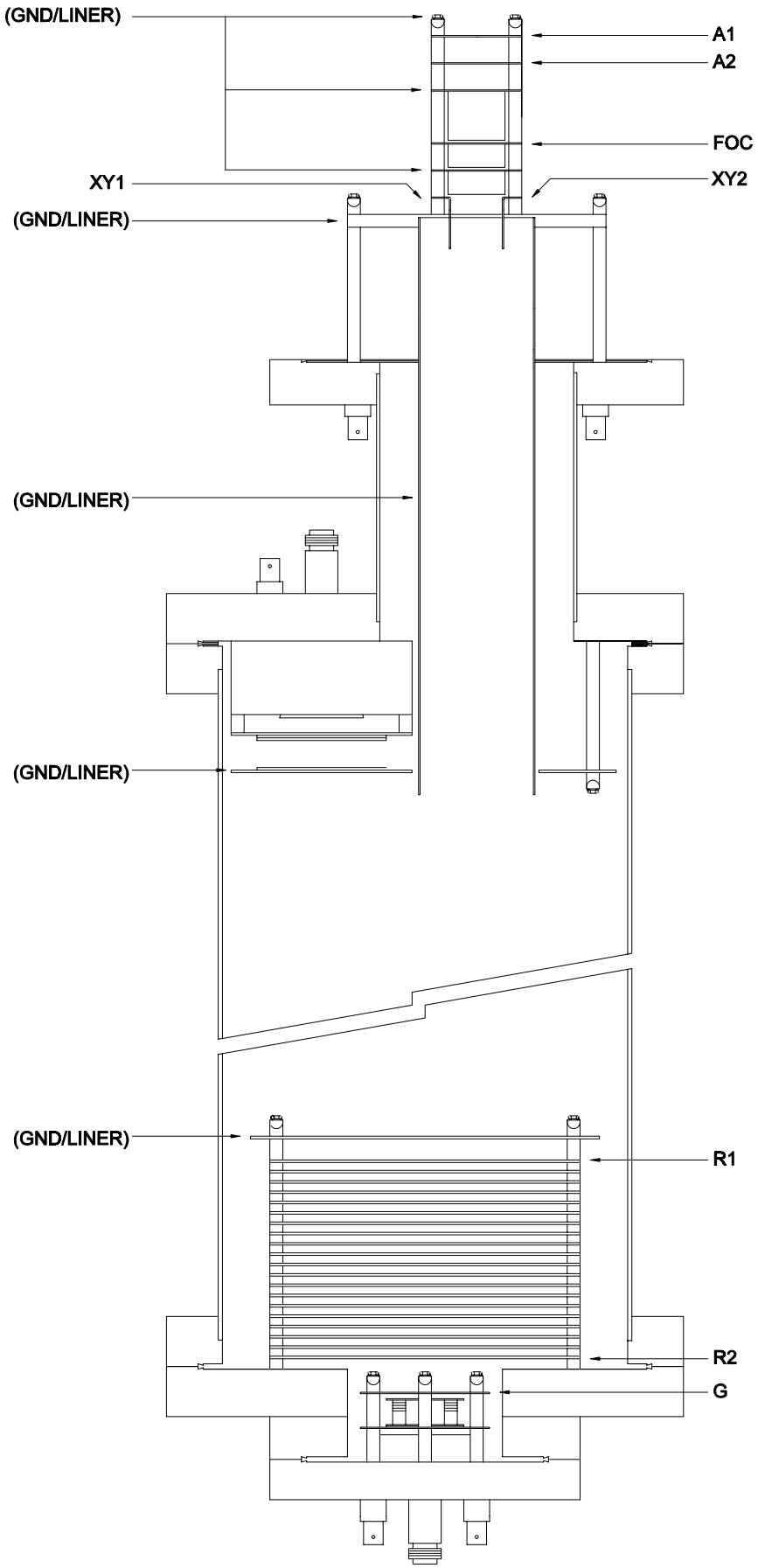
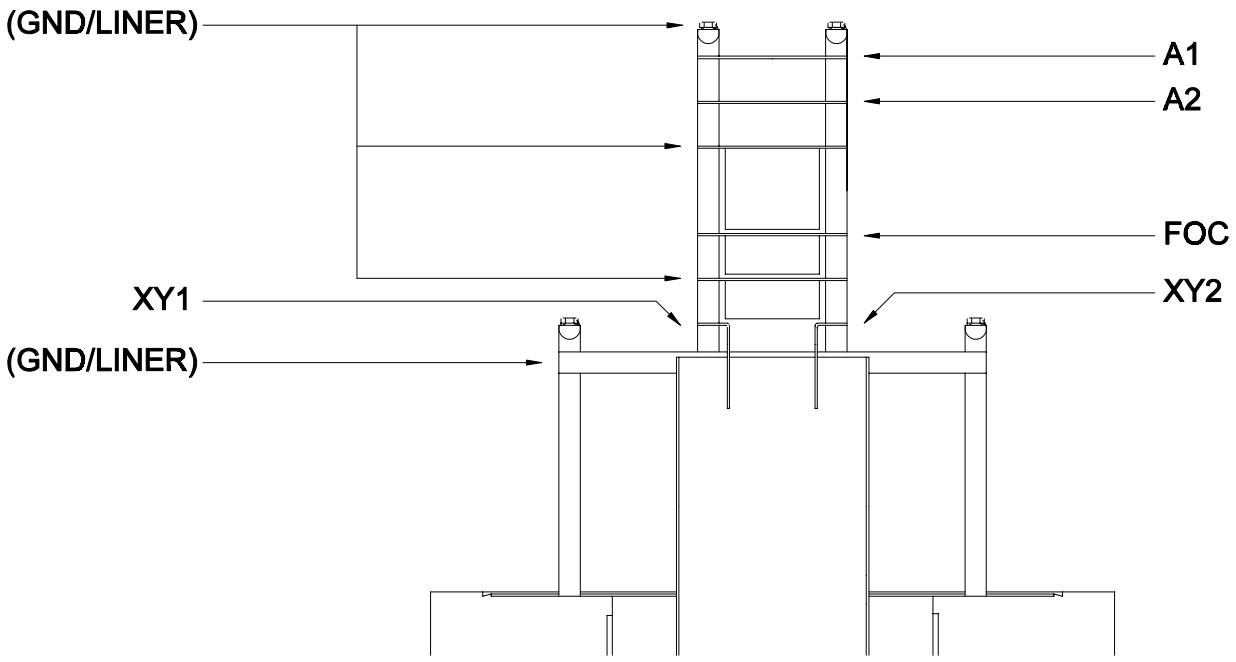
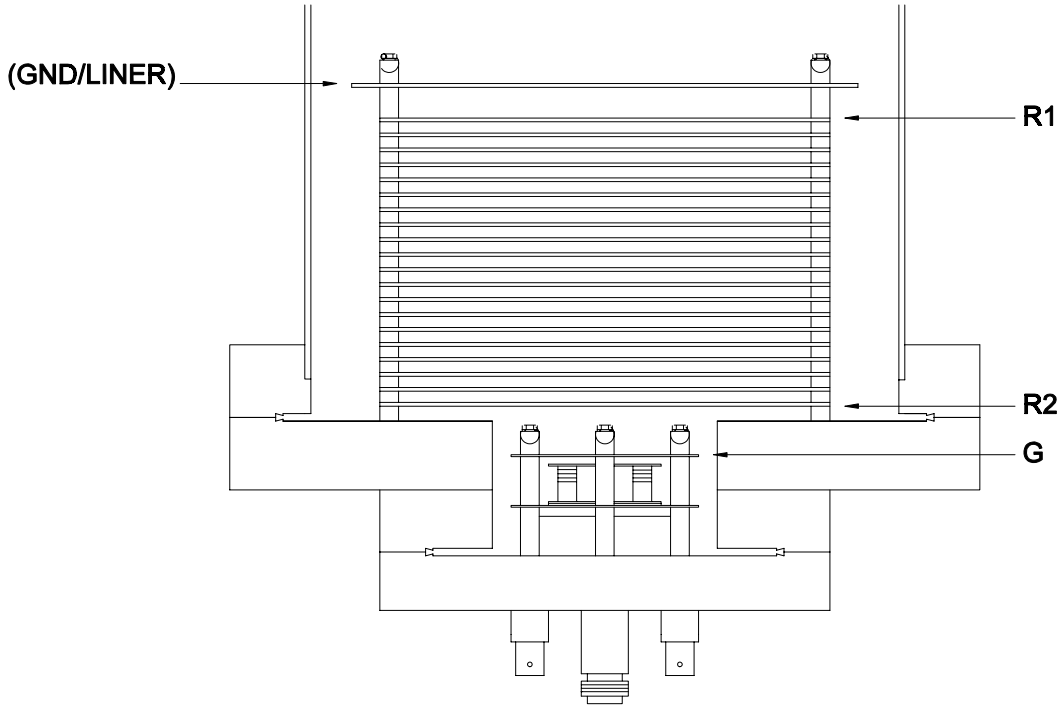


D-850 AREF ASSEMBLY

(INTERNAL CONNECTIONS SHOWN IN BRACKETS (_))



ION SOURCE ASSEMBLY DETAIL



REFLECTOR AND DETECTOR ASSEMBLY DETAIL

1.0 SPECIFICATIONS

1.1 PHYSICAL SPECIFICATIONS

Cabinet size 19.0" W. x 14.5" D. x 5.25" H.

Cabinet weight 20.5 Lbs.

1.2 ELECTRICAL SPECIFICATIONS

See 5.0

1.3 SERVICE REQUIREMENTS

Input Power 100/120/220/240 Volts
1 Phase, 50-60 Hz

2.0 GENERAL DESCRIPTION

The (AREF) Angular Reflectron Power Supply was designed to be a single compact source for the voltages used in a typical angular reflectron spectrometer. Choice of this unit should curtail instrument clutter in the immediate vicinity of the experiment. All voltages are monitored by the same meter. A voltage is only displayed while its monitor button is held down. Each end of every cable is labeled to match the receptacle to which it connects.

It is as simple and comprehensive as we can make it.

3.0 SYSTEM OPERATION

Ions which are created between repeller plate and extraction grid are repelled by the repeller plate (VA1 = +1700 Volts) and drawn through the extraction grid (VA2 = +625 Volts). They are then accelerated thru the ground grid into the flight tube.

During this transit the ions pass thru the Einsel lenses (no power supply is provided) and between the deflection plates (VXY = 0 to +450 Volts). These plates steer the beam on to the repeller and detector grid and compensate for the transverse displacement due to any initial molecular velocity vector. In use, one of the plates (usually XY1) is grounded and VXY is connected to plate XY2. The Einsel lens (FOC.) is at ground during initial start up.

At the end of the flight tube the ions pass thru a grounded grid, thru the retarding grid (VR1 = +750 Volts), then reflected out of the reflector assy. by the reflector grid (VR2 = 1200 Volts).

When each of these Ions arrives at the detector it will impact the first microchannel plate (VD1=-2200 Volts Max.). This impact will deliver approximately 10^4 electrons onto the

face of the second microchannel plate (VD2 = -1200 Volts Max.). Each of these secondary electrons will generate another 10^4 electrons in the second plate. These electrons will exit the bottom of the plate (VD3 = -200 Volts Max.) and accelerate the final 200 volts to the 50 Ohm anode which is at ground potential.

4.0 DESCRIPTION OF FRONT PANEL CONTROLS

4.1 VD (SCREWDRIVER ADJUST)

Adjusts the detector voltage from 0 to -5000 Volts D.C.

4.2 VD PUSH BUTTON

Enables the meter to measure the voltage on VD Output.

4.3 VA1 VOLTAGE ADJUST KNOB

Adjusts the VA1 output from 0 to +4500 Volts D.C.

4.4 VA1 PUSH BUTTON

Enables the meter to measure the voltage on the VA1 output.

4.5 VA2 VOLTAGE ADJUST KNOB

Adjusts the VA2 output from 0 to +4500 Volts D.C.

4.6 VA2 PUSH BUTTON

Enables the meter to measure the voltage on the VA2 output.

4.7 VXY COARSE (SCREWDRIVER ADJUST)

Adjusts the maximum voltage to which the VXY VOLTAGE ADJUST KNOB can be set, from 0 to +4500 Volts D.C.

4.8 VXY VOLTAGE ADJUST KNOB

Adjusts the VXY output from 0 to the VXY COARSE setting.

4.9 VXY PUSH BUTTON

Enables the meter to measure the voltage on the VXY output.

4.10 **VR1 VOLTAGE ADJUST KNOB**

Adjusts the VR1 output from 0 to +4500 Volts D.C.

4.11 **VR1 PUSH BUTTON**

Enables the meter to measure the voltage on the VR1 output.

4.12 **VR2 VOLTAGE ADJUST KNOB**

Adjusts the VR2 output from 0 to +4500 Volts D.C.

4.13 **VR2 PUSH BUTTON**

Enables the meter to measure the voltage on the VR2 output.

5.0 DESCRIPTION OF REAR PANEL OUTPUTS

5.1 **VA1 SHV CONNECTOR**

Adjustable output from 0 to +4500 Volts D.C. for the repeller plate.

5.2 **VA2 SHV CONNECTOR**

Adjustable output from 0 to +4500 Volts D.C. for the extraction grid.

5.3 **VXY SHV CONNECTOR**

Adjustable output from 0 to +4500 Volts D.C. for the XY2 steering plate.

5.4 **VR1 SHV CONNECTOR**

Adjustable output from 0 to +4500 Volts D.C. for the reflector entry grid.

5.5 **VR2 SHV CONNECTOR**

Adjustable output from 0 to +4500 Volts D.C. for the reflector plate.

5.6 **VD SHV CONNECTOR**

Adjustable output from 0 to -5000 Volts for the channel plate detector Voltage Divider Box.

6.0 CIRCUITRY DESCRIPTION

6.1 CONTROL UNIT

The control unit includes four 12 Volt D.C. Power Supplies, six high voltage regulated Power Supplies, and a printed circuit board that contains all the voltage dividers as well as the amplifier for the Digital Volt Meter.

6.2 CIRCUIT DESCRIPTION

See Control Unit Schematic, Drawing No. D0803 REV 4A

6.2.1 +/-12 Volt D.C. Power Supplies

The two +/-12 Volt D.C. Power Supplies are used to power all of the High Voltage Power Supplies as well as the metering circuit on the PC Board.

Line Power (100/120/220/240 Volts, 50 or 60 Hz) is brought in through a fuse, line switch, interlock switch, and a voltage selector switch to the main power transformer T301.

The power indicator light is powered from one of the 120 Volt primaries of T301.

The 28 Volt center tapped secondary of T301 is full wave rectified and supplies +19 Volts to C301 and -19 Volts to C303. The +19 Volts on the C301 supplies REG. 203 and REG. 201 which makes up two +12 Volt, 1.5 Amp regulated power supplies. The -19 Volts on C302 supplies, REG. 202 and REG. 204 which makes up two -12 Volt, 1.5 Amp regulated power supplies.

6.2.2 VD Detector Voltage Power Supply.

VD is adjusted by the front panel screwdriver control R106 which varies the output of PS302 from 0 to -5000 Volts D.C. This voltage goes to the PC Board thru J10 to the rear panel VD Output which is used to power the Voltage Divider Box for the MCP detector. The 100 megohm resistor R3, 97.6K resistor R17 and 5K trimmer resistor R16 make up a voltage divider for the meter circuit. When calibrated one volt to the meter circuit represents 1000 Volts on the VD Output.

6.2.3 VA1 and (VA2) Power Supplies

VA1 (VA2) is adjusted by the Front Panel Control R105 (R104) which varies the output of PS301 (PS305) from 0 to +5000 Volts D.C. This voltage goes to the PC Board thru J8 (J9) to the 10 megohm current limit resistor R8 (R6). This resistor limits the current to VA1 (VA2) to .5 milliamperes. The 100 megohm resistor R7 (R5), 97.6K resistor R19 (21) and 5K trimmer resistor R18 (20) make up a voltage divider for the meter circuit. When

calibrated one volt to the meter circuit represents 1000 Volts on the output. Because the current limit resistor and the meter voltage divider resistors make a voltage divider to the output, VA1 (VA2) only gets to 90% of the voltage from PS301 (PS305), so the VA1 (VA2) output is 0 to+4500 Volts D.C.

6.2.4 **VXY Power Supply**

VXY is adjusted by the Front Panel Control R103 and the COARSE VXY control R107. Depending on the COARSE VXY setting, the VXY knob can vary the output of PS306 from 0 to +4500 Volts D.C. This voltage goes to the PC Board thru J7 to the 10 megohm current limit resistor R11. This resistor limits the current to VXY to .5 milliamperes. The 100 megohm resistor R10, 97.6K resistor R23 and 5K trimmer resistor R22 make up a voltage divider for the meter circuit. When calibrated, one volt to the meter circuit represents 1000 Volts on the output. Because the current limit resistor and the meter voltage divider resistors make a voltage divider to the output, VXY only gets to 90% of the voltage from PS306, so the VXY output is 0 to +4500 Volts D.C.

6.2.5 **VR1 and (VR2) Power Supplies**

VR1 (VR2) is adjusted by the Front Panel Control R102 (R101) which varies the output of PS303 (PS304) from 0 to +5000 Volts D.C. This voltage goes to the PC Board thru J6 (J5) to the 10 megohm current limit resistor R13 (R15). This resistor limits the current to VR1 (VR2) to .5 milliamperes. The 100 megohm resistor R12 (R14), 97.6K resistor R25 (R27) and 5K trimmer resistor R24 (R26) make up a voltage divider for the meter circuit. When calibrated, one volt to the meter circuit represents 1000 Volts on the output. Because the current limit resistor and the meter voltage divider resistors make a voltage divider to the output, VR1 (VR2) only gets to 90% of the voltage from PS303 (PS304), so the VR1 (VR2) output is 0 to +4500 Volts D.C.

NOTE: The reflector has a resistance of 190 megohms between the VR1 and VR2 SHV Feedthroughs. Due to the series resistance in the power supply R13 (R15), there is some interaction between the VR1 and VR2 output voltages. Both VR1 and VR2 should be rechecked after adjustment.

6.2.6 **Metering Circuit**

The Metering Circuit is not enabled until a front panel push button (S101 thru S106) is depressed. When no buttons are depressed the normally closed contacts connect J4-9 to ground. When a push button is depressed it connects the voltage divider selected to R28 and onto the buffer amplifier A1 which has a gain of 1. The output of A1 drives the Digital Volt Meter.

6.2.7 **Digital Volt Meter**

The Digital Volt Meter is the small PC Board that is screwed to the front panel. An input voltage of ± 5.0 volts will read ± 5000 (volts) on the LED display.

See Digital Volt Meter schematic, Drawing No. D0814 REV 1

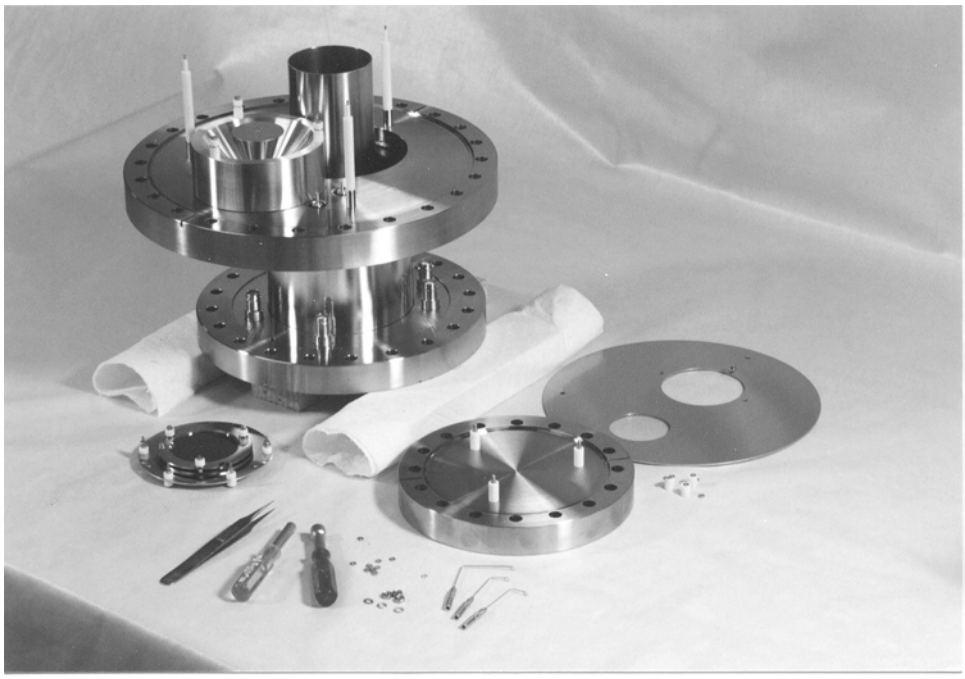
Most of the functions of the Digital Volt Meter are done by the 4½ digit Volt Meter IC A2 (ICL7135CPA). This IC compares an input voltage to a reference voltage of 1 volt and displays the ratio of these two voltages as a percentage on the LED display. When the two voltages are equal the LED display will read 9999. The input voltage from the AREF PC Board (0 to ± 5 volts) is divided by a factor of 10 by R24 and R25. The reference voltage is created by CR2 (6.2 volts) and divided by R18 and R19 down to 1 volt. It should be noted that the reference voltage does not need to be exactly 1 volt and the input divider ratio does not need to be exact. What is important is that they are temperature stable. The trimmer resistors for each output is what makes the Digital Volt Meter read correctly.

When a front panel push button is depressed the gate of Q1 is allowed to float which turns on Q1. When Q1 turns on, this turns off Q8 and Q11 which enables the "-" LED and 4 digit LED display.

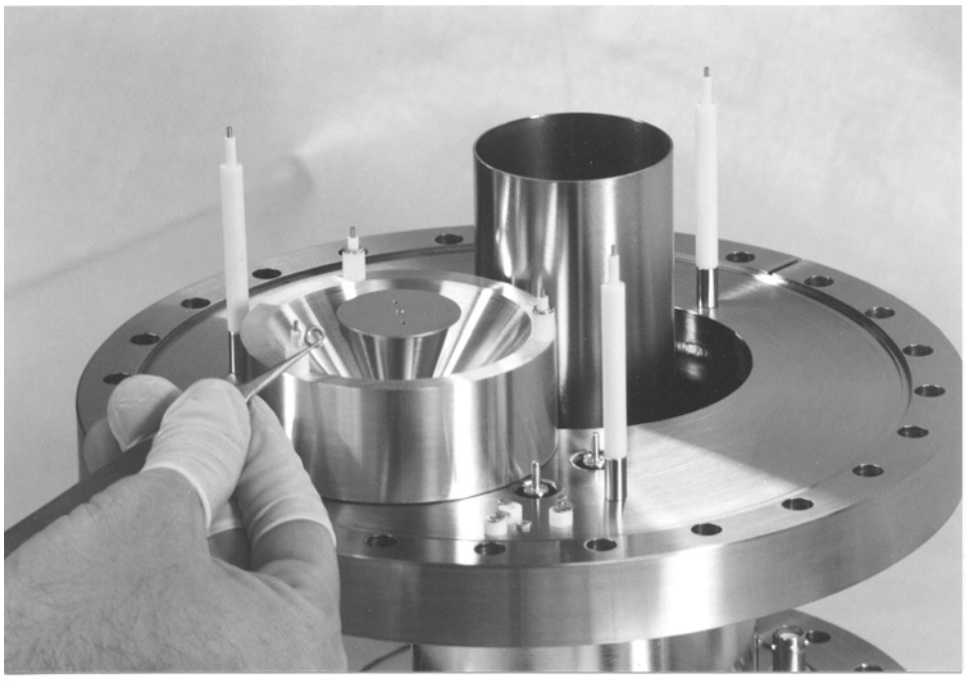
A3, Y1 and Q12 create a 100 KHz TTL square wave which is the timing for A2.

7.0 **INSTALLATION PROCEDURE FOR 40mm CHANNEL PLATE DETECTOR**

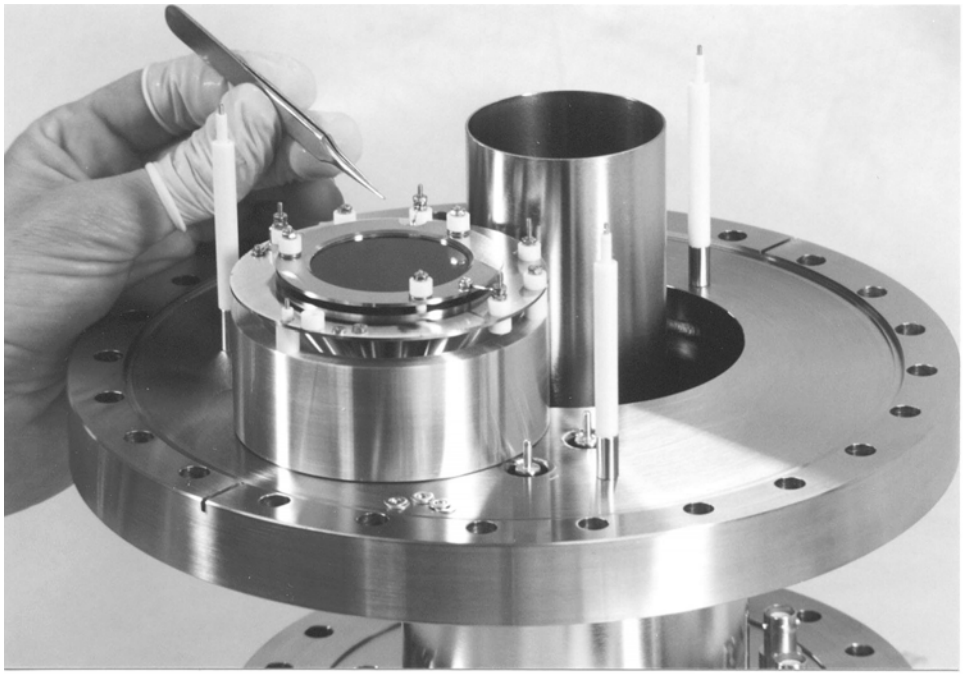
1. On machines **with liners,** remove 0-80 nuts, washers and ceramic insulators. **On machines without liners,** remove the three socket cap screws from the destination plate. Being careful not to damage the mesh, remove the destination plate.



2. Remove the three 0-80 nuts and washers securing the ceramic insulators to the anode shield. Remove insulators and discard the #4 washers.



3. Now the channel plate assembly is ready to be installed. Remove the assembly from the vacuum envelope. Inspect the channel plates for cracks before installing. Now install the assembly where the #4 washers once were. Be sure that the #2 stamped on the assembly is pointed toward the shield tube coming from the ion source. Reinstall the 0-80 nuts and washers.



4. Wire the detector using the lead kit provided. Push appropriate lead onto the feed-thru while guiding it onto the like numbered stud on the assembly. Secure the lead onto the stud with the 0-80 nuts and washers provided. Check to make sure that the numbers on the assembly correspond to the numbers on the feed thrus. (ie: D1 to 1, D2 to 2, D3 to 3.)

5. Now reinstall destination plate.

6. Refer to the manual for 18 mm detector for start up instructions.

8.0 DIVIDER BOX FOR DUAL MCP DETECTOR

8.1 -V IN SHV CONNECTOR

This is the input voltage for the voltage divider that provides the three voltages necessary for the dual MCP detector. The current draw for -5,000 volts is 400μA.

8.2 VD1 SHV CONNECTOR

Output voltage is a fixed 44% of the -V IN (VD) input for the input of the first channel plate.

8.3 VD2 SHV CONNECTOR

Output voltage is a fixed 24% of -V IN (VD) input for the center tap between the two channel plates.

8.4 VD3 SHV CONNECTOR

Output voltage is a fixed 4% of -V IN (VD) input for the output of the second channel plate.

9.0 CONNECTIONS

Before connecting the mains, make certain the Voltage Selector Switch (100/120/220/240) is set properly. If the voltage wheel needs to be changed, a fuse with a value shown in the following table, should be inserted into the fuse holder.

Mains voltage	Fuse valve
100V 50/60 Hz	1.2A slow-blow
120V 50/60 Hz	1A slow-blow
220V 50/60 Hz	½A slow-blow
240V 50/60 Hz	½A slow-blow

Before turning on power:

1. With all cables disconnected turn on power and preset VD (-V IN)to 3,000 volts using the VD (-V IN) trimmer on the front panel. With VD (-V IN) at 3,000 volts, the VD1 Output on the Divider Box will be about -1,300 volts, which represents about 600 volts for each microchannel plate. Set all other power supplies as required. Note: Do not apply voltage to the Channel Plates unless the detector is pumped below 10^{-6} Torr.

2. Turn off power and connect all cables which you intend to use. This will prevent a possible arc occurring when connecting to a live receptacle.

3. Turn on power and increase each voltage to the desired setting. It is best not to approach maximum VD unless you are monitoring the signal output for noise, arcing, etc.

With cables connected, set the voltages given in section 3. These are starting voltages only and should give some indication of spectra on the detector output. While observing the peaks, voltages can be trimmed for optimum sensitivity and resolution. It may be that VXY will give best results when connected to XY1 under some conditions with XY2 grounded and just the opposite will be true under other conditions for the same ion. The reason for this is too complicated to pursue here.

When performance has been otherwise optimized, a power supply can be connected to the Einsel lens (FOC). Some improvement in performance should be observed with either a positive or negative voltage on this element. Typically -100 Volts. A voltage module for this element was not provided in the power supply for lack of space.

10.0 SERVICE PROCEDURES

10.1 SAFETY PRECAUTIONS

This equipment uses voltages up to 5000 Volts D.C. and capacitors which store dangerous amounts of energy. The control unit should be unplugged from the power line before

opening. Although bleeder resistors are provided, all of the outputs should be shorted to ground before touching any electrical components.

If energized testing of internal circuits is required, connections to test points should be made with equipment off. The cover interlock can then be overridden by pulling the plunger.

10.2 TROUBLE SHOOTING

THE FOLLOWING TESTS SHOULD BE MADE WITH ALL OF THE CABLES DISCONNECTED FROM THE REAR PANEL. **BE SURE THAT THE POWER IS OFF BEFORE CONNECTING OR DISCONNECTING A CABLE FROM THE REAR PANEL.**

Note: All of the circuits in the control unit are high impedance circuits that will be changed by a low impedance volt meter. Even a 10 megohm volt meter can change the circuit parameters by as much as a factor of two.

10.2.1 No Power:
Check power source and 1 Amp slow blow fuse (120V) on rear panel.

10.2.2 VA1, VR1 and VD all Read Low or Zero Volts:
Reg 201 or Reg 202 is bad. Connector J202 or J203 has a loose pin.

10.2.3 VA2, VXY and VR2 all Read Low or Zero Volts:
Reg 203 or Reg 204 is bad. Connector J202 or J203 has a loose pin.

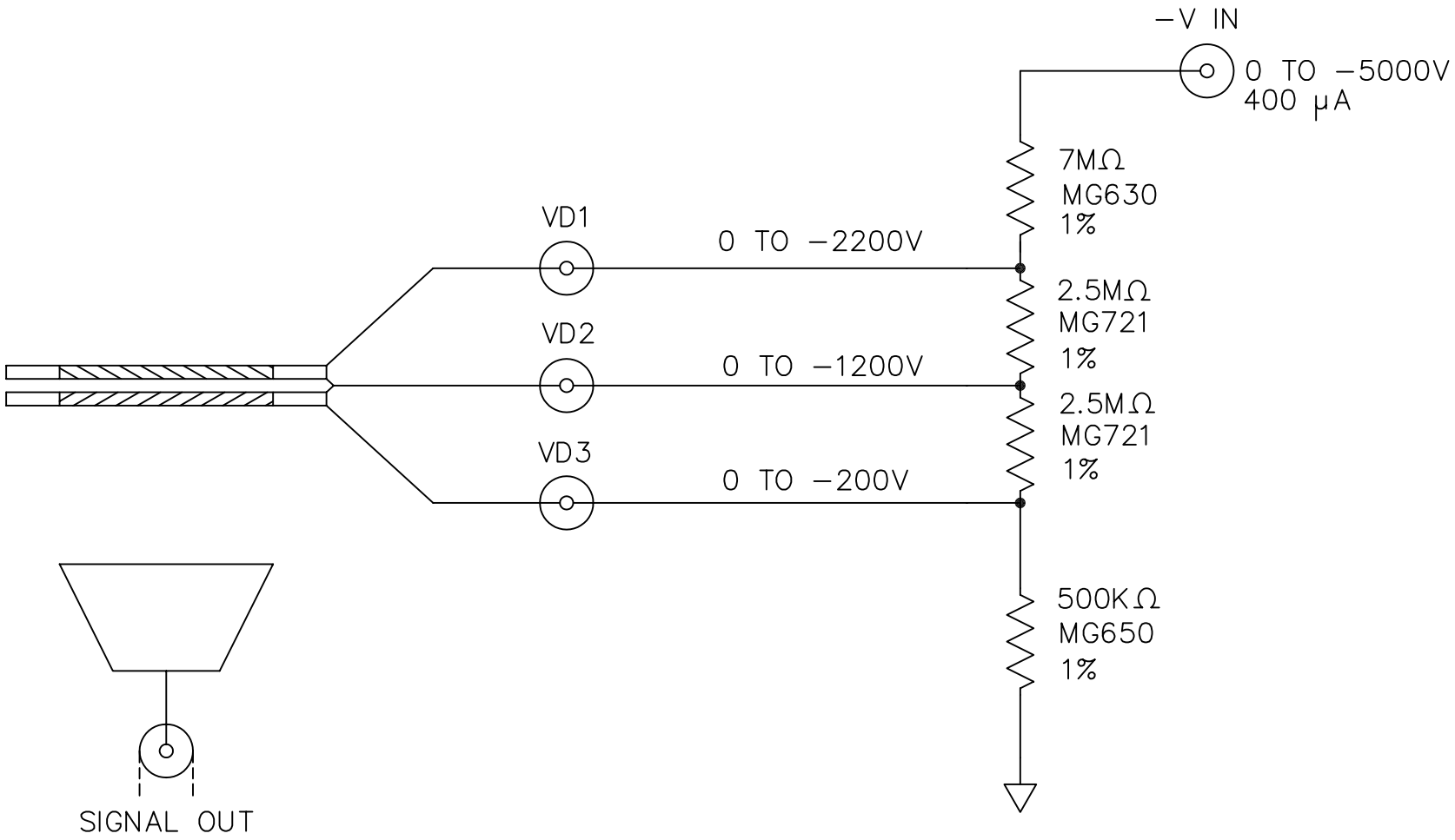
10.2.4 VD Reads Low or Zero Volts:
Reg 201 can be putting out a low voltage. Check Reg 201 for -12.7V output. PS302 is bad. J10 or J105 is disconnected, or J1 is disconnected.

Adjust the VD front panel control all the way counter clockwise. Slowly turn up VD while monitoring the output voltage on the front panel meter. If the voltage stays at zero volts and then suddenly jumps up to a high voltage then R106 is probably bad.

10.2.5 Substitution Testing

All integrated circuits in this equipment are mounted in sockets and can easily be changed. Do not reverse position of IC's or they will be destroyed. IC's have a notch on the end near Pin #1 and/or a dot over Pin #1. The IC sockets have a notch on one end to show the position of Pin #1.

Note: If the outputs act normal with the cables disconnected, it is an indication that the power supply is working properly and that the problem is a shorted cable, bad feed-thru, or bad insulator on the AREF itself.



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