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68806-M

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50-200 WATT He, Hg(Xe), and Hg ARC LAMP POWER SUPPLY MODEL 68806

Please read these instructions completely before operating this equipment. If there are any questions or problems regarding the use of this equipment, please contact: ORIEL INSTRUMENTS - or - the representative from whom this equipment was purchased.

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WARRANTY AND RETURNS

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I. HAZARDS/SAFETY

I.1 POWER SUPPLY

- Connections to or from any electrical device must never be made while the power supply is switched on.
- The Oriel Model 68806 Power Supply has an open circuit voltage of >100 volts when the start switch is pressed, and could be dangerous if care is not exercised when the power supply is switched on. Please follow these precautions when operating the power supply:
- Make all input and output connections before turning the power supply on.
- Do not use the power supply without its cover.
- Ensure that the output terminals are properly connected to the lamp housing or lamp socket before turning on the power supply.
- Don't open the power supply or disconnect the output leads while the power supply is on.
- Follow the lamp or lamp house manufacturer's recommendations and precautions when handling and using lamps.
- Never touch the lamp's quartz envelope with uncovered fingers; definitely not when operating the lamp or immediately after a shutdown. Also, follow this precaution during lamp installation to avoid damage to the lamp.
- Do not start the lamp with the output control set above the current rating for the lamp.

I.2 ARC LAMPS AND LAMP HOUSINGS

Make sure that the leads are properly connected to the arc lamp. ***INCORRECT CONNECTION WILL DESTROY THE LAMP ELECTRODES, AND POSSIBLY CAUSE AN EXPLOSION.***

XENON AND MERCURY XENON ARC LAMPS

Xenon and Mercury Xenon arc lamps only operate with the anode (positive end) up.

When an ORIEL LAMP HOUSING is used with a Xenon lamp, you should connect the cable from the (+ connection) on the lamp housing to the + (red) connection on the rear of the power supply.

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MERCURY ARC LAMPS

Mercury (Hg) lamps only operate with the anode (positive end) down. Unlike Xe and Hg(Xe) arc lamps, which stabilize quickly to the preset current, Mercury lamps require some time to reach their stable operating condition. Several minutes is typical, but the exact time depends on the cooling of the lamp.

- Make sure that the lamp is adequately cooled. A lamp, not properly cooled, will warm up and may lead to an explosion.

- Do not over cool the lamp. Over cooling will prevent the lamp from warming up. The lamp will operate in an unstable manner with a high light ripple, and possibly shortening its useful life.

USE AN APPROPRIATE ORIEL LAMP HOUSING WITH THE ARC LAMPS TO MAINTAIN PROPER COOLING

- During warm up, a Mercury lamp has a lower impedance than NORMAL OPERATION. The voltage during a warm up is lower than the final voltage and if the lamp is run at the rated power, the current is higher than rated current. The 68806 Power Supply controls the current rather than the lamp power. Increasing the current during lamp warm up will speed up the process.

- Make sure to reduce the current as the lamp warms up or the lamp will run at higher than rated power. **THIS WILL CAUSE SHORTER LAMP LIFE OR EXPLOSION.**

- The lamp is a source of constant current. **To prevent overpowering of the lamp as it ages, monitor its current on regular basis.**

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II. SPECIFICATIONS

AC Mains Input:	95–135 VAC @ 8 amperes 135–270 VAC @ 4 amperes 50 or 60 Hertz, 10 ampere inrush
DC Power Output:	300 watts maximum
DC Current Output:	Adjustable from 0.5 – 11 amperes Current limit at 12 amperes
DC Voltage Output:	
Pre-ignition	> 150 volts unloaded
Operating	Load dependent. Total output power should not exceed 240 watts.
Light Output Ripple:	
Resistive Load	< 0.25% R.M.S. 40 Hz to 40 kHz
Arc Lamp Load	Dependent on lamp, and operating conditions. Typically < 0.5% R.M.S.
Pre–Adjust Accuracy:	2%
Power Meter Accuracy:	2%
Line Regulation: 190–235 VAC mains input	0.1% change in output current for a 95–135 VAC mains input or a

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III. INTRODUCTION

III.1 DESCRIPTION

The Oriel model 68806 arc lamp power supply is a highly regulated source of current that maintains constant light output necessary for proper operation of arc lamps. Constant current operation of these sources of radiation is required whenever a radiometric measurement is being made or whenever a highly stable light output is needed.

The 68806 allows arc lamps to operate in constant current mode, with the output voltage being dependent on the lamp's impedance. The power supply will provide a constant current of up to 11 amperes with a load voltage range of 0 to 100 volts. A power limit, which limits the product of output voltage and current to 300 watts, protects the unit from output overloads. A constant current power supply regulates current even into a short circuit. Lamp current is limited to a maximum of 12 amperes. The reduced inrush current minimizes electrode erosion when starting the arc lamp. The Oriel model 68806 Arc Lamp Power Supply includes all of the circuitry to **start and power the lamps**, and **meter the output parameters.**

The following Oriel arc lamps may be operated with the model 68806 Arc Lamp Supply:

MODEL NO.	DESCRIPTION	DC VOLTAGE (V)	DC CURRENT (A)
6251	75 Watt Xe	14	5.4
6263	75 Watt Xe (Ozone free)	14	5.4
6254	150 Watt Xe UV (Ozone free)	20	7.5
6255	150 Watt Xe (Ozone free)	20	7.5
6356	150 Watt Xe	20	7.5
6282	50 Watt Hg	22	2.3
6281	100 Watt Hg	20	5
6283	200 Watt Hg	47-65	3.1-4.2
6291	200 Watt HgXe	20-25	8-9.5
6292	200 Watt HgXe (Ozone free)	20-25	8-9.5

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II.2 68806 FEATURES

Please refer to Figure 1 for the described equipment features.

- Controlled source of current to a wide variety of lamps.
- Built-in high voltage ignitor to start the arc lamp.
- A **preset switch** allows for setting the **output current** to the recommended operating value before lamp start.
- Contains circuitry to allow viewing the **output current**, the **output voltage**, and the **output power**.
- An **interlock** function that prevents the power supply from operating unless it is closed. Typical uses for the interlock on ORIEL equipment are:

  1. Microswitches to prevent access to the lamp area (electrical, optical, and other hazards).

  2. Thermal cutoffs to disable the power supply if the lamp housing overheats.

ORIEL lamp housings use this interlock for operator safety and to disable the power supply if the lamp housing overheats.

- Adjustable 0.5 to 11 A current output.
- Voltage compliance from 0 to 100 V.
- 300 Watt power limit for operating all arc lamps that are rated for DC operation in this voltage, current, and power range.

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IV. CONTROLS AND CONNECTIONS

This section will describe the various controls, the available connections, and their function. Please become familiar with their uses before operating the power supply with any lamps. This will reduce the possibility of damaging the power supply or the lamps through improper operation.

IV.1 FRONT PANEL

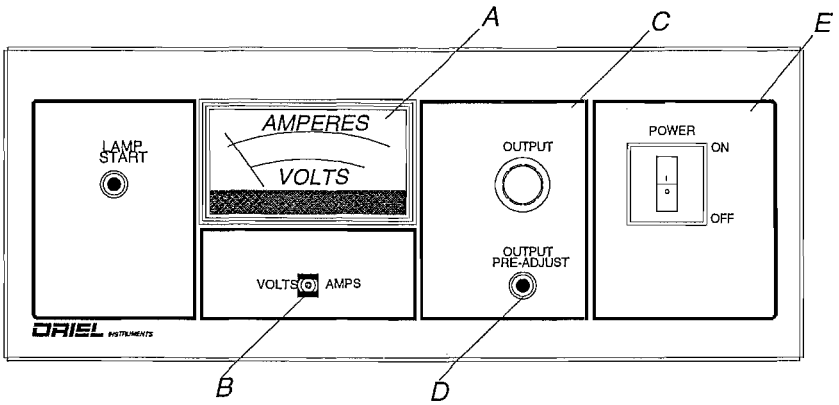


Figure 1 68806 Front Panel Layout

METER AND VOLTAGE, WATTS, AND AMPS SWITCH

The **analog meter**, (A in Figure 1), is scaled to display the output **voltage**, **current**, and **wattage**. *Keep in mind that the meter monitors the output voltage of the supply not the load, and that the output power is always displayed by the meter. The one exception is when the preadjust switch is pressed and operating current is displayed.* The **select switch**, (B in Figure 1), enables you to momentarily view the output **voltage** or **current** by pressing it left or right, respectively.

OUTPUT AND CURRENT PREADJUST SWITCH

A ten turn **potentiometer**, (C in Figure 1), is used to provide a precise means of output current adjustment. A shaft lock is mounted with this knob to lock in a setting if a readjustment from a previous current setting is not desired. When the **preadjust switch** (D, Figure 1) is pressed, the meter will display the value of the output current that will be delivered to the lamp after lamp start.

POWER SWITCH

This is the AC mains power switch (E in Figure 1). In the "ON" position AC power will be switched into the main circuitry of the power supply, and an integral indicator lamp will glow to indicate that the power supply is on. The power switch is also a circuit breaker which will open both of the AC lines to the internal circuitry in case of a fault within the unit.

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IV.2 REAR PANEL

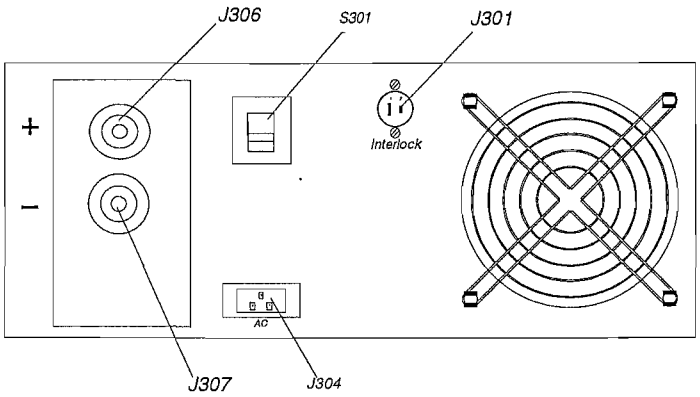


Figure 2 68806 Rear Panel Layout

AC MAINS INPUT (J304, Figure 2)

J304 is an IEC style socket which will accept power cords for worldwide use of the power supply. The AC mains cord is connected here.

LINE VOLTAGE SELECTOR (S301, Figure 2)

S301 sets the input voltage range for a nominal 115 VAC or 230 VAC. It is factory preset for your area, but should be checked before using the power supply.

INTERLOCK SOCKET (J301, Figure 2)

This connection must be made, otherwise the main power supply will not turn on. ORIEL normally ships a shorting plug which mates to this socket. The shorting plug must be replaced with the connector that is supplied with the lamp housing in order to take advantage of its protection feature. Lamp housings available through ORIEL use this connection as a safety arc lamp shut-off in case the access doors are opened when the lamp is operating or in case of an excessive temperature rise within the lamp housing. If you are not using an ORIEL lamp housing, for personal safety you should consider including an interlock circuit in your equipment.

DC OUTPUT CONNECTIONS (J306 and J307, Figure 2)

These two UHF screw on connectors are the connections for the main DC output to the load. J306 is the positive, and J307 is the negative. The low voltage side of an external ignitor or a lamp housing with built-in ignitor is connected to these two outputs. Both are earth ground isolated. **Never make any electrical connections to these sockets with the power supply on.**

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V. OPERATING THE POWER SUPPLY

IV.1 SETUP AND USE

The Oriel Model 68806 Arc Lamp Power Supply was designed for use with a wide variety of arc lamp light sources. Please follow the above precautions, and the following procedures to use the power supply safely.

OPEN CIRCUIT SETUP

Make all connections to the ignitor and to the housing. If an interlock cable is available, then connect this to the power supply interlock socket. Otherwise, use the jumper plug that was shipped with the power supply. The interlock operates by interrupting a 24 VAC source to an internal relay. Therefore, this must be a jumper or contact closure and not a ground connection.

CAUTION

YOU MAY USE THE JUMPER PLUG IF NO INTERLOCK CABLE EXISTS, HOWEVER, THERE WILL NOT BE ANY INTERLOCK OR TEMPERATURE PROTECTION.

Install the arc lamp according to the directions in the housing manual. Pay strict attention to the electrical, and the physical orientation of the lamp.

If the lamp operating current is unknown, then determine the current setting by using **Ohm's Law:**

amperes = power ÷ volts.

Check that the line voltage selector is in the proper position for operation in your area. Connect the line cord to the IEC socket, and plug the unit into an AC outlet.

Ensure that the "OUTPUT" control knob is set to the full counterclockwise position. Turn on the power supply. Place the meter select switch to "VOLTS" and observe that the output is ≈ 100 volts DC. Release the meter switch.

Press the "PREADJUST" switch. Read the meter display on the ampere scale. This is the operating output current which will be delivered to the arc lamp. Turn the "OUTPUT" knob to set the desired operating current. This step is necessary only when initially setting up the power supply or whenever a new lamp with a different current rating is going to be used.

CAUTION

IF THE PREVIOUS STEPS ARE NOT FOLLOWED DAMAGE TO THE LAMP COULD OCCUR BECAUSE OF THE POSSIBLE HIGHER OPERATING CURRENT SETTING OF THE "OUTPUT" CONTROL KNOB.

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Press the "START" switch on the power supply front panel. The output voltage should measure off-scale on the meter, and the ignitor should fire a high voltage pulse to begin the lamp start. Power will now be delivered to the lamp, and the meter will display this value. To view the output voltage or current simply place the momentary contact, and the meter select switch to the respective position, and monitor the appropriate scale.

V.2 IGNITION

Arc lamps are filled with inert gas so the gap between electrodes is normally non-conducting. Starting a lamp means making this gap conduct; to do this we apply fast, high voltage (up to 35 kV) pulses between the electrodes. These pulses cause ionization of the gas between the electrodes.

Short high voltage electrical pulses have other effects; you can get a shock or tingle if you are in contact with the electrodes or power supply output. Such pulses find unusual ways of escaping from the path you intend for them. They "leak" out of cables due to capacitive coupling and will "track to ground" across any dirty surface.

Loss or weakening of the ignition pulses will cause difficulty in starting the lamp (see also the Troubleshooting Section of this manual). If you are having such difficulty then:

- Check that the connections are tight
- Re-route power supply cable away from any conductive surfaces such as instrument housing or optical table tops.

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VI. CIRCUIT DESCRIPTION

VI.1 GENERAL

Please refer to schematic number 68806–3–1001 when reading this section. The schematic gives a block diagram view of the major components of the power supply. The 68806 was designed in a modular way for reliability and for maintenance, and the schematic reflects this component approach to the power supply design.

The input mains is applied via J304, through the circuit breaker/power switch, and the line voltage selector to T1. T1 steps down the input to a low voltage AC (24 volts nominal) which is then connected to the coil of K1. The AC connection is not complete unless the interlock is made by a jumper or a contact closure.

A complete connection at J301 will energize K1 and allow mains power to be applied to the main power supply module (27–20–007). The power supply module will then begin to operate and convert the AC mains voltage to a line isolated DC current. The power supply module is a state–of–the–art, current mode, switching power supply which operates at 40kHz.

The meter board (68806–1210) continuously monitors the output of the power supply via J1. It also provides the required voltage levels for the meter, and for the remote inputs and outputs via J2 and J302.

DC power is then delivered to the load through the rear panel mounted connectors, J306 (positive/+) and J307 (negative/-). Either of these connections may be ground referenced, if needed, because these are line isolated outputs.

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VII. CALIBRATION AND TROUBLESHOOTING

WARNING

THE POWER MODULE (27-20-007) OF THE MODEL 68806 POWER SUPPLY HAS NO FIELD SERVICEABLE PARTS. DO NOT ATTEMPT TO REPAIR THE MODULE IN THE FIELD. IF A FAILURE OF THE MODULE OCCURS, THEN CONTACT YOUR LOCAL REPRESENTATIVE FOR SERVICE.

ONLY QUALIFIED SERVICE PERSONNEL SHOULD ATTEMPT REPAIR OR CALIBRATION OF THE POWER SUPPLY. THEY MUST EXERCISE EXTREME CAUTION WHEN WORKING IN THE UNIT WITH POWER ON. DANGEROUS VOLTAGE LEVELS EXIST WITHIN THE UNIT WHICH COULD HARM IF PROPER, ELECTRONIC TROUBLESHOOTING TECHNIQUES ARE NOT ADHERED TO.

VII.1 CALIBRATION

The required equipment to calibrate the power the power supply, is an external 300 watt load resistor of less than 3Ω, and external voltage and current meters.

With the unit off, remove the top cover, and connect the ammeter in series with the load resistor. Connect the voltmeter across the positive and negative output posts at the rear panel. Turn the "ADJUST" knob full counterclockwise.

Switch the power supply on and adjust the output via the front panel control so that the output current, as viewed on the external ammeter, is an even value. Hold the meter select switch in the "AMPS" position and trim R6 so that the front panel meter display agrees with the external ammeter.

Without changing the control knob setting press the "PREADJUST" switch. Trim R16 so that the front panel meter displays the output current setting. There will be a slight decrease in the output current when this switch is pressed. Adjust R16 to the output current value that was measured with the external ammeter prior to pressing this switch.

Hold the meter select switch in the "VOLTS" position and, rotate the front panel control knob so that the output voltage is an even value. Trim R13 so that the front panel meter agrees with the external voltmeter.

Release the meter select switch and adjust the output with the front panel control until the product of the external meters is an even value. Trim R12 so that the front panel meter agrees with this value. Calibration is now complete. Switch the power supply off, and replace the cover.

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VII.2 TROUBLESHOOTING

The possibility of a fault occurring during its operational life is likely with any electronic equipment. We have strived to make this the most reliable power supply available. A competent service person should perform any maintenance if a problem does occur. It is strongly recommended that field repair be limited to the repair or replacement of all components which are readily available. *No attempt should be made to repair the power supply module to the component level.* Simply replace and return the defective module to Oriel.

A flow chart of a suggested approach to troubleshooting is on the next page. Please use it as a guide for resolving any problems. This is general in nature and should be used as a starting point. Do not forget the analysis of obvious problems such as; loose or broken wires, blown fuses or circuit breakers and unconnected external cables.

VII.3 SPECIFIC DESCRIPTIONS

POWER MODULE (27–20–007)

This module is not meant to be field serviceable, therefore only a general theory of operation is provided. The module is easily replaced in the field, and should be treated as a replaceable component. Please contact your representative if any problems arise.

This module is an off–line two transistor forward converter operating at a frequency of 40kHz. The switching stage operates in current mode for increased reliability and for improved line voltage regulation. The input stage is connected directly to the AC mains, and line voltage selection is done by S301. This is then rectified and filtered to provide the bulk, unregulated DC voltage for the switching stage. An on board, low current transformer steps down, and line isolates the control circuit's power source. An advanced secondary side filter network, and feedback loop serve to maintain a constant DC output current with excellent regulation and control.

METER BOARD (68806–1210)

Please refer to schematic number 68806–3–1211 for this circuitry.

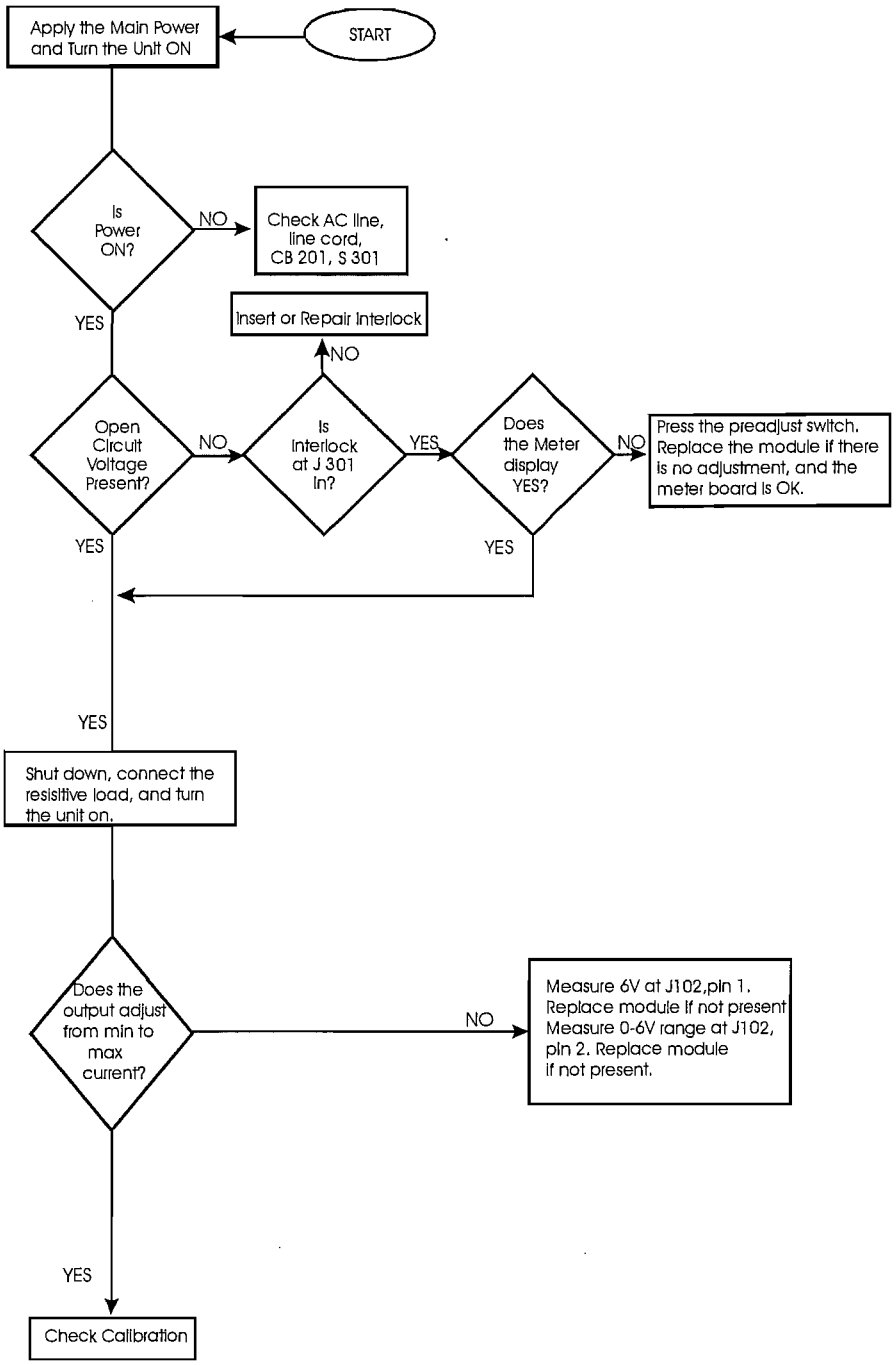
J1 pins 7 and 9 provide the AC for this circuit. This is rectified and filtered by CR1, C1 and C3. The raw DC is applied to VR1 and VR2 which then supply the regulated +/- 15 volts for the supervisory circuits.

The output current signal enters the board via J1 pin 6 where it is then amplified by a two stage operational amplifier (U1). The nominal voltage gain is 85. The output of the second stage is present at one of the inputs to U2, and is also scaled by R5 and R6 to provide the current for the meter.

The output voltage signal enters the board via J1 pin 10. A resistive voltage divider consisting of R8 and R11 scale this to a 0–10 volt level which is then present at the other input to U2. Scaling for the meter is done by the R9, R13 combination.

The power reading is derived by analog multiplier U2. This integrated circuit multiplies the proportional input representation of output current and voltage at pins 1 and 3. The output from U2 at pin 7 is then scaled for the meter to display power.

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Troubleshooting Flow Chart

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The reference voltage from the power module enters the meter board at J1 pin 1. It is then connected to the front panel mounted adjustment potentiometer, R201, whose wiper is connected to J3 pin 2. This variable voltage exits the meter board via J1 pin 2, and is then reconnected to the power module. As the wiper voltage changes from 0–5 volts, the output of the module changes.

J4 serves as the interface to the meter, the meter select switch, and the preadjust switch. See schematic number 68806–3–1001.

J2 serves as the interface to the rear panel mounted remote socket to provide the signal levels, or accept the external signal level for remote monitoring and control of the power supply. The nomenclature for the pins is given in Section III-5.

The four, top mounted trimmer potentiometers are used only to calibrate the meter. They have no interaction with the power module. Their function is as follows:

R6	Current display trimmer
R12	Power display trimmer
R13	Voltage display trimmer
R16	Preadjust display trimmer

See schematic number 68806-3-1211 for their location.

IGNITOR DRIVE (68810-3-1601)

Please refer to schematic number 68810-3-1601 for this circuitry.

IGNITOR DRIVE AND OUTPUT MONITOR CIRCUIT

The ignitor drive PCB contains circuitry to generate the 25kHz square wave required by the ignitor. It is a self oscillating inverter which starts when relay K401 energizes at an open circuit voltage of 95 volts or more. Relay contact K401-1 is closed and the start switch is pressed to apply 24 VAC to rectifier CR401. The filtered output is used by R402 to slightly bias Q401 into conduction.

Q401 goes into conduction more and more until T401 saturates. At saturation, Q401's collector current increases at the limit set by the beta of the transistor and input voltage. This limits collector current to one ampere. Since di/dt is removed from T401, Q401 shuts off due to lack of base drive. The flyback voltage is of the correct polarity to bias Q402 into conduction, and the action repeats but of opposite polarity. The result will be a two to one unregulated step up on T401's secondary. This is nominally a 100V P-P square wave @ 30kHz. This square wave is connected to the ignitor via J305 on the rear panel.

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VIII. DRAWINGS

The following drawing/schematics are included with this manual. Parts lists are provided upon request.

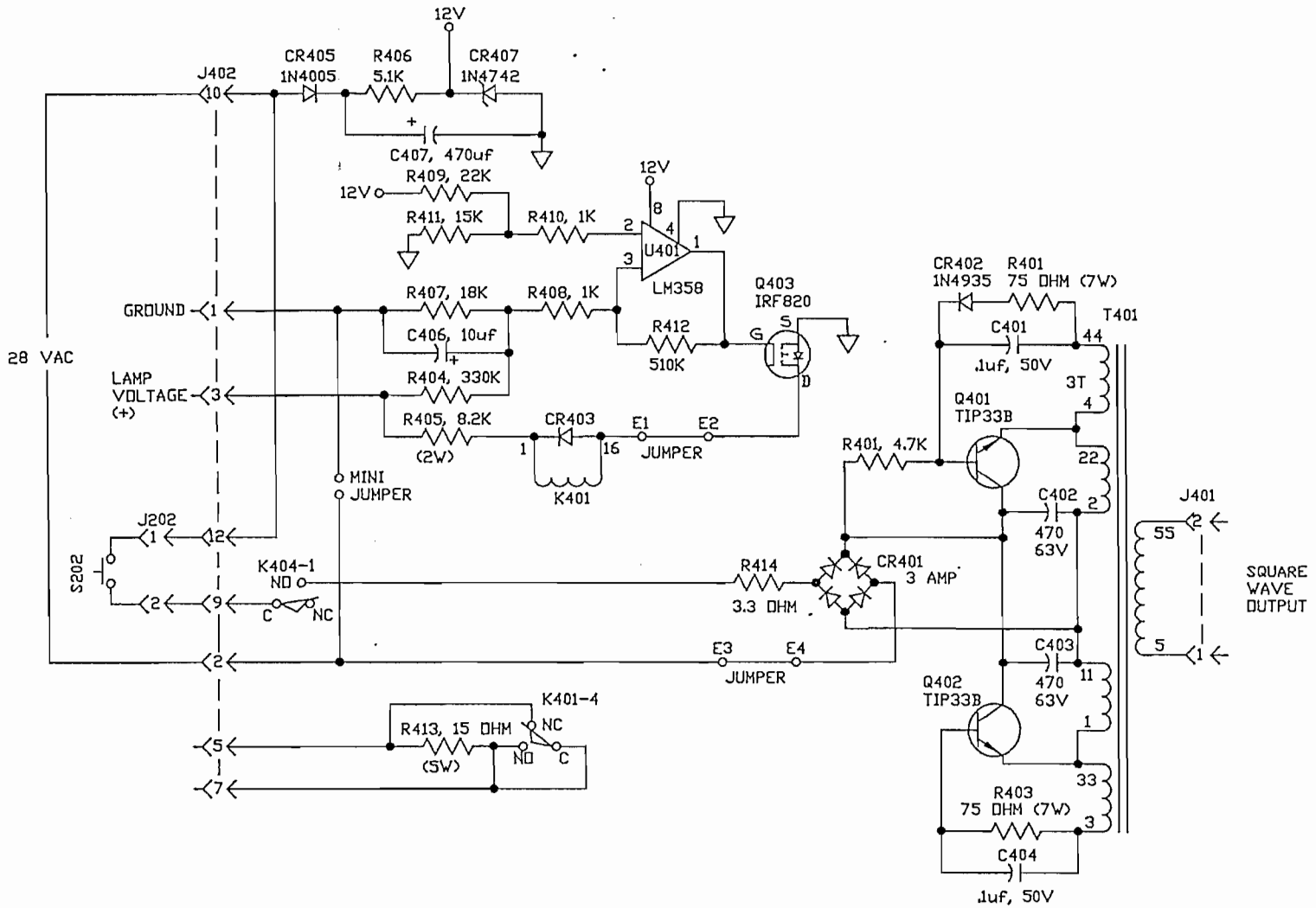
68806–3-1001 System Interconnect Diagram

68806–3–1211 Meter Board Schematic

68810-3-1601 Ignitor Drive Schematic

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REV	DESCRIPTION	DATE	BY



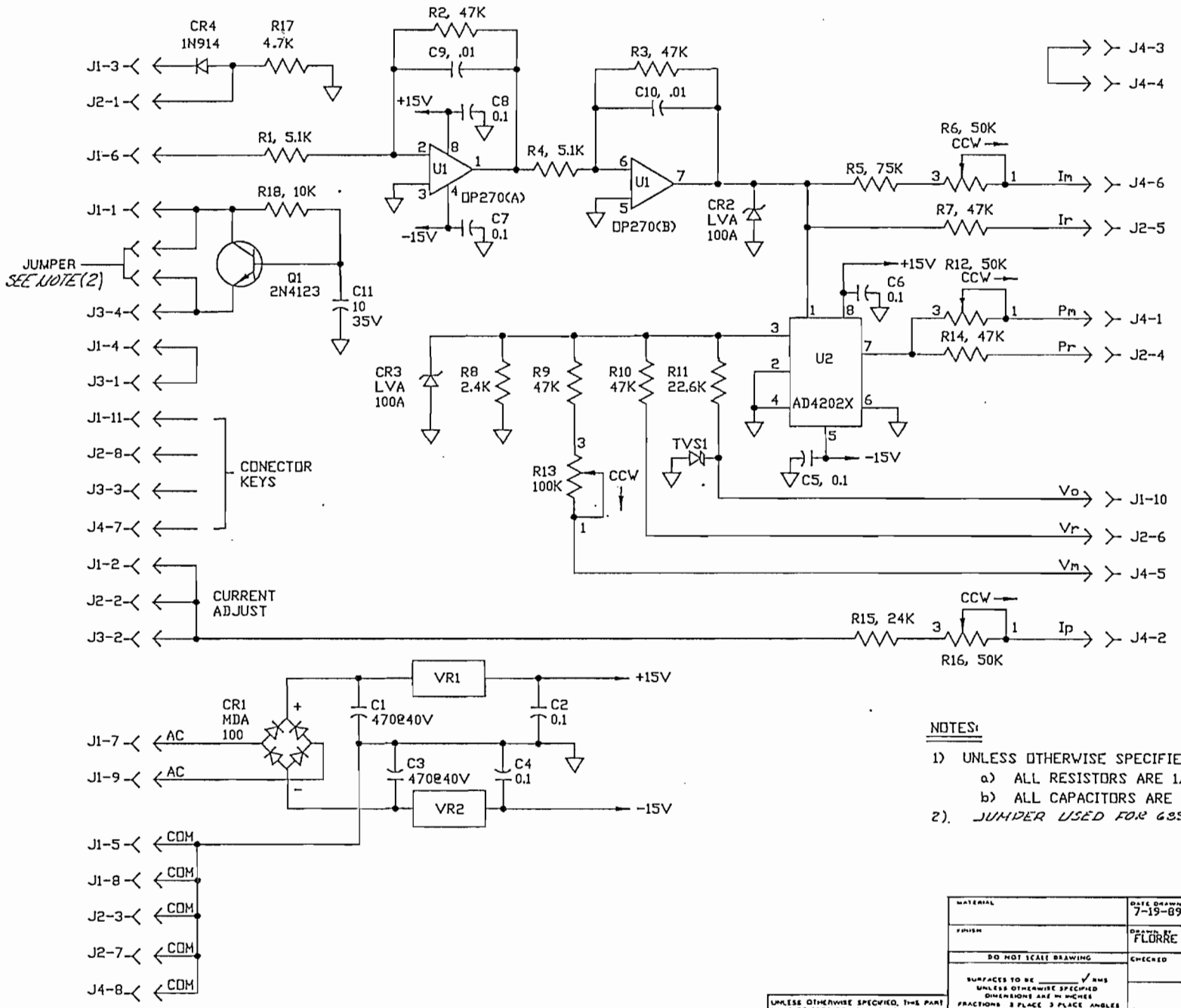
USED ON MODEL 68805 AND 68810

MATERIAL	DATE DRAWN 6-30-89	ORIEL CORPORATION STRATFORD, CONNECTICUT
FINISH	DRAWN BY FLORRE	
DO NOT SCALE DRAWING	CHECKED	TITLE: SCHEMATIC, IGNITOR DRIVE
SURFACES TO BE ____ ✓ RMS UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS 2 PLACE 3 PLACE ANGLES ± ____ ± ____ ± ____ SHARP CORNERS TO BE .003 MAX RADIUS		DRAWING NO

UNLESS OTHERWISE SPECIFIED THIS PART MUST BE FREE OF HEAVY MACHINING AND EXTRUSION MARKS, GOUGES NICKS AND DENTS BREAK ALL SHARP CORNERS AND RE-MOVE ALL BURRS PARTS MUST BE CLEANED

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REV	DESCRIPTION	DATE	BY
B	ERR 11497 ADDED C11, Q1, R18, R19, & CR4 R17 WAS 10K, 1/2 WATT, 5%.	7-10-89	RF
C	ERR 12102 DELETED R19, ADDED J5, R9 WAS 75K, R13 WAS 50K.	6-12-90	RF



NOTES:

1) UNLESS OTHERWISE SPECIFIED:
   a) ALL RESISTORS ARE 1/4W, 5%
   b) ALL CAPACITORS ARE IN uF.
2) JUMPER USED FOR 68805, 68806 ONLY

UNLESS OTHERWISE SPECIFIED, THIS PART MUST BE FREE OF HEAVY MACHINING AND EXTRUSION MARKS, GOUGES NICKS AND DENTS BREAK ALL SHARP CORNERS AND REMOVE ALL BURRS PARTS MUST BE CLEANED FREE OF CHIPS, OIL, GREASE, DIRT, ETC.

MATERIAL	DATE DRAWN 7-19-89
FINISH	DRAWN BY FLORRE
DO NOT SCALE DRAWING	CHECKED
SURFACES TO BE ✓ RMS UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS 2 PLACE 3 PLACE ANGLES	
SHARP CORNERS TO BE .005 MAX RADIUS CHAMFERS NOT DIMENSIONED TO BE .025 X 45°	SCALE

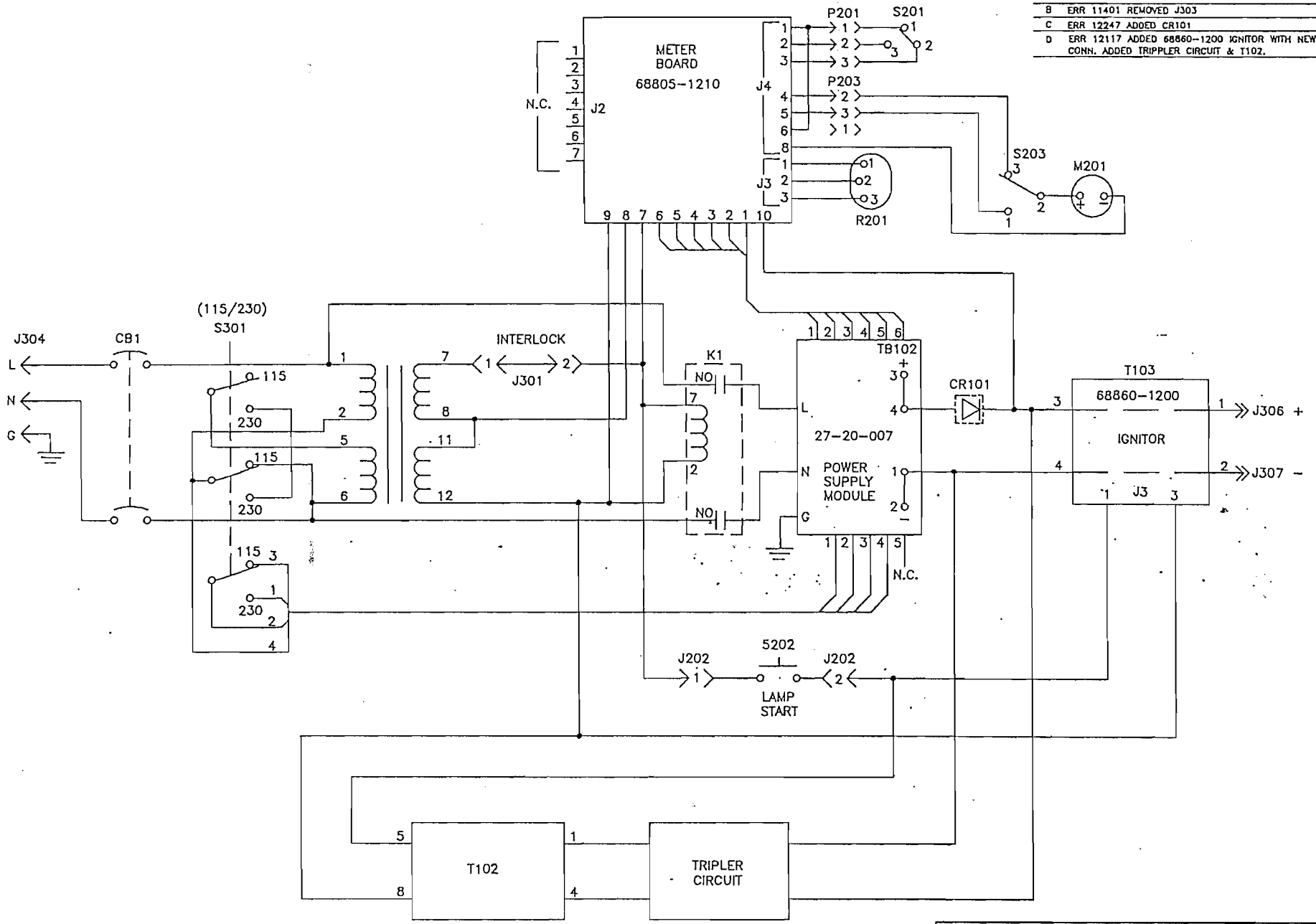
ORIEL
CORPORATION
STRATFORD, CONNECTICUT

TITLE: SCHEMATIC, METER P.W.B. UNIVERSAL POWER SUPPLY

DRAWING NO 68805-3-1211

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REV	DESCRIPTION	DATE	BY
A	ERN 1488 PRODUCTION RELEASE	2-10-89	F
B	ERR 11401 REMOVED J303	3-13-89	L.W.
C	ERR 12247 ADDED CR101	11-6-90	R.F.
D	ERR 12117 ADDED 68860-1200 IGNITOR WITH NEW CONN. ADDED TRIPPLER CIRCUIT & T102.	7-92	L.W.



MATERIAL		DATE DRAWN	7-14-88
FINISH		DRAWN BY	A.W.WHEELER
DO NOT SCALE DRAWING		CHECKED	

UNLESS OTHERWISE SPECIFIED, THE PART MUST BE FREE OF HEAVY MACHINING AND EXTRUSION MARKS, GOUGES, NICKS AND DENTS. BREAK ALL SHARP CORNERS AND RE- ALL BUR JUST BE C

SURFACES TO BE ✓ RMS
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
FRACTIONS 2 PLACE 3 PLACE ANGLES

ORIEL CORPORATION
STRATFORD, CONNECTICUT

TITLE
SYSTEM SCHEMATIC/ WIRING DIAGRAM
BASIC POWER SUPPLY

DRAWING NO 1806-

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WARRANTY AND RETURNS

WARRANTY

Oriel Instruments warrants that all goods described in this manual (except consumables such as lamps, bulbs, filters, ellipses, etc.) shall be free from defects in material and workmanship. Such defects must become apparent within the following period:

1. All products described here, except spare and repaired parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to buyer.

2. Spare parts: ninety (90) days after delivery of goods to buyer.

3. Repaired items: ninety (90) days after delivery of goods to buyer.

Oriel Instruments' liability under this warranty is limited to the adjustment, repair and/or replacement of the defective part(s). During the above listed warranty period, Oriel Instruments shall provide all materials to accomplish the repaired adjustment, repair or replacement. Oriel Instruments shall provide the labor required during the above listed warranty period to adjust, repair and/or replace the defective goods at no cost to the buyer ONLY IF the defective goods are returned, freight prepaid, to an Oriel Instruments designated facility.

Oriel Instruments shall be relieved of all obligations and liability under this warranty if:

1. The user operates the device with any accessory, equipment or part not specifically approved or manufactured or specified by Oriel Instruments unless buyer furnishes reasonable evidence that such installations were not a cause of the defect.

2. The goods are not operated or maintained in accordance with Oriel's instructions and specifications.

3. The goods have been repaired, altered or modified by other than Oriel authorized personnel.

4. Buyer does not return the defective goods, freight prepaid, to an Oriel repair facility within the applicable warranty period.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY SHALL REPLACE ALL WARRANTIES OF FITNESS AND MERCHANTABILITY. BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTIES, CONDITIONS OR LIABILITIES, EXPRESSED OR IMPLIED, ARISING BY LAW OR OTHERWISE, WHETHER OR NOT OCCASIONED BY ORIEL'S NEGLIGENCE.

This warranty shall not be extended, altered or varied except by a written document signed by both parties. If any portion of this agreement is invalidated, the remainder of the agreement shall remain in full force and effect.

CONSEQUENTIAL DAMAGES -

Oriel Instruments shall not be responsible for consequential damages resulting from misfunctions or malfunctions of the goods described in this manual. Oriel's total responsibility is limited to repairing or replacing the misfunctioning or malfunctioning goods under the terms and conditions of the above described warranty.

INSURANCE -

Persons receiving goods for demonstrations, demo loan, temporary use or in any manner in which title is not transferred from Oriel, shall assume full responsibility for any and all damage to the goods while they are in their care, custody and control. If damage occurs which is unrelated to the proper and warranted use and performance of the goods, then the recipient of the goods accepts full responsibility for restoring the goods to their condition upon original delivery, and for assuming all costs and charges.

RETURNS

Before returning equipment to Oriel for repair, please call the Customer Service Department at (203) 377-8282. Have your purchase order number available before calling Oriel. The Customer Service Representative will give you a Return Material Authorization number (RMA). Having an RMA will shorten the time required for the repair, because it ensures that your equipment will be properly processed. Write the RMA on the returned equipment's box. Equipment returned without a RMA may be rejected by the Oriel Receiving Department. Equipment returned under warranty will be returned with no charge for the repair or shipping. Oriel will notify you of the cost of repairs not covered by warranty before starting out of warranty repairs.

Please return equipment in the original (or equivalent) packaging. You will be responsible for damage incurred from inadequate packaging, if the original packaging is not used.

Include the cables, connector caps and antistatic materials sent and/or used with the equipment, so that Oriel can verify correct operation of these accessories.

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