

INIVENTM

INSTRUCTION MANUAL

IP-98 AND IP-98-1U POWER SUPPLIES

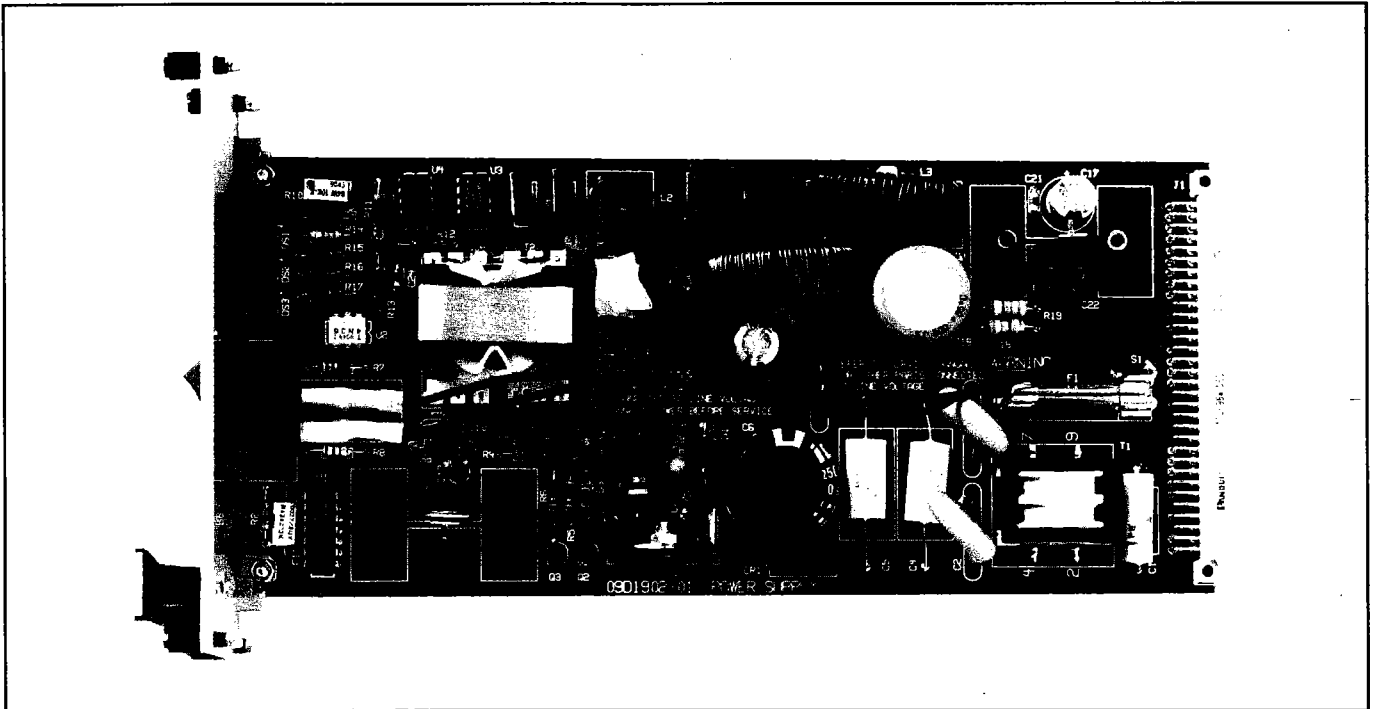


Fig. 1. IP-98 POWER SUPPLY

DESCRIPTION: The IP-98 and IP-98-1U are a series of Regulated Switching Power Supplies for use within the "3U" and "1U" EURO style chassis. The IP-98 is available in a wide range of input voltages; 115 Vac, 125 Vdc, 48 Vdc, 24 Vdc, and 12 Vdc each providing regulated +5 V, +15 V & -15 Vdc outputs. The IP-98-115Vac, IP-98-125Vdc, IP-98-48Vdc, and IP-98-24Vdc pro-

vide 55 Watts of power standard, while the IP-98-12Vdc and all IP-98-1U versions used in the 1U chassis deliver 20 Watts of power. All supplies except the 12 Vdc units have 5000 Vdc isolation from input to output and meet both SWC Standards ANSI/IEEE C37.90.1978 & C37.90a-1974.

FEATURES:

- Wide Range of Input Voltages.
- 5000 Vdc Isolation on 24, 48, 125 Vdc & 115 Vac.
- Cost Saving Design While Maintaining Reliability and Quality.
- Life Time Warranty.

SPECIFICATIONS:

Input Voltages:

115 Vac 86 Vac to 144 Vac
125 Vdc 94 Vdc to 156 Vdc
48 Vdc 36 Vdc to 60 Vdc
24 Vdc 18 Vdc to 30 Vdc
12 Vdc 9.6 Vdc to 14.4 Vdc

Output Voltages:

+ 5V supply +/- 1% 5 amp
+ 15V supply +/- 20% 3 amp
- 15V supply +/- 20% 2 amp

Total Output Power:

<u>55 Watts</u>	<u>20 Watts</u>
IP-98-115Vac	IP-98-12Vdc
IP-98-125Vdc	IP-98-1U-115Vac
IP-98-48Vdc	IP-98-1U-125Vdc
IP-98-24Vdc	IP-98-1U-48Vdc
	IP-98-1U-24Vdc
	IP-98-1U-12Vdc

Output Ripple:

+ 5V 20mV peak Maximum
+15V 50mV peak Maximum
- 15V 100mV peak Maximum

Efficiency: 80% at full load typical
12Vdc version 60% at full load typical

Isolation: 5000 Vdc from input to output
1000 Vdc from input to output on 12 volt supply.

Surge Withstand Capability: ANSI/IEEE C37.90.1978 & C37.90a-1974 except 12 Vdc supplies.

Environmental Requirements:

Temperature Range: -30 degrees C to +70 degrees C (-22 to +158 F)

Relative Humidity: 95% maximum, non condensing at 40 C (104 F)

Physical:

Weight: 1.4 lbs (.64 kg).

Dimensions: 2.8 inches (71 mm) Wide by 5.04" (128 mm) High by 9.76" (248 mm) Deep

Note: IP-98-1U has a special front panel and is intended for use in the 1U chassis only.

SAFETY

Standard safety precautions must be followed at all times when installing, operating, servicing, and repairing this equipment. INIVEN/CONOLOG CORP. assumes no liability for failure to observe standard or specifically noted safety requirements or to use this equipment for purposes other than intended.

GROUNDING:

A suitable ground is required to reduce the hazard of shock. Refer to the enclosed module, chassis, and/or cabinet wiring diagram for ground connection locations.

ENVIRONMENT:

Operation of any electrical equipment in any area containing gases, fumes, wet, or damp is a potential safety hazard. Necessary precautions should be taken.

MANUAL:

Operators and maintenance personnel should read this manual before installing the equipment and placing it in service. Only properly trained personnel with proper tools and equipment should operate, maintain, repair, or service this equipment.

SHOCK:

Potentially dangerous electrical shock can occur whenever working on this product. Protective measures and safety procedures should be observed at all times.

NOTE:

The IP-98 Series of Power Supplies Contain High Voltages. Do Not Handle Components With Power Applied to the Unit.

THEORY OF OPERATION:

GENERAL: The IP-98 and IP-981U series of switching type power supplies convert the rated input power into three separate DC output voltages, (+5 V, +15 V, and -15 V).

INPUT: The input voltage, dependent upon the version purchased, is applied to the power supply via the ON/OFF switch S1. Fuse F1 provides protection from input and output current overloads.

EMI FILTER: Transformer T1 and associated components C1 through C5 form a multi-function filter. This filter reduces line noise on the power source from entering the supply as well as filtering switching noise generated within the supply from returning to the source.

RECTIFIER: On AC units CR1 and C6 rectifies the 60 Hz power. The rectifier circuit is omitted on 12 and 24 Vdc input units.

PULSE WIDTH MODULATOR (PWM): The PWM (U1) is powered from 15 V produced by

Q1 and associated circuitry. Resistors R3, R4 and C12 provide a soft start for U1. The pulse width modulator switches at a 50 kHz rate. The switched signal is fed to Q4 via Q2 and Q3. This signal then modulates the source voltage through T2.

U3 provides the reference voltage for under and over voltage protection which controls op-amp U4. Potentiometer R10 is a factory adjustment which sets the +15 V level. Voltage feedback to the PWM is optically coupled in U2 to provide input/output isolation.

OUTPUT: D4 through D7 rectify the +5, +15, and -15 V sections of transformer T2. Output filtering is accomplished via L1, C18, and C19 on the +15 V output, (L2, C15, & C16 on the -15 V and L3, C17, & C21 on the +5 V). Regulator U5 provides current limiting on the 5 volt bus.

Refer to Figure 2, Block Diagram and Figure 6, Schematic.

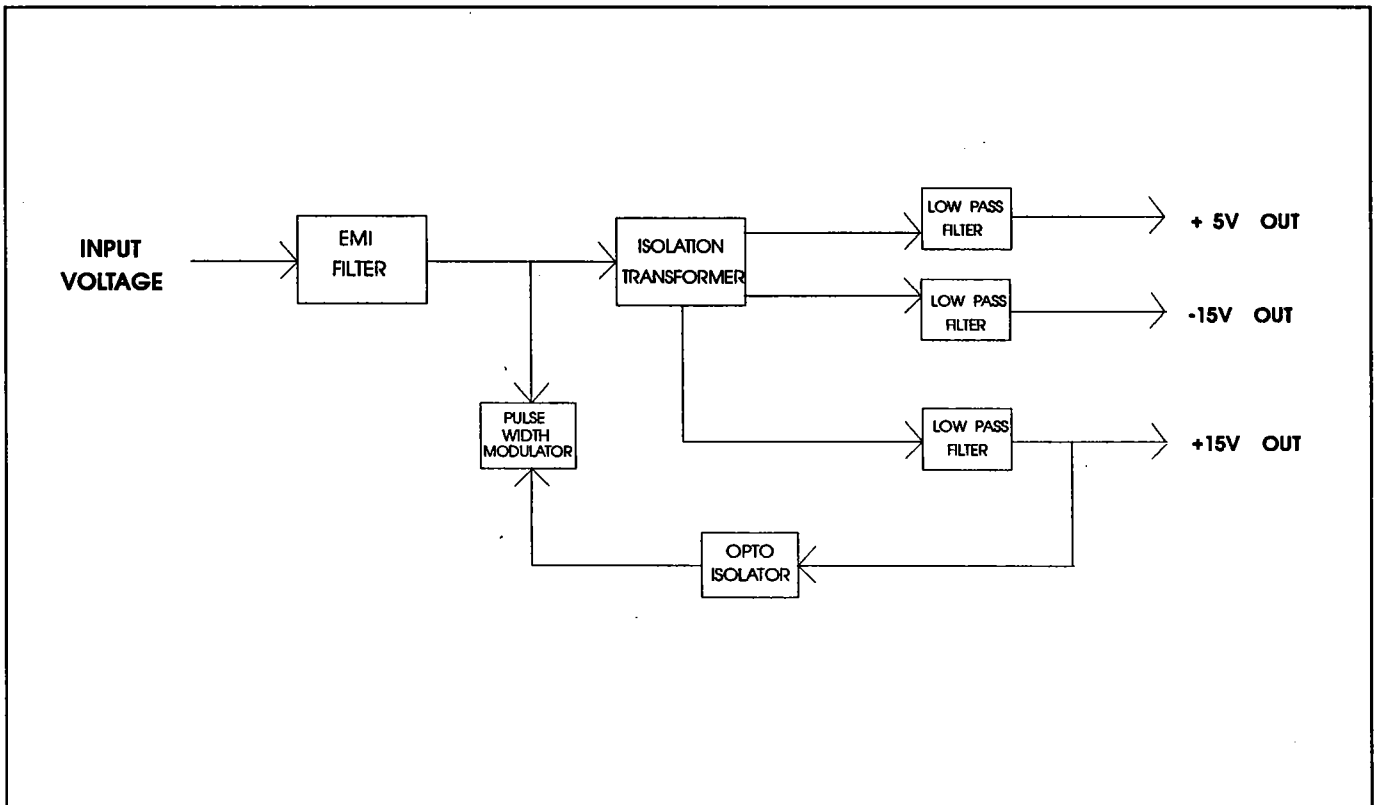


Fig. 2 Block Diagram

INSTALLATION:

GENERAL: Series 98 equipment is supplied in various forms depending on the application and system purchased. When supplied loose the module must be installed in a chassis and interwired. The method of bringing out the module inputs/outputs to the rear of the chassis is via an I/O connector (input/output). The I/O's are available in various styles, depending on application, and are purchased separate from the module. This section of the manual covers the most common supplied methods. Separate instructions will accompany equipment not covered herein.

UNPACKING: This equipment may be supplied loose, mounted in an individual chassis, stacked interconnected chassis, or as part of a rack or cabinet. Follow the procedure for the type of system supplied.

Loose and/or equipment mounted in an individual chassis will be packed in its own shipping carton. Inspect the carton for possible damage in transit. Open each carton carefully and remove the contents. Inspect the equipment for possible damage. Verify all items of value have been removed prior to discarding any packing material.

NOTE: It is suggested the carton be retained for possible onward shipment.

Interconnected chassis or equipment supplied in racks or cabinets will be supplied in special boxes, wood crates, or if shipped via air-ride van without any case. Inspect the crate or other packing for possible damage in transit. Carefully remove the equipment from the container and inspect it for possible damage. Verify all items of value have been removed from the crate prior to discarding any packing material and refer to the note above.

Should transit damage be found please notify INIVEN immediately.

MOUNTING: After unpacking follow the appropriate mounting procedure.

Loose module: (The following is for new installations - replacement of an existing module will have the card guides already mounted, refer to **MODULE REPLACEMENT** in the maintenance section of this manual). Each I/O connector comes with two Card Guides which are to be mounted within the chassis (A one-rack unit high chassis is supplied with the card guides mounted). Locate the desired position within the chassis for which the module is to be placed.

Remove blank panels if existing. Viewing the chassis from the front, the recommended arrangement is a power supply on the extreme left then followed by transmit and or receive modules working towards the right of the chassis. From the front of the chassis and with the boss side (rounded) facing to the right press the lower card guide into the holes provided for the desired location. Repeat this procedure for the upper card guide.

The I/O module, (provided separately) is installed from the rear of the chassis. Aligning the I/O with the appropriate desired location push the assembly into the chassis. Turn the four quarter turn screws (clockwise) using a flat blade screwdriver which will secure it in place.

Install the module by sliding it into the proper slot aligning to the card guides. Once the module is firmly seated use the flat blade screwdriver to turn the four quarter turn screws on the front panel (clockwise).

Individual Chassis: The chassis is a 1 or 3 rack unit high unit containing two mounting ears for 19" rack mounting. Two screws appropriate for the mating hardware are required for each mounting ear (total of four per chassis) and are not supplied with the chassis. Install the chassis in the desired location and securely tighten all four screws. Spacing on the mounting ear holes are compliant with EIA and DIN standards.

Interconnected Chassis or equipment mounted on shipping rails are to be mounted similar to an individual chassis. When shipping rails are provided the equipment is to be placed near the desired location. Remove the screws holding the shipping rails and then remove the rails. Slide the equipment into the rack or cabinet and secure it with proper screws for the mating hardware being used. Tighten all screws.

Systems provided in a rack or cabinet from the factory must be secured to the floor or wall as required. Mounting hardware is not supplied due to the various surfaces and mounting methods.

CAUTION: EQUIPMENT MOUNTED IN SWING RACK TYPE CABINETS MUST BE SECURED TO THE MOUNTING SURFACE PRIOR TO OPENING THE SWING RACK TO PREVENT THE CABINET FROM FALLING.

VENTILATION: Proper ventilation is required for most electronic equipment. Enclosed cabinets or rooms where this equipment is mounted

should be kept at temperatures within the limits of the equipment. Operation above these limits may affect reliability.

ELECTRICAL CONNECTIONS: User connections are made via the I/O on the rear of the chassis. Each unit in the 98 SERIES of equipment will contain these connections in the instruction manual for the specific individual module. On equipment supplied wired from the factory or on interwired chassis and cabinets an "as supplied" drawing will be included with the equipment. External wiring should be in accordance with the "as supplied" drawing when supplied.

The IP-98 and IP-98-1U supplied loose may be interfaced with the I/O shown herein. External wiring is to be in accordance with the appropriate I/O used and particular interface required for your application.

For safety reasons power on the leads to be connected to the unit are to be de-energized during installation.

Methods of making the wiring connections to the terminal blocks vary and based on local practice. It is suggested number 20 AWG size insulated wire, stripped portion tinned, be used. Approximately 1/4" of the insulation is to be removed and inserted in the terminal strip.

Module power and tone lines may be daisy-chained should the application require.

Tighten all connections and insure exposed wires do not touch each other or the chassis.

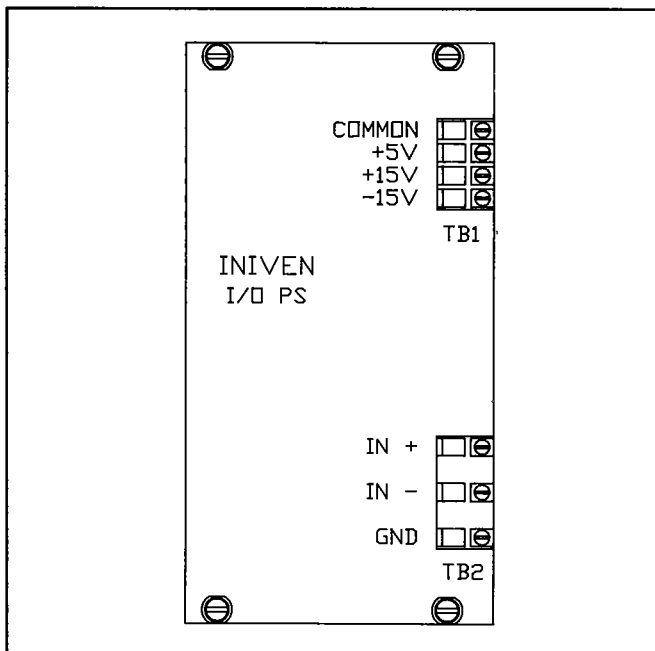


Figure 5. Power Supply I/O

INITIAL START-UP & POWER CHECKS

ADJUSTMENTS: The power supply contains one adjustment (R10) which sets the +15 V output. This adjustment is performed at the factory and should not require further adjustment.

The following equipment is recommended to perform the initial power checks:

1. Digital multimeter with dB readout function; Fluke 8010A or equivalent.

Additional equipment required to perform the +15 V output adjustment if required.

2. Flat-blade-screwdriver with 1/8 inch wide tip or potentiometer adjustment tool.

3. Card Extender

POWER CHECKS:

With the appropriate power applied to the power supply I/O and (S1) in the "ON" position, check the +15, -15, and +5 Vdc outputs on the I/O utilizing a multimeter in the DC mode set to the correct range and observing polarity for the voltage being measured. No further checks are required if the readings fall within the specified range.

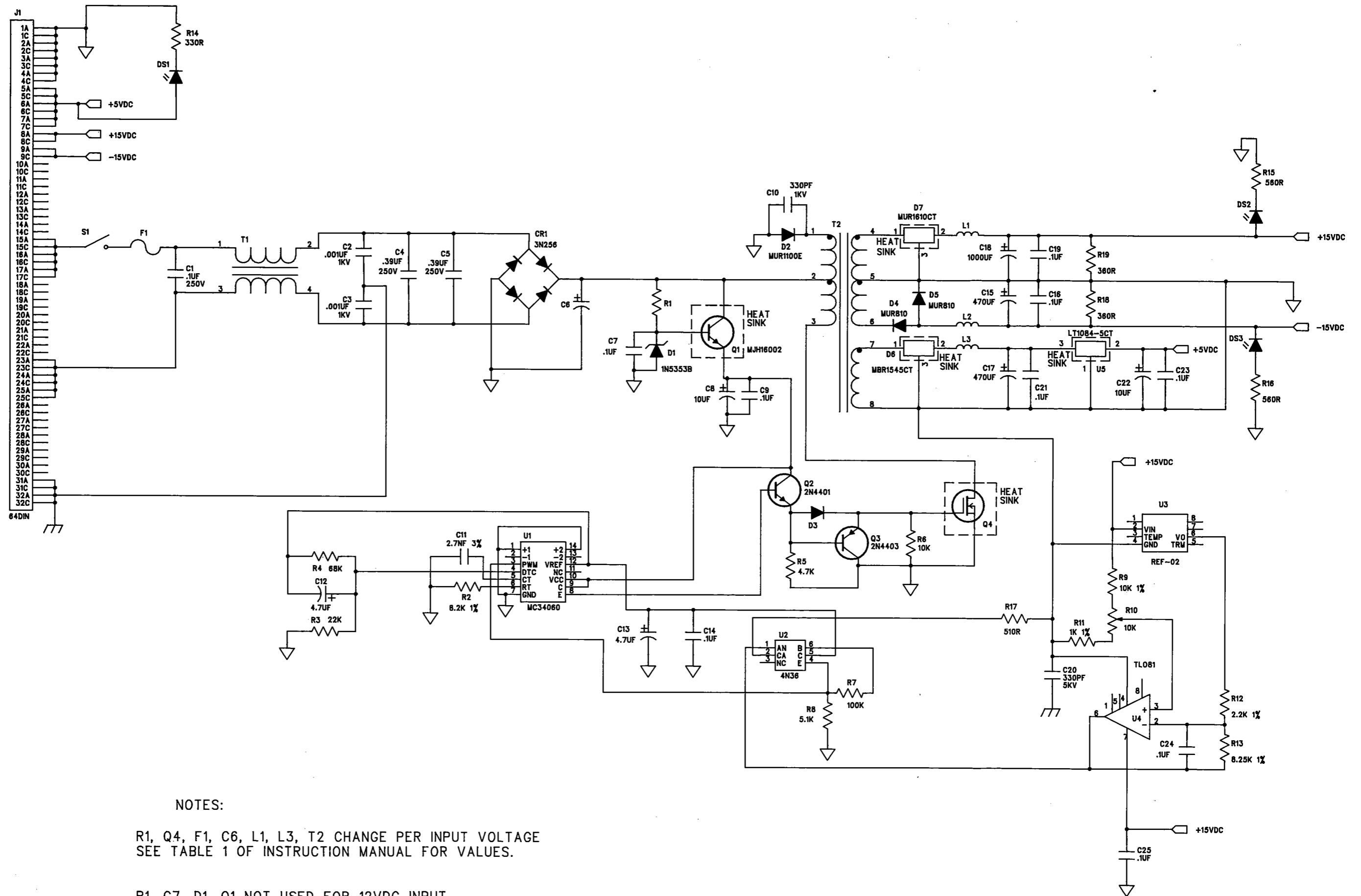
ADJUSTMENTS: The +15 V adjustment should not be required. However, if the outputs do not fall within the specified range or if component changes have been made this adjustment may be required.

With the power turned off to the module, loosen the four screws holding the front panel and remove the module from the chassis. Insert the card extender in the chassis and then the module in the extender via the handle. Monitor the +15 V output on the I/O connector as referenced in the power check section of this manual. Adjust (R10) using a screwdriver or adjustment tool until the meter reads +15 V (+/- 10%).

Turn off the power, remove the test leads, module, and card extender. Replace the module, tighten the front panel screws and turn on the power.

MAINTENANCE:

ALL SAFETY PROCEDURES ARE TO BE STRICTLY ADHERED TO AND ONLY QUALIFIED MAINTENANCE, OPERATORS, OR SERVICE PERSONNEL ARE TO PERFORM WORK ON THIS EQUIPMENT. LIFE THREATENING VOLTAGES AND CURRENTS ARE PRESENT WITHIN THIS EQUIPMENT. OBTAIN ALL REQUIRED APPROVALS PRIOR TO PLACING THIS EQUIPMENT IN OR OUT OF SERVICE.



NOTES:

R1, Q4, F1, C6, L1, L3, T2 CHANGE PER INPUT VOLTAGE
SEE TABLE 1 OF INSTRUCTION MANUAL FOR VALUES.

R1, C7, D1, Q1 NOT USED FOR 12VDC INPUT.
CR1 NOT USED FOR 12VDC AND 24VDC INPUT.

Figure 6, Schematic.

PREVENTIVE MAINTENANCE is meant to reduce system downtime by locating and correcting potential problems prior to catastrophic failure. The following procedure is recommended to be performed on six month intervals. Equipment located in harsh environments may require more frequent maintenance. It is not the intent of this schedule to replace preventive maintenance procedures in place within any particular organization.

Items required to perform the following procedure:

Soft-bristled brush with non-conductive handle OR a source of low level compressed air.

Clean dry cloth(s)

Flat blade screwdriver with 1/8" wide tip.

Flat blade screwdriver with 1/4" wide tip.

Mild non-abrasive detergent solution.

Test equipment described in the Installation Section.

1. Turn off the power switch on the power supply module and de-energize the power applied to the equipment.
2. Remove the modules from the chassis by using a flat blade screwdriver to turn the four quarter turn fasteners (counterclockwise) on the front panel of each module (note module location). Then remove each module by pulling on its handle.
3. Using a brush or low pressure compressed air remove all dust from the module and chassis.
4. Inspect module for signs of visual damage such as overheating or corrosion. Correct the conditions prior to proceeding further.
5. Use the cloth and mild detergent to clean the front panels of each module and front of the chassis. Insure all parts are dry prior to proceeding.
6. Replace all modules in the proper location as noted in step 2 above aligning each to the card guides in the chassis. Once each card is firmly seated in its correct position use the flat blade screwdriver to turn the four quarter turn screws on the front panel of each module (clockwise).
7. Energize power to the equipment and turn "on" the power switch on the power supply.

8. Perform the initial startup procedure located in the installation section of this manual.

MODULE REMOVAL is accomplished by first turning off the power switch on the power supply. Turn the four quarter turn screws (counterclockwise) on the front panel of the module to be removed. Pull out the module by the handle.

MODULE REPLACEMENT is accomplished by first turning off the power supply and then sliding the module into the proper slot aligning to the card guides. Once the module is firmly seated use the flat blade screwdriver to turn the four quarter turn screws on the front panel clockwise. Turn the power supply switch to "ON".

A FUSE is located on the module. It is held in place by set of clips. Refer to Figure 4 for physical location and to Table 1 for replacement part numbers.

To replace a faulty fuse turn off the switch to the Power Supply module and remove the module as described above. Using a flat blade screwdriver or fuse puller, remove the fuse from the clips being careful not to shatter the glass. Eye protection should be worn. Install a new fuse of the same physical and electrical characteristics as specified in this manual.

Install the module into its proper position following module replacement procedure above. Turn on the power switch. If the power on indicator lights the trouble has been corrected. If the light does not light or the fuse blows again further troubleshooting of the unit is required.

Note: In the event a replacement module is being installed check all switch and jumper positions prior to installation. Comparison with the removed module is one convenient method.

The equipment has been designed to operate in an industrial environment and should provide years of trouble free operation. In the unlikely event a malfunction should occur standard troubleshooting techniques may be followed to resolve the problem. To assist you we have included schematics, and detailed information (including parts list) within this manual.

If factory assistance is required **INIVEN** has set up a **toll free number (1-800-526-3984)** for sales and service information. Should a module require repair please refer to our **life time warranty** in this manual.

Table 1. Replaceable parts IP-98 & IP-98-1U

Circuit Symbol	Description	INIVEN Part Number
CAPACITORS:		
C2, 3	Capacitor,ceramic,.001uF,7.5KV,+/-20%,HK102MMPAE88 or equiv.	HK102MMPAE88
C4,5	Capacitor,metalized polycarbonate,.39uF,250V,+/-5%,MPC32G394J or equiv.	MPC32G394J
C7,9,14,16,19 21,23-25	Capacitor,ceramic,.1uF,100V,+/-10%,CM-X7R-E-104-K or equiv.	CM-X7R-E-104-K
C8, 22	Capacitor,tantalum,10uF,35V,+/-20%,DT35V106M or equiv.	DT35V106M
C10	Capacitor,ceramic,.330pF,1KV,+/-20%,JL331VMIAA29 or equiv.	JL331VMIAA29
C11	Capacitor,polystyrene,.0027uF,100V,+/-3%,PS32E272H or equiv.	PS32E272H
C12,13	Capacitor,tantalum,4.7uF,35V,+/-10%,DT35V475M or equiv.	DT35V475M
C18	Capacitor,electrolytic,1000uF,25V,+/-20%,108RSM025M or equiv.	108RSM025M
C15,17	Capacitor,electrolytic,470uF,25V,+/-20%,477RSM025M or equiv.	477RSM025M
C20	Capacitor,ceramic,330pF,7.5KV,+/-20%,HK331MMPAE75 or equiv.	HK331MMPAE75
C1	Capacitor,metalized polycarbonate,.1uF,250V,+/-5%,MPC32G104J or equiv.	MPC32G104J
RESISTORS:		
R2, 13	Resistor,metal film,8.25K,1/4 watt,+/- 1% or equiv.	RN55D8251F
R3	Resistor,carbon,22K,1/4 watt,+/- 5% or equiv.	RCF07J223
R4	Resistor,carbon,68K,1/4 watt,+/- 5% or equiv.	RCF07J683
R5	Resistor,carbon,4.7K,1/4 watt,+/- 5% or equiv.	RCF07J472
R6	Resistor,carbon,10K,1/4 watt,+/- 5% or equiv.	RCF07J103
R7	Resistor,carbon,100K,1/4 watt,+/- 5% or equiv.	RCF07J104
R8	Resistor,carbon,5.1K,1/4 watt,+/- 5% or equiv.	RCF07J512
R9	Resistor,metal film,10K,1/4 watt,+/- 1% or equiv.	RN55D1002F
R10	Resistor,potentiometer,10K,1/4 watt or equiv.	3299W-1-103
R11	Resistor,metal film,1K,1/4 watt,+/- 1% or equiv.	RN55D1001F
R12	Resistor,metal film,2.21K,1/4 watt,+/- 1% or equiv.	RN55D2211F
R14	Resistor,carbon,330 ohm,1/4 watt,+/- 5%.or equiv.	RCF07J331
R17	Resistor,carbon,510 ohm,1/4 watt,+/- 5% or equiv.	RCF07J511
R18,19	Resistor,carbon,36 ohm,1/2 watt,+/- 5% or equiv.	RCF20J361
R15,16	Resistor,carbon,560 ohm,1/4 watt,+/- 5% or equiv.	RCF07J561
SEMICONDUCTORS		
D1	Diode,zener,1N5353B,16V,5W or equiv.	1N5353B
D2	Diode,fast,MUR1100 or equiv.	MUR1100
D3	Diode,general purpose,1N914 or equiv.	1N914
D4,5	Diode,fast,MUR810 or equiv.	MUR810
D6	Diode,MBR1545CT or equiv.	MBR1545CT
D7	Diode,fast,MUR1610CT or equiv	MUR1610CT

Table 1. Replaceable parts (continued)

Circuit Symbol	Description	INIVEN Part Number
DS1-3	LED,Red Dialight 550-1106 or equiv.	550-1106
Q1	Transistor,NPN, MJH16002 or equiv.	MJH16002
Q2	Transistor,NPN,2N4401 or equiv.	2N4401
Q3	Transistor,PNP,2N4403 or equiv.	2N4403
Q4	Transistor,MOSFFET,IRF804 or equiv.	IRF840
CR1	Bridge Rectifier.single phase full-wave,3N256 or equiv.	3N256
U1	IC,pulse width modulation control,MC34060 or equiv.	MC34060P
U2	Optical isolator,4N36 or equiv.	4N36
U3	IC,reference,PMI REF-02 or equiv.	PMI REF-02
U4	IC,Op-amp,TL081CP or equiv.	TL081CP
U5	Regulator,positive fixed,5 amp,LT1084CP-5 or equiv.	LT1084CP-5
MISCELLANEOUS COMPONENTS:		
S1	Switch,SPST panel mount on-off Alco Electronic or equiv.	XR116A00+ON-OFF
T1	Transformer,Coilcraft or equiv.	E3495A
L2	Inductor, INIVEN	CC2018-00
THE FOLLOWING COMPONENTS ARE DEPENDENT UPON INPUT VOLTAGE		
IP-98		
CC1902-00	INPUT VOLTAGE 115 VAC - OUTPUT 55 WATTS	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-00
R1	Resistor, 1 Watt, 51K	RCF32J513
Q4	Transistor, MOSFET	IRF840
C6	Capacitor, 220uF	227LPR250M
CR1	Bridge Rectifier,single phase full wave,3N256 or equiv.	3N256
L1	Inductor, INIVEN	CC2017-00
L3	Inductor, INIVEN	CC2019-00
CC2029-00	INPUT VOLTAGE 125 VDC - OUTPUT 55 WATTS	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-04
R1	Resistor, 1Watt, 36K	RCF32J363
Q4	Transistor, MOSFET	IRF840
C6	Capacitor, 100uF	107LPR250M
L1	Inductor, INIVEN	CC2017-00
CR1	Diode, general purpose, IN4004	IN4004
L3	Inductor, INIVEN	CC2019-00

Table 1. Replaceable parts (continued)

Circuit Symbol	Description	INIVEN Part Number
CC2030-00	INPUT VOLTAGE 48 VDC - OUTPUT 55 WATTS	
F1	Fuse, 3 amp Bussman Inc. or equiv.	3AG-3AMP
T2	Transformer, INIVEN	CC2026-03
R1	Resistor, 1/2 Watt, 10K	RCF20J103
Q4	Transistor, MOSFET	IRF640
C6	Capacitor, 100uF	107LPR250M
L1	Inductor, INIVEN	CC2017-00
L3	Inductor, INIVEN	CC2019-00
CR1	Diode, general purpose, IN4004	IN4004
CC2031-00	INPUT VOLTAGE 24 VDC - OUTPUT 55 WATTS	
F1	Fuse, 5 amp Bussman Inc. or equiv.	3AG-5AMP
T2	Transformer, INIVEN	CC2026-02
R1	Resistor, 1/2 Watt, 5.1K	RCF20J512
Q4	Transistor, MOSFET	IRF540
C6	Capacitor, 100uF	107LPR250M
CR1	Diode, general purpose, IN4004	IN4004
L1	Inductor, INIVEN	CC2017-00
L3	Inductor, INIVEN	CC2019-00
CC2032-00	INPUT VOLTAGE 12 VDC - OUTPUT 20 WATTS	
F1	Fuse, 5 amp Bussman Inc. or equiv.	3AG-5AMP
T2	Transformer, INIVEN	CC2026-01
R1	Not Used	-----
Q4	Transistor, MOSFET IRF540/IRFZ40	IRFZ40
C6	Capacitor, 100uF	107LPR250M
L1	Inductor, INIVEN	CC2017-00
L3	Inductor, INIVEN	CC2019-00
CR1	Diode, general purpose, IN4004	IN4004
IP-98-1U		
CC2033-00	INPUT VOLTAGE 115 VAC - OUTPUT 20 WATTS (1U)	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-05
R1	Resistor, 1 Watt, 51K	RCF32J513
Q4	Transistor, MOSFET	IRF840
C6	Capacitor, 100uF	107LPR250M
CR1	Bridge Rectifier	3N256
L1	Inductor, INIVEN	CC2017-01
L3	Inductor, INIVEN	CC2019-01

Table 1. Replaceable parts (continued)

Circuit Symbol	Description	INIVEN Part Number
CC2034-00	INPUT VOLTAGE 125 VDC - OUTPUT 20 WATTS (1U)	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-09
R1	Resistor, 1 Watt, 36K	RCF20J363
Q4	Transistor, MOSFET	IRF840
C6	Capacitor, 100uF	107LPR250M
L1	Inductor, INIVEN	CC2017-01
L3	Inductor, INIVEN	CC2019-01
CR1	Diode, general purpose, IN4004	IN4004
CC2035-00	INPUT VOLTAGE 48 VDC - OUTPUT 20 WATTS (1U)	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-08
R1	Resistor, 1/2 Watt, 10K	RCF20J103
Q4	Transistor, MOSFET	IRF640
C6	Capacitor, 100uF	107LPR250M
CR1	Diode, general purpose, IN4004	IN4004
L1	Inductor, INIVEN	CC2017-01
L3	Inductor, INIVEN	CC2019-01
CR1	Diode, general purpose, IN4004	IN4004
CC2036-00	INPUT VOLTAGE 24 VDC - OUTPUT 20 WATTS (1U)	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-07
R1	Resistor, 1/2 Watt, 5.1K	RCF20J512
Q4	Transistor, MOSFET	IRF540
C6	Capacitor, 100uF	107LPR250M
L1	Inductor, INIVEN	CC2017-01
L3	Inductor, INIVEN	CC2019-01
CR1	Diode, general purpose, IN4004	IN4004
CC2037-00	INPUT VOLTAGE 12 VDC - OUTPUT 20 WATTS (1U)	
F1	Fuse, 2 amp Bussman Inc. or equiv.	3AG-2AMP
T2	Transformer, INIVEN	CC2026-06
R1	Not Used	— — — —
Q4	Transistor, MOSFET	IRFZ40
C6	Capacitor, 100uF	107LPR250M
L1	Inductor, INIVEN	CC2017-01
L3	Inductor, INIVEN	CC2019-01
CR1	Diode, general purpose, IN4004	IN4004

WARRANTY AGREEMENT

We hereby certify that the INIVEN product line carries a warranty for any part which fails during normal operation or service for the life of the product. A defective part should be returned to the factory, shipping charges prepaid, for repair f.o.b. Somerville, New Jersey. In case INIVEN cannot promptly return the unit to you, it will endeavor to provide a loaner until the repair or replacement is returned to you. Any unauthorized repairs or modifications will void the warranty. This warranty is contingent upon the commercial availability of parts as purchased by INIVEN. However, in the event that failure is less than two years from the date of delivery of the product, INIVEN will accept full responsibility.

INIVEN™ 5 Columbia Rd. Somerville, NJ 08876