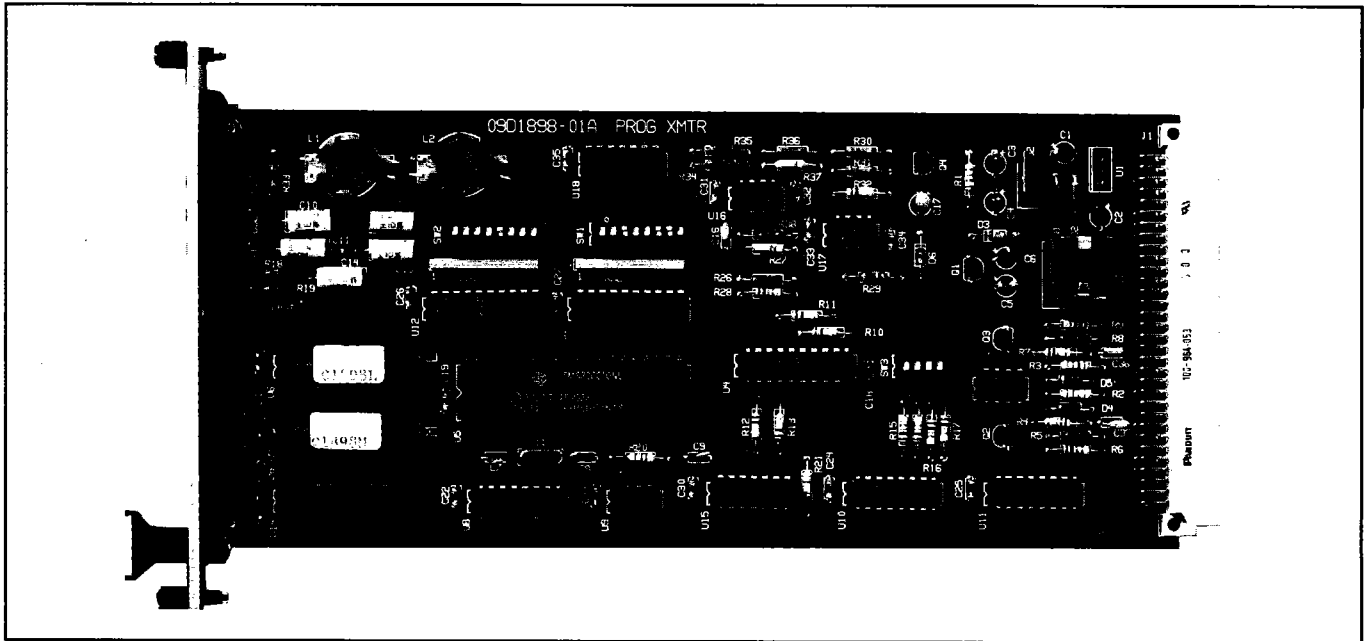


# INIVEN<sup>TM</sup>

## INSTRUCTION MANUAL

### IT-98DSP AND IT-98DSP-1U PROGRAMMABLE FSK TONE TRANSMITTERS



**Fig. 1. IT-98DSP FSK TONE TRANSMITTER**

**DESCRIPTION:** The IT-98DSP and IT-98DSP-1U are programmable frequency shift keyed (FSK) tone-transmitters intended for use on the sending end of a communication channel in supervisory control, telemetry, and data transmission applications. A transmitter/receiver combination may be used over voice grade circuits including carrier, wire line, fiber optics, and microwave.

Utilizing state of the art design and crystal controlled DSP (Digital Signal Processing) tech-

niques provides for improved performance, flexibility, and reliability.

Each transmitter module is field programmable for a specific center frequency, frequency shift (bandwidth/baud rate) and mode of operation via dip switches. Operational modes include two-frequency (2F) or three-frequency (3F) keying, carrier on/off (Request-To-Send, RTS), inverted keying, and flasher (keying of both mark and space simultaneously).

#### **FEATURES:**

- Optical or voltage keying inputs provided on each unit.
- Front panel level adjustment.
- Dip switch programmable - - no need for external equipment to change frequency, bandwidth, or mode of operation.
- Cost saving design while maintaining reliability and quality.
- Life Time Warranty.

## **SPECIFICATIONS:**

Output level: Front panel adjustable to +5 dBm.

Output Impedance: 15 k ohm minimum.

Keying input: Mark, Space, Request-To-Send (RTS/carrier on/off). High impedance 3-30 Vdc. Optically coupled 5-50 Vdc. Optional optically coupled inputs to 150 Vdc.

Keying methods: CMOS, TTL, RS232, Dry contact, opto isolation, voltage (various input/output interfaces available).

Operating Frequency Range: 200-3800 Hz. (See programming charts)

Operating Bandwidths: 50, 60, 85, 120, 170, 240, 300, or 600 Hz. Standard.

Data Level Outputs: Clear-To-Send (CTS) .5 ms delay @ + 5 Vdc.

Indicators: Front panel mounted for mark, space, RTS, and CD/carrier on (Clear-To-Send, CTS).

Spectral Purity: Harmonic content: 70 dB below carrier level. Spurious Signals at Adjacent Channels: 70 dB below carrier.

Bias distortion: Less than 7% with channel keyed in accordance to programmed bandwidth. Back to back, Transmitter/Receiver.

### **Environmental Requirements:**

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

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

### **Power Requirements:**

+5 Vdc +/- 5% (4.75 to 5.25 Vdc) 95 ma @ 5 V

+12 Vdc +/- 35% (7.8 to 16.2 Vdc) 13.9 ma @ 15 V

-12 Vdc +/- 35% (7.8 to 16.2 Vdc) 11.5 ma @ 15 V

### **Physical**

Weight: .5 lbs. (.23 Kg)

Dimensions: .999" (25.4 mm) Wide by 5.04" (128 mm) High by 9.76" (248 mm) Deep.

Note: IT-98DSP-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.

## THEORY OF OPERATION:

**GENERAL:** The unit generates an audio tone which changes frequency when the input is keyed. The keying inputs are referred to as mark and space. When the two frequency mode is selected the audio tone output is at a frequency plus or minus the shift (programmable) of the programmed center frequency. Upon keying (applying a voltage) the transmitter changes state to the opposite frequency. In a two-frequency system the carrier or center frequency is not produced.

In a three-frequency unit the center frequency is normally generated and keying of the mark input shifts the frequency by the frequency shift programmed. Keying of the space input shifts the frequency opposite of the mark frequency. Only one keying input is to be on at any one given time unless the Flasher option is used which allows the unit to shift between mark and space frequencies when both inputs are keyed.

A third keying input is available which allows the audio tone output to be turned on/off. The RTS (carrier on/off) input permits the transmitter to be used in systems requiring a quiet line until communications is needed such as a polling or data system.

**PROGRAMMING:** Upon applying power to the unit the digital signal processor DSP (U5) reviews the program information of octal inverting buff-

ers (U12 & U13) which have been set by switches SW1 and SW2.

**INPUT:** Standard inputs are via Q2, Q3, Q5, and associated circuitry. The input information is fed to (U4) octal bus driver along with the mode of operation settings of SW3. (U5) Stores the information in memory (RAM).

**DSP:** The microprocessor (U5) operating parameters are determined by the two EPROM's (2 k X 8-bit) U6 & U7. All sine wave generation and keying input information is then processed in (U5).

**WATCH DOG TIMER:** (U9) is a watch dog timer which recycles the microprocessor should its software sequence fail to perform as required. The timer effectively restarts the program to eliminate having to re-initiate power up of the module.

**OUTPUT:** The digital signal is processed through (U14) digital to analog converter and then passes through a low pass filter consisting of L1, L2 and associated capacitors C10 through C14 limiting the signals to 4 kHz. Variable resistor (R24) adjust the signal level which is amplified by operational amplifier (U16). The signal is coupled to the line via transformer T1.

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

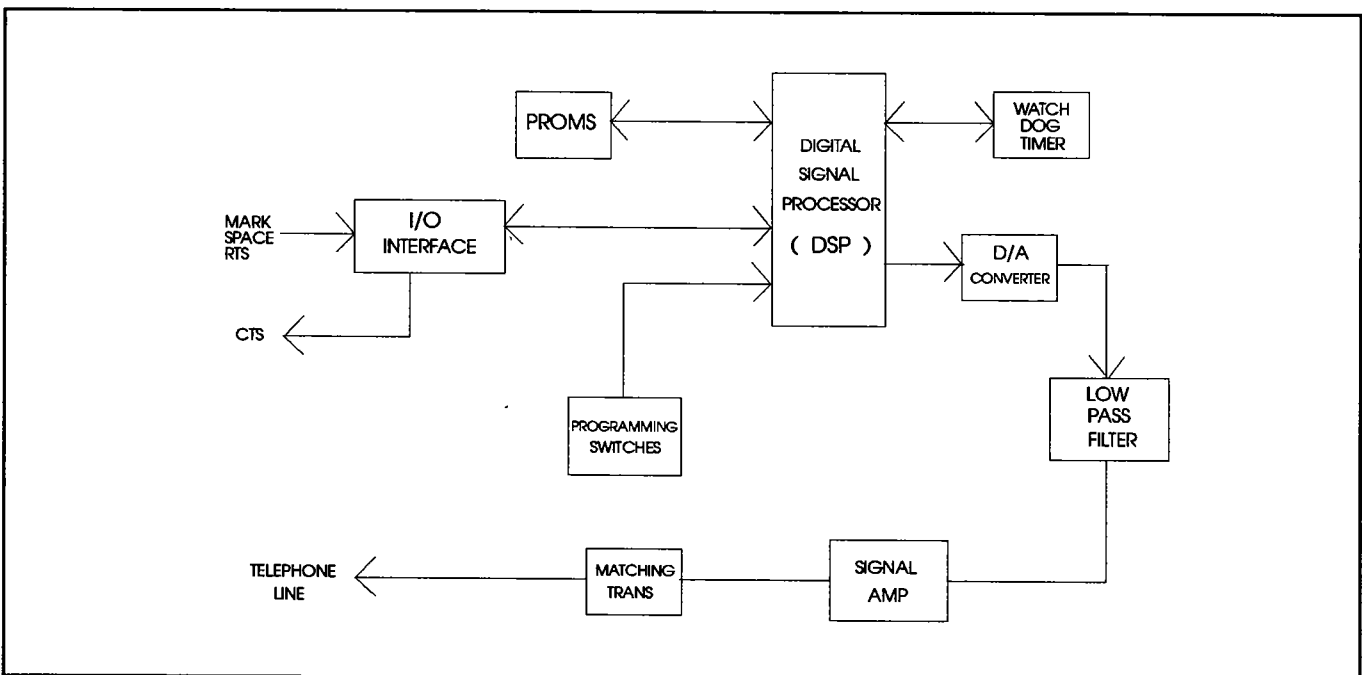
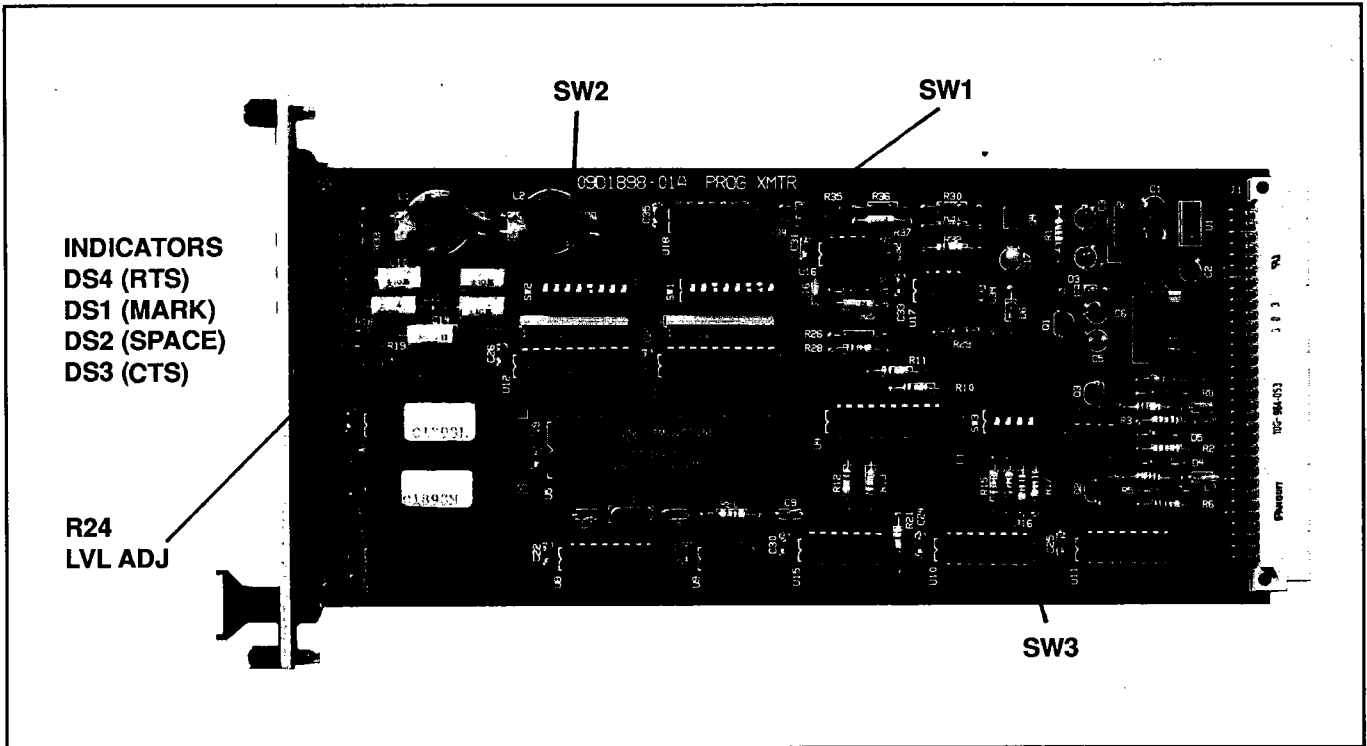


Fig. 2 Block Diagram



**Fig. 3. Controls & Indicators**

**Table 1 Controls and Indicators**

DS1	Indicator, Mark, Lights when mark is keyed on.
DS2	Indicator, Space, lights when space is keyed on.
DS3	Indicator, (CTS), Clear to send lights when carrier is preset at the output.
DS4	Indicator, (RTS), Request to send lights when carrier is on.
R24	Variable resistor, audio tone level adjustment.
SW1	Switch, Programs center frequency (see chart)
SW2	Switch, Programs frequency shift (see chart)
SW3	Switch, programs modes of operation (see listing)

**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 two 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 two 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 IT-98DSP and IT-98DSP-1U supplied loose may be interfaced with one of the I/O's 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.

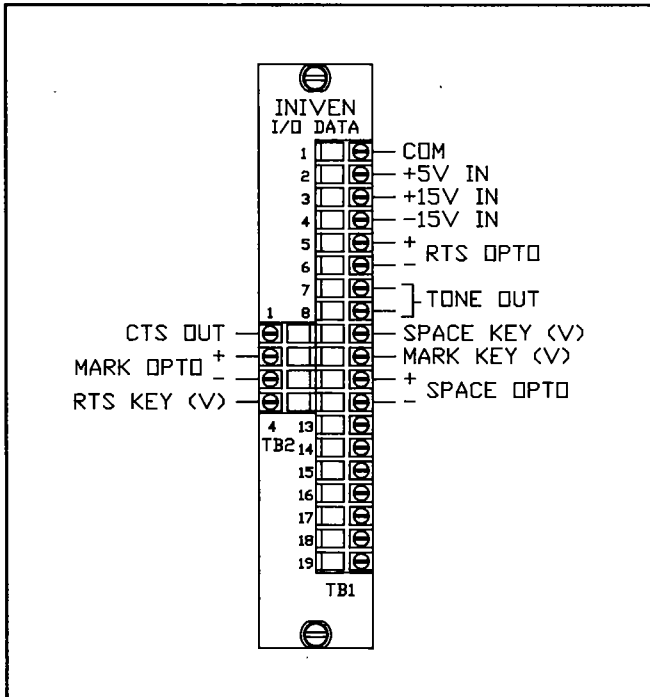


Figure 4. Standard I/O

**FREQUENCY SELECTION:** With the module removed from the chassis. Select the desired bandwidth and center frequency from the enclosed charts. Refer to figure 3 for switch location.

**EXAMPLE:** For an 85 baud channel at 1615 Hz center frequency, set SW2 position 3 to "ON" (only a single position within SW2 is to be "ON" at any one time). Set SW1 positions 1, 4, & 7 to "ON" (be sure all other positions on SW1 are "OFF").

**MODE OF OPERATION** Set SW3 to the desired mode of operation as detailed below. Refer to figure 3 for switch location.

**MODES OF OPERATION:** (SWITCH SW 3)

**Switch SW 3 programs the various methods of operation as follows:**

All Positions "OFF" 3F operation, carrier on, (RTS). Keying mark produces a mark frequency out, space provides a space frequency out.

Position 1 "ON" only 3F operation, carrier on, (RTS). Keying mark input produces space frequency out, keying space input produces mark frequency out. Center frequency during idle.

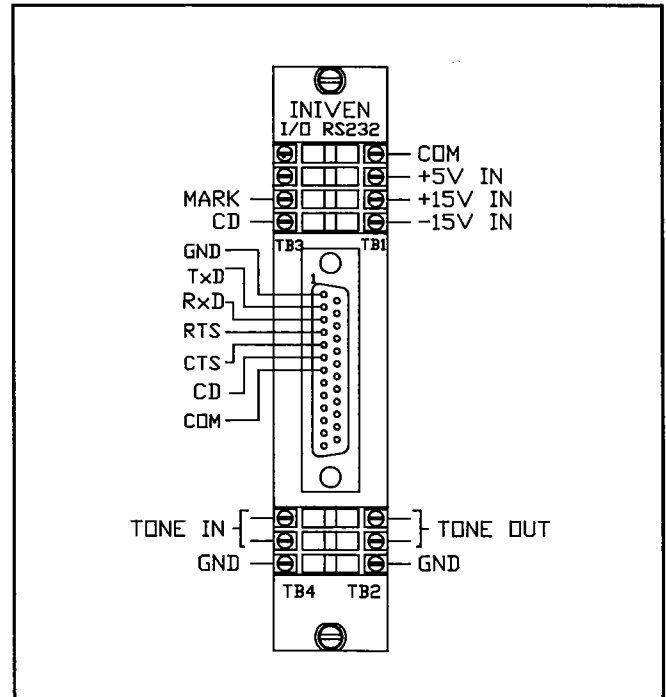


Figure 5. RS232 I/O

Position 2 "ON" only 2F operation, carrier on, (RTS). Produces mark frequency when keyed, space during idle. Keying leads on Mark input. (Not to be used with position 3).

Position 3 "ON" only FLASHER, 3F operation, carrier on, (RTS). Transmitter will shift at 20 msec intervals between mark and space when the mark and space inputs are keyed at the same time. (This operation will not function if position 2 is in the "ON" position).

Position 4 "ON" only RTS (Request-To-Send), carrier is off unless the RTS input is keyed. May be used in all modes.

Positions 1 & 2 "ON" 2F operation, carrier on, (RTS). Keying mark input produces space frequency output. Mark frequency during idle. Keying leads on mark input.

<b>FOR 50 BAUD OPERATION</b>	
<b>SET POSITION 1 OF SW2 "ON"</b>	
<b>To Obtain Center Freq. Hz</b>	<b>Set Listed Positions of SW1 to "ON"</b>
365	4
465	1,4
565	2,4
665	1,2,4
765	3,4
865	1,3,4
965	2,3,4
1075	1,2,3,4
1175	5
1275	1,5
1375	2,5
1475	1,2,5
1575	3,5
1675	1,3,5
1775	2,3,5
1875	1,2,3,5
2000	4,5
2100	1,4,5
2200	2,4,5
2300	1,2,4,5
2400	3,4,5
2500	1,3,4,5
2600	2,3,4,5
2700	1,2,3,4,5
2800	6
2900	1,6
3000	2,6
3100	1,2,6
3200	3,6
3300	1,3,6
3400	2,3,6
3500	1,2,3,6

<b>FOR 60 BAUD OPERATION</b>	
<b>SET POSITION 2 OF SW2 "ON"</b>	
<b>To Obtain Center Freq. Hz</b>	<b>Set Listed Positions of SW1 to "ON"</b>
420	4,6
540	1,4,6
660	2,4,6
780	1,2,4,6
900	3,4,6
1020	1,3,4,6
1140	2,3,4,6
1260	1,2,3,4,6
1380	5,6
1500	1,5,6
1620	2,5,6
1740	1,2,5,6
1860	3,5,6
1980	1,3,5,6
2100	2,3,5,6
2220	1,2,3,5,6
2340	4,5,6
2460	1,4,5,6
2580	2,4,5,6
2700	1,2,4,5,6
2820	3,4,5,6
2940	1,3,4,5,6
3060	2,3,4,5,6
3180	1,2,3,4,5,6
3300	7
3420	1,7

<b>FOR 85 BAUD OPERATION</b>	
<b>SET POSITION 3 OF SW2 "ON"</b>	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
425	2,7
595	1,2,7
765	3,7
935	1,3,7
1105	2,3,7
1275	1,2,3,7
1445	4,7
1615	1,4,7
1785	2,4,7
1955	1,2,4,7
2125	3,4,7
2295	1,3,4,7
2465	2,3,4,7
2635	1,2,3,4,7
2865	5,7
2975	1,5,7
3145	2,5,7
3315	1,2,5,7
3485	3,5,7

<b>FOR 170 BAUD OPERATION</b>	
<b>SET POSITION 5 OF SW2 "ON"</b>	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
850	2,6,7
1190	1,2,6,7
1530	3,6,7
1870	1,3,6,7
2210	2,3,6,7
2550	1,2,3,6,7
2890	4,6,7
3230	1,4,6,7

<b>FOR 240 BAUD OPERATION</b>	
<b>SET POSITION 6 OF SW2 "ON"</b>	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
600	2,4,6,7
1080	1,2,4,6,7
1560	3,4,6,7
2040	1,3,4,6,7
2520	2,3,4,6,7
3000	1,2,3,4,6,7

<b>FOR 120 BAUD OPERATION</b>	
<b>SET POSITION 4 OF SW2 "ON"</b>	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
480	1,3,5,7
720	2,3,5,7
960	1,2,3,5,7
1200	4,5,7
1440	1,4,5,7
1680	2,4,5,7
1920	1,2,4,5,7
2160	3,4,5,7
2400	1,3,4,5,7
2640	2,3,4,5,7
2880	1,2,3,4,5,7
3120	6,7
3360	1,6,7

<b>FOR 300 BAUD OPERATION</b>	
<b>SET POSITION 7 OF SW2 "ON"</b>	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
1020	5,6,7
1700	1,5,6,7
2380	2,5,6,7
3060	1,2,5,6,7

<b>FOR 600 BAUD OPERATION</b>	
<b>SET POSITION 8 OF SW2 "ON"</b>	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
1360	3,5,6,7
2720	1,3,5,6,7



## INITIAL START-UP & LEVEL CHECKS

**ADJUSTMENTS:** The transmitter contains a LEVEL adjustment (R24) which is located on the front panel (see Fig. 3 for location). Each transmitter is shipped from the factory set at -6 dBm and will be adequate for most applications.

The following equipment is recommended to perform the initial start-up and level checks:

1. Digital multimeter with dB readout function; Fluke 8010A or equivalent.
2. Flat-blade-screwdriver with 1/8 inch wide tip or potentiometer adjustment tool.
3. Optional - - Card Extender.

### INITIAL SETTINGS:

**WITH OPTIONAL CARD EXTENDER:** With the power turned off to the module, loosen the two screws holding the front panel and remove the module from the chassis. Insert the extender in the chassis and then the module in the extender. Connect the test leads from the multimeter to pins 11C & 12C of the connector (P1) located at the rear of the module. Turn on the power and note reading on the multimeter (the tone output on the I/O should be connected to the line or terminated in a 600 ohm resistor). Adjust R24 (LVL ADJ) with a screwdriver or adjustment tool to the desired level. Only one transmitter should be on line during this adjustment or a composite level will be read which is not a true reading of the transmitter output level. The "as set" level should be recorded for future reference. 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.

**WITHOUT CARD EXTENDER:** Connect the multimeter across the tone out terminals on the I/O (the tone output on the I/O should be connected to the line or terminated in a 600 ohm resistor). Adjust R24 (LVL ADJ) with a screwdriver or adjustment tool to the desired level. Only one transmitter should be on line during this adjustment or a composite level will be read which is not a true reading of the transmitter output level. The "as set" level should be recorded for future reference. Remove the test leads.

**COMPOSITE LEVELS:** When two or more transmitters are connected on one communications line each individual transmitter level should be adjusted at a reduced level in order for the combined (composite) signals not to exceed the

desired output level. Refer to the chart below for recommended levels referenced to 0 dBm. The recommended dBm levels may also be used as reference for any desired level setting in dB; Example: For two transmitters with a desired composite level of -6 dBm, reduce the desired level of each transmitter by 3 dB (from chart below) and set each to -9 dBm.

Number of tone channels on line	Recommended levels dBm	RMS Volts (600 Ohms)
1	0	0.78
2	-3	0.55
3	-5	0.45
4	-6	0.40
5	-7	0.35
6 to 7	-8	0.30
8 to 10	-10	0.25
12 to 16	-12	0.20

### 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.**

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 two 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 two 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 two 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 two quarter turn screws on the front panel clockwise. Turn the power supply switch to "ON".

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 IT-98DSP & IT98DSP-1U (1898-00)**

<b>Circuit Symbol</b>	<b>Description</b>	<b>INIVEN Part Number</b>
<b>CAPACITORS:</b>		
C1-4,6	Capacitor,tantalum dipped,1uF,20V,+/-10%,DT20V105K or equiv.	DT20V105K
C10	Capacitor,metalized polycarbonate,.01uF,100V,+/-3%,MPC32E103H or equiv.	MPC32E103H
C14	Capacitor,metalized polycarbonate,.022uF,100V,+/-3%,MPC32E223H or equiv.	MPC32E223H
C12	Capacitor,metalized polycarbonate,.027uF,100V,+/-3%,MPC32E273H or equiv.	MPC32E273H
C13	Capacitor,metalized polycarbonate,.0022uF,100V,+/-3%,MPC32E222H or equiv.	MPC32E222H
C16	Capacitor,ceramic,100pF,50V,+/-5%,CM-NPO-D-101-J or equiv.	CM-NPO-D-101-J
C7-9	Capacitor,ceramic,18pF,100V,+/-5%,CM-NPO-E-180-J or equiv.	CM-NPO-E-180-J
C36,37	Capacitor,ceramic,330pF,100V,+/-5%,CM-NPO-D-331-J or equiv.	CM-NPO-D-331-J
C11	Capacitor,metalized polycarbonate,.0082uF,100V,+/-2%,MPC32E822G or equiv.	MPC32E822G
C17	Capacitor,tantalum,4.7uF,35V,+/-10%,DT35V475K or equiv.	DT35V475K
C5,18-35	Capacitor,ceramic,.1uF,50V,+/-20%,CM-Z5U-D-104-M or equiv.	CM-Z5U-D-104-M
<b>RESISTORS:</b>		
R1	Resistor,carbon,6.2K,1/4 watt,+/- 5%. or equiv.	RCF07J622
R2,3	Resistor,carbon,5.6K,1/4 watt,+/- 5%. or equiv.	RCF07J562
R4,7	Resistor,carbon,50K,1/4 watt,+/- 5%. or equiv.	RCF07J503
R5,8	Resistor,carbon,20K,1/4 watt,+/- 5%. or equiv.	RCF07J203
R6,9	Resistor,carbon,1.0K,1/4 watt,+/- 5%. or equiv.	RCF07J102
R18,19,33	Resistor,carbon,680 ohms,1/4 watt,+/- 5%. or equiv.	RCF07J681
R21	Resistor,carbon,3.9K,1/4 watt,+/- 5%. or equiv.	RCF07J392
R20	Resistor,carbon,4.7K,1/4 watt,+/- 5%. or equiv.	RCF07J472
R14-17,28	Resistor,carbon,10K,1/4 watt,+/- 5%. or equiv.	RCF07J103
R10-13,32	Resistor,carbon,100K,1/4 watt,+/- 5%. or equiv.	RCF07J104
R30	Resistor,carbon,27K,1/4 watt,+/- 5%. or equiv.	RCF07J273
R31	Resistor,carbon,220K,1/4 watt,+/- 5%. or equiv.	RCF07J224
R29	Resistor,carbon,33K,1/4 watt,+/- 5%. or equiv.	RCF07J333
R22	Resistor,carbon,2.4K,1/4 watt,+/- 5%. or equiv.	RCF07J214
R26	Resistor,metal film,1.18K,1/4 watt,+/- 1%. or equiv.	RN55D1181F
R27	Resistor,metal film,10K,1/4 watt,+/- 1%. or equiv.	RN55D1002F
R34-36	Resistor,metal film,100K,1/4 watt,+/- 1%. or equiv.	RN55D1003F
R37	Resistor,metal film,105K,1/4 watt,+/- 1%. or equiv.	RN55D1053F
R24	Resistor,variable,50K,3/4 watt,10 turn or equiv.	3008P-1-503
<b>SEMICONDUCTORS</b>		
D1,2,4,5	Diode,avalanche,400V,1A,1N4004 or equiv.	1N4004
D3	Diode,Zener,5.6V,1N752A or equiv.	1N752A

**Table 1. Replaceable parts (continued)**

<b>Circuit Symbol</b>	<b>Description</b>	<b>INIVEN Part Number</b>
<b>SEMICONDUCTORS (continued)</b>		
D6	Diode,general purpose,1N914 or equiv.	1N914
DS1-4	LED,Red,Dialight 550-1106 or equiv.	550-1106-RED
Q1-5	Transistor,NPN 2N4401 or equiv.	2N4401
U1	NOT USED IN STANDARD APPLICATIONS	
U2	Negative voltage regulator,-5 Vdc,Motorola MC79M05CT or equiv.	MC79M05CT
U3	Dual phototransistor,Motorola MCT6 or equiv.	MCT6
U4	Octal/bus driver,non-inverting,National Semiconductor MM74HC244N or equiv.	MM74HC244N
U6,7	EPROM,2K x 8-bit,Cypress Semiconductor CY7C291-50WC or equiv.	CY7C291-50WC
U5	Digital signal processor (DSP),Texas Instruments TMS320C10NL or equiv.	TMS320C10NL
U10,11	Counter,Binary Resettable SYNC/ASYNc,National Semiconductor MM74HC161N or equiv.	MM74HC161N
U8	3 line to 8 line decoder/demultiplexer,National Semiconductor MM74HC138N or equiv.	MM74HC138N
U9	Watchdog Timer,Dallas Semiconductor DS1232 or equiv.	DS1232
U12,13	Octal inverting buffer,3 state,National Semiconductor MM74HC240N or equiv.	MM74HC240N
U15	Quad 2-input nand schmidt trigger,National Semiconductor MM74HC132N or equiv.	MM74HC132N
U14	14-bit DAC	AD7840JN
U16	Dual operational amplifier,Texas Instruments TL082IP or equiv.	TL082IP
U17	Dual amplifier,Texas Instruments TL081CT or equiv.	TL081CT
U18	Hex Inverter,National Semiconductor MM74HC04N or equiv.	MM74HC04N
<b>MISCELLANEOUS COMPONENTS:</b>		
T1	Transformer, INIVEN	CC1213-00
SW1,2	Switch,DIP 8 position,Alcoswitch or equiv.	ADF-08
SW3	Switch,DIP 4 position,Alcoswitch or equiv.	ADF-04
Y1	Crystal,quartz,20 MHz. or equiv.	SE200-AS

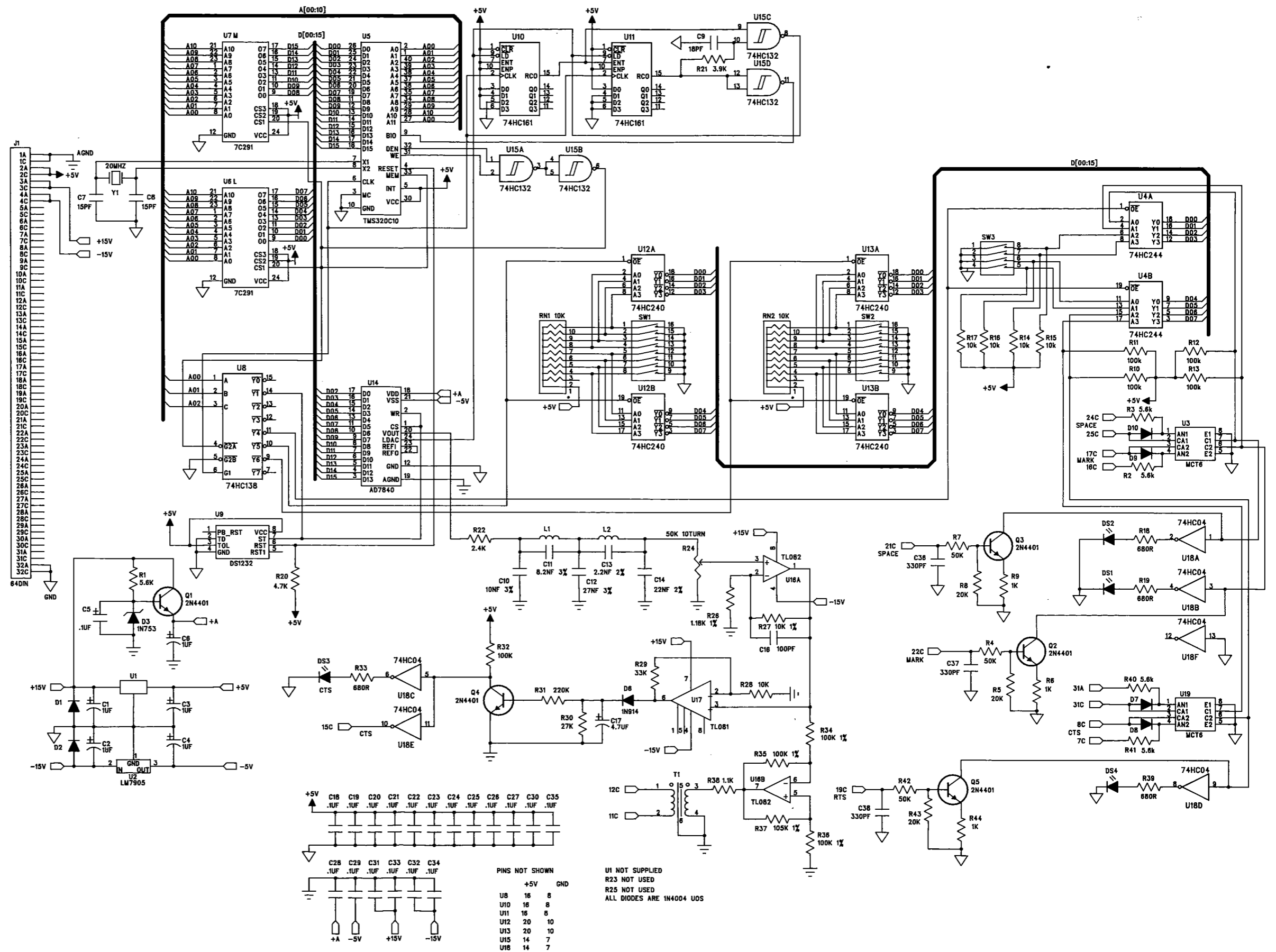


Figure 6, Schematic.

## WARRANTY AGREEMENT

We hereby certify that the INIVEN product line carries a warranty for any part which fails during normal operation or service for 12 Years. 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.

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