

INIVEN

DIVISION OF CONOLOG CORP.

INSTRUCTION MANUAL

IT-30DSP

PROGRAMMABLE FSK TONE TRANSMITTER

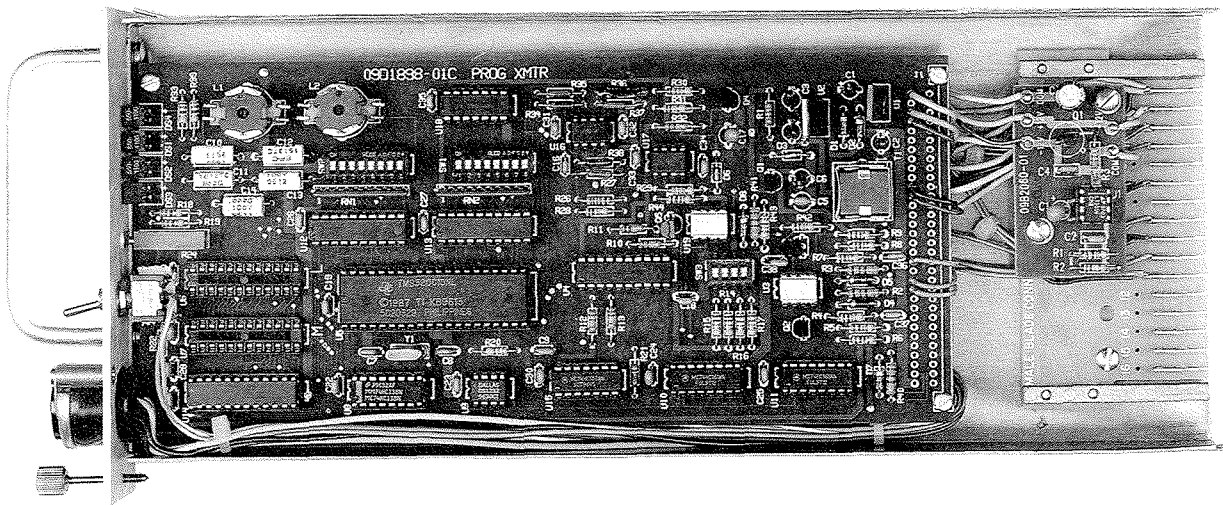


Fig. 1. IT-30DSP

DESCRIPTION: The IT-30DSP is a programmable frequency shift keyed (FSK) tone transmitter intended for the use on the transmitting 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.

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

Utilizing state of the art design and crystal controlled Digital Signal Processing (DSP) techniques provides for improved performance, flexibility, and reliability.

FEATURES:

- Voltage keying inputs provided on each unit (optical keying optional).
- 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.
- 12 Year Warranty.

SPECIFICATIONS:

Output Level: Front panel adjustable to +5 dBm.

Output Impedance: 15 K Ω minimum.

Keying inputs: Mark and Space, High impedance 3-30 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.

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

Spectral Purity: Harmonic content: 70dB below carrier level. Spurious signals at adjacent channels: 70dB 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: +12 Vdc \pm 35% (7.8 to 16.2 Vdc), 130 ma @ 12 V

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. In the two frequency mode, 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 center frequency is not produced.

In a three frequency unit the center frequency is normally generated when neither a mark or space output is present. When the transmitter is keyed to the space frequency the receiver space output is activated and when the transmitter is keyed to the mark frequency the receiver mark output is activated. Only one keying input should be on at a given time unless the IT-30DSP and receiver are set to operate in flasher mode. The Flasher option on the IT-30DSP allows the unit to shift between mark and space frequencies rapidly when both inputs are keyed simultaneously.

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 need 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 buffers (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(Digital Signal Processing): The microprocessor (U5) operating parameters are determined by the two EPROM's (2K 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 - C14) limiting the signals to 4kHz. Variable resistor (R24) adjust the signal level which is amplified by operational amplifier (U16). The signal is coupled to the line via transformer T1.

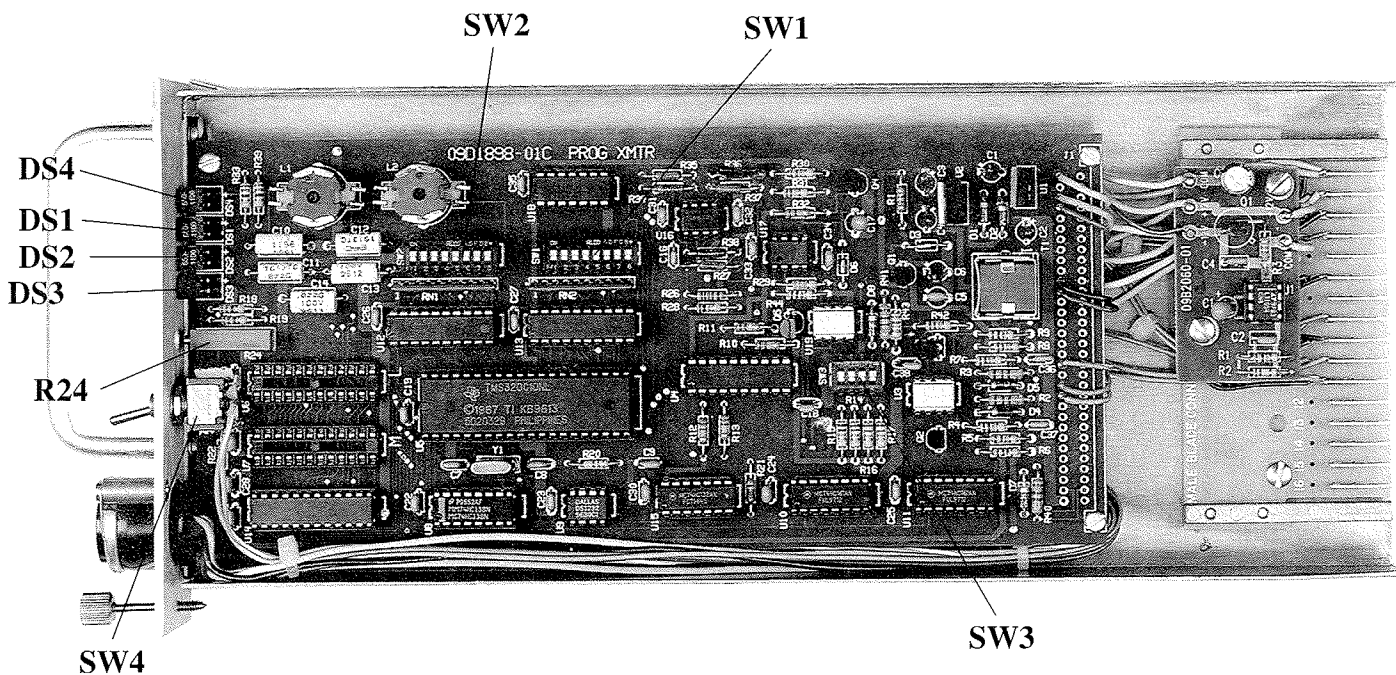
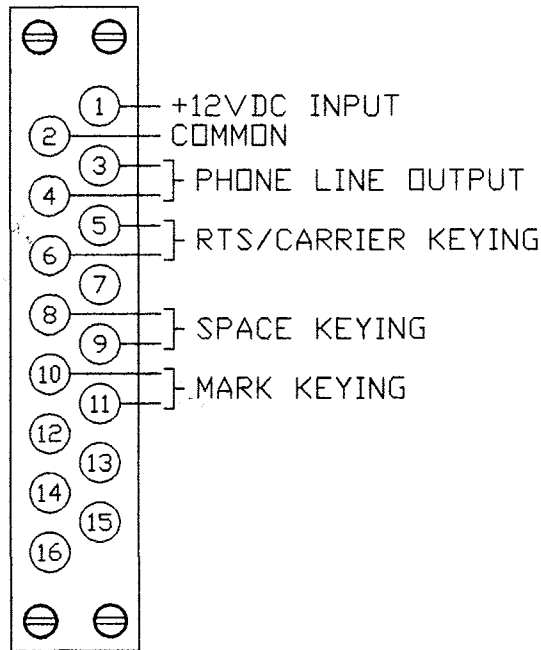


Fig. 2. Controls & Indicators

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 (mark, space or center) is present at the output.
DS4	Indicator, (RTS), Request to send, lights when RTS is keyed.
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).
SW4	Switch, Front Panel, Keys RTS when SW3 position 4 is on (see SW3 settings)



IT-30DSP

Fig. 3. Terminal Block (TB1)

INSTALLATION:

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 terminal block already mounted. Each new unit is shipped with the terminal block plugged into the rear of the unit. There are also four 6-32 screws shipped with it to mount the terminal block to the chassis. Locate the desired position within the chassis for which the module is to be placed. 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.

Interconnected Chassis or equipment mounted on shipping rails is 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 terminal blocks on the rear of the chassis. Each unit in the Gen 1 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 wired 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.

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 block.

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.

INITIAL STARTUP & LEVEL CHECKS:

FREQUENCY SELECTION: With the module removed from the chassis. Select the desired bandwidth and center frequency from the enclosed charts. Refer to figure 2 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 2 for switch location.

SWITCH SW3 SETTINGS:

All Positions "OFF": 3F Operation. Keying the Mark input produces a Mark frequency out, keying the Space input provides a Space frequency out. The center frequency will be output when the input is idle.

Position 1 "ON" only: 3F Operation, Inverted Output. Keying the Mark input produces a Space frequency out, keying the Space input produces a Mark frequency out. The center frequency will be output when the input is idle.

Position 2 "ON" only: 2F Operation. Keying the Mark input produces the Mark frequency when keyed. The Space frequency is output when the input is idle. The keying leads should be on the Mark input. Do not use this option with position 3 in the "ON" position.

Position 3 "ON" only: 3F Operation, FLASHER. The transmitter will shift at 20msec intervals between Mark and Space when the Mark and Space inputs are keyed at the same time. (This operation will not function if the position 2 is in the "ON" position).

Position 4 "ON" only: (RTS). When position 4 is on, the front panel switch is activated. When position 4 is in the off position, the front panel switch will not be able to turn off the output(s). RTS can also be keyed from the RTS input on the rear terminal block when the front panel switch (SW4) is in the "OFF" position. This option may be used in all modes.

Positions 1 & 2 "ON": 2F operation, Inverted Output. Keying the Mark input produces a Space frequency output. The Mark frequency is output when the input is idle. The keying leads should be on the Mark input. Do not use this option with position 3 in the "ON" position.

ADJUSTMENTS: The transmitter contains a front panel LEVEL adjustment (R24) (see figure 2 for location). Each transmitter is shipped from the factory with the level adjustment set at -6 dBm, which is adequate for most applications.

The following equipment is recommended to perform the initial startup and level checks at:

1. Digital multimeter with dB readout function; Fluke 8060A or equivalent.
2. Flatblade screw driver with 1/8 inch wide tip or potentiometer adjustment tool.
3. Optional - Card Extender.

WARNING: DO NOT INSERT THE UNIT INTO A RACK WITH THE POWER ON.

INITIAL SETTINGS: With the power (+12Vdc) and phone line wired to the terminal blocks on the rear of the chassis, connect the test leads of the multimeter (dB mode) across the "tone out" on the terminal block. Turn on the power and note the reading on the multimeter (the tone output on the terminal block should be connected to the line or if this is not possible, 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 the 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.

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.

MULTIPLE TONE OUTPUT LEVELS		
Number of Channels	dB Level	RMS V 600 Ω
1	0	0.7746
2	-3	0.5484
3	-4.8	0.4457
4	-6	0.3882
5	-7	0.3460
6	-7.8	0.3156
7	-8.5	0.2911
8	-9	0.2748
9	-9.5	0.2595
10	-10	0.2449
11	-10.4	0.2339
12	-10.8	0.2234
13	-11.1	0.2158
14	-11.5	0.2061
15	-11.8	0.1991
16	-12	0.1946
17	-12.3	0.1880
18	-12.5	0.1837
19	-12.8	0.1774
20	-13	0.1734
21	-13.2	0.1695
22	-13.4	0.1656
23	-13.6	0.1618
24	-13.8	0.1582

EXAMPLE: For two transmitters with a desired composite level of -6 dBm, reduce the desired level of each transmitter by 3 dB (from the chart below) and set each to -9 dBm.

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 IN OR OUT OF SERVICE. ANY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT WILL VOID THE WARRANTY.

NOTE: In the event a replacement module is being installed check all switch settings prior to installation. Comparison with the removed module is one convenient method.

FOR 50 BAUD OPERATION	
SET POSITION 1 OF SW2 "ON"	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
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

FOR 60 BAUD OPERATION	
SET POSITION 2 OF SW2 "ON"	
To Obtain Center Freq. Hz	Set Listed Positions of SW1 to "ON"
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

FOR 85 BAUD OPERATION	
SET POSITION 3 OF SW2 "ON"	
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
2805	5,7
2975	1,5,7
3145	2,5,7
3315	1,2,5,7
3485	3,5,7

FOR 120 BAUD OPERATION	
SET POSITION 4 OF SW2 "ON"	
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	1,4,5,6
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

FOR 170 BAUD OPERATION	
SET POSITION 5 OF SW2 "ON"	
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

FOR 240 BAUD OPERATION	
SET POSITION 6 OF SW2 "ON"	
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

FOR 300 BAUD OPERATION	
SET POSITION 7 OF SW2 "ON"	
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

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

Table 1. Replaceable parts IT-30DSP

Circuit Symbol	Description	INIVEN Part Number
CAPACITORS:		
C14, 6	Capacitor, tantalum dipped, 1uF, 20V, +/-10%	DT20V105K
C5, 18-35	Capacitor, ceramic, .1uF, 50V, +/-20%	CM-Z5U-D-104-M
C7-9	Capacitor, ceramic, 18pF, 100V, +/-5%	CM-NPO-E-180-J
C10	Capacitor, metalized polycarbonate, .01uF, 100V, +/-3%	MPC32E103H
C11	Capacitor, metalized polycarbonate, .0082uF, 100V, +/-2%	MPC32E822G
C12	Capacitor, metalized polycarbonate, .027uF, 100V, +/-3%	MPC32E273H
C13	Capacitor, metalized polycarbonate, .0022uF, 100V, +/-3%	MPC32E222H
C14	Capacitor, metalized polycarbonate, .022uF, 100V, +/-3%	MPC32E223H
C16	Capacitor, ceramic, 100pF, 50V, +/-5%	CM-NPO-D-101-J
C17	Capacitor, tantalum, 4.7uF, 35V, +/-10%	DT35V475K
C36, 37	Capacitor, ceramic, 330pF, 100V, +/-5%	CM-NPO-D-331-J
RESISTORS:		
R1	Resistor, carbon, 6.2K, 1/4 watt, +/-5%	RCF07J622
R2, 3	Resistor, carbon, 5.6K, 1/4 watt, +/-5%	RCF07J562
R4, 7	Resistor, carbon, 50K, 1/4 watt, +/-5%	RCF07J503
R5, 8	Resistor, carbon, 20K, 1/4 watt, +/-5%	RCF07J203
R6, 9	Resistor, carbon, 1.0K, 1/4 watt, +/-5%	RCF07J102
R10-13, 32	Resistor, carbon, 100K, 1/4 watt, +/-5%	RCF07J104
R14-17, 28	Resistor, carbon, 10K, 1/4 watt, +/-5%	RCF07J103
R18, 19, 23	Resistor, carbon, 680, 1/4 watt, +/-5%	RCF07J681
R20	Resistor, carbon, 4.7K, 1/4 watt, +/-5%	RCF07J472
R21	Resistor, carbon, 3.9K, 1/4 watt, +/-5%	RCF07J392
R22	Resistor, carbon, 2.4K, 1/4 watt, +/-5%	RCF07J214
R24	Resistor, variable, 50K, 3/4 watt, 10 turn	3008P-1-503
R26	Resistor, metal film, 1.18K, 1/4 watt, +/-1%	RN55D1181F
R27	Resistor, metal film, 10K, 1/4 watt, +/-1%	RN55D1002F
R29	Resistor, carbon, 33K, 1/4 watt, +/-5%	RCF07J333
R30	Resistor, carbon, 27K, 1/4 watt, +/-5%	RCF07J273
R31	Resistor, carbon, 220K, 1/4 watt, +/-5%	RCF07J224
R34-36	Resistor, metal film, 100K, 1/4 watt, +/-1%	RN55D1003F
R37	Resistor, metal film, 105K, 1/4 watt, +/-1%	RN55D1053F
SEMICONDUCTORS:		
D1, 2, 4, 5	Diode, avalanche, 400V, 1A	1N4004
D3	Diode, zener, 5.6V	1N752A
D6	Diode, general purpose	1N914
DS14	LED, red	550-1106-RED
Q1-5	Transistor, NPN	2N4401
U1	NOT USED IN STANDARD APPLICATIONS	
U2	Negative voltage regulator, 5 Vdc	MC79M05CT
U3	Dual phototransistor	MCT6
U4	Octel/bus driver, non-inverting	MM74HC244N
U6, 7	EPROM, 2K x 8bit	CY7C291-50WC
U5	Digital signal processor (DSP)	TMS320C10NL
U10, 11	Counter, binary resettable SYNC/ASYNC	MM74HC161N
U8	3 line to 8 line decoder/demultiplexer	MM74HC138N
U9	Watchdog timer	DS1232
U 12, 13	Octal inverting buffer, 3 state	MM74HC240N
U15	Quad 2input nand schmidt trigger	MM74HC132N
U14	14bit DAC	AD7840JN
U16	Dual operational amplifier	TLO82IP
U17	Dual amplifier	TL081CT
U18	Hex inverter	MM74HC04N

Circuit Symbol	Description	INIVEN Part Number
MISCELLANEOUS COMPONENTS:		
T1	Transformer, INIVEN	CC1992-00
SW1,2	Switch, DIP 8 position	ADF-08
SW3	Switch, push button	ADF-04
SW4	Switch, toggle	7101SYZB
Y1	Crystal, quartz,20 MHz.	SE200-AS

Table 1. Replaceable Parts, Voltage Converter board:

Circuit Symbol	Description	INIVEN Part Number
CAPACITORS:		
C4	Capacitor, ceramic, 0.1uF, 50V, +/-20%	CM-Z5U-D-104M
C1	Capacitor, tantalum, 10uF, 35V, +/-20%	DT35VI06M
C2	Capacitor, ceramic, 0.047uF, 50V, +/-10%	CM-X7R-D-473K
C3	Capacitor, electrolytic, 100uF, 35V, +/-10%	ER35V107
RESISTORS:		
R3	Resistor, carbon, 2.2K, 1/4 watt, +/-5%	RCF07J222
R1	Resistor, carbon, 20K, 1/4 watt, +/-5%	RCF07J203
R2	Resistor, carbon, 200K, 1/4 watt, +/-5%	RCF07J204
SEMICONDUCTORS:		
Q1	Transistor, NPN	2N4401
U1	Switched capacitor voltage converter	LT1054CN8

NOTES

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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