

INIVEN

INSTRUCTION MANUAL

IMT-98 AND IMT-98-1U

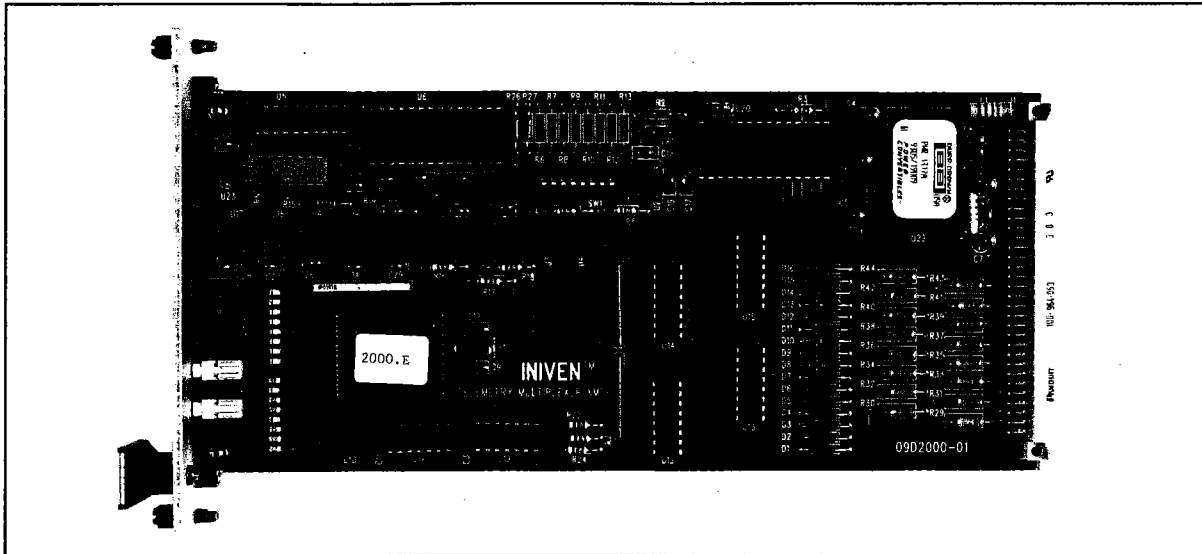


Fig. 1. IMT-98 Multiplexer Transmitter

DESCRIPTION: The IMT-98 and IMT-98-1U are programmable analog to digital transmitters when used in conjunction with the INIVEN IMR-98 and IMR-98-1U comprise a subsystem capable of sending up to 8 analog quantities and sixteen discrete (ex. controls, status) functions. The units work in conjunction with INIVEN's Series 98 FSK transmitters as well as other modems over a voice frequency communication media.

The Multiplexer transmitters are switch programmable for baud rates from 50 to 600 in eight steps. Options for 1200 and 2400 baud operation and polling applications are available.

A second switch permits field programming of eight standard analog input voltage ranges. Applications requiring other ranges are accommodated via a resistor change. Bi-polar and uni-polar are available with the highest range being +/- 10 volts.

FEATURES:

- 8 analog and 16 discrete quantity capability with no calibration required.
- Optically isolates analog & discrete inputs providing 1500 volt isolation from input to output.
- Added security through BCH Coding.
- Dip switch programmable for various input voltage ranges (analog), baud rates and number of analog and discrete channels (reducing update time).

SPECIFICATIONS:

Analog inputs: 0, 1 to 8.

Input Range: Various voltage ranges (See Chart 1, page 8), Current ranges are obtained by adding the appropriate Shunt resistor to the I/O MUX module.

Analog Resolution: 12 Bit A/D converter.

Analog Accuracy: +/- .05% of Full Scale.

Analog Linearity: +/- .025%

Input isolation: 1500 VDC for both Analog and Discrete inputs.

Discrete Input Voltages: 4VDC to 53VDC, Optional 25VDC to 150VDC available.

Digital Output: 0 (zero) V to 5 V [CMOS].

Operating Bandwidths: 50, 60, 85, 120, 170, 240, 300 & 600 baud standard. 1200 & 2400 baud rates available.

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: +5VDC 95 mA.
 +15VDC 70 mA. (for 8 analog & 16 discrete unit)
 -15VDC 12.5 mA.

Physical

Weight: 0.48 lbs. (.22 Kg)

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

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

When ordering, refer to Table 1 for multiplexer transmitter part numbers.

TABLE 1

MODEL NUMBER	PART NUMBER	# OF ANALOGS	# OF DISCRETES
IMT-98-00	CC2000-00	8	16
IMT-98-1U-00	CC2123-00	8	16
IMT-98-01	CC2000-01	1	16
IMT-98-1U-01	CC2123-01	1	16
IMT-98-02	CC2000-02	0	16
IMT-98-1U-02	CC2123-02	0	16

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: This unit generates a serial digital word which is dependent upon the status and analog information as compiled by the micro controller.

DIGITAL CODE: The code contains 5 digital words. Each word has a length of 8 bits, 1 start, 1 stop and 1 parity. The first word contains the BCH security code. The second word contains the eight (8) most significant bits of the Analog to Digital converter. The third word contains the next four (4) least significant bits of the Analog to Digital converter, 3 bits for the address code and one (1) extra bit for security. The fourth word contains the first eight status bits, while the fifth and final word contains the remaining eight (8) status bits.

PROGRAMMING: Upon applying power to the unit the micro-controller reviews the program information which has been set by the switches SW2 & SW3.

INPUT: The sixteen (16) status inputs are fed into the opto-isolators U12, U13, U14, U15. This status information is then sent to the micro-controller. The eight (8) analog inputs are fed into the input multiplexer (U1) and then amplified by the differential amplifier (U2). The desired gain level for the various selectable input voltages or currents is set by programming switch SW1. The A/D converter (U6) converts the analog voltage to a digital word & then is fed to the opto-isolators U8, U9, U16, U17.

MICRO CONTROLLER: The Micro Controller (U4) accepts the information from the 16 status and 8 analog inputs. It then converts this information into a serial data word and adds a trailing BCH security code for output to a modem.

WATCH DOG TIMER: (U10) 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.

See Figure 4 Block Diagram and IMT-98 Schematic for reference.

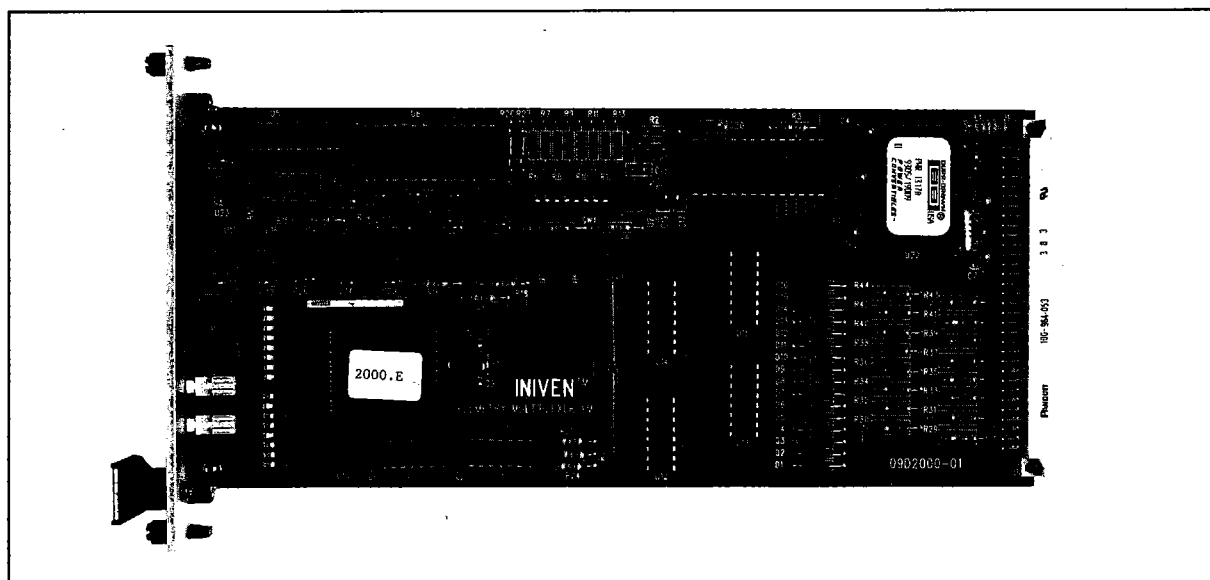


Fig. 2 Controls & Indicators

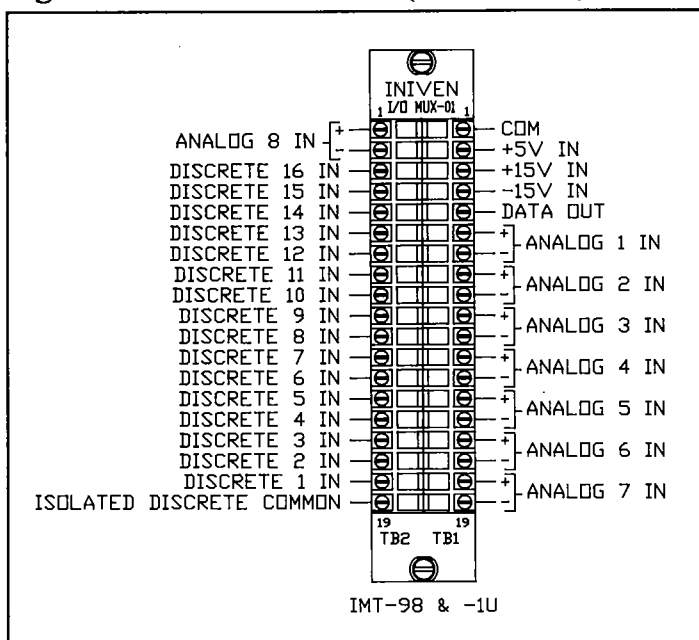
Table 2 Controls and Indicators

- DS1 Indicator, **(DATA OUT)**, lights when data is present.
- SW1 Switch, Programs analog input range.
- SW2 Switch, Programs baud rate, number of analog channels used and 8 or 16 status points in use.
- SW3 Switch, Future use.
- JP1 Jumper, determines unpolar or bi-polar.
- JP2 Jumper, determines 10 volt or 20 volt span.

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.

Fig. 3 Standard MUX I/O (CC2092-00)



I/O MUX-01 DESCRIPTION: This I/O module is installed from the rear of the chassis. There are 38 terminal connections on the terminal block. Four connections for power, 17 connections for status, 16 connections for the analogs and one for data out. The standard IMT-98 unit will permit for all inputs as shown in the programming charts. Designated locations for shunt resistors are located on this I/O board for current input. Shunt resistors can be provided and mounted as an option to the I/O MUX-01. See I/O MUX-01 schematic.

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 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 frame 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 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 IMT-98 and IMT-98-1U supplied loose may be interfaced with the I/O shown herein. External wiring is to be in accordance with the 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 may be daisy chained should the application require.
Tighten all connections and insure exposed wires do not touch the chassis.

BAUD RATE SELECTION: CHART 1

SETTING THE BAUD RATE

TO OBTAIN THIS BAUD	SET LISTED POSITIONS OF SW2 "ON"
50	3,4,5
60	3,4
85	3,5
120	3
170	4,5
240	4
300	5
600	NONE

NOTE: OTHER BAUD RATES AVAILABLE ON SPECIAL ORDER (EX. 1200 & 2400 BAUD)

To set the desired baud rate the user must position the switches of the Switch Bank labeled SW2 as shown in Chart 1. The multiplexer transmitter (IMT-98) baud rate must not exceed the baud rate of its corresponding FSK transmitter, however it can be equal to it. There will be no adverse effects if the multiplexer baud rate is slower than that of the FSK transmitter, however the baud rate of the multiplexer is what will determine the update time (See Chart 4). This is the total time for the unit to fully scan its code of 5 digital words. For this reason, to obtain the optimum update time, we recommend that the multiplexer baud rate be set equal to that of its associated FSK transmitter.

INPUT VOLTAGE SELECTION:

In order to insure accurate transmission of the analog quantities, the IMT-98 input voltage range must be set to correspond with the associated device output (current or voltage). In order to properly program the IMT-98 for the desired input voltage range the user must be prepared to modify three parameters; Jumpers JP1 & JP2 and positions of the switches on DIP SWITCH SW1, all located on the IMT-98 PC Board.

CHART 2

TO OBTAIN THIS RANGE	SET LISTED POSITIONS OF SW1 "ON"	SET JUMPER POSITIONS TO:	
		JP1	JP2
+/-10V	ALL OFF	A&B	B&C
+/-5V	ALL OFF	A&B	A&B
+/-4V	2	A&B	B&C
+/-2.5V	1	A&B	A&B
+/-2V	2	A&B	A&B
+/-1V	3	A&B	A&B
+/-0.5V	4	A&B	A&B
+/-250mV	5	A&B	A&B
+/-200mV	6	A&B	B&C
+/-100mV	6	A&B	A&B
+/-50mV	7	A&B	A&B
0-10V	ALL OFF	B&C	A&B
0-5V	1	B&C	A&B
0-4V	2	B&C	A&B
0-2V	3	B&C	A&B
0-1V	4	B&C	A&B
0-0.5V	5	B&C	A&B
0-0.2V	6	B&C	A&B
0-0.1V	7	B&C	A&B

Once you have located those components, refer to CHART 2 for the desired input voltage range. Remember that if a current range is desired, for each analog value, a shunt resistor must be used and can be mounted on the I/O STD module .

Note: Shunt resistor values must convert currents to any of the programmable voltage ranges shown in chart 2.

$$I \text{ (current)} * R \text{ (resistance)} = V \text{ (voltage)}$$

(Most common resistor used is 100 ohm)

Ex: A 4-20mA input could use a 100 ohm resistor in conjunction with programmable range 0-2V (load will produce actual voltage of .4 to 2V) (Resistor choice is dependent upon transducer capability).

Note: POWER (WATTAGE) is dependent upon the voltage range selected from Chart 2 and the current supplied by the external loop.

$$P \text{ (power)} = I \text{ (current)} * V \text{ (voltage)}$$

NUMBER OF CHANNELS IN USE

CHART 3A

NUMBER OF ANALOG CHANNELS IN USE.	
NUMBER OF ANALOGS	SET LISTED POSITIONS OF SW2 "ON"
1	6,7,8
2	6,7
3	6,8
4	6
5	7,8
6	7
7	8
8	

CHART 3B

NUMBER OF DISCRETE CHANNELS IN USE.	
NUMBER OF DISCRETES	SET LISTED POSITIONS OF SW2
8	2 "ON"
16	2 "OFF"

Now that the baud rate and desired input voltage range has been programmed, you may wish to further decrease the update time. Charts 3A & 3B permit the user to identify the number of analog and discrete channels in use. By only scanning the information for the precise number of analogs and discrettes in use, the user can further decrease the update time.

MULTIPLEXER UPDATE TIME

CHART 4

UPDATE TIME		
BAUD RATE	TIME 1 BIT	TIME 1 CYCLE
50	20 ms	1120 ms
60	16.666 ms	930 ms
85	11.76 ms	662 ms
120	8.33 ms	472 ms
170	5.88 ms	339 ms
240	4.166 ms	244 ms
300	3.333 ms	198 ms
600	1.666 ms	107 ms

Chart 4 shows the actual end to end update times required depending on the baud rate used. These times represent the IMT-98 set for 1 analog and 16 discrete quantities. When the IMT-98 is set for more than one analog, the number of analogs should be multiplied by the update time shown for the corresponding baud rate to derive the total update time.

IMPORTANT: THE 98 SERIES EQUIPMENT ONLY READS THE DIP SWITCHES DURING POWER-UP. IF YOU MOVE ANY OF THE DIP SWITCHES, THE POWER SUPPLY WILL HAVE TO BE TURNED OFF AND THEN TURNED BACK ON AGAIN BEFORE THE UNIT WILL RESPOND TO THE NEW SWITCH SETTINGS.

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 preventative 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.

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 the 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 supply.

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 "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 operating 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 **twelve year warranty** in this manual. All returns require an **INIVEN RMA #** which can also be attained by calling 800-526-3984.

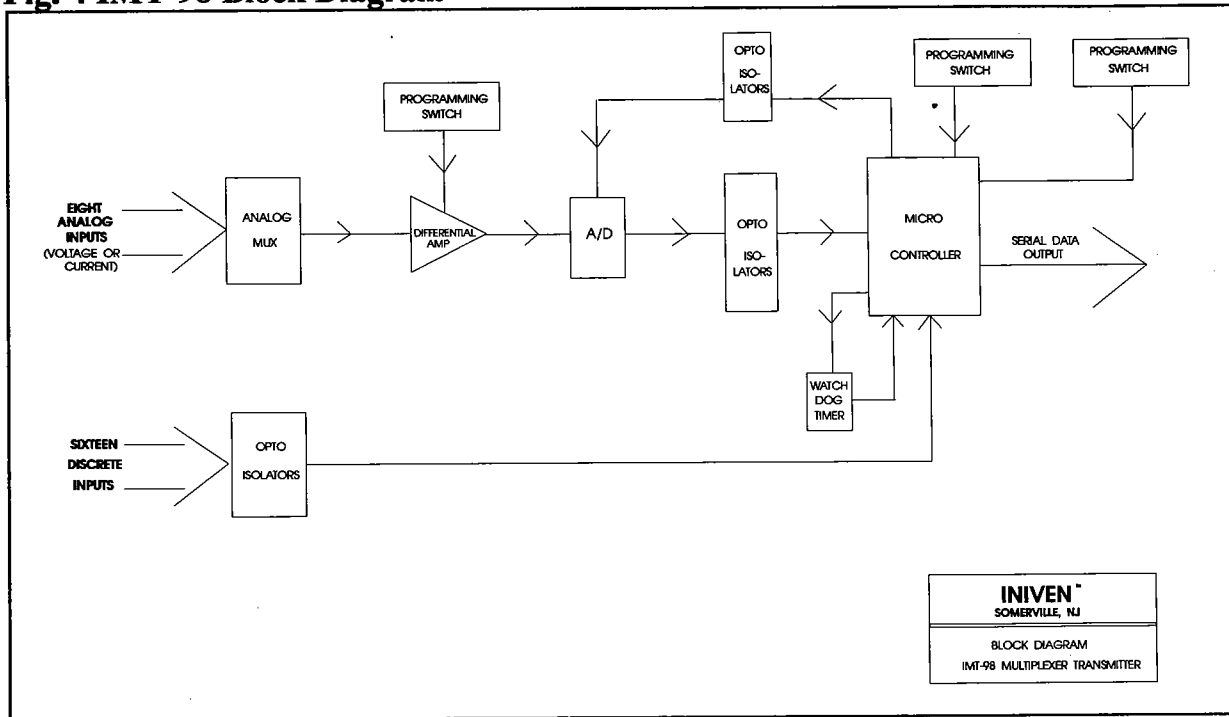
Table 1. Replaceable Parts IMT-98 (CC2000-00) & IMT-98-1U (CC2123-00)

Circuit Symbol	Description	INIVEN Part Number
CAPACITORS:		
C1,3-5,7	Capacitor,tantalum,10uF,35V,+/-20%,DT35V106M or equiv.	DT35V106M
C2,6,8	Capacitor,ceramic,0.1uF,100V,+/-5%,CM-X7R-E-104-J or equiv.	CM-X7R-E-104J
C11-22,26-32	Capacitor,ceramic,0.1uF,50V,+/-20%,CM-Z5U-D-104-M or equiv.	CM-Z5U-D104M
C23,24	Capacitor,tantalum,1uF,20V,+/-10%,DT20V105K or equiv.	DT20V105K
RESISTORS:		
RN1	Resistor Network,DIP 9 PIN 8 Resistor 2K,4116R001-202 or equiv.	4116R001-202
RN2	Resistor Network,SIP 10 PIN 9 Resistor 1K,4310R-101-102 or equiv.	4310R-101-102
RN3,RN4	Resistor Network,SIP 9 PIN 8 Resistor 100K,4309R-101-104 or equiv.	4310R-101-104
RN5	Resistor Network,SIP 4 PIN 3 Resistor 1K,4304M-101-102 or equiv.	4304M-101-102
R1,2	Resistor,carbon,2.2M,1/4 watt,+/-5% or equiv.	RCF07J225
R3-5	Resistor,carbon,4.7K,1/4 watt,+/-5% or equiv.	RCF07J472
R6	Resistor,wire wound,49.4K,1/4 watt,+/-0.01% or equiv.	wwr1/10T49400
R7	Resistor,wire wound,32.933K,1/4 watt,+/-0.01% or equiv.	wwr1/10T32933
R8	Resistor,wire wound,12350 ohm,1/4 watt,+/-0.01% or equiv.	wwr1/10T12350
R9	Resistor,wire wound,5488.88 ohm,1/4 watt,+/-0.01% or equiv.	wwr1/10T5488r88
R10	Resistor,wire wound,2.6K,1/4 watt,+/-0.01% or equiv.	wwr1/10T2600
R11	Resistor,wire wound,1008.16 ohm,1/4 watt, +/-0.01% or equiv.	wwr1/10T1008r16
R12	Resistor,wire wound,498.98 ohm,1/4 watt,+/-0.01% or equiv.	wwr1/10T498r989
R13	Resistor,wire wound,1K,1/4 watt,+/-0.01% or equiv.	wwr1/10T1000
R14	Resistor,carbon,20K,1/4 watt,+/-5% or equiv.	RCF07J203
R15	Resistor,carbon,10K,1/4 watt,+/-5% or equiv.	RCF07J103
R16-19,22-24	Resistor,carbon,2K,1/4 watt,+/-5% or equiv.	RCF07J202
R26,27	Resistor,metal film,49.9 ohm +/-100ppm,1/4 watt,+/-1% or equiv.	RN55D49R9F
R28	Resistor,carbon,620 ohm,1/4 watt,+/-5% or equiv.	RCF07J621

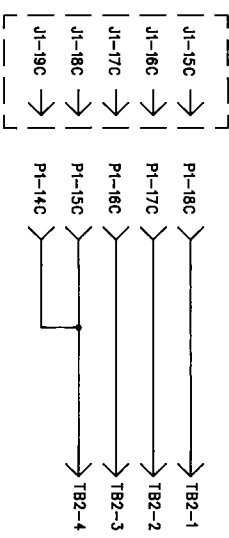
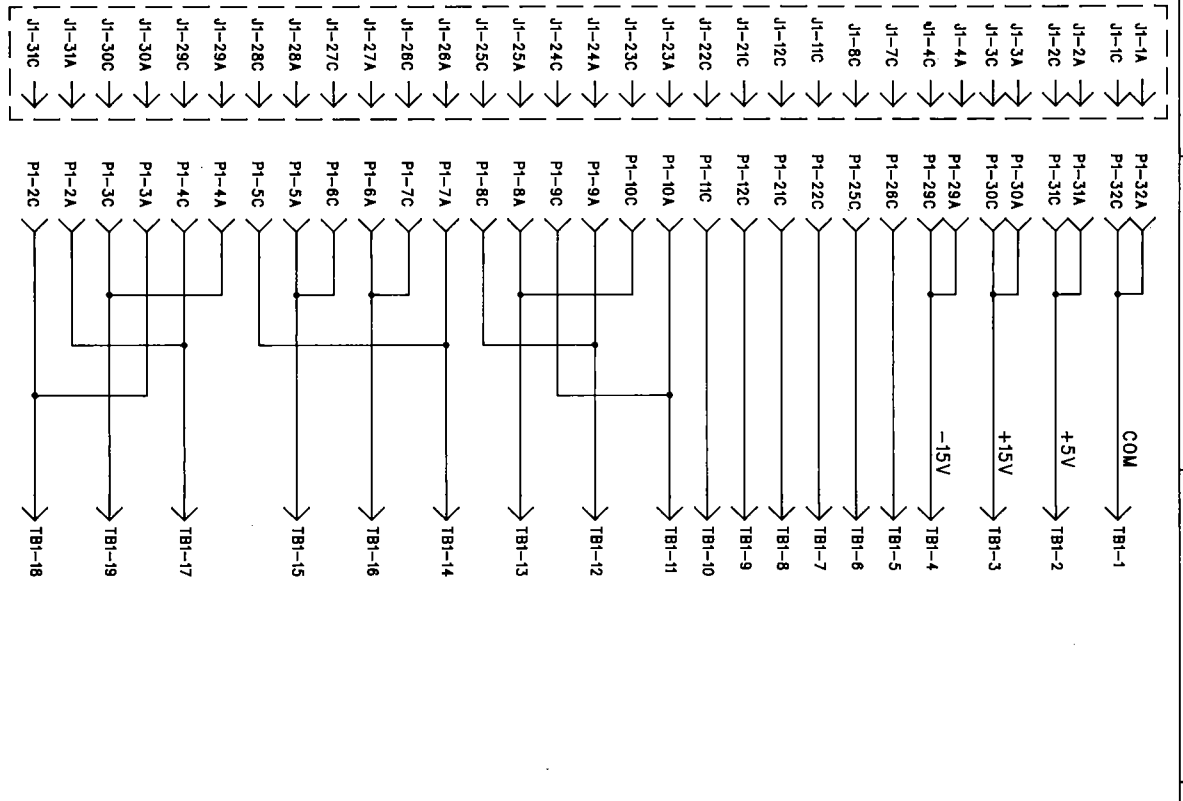
Table 1. Replaceable parts (continued)

Circuit Symbol	Description	INIVEN Part Number
SEMICONDUCTORS		
D1-16	Diode,general purpose,1N4004 or equiv.	1N4004
DS1	LED,Red,Dialight 550-1106-RED or equiv.	550-1106-RED
Q1	Transistor,NPN 2N4401 or equiv.	2N4401
U1	IC,16 Differential/8 analog multiplexer,Harris HI-507A-5 or equiv.	HI3-507A-5
U2	Op-Amp,Low Power Instrumentation,Analog Devices AD620AN or equiv.	AD620AN
U3-4	IC,Dual High Gain Opto-coupler,Hewlett Packard HCPL-2731 or equiv.	HCPL-2731
U5	Octal/Bus Driver,NonInverting,National Semicond. MM74HC244N or equiv.	MM74HC244N
U6	IC,12-bit A/D converter,Analog Devices AD674BKN or equiv.	AD674BKN
U7	Microcontroller,8-bit,4kX8 EPROM, Signetics SC87C451CCA68 or equiv.	SC87C451CCA68
U8,9,16-18,20,21	IC,Dual very high CMR optocoupler,Hewlett Packard HCPL-2231 or equiv.	HCPL-2231
U10	Watch Dog Timer,Dallas Semiconductor DS1232 or equiv.	DS1232
U11,19	Hex Inverter,National Semiconductor MM74HC04N or equiv.	MM74HC04N
U12-15	Optocoupler,Quad,Texas Instruments TIL193B or equiv.	TIL193B
U22	DC/DC Converter,Burr-Brown PWR1317A or equiv.	PWR1317A
U23	Positive Voltage Regulator,+5VDC,Motorola MC78L05ACP or equiv.	MC78L05ACP
MISCELLANEOUS COMPONENTS:		
L1-4	Inductor,molded axial 560uH +/-5%,Dale Electronics IRF-4-560 or equiv.	IRF-4-560
SW1-3	Switch,DIP 8 positions,Alcoswitch ADF-08 or equiv.	ADF-08
Y1	Crystal,quartz,12 MHz,CTS MP120 or equiv.	MP120

Fig. 4 IMT-98 Block Diagram



REVISION RECORD			
LTR	DESCRIPTION	APPROVED:	DATE:
A	REF. TO J1 ADDED	N.C.	12/13/93



J1 CONNECTOR SHOWN AS REFERENCE ONLY
IT IS NOT PART OF I/O DATA ASSEMBLY

INVEN™

I/O DATA AND I/O DATA-1U
CC1996-00 AND CC2005-00

DRAWN:	N.C.	DATED:	10/25/91
CHECKED:		DATED:	
QUALITY CONTROL:		DATED:	
RELEASED:		DATED:	

CODE:	SIZE:	DRAWING NO:	REV:
	B	SB1996-01	A
SCALE:	SHEET: 1 OF 1		

WARRANTY AGREEMENT

All INIVEN product lines carry an equipment warranty for any part which fails during normal operation or service for **twelve years** from date of shipment. A defective part should be returned to the factory, shipping charges prepaid, for repair f.o.b. Somerville, New Jersey. In the event INIVEN cannot promptly return the unit to you, it will endeavor to provide a loaner until the repair or replacement is returned to you.
