RITRON, INC.

12-2020

RITRON MODELS DTXM-NXDN SERIES

PROGRAMMABLE

FM TRANSCEIVER MODULES

MAINTENANCE & OPERATING

MANUAL

FOR USE ONLY BY AUTHORIZED SERVICE/MAINTENANCE PERSONNEL

TABLE OF CONTENTS

1 INTRODUCTION

1.1 GENERAL

The RITRON DTXM Plus modules are programmable 2-way radios, which operate either in the VHF or UHF professional FM communications bands as well as a number of other bands in the 220 MHz and 350 MHz region. Each of four channels can be programmed to contain a unique set of operating frequencies. The DTXM Plus module is made up of two PC boards, an RF board and a control/loader board. These two boards are enclosed in a metal case with two connectors on one end; a 50 ohm BNC connector for connection to an antenna and a DB-15 sub-miniature connector for power and control input/output.

In addition, the RF board is available as a stand-alone unit for system integrators.

1.2 MODEL IDENTIFICATION

The DTXM has a part number in the form of “DTXM-A60-BCDEF”

Where:

A is the major frequency band designator:

1=VHF (136-174 MHz)
2=217-245 MHz
3=340-400 MHz
4=UHF (400-520 MHz)

B is the sub-band designator:

G=340-360 and 400-420
A=420-440
B=430-450
0=136-174, 217-245, 360-380, and 450-470
M=380-400
C=470-490
T=490-512

C is the connector designator:

B=BNC connector
M= MCX connector
S=SMA connector

D designates the channel bandwidth:

S=6.25 kHz
N=12.5 kHz
W=25 kHz

E designates the maximum power level:

3=3 watts
6=6 watts
9=10 watts

F designates the regulator option

I=Internal regulator (10-16 VDC operation with regulated RF power amplifier)
D=No regulator (7.5 VDC operation)
L=RF PA is unregulated, but the remainder of the modem is regulated (10-watt versions)

Example: A DTXM-160-OBN6I would be a VHF module for operation between 136 and 174 MHz with a BNC RF connector, narrow (12.5 kHz channel spacing) IF bandwidth, 6 watts maximum output power, and an internal regulator to allow operation from 10 to 15 volts.

1.3 FCC/IC REGULATIONS

1.3.1 LICENSING

For those frequency bands governed by FCC rules, the FCC requires that the radio owner obtain a station license for his radio before using the equipment to transmit, but does not require an operating license or permit. The station licensee is responsible for proper operation and maintenance of his radio equipment, and for ensuring that transmitter power, frequency and deviation are within the limits specified by the station license. This includes checking the transmitter frequency and deviation periodically using appropriate methods. Note also, that wideband operation (25/30 kHz channel bandwidth) may not be permitted.

1.3.2 PRODUCT CERTIFICATION

The DTXM modules are certified by the FCC for operation in the United States and by Industry Canada for operation in Canada on certain frequency bands and sub-bands for transmission of either voice or data signals when aligned according to the alignment procedure for the proper bandwidth and when operated as a complete unit in the metal case. Operation of the RF board as a stand-alone unit or in combination with any other equipment, in any mode outside the alignment procedure, or with the clipper filter electronically disabled will require the filing of a new type acceptance application with the FCC by the user.

1.3.3 SAFETY STANDARDS-RF EXPOSURE

RF ENERGY EXPOSURE AWARENESS AND CONTROL INFORMATION, AND OPERATIONAL INSTRUCTIONS FOR FCC OCCUPATIONAL USE REQUIREMENTS:

BEFORE USING THIS 2-WAY RADIO, READ THIS IMPORTANT RF ENERGY AWARENESS AND CONTROL INFORMATION AND OPERATIONAL INSTRUCTIONS TO ENSURE COMPLIANCE WITH THE FCC'S AND IC'S RF EXPOSURE GUIDELINES.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

NOTE: THE GRANTEE IS NOT RESPONSIBLE FOR ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

NOTICE: This radio is intended for use in general population/uncontrolled conditions, where users do not have full knowledge of their exposure and cannot exercise control over their exposure to meet FCC/IC limits.

This 2-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, electric power, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health and industry work with organizations to develop standards for exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection. All 2-way radios marketed in North America are designed, manufactured and tested to ensure they meet government established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of 2-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it. Please refer to the following websites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html
http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

Federal Communications Commission Regulations:

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for mobile 2-way radios before they can be marketed in the U.S. When 2-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a label directing users to specific user awareness information.

The DTXM 2-way radio has an RF exposure product label. Also, this DTXM manual includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

Compliance with RF Exposure Standards:

The DTXM two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty factors of up to 50% talk and 50% listen and is authorized by the FCC for occupational use. In terms of measuring RF energy for compliance with the FCC exposure guidelines, your radio antenna radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.

The DTXM two-way radio complies with the following RF energy exposure standards and guidelines, and when used as directed, the DTXM radio is designed to comply with ISED RSS-102 Exposure Limits. In addition, the DTXM radio is designed to comply with the following Standards and Guidelines:

• United States Federal Communications Commission, Code of Federal Regulations; 47 CFR JJ 1.1307, 1.1310, 2.1091 and 2.1093.

• American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 3-2003.

• Institute of Electrical and Electronic Engineers (IEEE) C95.3-2003 Edition.

To control exposure to yourself and others and ensure compliance with the general population/uncontrolled environment exposure limits always adhere to the following procedures:

Guidelines:
• User awareness instructions should accompany device when transferred to other users.

• Do not use this device if the operational requirements described herein are not met.

Instructions:

• Transmit no more than the rated duty factor of 50% of the time. To transmit (talk or send data), assert the PTT input pin. To receive calls, un-assert the PTT input. Transmitting 50% of the time, or less, is important because this radio generates measurable RF energy exposure only when transmitting (in terms of
measuring for standards compliance).

• Transmit only when people are at least the recommended minimum lateral distance away, as shown in Table 1, from a properly installed according to installation instructions, externally-mounted antenna.

NOTE - Table 1 lists the recommended minimum lateral distance for bystanders in an uncontrolled environment from transmitting types of antennas (i.e., monopoles over a ground plane, or dipoles) at several different ranges of rated radio power for mobile radios installed on a vehicle.

Table 1. Rated Power and Recommended Lateral Distance for quarter-wave, unity gain, ground plane antenna:

Rated Power of DTXM 2-way Radio	Recommended Minimum Lateral Distance from Transmitting Antenna
6 watts	8 inches (22 cm)

Antennas

• Install antennas taking into account the recommended minimum lateral distances listed above. These antenna installation guidelines are limited to antennas with appropriate ground planes. The antenna installation should additionally be in accordance with:

a.) The requirements of the antenna manufacturer/supplier.
b.) Instructions in this manual including minimum antenna cable lengths.
c.) Antennas other than those shown in Table 1 must be tested with the DTXM module for RF exposure compliance in the environment in which it is to be used per the FCC's OET Bulletin 65, Edition 97-01 or Industry Canada RSS-102.

• Use only a VHF quarterwave antenna or equivalent antenna or other antennas as described above. Unauthorized antennas, modifications, or attachments could damage the radio and may violate FCC regulations.

Approved Accessories

• This radio has been tested and meets the FCC RF exposure guidelines when used with the Ritron accessories supplied or designated for this product. Use of other accessories may not ensure compliance with the FCC's RF exposure guidelines, and may violate FCC regulations.

• For a list of Ritron approved accessories see this user manual, or visit the following website which lists approved accessories: www.ritron,com

Contact Information:

For additional information on exposure requirements or other information, contact Ritron at (317) 846-1201 or at www.ritron.com.

INFORMATIONS DE SENSIBILISATION ET DE CONTRÔLE À L'EXPOSITION AUX ÉNERGIES RF, ET INSTRUCTIONS OPÉRATIONNELLES POUR LES EXIGENCES D'UTILISATION PROFESSIONNELLE DE LA FCC:

AVANT D'UTILISER CETTE RADIO À 2 VOIES, LISEZ CES INFORMATIONS IMPORTANTES SUR LA SENSIBILISATION ET LE CONTRÔLE À L'ÉNERGIE RF ET LES INSTRUCTIONS OPÉRATIONNELLES POUR VOUS ASSURER LA CONFORMITÉ AVEC LES DIRECTIVES D'EXPOSITION AUX RF DE LA FCC ET DES IC.

CET APPAREIL EST CONFORME À LA PARTIE 15 DES RÈGLES FCC. LE FONCTIONNEMENT EST SOUMIS AUX DEUX CONDITIONS SUIVANTES: (1) CET APPAREIL NE PEUT PAS CAUSER DES INTERFÉRENCES DANGEREUSES, ET (2) CET APPAREIL DOIT ACCEPTER TOUTE INTERFÉRENCE REÇUE, Y COMPRIS LES INTERFÉRENCES POUVANT CAUSER UN FONCTIONNEMENT INDÉSIRABLE.

REMARQUE: LE BÉNÉFICIAIRE N'EST PAS RESPONSABLE DES CHANGEMENTS OU MODIFICATIONS NON EXPRESSÉMENT APPROUVÉS PAR LA PARTIE RESPONSABLE DE LA CONFORMITÉ. DE TELLES MODIFICATIONS POURRAIENT ANNULER L'AUTORITÉ DE L'UTILISATEUR DE FAIRE FONCTIONNER L'ÉQUIPEMENT.

AVIS: Cette radio est destinée à être utilisée dans la population générale / dans des conditions non contrôlées, où les utilisateurs n'ont pas une connaissance complète de leur exposition et ne peuvent pas contrôler leur exposition pour respecter les limites FCC / IC.

Cette radio bidirectionnelle utilise l'énergie électromagnétique dans le spectre des radiofréquences (RF) pour fournir des communications entre deux ou plusieurs utilisateurs à distance. Il utilise l'énergie des radiofréquences (RF) ou des ondes radio pour envoyer et recevoir des appels. L'énergie RF est une forme d'énergie électromagnétique. D'autres formes comprennent, mais sans s'y limiter, l'énergie électrique, la lumière du soleil et les rayons X. L'énergie RF, cependant, ne doit pas être confondue avec ces autres formes d'énergie électromagnétique qui, lorsqu'elles sont mal utilisées, peuvent causer des dommages biologiques. Des niveaux très élevés de rayons X, par exemple, peuvent endommager les tissus et le matériel génétique.

Des experts en science, ingénierie, médecine, santé et industrie travaillent avec des organisations pour développer des normes d'exposition à l'énergie RF. Ces normes fournissent des niveaux recommandés d'exposition aux RF pour les travailleurs et le grand public. Ces niveaux d'exposition RF recommandés incluent des marges de protection substantielles. Toutes les radios bidirectionnelles commercialisées en Amérique du Nord sont conçues, fabriquées et testées pour garantir qu'elles respectent les niveaux d'exposition aux RF établis par le gouvernement. En outre, les fabricants recommandent également des instructions d'utilisation spécifiques aux utilisateurs de radios bidirectionnelles. Ces instructions sont importantes car elles informent les utilisateurs sur l'exposition à l'énergie RF et fournissent des procédures simples sur la façon de la contrôler. Veuillez consulter les sites Web suivants pour plus d'informations sur ce qu'est l'exposition à l'énergie RF et comment contrôler votre exposition pour assurer la conformité avec les limites d'exposition RF établies.

http://www.fcc.gov/oet/rfsafety/rf-faqs.html
http://www.osha.gov/SLTC/radiofrequencyradiation/index.html

Règlements de la Federal Communications Commission:

Les règles de la FCC exigent que les fabricants se conforment aux limites d'exposition à l'énergie RF de la FCC pour les radios mobiles bidirectionnelles avant de pouvoir être commercialisées aux États-Unis. et capables de contrôler leur exposition pour répondre aux exigences professionnelles. La sensibilisation à l'exposition peut être facilitée par l'utilisation d'une étiquette orientant les utilisateurs vers des informations spécifiques de sensibilisation des utilisateurs.

La radio bidirectionnelle DTXM est conçue et testée pour se conformer à un certain nombre de normes et directives nationales et internationales (énumérées ci-dessous) concernant l'exposition humaine à l'énergie électromagnétique de radiofréquence. Cette radio est conforme aux limites d'exposition IEEE et ICNIRP pour un environnement d'exposition professionnelle / contrôlée aux RF à des facteurs de service

allant jusqu'à 50% de conversation et 50% d'écoute et est autorisée par la FCC pour une utilisation professionnelle. En termes de mesure de l'énergie RF pour se conformer aux directives d'exposition de la FCC, votre antenne radio émet de l'énergie RF mesurable uniquement lorsqu'elle émet (pendant la conversation), pas lorsqu'elle reçoit (écoute) ou en mode veille.

La radio bidirectionnelle DTXM est conforme aux normes et directives d'exposition à l'énergie RF suivantes, et lorsqu'elle est utilisée selon les instructions, la radio DTXM est conçue pour se conformer aux limites d'exposition RSS-102 d'ISDE. De plus, la radio DTXM est conçue pour se conformer aux normes et directives suivantes:

• Commission fédérale des communications des États-Unis, Code of Federal Regulations; 47 CFR JJ 1.1307, 1.1310, 2.1091 et 2.1093.

• Institut national américain des normes (ANSI) / Institut des ingénieurs électriques et électroniques (IEEE) C95. 3-2003.

• Édition C95.3-2003 de l'Institut des ingénieurs électriciens et électroniciens (IEEE).

Pour contrôler l'exposition à vous-même et aux autres et garantir le respect des limites d'exposition de la population générale / de l'environnement non contrôlé, respectez toujours les procédures suivantes:

Des lignes directrices:
• Les instructions de sensibilisation de l'utilisateur doivent accompagner l'appareil lors du transfert à d'autres utilisateurs.

• N'utilisez pas cet appareil si les exigences opérationnelles décrites ici ne sont pas satisfaites.

Instructions:

• Ne transmettez pas plus que le facteur de service nominal de 50% du temps. Pour transmettre (parler ou envoyer des données), confirmez la broche d'entrée PTT. Pour recevoir des appels, désactivez l'entrée PTT. La transmission à 50% du temps, ou moins, est importante car cette radio génère une exposition à l'énergie RF mesurable uniquement lors de la transmission (en termes de mesure de la conformité aux normes).

• Ne transmettez que lorsque les personnes se trouvent au moins à la distance latérale minimale recommandée, comme indiqué dans le tableau 1, d'une antenne montée à l'extérieur correctement installée conformément aux instructions d'installation.

NOTE - Le Tableau 1 énumère la distance latérale minimale recommandée pour les spectateurs dans un environnement non contrôlé par rapport aux types d'antennes de transmission (c'est-à-dire monopôles sur un plan de masse ou dipôles) à plusieurs plages de puissance radio nominale pour les radios mobiles installées sur un véhicule.

Tableau 1. Puissance nominale et distance latérale recommandée pour l'antenne quart d'onde, gain unitaire, plan de masse:

Puissance nominale de DTXM	latérale minimale recommandée Distance radio bidirectionnelle de l'antenne émettrice
6 watts	8 pouces (22 cm)

Antennes

• Installez les antennes en tenant compte des distances latérales minimales recommandées ci-dessus. Ces directives d'installation d'antenne sont limitées aux antennes avec des plans de masse appropriés. L'installation de l'antenne doit en outre être conforme à:

a.) Les exigences du fabricant / fournisseur d'antenne.
b.) Les instructions de ce manuel, y compris les longueurs minimales de câble d'antenne.
c.) Les antennes autres que celles indiquées dans le tableau 1 doivent être testées avec le module DTX pour vérifier la conformité d'exposition RF dans l'environnement dans lequel il doit être utilisé, conformément au bulletin OET 65 de la FCC, édition 97-01 ou à l'industrie Canada RSS-102.

Utilisez uniquement une antenne quart d'onde VHF ou une antenne équivalente ou d'autres antennes comme décrit ci-dessus. Les antennes, modifications ou accessoires non autorisés peuvent endommager la radio et enfreindre les réglementations FCC.

Accessoires approuvés

• Cette radio a été testée et répond aux directives d'exposition RF de la FCC lorsqu'elle est utilisée avec les accessoires Ritron fournis ou désignés pour ce produit. L'utilisation d'autres accessoires peut ne pas garantir la conformité avec les directives d'exposition RF de la FCC et peut enfreindre les réglementations FCC.

• Pour une liste des accessoires approuvés par Ritron, consultez ce manuel de l'utilisateur ou visitez le site Web suivant qui répertorie les accessoires approuvés: www.ritron, com

Informations de contact:

Pour plus d'informations sur les exigences d'exposition ou d'autres informations, contactez Ritron au (317) 846-1201 ou sur www.ritron.com.

2 SPECIFICATIONS

2.1 GENERAL

DTXM-160-0

FCC ID:	AIERIT51-16006 (Pending)
IC ID:	1084A-RIT5116006 (Pending)
FCC Rule Parts	90
Industry Canada Rule Parts	RSS-119
Frequency Range	
DTXM-160-0	136-174 MHz
Number of Channels	4
Transmit/Receive Spacing	Up to the span of the sub-band
Mode of Operation	Simplex or Half Duplex
Frequency Control	PLL Synthesizer
Channel Increment (Synthesizer step size)	
DTXM-160	2.5 kHz/3.125 kHz 6.25 kHz
Emissions Bandwidth	
Very narrow mode	4.0-4.8 kHz depending upon modulation
Narrow Mode	10 kHz
Frequency Stability	
-30 °C to +50 °C	+/-1.0 ppm
-40 °C to +60 °C	+/-1.5 ppm
Supply Voltage	
3 and 6 watt versions	
w/o internal regulator	7.5 VDC
w internal regulator	11 to 16 VDC
RF Input/Output Connector	BNC standard
Power/Data Interface	15 pin subminiature D type
Operating Temperature	-30 to +60 °C
Maximum Dimensions (L x W x H)	3.6” x 2.3” x 1.0” including connectors
Weight	6 oz.

2.2 TRANSMITTER

Operating Bandwidth	Up to the span of the sub-band
RF Output Power(internally adjustable)	
6 watt version	1 to 6 watts (2.5 watts min. recommended)
Duty Cycle	5 to 100 % depending upon voltage and power level (see chart elsewhere in manual)
RF Load Impedance	50 ohms
Modulation Distortion (per TIA/EIA 603)	5 % max.
Modulation Frequency Response (+1/-3 dB, ref 1 kHz)	
Narrowband versions:	
w pre-emphasis	400 Hz to 2500 Hz
w/o pre-emphasis	50 Hz to 2700 Hz
Very narrowband versions:	
w/o pre-emphasis	50 Hz to 1200 Hz
Transmitter Attack Time:	10 ms max
Spurious and Harmonics	-25 dBm max.
FM Hum and Noise	
Very narrow channel (5/6.25/7.5 kHz) operation	40 dB min.
Narrow channel (12.5/15 kHz) operation	45 dB min.
Group Delay Variation (Within Frequency Response)	5 us max.
Current Drain	Depends upon supply voltage and regulator options (see chart elsewhere in manual).
AUX IN adjustment range (60% rated dev.)	
w pre-emphasis (@ 1 kHz)	200 to 1000 mV rms
w/o pre-emphasis (flat)	40 to 300 mV rms

2.3 RECEIVER

Operating Bandwidth	Up to span of the sub-band
Sensitivity (12 dB SINAD @ 1 kHz w de-emphasis)	0.25 uV (-119.0 dBm)
RF Input Impedance	50 ohms nominal
Adjacent Channel Selectivity	
+/-6.25 kHz w very narrow IF	45 dB min.
+/- 12.5 kHz w narrow IF	60 dB min.
Spurious and Image Rejection	
IF/2	60 dB min.
Image & other	70 dB min.
Intermodulation Rejection	68 dB min.
FM Hum and Noise	
Very narrow channel (5/6.25/7.5 kHz) operation	40 dB min.
Narrow channel (12.5/15 kHz) operation	45 dB min.
Conducted Spurious	-57 dBm max.
Receive Attack Time (transmit to receive)	10 ms max.
Carrier Detect Attack Time	5 ms max.
Audio Distortion	5 % max.
Audio Response (+1/-3 dB, ref 1 kHz)	
Narrowband versions:	
w de-emphasis	400 Hz to 2500 Hz
w/o de-emphasis	100 Hz to 3500 Hz
Very narrowband versions:	
w/o de-emphasis	100 Hz to 1500 Hz
Receive Current Drain	Depends upon supply voltage options (see chart elsewhere in manual).
AUX OUT Adjustment Range (60 % rated dev.)	
w de-emphasis (@ 1 kHz)	50 to 500 mV rms open circuit
w/o de-emphasis (@1 kHz)	250 to 1800 mV rms open circuit

3 DTXM INPUT/OUTPUT CONNECTORS

DB-15 Connector Pinout

Pin Number	Name	Description	Comments
1	Audio/Mic In	External Audio Input	Wideband input for data.
2	Audio Out	Auxiliary Output	Wideband output for data.
3	Speaker	Audio PA Output	Output of audio PA.
4	CS0	Channel Select low bit	
5	RSSI	Receive Signal Strength	Analog Receive Signal Strength Indicator
6	Raw Supply	Supply Voltage Input	+10 to +16VDC Input.
7	DISC Out		
8	RD	Receive Program Data	
9	TD	Transmit Program Data	
10.	CTS	Clear To Send	Asserted when transmitter can accept modulation.
11.	CS1	Channel Select mid bit	
12.	Test/PTT	Push To Talk	Activates transmitter.
13.	CD	Carrier Detect	Carrier detect output.
14.	RTS	Request To Send	
15.	GND	Ground	Negative supply point and reference for all inputs.

Pinout Description

Pin Number	Description
1	AUDIO/MIC IN -This is the main audio input for modulation. The gain through this input to the modulator is programmable, as is the use of pre-emphasis. This signal passes through the clipper and clipper filter.
2	AUDIO OUT-This is the broadband output of the receiver. The gain from the receiver to the output is programmable, as is the use of de-emphasis. The choice of AC or DC coupling from the RF board discriminator is also programmable. The coupling at the output of this pin is AC coupled, however. It can be converted to DC coupling with internal hardware modifications. **Note: The output impedance is approximately 600 ohms. Therefore, it is not recommended that this output drive loads with less than 1000 ohms unless the resultant voltage drop is accounted for.**
3	SPEAKER -This is the output of the audio power amplifier. This output can drive up to 100 milliwatts into an 8 ohm load. The output level can be controlled by programming. De-emphasis can be applied to this output, but not independently of the AUDIO OUT output. Note that this output level varies with the adjustment via the programmer of the AUX OUT level. Thus, the AUX OUT level should be set first before adjusting the AUDIO OUT level.

4 CS0-Least significant bit of the channel select lines. Active high 5 volt TTL/CMOS level. Internal 10 kΩ pull-up to +5 volts.

Channel	CS1	CS0
1	0	0
2	0	1
3	1	0
4	1	1

0 = Logic low
1 = Logic high

Note: Due to the internal pull-up resistors, the unit defaults to channel 8 if the channel pins are left open (unconnected). **Channel 4 would be the nominal channel when the Ritron programmer is connected.**

5 RSSI- This is an analog output whose amplitude is proportional to the signal strength of the received signal. The voltage at this pin varies from about 1.6 VDC for a -130 dBm signal to about 4 VDC for signals at or above -60 dBm.

6 RAW SUPPLY- Supply voltage input. +10VDC to +16VDC.

7 DISC OUT-

8 RD- Connect via RITRON DTXP-PCPK PC Programming Kit to computer for programming the unit.

9 TD-Connect via RITRON DTXP-PCPK PC Programming Kit to computer for programming the unit.

10 CTS-Clear-To-Send output from the unit which indicates that the unit is transmitting a carrier at the correct frequency and power level and is ready to accept an input signal to be transmitted. This output would normally become asserted in response to a PTT RTS (see pin 14 description below) activation. The polarity of this output can be programmed. The output is active low 5 volt logic with an internal 10 k ohm pull-up to 5 volts. It can source up to 10 mA when low.

11 CS1-Most significant bit of the channel select lines.

12 TEST/PTT- Push to Talk/Request to Send. This input commands the unit to transmit. Input levels are TTL/CMOS; polarity may be programmed. Internal 10 kΩ pull-up to +5 volts.

13 CD-Carrier detect output. This output becomes asserted when a signal strong enough to exceed the programmed squelch threshold is present. This output is not affected by the RX MON input. The polarity can be programmed. The output is active low 5 volt logic with an internal 10 kΩ pull-up to +5 volts. It can source up to 10 mA when low.

14 RTS- This RS-232 input pin is asserted by the host computer or device to indicate that it has data to be transmitted by the modem. If the modem is able to accept the data, the CTS pin will be asserted in response.

15 GND-System ground. All signals and voltages are referenced to this input. The negative side of the power supply should connect here.

4 ACCESSORIES

Note: Programming kits are for use by authorized service/maintenance personnel only.

The Programming Kit for DTXM Plus radios (via compatible computer) is model DTXM-NXDN-PCPK-1. It includes:

1) Programming Software, DTXM-NXDN-PCPS-1.

2) DB-9 to DB-15 connector cable with power cable.

3) 9-Pin to USB Adapter, 2147C002.

Factory programming of channels and features is also optional. Contact the factory for details.

5 OPERATION

5.1 CHANNEL SELECTION

The DTXM module supports eight channels. The desired channel is chosen via pins 4 and 11 of the 15 pin connector as shown:

Channel	CS1	CS0
1	0	0
2	0	1
3	1	0
4	1	1

0 = Logic low
1 = Logic high

Note: Due to the internal pull-up resistors, the unit defaults to channel 8 if the channel pins are left open (unconnected). **Channel 4 would be the nominal channel when the Ritron programmer is connected.**

A change in the channel selection in receive will cause the receiver to operate on the new channel. In transmit, however, the channel selection is only checked upon a push-to-talk activation. Changes in channel during transmit will not change the transmit operating channel of the unit until the unit is cycled from transmit to receive and back to transmit.

5.2 POWER SUPPLY VOLTAGE

The DTXM-160 unit uses a 7.5 volt RF power module. Two supply voltage options are available for these units depending upon whether the control/loader board has a regulator installed. If a regulator is not installed, the voltage should be 7.5 volts +/-10 %. This voltage should be “clean” and preferably regulated since the RF power module is powered directly from this source. Variations in voltage will cause variations in transmitted output power. Conversely, if the control/loader board has a regulator installed, the supply voltage can be at any voltage between 11 and 16 volts. The output power will vary with supply voltage. Switching power supplies can be used, but in models without the internal regulator, care must be taken that the output waveform is low noise. Also, the module antenna should never be placed near an unshielded switching power supply.

5.3 CURRENT DRAIN VS SUPPLY VOLTAGE

The current drain of the module is a function of the supply voltage, the RF output in transmit and the regulator option. The internal 7.5-volt regulator is a switching type such that the current drain actually decreases with an increase in supply voltage. Typical current drain values are shown in the table below:

Receive Mode

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	130 mA
11.0 V	Yes	100 mA
12.5 V	Yes	90 mA
16.0 V	Yes	75 mA

Transmit Mode – 1 watt output power

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	1.2 A
11.0 V	Yes	0.9 A
12.5 V	Yes	0.7 A
16.0 V	Yes	0.5 A

Warning: Although the output power can be set as low as 1 watt, and the module is certified as low as 1 watt, operation below 2.5 watts output power is not recommended. At low power levels, the output power can vary by 50% or more with variations in ambient temperature.

Transmit Mode – 3 watt output power

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	1.8 A
11.0 V	Yes	1.4 A
12.5 V	Yes	1.2 A
16.0 V	Yes	0.9 A

Transmit Mode – 6 watt output power

Supply Voltage	Internal Regulator	Current Drain
7.5 V	No	2.5 A
11.0 V	Yes	2.1 A
12.5 V	Yes	2.0 A
16.0 V	Yes	1.5 A

5.4 DUTY CYCLE/KEY-DOWN LIMITATIONS

The major heat generating component within the modules is the RF power amplifier which has a maximum temperature limit that should not be exceeded. In addition, the temperature within the module itself must be kept below the maximum temperature of the reference oscillator to ensure that regulatory frequency stability limits are observed. As a result, depending upon the RF output power, the supply voltage, and the ambient temperature, limits upon the average transmit duty cycle and the maximum continuous transmitter on time exist. These limits are summarized below for operation in still air:

	Ambient Temperature (°C)	Duty Cycle (%)	Key-Down Time (s)
3 watts RF output	25	30	45
	50	5	10
6 watts RF output	25	20	30
	50	3	5
10 watts RF output	25	20	15
(DTXM-460 Only)	50	3	5

Blowing air across the unit and/or adding a heat sink to the rear of the unit where the PA module is located can significantly improve the duty cycle/key-down times. Ritron offers an option where the case screws at the rear of the module are longer allowing heat sinks to be attached. Also, a fan option is available from Ritron which can significantly increase the duty cycle, up to 100% at room temperature in some cases. Contact Ritron for additional information on these options and special instructions on attaching heat sinks without compromising the mechanical integrity of the RF PA module.

5.5 OPERATING MODES

5.5.1 RECEIVE

Carrier Detect and Squelch Operation

The DTXM is a transceiver; i.e. it can receive and transmit, although not at the same time. A carrier detect system exists within the unit to detect the presence of a carrier which controls the logic state of the DCD (data carrier detect) output. The RF levels at which this output changes state are programmable. In addition, the unit may be programmed such that the audio outputs, AUDIO OUT and AUX OUT, are muted (squelched) in conjunction with DCD operation. In units where squelch operation has been enabled, the RX MON input can be used to override a squelched condition. The DCD output is not affected by the RX MON operation.

Receiver Audio Outputs

Two receiver audio outputs are present on the DTXM module. The AUX OUT is a general purpose output which can have pre-emphasis enabled or bypassed. Its gain can be controlled and its output is designed to drive 1000 ohm or higher loads. The coupling from the discriminator on the RF board may be set to AC or DC by the programmer. DC coupling allows for internal bandwidth to extend to DC, but if a high gain value is chosen for the AUX OUT, clipping may occur on the waveform due to discriminator voltage offsets. AC coupling removes this issue. The output stage is AC coupled, but can be modified for DC coupling. This requires replacing a coupling capacitor with a zero-ohm resistor. Contact Ritron for details on this modification. The AUDIO OUT is always de-emphasized, but its gain can be programmed. This output can drive 8-ohm speaker-type loads. In the programmer menu, there is provision to set both the AUX OUT levels and the AUDIO OUT levels. However, the AUDIO OUT level is dependent upon the AUX OUT level. Therefore, the AUX OUT level should be set before setting the AUDIO OUT level.

5.5.2 TRANSMIT

PTT Operation

The transmitter is activated by placing the PTT/RTS (Push-To-Talk/Request-To-Send) input in its asserted state. This state is programmable. If the unit is to operate in simplex (transmitter and receiver on the same frequency), one should check for activity on the channel before transmitting. This can be done by checking the state of the DCD output. In addition, the unit can be programmed so that transmit operation is inhibited if the DCD threshold has been exceeded (busy channel lockout option).

CTS Output

The CTS (Clear To Send) output goes to its active state when the unit has powered up the transmitter, it is locked on the correct transmit frequency, and it is ready to accept modulation. This output may be used to signal a modem to start transmitting data. If this output is not used, to avoid losing data, a delay of at least 12 ms is required between PTT/RTS activation and the application of data.

Transmitter Audio Inputs

Two mutually exclusive audio inputs are available on the DTX module. The AUX IN is a general-purpose input with an input impedance greater than 50 k-ohms and is capacitive coupled with a lower roll-off frequency of about 25 Hz. The MIC IN input is a higher gain input designed for connection to a standard electret or dynamic microphone. The choice of the input source is made via the programmer. The selected signal can be set for a pre-emphasized or flat audio response and the gain can also be set. At maximum gain, the AUX IN signal input can achieve 60% rated modulation with about 25 mv rms input signal while the MIC IN signal can achieve the same modulation with 4 mv rms in the low gain position and 0.5 mv in the high gain position.

High/Low Power

High and low power levels can be programmed into the unit on a channel by channel basis. High power is selected by placing the CSN input at a logic high state. Placing the CSN input at a logic low state chooses low power. The CSN input has an internal pull-up resistor; it will assume the high state and the module will be set for high power when left unconnected.

Specialized Modem Operation

Modems designed to achieve the highest data rates possible in a radio channel may require a direct DC connection to the modulation path and the removal of the limiter-filter. In order to receive FCC Certification, the DTX module must either be tested and approved with a specific modem connected to the transmitter, or a modulation limiter and limiter-filter must always be present in the transmit modulator audio path with the modulation inputs AC coupled. To allow for the most flexibility for the end user, the unit was certified as a stand-alone unit. It is possible, with hardware modifications and special programming software (not supplied with the unit), to DC couple the AUX IN input and/or defeat the limiter-filter. The modulation limiter would still be in place, but the deviation of the DTX module could be set such that the modulation limit within the DTX module is never reached. The deviation would be set by the modem level and the AUX IN gain setting. The end user/system integrator would then bear the responsibility of obtaining certification or operating in a frequency band where certification is not required. Contact RITRON for details. **Note: Most modems will connect directly to the DTX without requiring any special modifications or programming.**

Antenna Placement

The DTX module is enclosed in a metal housing for RF shielding. However, RF emitting sources located very close (less than 12 inches) to the unit can at times affect its operation. It is not recommended that an antenna be connected directly to the module's BNC connector unless the RF output power is set for less than 5 watts or the module is placed within another RF-tight enclosure.

6 PROGRAMMING

To program DTXM Module, the RITRON PC Programming Kit, DTXPNX-PCPK-1, must be used.

6.1 PC PROGRAMMING KIT

The user should install the programming software on the host computer. The RITRON adapter cables connect the radio to a computer's serial communications port. Once the cables are hooked up, the user runs the programmer software. This program transfers data between radio and computer memory.

6.1.1 PROGRAMMING KIT CONTENTS AND REQUIREMENTS

The Programming Kit for DTXM Plus radios (via compatible computer) is model DTXM-NXDN-PCPK-1. It includes:

1) Programming Software, DTXM-NXDN-PCPS-1.

2) DB-9 to DB-15 connector cable with power cable.

3) 9-Pin to USB Adapter, 2147C002.

The Programmer Kit requires a PC compatible computer with Windows 95 or later operating system installed. The computer must have a USB port available.

6.2 LOADING THE PROGRAMMER SOFTWARE

Insert the Software disc which contains the programmer in the CD/DVD/CD ROM drive of the host computer. The program should load automatically. If not, view the contents of the CD ROM and double click on the install.exe file. Follow the instructions as they appear on the screen. At the conclusion of the installation procedure, the programming software will be resident on the user's host computer.

6.3 COMPUTER SOFTWARE COPYRIGHTS

The RITRON, Inc. products described in this manual include copyrighted RITRON, Inc. computer programs. Laws in the United States and other countries grant to RITRON, Inc. certain exclusive rights in its copyrighted computer programs, including the exclusive right to distribute copies of the programs, make reproductions of the programs, and prepare derivative works based on the programs. Accordingly, any computer programs contained in RITRON, Inc. products may not be copied or reproduced in any manner without the express written permission of RITRON, Inc. The purchase of RITRON, Inc. products does not grant any license or rights under the copyrights or other intellectual property of RITRON, Inc. except for the non-exclusive, royalty fee license to use that arises in the sale of a product, or as addressed in a written agreement between RITRON, Inc. and the purchaser of RITRON, Inc. products.

6.4 USING THE PROGRAMMING SOFTWARE

Note: Power up the radio and connect it, via the programming cable, to the host computer before opening the programmer.

Upon starting the programming software, a screen will appear with two buttons at the upper right, Program Radio and Programmer Configuration. Program radio reads the configuration of the radio and moves the user to the program radio menus which are described below. Programmer configuration is used to select the appropriate serial port and password (if desired).

Note: Changes made to the radio via the programmer will be accepted by the radio, but will not be permanent i.e. if the radio is powered down, the changes will be lost. The pages of the radio menu will have a button, Update Radio, which will make changes permanent.

6.5 PROGRAMMER MENUS

The DTXM Programmer has five menus or pages, selectable via tabs at the top of each page, which are always visible. These pages are:

1. Frequency-Used to program the channel frequencies of the radio.

2. Settings-Used to set programmable features/functions of the radio.

3. Alignment-Used to align and set the internal digital potentiometers in the radio. Information on the use of this page is found in the Maintenance section of the manual.

4. Summary-Used to summarize on one page the model, settings, and alignment information.

5. Restore Data-Used to program the unit with a set of previously saved frequency and setting values.

The programmer also has radio buttons on the top right of each page. These are:

1. Receiving-This button is the software equivalent to the hardware PTT input. Clicking on this button forces the radio into transmit mode where the button will change to Transmitting. Clicking it again will put the radio back into receive.
2. Monitor-This button is the software equivalent to the hardware RX MON input. Clicking on this button will override any squelch operation.

3. Clone Radio-This button is used to update the radio with the changes that have been made via the programmer as shown on the programming screens with the exception of the deviation and balance settings. Since the deviation and balance settings are unique to each radio, even though the actual deviation may be the same, this button allows the personality of one radio to be shown on the programming screens and then loaded into another radio. Also, if the programmer is disconnected and then reconnected, this button will still function. If the deviation and balance settings have not been changed which is normal, this button is performs the same as the update radio button below.

4. Update Radio-This button is used to update the radio with all of the changes that have been made via the programmer. Although the radio accepts changes as they are made via the programmer, the changes are volatile i.e. they are lost when the radio is powered off. Clicking on this button makes the changes non-volatile so that they are saved and stored permanently unless changed via the programmer.

5. Read Radio-Forces the programmer to do a read of the radio to update the programmer screens with the current state of the radio. This allows a radio to be connected to the programmer and powered up without closing and then reopening the programmer.

6.5.1 FREQUENCY SELECTION

The Frequency page has fields for transmit and receive frequencies of each channel. Channel information can be entered by clicking on the appropriate box and entering the desired frequency. The frequency chosen must be within the operating range of the radio and on a frequency for which the synthesizer is capable of channeling i.e. for VHF, divisible by 2.5 kHz and for UHF, divisible by 5 or 6.25 kHz. When the RNET compatibility mode is chosen via the settings menu, only channel one and two are available for programming.

6.5.2 SETTINGS

The Settings page allows for programming various parameters of the radio. These are detailed below:

Audio Input- Allows a choice between the two audio inputs for transmit, the Aux In input and the Microphone input. As a rule, the microphone input has higher gain, but conversely, cannot accept as high an input level. If the Microphone input is selected, the Microphone Gain box to its right will allow a choice of two gain settings; there is no microphone gain setting available on the alignment page. Note that even if signals are applied to both inputs, only the one selected will be transmitted. Factory default is AUX IN.

TX Pre-emphasis- Allows for the signal path from AUX IN and the MIC IN input to be either pre-emphasized or flat. Most applications where the AUX IN input is used work best with a flat response. Factory default is flat response.

RX De-emphasis- Allows for the signal path from the discriminator to the AUX OUT and Audio Out to be either de-emphasized or flat. Most applications where the AUX OUT output is used work best with a flat response. Factory default is for flat response.

Busy Channel Lockout- Prevents the transmitter from activating when the carrier detect output is true. Used to prevent interference on a channel where activity already exists. Not normally enabled in half duplex operation since transmit and receive channels are not on the same frequency. Factory default is for this function to be off.

Squelch Enable- Allows receive audio paths to be muted when the carrier detect output is false. It is used to prevent the output of noise from the audio outputs when no signal is present. Due to the finite squelch attack time, some high-speed modems work best with unsquelched audio. The factory default is for this function to be set for never mute.

DCD Output Logic Level- Allows the setting of the polarity of the DCD (Data Carrier Detect) output. Active high means that the true state is a logic high while active low means that the true state is logic low. Normal setting is active high. The factory default is active high.

Microphone Gain- Available when the Audio Input selection is set to Microphone. This box allows the gain of the signal at the Microphone input to be set either low or high. Factory default is for the Microphone input gain to be set to low. Note that if the Audio Input is set to AUX IN above, no signal from the Microphone input will be passed to the transmitter.

Audio PA- Turns the AUDIO OUT output on or off. Turning the AUDIO OUT output off when not needed saves current drain in receive.

RX Discriminator Coupling- Selects whether the coupling from the discriminator output on the RF board is AC or DC coupled to the control/loader board. Since the audio outputs of the control/loader board are AC coupled, this function is normally set for AC as well. Setting this function to DC will extend the low frequency receiver response somewhat, but makes the audio output subject to clipping due to DC offsets on the discriminator output. For true response to DC, a hardware jumper options can be made for DC coupling at the AUX OUT. (See the Hardware Options section under Maintenance for details on this option.) If this is done, this function should be set for DC. For direct-modulated type of data streams such as true FSK, RRCFSK, 4FSK, etc., DC coupling may be indicated, even if the output of the unit is not modified for true DC coupling to the output. AFSK modulation types such as Bell 202, etc. should use AC coupling. The factory default is AC.

CSN Input- Selects whether RNET Compatibility mode is to be used. See section 5.6 for an explanation of this function. Normal operation is to set this for high/low Power. The factory default is high/low power mode.

High Pass Filter- When RX Discriminator Coupling is set to AC, this box is enabled. This box allows a choice of two roll off frequencies for the lower high-pass roll off. The 250 Hz selection may attenuate certain types of data signals and cause tilt on square waves, but is the fasted at responding to changes in discriminator DC level caused by frequency errors on either the receiver or the receiving transmitter. For better low-frequency response, 50 Hz may be selected.

CSN Input- Controls the function of the CSN pin. This pin can be used to select one of two transmitter power levels in the High/Low Power position or can be used to select one of two channels in the RNET Channel 1/2 mode. See Section 5.6, RNET COMPATIBILITY MODE for details on this selection.

CTS Output Logic Level- Sets the polarity of the CTS (Clear-To-Send) output. Setting for active high caused the true logic state to be high. Active high is the normal setting. The factory default is active high.

Monitor Polarity- The monitor input is used to override the action of the receiver squelch (mute) when squelch is active. This function sets the polarity, active low or active high, of this input. When active, squelch is disabled, even is enable via the Squelch Enable setting above.

PTT/RTS Input Logic Level- Sets the polarity of the PTT/RTS input. Normally set for active low i.e. transmitter is activated when this input is at the logic low state. **Due to the internal pull-up resistor, setting this to active high will cause activation of the transmitter when the PTT/RTS input is left unconnected.** The factory default is active low.

Green LED- Sets the operation of the green LED on the front of the radio. The choices are:

a. Off-The green LED is never on.
b. Power ON-The green LED is on whenever the radio is powered up.'
c. Carrier Detect-The green LED is on whenever a carrier is detected that is above the programmed carrier detect on threshold.
d. RX Synthesizer Lock-The green LED is on whenever the frequency synthesizer is locked while in receive mode. This is the factory default setting.

Red LED- Sets the operation of the red LED on the front of the radio. The choices are:

a. Off-The red LED is never on.
b. RX-The red LED is on whenever the radio is actually transmitting. This is the factory default setting.

TX Timeout Timer- Allows for limits on the maximum time the transmitter may be continuously keyed. When set, the maximum limit is set in the box. To prevent overheating and possible damage to the unit, this is normally set on with a time of 60 seconds of less. See section 5.4 for limits on maximum key-down times. The factory default is 60 seconds.

6.5.4 SUMMARY

The summary page summarizes the information shown on the other three pages and, in addition, includes the model and serial number of the unit.

6.5.5 RESTORE EEPROM

This selection is used to load a previously saved radio configuration file to the radio connected to the programmer. This is of benefit when a number of radios are to set to the same frequencies and with the same switch settings. There are three options for this page, but none will copy the deviation and balance settings since these are unique to each radio, even if the actual deviation of a set of radios is identical. The top selection allows all settable parameters, including power levels and squelch settings to be read. The second selection does not read in the power levels and squelch in case these have already been set in the recipient radio. The last selection is for someone who has a configuration file from a series DTX-X54 and want to load it into the series DTX-X60. Older radio parameters are converted and presented such that the audio levels should be the same. Note that the RF power levels and squelch levels cannot be converted and must be set on the new radio by hand.

6.5.6 SAVING A CONFIGURATION

Upon exiting the programmer via the exit button, the user will be presented with a box which allows the saving of the current configuration. This is useful if a number of other radios are to be programmed with the same frequencies and settings. If one does not wish to save the current configuration, the cancel icon should be selected. Also, if changes to the radio have been made via the programmer and the radio has not been updated, the user will be prompted to update the radio.

II MAINTENANCE

7 IMPORTANT MAINTENANCE INFORMATION

Surface Mount Repair: RITRON surface mount products require special equipment and servicing techniques. Improper servicing techniques can cause permanent damage to the printed circuit board and/or components, which is not covered by RITRON's warranty. If you are not completely familiar with surface mount component repair techniques, RITRON recommends that you defer maintenance to qualified service personnel.

Precautions For Handling CMOS Devices: The DTXM transceiver module contains complementary metal-oxide semiconductor (CMOS) devices, which require special handling techniques. CMOS circuits are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, with no failure appearing until weeks or months later. For this reason, take special precautions any time you disassemble the module. Follow the precautions below, which are even more critical in low humidity environments.

1) Storage/transport-CMOS devices that will be stored or transported must be placed in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are being used for other semiconductors. Conductive containers are typically gray or pink in color.

2) Grounding-All CMOS devices must be placed on a grounded bench surface. The technician that will work on the radio/CMOS circuit must be grounded before handling the radio. Normally, the technician wears a conductive wrist strap in series with a 100 kΩ resistor to ground.

3) Clothing-Do not wear nylon clothing while handling CMOS circuits.

4) Power Off-Remove power before connecting, removing, or soldering on a PC board that contains CMOS devices.

5) Power/Voltage Transients-Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, making sure that no voltage transients are present.

6) Soldering-Use a soldering iron with a grounded tip for soldering CMOS circuitry.

7) Lead-Straightening Tools-When straightening CMOS leads, provide ground straps for the tool used.

VCO Shield: The VCO shield is virtually impossible to remove without damaging either the PC board or nearby components. The parts within the shield are low failure items; repair or replacement should not be required unless the RF board is mishandled. If failure of a part within the shield is deemed to have occurred, the RF board should be returned to RITRON for service or replacement.

Unit Disassembly and Re-assembly:

1) Case Removal

   a) Remove the two screws at the rear of the unit. These screws secure the rear bracket to the case. Removal of these screws requires a TORX T-10 driver.

   b) Remove the three side screws (one on one side, two on the other). These screws secure the front bracket to the case. Removal of these screws requires a TORX T-9 driver.

   c) Slide the case off the two-board assembly.

2) Board Separation

Remove the two screws that secure the control/loader board to the rear bracket. The rear bracket stays connected to the RF board. Remove the two screws that secure the RF board to the front bracket. The front bracket stays connected to the control/loader board. These four screws are removed with a TORX T-9 driver. The two boards are held together by their interconnecting header/socket. Gently pry the two boards apart at the header/socket. The RF board is then rotated and tilted so to allow the right angle BNC connector to pass through the hole in the front bracket.

3) Re-assembly is the reverse of assembly with the rear screws installed before the side screws.

9 HARDWARE OPTIONS

The DTX is setup at the factory in a configuration that should be acceptable for most users. The most common changes required are effected through the programmer without removing the cover from the unit. There are, however, a number of component jumper changes which can be made which may result in more satisfactory integration in a data system. These changes require the soldering and unsoldering of SMD components and should be undertaken only by qualified service personnel. Refer to the PCB component locator and schematic diagrams as needed.

9.1 CONTROL/LOADER BOARD OPTIONS

9.1.1 AUX OUT COUPLING

The AUX OUT output is normally AC coupled through C399. If DC coupling is desired, an 0805 size SMD zero ohm jumper resistor (RITRON P/N 47100000) must be soldered in the location of MR384. (In lieu of a zero ohm jumper, a small piece of wire may be carefully soldered between the pads.) The AUX OUT DC level then becomes nominally 1.67 volts.

9.1.2 AUX IN COUPLING

The AUX IN input is normally AC coupled through C343. DC coupling is possible, however, the carrier frequency of the unit would then become directly affected by the DC voltage present. If DC coupling is desired, an 0805 size SMD zero ohm jumper resistor (RITRON P/N 47100000) must be soldered in the MR369 location**.** The DC voltage should be 2.5 volts nominal and very well regulated. **Note: The FCC Type Acceptance obtained by RITRON is invalid once this modification is made. The user is responsible for obtaining type acceptance in a configuration which includes the device which is connected to the AUX IN input.**

9.2 RF BOARD OPTIONS

9.2.1 DISCRIMINATOR POLARITY

The polarity of the discriminator output at pin 14 of J102 is configured at the factory such that an increase in RF frequency causes an increase in DC voltage. This is considered “normal” mode. An inverted mode is available where an increase in frequency causes a decrease in voltage. This is effected by removing R130 and placing it in the open pad pair denoted as MR125.