VHF/FM
DIGITAL
AIRBORNE TRANSCEIVER
MODEL TDFM-136

Installation and
Operating Instructions

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Technisonic Industries Limited

CAUTION

This unit contains static sensitive devices. Wear a grounded wrist strap and/or conductive gloves when handling printed circuit boards.

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: *This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

S   *Reorient or relocate the receiving antenna*
S   *Increase the separation between the equipment and receiver*
S   *Connect the equipment into an outlet or circuit different from that to which the receiver is connected.*
S   *Consult the dealer or an experienced radio/TV technician for help.*

WARRANTY INFORMATION

The Model TDFM-136, VHF/FM Digital Transceiver is under warranty for one year from date of purchase. Failed units caused by defective parts, or workmanship should be returned to:

Technisonic Industries Limited   Technisonic Industries Limited
250 Watline Avenue   3840 E. Robinson Road, Suite 214
Mississauga,   Amherst,
Ontario L4Z 1P4   New York 14228

Tel: (905) 890-2113   Fax: (905) 890-5338   Tel: (716) 691-0669

Summary of DO-160C Environmental Testing for Technisonic Model TDFM-136, VHF Digital Transceiver

Conditions	Section	Description of Conducted Tests
Temperature and Altitude	4.0	Equipment tested to categories B2 and D1.
Vibration	8.0	Equipment is tested without shock mounts to categories B, M and N.
Magnetic Effect	15.0	Equipment is class Z.
Power Input	16.0	Equipment tested to category B.
Voltage Spike	17.0	Equipment tested to category B.
RF Emission	21.0	Equipment tested to category Z.

GENERAL DESCRIPTION

1.1 INTRODUCTION

This publication provides operating and installation information on the TDFM-136, Digital Transceiver manufactured by Technisonic Industries Limited. The TDFM-136 is Project 25 (P25), Phase 1 compliant. The unit offers digital or conventional analog FM communications over an extended frequency range with selectable channel spacing and is intended for use (in the U.S.) only by government agencies or contractors thereto, who have obtained licensing for operation in the 136-150 MHz portion of the band. If the TDFM-136 transceiver is used in CANADA, operation is restricted to the following sub bands: 138-144, 148-148.99, 149.005-150.005 and 150.05-174 MHz. Furthermore the frequency agile transceiver is restricted to airborne use must not be operated as a base station in Canada.

1.2 DESCRIPTION

The TDFM-136, Transceiver is a frequency agile, fully synthesized airborne transceiver capable of operating in the 136.000 MHz to 174.000 MHz frequency range in 2.5 kHz increments with either 25 kHz analog, 12.5 kHz analog channel spacing and P25, 12.5 kHz digital modulation on a channel by channel basis. The Transceiver can operate without restriction on any split frequency pair in the band and also incorporates a two channel synthesized guard receiver.

The TDFM-136 Transceiver provides 150 operator accessible memory positions, each of which is capable of storing a transmit frequency, receive frequency, transmit frequency CTCSS tone or DPL code, receive frequency CTCSS tone or DPL code, an alphanumeric identifier for each channel and in the TDFM-136, wideband (25 kHz analog) or narrowband (12.5 kHz analog) channel spacing assignment. The P25 mode (12.5 kHz digital) channels include both NAC and Talk Group capability.

Operating frequency and other related data are presented on a 48 character, two line LED matrix display. Data entry and function control are performed via a 12 button keypad. Preset channels may also be scrolled and scanned through keypad function activation.

1.3 PURPOSE OF EQUIPMENT

The TDFM-136, Digital VHF/FM Transceiver is designed to provide secondary airborne communications to facilitate operations which are typically performed in a low altitude environment. The transmitter section of this unit has a minimum of 8 watts and does not exceed 10 watts output power, which may be reduced by a front panel switch to 1 watt, in order to reduce interference to land based systems.

1.4 MODEL VARIATION

There are four variations of the Model TDFM-136 Transceiver. All units offer identical features and performance except for the following differences:

TDFM-136, P/N 981087-1   GREEN display and 28 Volt back lighting.

TDFM-136, P/N 981087-1 (5V)   GREEN display and 5 Volt back lighting.

TDFM-136, P/N 981087-2   RED display and 28 Volt back ligting.

TDFM-136, P/N 981087-2 (5V)   RED display and 5 Volt back lighting.

Both P/N's 981087-1 and 981087-2 are always provided with 28 Volt back lighting unless a specific request is made for 5 Volt AC operation.

1.5   TECHNICAL CHARACTERISTICS

<u>Specification</u>	<u>Characteristic</u>
<u>GENERAL</u>	
Model Designation:	TDFM-136
Frequency Range:	136.000 to 174.000 MHz
Operating Modes:	P25 CAI and conventional analog 12.5/25 kHz conventional analog 12 KBPS FSK, 9.6 KBPS C4FM
Channel Spacing:	25 or 12.5 kHz
Physical Dimensions (including heatsink):	Approx. 8.0" X 3.0" X 5.75"
Weight:	Approx. 3.5 Lbs (1.6 Kg)
Mounting:	Panel Mount via Dzus fastners
Operating Temperature Range:	-45EC to + 70EC
Power Requirement:	
Voltage:	28.0 Vdc, ± 15%
Current:	Receive - 0.7 A Max. 1 Watt Transmit - 1.3 A Max. 8-10 Watt Transmit - 2.0 A Max.
Frequency Selection:	150 memories programmed with: a) Tx Frequency/Rx Frequency b) Tx/Rx CTCSS tone or DPL code c) 9 character alpha numeric title
Guard Receiver:	2 channels programmed with: a) Tx Frequency/Rx Frequency b) Tx CTCSS tone or DPL code c) 9 character alpha numeric title
CTCSS squelch/encoder:	All CTCSS tones available
DPL digital squelch/encoder:	All standard DPL codes
DTMF encoder:	All standard DTMF tones
Audio Output:	0.5 Watts into 600 ohms
Speaker Output:	2.5 Watts min. into 4 ohms
Back Lighting:	28 Volts (standard) or 5 Volts (specify)

| Display Colour: | Green (standard) or |
| Red (specify) |
| NVG Optional |

DPL is a trademark of Motorola Corporation

1.5   TECHNICAL CHARACTERISTICS (continued)

MAIN RECEIVER

Sensitivity at 12 dB SINAD	-116dBm
Adjacent Channel Selectivity	-60dB (25 or 12.5 KHz)
Spurious Attenuation	-70 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-80 dB
FM Acceptance	± 6 KHz
Hum and Noise	Better than 45dB
Audio Distortion	less than 5%
Antenna Conducted Emission	less than -57dBm

GUARD RECEIVER

All specifications identical to main receiver.

TRANSMITTER

RF Power Output	Lo -100mW to 1W (internal adjustment) or hi-power; 10 watts.
Output Impedance	50 ohms
Maximum Deviation (In narrowband mode)	± 5 KHz (25 KHz mode) ± 2.5 KHz (12.5KHz mode)
Spurious Attenuation	-90 dB below carrier level
Frequency Stability	± 2.5 ppm
Microphone Circuit	Carbon or equivalent
Sidetone Output	0.5W (max) into 600S
Harmonic Attenuation	-65 dB below carrier level
FM Hum And Noise	-40 dB

Audio Input	50 mV at 2.5 KHz into
	200 S input circuit for
	± 3.5KHz deviation, adjst.

Audio Distortion   Less than 5%

SECTION 2

OPERATING INSTRUCTIONS

2.1   OPERATING FEATURES

The Technisonic TDFM-136 airborne FM transceiver is visually similar to the industry standard TFM-138, a two line by 24 character display is centered at the top of the unit, just below the display are six user controls on the left and a 12 key keypad on the right (refer to Figure 2-1). The TDFM-136 support the following features:

1.   150 memory positions which can each be programmed with a transmit and receive frequency with 25 or 12.5 kHz analog channel spacing, Tx/Rx CTCSS tones or DPL codes and a 9-character alphanumeric title. Or the memory positions can be programmed to P25 Digital mode (12.5 kHz) with or without a P25 Talkgroup.
2.   2 guard channels which can each be programmed with a Rx frequency with 25 or 12.5 kHz channel spacing, CTCSS Tx tone or DPL code and a 9-character alphanumeric title. Or either guard channel can be programmed to P25 Digital mode (12.5 kHz) with or without a P25 Talkgroup.
3.   Scanning of programmed memories with selective memory scanning, in 5 scan lists.
4.   Priority scan of memory channel 1, if desired.
5.   Direct frequency entry mode.
6.   Receive frequency simplex function.
7.   Switchable RF output power between 1 watt and 8-10 watts.
8.   Lockout of keyboard to prevent inadvertent entries.
9.   Variable frequency mode to manually scan up and down in 2.5 kHz steps.
10.   LED display variable dimming mode.
11.   Selectable 90 second Tx time out feature.
12.   Quick download of any of the 150 memory positions to the guard memories.
13.   PC Memory Upload or download capability.

2.2   OPERATOR CONTROLS

The user controls comprise a main volume control – with integrated on/off switch - a guard volume control, a squelch defeat button, a MAIN/GD selection switch, a GD1/GD2 selection switch, and a high/low power switch. The keypad layout is a 3 by 4 matrix, the layout being similar to a telephone keypad, though the options are arranged differently.

FIRST CHARACTER INDICATES RECEIVE OR TRANSMIT STATUS
SECOND CHARACTER INDICATES SQUELCH MODE

LED DISPLAY
LINE 1 INDICATES MAIN RECEIVER/TRANSMITTER STATUS
LINE 2 INDICATES GUARD RECEIVER STATUS

KEYBOARD FOR FUNCTION CONTROL
SETUP, AND FREQUENCY DIRECT ENTRY

INDICATES RECEIVE FREQUENCY DURING RECEIVE
AND TRANSMIT FREQUENCY DURING TRANSMIT

INDICATES OPERATING MODE
FOR SELECTED CHANNEL

USER DEFINED ALPHANUMERIC
DESCRIPTION FOR CHANNEL

INDICATES SCAN-LIST NUMBER

INDICATES SELECTED MEMORY CHANNEL

MAIN RECEIVER SQUELCH INDICATOR
(LIGHTS WHEN SIGNAL RECEIVED)

GUARD RECEIVER SQUELCH INDICATOR
(LIGHTS WHEN SIGNAL RECEIVED)

MOMENTARY SQUELCH
OVERRIDE/TEST BUTTON

TRANSMIT OUTPUT POWER LEVEL

GUARD VOLUME CONTROL

GUARD CHANNEL SELECTOR

INDICATES MENU LEVEL

MAIN VOLUME CONTROL

MAIN/GUARD SELECTOR SWITCH

TL Technisonic

TDFM-136

123:FIRE TAC ñ153.7500Tt
GD12AIRLIFT D173.2350R9

MAIN   GUARD   SQUELCH

OFF

MN   GD

G1   G2

HI   LO

CHAN 1 | ↑2 | 3 MODE
↓4 | 5 SCAN | ↕6
7 FREQ | ↓8 | 9 SQL
ENTER | 0 PROG | * ESC

FIGURE 2-1   Operator's Switches and Controls - TDFM-136
2.3   DISPLAY INFORMATION

The display is divided into two (2) lines, the upper line displays information pertaining to the MAIN channel, the lower line displays information about the GUARD channel. The information displayed is similar for both the MAIN and GUARD and is formatted out as follows: (refer to figure 2-1).

The first three characters of the display indicate the CHANNEL selected, for MAIN the allowable values are 001 to 250, for GUARD only GD1 or GD2 can be displayed.

The fourth character indicates the SCAN list status of the channel, this is true for the MAIN channel only. If the selected channel is included in a scan list, then the scan list number (1-5) will be displayed in subscript.

The next nine (9) characters are spaces for a text DESCRIPTION of the channel.

The next character indicates the operating MODE of the radio as follows:

> lower case 'w' indicates analog wide mode
> lower case 'n' indicates analog narrow mode
> upper case 'D' indicates project 25 digital operation.

The next eight (8) characters indicate the channel frequency in MHz. The final two (2) characters indicate the SQUELCH mode and operation as follows:

> *For Receive Operation*
> Rx indicates no squelch mode has been chosen
> Rt indicates that CTCSS tones are being used
> Rc indicates that DCS codes are being used
> Rg indicates that project 25 TALK GROUPS are being used
> Rn indicates that NOISE Squelch is being used.

> *For Transmit Operation*
> Tx indicates no squelch mode has been chosen
> Tt indicates that CTCSS tones are being used
> Tc indicates that DCS codes are being used
> Tg indicates that project 25 TALK GROUPS are being used
> there is no noise squelch mode for transmit!

2.4   BASIC RADIO OPERATION

Upon turning on the radio, after the boot sequence is finished the operator sees a two line display the top line of which presents the operating parameters of the main channel, the bottom line of which presents the operating parameters of the chosen guard channel.

The operator can receive signals from two (2) sources simultaneously: the selected MAIN receive (Rx) frequency and the selected GUARD Rx frequency.

The operator may transmit on one (1) frequency at a time, the transmit (Tx) frequency is determined by the position of the **MN/GD** switch. If set to 'MN' then the unit will transmit on the Tx frequency of the selected MAIN channel. If the **MN/GD** switch is set to 'GD' then the unit will transmit on the Tx frequency of the selected GUARD channel.

The display will alter – on the appropriate line - to display the Tx frequency and squelch mode when the user presses the press-to-talk (PTT) switch.

The operator selects the guard channel used via the front panel **GD1/GD2** switch. Transmit occurs at a power level as determined by the position of the **HI/LO** power switch: HI is 10 watts, LO is 1 watt.

The user may cause the radio to defeat the squelch on both selected MAIN and GUARD channels by pressing –

and holding – the **SQUELCH** button. Upon release, the saved squelch parameters will be restored to the respective channels.

2.5   OPERATOR COMMANDS - OVERVIEW

The operator may affect the operation of the radio parameters by pressing the associated key on the keypad. The parameters that may be affected in this manner are shown in the table below.

Key	operator direct – L1	operator programming– L2	maintenance – L3
		Table 2-1 TDFM-136 Command Matrix	
1	select CHANNEL	program CHANNEL	select boot CHANNEL
2	display – brighter	edit chan DESCRIPTION	PC upload
3	edit chan MODE	LOCK keypad	RF Alignment
4	chan scroll down	fast GD prog	fast GD prog E/D
5	edit chan SCAN	scan ON/OFF	scan E/D
6	chan scroll up	PTT timer E/D	PTT timer set
7	edit chan FREQUENCY	FREQUENCY scroll	reserved
8	display – dimmer	FREQ split/Rx simplex	PC download
9	edit chan SQUELCH	reserved	terminal mode
0	go to level L2	go to level L3	reserved
ENTER	save channel	reserved	reserved
ESC	go to security - m	go to previous level	go to previous level

The commands are divided into levels: level one is a direct entry level, commands in this level are selected directly by pressing a key. Level 2 commands are accessed by first pressing the 'PROG' (0) key. Level 3 commands allow personnel to maintain and configure the radio. To avoid accidental activation, these commands are accessed by pressing the 'ESC' key followed by: '0', '0', '0', 'ENTER'.

2.6   USING OPERATOR DIRECT COMMANDS (Level 1)

1 (CHAN) - Select the Operating Channel

This command allows the user to select the MAIN channel that the radio is operating on. Upon selecting this command the cursor will appear at the first digit in the channel number, select a number from 001 to 250.

> 'ENTER' **– accepts this entry if valid (programmed) and will return standby condition. If the cursor remains then this channel number is not valid or there is no information programmed for the channel.**

> 'ESC' - abandons the command and returns to the standby condition.

2 (UP ARROW) - Increased Display Brightness

Press and hold the up arrow (2) key to increase the brightness of the LED display, it stops at maximum.

3 (MODE) - Edit Channel Operating Mode

This command will edit the `Operating MODE` of the selected channel; both MAIN and GUARD channels may be edited and the channel to be edited is determined by the position of the MN/GD switch and the G1/G2 switch.

2.6   USING OPERATOR DIRECT COMMANDS (Level 1) - continued

Upon selecting this command the cursor will appear at the MODE position, the forward arrow (6) key allows the user to scroll through the available modes one at a time. see the table below.

Table 2.2 Operating Modes	
Channel Operating Mode	**Indicator**
Analog Wide (25 kHz)	'w'
Analog Narrow (12.5 kHz)	'n'
Digital (12.5 kHz)	'D'

> **'ENTER'** – accepts this entry and returns.
> **'ESC'** - abandons the entry and returns.

4 (BACK ARROW) - Scroll Down the Channel List

This command will scroll DOWN through the programmed channels until reaching the lowest channel programmed, it will then wrap around and restart from the top.

5 (SCAN) - Edit Channel Scan List

This command will select the **SCAN LIST** - if any - that the selected channel is included in. The channel may be included in any one of the five (5) scan lists that are supported.
> **numbers 0-5** – select the Scan List (0 for none)
> **'ENTER'** – accepts this entry and returns.
> **'ESC'** - abandons the entry and returns.

6 (FORWARD ARROW) - Scroll Up the Channel List

Use the forward arrow This command will scroll UP through the programmed channels until reaching the highest channel programmed, it will then wrap around and restart from the bottom.

7 (FREQ) - Edit Channel Operating Frequency

This command will edit the **Operating Frequency** of the selected channel; both MAIN and GUARD channels may be edited and the channel to be edited is determined by the position of the **MN/GD** switch and the **G1/G2** switch.

8 (DOWN ARROW) - Decreased Display Brightness

Press and hold the down arrow (8) key to decrease the brightness of the LED display, it stops at minimum.

9 (SQL) - Edit Channel Squelch Mode

This command will edit the **Squelch Parameters** of the selected channel; both MAIN and GUARD channels may be edited and the channel to be edited is determined by the position of the **MN/GD** switch and the **G1/G2** switch.

For the receiver select a Squelch mode
> **6** (forward arrow) – scroll through available Squelch Modes.
> **'ENTER'** – accepts this entry.
> **'ESC'** - abandons the entry.

NOTE: Squelch modes available will depend on operating mode chosen. ie. analog modes will not offer P25 talkgroup as an option.

Table 2.3 Receive and Transmit Squelch Modes		
Squelch Mode	**Receive**	**Transmit**
carrier	Rx	Tx
noise	Rn	- (Tx)
CTCSS Tones	Rt	Tt
DCS Codes	Rc	Tc
P25 Talkgroup	Rg	Tg

Enter a key number pertaining to the Squelch mode chosen, refer to the tables below.

'ENTER' – accepts this entry.
'ESC' - abandons the entry.

Once the Rx Squelch Mode has been chosen, the process is repeated for the Tx Squelch modes.

Table 2.4 Noise Level	
Level	**Key Number**
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16

Table 2.5	CTCSS Tones
Tone	**Key Number**
67.0	1
69.3	2
71.9	3
74.4	4
77.0	5
79.7	6
82.5	7
85.4	8
88.5	9
91.5	10
94.8	11
97.4	12
100.0	13
103.5	14
107.2	15
110.9	16
114.8	17
118.8	18
123.0	19
127.3	20
131.8	21
136.5	22
141.3	23
146.2	24
151.4	25
156.7	26
162.2	27
167.9	28
173.8	29
179.9	30
186.2	31
192.8	32
203.5	33
206.5	40
210.7	34
218.1	35
225.7	36
229.1	41
233.6	37
241.8	38
250.3	39
254.8	42

Table 2.6 DCS Codes			
Code	**Key Number**	**Code**	**Key Number**
23	1	315	43
25	2	331	44
26	3	343	45
31	4	346	46
32	5	351	47
43	6	364	48
47	7	365	49
51	8	371	50
54	9	411	51
65	10	412	52
71	11	413	53
72	12	423	54
73	13	431	55
74	14	432	56
114	15	445	57
115	16	464	58
116	17	465	59
125	18	466	60
131	19	503	61
132	20	506	62
134	21	516	63
143	22	532	64
152	23	546	65
155	24	565	66
156	25	606	67
162	26	612	68
165	27	624	69
172	28	627	70
174	29	631	71
205	30	632	72
223	31	654	73
226	32	662	74
243	33	664	75
244	34	703	76
245	35	712	77
251	36	723	78
261	37	731	79
263	38	732	80
265	39	734	81
271	40	743	82
306	41	754	83
311	42		

0 (PROG) - Menu Level Up

Pressing this key selects the next Higher Menu Level, the Menu Level is indicated in the 4thcharacter position on the lower row of the display. The Menu Level is indicated in subscript and is as follows:

Table 2.7 Keypad Menu Level	
Level	**Display**
1 direct	blank
2 programming	2
3 maintenance	3

Upon pressing this key, the radio will remain in the new Command Level for 5 seconds, if there is no further user input within this time frame then the radio will revert to the Direct Command Level. The Direct Command Level (level 1) is the normal operating mode for the radio.

NOTE: The Operator Direct Command Level (level 1) is indicated by a blank space, this is the normal operating mode of the radio.

'ENTER' – save changes to selected channel if any

If there have been changes made to the current operating channel, pressing 'ENTER' will allow the user to save these changes to the channel memory.

'ESC' – Menu Level Down

Pressing this key selects the next Lower Menu Level, the Menu Level is indicated in the 4thcharacter position on the lower row of the display. The Menu Level is indicated in subscript and is as given in the table in '0' above.

2.7 USING OPERATOR PROGRAMMING COMMANDS (Level 2)

Access the **Operator Programming Command Level** (level 2) by pressing the **'PROG'** key from the **Operator Direct Command Level** (level1) once. The Menu Level is indicated in the 4th character position on the lower row of the display, this will indicate a subscript **'2'**.

Having selected the Operator Programming Command Level, the keys provide a new set of functions for the operator as follows:

1 - Program Channel Information

This command allows the user to program all the information for an operating channel. If the selected channel contains valid information then that information will be displayed.
The channel to be programmed depends on the position of the front panel switches: If the MN/GD switch is in the 'MN' position then the Main channel will be edited, if it is in the 'GD' position then the Guard channel will be edited depending on the position of the G1/G2 switch.

For each step below, if there is valid data in the field:
> Pressing the **'ENTER'** key will accept the entered value and proceed to the next step.
> Pressing the **'ESC'** key will proceed to the next step without accepting the entered value.

> 5   Enter a **Channel** number (001 to 250), press 'ENTER'.
> 6   Enter a **Scan List** for the channel if desired, press 'ENTER'.
> 7   Enter a **Text Description** for the channel (up to 9 characters)
>   Up/Down arrow keys scroll through the alphabet, right/left arrow keys allow editing, when done, press 'ENTER'.
> 8   Select the **Operating Mode**, scroll through options using the forward arrow (6), press 'ENTER'.
> 9   Select a **Rx Frequency** in the range 136.0000 to 174.0000, press 'ENTER'.
> 10   Select a Rx **Squelch Mode**, choose TONES, CODES etc as required, press 'ENTER'. Note that the available Squelch modes will be affected by the selected Operating Mode, that is, if analog narrow Operating Mode was selected then the user cannot select P25 talkgroup as a Squelch Mode.
> 11   repeat 5 & 6 for Tx.

2 – Edit Channel Description

This command allows the user to edit the text description for the selected channel. The arrow keys allow editing as follows:

> **2** (up arrow) – scroll up through the alphabet
> **8** (down arrow) – scroll down through the alphabet
> **4** (back arrow) – move cursor backwards
> **6** (forward arrow) – move cursor forwards
>
> **'ENTER'** – accepts this entry.
> **'ESC'** - abandons the entry.

3 – Lock Keypad

This command locks the keypad to prevent accidental change to parameters of the radio unbeknownst to the operator. This will disable all keyboard functions (except keyboard unlock). To unlock the keyboard, press and hold the '**ESC'** key until the display indicates "UNLOCK" (about 2 seconds).

2.7 USING OPERATOR PROGRAMMING COMMANDS (Level 2) - continued

4 – Fast Guard Program

This command transfers the displayed main memory positions' parameters to the Guard Memory position according to the position of the **G1/G2** front panel switch.
The selected Guard channel will now contain the information from the selected Main channel memory.
This feature may be disabled via Maintenance Command (Level 3) **'4'.**

> **'ENTER'** – accepts this transfer.
> **'ESC'** - abandons the transfer.

5 – Scan Mode: ON/OFF

This command allows the user to start and stop the Scan operation.
Select Scan and follow the command key with a number from 0 to 5, this will start scanning using the selected scan list, if 0 was selected then scanning will be terminated.

NOTE: Scan operation automates the process of selecting pre-programmed channels that have been saved to memory, it DOES NOT sweep the frequency band!

6 – PTT Timer: Enable/Disable

This command toggles the operation of the PTT timer. When ENABLED, the timer will stop the unit from transmitting after the programmed time-out period, this protects against accidental PTT lockup. The user can re-start the timer by releasing PTT for a moment.

!CAUTION!   *When DISABLED the PTT timer will not protect against continuous transmission.*

The default is: PTT Timer *ENABLED.*

7 – Frequency: Scroll Mode

This command places the unit into frequency scroll mode, when in scroll mode the frequency may be changed as follows:

> **2** (up arrow) – scroll frequency up in 2.5 kHz. steps.
> **8** (down arrow) – scroll frequency down in 2.5 kHz. steps.
> **4** (back arrow) – scroll frequency down in 1 MHz. steps.
> **6** (forward arrow) – scroll frequency up in 1 MHz. steps.

> **'ENTER'** – accepts this entry.
> **'ESC'** - abandons the entry.

8 – Rx/Tx Simplex/Split Pair Operation

This command allows you to quickly change the transmit frequency, when operating on a split pair (repeater/semi-duplex mode), to the receive frequency to allow direct communications.
  ie/ If you are transmitting on 152.000 MHz and receiving 152.555 MHz, press **8** (in command level 2) to transmit on 152.555 MHz.

 To return to the split pair condition, you must recall the memory channel again.

> **'ENTER'** – accepts this entry.
> **'ESC'** - abandons the command and returns to the normal operating mode

2.7   USING OPERATOR PROGRAMMING COMMANDS (Level 2) - continued

9 – not currently used - reserved

0 (PROG) - Menu Level Up

Pressing this key selects the next Higher Menu Level, the Menu Level is indicated in the 4thcharacter position on the lower row of the display. The Menu Level is indicated in subscript and is as follows:

Table 2.8 Keypad Menu Level	
Level	**Display**
1 direct	blank
2 programming	2
3 maintenance	3

Upon pressing this key, the radio will remain in the new Command Level for 5 seconds, if there is no further user input within this time frame then the radio will revert to the Direct Command Level. The Direct Command Level (level 1) is the normal operating mode for the radio.

'ENTER' – n/a

'ESC' – back one Menu Level – (to operator direct menu level)

2.8   USING MAINTENANCE COMMANDS (Level 3)

The Maintenance Command Level is available to allow configuration and testing of the radio in a bench test environment. This command level may be disabled by removing the jumper Jn on the MCU board.

NOTE: *this command level should NOT BE ENABLED when the radio is installed in the airframe.*

This command level is for bench operation only and as such does not preserve the Normal Operating display characteristics, that is: the Main and Guard displays are replaced by suitable command prompt information.

1 – Channel: Select Power-On Channel

This command toggles through the available power-on channel defaults. This allows selection of which channel will be selected when the unit is turned on. The available choices are: the *last used channel* or the *last programmed channel*.
The default is: *last used channel.*

2 – PC upload

Upload data from the radio to a PC. The unit must be connected to a PC running Windows 95, 98, or NT 4.0 and the TiL Radio Communications Software package.

3 – not currently used - reserved

4 – Fast Guard Program: Enable/Disable

This command allows the maintenance personnel to Enable or Disable the Fast Guard Program capability (Level 2 command 4).
The default selection is: *DISABLED.*

5 – Scan Operation: Enable/Disable

This command allows the maintenance personnel to Enable or Disable the Scan function (Level 2, command 5). When Enabled, the Scan function operates normally, when Disabled, the Scan function cannot be started. The default selection is: *ENABLED.*

6 – PTT Timer: Set Time

The PTT timer duration may be set using this command: select 0 – 9, this number is multiplied by 10 seconds to yield a timer duration between 0 and 90 seconds.
Note that selecting 0 effectively disables the radio from transmitting.
        'ENTER' – accepts this entry and returns.
        'ESC' - abandons the entry and returns.

7 – not currently used - reserved

8 – PC download

Download channel data from a PC to radio. The unit must be connected to a PC running Windows 95, 98 or NT 4.0 and the TiL Radio Communications Software package.

2.8   USING MAINTENANCE COMMANDS (Level 3) - continued

9 – Terminal Mode

Put the TDFM-136 into Terminal Mode. This is a bench test mode and allows the maintenance personnel to control the radio for testing.
　　　　'ESC' - abandons Terminal Mode and returns.

0 – not currently used - reserved

'ENTER' – not currently used - reserved

'ESC' – back one Menu Level – (to operator programming menu level)

SECTION 3

INSTALLATION INSTRUCTIONS

3.1 GENERAL

This section contains information and instructions for the correct installation of the TDFM-136, VHF/FM Digital Transceiver.

Make certain that the correct frequencies are preprogrammed in accordance with the equipment user's valid FCC operator's license, prior to installation.

3.2 EQUIPMENT PACKING LOG

Unpack the equipment and check for any damage that may have occurred during transit. Save the original shipping container for returns due to damage or warranty claims. Check that each item on the packing slip has been shipped in the container. Verify that the equipment display and backlighting configuration are the same as those ordered.

3.3 TRANSCEIVER INSTALLATION

The TDFM-136 Transceivers are designed to be Dzus mounted and should be installed in conjunction with a IN-150 installation kit. See Figure 3-1 for an outline drawing of the unit with dimensions to facilitate the installation.

3.4 INSTALLATION KIT - CONTENTS

The IN-150 installation kit consists of:

1. One 15 pin Cannon D mating connector (female) complete with crimp pins and hood.

2. One BNC antenna mating RF connector (male) and hood.

3.5 ANTENNA INSTALLATION

Antenna, P/N ATM-150 may be obtained from Technisonic Industries Limited or a suitable equivalent 0dB gain antenna may be utilized with the TDFM-136 transceivers. The antenna should be mounted on the bottom of the aircraft whenever possible and must be located at least 20cm (8 inches) from any occupant in the airframe. Consult with instructions provided with the antenna. Connect RF cable from antenna to the back of the TDFM-136 unit by utilizing the BNC mating connector provided in the installation kit.

3.6 INSTALLATION - PIN LOCATIONS AND CONNECTIONS

The pin numbers and locations for the 15 pin Cannon D located on the rear of the TDFM-136 digital transceivers are shown below. Pin connections are in provided in TABLE 3-1.

Transceiver mounted view of 15 pin connector

15 14 13 12 11 10 9
8 7 6 5 4 3 2 1
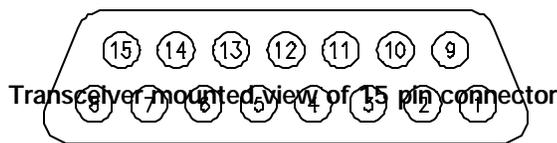
FIGURE 3-1   Outline Drawing for Model TDFM-136 Transceiver

3.6   INSTALLATION - PIN LOCATIONS AND CONNECTIONS (continued)

TDFM-136 Transceiver 15-Pin D Connections	
Pin #	**Description**
1	600 Ohm Output
2	Data Output
3	Panel Lighting (28VDC or 5VAC)
4	Memory UP/PC Download Input
5	Memory Down/PC Download Input
6	Mic Signal Input
7	Main Power + 28VDC
8	Main Ground
9	4 ohm Speaker Output
10	4 ohm/600 ohm Output Ground
11	Data Input
12	PC Download Input
13	PTT (Ground Keying)
14	Main Power + 28VDC
15	Main Ground

TABLE 3-1

3.7   WIRING INSTRUCTIONS

Figure 3-2 shows all required connections and recommended wire sizes for the TDFM-136 Transceiver.

3.7.1   Main Power + 28VDC

The main power + 28VDC (± 15%) is connected to pins 7 and 14 of the transceiver. Both pins should be connected.

3.7.2   Main Ground

Ground connections for the transceiver are made on pins 8 and 15. Both pins should be connected.

3.7.3   PTT (Ground Keying)

The PTT line is connected to pin 13 and should be floating when the transceiver is in receive mode, and grounded during transmit mode.
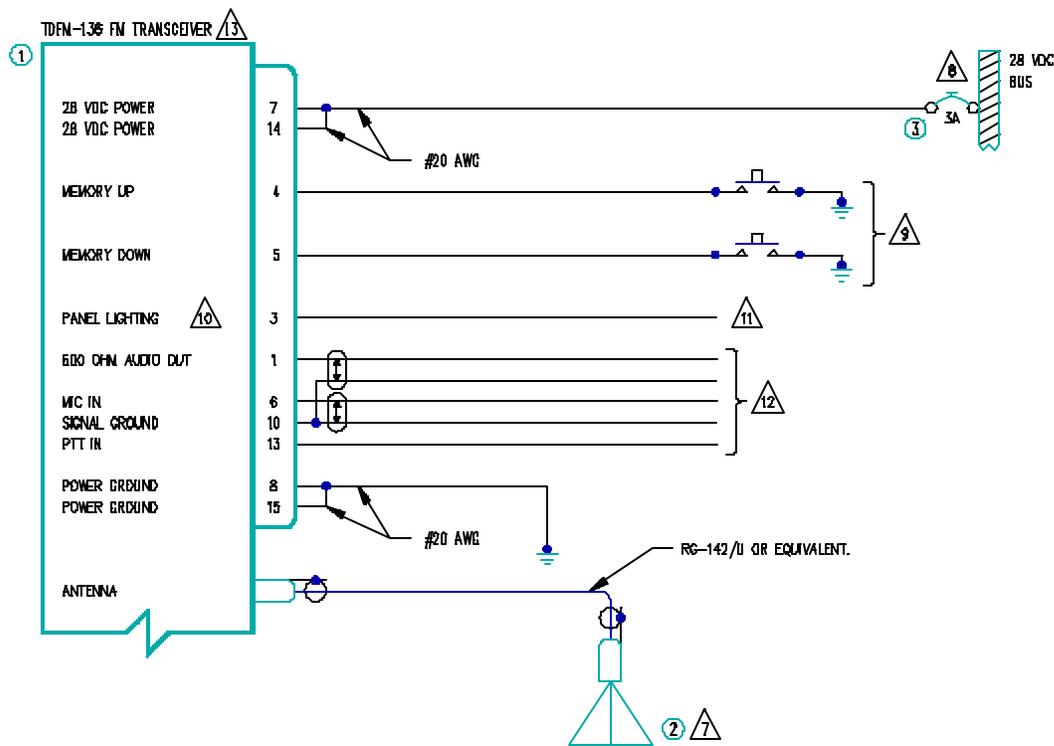
QTY	ITEM	PART NUMBER	DESCRIPTION	SPEC	MATERIAL
1	1	TDFM-136	VHF/FM COMMUNICATIONS TRANSCEIVER.	TECHNISONIC INDUSTRIES LIMITED	
1	2	AT-150	ANTENNA	TECHNISONIC INDUSTRIES LIMITED	
1	3	7274-11-3	CIRCUIT BREAKER, 3 AMPS	KLIXON	

NOTES:

1) ALL WIRE IAW MIL-W-22759 UNLESS OTHERWISE SPECIFIED.
2) ALL CABLE IAW MIL-C-27500 UNLESS OTHERWISE SPECIFIED.
3) COAXIAL CABLE IAW MIL-C-17 UNLESS OTHERWISE SPECIFIED. DO NOT USE COAX WITH PVC INSULATION.
4) FABRICATION & INSTALLATION OF WIRING HARNESS IAW AC 43.13-1A CHAPTER 11, SECTION 3, PARA 445 TO 462 AND SECTION 7.
5) GROUNDING AND BONDING IAW AC 43.13-1A CHAPTER 11, SECTION 3, PARA 452.
6) ALL SINGLE WIRE TO BE #22 AWG MINIMUM AND ALL SHIELDED WIRE TO BE #24 AWG MINIMUM, UNLESS OTHERWISE SPECIFIED.

7) INSTALLATION OF ANTENNA IAW AC 43.13-1A CHAPTER 2, SECTION 3, CHAPTERS 5 & 6, AND AC 43.13-2A CHAPTER 3.
   IF POSSIBLE, THE ANTENNA SHOULD BE LOCATED A MINIMUM OF 12 FT FROM AIRCRAFT NAVIGATION RECEIVER ANTENNAS AND
   A MINIMUM OF 4 FEET FROM AIRCRAFT COMMUNICATIONS AND ELT ANTENNAS. BE CAREFUL NOT TO CHOSE SEPARATIONS THAT
   CLOSELY APROXIMATE 1/4 OR 1/2 OR WHOLE NUMBER MULTIPLES OF THE NAVIGATION OR COMMUNICATIONS SYSTEM WAVELENGTH.

8) AN EQUIVALENT CIRCUIT BREAKER OR FUSE MAY BE USED.

9) THE MEMORY UP/DOWN PUSH BUTTONS ARE OPTIONAL.

10) THE TDFM-136 IS AVAILABLE WITH 28V OR 5V PANEL LIGHTING. CHECK THE CONFIGURATION CONTROL LABEL FOR THE CORRECT VOLTAGE.

11) CONNECT TO THE APPROPRIATE AIRCRAFT DIMMING BUSS.

12) CONNECT TO THE AIRCRAFT AUDIO SYSTEM OR STAND-ALONE HEADSET JACKS.

13) INSTALLATION OF TRANSCEIVER IAW AC 43.13-1A CHAPTER 2, SECTION 3 AND AC 43.13-2A, CHAPTER 2. PR 3 1/2 DZUS RAIL OR EQUIVALENT MAY BE USED.

14) TEST THE SYSTEM IN ACCORDANCE WITH THE POST-INSTALLATION TEST PROCEDURE IN THE INSTALLATION AND OPERATING INSTRUCTIONS MANUAL.

15) REFER TO THE AIRCRAFT STRUCTURAL REPAIR MANUAL AND THE MAINTENANCE MANUAL FOR INSTRUCTIONS AND INFORMATION PERTINENT TO THIS INSTALLATION.

16) THE USE OF RED DISPLAYS SHOULD BE MINIMIZED OR AVOIDED SO AS NOT TO DETRACT FROM THE ATTENTION GETTING CHARACTERISTICS NEEDED IN WARNING
    AND CAUTION ANNUNCIATORS. RED SHOULD BE USED TO ANNUNCIATE EMERGENCY CONDITIONS REQUIRING IMMEDIATE RESPONSE BY THE FLIGHT CREW. UNITS WITH
    RED DISPLAYS SHOULD NOT BE LOCATED IN CLOSE PROXIMITY TO WARNING AND CAUTION ANNUNCIATORS. THE INSTALLATION OF UNITS WITH RED DISPLAYS MUST
    BE EVALUATED ON A CASE BY CASE BASIS TO ENSURE THAT THE EFFECTIVENESS OF THE WARNING AND CAUTION ANNUNCIATORS IS NOT ADVERSELY AFFECTED.

Figure 3-2 Wiring Connections for TDFM-136 Transceiver

3.7.4 Front Panel Back Lighting

Front panel back lighting connection should be made on pin 3 of the transceiver. The opposite end of this lead should be connected to the panel lighting system of the aircraft. Before connecting, verify the required panel lighting voltage (28 VDC or 5VAC) on the transceiver configuration control label.

3.7.5 Audio Outputs (600 ohms and 4 Ohms)

The audio output from pin 9 can be used to drive a 4 ohm speaker up to 2.5 watts. Audio output from pin 1 is 600 ohms, 0.5 watts maximum.

3.7.6 Audio Output Ground

Pin 10 is the ground for both the 4ohm and 600 ohm audio output signals on pins 9 and 1.

3.7.7 Mic Signal Input

The microphone input signal is to be provided on pin 6, utilizing shielded wire with the shield grounded to pin 10.

3.7.8 Memory Up/Memory Down

Remote scrolling through the 150 memory positions can be achieved by providing a ground to pins 4 (up) and 5 (down) through a momentary contact cyclic switch.

3.7.9 Data Input

Channel data may be transferred to and from the unit using RS-232 communications protocol via pins 2 and 11.

3.8   TRANSMITTER SIDETONE LEVEL ADJUSTMENT

1.   Set the transceiver operating frequency to 155.000 MHz and connect an appropriate test receiver to the RF output connector. Ensure that the output of the transceiver is terminated into a proper dummy load.

2.   Key the transmitter and input a -10 dBm (0.25 VRMS), 1 KHz audio signal into the microphone input.

3.   Select the sidetone adjust command and then adjust the sidetone level using the guard volume control to produce a + 3.0 dBm (1.0 VRMS) 600 ohm audio output.

3.9   MAIN AND GUARD SQUELCH ADJUSTMENT

The squelch on both the main and guard receivers is factory set to open at approximately 0.5 microvolts. This adjustment can be made or altered to suit local conditions as follows:

1.   Set the main receiver of the transceiver to 155.000 Mhz. Connect a signal generator to the antenna input of the transceiver.

2.   Set the signal generator to produce a ± 3 KHz deviation with a 1 KHz tone on 156.000 MHz. Increase the signal generator RF level from 0.1 uV until the squelch indicator LED is on. Verify the receiver SINAD ratio is between 12 and 14 dB.

3.   If not, re-adjust main receiver squelch via the main receiver squelch software command.

4.   Repeat the above procedure to adjust the guard receiver squelch setting using guard receiver squelch adjustment software command.