DANIELS™
ELECTRONICS LTD.

MT-3 RADIO SYSTEMS

VHF ENHANCED TRANSMITTER INSTRUCTION MANUAL

Covers model: VT-3H035-SWA3, VT-3H045-SWA3

Issue:	1 Rev A	Previous Issue:	1	
Issue Date:	September 98	Previous Issue Date:	July 97	Daniels Electronics Ltd.
Printing Date:	Month Year			Victoria, B.C.
Part No.:	IM20-VT3H040	PRINTED IN CANADA		

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1 GENERAL

1.1 Introduction

The VT-3H040 transmitter is a low power, synthesized FM transmitter capable of operating in 20 kHz or 25 kHz channels and within one of two bands: 29 MHz to 38 MHz or 38 MHz to 50 MHz. The transmitter is rated for continuous duty at an RF output power of 3.0 Watt. The RF output power level is preset at the factory. A modular design allows each of the transmitter's modules; MT-3 Transmitter Main Board, MT-3 Audio Processor, VT-3H040 Amplifier and OS-3H040 Synthesizer to be individually assembled and tested. This facilitates construction, tuning, maintainance as well as troubleshooting procedures. The synthesizer module can be programmed to have up to 16 channels exclusive to one frequency band.

The VT-3H040 Transmitter is designed to interface with Daniels Electronics' MT-3 Repeater System while maintaining MT-2 System compatibility. Both radio systems are characterized by dependable, low maintanence performance under the most severe environmental conditions.

1.2 Manual Organization

The organization of this manual reflects the modular makeup of the VT-3 product line. Each module is fully described within its respective submanual, all of which are contained within this document. In general, each submanual contains:

1. A functional description and specification summary,
2. a detailed technical description (Theory of Operation) and
3. assembly, setup and alignment procedures relevent to that particular module.

The module manuals are as follows.

Note: material presented in a given "sub-manual" may include information related to other module versions not directly appllicable to the VT-3H040 Transmitter family (eg, the OS-3H Synthesizer Instruction Manual covers models from 29 MHz to 512 MHz).

Transmitter Manual: This manual provides an overview of the complete transmitter, manual organization and assembly in terms of the other modules.

MT-3 Transmitter Main Board: This manual pertains to the audio processor module, transmitter Main Board and Front Panel Board. Most of the user selectable options are accessed within the Transmitter Main Board module, including channel selection. Since all external connections (including power and signal lines) are made to the Transmitter Main Board, most of the material pertaining to transmitter operation and installation is found here.

VT-3H040 VHF Amplifier: The amplifier module provides the final stages of RF power amplification and harmonic filtering for the transmitter. This manual is intended primarily as a reference since the amplifier module is adjusted at the factory.

OS-3H040 Synthesizer: This manual pertains to the synthesizer module. Channel selection is described in the 'Transmitter Main Board' Manual.
VT-3H040 Channel Designation Table: This document relates operating frequency to the transmitter channel number (see section 2.1).

1.3 VT-3H040 Transmitter Family Models

The VT-3H040 line of transmitters has a single RF power output rating of 3.0 Watt, with wide band FM (20 kHz or 25 kHz channels) and employs synthesizer based frequency generation. The two basic (i.e. no options added) band specific models of the transmitter are as follows:

VT-3H035-SWA3:	29 MHz to 38 MHz
VT-3H045-SWA3	38 MHz to 50 MHz

The frequency is determined by the model of synthesizer and by the lowpass filter that is installed in the amplifier module (see the VT-3H040 VHF Amplifier manual for details). A group of channels spanning 38 MHz can be accomodated by one of the models providing that the frequency span does not exceed 1.0 MHz. Model VT-3H035-SWA3 can operate at frequencies up to 38.5 MHz and is the preferred choice when spanning 38 MHz. Consult the factory for futher information regarding operation around this frequency.

1.4 Performance Specifications

1.4.1 General

The following is a general set of specifications for the generic VT-3H040 transmitter. Additional specifications, specific to individual modules may be found in their respective submanuals.

Type:	MT-3 Series Transmitter
Family:	VT-3H040
Compatibility:	MT-2 Series and MT-3 Series Radio Systems
Frequency Range:	29.0 MHz to 50.0 MHz
RF Power Output:	3.0 Watt Fixed (± 1.5 dB with temperature and supply voltage).
System Impedance:	50 Ω ; Type N connector.
Duty Cycle:	100%: Continuous operation from -30˚ C to +60˚C (optional -40˚ C to +60˚C).
Harmonic Emissions:	More than 90 dB below carrier.
Spurious Emissions:	More than 80 dB below carrier.
Transmitter Mismatch Protection:	20:1 VSWR at all phase angles.
Transmitter Alarm:	Forward power sense and reverse VSWR; - open collector output (separate or 'OR'ed); - linear output (separate lines only).
Modulation:	16K0F3E
Synthesizer Reference Frequency:	9.600000 MHz or 10.000000 MHz ; selectable.
Channel Spacing:	20 / 25 kHz
Frequency Stability:	Standard: ±1 ppm, -30˚C to +60˚C, optional -40˚C to +60˚C
Channel Selection:	In 5 kHz or 6.25 kHz increments selected through four internal BCD rotary switches. Preset capability for 16 channel memory selectable through external control.

Standby Current and rise time: (See also 'Transmitter Main Board Instruction Manual)	95 % RF power, 95 % system deviation within; • 10 ms: typ. 185 mA (Mode 4); • 25 ms: typ. 160 mA (Mode 2); • 50 ms: typ. 15 mA (Mode 1); • Mode 3 not used in Synthesized Transmitters.
DOC Type Approval	RSS119 Issue 6
FCC Type Acceptance:	Parts 22, 90 FCC ID: H4JVT-3H040-S
Operating Temperature Range:	-30˚ C to +60˚ C, optional -40˚ C temperature test.
Operating Humidity:	95% RH (non-condensing) at +25˚ C.
Operating Voltage:	+13.8 Vdc Nominal (range +11 to +16 Vdc), +9.5 Vdc Regulated.
Total Transmit Current:	0.8 Amp typical; 1.2 Amp maximum
Front Panel Controls:	NORM (repeat mode), OFF, and KEY TX (Tx on).
PTT Activation:	Active to ground with or without time-out timer. Microphone activated with or without time-out timer. Front Panel switch: KEY TX - without time-out timer; NORM - with or without time-out-timer; Isolated (optional relay) with or without time-out timer.
PTT Time Out Timer:	Selectable from 1 sec. to 8 hrs. (factory set 5 min.).

1.4.2 Audio Specifications

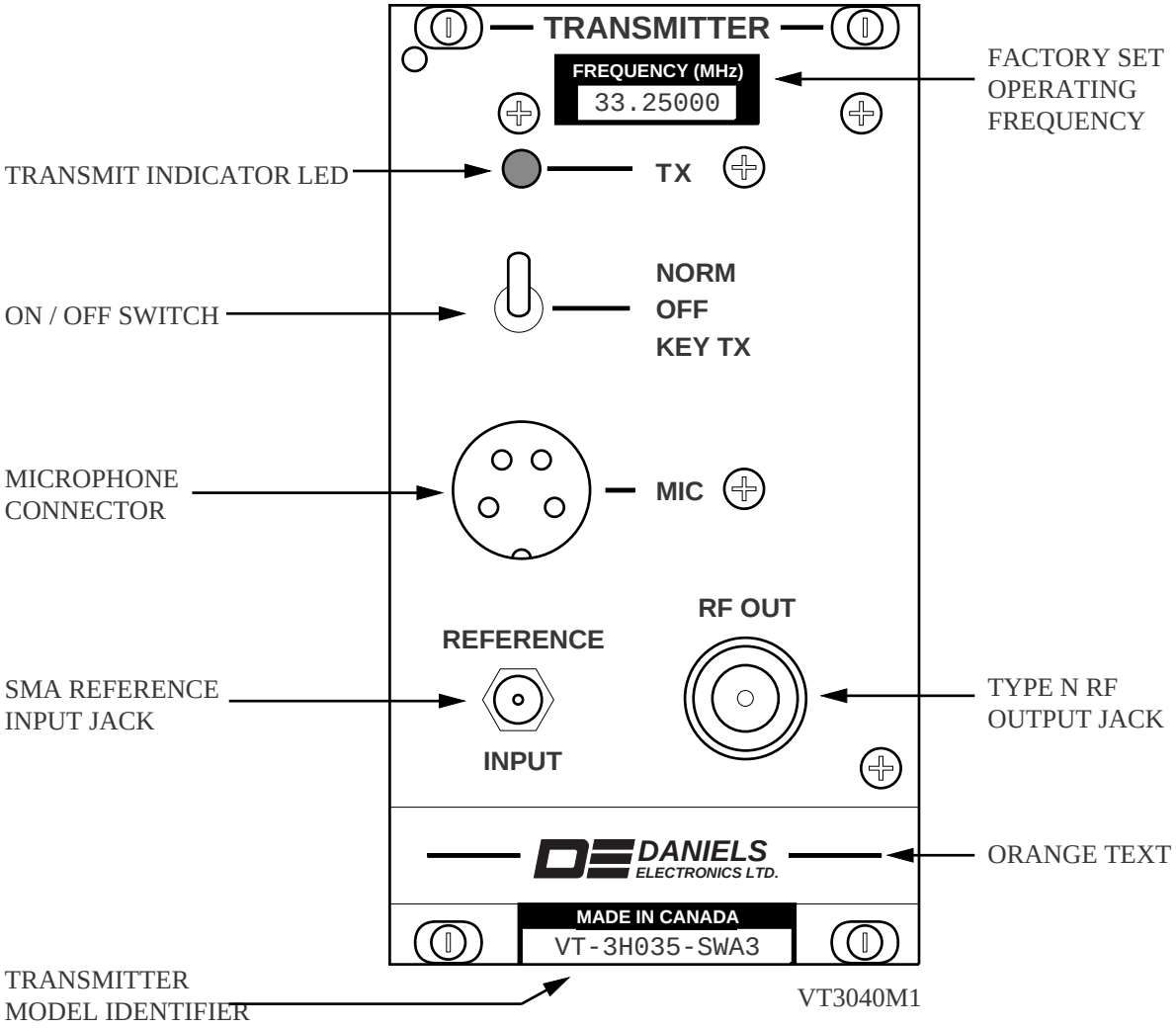
Audio Input:	Balanced 600 ohm or unbalanced (optional). Input level sensitivity, -25 dBm to 0 dBm.
Audio Response:	Pre-emphasis (6 dB per octave); +1.0 to -2.0 dB from 300 Hz to 3 kHz;
Flat Audio Response:	+1 to -1 dB from 100 Hz to 3 kHz.
Audio Deviation:	Preset to ±3.0 kHz with a 1 kHz tone.
Subtone Audio Input 1:	0.5 Vpp at 200 Hz for ±500 Hz deviation (internally adjustable).
Subtone Audio Input 1 Frequency range:	60 Hz to 300 Hz.
Subtone Audio Input 2:	0.5 Vpp at 100 Hz for ±500 Hz deviation (internally adjustable).
Subtone Audio Input 2 Frequency range:	DC to 150 Hz.
Direct Modulation Input:	0.5 Vrms at 1 kHz or ±3 kHz deviation.
Direct Modulation Frequency range:	DC to 5 kHz.
Audio Distortion:	Less than 2.5% THD; 1 kHz tone at 1.5 kHz or 3 kHz deviation (-40°C to +60°C).
Hum and Noise:	Better than 55 dB (test receiver band limited: 400 Hz to 30 kHz).

1.4.3 Physical Specifications

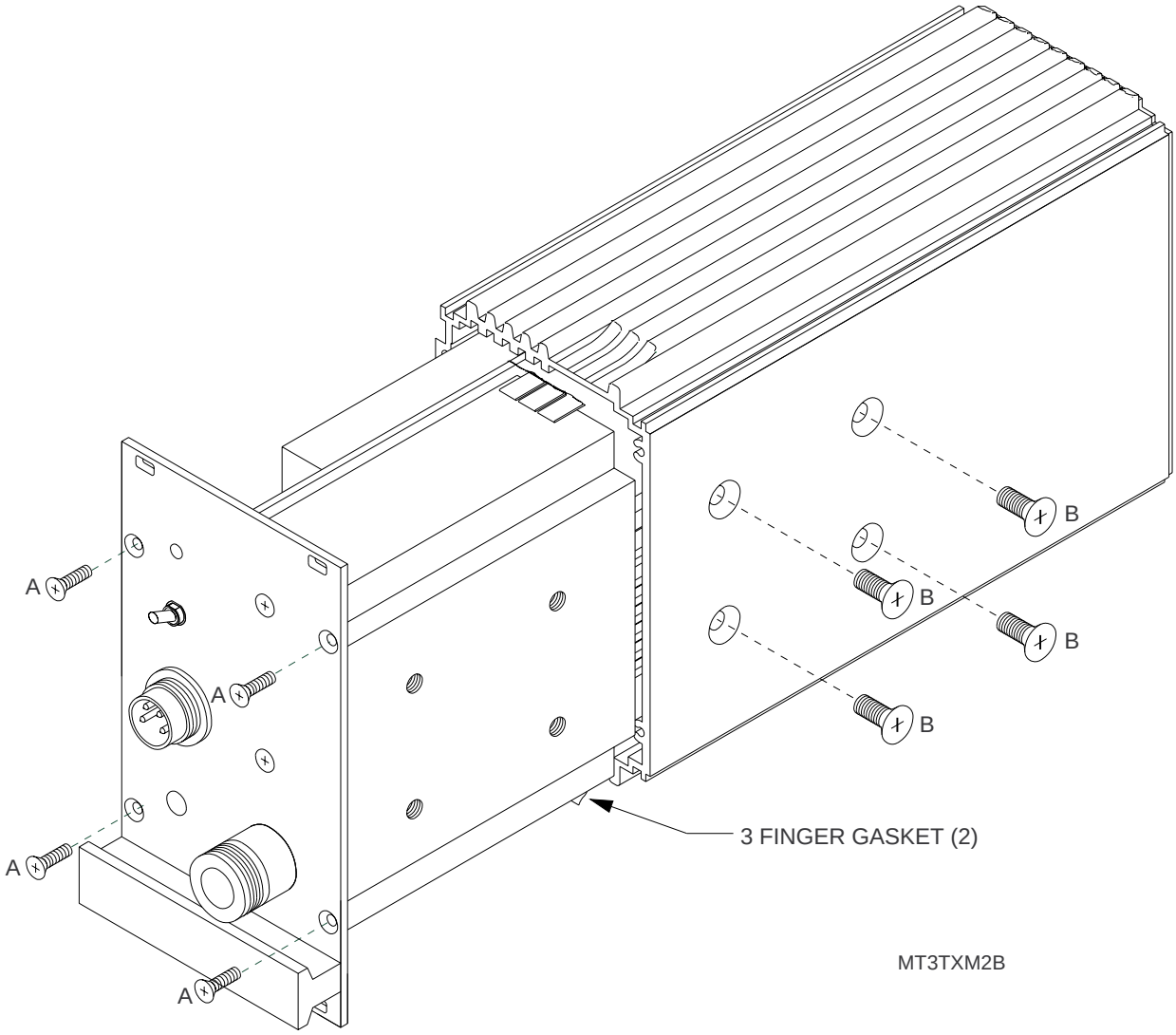
Physical Dimensions:	Width:	Height:	Depth:
	7.1 cm (2.8 in)	12.8 cm (5.05 in)	19 cm (7.5 in)
Module Weight:	1.5 kg (3.3 lbs)		
Corrosion Prevention:	Anodized aluminum construction. Stainless steel hardware. Selectively conformal coated glass epoxy 2 and 4 layer printed circuitboards. Gold plated module connectors.		
Module Design:	Compact Eurostandard modular design. Plug-in modules mate with Daniels standard M3 repeater subrack. Subracks / modules comply with IEEE 1101, DIN 41494 and IEC 297-3 (mechanical size / modular arrangement).		
External Connections:	RF Connection: type N connector located on the transmitter module front panel. Motherboard Connections (Audio, Power, and Control) are made through a 48 pin, gold plated, type F connector on the rear of the transmitter module. User connection made through mated "mother board" assembly of the repeater subrack. Type F standard connector complies with DIN 41612 Level 2 (200 mating cycles, 4 day 10 ppm SO_2 gas test with no functional impairment and no change in contact resistance).		
Handle Text Colour:	Orange.		

3 ILLUSTRATIONS

3.1 MT-3 Transmitter Front Panel



3.2 MT-3 Transmitter Case - Exploded View



5 REVISION HISTORY

ISSUE	DATE	DESCRIPTION AND (REASON)

DANIELS™
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MT-3 RADIO SYSTEMS

FM TRANSMITTER
MAIN BOARD
INSTRUCTION MANUAL

Covers: Main Board for
UT-3/xxx-xxxx UHF FM Transmitters and
VT-3/xxx-xxxx VHF FM Transmitters
With: Version 1.8 FM Audio Processor Board or
Version 2.3 FM Audio Processor Board

Printing Date:	Apr 2003			Daniels Electronics Ltd.
Issue Date:	**Apr 2003**	Previous Issue Date:	Nov 98	Victoria, BC
Issue:	**4**	Previous Issue:	3	
Part No.:	**IM20-MT3TXMN**			PRINTED IN CANADA

Reviewed By:

Quality Assurance:

CLAUDIA BOORMAN	C Boorman	APR 9, 2003
Quality Manager	Signature	Date

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1 GENERAL

1.1 Introduction

The MT-3 Transmitter Main Board integrates the MT-3 Front Panel Board, MT-3 Audio Processor, Synthesizer or Crystal Controlled Oscillator module, and Amplifier module together to comprise a MT-3 series transmitter (see section 5.1: MT-3 Transmitter Block Diagram). The Front Panel Board and the Audio Processor are soldered directly to the Transmitter Main Board while the Amplifier and the Synthesizer or Crystal Controlled Oscillator module are frequency band sensitive, plug-in modules. Circuitry and jumpers on the Transmitter Main Board control the operation of the modules as well as the overall operation of the MT-3 transmitter. Power and signal connections are made through the 48 pin type 'F' connector on the rear of the Transmitter Main Board where they are then routed to the other MT-3 modules. The front and rear panels are attached to the Transmitter Main Board and together with the extruded aluminum shell, form the transmitter enclosure.

Note: **LTR™** is a trademark of E.F. Johnson Co.

1.2 Performance Specifications

1.2.1 General Specifications

Type:	MT-3 Series Transmitter
Compatibility:	MT-3 Series Amplifier, OC-3 Crystal Controlled Oscillator module, OS-3 and OS-3H Frequency Synthesizer modules.
Modulation:	11K0F3E or 16K0F3E (Frequency Modulation).
Operating Temperature Range:	-30˚C to +60˚C, optional -40˚C to +60˚C temperature test.
Operating Humidity:	95% RH (non-condensing) at +25°C.
Operating Voltage:	+9.5 VDC Regulated. +13.8 VDC Nominal (11 - 16 VDC).
Front Panel Controls:	NORM (repeat mode), OFF, and KEY TX (TX on).

PTT Activation:	• Active to ground with or without time-out-timer. • Microphone activated with or without time-out-timer. • Front Panel switch: KEY TX - without time-out-timer. • NORM - with or without time-out-timer. • Isolated (optional relay) with or without time-out-timer.
PTT Time-Out-Timer:	Selectable from 1 sec. to 8 hrs. (Factory Default: 5 min.).

1.2.2 Audio Specifications

Audio Input:	Balanced 600 ohm or unbalanced (optional). Input level sensitivity, -25 dBm to 0 dBm.
Audio Response:	Pre-emphasis (6 dB per octave); +1.0 to -1.0 dB from 500 Hz to 2.5 kHz;
Flat Audio Response:	+1 to -1 dB from 300 Hz to 2.5 kHz.
Audio Deviation:	Preset to ±1.5 kHz (Narrow Band) or ±3.0 kHz (Wide Band) with a 1 kHz tone (capable ±2.5 kHz or ±5.0 kHz).
Subtone Audio Input 1:	0.5 Vpp at 200 Hz for ±500 Hz deviation (internally adjustable).
Subtone Audio Input 1 Frequency range:	60 Hz to 300 Hz.
Subtone Audio Input 2:	0.5 Vpp at 100 Hz for ±500 Hz deviation (internally adjustable).
Subtone Audio Input 2 Frequency range:	DC to 150 Hz.
Direct Modulation Input:	0.5 Vrms at 1 kHz or ±3 kHz deviation.
Direct Modulation Frequency range:	DC to 5 kHz.

10 REVISION HISTORY

Issue	Issued	Revised	Details

DANIELS™
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MT-3 RADIO SYSTEMS

VHF AMPLIFIER
INSTRUCTION MANUAL
VT-3
29 - 50 MHz

Covers Models: VT-3H040 Amplifier

Issue:	3	Previous Issue:	2	
Issue Date:	Feb 03	Previous Issue Date:	June 97	Daniels Electronics Ltd.
Printing Date:	Feb 03			Victoria, B.C.
Part No.:	IM20-VT3040AMP			PRINTED IN CANADA

Reviewed By:

Quality Assurance:

CLAUDIA BOORMAN	C Boorman	MAR 04, 2003
Quality Manager	Signature	Date

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1 GENERAL

1.1 Introduction

The VT-3H040 Amplifier provides the final stage of RF amplification and filtering for the VT-3H040 and VT-3H040 Transmitters. The amplifier operates over one of two distinct frequency ranges; either 29 to 38 MHz or 38 to 50 MHz, depending on which of the two lowpass output filters is installed. The output power is set to 3.0 Watts by means of an externally accessed control. The VT-3H040 Amplifier is housed in a machined aluminum case that ensures optimum RF shielding, provides a good ground, and also acts as a heatsink.

Additionally, the VT-3H040 Amplifier is equipped with output power and VSWR sensing lines which can be individually configured as open collector or linear outputs. The internal VSWR sensor protects the amplifier from high antenna VSWR by approximately halving the amplifier's RF gain when a VSWR overload condition is present.

Output filtering for the VT-3H040 Amplifier is provided by the Output Lowpass Filter Board. The Output Lowpass Filter Board is mounted in a separate compartment of the amplifier case in order to provided maximum attenuation of harmonic and other spurious signals.

Refer to Section 4.4 "VT-3H040 Amplifier Schematic Diagram" for the amplifier and Section 4.2 for the Output Lowpass schematic diagram.

1.2 Performance Specification

Type:	MT-3 series VHF Amplifier module.
Compatibility:	MT-3 series Transmitter Main Board, OS-3H040 Synth.
Frequency Range:	29.0 MHz to 38.5 MHz or 37.5 MHz to 50.0 MHz.
RF Power Output:	3.0 Watts Fixed (± 1.5 dB with temperature and supply voltage).
RF power Input:	nominal level adjustable from +4 dBm to +10 dBm, held within +/- 2 dB of nominal.
Output Impedance and VSWR:	50 Ω, Type N connector; 3:1 max. VSWR.
Input /Output Isolation:	> 60 dB
Duty Cycle:	100%: Continuous operation from -30˚ C to +60˚C (optional -40°C to +60°C)

Harmonic Emissions:	Greater than 80 dB below the carrier.
Spurious Emissions:	Greater than 90 dB below the carrier.
Transmitter Mismatch Protection:	20:1 VSWR at all phase angles.
Transmitter Alarm:	Forward power sense and reverse VSWR; - open collector output (separate or 'OR'ed configuration); -linear output (separate lines only).
Operating Temperature Range:	-30˚ C to +60˚ C, optional -40˚ C to +60°C temp test.
Operating Humidity:	95% RH (non-condensing) at +25˚ C.
Operating Voltage:	+13.8Vdc Nominal (range +11 to +16Vdc), +9.5Vdc Regulated.
Amplifier Transmit Current:	0.7 Amp typical; 1.1 Amp maximum
Amplifier Standby Current:	less than 0.5 mA.
Amplifier Enable:	Active to ground.
Amplifier Enable Response:	typically overdamped, rising to within 90% of full power within 5 msec; maximum (underdamped) overshoot of 30%.

6 REVISION HISTORY

Issue	Date	Description

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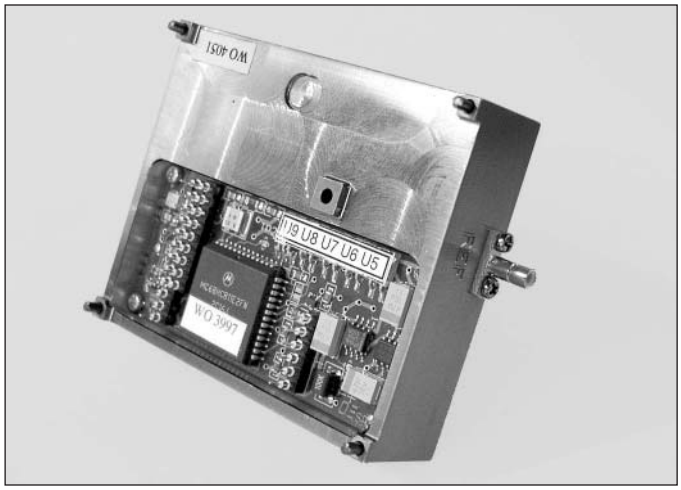

ENHANCED FM SYNTHESIZER INSTRUCTION MANUAL

OS(R/T)-3H 29-470 MHZ

Covers Models:

OSR-3H061	OST-3H035
OSR-3H141	OST-3H045
OSR-3H162	OST-3H141
OSR-3H440	OST-3H162
	OST-3H440

Document Number: IM10-OS3AH
Revision: 5-0-1
Revision Date: Aug 2003

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Victoria, BC
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MANUAL SECTION LOCATOR

To help determine the correct section for the synthesizer in question, refer to this chart. Note that the operating frequency of the synthesizers in receivers is different from the receive frequency of the radio itself. This is the IF Offset correction factor, and is described in each section.

	Transmitters			Receivers		
Radio Frequency	**Transmitter Model & Frequency Range**	**Enhanced Synthesizer Model & Synthesizer Frequency**	**Location in Manual**	**Receiver Model & Frequency Range**	**Enhanced Synthesizer Model & Synthesizer Frequency**	**Location in Manual**
VHF Low Band 29 - 50 MHz	VT-3H035 29-38MHz	OST-3H035 29-38MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4 Mhz	VR-3H035 29-38MHz	OSR-3H061 50.4-71.4MHz	See Page 3 Enhanced FM Synthesizer OS(R/T)-3H 29-71.4 Mhz
	VT-3H045 38-50MHz	OST-3H045 38-50MHz		VR-3H045 38-50MHz		
VHF 128-174 MHz	VT-3/140 128-150MHz	OST-3H141 128-152.6MHz	See Page 27 Enhanced FM Synthesizer OS(R/T)-3H 128-174 Mhz	VR-3H140 128-150MHz	OSR-3H162 150-174MHz	See Page 27 Enhanced FM Synthesizer OS(R/T)-3H 128-174 Mhz
	VT-3/160 150-174MHz	OST-3H162 150-174MHz		VR-3H160 150-174MHz	OSR-3H141 128-152.6MHz	
UHF 406-512 MHz	UT-3/420 406-430MHz	OST-3H418 406-430MHz	See Page 51 Enhanced FM Synthesizer OS(R/T)-3H 406-470 Mhz	UR-3H420 406-430MHz	OSR-3H440 427.4-451.4MHz	See Page 51 Enhanced FM Synthesizer OS(R/T)-3H 406-470 Mhz
	UT-3/460 450-470MHz	OST-3H460 450-470MHz		UR-3H460 450-470MHz		

ENHANCED SYNTHESIZER OS(R/T)-3H 29-71.4 MHZ

Covers Models:
OST-3H035
OST-3H045
OSR-3H061

	Transmitters			Receivers		
Radio Frequency	Transmitter Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual	Receiver Model & Frequency Range	Enhanced Synthesizer Model & Synthesizer Frequency	Location in Manual
VHF Low Band 29 - 50 MHz	VT-3H035 29-38MHz	OST-3H035 29-38MHz	Enhanced FM Synthesizer OS(R/T)-3H 29-71.4 Mhz	VR-3H035 29-38MHz	OSR-3H061 50.4-71.4MHz	Enhanced FM Synthesizer OS(R/T)-3H 29-71.4 Mhz
	VT-3H045 38-50MHz	OST-3H045 38-50MHz		VR-3H045 38-50MHz		
VHF 128-174 MHz	VT-3/140 128-150MHz	OST-3H141 128-152.6MHz	See Page 27 Enhanced FM Synthesizer OS(R/T)-3H 128-174 Mhz	VR-3H140 128-150MHz	OSR-3H162 150-174MHz	See Page 27 Enhanced FM Synthesizer OS(R/T)-3H 128-174 Mhz
	VT-3/160 150-174MHz	OST-3H162 150-174MHz		VR-3H160 150-174MHz	OSR-3H141 128-152.6MHz	
UHF 406-512 MHz	UT-3/420 406-430MHz	OST-3H418 406-430MHz	See Page 51 Enhanced FM Synthesizer OS(R/T)-3H 406-470 Mhz	UR-3H420 406-430MHz	OSR-3H440 427.4-451.4MHz	See Page 51 Enhanced FM Synthesizer OS(R/T)-3H 406-470 Mhz
	UT-3/460 450-470MHz	OST-3H460 450-470MHz		UR-3H460 450-470MHz		

General Information

Introduction

The OS(R/T)-3H Synthesizer is a compact, fully shielded and environmentally rugged frequency synthesis module that is the nucleus of every MT-3 synthesized Receiver and Transmitter radio module. The OS(R/T)-3H generates a high stability, low distortion radio frequency signal in one of several frequency bands. The OS(R/T)-3H utilizes an internal temperature compensated 9.6 or 10.0 MHz reference to produce a signal stable to ±1 ppm within the temperature range of -40°C to +60°C. Alternately, the OS(R/T)-3H can be disciplined by an external 9.6 MHz or 10 MHz reference of higher stability. All synthesizer modules are designed to be easily removed for programming, calibration and/or repair. The synthesizer circuitry is distributed between two printed circuit boards (PCBs) which are isolated yet interconnected via photo-logic optical transceivers that effectively eliminate residual electrical noise between digital and analog circuitry. Further shielding of the synthesizer's RF filter circuitry is provided by an internal shielded enclosure.

Note: This section of the manual provides service and operating information for just the synthesizer modules listed below. It is important to establish the correct synthesizer model number, as documentation is model-specific. The model number can be found on the synthesizer label, located on the synthesizer module top cover.

This section of manual covers the following Synthesizers:

OST-3H035	29-38 MHz RF output installed in FM transmitter
OST-3H045	38-50 MHz RF output installed in FM transmitter
OSR-3H061	50.4-71.4 MHz RF output installed in FM receiver

OS(R/T)-3H Enhanced Synthesizer Family Models

The OS(R/T)-3H Synthesizer Module is utilized in both the MT-3 Receiver and Transmitter product lines. In MT-3 Transmitters, the OS(R/T)-3H synthesizer provides a modulated, low-level RF signal to the Power Amplifier module. In MT-3 Receivers, the OS(R/T)-3H synthesizer provides a low noise local oscillator (LO) signal that either directly drives the mixer circuitry or first drives a buffer amplifier which precedes the mixer circuitry (if a higher LO drive signal is required for enhanced intermodulation capability).

All OS(R/T)-3H Enhanced Synthesizer Modules, regardless of the frequency band, use the same digital PCB and mechanical construction. There are, however, significant differences between the various models when it comes to the analog PCB. Each model's specific sub-band of operation within a given frequency band is determined through SELECT components on the corresponding analog board.

Performance Specifications

Type:	Narrow band FM, Single loop synthesizer module utilizing low noise VCO and PLL technology. Compatible with Daniels MT-3 series Transmitter and Receiver modules.
Frequency Range (Tuning range with no adjustment is shown in [ ] brackets.):	29 MHz-38 MHz [±0.5 MHz] (OST-3H035) 38 MHz -50 MHz [±1.0 MHz] (OST-3H045) 50.4 MHz-71.4 MHz [±1.0 MHz] (OSR-3H061)
Output Power:	+5 dBm ±2 dBm into 50Ω
Harmonics:	<-30 dBc
Spurious:	<-90 dBc
Hum and Noise:	-55 dB
Modulation Sensitivity:	3.0 kHz peak deviation (400 mVrms input)
External Reference Input:	External reference input signal via SMB connector J1 Input level 0 dBm ±3 dB Input impedance 50 Input frequency 10.0 MHz or 9.6 MHz (selectable through digital board jumper JU1)
Power Requirements:	Normal Configuration: +9.5 Vdc @ 160 mA Low Current Standby Mode (TCXO enabled): +9.5 Vdc @ 14 mA

Printed Circuit Board Numbering Convention

To expedite troubleshooting and maintenance procedures, Daniels Electronics Ltd. has adopted a printed circuit board (PCB) numbering convention in which the last two digits of the circuit board number represent the circuit board version. All PCB's manufactured by Daniels Electronics Ltd. are identified by one of the following numbering conventions:

PCB number	43-912010	indicates circuit board version 1.0
PCB number	50002-02	indicates circuit board version 2 (no decimal version)

Parts List

Analog Board Electrical Parts List

Ref Desig	Description	Part Number

REVISION HISTORY

Revision	Date	ECO	Description

DANIELS™
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PAGING MODULATOR INSTRUCTION MANUAL

CI-PM-3

Covers Models:
CI-PM-3-00

Document Number: IM55-CIPM3
Revision: 5-0-0
Revision Date: Aug 2003

Daniels Electronics Ltd.
Victoria, BC
PRINTED IN CANADA

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Contents

GENERAL INFORMATION

Introduction

The CI-PM-3 Paging Modulator module is an optional plug-in component of the MT-3 Radio Repeater System. This module provides digital and/or analog paging capability for Daniels MT-3 transmitters in all supported frequency bands.

The CI-PM-3 is designed for low power consumption, typically drawing less than 250 mA in steady state. In its standard configuration, the CI-PM-3 uses an on-board frequency reference source consisting of a 10 MHz OCXO with a standard stability of 0.03 PPM. For high stability applications (such as Simulcast), the CI-PM-3 Paging Modulator may be configured to use an external high stability reference source (i.e. rubidium, GPS or WWV) with a standard stability greater than or equal to 0.002 PPM, to discipline the on-board phase-locked loop OCXO oscillator. To ensure that paging signals are the same relative to each transmitter, the CI-PM-3 also incorporates a limited delay compensation for the different link propagation paths between transmitters.

The CI-PM-3 Paging Modulator supports both analog and digital paging formats, and can transmit POCSAG and other 2-level modulation schemes at data transfer rates of 512, 1200, and 2400 Baud. It can also be configured for use as a data repeater, whereby 2-level paging data is recovered, re-shaped and then re-transmitted to an additional repeater/paging transmitter.

The CI-PM-3 supports 4-level modulation formats at data transfer rates up to 1600 BPS. Each of the four modulation deviation levels can be independently set, making the CI-PM-3 suitable for use in such pager signaling schemes as Motorola's FLEX™ Paging Protocol.

Setup conditions are established via front panel switch settings, while internal jumper settings and setup adjustments are easily accessible using the EC-96, 96 Pin Extender Card.

The CI-PM-3 Paging Modulator includes the following standard features:

- low power analog and CMOS control circuitry.
- extended operating temperature range;
- jumper selectable Repeater/paging transmitter configuration;
- on-board +/-0.03 PPM 10 MHz OCXO;
- front panel selection of PLL OCXO using external high stability frequency reference;
- jumper and line selectable analog/digital paging configuration;
- connection for optional CTCSS encoder/decoder;
- balanced 600 Ω/single-ended microphone input;
- selectable digital delay for Simulcast operation

Performance Specifications

Model Number:	CI-PM-3	
Type:	MT-3 Series Paging Modulator	
Compatibility:	MT-3 Series Radio Systems	
Modulation:	16K0F3E (FM Analog)	
	14K7F1D (FM Data Transmission)	
Audio Input:	Balanced 600 Ω(tone or voice)	
Digital Input:	Bipolar: RS-232 compatible	
Reference Input:	10 MHz, 0.5 to 2.5 V rms, 50 Ω Front Panel SMA	
Reference Output:	10 MHz (Modulated), 2.5 V rms, 50 Ω Front Panel SMA	
Frequency Stability:	Standard: Optional:	±0.03ppm from -40°C to +60°C External High Stability ±0.002ppm from -40°C to +60°C (requires WWV or GPS reference source).
Duty Cycle:	Continuous, 100% from -40°C to +60°C	
Audio Response:	0 Hz to 3.4 kHz	
Maximum Deviation:	+/- 50 PPM	
Analog / Digital PTT Activation:	Front panel connector and rear motherboard connection	
Current Consumption:	+13.8 VDC supply: +9.5 VDC supply:	600 mA power 200 mA steady state 200mA (all options enabled) 80mA (all options disabled) 70mA (LED indicators off).
Operating Temperature Range:	-40°C to +60°C	
Paging Formats:	4-Level Multiple Transmitter paging (Flex)	
	2-Level Multiple Transmitter paging (POCSAG)	
Simulcast Operation:	Supported with the addition of WWV/GPS receiver.	
IC Type Approval:	Approved for use with MT-3 VHF 138-174 MHz, UHF 450-470 MHz, UHF 928-935 MHz, Additional model/frequency band approvals TBA	
FCC Type Acceptance:	Approved for use with MT-3 VHF 138-174 MHz, UHF 450-470 MHz, UHF 928-935 MHz, Additional model/frequency band approvals TBA	

CTCSS Decoder/Encoder (Option)

Manufacturer:	Communications Specialists Inc.
Model Number:	TS-64
Number of Tones:	64
Frequency Range of Tones:	33.0 to 254.1 Hz
Signal to Noise:	Better than 4 dB SINAD
Decode Time:	150 ms nominal
Fade Time:	350 ms nominal
Squelch Tail Elimination::	160 ms reverse phase burst
Current Consumption:	9 mA

Physical Specifications

Physical Dimensions:	Width: 3.5 cm (1.38”)	Height: 12.8 cm (5.05”)	Depth: 19 cm (7.5”)
Module Weight:	0.4 kg (1 lb.)		
Corrosion Prevention:	Anodized aluminum construction with stainless steel hardware. Selectively applied Conformal coated glass epoxy 4 layer printed circuit boards. Gold plated module connectors.		
Module Design:	Compact Eurostandard modular design. Plug-in module mates with Daniels standard 19” MT3 repeater subrack. Interchangeable for test and repair.		
External Connections:	REF Input and Output SMA connectors located on the module’s front panel. Motherboard Connections (Audio, Modulation, Power, and Control) are made through a 96 pin, gold plated type C connector on the rear of the module. User connections (Audio, Modulation, and Control) are made through a front panel DB-15 connector as well as through the 96 pin connector on the rear of the module.		

THEORY OF OPERATION

ALIGNMENT

Repair Notes

Removal and replacement of surface mount components should be performed only in specifically designed surface mount rework and repair stations complete with electrostatic discharge (ESD) protection.

To help prevent damage to the circuit board pads when removing Surface Mount Solder Jumpers, it is recommended that solder braid be used in place of manual vacuum de-soldering tools.

CONNECTOR PIN FUNCTIONS AND JUMPER SETTINGS

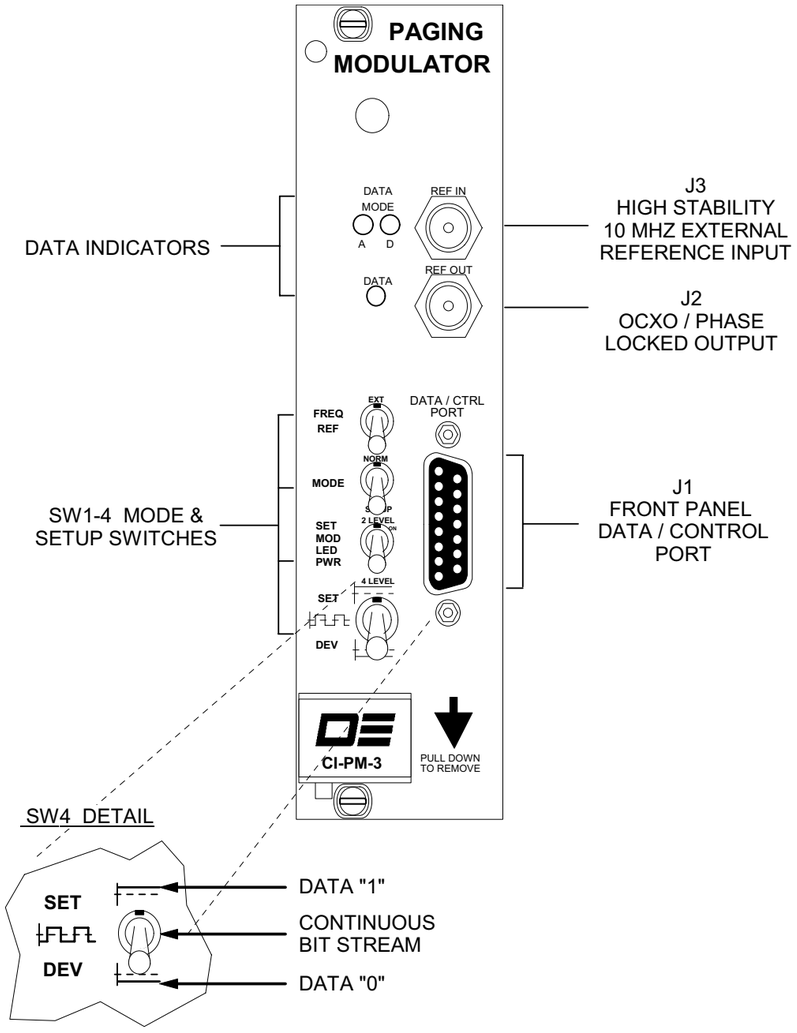
ILLUSTRATIONS AND SCHEMATICS

Printed Circuit Board Numbering Convention

Daniels Electronics Ltd. has adopted a printed circuit board (PCB) numbering convention in which the last two digits of the circuit board number represent the circuit board version. All PCB's manufactured by Daniels Electronics Ltd. are identified by one of the following numbering conventions:

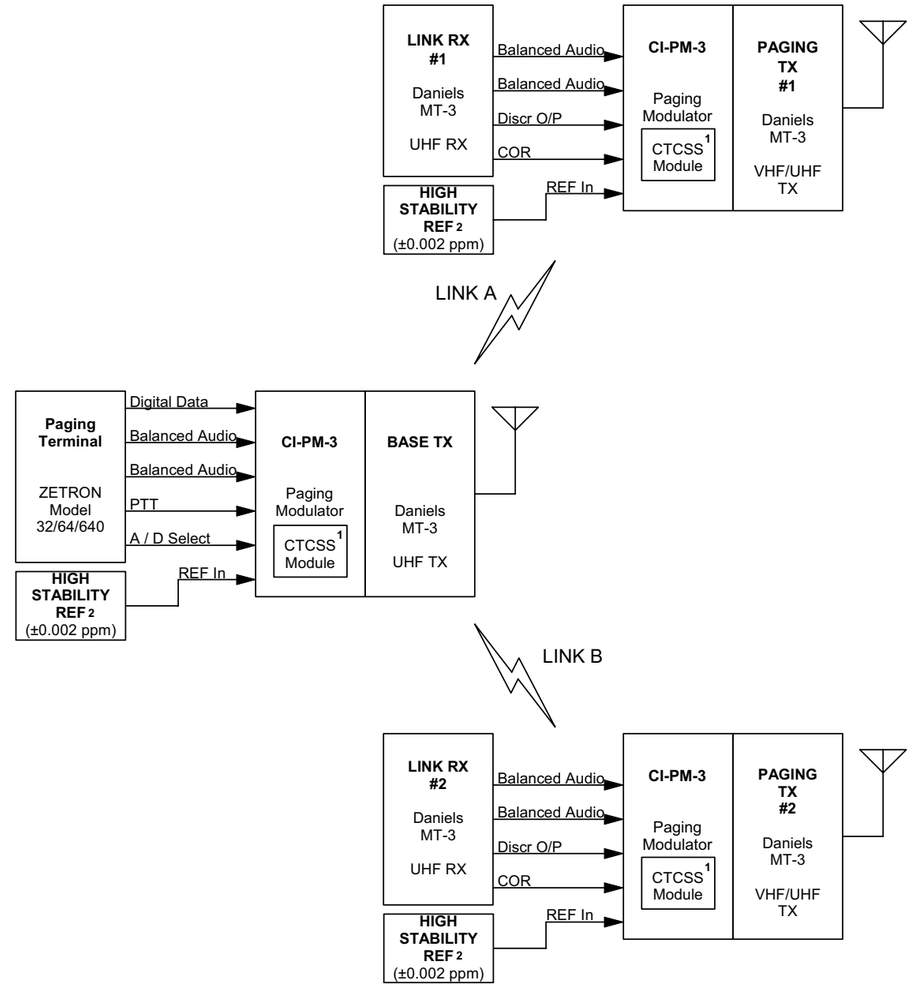
PCB number	43-912010 Indicates circuit board version 1.0
PCB number	50002-02 Indicates circuit board version 2 (no decimal version)

CI-PM-3 Front Panel Controls



DANIELS ™ ELECTRONICS LTD.	
TITLE: PAGING CARD FRONT PANEL	
DATE: 25 JUNE 2003	DRAWN BY: EVA DANIELS
DWG No: B0283	REV DATE: 3 JULY 2003

Simulcast Paging



Notes:

1. CTCSS selects Analog / Digital Paging Mode.
2. High stability oscillators are referenced to a common GPS, WWV or other signal.

DANIELS ™ ELECTRONICS LTD.	A
TITLE: Simulcast Paging	
DATE: 07 July 2003	DRAWN BY: Bryan Harper
DWG No: B0284	REV DATE: -

PARTS LISTS

Electrical Parts List

Ref Desig	Description	Part Number

REVISION HISTORY

Revision	Date	ECO	Description