



## ***MT-3 FM TRANSMITTER MAIN BOARD INSTRUCTION MANUAL***

Covers Models:

All VHF FM Transmitters

All UHF FM Transmitters

With:

Version 2.3 FM Audio Processor

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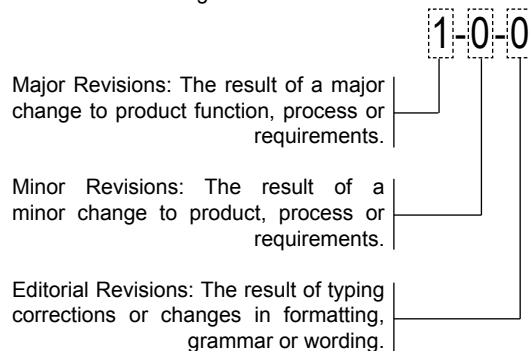
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Daniels Electronics Ltd. utilizes a three-level revision system. This system enables Daniels to identify the significance of a revision. Each element of the revision number signifies the scope of change as described in the diagram below.



Three-level revision numbers start at 1-0-0 for the first release. The appropriate element of the revision number is incremented by 1 for each subsequent revision, causing any digits to the right to be reset to 0.

For example:

If the current revision = 2-1-1 Then the next major revision = 3-0-0

If the current revision = 4-3-1 Then the next minor revision = 4-4-0

If the current revision = 3-2-2 Then the next editorial revision = 3-2-3

The complete revision history is provided at the back of the document.

## NOTE

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The design of this equipment is subject to change due to continuous development. This equipment may incorporate minor changes in detail from the information contained in this manual.

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## GENERAL INFORMATION

### Introduction

The MT-3 Transmitter Main Board integrates the MT-3 Front Panel Board, MT-3 Audio Processor, Synthesizer (Low Current OS-3 or Enhanced OS-3H) module, and Amplifier module together to comprise a MT-3 series transmitter. The Front Panel Board and the Audio Processor are soldered directly to the Transmitter Main Board while the Amplifier and the Synthesizer modules 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 transmitter enclosure is formed by the front panel face plate and aluminum shell attached to the transmitter main board and the rear panel plate attached to the aluminum shell.

## PERFORMANCE SPECIFICATIONS

### General Specifications

Parameter	Specification
Type:	MT-3 Series Transmitter
Compatibility:	MT-3 Series Amplifier, OS-3 and OS-3H Frequency Synthesizer Modules
Modulation:	11K0F3E or 16K0F3E (Frequency Modulation)
Operating Temperature:	-30°C to +60°C, optional -40°C to +60°C
Operating Humidity:	95% RH (non-condensing) at +25°C
Operating Voltage:	+9.5VDC Regulated. +13.8VDC Nominal (11 - 16VDC)
Front Panel Controls:	NORM (repeat mode), OFF, and KEY TX (TX on)
PTT Activation:	<ul style="list-style-type: none"> <li>• Active to ground with or without time-out-timer.</li> <li>• Microphone activated with or without time-out-timer.</li> <li>• Front Panel switch: KEY TX - without time-out-timer.</li> <li>• NORM - with or without time-out-timer.</li> <li>• Isolated (optional relay) with or without time-out-timer.</li> </ul>
PTT Time-Out-Timer:	Selectable from 1sec to 8hrs (Factory Default: 5 min)

### Audio Specifications

Parameter	Specification
Audio Input & Impedance:	Balanced 600Ω or unbalanced (optional)
Audio Input Level:	-25dBm to 0dBm.
Audio Frequency Response: (Pre-emphasis)	6dB per octave, 1kHz reference deviation Complies with T1A-603-B (Section 3.2.6)
Audio Frequency Response: (Flat)	1kHz reference deviation +1 to -1dB (300 to 2000Hz) 0 to -2dB (2.5kHz) -1 to -3dB (2.8kHz) -2 to -4dB (3.0kHz)
Audio Deviation:	Preset to ±1.5kHz (NB) or ±3.0kHz (WB) with a 1kHz tone (capable ±2.5kHz or ±5.0kHz)
Subtone Audio Input 1:	0.5 Vpp at 200Hz for ±500Hz deviation (intern adjust)
Subtone Audio Input 1 Frequency Range:	60Hz to 300Hz
Subtone Audio Input 2:	0.5Vpp at 100Hz for ±500Hz deviation (intern adjust)
Subtone Audio Input 2 Frequency Range:	DC to 150Hz
Direct Modulation Input:	0.5Vrms at 1kHz or ±3kHz deviation
Direct Modulation Frequency Range:	DC to 5kHz



## THEORY OF OPERATION

### TRANSMITTER MAIN BOARD

#### General

Switch SW1 on the Front Panel Board is a DPDT switch that controls the operation of the transmitter. When SW1 is in the 'OFF' position the transmitter is turned off; however, +13.8VDC is still present on the Transmitter Main Board as the +13.8VDC supply is not switched. When SW1 is in the 'KEYED' position, +9.5VDC is supplied to the transmitter circuitry and the transmitter is continuously keyed on. When SW1 is in the 'NORM' position, +9.5VDC is supplied to the transmitter circuitry and the transmitter can be keyed from any of the several Push-To-Talk inputs.

## Transmitter Push-To-Talk

All three of the Push-To-Talk (PTT) inputs that key the transmitter are active low (< +2VDC). One PTT input is on the front panel microphone connector. The other two PTT inputs: PTT WTO (PTT With Time-Out-Timer) and PTT NTO (PTT No Time-Out-Timer), are on the backplane connector of the transmitter board. If required, the microphone's PTT input can be configured to activate the transmitter's Time-Out-Timer (TOT). An isolated PTT input can be made available by installing an optional relay (RELAY1) and configuring jumpers J1 to J4 so that the relay controls the PTT circuitry.

### Microphone PTT

Jumper J1 on the MT-3 Front Panel Board configures the microphone's PTT input (MIC PTT) to either bypass or activate the transmitter's TOT. Installing surface mount jumper J1 in the 'X' position (default) selects the MIC PTT NTO line, which bypasses the TOT. Installing surface mount jumper J1 to the 'Y' position selects the MIC PTT WTO line, which activates the transmitter's TOT. When SW1 is in the 'KEYED' position the MIC PTT NTO line is automatically grounded.

### PTT With Time-Out-Timer

Pins B10 and Z10 of the backplane connector are the PTT WTO input. When the PTT WTO signal, which is normally high, falls below +2.0VDC, the transmitter is keyed. The transmitter is disabled when the PTT WTO input rises above +2.3VDC or if the TOT's time-out period is exceeded. If the time-out period is exceeded the PTT WTO input must go high (>+2.3VDC) and then low again in order to re-key the transmitter.

The PTT WTO threshold of approximately +2VDC (0.3VDC hysteresis) is set by U1a, R1, R2, R3, R4, R9, and R10 while diodes D1 and D2 provide overvoltage protection for U1a. The PTT WTO signal output from U1a is 'AND'ed with the MIC PTT WTO by U2a. When either the PTT WTO or the MIC PTT WTO is activated the output of U2a goes low which triggers the transmitter's TOT located on the MT-3 Audio Processor. The TOT's output is 'AND'ed with the MIC PTT NTO signal (U2c) and the PTT NTO signal (U2d).

When any one of the preceding three signals (TOT's output, MIC PTT NTO, PTT NTO) go low the transmitter is activated by transistors Q1 to Q7 which switch power to the various modules.

### PTT No Time-Out-Timer

Pins B14 and Z14 of the backplane connector are the PTT NTO input. When the PTT NTO signal, which is normally high, falls below +2.0VDC, the transmitter is keyed. As long as the PTT NTO signal remains below +2.0VDC the transmitter will remain keyed. The transmitter is disabled when the PTT NTO signal rises above +2.3VDC.

The PTT NTO threshold of approximately +2VDC (0.3VDC hysteresis) is set by U1b, R5, R6, R7, R8, R9, and R10 while diodes D3 and D4 provide overvoltage protection for U1b. The PTT NTO signal is 'AND'ed with the output of U2c (MIC PTT NTO signal 'AND'ed with the TOT output) by U2d. When the output of U2d goes low transistors Q1 to Q7 activate the transmitter, which switch power to the various modules.

### PTT Relay

The transmitter's PTT circuitry can be completely isolated by installing RELAY1. Jumpers J1 to J5 configure the relay to provide an isolated PTT input for either the PTT WTO line or PTT NTO line. Energizing the relay enables the isolated PTT input. The transmitter board will accept any of the Aromat TF2E line relays. These relays are DPDT, single side stable, and have coil voltages ranging from +3VDC to +48VDC. Only one set of relay contacts is used to activate the PTT circuitry.

To configure the isolated input for PTT WTO operation jumpers J2, J3, and J4 must be in the 'Y' position. In this mode, pins B10 and Z10 no longer function as the PTT WTO input; however, pins B14 and Z14 continue to function as the normal PTT NTO input.

To configure the isolated input for PTT NTO operation jumpers J2, J3, and J4, must be in the 'X' position. In this mode, pins B14 and Z14 no longer function as the PTT NTO input; however, pins B10 and Z10 continue to function as the normal PTT WTO input.



## PTT Output

Pin B24 on the backplane connector is an open drain output (Q9), which is pulled low anytime the transmitter is keyed and the synthesizer is locked. An N-channel MOSFET Q9 is capable of sinking currents up to 2 Amps and is activated by Q8, which is activated by the Qualified PTT signal (JS2-6) of the Synthesizer module. The Qualified PTT signal also controls the LED ENA line for diode D1 on the front panel board and enable line for the MT-3 Amplifier Module (JP1-1).

## PTT Voltage Switching

The PTT voltage switching circuitry is comprised of transistors Q1 through Q7 and the associated resistors. The base of Q1 is driven by the output of U2d, which is the combined PTT signal from all of the PTT inputs. When the transmitter is keyed, Q1 is turned off and subsequently transistors Q3, Q4, and Q6 are turned on. Transistors Q3, Q4, and Q6 provide three separate functions:

---

Q3 Provides the active low signal for the Synthesizer module PTT input.

---

Q4 Turns on Q5, which turns on the +9.5VDC Switched supply.

---

Q6 Turns on Q7, which turns on the +9.5VDC PTT Switched supply.

---

The '+9.5VDC Switched' supply (Q5) can also be activated by installing jumper J6 or by externally grounding the TX Standby Line (pins B12 and Z12). The '+9.5VDC PTT Switched' supply and the '+9.5VDC Switched' supply both provide +9.5VDC but depending on how jumpers J6, J7 and J18 are configured the transmitter's standby mode will change.

## MT-3 Front Panel Board

The MT-3 Front Panel Board is attached to the MT-3 Transmitter Board and is used to mount the front panel switch, diode, and microphone connector. The main purpose of the board is to eliminate a wiring harness for the front panel components. Jumper J1, located on the rear of the circuit board, is used to select whether or not the MIC PTT line activates the transmitter's TOT. Jumper J2 is used to select whether or not Rx Audio or 13.8 Volt is supplied to pin 4 of the microphone.

---

J1	'X' position	MIC PTT NTO - no time-out timer (factory setting)
	'Y' position	MIC PTT WTO with time-out-timer

---

J2	'X' position	Rx Audio enabled to MIC-4 pin (factory setting)
	'Y' position	+13.8 Volts supplied to MIC-4 pin

---

## Transmitter Standby Modes

The MT-3 series transmitters have 8 different standby modes that trade-off standby current consumption for start-up speed.

Three jumpers are found on the Transmitter Main Board:

---

J6 Continuously enables the '+9.5VDC Switched' supply.

---

J7 Selects the power source for the MT-3 FM Audio Processor.

---

J18 Selects the enable line for the OS-3 or OS-3H Synthesizer module.

---

Additionally, there is a jumper on the FM Audio Processor Board:

JU36 Determines the power source for the dual compression amplifiers.

If JU36 is not installed on the FM Audio Processor, both microphone and balanced audio compression amplifiers will be disabled, eliminating the use of the front panel microphone jack for local microphone operations. With this configuration, the balanced audio is routed around the compression circuitry via JU11 (installed) with JU1 and JU2 removed.

---

## Mode Condition Table

Mode #	J6	J7	J18	Synthesizer/ Osc. State	Audio Processor State (8V Switched)	Audio Processor Compression JU36
1a	OUT	Y	Y	PTT Switched	PTT Switched	Switched +8.0V(X)
1b	OUT	Y	Y	PTT Switched	PTT Switched	Continuous 9.5V(Y)
1c	OUT	Y	Y	PTT Switched	PTT Switched	Disabled (Not Installed)
2a	IN	Y	X	Always enabled	PTT Switched	Switched +8.0V (X)
2b	IN	Y	X	Always enabled	PTT Switched	Continuous 9.5V (Y)
2c	IN	Y	X	Always enabled	PTT Switched	Disabled (Not Installed)
3	IN	X	Y	PTT Switched	Always enabled	Doesn't matter
4	IN	X	X	Always enabled	Always enabled	Doesn't matter

The actual current and start-up time depend on the oscillator source and amplifier module. The current and start-up times given below are representative values intended only as guidelines. Refer to the appropriate modular instruction manuals for specific oscillator and amplifier types for further information.

### Standby Mode Selection Table

Mode #	Standby Current	Turn-on Time
1a	14mA	150mS
1b	21mA	10mS
1c	14mA	10mS
2a	166mA	150mS
2b	173mA	10mS
2c	167mA	10mS
3	29mA	10mS
4	181mA	10mS

Note: Standby Current is the total current drawn by the Synthesizer and Audio Processor from the +9.5VDC supply.

### FM Audio Processor Total Current Consumption

Compression Configuration	Audio Processor Current Draw keyed / unkeyed
Compression enabled (JU36X)	15mA / 0.45mA
Compression and microphone disabled (JU36 Open)	9.2mA / 0.45mA
Compression enabled (JU36Y)	15mA / 9.2mA

### Audio Circuits

The MT-3 Audio Processor performs audio signal conditioning (e.g. limiting, filtering, and pre-emphasis). The transmitter board routes the audio lines from the backplane connector to the audio processor and then to the synthesizer. The audio lines routed to the audio processor are two subtone inputs (backplane pins B22 and Z24), a direct modulation input (pin Z28), a squelched/flat audio input (pin Z20), a 600Ω balanced input (pins B18 and Z18), and an audio control line (pin Z22). The audio processor's balanced input pins are isolated from pins B18 and Z18 by a transformer (T1).

Two audio outputs from the MT-3 Audio Processor are routed to the synthesizer modules.

### Microphone Audio

Normally the microphone audio is sent from the attached transmitter, however the MIC IN and MIC OUT lines can be configured on the Transmitter Main Board such that the microphone audio modulates a different transmitter. The configuration of the MIC IN (pin Z4) and MIC OUT (pin B4) lines on the MT-3 Transmitter Main Board are controlled by jumpers J16 and J17 respectively. Jumper J16 selects the audio source for the MT-3 Audio Processor's microphone input. Jumper J17 is used to enable or disable the MIC OUT line. Normally the transmitter's microphone is selected (J16 in the 'X' position) and the MIC OUT line is enabled (J17 is installed).

### Received Audio

Pin B20 is the audio input from the transmitter's corresponding receiver. The default setting for this line is to have it AC coupled (Jumper J9 is out) and directly connected to the front panel board RX AUDIO line.

### Channel Selection

#### Synthesized Transmitter

Seven backplane connections are used to communicate with the synthesizer unit. Pins D28, D30, and D32 are used (in house) to program the synthesizer. Channel select lines CSEL 0 (least significant bit) through CSEL 3 (most significant bit), which are available at pins D20, D22, D24, and D26, are used once the synthesizer is programmed to select one of 16 channels. If the channel select lines are all low (channel 1) the channel for the synthesizer is read from switches FSW1 (most significant), FSW2, FSW3, and FSW4 (least significant); otherwise one of 15 pre-programmed frequencies is selected. Since the resulting frequency is dependent on the transmitter model, refer to the section on frequency selection in the Transmitter Manual or to the channel designation tables for that particular transmitter.

## Amplifier Circuits

The MT-3 series Amplifier has 6 connections that are cabled to the transmitter board: +13.8VDC, +9.5VDC, Enable, Forward Power Sense, Reverse Power Sense, and Ground. The +13.8VDC supply (JP1-3) is always on while the +9.5VDC supply (JP1-2) is always switched by a PTT signal. The enable line (JP1-1) is active low and is controlled by the Qualified PTT signal from the synthesizer module module.

Jumpers J12, J13, J14, and J15 are used to configure the amplifier's forward and reverse power sense lines (JP1-4 and JP1-5). Normally jumpers J13, J14, and J15 are in the 'X' position, which directly connects the amplifier's forward, and reverse power sense lines to the backplane connector (pins B26 and Z26 respectively). The forward and reverse power sense lines from the Amplifier can be open collector or linear outputs depending on how they are configured in the amplifier module. In open collector configuration the lines are active low, that is, the output will go low when a 'fail' condition is detected. If both lines from the amplifier module are configured as open collector outputs, the power sense lines can be 'OR'ed together to make a general fail indicator (jumper J12 in, jumpers J13, J14, and J15 in the 'Y' position). The Fail Indicator is also an open collector output; however, the Fail Indicator is active high (the output goes high when a 'fail' condition is detected). When the transmitter is configured with the general fail indicator option, pin Z26 (VSWR reverse) is not used and pin B26 becomes the Fail Indicator output.

## Time-Out-Timer Circuitry

The MT-3 Transmitter also has an associated programmable push-to-talk (PTT) time-out-timer (TOT) circuitry on the Transmitter Main Board. The TOT circuitry is powered via J34 from the continuous +9.5VDC supply and is programmable for various time-out periods.

The TOT input trigger (enabled by J33) is normally high and in this state the timer is disabled. When the input trigger level falls below +2.0VDC, the timer is activated, the TOT output trigger (enable by J35) is pulled low, and the transmitter is keyed. If the input trigger rises above +2.4VDC or if the time-out period is exceeded, the output trigger will go high, disabling the transmitter. If the time-out period is exceeded, the TOT input trigger must go high and then low again in order to re-key the transmitter.

The time-out duration is jumper selectable from 1 second to 8 hours. The positions of the jumpers are on the top (Through hole component) side of the Transmitter Main Board.

J32	J31	J29	J28	J26	J27	
I	I	I	I	I	I	0.01
I	I	I	I	I	N/I	0.01
I	I	I	I	N/I	I	0.01
I	I	I	N/I	I	I	0.01
I	I	I	N/I	I	N/I	0.02
I	I	N/I	I	I	I	0.02
I	I	I	N/I	N/I	I	0.03
I	I	N/I	I	I	N/I	0.04
I	I	N/I	N/I	I	I	0.05
I	I	N/I	I	N/I	I	0.06
I	I	N/I	N/I	I	N/I	0.08
I	N/I	I	I	I	I	0.10
I	I	N/I	N/I	N/I	I	0.12
I	N/I	I	I	I	N/I	0.15
I	N/I	I	N/I	I	I	0.19
I	N/I	I	I	N/I	I	0.23
I	N/I	I	N/I	I	N/I	0.31
I	N/I	N/I	I	I	I	0.38
I	N/I	I	N/I	N/I	I	0.47
I	N/I	N/I	I	I	N/I	0.62
I	N/I	N/I	N/I	I	I	0.75
I	N/I	N/I	I	N/I	I	0.94
I	N/I	N/I	N/I	I	N/I	1.25
N/I	I	I	I	I	I	1.5
I	N/I	N/I	N/I	N/I	I	1.88
N/I	I	I	I	I	N/I	2.5
N/I	I	I	N/I	I	I	3.0
N/I	I	I	I	N/I	I	3.75
<b>N/I</b>	<b>I</b>	<b>I</b>	<b>N/I</b>	<b>I</b>	<b>N/I</b>	<b>5.0</b>
N/I	I	N/I	I	I	I	6.0
N/I	I	I	N/I	N/I	I	7.5
N/I	I	N/I	I	I	N/I	10
N/I	I	N/I	N/I	I	I	12
N/I	I	N/I	I	N/I	I	15
N/I	I	N/I	N/I	I	N/I	20
N/I	N/I	I	I	I	I	24
N/I	I	N/I	N/I	N/I	I	30
N/I	N/I	I	I	I	N/I	40
N/I	N/I	I	N/I	I	I	48
N/I	N/I	I	I	N/I	I	60
N/I	N/I	I	N/I	I	N/I	80
N/I	N/I	N/I	I	I	I	96
N/I	N/I	I	N/I	N/I	I	120
N/I	N/I	N/I	I	I	N/I	160
N/I	N/I	N/I	N/I	I	I	192
N/I	N/I	N/I	I	N/I	I	240
N/I	N/I	N/I	N/I	I	N/I	320
N/I	N/I	N/I	N/I	N/I	I	480

N/I = Not Installed

I = Installed

**Bold** text represents default settings.

# AUDIO PROCESSOR

## Introduction

The MT-3 FM Audio Processor is a versatile circuit board that can provide several types of audio processing for voice or data transmission.

## Bandwidth Table

Term	Channel Spacing	Rated System Deviation
Wideband (WB)	25kHz or 30kHz	±5.00kHz
Narrowband (NB)	12.5kHz or 15kHz	±2.50kHz

## Features include:

- Automatic level control using a compression amplifier with a 25 dB dynamic range.
- Limiter and Splatter filter that removes noise and harmonics.
- Selectable pre-emphasis or flat audio response.
- Temperature compensated audio output.
- Ability to transmit data and voice switched by a single control line.
- Backwards compatible with Daniels Electronics MT-2 series transmitters.
- Multiple jumpers that can be configured to allow maximum flexibility in routing signals from inputs to outputs, and disabling selected circuits to reduce operating current.
- Dual microphone and balanced audio compression circuits.
- On-board multi-configurable temperature compensation to correct for changes in transmitter deviation over temperature caused by changing characteristics of synthesizers and oscillators.

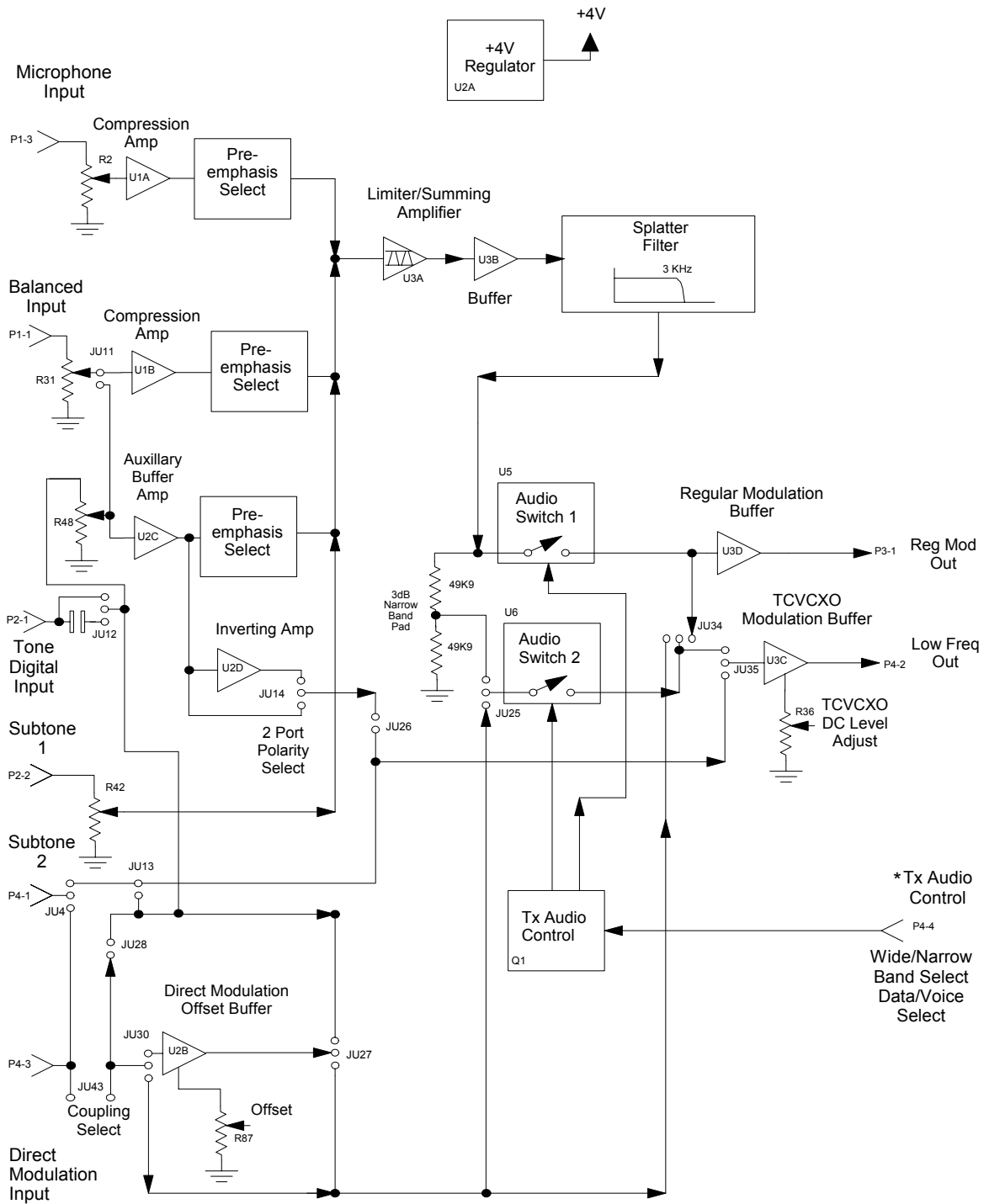
- A single chip 10<sup>th</sup> Order Linear Phase Low pass splatter filter for increased cutoff attenuation responses needed in today's narrow band environment
- The ability to switch between narrow and wideband through a single control line, which can be externally controlled. This can be useful when configured as a multi-channel transmitter, which uses mixed wide and narrowband frequencies.
- The ability to easily reconfigure fixed operations from narrow to wideband through simple jumper settings.
- Separate voice and direct modulation outputs, each individually configurable.
- Direct modulation input for LTR™, DCS, paging and other digital modulations that require very low frequency modulation to the synthesizer module.
- Multiple audio inputs for various audio filter or modulation configurations.

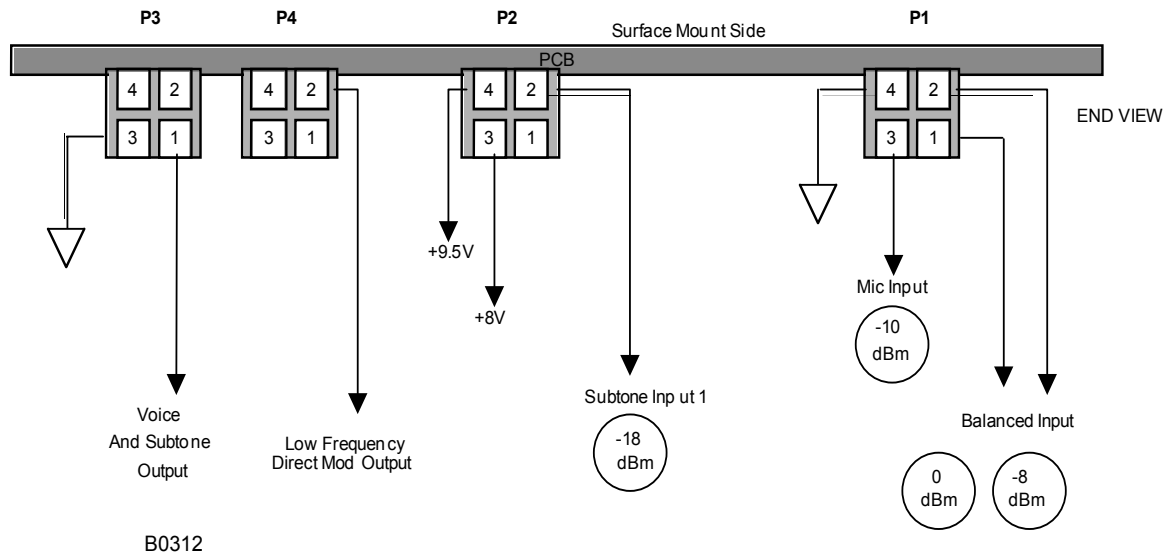
**Note:** If dual mode CTCSS and LTR™/DCS is desired in the same transmitter may be possible with dual port modulation synthesizers. It is not feasible with single port modulation synthesizers. These synthesizers are characterized by the lack of a modulation port in their VCO circuit. This is covered in the Applications Manual AM10-DMS, Data Modulation and Signaling Applications Manual. It is recommended that the Factory be contacted for further details.

A continuous +9.5VDC supply and a switched +8.0VDC supply are required to power the module which is normally supplied by the Main Transmitter Board.

The Audio Processor's balanced input pins are isolated by a transformer (T1) on the Transmitter Main Board. Two audio outputs from the MT-3 Audio Processor are routed to the Synthesizer Module.

# Audio Processor Block Diagram





Interconnection Pin Layout Diagram

### Factory Configuration

The MT-3 FM Audio Processor is factory configured as follows:

Parameter	Specification
Maximum Deviation	<ul style="list-style-type: none"> <li>• ±2.5kHz (Narrowband),</li> <li>• ±5.0kHz (Wideband).</li> </ul>
Microphone Input	<ul style="list-style-type: none"> <li>• 1kHz signal at -10dBm gives ±60% rated system deviation</li> <li>• 1kHz signal compression set at ±84% rated system deviation</li> </ul>
Audio Balanced Input	<ul style="list-style-type: none"> <li>• 1kHz tone at -8dBm gives pre-emphasis response ±60% rated system deviation</li> <li>• 1kHz signal compression set at ±84% rated system deviation</li> </ul>
Subtone Input 1	<ul style="list-style-type: none"> <li>• 100Hz tone at -18dBm gives ±500Hz (Wideband)</li> <li>• ±350Hz (Narrowband) deviation</li> </ul>
All other audio inputs	<ul style="list-style-type: none"> <li>• Disabled</li> </ul>



## Turn on Time

Mode	Turn on time	Audio Processor Standby Current
Fast turn on – higher current	Approx 1mS	15mA
Current save – slower response	Approx 150mS	450 $\mu$ A

## Turn on Time

The “turn-on time” is the time it takes the FM Audio Processor to output a stable audio signal to P3-1 once the +8.0VDC power is enabled. The turn-on time can be virtually eliminated by configuring the FM Audio Processor for continuous audio standby. However this results in increased current consumption. Powering of the compression amplifier contributes to most of the time delay. So transmitters configured with the compression amplifier disabled (for data or non-compressed audio) will exhibit the fast turn-on time. The response measurement is made with the standard factory settings with a 1kHz tone applied to the balanced input.

## Low Frequency Modulation

The transmitter has an additional option to address low frequency user modulation requirements. A phase modulated bandwidth from 0 (DC) to 100Hz (PLL loop filter bandwidth) allows specialized applications such as paging or trunking where a separate low frequency digital/analog modulation channel is required. Low Frequency Modulation allows external access to the low frequency modulation capabilities of the synthesizer module. The DIRECT MODULATION inputs on the J1 control connector of the M-3 motherboard will be used (B20 for TX A, and A20 for TX B). Refer to “Data Modulation and Signalling Applications Manual”, AM10-DMS for specific FM Audio Processor configuration methods.

## Audio Processor Signals

The MT-3 FM Audio Processor has six audio inputs, two audio outputs and one audio control input. Five of the audio inputs are used primarily for voice and tone signals. The sixth, the Direct modulation input, is used primarily for data signals. The audio control input is used to switch audio outputs so the transmitter can transmit voice or data.

The audio inputs on the FM Audio Processor are:

- Dynamic microphone input

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- 600 $\Omega$  balanced input

---

- Subtone inputs

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- Auxiliary input.

---

- Direct modulation input for data signals.

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## FM Audio Processor Outputs

Both the audio outputs, Modulation Output (P3-1) and Low Frequency / Direct Modulation Output (P4-2), are gated by audio switches U5 and U6 respectively which are controlled by the Transmit Audio Control Input (P4-4). The audio switches can be operated complimentary to each other so that only one source modulates the transmitter. In standard configuration, the Modulation Output port is used so switch U5 is always on.

### Audio Processor Modulation Outputs

The Modulation Output port is used by all voice input signals. The voice inputs are passed to U1A and U1B, a dual programmable compressor - expander that is configured as an automatic level control amplifier. Op-amp U3A provides the limiting action for the FM Audio Processor. After the audio signals have been combined, limited and buffered, they are filtered by a 10th order Linear Phase Low pass Filter (U4). The output signal from the filter is then level adjusted by the deviation control pot, R29, at the input of buffer amplifier U3D. In special applications, jumper JU6 can be disabled and JU7 enabled allowing the transmitter to be modulated directly from the auxiliary input. External filtering may be required since jumper JU7 bypasses the limiting and filter circuits.

The Low Frequency / Direct Modulation Output port has two functions depending on whether the transmitter is synthesized. In a synthesized transmitter, this port is used to modulate the synthesizer reference frequency. The frequency response of this port is typically DC to 300Hz.

### Audio Processor Microphone Input

The microphone input has an automatically level controlled (ALC) preamplifier U1 whose input level is controlled by R2. The microphone input level control (R2) can accommodate a -25dBm to 0dBm input signal. The microphone input is limited and filtered and is output at the standard modulation output port. The microphone input can have a standard 6dB/octave pre-emphasis response or a flat-audio response, jumper JU1 at 'Y' and 'X' position respectively.

### Audio Processor Balanced Input

The 600- $\Omega$  balanced input uses the ALC preamplifier U1B, with input level control pot (R31). The balanced input level control can accommodate a -25dBm to 0dBm input. (install JU17 when using the lower input levels). Like the microphone input, the balanced input is limited and filtered and is output at the standard modulation output port.

If no compression is required (i.e.: customer is providing their own), JU11 can be enabled providing a path through R48 (Auxiliary Input Level Control) to amplifier U2C where pre-emphasis or flat audio can then be selected from its output.

### Audio Processor Auxiliary Input

The auxiliary input is a special input and does not have an ALC. This input can be configured for a pre-emphasis response (enable JU9Y) or a flat-audio response (enable JU9X). The level for this input is set by R48. The auxiliary output is normally summed with the voice signals by op-amp U3A, limited, then filtered and output at the standard modulation output port. The value of R57 (Select) can be tailored for specific applications.

When jumper JU6 is disabled and jumper JU7 is enabled, the auxiliary input can be used to directly modulate the transmitter. Care should be taken when directly modulating the transmitter with the auxiliary input because the MT-3 transmitters use direct FM modulation and there is no filtering or limiting action provided by the auxiliary input. The input level to the auxiliary input should be -18dBm and can be driven by one of three inputs:

- 
- The balanced input – JU11.
- 
- The tone/digital input – JU12 X or Y enabled.
- 
- The direct modulation input – through JU28.
- 

When the 600 $\Omega$  balanced input is connected to the auxiliary input, the balanced input level control can be used to adjust the level for the auxiliary input.

## Audio Processor Subtone Inputs

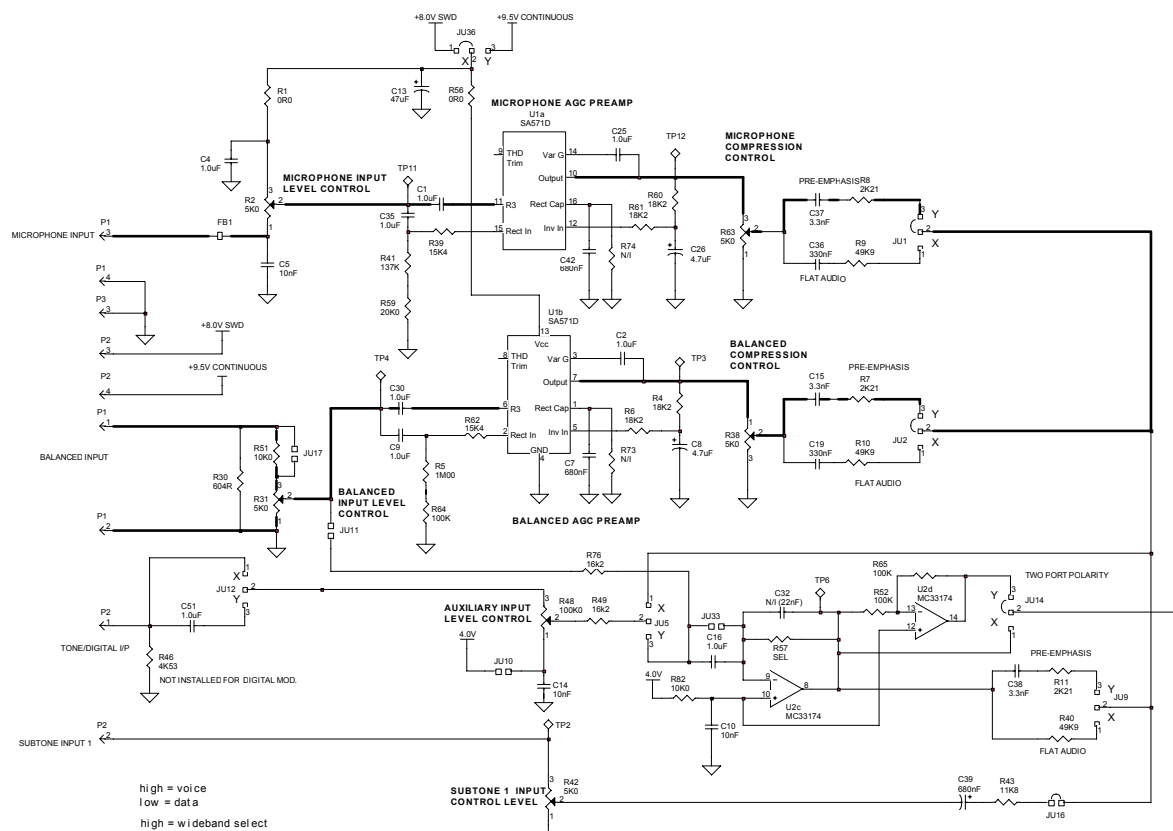
There are two subtone inputs available on the FM Audio Processor. Both subtone inputs can be individually configured to be output from the standard Modulation Output port or to be output from the Low Frequency / Direct Modulation Output. In standard configuration, Subtone 1 is summed with the voice signals to be output from the standard Modulation Output port while Subtone 2 is used for DCS. Both subtone inputs have an input level control.

In order to maintain a uniform frequency response from 50Hz to 300Hz, dual-port modulation techniques are used when the FM Audio Processor is used with an enhanced UHF and VHF synthesized transmitter (Synthesizer: OST-3H418, OST-3H460, OST-3H141, OST-3H162). Refer to the schematic diagrams and alignment procedures.

## Direct Modulation Input

The Direct Modulation Input is an extremely versatile input. This port is designed to be used for data signals. Depending on the application, the signal can be amplified, AC or DC coupled and output to the Modulation Output or the Low Frequency / Direct Modulation Output port. Please consult the factory for specific jumper settings for your application.

## Audio Processor Signal Paths (Version 2.3)

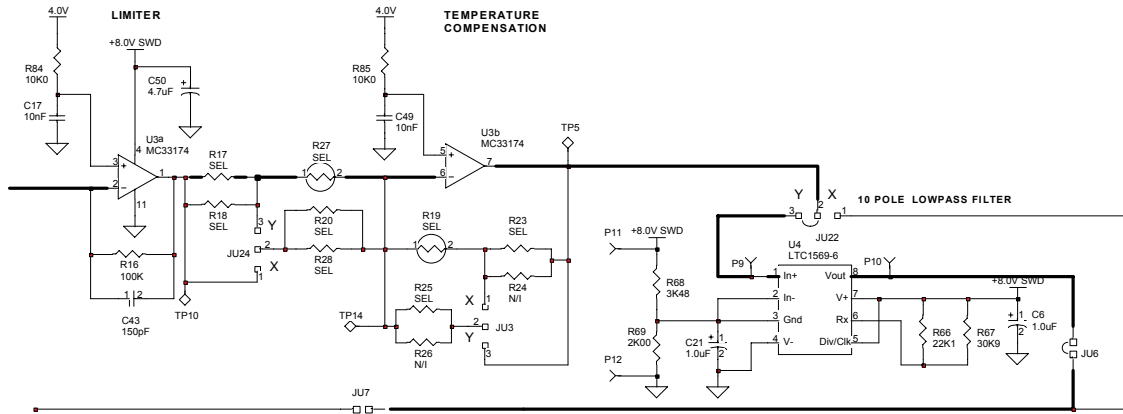


B0313

Microphone and Balanced Input Circuitry, V2.3 Audio Processor

Voice band audio normally enters the Balanced Input at P1-1 and P1-2 on the subrack connector while microphone audio enters at P1-3. Potentiometer R31 sets the Balanced compression level of U1B while R2 sets the microphone compression level of U1A.

Each amplifier has a dynamic range of 25 dB. Jumper JU17 is only installed when using very low input levels (-18 to -25dBm) and allows better tuning range for R31. The output of the compression amplifiers are normally set for Pre-emphasis (6dB/Octave) but can be set for a flat audio response using jumpers JU1 and JU2.



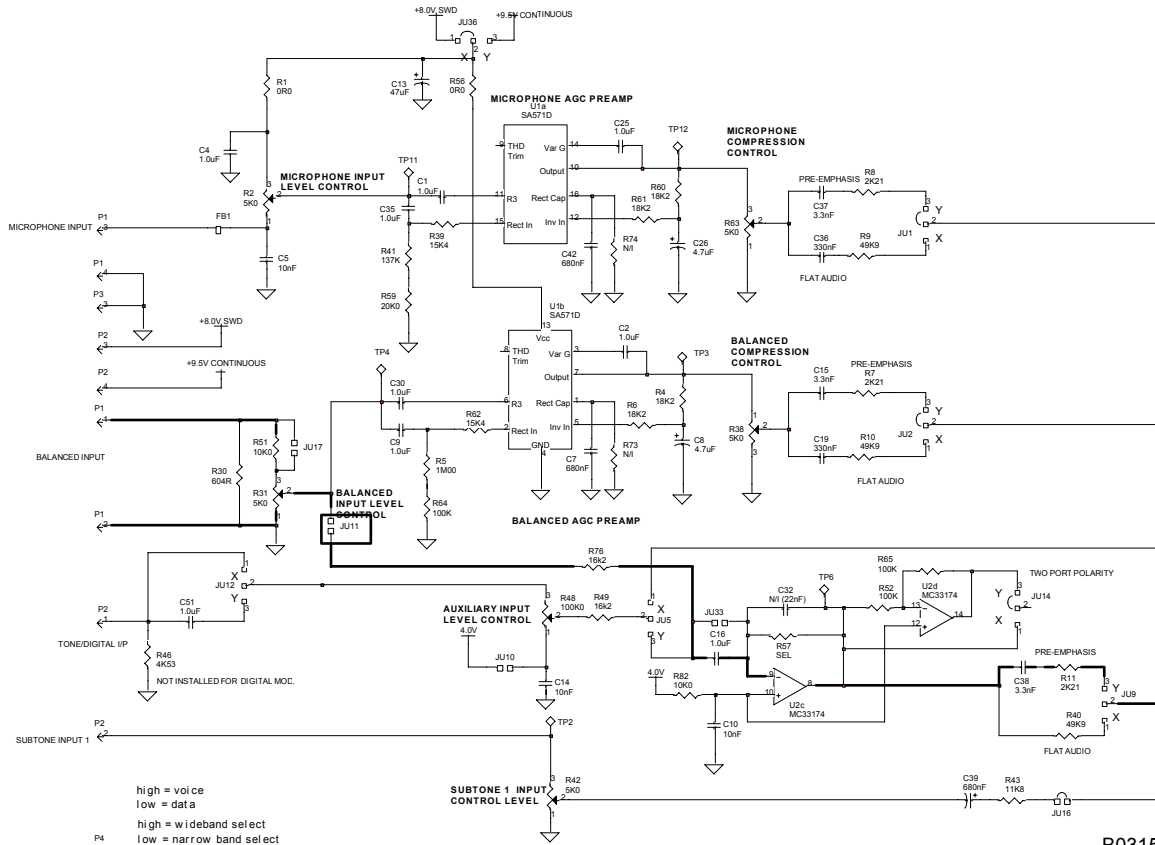
B0314

### Limiter and Splatter Filter, V2.3 Audio Processor

The microphone and balanced audio signals are summed and limited by U3A. Op-amp U3B provides audio level temperature compensation (for synthesizer sensitivity variations). Due to the many different characteristics of various synthesizers, many components are selected for best performance over the temperature range.

The audio is then filtered by a 10th order linear phase low pass splatter filter. This is to provide the linearity and cutoff attenuation response required for narrow band operation and digital applications.

The filter output level is set by R29, the deviation control. From this point, the signal goes to U5 a bilateral audio switch. U5 is normally configured to be always on. The output of U5 goes to the final buffer amplifier U3D. Installing JU23 lowers the audio level by one half facilitating a quick conversion of a wideband transmitter for narrowband operation. The output of U3D has many capacitors with values selected depending on the installed synthesizer module type.



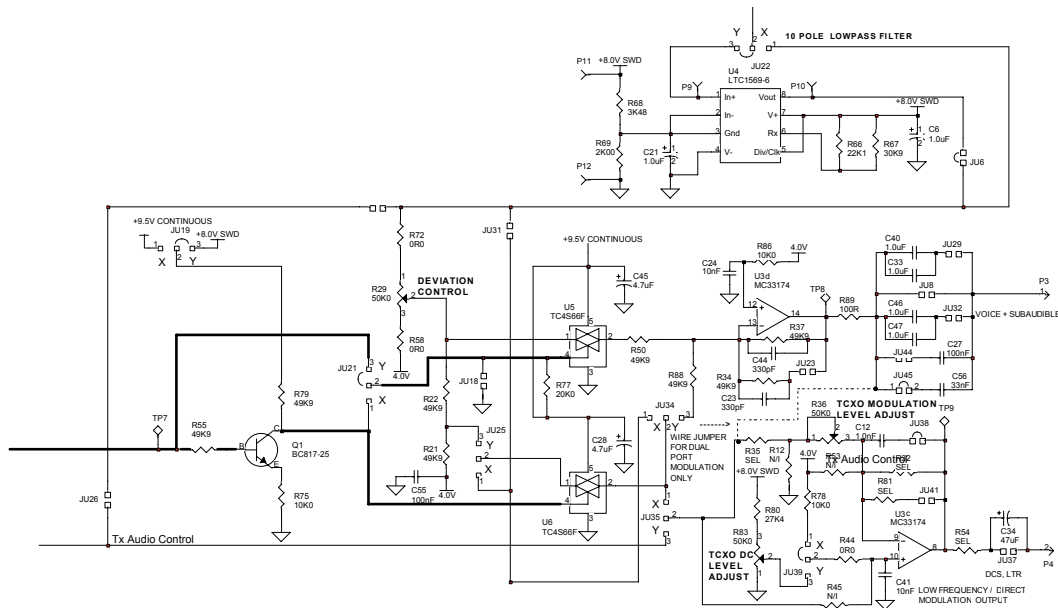
B0315

### Bypassing Compression, V2.3 Audio Processor

If no compression circuitry is required, the balanced input signals can be routed around the compression circuitry using jumper JU11. Op-amp U2C then provides buffering and amplification. Pre-emphasis filtering at the output is enabled or disabled using jumper JU9. The audio signal is then normally routed to U3A, the summing amplifier/limiter and processed as indicated previously.

Assuming no data modulation, a second way to route around audio compression is via the direct modulation port P4-3 and route through JU28 to R48 and Op-amp U2C. Subaudible tones enter at P2-2 where level is controlled by R42. A single jumper JU16 enables the audio path to U3A, the summing amplifier/limiter.

Note however, if compression is bypassed, the THD may be higher due to the reduced dynamic input range causing more clipping. "Key down" current consumption can be reduced by 9mA by disconnecting the compression amplifier power by removing JU36, however the microphone circuit will be disabled.



B0316

### TX Audio Control Circuitry, V2.3 Audio Processor

Voltage regulator U2A provides a regulated +4.0VDC to all Op-amp stages. Optional potentiometer R14 can be installed (and JU15 removed) for special applications where a voltage other than +4.0VDC is required.

Data normally enters at P4-3, the Direct Modulation Input, then connected via many possible routes selected with jumpers. JU43 allows direct or on-board capacitor coupling. Op-amp U2B can be configured as a buffer with a DC offset to accommodate input data that has a positive DC voltage offset. The data signals can be sent to gain buffers U2C and U2D through potentiometer R48. Jumper JU14 is normally installed so that the output from U2D provides the correct data polarity when using two-port modulation.

A single TX Audio control line on P4-4 has 2 functions. It can be configured to switch U3D inputs between data and voice. Alternately, it can be configured to remotely switch between wideband and narrowband applications by switching between the regular audio path and one carrying half the audio level as determined by resistive divider comprised of R22 and R21.

Due to the complex nature of data modulation methods, the actual configurations and values of selected components for LTR™, DCS, and Paging modulation are contained in a separate applications manual, AM10-DMS.







## TRANSMITTER ALIGNMENT

### REPAIR NOTE

MT-3 Transmitter modules are mainly made up of surface mount devices which should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with Electrostatic Discharge (ESD) Protection.

When removing Surface Mount Solder Jumpers, it is recommended to use solder braid in place of manual vacuum type desoldering tools. This will help prevent damage to the circuit boards.

## RECOMMENDED TEST EQUIPMENT LIST

Alignment of the complete transmitter requires the following test equipment or its equivalent. It is assumed that any adjustment of the Transmitter Main Board will also involve the other modules.

Dual Power Supply:	Regulated +9.5VDC at 2A. (e.g. Topward TPS-4000) Regulated +13.8VDC at 2A
Oscilloscope:	20MHz or better (e.g. Fluke 97 Scopemeter)
Digital Multimeter	for DC, RMS AC Voltage and Current (e.g. Fluke 75)
Radio communications test set:	e.g. Marconi Instruments 2955R
VSWR 3:1 mismatch load:	e.g. JFW 50T-035-3.0:1
Alignment Tool:	Johanson 4192
Audio Signal Generator	600Ω Output Impedance, 67Hz to 5KHz range

It is recommended that the radio communications test set be frequency locked to an external reference (WWVH, GPS, Loran C) so that the high stability oscillator may be accurately set to within its  $\pm 1$  ppm frequency tolerance.

## GENERAL

Before proceeding with the transmitter alignment, check that the appropriate jumpers are installed. The standard jumper configuration for the Transmitter Main Board is normally employed for transmitter alignment. In a standard configuration, the only alignment required on the MT-3 Transmitter Main Board for a synthesized transmitter is to set the frequency switches (FSW1, FSW2, FSW3, and FSW4) for the desired channel frequency. FSW1 is the most significant digit of the frequency switches. The switch settings for the desired channel frequency can be found in the channel designation tables.

Transmitter alignment is simplified by using a M-3 Subrack, SM-3 System Monitor, and RF extender cable to provide transmitter power and signal interconnection. Alternatively connect power and audio to the subrack connector as follows:

	Subrack Connector P1 Pin:
+9.5VDC	B6, Z6
+13.8VDC	B2, Z2
Ground	B30, Z30, B32, Z32
600Ω Balanced Audio	Across B18 and Z18

## Module Installation and Removal

### Enhanced or Low Current Synthesizer

To remove the Enhanced Synthesizer module, simply remove the center screw from the module lid and pull the module out. The module should be pulled straight out so that the four alignment pins do not bend or damage the circuit board.

Installation of the Enhanced Synthesizer module is facilitated by alignment pins on each corner of the module. When the four pins are aligned with their corresponding hole in the Transmitter Main Board, push the module down, taking care to ensure that the connector pins on the bottom of the Synthesizer module are not bent.

### Low Current Synthesizer

When removing the Low Current Synthesizer module, it is important to gently lift the synthesizer module “straight out” in order to prevent damage to the connector pins. Remove the two side screws holding the synthesizer module to the tabs. Using a plastic coated lifting tool (such as a small screwdriver with the tip covered in heat shrink material) wedged under the module, gently lift the synthesizer module from the Transmitter Main Board by applying pressure under the four corners in turn. Replace the two side screws.

The Low Current Synthesizer uses two tabs soldered to the Transmitter Main Board for mounting. No alignment pins are used. As a result care must be taken to ensure the connector pins on the bottom of the Synthesizer are not bent. To install the Low Current Synthesizer module, remove the two screws on the side of the synthesizer that correspond to the tabs on the Transmitter Main board and install the synthesizer module taking care not to bend the pins. Replace the two side screws, installing them through the tabs to hold the synthesizer module in place.

## STANDARD FACTORY SETTINGS AND JUMPER CONFIGURATION

Standard factory settings and the associated jumper configuration for each module of the MT-3 series transmitter are given below.

### MT-3 Transmitter Main Board Factory Configuration

The MT-3 Transmitter Main Board is factory configured as follows:

- 
- Transmitter standby mode 1 (lowest standby current consumption).
- 
- Receiver squelched, de-emphasized audio amplifier disabled.
- 
- Optional relay installed, but with active ground contact disabled.
- 
- Separate amplifier power sense outputs.
-

## AUDIO PROCESSOR ALIGNMENT

Prior to commencing the standard deviation adjustment procedure, determine the specific configuration of the Transmitter (i.e. flat audio, pre-emphasis, etc.)

The following points should be noted:

- 
- If the transmitter's operating frequency is changed beyond the factory recommended bandwidth or if the synthesizer is changed, the FM Audio Processor should be realigned to optimize the transmitter's performance. The settings tolerance is +/- 0.1kHz.
- 
- At present, LTR™ /DCS is not implemented in the 30-50MHz synthesizers.
- 
- There are slight differences when setting up the transmitter for Flat Audio or Pre-emphasized audio. Although the tuning procedure is the same, there will be skipped sections depending on the transmitter type being tested.
- 
- Although the transmitter is most commonly set up for a single frequency operation, there are times when an application requires multiple frequencies per transmitter. This also changes the standard tuning procedure slightly.
- 
- Before tuning an Audio Processor being used with the following synthesizers:  
OST-3H035-xxxxx OST-3H045-xxxxx  
OST-3H141-xxxxx OST-3H162-xxxxx
- It is important that the synthesizer is providing a signal at the assigned frequency within the specified limits and that the PLL Error DC level (on TP4) is either 2.3V or 4.5V depending on the type of synthesizer.
- 
- Newer versions of the following synthesizers utilize dual-port modulation and are marked with a label indicating "Dual-Port or 2-Port". They include:  
OST-3H141-xxxxx OST-3H162-xxxxx  
OST-3H418-xxxxx OST-3H460-xxxxx
- 
- Due to the variations in the circuitry between models of synthesizer, oscillator and FM Audio Processor, version specific tuning steps are outlined in italics.
- 
- Section C is not an alignment procedure but is included as a final performance measurement that confirms correct Audio Processor alignment.
- 

### Multiple Channel Transmitters

In the tuning of the FM Audio Processor for multiple channel transmitters, the procedures on the following pages apply with the following exception:

- 
- The maximum deviation is set on the channel which gives the maximum deviation when using a 1.8kHz tone @ +10dBm. Once that level is set (R29), it is not adjusted again.
- 

The rest of the tuning instructions are carried out while the transmitter frequency is set for the channel, which is roughly in the middle of the band of pre-programmed channels.

Each transmitter manual contains performance specifications for their respective bands. Be aware that the limits change from band to band.

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NB=Narrowband (System deviation = ±2.5kHz)

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WB=Wideband (System deviation = ±5.0kHz)

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# TRANSMITTERS WITH PRE-EMPHASIS AND CTCSS SUBTONE


## Section A: Balanced and Subtone Audio Setup

VCO Select Components Table (928-935MHz Band Transmitters)		
Designation	Sirerza Micro (VARIL)	Murata
	VCO 913-939MHz (VCO 190-926MT)	VCO 914-939MHz (MQC505-926)
JU44	Installed	Not Installed
JU45	Not Installed	Installed
C56	Not Applicable	33nF / 47nF

Step	Reference	Action	Desired Results	Notes
1	<b>R2</b> (Mic I/P) <b>R29</b> (Deviation) <b>R31</b> (Balanced) <b>R38</b> (Compress) <b>R42</b> (Subtone1) <b>R63</b> (Mic Comp) <b>R36</b> (TCXO)	Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b>	AF Filter: Low Pass <b>5kHz or 15kHz</b>	
2	Balanced Input P1-1 and P1-2	Set AF Tone Freq; Level; Filter	AF Gen: <b>1.8kHz @ +10dBm</b>	
3	<b>R29</b> (Deviation)	Adjust <b>R29</b> for deviation <b>Do not re-adjust.</b>	<b>± 4.8kHz (WB)</b> <b>± 2.4kHz (NB)</b>	
4	Subtone 1 input	Apply tone	2-Port Synthesizers only AF Gen: <b>1kHz Tone @ -18dBm</b>  Remaining synthesizers: AF Gen: <b>100Hz Tone @ -18dBm</b>	
5	<b>R42</b> (Subtone1)	Adjust and measure	<b>± 500Hz (WB)</b> <b>± 350Hz (NB)</b>	Deviation Monitor
6	OST-3H141 (2-Port) OST-3H162 (2-Port) OST-3H418 (2-Port) OST-3H460 (2-Port)	Change AF Gen. freq.	AF Gen: <b>40Hz @ -18dBm</b>	<b>Remaining</b> synthesizers Skip this step: Go to step 10
7	<b>R36</b> (TCXO)	Adjust and measure	<b>± 500Hz (WB)</b> <b>± 350Hz (NB)</b>	
8	Subtone 1 input	Change AF Gen. freq.	AF Gen: <b>300Hz @ -18dBm</b>	
9	Deviation Monitor	Should measure	<b>500Hz (WB)</b> <b>350Hz (NB)</b>	Tolerance on this measurement is <b>± 50Hz</b>
10	Deviation Monitor	Sweep AF Gen. freq. between <b>67Hz</b> and <b>250Hz</b> . Measure resultant deviation	<b>± 300Hz to 700Hz (WB)</b> <b>± 250Hz to 550Hz (NB)</b>	
11	Balanced Input P1-1 and P1-2	Change frequency, level	AF Gen: <b>1kHz Tone @ +10dBm</b>	
12	<b>R38</b> (Compress)	Adjust and measure	Deviation should be greater than <b>± 4kHz (WB)</b> <b>or ± 2kHz (NB)</b>	Distortion Analyzer AF Filter: 15kHz 4.0% THD

13	AF Gen.	Change level	<b>1kHz Tone @ -8dBm</b>	
14	<b>R31</b> (Balanced)	Adjust and measure	<b>± 3kHz (WB)</b> <b>± 1.5kHz (NB)</b>	Deviation Monitor
15	AF Gen	Change level	<b>1kHz Tone @ -18dBm</b>	
16	<b>R31</b> (Balanced)	Measure and confirm	<b>± 1kHz (WB)</b> <b>± 0.5kHz (NB)</b>	Tolerance on this measurement is <b>± 50Hz</b>

## Section B: Microphone Audio Setup

Step	Reference	Action	Desired Results	Notes
17	Microphone Input Front Panel Pin 2	Apply Tone	AF Gen: <b>1kHz Tone @ +10dBm</b>	 <p>MIC Connector - Front View</p>
18	<b>R63 (Mic Comp)</b>	Adjust and measure	Deviation should be <b>&gt;± 4kHz (WB)</b> or <b>± 2kHz (NB)</b>	Distortion Analyzer AF Filter: 15kHz 4.0% THD
19	Microphone Input Front Panel Pin 2	Change level	AF Gen: <b>1kHz Tone @ -10dBm</b>	
20	<b>R2</b> (Microphone)	Adjust and measure	<b>± 3kHz (WB)</b> <b>± 1.5kHz (NB)</b>	Deviation monitor
21	Microphone Input Front Panel Pin 2	Change level	AF Gen: <b>1kHz Tone @ -20dBm</b>	
22	<b>R2</b> (Microphone)	Measure and confirm <b>± 50Hz</b>	<b>± 1kHz (WB)</b> <b>± 0.5kHz (NB)</b>	Deviation monitor

## Section C: Audio Frequency Response and Deviation

Step	Reference	Action	Desired Results	Notes
23	AF Gen level	Set and measure	AF Gen: <b>+10dBm</b>	
24	Balanced Audio Input	Sweep from <b>300Hz</b> to <b>2.5kHz</b> in <b>100Hz</b> steps	<b>± 5.0kHz (WB)</b> <b>± 2.5kHz (NB)</b>	Deviation should not exceed maximum deviation.  Note the maximum deviation frequency. Record this on the test sheet.
25	Balanced Audio Input	Apply tone	AF Gen <b>1kHz @ -18dBm</b>	
26		Perform AF Frequency Response from <b>300Hz</b> to <b>5kHz</b>	As per test sheet limits (FIT-018)	

## TRANSMITTERS WITH FLAT AUDIO


VCO Select Components Table (928-935MHz B and Transmitters with Flat Audio)		
Designation	Sirerza Micro (VARIL)	Murata
	VCO 913-939MHz (VCO 190-926MT)	VCO 914-939MHz (MQC505-926)
JU44	Installed	Not Installed
JU45	Not Installed	Installed
C56	Not Applicable	33nF / 47nF

### Section A: Balanced and Subtone Audio Setup

Step	Reference	Action	Desired Results	Notes
1	<b>R2</b> (Mic I/P) <b>R29</b> (Deviation) <b>R31</b> (Balanced) <b>R38</b> (Compress) <b>R42</b> (Subtone1) <b>R63</b> (Mic Comp)	Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b> Turn Fully <b>CW</b>	AF Filter: Low Pass <b>5kHz or 15kHz</b>  <b>NO COMPRESSION</b>  <b>NO COMPRESSION</b>	
	<b>R36</b> (TCXO)	Turn Fully <b>CCW</b>		
930 and 950MHz Go to step 4				
2	Balanced Input P1-1 and P1-2	Set AF Gen. Freq; Level; Filter	AF Gen: <b>1.8kHz @ +10dBm</b>	
3	<b>R29</b> (Deviation)	Adjust <b>R29</b> for deviation <b>Do not re-adjust.</b>	<b>± 4.8kHz (WB)</b> <b>± 2.4kHz (NB)</b>	
Step 4 to 7 for 930 and 950MHz ONLY				
4	Balanced Input P1-1 and P1-2	Set AF Gen level	AF Gen: <b>+10dBm</b>	
5	Deviation Monitor	Sweep AF Gen frequency between <b>300Hz</b> and <b>2.5kHz</b> in 100Hz steps.	Search and record the frequency with max deviation.	
6	Balanced Input P1-1 and P1-2	Set AF Gen. Freq. on the freq. recorded at step 5.	AF Gen: <b>+10dBm</b>	
7	<b>R29</b> (Deviation)	Adjust <b>R29</b> for deviation <b>Do not re-adjust.</b>	<b>± 4.8kHz (WB)</b> <b>± 2.4kHz (NB)</b>	
8	Subtone 1 input	Apply tone	2-Port Synthesizers only AF Gen: <b>1kHz Tone @ -18dBm</b>  Remaining synthesizers; AF Gen: <b>100Hz Tone @ -18dBm</b>	
9	<b>R42</b> (Subtone1)	Adjust and measure	<b>± 500Hz (WB)</b> <b>± 350Hz (NB)</b>	Deviation Monitor
10	OST-3H141 (2-Port) OST-3H162 (2-Port) OST-3H418 (2-Port) OST-3H460 (2-Port)	Change AF Gen. freq.	AF Gen: <b>40Hz @ -18dB</b>	<b>Remaining</b> synthesizers skip this step: Go to step 14
11	<b>R36</b> (TCXO)	Adjust and measure	<b>± 500Hz (WB)</b> <b>± 350Hz (NB)</b>	
12	Subtone 1 input	Change AF Gen. freq.	AF Gen: <b>300Hz @ -18dBm</b>	

13	Deviation Monitor	Should measure	<b>500Hz (WB) 350Hz (NB)</b>	Tolerance on this measurement is $\pm 50\text{Hz}$ for both WB and NB.
14	Deviation Monitor	Sweep AF Gen. freq. between <b>67Hz</b> and <b>250Hz</b> . Measure resultant deviation	$\pm 300\text{Hz}$ to <b>700Hz (WB)</b> $\pm 250\text{Hz}$ to <b>550Hz (NB)</b>	
15	AF Gen	Change level	<b>1kHz Tone @ -8dBm</b>	
16	<b>R31 (Balanced)</b>	Adjust and measure	$\pm 3\text{kHz}$ (WB) $\pm 1.5\text{kHz}$ (NB)	Deviation Monitor
Step 17 is for 930MHz with Murata MQC505-926 (914-939MHz) VCO only				
17	<b>C56</b>	Change to 47nF	only <b>if</b> audio response falls below -1.0dB between 300Hz and 2.0kHz	Also apply to 930 and 950MHz TX's with flat audio config. <b>IF</b> audio response @300Hz falls below -1.0dB limit.

## Section B: Microphone Audio Setup

Step	Reference	Action	Desired Results	Notes
18	Microphone Input Front Panel Pin 2	Change level	AF Gen: <b>1kHz Tone @ -10dBm</b>	 <p>MIC Connector - Front View</p>
19	R2	Adjust and measure	$\pm 3\text{kHz}$ (WB) $\pm 1.5\text{kHz}$ (NB)	Deviation monitor

## Section C: Audio Frequency Response and Deviation

Step	Reference	Action	Desired Results	Notes
20	AF Gen level	Set and measure	<b>+10dBm</b>	
21	Balanced Audio Input	Sweep from <b>300Hz</b> to <b>2.5kHz</b> in <b>100Hz</b> steps	$\pm 5.0\text{kHz}$ (WB) $\pm 2.5\text{kHz}$ (NB)	Deviation should not exceed maximum deviation.  Note the maximum deviation frequency. Record this on the test sheet.
22	Balanced Audio Input	Apply tone	AF Gen <b>1kHz @ -18dBm</b>	
23		Perform AF Frequency Response from <b>300Hz</b> to <b>5kHz</b> ( <b>4kHz</b> for 900MHz)		As per test sheet limits (FIT-018)



## TROUBLESHOOTING

### Balanced Input Test

- 1) Connect an Audio Generator set for a 1.8kHz tone @ +10dBm output to the Balanced Input (P1-1 and P1-2). The Waveform Levels Table below indicates expected levels and waveforms for various measurement points.
- 2) Change the Audio Generator settings for a 1kHz tone @ +10dBm output. Confirm the waveforms and levels using the Waveform Level Table below.
- 3) Repeat for the various audio frequencies and levels and compare with the levels in the table below.

### Waveform Levels

Test Point <i>Measured @</i>	Limiting Test <i>1.8kHz @ +10dBm</i>	Std Level <i>1kHz @ -8dBm</i>	Mic Test <i>1kHz @ -10dBm</i>	Subtone <i>100kHz @ -18dBm</i>
TP3	5.2V P-P	3.8V P-P	N/A	N/A
TP12	N/A	N/A	3.8V P-P	N/A
TP10	6.5V P-P	4.9V P-P	4.8V P-P	1.1V P-P
TP5	2.4V P-P	1.3V P-P	1.9V P-P	0.4V P-P
JU6	2.8V P-P	1.7V P-P	1.8V P-P	0.4V P-P
*TP8	1.5V P-P NB	0.9V P-P NB	0.9V P-P NB	0.2V P-P NB
	3.0 V P-P WB	1.8 V P-P WB	1.8 V P-P WB	0.4V P-P WB

\*These values will differ depending on the oscillator/synthesizer model

### Frequency Response Test

Measurements are made at JU8 with respect to ground.

- 1) Reduce Audio Generator level to -18dBm (98 mV RMS).
- 2) Step frequency to 300, 500, 1000, 2000 and 2500Hz.
- 3) Ensure that the results conform to the 6dB/octave +/- 1 dB from 500Hz to 2500Hz referenced to 1000Hz (+1/-2 dB at 300Hz).

### Subtone Input Test

- 1) Change Audio Generator frequency to 100Hz and maintain level at -18dBm (98 mV RMS).
- 2) Connect signal to Subtone Input 1 (P2-2) and ground (P1-4).
- 3) Refer to the Waveform Levels Table above and confirm levels.

## TEMPERATURE COMPENSATION

The FM Audio Processor includes temperature compensation circuitry to maintain a constant transmitter audio deviation with a fixed level input signal. It is capable of not only compensating for temperature related level variations within the FM Audio Processor (typically  $-0.3$  to  $-0.5$  dB at  $-40^{\circ}\text{C}$ ) but can also compensate for changes caused by the synthesizer that is not equipped with its own temperature compensation.

Specifications:

### Wideband

When a 1.8kHz tone is applied at a level of +10dBm to the balanced input of the transmitter, the transmitter deviation shall be  $\pm 4.8$ kHz at room temperature and can vary from  $\pm 4.5$ kHz to  $\pm 5.0$ kHz from  $-40^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .

### Narrowband

When a 1.8kHz tone is applied at a level of +10dBm to the balanced input of the transmitter, the transmitter deviation shall be  $\pm 2.4$ kHz at room temperature and can vary from  $\pm 2.25$ kHz to  $\pm 2.5$ kHz from  $-40^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$ .

Since the specifications of the components used in the synthesizer or oscillator may change over time, changes to the temperature compensation circuit may be necessary even for the same type of equipment.

Contact the factory for more information on values used.



## INTERCONNECT PIN DEFINITIONS AND JUMPER CONFIGURATIONS

The MT-3 series Transmitter employs a 48 pin Eurostandard connector for interfacing to all transmitter power, audio, and control functions. The following are the MT-3 series Transmitter backplane connections to the M-3 Motherboard.

### INTERCONNECTION PIN DEFINITIONS

Pin	Name	Pin	Name	Pin	Name
D2	No Connect	B2	+13.8VDC	Z2	+13.8VDC
D4	No Connect	B4	MIC Out	Z4	MIC In
D6	No Connect	B6	+9.5VDC	Z6	+9.5VDC
D8	No Connect	B8	Relay Positive	Z8	Relay Negative
D10	No Connect	B10	PTT WTO	Z10	PTT WTO
D12	No Connect	B12	TX Standby	Z12	TX Standby
D14	No Connect (IMC1)	B14	PTT NTO	Z14	PTT NTO
D16	No Connect (IMC2)	B16	No Connect (MT-2 +9.5V)	Z16	No Connect (MT-2 +9.5V)
D18	No Connect (IMC3)	B18	Balanced Input 2	Z18	Balanced Input 1
D20	Channel Select 0 (LSB)	B20	Squelched, De-emph Audio In	Z20	Squelched, Flat Audio In
D22	Channel Select 1	B22	Subtone Input 1	Z22	TX Audio Control
D24	Channel Select 2	B24	PTT Output	Z24	Subtone Input 2
D26	Channel Select 3 (MSB)	B26	Forward Power Sense	Z26	VSWR Reverse Sense
D28	Synth TX Data (Output)	B28	RX Monitor Out	Z28	Direct Mod Input
D30	Synth Rx Data (Input)	B30	Ground	Z30	Ground
D32	Synth Bootstrap (Input)	B32	Ground	Z32	Ground

## MT-3 Transmitter Main Board Jumpers

Jumper	Default Position	Description
J2	X	Optional relay configuration
J3	X	Optional relay configuration
J4	Y	Optional relay configuration
J6	Not Installed	Transmitter standby mode select - Mode 1
J7	Y	Audio processor standby mode select
J9	Not Installed	Receiver audio AC/DC input coupling
J12	Not Installed	Amplifier power sense output configuration
J13	X	Amplifier power sense output configuration
J14	X	Amplifier power sense output configuration
J15	X	Amplifier power sense output configuration
J16	X	Microphone configuration
J17	Installed	Microphone output line
J18	Y	Synthesizer module standby mode select
J19	X	600Ω audio transformer enable 'Y' position disables
J20	X	600Ω audio transformer enable 'Y' position disables
J21	Not Installed	+8VDC audio processor supply bypass
J22	X	600Ω audio transformer enable 'Y' position disables
J23	X	600Ω audio transformer enable 'Y' position disables
J24	Installed	Subtone #2 output enable
J25	X	Audio output enable
J26	Installed	Time-Out-Timer Timing resistor select
J27	Not Installed	Time-Out-Timer Timing resistor select
J28	Not Installed	Time-Out-Timer Timing period output select
J29	Installed	Time-Out-Timer Timing period output select
J31	Installed	Time-Out-Timer Timing period output select
J32	Not Installed	Time-Out-Timer Timing period output select
J33	Installed	Time-Out-Timer input enable
J34	Installed	Time-Out-Timer power enable
J35	Installed	Time-Out-Timer output enable

Note: Jumpers J1, J5, J8, J10, and J11 designations not used

## AUDIO PROCESSOR JUMPER TABLES

## Wideband VHF and UHF Synthesized Transmitters

Jumper	Default Type	Position	Description	WB VHF Pre-emphasis CTCSS / Synthesized	WB VHF Flat CTCSS / Synthesized	WB UHF Pre-emphasis CTCSS / Synthesized	WB UHF Flat CTCSS / Synthesized
1	XY	Y	Microphone Pre-Emphasis/Flat Audio	Y	X	Y	X
2	XY	Y	Balanced Audio Pre-Emphasis/Flat Audio	Y	X	Y	X
3	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
4	XY	Not Installed	Subtone input 2 audio path select				
5	XY	Not Installed	Auxiliary Input routing				
6	Single	Installed	Splatter Filter Output	Installed	Installed	Installed	Installed
7	Single	Not Installed	Auxiliary output routing				
8	Single	Not Installed	Direct Coupled final OP Amp O/P				
9	XY	Not Installed	Auxiliary Output - Pre-Emphasis/Flat	Not Installed	Not Installed	Not Installed	Not Installed
10	Single	Not Installed	4V AC Ground	Not Installed	Not Installed	Not Installed	Not Installed
11	Single	Not Installed	Balanced Input Compression Bypass				
12	XY	Not Installed	Tone/Digital Input AC/DC Coupling				
13	Single	Not Installed	Direct Modulation Audio Routing				
14	XY	Not Installed	Two Port Polarity Select	Not Installed	Not Installed	Not Installed	Not Installed
15	XY	XY	4V Regulator adjust (Bypassed)	X and Y both	X and Y both	X and Y both	X and Y both
16	Single	Installed	Subaudible Enable	Installed	Installed	Installed	Installed
17	Single	Not Installed	Balanced Input Adjust Range extend				
18	Single	Not Installed	Audio Gate disable				
19	XY	Y	Voltage Select (+9.5V/8V) Audio gates	Y	Y	Y	Y
20	XY	Not Installed	Direct Modulation Audio Routing				
21	XY	X	Audio Gate Switch	X	X	X	X
22	XY	Y	Splatter Filter Enable/Bypass	Y	Y	Y	Y
23	Single	Not Installed	Narrow Band gain reduction	Not Installed	Not Installed	Not Installed	Not Installed
24	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
25	XY	Not Installed	Wide/Narrow Band switched select	Not Installed	Not Installed	X	X
26	Single	Not Installed	Auxiliary output routing	Not Installed	Not Installed	Not Installed	Not Installed
27	XY	Not Installed	Direct Modulation Input Offset Output				
28	Single	Not Installed	Direct Modulation Input Routing	Not Installed	Not Installed	Not Installed	Not Installed
29	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Installed	Installed
30	N/A	N/A	This skipped designator has been deleted				
31	Single	Not Installed	Splatter Filter output routing	Not Installed	Not Installed	Not installed	Not installed
32	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Installed	Installed
33	Single	Not Installed	Direct Input Coupling - Auxiliary amplifier	Not Installed	Not Installed	Not Installed	Not Installed
34	XY	Not Installed	Audio Routing				
35	XY	Not Installed	Audio Routing	See Note	See Note	See Note	See Note
36	XY	X	AGC Preamp Power select	X	X	X	X
37	Single	Not Installed	Direct Couple (TCXO)				
38	Single	Installed	Low pass enable	Installed	Installed	Installed	Installed
39	XY	X	Low Frequency amplifier bias select	X	X	X	X
40	N/A	N/A	This skipped designator has been deleted				
41	Single	Not Installed	Narrow Band gain reduction	Not Installed	Not Installed	Not Installed	Not Installed
42	XY	Not Installed	Direct Modulation input bias select				
43	Single	Not Installed	Direct Modulation Direct/Cap couple				
44	Single	Not Installed	Coupling Capacitor selection			Installed	Installed
45	Single	Installed	Coupling Capacitor selection (Default)	Installed	Installed	Installed	Installed

TCXO Op Amp		
Desig.	WB VHF/CTCSS	WB UHF/CTCSS
C34	1uF	1uF
C44	330pF	330pF
C56	33nF	33nF
R32	51K	51K
R35	0R0	0R0
R54	100R	100R
R81	Not Installed	Not Installed
Auxiliary Op Amp		
Desig.	WB VHF/CTCSS	WB UHF/CTCSS
R57	Not Installed	Not Installed

Note: Install wire jumper from JU35 (No jumper on X or Y) to right pad of R89 (next to JU26)

### Narrowband VHF and UHF Synthesized Transmitters

Jumper	Default Type	Position	Description	NB VHF Pre-emphasis CTCSS / Synthesized	NB VHF Flat CTCSS / Synthesized	NB UHF Pre-emphasis CTCSS / Synthesized	NB UHF Flat CTCSS / Synthesized
1	XY	Y	Microphone Pre-Emphasis/Flat Audio	Y	X	Y	X
2	XY	Y	Balanced Audio Pre-Emphasis/Flat Audio	Y	X	Y	X
3	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
4	XY	Not Installed	Subtone input 2 audio path select				
5	XY	Not Installed	Auxiliary Input routing				
6	Single	Installed	Splatter Filter Output	Installed	Installed	Installed	Installed
7	Single	Not Installed	Auxiliary output routing				
8	Single	Not Installed	Direct Coupled final OP Amp O/P				
9	XY	Not Installed	Auxiliary Output - Pre-Emphasis/Flat	Not Installed	Not Installed	Not Installed	Not Installed
10	Single	Not Installed	4V AC Ground	Not Installed	Not Installed	Not Installed	Not Installed
11	Single	Not Installed	Balanced Input Compression Bypass				
12	XY	Not Installed	Tone/Digital Input AC/DC Coupling				
13	Single	Not Installed	Direct Modulation Audio Routing				
14	XY	Not Installed	Two Port Polarity Select	Not Installed	Not Installed	Not Installed	Not Installed
15	XY	XY	4V Regulator adjust (Bypassed)	X and Y both	X and Y both	X and Y both	X and Y both
16	Single	Installed	Subaudible Enable	Installed	Installed	Installed	Installed
17	Single	Not Installed	Balanced Input Adjust Range extend				
18	Single	Not Installed	Audio Gate disable				
19	XY	Y	Voltage Select (+9.5V/8V) Audio gates	Y	Y	Y	Y
20	XY	Not Installed	Direct Modulation Audio Routing				
21	XY	X	Audio Gate Switch	X	X	X	X
22	XY	Y	Splatter Filter Enable/Bypass	Y	Y	Y	Y
23	Single	Not Installed	Narrow Band gain reduction	Installed	Installed	Installed	Installed
24	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
25	XY	Not Installed	Wide/Narrow Band switched select	Not Installed	Not Installed	X	X
26	Single	Not Installed	Auxiliary output routing	Not Installed	Not Installed	Not Installed	Not Installed
27	XY	Not Installed	Direct Modulation Input Offset Output				
28	Single	Not Installed	Direct Modulation Input Routing	Not Installed	Not Installed	Not Installed	Not Installed
29	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Installed	Installed
30	N/A	N/A	This skipped designator has been deleted				
31	Single	Not Installed	Splatter Filter output routing	Not Installed	Not Installed	Not installed	Not installed
32	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Installed	Installed
33	Single	Not Installed	Direct Input Coupling - Auxiliary amplifier	Not Installed	Not Installed	Not Installed	Not Installed
34	XY	Not Installed	Audio Routing				
35	XY	Not Installed	Audio Routing	See Note:	See Note:	See Note:	See Note:
36	XY	X	AGC Preamp Power select	X	X	X	X
37	Single	Not Installed	Direct Couple (TCXO)	Not Installed	Not Installed	Not installed	Not installed
38	Single	Installed	Low pass enable	Installed	Installed	Installed	Installed
39	XY	X	Low Frequency amplifier bias select	X	X	X	X
40	N/A	N/A	This skipped designator has been deleted				
41	Single	Not Installed	Narrow Band gain reduction	Not Installed	Not Installed	Not Installed	Not Installed
42	XY	Not Installed	Direct Modulation input bias select				
43	Single	Not Installed	Direct Modulation Direct/Cap couple				
44	Single	Not Installed	Coupling Capacitor selection			Installed	Installed
45	Single	Installed	Coupling Capacitor selection (Default)	Installed	Installed	Installed	Installed

TCXO Op Amp		
Desig.	NB VHF/CTCSS	NB UHF/CTCSS
C34	1uF	1uF
C44	330pF	330pF
C56	33nF	33nF
R32	51K1	51K1
R35	0R0	0R0
R54	100R	100R
R81	Not Installed	Not Installed
Auxiliary Op Amp		
Desig.		
R57	Not Installed	Not Installed

Note: Install wire jumper from JU35-2 (No jumper on X or Y) to left pad of R89 (next to test point 8)

## Lowband VHF (35 MHz and 45 MHz) Wideband Synthesized Transmitters

Jumper	Default Type	Position	Description	WB VHF Pre-emphasis CTCSS / Synthesized	WB VHF Flat CTCSS / Synthesized
1	XY	Y	Microphone Pre-Emphasis/Flat Audio	Y	X
2	XY	Y	Balanced Audio Pre-Emphasis/Flat Audio	Y	X
3	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43
4	XY	Not Installed	Subtone input 2 audio path select	Not Installed	Not Installed
5	XY	Not Installed	Auxiliary Input routing	Not Installed	Not Installed
6	Single	Installed	Splatter Filter Output	Installed	Installed
7	Single	Not Installed	Auxiliary output routing	Not Installed	Not Installed
8	Single	Not Installed	Direct Coupled final OP Amp O/P	Not Installed	Not Installed
9	XY	Not Installed	Auxiliary Output - Pre-Emphasis/Flat	Not Installed	Not Installed
10	Single	Not Installed	4V AC Ground	Not Installed	Not Installed
11	Single	Not Installed	Balanced Input Compression Bypass	Not Installed	Not Installed
12	XY	Not Installed	Tone/Digital Input AC/DC Coupling	Not Installed	Not Installed
13	Single	Not Installed	Direct Modulation Audio Routing	Not Installed	Not Installed
14	XY	Not Installed	Two Port Polarity Select	Not Installed	Not Installed
15	XY	XY	4V Regulator adjust (Bypassed)	X and Y both	X and Y both
16	Single	Installed	Subaudible Enable	Installed	Installed
17	Single	Not Installed	Balanced Input Adjust Range extend	Not Installed	Not Installed
18	Single	Not Installed	Audio Gate disable	Not Installed	Not Installed
19	XY	Y	Voltage Select (+9.5V/8V) Audio gates	Y	Y
20	XY	Not Installed	Direct Modulation Audio Routing	Not Installed	Not Installed
21	XY	X	Audio Gate Switch	X	X
22	XY	Y	Splatter Filter Enable/Bypass	Y	Y
23	Single	Not Installed	Narrow Band gain reduction	Not Installed	Not Installed
24	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43
25	XY	Not Installed	Wide/Narrow Band switched select	Not Installed	Not Installed
26	Single	Not Installed	Auxiliary output routing	Not Installed	Not Installed
27	XY	Not Installed	Direct Modulation Input Offset Output	Not Installed	Not Installed
28	Single	Not Installed	Direct Modulation Input Routing	Not Installed	Not Installed
29	Single	Not Installed	Coupling Capacitor selection	Not Installed	Not Installed
30	N/A	N/A	This skipped designator has been deleted	N/A	N/A
31	Single	Not Installed	Splatter Filter output routing	Not Installed	Not Installed
32	Single	Not Installed	Coupling Capacitor selection	Not Installed	Not Installed
33	Single	Not Installed	Direct Input Coupling - Auxiliary amplifier	Not Installed	Not Installed
34	XY	Not Installed	Audio Routing	Not Installed	Not Installed
35	XY	Not Installed	Audio Routing	Not Installed	Not Installed
36	XY	X	AGC Preamp Power select	X	X
37	Single	Not Installed	Direct Couple (TCXO)	Not Installed	Not Installed
38	Single	Installed	Low pass enable	Installed	Installed
39	XY	X	Low Frequency amplifier bias select	X	X
40	N/A	N/A	This skipped designator has been deleted	N/A	N/A
41	Single	Not Installed	Narrow Band gain reduction	Not Installed	Not Installed
42	XY	Not Installed	Direct Modulation input bias select	Not Installed	Not Installed
43	Single	Not Installed	Direct Modulation Direct/Cap couple	Not Installed	Not Installed
44	Single	Not Installed	Coupling Capacitor selection	Installed	Installed
45	Single	Installed	Coupling Capacitor selection (Default)	Installed	Installed

TCXO Op Amp		
Desig.	WB VHF Pre-emphasis CTCSS / Synthesized	WB VHF Flat CTCSS / Synthesized
C44	Not Installed	Not Installed

### LTR™ Modulated Transmitters

Jumper	Default Type	Position	Description	VHF LTR™	UHF LTR™	860 MHz LTR™	Default 950 MHz LTR™
1	XY	Y	Microphone Pre-Emphasis/Flat Audio	Y	Y	Y	Y
2	XY	Y	Balanced Audio Pre-Emphasis/Flat Audio	Y	Y	Y	Y
3	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
4	XY	Not Installed	Subtone input 2 audio path select				
5	XY	Not Installed	Auxiliary Input routing	Y	Y	Not Installed	Y
6	Single	Installed	Splatter Filter Output	Installed	Installed	Installed	Installed
7	Single	Not Installed	Auxiliary output routing				
8	Single	Not Installed	Direct Coupled final OP Amp O/P				
9	XY	Not Installed	Auxiliary Output - Pre-Emphasis/Flat	X	X	Not Installed	X
10	Single	Not Installed	4V AC Ground	Installed	Installed	Not Installed	Installed
11	Single	Not Installed	Balanced Input Compression Bypass				
12	XY	Not Installed	Tone/Digital Input AC/DC Coupling				
13	Single	Not Installed	Direct Modulation Audio Routing			Installed	
14	XY	Not Installed	Two Port Polarity Select	Y	Y	Not Installed	Y
15	XY	XY	4V Regulator adjust (Bypassed)	X and Y both	X and Y both	X and Y both	X and Y both
16	Single	Installed	Subaudible Enable	Not Installed	Not Installed	Not Installed	Not Installed
17	Single	Not Installed	Balanced Input Adjust Range extend				
18	Single	Not Installed	Audio Gate disable				
19	XY	Y	Voltage Select (+9.5V/8V) Audio gates	Y	Y	Y	Y
20	XY	Not Installed	Direct Modulation Audio Routing				
21	XY	X	Audio Gate Switch	X	X	X	X
22	XY	Y	Splatter Filter Enable/Bypass	Y	Y	Y	Y
23	Single	Not Installed	Narrow Band gain reduction	NB Only	NB Only	NB Only	NB Only
24	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
25	XY	Not Installed	Wide/Narrow Band switched select				
26	Single	Not Installed	Auxiliary output routing	Installed	Installed	Not Installed	Installed
27	XY	Not Installed	Direct Modulation Input Offset Output				
28	Single	Not Installed	Direct Modulation Input Routing	Installed	Installed	Installed	Installed
29	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Not Installed	Installed
30	N/A	N/A	This skipped designator has been deleted				
31	Single	Not Installed	Splatter Filter output routing	Not Installed	Not Installed	Not Installed	Not Installed
32	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Not Installed	Installed
33	Single	Not Installed	Direct Input Coupling - Auxiliary amplifier	Installed	Installed	Not Installed	Installed
34	XY	Not Installed	Audio Routing				
35	XY	Not Installed	Audio Routing	Y	Y	Y	Y
36	XY	X	AGC Preamp Power select	X	X	X	X
37	Single	Not Installed	Direct Couple (TCXO)	Not Installed	Not Installed	Not Installed	Not Installed
38	Single	Installed	Low pass enable	Installed	Installed	Installed	Installed
39	XY	X	Low Frequency amplifier bias select	X	X	X	X
40	N/A	N/A	This skipped designator has been deleted				
41	Single	Not Installed	Narrow Band gain reduction	Not installed	Not installed		Not installed
42	XY	Not Installed	Direct Modulation input bias select	Not installed	Not installed		Not installed
43	Single	Not Installed	Direct Modulation Direct/Cap couple	Not installed	Not installed		Not installed
44	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Not Installed	Installed
45	Single	Installed	Coupling Capacitor selection (Default)	Installed	Installed	Installed	Installed

TCXO Op Amp		
Desig.	VHF LTR™	UHF LTR™
C34	47uF	47uF
C44	330pF	330pF
C56	33nF	33nF
R32	51K1	51K1
R35	0R0	0R0
R54	10K0	10K0
R81	Not installed	Not installed

Auxiliary Op Amp		
Desig.		
R57	22K1	38K3

TCXO Op Amp		
Desig.	860 MHz LTR™	950 MHz LTR™
C34	47uF	47uF
C44	330pF	330pF
C56	22nF	33nF
R32	51K1	51K1
R35	0R0	0R0
R54	10K0	10K0
R81	Not installed	Not installed

Auxiliary Op Amp		
Desig.		
R57	Not Installed	38K3

Note: For more detailed inFormation on LTR™ setup, contact the factory and refer to the Data Modulation and Signaling Applications Manual, AM10-DMS.





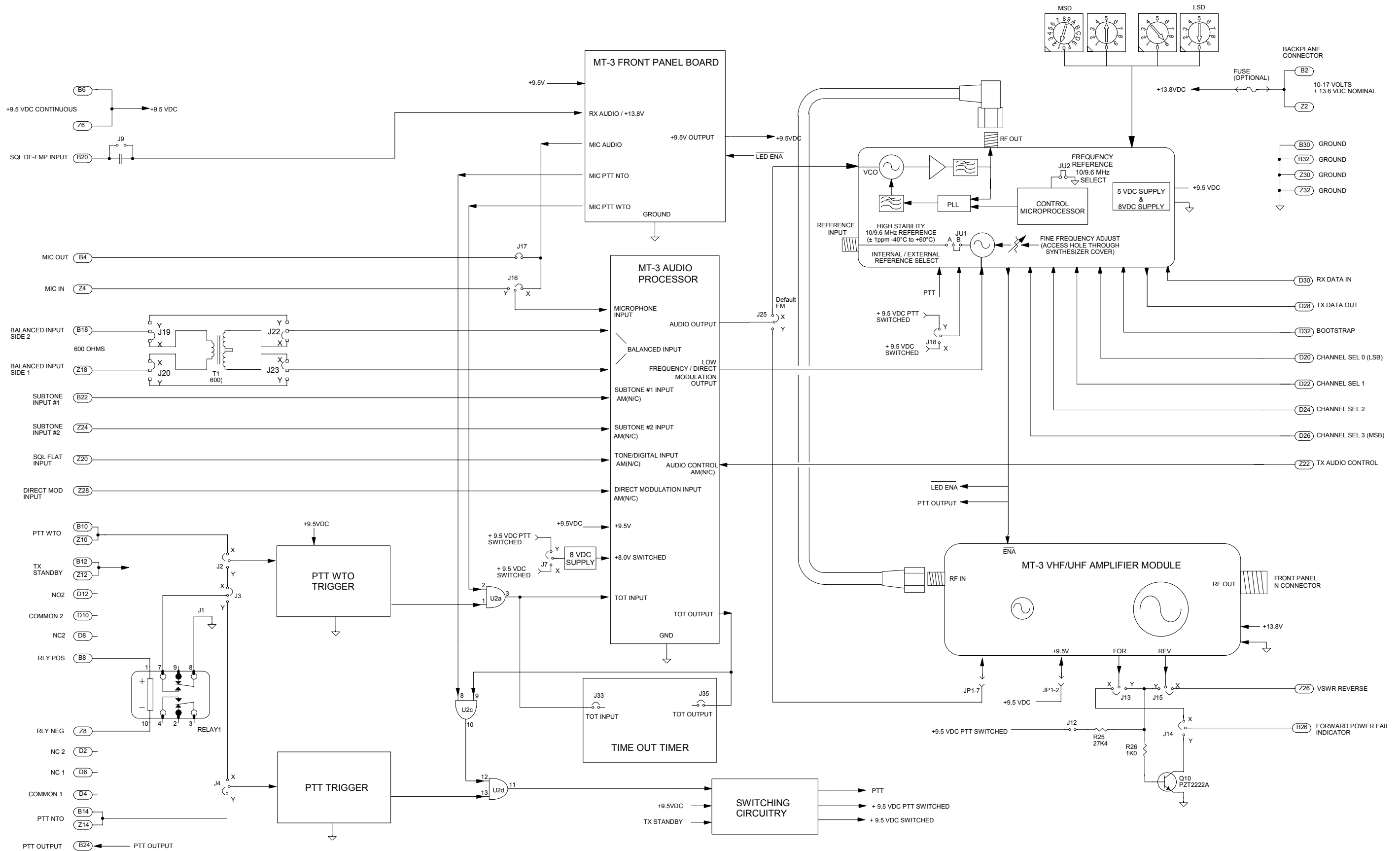
## ILLUSTRATIONS AND SCHEMATICS

### 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	43-9120 <u>10</u> Indicates circuit board version 1.0
PCB number	50002- <u>02</u> Indicates circuit board version 2 (no decimal version)

# TRANSMITTER BLOCK DIAGRAM

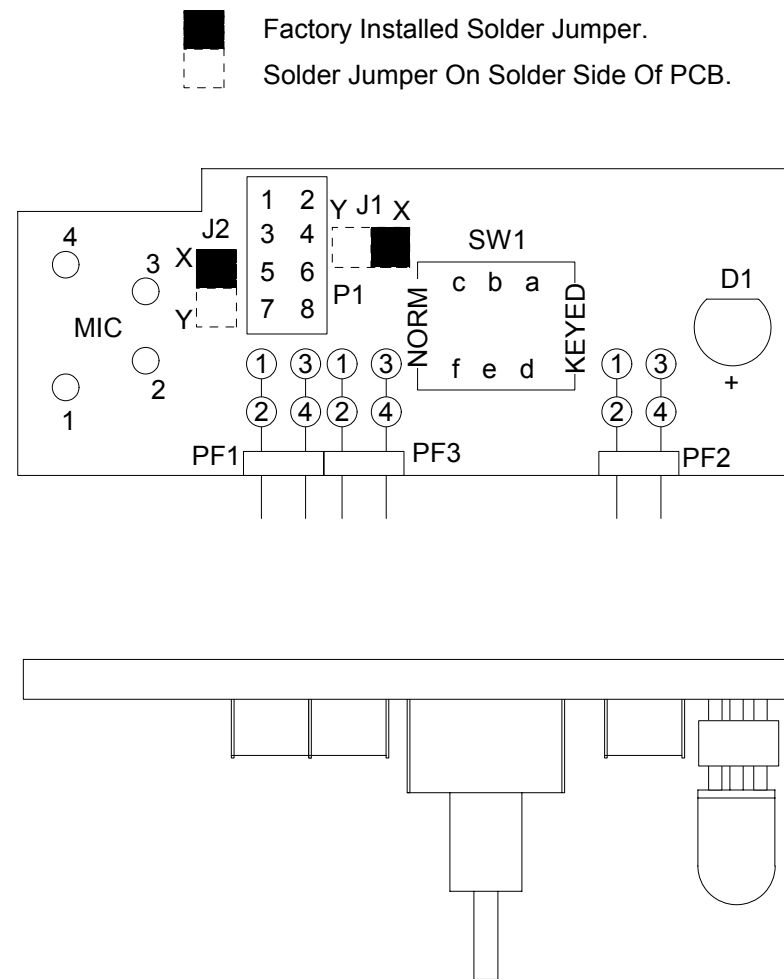




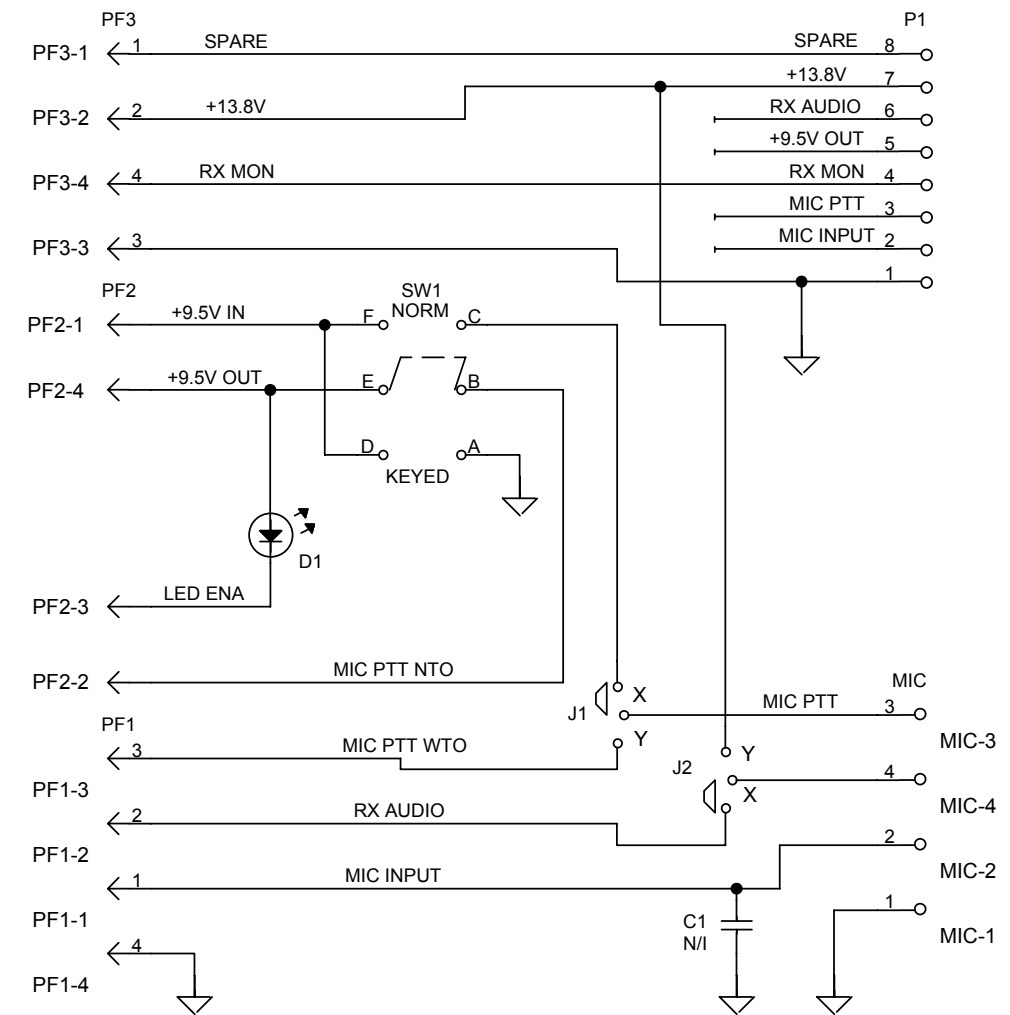




### FRONT PANEL BOARD COMPONENT LAYOUT



### FRONT PANEL BOARD SCHEMATIC DIAGRAM



# AUDIO PROCESSOR BOARD COMPONENT LAYOUT

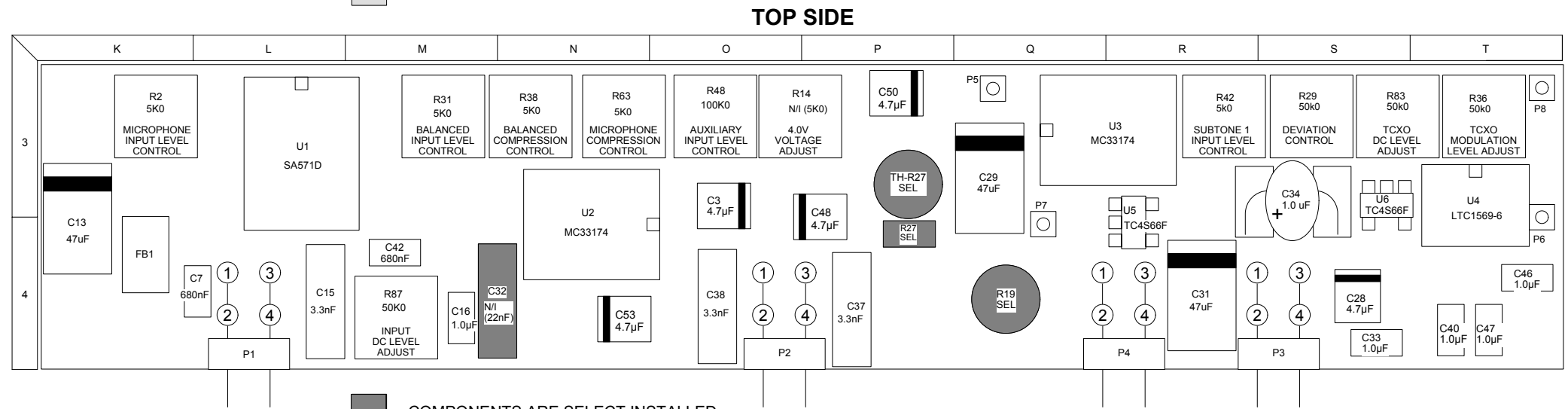
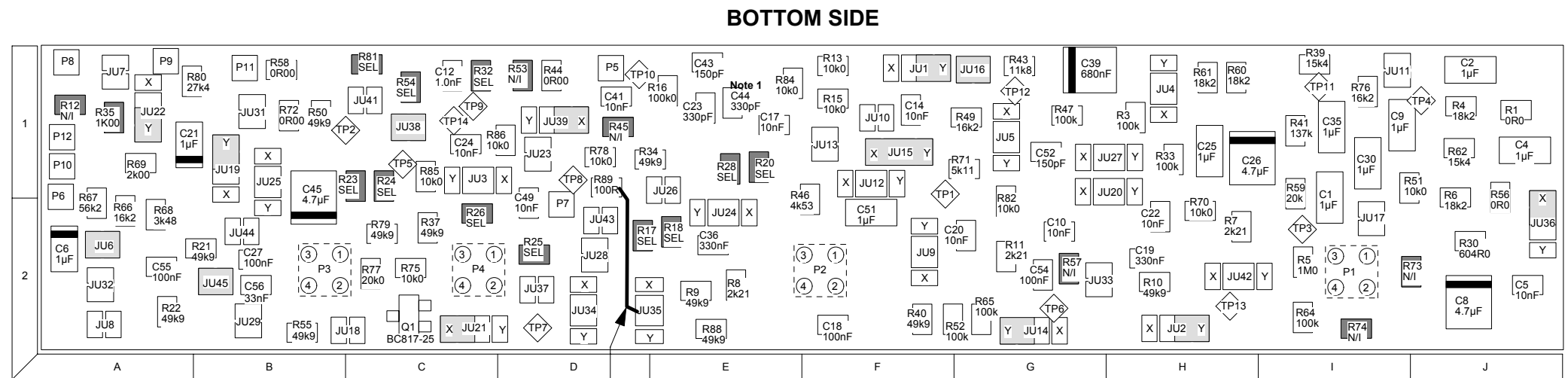
COMPONENT LOCATION TABLE																							
DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC	DES	LOC
C1	I1	C26	H1	C51	F2	JU1	F1	JU26	E1	P1	L4	R1	J1	R26	C2	R51	I1	R76	I1	TP1	F1	U1	L3
C2	J1	C27	B2	C52	G1	JU2	H2	JU27	H1	P2	O4	R2	K3	R27	P3	R52	F2	R77	C2	TP2	B1	U2	N3
C3	O3	C28	S4	C53	N4	JU3	C1	JU28	D2	P3	S4	R3	H1	R28	E1	R53	D1	R78	D1	TP3	I2	U3	R3
C4	J1	C29	Q3	C54	G2	JU4	H1	JU29	B2	P4	R4	R4	J1	R29	S3	R54	C1	R79	C2	TP4	J1	U4	T3
C5	J2	C30	I1	C55	A2	JU5	G1	JU30	N/A	P5	Q3	R5	I2	R30	J2	R55	B2	R80	A1	TP5	C1	U5	R3
C6	A2	C31	R4	C56	B2	JU6	A2	JU31	B1	P6	T4	R6	J2	R31	M3	R56	J1	R81	C1	TP6	G2	U6	S3
C7	L4	C32	M4			JU7	A1	JU32	A2	P7	O4	R7	H2	R32	C1	R57	G2	R82	S3	TP7	D2		
C8	J2	C33	S4			JU8	A2	JU33	G2	P8	T3	R8	E2	R33	H1	R58	B1	R83	E1	TP8	D1		
C9	I1	C34	S3	FB1	K4	JU9	F2	JU34	D2	P9	A1	R9	E2	R34	D1	R59	I1	R84	E1	TP9	C1		
C10	G2	C35	I1			JU10	F1	JU35	D2	P10	A1	R10	H2	R35	A1	R60	H1	R85	C1	TP10	D1		
C11	N/A	C36	E2			JU11	I1	JU36	J2	P11	B1	R11	G2	R36	T3	R61	H1	R86	M4	TP11	I1		
C12	C1	C37	P4			JU12	F1	JU37	D2	P12	A1	R12	A1	R37	C2	R62	J1	R87	M4	TP12	G1		
C13	K4	C38	O4			JU13	F1	JU38	C1			R13	F1	R38	N3	R63	N3	R88	E2	TP13	H2		
C14	F1	C39	G1			JU14	G2	JU39	D1			R14	O3	R39	I1	R64	I2	R89	D1	TP14	C1		
C15	L4	C40	T4			JU15	F1	JU40	N/A	Q1	C2	R15	F1	R40	F2	R65	G2						
C16	M4	C41	D1			JU16	G1	JU41	C1			R16	E1	R41	I1	R66	A2						
C17	E1	C42	M4			JU17	I2	JU42	H2			R17	D2	R42	R3	R67	A2						
C18	F2	C43	E1			JU18	B2	JU43	D2			R18	E2	R43	G1	R68	A2						
C19	H2	C44	E1			JU19	B1	JU44	B2			R19	O4	R44	D1	R69	A1						
C20	G2	C45	B1			JU20	H1	JU45	B2			R20	E1	R45	D1	R70	H2						
C21	A1	C46	T4			JU21	C2					R21	B2	R46	F2	R71	G1						
C22	H2	C47	T4			JU22	A1					R22	A2	R47	G1	R72	B1						
C23	E1	C48	P3			JU23	D1					R23	C1	R48	O3	R73	I2						
C24	C1	C49	D2			JU24	E2					R24	C1	R49	G1	R74	I2						
C25	H1	C50	P3			JU25	B1					R25	D2	R50	B1	R75	C2						

Select Component Table

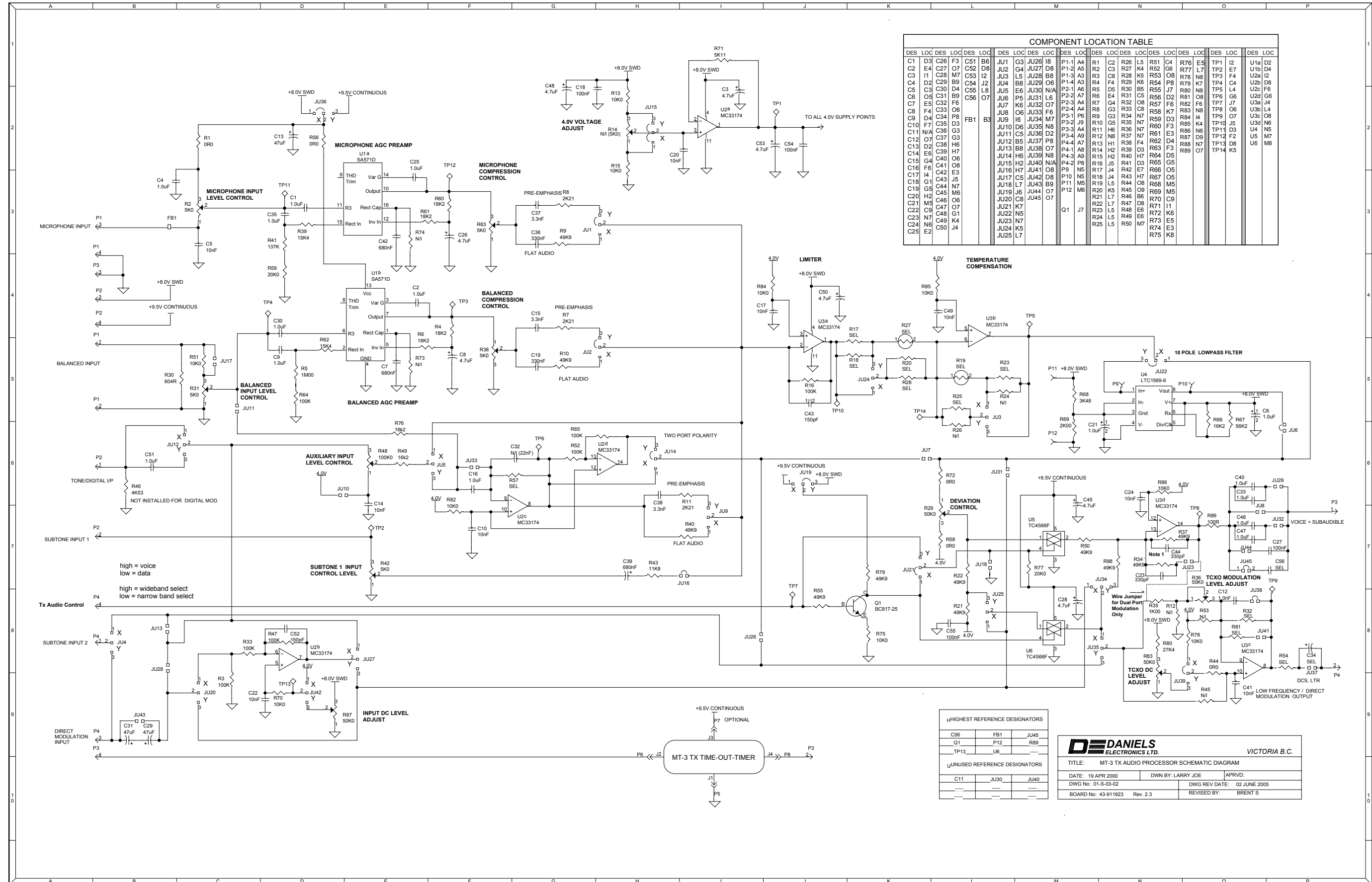
Ref. Desig.	UT-3/420-SXCX00	UT-3/460-SXCX00	UT-3/815-SXC300	UT-3/860-SXC300	UT-3/930-SXB300	UT-3/950-SXB300	VT-3/140-SXAX00	VT-3/160-SXAX00	VT-3H035-SXAX300	VT-3H045-SXAX300
C44	330pF	330pF	330pF	330pF	330pF	330pF	330pF	330pF	N/I	N/I
R17	13K3	13K3	N/I	2K00	N/I	N/I	36K5	11K3	11K8	5K11
R18	N/I	N/I	N/I	N/I	N/I	N/I	36K5	N/I	3K01	4K75
R19	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I
R20	6K81	6K81	6K81	604R	6K81	6K81	15K0	11K8	2K21	3K01
R23	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I
R24	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I
R25	18K2	18K2	1K00	1K00	1K00	1K00	18K2	11K8	1K00	1K00
R26	8K25	8K25	N/I	N/I	N/I	N/I	18K2	11K8	N/I	N/I
R27	10K	10K	N/I	N/I	N/I	N/I	10K	10K	300R	300R
R28	N/I	N/I	4K53	N/I	4K53	4K53	N/I	N/I	1K50	1K00
R32	51K1	51K1	N/I	N/I	N/I	N/I	51K1	51K1	N/I	N/I
R35	1K00	1K00	N/I	N/I	N/I	N/I	1K00	1K00	N/I	N/I
R54	100R	100R	N/I	N/I	N/I	N/I	100R	100R	N/I	N/I
R81	51K1	51K1	N/I	N/I	N/I	N/I	N/I	N/I	N/I	N/I
R89 to JU35	install	install	N/I	N/I	N/I	N/I	install	install	N/I	N/I
JU3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
JU24	Y	Y	X	Y	X	X	Y	Y	Y	Y
JU29	install	install	N/I	N/I	N/I	N/I	install	install	N/I	N/I
JU32	install	install	N/I	N/I	N/I	N/I	install	install	N/I	N/I
JU44	install	install	N/I	N/I	N/I	N/I	N/I	install	install	

N/I - Not Installed

For VT-3H035 and VT-3H045 Low Band VHF Transmitters only; C44 is NOT INSTALLED and there are trace cuts.



# AUDIO PROCESSOR BOARD SCHEMATIC DIAGRAM







## PARTS LIST

### TRANSMITTER MAIN BOARD ELECTRICAL PARTS LIST

Ref. Desig.	Description	Part Number
C1	CAP., SM, 10uF TANT., 10%, 35V	1055-6D106K35
C2	CAP., SM, 1uF TANT., 20%, 35V	1055-5B105M35
C3	CAP., SM, 10uF TANT., 20%, 16V	1055-6C106M16
C4	CAP., SM, 1uF TANT., 20%, 16V	1055-5A105M16
C5	CAP., SM, 100nF CER, 0805, X7R, 50	1008-5A104K5R
C6	CAP., SM, 10nF CER, 0805, X7R, 50V	1008-4A103K5R
C7	CAP., SM, 10nF CER, 0805, X7R, 50V	1008-4A103K5R
C8	CAP., SM, 100nF CER, 0805, X7R, 50	1008-5A104K5R
C10	CAP., SM, 1uF, CER/2225, 50V,, X7R	1008-6H105J5R
C12	CAP., SM, 10nF CER, 0805, X7R, 50V	1008-4A103K5R
C13	CAP., SM, 10nF CER, 0805, X7R, 50V	1008-4A103K5R
C14	CAP., SM, 10nF CER, 0805, X7R, 50V	1008-4A103K5R
C15	CAP., SM, 4.7uF TANT., 10%, 16V	1055-5B475K16
C20	CAP., SM, 4.7uF TANT., 10%, 16V	1055-5B475K16
C21	CAP., SM, 100nF CER, 0805, X7R, 50	1008-5A104K5R
C22	CAP., SM, 100nF CER, 0805, X7R, 50	1008-5A104K5R
C23	CAP., 100nF FILM, MMK5, 10%, 63V	1016-5A104K63
CONN1	CONNECTOR, F/48 MALE, R/A PCB	3720-6048M0RA
	SCREW, M2.5 x 10 PAN/PHIL, A2	5812-2M5PP10S
	NUT, M2.5, HEX, 5.0mm FLATS, A2	5813-2M5HX50S
D1	DIODE, BYD17J, RECTIFIER, SOD87	2101-BYD17J00
D2	DIODE, BYD17J, RECTIFIER, SOD87	2101-BYD17J00
D3	DIODE, BYD17J, RECTIFIER, SOD87	2101-BYD17J00
D4	DIODE, BYD17J, RECTIFIER, SOD87	2101-BYD17J00
D5	DIODE, BYD17J, RECTIFIER, SOD87	2101-BYD17J00
D6	DIODE, BYD17J, RECTIFIER, SOD87	2101-BYD17J00
D7	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000
D8	DIODE, BAS16, SWITCHING, SOT23	2100-BAS16000

## Transmitter Main Board Electrical Parts List continued

Ref. Desig.	Description	Part Number
FSW1	SWITCH, BCD-16 STEPS,5 PIN,PCB	5273-16BCD001
FSW2	SWITCH, BCD-10 STEPS,5 PIN,PCB	5273-10BCD001
FSW3	SWITCH, BCD-10 STEPS,5 PIN,PCB	5273-10BCD001
FSW4	SWITCH, BCD-10 STEPS,5 PIN,PCB	5273-10BCD001
JS1	SOCK. STRIP-L/P,1ROW x12PIN,Au	5016-SL112G08
	SOCK. STRIP-L/P,1ROW x 9PIN,Au	5016-SL109G08
JS2	SOCK. STRIP-L/P,1ROW x 6PIN,Au	5016-SL106G08
JS3	SOCK. STRIP-L/P,1ROW x 2PIN,Au	5016-SL102G08
LPF1-5	FILTER, SM, EM1/LPF, 360pF,FER	1306-T361F2D5
LPF8	FILTER, SM, EM1/LPF, 360pF,FER	1306-T361F2D5
LFP10	FILTER, SM, EM1/LPF, 360pF,FER	1306-T361F2D5
LPF12	FILTER, SM, EM1/LPF, 360pF,FER	1306-T361F2D5
LPF14-35	FILTER, SM, EM1/LPF, 360pF,FER	1306-T361F2D5
PEM	NUT, PRESS,M2.5,5.6mmOD,PC MNT	5833-T2M55615
PCB	PCB, MT-3 TRANSMITTER, MAIN	4321-10920917
Q1	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q3	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q4	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q5	MOSFET, D5P06V, P-CHAN., D-PAK	2144-D5P06V00
Q6	TRANSISTOR, BC817-25,NPN,SOT23	2120-BC817025
Q7	MOSFET, D5P06V, P-CHAN., D-PAK	2144-D5P06V00
Q8	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025
Q9	MOSFET, D15N06V, N-CHAN., DPAK	2144-D15N06V0
Q10	TRANSISTOR, PZT2222A,NPN,ST223	2120-PZT2222A
Q11	TRANSISTOR, BC807-25,PNP,SOT23	2120-BC807025
R1	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP
R2	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R3	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R4	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R5	RES., SM, 10R0 0805, 1%,100ppm	1150-1A10R0FP
R6	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R7	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R8	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R9	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R10	RES., SM, 100K 0805, 1%,100ppm	1150-5A1003FP
R11	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R12	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R13	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP

## Transmitter Main Board Electrical Parts List continued

Ref. Desig.	Description	Part Number
R14	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R15	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R16	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R17	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R18	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R19	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R20	RES., SM, 68K1 0805, 1%,100ppm	1150-4A6812FP
R21	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R22	RES., SM, 68K1 0805, 1%,100ppm	1150-4A6812FP
R23	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R24	RES., SM, 68K1 0805, 1%,100ppm	1150-4A6812FP
R25	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R26	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R29	RES., SM, 82K5 0805, 1%,100ppm	1150-4A8252FP
R30	RES., SM, 15K0 0805, 1%,100ppm	1150-4A1502FP
R31	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R32	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R33	RES., SM, 68K1 0805, 1%,100ppm	1150-4A6812FP
R34	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R35	RES., SM, 27K4 0805, 1%,100ppm	1150-4A2742FP
R36	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R37	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
R38	RES., SM, 100K 0805, 1%,100ppm	1150-5A1003FP
R39	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R40	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R41	RES., SM, 15K0 0805, 1%,100ppm	1150-4A1502FP
R43	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R44	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R45	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R46	RES., SM, 221K 0805, 1%,100ppm	1150-5A2213FP
R47	RES., SM, 1K00 0805, 1%,100ppm	1150-3A1001FP
RELAY1	RELAY, 9VDC, 2 FORM C,PCB MNT.	5310-2C09P005
T1	TRANSFORMER, AUDIO,600R,1:1	1280-600P6005
U1	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08
U2	IC, 4081, QUAD 2/P AND, SO-14	2375-40810N14
U3	IC, MMAD1108,8 DIODE/ARY.,SO16	2331-11080N16
U4	IC, MMAD1108,8 DIODE/ARY.,SO16	2331-11080N16
U6	IC, LP2951,PROG. VOLT REG,SO-8	2305-29510N08
U7	IC, MC33172, DUAL OP AMP, SO-8	2302-33172N08
U8	IC, 4536, PROG. TIMER, SO-16L	2375-45360W16

## AUDIO PROCESSOR ELECTRICAL PARTS LIST

Ref. Desig.	Part Number	Description	ALL MODELS	UT-3/420-SXCX00	UT-3/460-SXCX00	UT-3/815-SXC300	UT-3/860-SXC300	UT-3/930-SXB300	UT-3/950-SXB300	VT-3/140-SXAX00	VT-3/160-SXAX00	VT-3H035-SXA300	VT-3H045-SXA300
C1	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C2	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C3	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C4	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C5	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C6	1055-5A105M16	CAP., SM, 1uF TANT., 20%, 16V	•										
C7	1008-5B684M3R	CAP.,SM,680nF CER,1206,X7R,25V	•										
C8	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C9	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C10	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C12	1008-3A102K5R	CAP., SM, 1nF CER,0805,X7R,50V	•										
C13	1055-6D476M16	CAP., SM, 47uF TANT., 20%, 16V	•										
C14	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C15	1016-3A332K63	CAP., 3.3nF FILM, MMK5,10%,63V	•										
C16	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C17	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C18	1008-5A104K5R	CAP., SM,100nF CER,0805,X7R,50	•										
C19	1008-5A334M3R	CAP.,SM,330nF CER,0805,X7R,25V	•										
C20	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C21	1055-5A105M16	CAP., SM, 1uF TANT., 20%, 16V	•										
C22	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C23	1008-2A331J1G	CAP., SM, 330pF CER., 0805,C0G	•										
C24	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C25	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C26	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C27	1008-5A104K5R	CAP., SM,100nF CER,0805,X7R,50	•										
C28	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C29	1055-6D476M16	CAP., SM, 47uF TANT., 20%, 16V	•										
C30	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C31	1055-6D476M16	CAP., SM, 47uF TANT., 20%, 16V	•										
C33	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C34	1054-5A105M35	CAP., 1uF DIP. TANT., 20%, 35V	•										
C35	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C36	1008-5A334M3R	CAP.,SM,330nF CER,0805,X7R,25V	•										
C37	1016-3A332K63	CAP., 3.3nF FILM, MMK5,10%,63V	•										
C38	1016-3A332K63	CAP., 3.3nF FILM, MMK5,10%,63V	•										
C39	1055-4B684K35	CAP., SM, 680nF TANT., 10%,35V	•										

## Audio Processor Electrical Parts List continued

Ref. Desig.	Part Number	Description	ALL MODELS	UT-3/420-SXCX00	UT-3/460-SXCX00	UT-3/815-SXC300	UT-3/860-SXC300	UT-3/930-SXB300	UT-3/950-SXB300	VT-3/140-SXAX00	VT-3/160-SXAX00	VT-3H035-SXA300	VT-3H045-SXA300
C40	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C41	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C42	1008-5B684M3R	CAP.,SM,680nF CER,1206,X7R,25V	•										
C43	1008-2A151J1G	CAP., SM, 150pF CER., 0805,C0G	•										
C44	1008-2A331J1G	CAP., SM, 330pF CER., 0805,C0G		•	•			•	•	•	•		
C45	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C46	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C47	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C48	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C49	1008-4A103K5R	CAP., SM,10nF CER,0805,X7R,50V	•										
C50	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C51	1008-6B105Z3R	CAP., SM, 1uF CER,1206,X7R,25V	•										
C52	1008-2A151J1G	CAP., SM, 150pF CER., 0805,C0G	•										
C53	1055-5B475K16	CAP., SM, 4.7uF TANT., 10%,16V	•										
C54	1008-5A104K5R	CAP., SM,100nF CER,0805,X7R,50	•										
C55	1008-5A104K5R	CAP., SM,100nF CER,0805,X7R,50	•										
C56	1008-4A333K5R	CAP., SM,33nF CER,0805,X7R,50V	•										
FB1	1213-43181200	FERRITE BEAD, SM,43MIX,.18x.12	•										
P1	5010-H202RA9T	HEADER, .1", R/A, 2 ROW X 2PIN	•										
P2	5010-H202RA9T	HEADER, .1", R/A, 2 ROW X 2PIN	•										
P3	5010-H202RA9T	HEADER, .1", R/A, 2 ROW X 2PIN	•										
P4	5010-H202RA9T	HEADER, .1", R/A, 2 ROW X 2PIN	•										
PCB	4321-30911923	PCB, AUDIO PROCESSOR, MT-3 TX	•										
Q1	2120-BC817025	TRANSISTOR, BC817-25,NPN,SOT23	•										
R1	1150-0A0R0000	RES., SM, ZERO OHM JUMPER,0805	•										
R2	1174-DM2502J0	POT.,SM/4mmSQ,5K0,MUL/TRN,SIDE	•										
R3	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R4	1150-4A1822FP	RES., SM, 18K2 0805, 1%,100ppm	•										
R5	1150-6A1004FP	RES., SM, 1M00 0805, 1%,100ppm	•										
R6	1150-4A1822FP	RES., SM, 18K2 0805, 1%,100ppm	•										
R7	1150-3A2211FP	RES., SM, 2K21 0805, 1%,100ppm	•										
R8	1150-3A2211FP	RES., SM, 2K21 0805, 1%,100ppm	•										
R9	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R10	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R11	1150-3A2211FP	RES., SM, 2K21 0805, 1%,100ppm	•										

Audio Processor Electrical Parts List continued

Ref. Desig.	Part Number	Description	ALL MODELS	UT-3/420-SXCX00	UT-3/460-SXCX00	UT-3/815-SXC300	UT-3/860-SXC300	UT-3/930-SXB300	UT-3/950-SXB300	VT-3/140-SXAX00	VT-3/160-SXAX00	VT-3H035-SXA300	VT-3H045-SXA300
R13	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R15	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R16	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R17	1150-3A2001FP	RES., SM, 2K00 0805, 1%,100ppm					•						
	1150-3A5111FP	RES., SM, 5K11 0805, 1%,100ppm											•
	1150-4A1182FP	RES., SM, 11K8 0805, 1%,100ppm											•
	1150-4A1332FP	RES., SM, 13K3 0805, 1%,100ppm		•	•								
	1150-4A3652FP	RES., SM, 36K5 0805, 1%,100ppm								•			
	1150-4B1132FP	RES., SM, 11K3 1206, 1%,100ppm									•		
	1150-4A3652FP	RES., SM, 36K5 0805, 1%,100ppm								•			
R18	1150-3A3011FP	RES., SM, 3K01 0805, 1%,100ppm											•
	1150-3A4751FP	RES., SM, 4K75 0805, 1%,100ppm											•
	1150-2A6040FP	RES., SM, 604R 0805, 1%,100ppm					•						
R20	1150-3A2211FP	RES., SM, 2K21 0805, 1%,100ppm											•
	1150-3A6811FP	RES., SM, 6K81 0805, 1%,100ppm		•	•			•	•				
	1150-4A1182FP	RES., SM, 11K8 0805, 1%,100ppm									•		
	1150-4A1502FP	RES., SM, 15K0 0805, 1%,100ppm								•			
R28	1150-3A3011FP	RES., SM, 3K01 0805, 1%,100ppm											•
R21	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R22	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R25	1150-3A1001FP	RES., SM, 1K00 0805, 1%,100ppm				•	•	•	•			•	•
	1150-4A1182FP	RES., SM, 11K8 0805, 1%,100ppm									•		
	1150-4A1822FP	RES., SM, 18K2 0805, 1%,100ppm		•	•					•			
R26	1150-3A8251FP	RES., SM, 8K25 0805, 1%,100ppm		•	•								
	1150-4A1182FP	RES., SM, 11K8 0805, 1%,100ppm									•		
	1150-4A1822FP	RES., SM, 18K2 0805, 1%,100ppm								•			
R27	1185-4B103AAK	THERMISTOR/SMT, 10K, NTC, 1206		•	•					•	•		
	1180-2RDH301K	THERMISTOR, 300R,NTC,10%,RADL.										•	•
R28	1150-3A4531FP	RES., SM, 4K53 0805, 1%,100ppm				•		•	•				
	1150-3A1501FP	RES., SM, 1K50 0805, 1%,100ppm											•
R29	1174-DM3503J0	POT.,SM/4mmSQ,50K,MUL/TRN,SIDE	•										
R30	1150-2A6040FP	RES., SM, 604R 0805, 1%,100ppm	•										
R31	1174-DM2502J0	POT.,SM/4mmSQ,5K0,MUL/TRN,SIDE	•										
R32	1150-4A5112FP	RES., SM, 51K1 0805, 1%,100ppm		•	•					•	•		
R33	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R34	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R35	1150-3A1001FP	RES., SM, 1K00 0805, 1%,100ppm		•	•					•	•		
R36	1174-DM3503J0	POT.,SM/4mmSQ,50K,MUL/TRN,SIDE	•										
R37	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										



## Audio Processor Electrical Parts List continued

Ref. Desig.	Part Number	Description	ALL MODELS	UT-3/420-SXCX00	UT-3/460-SXCX00	UT-3/815-SXC300	UT-3/860-SXC300	UT-3/930-SXB300	UT-3/950-SXB300	VT-3/140-SXAX00	VT-3/160-SXAX00	VT-3H035-SXA300	VT-3H045-SXA300
R38	1174-DM2502J0	POT.,SM/4mmSQ,5K0,MUL/TRN,SIDE	•										
R39	1150-4A1542FP	RES., SM, 15K4 0805, 1%,100ppm	•										
R40	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R41	1150-5A1373FP	RES., SM, 137K 0805, 1%,100ppm	•										
R42	1174-DM2502J0	POT.,SM/4mmSQ,5K0,MUL/TRN,SIDE	•										
R43	1150-4A1182FP	RES., SM, 11K8 0805, 1%,100ppm	•										
R44	1150-0A0R0000	RES., SM, ZERO OHM JUMPER,0805	•										
R46	1150-3A4531FP	RES., SM, 4K53 0805, 1%,100ppm	•										
R47	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R48	1174-DM4104J0	POT.,SM/4mmSQ,100K,MUL/TN,SIDE	•										
R49	1150-4A1622FP	RES., SM, 16K2 0805, 1%,100ppm	•										
R50	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R51	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R52	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R54	1150-2A1000FP	RES., SM, 100R 0805, 1%,100ppm		•	•					•	•		
R55	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R56	1150-0A0R0000	RES., SM, ZERO OHM JUMPER,0805	•										
R58	1150-0A0R0000	RES., SM, ZERO OHM JUMPER,0805	•										
R59	1150-4A2002FP	RES., SM, 20K0 0805, 1%,100ppm	•										
R60	1150-4A1822FP	RES., SM, 18K2 0805, 1%,100ppm	•										
R61	1150-4A1822FP	RES., SM, 18K2 0805, 1%,100ppm	•										
R62	1150-4A1542FP	RES., SM, 15K4 0805, 1%,100ppm	•										
R63	1174-DM2502J0	POT.,SM/4mmSQ,5K0,MUL/TRN,SIDE	•										
R64	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R65	1150-5A1003FP	RES., SM, 100K 0805, 1%,100ppm	•										
R66	1150-4A1622FP	RES., SM, 16K2 0805, 1%,100ppm	•										
R67	1150-4A5622FP	RES., SM, 56K2 0805, 1%,100ppm	•										
R68	1150-3A3481FP	RES., SM, 3K48 0805, 1%,100ppm	•										
R69	1150-3A2001FP	RES., SM, 2K00 0805, 1%,100ppm	•										
R70	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R71	1150-3A5111FP	RES., SM, 5K11 0805, 1%,100ppm	•										
R72	1150-0A0R0000	RES., SM, ZERO OHM JUMPER,0805	•										
R75	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R76	1150-4A1622FP	RES., SM, 16K2 0805, 1%,100ppm	•										
R77	1150-4A2002FP	RES., SM, 20K0 0805, 1%,100ppm	•										
R78	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R79	1150-4A4992FP	RES., SM, 49K9 0805, 1%,100ppm	•										
R80	1150-4A2742FP	RES., SM, 27K4 0805, 1%,100ppm	•										
R82	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										

## Audio Processor Electrical Parts List continued

Ref. Desig.	Part Number	Description	ALL MODELS	UT-3/420-SXCX00	UT-3/460-SXCX00	UT-3/815-SXC300	UT-3/860-SXC300	UT-3/930-SXB300	UT-3/950-SXB300	VT-3/140-SXAX00	VT-3/160-SXAX00	VT-3H035-SXA300	VT-3H045-SXA300
R83	1174-DM3503J0	POT.,SM/4mmSQ,50K,MUL/TRN,SIDE	•										
R84	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R85	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R86	1150-4A1002FP	RES., SM, 10K0 0805, 1%,100ppm	•										
R81	1150-4A5112FP	RES., SM, 51K1 0805, 1%,100ppm		•	•								
U1	2327-SA571D00	IC, SA571D, COMPANDOR, SO-16L	•										
U2	2304-33174N14	IC, MC33174, QUAD OP AMP,SO-14	•										
U3	2304-33174N14	IC, MC33174, QUAD OP AMP,SO-14	•										
U4	2326-15696N08	IC, LTC1569I,LPF,10TH ORD,SO-8	•										
U5	2375-4S66FSMV	IC, 4S66F,BILATERAL SWITCH,SMV	•										
U6	2375-4S66FSMV	IC, 4S66F,BILATERAL SWITCH,SMV	•										

## FRONT PANEL BOARD ELECTRICAL PARTS LIST

Ref. Desig.	Description	Part Number
D1	SPACER, LED-T1 3/4, .300"H,NYL	5620-503S300N
	LED, RED, 5mm OD, T-1 3/4	2010-503001RD
PCB	PCB, MT-3 TX, FRONT PANEL,V1.2	4321-40921212
PF1	HEADER, .1", R/A, 2 ROW X 2PIN	5010-H202RA9T
PF2	HEADER, .1", R/A, 2 ROW X 2PIN	5010-H202RA9T
PF3	HEADER, .1", R/A, 2 ROW X 2PIN	5010-H202RA9T
SW1	WASHER, TFE,0.036ID,1/8OD,.02T (Qty. 2)	5805-T3612F20
	SWITCH, TOG/DPDT,O-O-O,PCB/STR	5215-T2031V02





## REVISION HISTORY

Revision	Date	ECO	Description
3	Nov 98		<ul style="list-style-type: none"> <li>MT-3 FM Audio Processor now version 1.8</li> <li>The MT-3 FM Audio Processor was re-designed because the IC, SL62070, VOGAD, SO-8 is no longer available from the supplier. Also, the new design improves the flat and 300Hz Pre-emphasis audio responses.</li> <li>Included PCB version 1.8 Component Layout, Schematic diagram, Parts List and Section 2.4, 3.9 and 3.10.</li> <li>Updated the DE Logo and added the statutory trademark statement to the title page.</li> <li>Updated the Low Frequency Modulation section. 3.11 to reflect the in house document A0361-06.</li> </ul>
3	Dec 98		<ul style="list-style-type: none"> <li>Corrected the part number for U1 on the Audio Processor (V1.8).</li> <li>Updated the tuning procedures for the Audio Processor (V1.8), section 3.10.2</li> <li>Corrected JU30 on the Audio Processor (V1.8) component layout, x &amp; y were labelled backwards.</li> </ul>
3	Jan 99	5012	<ul style="list-style-type: none"> <li>Corrected the description of operation for the Received Audio (section 2.1.3.2). The Audio Amplifier circuitry was removed in version 1.7 of the main board.</li> <li>The aluminum extrusions are no longer subcontracted parts. CASE, 14HP RF PLUG-IN, MT-3 TX was 3802-62502010 now 3702-62502010.</li> </ul>
3	Jul 00		<ul style="list-style-type: none"> <li>Corrected the parts description of D7 &amp; D8 on the TX Main Board Parts List. (Section 6.1.1)</li> </ul>
3	Oct 00		<ul style="list-style-type: none"> <li>Corrected the Pinout for P1 on the Front Panel Board Component Layout (Page 5-6).</li> <li>New Version (2.3) Audio Processor Board.</li> <li>"Addendum" IM20-AP20 issued to provide information for new board separate from this manual.</li> <li>IM20-AP20 covers only the Version 2.3 Audio Processor.</li> </ul>
3	Feb 01	5073	<ul style="list-style-type: none"> <li>The relay is always installed now. J3-X was not installed now installed</li> </ul>
3	Apr 01	5069	<ul style="list-style-type: none"> <li>The SMA and SMB are now a turnkey production. Part numbers were \$7910... are now 7910...</li> </ul>

Revision History continued next page

Revision	Date	ECO	Description
3	May 01		<ul style="list-style-type: none"> <li>• Updated audio-response specification (pg 1-2.)</li> <li>• Incorporated the AM Audio Processor documentation into the Addendum Audio Processor manual, IM20-AP3.</li> <li>• Updated FM Audio Processor Tuning Procedure, expanded to Flat audio.</li> <li>• Corrected typos for Flat Audio tuning</li> <li>• Corrected schematic typo R1. Was 215R, now 0 Ohms.</li> <li>• Changed Parts List Select Components to Select instead of TBA.</li> <li>• Inserted correct part number for 16k2 SM resistors instead of TBA</li> <li>• New Audio Processor jumper tables updated.</li> <li>• Table 5: Standby Mode Selection Table updated.</li> <li>• V2.3 Audio Processor Addendum reissued for internal release 1A in the Nov/01 revision numbering convention.</li> <li>• JU29 and JU32 installed now for UHF &amp; VHF Crystal transmitters. Improves subtone frequency response at 67 Hz as used in version 1.8. Jumper table updated.</li> </ul>
		639	<ul style="list-style-type: none"> <li>• Changed the FM Audio Processor tuning procedure section to provide two procedures: <ul style="list-style-type: none"> <li>- Pre-Emphasis for Versions 1.8, 2.2 and 2.3</li> <li>- Flat Audio for Versions 1.8, 2.2 and 2.3.</li> </ul> </li> <li>• Changed jumper label on schematic to indicate "Dual Port modulation only" (was "UHF only")</li> </ul>
		641	<ul style="list-style-type: none"> <li>• C39 was 2.2<math>\mu</math>F now 680nF</li> </ul>
3	Jun 01		<ul style="list-style-type: none"> <li>• Corrected formatting error in Flat Audio Alignment procedures. Step 14 - Analyzer Level should read -10 dBm.</li> <li>• Removed all AM Transmitter and AM Audio Processor information from the Version 2.3 Audio Processor Addendum, IM20-AP3 and changed its document title to reflect use for FM transmitters only.</li> </ul>
3	Jun 01		<ul style="list-style-type: none"> <li>• Second Issue of IM20-AP3 Audio Processor Addendum</li> </ul>
3	Aug 01	657	<ul style="list-style-type: none"> <li>• Some multi-layer ceramic capacitor types upgraded in tolerance and voltage and were more readily available for stock than original parts specified in the parts list. Parts list updated.</li> </ul>
		655	<ul style="list-style-type: none"> <li>• Changes to V2.3 Audio Processor Addendum, IM20-AP3: <ul style="list-style-type: none"> <li>C19, C36 now 1008-5A334K4R</li> <li>C7, C42 now 1008-5B684K4R</li> <li>C1,2,4,9,16,25,30,33,35,40,46,47 &amp; 51 now 1008-6B105K3R.</li> </ul> </li> <li>• Updated Audio Processor Jumper and Select Tables for VHF/UHF. Wideband/Narrowband and LTR™ configurations tables also include R54 change for synthesizers with BeckElec TCVCXO</li> </ul>
3	Oct 01		<ul style="list-style-type: none"> <li>• Added notes regarding dual mode CTCSS and DCS/ LTR™.</li> </ul>
		676	<ul style="list-style-type: none"> <li>• Transmitter Front Panel Switch shorting to trace. Added Teflon Washers TFE, 0.036ID, 1/8OD,.02T to the mechanical part list. Qty 2 per. These are installed over the switch leads between the PCB and the switch body.</li> </ul>
3	Nov 01		<ul style="list-style-type: none"> <li>• Instruction sheet references added to Audio Processor Jumper Tables. Audio Processor Version 2.3 Addendum, IM20-AP3 reissued as 2A for internal use.</li> </ul>
3	Dec 01		<ul style="list-style-type: none"> <li>• Audio Processor Version 2.3 Addendum, IM20-AP3 reissued as 2B for internal use.</li> <li>• Improved tuning procedure using distortion technique for setting compression for Pre-emphasis/CTCSS.</li> </ul>
3	Mar 02	701	<ul style="list-style-type: none"> <li>• TOT specification changed from 5min <math>\pm</math> 30sec to 5min <math>\pm</math> 50sec.</li> </ul>
3	Apr 02	697	<ul style="list-style-type: none"> <li>• Improve hum &amp; noise performance, UT-3/8xxx only Version 2.3 Audio Processor changes: <ul style="list-style-type: none"> <li>- C56 now 22nF for 800 MHz LTR™ only (remains as 33nF for other bands.)</li> <li>- JU29, JU32, and JU44 Not Installed for 800 MHz LTR™</li> </ul> </li> </ul>

Revision History continued next page

Revision	Date	ECO	Description
3	Feb 02	678	<ul style="list-style-type: none"> <li>To prevent frequency error when PTT first activated. Reduction of charge time for C34 on the Version 2.3 Audio Processor.               <ul style="list-style-type: none"> <li>- C34 now 1.0<math>\mu</math>F, DIP Tantalum (was 47<math>\mu</math>F SM Tantalum)</li> <li>- C34 remains as 47<math>\mu</math>F for LTR™ &amp; DCS applications.</li> </ul> </li> </ul>
4	Mar 03	699	<ul style="list-style-type: none"> <li>Reissue including Version 2.3 Audio Processor information. Version 1.6 Audio Processor information is removed.               <ul style="list-style-type: none"> <li>- Issue 4 covers Version 1.8, 2.2 &amp; 2.3 Audio Processors.</li> <li>- Issue 4 contains no AM information - the document title is changed to reflect coverage of only FM transmitters.</li> </ul> </li> </ul>
		701	<ul style="list-style-type: none"> <li>For VT-3H035 &amp; VT-3H045 transmitters, to reduce spurious emissions for CE approval, the PCB trace pattern is modified and C44 is Not Installed.</li> </ul>
4-1-0	Sept 03		<ul style="list-style-type: none"> <li>Time Out Timer tolerance is changed to <math>\pm 17\%</math>. Tolerance for 5 minutes setting is <math>\pm 50</math>sec.</li> <li>New Manual Format</li> <li>Removed all reference to Version 1.8 Audio Processor</li> </ul>
4-1-1	Oct 03	- - -	<ul style="list-style-type: none"> <li>Typographical updates to manual.</li> </ul>
4-2-0	Jan 05	660	<ul style="list-style-type: none"> <li>Update Audio Processor Component Layout Dwg:               <ul style="list-style-type: none"> <li>43-911923-01-T-01-01 to 43-911923-01-T-02-01</li> <li>43-911923-01-S-0101 to 43-911923-01-S-02-01</li> </ul> </li> <li>Add Select table for Audio Processor Components: "Audio Processor Component Layout Selection Table"</li> </ul>
		791	<ul style="list-style-type: none"> <li>Update Main Board Component &amp; Schematic Dwg to update J25 SEL: X installed for FM Products &amp; Y installed for AM Products</li> </ul>
		- - -	<ul style="list-style-type: none"> <li>Update Tx Front Panel Component Dwg:               <ul style="list-style-type: none"> <li>43-921212-01-T-01-01 to 43-921212-01-T-02-01</li> </ul> </li> <li>Update specification tables and part list</li> </ul>
		829	<ul style="list-style-type: none"> <li>Update Parts List</li> </ul>
		836	<ul style="list-style-type: none"> <li>Update C56 to 47nF for 950MHz transmitters.</li> </ul>
4-3-0	Jun 05	836A1	<ul style="list-style-type: none"> <li>CO 836 expanded to include the UT-3/930-SXB300 Audio Processor model selected components</li> </ul>
		836A2	<ul style="list-style-type: none"> <li>CO 836 expanded to include the UT-3/930-SXB300 with this main board.</li> </ul>
		846	<ul style="list-style-type: none"> <li>Update Audio Processor Component Layout and the Audio Processor Component Layout Selection Table.</li> </ul>
		- - -	<ul style="list-style-type: none"> <li>Alignment procedures updated.</li> <li>Revision History older than 7yrs removed from publication.</li> <li>Top level mechanical parts moved to the top level Transmitter IM's;               <ul style="list-style-type: none"> <li>- for all VHF Synthesized Tx mech parts consult IM20-VT3150</li> <li>- for all UHF Synthesized Tx mech parts consult IM23-UT3400</li> <li>- for all Crystal Tx mech parts consult IM21-xT3C</li> </ul> </li> </ul>
4-4-0	Dec 05	6056	<ul style="list-style-type: none"> <li>OC-3 Product discontinued. Remove references.</li> </ul>
		6113	<ul style="list-style-type: none"> <li>VT-3/140 Audio Processor select value table updated</li> </ul>
		6115	<ul style="list-style-type: none"> <li>VT-3/160 Audio Processor select value table updated</li> </ul>
4-5-0	Feb 06	6129	<ul style="list-style-type: none"> <li>UT-3/420-SXCX00 Audio Processor select value table updated</li> </ul>
		6130	<ul style="list-style-type: none"> <li>UT-3/460-SXCX00 Audio Processor select value table updated</li> </ul>
		- - -	<ul style="list-style-type: none"> <li>Audio Processor Parts list expanded to display all models and thier band selected components.</li> </ul>

