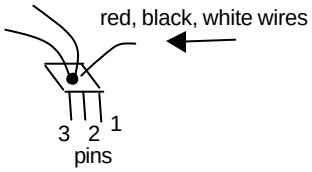
MX 692 Description and Alignment Procedure

General Information

Model numbers: MX692/C-UA, MX692/C-UB
Product line: Microflex
Applications: Boundary microphone applications in which cable installs are not preferred
Transducer type: Electret condenser, charged backplate, cardioid (99A926)
Transmitter: UHF (Model UC1 circuitry), microprocessor controlled, operating over the range of 782-806 MHz (UA) and 692-716 MHz (UB)

NOTE: For regulatory testing, use the enclosed Tiny QG jack to input the audio signal to the transmitter. Remove the existing three-pin jack interface (with the red, white, and black wires linking the mic board) and connect this Tiny QG jack in its place. On the three-pin jack with the wires, apply +5 V DC to pin 3 and ground pin 2 as shown:



Doing this supplies bias to the mic board, so that the logic circuitry will work to trigger tonekey toggling. To disable tonekey, simply press the "PUSH" button on top of the MX692 unit.

Features

- Integrated functionality of Microflex cardioid cartridge with UC1 UHF transmitter circuitry
- Frequency agile transmitter offers 191 user selectable channels for both UA and UB country codes
- User programmable membrane switch and status LED (4 operational modes)
- 9V battery-powered with 3-stage battery life LED indicator
- Thread mount cartridge connection for easy field replacement
- Internally mounted antenna

Circuit Description

The MX692 microphone utilizes modified versions of the MX392 PCA (95A8805) and the UC1 bodypack PCA (90-8762). The audio preamp portion of the original MX392 circuitry has been omitted for use in the MX692, with the microphone level output of the cartridge now hardwired directly to the mic jack board of the modified UC1 PCA. No longer intended for use with phantom power, the modified MX392 PCA is instead powered by the regulated +5V bias supply from the UC1 circuit. All four mute/LED logic modes of the MX392 have been preserved in the MX692. Transistor

Q12, used to mute the audio preamp in the original MX392 circuitry, is hardwired directly to the mute jack input of the modified UC1 PCA. To allow for the hardwired connections between the two MX692 PCA's, both the 1/8" stereo mute jack and the mini 4-pin connector have been deleted from the modified UC1 PCA used in the MX692.

Mechanical Specifications

Dimensions:	Approximate footprint 5.2" x 3.6", height 1.8"
Housing:	Black ABS
Grille:	Black chrome-plated steel
Weight:	214 grams with battery (167 grams without battery)

Audio Section

The audio signal is hardwired into the micjack board, which is connected to J204. The signal then enters a switchable 20dB pad made up of SW201, R203,R204, C204 and C206. The back to back diodes, D206, are used to keep the op amp from snapping to the rail and reverse phasing when maximum input voltage is exceeded.

The signal is ac coupled through C205 into a 40dB (30dB Japan) user adjustable gain stage around amplifier U204A. This gain stage is externally accessible to the user. This is a unique stage in that it is non-inverting, and allows for a gain less than unity. R205 and R207 set up a half-supply bias and R206 sets the input impedance.

The amplified audio signal then passes through a premphasis network before entering the compression stage. R221, R222, and C216 set up two corners for the premphasis network. The premphasis network feeds the NE575 compandor, U203, which utilizes an external amplifier U201D. The compandor performs 2:1 logarithmic compression of the audio signal.

Transistors Q201 and Q202 with crystal Y201 form the tone-key oscillator circuit which provides a stable continuous 32.768 kHz sine wave. Transistor Q204 buffers the tone key signal before it is added to the audio signal. The tone key signal is used in the receiver to provide audio output only when the tone key signal is present in the transmitted signal. Therefore, if the tone key or the transmitter is turned off, the receiver will be muted. Q211 acts as a switch for toggling the tone key ON/OFF. It is controlled from the µProcessor, via the TONEMUTE0 signal. The tone key signal along with the processed audio signal is then fed to a summing amplifier U201A. After passing through the ac coupling capacitor, (C240), the signal is then fed to the RF module.

The muting circuitry is provided by a modified assembly of circuitry for the MX392 boundary mic, as noted in the Circuit Description. The circuitry is on a daughterboard that is hardwired to the UC1 boards. Four mute modes are possible. The modes are programmed by setting a DIP switch SW1, and the selected mode is engaged by a membrane switch connected to J4. The three commonly used modes are:

- Momentary audio and LED on
- Momentary mute and LED off
- Latch to either state

A fourth mode settable using SW1 is audio latched on and LED off. The muting logic signal is wired from W3 on the daughterboard to what would be terminal 3 of J102 on the UC1 boards. J102 is not placed, however.

The battery meter circuit is made up of comparator U208, LED's D201, D202, D203, and various resistors. The meter works by comparing a divided down version of the battery voltage (R255, R256) to two thresholds (set by R274, R275, and R276), and lighting the appropriate LED. When the battery voltage is less than 6.5 V, the output of U208 at pin13 changes low which turns the red LED on. Through Q222 and U201B the voltage applied to the tone key oscillator circuit switches high; thus, when the red LED goes on the tone key level increases. The tone key amplitude change is utilized by the receiver to indicate the transmitter battery level. When the on/off switch, SW202, is turned off the PWRDN0 signal goes low. The microprocessor will then change the RFOFF0 signal to a high level which shuts down the sytem.

Power to the audio pcb comes from a 9V battery, via switch SW202. FET Q217 is used for electrical reverse battery protection by connecting the negative battery terminal to the PCB ground, only when the battery is connected with the correct polarity. 9V then enters U205, a low dropout 5V regulator, which gives a clean regulated 5V supply to run the audio circuitry. The regulator has appropriate bypass capacitors on its input and output. Q213, Q215, Q216, Q218, and their respective resistors, are used for power management and timing.

RF section

Processed audio enters R149, an internal potentiometer which is adjusted for 45kHz deviation (100% modulation) with a -7.2 dbV (0.355 Vrms) 1kHz tone at the output of the front audio stage (pin 1 of U201). The audio is then fed to the tuning voltage pin of the voltage controlled oscillator (VCO) and modulates the carrier directly. The use of a phase locked loop (PLL) frequency synthesized system eliminates the need for multiplier stages, resulting in a much higher degree of spectral purity. The VCO is shielded to prevent external RF fields from affecting its operation. Regulated 5Vdc power is provided to ensure frequency stability with changes in battery voltage.

The VCO is capable of tuning across the nominal frequency band with a 1 to 4 volt tuning voltage range. At the output of the VCO, the RF signal splits into two paths. The output of the VCO is coupled by C134 to the frequency control pin of the synthesizer U104 pin 8. The synthesizers internal circuitry divides the signal as necessary to the desired reference frequency of 125kHz. The synthesizer contains a reference oscillator circuit operating from a 4.0 MHz quartz crystal Y101 which is adjusted by means of trimmer C123. The transmitter output frequency is user selectable in 125kHz increments across the nominal frequency band. Frequency selection is made via microprocessor

U101 which interfaces with the user by means of the mode/select switches. The output of the synthesizer is a series of pulses which are integrated by a passive loop filter R121, C130, R122, C129, C130, R123, and C132 to produce a control voltage signal. The control voltage signal is then connected to the VCO through amplifier U106A which is used to isolate the PLL filter from the audio modulation signals.

The VCO output is also coupled to an RF power amplifier through a resistive pad consisting of R127, R128, R129, and R130. The signal is then low pass filtered through U107. The signal is coupled through C144. Transistor Q102 acts as a RF preamplifier stage with typically 8 dB of gain. R131, R132, and R133 provide dc bias to Q102. C145, C146, C147, C149, C150 and L111 are used to decouple the RF off the emitter of Q102, VCC, and +9VDC supply voltages. C152 couples the output of Q102 to low pass filter U108. The signal is then low pass filtered through U108. The signal is coupled through C157. Transistor Q104 acts as a RF amplifier stage with typically 16 dB of gain. L110, R136, R137, and R138 provide dc bias to Q102. C160, C161, C162, C163, C164, C165 and L114 are used to decouple the RF off the emitter of Q104, VCC, and +9VDC supply voltages. L115 and C167 match the output of Q104 to low pass filter U109. The signal is coupled through C173 to the output antenna W101.

The transmitter is capable of delivering +17dbm (50 milliwatts) maximum to the 50 ohm antenna. During transmitter power up and frequency selection the RF power is muted by bringing the gate of Q103 and Q105 high (RFUNMUTE signal is 5 volts). This provides approximately 45dB RF attenuation until the PLL has locked. The transmitter RF power is then unmuted by bringing the gate low (RFUNMUTE). During transmitter power off conditions, the RF power is first muted by bringing the base of Q103 and Q105 high. When the RF is turned off in this manner the carrier signal of the transmitter is not allowed to drift off frequency during power on or power off conditions.

Alignment Procedure

The alignment procedure is sequential and does not change unless specified. Use RG58 or any other low loss, 50 ohms cables for all RF connections. Keep test cables as short as possible. Include the insertion loss of the cables and the connectors for all RF measurements. DC voltages are present at most RF test points. Use DC blocks to protect the test equipment, if necessary.

Initial Setup

1.0 The rf-digital board and audio board should be connected through the 11 pin board interconnects J101 and J201.
1.1 Apply +9V across the battery terminals, J202 and J203.
1.2 Set the audio gain pot, R7, to minimum.
1.3 Connect audio generator to TPMIC1. For bench testing, the audio generator can be directly connected to the mic jack input.
1.4 Turn on the UC1 through SW202.

1.5 Set the Group and Channel switches, S101 and S102, according to the group designators on the board and the following table.

Table A

Group	Group Code	Group Switch (S101)	Channel Switch (S102)	Carrier Frequency	Tuning Voltage TP130 (Vdc)	Deviation (kHz)
UA	A	4	0	805.500	3.7	45
UB	F	1	A	703.750	2.6	45

Tuning Voltage / Frequency Alignment

2.1 Make sure the receiver and spectrum analyzer are set to the appropriate frequency from *Table A*.
2.3 Measure the dc voltage at TP130 (tuning voltage line). Adjust the VCO trimmer C510 until the voltmeter reading equals that shown in *Table A*, ± 0.125 V.
2.4 Adjust the variable capacitor C123 until the frequency counter measurement matches the desired frequency in *Table 2*, ± 1 kHz.

Deviation Adjustment

The following procedure requires a U4S, U4D, or a UC4 receiver and is designed to tune the UC transmitter regardless of the accuracy of the receiver's tuning. It is, however, recommended that a properly tuned receiver be used to perform the transmitter deviation adjustment.

3.0 Receiver Setup
3.0.1 Turn off the UC1 and connect the rf signal generator to one of the receiver antenna ports.
3.0.2 Set the receiver frequency to match the transmitter.
3.0.3 Set the rf signal generator frequency to match the transmitter.
3.0.4 Set the deviation according to *Table A*.
3.0.5 Modulate the rf signal with a 1kHz audio tone.
3.0.6 Turn the receiver on and set the tone key switch to the OFF position.
3.0.7 Connect the ac voltmeter to the unbalanced output of the receiver.
3.0.8 Note the voltage obtained. This is *the **deviation reference voltage***.
3.0.9 Disconnect the RF generator from the receiver and return the tone key switch to the ON position.
3.1 Turn on the UC1 and input a 1kHz tone.
3.2 **Domestic (UA,UB):** Adjust audio input level to give -6.8 dBu ± 0.02 dB (354mV ± 1mV) at TP3 (U201.7).
3.3 Transmit from the UC1 transmitter to the receiver. If transmission is conductive instead of radiative, insert a 20-60 dB pad between the transmitter rf output and the

receiver rf input. Turn the transmitter ON and adjust R149 until the audio voltmeter at the receiver output reads the ***deviation reference voltage*** ± 0.1 dB, as measured in 3.0.8.

3.4 Disconnect the audio generator.