

# QUAL-TRON INC

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**MMCT**



**MMCR**

## **EMIDS INSTRUCTION MANUAL**

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## THEORY OF OPERATION

### POWER AMPLIFIER ASSEMBLY

#### Driver Amplifier

The driver amplifier section provides the following function.

- \* Amplifies the output signal of the synthesizer.
- \* Matches the low impedance of the power amplifier.
- \* Provides some attenuation of harmonics.

#### Power Amplifier

The final power amplifier further amplifies this signal to the specified output level.

#### Low Pass Filter

The low pass filter provides the following functions:

- \* Attenuates harmonics by approximately 50 dBm.
- \* Matches the final power amplifier to 50 Ohms.

#### Power Supply

The power supply section provides a means of switching DC power to the final stage of the Power amplifier.

### SYNTHESIZER LO ASSEMBLY

#### Crystal Oscillator

A fundamental frequency crystal oscillator is operated in a Colpitts temperature-compensated circuit to give a stability of (2.5 PPM over the operating temperature range. The 12.8 MHz output of the TCVCXO drives the PLL chip. The PLL chip divides this frequency, to establish a reference frequency. This frequency is the reference (frequency) for phase comparison used internally in the chip as well as providing the channel spacing. The low frequency component of the modulating signal is used to modulate of the TCVCXO, for improved DC response.

#### Voltage controlled Oscillator "VCO"

The VCO operates at the output frequency and is controlled by applying a voltage to the voltage variable capacitor. The oscillator is tuned to the center of the operating frequency range so the voltage on the capacitor is compatible with the output range of the low pass filter.

#### Phase Locked Loop "PLL"

The PLL compares the VCO frequency, divided by the dual-modulus divider and internal dividers, to the reference frequency and outputs a series of correction pulses to the low pass filter to correct the VCO frequency.

#### Dual Modulus Pre-Scalar & Buffer

Dual Modulus operation will not be described here, since operation of this circuit is explained in great detail in common technical literature.

A simplified explanation of dual modulus circuit operation is that it is an additional frequency divider used by the PLL. The buffer provides isolation to prevent switching spikes from getting back into the VCO and erroneously modulating the output frequency.

#### Modulation Filter

The modulation signal is passed through an active filter which attenuates all audio signals above the cutoff frequency, resulting in an improved signal to noise ratio.

#### Modulation Attenuation Circuit

The Modulation Attenuation Circuit consists of several resistors that may be switched in and out of the circuit to control the modulation level across the operating bandwidth of the Transmitter.

### **Encoder**

#### Microcontroller

The microcontroller includes Eeprom, EEeprom, Ram and various peripheral devices to accomplish the task required of the encoder.

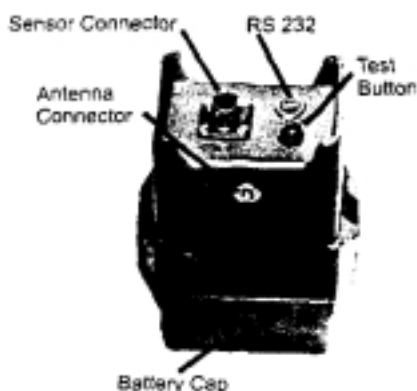
#### Additional Support Circuitry

The following are some of the support circuits associated with the encoder:

- \* Sensor Interface circuit.
- \* Power Supply circuit.
- \* User interface circuit (Switches and Pushbutton).
- \* External state of health timer.

- \* Low Battery detection circuit
- \* Low voltage reset circuit.
- \* Serial communications circuit (RS-232).

## Section 2: EMIDS Transmitter (MMCT) Operational Mode



<b>Channel:</b>	25 KHz spacing
<b>ID Code:</b>	0-999/per RF channel
<b>Antenna:</b>	1/4 wire whip
<b>R.F. Output:</b>	Nominal 1 Watt
<b>Frequency Range:</b>	138.025-152.972 MHz
<b>Power Supply:</b>	4 commercial 9 volt (MN1604)
<b>Battery Life:</b>	90 -120 days @ 25 C
<b>Sensor:</b>	Any MIDS sensor can be used with this transmitter. With special instructions additional sensors can also be used
<b>Pin Connection:</b>	<b>A:</b> Ground <b>B:</b> +9 VDC <b>C:</b> Tx Trigger <b>D:</b> ID Code control

### Description

Normal operation for the transmitter is to receive, process and transmit via RF frequencies, data from various types of attached ground sensors. The transmitter frequency is selectable via synthesizer control circuits providing a selection of 600 RF channels to choose from:

**Channel 001 = 138.025 MHz**  
**Channel 600 = 153.000 MHz**

### Design Features:

- ID Code Selection 001 - 999
- Internal power ON - normal operation - antenna up
- Internal power OFF - non operating - battery cap up
- Internal Power ON - align (sensor set) battery cap down
- Transmit ID Code Alarms
  - Transmit State -Of-Health-*Messages*
    - Sensor Fault (left-right/right-left indication)
    - Tamper
    - Test
    - Low Battery
- Three switches for programming operation functions
- A sealed battery compartment
- A Tri colored LED used to confirm programming process functions
- An RS-232 data port for interfacing with a computer

During normal operation the transmitter may be triggered by an external sensor through its sensor connection. A message will then be transmitted on a selected channel (000-600). A message may also be initiated with the push button on the top of the unit. The unit may be put in the align mode by placing it with the battery cap down. Power is turned off by placing the unit with the battery cap up. Power will remain on for five minutes after it is initially applied.