2.2.- BRIEF DESCRIPTION AND DESTINATION (USE) OF UNIT.

The TM60 remote control system has been designed to operate remotely by radio, electrical or electrohydraulic machinery operated with relays, frequency inverters or valves. The most common application for it, is the remote control of lifting machines such overhead cranes, tower cranes, loader cranes or concrete pumps, as well as driverless vehicles.

The set consists on a portable battery powered transmitter which is controlled by the operator, and a receiver which is installed in the machine which is going to be operated. The set is supplied with a battery charger and two rechargeable batteries.

There is a great variety of machinery and therefore, the configuration of the set is variable, particularly in the case of transmitter. The basic configurations have been described above.

2.3.- POSSIBLE VARIATIONS.

When a fixed transmitter is requested, instead of a portable unit, then, the transmitter is introduced in a box with external power supply. In such cases, models are named:

TM60/F.9 – systems with 9 output relays
TM60/F.18 – systems with 18 output relays

3.- RADIO TRANSMITTER TD450

3.1.- GENERAL FUNCTIONAL DESCRIPTION.

The Radio Transmitter module TD450 converts the analogue signal given by the GMSK modem of the transmitter logic unit, into a FM modulated radio signal.

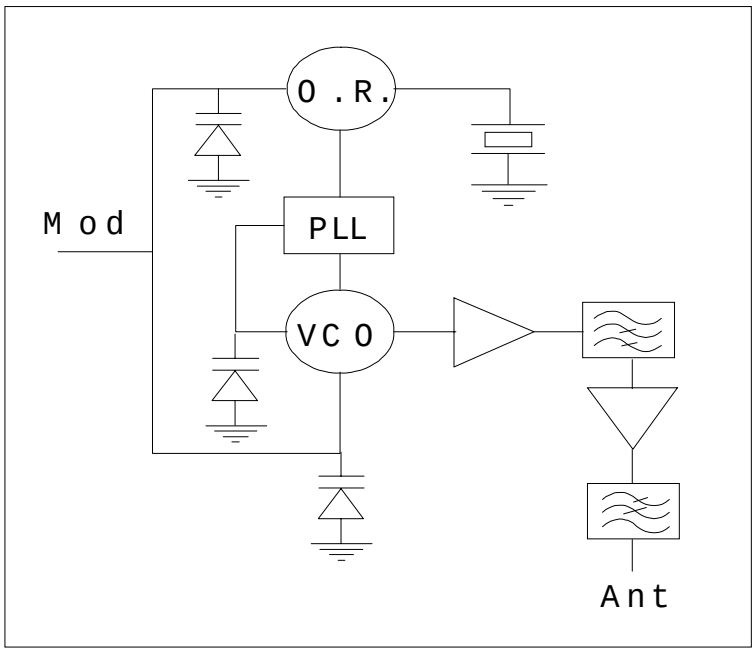
Features:

- 450-470 MHz frequency band.
- Frequency selected through a serial data input, with 25 KHz steps.
- Synthesised frequency through a PLL phase loop.
- Double modulation.

Radio Transmitter TD450 consists on a 6 layers printed circuit board, containing following blocks:

- Analogue input signal equalizer.
- Oscillator – Modulator and Frequency Synthesiser.
- Buffer – preamplifier.
- Amplifier and filters.

3.1.1.- BLOCK DIAGRAM.



3.1.2.- ANALOGUE INPUT SIGNAL EQUALIZER.

The signal to be modulated is first equalised to a suitable level to obtain a wider band in the receiver. Also, a 5V stabilised voltage is obtained for the supply of the synthesiser and output power stage.

3.1.3.- OSCILLATOR – MODULATOR AND FREQUENCY SYNTHESISER.

The oscillator is a VCO controlled by a PLL, working at $f_{OSC} = (f_{RF} /2)$. The VCO frequency is set by the transmitter logic unit through a serial data input, and the reference frequency is obtained by a 6,4 MHz crystal controlled oscillator. The modulation signal is introduced simultaneously in both, the VCO, which modulates the higher part of the input spectrum, and the reference oscillator, which modulates the lower part.

The level of the low frequency data signal supplied by the transmitter logic unit, is set through the R7 potentiometer, thus adjusting the emission bandwidth.

The synthesizer features a VCO composed by transistor Q4 and its associates components, plus a PLL circuit composed by integrated circuits U6 (counter and phase comparator), U4 (preescaler) and U5 low pass filter. The reference oscillator circuit, is composed by transistor Q6 and its associates components. A temperature compensated frequency network featuring a NTC R1, keep the frequency independent form temperature changes.

The error voltage (control voltage over VCO) varies D1’s capacitance then moving the central frequency of VCO.

The higher frequency part of modulation signal varies D2’s capacitance while the lower part varies D4’s capacitance.

The PLL circuit consists in a 6,4 MHz reference oscillator, which give the 6,25 KHz reference frequency, a phase comparator, the prescaler divisor and a circuit which gives a signal when the PLL is locked, thus allowing to supply power to the RF amplification stage.

3.1.4.- BUFFER–PREAMPLIFIER.

This stage separates the VCO and the RF amplifier, thus reducing the influence of load variations produced by level changes in the transmitter output stage. The amplification at this stage is non linear, producing harmonics at two times its input frequency, thus giving the output frequency f_{RF}. A high pass filter eliminates harmonics produced under frequency f_{RF}.

3.1.5.- AMPLIFIER AND FILTERS

This two stage amplifier gives the RF output power. Then the signal is filtered through a low pass elliptic filter to eliminate the resulting components higher in frequencies than f_{RF}.

When the EMIS emission control signal is off, power supply to all RF parts of the circuit is switched off, and the transmitter remains on Stand-by mode.