1) INTRODUCTION

NOTE: PLEASE READ THE ENTIRE CONTENTS OF THIS INSTRUCTION MANUAL BEFORE INSTALLING THIS UNIT. IF YOU HAVE ANY QUESTIONS CONCERNING THE OPERATION OR INSTALLATION OF THIS UNIT, PLEASE CONTACT THE FACTORY.

The FMT-30 FM Broadcast Transmitter will replace older broadcast transmitters that are either unreliable or unrepairable. Many tube and early-model transmitters are operating beyond modern state-of-the-art standards. The FMT-30 can replace the older equipment, and will remain acceptable to F.C.C. broadcast standards. The FMT-30 will operate in the 88-108 MHz range, which is DIP switch programmable. All critical voltages & currents are monitored by a front-panel LCD display and selector switch. The output can be adjusted/switched with front panel controls, with a range from 0-30+ watts, into a 50 ohm load. The output is protected against excessive VSWR with automatic power control. The output is filtered with a 6 pole low-pass filter. Standard audio input is an unbalanced 600 ohm composite with a factory option 600 ohm 75 μS pre-emphasized input. The PLFM-100 PC board, is enclosed in a shielded metal boxes, for maximized protection against RF fields. The FMT-30 is designed to mount in a standard 2-rack unit (3.5”) area.

THEORY OF OPERATION

POWER SUPPLY

A.C. power is applied to J1, a filtered AC line connector. The combination of bridge and input filter capacitors provide the unregulated DC input for the PA power circuit. PS2 provides the +/-12V and 5V for the display. A portion of the unregulated PA power connects to U3 voltage regulator. The components affiliated with Q2 control the lock-up signal which derives from the PLFM-100. Upon loss of lock, or initial power-up, Q1 shorts, disabling output of U3. U3 drives Q3, which provides regulated voltage to the PA stage. Q3 is mounted on the PA heatsink. The maximum current flow to the PA stage is also regulated by U3. U1C and D sample the RF...
signal from the output VSWR bridge, and the output of the Reflected power sample U1C is routed to U3. The increase in reflected VSWR will increase the output of U1C; this increase in voltage will reduce the PA voltage to a safe level. Q1A SCR provides over-voltage protection against power supply over-voltage. When activated, it will short-circuit, blowing fuse F1. SW1 selects the various metering functions.

OVER TEMPERATURE CONTROL- In the event the internal fans fail to provide sufficient cooling as in a failure or excessive room temperature, the FMT-30 contains a thermal sensor which will shut-down the B+ to the PA control board, disabling any additional heat build-up, until the condition corrects itself. The thermal cutoff is self-resetting and the shut-down temperature is 140 degrees F, and is mounted on the internal heat-sink.

PLFM-100 EXCITER

The PLFM-100 is a phase locked Direct FM Modulated oscillator. Referring to the schematic, Q1 is a low-noise RF oscillator, tuned by the combination of L1 and varactor CR2. The capacitance of CR2 is biased at 2V for linearity by the AFC voltage from U2. The modulation and AFC voltage component is connected to CR2. The RF signal is further buffered and amplified by Q2 & Q3. Q4 is a 3W power transistor operating at minimal range.

A portion of the RF signal is sampled at the output of Q3, and routed into U1, a divide-by-40 prescaler. The output of the prescaler is connected into U2, a parallel load PLL. Y1, a 2.56 mHz crystal is internally divided in the PLL to a low frequency reference. The output (AFC Voltage) is a 2500 Hz pulse, whose duration is dependent upon the phase difference between the reference and the incoming signal from the prescaler. As Q1 varies slightly in frequency due to temperature and time, the correction voltage also varies directly to the frequency. The AFC voltage is further filtered and routed to CR2. The characteristics of the loop filter are such that the modulating audio frequencies have minimal effect on the PLL loop stress. Selection of the DIP switches changes the binary number of the PLL; this in turn changes the AFC voltage, and the operating frequency. Large changes in frequency requires L1 to be changed. L1 contains an aluminum slug. The aluminum has a better characteristic at RF and a lower distortion than ferrite materials. Also the aluminum slug INCREASES in frequency when the slug is inserted into the coil stock.

POWER AMPLIFIER/ LPF/BRIDGE-

The FMT-30 contains a broadband RF amplifier for no-tune operation. The SWR bridge meters output parameters and high VSWR conditions, and the LPF filters harmonics to an acceptable FCC limit.

2) INSTALLATION

AC POWER

The FMT-30 is designed to connect to a conventional 120/240 VAC, 50/60 Hz power source. Internal jumpers on the power supply allow selection between 120 & 240V operation. For 240V operation, remove Blue and Red jumpers, and move them so that they are next to each other. Be sure to replace AC line fuse with 0.5 amp rating during 240 VAC operation.

AUDIO CONNECTIONS-

The FMT-30 uses an unbalanced composite (flat) and an optional 75 uS pre-emphasis inputs. An operating level of 0 dB re.0.7Vrms should be sufficient for full deviation. The composite input has an impedance of 500 ohms resistive and should be connected from a low-impedance composite source. The pre-emphasized input is about 7.5 K resistive, and should also be driven from a low-impedance source. This input is frequency sensitive and the caution must be observed when using this input. The input connections are located on the terminal block, pins 7 (low) and 8 (hi).
RF CONNECTION

The FMT-30 is a 50 ohm nominal output impedance. The output circuitry provides protection against high VSWR by reducing the output to a safe level whenever the impedance deviates from 50 ohms. There is a built-in DC choke for antenna surges (lightning). For absolute protection against excessive antenna surges such as lightning, etc., It is recommended that a BNC-T connection be attached to the output, and a shorted stub at the operating frequency be attached at this point. This will provide a DC short. Remember to recalculate the shorted stub length when changing operating frequency.

REAR PANEL-

AC POWER CONNECTION-
A standard IEC filtered power connector provides the connection to the AC line.
A factory-supplied AC power cord is supplied for conventional AC power connection.

REMOTE CONNECTIONS

The FMT-30 contains several connections for remote accessability. All access points are located on REAR PANEL.

TERMINAL BLOCK TB1 numbered from left to right

1- Ground- Low reference for remote power control wiper low and remote RF control.
2- Voltage Reference- An internal voltage reference for external power control. Connect this lead to the high side of an external power control potentiometer,
3- Pwr. Control in- Varying this voltage from the reference and ground will control output power remotely from front panel (NOTE- remove jumper from TB1-2 & 3 to access this feature.
4- Front panel control wiper- This is the wiper voltage from the front panel power control. Factory set to operate locally, a jumper from pin 2-3 enables this front panel control. Leave this jumper in place for local control.
5- Front panel control RF activate- This is the signal from the front panel RF-On, which becomes grounded when activated (on).
6- Remote RF ON- grounding this pin will remotely activate RF carrier. (NOTE-jumper from pin 4-5 allows local control. Remove jumper to remotely control RF.
7- Audio input low.
8- Audio input high.

DIN JACK REMOTE METERING CONTROL- (IF INSTALLED)

Pin5- Remote PA voltage- scale is 1V/V
Pin4- Remote PA current – scale is 1V/amp
Pin3- Remote Power output- Scale is 10V=30W- 7V=15W- 5V=7.5W (reading^2 X 0.3)
Pin1- Remote Power shutdown- This signal is derived from an external RF power amp. Its purpose is to reduce exciter output power when this signal increases above 3V. An example would be high-power VSWR protection foldback.
NOTE- use TB1- pin6 for ground reference of this jack.
3) OPERATION

FRONT PANEL CONTROLS

METER SELECT SWITCH

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
<th>SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>+V</td>
<td>power supply +12V</td>
<td>direct</td>
</tr>
<tr>
<td>-V</td>
<td>power supply -12V</td>
<td>direct</td>
</tr>
<tr>
<td>AFC</td>
<td>PLL AFC voltage</td>
<td>nominally 2.0</td>
</tr>
<tr>
<td>PA V</td>
<td>PA voltage</td>
<td>reading *10 (2.13V= 21.3V)</td>
</tr>
<tr>
<td>PA I</td>
<td>PA current</td>
<td>direct</td>
</tr>
<tr>
<td>Ref F</td>
<td>Relative forward output power</td>
<td>reading^2 * 0.3  10.0 =30W</td>
</tr>
<tr>
<td>Ref R</td>
<td>Relative reflected output power</td>
<td>reading is typically under 4.5 for 1.3 VSWR.</td>
</tr>
<tr>
<td>RF ON</td>
<td>This supplies B+ to Amplifier board. This control is a logic low to activate.</td>
<td></td>
</tr>
<tr>
<td>POWER</td>
<td>adjusts output power. Clockwise increases power from 0 to full output.</td>
<td></td>
</tr>
</tbody>
</table>

A) FREQUENCY SET- COARSE

The FMT-30 has been factory set to your specified frequency. Changing operating frequency requires a non-ferrous screwdriver. Remove top cover from the PLFM-100. Locate the enclosed DIP switch setting chart. You will notice that the binary number for the desired frequency is also the operating frequency (100.0 mHz=1000). First connect output to dummy load, then set the modulated oscillator dip switches to the corresponding frequency. Set the front panel meter to the “AFC” position. While observing the meter, rotate L1. If the desired frequency is less than the factory set, rotate the coil counter-clockwise. If the desired frequency is more than the factory set frequency, rotate the coil clockwise. Continue turning slowly until the meter reads 2.0. The PLL is now “locked” to the desired frequency. The out of lock LED on the PLFM-100 should also be out. Turn the FMT-30 off, then on, and observe the LED. It will come on, then go out after approx. 1 second. This verifies that the FMT-30 is phase-locked to the desired frequency. To change the frequency again, repeat the above procedure. The greater you deviate from the present frequency, the further you will need to rotate L1. Remember to set the coil so that you obtain 2.0 on the meter. This will keep the FMT-30 at highest linearity and guarantee optimum lock performance.

PLEASE NOTE- IT WILL BE NECESSARY TO RETUNE THE RF TRIMMER CAPS IF A LARGE CHANGE FROM THE FACTORY SET FREQUENCY IS REQUIRED. IT IS RECOMMENDED THAT THIS BE PERFORMED WITH AN EXTERNAL DUMMY ANTENNA/WATTMETER FOR ACCURATE RESULTS. A SPECTRUM ANALYZER MAY BE UTILIZED FOR MINIMIZED HARMONIC ADJUSTMENT. It is recommended that these adjustments be performed by a qualified engineer.

FREQUENCY SET- FINE

This adjustment is located on the PLFM-100 pc board. If it becomes necessary to change the fine (within 5 kHz) frequency, connect a frequency counter (attenuated) to the RF output, and with power control turned to minimum, rotate the trimmer capacitor located near the reference crystal Y1 until the desired frequency is obtained. Be sure the counter has been calibrated to a primary frequency standard prior to adjusting.
# 4) TROUBLESHOOTING

If a problem exists in this unit, please refer to this chart.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No output / low output</td>
<td>1, 9</td>
</tr>
<tr>
<td>Unit will not lock (led will not extinguish)</td>
<td>2, 3, 6, 8</td>
</tr>
<tr>
<td>Audio distortion</td>
<td>4, 5</td>
</tr>
<tr>
<td>Unit locks randomly</td>
<td>5, 6, 8</td>
</tr>
<tr>
<td>Tuning voltage not at 2.0 V on DVM</td>
<td>2, 3, 5, 6</td>
</tr>
<tr>
<td>Tuning voltage jumps from below 2V to above 2V</td>
<td>7</td>
</tr>
<tr>
<td>Unit will not lock on desired frequency</td>
<td>2</td>
</tr>
<tr>
<td>Unit has low output after changing frequency</td>
<td>9</td>
</tr>
</tbody>
</table>

**Solutions**

1) Check power supply.
2) Dip switches not properly set, see instructions.
3) L1 coil out of lock range.
4) Excessive audio input.
5) L1 on PLFM-100 assy. at end of lock range.
6) L1 on PLFM-100 assy. improperly adjusted, see instructions.
7) Turning L1 on PLFM-100 assy. too rapidly.
8) Excessive RF, see instructions, or reinstall shields.
9) PLFM-100 Interstage capacitors not set properly

---NOTICE---

If you can not find solution to problem, contact factory for technical assistance. We will be happy to assist you at no additional charge (in or out of warranty).

---8) SWITCH PROGRAMMING CHART---

When changing frequency, the following items are affected and may require and readjustment of the following controls will be necessary when changing frequency:

PLFM-100 assy - trimcaps , TC1, TC2
Use a spectrum analyzer or 200mHz oscilloscope to assure tuning accuracy.

n = not used

Please refer to switch legend.

Note that a logic "0" is closed (on) ^ dip switch layout

And a logic "1" is open (off) ^ nnnnn123 ---- 4567891011

^ LSB-----------MSB

Pcb edge ----- ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^ I

11 9 8 7 6 5 4 3 2 1 <--switch location on diagram above----I
0 1 1 0 1 1 1 0 0 0 0 88.0
0 1 1 0 1 1 1 0 0 0 1 88.1 0 1 1 0 1 1 1 0 1 1 89.1
0 1 1 0 1 1 1 0 0 1 0 88.2 0 1 1 0 1 1 1 1 1 0 89.2
0 1 1 0 1 1 1 0 0 1 1 88.3 0 1 1 0 1 1 1 1 1 0 89.3
0 1 1 0 1 1 1 0 1 0 0 88.4 0 1 1 0 1 1 1 1 1 0 89.4
0 1 1 0 1 1 1 0 1 0 1 88.5 0 1 1 0 1 1 1 1 1 1 89.5
0 1 1 0 1 1 1 0 1 1 0 88.6 0 1 1 1 0 0 0 0 0 0 89.6
0 1 1 0 1 1 1 0 1 1 1 88.7 0 1 1 1 0 0 0 0 0 1 89.7
0 1 1 0 1 1 1 1 0 0 0 88.8 0 1 1 1 0 0 0 0 0 1 89.8
0 1 1 0 1 1 1 1 0 0 1 88.9 0 1 1 1 0 0 0 0 1 1 89.9
0 1 1 0 1 1 1 1 0 1 0 89.0 0 1 1 1 0 0 0 0 1 0 0 90.0