

FM Experts Pro-Audio Analog FM Stereo Transmitter

FM Experts Model No.

FM-110

Finally an economical ANALOG DESIGNED Professional FM transmitter /exciter. Dual RCA; miniature stereo; and powered microphone inputs for "audiophile" quality without the need expensive external low pass input filtering ! Remember the days of "hi-fi"...well that High Fidelity is back in our analog design !

- No more disappointment in audio quality ! This baby knocks the doors off those cheesy digitally multiplexed units, whatever the price!
- Designed by John Ramsey, synonymous with low cost high quality FM exciter, utilizing 7 Analog Integrated Circuits to generate the stereo signal.
- PLL Rock solid Frequency Output
- Smooth slide level adjusters, just like a professional mixer board!
- LCD display monitor with E-Z setup controls. Output power Monitor standard



INTRODUCTION

With the continued technological growth of audio, our ever expanding input of information and entertainment comes from more and more numerous sources. On-line music and news services are replacing shortwave radio of the past, and entertainment from satellite radio lets us dial up our favorite music, news, and sports entertainment choices at the touch of a button. Truly, the digital age has overtaken our concept of music and entertainment in a short period of time.

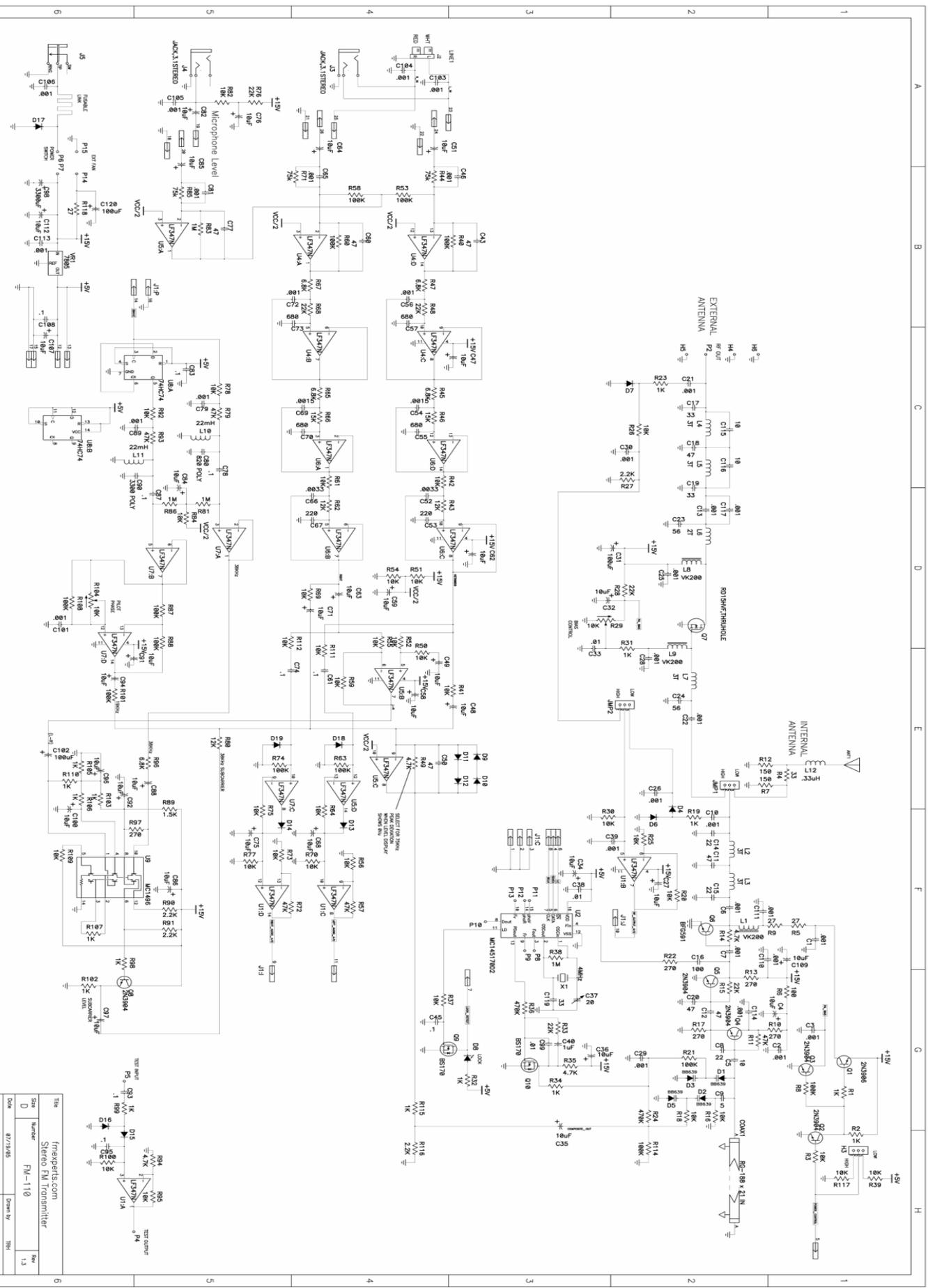
Along side this revolution has come the need to connect our entertainment to wireless sources of transmission, so that we can enjoy our favorite selections via short range transmission. There are a myriad of tiny hand held appliances to re-broadcast our entertainment, but herein lies the problem, the “catch 22” of the digital age, our hearing is an *analog* function. The net result of capturing information, digitizing it for transmission, and demodulating it for our enjoyment depends on the quality of the analog signal we listen to, and our ears can detect the slightest bit of distortion or background noise in the signal. In fact, many times when listening to such a transmitted signal we actually focus on the distortion as opposed to the information or entertainment we intended to listen to!

FM Transmission 101:

Let's take a closer look at Frequency Modulation, or FM radio transmission. The true “invention” of FM radio was less than one hundred years ago, thanks to Edwin Howard Armstrong, in his quest to do away with the static produced by the then standard AM transmissions of the time. Another advantage of FM that was discovered is the superior frequency range of audio signals that could be contained within it, with a range from about 50 Hz to 15 kHz, far surpassing the range of AM transmission, giving a High Fidelity audio signal to the end user. Typical human hearing range is from about 20-20 kHz (although more typically 14-18 kHz is the high range of an average adult.). Fast forward to the 1960's, and the roll-out of the stereo multiplex system that would allow for compatible transmission of stereo and mono FM radio. Hey...I wanted an FM transmitter and got a history lesson!

The following figure represents the audio components encoded in the current FM broadcast signal FM. The Left + Right signal is the original FM modulation, and contains the information for monaural, or non-stereo reception. Injected above the monaural audio is the 19 kHz stereo pilot signal, which the stereo receiver doubles to use as a reference for demodulating the Left - Right audio information. So how do we get two channels of audio from that? If the demodulated L-R is added or subtracted to the L+R signal I.e. $(L+R) - (L-R) = 2R$ or $(L+R) + (L-R) = 2L$, the result is an independent L and R demodulated signal.

Now that we have outlined what we needed to accomplish for the high fidelity signal, lets get to the schematic and see how it is done.



File	fmproject.com
Size	1.3
Number	FM-110
Date	07/19/05
Drawn	MATLABACKEN
Checked	THI
Sheet	1
Total	1

FM EXPERTS FM110 USAGE INSTRUCTIONS:

We know you are anxious to get your transmitter up and running; here are the rules of thumb for set up and operation.

CHOOSING AN FREQUENCY OF OPERATION

It is your responsibility that your personal transmissions not interfere with any existing FM broadcast station. We recommend that you research station listings in your local area, paying particular attention to the lower end of the FM broadcast band (88—92 MHz) as medium power stations are typically allocated in that frequency range. Another test may be to use either a high quality FM receiver with an external antenna to search for low power stations and acceptable substitute for this would be a current automotive radio connected to the external car antenna.

CONFIGURING YOUR FM110 FOR OUTPUT POWER SELECTION

Your transmitter has been designed for operation with different output power configurations. Note that for many countries, only low power operation is permitted, using the “on board” whip antenna in the lower power configuration. It is your responsibility to be aware the laws in your country before operating the transmitter.

When jumpered in Low power mode, only the internal whip antenna is active, the rear panel RF output connector is disabled.

When jumpered in the High power mode, the internal whip is disabled and the rear panel RF output connector is enabled—you must connect a suitable antenna or dummy load to the transmitter when in High power mode!

Please note the following steps for proper configuration of your unit. There are three “jumper wires” that must be configured properly for lower power operation. See the flowing diagram for jumper locations.

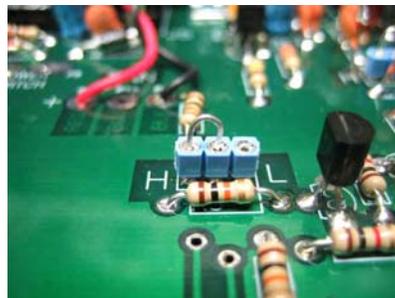
- 1. Disconnect power to the unit.
- 2. To configure the unit to low power, whip antenna operation, you should remove the four cover screws on the bottom side of the unit. The case will open into two halves. **USE CAUTION** as there are several jumper wires that run between the circuit boards. Gently open the case top so that you can see the main circuit board, the area of interest is the three jumper wire headers as shown in the diagram and pictures. There is no need to disconnect the internal wires that connect the main pc board to the display pc board.

- 3. For Low power operation, the three jumper wires (in the H1, H2 and H3 locations) should be placed in the header

center hole of
and
connected to
connection.



Header H1 and H2 Location
(High Power configuration shown)

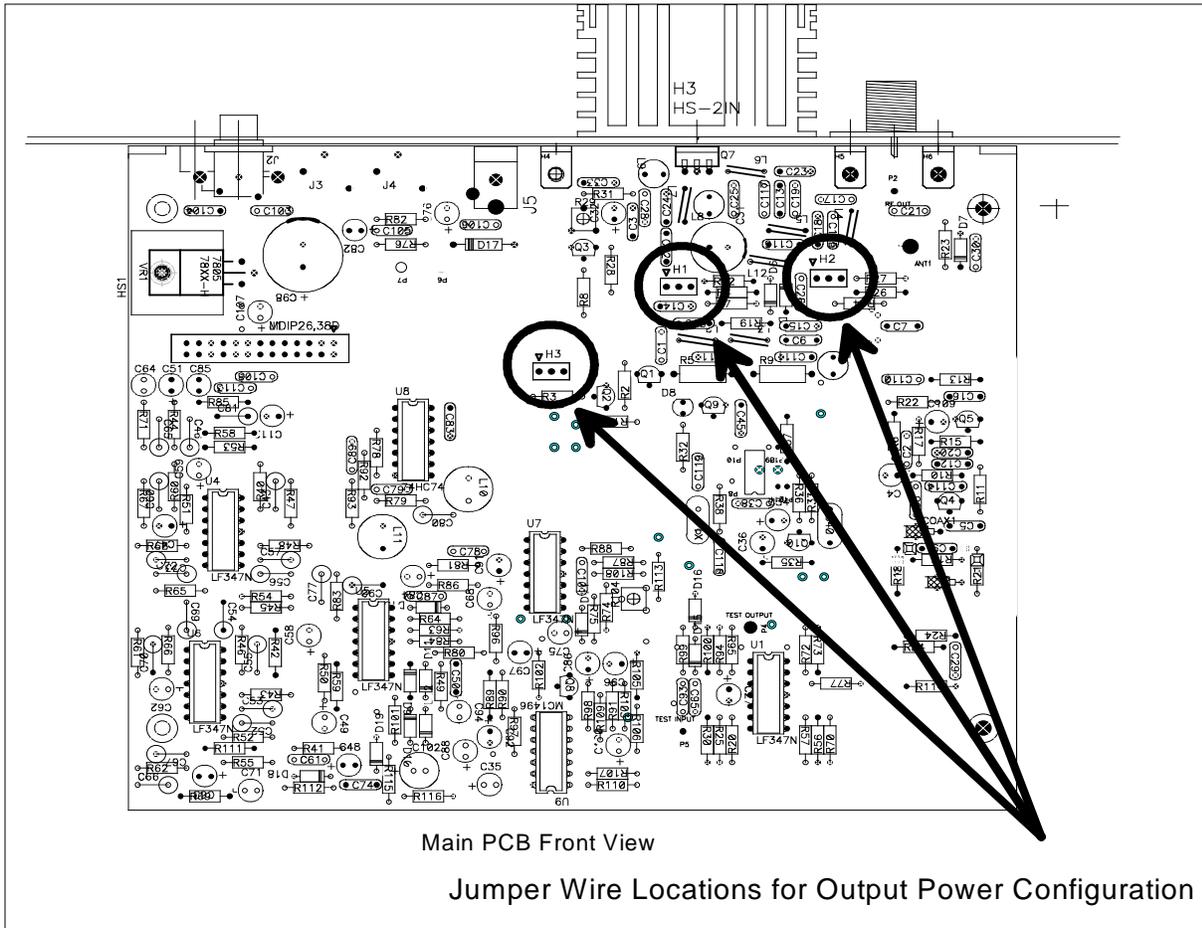


the
the “L”

FM110 • 5

Header H3
(High Power configuration shown)

- ❑ 4. For High power operation, the three jumper wires (in the H1, H2 and H3 locations) should be placed in the center hole of the header and connected to the “H” connection.
 - ❑ 5. The jumper wires can be removed and replaced with a small needle-nose pliers or tweezers, be sure that the wire fits snug into the center and L holes provided on the header.
6. Re-install cover and cover screws.



E-Z SETUP AND OPERATION INSTRUCTIONS

Be sure to have your whip antenna connected for low power operation, or a proper antenna or load if using the SO-239 high power output configuration.

Insert the power cord into the appropriate rear panel connector. Plug the AC power cord into an appropriate outlet.

Energize the unit by toggle in the power switch to the "ON" position. An indication of proper power up will be the display energizing and briefly displaying the startup screen showing software revision and power jumper setting. The display will then cycle to the Frequency/Locked indicator screen (fig. 1) and then finally to the default Right Left audio level bar graph indicator screen as shown in figure 2.

Fig 1: Display shows the callsign - "FM EXP" in this case, as well as frequency and "Locked" indication which means that the PLL frequency control circuitry is locked.

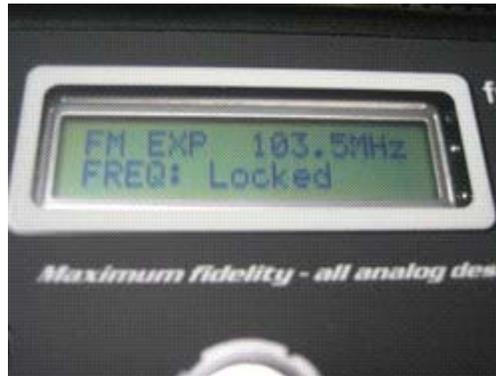


Fig 2: Default display showing Right and Left audio level bar-graph screen.

SETTING THE OUTPUT FREQUENCY OF YOUR TRANSMITTER

- Rotate the DATA ENTRY knob on the front panel until you reach the edit frequency screen (fig. 3). Press ENTER to edit frequency (exactly what it said in the screen!).

Dial the DATA ENTRY knob to the desired Mhz value (fig. 4).

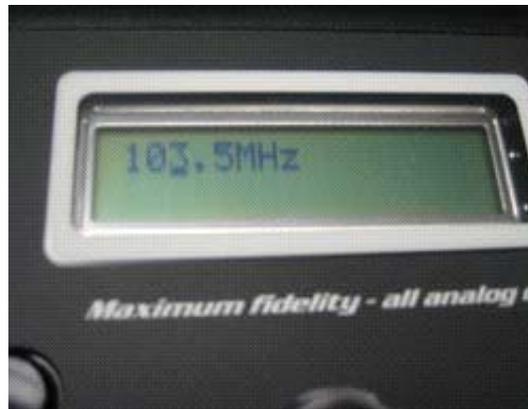


Fig 3: Edit frequency screen

- Depress the ENTER key again, and the MHz place for the frequency will be stored, and the decimal place for the frequency will be displayed.
- Dial the DATA ENTRY knob to the desired decimal value.

Depress the ENTER key again, the display will say "Saving data, please wait" then the screen will revert back to the Frequency/Locked screen (Fig. 1) and the transmitter will be operating on the new frequency.

Fig 4: Screen showing frequency entry



NAVIGATING THROUGH THE MENU SELECTIONS

There are several different display screens as you scroll through using the DATA ENTRY screens. Some of the additional screens monitor your output power, display a bar graph audio input, and display the transmit frequencies.

- As a rule of thumb, any entry screen that allows user inputs will follow the same conventions as the frequency setup screen. Pressing the ENTER key allows you to access the sub-menu, and the DATA ENTRY knob allows you to select individual text.

A few examples of data type displays are as follows:



Audio Input Level Indicator

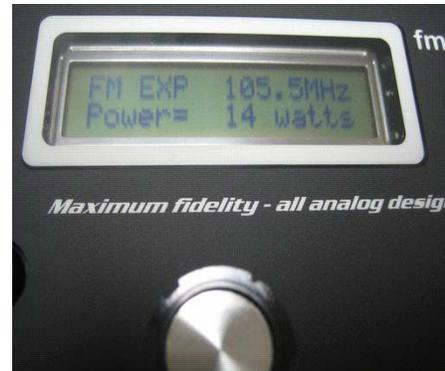
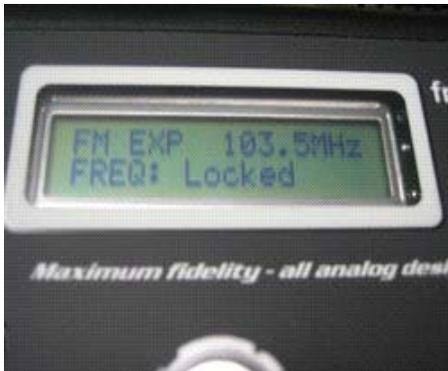


Frequency Display



Output Frequency and Output Power Level Displays

(Note: the power level indicated is only approximate and varies depending upon antenna match and frequency. Measured with a true RF power meter into a 50 ohm load, power is minimum 10 watts (high power jumper) across the FM band).



What about an antenna?

We recommend the use of the internal antenna and low power jumpering, however if your jurisdiction permits, using the unit on high power with an effective antenna will provide for best operating range. The external antenna jack is a standard SO-239 coax connector as found on most amateur and CB equipment, and this connector is readily available at most any electronic supplier. An effective and simple antenna called a "dipole" can be easily constructed from coax cable and TV twin lead. While it is beyond the scope of this manual, a google search for "fm dipole antenna" will yield many hits! Correct dipole lengths for various parts of the FM band are:

88 MHz: each leg 2.7 feet - 5.4 feet total
98 MHz: each leg 2.4 feet - 4.8 feet total
108 MHz: each leg 2.2 feet - 4.4 feet total

ALL SET !

We are hoping by now you have become more comfortable with the menu selections and operation of this transmitter. By now you should have your transmit frequency set and locked, and found the display you would most like to see during operation. To save your selection so that when the unit is turned off and then back on, press the ENTER key one more time on the screen you would like to use upon power up.

Slide all three of the volume controls to their minimum position.

Now the fun part, connect a line level output from your CD or MP3 player to the unit, and dial a stereo receiver to the transmitting frequency.

Your microphone input was designed to accommodate a standard "computer type" external microphone input (the ones with a small stand do nicely).

Play some music from your source, set the volume to a reasonable level on the output (about half way or so), and slide the associated front panel sliding control until you hear the rich, full sound coming from your receiver.

You are all set, and on the air!

We sincerely hope that you enjoy the use of this product. We have tried to compose our manual in the easiest, most user-friendly format that is possible.

Keep an eye on our website for manual revisions, as we receive feedback we hope to pass along helpful information regarding this product.