FM5 Transmitter

User's Manual

Revision Control

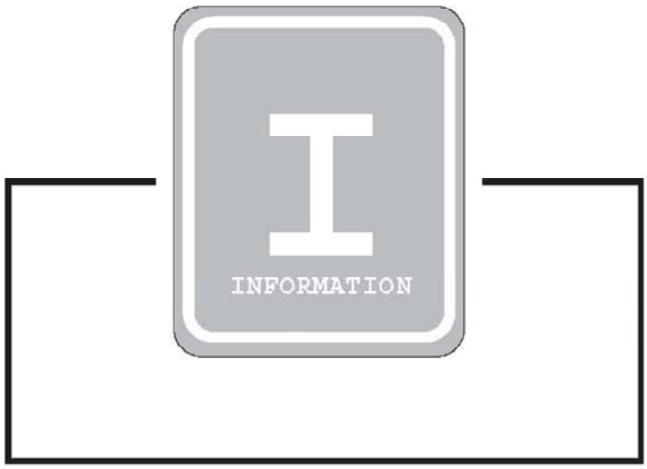
Revision	Print Date
Initial Release	2020

Important Notices

Crown Broadcast attempts to provide information that is accurate, complete, and useful. Should you find inadequacies in the text, please send your comments to the following address:

International Radio & Electronics Corporation
2524 Toledo Rd,
Elkhart, IN 46516 U.S.A.

Contents



Section 1—Getting Acquainted

This section provides a general description of the FM5 transmitter and introduces you to safety conventions used within this document. *Review this material before installing or operating the transmitter.*

1.1 Your Transmitter

The FM5 is a member of a family of FM stereo broadcast transmitters. Crown transmitters are known for their integration, ease-of-use, and reliability.

The integration is most apparent in the standard transmitter configuration which incorporates stereo generation and RF amplification without compromised signal quality.

Ease-of-use is apparent in the user-friendly front panel interface and in the installation procedure. Simply select your operating frequency (using 5 external switches), add an audio source, attach an antenna, and connect AC power and you're ready to broadcast.

Reliability is a Crown tradition. The first Crown transmitters were designed for rigors of worldwide and potentially portable use. The modular design, quality components, engineering approach, and high production standards ensure stable performance.

Illustration 1-1 FM5 Stereo Broadcast Transmitter

1.2 Applications and Options

Crown transmitters are designed for versatility in applications. The FM5 can be used as a stand-alone transmitter and in nearcast applications. The following discussion describes these applications further.

Model numbers describe the configuration of the product (which has to do with its intended purpose) and the RF output power which you can expect.

The number portion of the name represents the maximum RF output power. The FM5 generates up to 5 watts of RF output power

The FM5 is the standard or transmitter configuration. In this configuration, the product includes the following components (functions):

- RF Exciter & Stereo Generator
- RF Low-Pass filter
- RF Amplifier
- Power Supply

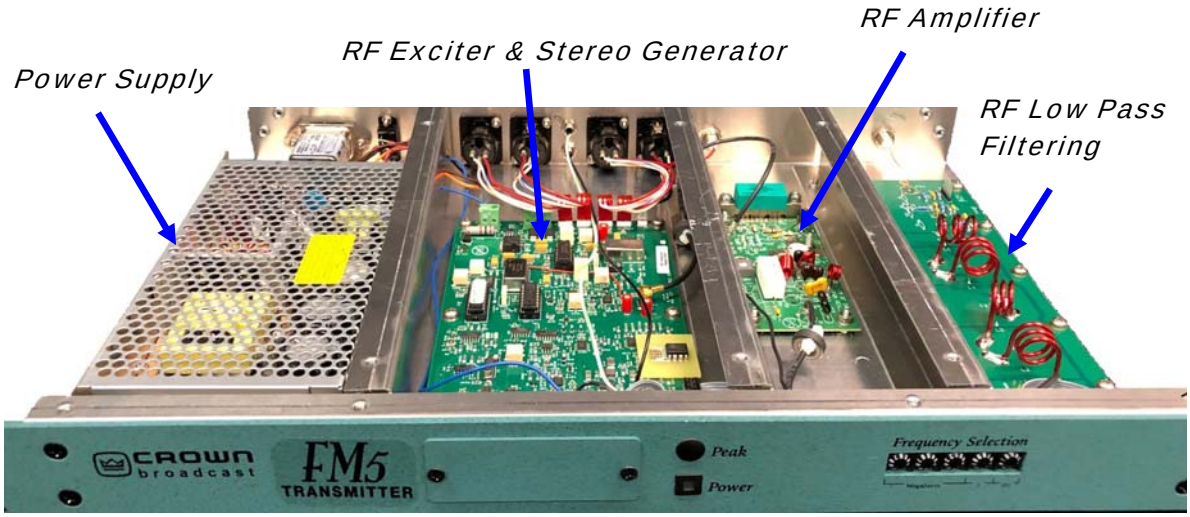


Illustration 1–2 Standard (Transmitter) Configuration

1.2.1 Stand-Alone

In the standard configuration, the FM5 is an ideal stand-alone transmitter. When you add an audio source (monaural, L/R stereo, or composite signal), an antenna, and AC power, the transmitter becomes a complete FM stereo broadcast station, capable of serving your small venue requirements, whether inside a church, outside in a parking lot, football stadium, race track or drive-in-theater.

1.2.2 FM5, SDoC approved

The FM5 is an SDoC (Supplier Declaration of Conformity) approved transmitter. (Go to ecfr.gov and do a simple search Title 47, 2.906) This means Crown Broadcast must send with the transmitter a Proof of Performance that states this transmitter meets or exceeds the FCC requirements for an FM transmitter.

This transmitter can be used with an FCC granted STA (Special Temporary License. Go to ecfr.gov and do a simple search Title 47, 5.61) An application must be sent to the FCC, if approved it would give a Special Temporary License at a specific frequency, for a specific area, for no more than 6 months.

You could also turn this transmitter down to 1 watt and transmit in compliance with Part 15 requirements as long as your antenna does not broadcast outside 250 µV/m at 3 m. You need to be aware that the FCC requires Part 15 Transmitters to be approved by the FCC and this transmitter does NOT have Part 15 approval and could be subject to heavy FCC fines for operating without a license. See 3.5 for suggestions on how to reduce the chances that you are violating Part 15.

To find vacant channels in your zip code area, go to radio-locator.com and choose the vacant channels option. It will request the zip code of the area you are wishing to broadcast in and will give you any vacant channel options - best, good, and ok.

The following was copied from fcc.gov website:

Penalties for Operation Without A Permit or License

The Commission considers unauthorized broadcast operation to be a serious matter. Presently, the maximum penalty for operating an unlicensed or "pirate" broadcast station (one which is not permitted under Part 15 or is not a Carrier Current Station or Campus Radio Station) is set at $10,000 for a single violation or a single day of operation, up to a total maximum amount of $75,000.

Adjustments may be made upwards or downwards depending on the circumstances involved. Equipment used for an unauthorized operation may also be confiscated. There are also criminal penalties (fine and/or imprisonment) for "willfully and knowingly" operating a radio station without a license. ***DON'T DO IT!***

1.3 Transmitter/Exciter Specifications

Frequency Range	87.9 MHz–107.9 MHz
RF Power Output	(VSWR 1.7:1 or better)
FM5	0-5.5 Watts adjustable
RF Output Impedance	50 Ohms
Frequency Stability	Meets FCC specifications from 0-50 degrees C
Audio Input Impedance	50k Ω bridging, balanced, or 600 Ω
Audio Input Level	Selectable for –10 dBm to +10 dBm for 75 kHz deviation at 400 Hz
Pre-emphasis	Selectable for 50, 75 µsec or flat
Audio Response	Conforms to 75 µsec pre-emphasis curve as follows:
Complete Transmitter	±0.30 dB (50 Hz–10 kHz) ±1.0 dB (10 kHz–15 kHz)
Exciter only	±0.25 dB (50 Hz–15 kHz)
Distortion (THD + Noise)	
Complete Transmitter	Less than 0.7% (at 15kHz)
Exciter only	Less than 0.3% (50Hz-15kHz)
Stereo Separation	
Complete Transmitter	Better than –40dB (50Hz-15kHz)
Exciter only	Better than –40dB (50Hz-15kHz)
Crosstalk	Main into Sub, better than –40dB Sub into Main, better than –40dB
Stereo Pilot	19 kHz ±2 Hz, 9% modulation

Subcarrier Suppression	50dB below ±75 kHz deviation
FM S/N Ratio (FM noise)	
Complete Transmitter	Better than –60dB
Exciter only	Better than –70dB
AM S/N Ratio	Asynchronous and synchronous noise better than FCC requirements
RF Bandwidth	±120 kHz, better than –35 dB
	±240 kHz, better than –45 dB
RF Spurious Products	Better than –70dB
Operating Environment	Temperature (0°C to 50°C)
	Humidity (0 to 80% at 20°C)
	Maximum Altitude (3,000 Meters; 9834 Feet
AC Power	120 volts +10%/-15%); 50/60Hz

Note: We set voltage and ampere requirements to assist you in designing your system. Depending on your operating frequency, actual requirements for maximum voltage and current readings are 10–15% lower than stated.

Regulatory	
FM5	Type notified FCC SDoC Meets FCC, DOC, and CCIR requirements
Dimensions	27.94 x 41.91 x 2.54 cm 11 x 16.5 x 1 inches
Weight	
FM5	2.7 kg (6 lbs) 3.6 kg (8 lbs) shipping weight

1.4 Safety Considerations

Crown Broadcast assumes the responsibility for providing you with a safe product and safety guidelines during its use. “Safety” means protection to all individuals who install, operate, and service the transmitter as well as protection of the transmitter itself. To promote safety, we use standard hazard alert labeling on the product and in this manual. Follow the associated guidelines to avoid potential hazard.

1.4.1 Dangers

DANGER represents the most severe hazard alert. Extreme bodily harm or death will occur if DANGER guidelines are not followed.

1.4.2 Warnings

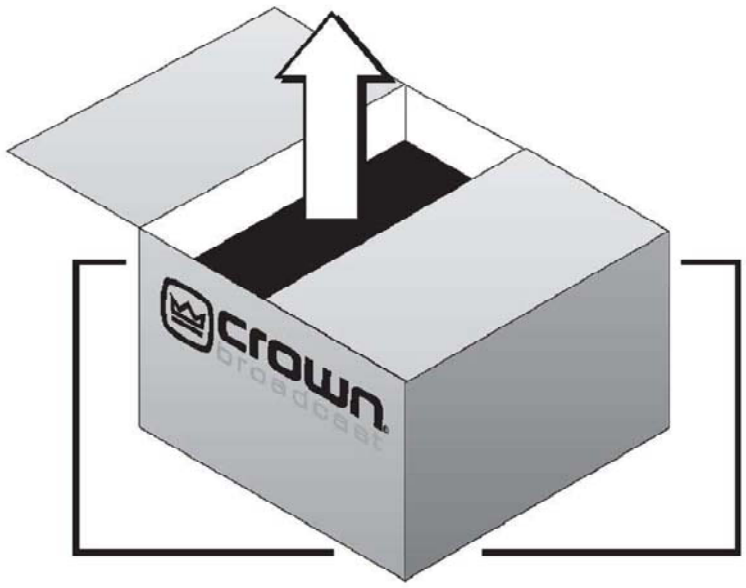
WARNING represents hazards which could result in severe injury or death.

1.4.3 Cautions

CAUTION indicates potential personal injury, or equipment or property damage if the associated guidelines are not followed. Particular cautions in this text also indicate unauthorized radio-frequency operation.

Illustration 1–3 Sample Hazard Alert

Installation 2-3



Section 2—Installation

This section provides important guidelines for installing your transmitter. Review this information carefully for proper installation.

CAUTION

Possible equipment damage!

Never connect a battery charger to the input terminals of the transmitter unless a battery is also connected. Voltage peaks from a typical charger (without the load of a battery) can be destructive to the transmitter.

2.1 Operating Environment

You can install the FM transmitter in a standard component rack or on a suitable surface such as a bench or desk. In any case, the area should be as clean and well ventilated as possible. Always allow for at least 2 cm of clearance under the unit for ventilation. If you set the transmitter on a flat surface, install spacers on the bottom cover plate. If you install the transmitter in a rack, provide adequate clearance above and below. Do not locate the transmitter directly above a hot piece of equipment.

2.2 Power Connections - AC & Fuse

The FM5 operates on 120 volts AC (50 or 60 Hz; single phase).
The fuse holder is located on the back panel to the left of the On/Off switch.

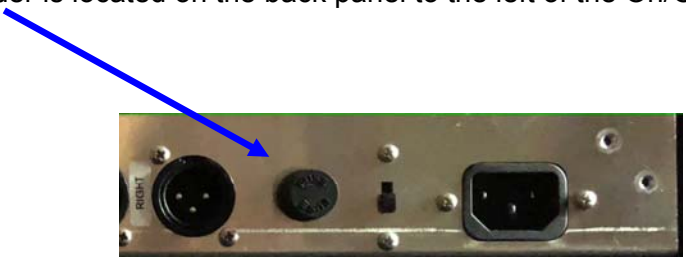


Illustration 2–1 Fuse Holder

For 120 VAC operation, use the fuse installed at the factory.

Transmitter	Input Power	Fuse
FM5	100–120 V	6 A

Illustration 2–2 Fuse Reference Table

2.3 Frequency (Channel) Selection

Your transmitter is capable of operating between 87.9 and 107.9 MHz in the FM band. To adjust the operating frequency, follow these 0.1 MHz steps:

1. Locate the frequency selector switch on the front panel which will be used to change the setting. See Illustrations 2–6 and 2–7.

2. Use small flat blade screwdriver or another suitable device to rotate the switches to the desired setting. (The selected number will appear directly above the white indicator dot on each switch.) See examples of selected frequencies in the illustration below.

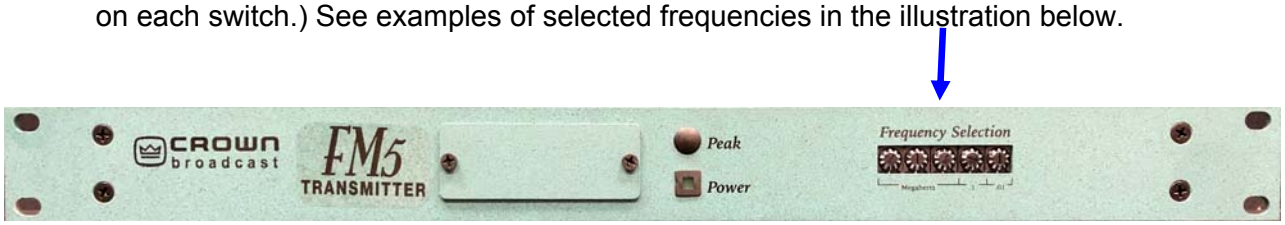


Illustration 2–3 Front Panel

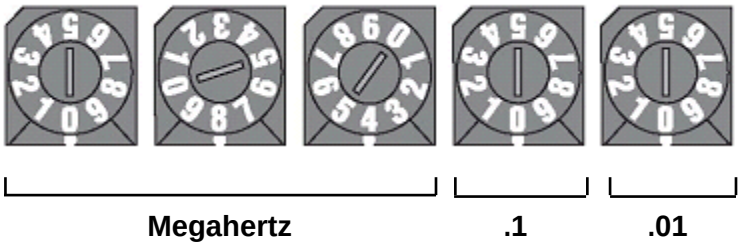


Illustration 2–4 Transmitter Front Panel (Frequency Selector Switches)

= 88.10 MHz

= 107.90 MHz

Illustration 2–5 Two Sample Frequency Selections

3. To set the changed frequency, either turn the transmitter off and then back on or press, the black push button inside the front panel opening twice.

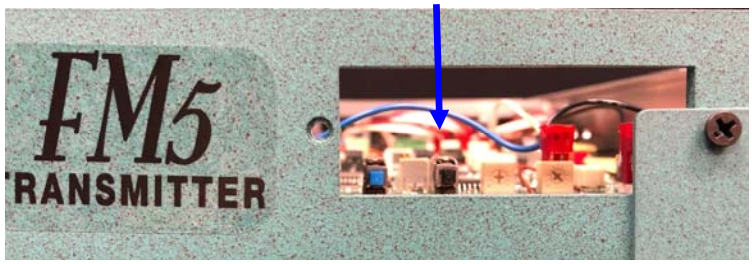


Illustration 2–6 Front Panel Opening

2.4 RF Connections & Antennas

Connect the RF load, an antenna or the input of an external power amplifier, to the type-N, BNC output connector on the rear panel.

A simple antenna is included which will work for most applications.

However, if another antenna is attached, you will need to remove the top cover and clip or unsolder the wire from the resistor to the BNC. See illustration 2-10 below.

Illustration 2–9 RF Output

Cut or Unsolder before attaching a different antenna

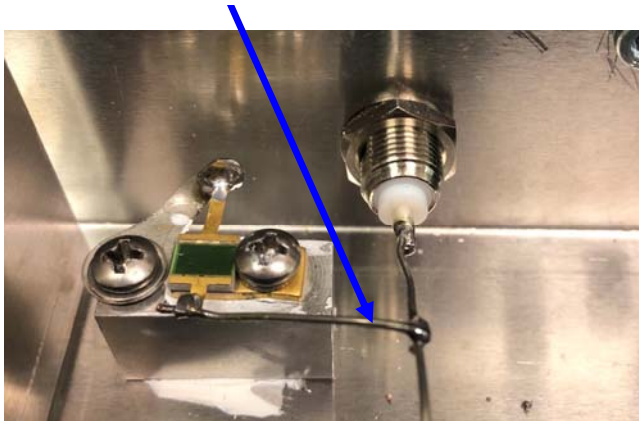


Illustration 2–10

2.5 Audio Input Connections

Attach audio inputs to the Left and Right XLR connectors on the rear panel. (The Left channel audio is used on Mono.) Pin 1 of the XLR connector goes to chassis ground. Pins 2 and 3 represent a balanced differential input with an impedance of about 50 kΩ . They may be connected to balanced or unbalanced left and right program sources.
The audio input cables should be shielded pairs, whether the source is balanced or unbalanced. For an unbalanced program source, one line (preferably the one connecting to pin 3) should be grounded to the shield at the source. Audio will then connect to the line going to pin 2.

Illustration 2–10 XLR Audio Input Connectors

By bringing the audio return line back to the program source, the balanced differential input of the transmitter is used to best advantage to minimize noise. This practice is especially helpful if the program lines are fairly long, but is a good practice for any distance.

2.6 Audio Output Connections

Attach audio outputs from the Left and Right XLR connectors on the rear panel. (The Left channel audio is used on Mono.) Pin 1 of the XLR connector goes to chassis ground. Pins 2 and 3 represent a balanced differential input with an impedance of about 50 kΩ . They may be connected to balanced or unbalanced left and right program sources.
The audio output cables should also be shielded pairs, whether the source is balanced or unbalanced.

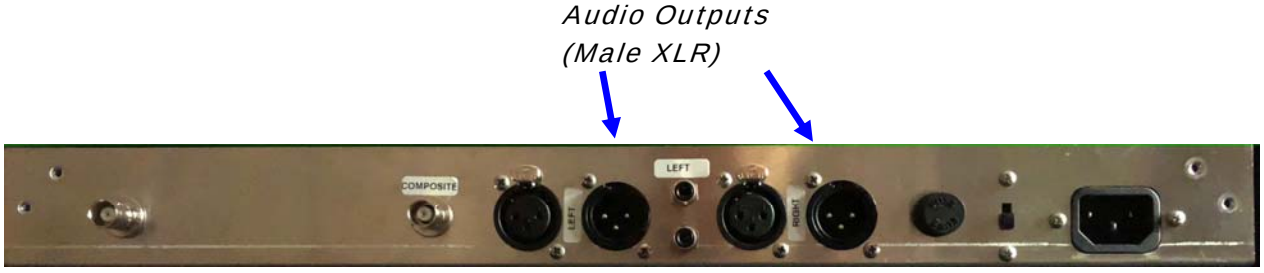


Illustration 2–11 XLR Audio Output Connectors

2.7 Composite Input Connection

You may feed composite stereo (or mono audio) directly to the RF exciter bypassing the internal audio processor and stereo generator. To use the Crown transmitter with composite input, it is necessary to use the Composite Input section of the transmitter. This will feed composite stereo (or mono audio) directly to the RF exciter and will bypass the internal stereo generator.

Input sensitivity is approximately 3.5–volt P-P for 75 kHz deviation.

1. Enable the Composite Input by adding a jumper across the pads of JP2 (see Illustration 2–12).

2. Connect the composite signal using the “Composite In” BNC connector.

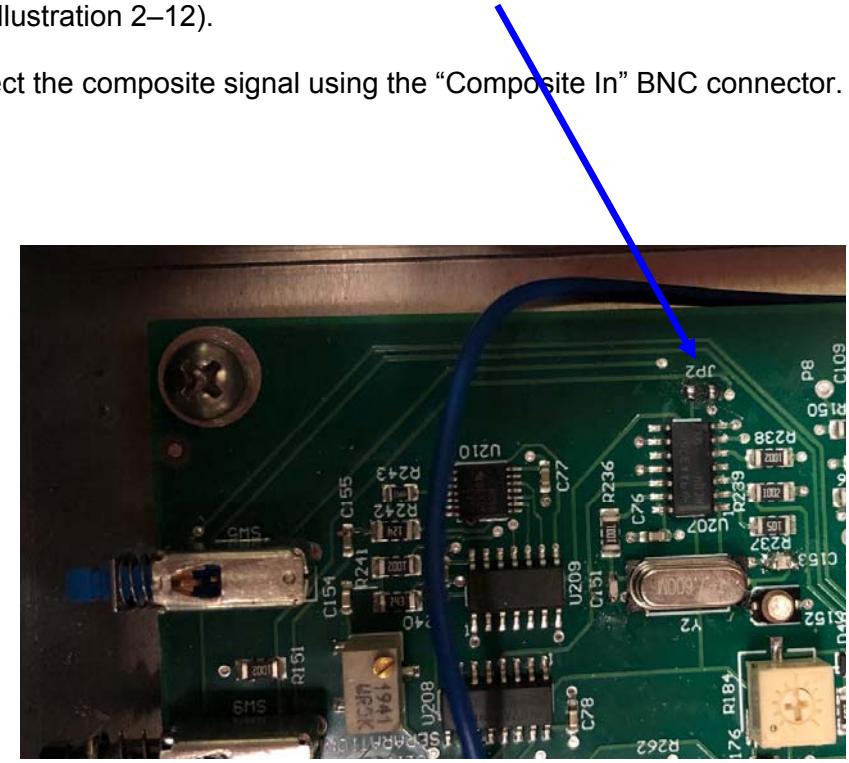


Illustration 2–12 Jumper JP2

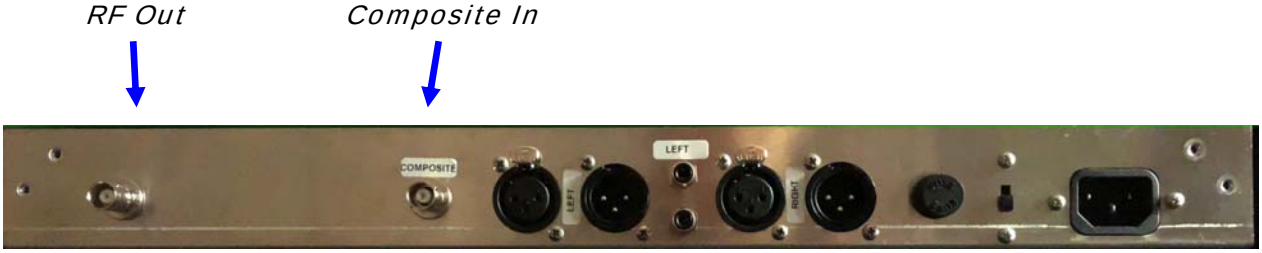


Illustration 2–13 Composite In Connection

2.8 Audio Monitor Connections

Processed, de-emphasized samples of the left and right audio inputs to the stereo generator are available at the Monitor jacks on the rear panel. The signals are suitable for feeding a studio monitor and for doing audio testing. De-emphasis is set for 75 µsec.

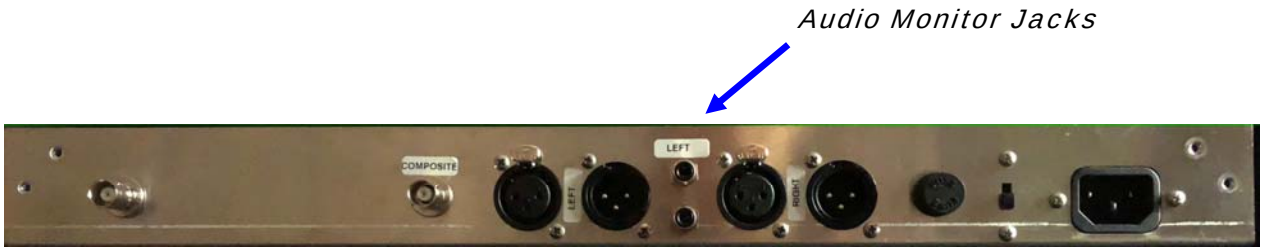


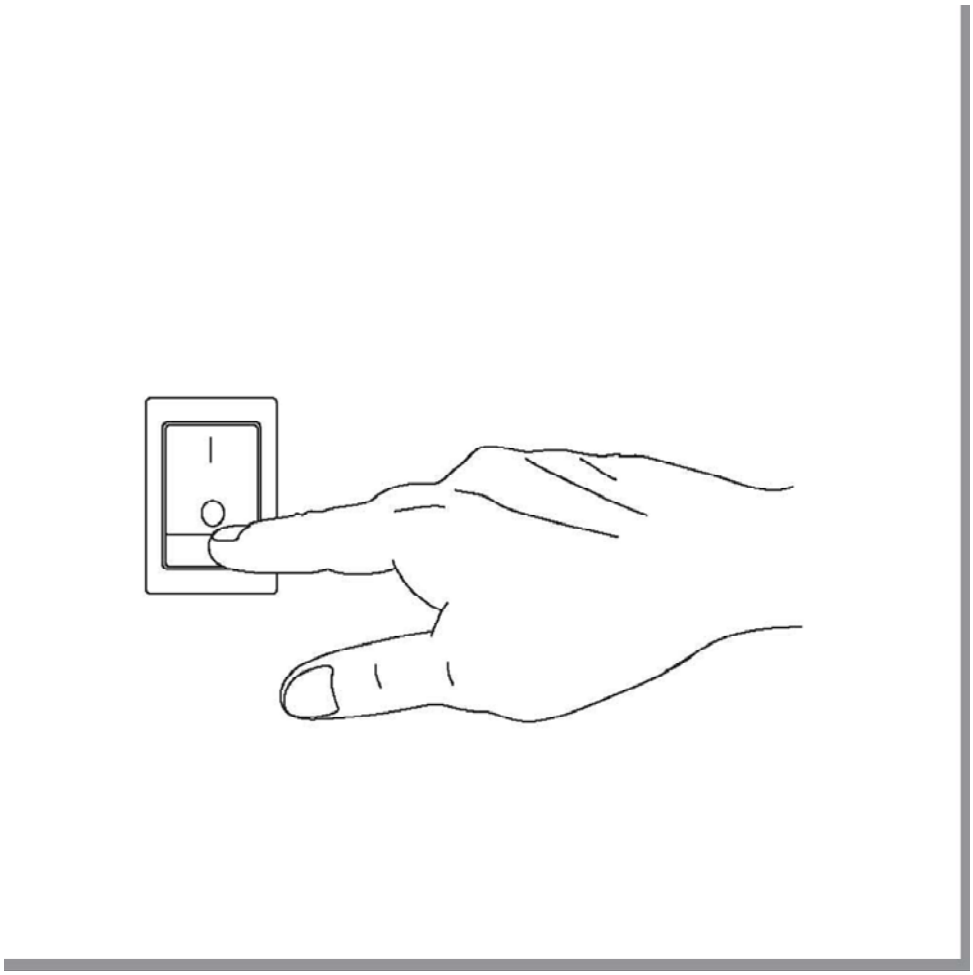
Illustration 2–14 Audio Monitor Connections

2.9 Pre-emphasis Selection

FM5 is set-up for 75 µsec. If you wish to change it to be 50 µsec or flat, please call the Crown Service department and they will walk you through the steps.

2.10 Modulation Compensator

The Modulation trim-potentiometer is NOT a modulation control. This pot compensates for slight variations in deviation sensitivity with frequency. From the factory, it is set for 50% or midrange and this is where we recommend that it remain. However, if there is a reason that this needs to be adjusted, go to Appendix A for details on how to do this.



Section 3—Operation

This section provides general operating parameters of your transmitter and a detailed description of the front panel display.

3.1 Power Switch

These steps summarize the operating procedures you should use for the initial operation of the transmitter. More detailed information follows.

⚠ CAUTION

Possible equipment damage!

Before operating the transmitter for the first time, check for the proper AC line voltage setting and frequency selection as described in sections 2.2 and 2.3.

1. Plug in the power cord at the back of the unit.
2. Turn on the power switch.

Illustration 3–1 Rear Panel Power Switch

3.2 Peak Modulation

This part of the circuitry is not yet available.

3.3 Stereo-Mono Switch

The Stereo-Mono blue push button switch is located inside the front panel opening. This switch selects the transmission mode. In Mono, feed audio *only to the left channel*. Although right-channel audio will not be heard as audio modulation, it will affect the audio processing.

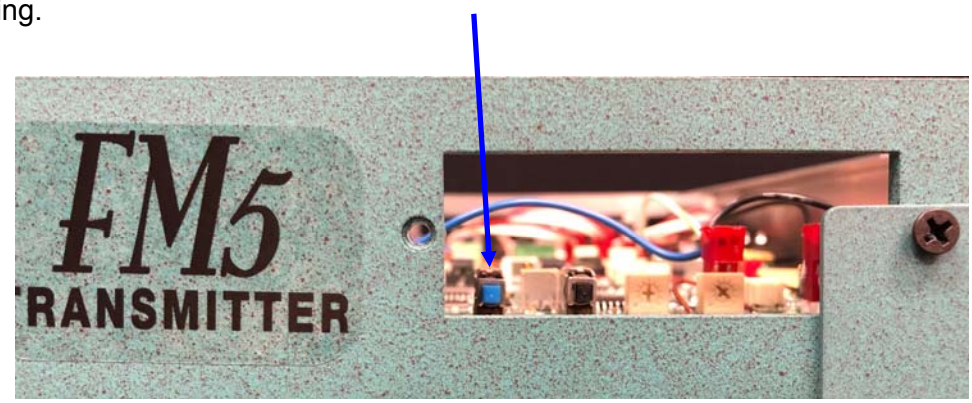


Illustration 3–3 XLR Stereo-Mono switch

3.4 Frequency Selector Switch

The Frequency Selector button switch is located inside the front panel opening. This switch resets the frequency of the transmitter if you push it twice. You can also turn the transmitter off and back on again. See also 2.3.

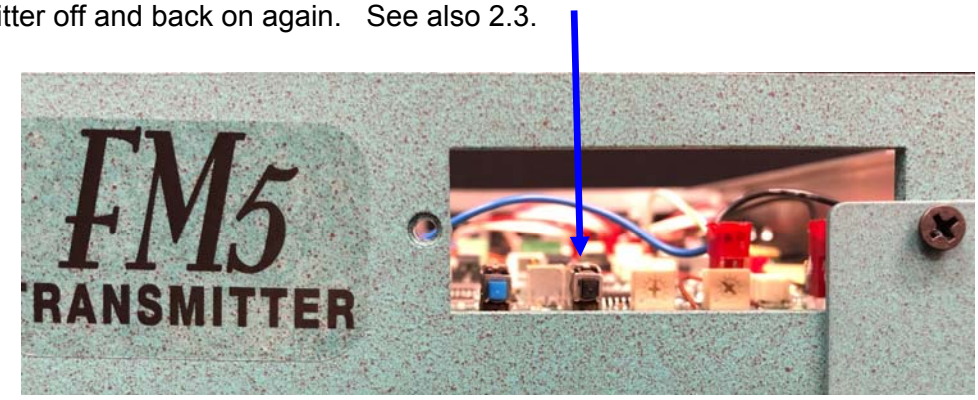


Illustration 3–4 Frequency Selector Switch

3.5 RF Output Control

This is the Trim pot to the far right in the front panel opening. Using a small screwdriver, turning to the left turns down the RF watt output, turning to the right turns it up. This transmitter is set so that you cannot turn it above 5 watts. However, be aware, that your antennae has more to do with how far you transmit than the actual RF watts being used. (FYI, if you do not fully extend the antenna that is included and it will also reduce the transmitting range.)

Set this control for the desired output power level. Preferably, set the power with an external RF wattmeter connected in the coaxial line to the antenna. You may also use the RF power reading on the digital multimeter.

It is recommended that once you are set up, you drive around the outskirts of your intended area of transmission, to ensure that you are not broadcasting a strong signal outside the area you were intending. Whether you are using a STA or Part 15, you must stay within your broadcast permission area or the FCC may access heavy fines.

Illustration 3–3 XLR RF Output Control

.

Section 4—Service and Support

We understand that you may need various levels of support or that the product could require servicing at some point in time. This section provides information for both of these scenarios.

4.1 Service

The product warranty (see opposite page) outlines our responsibility for defective products. Before returning a product for repair or replacement (our choice), call our Customer Service department using the following telephone number:

(574) 218-6547

Our Customer Service Representative will give you further instructions regarding the return of your product. Use the original shipping carton or a new one obtained from Crown.

You may be required to leave a message at this number but your call will be returned promptly from our on-call technician.

4.2 Spare Parts

Included are 5 Fuses, 6.3A Slo-Blo 5mmX20mm. You can purchase these anywhere you prefer. If you want to order them through us, please be aware that we have a minimum parts order of $15.

Crown Broadcast Five Year Limited Product Warranty

Summary Of Warranty

Crown Broadcast IREC warrants its broadcast products to the ORIGINAL PURCHASER of a NEW Crown Broadcast product, for a period of five (5) years after shipment from Crown Broadcast. All products are warranted to be free of defects in materials and workmanship and meet or exceed all specifications published by Crown Broadcast. Product nameplate with serial number must be intact and not altered in any way. This warranty is non - transferable. This warranty in its entirety is the only warranty offered by Crown Broadcast. No other warranties, expressed or implied, will be enforceable.

Exclusions

Crown Broadcast will not warranty the product due to misuse, accident, neglect and improper installation or operation. Proper installation includes A/C line surge suppression, lightning protection and proper grounding of the entire transmitter, and any other recommendations designated in the Instruction manual. This warranty does not extend to any other products other than those designed and manufactured by Crown Broadcast. This warranty does not cover any damage to any accessory such as loads, transmission line or antennas resulting from the use or failure of a Crown Broadcast transmitter. Warranty does not cover any loss of revenue resulting from any failure of a Crown Broadcast product, act of God, or natural disaster.

Procedure for Obtaining Warranty Service

Crown Broadcast will repair or service, at our discretion, any product failure as a result of normal intended use. Warranty repair can only be performed at our plant facility in Elkhart, Indiana USA or at a factory authorized service depot. Expenses in remedying the defect will be borne by Crown Broadcast, including two-way ground transportation cost within the continental United States. Prior to returning any product or component to Crown Broadcast for warranty work or repair, a Return Authorization (RA) number must be obtained from the Crown Broadcast Customer Service Department. Product must be returned in the original factory pack or equivalent. Original factory pack materials may be obtained at a nominal charge by contacting Crown Broadcast Customer Service. Resolution of the defective product will be made within a reasonable time from the date of receipt of the defective product.

Warranty Alterations

No person has the authority to enlarge, amend, or modify this warranty, in whole or in part. This warranty is not extended by the length of time for which the owner was deprived the use of the product. Repairs and replacement parts that are provided under the terms of this warranty shall carry only the unexpired portion of the warranty.

Product Design Changes

Crown Broadcast reserves the right to change the design and manufacture of any product at any time without notice and without obligation to make corresponding changes in products previously manufactured.

Legal Remedies of Purchaser

This written warranty is given in lieu of any oral or implied warranties not covered herein. Crown Broadcast disclaims all implied warranties including any warranties of merchantability or fitness for a particular purpose.

Crown Broadcast
2524 Toledo Road, Elkhart, Indiana 46516-5768,
Phone: (574) 262-8900, E-mail: FMSales@irec1.com
www.crownbroadcast.com

Glossary

AF	Audio Frequency; the frequencies between 20 Hz and 20 kHz in the electromagnetic spectrum.
AM	Amplitude Modulation; the process of impressing information on a radio-frequency signal by varying its amplitude.
Bandwidth	The range of frequencies available for signaling.
BNC	A bayonet locking connector for miniature coax; said to be short for Bayonet-Neill-Concelman.
Broadband	As used in the FM transmitter; refers to the entire audio spectrum as opposed to the spectrum influenced by the pre-emphasis; also called “Wideband”.
Crosstalk	In FM broadcasting, the term generally refers to the interaction between the main (L+R) and the subcarrier (L_R) signals as opposed to “separation” which generally refers to leakage between left (L) and right (R) channels.
Deviation	The amount by which the carrier frequency changes either side of the center frequency.
Distortion	The unwanted changes in signal wave shape that occur during transmission between two points.
Exciter	(1) A circuit that supplies the initial oscillator used in the driver stage. (2) A transmitter configuration which excludes stereo generation and audio processing.
FM on	Frequency Modulation; the process of impressing a radio signal by varying its frequency.
LED	Light Emitting Diode
Modulation	The process by which a carrier is varied to represent an information-carrying signal.
Nearcast	A transmission within a localized geographic area (ranging from a single room to several kilometers).
Pilot	A 19-kHz signal used for stereo transmissions.
Pre-emphasis	The deliberate accentuation of the higher audio frequencies; made possible by a high-pass filter.

Processing	The procedure and/or circuits used to modify incoming audio to make it suitable for transmission.
RF	Radio Frequency; (1) A specific portion of the electromagnetic spectrum between audio-frequency and the infrared portion. (2) A frequency useful for radio transmission (roughly 10 kHz and 100,000 MHz).
S/N	Signal to Noise
Spurious products	Unintended signals present on the transmission output terminal.
Stability	A tolerance or measure of how well a component, circuit, or system maintains constant operating conditions over a period of time.
Stereo Pilot	See “Pilot.”
Stereo separation	The amount of left channel information that bleeds into the right channel (or vice versa).
Subcarrier	A carrier signal which operates at a lower frequency than the main carrier frequency and which modulates the main carrier.
Suppression	The process used to hold back or stop certain frequencies.
THD	Total Harmonic Distortion
VSWR	Voltage Standing Wave Ratio; see “SWR.”
Wideband	See “Broadband.”

2.3.1 Modulation Compensator

The Modulation trim-potentiometer (see illustration A–2) compensates for slight variations in deviation sensitivity with frequency. If you have a problem, R72 can be adjusted. From the factory, it is set for 50% or midrange. Set the trim-pot dial according to the following graph:

Frequency of Operation (MHz)	Modulation Compensation Pot Setting
108	0
106	10
104	15
102	25
100	35
98	40
97.1	45
96	55
94	60
92	70
90	75
88	80
86	80
84	80
82.4	70
82	65
80	55
78	30
76	0

Illustration A-1 Modulation Compensator Settings

These compensator settings are approximate. Each mark on the potentiometer represents about 10% modulation compensation.

Modulation Compensator Pot

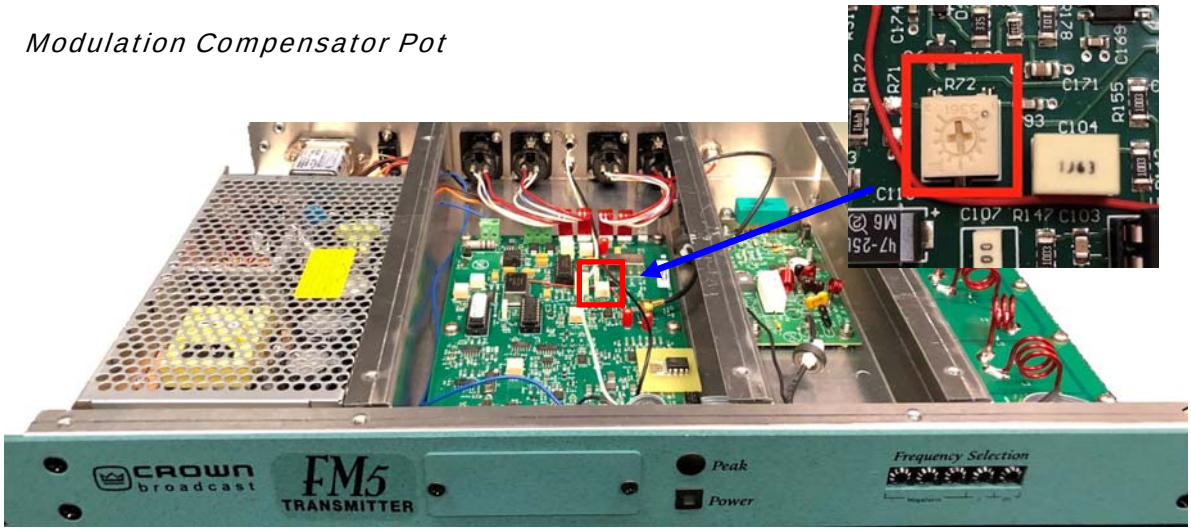


Illustration A-2 Modulation Compensator Pot