



Model M15-25

Solid-State VHF Aeronautical Band
Radio Receiver/Transmitter Base Station

(118.000-136.975 MHz)

INTRODUCTION

This equipment includes a Mentor Model M15 transceiver, a Mentor Model PA25 radio frequency RF power amplifier, power supplies and remote interface circuits, all contained within a 3-1/2 inch high rack cabinet. The M15 front panel is accessible through a cutout in the rack panel. The front panel controls include the main power on-off switch (with green LED indicator), and receiver volume and squelch controls which are part of the M15. The M15 also contains a frequency selector switch, which provides for optional operation on as many as six channels. A speaker is mounted behind the grille on the front rack panel. The M15-25 includes an interface for a variety of types of remote operation.

In addition to the M15-25, a complete installation requires a suitable antenna and coaxial cable, with connectors, and an suitable aviation-type microphone with a 3/16 inch 3-circuit plug.

DESCRIPTION

The M15 transceiver contains a solid state receiver and a 5 watt (carrier) solid-state amplitude modulated (a.m.) transmitter. Its transmitter output is applied to the PA25 RF. power amplifier unit, which has a gain of approximately 5 times (7 dB), thereby producing a 25 watt carrier signal at the antenna.

The M15 receiver is a single conversion superheterodyne with a crystal controlled local oscillator. To obtain good rejection of unwanted off channel signals, the receiver's dual gate mosfet RF. amplifier is quadruple-tuned using varactor tracking. The local oscillator output is frequency-tripled to 10.7 Mhz above the channel frequency and then applied to a dual-gate mosfet mixer (down-converter) stage. Receiver selectivity is primarily determined by two crystal filters; the first filter (6-poles) is between the mixer output and the 1st integrated circuit intermediate frequency (I.F.) stage, while the second filter (2 additional poles) is between the 1st and 2nd I.F. amplifier stages. Following a diode detector, the audio signal is processed through a noise limiter, squelch "gate" and an integrated circuit audio power amplifier.

The oscillator of the M15's transmitter is also crystal controlled at one third the channel frequency. The oscillator output passes through a frequency tripler and buffer amplifier, then to a three stage power amplifier. Amplitude modulation is applied to the last two stages. The audio voice signal from the microphone is "leveled" to provide more uniform modulations levels for different microphones and operator "microphone techniques".

The 25 watt RF transmitter power amplifier contains a single mosfet power transistor, operating class AB, on a microstrip type printed circuit board. Two internal relays operate when the push-to-talk microphone switch is pressed. These relays switch the amplifier's input and output connections, so that in the receive mode the signal from the antenna is passed directly back to the M15's receiver, while in the transmit mode the M15's transmitter output is applied to the 25 watt amplifier, whose output is in turn connected to the antenna. The power amplifier also contains a 5 section low-pass filter that greatly attenuates transmitter harmonics so that the system meets FCC requirements for signal purity.



INSTALLATION

The M15-25 can either simply rest on a shelf or desk, or it may be mounted in a 19 inch relay rack. When rack mounted, rear support is not required. This unit does not contain a cooling fan, and does not normally need one. However, when rack mounted there should be a minimum of 1-1/4 inch above and below the cabinet to allow air circulation. When the M15-25 is located on a desk or shelf, do not place equipment, papers, magazines, etc. on top of it that would restrict its ability to stay cool. Note that during extended or frequent transmissions, the heat sinks on the rear panel will become quite hot. While these have nylon covers for safety, under heavy use conditions operators should be cautious about reaching behind the M15-25 and touching these parts.

Power is applied via a standard power inlet and IEC removable line cord. A rotary switch on the inlet allows selection of either 115 or 230 volts ac. The fuse (part of power inlet), a 4 amp. “international” type, can be replaced by pulling out the fuse holder section (the cord must be removed first; and a light pry from a screw driver may help in accessing the fuse). There is room for a spare fuse inside the power inlet.

The antenna connector is type N. If the antenna coax does not mate with this type, adapters are available from Mentor Radio or from many electronic distributors. Connections for remote operation, when needed, are made via the 25 pin connector (type DB25) on the rear of the cabinet.

The antenna should be either a wideband type (118-137 MHz) or a narrow band type tuned to the channel frequency. If a 3 or 6 dB gain antenna is used, communications range will be increased, because gain antennas effectively increase both receiver sensitivity and transmitter power. Low loss coaxial cable is recommended, especially if the cable length exceeds 30 feet (10 meters).

Plug an aircraft type or suitable pedestal type microphone into the microphone jack on the front panel of the M15. Be sure the plug is pushed all the way into the jack.

If remote operation is to be used, refer to the section on this subject later in this manual.

OPERATION

An on-off “rocker” type switch is in the center of the front panel. When lit, the built-in green LED indicator shows that (1) the switch is in the *on* position (2) the equipment is receiving power from the ac line (3) the internal dc power supply is operating.

To operate, the M15 transceiver, which projects through M15-25 the rack panel, must also be turned on by rotating its volume control switch clockwise. If the squelch control knob is turned fully counterclockwise, receiver noise should be heard in the speaker; the noise should get louder as the volume control is rotated more clockwise. If there is to be no operator at the radio, and only remote operation is to be used, the volume control may be set to minimum (fully CCW, without turning radio off). It is not necessary to turn off the M15 if the M15-25 is turned off—the power to the M15 is removed when the front panel rocker switch is turned off (green LED goes off).



If the M15 has more than one frequency, select the desired channel. Frequency selection may not be made remotely. If the M15 contains crystals for only one channel, the frequency selector switch will have two positions and either position will select the one available frequency.

If the background noise is annoying, it can be eliminated by rotating the squelch control clockwise. Turn the squelch knob only as far as necessary to stop the noise—turning it farther than necessary may prevent calls from distant aircraft from being heard in the receiver’s speaker. If it is anticipated that it may be necessary to receive some very weak signals, use no squelch at all (control fully CCW).

To transmit to an aircraft, fully depress the push-to-talk (PTT) switch on the microphone and speak clearly and distinctly into the front of the microphone. Use a normal voice—not too soft nor too loud (many readability problems are caused by poor “mike technique”). If the microphone is a noise-canceling type it is absolutely necessary to hold the microphone very close to your mouth—these microphones are very sensitive to this distance.

A red LED lamp on the M15 lights up when power is applied to the transmitter by pressing the PTT switch. If this lamp stays on after the PTT button is released, a “stuck microphone” is indicated. If you cannot release the PTT switch (button), turn off the radio or remove the microphone plug so that your continuous transmission will not prevent others from using the radio channel. In an emergency, you can transmit by plugging the microphone back in each time you want to transmit.

Although this equipment has been designed for congested radio signal environments, very strong nearby transmissions on other channels may “bleed through” or desensitize the receiver. This does not mean that the receiver is operating improperly. If interference is a significant problem, contact Mentor Radio for assistance.





Phone: 216-265-2315 Fax: 216-267-2915, www.mentorradio.com (4/11)

REMOTE OPERATION

The 25 pin D-subminiature type connector on the rear panel contains all the connections needed for various types of remote operation. The functions of the different connector pins are as follows:

<u>PIN NUMBER</u>	<u>FUNCTION</u>	<u>COLOR</u>
	Mic PTT	Gray
2	Mic Audio	Violet
3	Ground	Black
4	Ground	Black
5	Ground	Black
6	Ground	Black
7	4 Ohm RCVR out	Green
8	4 ohm RCVR out	Green
9	500/600 Ohm RCVR out	Green
10	Squelch Break	Blue
25	+14 VDC	Yellow

Connections to the mating connector can use #22 gauge wire. Note that there are four ground terminals and two terminals for the 4 ohm receiver audio output. The ground terminals may be used as needed for various remote connections; in some circumstances it may be desirable to “double-up”, using two ground pins in parallel. (Each pin is rated for 1 ampere.) The 4 ohm audio receiver outputs can be used with one or two external speakers. The +14 vdc can supply up to 500 ma. To operate external remote equipment. The 500/600 ohm receiver audio output can be used for remote stations or for a tape recorder output. Its level is factory adjusted to 0 dBm (0.77 v rms) but may be adjusted internally for any level from -7 to +10 dBm by trimmer potentiometer R205 on the printed circuit board inside the M15-25. Both the 4 ohm and the 500/600 ohm receiver audio outputs are unaffected by the volume control on the M15, the latter affecting only the speaker on the front panel of the M15-25.

The remote microphone audio input should be in the range -10 to -16dBm (0.3 to 0.15 v rms). If this voltage is too high the modulation may be distorted when transmitting—that is, the voice transmissions may not sound as clear. If this occurs, trimmer potentiometer R207 (on printed circuit board inside M15-25) can be adjusted to reduce the microphone audio level. The colors listed above refer to the usual color codes when using Mentor Radio part number 1101368 6-conductor remote cable.



MAINTENANCE

No routine maintenance is necessary, other than to remove accumulated dust. If the equipment is accidentally impacted or dropped operation should be fully checked and an internal inspection made for loose or broken parts.

SERVICING AND REPAIR

Should the M15-25 require warranty servicing, return it to us with a description of the problem. For out-of-warranty servicing we also recommend returning the unit to us, however, if local servicing is preferred, service manuals can be obtained from this website. **SERVICE SHOULD ONLY BE ATTEMPTED BY TECHNICIANS EXPERIENCED WITH THIS TYPE OF EQUIPMENT AND WHO HAVE AVAILABLE THE APPROPRIATE TEST EQUIPMENT.**

LICENSING

In the United States, all transmitters must be licensed by the Federal Communications Commission (FCC). Applications for base stations are filed on FCC form 406. The M15-25 contains two different pieces of equipment which must be listed on the application. Do not list the M15-25; instead list the M15 transceiver (FCC identification no. QQTM15) and the PA-25 power amplifier (FCC identification No. QQTPA25). With each new M15-25, Mentor Radio includes instructions on how to complete form 406 online at the FCC Internet web site (Dwg. 1100958).

If the M15-25 is to be used on a channel in the frequency range of 128 to 132 Mhz (the “enroute” channels), the license application is handled differently. Assignment of specific frequencies and the completion of form 406 is done by Aeronautical Radio Incorporated (ARINC), a private organization which contracts to the FCC to manage this part of the spectrum. Refer to Mentor Radio drawing number 1101472, enclosed with new units containing an enroute frequency.





FCC LICENSE NOTICE

The radio equipment you have purchased requires FCC licensing. This was formerly done by completing and mailing FCC Form 406. This has been replaced by electronic online filing via the Universal Licensing System (ULS). The Internet address for this is www.wireless.fcc.gov/uls. This site provides instructions for the application, as well as online forms to complete and transmit electronically, as well as instructions for payment of filing fees.

In the past, Mentor Radio provided information required by Form 406 for its specific models. This information may still be needed when you make the online application, and is provided below for your assistance. The Mentor Radio Model identification is not the same as the FCC Identification. The first table below gives the FCC Identification and the transmitter power for Mentor models.

For all Mentor Radio transmitters enter “6K00A3E” for “emission and bandwidth” (“0” is a numerical zero, not the letter following “N”).

You may be asked for a “Class of Station”. The second table below can help you select your Class. You must apply for a frequency that the FCC permits for your selected Class. Some of the permissible frequencies are listed below. For a complete listing of available frequencies, consult the FCC rules, Part 87.173 (available online at www.wireless.fcc.gov/rules).

Mentor Model	FCC Identification	Transmitter Output
M15	QQTM15	5 watts
M15-25	QQTM15 and QQTPA25	25 watts
MB	QQTMB	10 watts

Class of Station	FCC Code	MR Models	Typical Use	Frequencies Available
Aeronautical Advisory	FAU	MB, M15	Unicom	No tower: 122.700, 122.800 Tower on field: 122.950 Heliport: 123.050, 123.075
Aeronautical Multi-com	MFL	MB, M15	Air/Ground	Coordination 122.850, 122.900, 123.100
Search & Rescue	SAR	MB, M15		123.100
Aviation Support	FAS	all	Flight Schools, Soaring	123.300, 123.500, 121.950
Aero. Utility Mobile	MOU	M15	Airport vehicles Gnd. Cont. & tower freqs	
Aeronautical Enroute	FA	all	ARINC, Corp.	128.825 to 132.000
Flight Test	FAT	all	Manufacturers	123.200, 123.225
Control Tower	FAC	MB, M15-25	numerous	118.000-136.975





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LIMITED WARRANTY

Your Mentor Radio Division equipment is warranted to the original consumer purchaser only, for one full year, to be free from defects in materials and workmanship under normal use. This warranty does not include damage to the product resulting from accident or misuse. This warranty will not be effective unless you submit a Warranty Registration online at <http://www.mentorradio.com>.

If the equipment should become defective within the warranty period, we will elect to repair or replace it, without charge, if returned, postage prepaid, to the address shown below. We are not liable for defects or damages caused by the use of unauthorized replacement parts and/or service.

ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO ONE YEAR. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

MENTOR RADIO, LLC., BECAUSE OF LACK OF CONTROL OVER THE CONDITIONS OF USE OF THIS EQUIPMENT, IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. ANY RECOVERY MAY NOT BE GREATER THAN THE PURCHASE PRICE PAID FOR THE EQUIPMENT. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above may not apply to you.

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