

OWNERS MANUAL

RFCAST

Model MT300 (-E & -U)
300 WATT FM STEREO TRANSMITTER



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USER NOTICES

IT IS VERY IMPORTANT TO READ THE FOLLOWING MANUAL SECTIONS PRIOR TO OPERATION OF THIS TRANSMITTER!

Notice 1

The transmitter main operating voltage setting is marked on the rear of the MT300 chassis. It may be necessary to change this setting for your operating condition.

Please refer to AC Main Voltage Setting in section 6.0 Set Up Procedure.

Notice 2

The transmitter operating frequency from the factory may not be set for your authorized frequency as it is normally set for a mid band value such as 98.0 MHz.

Please refer to Frequency Of Operation Change in section 6.0 Set Up Procedure.

Notice 3

For adjusting the RF output power setting a qualified technician should employ the use of an RF Wattmeter and a calibrated dummy load.

Please refer to the section entitled RF Power Control in section 3.4 of this manual.

Notice 4

The factory settings of this manual for such this as Input Selection, preemphasis, and input sensitivity may not be correct for your application or installation requirements.

Please refer to the other exciter settings in section 6.0 Set Up Procedure where you will be directed where else to reference in this manual.

GENERAL COMMENTS

THIS PRODUCT DOES NOT INCLUDE A DETAILED TECHNICAL MANUAL, RATHER AN ENHANCED OPERATORS MANUAL. WHAT THIS DOCUMENTATION IS INTENDED TO DO IS TO GIVE THE USER THE CORRECT INSTRUCTIONS AND INDICATIONS ABOUT HOW TO OPERATE AND PERFORM PERIODIC CHECKS AND DETERMINE IF THE TRANSMITTER IS FUNCTIONING PROPERLY.

WE ARE AWARE THAT THE TRANSMITTER DOCUMENTATION MAY PRESENT SOME SMALL AMBIGUITIES AND IMPERFECTIONS, MANY OF WHICH HAVE ALREADY BEEN NOTED AND RESOLVED IN THE NEXT RELEASE AND PRODUCTION. FOR THIS REASON, EVERY OBSERVATIONS/SUGGESTIONS OR PARTICULAR COMMENTS ARE WELCOME.

ELECTRONIC FILES OF THE SCHEMATIC DIAGRAMS IN THIS MANUAL ARE AVAILABLE. SHOULD A LARGER MORE VIEWABLE VERSION OF ANY DIAGRAM BE REQUIRED NOTIFY RICHARDSON ELECTRONICS, LTD.

TO CALL OUR TECHNICAL SUPPORT CENTER OR FOR OTHER CUSTOMER SERVICE ISSUES AT RICHARDSON ELECTRONICS IN LA FOX, ILLINOIS REFER TO THE FOLLOWING NUMBERS:

TECHNICAL SUPPORT: 630-208-2790

CUSTOMER SERVICE: 630-208-2304

WARNING!

THE VOLTAGES AND CURRENTS IN THIS EQUIPMENT ARE DANGEROUS. PERSONEL MUST, AT ALL TIMES, OBSERVE SAFETY WARNINGS, INSTRUCTIONS, AND ANY REGULATIONS.

This owner's manual is intended as a general guide for trained and qualified personnel who are aware of the dangers that are inherent in the handling and operation of potentially hazardous electrical and electronic circuits. It is not the intent of this manual to provide a complete set of safety instructions or precautions that should already be understood by trained or experienced personnel in using this or other types of electronic equipment.

The installation, operation, and maintenance of this equipment involves risks to personnel and also to the equipment. Broadcast Richardson or Richardson Electronics, Ltd. shall not be responsible for injury or damage that is the result of improper procedures or use by persons improperly trained or lacking the knowledge to perform associated tasks.

All local codes for building, safety, fire, or related standards must be observed. Consult local authorities for the standards for the area or region where the equipment will be installed and put in use.

WARNING!

AT ALL TIMES DISCONNECT AC/MAINS POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, PANELS, OR PROTECTIVE SHIELDS THAT EXPOSE LIVE CIRCUITS. USE ANY GROUNDING STICKS OR OTHER SHORTING PROBES TO DRAIN ENERGY FROM CIRCUITS BEFORE SERVICING. NEVER PERFORM MAINTENANCE, MAKE ADJUSTMENTS, OR SERVICE THE EQUIPMENT WHEN ALONE OR FATIGUED.

WARNING!

IF ELECTROLYTIC OR OIL FILLED CAPACITORS ARE UTILIZED IN THE EQUIPMENT AND THE COMPONENT APPEARS LEAKY, OR IS BULGING, OR IF THE CASE OR COVERING OF THE COMPONENT APPEARS DAMAGED OR DISTRESSED ALLOW SUFFICIENT TIME FOR THE UNIT TO COOL OR FULLY DISCHARGE BEFORE SERVICING. SERVICING HOT OR LEAKY CAPACITORS CAN CAUSE A RUPTURE OF THE CASE AND POSSIBLE INJURY.

Should accident or injury occur personnel engaged in the installation, operation, or service of the equipment should seek proper medical attention. It is advisable that such personnel have familiarity with first-aid practices.

Returns and Exchanges

Equipment (Damaged or undamaged) should not be returned unless written approval and a Merchandise Return Authorization (MRA Number) is received from your Richardson Sales representative or **Richardson Customer Service**. Special shipping instruction will be provided which will assure proper handling. The circumstances and reasons for the return must be included in the request for return. Equipment that is special or “custom” ordered may be not returnable. In situations where return or exchange is at the request of the customer a restocking fee may be charged. All returns must be sent freight prepaid and properly insured by customer. When communicating with **Broadcast Richardson** please refer to your Order or Invoice Number.

Unpacking

Use care when unpacking the equipment. First perform a visual inspection of the item(s) to determine if any damage occurred during shipment. Be sure to retain all the shipping materials (crates and boxes or cartons) until such time that it has been determined that the received equipment arrived undamaged. Find all PACKING LISTS and keep them to assist in locating and identifying any components or assemblies that may have been removed for shipping and might need to be reinstalled in the equipment. Make sure that all shipping straps, supports and packing materials are completely removed from the equipment prior to initialization and use.

Technical Support

Should you need technical assistance or trouble shooting guidance contact **Broadcast Richardson** in your local area or you can reach assistance from **Broadcast Richardson** in La Fox, Illinois at telephone +1 (630) 208-2782, Fax +1 (630) 208-2551 or Customer Service at +1 630-208-2304.

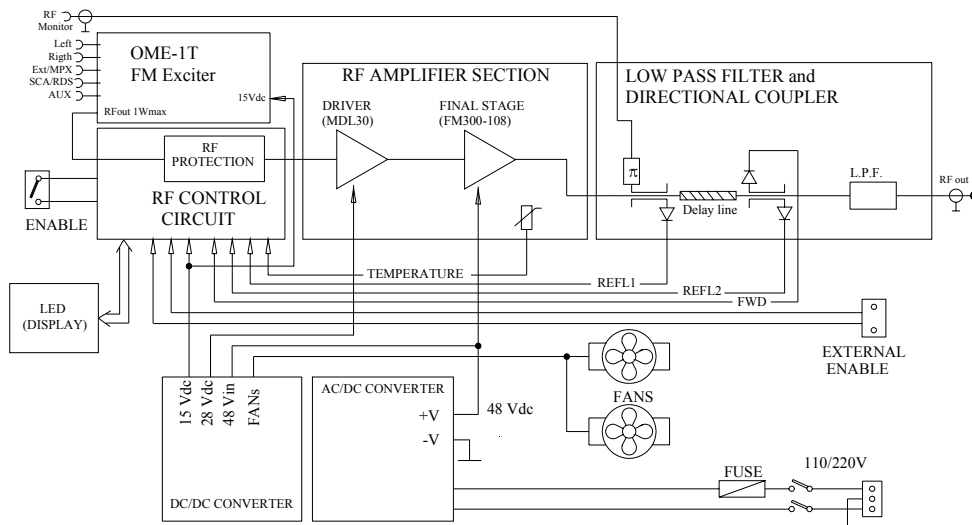
Throughout the world there are many Richardson Electronics, Ltd. offices that are also able to assist in contacting our technical support team.

MT300 FM LOW POWER TRANSMITTER 300 WATT

1.0 OVERVIEW

MT300 is a 300 Watt FM Stereo Low Power Transmitter. It is very simple and easy to operate. It is composed of a mechanical frame (19 inches std., 3 RU high and 500mm depth), a stereo exciter (OME-1T), a RF section, comprised of a RF control board and an amplifier section, a directional coupler and low pass filter, a display, and power supply composed of a AC/DC converter and a DC/DC converter.

2.0 BASIC BLOCK DIAGRAM OF MT300



3.0 SUBASSEMBLIES DESCRIPTION

3.1 MT300 AC/DC Power Supply

This power supply is a vendor-supplied product. The supply is an AC/DC supply that has a wide operating range permitting input voltages of 85 to 265 V producing an output voltage of 48V. Below are the technical specifications:

Nominal Output Voltage	48V
Max Output Current	13A
Max Output Power	624 Watt
Efficiency	83% typ.
Input Voltage Range	85-265VAC (47-63Hz)
PFHC	Built to meet EN61000-3-2
Power Factor(100/200VAC) (typ)	0.99/0.95
Output Voltage Range	43.2-52.8V
Over Voltage Protection	55.2-64.8

3.2 MT300 DC/DC Power Supply

The MT300 uses a DC/DC converter to provide a voltage of 15V to the exciter and a pulsed voltage of 28V to the fans (pulsing does not reduce the fans effectiveness but provides for hard start conditions). In addition, it supplies a voltage of 28V to the driver (MDL30). Below, are the technical specifications:

Vdc Input	20 up to 53 Vdc
Output 1	15 Vdc/1.5 A
Output 2	28 Vdc/3 A

3.3 FM Stereo Exciter

The exciter is RFCast model OME-1T. The declared nominal RF output power is 1 Watt; this signal is delivered to the RF final stage through the RF protection circuit. All the input connections are arranged on the front panel. (See the annex datasheet at a later section in this manual). Located on the rear panel of the MT300 are also Left & right audio inputs that appear on a screw terminal strip for convenience when rack mounted.

3.4 MT300 RF Control Circuit

The RF input circuit has 3 main functions:

RF power control

RF protection

Measurement/status indication

RF Power Control. A pin diode attenuator controls the RF input power coming from the exciter (OME-1T). This attenuator can be manually controlled by trimmer RT3 located on the internal control panel, to permit adjustment for the desired output power. To access RT3 the operator engineer will need to remove the transmitter top cover and locate the trimmer on the control panel using the Logic Control Board Layout Drawing found later in this manual. An AGC control regulates the output power, manually set, versus frequency and/or temperature changes. Moreover, the input attenuator includes a soft start, activated when switching on or after any RF protection intervention.

When the MT300 operates at a very high temperature and/or high reflected output power, a derating circuit is provided to decrease the output power to maintain equipment operation, although at a lower power.

RF Protection. A fast comparator switches when the detected output reflected power exceeds a pre-set threshold. The regulation of this threshold is made by RT2 trimmer, factory adjusted to a value of 30 Watts reflected power. When the protection is activated, the protection circuitry removes the RF drive signal applied to the final stage amplifier very quickly, in about 1 micro second.

Measurement/status indication. The two main measurements, FWD and REF power, are displayed by two BAR LEDs. The MT300 status is indicated with 3 LEDs: RF nominal, RF fault, RF derating. The RF fault is turned on when the output power is lower than 3 dB related to the nominal output power. If the power decreases in derating conditions, the fault is off in all cases. The enable switch SW1 is on the front panel. It is possible to turn on (enable) the transmitter using the contacts on the screw terminal on the transmitter rear panel. Enable or turning on the RF amplifier is realized when switch SW1 is in the on position and the rear panel enable is closed using a jumper connection or external relay.

WARNING: with enable off, there is no RF output, however all internal circuits are powered (stand by condition). For safety, it is important to switch off the mains voltage source or unplug the transmitter before operating inside. Be sure to return the transmitter cover before operating to permit the proper airflow and cooling of components.

3.5 MT300 RF Amplifier

The RF amplifier section serves to amplify the RF signal coming from the RF control circuit and exciter.

It is composed of:

MDL30 (Driver)

FM300-108 (Final Stage)

The **MDL30** provides the first step of amplification of minimum 17dB gain in order to correctly drive the final stages. It is composed of a stage operating in class AB. Below, the technical specifications:

VCC	28V
Idq	200 mA typ.
Frequency range	FM (87.5-108 MHz)
Power Gain	> 17 dB typ.
Output Power	> 25 W

The **final stage** is an RF amplifier for FM signals operating in band II (87.5 – 108 MHz), with nominal output power of 300 Watt CW.

Normally it works up to 330 Watt, in order to overcome the Insertion loss of the circuitry that follows the amplifiers, being the Directional couplers and Low Pass Filter.

FM300-108 uses MOSFET technology where the RF MOSFET's bias is integrated on its printed circuit board. The polarization is in class B, with a 180 mA quiescent current.

VCC nominal	48V
IDC (@ Full Power)	11 A typ.
Idq	180 mA typ.
Frequency range	FM (87.5-108 MHz)
Power Gain	Typ. 18 dB
Output Power	300 W min

3.6 Low Pass Filter and Directional Coupler Unit

The filter has a particular elliptic configuration; this configuration has been specifically chosen to guarantee the values of the harmonic components levels.

In-band Insertion Loss	<0.5 dB
Insertion Loss @ 175MHz	>55 dB
In-band Return Loss	<-20 dB

The directional coupler is a block composed by 2 directional couplers and a quarter wave delay line. Both ports of each directional coupler are used. Two of them detect the reflected power, one detects the FWD power and one is used as RF monitor. The function of the delay line is to have two reflected power signals detected at 90° of electrical angle. In this way, it is possible to have a quite constant reflected power level vs. the phase angle of that signal. The RF monitor is connected to the front panel (RF monitor port) to have 0 dBm nominal signal.

4.0 MT300 Technical Specifications

Environmental

Storage Temperature:	-20/+65 °C
Operating Temperature:	-5/+45 °C
Guarantee Performance Temperature:	0/+45 °C
Relative Humidity (Non Condensing):	< 90%
Guarantee Performance Altitude:	2000 m, (6560 ft)
Cooling:	> 150 cubic meters/hour

RF Characteristics

Frequency Range:	87.5 – 108 MHz, 50Khz step, synthesized.
Output Power:	300 Watts nominal, (VSWR < 1.8:1).
RF Power Devices Technology:	MOSFET
Off lock Attenuation:	> 60 dBc
RF Output connector:	N Female
RF Output Impedance:	50 Ω
RF Output monitor level:	0 dBm nominal (BNC connector on the front panel)
RF Spurious:	< -95dBc @ +/-1MHz (Exceed .EBU/CCIR/FCC)
Harmonic:	< -70dBc
Frequency stability:	< 500 Hz / 6 months @ Center Frequency
Inputs:	Mono, Stereo, MPX, AUX, SCA/RDS
Input Impedance:	600 Ω or 5K Ω unbalanced
Modulation Type:	F3E/F8E Direct FM at the carrier frequency
Frequency deviation:	+/-75KHz=100%
Variation of sensitivity for 75 KHz Deviation:	+/-1dB from 87.5 to 108 MHz
AF Limiter:	+1dB
Center Frequency Shift:	< +/-500Hz, (Due to +/-75KHz Mod)
Stereo Operation:	CCIR 450/S2 “Pilot Tone System”
Asynchronous AM SNR: (REF=100% AM Mod, @400Hz, BW=30Hz to 20KHz, FM Mod OFF)	- 56dB
Synchronous AM SNR: (REF=100% AM Mod, @400Hz, BW=30Hz to 20KHz, FM Mod +/-75KHz @400Hz)	-50dB

Electrical

Power Supply:	96/130 or 200/268 V, Single Phase AC, 48 to 62Hz.
Power Consumption:	< 620 VA
Power Factor:	> 0.9

R & Mono Input

Input connectors:	BNC female (front panel)
Input Impedance:	1 Mohm resistive, unbalanced, source impedance <10kOhm
Input level (For +/-75KHz deviation):	3 to 9 dBm/600Ω
Frequency response (30Hz to 15KHz):	+/- 0.15dB
Pre-emphasis:	Flat/50μSec/75μSec +/-3%
THD (30Hz to 15KHZ):	0.1%
FM S/N Ratio (REF=+/-75KHz):	
Weighted CCIR 468-2; BW= 30Hz to 20KHz	
flat	-68dBc
with de-emphasis 50μsec	-73dBc
with de-emphasis 75μsec	-76dBc
No-weighted; BW= 30Hz to 20KHz	
flat	-73dBc
with de-emphasis 50μsec	-76dBc
with de-emphasis 75μsec	- 78dBc
Audio Filter rejection: (19KHz to 100KHz)	>30 dB
19KHz suppression:	> 46dB

External MPX Input

Input connectors:	BNC female (front panel)
Input Impedance:	10K Ω
Input level (For +/-75KHz deviation):	3 to 9 dBm/600 Ω
Composite amplitude response (30Hz to 100KHz):	+/- 0.5dB
Composite phase response (30Hz to 53KHz):	+/- 0.5°
SNR: (30Hz to 200KHz; with de-emphasis 50 μ sec)	> 75dB

Stereo Operation (L & R Channels)

Input connectors:	BNC female (front panel)
Input Impedance:	1 Mohm resistive, unbalanced, source impedance <10kOhm
Input level:	3 to 9 dBm/600 Ω
Audio Filter Attenuation:	> 68 dB @ 19 KHz
Crosstalk Attenuation (From 30 Hz to 15 KHz):	> 50 dB
Pre-emphasis:	Flat/50 μ Sec/75 μ Sec +/-3%
38 KHz Suppression:	> 50 dB
Sub-Carrier Frequency:	38 KHz +/- 2Hz
Pilot Frequency:	19 KHz +/- 1Hz
Phase Difference 19/38 KHz:	0° +/- 2°
THD on Encoded Channels (30Hz to 15KHz):	< 0.1%
Audio Response (30Hz to 15KHz):	+/- 0.25dB
Nominal Pilot Deviation:	+/- 7KHz
Pilot Output level:	1 Vpp, square wave

SCA/RDS & AUX input

Input connectors:	BNC type female (front panel)
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Input Impedance:	5K Ω
Input level (for +/-7.5KHz deviation @97.5MHz):	2.2Vpp/5K Ω
Amplitude Response (10KHz to 100KHz):	+/- 0.15dB

5.0 Set up procedure

The MT300 is shipped in a wooden box. It should be removed carefully removing the foam packing material and the clear protective film. This equipment can be operated freestanding or by its standard mechanical frame (19 inches), it may be mounted in an equipment rack.

AC Main Voltage Setting

The MT300 is supplied for 220Vac, +/- 15%, single phase at 50Hz or 60Hz operation but it can operate at 110VAC single phase, because its AC/DC power supply capable of a wide operating range. The normal current draw is approximately 2.8 amps for 220Vac operation, but, if supplied at 110Vac, the normal current is around 5.3 amps. It is installer's responsibility to correctly connect the three wires (line, N, GND) to the mains line use the power cord supplied. It is also recommended that a transient or surge protector be properly grounded and the MT100 connected through the protector. Before switching the transmitter on, it is necessary to connect the RF output power type "N" (female) connector to either a dummy load or an FM antenna with low loss coaxial transmission line.

Frequency of Operation Change

The MT300 transmitter operating frequency at time of shipment from the factory may not be set for your authorized frequency. In order to change the frequency of operation, locate, the OME-1T exciter section of this manual and review the information on page 4 of 4. After review the frequency setting examples in this section, substitute your values for the switch settings through the OME-1T chassis top. You should make sure that the transmitter is unplugged and that no power present.

To access the frequency change selector switches may be necessary to remove the four (4) screws on the front of the OME-1T and slide it forward far enough to allow a small screwdriver blade to adjust the three (3) rotary frequency selector switches.

Output Power Setting

Please refer to the earlier section entitled RF Power Control in section 3.4 of this manual.

Other Exciter Settings

Please refer to the OME-1T exciter section of this manual, page 4 of 4, for jumper settings for left and right channel preemphasis selection (75 microseconds un-preemphasized, or 50 microseconds), left and right input sensitivity selection (6..9dBm, 3..6dBm or 0..3dBm), modulation limiter selection (On or Off), and input selection (Mono, Multiplex Internal, or Multiplex External). This page of the manual shows the various positions for the jumpers and their location on the OME-1T printed circuit board.

Turning On the transmitter

After the above procedures are followed, it is possible to turn the transmitter on. On the front panel, the mains power LED indicates the status of the MT300. If it is on, the equipment has been correctly supplied the AC line voltage. By activating the enable switch, on the front panel, the transmitter reaches the maximum RF power set. Other LEDs provide further information on the functioning of the MT300:

RF nominal (green): ON if some RF output power appears

Derating (yellow): ON in two situations

when the reflected power is higher than 10dB (the transmitter power output is maintained until VSWR 2:1. If the VSWR is higher, the derating protection intervenes which stabilizes the output power at a non-dangerous value of operation for the amplifier)

when the working temperature is too high (the temperature protection intervenes when the ambient room temperature is $\geq 45^{\circ}$. In this case, the output power is reduced of about 6dB)

Fault (red): ON if the transmitter has other faults (for example, input power without output power, with for example a fault in the RF amplifier or RF control circuit).