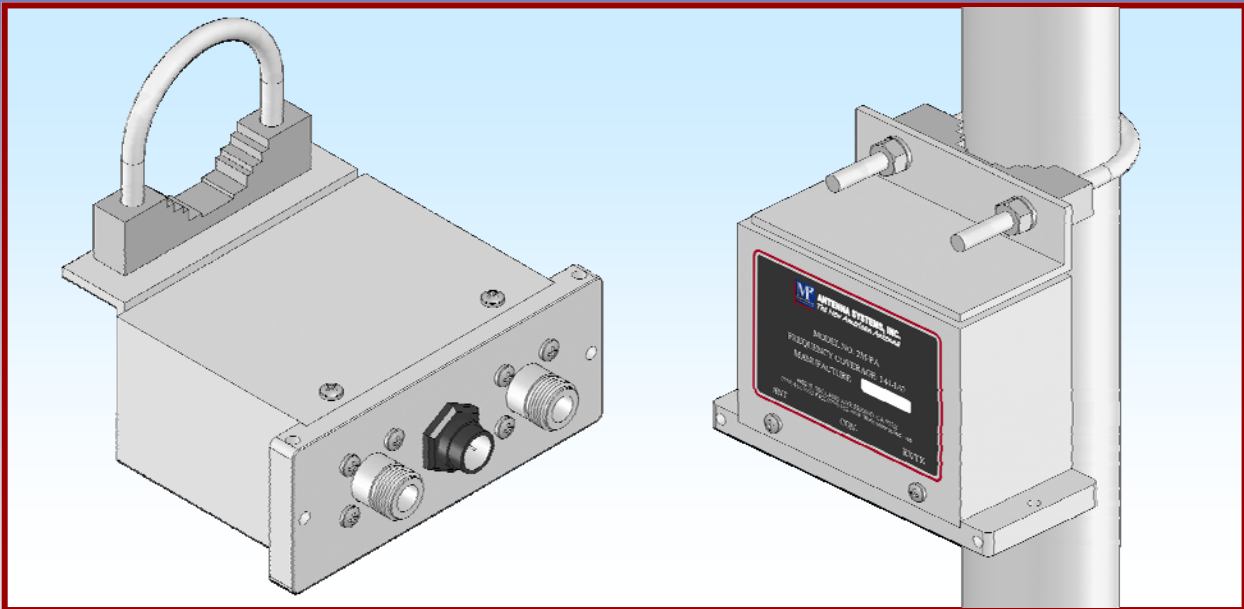




# M2 Antenna Systems, Inc. Model No: 2M-PA

## 2M Low Noise Preamp (LNA)

### Operating Instructions



OVERVIEW

INSTALLATION

TROUBLESHOOTING

ADDENDUM

WARRANTY

**PLEASE READ BEFORE USE AND SAVE**

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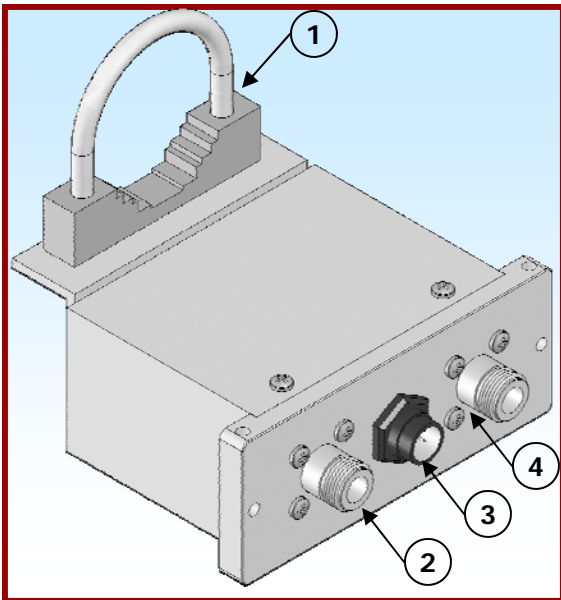
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# OVERVIEW



## MAJOR COMPONENTS

1. **U-Bolt and Uni-cradle.** (Mast mount units) Will accommodate most diameters from 1-1/4" (30mm) up to 2" (50mm). This will fit many masts, tower legs and cross-booms. Mount the preamplifier close to the antenna, and for maximum weather protection keep it vertical as much as practical.
2. **RX/TX Connector (J3).** Type "N" connector, used to connect the receiver or transceiver to the preamp. Maximum rated thru power is 150W.
3. **Control Connector (J1).** Uses a 4 pin weather resistant Switchcraft® EN3C series connector to provide power and control signals. A shielded, 4 conductor cable with a minimum of 20 AWG (.5 mm<sup>2</sup>) is recommended. See "Control Connector Information" for pin-outs and detailed description.
4. **Antenna Connector (J2).** Type "N" connector, used to connect to the antenna. Use a quality coax with as short a run as possible to minimize loss and noise.

## THEORY OF OPERATION

Feedline loss is an inevitable factor in any antenna system. What is heard by the antenna may not make it to the receiver, resulting in lower a signal to noise ratio on critical communications paths, such as with weak signal work, Earth-Moon-Earth, satellite or even distant repeater work. A good low noise amplifier, or preamp, overcomes those losses and improves the signal-to-noise ratio at the receiver.

### WHY USE A MAST-MOUNTED PREAMP?

Even the highest quality feedline and connectors exhibit some loss. Energy that is lost becomes thermal noise, which degrades overall receiver performance and crushes weaker signals. By placing the preamp close to the antenna feed-point, signals are amplified by up to 20 dB, overcoming those losses and pulling weak signals right out of the noise.

### HERE'S HOW IT WORKS

#### Receive

During receive, with power on, the internal transmit and receive relays RY1 and RY2 and input protection relay RY3 are energized, placing the preamplifier in the transmission line path. The receive signal is fed to the PHEMT device (Q6) where it is amplified. The resulting signal is filtered via helical filter FL1, eliminating any out of band signals, and is then sent back down the feedline to the receiver, with a gain of 20 dB and a noise figure <.5 dB.

#### Transmit

On transmit, ground potential on pin 2 of J1 (Control Connector) causes Q2 to conduct, turning off Q3 and turning power off to the preamp. De-energizing the T/R Relays bypasses the preamp circuit, while de-energizing RY3 shorts the preamp input to ground. As a backup, D5 functions as an RF detector, which causes Q1 to conduct, keying Q2 and saving your investment. For further protection a PIN diode at D6 shunts high power RF to ground before it can reach Q6, while the power is dissipated by the pi network formed by R20-R22.

#### Test

When Pin 3 on J1 is grounded during receive, Q4 conducts, turning on a calibrated noise source (Q5). R10 is preset at the factory to adjust the noise level to 10 dB (+/- .5 dB).

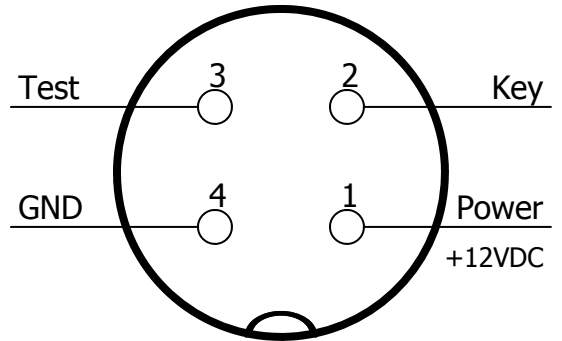
# INSTALLATION

## CONTROL CONNECTOR INFORMATION

### Control Connector (J1) Description

Pin	Description
1	<b>Power</b> — +11 TO 18 VDC, 150 mA max.
2	<b>Key</b> — Ground to key. Switch, relay closure or open collector will actuate the T/R and isolation relays. 15 mS switching time.
3	<b>Test</b> — Ground to actuate (see above). Activates 10 dB noise source to allow testing of the preamp.
4	<b>GND</b> — Return for power and controls on pins 1-3.

### Preamp Control Cable Connector (as viewed from rear/solder cup side)



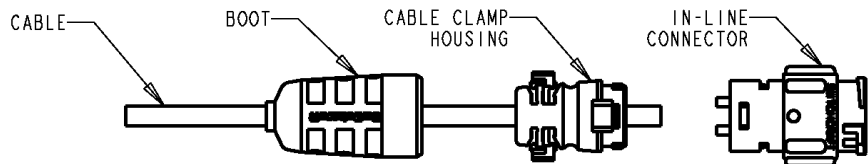
INSTALLATION

## CONNECTOR ASSEMBLY DETAIL

### SWITCHCRAFT CABLE CONNECTOR ASSEMBLY INSTRUCTIONS

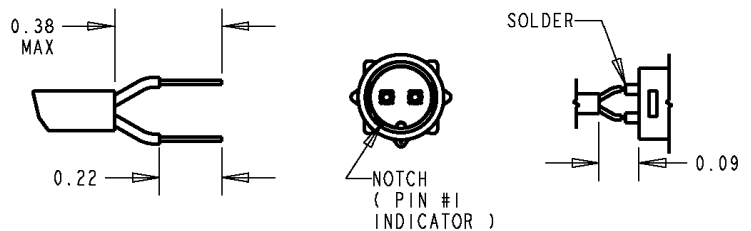
#### STEP 1

FEED THE END OF THE CABLE THROUGH THE BOOT AND CABLE CLAMP HOUSING IN THE ORDER AND POSITION SHOWN.



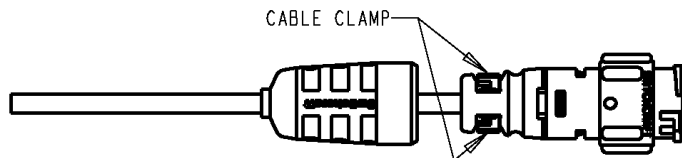
#### STEP 2

STRIP CABLE AS SHOWN AND BEGIN SOLDERING CONDUCTORS TO PINS. STARTING WITH CONTACT NO. 1 NEXT TO THE "NOTCH" AND FOLLOW WITH THE REMAINING CONDUCTORS CLOCKWISE WITH NO. 6 CONDUCTOR IN THE CENTER.



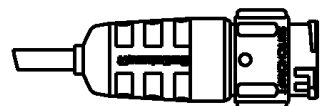
#### STEP 3

PUSH THE CABLE CLAMP HOUSING FORWARD UNTIL IT LOCKS INTO THE CONNECTOR BODY AND SNAP THE TWO CLAMPS INTO ITS COMPARTMENTS.



#### STEP 4

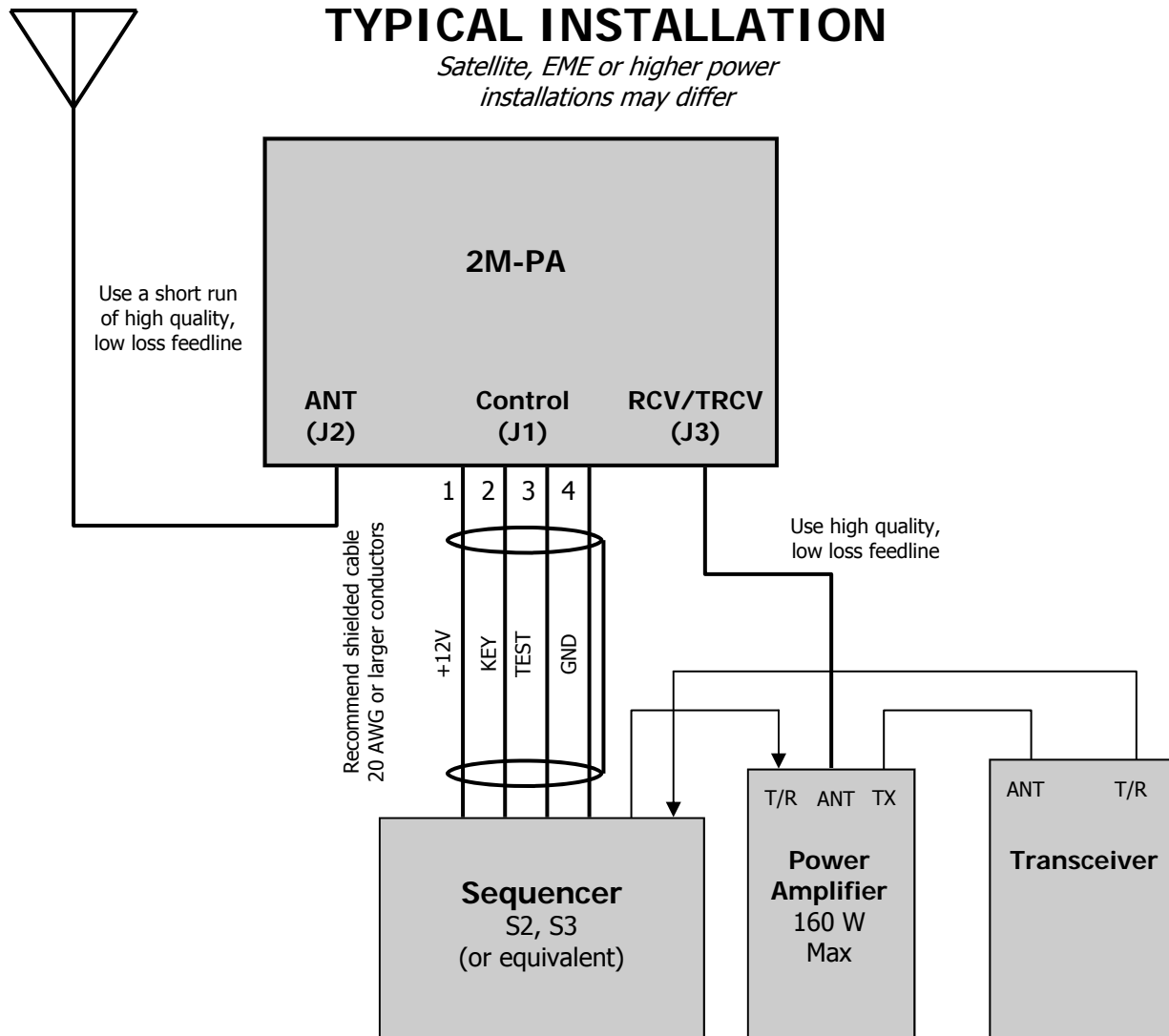
PUSH THE BOOT ALL THE WAY FORWARD TO SEAT TIGHTLY ONTO THE CABLE CLAMP HOUSING.



# INSTALLATION

## TYPICAL INSTALLATION

*Satellite, EME or higher power installations may differ*



INSTALLATION

## INSTALLATION CONSIDERATIONS

- **WARNING:** SAFETY IS ALWAYS A PRIORITY! ALWAYS OBSERVE APPROPRIATE CLIMBING AND ELECTRICAL SAFETY PRECAUTIONS WHEN INSTALLING ANTENNAS AND RELATED EQUIPMENT.
- **CAUTION:** THE USE OF LIGHTNING PROTECTION DEVICES ON ALL CABLES ENTERING ANY BUILDING IS STRONGLY ENCOURAGED. CONSULT LOCAL ELECTRICAL CODES FOR INSTALLATION REQUIREMENTS.
- Always mount the preamp in an upright position. Failure to do so may reduce its water resistance.
- Use weather resistant tape on the coax and control connectors. While the control connector and type N connectors are inherently water resistant, proper application of standard waterproofing measures ensures the long life of your preamp.
- Use a SHIELDED control line with at least 20 AWG (.5 mm<sup>2</sup>) or larger.
- A sequencer, such as the M<sup>2</sup> S2 EME Sequencer, or the S3 Sequencer will help manage transmit/receive timing to ensure that outgoing RF is not inadvertently transmitted through the preamp.
- When using high power (above 160W), the use of external high power coaxial relays to bypass RF in excess of 150W will ensure that proper isolation is maintained. The HPR-1 made by M<sup>2</sup> is an excellent choice.
- Should a mast mount installation not be practical, the preamp will work close to the receiver too. While it will not be able to recover signals lost by a long transmission line run, it can go a long way toward boosting the signal to noise ratio of signals above the noise floor but below the receiver threshold—perfect for receivers with weak front end sensitivity!

# TROUBLESHOOTING

## TROUBLESHOOTING GUIDE

Problem	Possible Cause	Solution
No change in background noise when power is applied	12 VDC not reaching J1	Verify +12 VDC at Pin 1 of Control Cable Plug.
	Preamp is Keyed	Check Control Cable Plug for short to ground.
	Feedline Problems	Verify feedline connections from receiver to J3.
	Power fed into preamp while in receive	Check pi network resistors R20, R21 and R22. Replace as necessary (repair kit provided).
	Power supply section defective	Check operation of U1, D3, Q3, D1, D6 and Q2. Replace defective components as necessary.
No change in noise level when Test function is activated	Faulty connection to J1	Verify wiring from Test switch to J1, Pin 3.
	High system noise	Disconnect preamp from system. Check antenna and feedline system for noise; troubleshoot and repair as necessary.
	Q4 defective	Check Q4. Replace Q4 if necessary.
	Q5 defective	Replace Q5.
T/R Relay will not actuate	Faulty connection to J1	Verify wiring from sequencer/switch to J1, Pin 2.
	Defective switching circuit	Check D2, Q1, Q2, Q3 and D3 for proper operation.
	Defective T/R relay	Check RY1 and RY2 for proper operation.

### Still don't see what you are looking for?

This guide is not all-inclusive, as there is just no way to predict every failure. However, we will be more than happy to provide any assistance we reasonably can. Please see "Support, Service and Returns" below.

### SUPPORT, SERVICE AND RETURNS

If you have followed the provided troubleshooting steps and your product is still not performing as specified, please contact us for further technical support. You may email us any time, or call between 8:00 am and 4:00 pm Pacific Time (UTC -7 / -8). Our contact information is:

**M<sup>2</sup> Antenna Systems, Inc.**  
**4402 N. Selland Ave.**  
**Fresno, CA 93722 USA**  
**Tel: (559) 432-8873**  
**Email: sales@m2inc.com**

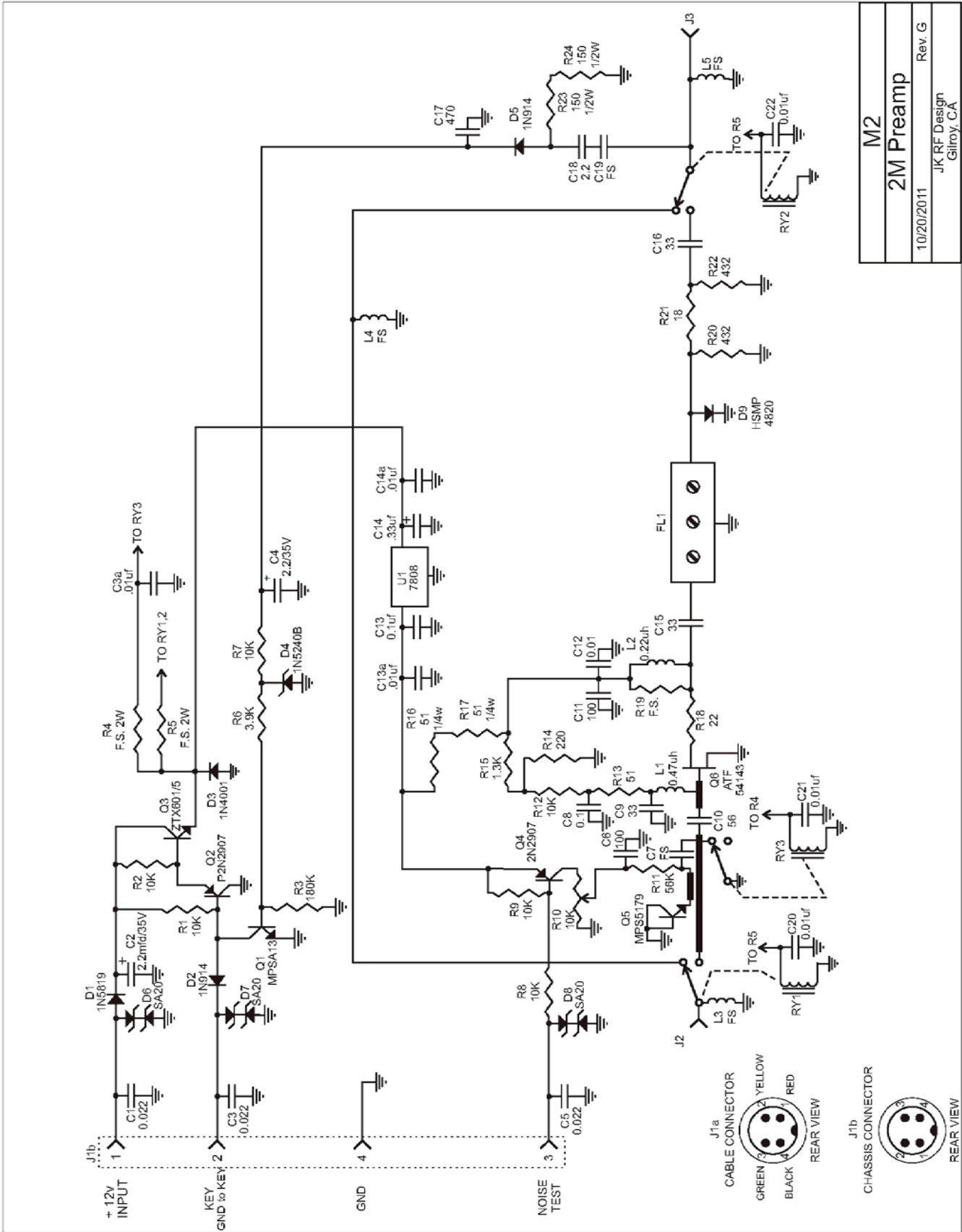
When writing, please include the following:

- Your name and contact information
- The product you are writing about
- A synopsis of the problem
- The troubleshooting steps you have already taken

Should you require factory service, we will be happy to provide you with a Return Authorization. If the item is outside the warranty period, an estimate of the repair costs will be provided once the item has been examined by a technician.

Contacting us before returning any products to our factory will not only prevent lost items, but also expedite their repair.

# TROUBLESHOOTING



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# ADDENDUM

## PARTS LIST

DESCRIPTION .....	QTY
2M-PA LOW NOISE PREAMPLIFIER.....	1
2M-PA OPERATING INSTRUCTIONS .....	1
<b>HARDWARE BAG (FOR MAST-MOUNT UNITS):</b>	
UNI-CRADLE (M2AMC0076) .....	1
U-BOLT, 2", SS .....	1
LOCKWASHER, 1/4" SS .....	2
NUT, 1/4-20 SS .....	2
<b>CONNECTOR BAG:</b>	
CONTROL CABLE CONNECTOR (4 PCS) .....	1
<b>PI NETWORK REPAIR KIT:</b>	
RESISTOR, 432 $\Omega$ , 1/8 W, 1% .....	2
RESISTOR, 18 $\Omega$ , 1/8 W, 1% .....	1



# ADDENDUM

## SPECIFICATIONS

Model .....	2M-PA
Frequency Range .....	144-147 MHz / useable up to 148 MHz
Noise Figure .....	0.5 dB
Gain.....	20 dB Nominal
Insertion Loss .....	0.2 dB Nominal
Inline SWR .....	< 1.2:1
Voltage .....	+11 to +18 V DC
Current .....	150 mA
Maximum through power .....	160 W w/ext keying
External Keying .....	Key to GND (Relay closure or open collector)
Noise Test .....	10 dB noise generator, GND to activate.
Filter .....	Helical Band Pass
Mast Size.....	1-1/4" (30 mm) - 2" (50 mm)
.....	2-1/4" (57 mm) Hole Spacing
.....	(Also available without mounting tab)
TR delay.....	15 ms
Device details .....	Avago ATF 54143 E-PHEMT
.....	Output 20mW @ 60 mA, Dissipation = 725 mW

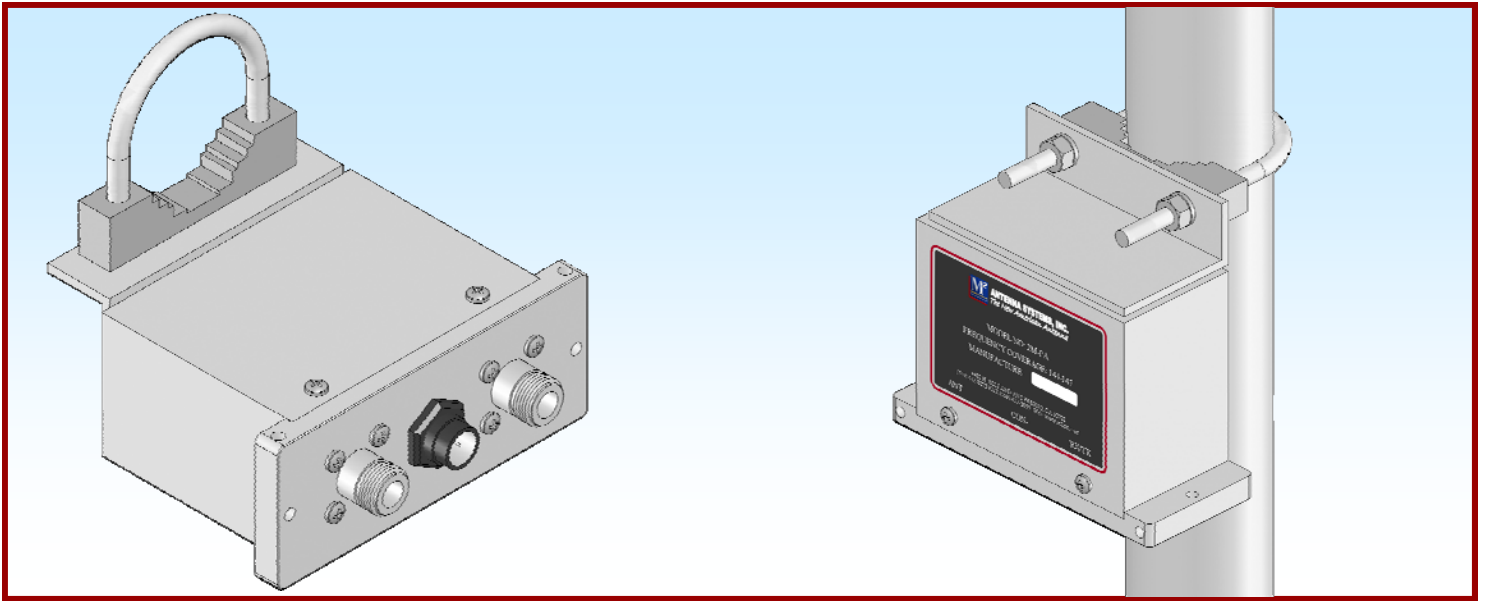
# ADDENDUM

**NOTES:**

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**NOTES:**

# 12 MONTH LIMITED WARRANTY



This warranty gives you specific legal rights. You may also have other rights which will vary from state to state or province to province.

**M2** warrants the **2M-PA** preamplifier against defects in material and workmanship for a **period of 12 months** from date of purchase. During the warranty period, **M2** will, at its option, either repair or replace products or components which prove to be defective. The warranty shall not apply to defects or damage resulting from:

- Improper or inadequate maintenance by user
- Improperly prepared installation site
- Unauthorized modifications or misuse
- Accident, abuse, or misapplication
- Normal wear

**M2** specifically does not warrant this product for any direct, indirect, consequential, or incidental damages arising from the use or inability to use the product. Some states or provinces do not allow the exclusion or limitation of liability for consequential or incidental damages so the above limitation may not apply.

In the event repair or replacement are necessary, purchaser shall contact M2 for return authorization. In many cases this contact can simplify and expedite the repair/replacement process and help reduce costs and downtime.

The purchaser shall be responsible for packing the product properly for return and for charges to ship the product to **M2**. Always include with the shipment a statement detailing the problem or failure and any other pertinent observations. Insuring the product for shipment is recommended. Use the original packing materials whenever possible. **M2** is responsible for charges (**in the United States**) to return the repaired or replaced product only where warranty service is involved.

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