OPERATION MANUAL

Features

- Operating Bands 160m – 6m
- RF Auto Band Decoding
- 7-inch Color Touch Screen
- FWD/REF/SWR Meter
- DI Voltage/DI Current Meter
- All Protection
- Selection for 3 Antennas w/Memory.
- 1200 watts SSB/CW
- 700 watts DIGI mode

mercuryIIIS
LDMOS POWER AMPLIFIER KIT

Designed and Manufactured in the USA

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KM3KM HAM RADIO PARTS

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WHAT IS AN LDMOS?

- LDMOS (laterally diffused metal oxide semiconductor) transistors are used in microwave/RF power amplifiers. These transistors are often fabricated on p/p+ silicon epitaxial layers. The fabrication of LDMOS devices mostly involves various ion-implantation and subsequent annealing cycles. As an example, the drift region of this power MOSFET is fabricated using up to three ion implantation sequences in order to achieve the appropriate doping profile needed to withstand high electric fields.
- Silicon-based LDMOS FETs are widely used in RF power amplifiers for base-stations as the requirement is for high output power with a corresponding drain to source breakdown voltage usually above 60 volts. Compared to other devices such as GaAs FETs they show a lower maximum power gain frequency.
- We use the BLF189XRA from Ampleon USA Inc:
- We have performed a test of ruggedness with a controlled load mismatch through all phases, enabled by the test fixture. The mismatch unit is connected to a network analyzer. Through a network control, we can set it to work through all phases of the Smith chart. This mismatch unit will create voltage standing waves with ratios from 55: 1 up to a maximum of 125: 1. With the normal situation (standard, 50 volts 1200 watts into a 50-watt load) the amp is operating at full power. The mismatch unit now replaces the dummy load connected to the output of the amp and the test set up is powered up again. We then vary the mismatch unit to expose the LDMOS transistor to a range of extreme mismatch conditions and positions on the Smith chart. The extreme conditions range from a VSWR of 55: 1 to 125: 1. The transistor is still alive by going back to the original load and showing the 1200-watt output power. It still works! Would you ever treat a transistor worse than this? Check out the next test.
- Even though the transistor is normally used at 50 volts, we then test it at 55 volts to challenge the extremely rugged LDMOS. The transistor was powered at 55 volts 1200 watts into 50 ohms when we suddenly disconnect the output load, creating a very unfriendly open circuit situation. Then, we powered up the transistor to 1200 watts. A short was introduced to the output of the amp while the transistor is powered up. When placed back into the 50-ohm load and powered up to 1200 watts, we see that it again survives and works perfectly. This is what we mean by extremely rugged. This transistor seems to be unbreakable.

FEATURES & SPECIFICATIONS

FEATURES

- Maintains linearity under full output power (1200watts).
- Low harmonic content (below -43dBc on HF & -65dBc on VHF bands) thanks to an efficient Chebyshev filter.
- Fast and effective protection systems maintain the amplifier's safety from operational damage.
- Compact linear amplifier with 1200 watts SSB/CW & 700 watts DIGI-MODE of output power on all amateur bands from 1.8 to 54MHz (<800watts 50 to 54MHz)
- Auto sensing power supply from 120 to 240VAC.
- Full power on 120 or 240VAC – SSB **CW MODE AC LINE 240V REQUIRED, NOT CW FULL BREAK-IN CAPABLE.**
- Generous power and great dynamics with the proven BLF189XRA by Ampleon Inc.
- Easy to read 7", 165x100mm, high-resolution touch screen color display w/800x480 pixels and 24-bit colors.
- Compatible with all transceiver models available on the market - ground on transmit (PTT) and 50W of RF drive power is sufficient.
- The amplifier monitors the frequency of the input signal through the built-in RF Band decoder chip and automatically switches bands accordingly.
- Monitors itself during operation with full-time protection circuits in all modes so the operator does not need to monitor.
- Convenient for expeditions and field operation: extremely compact and light construction, mains voltage range (100V÷240V), protects operation from unstable mains, generators etc. These features are achieved thanks to the built-in switching mode power supply (SMPS).
- Exceeds electromagnetic compatibility (EMC) both for the highly-sensitive as well as with the powerful appliances in the radio station.

SPECIFICATIONS

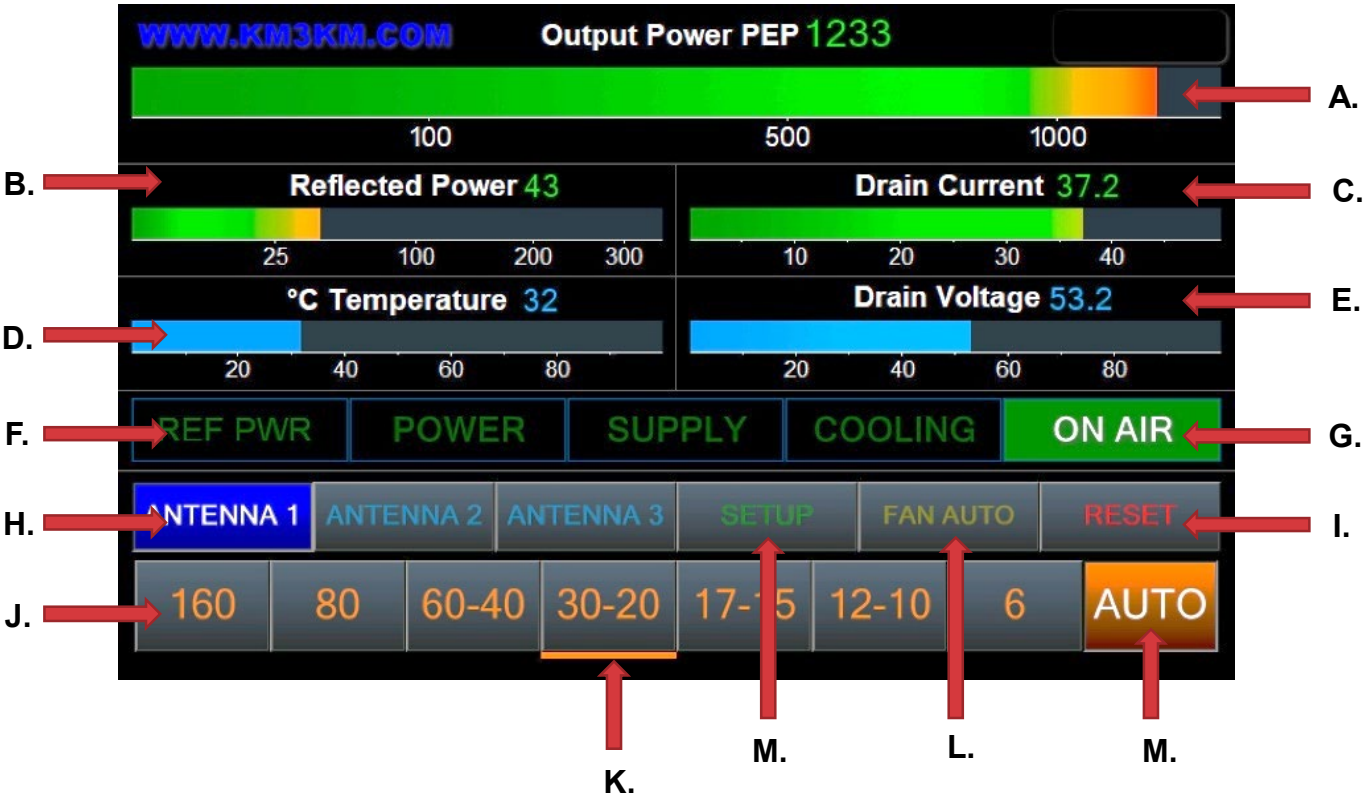
- Intermodulation distortions (IMD3): better than 30dB below the rated PEP output.
- Input and output impedances: nominal value: 50 Ohm unbalanced, UHF (SO239) type connectors
- input circuit: broadband, SWR below 1.2:1 (1.1:1 typically); 1.8 – 54 MHz continuous range without retuning or switching
- temperature range: 14 F to 149 F (-10 C to +65 C)
- Dimensions (projections not included) and weight, operating: (W x H x D) 12 x 5.5 x 13.5 In (305 x 140 x 343 mm); 27Lbs (12.2 kg).
- This unit complies with the FCC RF Exposure limits for an uncontrolled environment. To comply with FCC RF exposure limit requirements, antennas must be operated at a minimum distance of 740.25 cm or 24.29' between the radiator and any person's body.

QUICK START GUIDE

- Connect the amplifier to a 120 or 240-volt AC outlet; the power supply is AUTO sensing.
- Connect the output of the amplifier ANT-1 to a 50-ohm load or the corresponding antenna.
- Connect the RF-IN of the amplifier to the RF-OUT of transceiver.
- Connect the RCA PTT terminals from amplifier and to transceiver.
- Do NOT connect ALC unless it has been adjusted…(not needed for quick startup).
- Set the transceiver to the minimum power.
- Gradually increase power by SSB modulation, while checking for output power.

WARNING: Input power less than 35-watts for (RTTY, CW, AM, FM, DATA) Modes.

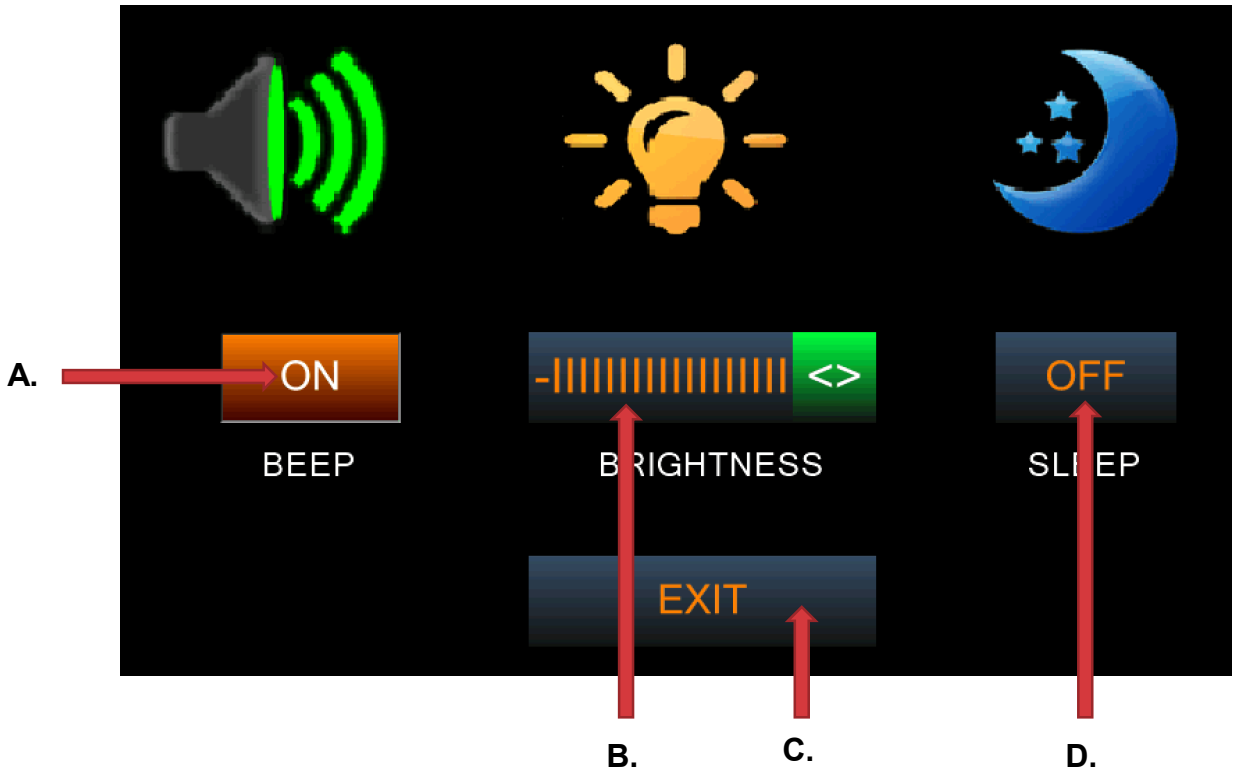
MAIN SCREEN



A. FWD Power Meter Output (pep)
B. SWR/REF Meter Output
C. Drain Current Meter
D. Temperature Indicator °C
E. Drain Voltage Meter
F. Alarm Indicators Zone
G. Transmission Indicator
H. Antenna Switch zone
I. Protections and Alarms Reset Button
J. Manual Band Select Buttons zone
K. Automatic Segment Indicator
L. Automatic or Manual Fan Control Button
M. Configuration

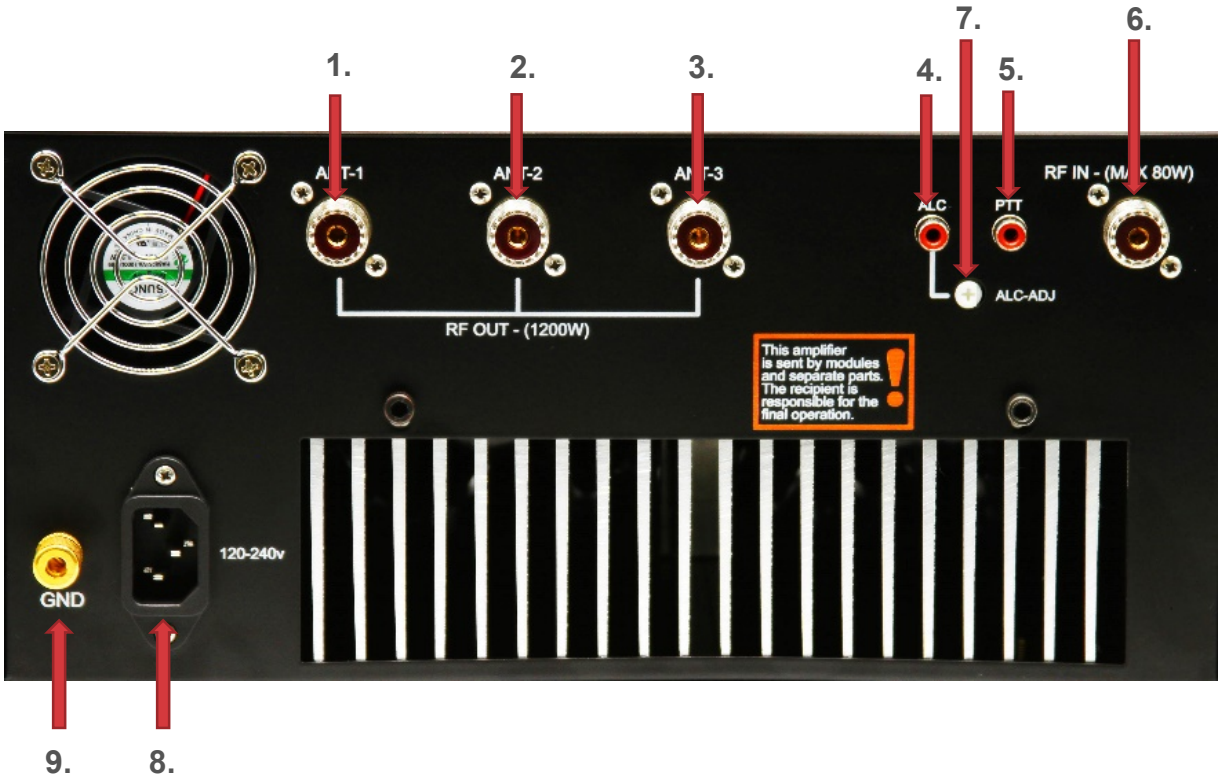
DISPLAY SETTING SCREEN

Main screen / Setup button / Display button



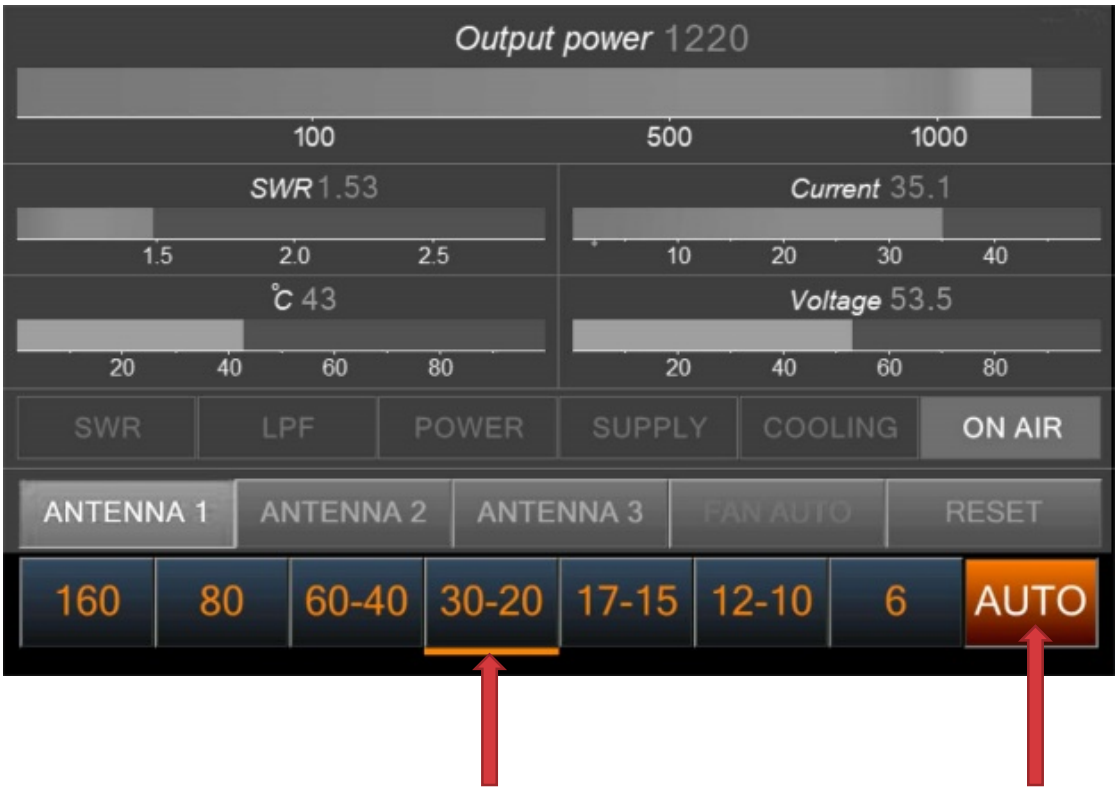
A. ON / OFF Sound Main Screen
B. Screen Brightness Slider
C. Exit to Main Screen
D. Turns off the display after 45 minutes; touch the display to turn on

REAR PANEL LAYOUT



1. SO239 Antenna 1 (default)
2. SO239 Antenna 2
3. SO239 Antenna 3.
4. RCA Plug ALC to Radio.
5. RCA Plug PTT Key to Radio.
6. SO239 RF Input Driver.
7. ALC adjustment fits Philips.
8. IEC 320 C14 AC Outlet.
9. Ground connection.

BAND SELECTOR



2. **1.**

RF Band Decoder will be in AUTO when amplifier starts-up (1).

A signal emitted by the transceiver selects the appropriate Low Pass Filter segment. Display sample (2) shows automatically selected segment indicator.

Keep in mind that in SSB mode the radio will not emit RF until it modulates; 200 milliwatts is necessary to detect the current frequency. It is worth noting that some radios make a small click when you press PTT which is enough to detect the appropriate segment quickly.

If you manually select an incorrect band above the frequency in use, the protection shut the amplifier down, the display shows ERROR LOW PASS FILTER (3)

3. **4.**

For recovery, correct the selected segment and press the Reset button (4)

OUTPUT POWER ALC (optional)

The amplifier provides an output power of 1000 - 1200 watts in HF bands. For 50 MHz, the output power does not exceed 900 watts. The input level is different in each segment; the use of ALC is recommended for constant output in all bands without regulating the input power.

How to adjust ALC for maximum power:

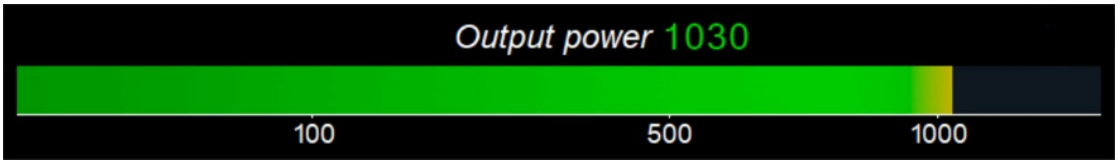
1. Connect an RCA-type cable from the ALC port on the amplifier (1) to the ALC port on the transceiver. Some radios do not have an RCA-type output for ALC.

2. Turn the regulator completely to the **left, counter-clockwise.**

3. Set the transceiver output to 40-60 watts. The 20-meter band is recommended for this adjustment.

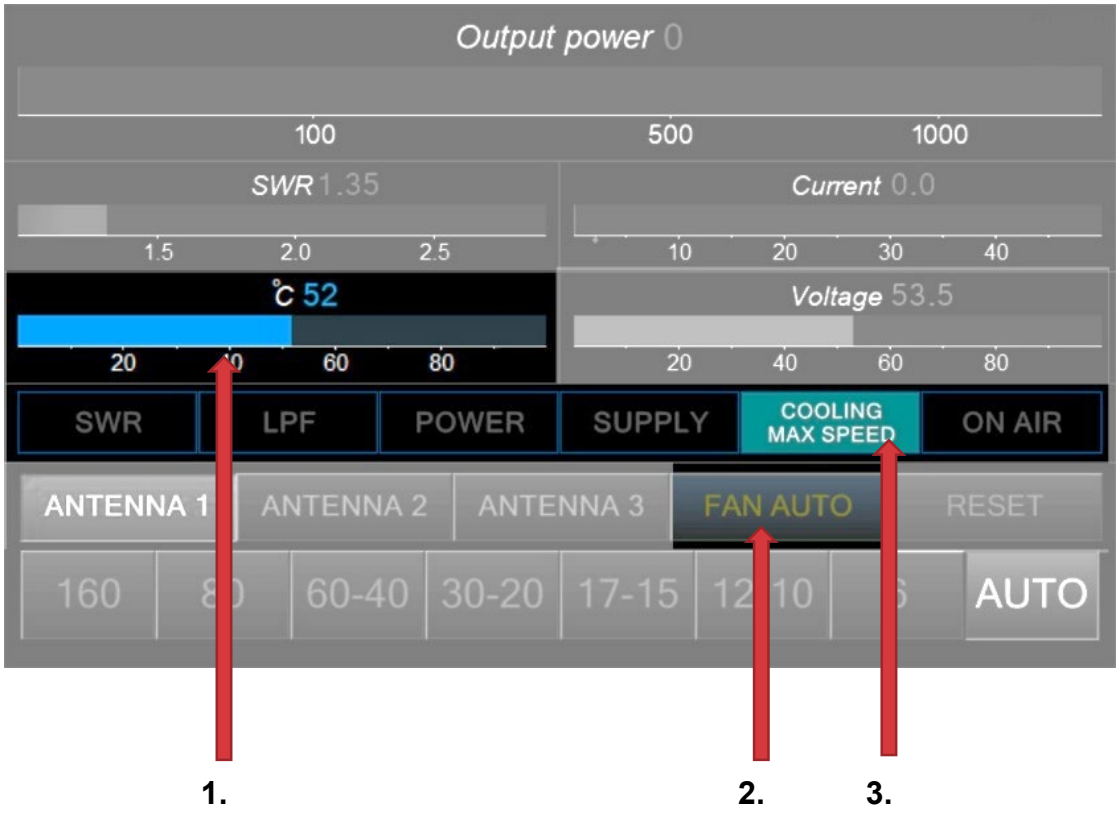
4. Begin to modulate and turn the regulator to the **right, clockwise**, noting that the power will be low and will begin to rise (2).

5. Stop when you see the level bar in approximate peaks of 1000 watts. Some radios have a narrow adjustment.



WARNING: Use an input power less than 35-watts for (RTTY, CW, AM, FM, DATA) Modes.

TEMPERATURE & COOLING FANS



The temperature is constantly monitored and shows on the Display (1). If the temperature is <50°C the cooling fans will turn constantly at 30% of their speed. When the temperature is >50°C, the fans automatically accelerate to 100% and return to 30% when the temperature is =<45°C.

Maximum fan speed is recommended for prolonged operations (contests, Digi mode, etc.)

The fan control button (2) sets the fan to AUTO/MAX.

When the fan speed is 100%, it is shown in the area of the display indicator (3).

If the temperature is >65°C, the system goes to Cool Down (4), the recovery is =<55°C.

ALL PROTECTION

Despite the robust build of an LDMOS PA, it is necessary to protect the circuits to avoid damage caused either by user error or accidents. This ensures correct handling by the user and extends the life of the device.

The error indicator area (1) shows several errors on the same tab (2).

1.

2.

ERROR REF: The Amplifier will stop transmitting when REF is >125 Watts. For recovery, decrease power input or check the antenna - press RESET.

ERROR LP FILTER: The Amplifier will stop transmitting when lower segment is selected in error. For recovery, check the selected segment and press RESET.

ERROR PWR 700 WATTS: With continuous carriers of >700 watts for more than 8 seconds, the amplifier stops transmitting. For recovery, reduce RF input and press RESET.

ERROR PWR: The amplifier will stop transmitting if the output power is >1400 watts. For recovery, reduce RF input and press RESET.

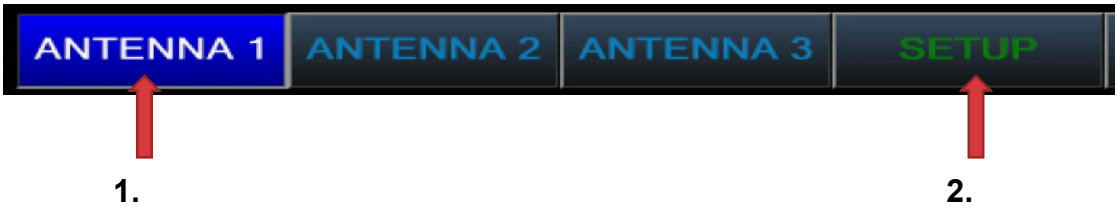
ERROR HI CURRENT: The amplifier will stop transmitting if the drain current is >37 amps, or REF is high. For recovery, reduce RF input and press RESET.

ERROR HI VOLTAGE: The solid-state switch does not deliver if the voltage is >55 volt. For recovery, turn amplifier off/on; if the problem persists, there is a fault in the device.

ERROR TEMP: If the temperature is >65°C, the system goes to Cool Down; the recovery point is <55°C.

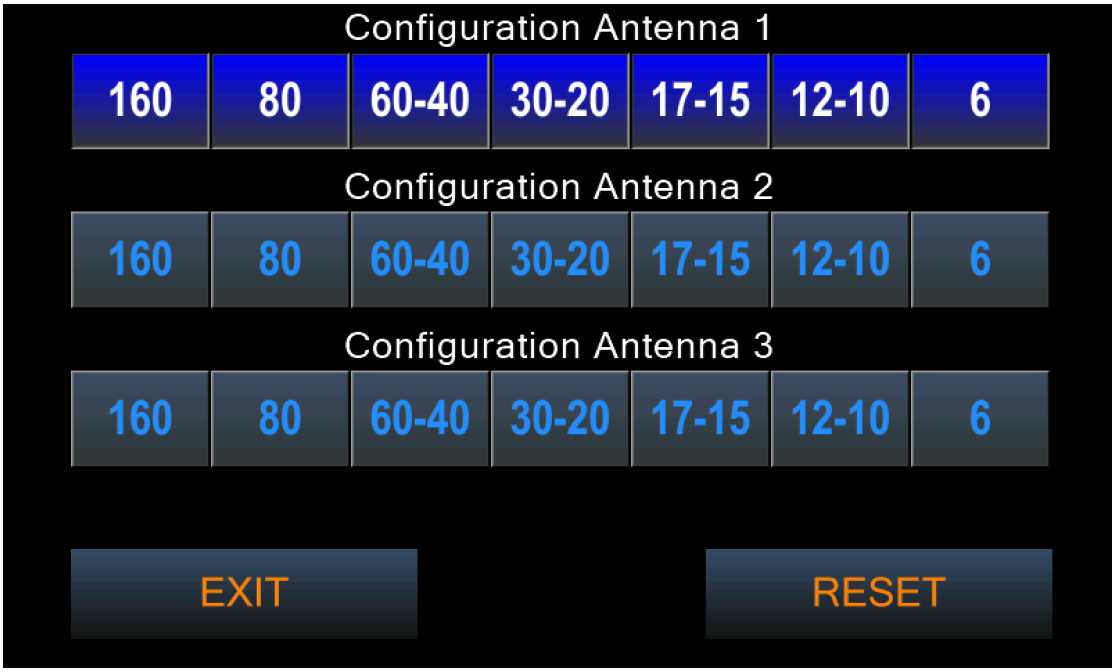
ANTENNA SWITCHES

You can manually select one of three antenna outputs (1). This selection is not kept in memory once the amplifier is turned off.



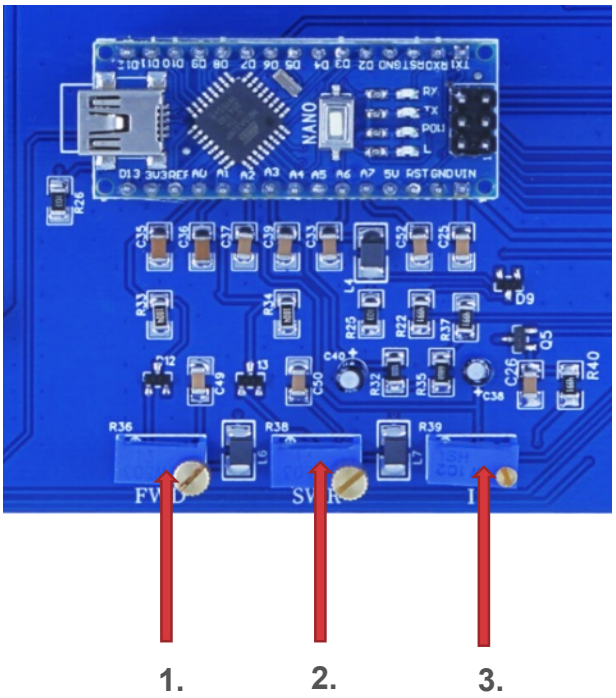
The setup button (2) displays the automatic antenna selection board. Configure the three antenna outputs with your antennas. The configuration remains in memory. At powerup Antenna 1 is the default. Reset button restores all bands to antenna 1.

Main screen / Setup button / Ant config button.



NOTE: Even though the PA's protection will trigger a REF POWER alarm, it is always recommended to have an antenna or 50-ohm load connected to the programmed output in order to avoid probable severe damage to components.

INTERNAL SETTINGS (if required)



The correct measurement of FWD and SWR may be affected if you connect an SWR meter at an intermediate point on the antenna line.

Use these recommendations to adjust the Meters:

Output Power Meter reference 1000-watts REF <10 watts SSB mode. Potentiometer (1) CCW +

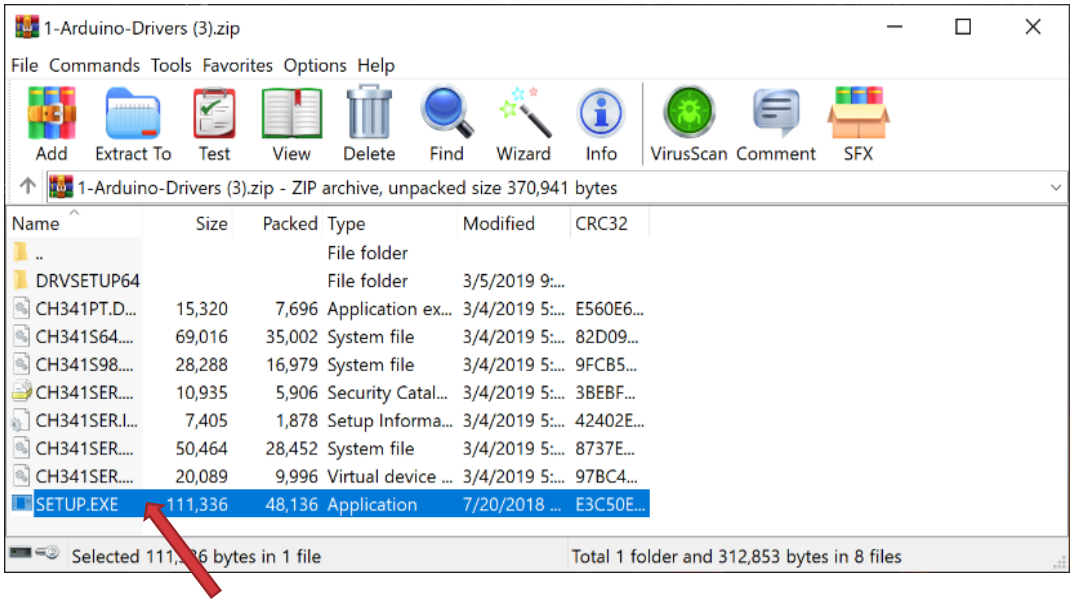
SWR Meter Reference 1000-watt output power and SWR 2.0 SSB mode. Potentiometer (2) CCW +

For the **Drain Current Meter**:

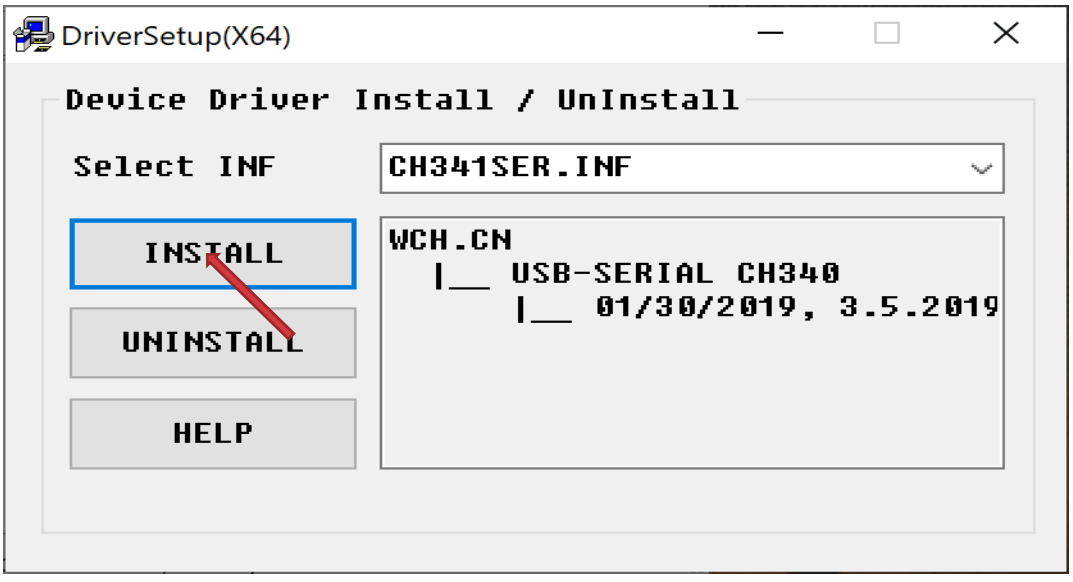
Reference 35 Amps. Potentiometer (3) CCW +

ARDUINO FIRMWARE UPDATE (if required)

1. Remove the Arduino Nano Module from the controller board
2. Use a Mini USB cable and connect Arduino to the PC
3. Download Arduino Nano Drivers file https://www.km3km.com/downloads
4. Open WinRAR File
5. Run SETUP.EXE

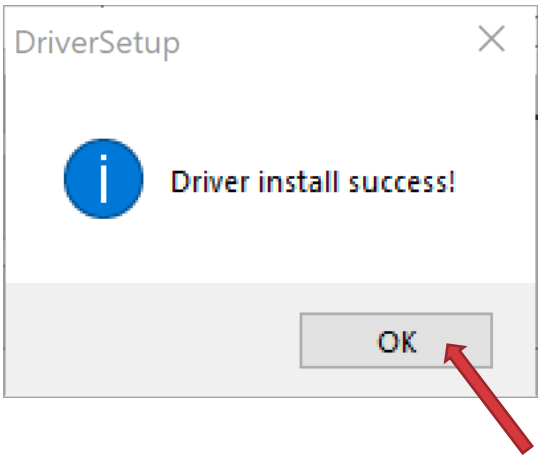


6. Run Install

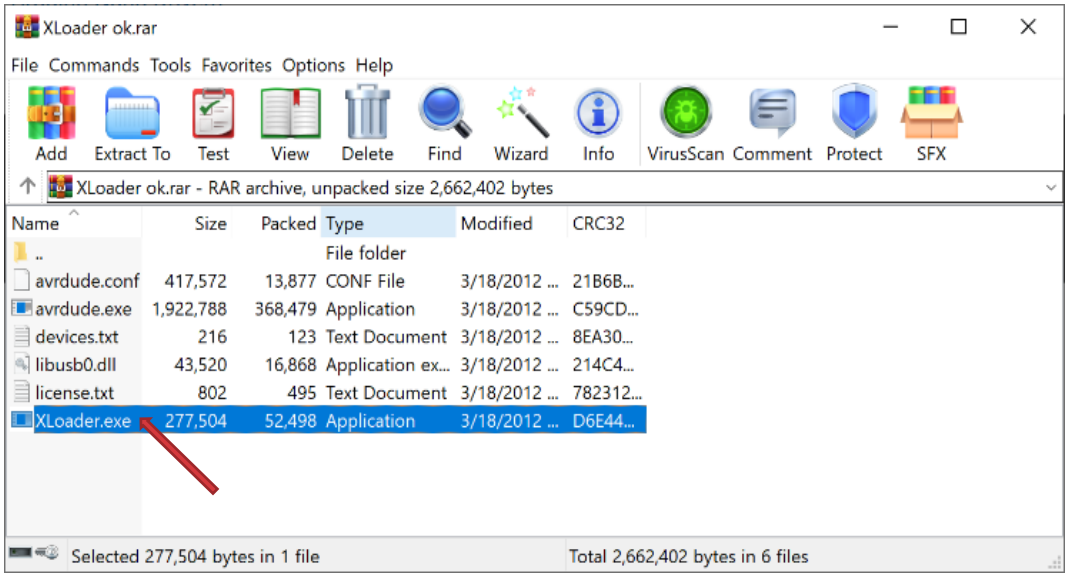


ARDUINO FIRMWARE UPDATE (continued)

7.Press OK Driver Installed

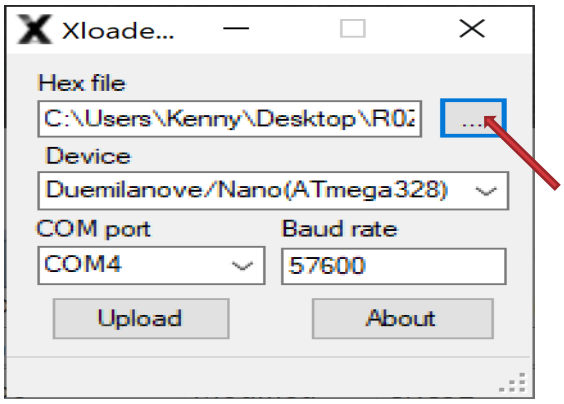


8. Download XLoader file https://www.km3km.com/downloads
9. Open WinRAR File
10. Run XLoader.exe

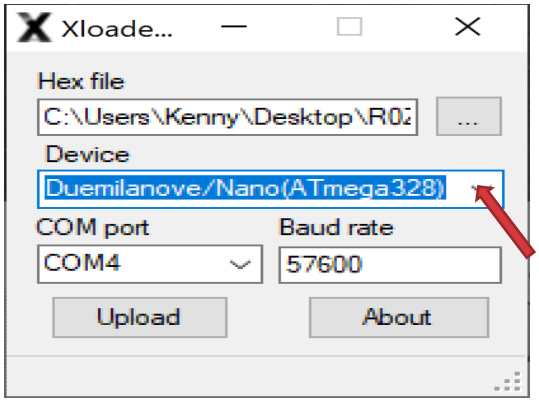


ARDUINO FIRMWARE UPDATE (continued)

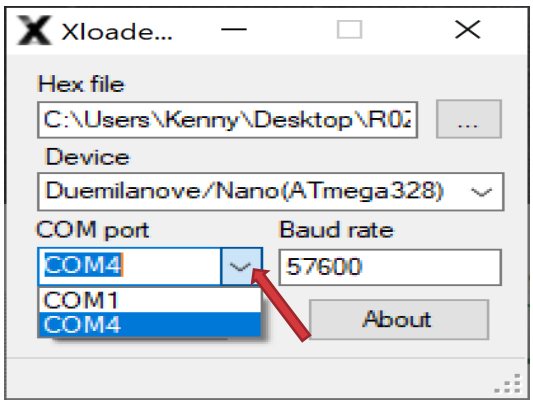
11. Look for the file (.hex) and select



12. Select Nano AT mega 128 device

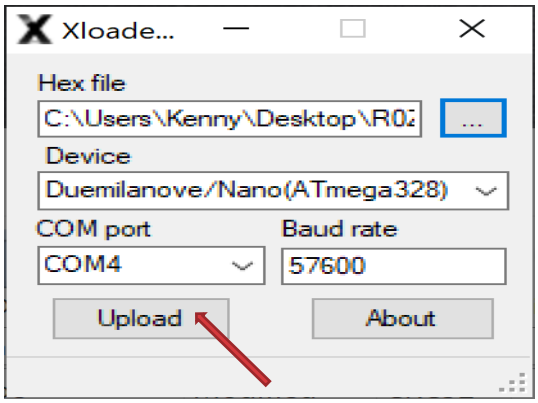


13. Select the Port (You can see the assigned port in Windows Device Manager)

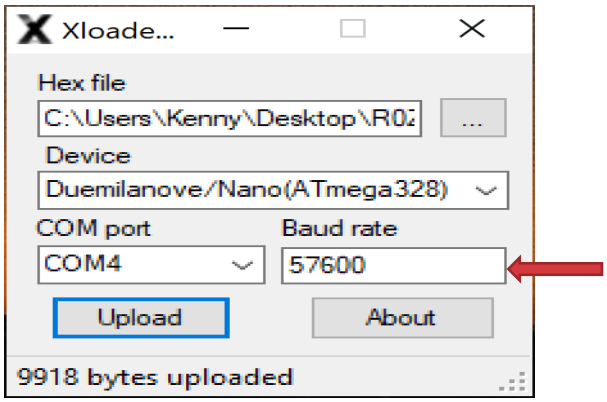


ARDUINO FIRMWARE UPDATE (continued)

14. Press Upload Tab



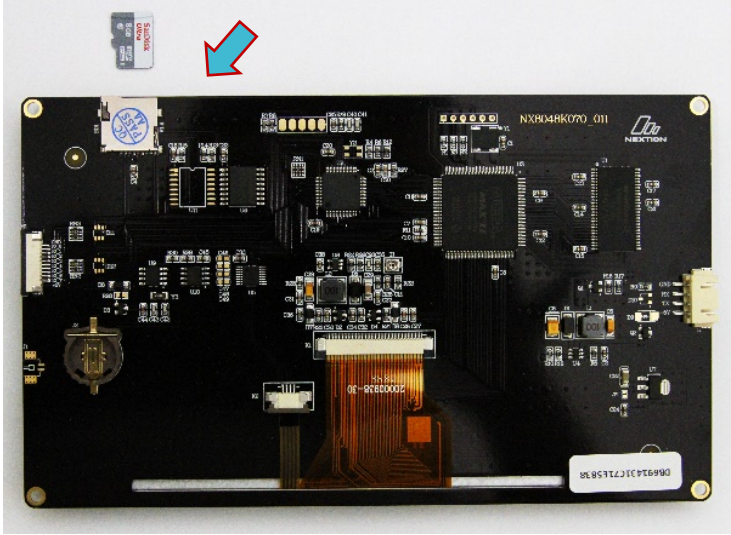
The load should not exceed 10 seconds. If (Uploading ...) takes a long time, repeat the process and type 115200 Baud.



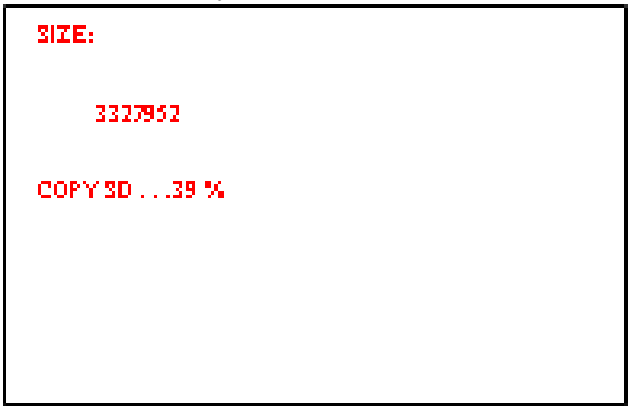
Congratulations, Arduino was updated

DISPLAY FIRMWARE UPDATE (if required)

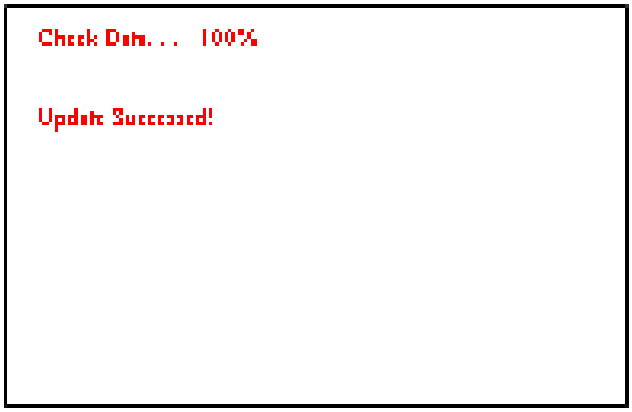
1. Clean or format an SD Card memory
2. Copy the file (.tft) to the SD card
3. Display off, Insert the SD card into the SD slot
4. Turn on Display



The display will take several seconds:



Congratulation, Display was updated:



Turn off the Display and remove SD Card.