Palstar products are designed by hams for hams, carrying on the Palstar tradition for high-quality products designed and manufactured in Ohio, USA.

LA-1K RF SENSING 1000W DUAL HF LDMOS AMPLIFIER

Specifications Summary

- **1000 Watts PEP CW ICAS (160m to 6m)**
- **RF Sensing Auto Band Switching**
- **Color TFT Touch Screen**
- **Variable Speed Fans**
- **12.75" x 6.25" x 16.5"**
- **Weight: 27 lbs, 12.3 kg**

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LA-1K RF SENSING 1000W DUAL HF LDMOS AMPLIFIER Technical Manual

Designed and Manufactured in the USA

LA-1K SPECIFICATIONS

- SSB POWER: Power levels up to 1000 W PEP
- CW MODE: 1000 W CW ICAS
- FM/RTTY: 500 W
- AM: 250 W
- FREQUENCY RANGE: 1.8 to 54 MHz
- DISPLAY: Color TFT touch screen
- INPUT DRIVE LEVEL: 45- 55W (all bands) 40-55W (typical), 60W max
- OUTPUT: 3 x RF SO-239 or Type-N
- ALC: Exciter power control
- GAIN: 13 dB + or -1dB (nominal)
- RF SENSING: Auto band switching without band data
  Cable from transceiver
- RF OUTPUT: Relay T/R switching
- POWER SUPPLY: Internal medical grade
- AC POWER: 100-125VAC @ 15A or 200-250VAC @ 10A
  NEMA 6-15R or NEMA 6-20R wall receptacle
- DC SUPPLY: 50 VDC @ 42A
- POWER DEVICES: 2 x 5600H 600W LDMOS
- AUTO-PROTECT: SWR/Short circuit/Over temperature
- COOLING: Variable speed fans (3)
- INTERMOD: Low IMD distortion > -35dB (typical)
- PURE SIGNAL: Sample @ +10dBm @ 1kW output (rear panel)
- CHASSIS: .090 ga. aluminum
- TOP COVER: .090 ga. aluminum powder coated
- DIMENSIONS: 12.75" W x 6.25" H x 16.5" D
- WEIGHT: 27 lbs., 12.25 kg
- DESIGN CONCEPT: Full compatibility with
  Palstar HF-AUTO automatic tuner
- WARRANTY: One year

FAULT DISPLAY INDICATIONS

As noted below, these flashing fault displays clear automatically on next transmission, when fault condition is corrected.

Note that TX shows on display any time that the PTT input line is grounded.

TX BYPASS SWR: The SWR has gone high during a transmission. It may do this with a transient SWR fault (such as an arc fault on the antenna, or lightning arrestor) The SWR reading may be low or high after tripping but the LA-1K **STAYS** in bypass until you unkey the transmitter. The "**BYPASS SWR**" graphic will then continue to flash until transmitting shows a lower SWR. Adjusting the antenna tuner while transmitting at high power may trigger this indication. The LA-1K should always be in **BYPASS** for antenna tuner adjustments.

SWR HIGH, TX WAIT displays: The amplifier will not key up until the SWR indication is below 2.5:1. It is waiting for lower SWR before keying up. When you unkey, the display continues flashing **BYPASS SWR**.

SWR low, TX wait displays: The amplifier is keyed on the PTT line but waiting for RF to be applied before transmit mode completes. (In Operate Mode) This indication does not occur in direct keying mode if band data is present.

BYPASS I_d: This fault trips to protect the transistors whenever the drain current (I_d) exceeds 45.9A. This may occur with a poor load SWR that places high capacitive reactance on the LA-1K output. If the SWR cannot be adjusted to provide lower I_d values, the LA-1K drive level must be reduced to prevent tripping. Normal I_d values should never exceed 42A at 1,000 W carrier power.

BYPASS TEMP: The LA-1K heatsink temperature has exceeded 99°C. The LA-1K stays locked in **STANDBY** until the temperature has dropped below 70° C. If the power to the LA-1K is cycled the amplifier lockout may be reset immediately providing that temperature is below 99°C. Make sure the LA-1K vents are not blocked. Reduce power if necessary.

TX OVERDRIVE: The LA-1K has detected drive levels exceeding 70 W. It has bypassed to protect the transistors from possible damage. Drive level should not exceed 60 W.

BYPASS FQ: This fault indication displays when MARS operators transmit on a filter change over frequency. These are 2.002, 4.502, 9.002, and 22.002 MHz.

Frequency turns red, and the LA-1K won't key: This can occur if you are transmitting in a locked out frequency range such as 27 MHz CB band. The normal lockout window is from to 25.983 MHz 28.001 MHz.

Note that if transmitting below 1.8 MHz, the LA-1K simply says **TX BYPASS.** It will not operate in this frequency range. All matching adjustments must be completed at low power.

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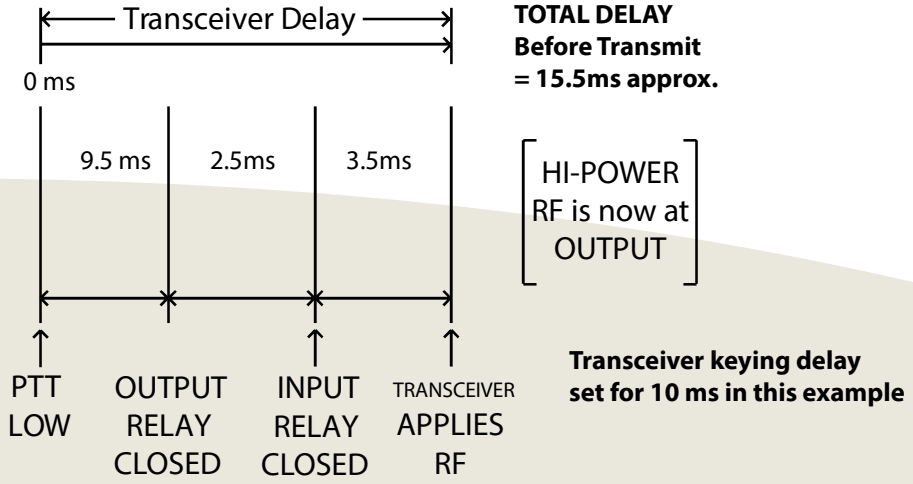
DIRECT MODE LA-1K KEYING



TOTAL DELAY Before Transmit = 15.5ms approx.

HI-POWER RF is now at OUTPUT

Transceiver keying delay set for 10 ms in this example

Selecting **DIRECT KEYING** mode closes the LA-1K transmit relays in direct response to the PTT line. This way the transceiver's built-in transmit RF delay ensures enough time for the relays in the LA-1K to be in transmit position before RF is applied. Approximately 11 ms is required for relay closing so if adjustable, the transceiver keying delay should be set to a value higher than 11 ms.

NOTE: A band data cable is required in this mode. The LA-1K reverts to normal keying without the band data cable connected.

THEORY OF OPERATION

The LA-1K RF Sensing Dual HF LDMOS amplier is a complete stand-alone RF LINEAR amplier.

It is completely independent of data from an external source to determine frequency for tracking from band to band. As a result of this feature the LA-1K will function with any transmitting device without interconnecting data cable attachments.

The LA-1K was designed to meet and exceed FCC requirements on all U.S. amateur radio frequencies where ampliers are allowed. If this amplier is used on non-amateur frequencies please note that specications are not guaranteed on these out-of-band frequencies.

The power output of the LA-1K is 1000 Watts PEP CW ICAS (Intermittent Commercial and Amateur Service). Under the ICAS classication, the use of the LA-1K is designed for transmissions that are of an intermittent nature.

Intermittent operation of the LA-1K implies that no operating or "ON" period of 1000W of Continuous Carrier Power will exceed approximately ONE minute. On Single Side Band (SSB) voice duty there is no limit on transmit time at full power of 1000W PEP.

Every "on" period must be followed by an "off" or standby period of at least the same or longer duration. The LA-1K provides a +10dBm@1kW RF tap feed at the rear panel to provide provisions for "PURE SIGNAL" operation provided by compatible transceivers. The level adjustment is calibrated at the factory. The LA-1K was designed to be fully compatible with the Palstar HF-AUTO automatic antenna tuner.

Included with the LA-1K:

- Two (2) line cords for 120VAC and 240VAC
- User manual
- Shipping box (please keep for warranty repairs etc.)

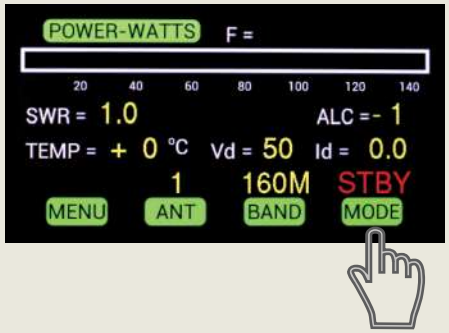
As per FCC 15.21 changes or modifications not expressly approved by Palstar could void the users authority to operate the equipment. No tune up procedure exists.

SCREEN DISPLAY ON POWER-UP

ON INITIAL POWER-UP
Display will indicate STBY mode (stand by). To switch the mode press the "MODE" button on the touch-screen display to switch to "OPR" mode (operational)

To change the POWER UP MODE push MENU then NEXT until SELECT POWER UP MODE displays at the top. Now select desired POWER UP MODE: STANDBY, LAST USED or OPERATE.

STANDBY MODE



NOTE: The wattmeter only shows the horizontal red power bar indicator when the LA-1K is producing power.

It is recommended that for power up mode "STBY" is selected to allow a tune sequence when using our HF-AUTO Antenna Tuner. After the HF-AUTO is tuned, push MODE to select "OPR" for operation mode.

NORMAL MODE KEYING

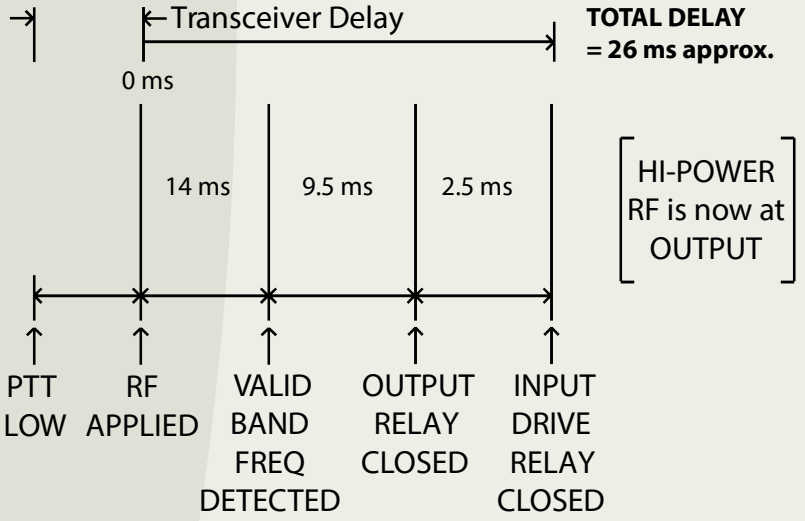
HOW KEYING WORKS:

When the PTT line goes low, the amplifier won't close it's transmitting output relay until it gets a solid frequency reading and switches bands. This requires 14 ms of RF being applied.

The output relay then closes, requiring 9.5 ms to close. The total elapsed time at this point is 23.5 ms.

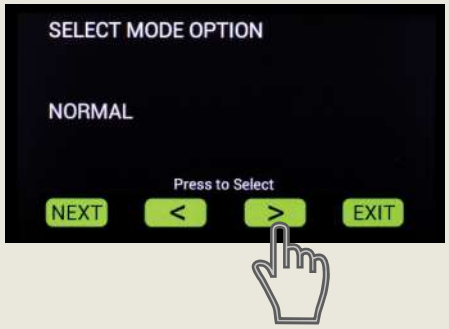
The input relay then closes (it was energized 2 ms after the transmit relay) This adds a 2.5 ms delay. High power now appears at the output.

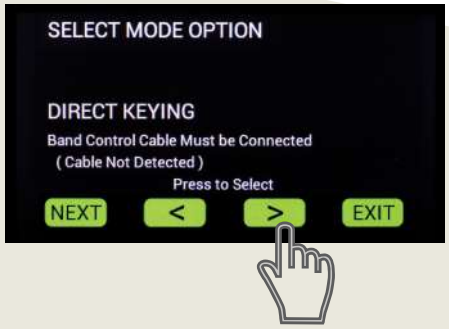
The total delay therefore is approximately 26 ms.



KEYING MODES

To select NORMAL MODE KEYING or DIRECT MODE KEYING press the MENU button on the TFT display then continue to press NEXT several times until you see the SELECT MODE OPTION. Use the arrow keys (< and >) to select NORMAL or DIRECT KEYING. NOTE: In DIRECT KEYING MODE the LA-1K will switch to STANDBY when a band change occurs.

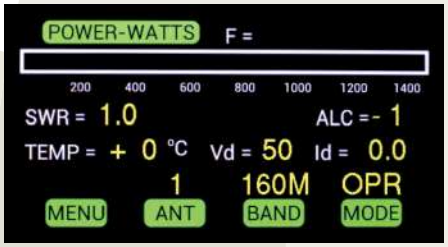




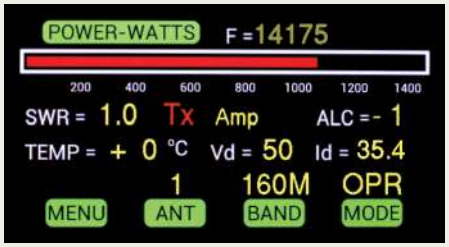
OPERATIONAL MODE

OPERATIONAL MODE
To switch into operational mode or "OPR" press the MODE button on the touch-screen display until "OPR" mode (operational) is displayed. The red power bar indicator will only be visible when transmitting.

OPERATIONAL MODE (NOT TRANSMITTING)



OPERATIONAL MODE (TRANSMITTING)



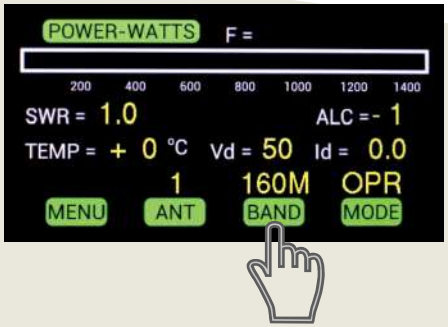
ADDITIONAL FEATURES

- Automatic band selection when transmitting
- Automatic antenna selection of last used antenna output when band selected
- Over-temperature protection by fan speed control and bypass mode if temperature exceeds 100°C (fault temperature appears on display)
- Unit is locked in BYPASS until temperature drops below 70°C
- Frequency operation lockout from 25.99 MHz - 28.00 MHz

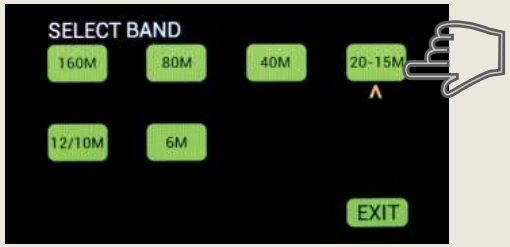
OPERATIONAL MODE

BAND SELECT
To switch bands (160M, 80M, 40M, 20M-15M, 12M/10M, 6M) press the BAND button on the touch-screen display then select the desired band.

NOTE: The LA-1K selects the proper band automatically when transmit (PTT or Push To Talk) is activated.



Select the band by pressing the button corresponding to the desired band. A yellow arrow below the band designation will indicate which band is selected. Press EXIT to return to the main menu.



TROUBLESHOOTING

TX Wait: (as seen on the TFT display)

This message appears on the display when the PTT line is grounded but no RF is present. RF must be applied with PTT line low to key the amplifier to the transmit state.

Won't amplify or auto-band switch when transmitting:

Solution:

Make sure that the PTT cable is connected to the transceiver. This is a **REQUIRED** connection. Note that TX will show on the display when the PTT connector sees a ground. Some transceivers must have their PTT keying output enabled in the transceiver menu settings.

Low SWR on transceiver, high SWR on the LA-1K

Solution:

Always disable (bypass) the auto-tuner in your transceiver when driving any amplifier.

The transceiver's autotuner can not match loads connected to the amplifer's output.

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TROUBLESHOOTING

Bypass TEMP: (as seen on the TFT display)

The LA-1K is in **BYPASS** to protect itself from high temperatures. The temperature will show in red when it exceeds 70°C. When the heatsink temperature exceeds 100°C **BYPASS TEMP** will show on the display.

Solution:

Allow time for the heatsink to cool down below 70°C.

Operate (OPR) will automatically return. Verify that the side vents are clear from obstructions.

High SWR or prolonged transmission in carrier modes may cause elevated temperatures.

TX OVERDRIVE: (as seen on the TFT display)

This displays when the drive level exceeds approximately 60W.

Solution:

Reduce the drive level to prevent displaying this fault.

Bypass + V_d: (as seen on the TFT display)

The LA-1K is in **BYPASS** to protect from loss of +50V, drain voltage supply. The fault should clear in a few seconds. This can occur when operating on 120V if the drain current (I_d) exceeds 32A.

Solution:

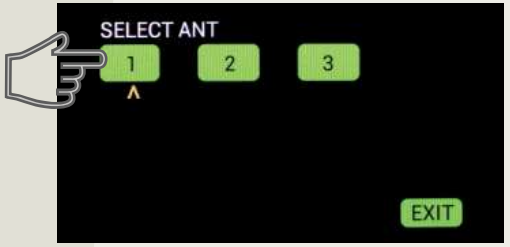
Switch the supply voltage to 240VAC or if operating on 120VAC is desired, reduce drive power.

OPERATIONAL MODE

ANTENNA SELECT

To switch antennas between ANT 1 (Coax 1), ANT 2 (Coax 2) and ANT 3 (Coax 3) press the ANT button on the touch-screen display.

Then select the desired antenna output. This setting will automatically select when changing bands to the last one used on any particular band. The default value is ANT 1 (Coax 1).



Select the antenna by pressing the corresponding number on the touch-screen display. A yellow arrow below the number of the antenna will indicate which antenna is selected. Press EXIT to return to the main menu.

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OTHER MENU OPTIONS

SELECT BACKLIGHT
To adjust the backlight on the touch-screen display press MENU and then NEXT until the SELECT BACKLIGHT LOW or SELECT BACKLIGHT HIGH screen appears.

SELECT BACKLIGHT LOW/HIGH

Press and hold the < or > buttons to adjust BACKLIGHT LOW (the screen intensity used when no buttons are pressed). Click NEXT until the SELECT BACKLIGHT HIGH screen is displayed (the screen intensity used when buttons are being pressed) and use < or > to adjust.

Press EXIT to return to the home screen.

AM/FM POWER SET PROCEDURE

For AM mode set the carrier no higher than 250 Watts. AM peak power is 4 x the carrier level.

TROUBLESHOOTING

Transmit Fault Indications

Bypass SWR: (as seen on the TFT display)

The LA-1K is in **BYPASS** to protect itself against high SWR. This indication appears when the SWR is (or has been) over 2.5:1 during a transmission. Transient faults such as antenna arcing can show a low SWR after the fault event while the transmitter is still keyed up.

Solution:

Make sure the correct LA-1K antenna connector is selected.

Verify that your HF-AUTO or other tuner has obtained a good match while the LA-1K is in standby. Attempting to tune at high power can cause this alert.

With some auto-tuners it may be necessary to select manual mode after obtaining a low SWR to prevent unwanted tuning in the middle of your transmission.

If antenna arcing or loose connections are suspected, try the amplifier on a dummy load. If it works normally there is likely some type of intermittent SWR problem.

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POWER SUPPLY PERFORMANCE

If the LA-1K is used with 120VAC the max current rating is 33A. The **DRIVE LEVEL** on some of the bands may need to be reduced.

If the current exceeds 33A, the power supply will shut down and the V_d reading on the LA-1K's display will read **ZERO; "BYPASS + V_d".**

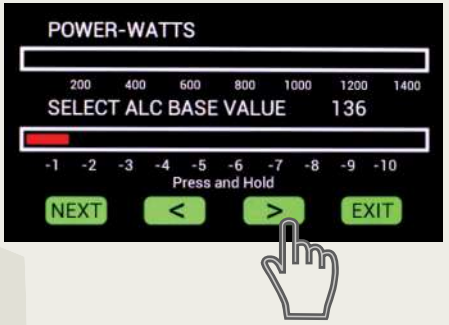
The power supply will immediately come back on in 1 to 2 seconds and the TFT display will read 50V. Reducing the **DRIVE LEVEL** will prevent this from occuring.

The medical grade power supply of the LA-1K was designed to behave this way and will not be damaged.

When using the LA-1K with a 208-250 VAC supply, operation at 1000W PEP is available on all bands. It is recommended that 240VAC be used for all modes.

OTHER MENU OPTIONS

SELECT ALC BASE VALUE
To adjust ALC base value push the MENU button on the touch-screen display and then NEXT until the following screen appears:



Press and hold the < or > buttons to increase or decrease the ALC BASE VALUE. If using ALC this should be adjusted carefully to match your transceivers requirements. See the section titled "ALC ADJUSTMENT PROCEDURE" for further instructions.

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ALC ADJUSTMENT PROCEDURE

NOTE: Amplifier ALC is only used for SSB voice transmission.

- Connect the ALC cable from transceiver to the LA-1K amplifier
- Set the ALC BASE VALUE to minimum on the LA-1K as described on the previous page
- Place the transceiver in CW or RTTY (NOT AM or FM)
- With the LA-1K in standby mode set the transceiver to an initial power level of about 30 Watts then unkey the transmitter
- Switch the LA-1K to OPERATE MODE (OPR) by pressing MODE
- Transmit and adjust transmitter output to achieve the desired output power level. Do not exceed 1000 Watts output or 60 Watts drive power (to avoid splatter). **UNKEY TRANSMITTER**
- Switch transceiver to LSB or USB transmission. Press MENU on the LA-1K and NEXT until the SELECT ALC BASE VALUE screen is visible. Transmit speaking in the microphone and adjust the LA-1K ALC base value increasing the ALC voltage until the power output starts to drop. The point where power drops slightly is the correct setting. Push EXIT to return to the main screen on the LA-1K

NOTE: More precise adjustments may be made by connecting an oscilloscope to observe the output for clipping.

HOW TO UPDATE FIRMWARE

DOWNLOADING and INSTALLING LA-1K FIRMWARE

- **DOWNLOAD the latest Firmware file (a ZIP archive) from the Palstar website**: **http://www.palstar.com/en/la-1k/**. The download link is near the bottom of the page. The link to the file is named "LATEST FIRMWARE LINK: LA-1K FIRMWARE x.x.ZIP" where x.x is the latest revision number.
- **SAVE** the ZIP file to a location on your computer
- **OPEN** the folder by right-clicking on the ZIP file and select "Extract All" - follow the steps in the Extraction Wizard. After extracting, a FOLDER will be created called "la-1k_firmware_XX" where XX is the revision number.
- **CONNECT** one end of the USB cable to a USB port on your computer.
- **DOUBLE-CLICK** "LOAD_LA-1K.exe" within the folder containing the firmware download.
- Follow the instructions on the opened computer window and use the "Browse" button to select the firmware version to be loaded.
- Press and **HOLD** the GREY button to the right of the USB port labeled "**PROGRAM UPDATES**" during the next two steps.
- **CONNECT** the other end of the USB cable to the LA-1K front panel. A "Found 1 Device" message will appear on the right side of the opened computer window.
- **TURN ON** the LA-1K.
- **RELEASE** the GREY button on the LA-1K front panel.
- **CLICK** on the "Update Firmware" button that is on the opened computer window. Wait until the green bar in the middle of the computer window shows that the programming completes by scrolling from left to right. The firmware version number on the LA-1K is on the bottom line of the start up screen.

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EXTERNAL DATA CONNECTORS

The LA-1K automatically selects bands and it is normally NOT necessary to connect band data cables between your transceiver and the LA-1K amplifier.

Radio Interface (ICOM/YAESU) Connector
This connector is designed to be pin compatible with other amplifiers. The required cables are widely available. They can be used to connect to the ICOM and YAESU transceivers.

RS-232 Band Control (Kenwood) Connector
This connector is designed to be used with Kenwood transceivers for band selection using a null modem adaptor. It is also designed to control the amplifier from a computer.

XCVR Interface (Radio Interface Pinout)

PIN	FUNCTION
1	BCD B IN
2	BCD A IN
3	Kenwood RX (data IN) *
4	Kenwood TX (data OUT) *
5	ICOM Band Data
6	GROUND
7	Amp-Key IN
8	BCD D IN
9	BCD C IN

* Custom cable required

RS-232 Band Control (Kenwood) Pinout

PIN	FUNCTION
1	N/C
2	RS-232 Transmit
3	RS-232 Receive
4	N/C
5	GROUND
6	N/C
7	RTS
8	1kΩ Pullup Resistor to +12V *
9	N/C

* Required with Kenwood transceivers

PREVENTING DAMAGE TO THE LA-1K

WARNING
TO PREVENT DAMAGE TO THE AMPLIFIER:

Never drive input power in excess of 60 Watts.

Never use a tuning pulser in CW full break-in mode. The LA-1K was **NOT** designed for full break in CW operation Very high speed full break in keying which toggles the PTT line can lead to amplifier damage.

Never block the air vents of the LA-1K. Without proper airflow, excess heating of internal components may occur.

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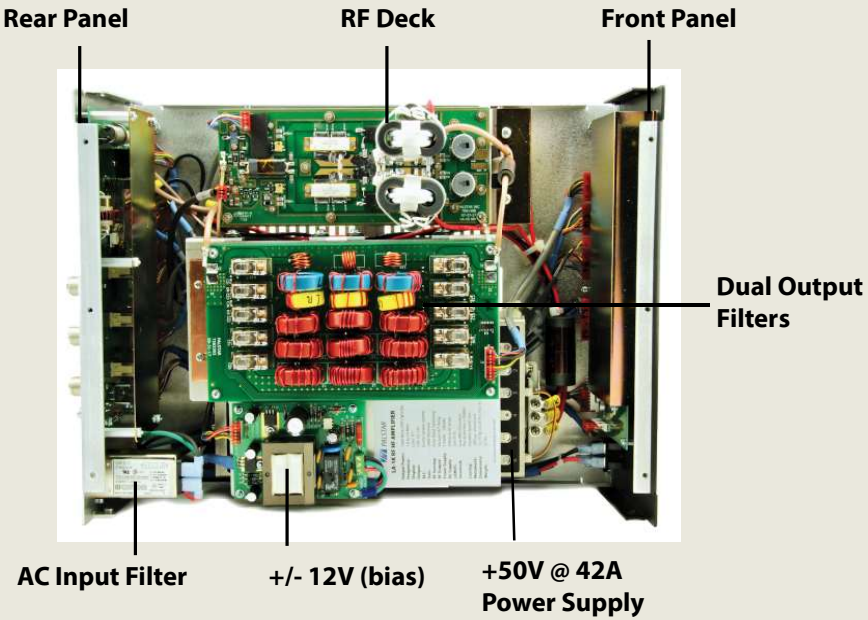
REQUIRED CONNECTIONS

Required connections are: RF IN, RF OUT and PTT.

The phono input PTT can be activated by any transceiver with a PTT cable from the LA-1K to the transceiver (not supplied). When PTT is grounded **TX** is displayed and the LA-1K is ready to transmit.



EXTERNAL DATA CONNECTORS

Table of YAESU/ELECRAFT Band Selections and 4 Bit BCD Codes

Band	DBCA
60m	0000
160m	0001
80m	0010
40m	0011
30m	0100
20m	0101
17m	0110
15m	0111
12m	1000
10m	1001
6m	1010
NC	1111

0 = low voltage (0 V)
1 = high voltage (5 V)

Table of ICOM Bands and Voltage Level (Pin 5)

NC	0 V
160m	7.5 V
80m	6.5 V
40m	5.5 V
30m	0.5 V
20m	4.5 V
17/15m	3.5 V
12/10m	2.5 V
6m	1.5 V

NOTE: 30M is NOT a separate band on the LA-1K. When the band voltage drops to zero, the LA-1K correctly switches to 20M. This allows operation on the 30M band but without "**DIRECT KEYING**" due to cable detection by checking for voltage on ICOM band data input. 30M is limited to 200W and amplifier operation is not normally required on this band.

MARS Frequency Usage

Range	2.011-25.401 MHz
Power Level	400 W
Emissions	3K00J3E/J2D