

# Q5 SIGNAL 70cm 120W Linear Amplifier

A Down East Microwave Product Manufactured by Q5 SIGNAL, LLC

**Part Number 70120PA**\_\_\_\_ **SN**\_\_\_\_\_

<b>Frequency Range:</b>	420 - 450 MHz	
<b>Power Output :</b>	100 Watts linear, +120W Saturated	
<b>Input Drive Level:</b>	<input type="checkbox"/> 200 mw <input type="checkbox"/> 1 watt <input type="checkbox"/> 3 watt <input type="checkbox"/> 10 watt	
<b>DC Power Requirement:</b>	13.8 VDC @ 25 amps.	
<b>Connectors:</b>	<input type="checkbox"/> N (F) <input type="checkbox"/> BNC (F) on Input Only	
<b>Options:</b>	<input type="checkbox"/> LNA <input type="checkbox"/> RF Sense <input type="checkbox"/> TR Bias <input type="checkbox"/> Mast Mount	
<b>DC Connector:</b>	<b>Color</b>	<b>Function</b>
<b>Pin 1</b>	White	<input type="checkbox"/> PTT- L <input type="checkbox"/> PTT-H
<b>Pin 2</b>	Red	RX ON
<b>Pin 3</b>	Blue	LNA ON
<b>Pin 4</b>	Green	RF Power Monitor
<b>Pin 5</b>	Black	GND
<b>Pin A2</b>	Large Red	+13.8VDC
<b>Pin A1</b>	Large Black	GND
<b>Special Options:</b>		

**Description:**

The 70120PA series of 70cm power amplifiers is a new design utilizing the standard configuration of two combined MOSFET power modules. This design offers a new attractive physical design and options and features that were not previously available. Your amplifier has been custom configured to your specific requirements and should be ready to operate after a quick review of the details provided within this manual. Understand that any configuration can be user modified if your requirements change in the future. Please refer to your configuration indicated above when reviewing this complete document.

## **Specification Review:**

**Part Number:** Your desired part number is marked. The **70120PA** is the standard power amplifier for Transmitting only. The **70120PAS** has Transmit/Receive RF switching enabling a receive signal to pass through the amplifier for Transceiver type operation.

**Frequency Range:** All versions of this amplifier will operate from 420 – 450 MHz.

**Power Output:** Power output is optimized for a minimum of 100 watts linear or +120 watts saturated. This power level is only achieved with the specified operating voltage of 13.8 VDC and at the maximum specified drive level selected at the time of ordering. The amplifier will operate out of the selected frequency range at reduced levels.

**Input Drive level:** The Input Drive Level is the power level that will produce the maximum linear output power. Saturated output power will be achieved 1 or 2 dB above that level. It should also be considered the Maximum drive power level.

**DC Power Requirement:** This is the specified Voltage that all RF power measurements are made. The DC current specification is the drain at maximum output power. The Amplifier will have an idle current of up to 18 Amps with no drive applied.

**Connectors:** Connectors are Type N. However, a BNC type may be requested for the input connector only and mixed connectors may be utilized with no additional charge.

## **Options:**

**LNA:** This is an internal LNA that is switched in/out of line during Transmit and can be bypassed and controlled with connections made through the DC connector. It is only available in the 70120PAS version amplifier.

**RF SENSE:** This option is not recommended for CW or SSB. Excessive relay chatter at this power level and frequency will damage the TR relays. This option is only provided for FM or ATV operation in the 70120PAS. The RF sense circuit activates the Bias and T/R function of the amplifier. It is not compatible with the LNA option.

**MAST MOUNT:** This option is the 70120PA or 70120PAS amplifier without the Heat Sink and cooling fan. As provided, it is intended to be mounted in a separate metal enclosure that may be mast mounted or in a remote enclosed environment providing conduction cooling. The amplifier will dissipate more than 200 watts of heat and if cooling is not adequate, damage may occur. If this option is ordered there will be an additional Installation document provided.

**TR BIAS:** A PTT-High signal is applied to the input coax of the amplifier.

**DC Connector:** The DC connector is a multi-pin device and is provided pre-wired for use. The pins and wire color codes are indicated. Extension of the large diameter RED (**Pin A2**) and BLACK (**Pin A1**) paired wire is not recommended. Shorten this wire if possible to eliminate any additional voltage drop that will occur when the amplifier is under full output power. Utilize a DC power supply with some “headroom” in current over the required 25 amps. Power supply voltage may be as high as 15 VDC. But below 13.8VDC, full output power may not be as specified.

## The Pinout for the DC Connector is as follows:

**Pin 1----- PTT Low or High.** If you desire a PTT to ground, “L” will be indicated. It will sink a maximum of 30 mA. If you require a Positive Voltage for keying, “H” will be indicated. It will require a source of 2 mA. If some sort of special keying such as bias on the coax is required, it will be indicated in the last row labeled “Special Options”

**Pin 2---- RX ON.** This signal may be utilized to determine if the amplifier is connected to DC voltage. This can be helpful if the amplifier is mast mounted or in a remote location. The RX ON signal is toggled between transmit and receive, open (or low) in Transmit and Active High in Receive. Its DC Voltage value is a direct measurement of the Voltage supplied to the amplifier.

**Pin 3---LNA ON.** This is the control line for the LNA option if installed. It can be connected to a sequencer along with the PTT signal or directly connected to pin 2, the RX On signal and the amplifier will toggle the LNA circuit between TX and RX. A manual switch may be connected between pin 2 and 3 to bypass the LNA if desired during normal receive operation. This switch may also be implemented in to any sequencer scheme. Pin 3 is not connected in the amplifier if the LNA option is not installed.

**Pin 4---RF Power Monitor.** This signal is a referenced non-calibrated power output indicator. It may be utilized for any application such as to drive a voltage meter or LED circuit. It may be roughly calibrated when connected to a desired antenna but may change if the antenna is changed or the antennas performance changes due to excessive VSWR. It is a reference-only indication.

**Pin 5--- GND.** This is a ground connection to the amplifier and may be utilized for the PTT-L circuit or the RF Power Monitor return circuit. This circuit is directly connect to the negative side of the DC power supply but is not capable of handling more than 1 amp of DC current.

**RF Connections:** They are labeled “**XCVR**” the port that is connected to your transceiver or transmitter and “**ANT**” the port that is the output of the amplifier or connected to the antenna.

### **Instructions for Set Up and Use:**

Connect the amplifier in your circuit or on your test bench to your transmitter and quality load or antenna within the 70cm band. Use quality RF cables specified for use above 450MHz on both RF ports of the amplifier. Connect the Red/Black zip cord to a regulated 13.8 VDC supply. Make the zip cord as short as possible in the final installation. If required, simple soldering can replace the cord if cut too short.

Strip and tin the Control cable (gray sheath) to reveal the 6 color coded wires within. The Brown wire is not utilized and may be cut short if desired. The other wires may be connected as specified in the “DC Connector” section found on the cover page. If you do not have the LNA option installed, its connection may be left as is **but the RX ON connection is always connected internally and should be insulated from all other pin connections including ground if not utilized.**

The RF monitor signal should be checked and utilized to keep track of the amplifier's performance. It can also act as a "Drive Set" indicator if accurate RF power measurement equipment is not available. If you have the RF Sense option, there is no need for the PTT signal but understand it is connected as PTT-L and if this line contacts with ground, it will place the amplifier into transmit. Insulate it if required. If you have ordered the amplifier without the heat sink and fan, be sure to have it mounted to an adequate heat sink for testing or have it installed in the final enclosure to verify its capacity.

**Testing:**

Apply the DC power. The cooling fan may start if the heat sink temperature is above 75 degrees F. Apply signal to the PTT. If you have the RF sense option, first key the amplifier with the PTT signal to ground to verify the amplifiers operation. You will notice the RED TX indicator light and if you have a current meter in your DC supply, it will show about 16 -20 Amps of current drain. You can verify that the Red wire (RX ON) in reference to Ground indicates the DC supply voltage and it toggles when the PTT is toggled. If possible, set the TX power of your transmitter to the lowest possible setting and after keying the PTT; apply RF power to the amplifier. Verify an increase in current drain and measure the voltage on the RF Monitor pin. Slowly increase the drive power watching the Current meter and or RF power monitor Pin. If you see that either reached a point of "Compression" meaning that the current or RF monitor voltage doesn't increase any more as the input drive power is increased, recheck your drive power vs the power indicated on the front sheet of this document. What is desired is that all keeps increasing up to you reach you maximum drive level. If not, please consult Q5 Signal with your issue.

If all is well with the output power level, you can now test the RF sense circuit if you have that option installed. Also verify that the LNA option is operational if installed by detecting an increase in noise when activated. If all is well, you are ready to utilize the 70120PA in your completed system

**Caution:** Do not exceed 3dB over the indicated RF drive level or 15 volts on the DC line. Test all coaxial relays for VSWR and insertion loss before use. The amplifier may be mounted in any position but it is best to install the amplifier with the heat sink on top or with the fins vertical so the amplifier will convection-cool with the help of the fan. It is not recommended to keep the amplifier continuously keyed in any type of operation but transmitting of up to 15 min. is acceptable. Use only the supplied DC power cord after installing your fuse of choice. Install protection diodes for reverse and over voltage protection.

## 70120PA Mast Mount Option

If you have ordered the 70120PA as a mast mount version, understand that it was designed with full intention to be utilized in this fashion. Also understand it was fully tested on our test bench with adequate conduction cooling to maintain a steady power level under key down conditions. Under no circumstances should it be assumed that the amplifier will withstand even a short communication in its shipped configuration. The amplifier requires mounting to a metal enclosure with a preferable machined flat surface that will “Sink” heat away from the amplifier enclosure. It also requires a thermal compound or pad be installed between the enclosure and mounting surface.

When the option is delivered, it will have a template to aid attachment to any type of conduction cooling device. The 8 attachment holes within the 70120PA enclosure are tapped to a 4-40 screw size. Further clearing or adjustment may be required to ensure that the amplifier enclosure fits flush with the assembly to which it is attached. This attachment will be required to sink at least 200 watts of heat.

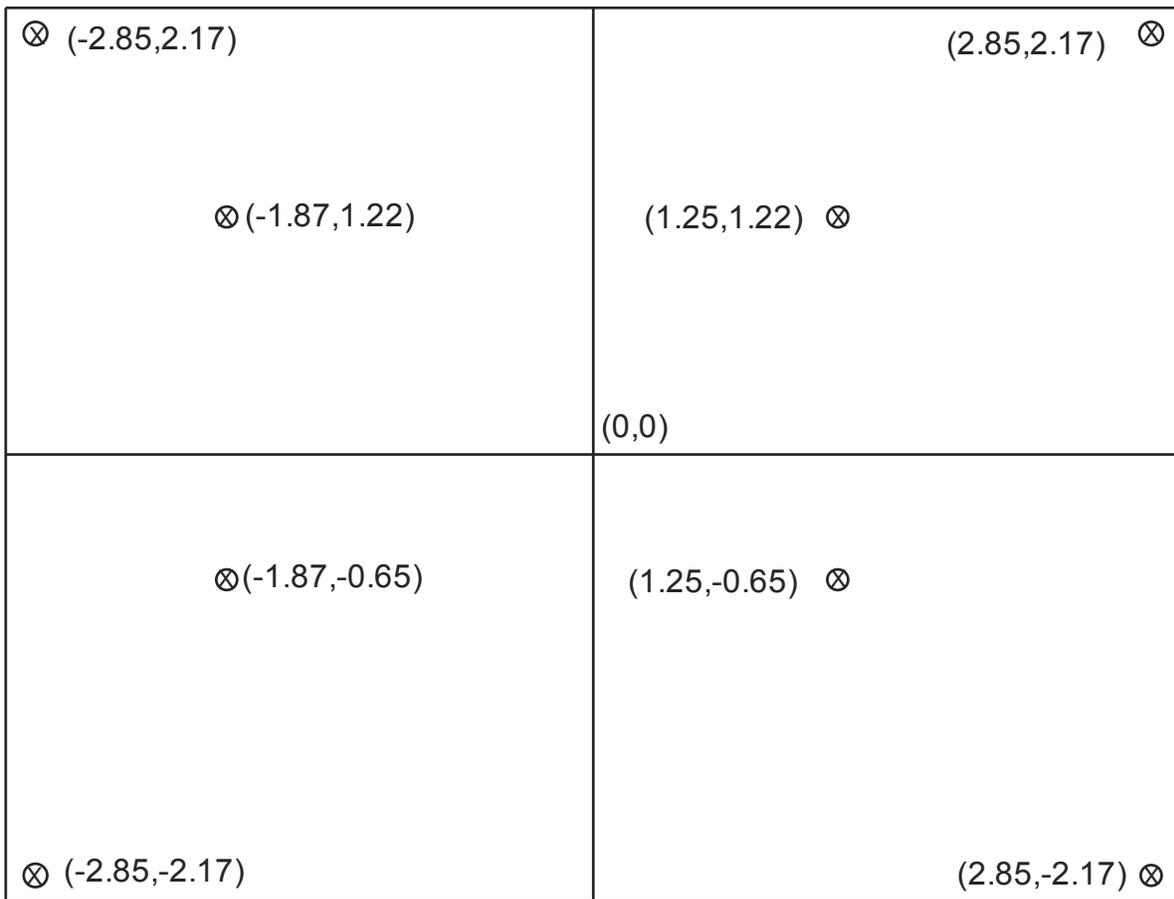
After installation, all testing may be done as specified on the previous pages and should be conducted on the test bench first to ensure the amplifier’s operation. Take into consideration the insertion loss of the Input drive cable. Use the actual cable to be utilized during the remotely mounted operation. If you find that the wrong input attenuator is in use for your operation, consult Q5 Signal for advice.

Also consider the loss in the DC cable if a long length is utilized. It is best to keep the DC source as close to the amplifier as possible. If that is not possible, utilize any current sensing your DC power supply may have or adjust it to +15VDC for operation. This is a safe value for the amplifier to operate at and will help with any voltage drop during transmit.

If your transceiver side cable length has more than 3dB of loss, the LNA option should be utilized. You may extend any of the control cables to any required length and would be most important to understand their functions and importance with a remote mounted amplifier. The ability to toggle the LNA on and off to verify receive performance and having the RX ON voltage to ensure that there is DC voltage to the amplifier is a plus. The RF Monitor will verify that the amplifier is operating and varying the RF drive level will ensure the linearity of the amplifier if required.

If for whatever reason you decide to utilize the amplifier back in the shack or in your mobile as additional power for a rover, the Heat Sink and Fan kit can be ordered and installed by any user.

### Heat Sink mounting hole pattern.



All 4-40 clear holes. Heat Sink Top.

