

# ***DX Connection***

## **QSK 2500<sup>®</sup> Instruction Manual**



### **1) Description**

The DX Connection QSK 2500<sup>®</sup> allows operating a non-QSK amplifier in QSK mode (or SSB mode) with no amplifier modifications. No amplifier T/R relay voltage interface is required. The QSK unit will interface to amplifiers whose relay key jack presents less than 200 volts positive or negative polarity to the QSK unit. The QSK 2500<sup>®</sup> adds a nominal 10ms delay to the transceiver's normal RF delay to eliminate hot switching of the amplifier's internal T/R changeover relay before the first dit or dah of a transmission. After the first dit or dah, the amplifier remains keyed up for the remainder of the transmission preventing excessive T/R relay switching. The QSK 2500<sup>®</sup> returns the amplifier to standby 2 sec to 10 sec (user settable) following the last dit or dah of a transmission. The QSK unit incorporates hot switching T/R relay protection caused by some transceivers removing the amplifier key signal before the RF envelop has decayed to zero. The QSK unit senses for RF on the amplifier RF input connector and only switches from Transmit-to-Receive when the RF envelop is no longer present. A functional block diagram is included later in this manual.

The QSK 2500<sup>®</sup> Key/Paddle input jack accepts a straight key, an external keyer, a bug, a paddle (to use the transceiver's internal keyer), computer generated CW, or anything that keys the transceiver by grounding a circuit(s). The input device must sink 1 ma to ground and accommodate 5 volts open circuit. These requirements are compatible with the transceiver's Key/Paddle Input jack requirements.

### **2) Specifications**

- a) RF Power: 2500 Watts CW/SSB/Data modes
- b) Antenna VSWR: < 1.5:1 at 2.5KW, < 2.5:1 at 1.5KW, < 3.0:1 at 1.250KW
- c) RF losses: almost lossless relays (much less loss than PIN diodes), silver plated SO-239 connectors
- d) QSK internal relays: acoustically quieted and sealed for quiet operation
- e) No hot switching of QSK internal relays
- f) Provides T/R relay high voltage interface for both new and older amplifiers: The QSK 2500<sup>®</sup> input presents a 5VDC 1ma signal to transceiver Amp key jack. The QSK 2500<sup>®</sup> output keys (to ground) amplifier T/R relays up to +/-200VDC and 150ma. (No need for MFJ ARB-704 or Jackson Harbor Keyall Interface.)

- g) Amplifier TX-to-RX hot switching protection: QSK unit returns to Rx mode only after the RF envelop has decayed to zero preventing hot switching the amplifier T/R relay.
- h) Amplifier RX-to-TX hot switching protection: QSK unit adds nominally 10ms (see next item) of delay to the transceiver's internal 5 to 15ms time delay (see Table 1 below) before the start of the transceiver RF envelop output. The 15 to 25ms total time delay allows the amplifier T/R changeover relay ample time to switch to TX prior to the first dit or dah of each transmission. The amplifier remains keyed after the first dit or dah of each transmission preventing excessive T/R relay switching during the transmission. *(The 5 to 15ms initial key delay is not available in SSB VOX mode because the Key/Paddle input delay channel is not used in SSB VOX mode.)*
- i) QSK timing delay: The Key/Paddle output to the transceiver is delayed 10ms from Key/Paddle input with the factory settings. This should accommodate almost all transceiver/amplifier combinations. However, solder jumpers are provided to adjust this timing delay from 4ms to 16ms to accommodate custom transceiver/amplifier timing requirements. (See comment above on SSB VOX mode.)
- j) Amplifier keying delay following the last dit or dah of a transmission: User adjustable from 2 sec to 10 sec (factory setting: 3 sec) SSB VOX mode is fixed at 30 sec
- k) Duty cycle: continuous duty
- l) DC power input: 17 to 25 volts at 200ma (max) [120VAC power block included.]
- m) Two LED indicators: Power On (green), Transmit (red)
- n) Acoustically-quieted, sealed relays for quiet operation
- o) Key/Paddle input jack: 1/4" stereo
- p) Xcr Key/Paddle output jack: 1/8" mini stereo
- q) Amp Key 'IN' phono jack: 5VDC open; 1ma shorted (transceiver keys to ground)
- r) Amp Key 'OUT' phono jack: keys Amp T/R relay to ground. Accepts T/R relay voltages +1 to +200 VDC or -1 to -200 VDC, 150ma (max)
- s) Power jack: 2.1mm male (center positive)
- t) Size: 5 1/4 in W x 2 in H x 3 in D (excluding SO-239 connectors)
- u) Weight: < 1 lb.
- v) Optional cable set: One 6 ft long 1/8" mini-stereo cable, two 6 ft long cables with male RCA plugs, plus one 1/8" to 1/4" stereo adapter.
- w) Factory option to use the Kenwood transceiver +12VDC Amp Key output signal: Contact DX Connection for information.
- x) 1 year Limited Warranty



**(back view)**

### 3) Interconnections

The Control interconnections are shown in Figure 1. The RF interconnections are shown in Figure 2. Referring to Figure 1, the CW input device (i.e. key, paddle, bug, computer, keyer, etc.) connects to the ¼" Key/Paddle stereo input jack on the QSK unit. For single line input devices such as a key, keyer, bug, computer CW, etc., a stereo jack must still be used. The center pin is used for CW; the sleeve is left unconnected. Paddles connect to the center pin and the sleeve in the normal manner (dit center, dah sleeve).

***Update: A stereo plug is no longer required for new QSK units when not using a paddle. The QSK 2500 automatically disables the ring channel at power up if it is found to be shorted to ground.***

The delayed CW appears at the Xcvr Key/Paddle mini stereo jack on the QSK unit in 10ms (nominal setting). This jack connects to the Key or Paddle input on the transceiver.

The transceiver's Amplifier Key jack connects to the AMP Key IN phono jack on the front of the QSK unit. The transceiver keys to ground a 5VDC 1ma signal from the QSK unit. (Contact DX Connection to use Kenwood's +12 VDC for QSK 2500 keying.) The QSK's AMP Key OUT phono jack connects to the amplifier's transmit key jack (i.e 'antenna relay', 'T/R relay', or 'transmit key') as shown in Figure 1. It keys the amp T/R relay to ground. No QSK setting changes are required for keying either positive or negative amp T/R relay voltage polarity.

A 17 to 25 volt, 200 milliamp, 'wall wart' type DC power supply (included with the QSK unit) connects to the 'Pwr In' jack on the front panel. The power supply requires a 2.1 mm power plug (center positive). See this video for an example. [Adding QSK to unmodified Ham Radio Amplifier - YouTube](#)

### 4) Example: Interface to Ameritron AL-811H amplifier series

The QSK 2500<sup>®</sup> interface to the Ameritron AL-811H series of amplifiers is shown in Figures 5, 6, and 7.

### 5) Operation

The QSK power switch places the unit in either 'AMP mode' or 'ByPass mode'. In AMP mode, the QSK unit is active and performs the expected switching of the RF signal.

***The QSK unit must be in AMP mode anytime that the amplifier is to be used regardless of the operating mode, i.e. SSB, CW, RTTY, PSK, AM, etc.***

If the amplifier is not to be used, then the QSK unit can be set to ByPass mode which turns it's DC power off, routes the Key/Paddle input jack to the Xcvr Key/Paddle output jack, and routes the transceiver RF directly to the antenna connector. See Figure 3. The QSK unit can be set to AMP mode for transceiver-only operation if the amplifier power is turned off or the amplifier key input is disabled.

*Optional: Some amplifiers can be disabled by a switch on the front panel. For this case, it is not necessary to set the QSK unit to ByPass to operate without the amplifier. However, the amplifier RF ports must remain connected to the QSK unit. The transceiver RF then goes through the amp bypass circuit.*

## 6) Adjusting Amplifier Keying Delay

After the last dit or dah of a transmission, the amplifier is held keyed for a short time to prevent excessive switching of the amplifier T/R relay. The nominal factory setting is for a 3 sec delay which satisfies most users. Faster CW operators tend to prefer shorter delays and slower operators tend to prefer longer delays. This setting is not critical and is mainly a user preference. (It does not affect QSK receive or transmit timing.) A 20-turn screw-adjustable potentiometer is located next to the PIC16F676 chip (see Figure 1a below). It allows setting the delay from 2 sec to 10 sec. **After adjusting the potentiometer, the QSK2500<sup>®</sup> must be switched off and back on for the adjustment to take effect.** Also, see video: [Adjusting QSK 2500 Delays high resolution Rev - YouTube](#) .

Method 1:

The safe method is to adjust the potentiometer a few turns with the QSK unit turned off, and then turn it on to see how the delay time has changed. Be sure to remember (or write down) the direction of the adjustment and the number of turns so you can estimate which direction to turn the potentiometer screw the next time and how many turns. The adjustment is approximately linear.

Method 2:

Be careful to not short any of the PIC16F676 pins. The delay can be set with the QSK unit powered up by measuring the voltage on pin 8 of the PIC 16F676, and according to the following formula.

$$\text{Potentiometer voltage} = (\text{desired delay in sec} - 2.0\text{sec})/10.1\text{sec} * 5.0\text{volts}$$

**Remember: The QSK unit must be switched off and back on for the delay change to take effect!**

## 7) SSB PTT and SSB VOX operation.

SSB PTT operation uses normal QSK CW settings. You can switch between QSK CW and SSB PTT with no changes to the QSK 2500.

SSB VOX mode is selected by shorting-to-ground the tip of the Key/Paddle input plug prior to power-up. If CW is not used, a 1/4 inch plug with the tip shorted to ground can be inserted in and left in the Key/Paddle input jack. If both SSB VOX and CW are used, the tip must be shorted to ground for 2 seconds during and immediately following QSK 2500 power-up. Holding the key down or holding the dit input with a paddle during power up works fine.

When SSB VOX mode is selected, the QSK 2500 holds the amplifier keyed for 30 seconds following the last voice transmission. (CW cannot be used while in SSB VOX mode.) The QSK 2500 is keyed by the 'AMP in' being grounded by the transceiver's amp key output shorting it to ground. This key line is no change from CW QSK mode.

To exit SSB VOX mode, remove the tip short-to-ground and turn the QSK 2500 power off and back on.

## 8) Optional Key/Paddle Delay timing

The factory setting for the delay from the QSK2500<sup>®</sup> Key/Paddle Input jack to the key/paddle Xcvt Output jack is 10ms. This value is suitable for most amplifier/transceiver combinations. The user is encouraged to use this setting unless this delay is known to be too short. Table 2 below shows that by adding the appropriate solder jumpers, the timing can be adjusted from 3ms to 16ms. There are pairs of holes located next to pins 2, 3, and 4 of the PIC16F676 for the jumpers (see Figure 1a below). A 1/4" long bare #22 solid wire makes a suitable jumper. The delay should not be lowered below 10ms unless test equipment is available to assure hot switching of the amplifier T/R relay does not occur at the start of the first dit or dah of each transmission. See [Adjusting QSK 2500 Delays high resolution Rev - YouTube](#).

**Note:** *Many commercial external QSK units (including PIN diode types) do not protect against hot amplifier T/R relay switching at the start of the first dit or dah of each transmission.*

## 9) Limited Warranty

The QSK 2500 is warranted to be free of defects in materials and workmanship for 1 year to the original purchaser. This limited warranty is for either the repair or replacement of the QSK unit only. There is no coverage for anything other than the QSK unit. This warranty is exclusive of abuse, misuse, accidental damage, acts of God or consequential damages, etc. A DX Connection Return Authorization (RA) is required for warranty service. Email or mail a copy of the purchase receipt and a description of the problem to DX Connection to obtain a Return Authorization. Upon receipt of the Return Authorization, return the unit shipping prepaid to DX Connection. DX Connection will pay return shipping. 73

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**YouTube video 1:** [Adding QSK to unmodified Ham Radio Amplifier - YouTube](#)

**YouTube video 2:** [Adjusting QSK 2500 Delays high resolution Rev - YouTube](#)

**YouTube Video 3:** [QSK2500 TR RelayTiming - YouTube](#)



Figure 1a Delay potentiometer & jumper holes adjacent to PIC processor

Table 1: Total time available for Amp T/R relay to switch using factory setting (factory setting= 10ms)				
transceiver	transceiver RF delay	QSK 2500 <sup>®</sup> key delay (factory setting)	total T/R actuation time	comment
Yaesu FT-1000MP MKV	5ms (min)	10ms	15ms (min)	longer settings in Xcvr <sup>(1)</sup>
Elecraft K3	8ms (min)	"	18ms (min)	" " " "
Kenwood TS-480, TS-2000, TS-590S, TS-590SG	10ms	"	20ms	fixed in Xcvr
Icom IC-7000	8ms	"	18ms	" " "
Yaesu FTDX-9000, FT-2000	15ms	"	25ms	" " "
TenTec Omni VII & Orion I/II	15ms	"	25ms	" " "
Ten Tec Eagle	17ms	"	27ms	" " "
ICOM IC-706 MKIIg	12ms	"	22ms	" " "
IC-756 PRO, PRO II, IC-746 PRO	10ms	"	20ms	" " "
ICOM IC-735	5.5ms	"	15.5ms	" " "
ICOM 7300	6ms (default)	"	16ms	See footnote below <sup>(2)</sup>

Note: (1) Based on the K3 User Manual, use the default 8ms delay in the K3 plus the 10ms delay in the QSK 2500 for 'external' keyers, computer-generated CW, etc. When using the internal K3 keyer or the internal K3 memories, set CONFIG: TX DLY to 18ms in the K3. Plug the key or paddle directly into the K3. Do not route the paddle or key lines through the QSK 2500 for this configuration.

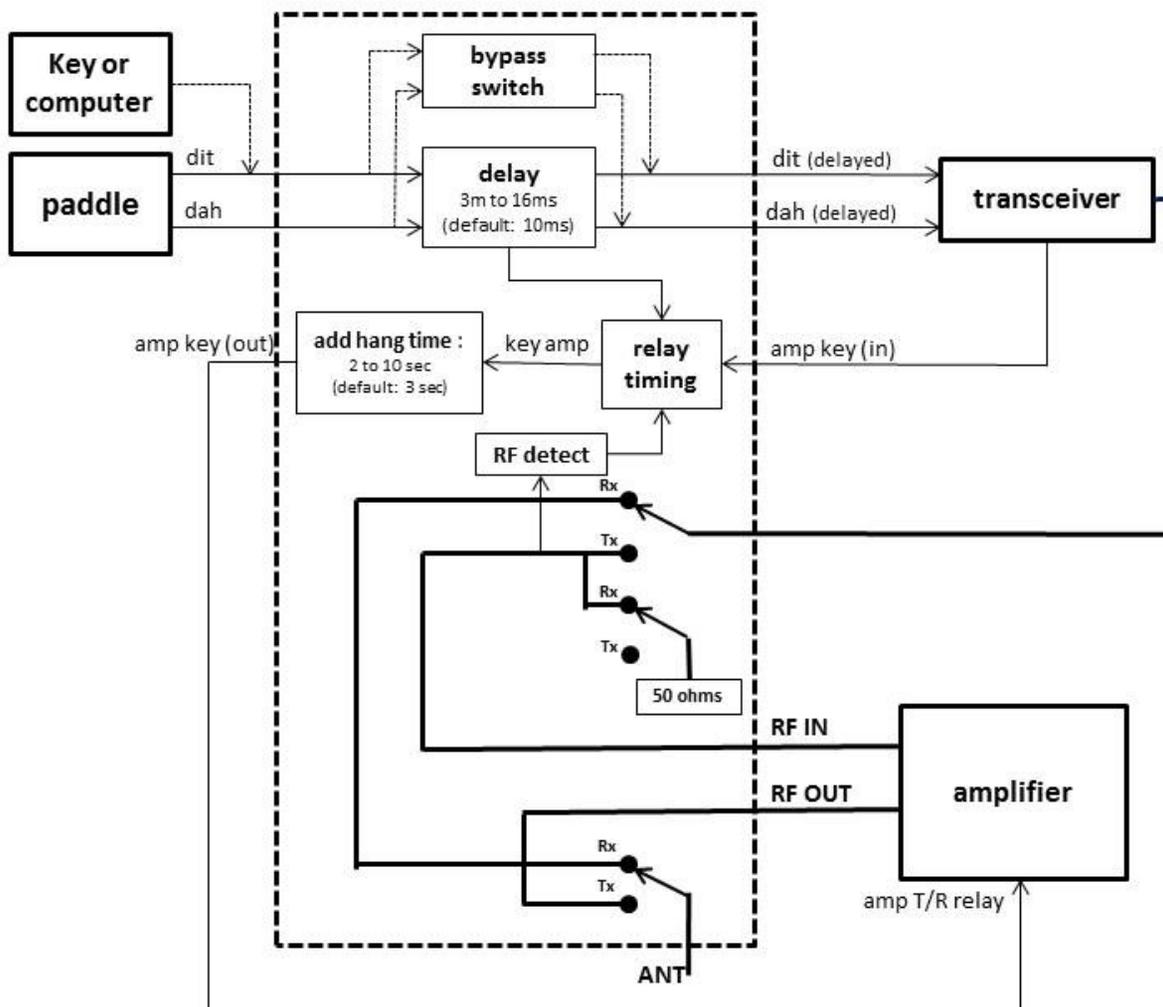
(2) The preferred configuration for the IC-7300 is to set its RF Delay to 20m, (i.e .set TX Delay to 20ms) and route all key, paddle, computer, etc. inputs directly to the IC-7300, instead of through the QSK 2500. This allows using the IC-7300 keyer and memories. No hot switching of Amp T/R relay if using QSK 2500.

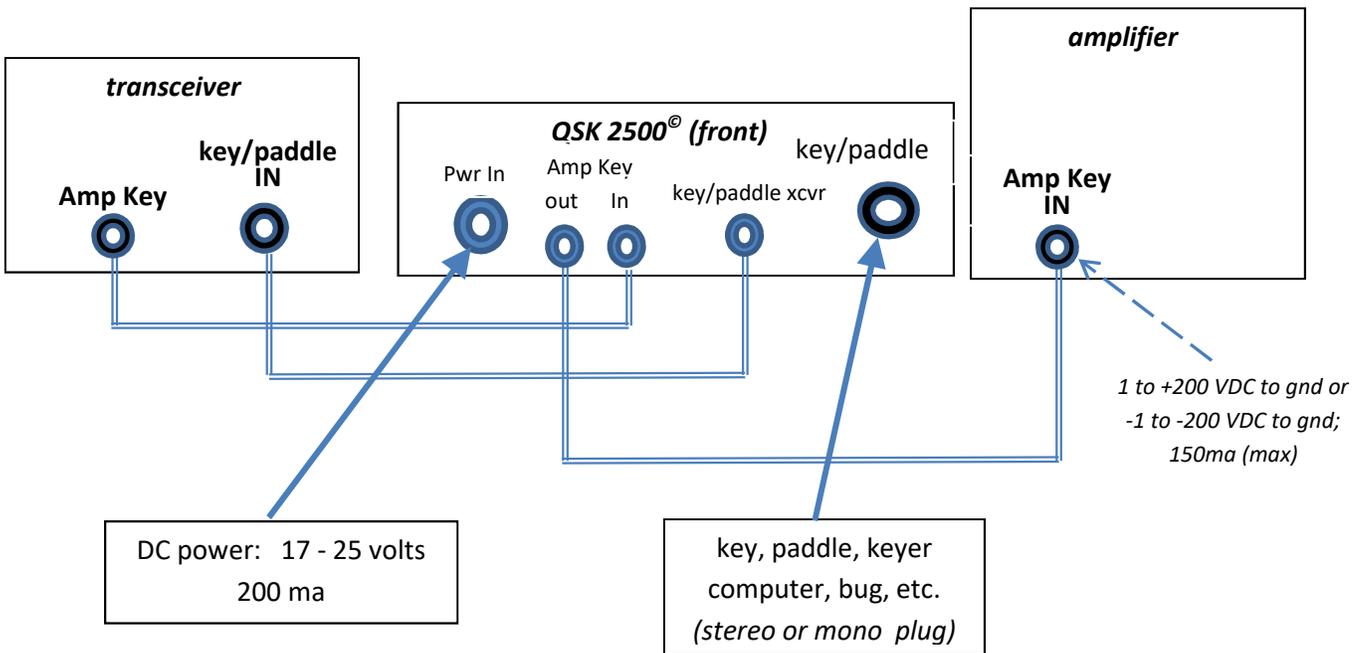
**Table 2: Changing QSK timing delay (Optional)**

Jumper 2 adjacent holes together located next to the PIC16F676 pin specified in table.

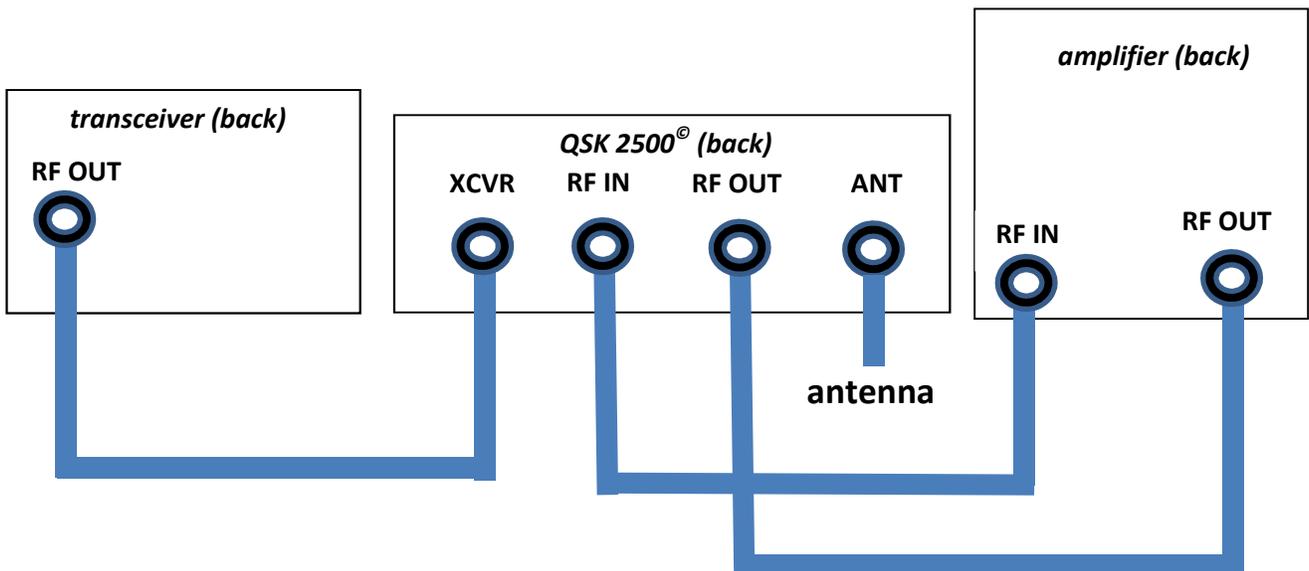
pin 2	pin 3	pin 4	QSK delay	Comment
-	-	-	<b>10ms</b>	factory setting (no jumpers)
jumper	-	-	<b>8ms</b>	add 1 jumper
-	jumper	-	<b>6ms</b>	add 1 jumper
jumper	jumper	-	<b>4ms</b>	add 2 jumpers
-	-	jumper	<b>3ms</b>	add 1 jumper
jumper		jumper	<b>12ms</b>	add 2 jumpers
-	jumper	jumper	<b>14ms</b>	add 2 jumpers
jumper	jumper	jumper	<b>16ms</b>	add 3 jumpers

### QSK 2500 Block Diagram (2/19/16)

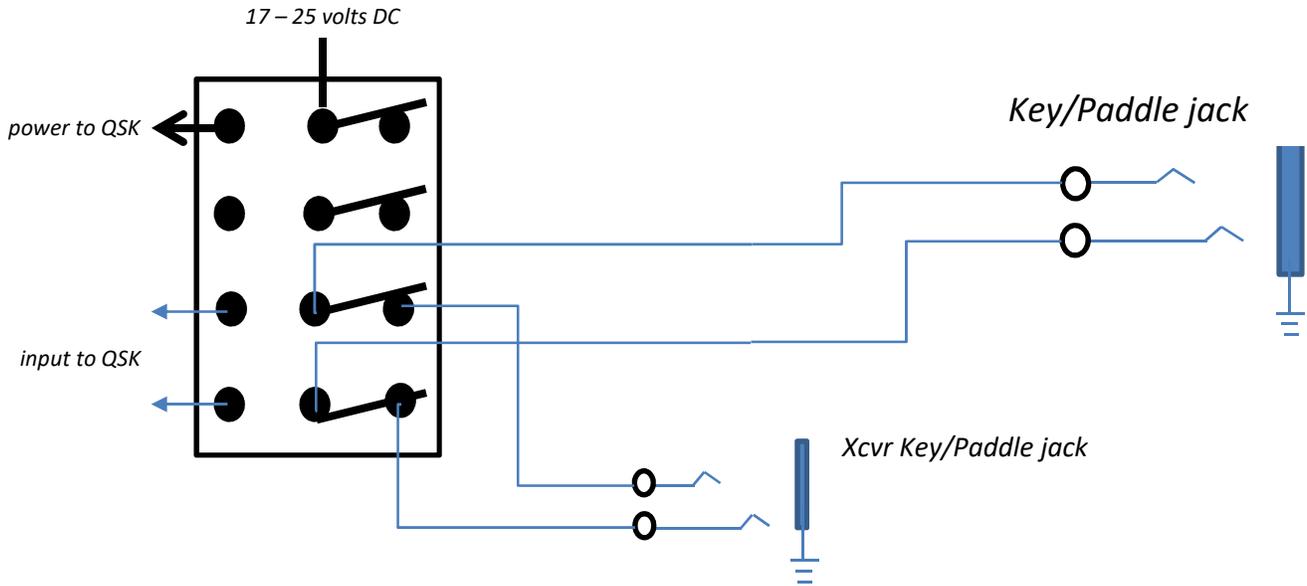




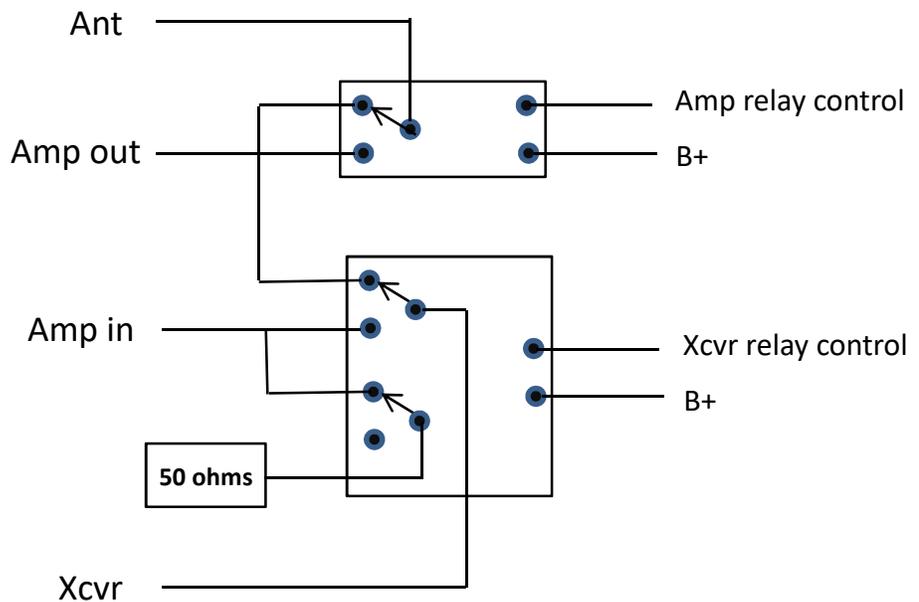
**Figure 1 Control Connections (QSK 2500® front)**



**Figure 2 RF Connections (back)**



**Figure 3 Circuit for power switch set to 'Bypass'**



**Figure 4 RF circuit in 'receive' & when Switch set to 'bypass'**

### Example: QSK 2500 interface to AL-811H Amplifier

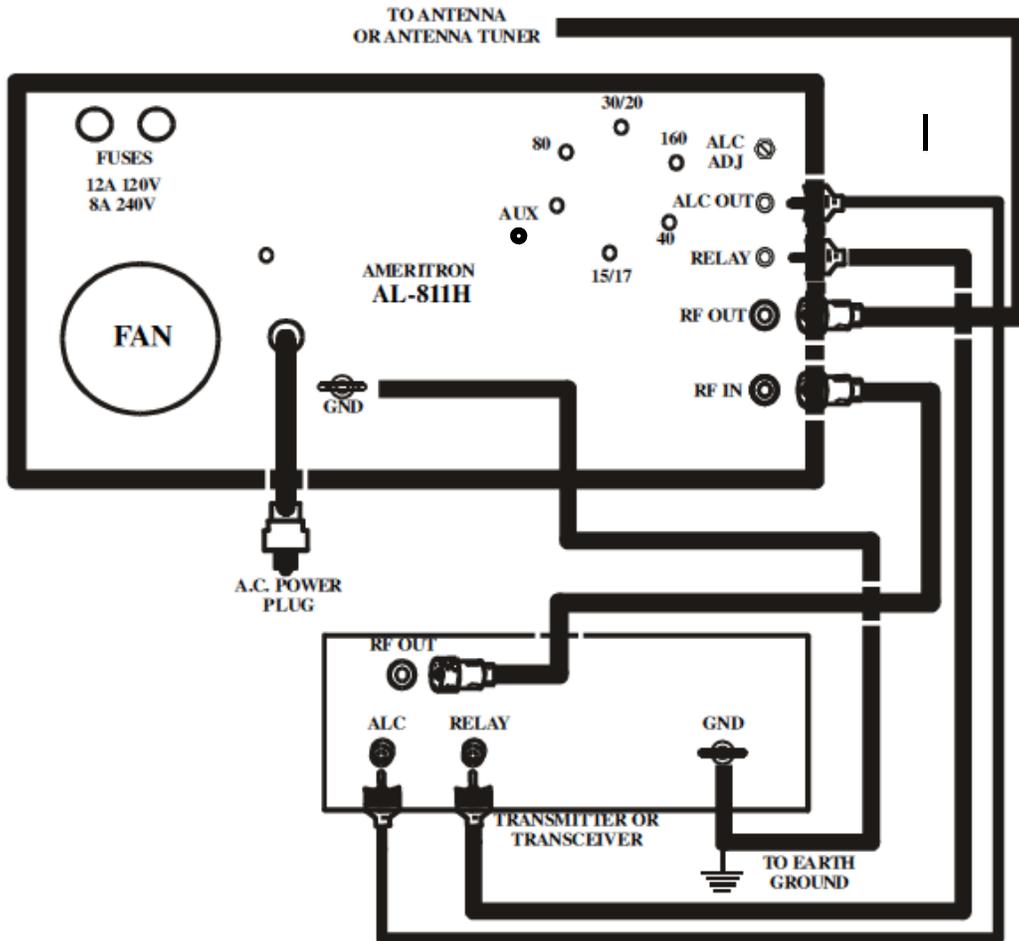
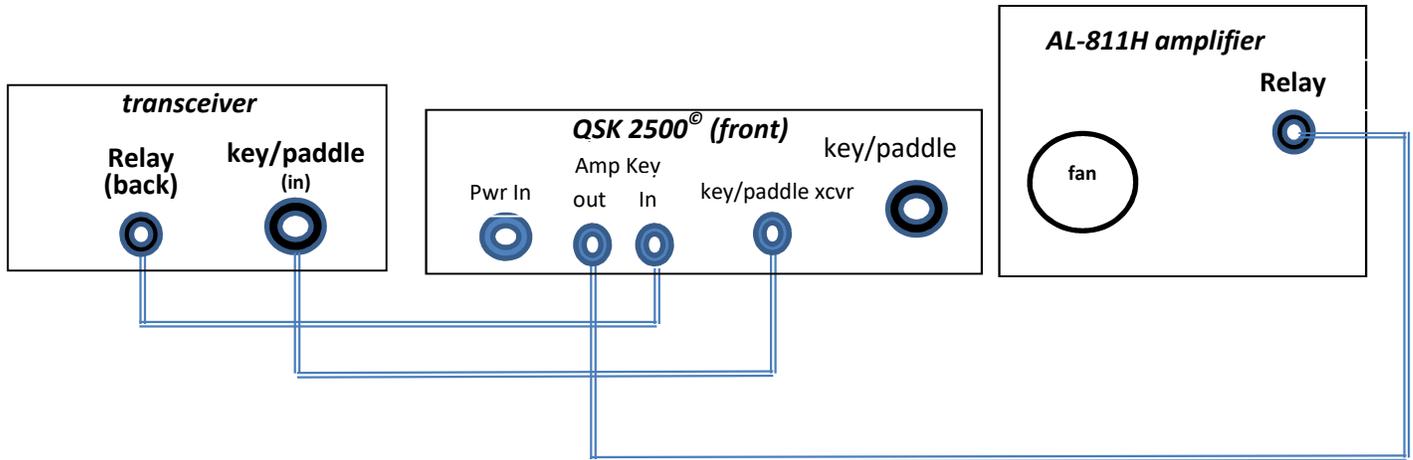
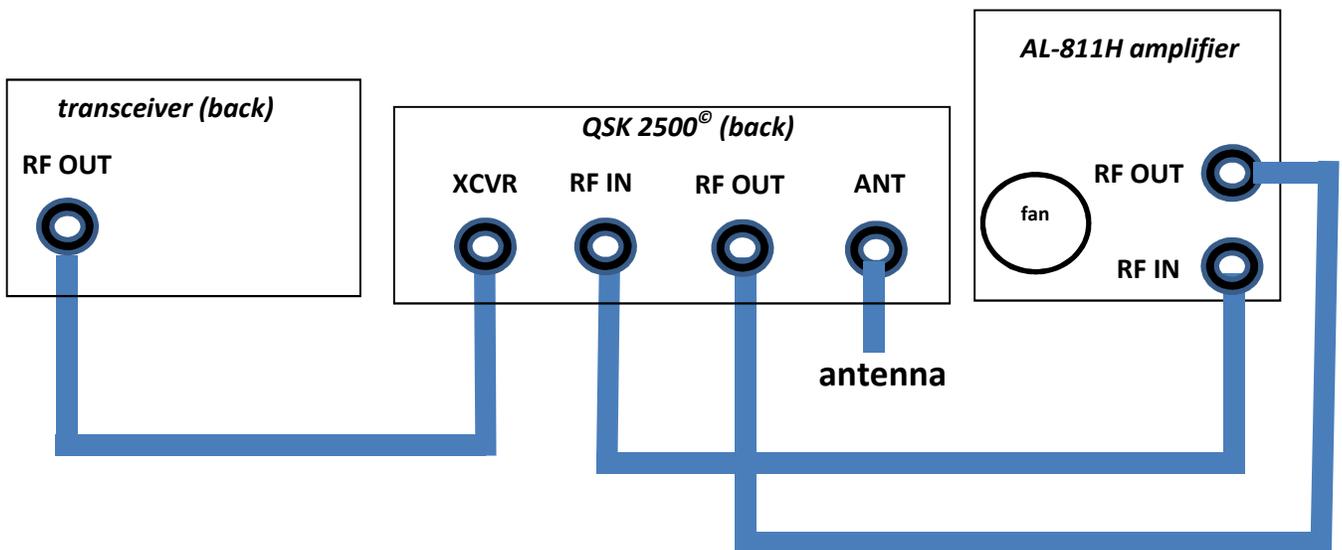


Figure 5 AL-811H without QSK 2500



**Figure 6 AL-811H relay connection**



**Figure 7 AL-811H RF connections (ALC cable is unchanged)**