

# JFET Replacement Instructions for the SR86x Lock-In Amplifier Family

The input voltage preamplifier uses a low-noise matched JFET, Q202, as the front-end active component. This component is sensitive and may be damaged by overvoltage, including overvoltage from a static discharge (ESD). There may be situations in which the user suspects a damaged or destroyed input JFET. Symptoms of a damaged JFET can be excess noise, or partial or complete signal loss.

The SR86x series lock-in amplifiers are designed to permit the user to replace the input JFET in the field if needed. The entire process should take about 90 minutes, including the 60-minute warm-up period needed after replacing the JFET before trimming the offset voltage.

## Materials

To do this, you will need:

1. Replacement JFET (obtained from SRS)
2. Phillips head screwdriver
3. Hex wrenches, imperial size 7/64, and 0.050

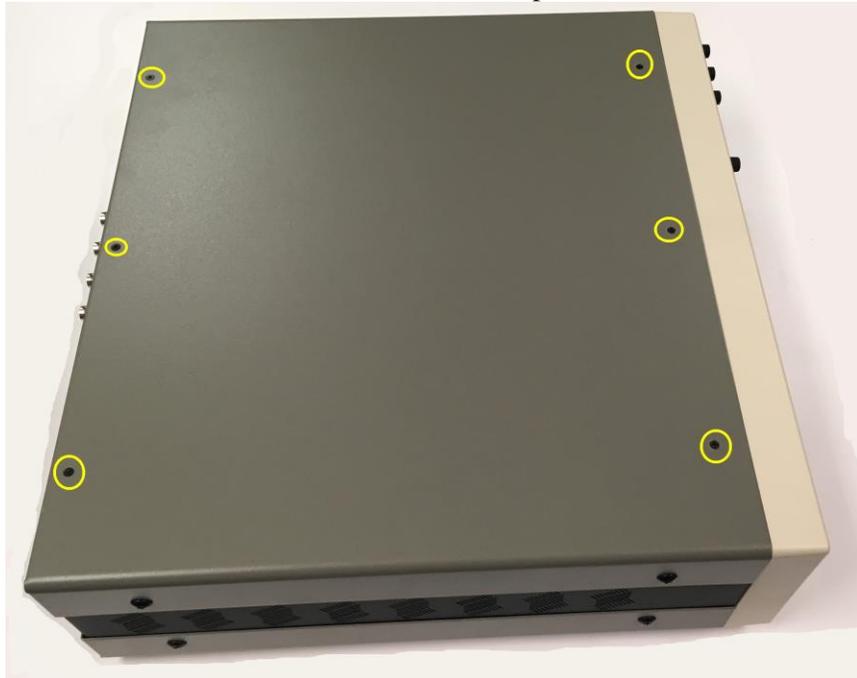
# Procedure

Work should be performed in an ESD-controlled environment or workstation. Be sure the technician is grounded before opening the instrument.

1. Turn off power to the unit, and remove the AC power cord. Disconnect all other cables from the SR865. To access the preamplifier, the top and bottom covers must be removed from the unit.
2. Remove the top and bottom covers
  - 2.1. Remove the 4 large black screws from the *top* cover (2 on each side):



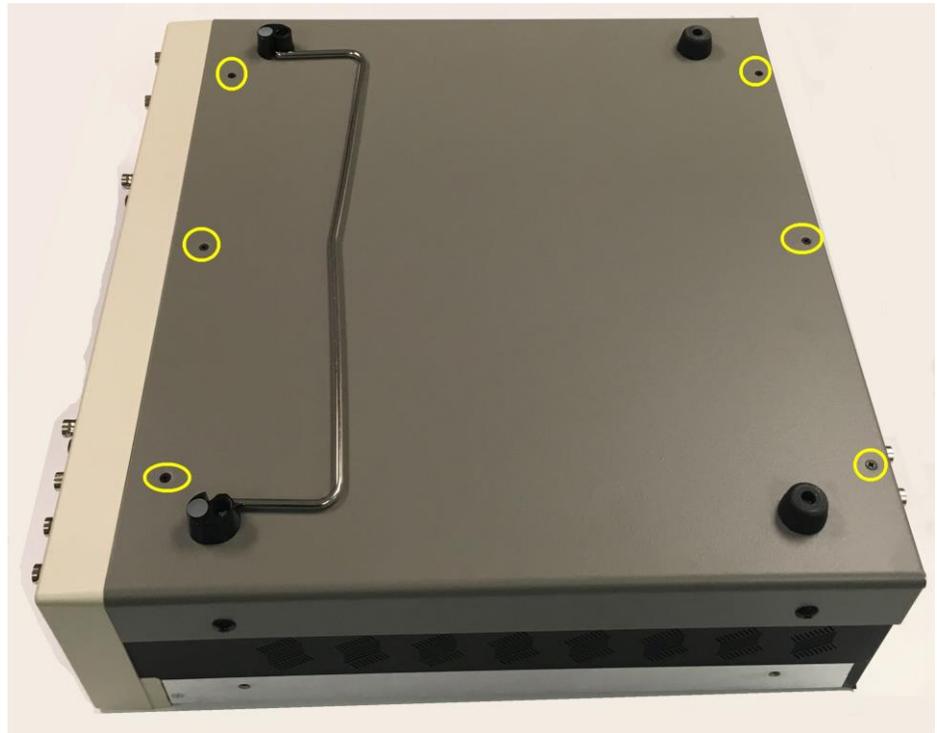
- 2.2. Remove the 6 small black screws from the top cover:



- 2.3. Remove the top cover. Turn the instrument upside down, carefully resting on the top. Remove the 4 large black screws from the *bottom* cover (2 on each side):



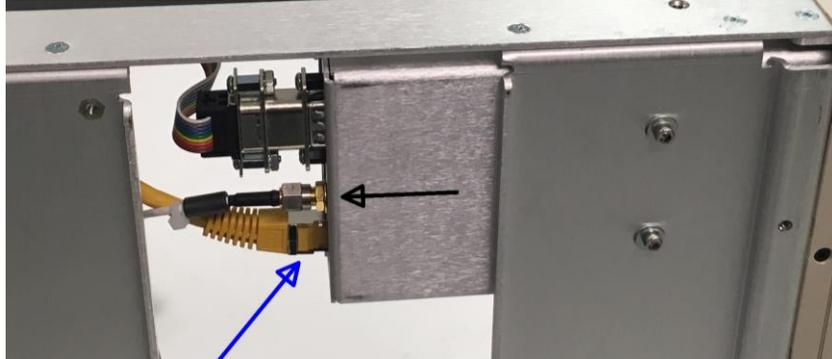
- 2.4. Remove the 6 small black screws from the bottom cover:



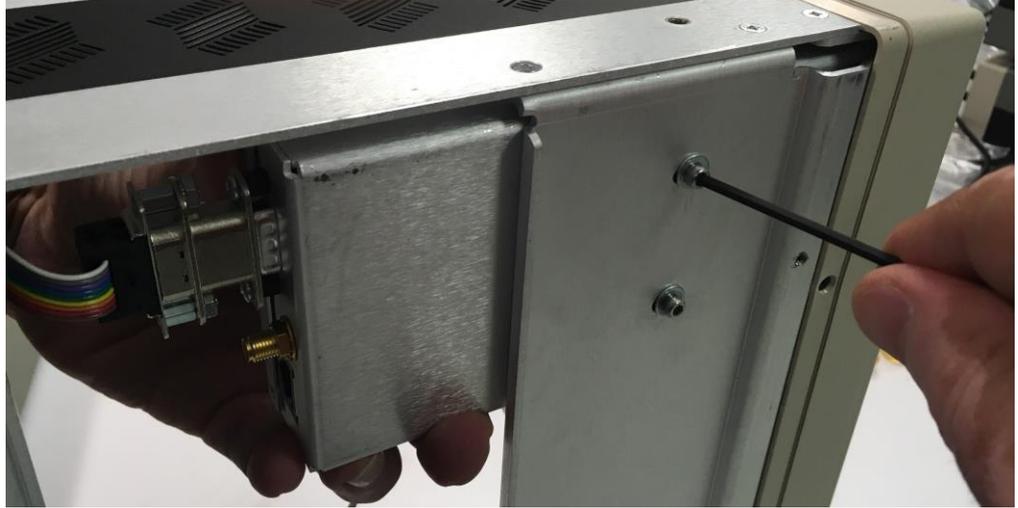
3. Turn the instrument on its side, so the “SIGNAL” section is near the top:



4. Disconnect the white coax cable, and the RJ-style modular cable, from the preamplifier enclosure. Do not attempt to disconnect the ribbon cable yet:



5. While supporting the metal preamplifier enclosure, remove the two #6 size hex screws securing the preamp to the chassis, using a 7/64 hex driver. Be careful to not lose the washers beneath each hex screw:

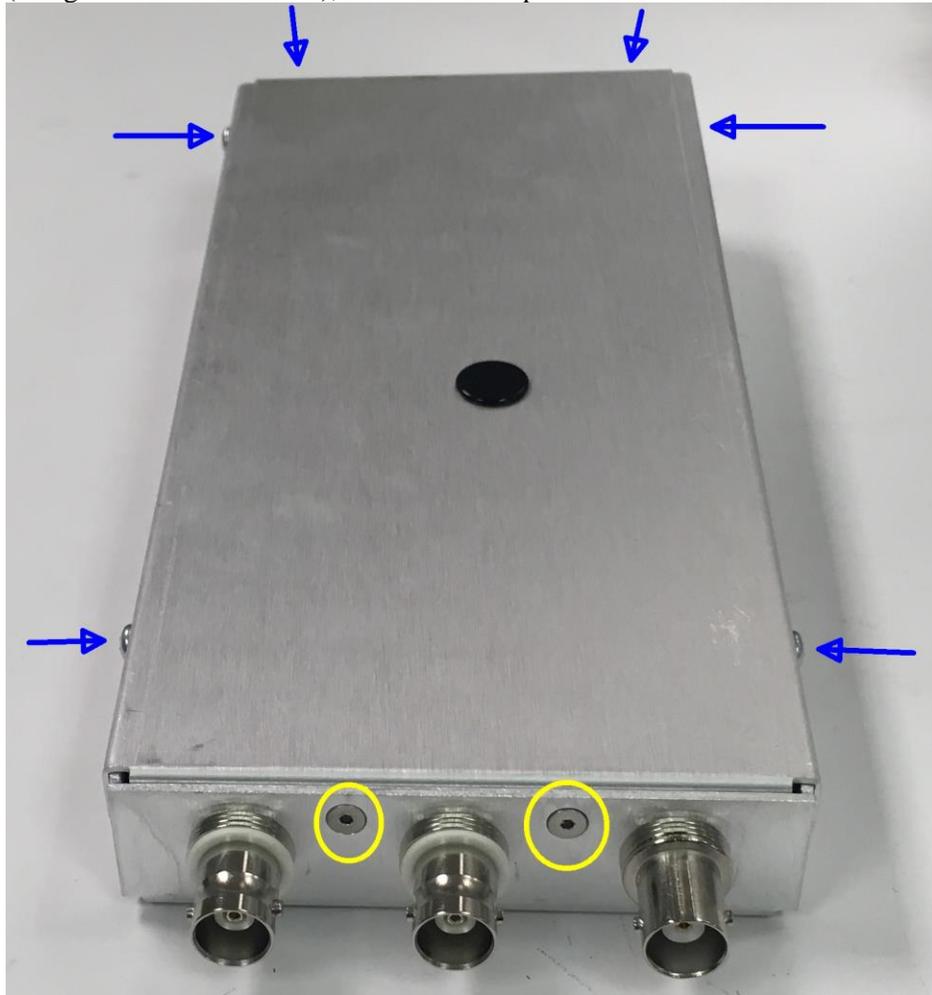


6. Carefully back the preamp enclosure out of the instrument chassis.
  - 6.1. Pull the box back from the front panel so the BNC connectors all slide back out of the instrument. Be careful to not tug on the remaining ribbon cable connected to the preamp.
  - 6.2. With the preamp enclosure removed from the chassis, remove the two screws holding the ribbon cable to the preamp:



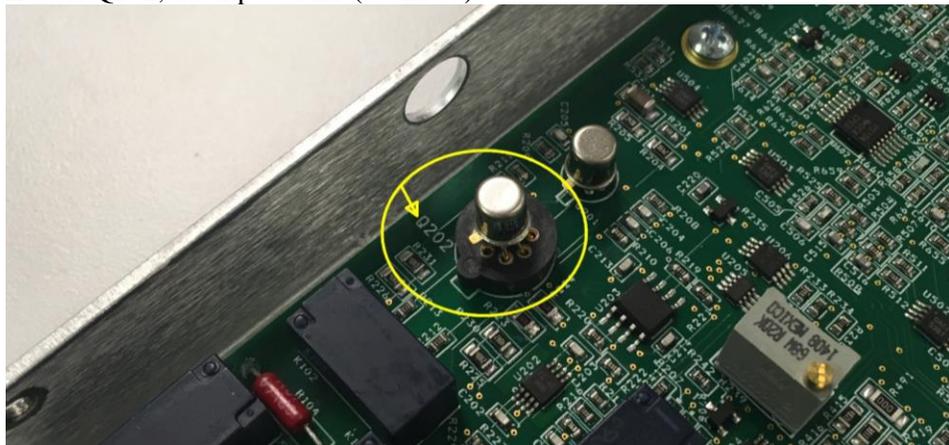
Once the screws are removed, disconnect the ribbon cable from the preamp.

7. Open the preamp assembly by removing the two small hex screws from the front (using the 0.050 hex driver), and the 6 Phillips head screws:

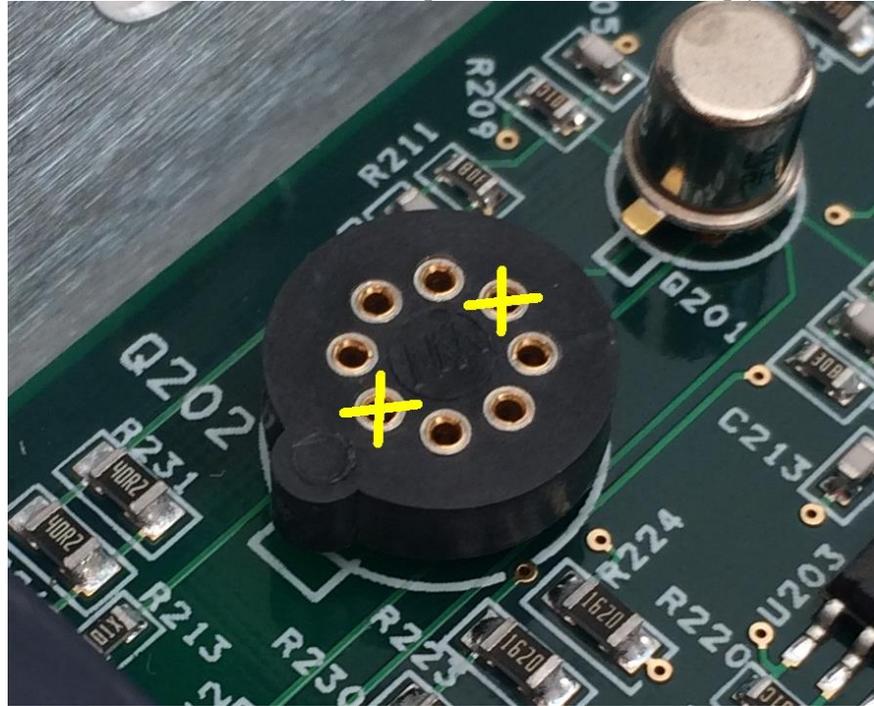


Remove the lid to the preamp assembly.

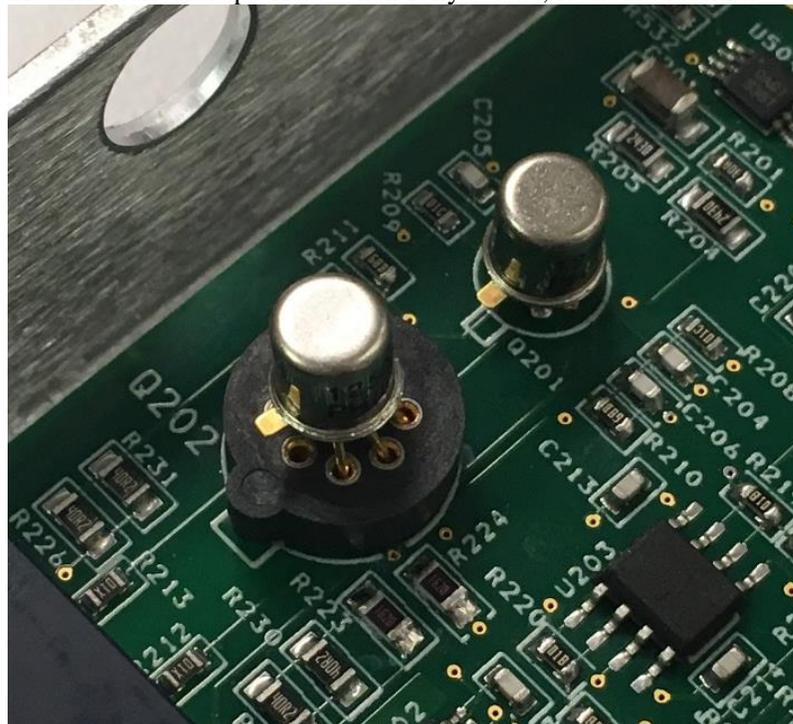
8. Locate Q202, the input JFET (socketed):



9. Carefully remove the old part from socket Q202 part (mark the old part first to avoid possible confusion). If necessary, trim and form the leads for the replacement JFET to match the removed part. Notice that two of the socket positions on Q202 are left empty—it is critical that the new part be installed with this same orientation, leaving the top and bottom contacts empty:



10. Install the replacement JFET, applying gentle pressure to fully seat all 6 leads into the socket receptacles. When fully seated, it should look like this:



**11.** Reinstall the lid for the preamp enclosure.

- 11.1. Be sure to align the lid so the front lip is *interior* to the enclosure walls; the side and rear lips should be *exterior* to the walls:



- 11.2. Loosely thread the two small hex screws in the front, but do not tighten.  
11.3. Loosely thread the remaining 6 Phillips screws, again without tightening.  
11.4. Tighten the two small hex screws fully. Do not overtighten.  
11.5. Tighten the remaining 6 Phillips screws.

**12.** Re-attach the ribbon cable. Be careful to not stress the ribbon cable



**13.** Slide the preamp enclosure back into the instrument chassis.

13.1. Check that the BNC connectors are *fully* engaged and flush to the front panel

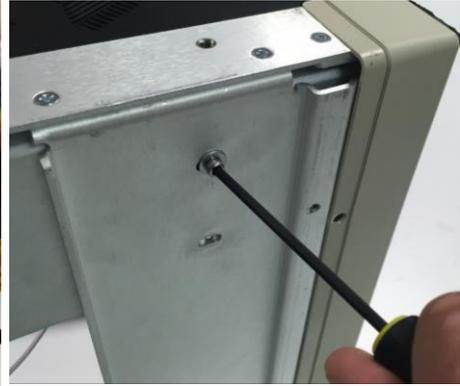


partial:

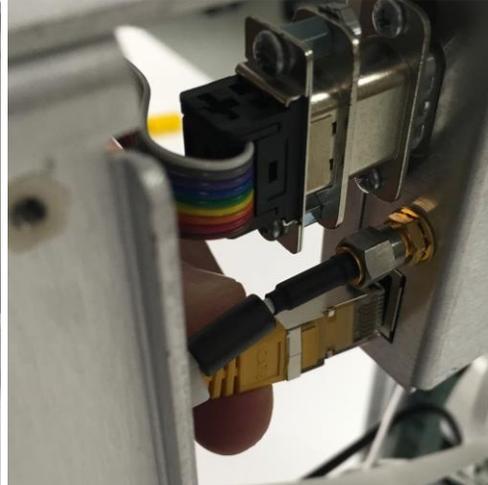


fully:

13.2. Apply pressure to keep the preamp engaged when reinstalling the two #6 hex screws. Be sure to install one washer with each screw:



**14.** Reconnect the coax and RJ-style connectors:



15. Turn the instrument upside down, and reinstall the bottom cover.
  - 15.1. Loosely thread the 6 small black screws first.
  - 15.2. Loosely thread the 4 large black screws.
  - 15.3. Tighten the 6 small black screws.
  - 15.4. Tighten the 4 large black screws.
16. Turn the instrument right side up, and reinstall the top cover.
  - 16.1. Loosely thread the 6 small black screws.
  - 16.2. Loosely thread the 4 large black screws.
  - 16.3. Tighten the 6 small black screws.
  - 16.4. Tighten the 4 large black screws.
17. Install a 50Ω terminator, or a shorting cap, onto the A input BNC.
18. Reconnect the AC power cord, turn on the instrument, and allow 60 minutes to warm up.
19. Press the [Save Recall] button to bring up the following screen:



20. Touch the “Recall default” tile on the screen to restore default settings. Touch the “Confirm” tile on the screen that pops up to confirm restoring default settings.
21. Press the [Couple] button to set DC coupling.

22. Press and hold the [Local *default*] button and the [Auto Phase] buttons simultaneously. The following screen should appear:



23. The “Offset Cal” tile will perform a single offset voltage. “Offset Cal” must be performed for each of the 5 input range settings (10 mV through 1 V), and for AC and DC coupling separately. Each calibration will require **about 1 minute** to complete, for a total of 10 minutes.

24. Begin with calibrating the DC coupled settings, starting at 1 V input range:

- 24.1. Touch the “Offset Cal” tile. You should hear several relays click. You can watch the calibration progress by noticing the display “R” value changing. You will hear the instrument make a short tune when completed.
- 24.2. Press the INPUT RANGE [Down Arrow] button to select 300 mV input range. Touch the “Offset Cal” tile to calibrate the 300 mV DC range.
- 24.3. Press the INPUT RANGE [Down Arrow] button to select 100 mV input range. Touch the “Offset Cal” tile to calibrate the 100 mV DC range.
- 24.4. Press the INPUT RANGE [Down Arrow] button to select 30 mV input range. Touch the “Offset Cal” tile to calibrate the 30 mV DC range.
- 24.5. Press the INPUT RANGE [Down Arrow] button to select 10 mV input range. Touch the “Offset Cal” tile to calibrate the 10 mV DC range.

25. Next, calibrate the AC settings. Press the [Couple] button to select “AC”. Press the INPUT RANGE [Up Arrow] several times to select the 1 V input range.

- 25.1. Touch the “Offset Cal” tile to calibrate the 1 V AC range. Remember to wait for the completion tune before moving on.
- 25.2. Press the INPUT RANGE [Down Arrow] button to select 300 mV input range. Touch the “Offset Cal” tile to calibrate the 300 mV AC range.
- 25.3. Press the INPUT RANGE [Down Arrow] button to select 100 mV input range. Touch the “Offset Cal” tile to calibrate the 100 mV AC range.
- 25.4. Press the INPUT RANGE [Down Arrow] button to select 30 mV input range. Touch the “Offset Cal” tile to calibrate the 30 mV AC range.
- 25.5. Press the INPUT RANGE [Down Arrow] button to select 10 mV input range. Touch the “Offset Cal” tile to calibrate the 10 mV AC range.

**26.** After all 10 range / coupling combinations are calibrated, power cycle the instrument. When the lock-in turns on, with the 50  $\Omega$  or shorting cap still installed and the frequency at 3.0 Hz (set by the Offset Cal function), verify the displayed “R” value is less than 1.0 mV on all settings of Input Range and Coupling.