

MULTUS SDR PROFICIO ASSEMBLY MANUAL

Table of Contents

<input type="checkbox"/> WELCOME.....	2
<input type="checkbox"/> 1.Preparation.....	4
<input type="checkbox"/> 2.USB Connector.....	4
<input type="checkbox"/> 3.Regulator Heat Sinks.....	4
<input type="checkbox"/> 4.Power on test.....	5
<input type="checkbox"/> 5.Remaining Connectors.....	6
<input type="checkbox"/> 6.BPF and LPF Relays.....	6
<input type="checkbox"/> 7.TX Relay.....	7
<input type="checkbox"/> 8.PA Heat Sink.....	7
<input type="checkbox"/> 9.PA MOSFET.....	8
<input type="checkbox"/> 10.BOOT Header.....	9
<input type="checkbox"/> 11.Toroids.....	9
<input type="checkbox"/> 12.MSCC–Core installation and configuration.....	10
<input type="checkbox"/> 13.Get on the air!.....	10
<input type="checkbox"/> Appendix A: LED Status.....	11
<input type="checkbox"/> Appendix B: Proficio Operational Notes.....	12
<input type="checkbox"/> Appendix C: Proficio Connectors.....	13
<input type="checkbox"/> Appendix D: Proficio OP AMP and Fan Configuration.....	14
OP Amp Configuration.....	14
Fan Control Configuration Options.....	15



MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ WELCOME

Welcome to the Multus SDR Proficio. The Proficio is a multi band (160M-10M) 5W transceiver for use in the Amateur Radio Service. The kit is designed as an advanced project for assembly by hand. It is a precision device and requires precision building. If the guide lines presented here and in the builders notes are followed, the result will be a high quality transceiver that will bring ham radio enjoyment for many years.

NOTE: To complete the assembly of the Proficio, MSCC-Core is required and must be run at least once so that the correct default parameter values are configured in the transceiver. It is available for download here: [MSCC-Core](#).

NOTE: This version of the assembly manual is for use with Version 4.3 of the PCB only.

DO NOT ATTEMPT TO REMOVE INTEGRATED CIRCUITS EXCEPT WITH A HOT AIR TOOL. THIS WILL DAMAGE BOTH THE IC AND CIRCUIT BOARD.

Required Tools / Supplies

Safety glasses
Illuminated magnification
Soldering iron with 1/32" tip
Flux core solder, 0.020" or 0.015"
Solder flux, pen or syringe
Desoldering wick
ESD-safe work area
#1 and #2 Phillips screwdrivers
Electronic multi-meter
Emory Cloth (or sand paper)
Wire cutters
X-ACTO knife or Scissors
USB Cable Type A to Type B

Optional Tools / Supplies

Oscilloscope
RF signal generator
Hot air rework tool
Thermal Paste Compound Grease
CW or SSB receiver

Additional Equipment

13.8V 2A regulated power supply
Power supply wire, 18AWG or better
50 ohm antenna, BNC terminated
50 ohm dummy load
Computer to run SDR software

All support for the Multus SDR Proficio is located at: [Multus SDR](#). Please join the group. Please refer to the ECN and Errata documents for the latest changes and



MULTUS SDR PROFICIO ASSEMBLY MANUAL

updates at [Multus SDR](#).

PLEASE SEE THE BUILDERS GUIDE FOR ADDITIONAL INFORMATION

Most of the time, a simple multi-meter is the only diagnostic tool needed to successfully assemble the Multus SDR Proficio. If there's a difficult problem then a signal generator and oscilloscope may be needed. Soldering errors can be found with a 5X or 10X illuminated magnifier. A bad part is extremely rare. Even electronics built by robotics will have problems due to soldering errors. Work slowly and take lots of breaks. Please use our forum [Multus SDR](#) to ask for help and help others.

MULTUS SDR PROFICIO ASSEMBLY MANUAL

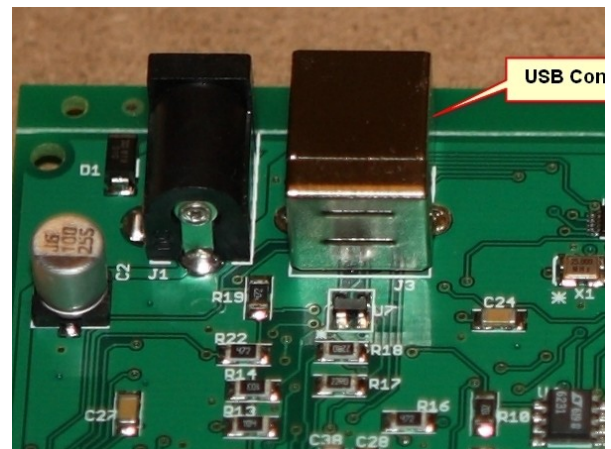
□ 1. Preparation

There are not many steps for completing the build of the Proficio. Only thru-hole components and four toroids need installed to complete the build.

Observe ESD precautions and don't forget your safety glasses when cutting wire or soldering.

□ 2. USB Connector

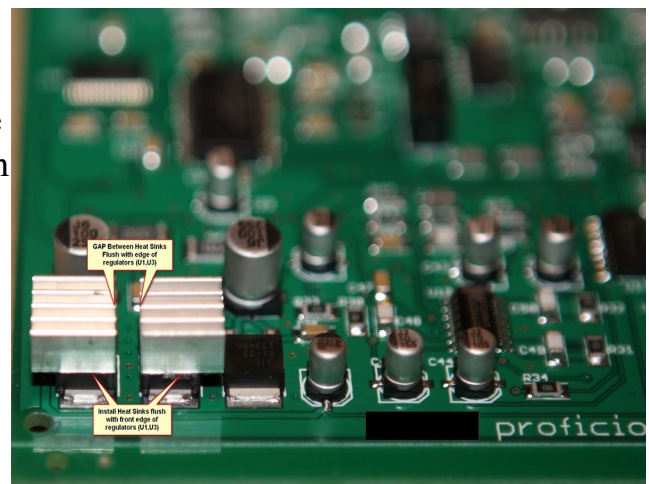
Install the USB connector. The mounting tabs will require a bit more heat than the connector pins. Solder the tabs first using just enough heat to melt the solder so the connector is not over heated and potentially damage the connector. Now solder the pins.



□ 3. Regulator Heat Sinks

Locate the two small heat sinks. Please refer to the photo for the proper placement of the heat sinks. Align the heat sinks with the inside edge flush with the inside of U1 and U3. Align the front edge of the heat sinks with the front edge of U1 and U3.

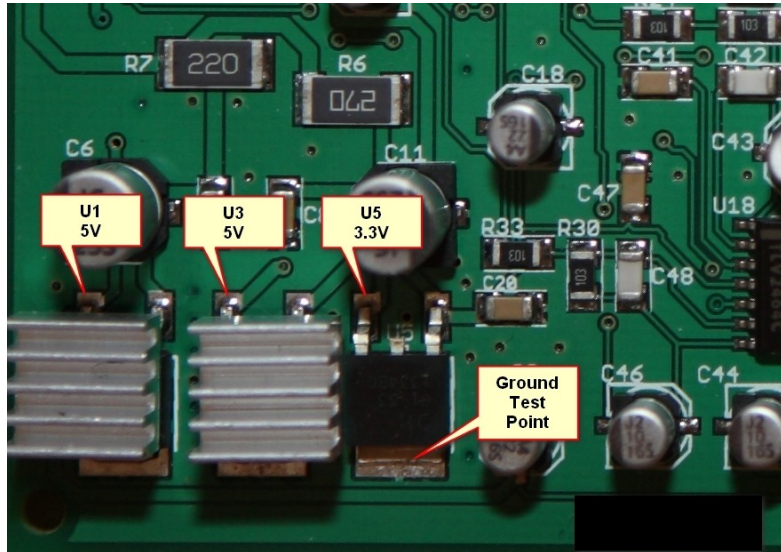
Remove the protective paper and press the heat sinks into place.



MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ 4. Power on test

U1 and U3 will be very hot during normal operation of the radio. Burns may occur if they are touched. These devices are designed to operate properly up to 150°C/300°F. The regulators have a thermal shutdown feature. If the regulators are hot, they are working.



Testing

A power plug and an in line fuse holder are included in the kit. Wire it up to a 13.8V DC power supply with the center positive.

WARNING! The inline fuse MUST be used to protect the Proficio from polarity reversal of the power source or other causes of excessive current draw. Failure to do so may result in permanent damage to the radio. Do not use a fuse with a capacity of greater than 2 amps. The fuse must be a fast blow type.

Use a power supply with a nominal output voltage of 13.8V for optimal performance. The Multus SDR Proficio is not rated for voltages higher than 15V. Damage may occur if the supply voltage is greater than 15V.

Ensure the regulators are putting out the correct voltage.

U1 PIN 2 - 5.0V +/-2%

U3 PIN 2 - 5.0V +/-2%

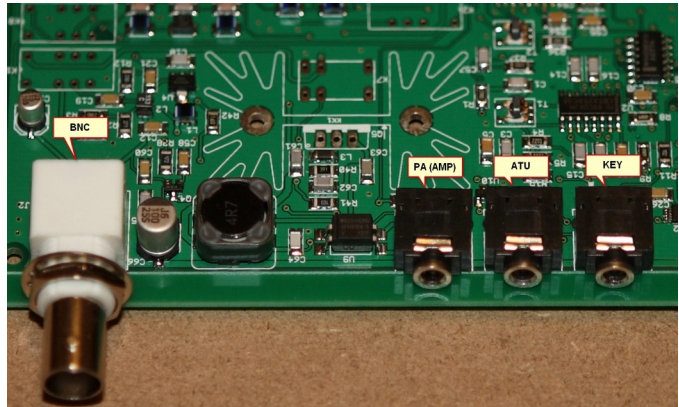
U5 PIN 2 - 3.3V +/-2%

Once a power source is attached to the Proficio, the LED should be in a solid ON state. (See Appendix A for further information).

MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ 5. Remaining Connectors

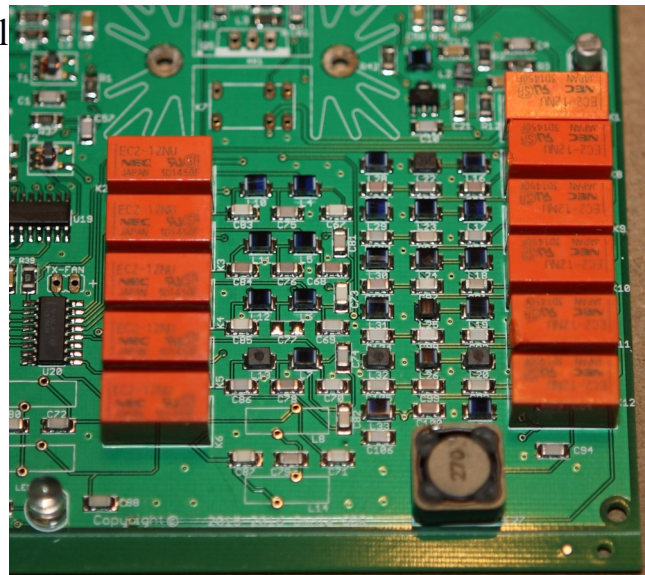
Disconnect the power attached in the previous step and install the BNC and three stereo connectors. The BNC jack will require a lot of heat to attach but use only enough to melt the solder around the mounting pins. Over heating may damage the connector.



□ 6. BPF and LPF Relays

Install the BPF relays (K8 thru K12). Install the LPF relays (K2 thru K6). Also install relay K1. All these relays are the same part number. There are many pins to solder. Take time and patience when soldering. Check for cold solder joints.

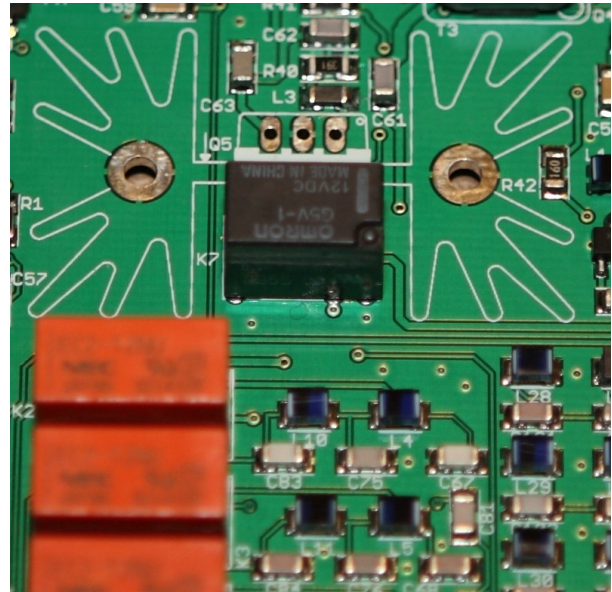
When installing the relays, apply flux with a flux pen or other type of flux application. The pins of the relays are not as pristine as the leads of a SMD device. The pins need extra flux to clean the pins. A higher soldering temperature as well as a longer period of heat application is required. If these recommendations are followed, the occurrence of cold solder joints is greatly reduced.



MULTUS SDR PROFICIO ASSEMBLY MANUAL

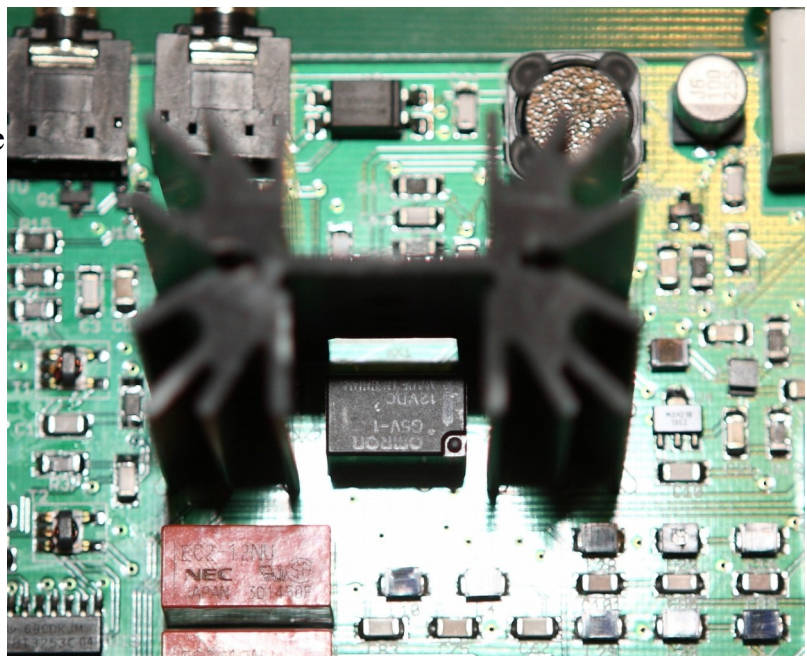
□ 7. TX Relay

Install the TX relay (K7)



□ 8. PA Heat Sink

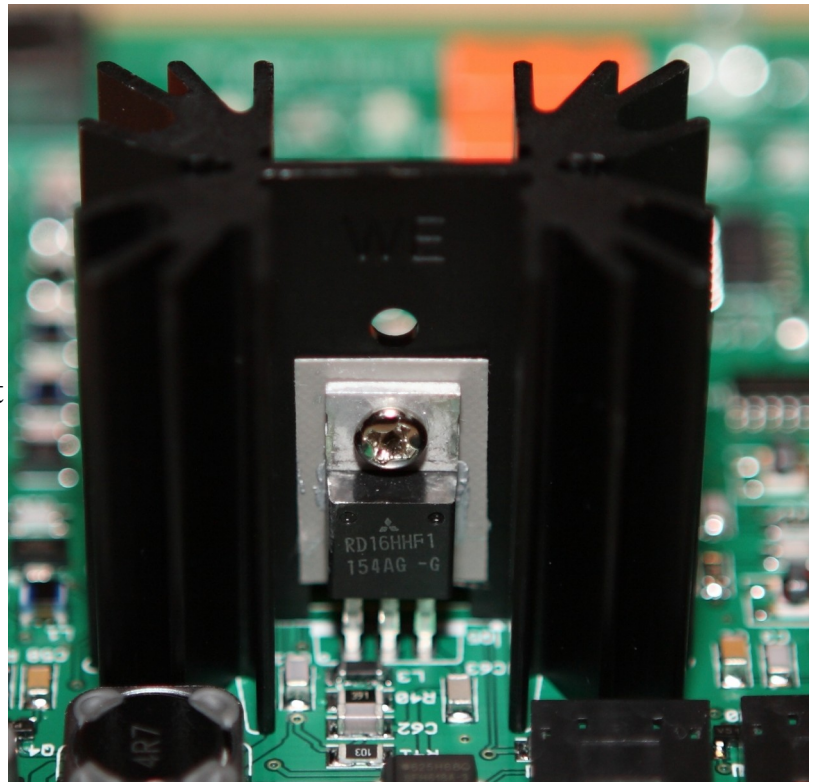
Install the PA heat sink. Using emery cloth or sand paper sand the area surrounding the mounting holes on either side of the heat sink until bare metal can be seen. Now insert the heat sink with the sanded side facing K1. Soldering the mounting tabs will require a lot of heat. However do not apply more than is required to melt the solder. The MOSFET requires ground connection to the heat sink.



MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ 9. PA MOSFET

Locate the PA MOSFET (Q5 – RD16HHF1), thermal pad and mounting hardware. If thermal paste is available, the thermal pad is not necessary and apply a very small amount on the back of the MOSFET. Place the mounting bolt through Q5 and if the thermal pad is being used, place the thermal pad on the back of Q5. Now insert Q5 through the PCB and bolt through the heat sink. Attach the star washer and nut on the bolt. Do not tighten the nut. Align Q5 and the thermal pad (if used) as shown in the photograph. Turn the PCB over and solder Q5. Cut the excess leads flush with the PCB. Now securely tighten the nut.



NOTE: Q5 is static sensitive: Be sure to use a grounding strap before performing the above procedure.

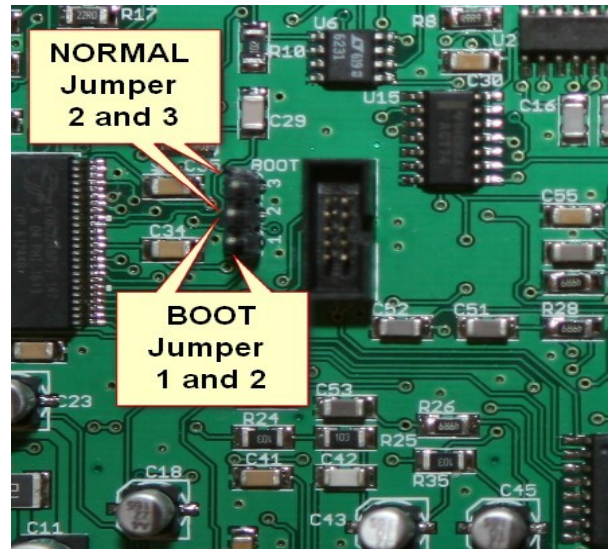
MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ 10. BOOT Header

Install the 3 pin header.

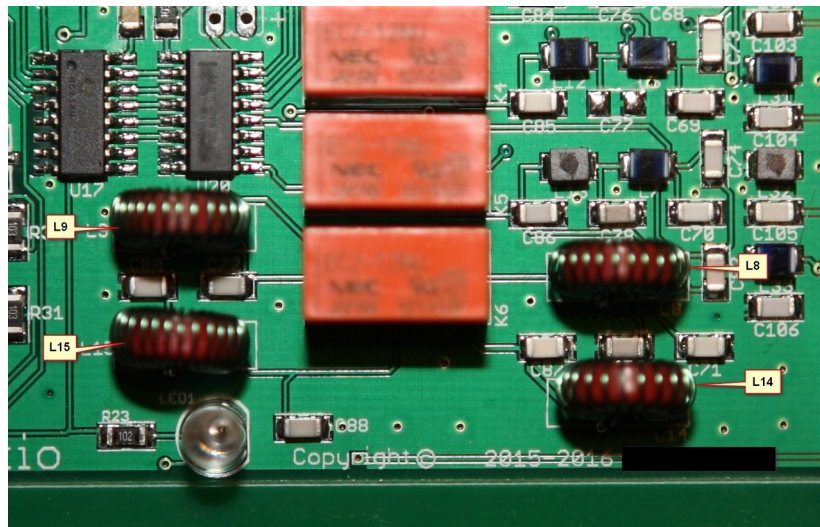
For normal operation, place a jumper on the side nearest C29 (Pins 2 to 3).

Appendix C has information about using this header to upgrade the firmware.



□ 11. Toroids

Locate the four supplied toroids. Take note of the locations in the photograph and install as indicated. Clip off the excess leads.



The construction of the Proficio is now complete.

NOTE: Consult Appendix D for further information on additional header installation.

MULTUS SDR PROFICIO ASSEMBLY MANUAL

12. MSCC–Core installation and configuration

1. Instructions for installing and operating the required host application are found in the MSCC-Core Operators Guide
2. ***NOTE: MSCC-Core must be installed and run at least once so that the transceiver is configured with the proper default parameter values.***

13. Get on the air!

Your Multus SDR Proficio is complete. Get on the air and enjoy it. MSCC-Core is the preferred application to use with the Proficio. It has all the functions normally found with other host application and is specifically designed to work with the Proficio. You may prefer a different host application.

MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ Appendix A: LED Status

A power-on self-test function is included in the Multus SDR Proficio. The status LED sends error messages in Morse code at 5 WPM.

STATUS	INFORMATION
OFF	PSoC NOT INITIALIZED (OR LED FAILURE)
STEADY ON	NORMAL OPERATION
RAPID BLINKING	TRANSMIT MODE (TRANSMITTER ACTIVE)
LOADER (or BOOT) (depending on firmware version)	READY TO RECEIVE FIRMWARE
E (repeats one blink)	NO COMMUNICATIONS WITH SI5351 OR PCM3060
S (repeats three blinks)	SI5351 U12 NOT RESPONDING
I (repeats two blinks)	PCM3060 U14 NOT RESPONDING
H (repeats four blinks)	CRYSTAL FAILED
5 (repeats five blinks)	INTERNAL QUEUING ERROR
C (repeats the letter C)	TRANSCEIVER IN CW MODE
0 (repeats five long blinks)	INVALID PCB VERSION CONFIGURATION
L 1 (repeats letter "L" followed by number "1")	PPM LOGIC ERROR
L 2 (repeats letter "L" followed by number "2")	POWER CALIBRATION LOGIC ERROR

MULTUS SDR PROFICIO ASSEMBLY MANUAL

Appendix B: Proficio Operational Notes

- 1) The firmware prevents out of band transmission.
- 2) When attaching the USB cable or when the Proficio is powered on with a USB cable attached, the LED may blink for a short period of time before turning to solid on. This is due to the firmware syncing the PSoC 3 internal PLL to the USB 1ms timing pulse (Start of Frame). The LED not turning to a solid on condition is an indication of a marginal or defective USB port or cable.
- 3) The Proficio operates in one of two modes, Si570 mode or Si5351 mode. Si570 mode is the default when the Proficio is powered on. This allows all SDR applications that are compatible with transceivers such as the Multus Basic, Softrock RXTX and the like. When using the preferred MSCC-Core application the Proficio is set to Si5351 mode.

NOTE: If MSCC-Core use been used at anytime, the Proficio must be power cycled to return to default Si570 mode.

MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ Appendix C: Proficio Connectors

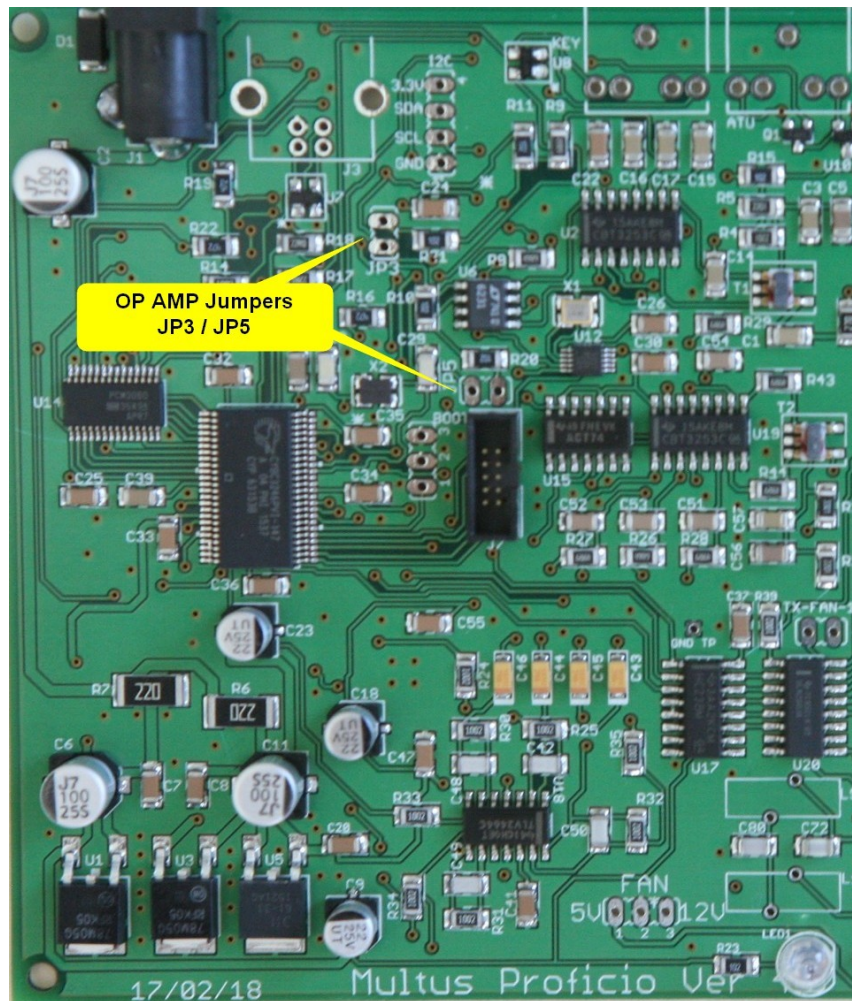
1. J1/Power – 13.8V. This is a female 2.1mm x 5.5mm jack. A male counterpart is required. Connect the positive (+) to the center post of a male connector and the negative (-) to the sleeve.
2. USB. This is a type B female. A USB cable of type A to Type B is required. The USB connections provides both control and audio to and from the host computer.
3. KEY. This is a 3.5mm female stereo connector. The KEY jack is for attaching a straight or paddle type key.
4. ATU. This is a 3.5mm female stereo connector. The ATU jack is for attachment of an Elecraft T1 tuner. The Proficio will automatically signal band information to the T1. Please refer to the T1 users manual for more information. The Multus ATU Port Expander may also attached to this port. The T1 and the ATU Port Expander may not be attached to the ATU port at the same time.
5. AMP. This is a 3.5mm female stereo connector. The AMP jack is for controlling the PPT line of an external amplifier. It is compatible with most modern amplifiers. It is not compatible with grid keying type amplifiers or amplifiers that use a relay for PTT switching. Attach an amplifier using the TIP and Sleeve of a male 3.5mm stereo plug.
6. J2/BNC. This is a standard female BNC connector and is the antenna connection of the Proficio. It is an unbalanced 50Ω connection.

MULTUS SDR PROFICIO ASSEMBLY MANUAL

□ Appendix D: Proficio OP AMP and Fan Configuration

OP Amp Configuration

Install a two (2) pin header in locations JP3 and JP5. If a 50% reduction in operational amplifier gain is desired, place a jump on each header.



MULTUS SDR PROFICIO ASSEMBLY MANUAL

Fan Control Configuration Options

1. 12V constant on. Install the two pin fan connector (supplied with the Proficio enclosure) in the location as indicated in the illustration. The key tab faces the LED.
2. 5V constant on. Install the two pin fan connector (supplied with the Proficio enclosure) in the location as indicated in the illustration. The key tab faces the LED.
3. 12V switched. Install the two pin fan connector (supplied with the Proficio enclosure) in the location as indicated in the illustration. Make note of the position of the key tab.
4. For 5V switched operation a Zener voltage drop down circuit is required. This is provided if the Proficio Enclosure is purchased. Install the two pin fan connector in the 12V Switched location.

