516F-2 Power Supply Modification Instructions
(Original PCB 2014-04)

Modification Features

- Modern Electrolytic Filter Capacitors
- Option for Changing C1 to a Modern High Voltage Film Capacitor
- AC Relay Switching of Primary Power to prolong life of S/Line & KWM-2 Switch
- Option for Solid State Rectifiers or Retain Vacuum Tube Rectifiers
- Reduction of 25 Watts of Filament Heat Using Solid State Rectifiers
- Option to Reduce DC Voltages Due to High AC Line and Solid State Rectifiers
- New AC Line Cord

Note: Kit includes everything to implement all options.

Modifications Options

1. Continue using the original C1. This is the 0.05 uF @ 1kV capacitor that tunes the HV filter choke L1. If this option is selected, simply do not install C1 on the PCB.

> Note: C1 will often fail shorted. When this happens, L1 is shorted out making the HV filter a capacitor input filter causing the no load voltage to soar to 1200 Vdc or more. This sometimes damages components in the 32S-( ) or KWM-2 radios. If C1 should fail open, choke L1 is no longer "tuned" to the 120 Hz ripple frequency thus compromising the HV rectifier filter circuit.

2. Continue using the tube rectifiers. See the description of pro and con below.

3. Solid State rectifiers
    2a. Implement "Buck Mode" AC line connections
    2b. No "Buck Mode" AC line connections

The 516F-2 Power Supply was designed for a nominal AC line voltage of 115 Vac. Today many residential lines run 120 Vac or higher. Since none of the 516F-2 supplies are regulated, this results in about 5% higher dc voltages.

The 516F-2 modification provides the option of using solid state diode rectifiers. Solid state diodes have a lower conduction voltage drop, resulting in increased dc output voltages. They also offer increased reliability and elimination of 25 watts of tube filament heat in the power supply.

In order to bring the dc output voltage back to the nominal design values, the unused 5 Vac filament winding used on the 5U4 may be connected in series with the transformer primary but in opposite phase. This 5 Volt winding is said to "buck" the primary winding, thus reducing the transformer voltages.

This "buck mode" of operation is not available if you choose to continue operating with the tube rectifiers.

Mounting the PCB

1. Remove the four bolts mounting the power transformer to the chassis. This will allow enough separation between the transformer core and the chassis to remove the rivets that secured the capacitor clips and insert four flat-head 4-40 screws in the holes. The flat-heads will be below the transformer core.

2. Inside the chassis install a split-lock washer and 3/8-in 4-40 Hex post on each screw.

3. Mount the PCB to the Hex posts using 1/4-in. 4-40 pan head screw with a flat washer atop the PCB.

4. Tighten the flat-head screws under the power transformer.

5. Re-install the transformer mounting bolts and tighten.

AC Power Connections (without the 5 volt filament "buck mode" connections)

1. Remove the fuse from the holder before soldering the terminals

2. Remove the black wire from the Fuse Ring terminal (F1-R) and connect it to P12B on the PCB

3. Remove the white/brown wire from the Fuse Tip terminal (F1-T) and connect it to P13B on the PCB

4. Remove the white/blue wire from TB1-3 and connect to the Fuse Ring terminal (F1-R)

5. Remove the power cord black wire from TB1-3 and connect it to the Fuse Tip terminal (F1-T) -- Or leave it on TB1-3 and use a new wire between TB1-3 to F1-T

6. Connect a new wire from the Fuse Ring terminal (F1-R) to P12A on the PCB

7. Connect a new White wire from TB1-1 to P13A on the PCB

8. Install fuse back in holder

Wiring To-From Chart (Without "Buck Mode" Filament Connections)

No.	FROM	TO	FUNCTION	WIRE	NOTES
1	Transformer	P1A	HV AC	Existing - Black	Remove from 5R4-4
2	Transformer	P1B	HV AC	Existing - Black	Remove from 5R4-6
3	L1 (in)	P2A	Rectified HV	Existing - Red	Remove from 5R4-8
4	L1 (out)	P2B	+ 800 Vdc	Existing - Black	Remove from TB3
5	P1-2	P3+	+ 800 Vdc	Existing - White/Red	Remove from TB3
6	TB2-3	P3 Gnd	Ground	New - White #20	
7	Transformer	P4A	LV AC	Existing - Red	Remove from 5U4-4
8	Transformer	P4B	LV AC	Existing - Red	Remove from 5U4-6
9	L2 (in)	P5A	Rectified LV	Existing - Black	Remove from 5U4-2
10	TB2-1	P5B	Jct. of L2 & L3	Existing - White/Blue #22	
11	TB2-2	P6B	+275 Vdc	Existing - White/Red #22	
12	TB1-4	P8B	Bias AC	New - Purple #22	
13	Bias Pot Wiper	P11-	Neg. Bias Volt Adj.	Existing - White/Green #22	
14	Bias Pot End	P9-	Neg. Bias Voltage	New - Yellow/Black #22	
15	P1-5	P13B	AC Switched	Existing - White/Brown	Remove from F1-T
16	TB1-1	P13A	AC Neutral	New - White/Black	
17	T1 Black	P12B	Transformer Pri.	Existing - Black Wire	Remove from F1-R
18	P1-7	F1-R	AC Line	Existing - White/Blue	Remove from TB1-3
19	Line Cord	F1-T	AC Line (Hot)	New - Line Cord Black	
20	Line Cord	TB1-1	AC Line (Neutral)	New - Line Cord White	
21	F1-R	P12A	AC Line	New - Blue	

Determine Transformer Phasing for Implementing " Buck Mode" Using 5 Volt Filament Winding

1. Connect a voltmeter (suggest ~60 Volt Full Scale Range) with the positive lead on P1A and the negative lead on P1B

2. Connect a 9 Volt battery with the negative lead on P12B, then touch the positive battery lead to TB1-1. Observe the voltmeter to momentarily deflect up scale and then deflect negatively when removing the positive battery lead from TB1-1. Mark the black transformer lead on TB1-1 as "+". If the meter deflects opposite to the above description, then label the black transformer lead on P12B as "+".

CAUTION: Do Not Touch the Transformer Secondary circuits when doing these tests!

3. Move the 9-volt battery leads to the filament leads on the 5U4 tube socket. Connect the negative battery lead to 5U4-8 and touch the positive battery lead to 5U4-2. Observe the voltmeter to momentarily deflect up scale and then deflect negatively when removing the positive battery lead from TB1-1. Mark the filament lead on 5U4-2 as "+". If the meter deflects opposite to the above description, then label the filament lead on 5U4-8 as "+".

4. Unsolder the filament leads from the 5U4 socket. Connect the "-" filament lead to the Primary "-" lead using the supplied insulated crimp splice. Connect the "+" filament lead to P12B on the PCB. The "+" primary lead remains connected to TB1-1.

Wiring To-From Chart (With "Buck Mode" Filament Connections)

No.	FROM	TO	FUNCTION	WIRE	NOTES
1	Transformer	P1A	HV AC	Existing - Black	Remove from 5R4-4
2	Transformer	P1B	HV AC	Existing - Black	Remove from 5R4-6
3	L1 (in)	P2A	Rectified HV	Existing - Red	Remove from 5R4-8
4	L1 (out)	P2B	+ 800 Vdc	Existing - Black	Remove from TB3
5	P1-2	P3+	+ 800 Vdc	Existing - White/Red	Remove from TB3
6	TB2-3	P3 Gnd	Ground	New - White #20	
7	Transformer	P4A	LV AC	Existing - Red	Remove from 5U4-4
8	Transformer	P4B	LV AC	Existing - Red	Remove from 5U4-6
9	L2 (in)	P5A	Rectified LV	Existing - Black	Remove from 5U4-2
10	TB2-1	P5B	Jct. of L2 & L3	Existing - White/Blue #22	
11	TB2-2	P6B	+275 Vdc	Existing - White/Red #22	
12	TB1-4	P8B	Bias AC	New - Purple #22	
13	Bias Pot Wiper	P11-	Neg. Bias Volt Adj.	Existing - White/Green #22	
14	Bias Pot End	P9-	Neg. Bias Voltage	New - Yellow/Black #22	
15	P1-5	P13B	AC Switched	Existing - White/Brown	Remove from F1-T
16	TB1-1	P13A	AC Neutral	New - White/Black	
17	T1 Black	Lead from 5U4-8	Primary AC buck	Existing - both wire leads	Splice wire leads together using ????
18	Lead from 5U4-2	P12B	Primary AC buck	Existing	(see phasing instructions)
19	P1-7	F1-R	AC Line	Existing - White/Blue	Remove from TB1-3
20	Line Cord	F1-T	AC Line (Hot)	New - Line Cord Black	
21	F1-R	P12A	AC Line	New - Blue	
22	Line Cord	TB1-1	AC Line (Neutral)	New - Line Cord White	

516F-2 Power Supply Modification Instructions
(New PCB 2014-05)

Modification Features

- Modern Electrolytic Filter Capacitors
- Option for Changing C1 to a Modern High Voltage Film Capacitor
- AC Relay Switching of Primary Power to prolong life of S/Line & KWM-2 Switch
- Option for Solid State Rectifiers or Retain Vacuum Tube Rectifiers
- Reduction of 25 Watts of Filament Heat Using Solid State Rectifiers
- Option to Reduce DC Voltages Due to High AC Line and Solid State Rectifiers
- New AC Line Cord

Note: Kit includes everything to implement all options.

Modifications Options

1. Continue using the original C1. This is the 0.05 uF @ 1kV capacitor that tunes the HV filter choke L1. If this option is selected, simply do not install C1 on the PCB.

> Note: C1 will often fail shorted. When this happens, L1 is shorted out making the HV filter a capacitor input filter causing the no load voltage to soar to 1200 Vdc or more. This sometimes damages components in the 32S-( ) or KWM-2 radios. If C1 should fail open, choke L1 is no longer "tuned" to the 120 Hz ripple frequency thus compromising the HV rectifier filter circuit.

2. Continue using the tube rectifiers. See the description of pro and con below

3. Solid State rectifiers
    - 2a. Implement "Buck Mode" AC line connections
    - 2b. No "Buck Mode" AC line connections

The 516F-2 Power Supply was designed for a nominal AC line voltage of 115 Vac. Today many residential lines run 120 Vac or higher. Since none of the 516F-2 supplies are regulated, this results in about 5% higher dc voltages.

The 516F-2 modification provides the option of using solid state diode rectifiers. Solid state diodes have a lower conduction voltage drop, resulting in increased dc output voltages. They also offer increased reliability and elimination of 25 watts of tube filament heat in the power supply.

In order to bring the dc output voltage back to the nominal design values, the unused 5 Vac filament winding used on the 5U4 may be connected in series with the transformer primary but in opposite phase. This 5 Volt winding is said to "buck" the primary winding, thus reducing the transformer voltages.

This "buck mode" of operation is not available if you choose to continue operating with the tube rectifiers.

Mounting the PCB

1. Remove the four bolts mounting the power transformer to the chassis. This will allow enough separation between the transformer core and the chassis to remove the rivets that secured the capacitor clips and insert four flat-head 4-40 screws in the holes. The flat-heads will be below the transformer core.

2. Inside the chassis install a split-lock washer and 3/8-in 4-40 Hex post on each screw.

3. Mount the PCB to the Hex posts using 1/4-in. 4-40 pan head screw with a flat washer atop the PCB.

4. Tighten the flat-head screws under the power transformer.

5. Re-install the transformer mounting bolts and tighten.

AC Power Connections (without the 5 volt filament "buck mode" connections)

1. Remove the fuse from the holder before soldering the terminals

2. Remove the black wire from the Fuse Ring terminal (F1-R) and connect it to P12B on the PCB

3. Remove the white/brown wire from the Fuse Tip terminal (F1-T) and connect it to P13B on the PCB

4. Remove the white/blue wire from TB1-3 and connect to the Fuse Ring terminal (F1-R)

5. Remove the power cord black wire from TB1-3 and connect it to the Fuse Tip terminal (F1-T) -- Or leave it on TB1-3 and use a new wire between TB1-3 to F1-T

6. Connect a new wire from the Fuse Ring terminal (F1-R) to P12A on the PCB

7. Connect a new White wire from TB1-1 to P13A on the PCB

8. Install fuse back in holder

Wiring To-From Chart (Without "Buck Mode" Filament Connections)

No.	FROM	TO	FUNCTION	WIRE	NOTES
1	Transformer	P1A	HV AC	Existing - Black	Remove from 5R4-4
2	Transformer	P1B	HV AC	Existing - Black	Remove from 5R4-6
3	L1 (in)	P2A	Rectified HV	Existing - Red	Remove from 5R4-8
4	L1 (out)	P2B	+ 800 Vdc	Existing - Black	Remove from TB3
5	P1-2	P3+	+ 800 Vdc	Existing - White/Red	Remove from TB3
6	TB2-3	P3 Gnd	Ground	New - White #20	
7	Transformer	P4A	LV AC	Existing - Red	Remove from 5U4-4
8	Transformer	P4B	LV AC	Existing - Red	Remove from 5U4-6
9	L2 (in)	P5A	Rectified LV	Existing - Black	Remove from 5U4-2
10	TB2-1	P5B	Jct. of L2 & L3	Existing - White/Blue #22	
11	TB2-2	P6B	+275 Vdc	Existing - White/Red #22	
12	TB1-4	P8	Bias AC	New - Purple #22	
13	Bias Pot Wiper	P11	Neg. Bias Volt Adj.	Existing - White/Green #22	
14	Bias Pot End	P9	Neg. Bias Voltage	New - Yellow/Black #22	
15	P1-5	P13B	AC Switched	Existing - White/Brown	Remove from F1-T
16	TB1-1	P13A	AC Neutral	New - White/Black	
17	T1 Black	P12B	Transformer Pri.	Existing - Black Wire	Remove from F1-R
18	P1-7	F1-R	AC Line	Existing - White/Blue	Remove from TB1-3
19	Line Cord	F1-T	AC Line (Hot)	New - Line Cord Black	
20	Line Cord	TB1-1	AC Line (Neutral)	New - Line Cord White	
21	F1-R	P12A	AC Line	New - Blue	

Determine Transformer Phasing for Implementing " Buck Mode" Using 5 Volt Filament Winding

1. Connect a voltmeter (suggest ~60 Volt Full Scale Range) with the positive lead on P1A and the negative lead on P1B

2. Connect a 9 Volt battery with the negative lead on P12B, then touch the positive battery lead to TB1-1. Observe the voltmeter to momentarily deflect up scale and then deflect negatively when removing the positive battery lead from TB1-1. Mark the black transformer lead on TB1-1 as "+". If the meter deflects opposite to the above description, then label the black transformer lead on P12B as "+".

CAUTION: Do Not Touch the Transformer Secondary circuits when doing these tests!

3. Move the 9-volt battery leads to the filament leads on the 5U4 tube socket. Connect the negative battery lead to 5U4-8 and touch the positive battery lead to 5U4-2. Observe the voltmeter to momentarily deflect up scale and then deflect negatively when removing the positive battery lead from TB1-1. Mark the filament lead on 5U4-2 as "+". If the meter deflects opposite to the above description, then label the filament lead on 5U4-8 as "+".

4. Unsolder the filament leads from the 5U4 socket. Connect the "-" filament lead to the Primary "-" lead using the supplied insulated crimp splice. Connect the "+" filament lead to P12B on the PCB. The "+" primary lead remains connected to TB1-1.

Wiring To-From Chart (With "Buck Mode" Filament Connections)

No.	FROM	TO	FUNCTION	WIRE	NOTES
1	Transformer	P1A	HV AC	Existing - Black	Remove from 5R4-4
2	Transformer	P1B	HV AC	Existing - Black	Remove from 5R4-6
3	L1 (in)	P2A	Rectified HV	Existing - Red	Remove from 5R4-8
4	L1 (out)	P2B	+ 800 Vdc	Existing - Black	Remove from TB3
5	P1-2	P3+	+ 800 Vdc	Existing - White/Red	Remove from TB3
6	TB2-3	P3 Gnd	Ground	New - White #20	
7	Transformer	P4A	LV AC	Existing - Red	Remove from 5U4-4
8	Transformer	P4B	LV AC	Existing - Red	Remove from 5U4-6
9	L2 (in)	P5A	Rectified LV	Existing - Black	Remove from 5U4-2
10	TB2-1	P5B	Jct. of L2 & L3	Existing - White/Blue #22	
11	TB2-2	P6B	+275 Vdc	Existing - White/Red #22	
12	TB1-4	P8	Bias AC	New - Purple #22	
13	Bias Pot Wiper	P11	Neg. Bias Volt Adj.	Existing - White/Green #22	
14	Bias Pot End	P9	Neg. Bias Voltage	New - Yellow/Black #22	
15	P1-5	P13B	AC Switched	Existing - White/Brown	Remove from F1-T
16	TB1-1	P13A	AC Neutral	New - White/Black	
17	T1 Black	Lead from 5U4-8	Primary AC buck	Existing - both wire leads	Splice wire leads together using ????
18	Lead from 5U4-2	P12B	Primary AC buck	Existing	(see phasing instructions)
19	P1-7	F1-R	AC Line	Existing - White/Blue	Remove from TB1-3
20	Line Cord	F1-T	AC Line (Hot)	New - Line Cord Black	
21	F1-R	P12A	AC Line	New - Blue	
22	Line Cord	TB1-1	AC Line (Neutral)	New - Line Cord White	