



**synthesis  
technology**

**MOTM-950 Power Supply  
Assembly Instructions & Owner's Manual**

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# SYNTHESIS TECHNOLOGY MOTM-950 POWER SUPPLY

## BILL OF MATERIALS

Please check off each item as you verify the contents.

- 1ea Power One linear supply, Model HTAA-16W-A
- 1ea MOTM-950 front panel
- 1ea AC Input connector & fuse (EC version will include a jumper wire).
- 1ea Power distribution pc board
- 1ea Power switch
- 1ea No-clean solder
- 1ea Wire set of 10 individual wires:
  - 1ea green wire with #6 ring terminal & 0.250 FASTON, 600V
  - 1ea black wire with 0.187 uninsulated and 0.250 FASTONS, 600V
  - 1ea white wire with 0.187 uninsulated and 0.250 FASTONS, 600V
  - 1ea white wire with 0.250 FASTON and stripped end, 600V
  - 1ea black wire with 0.250 FASTON and stripped end, 600V
  - 1ea white wire with 0.250 FASTON and stripped end, 300V
  - 1ea red wire with 0.250 FASTON and stripped end, 300V
  - 1ea black wire with 0.250 FASTON and stripped end, 300V
  - 1ea blue wire with 0.250 FASTON and stripped end, 300V
  - 1ea brown wire with 0.250 FASTON and stripped end, 300V

The 600V wire has thicker insulation. The voltage rating may be printed on the wire itself.

- 1ea Hardware set, including:
  - 2ea larger diameter heat-shrink tubing
  - 8ea small diameter heat-shrink tubing
  - 1ea #6 KEPS nut
  - 2ea #8 KEPS nut
  - 2ea 4-40 x 1/2 screw
  - 2ea #4 KEPS nuts
  - 6ea #6-32 x 1/4 screw
  - 1ea small tie-wrap
  - 6ea #8-32 x 3/8 black screw (4 are for mounting the module)

The MOTM-950 Power Supply is a UL/CSA/CE approved linear regulator for powering modules using the 4-pin power connector (+-15VDC) and the 6-pin power connector (+-15VDC, +5VDC). The supply can power approximately 11 4-pin modules and 8 6-pin modules. An expansion connector board, the MOTM-990, is available for attaching additional modules. Input voltages from 100VAC to 240VAC can be used with the proper wiring.

This kit requires very little soldering and can be assembled in about 1 hour.

## PARTS LIST

Please carefully check that you have received all of the parts on the Parts List. If you have a shortage, please notify us at once.

## TOOLS REQUIRED

The following tools are needed in order to build your kit.

- #1 Phillips screwdriver
- soldering iron (special no-clean solder is provided)
- chain nose or needle-nose pliers
- a set of nut drivers
- diagonal wire cutters
- a heat-gun is *highly recommended*. Try the Alpha FitGun 3.
- A DVM with a lead set that has “grabber” tips, **NOT** probe tips, is **required** to properly set the output voltages. If your DVM only has standard test probe tips, you will need to acquire a pair of banana jack to “grabber” leads. These can be purchased from Allied, Newark, Mouser and Digi-Key and are made by several companies (Pomona is the largest). *If you are unsure about this, send us an email BEFORE YOU BEGIN.*

The recommended set of DVM leads is Pomona #3786-C-36, about \$14US.

Here is a picture of this type of test lead. Note the little molded GND tab near one banana plug. This indicates that the DVM’s ‘-’ jack is for this banana plug.



## HOW THE INSTRUCTIONS ARE FOLLOWED

There is a check box  by each instruction. After completing the step, check the box. This is useful if you have to stop in the middle and need to remember where you are in the process. Please read the instruction BEFORE you start: there may be info at the end that's important.

Remember: this is NOT a speed contest. It is an accuracy contest.

### PHASE 1: Power input switch and fuseholder.

- 1)  Locate the power switch. It is a 'press fit' into the front panel. It goes in the small rectangular hole. **IMPORTANT:** the '0' (off position) MUST be oriented to the top. The '1' (on position) is the bottom of the switch. Firmly press the switch into the hole. You may hear a slight 'snap'.
- 2)  Locate the AC input connector. Check to see that the proper fuse is installed. It is located in a little slide-out drawer: get a fingernail on the small lip and pull out. For North America & Japan versions, this is a 800ma fuse. For all others, it is a 400ma fuse. Replace the drawer.

Attach the AC connector to the front panel, with the fuse drawer on the bottom side. Locate the 2 #4-40 x ½ flat head screws and the 2 #4-40 KEPS nuts in the hardware bag. Put the screws in the 2 holes on the connector, put the connector through the front panel and tighten the nuts.

- 3)  Locate the bag of 10 wires.
- 4)  Locate the short white wire with 2 red terminals. Note that one terminal is slightly smaller, and is not fully insulated. All of the following references are from the point of the back of the panel.

Firmly slide the larger terminal (it is a snug fit!) on the lower left terminal of the AC connector. BE SURE IT IS ALL OF THE WAY ON. Slide the smaller terminal on the lower left power switch connector.

- 5)  Locate the short black wire. It also has 1 large red terminal and 1 smaller red un-insulated terminal. Slide the large red terminal on the middle terminal of the AC connector. Slide the smaller terminal on the lower right power switch connector.

### PHASE 2: Wiring to the power supply

- 1)  The MOTM-950 uses a pre-assembled, pre-tested Power One linear supply. It attaches to the front panel using 2 #8-32 x 3/8 black screws and 2 #8 KEPS nuts.

Using the screws and nuts, secure the power supply to the panel. NOTE: the supply is oriented so that the transformer (that big heavy black box thing) is towards the bottom.

Attaching the one nut under the transformer is tricky: what I suggest is to loosely attach the top screw and nut first. Then, using a pair of needle-nosed pliers, grab the nut and slide it under the transformer. Use a screwdriver to turn the screw into the nut as you hold it with the pliers. If you have small fingers, you can hold the nut with one finger as you tighten with the other hand. Tighten both screws.

- 2)  Locate the green wire with the 'ring terminal' on one end. This is the grounding wire for the AC line. Press the red terminal on the top connector on the AC connector.
- 3)  Locate the #6 KEPS nut. This nut secures the ring terminal to the frame of the Power One supply. Look at the supply: see that the transformer has 4 screws securing it to the frame. Also note that the screws are slightly longer than needed: we will use this to our advantage!

Locate the transformer screw nearest the bottom, closest to the AC connector. Slip the ring terminal over the protruding threads. Secure the ring terminal with the #6 KEPS nut.

- 4)  Locate the long (7") white wire, with the thicker insulation and large red terminal. Push it firmly on the top left power switch connector.
- 5)  Locate the long black wire, with the thicker insulation and large red terminal. Push it firmly on the top right power switch connector.

### **PHASE 3: Wiring the AC input wires to the transformer**

#### **IMPORTANT NOTE!!!**

**The Power One transformer is shipped as configured for 100V (Japan) or 110V/120V operation (North America). If you have a 220V or 230V/240V system, then you MUST RECONFIGURE THE TRANSFORMER.**

Look carefully at the transformer. Note that there are 5 terminals. Each terminal is numbered (but not in order). For the North America 110/120VAC input, the 1&3 terminals and the 2&4 terminals are connected. The AC voltage (the white and black wires in the 2 preceding steps) attaches to the #1 and #4 terminals.

***If you will use the supply with other AC input voltages, the pre-soldered wires on the terminals must be cut, and new wire (supplied) is used to jumper the terminals differently.***

Here is a chart that shows the different jumper settings. Note that the supply does not care if your AC line frequency is 50Hz or 60Hz. Please note this chart is printed on the side of the Power One supply.

AC INPUT VOLTAGE	100	110/120	220	230 & 240
JUMPER	1&3 2&4	1&3 2&4	2&3 ONLY	2&3 ONLY
BLACK WIRE	1	1	1	1
WHITE WIRE	5	4	5	4

After the terminals are properly jumpered, the AC wires from the power switch are connected. Note that for 220-240V, the two existing jumpers are cut off, and one jumper is added, using the supplied wire.

## **DANGER! THE AC INPUT TERMINALS AND POWER SWITCH TERMINALS CARRY LETHAL VOLTAGES WHEN POWER IS ON.**

- Locate a piece of the large heat-shrink tubing. Slip a piece on the white wire that is attached to the power switch. Using the pliers, put the stripped end of the wire into the terminal hole (you may need to heat the wire first with the soldering iron to melt the solder on the wire) **as shown in the chart**. Wrap the excess wire around the terminal tightly. Solder the wire using the supplied solder. Make sure the connection is secure. Don't use too much force or you could loosen the terminal from the transformer.
- 2)  Do the same for the black AC wire. Be sure to put the large heat-shrink tubing on first! **Solder to the #1 terminal ONLY!**
- 3)  Slip the heat shrink tubing over the soldered transformer terminal down as far as you can. Using a heat gun, or other heat source (you can hold the soldering iron **close to but not touching** the heat-shrink and it will work) shrink the tubing to the transformer terminals.
- 4)  Locate 3 pieces of small tubing. Slide them over the 3 unused, exposed transformer terminals. Shrink the tubing on these terminals. This is to prevent contact with the transformer terminals.

**DANGER: HIGH VOLTAGE CAN BE PRESENT ON THE UNUSED TRANSFORMER TERMINALS WHEN IN USE. THESE TERMINALS MUST BE COVERED!**

### **PHASE 4: Wiring to the power distribution board**

- 1)  Locate the small pc board with the white connectors. This is where each power cable plugs into from the modules.
- 2)  Locate the 6ea #6-32 x ¼ screws. The pc board attaches to the front panel. Note that there are 6 standoffs on the panel: the pc board sits on top of them and the 6 screws go in the standoffs.

Look at the pc board. You will see 5 little bare metal connectors like on the AC connector. These are called FASTONS.

The pc board sits on the standoffs, with the 5 FASTONS *towards* the Power One supply. Use the 6 screws to secure the pc board.

- 3)  The 5 remaining wires are red, white, black, blue and brown. Each one has a large red terminal.
- 4)  Look at the Power One supply's pc board. It has 5 terminals. From left to right, they read -OUT, +OUT, -OUT, COM and +OUT. These correspond to +5V Ground, +5V, -15V, analog ground, and +15V. Yes, it is *very confusing* that they are labeled this way.

Now comes the hardest (and most critical!) part of the kit: soldering the 5 wires from the power distribution board to the Power One terminals. Why? Because if these connections are not secure, all of the modules will loose power.

The secret to getting a good connection on these terminals is applying enough heat to get the solder to flow evenly around the wire and terminal. This is probably the only time you will be encouraged to apply lots of heat! Again, not too much solder.

There are two methods to attach the wires to the terminals. If you have a heat-shrink gun, we suggest method #1. Otherwise, use method #2.

### **METHOD #1 - if you have a heat-shrink gun**

Look at the terminals on the Power One pc board. Notice each one has a small hole in the top of the terminal. We will insert the wire into the hole and solder.

- a)  Cut half of the exposed end of the red wire off
- b)  Slide a piece of the small heat-shrink tubing on the wire.
- c)  Insert the wire into the hole in the *far right* +OUT terminal (beside the white box printed on the pc board).
- d)  Apply heat to the top of the terminal for 3 full seconds before applying solder. Use enough solder so the hole is filled, but resist the urge to goop more on.
- e)  Wait 15 full seconds for the solder and terminal to cool. Slide the heat-shrink tubing over the wire so the entire terminal is covered. Shrink the tubing. If you don't wait, the tubing will partially shrink around the wire, and you will not be able to slide it over the terminal (not that I ever did this....<grin>)
- f)  Repeat the procedure with the black wire, in the COM terminal.
- g)  Repeat the procedure with the white wire in the -OUT terminal, the middle terminal on the board (the clever assembler will note we are proceeding from right to left).
- h)  Repeat the procedure with the blue wire, in the +OUT terminal.
- i)  Repeat the procedure with the brown wire in the left -OUT terminal.

## **METHOD #2 - wrapping and soldering.**

Look carefully at the terminal. Notice it has a ring in the middle. You will wrap the wire around the top “section” and solder. NOTE: the wire is rather stiff, and will take some practice to wrap it around the terminal. Since the connection will be at a right angle to the terminal, the heat shrink tubing is not used. Apply heat to the wire/terminal for 3 seconds before applying solder.

- a)  Wrap the red wire around the far right +OUT terminal. Apply heat and solder.
- b)  Wrap the black wire around the COM terminal. Apply heat and solder.
- c)  Wrap the white wire around the right -OUT terminal. Apply heat and solder.
- d)  Wrap the blue wire around the +OUT terminal. Apply heat and solder.
- e)  Wrap the brown wire around the left -OUT terminal. Apply heat and solder.

Carefully inspect each joint. Make sure the solder is on all sides of the terminal. Don't put so much solder on that it looks like a pyramid.

## **ATTACHING WIRES TO THE CONNECTOR BOARD**

The 5 wires soldered to the Power One board are not attached to the connector board. These are press-fits connections, although the connection is **very tight on purpose**.

The best way to press the wire onto the FASTON terminals is to use a pair of needle-nose pliers to grasp the red wire terminal. This helps prevent your hand slipping down and becoming impaled on the protruding connectors.

Firmly press the wire connectors onto the FASTONS all the way down. The connections are as follows:

- Brown wire to the DGND FASTON.
  - Blue wire to the +5V FASTON.
  - White wire to the -15VDC FASTON.
  - Black wire to the GROUND FASTON.
  - Red wire to the +15VDC FASTON.
- 7)  Put a nylon tie-wrap around the 5 wires about in the middle.

**Congratulations! You have just completed the MOTM-950 Power Supply!**

**HOWEVER, YOU *MUST* SET THE +15V OUT AND THE -15V OUT TO THE PROPER VOLTAGES BY ADJUSTING 2 TRIM POTS ON THE SUPPLY.**



## SETTING THE PROPER OUTPUT VOLTAGES

Examine the Power One's pc board. You will notice 3 trim pots (usually, these are white). The left one is marked +5V ADJ, the center one is marked -12V ADJ and the right one is marked +12V ADJ.

**DO NOT ADJUST THE +5V TRIMMER! IT'S ALREADY SET TO THE CORRECT VOLTAGE.**

You will use the connector labeled J1 (6-pin) on the MOTM-950 pc board, to clip the leads to and make the adjustments. The connector pin, closest to the 'J1' white lettering, is called the **BOTTOM PIN**. The connector pin nearest the "WWW.SYNTHTECH.COM" white lettering is called the **TOP PIN**.

The pinout on the connector, *from top to bottom*, is:

**TOP PIN (+5V)** ----->  
**Ground pin** ----->  
**-15V pin** ----->  
  
**2 Ground pins** ----->  
  
**BOTTOM PIN (+15V)** ----->



## WARNING!

**ADJUSTMENTS MUST BE MADE WHEN THE MODULE IS POWERED BY THE AC LINE. DANGEROUS VOLTAGES ARE PRESENT ON PARTS OF THE POWER SUPPLY DURING THE ADJUSTMENT. EXERCISE *EXTREME CAUTION*, AND FOLLOW THE PROCEDURE EXACTLY!**

**IF YOU DO NOT WISH TO CONTINUE, THEN CONTACT US. WE WILL GLADLY CALIBRATE YOUR POWER SUPPLY FOR THE COST OF POSTAGE.**

***IF YOU ARE NOT SURE, THEN STOP NOW AND CONTACT US.***

The following adjustment procedure is to be followed **EXACTLY!**

- a) Disconnect the AC power cord from the MOTM-950.
- b) **After** the AC line cord is **removed** from the MOTM-950, turn the front panel AC switch to the ON position (the '1').

We will apply AC power to the MOTM-950 using the AC line cord. **DO NOT, UNDER ANY CIRCUMSTANCES, USE THE FRONT PANEL AC POWER SWITCH TO TURN THE UNIT OFF AND ON. REPEAT, DO NOT USE THE MOTM-950's POWER SWITCH.**

- c) **BE ABSOLUTELY SURE** THAT THE AC LINE CORD IS NOT PLUGGED INTO AN AC OUTLET. THEN, FIRMLY INSERT THE FEMALE END OF THE AC LINE INTO THE MOTM-950.

- d) Attach the DVM to J1 as follows:

DVM + lead to the BOTTOM PIN.

DVM – lead to the adjacent pin (one of the 3 Ground pins)

Set the DVM for DC Volts. Place the DVM such that when you are adjusting the trimmer, the DVM's display is easily seen. **IMPORTANT! DO THIS BEFORE YOU GO 1 STEP FARTHER!**

**DO NOT, UNDER ANY CIRCUMSTANCES, REPOSITION THE DVM WHILE AC POWER IS APPLIED TO THE MOTM-950. Remove ac power by unplugging the AC line cord FROM THE WALL SOCKET (or by a switched power strip) BEFORE you reposition the DVM OR adjust/move the clip leads.**

- e) **BE ABSOLUTELY SURE** that the DVM leads are properly clipped to the 2 connector pins (not touching). If you are using alligator leads, you can move the – lead from the second from the bottom pin, to the second from the top pin (another Ground connection). Just be **SURE** it does **NOT** touch adjacent pins (like the +5V pin!).

- f) **BE ABSOLUTELY SURE** that the DVM leads are “out of the way” (the DVM should be at least 12 inches away from the MOTM-950) and that the DVM's display is easily visible.

- g) If you have access to a switched AC power strip, turn the strip **OFF** and attach the MOTM-950 AC power cord to the strip. If you do not, you will act as the AC power switch by plugging/unplugging the AC cord into the wall.

- h) Turn on the strip power, or plug the AC cord into the wall. The DVM should read +12VDC within 0.75V. If the voltage is correct, proceed to step (i).

If the voltage reads  $-12\text{V}$ , you have the DVM leads **BACKWARDS**. Turn AC power off at the power strip, or unplug the AC cord from the wall. Reverse the leads at the DVM (NOT at the connector). Reapply AC power, and the DVM should read close to  $+12\text{V}$ .

If the DVM reads less than  $+1\text{V}$ , turn AC power off at the power strip, or unplug the AC cord from the wall. Check the DVM range, check for the clip/alligator leads touching an adjacent connector pin and check the AC fuse (it's in a little drawer that you pull out of the MOTM-950's power switch).

If you still cannot read the proper voltage **STOP RIGHT NOW** and notify us. Remove the AC cord from the wall, then switch off the MOTM-950's power switch.

i) **VERY CAREFULLY**, so that you do not come in contact with the MOTM-950, use a small screwdriver (or preferably, an insulated adjustment tool), and slowly turn the  $+12\text{V}$  ADJ pot to read  $+15\text{V}$  on the DVM, within  $+0.2\text{V}$ .

j) Turn AC power off at the power strip, or unplug the AC cord from the wall.

k) Leave the clip lead on the Ground connector pin in place. Remove the clip lead from the bottom pin, and place it on the  $-15\text{V}$  pin. This pin is the **THIRD PIN FROM THE TOP**. Switch on the powers strip or plug the cord into the wall. The DVM should read near  $-12\text{V}$ .

If it reads the proper voltage, go to step (l).

If the voltage is low, say  $+1\text{V}$  or less, switch off the power strip or unplug the AC line cord from the wall. Check to see the clip leads are on the proper connector pins (DVM  $-$  lead on Ground, DVM  $+$  lead on the third connector from the top). Reapply AC power.

If you still cannot read the proper voltage **STOP RIGHT NOW** and notify us. Remove the AC cord from the wall, then switch off the MOTM-950's power switch.

l) **VERY CAREFULLY**, so that you do not come in contact with the MOTM-950, use a small screwdriver (or preferably, an insulated adjustment tool), and slowly turn the  $-12\text{V}$  ADJ pot to read  $-15\text{V}$  on the DVM, within  $+0.1\text{V}$ .

**YOU ARE NOW FINISHED! TURN OFF THE POWER STRIP OR UNPLUG THE AC LINE CORD FROM THE WALL. TURN THE MOTM-950's AC POWER SWITCH OFF.**

## **ATTACHING POWER CABLES TO THE MODULES**

The module power cables plug onto the pc board, with *the wires extending out from the left side* (as looking from the back of the unit). Notice there is a 'locking tab' on the connectors on the pc board, and an angled 'lip' on the cable's connector. The cables/connector plug together so that they interlock together.

This power supply can power BOTH 4-pin modules AND newer 500/600 Series modules at the same time. Just remember, the MOTM-950 can ONLY power about 12 4-pin modules maximum. It can power 6 to 8 500/600 Series 6-pin modules as well.