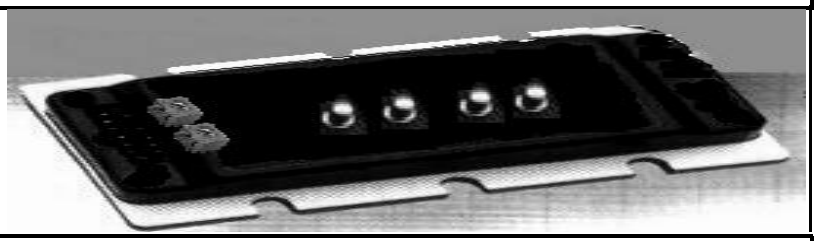
EE30080A / EE40080A DC Electric Load 300 Watt

Product Data Sheet and Installation Information



Input Voltage (EE40080A)
0 - 5 VDC (External power supply required) +12VDC
5 - 58 VDC (Using Units Internal Power Supply)
Note: Internal power supply will run down to 4.0 Vdc once unit is running.

Input Voltage (EE30080A)
0 - 58 VDC (**NO INTERNAL POWER SUPPLY)**

Input Current (adjustable) 10k pot Int./ Ext.
0 - 80 Amps (Power mode)

Switch Voltage (adjustable) 500k pot Int./ Ext.
0 - 58 Vdc. (Switch from resistance mode to constant power mode.)(startup resistance is minimum of 1.0 meg ohms looking into power source.)

Turn on time (Selectable)
(slew rate) standard 0.5 seconds & 0 - 10 Sec.
(requires external capacitor, customer supplied)
See chart for time delay / slew rate.

Power Dissipation @ 25 & 50 Deg. C
300 Watts (continuous) customer supplied head sink
Maximum base plate temperature 100 Deg. C.
Do not exceed 100 C temperature or the unit will shut down the electronic load.

Automatic Power Control Circuit
Monitors input voltage for maximum current setting never allowing the unit to exceed its maximum current rating for that voltage.

Dynamic Load Operation
2.0 Khz @ Full Load

Thermal Shutdown Circuit
100 Deg C. (turn on after cool down.)

Temperature Range (operating)
0 Deg. C to + 100 Deg. C

Size:
High 1.25 x Length 4.91 x Width 3.0 inches.

WARRANTY:
The EE40080A EE30080A DC Electronic Load comes with a 90 day limited warranty.

Preliminary Information, Last Update: 2-07-98

Basic Operation:
The EE40080 is a Stand Alone DC Electronic Load that you can use just like a power resistor, only better! It has its own internal power supply to run the electronics and draws only a few mills of current. Or, if you want, you can use an external +12 Vdc power supply to run the 40080 load. The load starts up in resistance mode and then switches over to constant power / constant current mode, with this point being adjustable & selectable. The load also has thermal and automatic over power protection. All you have to do is mount it on a heat sink & wire it to your power source**.**

Default Settings:
Your EE40080 comes from the factory adjusted for a 5.0 +/- 0.25 volts switch from resistance to constant current mode. The current adjust is set for 1.0 amp +/- 0.5 amp of constant current. The load is wired for internal power supply use and the internal power supply will start to operate at about 4.0 - 5.0 volts. The slew rate is set for 0.5 seconds from no load to full load.

Input Voltage:
Recommended input voltage range is 0-50 Vdc. (60 Vdc absolute maximum). **Voltages above 60 volts will damage the unit.** This includes voltage over shoots from power supplies. The electronic load has transient over voltage protection in it but this does not guarantee that the unit will not be damaged. Accidental reversal of input can damage the unit. **(No Warranty Coverage on Misswired or Over Stressed units.)**

Input Current Adjust:
Your electronic load current can be adjusted internally with the supplied 18 turn potentiometer on the side of the module. 0 - 80 Amps. +/- 2.5% Or you can add your own external 10K 1/8 watt potentiometer to the connector on top of the module by removing three jumpers on the connector. See figure 3.

Switch Mode Point:
This is the point where your electronic load switches from a very high resistance to a constant power mode. The point is adjustable from 0-60 Vdc. and can be changed by adjusting the 18 turn potentiometer on the side of the module. You may also use a 500K 1/8W external potentiometer by removing the three jumpers on the connector. See figure 3.

Slew Rate:
This controls how fast the rate of change is applied to your power source. (i.e. when the electronic load changes from resistance mode to constant current). The load is set to half a second, this is considered adequate for most users. However, if you need to change it, you may remove jumper from the connector and add your own capacitor for the slew rate, you require. See figure 2 & 3. For correct capacitance and polarity connection.

Automatic Power Control:
The power control circuit samples the amount of voltage and / or current that is applied to the electronic load and adjusts the maximum amount of voltage and / or current that the load can draw at that voltage level. So, if you have the unit adjusted for full load current, and that exceeds 300 watts, the circuit will reduce the current, or limit the current for no more than 300 watts of power dissipation +/- 25 watts but not less than 300watts.

Thermal Protection:
Base plate temperature range is 0 to +100 degrees C. If for some reason the base plate gets too hot a thermal circuit will shut down the unit until the base plate cools off below 100 degrees C.

Internal / External Power Supply Operation:

The EE40080A has its own internal power supply for running the control and operation circuitry of the unit. Voltage operation is from 5.0 to 58 Vdc and uses a little current (typically 200 ma. avg.) from the power source that is connected to it. **Note: this current is not accounted for in the current monitor circuit.** The power supply will start to operate from 4.0-5.0 volts and once operational will continue to operate even if the voltage goes below 5.0 volts. If, however, you are going to use the unit at startup into a source that operates below 5.0 volts we suggest that you use an external power source to run the unit. The power supply should be a +12 Vdc +/- 0.1 volts @ 250 ma. with a well regulated output.

Note: when connecting two or more loads to one power supply, the loads will share a common return path to each load's ground (i.e. you need a separate +12 volt supply for each isolated electronic load)

Current Monitor Current Share Output:

Full range output is from 0-0.4 volts with 0.4volts being full scale. This represents a 0-80 amp output, the output voltage is +/- 2.5% accurate at any point in that range. Current monitor can be measured at the connector on top of the module. This output can also be used to drive another unit as a slave load.

Temperature Range:

The operation range of the unit is 0 Degree C to +100 Degree C.

Mechanical Mounting:

When mounting the EE40080A to a heat sink make sure that you have good heat conductivity and thermal flow. For your application try not to exceed the maximum temperature range of the unit. Use all mounting holes to get the best thermal bond / pressure that you can, to the heat sink In most cases, adding thermal compound should help in heat transfer or use a metal heat transfer strip to help in the heat conduction.

Note: You should test each base plate to make sure that you are not exceeding +100 degree C. temperature range at your full load operation. Not all heat sinks and base plates conduct heat in the same manner or dissipate heat equally.

Warranty:

What does your warranty cover:

Any defect in material or workmanship.

For how long after purchase:

90 days for unit replacement.
The warranty period for exchange unit begins with date sent.

What will we do:

Provide new or, at our option, replacement for repair of your unit.

How do you get service:

Get a return authorization number from the factory, or call the factory for a replacement unit and one will be charged to your account. When the returned unit arrives and is evaluated as a good unit it will be credited to your account.

What does your warranty *not* cover:

Customer instructions. The installation manual provides information regarding operation. Installation and set-up. Damage from misuse or neglect. Unit that has been modified or incorporated into other products.

How does state law relate to this warranty:

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

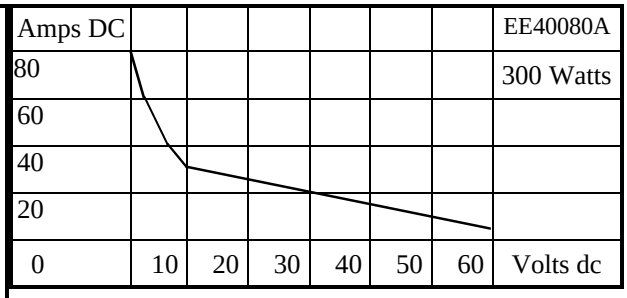


Figure 1.
Input Power Table: (Volts) x (Amps) = Watts

uF"s 20.0Vdc	0.02	0.03	0.70	0.14	0.28	.57	1.13	2.26	4.50	9.0	18.0
Time Seconds	.002	.035	.007	.014	.028	.057	0.113	0.226	0.45	0.9	1.8

Figure 2. Slew Rate (speed of turn on) +/- 10%
(100k) x (Ext. Cap. in uF) = Up Time Apx.
(3.3k) x (Ext. Cap. in uF) = Down Time Apx.

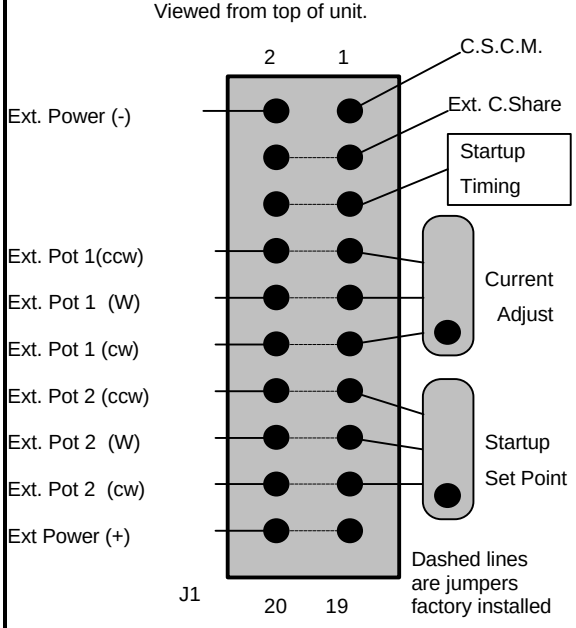


Figure 3. Connector : Electrical Connections

Special Connection & Operation

Parallel Operation: (Yes) just parallel the inputs of two or more modules. Each load will need to be adjusted separately except if you are using current share.

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President
David G. Weber

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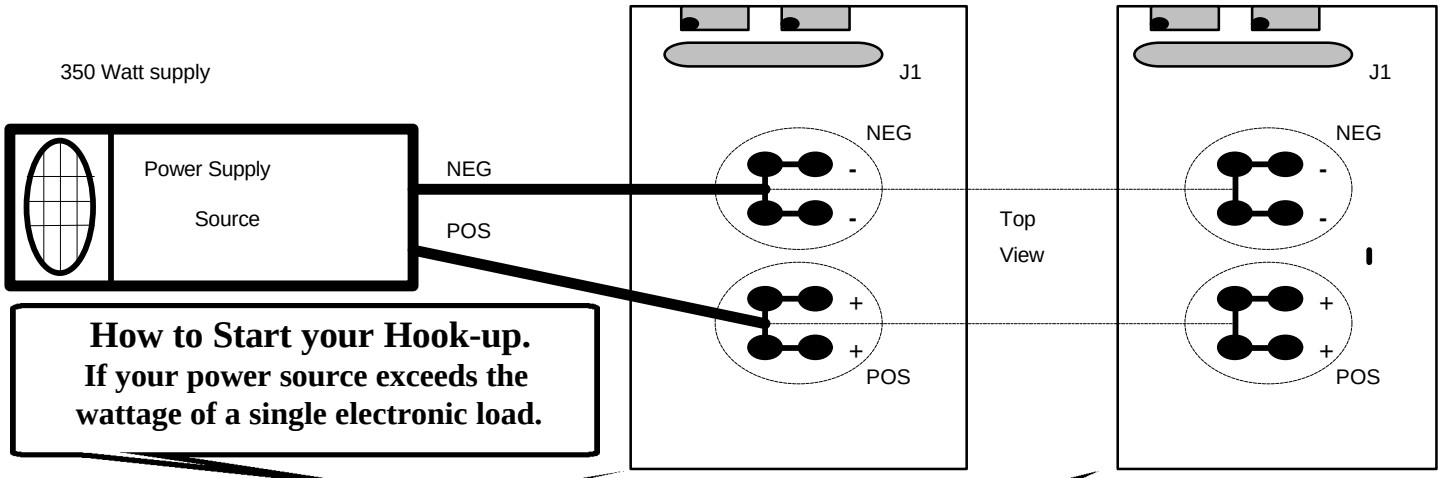
How to install your electronic load and typical hookup option information.

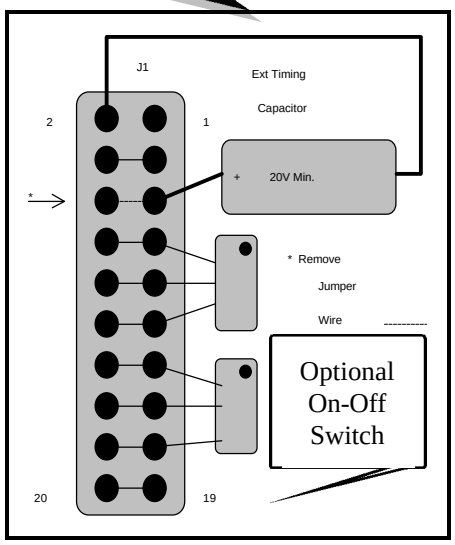


How to Start your Hook-up.
If your power source exceeds the wattage of a single electronic load.

FOR EXAMPLE: 350 WATT POWER SUPPLY. FIRST WHAT IS YOUR VOLTAGE ? LET'S SAY 12V, 350 W / 12V = 29.17 AMPS FOR FULL POWER. TAKE HALF OF THAT 29.17 / 2 = 14.58 THAT IS WHAT ONE EE40080A IS GOING TO DISSIPATE. (175 WATTS) ONE HALF OF THE TOTAL POWER. NOW TAKE THE CURRENT 14.58 X .005 = .0729 VOLTS AT THE CURRENT MONITOR OUTPUT.

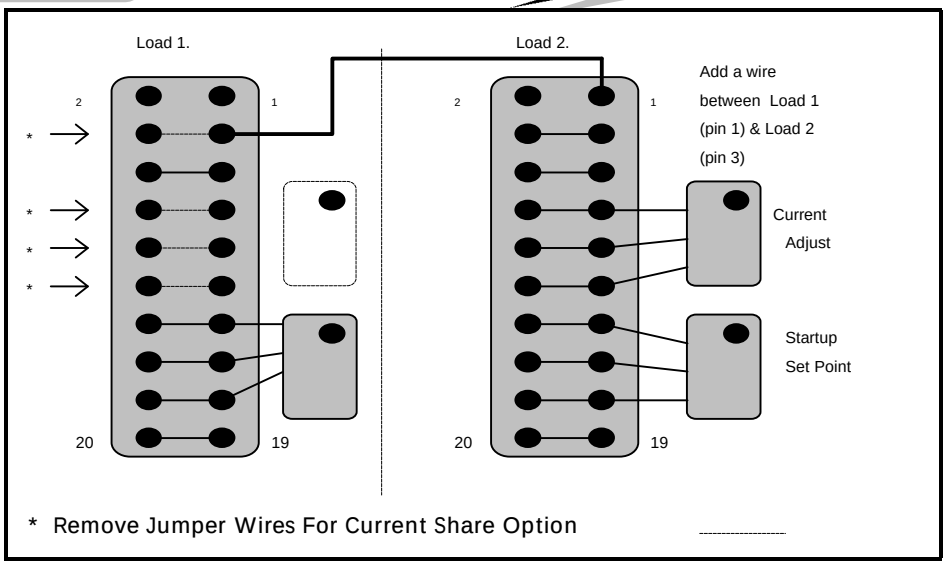
THEN CONNECT THIS LOAD IN PARALLEL WITH THE OTHER LOAD . THE FIRST LOAD IS NOW DISSIPATING 175 WATTS, THEN ADJUST THE SECOND EE40080A LOAD FOR 175 WATTS. YOU NOW HAVE A 350 WATT LOAD.

How do I change the Startup Timing? Look at figure 2. for the time you want and wire the J1 connector as follows.



Can I use one pot to control the current in both units? YES !

And here is how you do it !



To add a **Power On-Off switch** remove the jumper on J1 pins 19 & 20 and replace that jumper with a switch. The switch must be capable of handling 250 mA. @ 12 VDC. **Note: DO NOT hook the power supply of one electronic load to the other!** To switch more than one load On-Off at a time, use a multi-pole switch.

FAQ (Frequently Asked Questions)

What is an electronic load ?
An electronic load dissipates power just like a power resistor.

Why is an electronic load better than a power resistor?
With an electronic load you have better current control versus power dissipation at low resistance levels. For example, you have to have several different power resistors at 250 Watts for different voltages versus one electronic load.

What is paralleling & what advantage do I have using it?
Just like with resistors, in most cases, you can parallel electronic loads of the same type... The load will share the power just like a resistor. And, in some cases, loads that have current share need only one adjustment potentiometer to control all the electronic loads at the same time.

Do I have to use a HEAT SINK with the EE400xx series?
Yes..Yes..Yes...! First, you need to know how much heat you are going to dissipate. In some cases, for low heat dissipations, you may only need to mount the electronic load to the side of your test box. But, when you get up around that 15 watt level you will need a full fledged heat sink. The following factors should be considered - Is the unit going to be run in a continuous mode or intermittent mode? What is the ambient air temperature? If you are going to use the unit in a BURN-IN room that is at 50 C. you will need more heat dissipating ability. If you look in the Wakefield Heat Sink Book, the EE400xx series is designed to mount directly to 392 & 860 series heat sinks. Or, you can use the AAVID high power series heat sinks. The EE400xx / EE300xx was designed to be used on any heat sink with a 3.150 hole spacing, of which there are numerous ones that fit this specification. You can use heat sinks that are either forced air cooled or convection cooled. And. of course, forced air cooling works better than convection cooling. Also, forced air cooling will allow you to use a smaller heat sink.

Do I have to use an insulator with the EE400xx /EE300xx series?
No..! You can mount the electronic load directly to the heat sink. The base plate of the electronic load is isolated electrically.

Can I use current share with more than one unit?
Yes..! You can use up to 4 units in parallel. Beyond this the current sharing may become unequal.

What does the Start-up set point do for me?
In some cases, the source that is hooked to the electronic load can not start-up into a constant current or can only start-up after it has reached a certain voltage level. The EE400xx /EE300xx series allows you to set the point at which your electronic load will switch from its resistance mode to its constant current mode.

What advantages do I have with constant power?
Most measurement and burn-in is done in constant power or constant current. This allows the current from the power supply, or power source, to remain at the same same power though the voltage may be changing somewhat.

What happens if the power supply shuts off and then restarts?
Every time the power supply shuts off, the electronic load will recycle just as it did at startup. If for some reason the power supply voltage starts to droop (goes lower) the EE400xx series load will continue to work even below the 5 volt startup level.

Can I run two EE400xx \ EE300xx in series to increase the voltage range?
In theory this may work. In practice it may not. A lot of factors must be taken into consideration. You should contact the factory before trying something like this. (**There are some modes that you can not use...)**.

Can I use a computer to controlled a dc source, to control the electronic load?
Yes you can! Note: If you use this to control the load, there is **NO Automatic Power Control, Over Temperature, or Startup Time Delay,** in the load. You are now controlling that.

Can I run the load in true constant current mode?
Yes! but you will have No Automatic Power Control, Over temperature, or Startup Time Delay.

Does the electronic load power supply shut off if I add a power On-Off switch?
No. The loads power supply will run whenever there is enough power / voltage supplied to it. However, by adding a power On-Off switch you will be able to switch the internal power control electronics on and off in the load. (For the EE300xx series this turns the electronic load on-off)

How much current can the CMCS (current monitor current share) supply?
The maximum load should be no more than a 4.0 K ohms. About 3 - 4 ma.

What is the maximum size of the timing capacitor?
The size is not the problem, the leakage is. The maximum leakage can be no more than about 50 uA and still work well. The leakage is a factor in the timing circuit, and when using very large capacitors may be more of a factor for timing.

Should I use All of the Current Input Pin when connecting the load?
In most cases yes. Each input pin is designed to handle about 25 Amps. By using more than one pin your total input load resistance will be lower. This can be very important to low voltage power supply sources. Otherwise you may not be able to get the maximum current that you desire.

What is the maximum ON-Resistance of the electronic load?
About 0.01 ohms when you add all the circuits together. So, for example, how much current at 2 volts? Well that would be about 134 amps but the automatic power control will limit you to 80 Amps.

Can I use the electronic load below 2 volts?
Yes. But remember you will need very large gage wire to get large currents to the load... in fact the gage of the wire may be more of a limiting factor to current than the electronic load is.

When using a power supply to run the electronic load externally, for low voltage operation, can I use it for more than one electronic load?
Yes. But the loads that are hooked to that power supply will have a common ground. I.E. the power sources that are connected to the electronic loads will have a common ground and will not be isolated.

Can I put a short circuit switch across the electronic load?
NO ! NO ! NO ! This is not recommended. Most of the time you will have transients that exceed the input voltage rating of the electronic load. This is especially true with higher voltages. This may cause the electronic load to be damaged. Our suggestion is have a separate load control switch that switches the power source away from the electronic load and switches it to only the shorting switch in use. Remember to switch both the positive and the negative lines, not just one line, to the shorting device.

What is the difference between the EE40080A and the EE30080A?
The only difference is the internal power supply components. The EE30080A does not have a power supply in the unit. This was done to save cost to our customers and give the unit different power supply isolation options for our customers.

Do I need to FUSE the bias supply power?
Yes! Yes! Yes! Both the positive and the negative inputs to the bias power need to be fused ... a 32 Vdc @ 1/4 Amp. Pico Fuse should be used on both inputs and Do Not use a larger Fuse as this may damage the circuits inside the Electronic Load.
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Remember, if you can't find the answer here, Call us, Fax us, E-mail us, Write us.
We will get back to you just as soon a possible with your answer!

Test & Operation Setup of EE40080A & EE30080A

1. **Read all of the information on these pages.**
2. **Determine if you are using an EE40080A or an EE30080A**
3. **Note: any series that starts with an EE300xx will require an external power supply of 2 Vdc @ 0.250 Amps. Also, the power supply should be of an isolated type.**
4. **If you are using the EE400xx series, the unit has a built in power supply that will supply power to the internal circuits. This power supply starts to work at about 3-5 vdc.**
5. **If the unit is from the factory, it is set as follows: the unit is set to turn on at 5.0 Vdc input and will draw 1.0 Amps at all voltage levels above 5 Vdc.**
6. **Should you be using a used unit the first step is to turn the current pot clockwise until you hear it click or 18 turns.**
7. **Then turn the startup pot counterclockwise until you hear it click or 18 turns.**
8. **At what voltage do you want to turn the load on? For the power supply or circuit you want to test with the electronic load usually a good choice is to have the startup pot adjusted to approximately 10% of the full voltage.**
9. **If necessary, next hook up the bias supply (12VDC).**
10. **Apply the turn-on voltage you want to the main power input terminals and adjust the startup pot clockwise until you measure a voltage on pin 5 of J1 to pin 2 of J1 of approximately 10 - 12 Vdc. This tells you that the startup timing circuit is on. If you have 0-2 Vdc the circuit is in the Off mode and the unit will not allow any current to flow.**
11. **Adjust the current pot counterclockwise until you get current flow. You may use an amp meter current probe or measure the millivolts or volts from Pin 1 - J1 to Pin 2 - J1 to derive the current you are drawing from your power supply or circuit. (10.0 mv per Amp) .**

    Note: To get an accurate reading of current at low power you may want to measure the off set voltage with no current from the current monitor circuit. Then, by subtracting the offset voltage, you can obtain a more accurate current reading. Remember that this is not a precision load and it has a total of a 5% tolerance.
12. **Your Electronic Load should now be fully operational.**

Current Share Operation & Setup

13. **For each load that is going to be current shared you should perform steps 1 - 10 first. You will need to pick one load that is going to be your master load. This load will control all the other loads. (Maximum slave loads recommended is 3).**
14. **You will need to make a cable and wire the current monitor output from Pin 1 - J1 master load to Pin 4 - J1 of all the (Slave Loads) and remove the jumpers on pins (3-4),(7-8),(9-10),(11-12).**

    Note: You can not current share with one load running positive voltage and another load running a different voltage. The loads have a common ground using the internal or external bias power supply. You can only current share a single power source.

Remote Control Setup & Operation

15. **Note: In using the remote control, the power foldback, startup time delays and thermal protection are disabled... ! (Maximum power can be exceeded) It is the customers responsibility to make sure the power level is not in excess of the 300 watt level at any voltage or exceed a temperature of 100C on the unit's base plate.**
16. **Remove jumpers (7-8), (9-10), (11-12). Apply a dc voltage (0-4.0Vdc) from Pin 10 - J1 positive and return ground to Pin 16, 2 - J1 Jumper (Pin 3-4). Your power supply voltage must be very stable and clean of noise (remember .11 volts is 1 Amp of power.) We suggest using a divider right at the connector of the electronic load to reduce the noise and add stability.**

Temperature Shutdown

17. The unit should never be allowed to go into thermal shutdown. If it does, when the unit cools it will turn on in constant current mode of operation (Bypassing time delay & resistance mode).

Constant Power / Automatic Power Control

18. How can I tell if the power control circuit is working?
Hook up an external power supply to the load input pins. Set the power supply to 10 Vdc. Measure Pin 12 - J1 for an approximate voltage of 3.0 Vdc. Then increase the power supply voltage output to 15 Vdc. The voltage at Pin 12 -J1 should have decreased to approximately 2.0 Vdc.

Note: The constant power circuits adjust the reference voltage as the voltage goes up or down to the electronic load thereby adjusting the power (current) the electronic load is pulling from the external power source.

Constant Current Operation

19. Can I operate the electronic load in true constant current mode?
Yes, remember that by doing this you will disable the startup, Over temperature, and automatic power control circuits.
First remove the jumper from Pin (11 - 12)
Then with a 1.5K 1watt resistor as well as a 5.1 Vdc Zener diode (1N5231B) connect the resistor from Pin 20 - J1 to the Banded side of the diode. Connect the other end of the diode to Pin 2 - J1 (ground). Also, connect a wire from the banded side of the diode to Pin 11 - J1. The electronic load will now run in constant current.

Note: It is assumed that the jumpers are in use in the circuits and that they will stay in use unless we tell you to do something different.

Time Delay Adjustments

20. The time delay can be changed by removing the jumper from Pins (5 - 6) and connecting a new time delay capacitor from Pin 2 - J1 (ground) to Pin 5 - J1 (positive). See the time delay chart for capacitor size for the time delay you need.

Note: The charge and discharge times are different.

Adding an External Bias Power Supply

21. If you are using an EE400xx series, and want to disable the internal power supply first remove the jumper from Pins (19 - 20) - J1. Next, connect a 12 Vdc @ 250 ma to Pin 20 - J1 (Positive) and Pin 2 - J1 (Return). Your 15 Vdc power supply should be set to within +/- 10 mv of 12 volts. Depending on the noise from your bias supply, you may have to add filter caps at the J1 connector input to reduce noise to the internal circuits.

Remember that the (return) side of your bias supply is also connected to the (return / Neg) side of the Electronic Load input side. We recommend that you use an isolated type bias power supply. The EE300xx series requires a bias power supply to operate.

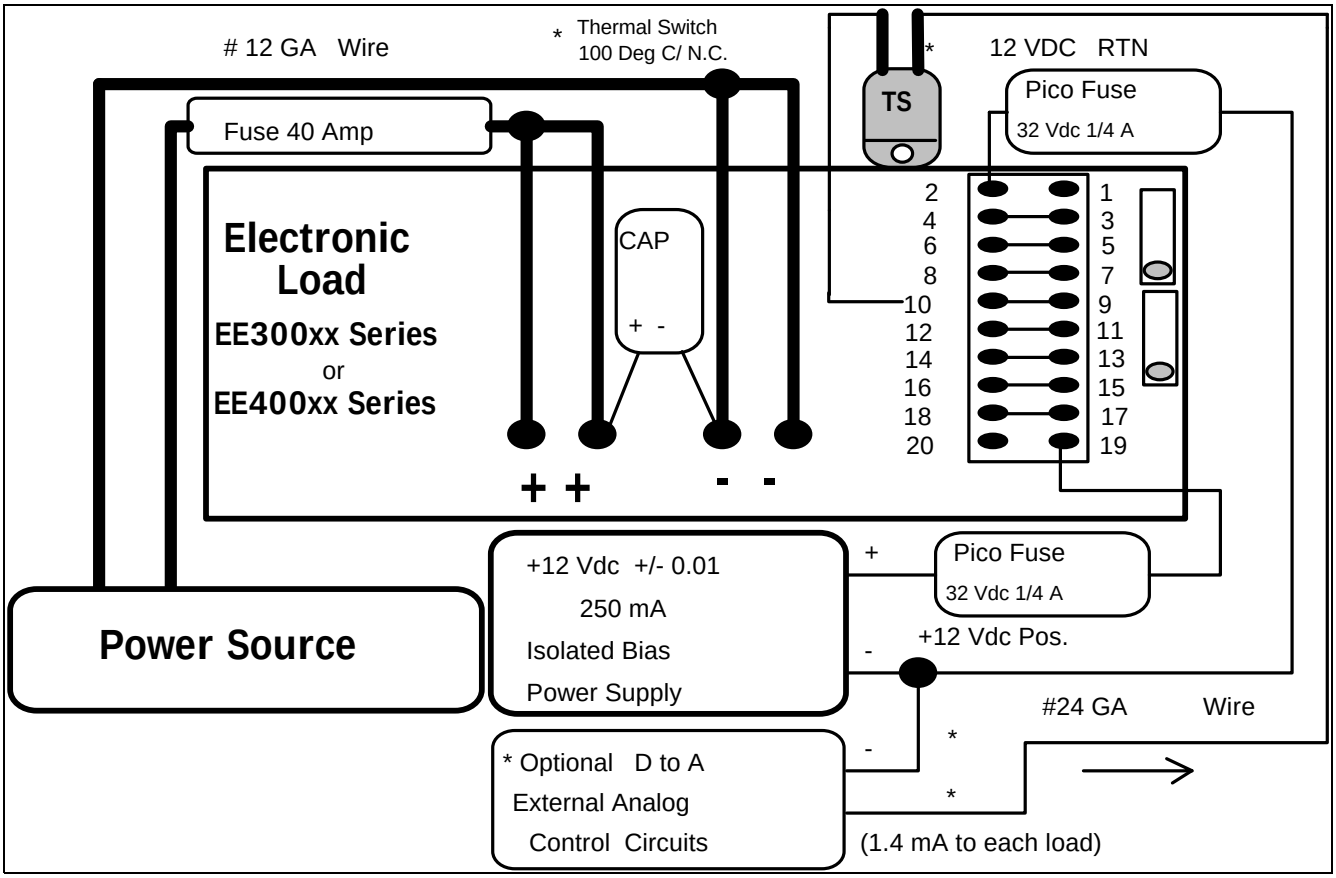
General Hookup

22. Effect of wire length & size and impedance: If you have a scope you should check to make sure that the electronic load is not oscillating (can't hear it sing, whistle or change pitch as the current is adjusted). Note: That all Power FET Electronic Loads have a tendency to oscillate under certain conditions. This is due to the inductance of the wire (length) resistance and the source impedance.

How Do I Fix the Oscillation?
The easy fix is to add some capacitance to the input terminals at the Electronic Load end.
Typical values are between 500uF - 3000uF at what ever your maximum input voltage is.
If you don't want to add capacitance to the load you can use low impedance coax cable.
Or you can use twisted-pair wiring to the load input. Any of these options can be used to help in your application.

Note: You will not damage the Electronic Load if it starts to oscillate.

23. Default Hookup (typical)



24. If you are using Electronic Load in parallel, all the loads should have their own fuses. You can use a single Bias Supply for all the loads.

25. If you are going to add an external thermal switch it should be added to either the control input line as shown in the schematic above or added in the positive bias supply line. The switch should be in the normally closed (N.C.) mode and open at or before 100 Deg C.. You should mount the switch to the top side of the center screw on the same side as connector of the base plate of the load. The thermal switch should NOT have any air flow directed at or around it, as this will keep it from opening at the correct temperature. If you do have air flow around the thermal switch you can add some RTV over top of the thermal switch to block the air flow.

26. The maximum external control current is about 1.4 mA per electronic load (3.6K) .