Power Line Series by High End Systems

TECHNICAL INFORMATION For use by qualified service personnel only !

Safety First : Always allow the unit to cool for 30 minutes and disconnect the power before any attempt at servicing.

The wiring of the mains side of the unit is very simple to follow, but please note there three variations. The first is a 120V only system and used a ballast / igniter manufactured by Advance ballasts. This can only be used for 120V 60Hz settings. The PCB transformer in this model has a 120V primary (denoted by a red spot on the shroud). From week 27 (1999), a ballast / igniter manufactured by Venture Lighting was used. This has tappings for 120V, 208V, 240V and 277V (at 60Hz only), this setting is hard wired inside. The PCB transformer for this system has a 230V primary and is powered from a 240V auto tapping on the ballast (this is denoted by a blue spot on the shroud). The third system has tappings for 220V 60Hz and 230V 50Hz. The ballast / igniter system is simpler in design and uses a super-imposed design.

The mains inlet has an external fuse draw which is the first protection against over current faults. The live connection from this goes to the manually resetable thermal trip mounted on the reflector plate near the transformer (rating 140°C). If the unit exceeds this temperature, the trip will open and switch the power off to the entire unit. Note that this will only happen if the fan fails or the unit is ran with the vents blocked. It can be reset by pushing the button between the terminals in until a click is felt.

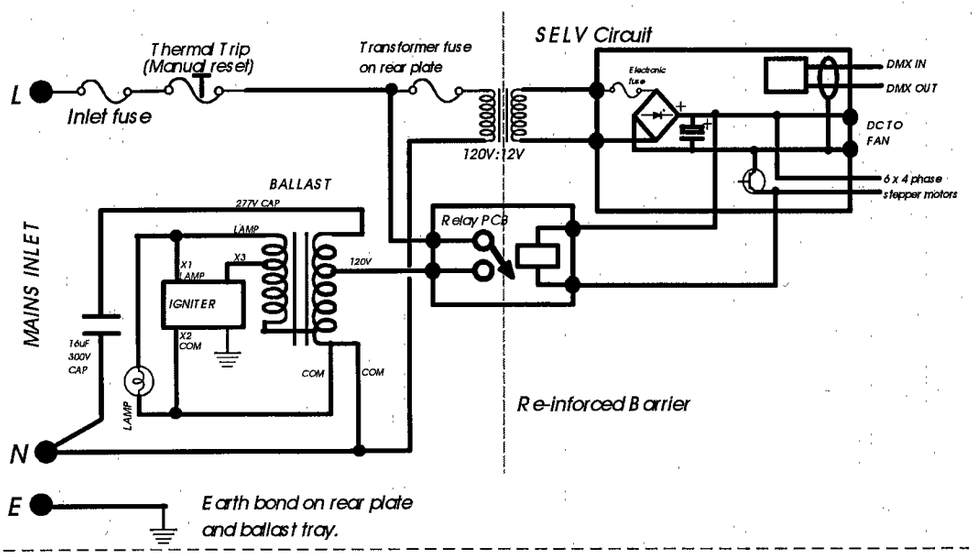
The live output of this thermal trip is split to two circuits now. The first is the PCB transformer which is mounted next to the thermal trip. This has a series fuse mounted on the back plate near the lamp holder. The primary of the transformer is about 100Ω and this can be read across the mains inlet also as the discharge circuit has no DC resistance. The secondary of this (12V) feeds the circuit board with the wires routed in a cable run below the ballast plate. Two types of transformer are used, the 20VA for units with upto 4 channels and the 30VA for units with 5 or more channels. The second live feed from the thermal trip goes to the ballast through a relay. The relay contacts are only closed when DMX is present of the effect is in local mode.

A discharge lamp requires a very high voltage to produce the arc and so care must be taken when dealing with this circuit. On power up, the igniter pulses the power which causes the ballast to give the high voltage required to strike the arc in the lamp. This will keep trying until an arc is drawn. The igniter then senses that there is now current being drawn and drops out of circuit. The ballast now left inline with the lamp is used to reduce the power to lamp for normal running. If the lamp is hot, it will not re-ignite and trying to do this to a warm lamp reduces its life.

Circuit diagrams for the mains wiring are shown below.

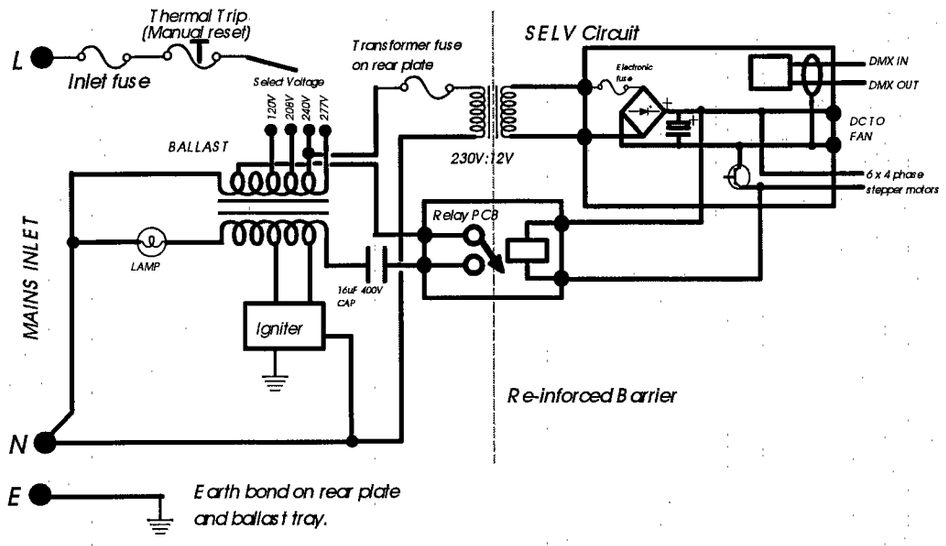
Wiring system used for Advance ballast (up to week 27, 1999)

Only 120V 60Hz is available with this system

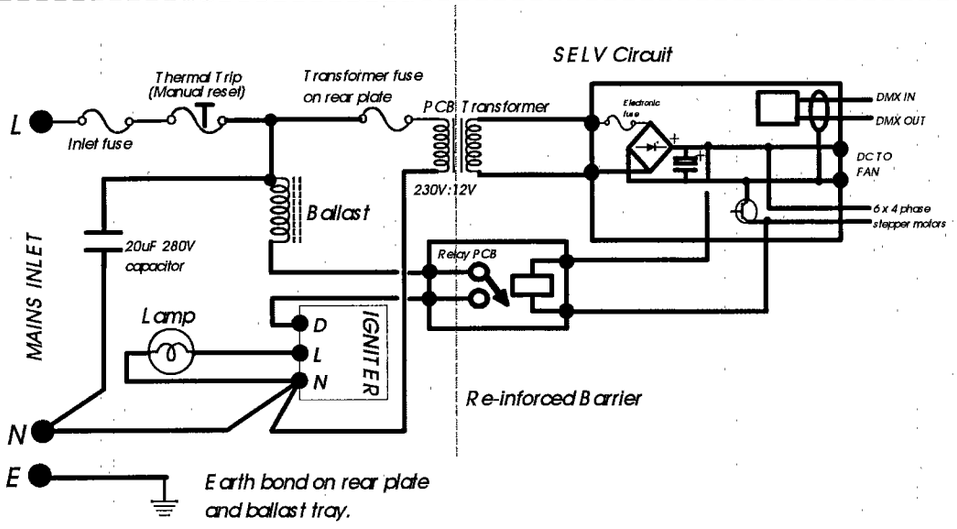


Wiring system used for Venture ballast (from week 27, 1999)

120v Wiring to allow multi-voltage selection. Voltages available (all 60Hz) are: 120V/208V/240V/277V



Wiring for 220V 60Hz and 230V 50Hz.



GENERAL FAULTS

The whole unit is dead.
1) Check that the euro lead has power to it. Make sure the lead is fully inserted as a poorly fitted euro lead can cause arcing and blow the fuse.
2) Check the inlet fuse by removing the fuse in the draw and check with a continuity meter that it is still okay, do not rely on a visual check.
3) Remove the case lid and check the PCB transformer fuse (mounted on the metal plate at the rear holding the lamp holder). Always check with a continuity meter, do not rely on a visual check.
4) Check if the thermal trip is open circuit, if so click back on and look for any obstruction in the venting and check the fan is running.
5) Measure the DC resistance across the primary of the PCB transformer (this can be done externally across the mains inlet), it should be about 100Ω -50Ω. If not, check the fuse on the rear plate near the lamp holder (T-250-500mA).
6) If the resistance of the primary can be measured on the inlet, check there is about 11V AC at the secondary.

The lamp does not light but the motors reset.
1) Check the connector on relay PCB.
2) Check the lamp is not to warm to re-strike.
3) Either check the PCB is receiving DMX or set to local mode (c000), the relay will only turn on if it is receiving a DMX signal or is local mode. The obvious indication of this is the fan will be running if the relay coil is energised.
4) Check the lamp is located in the socket correctly and check its contacts.
5) The lamp can be faulty but due to its life expectancy, its rare.

The motors reset and the do nothing.
1) Check the unit is receiving DMX either with an oscilloscope on the sockets or with a specialised DMX test set.
2) Check the DMX address by pressing either the ↓ or ↑ keys, the display will show the address 3 times. Note that when the display is active, DMX signal can not be read. Also, after a change of DMX addressing, the new channel becomes active when it reads the first signal it is addressed to. Make sure the controller is transmitting data correctly.
3) To prove the unit functions, remove the DMX signals and set the DMX address to c000. When the built in mic picks up a signal (or it is tapped) the unit should animate. To leave local mode, simply enter a new address. Be careful when setting the local mode as the unit will then start transmitting DMX itself so ensure the DMX connectors are removed to other effects.
4) if the unit functions in local mode, check that there the DMX is correctly wired (1=Earth 2=Negative 3=Positive / hot).

The unit starts up okay but the colour / GOBO loose step.
1) Check that the motor plugs are correctly pushed onto the motors and the PCB are not loose.
2) Make sure the wheels are not catching or rubbing on the end-stops.
3) Set a digital meter to AC volts and measure the voltage at the +/- terminals on the top of the board, this will give a ripple voltage. The voltage should not be above 250mV, if so, check the main smoothing capacitors.

The PAN / TILT loose step.
1) Check that the motor plugs are correctly pushed onto the motors and the PCB are not loose.
2) Make sure the tilt wires are free moving and are not snagging as it is scanning.
3) Set a digital meter to AC volts and measure the voltage at the +/- terminals on the top of the board, this will give a ripple voltage. The voltage should not be above 250mV, if so, check the main smoothing capacitors.

The shutter does not black out the light.
1) Make sure that you are sending DMX level 0 (blackout).
2) To align it, send blackout to the shutter channel (DMX level 0). Look at the beam projection and loosen the grub screw and re-align the shutter (made of aluminium) to cover the beam. Reset the unit by either shorting the reset pins near the main chip, sending DMX level 1 on all channels for 4 seconds or turn the Power DMX controller off and then on. If no controller is available, removing the DMX signal will cause the shutter to close after 5 seconds, please be aware thought that if DMX is left out for 5 minutes, power to the lamp and fan will be turned off.

A rotating GOBO does not spin.
1) Check to see if it is just one GOBO or if the majority are affected. If there are several with problems, then the wheel is either out of alignment or the coils are not set correctly.
2) If it is just one GOBO, then careful alignment with a pair of very fine nose pliers may be possible. The spindle must be perpendicular to the wheel, if it is twisted then it will not sit in the magnetic field correctly. Whenever an adjustment is made, you will need to select a different GOBO and then go back to the faulty one. This causes the field to stop and re-start again.
3) Check the connectors are on both the PCB and the GOBO plate PCB correctly.
4) There should be 12V DC approx. between the common (signified by a different colour) connection of the GOBO wire and ground (an easy ground point for measuring is the 0V point on the fan connector). If not, check the secondary voltage of the transformer. It will give about 11V AC when presented with the correct voltage as selected, e.g. 120V AC (off load).
5) make sure there is the IR filter placed in front of the reflector,

Details & help for the circuit board

Power Supply :
11 volts AC is fed into connector TB1. This is a push fit connector and to release the wire a pin is inserted into the slots on the top of the block. C2 (1nF) removes any conductive rogue signal. After the bridge rectifier, R11 & C16 power IC5 (the op-amp). The LM2940T provides the regulated 5 volt supply. The initial reset signal is internal in the main IC which also provides brown out protection. Two pins near pin 1 are the reset terminals for manual reset and R6 is the pull up resistor. The LED is powered by the 5 volt rail to show that the regulator is functioning. REG2 position was used for the early rotating GOBO system, this is now replaced by a link.

DMX Section :
3 pin XLR connectors are used for DMX connections, pin 1 is ground, pin 2 is -ve and pin 3 is the +ve (hot) terminal. D4, D5 and D6 are transient suppressers to provide protection from voltage spikes. IC7 is a line driver IC and the data lines go to IC1 pins 25 & 26 and the direction is controlled by pin 36 of IC1.

Audio Section :
Sound is picked up from an electret mic insert which is mounted on fly leads in the rear of the case. R14 provides a phantom power source for it and C10 provides DC blocking. The op amp (IC5) is a standard bi-polar 741 type with its gain being set by R17. Power for this is from R11 / C16 and is fed to pin 7, the 5 volt rail is used as a virtual ground for signal reference. R15, C11 & C12 provide a basic passive bass filter. The next part of the audio circuit is an automatic gain control (AGC) to keep the signal level constant. TR2 is the final switch, the output of which is fed to pin 33 of IC1.

Keyboard / Display :
4 push buttons are used to enter data to the system with a low current display used for data indication. Note the display must only be replaced with an exact type. R1-R4 are series resistors for the switches and R5 is the current limiting resistor for the display. The common for the switches (pin 33 of IC1) is also the common for the display.

Micro functions :
IC1 is the main control IC. This looks after the keyboard, display, memory, audio input, DMX control and the motor drive parts. The motor outputs drive the inputs of the Darlington drivers which act as the power switches to the stepper motors. The memory (IC 2) is an EEPROM with a 40 year memory requiring no battery protection. This holds the DMX channel and option information. If the memory is faulty or not fitted, the display will flash the word **ERROR** when the main IC writes to it (such as in a change of DMX address).

Faults and possible causes :

1) Unit does not reset.
Power missing. Test 11V AC and 5V DC rails.
No clock signal on pin 13/14 of IC1.
No reset signal, check logic 1 (Hi) on pin 1 of IC1 (logic 0 = reset).

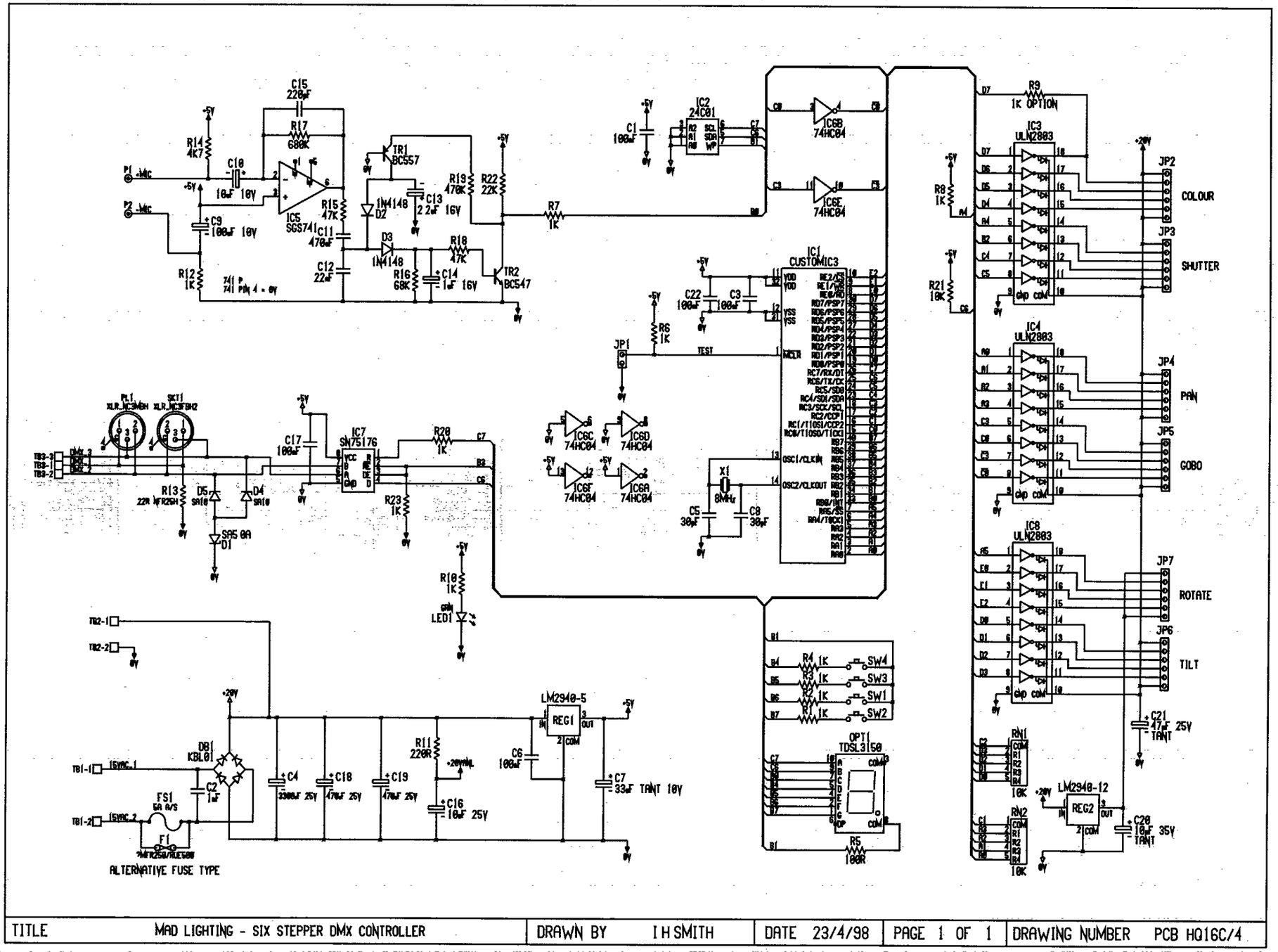
2) Fan does not run.
Power missing, check 11V AC input and unregulated DC rail.
Check that fan can turn and is not jammed.
Fan will only run if DMX is present or in local mode (relay pulled in)

3) DMX address read is wrong.
Check DMX address. If lock is enabled, address may not have been entered correctly.

4) No operation in local mode.
Mic wires broken, check for power / signal on back of mic.
IC5 faulty, check for signal input on pin 2 (if not, check C10 connections) and output on pin 6
Phantom power circuit for mic faulty (R14).
If IC5 is okay, test for logic levels on junction of R7 and R22 when MIC is tapped.
Check DMX address is c000

5) Motor jumps erratically.
Motor wire is broken. Test for equal continuity when disconnected from PCB (47R per phase).
ULN2803 driver IC is faulty, check drive inputs to outputs.
IC1 is not in its socket correctly or faulty
Motor shaft is catching / bearings worn.
If it is the pan or tilt motor, check RN1 and RN2 resistor networks.
Make sure the motor can turn freely when disconnected (or power is off).

6) Motor loses step.
Motor wire is broken. Test for equal continuity when disconnected from PCB.
Motors should move freely with no power applied and should have no restraints.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MAD LIGHTING - SIX STEPPER DMX CONTROLLER
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