SHAPE LLC

Custom magnetic transformers, inductors, and power supplies

Controlled Ferroresonant Ballast

(CFB)

Generation #3

Manual

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GENERAL DESCRIPTION

Congratulations on your purchase of the new Controlled Ferroresonant Ballast (CFB). The CFB is an electronically controlled ballast that regulates the output current to assure constant power. Unlike other SCR based power controllers that suffer from low input power factor and high lamp current THD, the CFB controls power delivery to the lamp by varying the electrical resonance of the system. The lamp output can be infinitely controlled to meet your manufacturing process and flow requirements. This makes the CFB ideal for most applications using mercury vapor or metal halide lamps.

INSTALLATION

In order to ensure the optimum performance of your Controlled Ferroresonant Ballast, it is recommended that a qualified electrician install this product. This unit must be connected in strict accordance with all national and electrical codes.

CONNECTIONS

PRIMARY

Typical input voltages and connections.

Input Voltage	Connections	Jumpers
208	H1 - H5	H1 & H4 - H2 & H5
240	H1 - H6	H1 & H4 - H3 & H6
460	H1 - H5	H3 & H4
480	H1 - H6	H3 & H4

Typical input voltages and connections for higher wattage ballasts that may only have a 460 or 480V input. These ballasts can be identified by having only three input terminals, H1 – H3.

Input Voltage	Connections	Jumpers
460	H1 – H2	NONE
480	H1 – H3	NONE

If your primary voltage is not listed here, contact the factory for help.

PRIMARY CURRENT

Use the following formula to determine the input current: $I_{IN}(Amps) = \frac{P(W) \times 1.15}{V_{IN}(Volts)}$

Input Circuit Breakers or Fuses are rated according to the following formula: $I(Amps) = \frac{P(W) \times 1.5}{V_{IN}(Volts)}$

EXTERNAL CAPACITORS

All of the capacitors are rated 660vac and need to be connected to the terminal block located on the base plate. #10 gauge wire should be used to connect the capacitors to the terminal block. No more that 200µF should be run on any pair of wires to minimize the capacitor current through the capacitor connectors. Use multiple pairs of wires to the terminal block when necessary.

LAMP

Connections to the lamp require high voltage wire. Use a minimum of 20 KV installation lead wires. In some instances the output voltage from the ballast may exceed 6000 VAC. The two lamp wires are connected to the terminal panel mounted to the CFB. The two terminals are marked “LAMP”.

VL-VL

The CFB provides a convenient way to measure lamp voltage accurately and without the need for a potential transformer. Connect the voltmeter probe to the 10:1 scaled lamp voltage terminals V_L – V_L on the CFB terminal panel. Example: 2,400V_{Lamp} = 240V VL-VL.

PLC

Use the provided PLC connector only and shielded cable. Insert the PLC connector. The amber LED (D2) will turn on indicating PLC mode. You will then need to match PLC signal to lamp current; this can be achieved by adjusting R26 (clockwise decreases lamp current) while keeping the PLC setting constant.

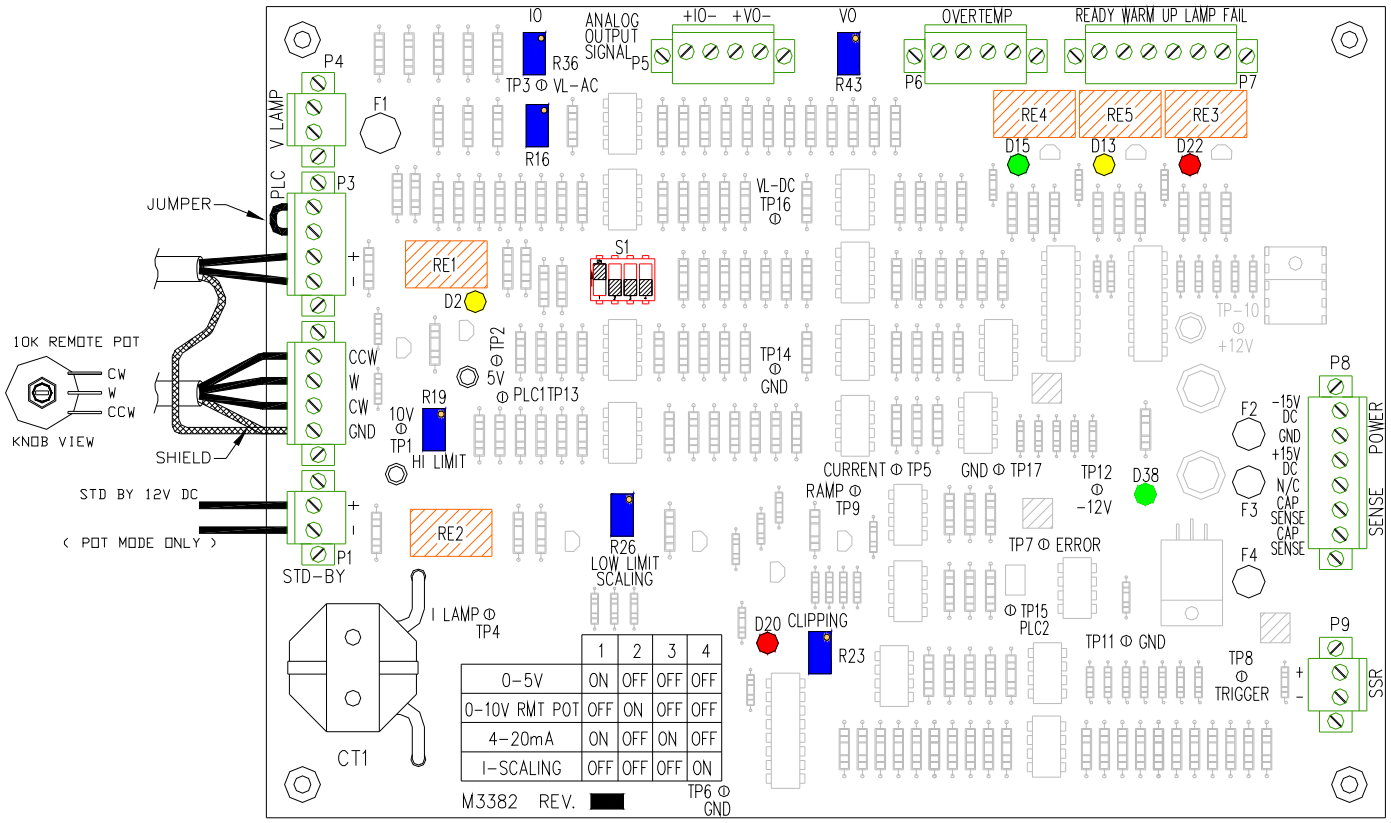
Due to its inherent noise immunity, it is recommended to use 4mA – 20mA source type output, current source PLC. The circuit board is configured by setting the DIP switches.

Note: when the PLC connector is inserted, the CFB will only respond to the PLC signal and disregard the Potentiometer setting. If the PLC connector is removed in mid operation, the system will immediately switch to the potentiometer setting.

REMOTE POTENTIOMETER

Before you begin, remove the PLC connector. The external potentiometer will be 10KΩ. The potentiometer must be connected to the PC board using a 3-wire shielded cord.

CIRCUIT BOARD



OPERATION

PLC / Remote Pot set-up

1) set dip switches for Remote Pot or your type of PLC (see chart on PC board)

2) set R23 during Warm-Up (same as Gen #2)

3) set maximum output using R19 (CW increases output) **(skip this step if using scaling)** (this step must be performed before setting the minimum output, if the maximum setting is changed the minimum setting will change)

4) set minimum output using R26 (CW increases output) **(skip this step if using scaling)** (this setting is dependent on the maximum setting)

5) set scaling output using R26 (CW decreases output)

Transfer

set transfer using R16 (same as Gen #2) (CW raises transfer voltage)

Analog Outputs

max output voltage is approximately 10.5Vdc

set IO (Lamp current analog output) using R36 (CW increases output)

set VO (Lamp voltage analog output) using R43 (CW increases output)

(Cheater Set-Up)

1) energize ballast & ensure PLC input signal is at stand-by (0 Vin)

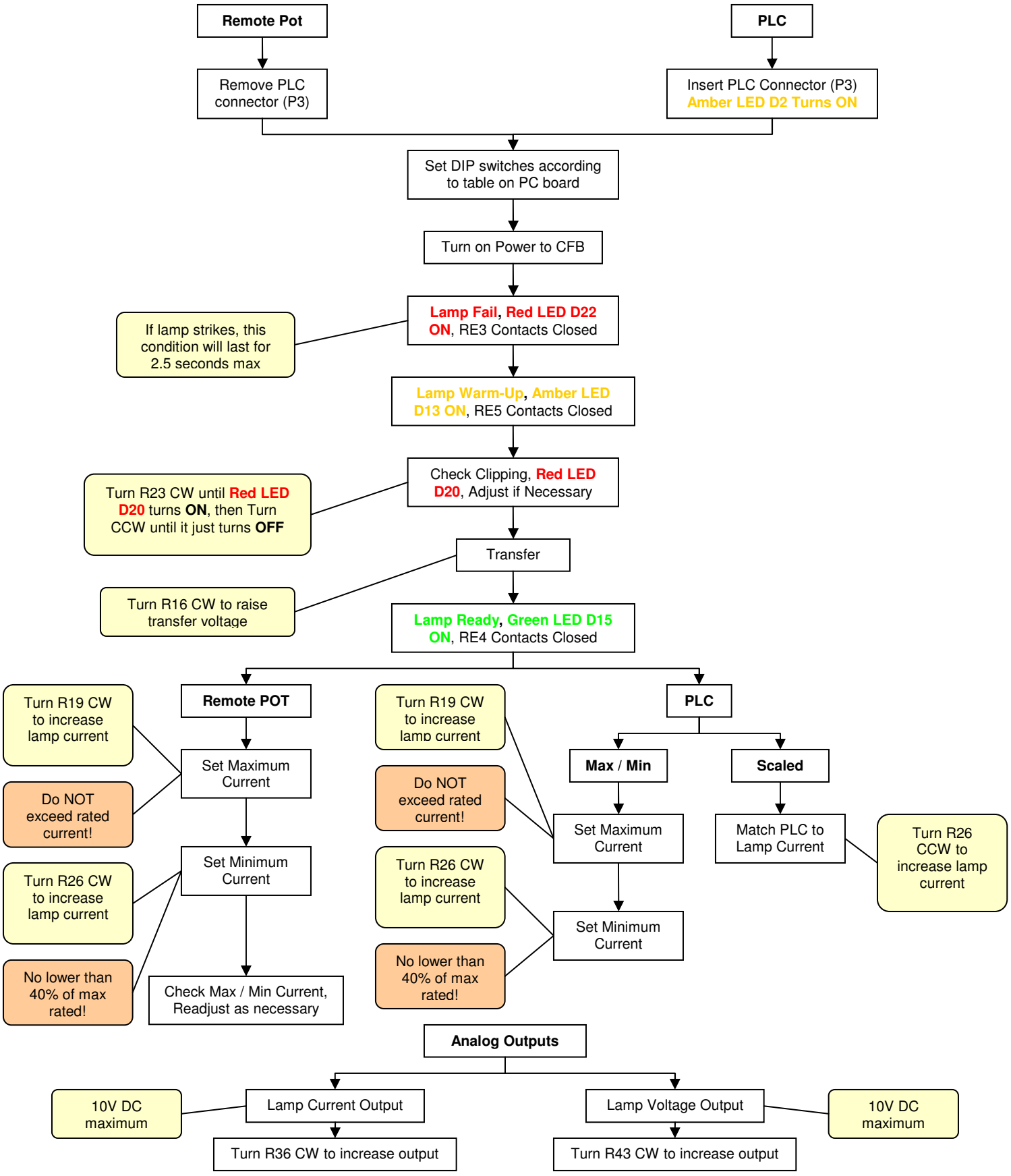
2) turn R23 (clipping) CW until clipping light comes on, turn CCW until clipping light goes out STOP, turn R23 CCW 2 full additional turns (this prevents occasional flickering of the Clipping indicator) (You only need to do this step if using a completely un-calibrated PC board)

3) turn R26 (low limit) pot fully CW (25 turn pot) [must complete this step while in Warm-Up, or before energizing ballast]

4) turn R19 (hi limit) pot fully CW (25 turn pot) [must complete this step while in Warm-Up, or before energizing ballast]

5) upon transfer to Ready (ballast will be giving full current to lamp), turn R19 (hi limit) CCW until maximum current is set [this setting is independent of the PLC input signal i.e. doesn't matter if PLC is 0 Vin or 10 Vin]

6) PLC input must be at stand-by (0 Vin), turn R26 low limit CCW until minimum current is set [this setting is dependent on the PLC input and the maximum set point (if the maximum setting is changed the minimum setting will change)]


Remote Pot
PLC
Remove PLC connector (P3)
Insert PLC Connector (P3) Amber LED D2 Turns ON
Set DIP switches according to table on PC board
Turn on Power to CFB
If lamp strikes, this condition will last for 2.5 seconds max
Lamp Fail, Red LED D22 ON, RE3 Contacts Closed
Lamp Warm-Up, Amber LED D13 ON, RE5 Contacts Closed
Turn R23 CW until Red LED D20 turns ON, then Turn CCW until it just turns OFF
Check Clipping, Red LED D20, Adjust if Necessary
Transfer
Turn R16 CW to raise transfer voltage
Lamp Ready, Green LED D15 ON, RE4 Contacts Closed
Remote POT
PLC
Turn R19 CW to increase lamp current
Set Maximum Current
Do NOT exceed rated current!
Turn R26 CW to increase lamp current
Set Minimum Current
No lower than 40% of max rated!
Check Max / Min Current, Readjust as necessary
Turn R19 CW to increase lamp current
Do NOT exceed rated current!
Turn R26 CW to increase lamp current
No lower than 40% of max rated!
Max / Min
Scaled
Set Maximum Current
Set Minimum Current
Match PLC to Lamp Current
Turn R26 CCW to increase lamp current
Analog Outputs
10V DC maximum
Lamp Current Output
Turn R36 CW to increase output
Lamp Voltage Output
Turn R43 CW to increase output
10V DC maximum

TROUBLESHOOTING

The following troubleshooting tips may help you if you experience problems. Contact your dealer for more advanced troubleshooting information.

- *Lamp does not start*
  - Lamp is warm. Allow lamp to cool.
  - Lamp is bowed or swollen, replace lamp.
  - Lamp is out of spec. Check lamp for correct voltage and part number.
  - With input power applied to the ballast, check the output voltage. It has to be greater than the lamp's striking voltage. If not, see "Low open circuit (striking) voltage" below or contact the factory.

- *Low open circuit (striking) voltage*
  - Check input terminal panel wiring.
  - Bad capacitor or capacitor connection, check capacitors.
  - SSR is shorted, check SSR.
  - Ferro shorted internally, check resonance.

- *Lamp does not transfer to Ready*
  - Transfer point is set too high. Turn R16 CCW to lower transfer point.
  - Lamp is out of spec. Check lamp for correct voltage.

- *System oscillates between Warm-Up and Ready*
  - Lamp is overcooled. Reduce lamp cooling.
  - Transfer point is set too high. Turn R16 CCW to lower transfer point.
  - Lamp minimum current setting too low, raise minimum current setting.
  - Lamp is out of spec. Check lamp for correct voltage.

- *Lamp current is less than rated current*
  - Lamp is out of spec. Check lamp for correct voltage and part number.
  - Check the capacitors for correct values or bad connections.
  - If using Remote Pot, check if maximum current limit is set too low. Turn R28 CW to increase lamp current.
  - If using PLC, check if scaling is properly matched to PLC signal. Turn R30 CW to increase lamp current.

- *Low UV Output*
  - Check input terminal panel wiring.
  - Bad capacitor or capacitor connection, check capacitors.
  - Lamp is out of spec. Check lamp for correct current.
  - Control circuit out of adjustment, re-adjust PC board.
  - Shorted SSR (lamp current will be approximately ½ or less, than full rated current), check SSR and check resonance.
  - Old lamp, replace lamp.

- *Lamp is unstable*
  - Lamp is overcooled. Reduce lamp cooling or operate at a higher minimum current setting.
  - Check lamp for correct voltage.
  - Check LED D17 for clipping. Turn R23 CCW.
  - Lamp is out of spec.

- *Lamp Extinguishes after transferring to Ready*
  - Transfer point set too low. Turn R16 CW to raise transfer point to approximately 75% of full rated voltage.
  - Lamp is overcooled. Reduce lamp cooling.
  - Lamp is out of spec. Check lamp for correct voltage.
  - Controls are set to low power (Remote Pot or PLC). Set controls so that CFB transfers to high power and not stand-by.

- *System does not respond to controls*
  - If in Remote Pot mode, check if PLC connector is installed. If so, remove the PLC connector.
  - If in PLC mode, check PLC jumper and DIP switch settings.
  - Check if Lamp Ready LED D21 is ON. If not, turn R16 CCW to lower the transfer point.

- *Circuit Breaker Trip or Input Fuse Blown*
  - Check input terminal panel wiring.
  - Check for proper rating of circuit breaker or fuse.
  - Main transformer input winding shorted. Contact factory for assistance.

- *Resonance Check (Checks basic ballast operations)*
  - Short the lamp output of the ballast with a jumper and energize the ballast. Measure the current running through the jumper. It must be greater than the lamp's rated current. If not, check the capacitor connections, SSR and Control Circuit. PC board should indicate Warm-Up.

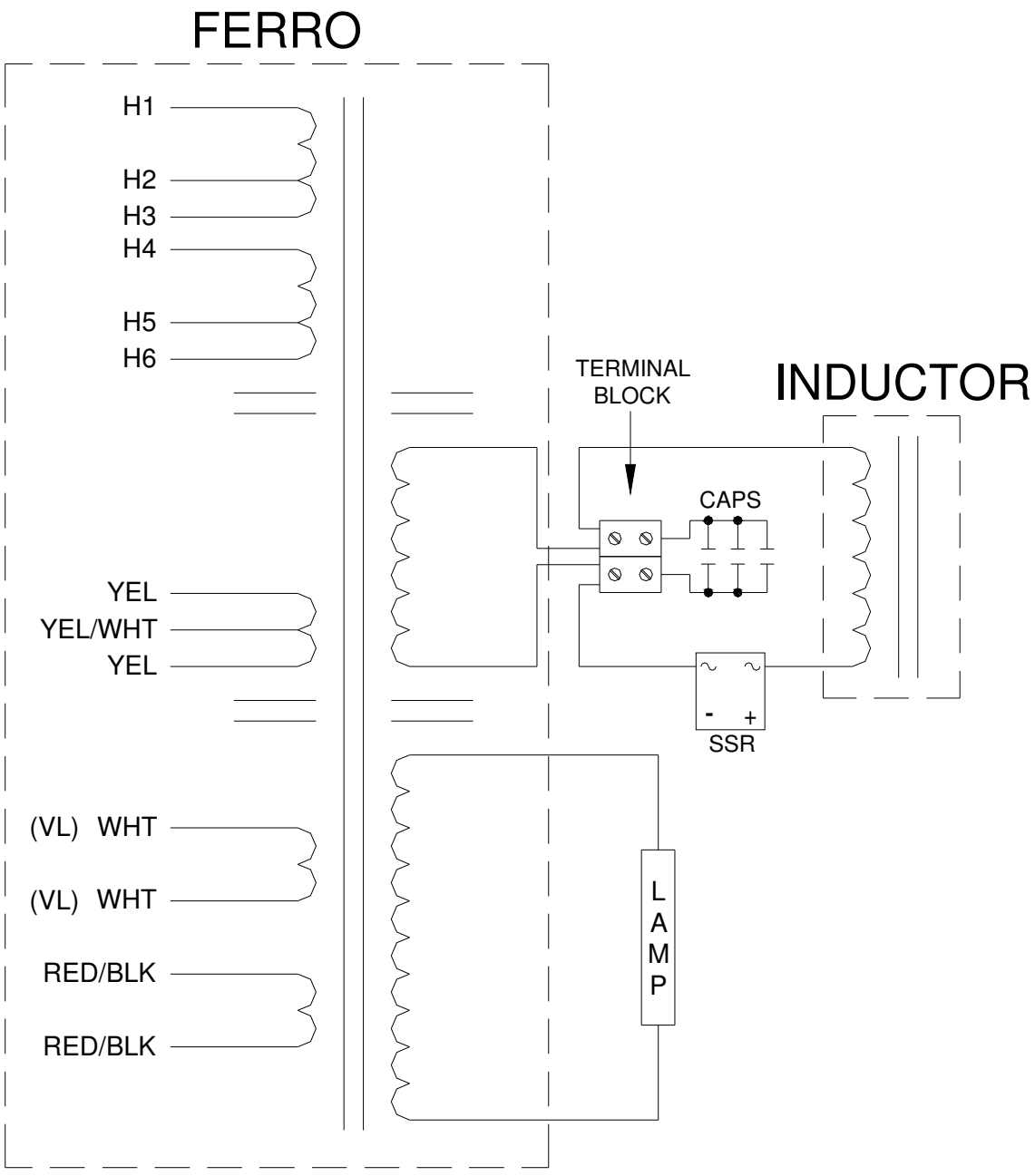
- *Capacitor Check*
  - Disconnect the terminals of the capacitors and measure with a capacitance meter.
  - Check the integrity of the cap connections at the capacitors and terminal block.
  - Check that the number of capacitors matches the capacitance value on the chassis label.

- *SSR and Control Circuit Check*
  - Disconnect the AC (high power) terminals of the SSR and check resonance. If resonance is OK, then either the SSR or the control circuit is damaged or both.
  - Disconnect the AC (high power) terminals of the SSR and check the resistance. If the resistance is less than 100 ohms, the SSR is internally shorted. Replace the SSR and test resonance.
  - Reconnect the leads to the AC terminals of the SSR, and disconnect the shielded cable, on the input side of the SSR, from the control circuit. Check for resonance. If resonance is restored, then the circuit board is faulty. If resonance is not restored, then the SSR is damaged. Replace SSR and test resonance. If no resonance then replace control circuit.

DISCLAIMER

The manufacturer assumes no liability for any damage, caused directly or indirectly, by improper installation of any components by unauthorized service personnel. If you do not feel conformable performing the installation, consult a qualified electrician.

SCHEMATIC


FERRO
H1
H2
H3
H4
H5
H6
YEL
YEL/WHT
YEL
(VL) WHT
(VL) WHT
RED/BLK
RED/BLK
TERMINAL BLOCK
INDUCTOR
CAPS
SSR
LAMP