ELECTRONIC ENTERPRISES
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Electronic Decorating Screen Heater Control

Historical:

Previous screen decorating heater controls have been "Brute Force" units consisting of variable voltage input control to the primary of the low voltage transformer which is connected to the metal decorating screen.

Voltage input control was by means of an auto-transformer such as a Powerstat unit with adequate rating. Such designs are stable, and reliable. However, they are physically large and heavy. In addition, over the years components have increased in cost to the extent that such control units now represent a major investment to the decorating machine builder.

Requirements:

The object of any screen heater control is to provide a variation of electrical power to the decorating screen, thus offering a variation in screen temperature. A low voltage - high current AC transformer is used for this purpose. Variation of the transformer output is by means of an auto-transformer (Powerstat) in the primary winding of the low voltage transformer. This provides an analog variation of the voltage output.

Electronic Design:

To reduce the size, weight, and cost of the screen heater control a more modern approach has been achived.

Rather than the use of analog variation of the electrical power, a modified digital or pulse system is used. The electronic heater control operates on the principal of "Timed Bursts" of the low voltage transformer output. The time ratio of the transformer operating on-off in a series of pulses determines the operating temperature of the screen. This pulse ratio is adjustable over a wide range.

With the use of solid state design and components a very small size unit can be constructed. The reliability of such solid state devices has been proved in many industrial applications, and has also been used in the screen decorating industry.

The electronic screen control consists of several discrete design components. A 555 type IC timer unit is used as the strobe, or pulse generator. Its pulse output drives a power NPN transistor which in turn is coupled to a Triac Optocoupler which acts as both an isolation stage, and driver to a power Triac which provides the output to the low voltage transformer primary.

The output Triac has a continuous rated capability of 6A. at 400V. This twice that required by the low voltage transformer input. The interstage Optocoupler provides a minimum of 1,000 volt isolation of the control to output stages.

It should be noted, that in all cases Triac units are used rather than SCR's. This allows full AC operation without the generation of voltage spikes or switching harmonics, and the Triac output is a unmodified 60Hz. sine wave. This is most important as the low voltage transformer primary presents an inductive load to the control unit. SCR outputs contain DC, or square wave rather than sine wave output. This can cause core heating of the transformer and distorted wave output. The Triac design avoids all of these problems. In operation, the control unit gives a burst, or timed pulse of 60Hz sine wave to the transformer primary. The longer the burst, the longer the transformer operates the screen. The shorter the burst, the lesser the screen operation. It is the total ratio of on-off power to the screen that determines the screen temperature. The pulse ratio is short enough, that the thermal lag inertia of the screen itself averages the screen temperature.

Since the control unit is compact and self contained, the low voltage screen transformer may be remotely located some distance from the control if desired. Provisions are made in the control design for both manual and automatic drop-back of the screen temperature. Various means are available for monitoring the control output. Visual observation of a "pulse lamp" indicates the screen input by the rapidity of the lamp flashes. A meter readout can also be provided which is an analog frequency meter or pulse counter. The simple lamp observation is practical and inexpensive.

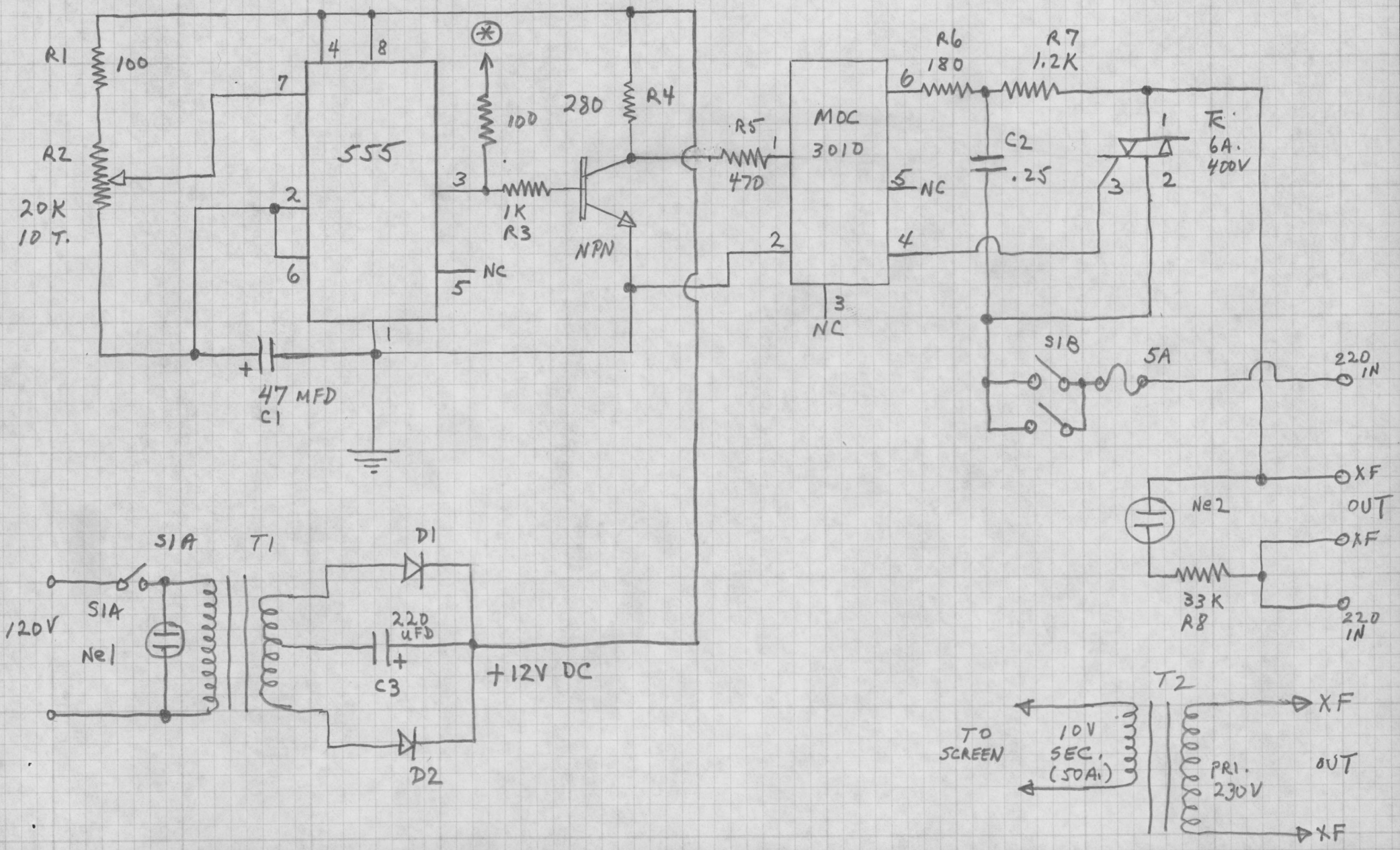
With the use of this modern solid state design many additional operating paramaters can be included when required.

A. A. Panzer
8 July, 1985

(Ckt. attached)

July - 1985

ELECTRONIC ENTERPRISES
ELECTRONIC SCREEN HEATER CONTROL
(BASIC OPERATING CKT.)



R1 - LIMITING MINIMUM RESISTANCE (PART OF TIMING CKT.)

R2 - PULSE RATIO ADJUST CONTROL - 10 TURN(" " " ")

C1 - PULSE RATIO TIMING CAPACITOR " " " "
(10V ELECTROLY.)

R3 - BASE RESISTOR FOR NPN DRIVER TRANSISTOR
R4 - COLLECTOR LOAD RESISTOR
R5 - LOAD RESISTOR FOR OPTOISOLO LED INPUT

R6, R7 } INDUCTIVE LOAD PHASE CORRECTOR FOR TRIAC

R8 - DROP RESISTOR FOR 120V NEON "PULSE LAMP"
C2 - TRIAC PHASE CAPACITOR - .25 MFD - 400V
C3 - FILTER CAPACITOR LOW VOLTAGE CONTROL 50V. ELECTROLY.

T1 - 24V - 400 Ma. CT

D1, D2 } FULL WAVE DIODES - 100V - 1A.

T2 - STANDARD EE - 220V PRI - 10V - 5A SEC.

NPN - TIP 31 OR EQUIV. NPN TRANSISTOR - (DRIVER)

TC - TRIAC - 400V - 6A OR HIGER

(ALL RESISTORS = 1/2 WATT - 5% TOL)

USE THERMAL HEAT SINK ON TRIAC (TC) IF REQUIRED.

R1, R2, C1 REPRESENTS PULSE TIME CKT. VALUES CAN BE CHANGED TO CHANGE TIMED PULSE RATIO OVER WIDE PARAMETERS.

OUT PUT METER FOR ELECTRONIC SCREEN HEATER

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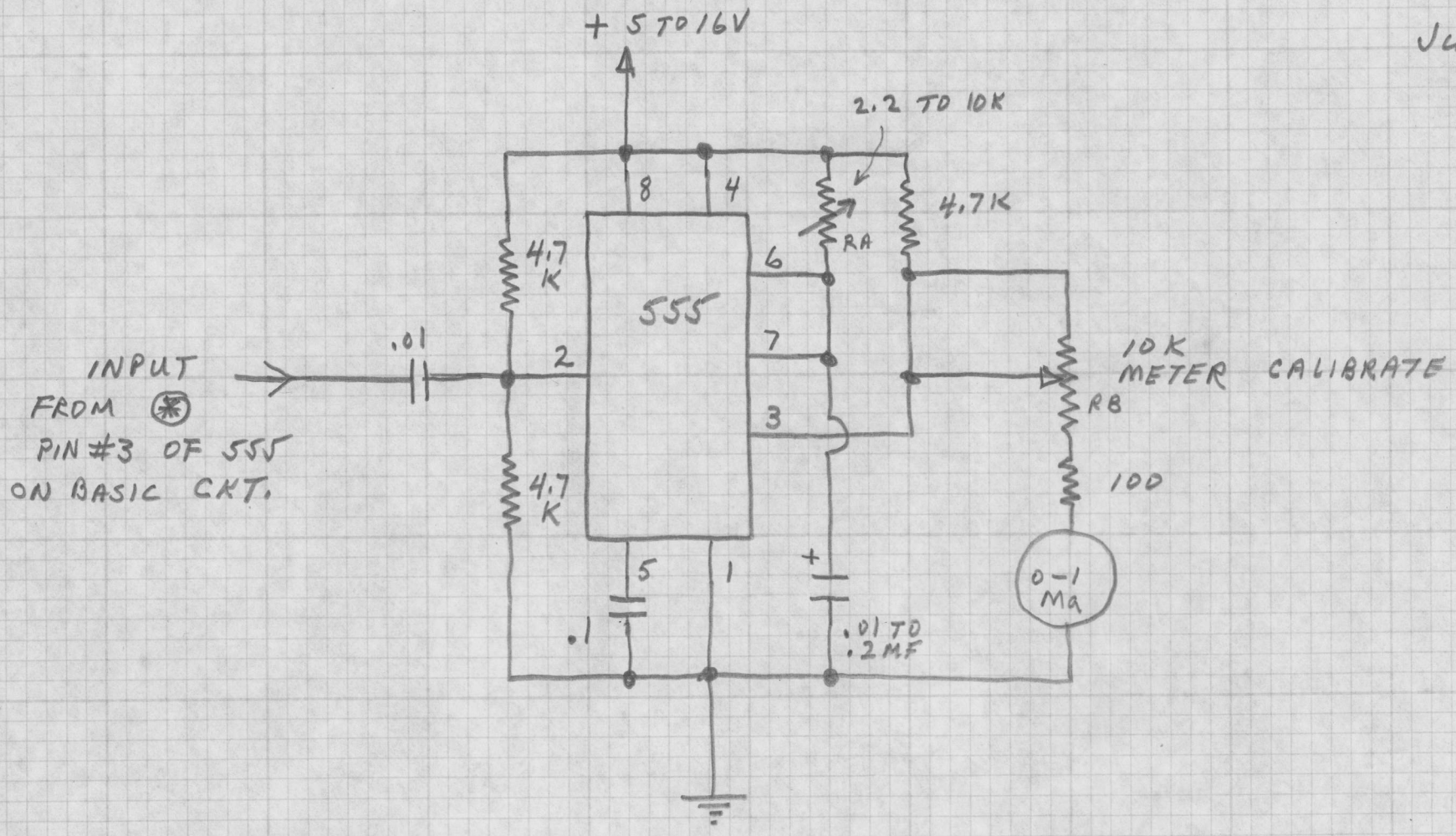

INPUT SHOULD RANGE FROM 2.5 TO 5 VOLTS

R3 AND C3 DETERMINE FREQ. RANGE. (PULSE RATE)

RA + RB MAY BE 10 TURN SCREW DRIVER ADJ. POTS.

DOT/BAR DISPLAY FOR ELECTRONIC SCREEN HEATER CONTROL.

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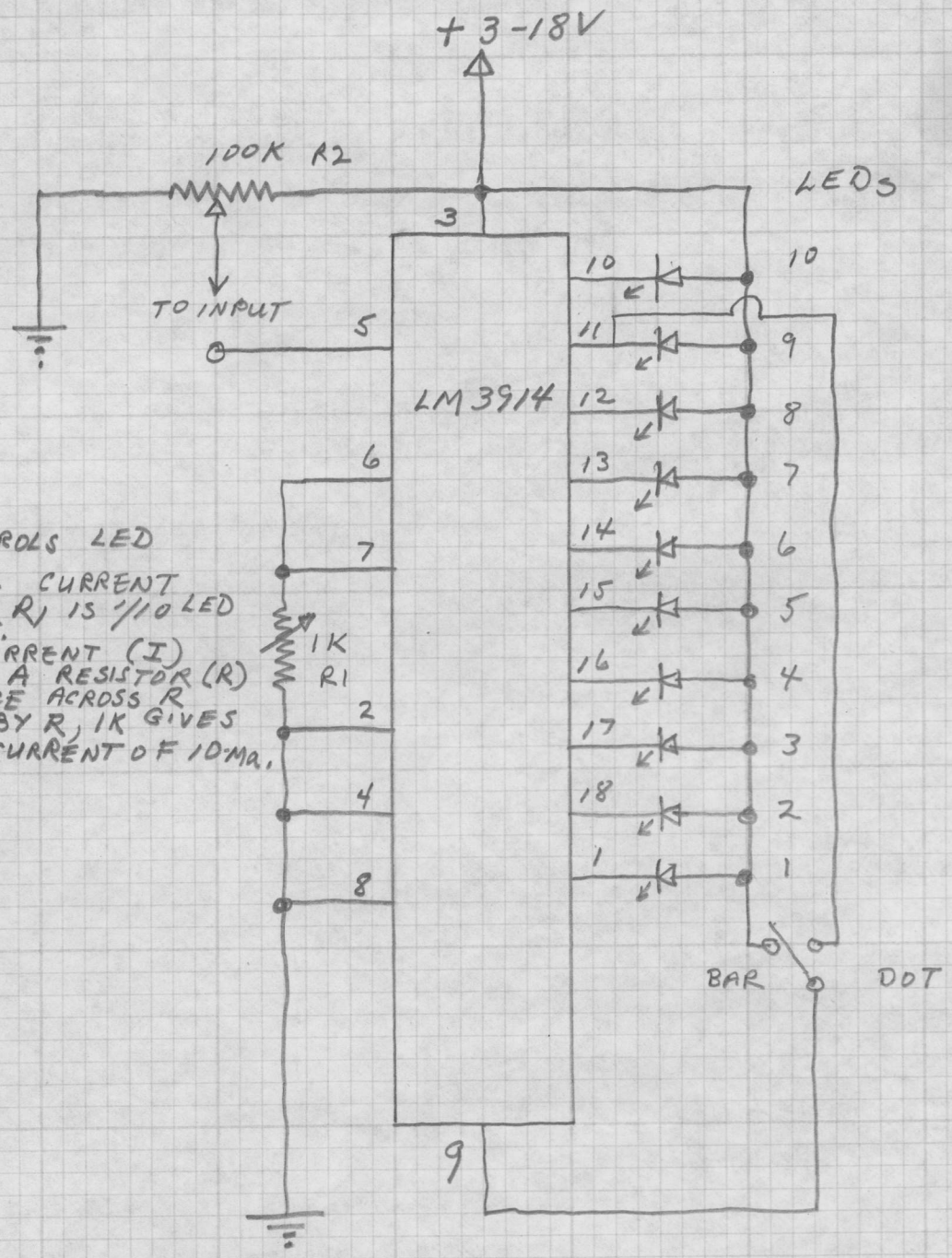

R1 CONTROLS LED CURRENT. CURRENT THROUGH R1 IS 1/10 LED CURRENT. SINCE CURRENT (I) THROUGH A RESISTOR (R) IS VOLTAGE ACROSS R DIVIDED BY R, 1K GIVES AN LED CURRENT OF 10 MA.

WHEN +V = 3-18V, THE READ OUT RANGE IS 0.1 - 1.30V. TO CHANGE RANGE TO 0.1 - 1.0V - (0.1V PER LED), INSERT A 5K POT. BETWEEN PINS 6 & 7. CONNECT VOLTMETER ACROSS PINS 5 & 8 AND ADJUST R_2 FOR 1 VOLT AT PIN 5. THEN ADJUST 1K POT UNTIL LED 10 GLOWS. REPEAT THIS PROCEDURE FOR 0.1V AT PIN 5 AND LED 1.

TWO OR MORE DISPLAYS CAN BE CASCADED.
CONTROLER FEATURE ALSO CAN BE ADDED.