

Application Brief 42021

Control Interface for Standard 0 - 10VDC Dimmers

INTRODUCTION

This Application Brief describes a very simple and cost effective interface circuit that, when used with a standard 0 to 10 VDC manual dimmer such as the Honeywell Model EL7316A, can effectively control the lamp power (light output) of the 220V ML4831 Evaluation ballast from full power to 15% of full power.

CIRCUIT DESCRIPTION

Figures 1 and 2 show a schematic diagram of the ML4831EVAL-220V ballast and control interface circuit. An additional secondary winding of 25 turns is wound on T1 (see figure 2) to obtain the bias voltage for circuit operation and the required safety isolation. Components D17, C26, R37, C29 and D18 rectify, filter and regulate this voltage to 18VDC. Components R36, R35, R34, C27 and the Programmable Unijunction Transistor, Q4, form an astable sawtooth oscillator. The sawtooth voltage appearing across C27 is connected to the (+) input of the voltage comparator, U3, and a pulse width modulation circuit is formed by connecting the (-) input to the 0 to 10 VDC dimming control unit through R33.

Components R33 and C28 are used to control the dimming slew rate and to initialize the circuit for maximum light output at power up. Since the dimming control unit is an adjustable current sink, R32 is needed to limit the current to 0.5 mA.

The optoisolator, U4, is used to reference the PWM signal to the ML4831 Evaluation ballast common while preserving the safety isolation. By pulse width modulating the sampled lamp current between R20 and R30 the circuit behaves like a potentiometer, with the parallel combination of R20 / R30 being the minimum resistance, and R20 alone being the maximum resistance. R20 is usually much larger than R30 and can be increased in value if more dimming is desired.

CIRCUIT PERFORMANCE

Table 1 shows the performance of the Dimming Control Interface Circuit when operated with the Honeywell Model EL7316A Manual Dimmer. Note: R20 must be adjusted to its maximum value (fully counterclockwise) for proper interface circuit performance.

Table 1.

Dimmer (VDC)	Input Power (Watts)	THD	Power Factor	Lamp Voltage (VRMS)	Lamp Current (IRMS)	% Full Lamp Arc Power	Freq. (kHz)
9.6 (max)	61.5	5.5	0.99	271	0.186	100	31.7
8.5	59.2	5.5	0.99	276	0.172	94.0	33.8
6.9	52.6	6.0	0.99	288	0.137	78.6	36.4
6.1	48.7	4.9	0.99	297	0.119	70.0	37.4
5.3	44.9	5.4	0.99	304	0.102	61.5	38.0
3.1	35.0	6.5	0.99	318	0.065	41.1	39.0
0.78 (min)	23.1	10.4	0.98	322	0.028	17.8	39.6
switch off (0)	22.0	10.8	0.98	323	0.025	16.1	39.6

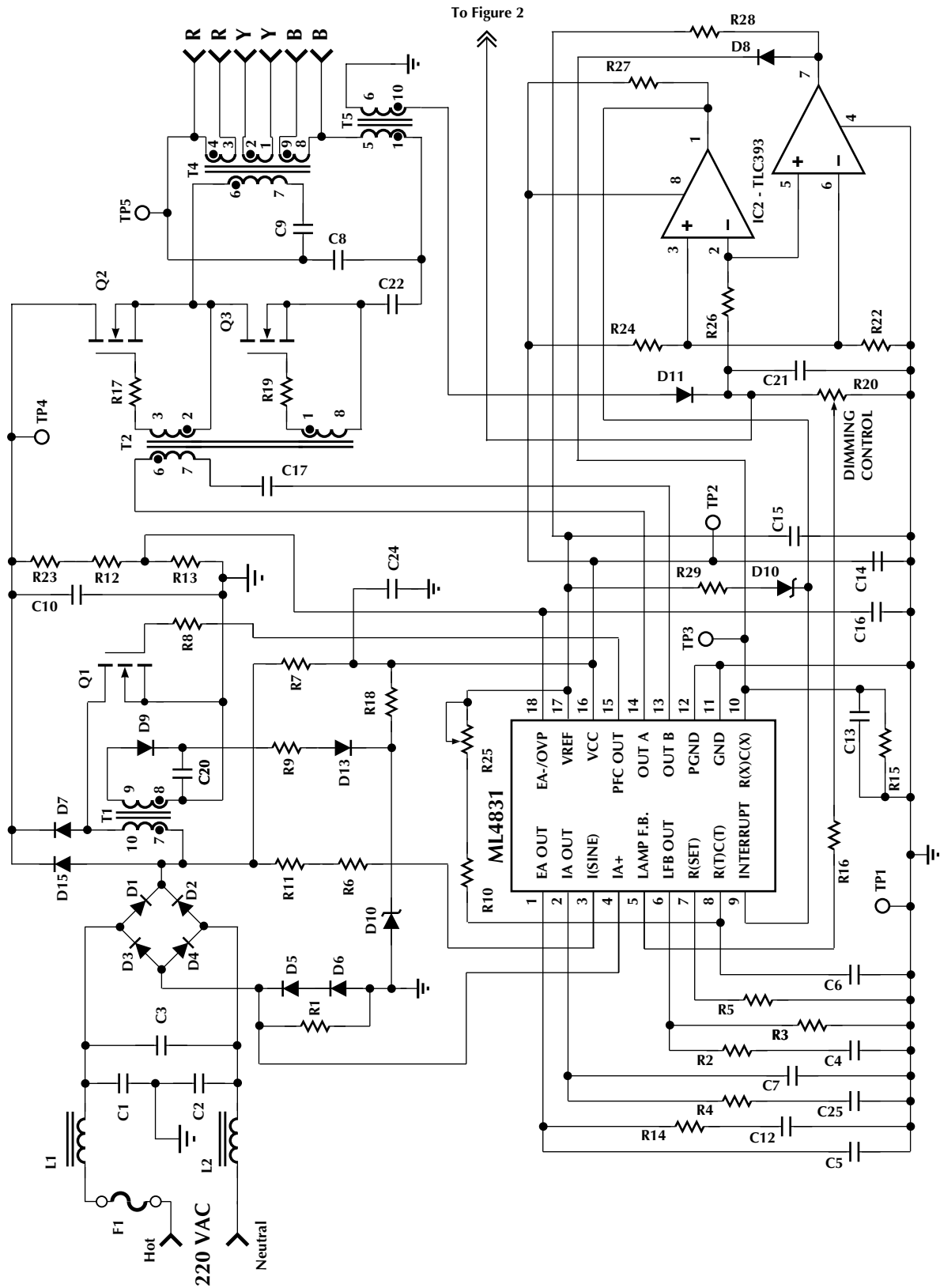


Figure 1. Schematic, Standard Evaluation Board

Table 2.

Item	Quantity	Description	Manufacturer / Parts	Designation
Resistors				
1	2	1.2kΩ, ¼ W, 5%, carbon film, 5%	Yageo / 1.2K-Q	R30, R31
2	1	16.2kΩ, ¼ W, 1%, metal film	Yageo / 16.2K-X	R32
3	1	220kΩ, ¼ W, 5%, carbon film ¼	Yageo / 220K-Q	R33
4	1	1.0mΩ, ¼ W, 5%, carbon film	Yageo / 1.0M-Q	R34
5	2	10.0kΩ, ¼ W, 1%, metal film milim	Yageo / 10.0K-X	R35, R36
6	1	180Ω, ¼ W, 5%, carbon film	Yageo / 180-Q	R37
Capacitors				
7	1	47μF, 35 V, 20%, Electrolytic	Panasonic / ECE-A1VU470	C26
8	1	3.3nF, 63 V, 5%, Ceramic	Panasonic / ECU-S1J332JCB	C27
9	1	4.7μF, 35 V, 20%, Electrolytic	Panasonic / ECE-A1VU4R7	C28
10	2	10μF, 35 V, 20%, Electrolytic	Panasonic / ECE-A1VU100	C29, C30
Diodes				
11	1	1N4148, 0.1 A, 75 V, signal	Motorola / 1N4148TR	D17
12	1	1N5248B, 18 V, 5%, Zener	Motorola / 1N5248	D18
ICs				
13	1	TLC393 Dual Comparator	TI / TLC393	U3
14	1	MOC8102 Optoisolator	Motorola / MOC8102	U4
Transistors				
15	1	2N6027 Programmable Unijunction Transistor	Motorola / 2N6027	Q4

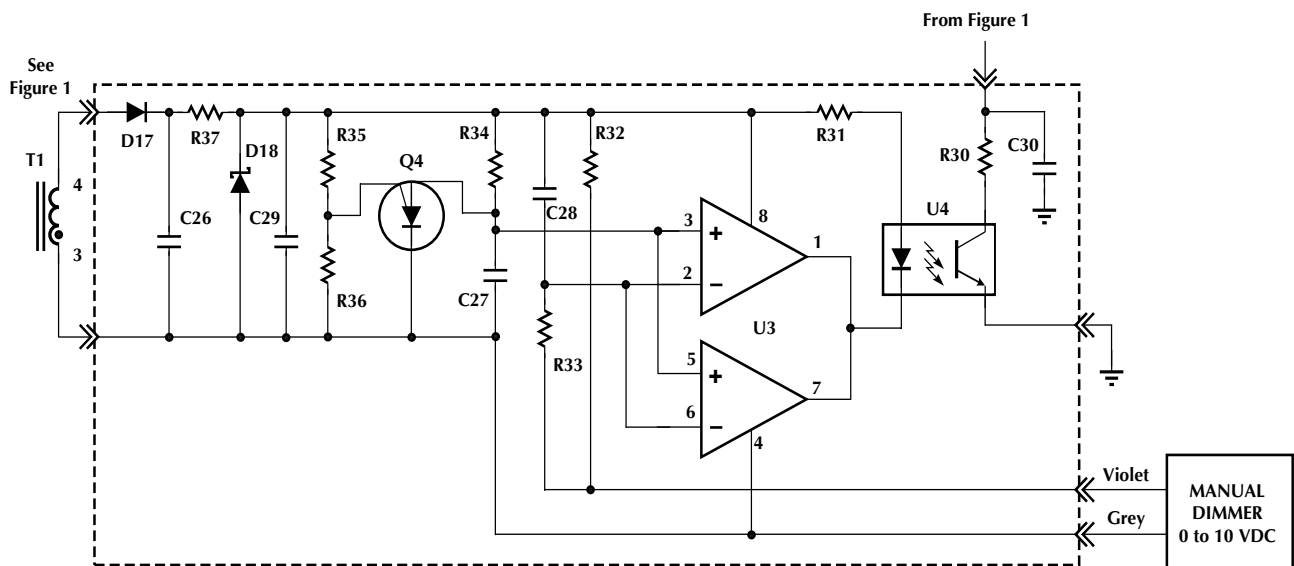


Figure 2. Schematic, Dimming Control Interface Circuit

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.