

**WARNING:** The LEDs on this demo board produce very bright light. Do not look directly at LEDs when power is applied. Serious eye damage may occur.

## DESCRIPTION

Demonstration circuit 1071 is a multi-display LED controller featuring the LTC3210-2 or the LTC3210-3.


The LTC3210-2/LTC3210-3 are low noise charge pumps designed to drive three or four MAIN LEDs and one high current CAM LED. The LTC3210-2/LTC3210-3 require only four small ceramic capacitors plus two resistors to form a complete LED power supply and current controller.

The maximum display currents are set with a 30.1K ohm resistor to provide up to 20mA for each Main LED and a 24.3K ohm resistor to provide up to 378mA for the CAM display. Current for each LED is controlled with a precision internal current source. The intensity of the displays are adjusted by strobing the ENM and ENC pins. See the LTC3210-2/LTC3210-3 data sheet for more information on this process.

The DC1071 uses a PIC controller to interface between the DC590 board and the LTC3210-2/LTC3210-3 via a 2-wire I<sup>2</sup>C serial interface. There are 32 dimming states available for the MAIN display and 8 dimming states available for the CAM display.

The charge pump optimizes efficiency based on the voltage across the LED current sources. The part powers up in 1X mode and will automatically switch to boost mode whenever any enabled LED current source begins to drop out. The first dropout switches the part to 1.5X mode and a subsequent dropout switches the part into 2X mode. The part resets to 1X mode whenever the part is shut down.

**Design files for this circuit board are available. Call the LTC factory.**

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## QUICK START PROCEDURE

Demonstration circuit 1071 is easy to setup. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below.

1. Refer to the DC590 Quick Start guide for QuikEval™ setup and software installation details.
2. Make sure the USB cable is connected between the computer and the DC590 controller board.
3. Connect DC1071 to the DC590 USB Serial Controller using the supplied 14-conductor ribbon cable as shown in Figure 1.
4. Attach a 2.9 – 4.5V power source to the Vin and GND turrets of the DC1071 demo board. This is the Vin power supply for the device (see application schematic). The DC1071 has an extra 4.7uF de-coupling capacitor between Vin and GND to help accommodate long lead lengths. The DC590 board gets its power from the USB cable.
5. Run the QuikEval™ program. The program detects the DC1071 and displays the LTC3210-2/ 3 control window (shown in Figure 2).

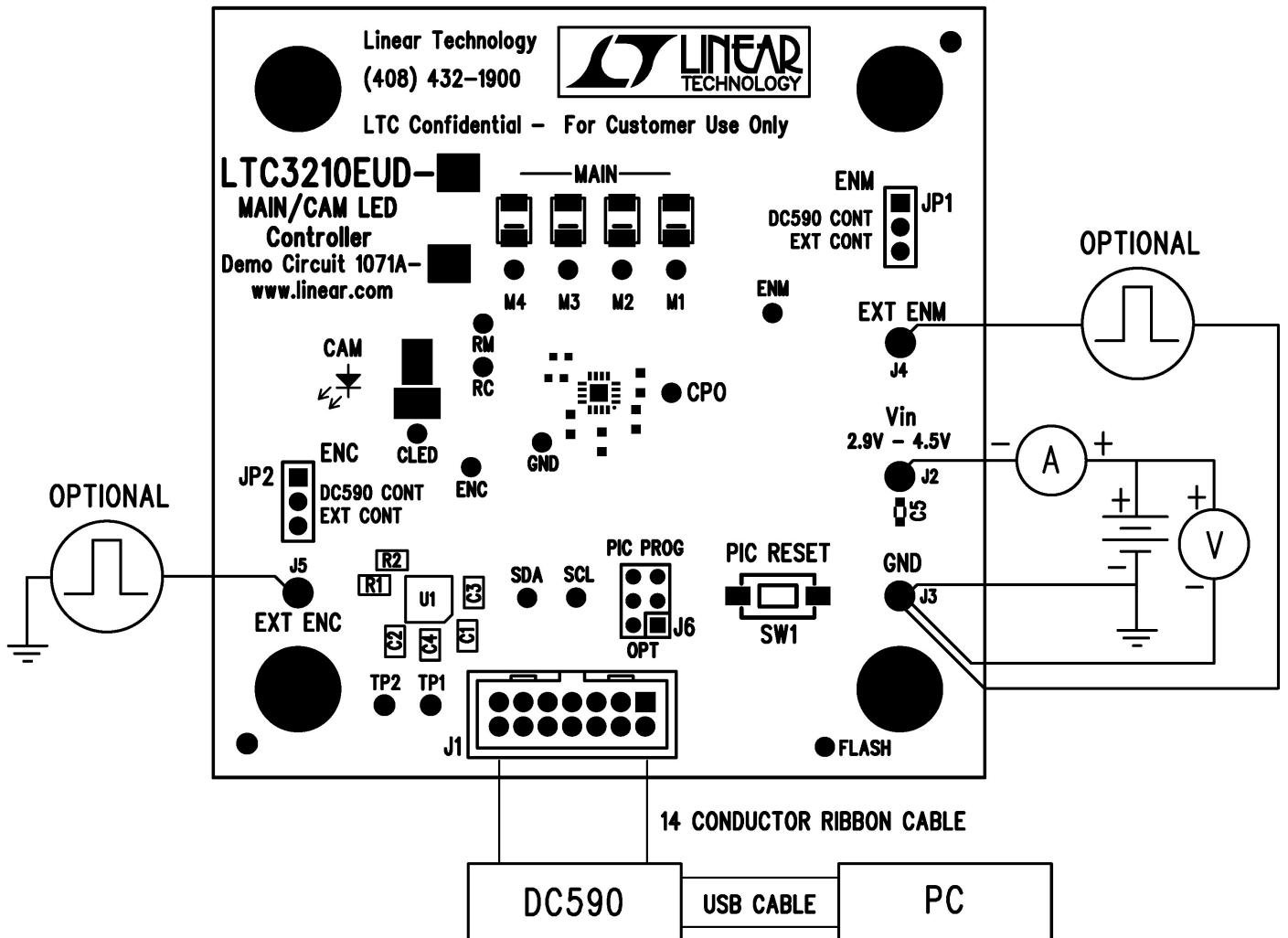


Figure 1. Proper Measurement Equipment Setup for DC1071A

## USING THE LTC3210-2/LTC3210-3 QUICKEVAL SOFTWARE

The program provides brightness controls for the MAIN and CAM LEDs. The **UPDATE** button updates the PIC controller and the LED displays to the current settings on the LTC3210-2/LTC3210-3 demo control window. The **FLASH** button flashes the CAM LED from the ENCT (Torch) setting to the ENCF (Flash) setting for the time selected in the FLASH TIME drop-down window. The **FLASH TIME** drop-down window allows the user to select the flash time from 50ms to 1000ms in various

increments. The **GRADATION Cycle** button briefly illustrates how the LTC3210-2/LTC3210-3 may increment and decrement the displays. The **LEDS OFF** button resets all LEDs to zero and stops the gradation cycle.

**VIEW LTC3210-2/3 PRODUCT PAGE Button** – This button opens an internet browser and searches the Linear Technology Corporation web site for information on the LTC3210-2 when an internet connection is available.

**ENM Control** – This vertical slide control adjusts the MAIN display from 0 to 20mA in 32 steps. This is accomplished by clicking on the up or down arrows to change it by one LSB, by clicking in the vertical scroll bar to increment by 4 LSBs, or by clicking and dragging the slide pointer. The individual LED current and the number of pulses required to achieve this current are displayed in the two text boxes below the slider.

**ENCT Control** – This vertical slide control adjust the CAM display from 0 to 162mA in 4 steps. The current is limited in software because some LEDs can not handle large continuous currents. The LED intensity may be adjusted by clicking on the up or down arrows to change it by one LSB, by clicking and dragging the slide pointer, or by clicking in the vertical scroll bar. The LED current and the number of pulses required to achieve this current are displayed in the two text boxes below the slider.

**ENCF Control** – This vertical slide control sets the CAM display intensity during a flash condition from 0 to 378mA in 8 steps. When the FLASH button is selected, the CAM display illuminates at the intensity set by the ENCF control on the release of the mouse button for the length of time selected in the FLASH TIME drop-down window. The LED flash intensity may be adjusted by clicking on the up or down arrows to change it by one LSB, by clicking and dragging the slide pointer, or by clicking in the vertical scroll bar. The LED flash current and the number of pulses required to achieve this current are displayed in the two text boxes below the slider.

**FLASH Button** – When this button is selected and released, the CAM LED will flash at the intensity selected in the ENCF register for a period selected in the FLASH TIME drop-down window. This is accomplished by resetting the internal counter and DAC by holding

ENC low for the set PULSE TSD time then applying the set number of pulses on the ENC pin when the mouse button is released. After the flash time has elapsed, the CAM display is set back to the ENCT setting by holding ENC low for set PULSE TSD time then applying the set number of pulses on the ENC pin.

**FLASH TIME Drop-Down Window** – This window allows the user to select a flash time from 50ms to 1000ms in various increments. The flash time is the time the program sets the CAM display to the ENCF setting on the release of the mouse button after the FLASH button was selected.

**PULSE TON Drop-Down Window** – This window allows the user to select a pulse ON time for the ENM and ENC pulses. The ON time may be adjusted from 5us to 20us in 5us increments.

**PULSE TOFF Drop-Down Window** – This window allows the user to select a pulse OFF time for the ENM and ENC pulses. The OFF time may be adjusted from 5us to 20us in 5us increments.

**PULSE TSD (RESET) Drop-Down Window** – This window allows the user to select a pulse TSD time for the ENM and ENC pulses. This is the time the ENM and ENC pins are held low to reset the internal counters and DACs prior to sending the pulses to the enable pins. This time may be adjusted from 250us to 1000us in various increments.

**GRADATION STEP TIME Drop-Down Window** – This window allows the user to select the length of time for each gradation step while running the GRADATION Cycle. See GRADATION Cycle button for more details on this function. The gradation step time may be adjusted from 50ms to 250ms in various increments.

**UPDATE Button** – When this button is selected, the PIC is updated with the timing and ENM and ENC information, and the LED dis-

plays are updated to the present settings on the demo control window. This is beneficial when power is initially applied to the demo board, the ribbon cable has been disconnected, or when the PIC RESET push button has been depressed.

**GRADATION Cycle Button** – This button may be selected to start or stop the GRADATION Cycle. The GRADATION Cycle cycles through the brightness levels of all the LEDs starting from the lowest to the highest intensity of the Main display and then back to the lowest. Then it cycles through the intensities of the CAM display, and then both displays. To increase the LED intensity, the enable pins are held low for the set PULSE TSD time prior to the first pulse of each step. After the highest intensity is reached, the intensity is then decreased by a single low pulse equal

to the PULSE TOFF time for each step. This pulse decrements the internal counter by one from the previous setting. This is done until the lowest setting is reached. The gradation cycle is repeated until the GRADATION Cycle button is selected again or until the LEDS OFF button is selected.

**LEDS OFF Button** – This button turns off all of the LEDs and turns off GRADATION Cycle.

**PIC RESET Push Button** – This button is located on the DC1071 demo board. It Resets the PIC when depressed. The reset button will not update or change the demo control window. The UPDATE button may be used to update the PIC to the current demo control window settings.

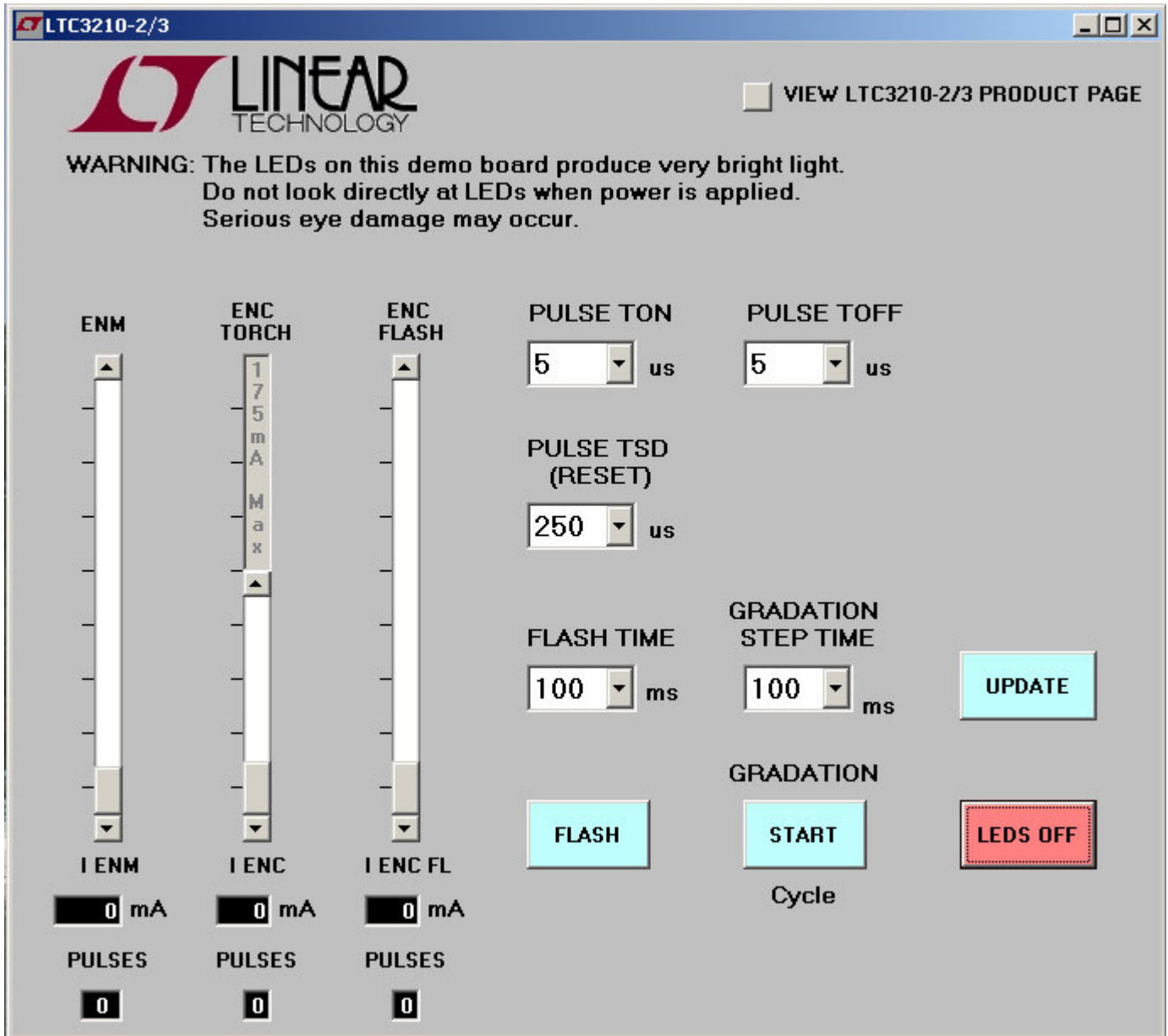


Figure 2. LTC3210-2/3 Control Window