

Paul C. Buff **EINSTEIN™**

Preliminary Operating Instructions for Einstein™ 640 Studio Flash

March 2010 v.2

Every decade or two a quantum leap occurs in ideas and technology that sets the stage for years to come. While most are content to follow the leader and add a feature or two, a few innovators take the lead with revolutionary advancements that redefine the future state of the art.

Paul C. Buff, Inc.™ has a track record for such innovations, first in 1986 with the forerunner of the modern self-contained studio flash – White Lightning™ Ultra. Then again in 2001 with the first full featured affordable-yet-professional monolight for the new masses of young digital photographers – the colorful little light that could – and did – AlienBees™.

For 2010, we are pleased to present the most advanced integrated studio flash system ever conceived – at any price, with performance and features far beyond any “Professional” monolight. After two years of intense design, evolution, blood, sweat, and tears, welcome to the brave new future of studio lighting - Einstein™, and the companion Cyber Commander™ extreme integrated wireless control system. Proudly designed and manufactured in America.





- 1 CSXCV Transceiver
- 2 Umbrella Holder
- 3 Slave Flash Sensor
- 4 Micro SD Card Slot
- 5 Function Button
- 6 Adjust Up/Down Buttons
- 7 8A Fuse
- 8 Power Button
- 9 Power Cord Socket
- 10 Test Button
- 11 Easy Set Button
- 12 Sync Jack (1/8-inch)
- 13 Quick-Release Levers
- 14 Swivel Ratchet Handle
- 15 Stand Mount
- 16 Tightening Knob
- 17 Frosted Glass Dome
- 18 Spring Clips
- 19 Holding Fingers

INITIAL SETUP: Place Einstein™ on a standard light stand (with 5/8" top coupler) inside the **Stand Mount (15)** and secure with the **Tightening Knob (16)**. Loosen the **Swivel Ratchet Handle (14)** to allow swiveling Einstein™ up or down. Note the **handle (14)** has a ratchet action. Pulling the **handle (14)** out from Einstein™ allows you to position it so that it doesn't run into the body of the unit when tightened.

Connect the supplied power cord into the **Power Socket (9)**, and into a 120V or 240VAC, 50 or 60Hz outlet, or to Vagabond™. Einstein™ will automatically sense the voltage and frequency. Press **Power Button (8)** to turn unit on. Note that when Einstein™ is turned OFF it's actually in **STANDBY Mode** and can be turned ON remotely if it is fitted with the optional **CSXCV Transceiver (1)** and **Cyber Commander™** remote.

EASY SET USE: The recessed **Easy Set Button (11)** allows instant setup for most users. Pressing this button clears any special programming and sets Einstein™ to the following parameters:

1. Modeling lamp tracks flashpower and produces 250W at Full Power. Recycle indication is provided by an audible beep and by the modeling lamp dimming then restoring brightness.

2. Einstein™ is placed in **Constant Color Mode**, the **Slave Flash Sensor (3)** is turned on, and the optional **CSXCV Transceiver (1)** is set to Frequency 1 and Channel 1, if present.

PRELIMINARY TESTING: With Einstein™ on, operating the **Adjust Buttons (6)** should increase or decrease both the flashpower and the modeling brightness by 1/10 f-stop per click. If you hold either button in, the power will scroll.

DISPLAY FUNCTION: As you adjust the power using the **Adjust Buttons (6)**, you should see the **Flash and Model Bargraphs (A and B)** on the LCD display go up or down correspondingly.

Since **Easy Set (11)** defaults the modeling lamp to track the flash power, both bars should move in unison.

If you press the **Test Button (10)** at any power, the unit should flash and the modeling lamp should dim. Then, when the unit is recycled, the modeling lamp will return on and the audible recycle indicator beep will sound.

The same should happen if the **Sync Jack (12)** is connected to your camera via sync cord to your camera's PC jack or Hotshoe Adapter (see **Camera Sync**; see also **CyberSync/Cyber Commander™** Radio Remote).

DEFAULT-TO-FLASH SCREEN: Einstein™ defaults automatically to the **Flash Adjustment Screen (C)** after a few seconds following any setup changes; this is the screen with the flash icon, highlighted in blue in the LCD screen diagram example. Power adjustment is performed by operating the **Adjust Buttons (6)**. Notice as you change the flashpower with these buttons (6), the blue-highlighted **screen (C)** will display the current flashpower relative to Full Power (-1.0f in this example), the color temperature (5750°K in this example), the t.1 flash duration (1/2050 second in this example), the EU Number (5.7 in this example), and the WS (320WS in this example).

Since the modeling lamp was set to track the flashpower by the **Easy Set Button (11)**, the **Model Adjustment Screen (D)** will also change (-1.0f and 125W in this example).

ATTACHING LIGHT MODIFIERS: Light modifiers may be attached to Einstein™ via two mechanisms: the **Umbrella Holder (2)** or the front Reflector / Softbox Attachment Mechanism - the **Holding Fingers (19)** and **Quick-Release Levers (13)**.

The umbrella tube runs the entire length of the top of the unit. It holds standard umbrella shafts up to 0.350" diameter, accommodating shafts 9mm and smaller. The **Umbrella Holder Tightening Knob (2)** secures the umbrella in the desired position.

Reflectors, softboxes and similar accessories use the standard AB / WL / Balcar mount, and are held securely by the **Holding Fingers (19)**. **Quick-Release Levers (13)** are spring loaded and accessible from either side of the unit. Einstein™ mounts all accessories that fit previous Paul C. Buff, Inc.™ lights except the obsolete WL130, WL5,000 and WL10,000 models.

MICRO SD CARD SLOT (4): Firmware updates can be downloaded and installed via a standard Micro SD Card plugged into this **slot (4)**.

FLASHTUBE and MODELING LAMP: The replaceable flashtube and lamp are covered by the **Frosted Glass Dome (17)**.

The modeling lamp is a 120VAC 250W bayonet-style quartz halogen lamp. **Do not substitute other lamps.** Proprietary circuitry automatically regulates the lamp output such that the lumen output exactly tracks the back panel settings regardless of input voltage fluctuations from 95VAC to 265VAC, thus eliminating any need to change the modeling lamp when operating at different powerline voltages.

The position of the lamp filament is precisely at the center of the flashtube, assuring the modeling lamp pattern is exactly the same as the flash pattern, regardless of the modifier used. The **Frosted Glass Dome (17)** further enhances the coherency between flash and model lamps, acts as a UV filter and completely eliminates pattern irregularities and hotspots with all reflectors. The **dome (17)** causes no loss of power.

The flashtube is made of UV-coated borosilicate glass, yielding a 5600°K base color balance and the lowest possible UV emission. Highly advanced IGBT control of flashpower allows extremely fast flash durations (as short as 1/13,500 second t.1) and tightly controlled constant color over the entire power range (see **IGBT advantages**).

REPLACING THE MODELING LAMP AND FLASHTUBE: Always **unplug the unit from power** and **allow to sit for five minutes** before attempting to remove or replace lamps. This allows the flash capacitors to discharge any dangerous voltages.

The **Frosted Glass Dome (17)** is held in place by four **Spring Clips (18)** that allow protection against mechanical shock and heat expansion. To remove the **dome (17)**, bend two of the **clips (18)** outward, then pull the **dome (17)** away from the other two **clips (18)** and off the unit. **Do not remove the screws that hold the spring clips in place.**

To remove the modeling lamp, use a clean paper towel or cotton gloves to protect the surface from body oils. Press in on the lamp and twist counterclockwise, then pull the lamp out. Reverse this procedure to replace the modeling lamp, twisting clockwise.

The flashtube plugs into the unit via three very tightly fit "banana plugs."



- A** Flashpower Bargraph (Full to 1/256 power)
- B** Modeling Lamp Bargraph (0 to -8f)
- C** Flash Adjustment Screen
- D** Model Adjustment Screen
- E** Model Lamp Mode Screen
Full Power **ON** Tracks Flashpower
Independently Adjustable Off **OFF**
- F** Recycle / Ready Indicator Screen
Audible Indicator Visual Indicator
Both Neither **OFF**
- G** Slave Eye Status Screen (slave on or off)
- H** Action / Color Mode Screen
- I** Remote Channel (channel 01 - 16)
- J** Remote Frequency (frequency 01 - 16)

REPLACING THE MODELING LAMP AND FLASHTUBE (continued): The flashtube "banana plugs" fit tightly into the Einstein™ sockets in order to eliminate the possibility of arcing from the extremely high electrical currents involved. Accordingly, removing and replacing a flashtube requires extreme care and patience. To remove the flashtube, use a clean paper towel or cotton gloves. Grasp the tube and pull it out of the unit, using a slow and careful rocking motion to release all three contacts. To replace the tube, first ensure that all three banana plugs are aligned with the internal sockets, then press and rock the tube slowly until it is fully seated. **Never touch the flashtube or model lamp directly with your fingers**, as this can deposit body oils on the lamps. The presence of oils on the lamps can cause localized overheating and early failure.

NAVIGATING EINSTEIN™ PARAMETERS:

With the **Easy Set Button (11)**, most simple Einstein™ shoots are plug-and-play, not requiring parameter adjustments other than flashpower. But for more advanced shoots, all parameters may be easily manipulated.

The display automatically defaults to the **Flash Screen (C)**, identified by the blue background color in the LCD screen example, where adjustments begin. The **Flash and Modeling Bargraphs (A and B)** are always present and indicate the power, relative to Full Power, in 1/10f increments.

As adjustments are made, the digital parameters in the **Flash (C)** and **Model (D) Adjustment Screens** will update. To navigate the adjustment screens, pressing the **Function Button (5)** will sequence through the screens (C) through (J). The currently active screen background will turn blue. If no adjustments are made to the active screen for 10 seconds, the display will revert to the default state with the **Flash Adjustment Screen (C)** active.

Flash Adjustment Screen (C) (default): **Adjust Buttons (6)** raise or lower flashpower at 1/10f per click. Holding either button scrolls flashpower up or down. At any flashpower setting, the digital numerical display in the **screen (C)** and the left **Flash Bargraph (A)** indicate all flash data. If the model lamp is set to **Tracking**, the numerical model data and the right **Model Bargraph (B)** will also change.

Model Mode Screen (E): When this screen is active, you may select between four modeling lamp modes by pressing the **Adjust Buttons (6):** **On (Full Power)**, **Independently Adjustable**, **Track Flashpower and Off**. When the modeling lamp is set to **Track**, there is a provision in the **Model Adjustment Screen (D)** to offset the modeling lamp brightness such that full flashpower (640WS) results in a modeling brightness other than the default 250W. This feature is useful when Einstein™ is used with other monolights and it is desirable to maintain a constant ratio of model brightness to flashpower for accurate modeling previews. For example, if an Einstein™ is used in a mixed system containing AlienBees™ 1600 units (640WS) with 150W lamps, it would be advantageous to set the Einstein™ such that its model lamp also produces 150W when it is set to 640WS (see **Model Adjustment Screen**).

Model Adjustment Screen (D): Selecting this screen allows modeling lamp adjustment in either the **Independent Adjustment** mode or **Tracking** mode. In the **Independent Adjustment** mode, the **Adjust Buttons (6)** may be used to raise or lower the modeling brightness. The digital display of watts and f-brightness relative to full 250W will update. In the **Tracking** mode, operating the **Adjust Buttons (6)** introduces an offset between flashpower and modeling intensity. The bargraphs will still move in unison, but with an offset between the bars.

Recycle / Ready Indicator Screen (F): In this screen, recycle indication can be set to **Audible**, **Visual**, **Both** or **Neither** via the **Adjust Buttons (6)**. In the **Visual** mode, the lamp dims as the unit recycles and restores when ready. In the **Audible** mode, a **beep** sounds when recycle is complete; the modeling lamp does not dim as this might be disconcerting to models.

When the flashpower is lowered, Einstein™ automatically rapidly dumps excess capacitor voltage. The **screen (F)** turns red during dump and back to green when dump is complete.

Slave Eye Status Screen (G): The slave can be turned on or off using the **Adjust Buttons (6)**.

Remote Channel (I) and Frequency (J): These screens set the channel and frequency of the optional **CSXCV Transceiver (1)**, if present, via the **Adjust Buttons (6)**. If the optional **Cyber Commander™** is used, each light in the studio must be set to the same frequency as the **Cyber Commander™** and each light must be set to a different channel. The **Cyber Commander™** allows you to capture, control and display every parameter of Einstein™ remotely, including remote power down (**please request the Cyber Commander™ manual for complete information**).

If only the **CST Trigger Transmitter** is used, without the **Cyber Commander™**, all lights on the same frequency as the **CST** will fire regardless of channel selection.

Action / Color Screen (H): Most users will set this mode to **Color Mode** – reserving **Action Mode** for shooting where the fastest possible flash durations are desired and where constant color is a secondary consideration. The **Adjust Buttons (6)** allow mode changing when the **Action / Color Screen (H)** is active.

IGBT ADVANTAGES: Even the most expensive Pro Monoflash units usually control flashpower by varying the voltage applied to the flash capacitors. This simple and inexpensive method has three distinct limitations to the achievement of truly professional performance: 1. The range of power reduction is typically limited to 1/8 to 1/32 power, often resulting in an inability to achieve low aperture settings with close lighting techniques; 2. As power is reduced, the Flash Duration becomes longer – typically twice as long at minimum power relative to maximum power. The median t.1 flash duration of the ten most popular Pro monolights ranges from 1/200 second to 1/400 second – too slow for sharp freezing of action in sports, dance and other rapid movement shots (see *graph and list of products*); and 3. Color Temperature typically varies by 75° to 80°K per f-stop of power reduction, resulting in about 400°K color difference between minimum and maximum power. Einstein™ employs proprietary advanced digitally controlled IGBT technology to control flash power. This results in an extreme range of power reduction (1/256 power) in precise 1/10f stops. As power is reduced, the t.1 flash duration also decreases dramatically instead of increasing. This technology allows Einstein™ to maintain a constant color temperature throughout the entire 256:1 power range.

Two operating modes are provided – **Action Mode** and **Constant Color Mode**. In **Action Mode**, the t.1 flash duration shortens rapidly from 1/588 seconds at Full power to 1/13,500 seconds at minimum power for incredible action freezing capability, but the color temperature increases as power is reduced. In **Constant Color Mode**, the t.1 flash duration drops less rapidly, to a minimum of 1/8000 second, while maintaining a constant color temperature of 5600°K (+/- 50°K) throughout the entire power range. The processor controls the accuracy and repeatability with very high precision (see *graphs and specifications*).

EU NUMBERS: When lights with different WS ratings are mixed in a studio, terms like "1/4 power" or "-3f" don't tell the user how much light one unit outputs compared to another. In order to allow a direct comparison between lights of different ratings, several European manufacturers have instituted a numbering system that directly compares lights in 1/10f increments without requiring calculations or WS math conversions. The EU Number defines a 6400WS power level as EU10.0, and each 1/10 f-stop change is represented by a one digit change in the decimal. Thus, EU9.9 is 1/10f less power than EU10.0. A full f-stop change is a one digit change before the decimal point.

EU9.0 = 3200WS	EU8.0 = 1600WS
EU7.0 = 800WS	EU6.0 = 400WS
EU5.0 = 200WS	EU4.0 = 100WS
EU3.0 = 50WS	EU2.0 = 25WS
EU1.0 = 12.5WS	EU0.0 = 6.25WS
EU-1.0 = 3.13WS	EU-2.0 = 1.56WS

If your main light is EU6.4 and your fill is EU5.3, you quickly know your fill light is 1.1f less powerful than your main light.

SPECIFICATIONS

Weight: 4 lbs., 5 oz. (without power cord)

Dimensions: 4.8" H by 4.8" W by 5.7" L (body dimensions without lamps or mounting hardware); 7" H by 5.4" W by 7.8" L (overall dimensions with lamps, dome and mounting hardware); plus reversible stand mount for left or right hand use and accessory attachment levers are located on both sides.

Power: Auto-switches from 40 to 265VAC, 50/60Hz with no lamp change or user settings. Allows crash-free operation of multiple units from Vagabond™ and other current-limited pure sine wave battery inverter supplies. Reaches Full 640WS at voltages from 95 to 265VAC. Fused for 8A (user-accessible fuse holder takes a SR5-F type 8A fuse). Supplied with USA standard IEC power cord; for use in other countries, IEC style cords are available. If AC power is disconnected or switched off, Einstein™ must be turned on either from the rear panel power switch or remotely from Cyber Commander™.

Flash Power: 640 True WS / Joules at Full Power (maximum); 2.5 True WS / Joules at 1/256 Power (minimum)

Recycle: 1/10 to 1.7 second at 120V or 240VAC. Switchable audible and visual ready indicators. May be fired before 100% recycle for speed shooting at reduced power.

Flash Variability (Informal term): 9 f-stops in precise 1/10f digital steps. Accuracy is +/- 1/10f from Full to 1:128 power, +/-2/10f at 1:256 power. Correctly defined range is 8f (Full to 1/256 power). Voltage and IGBT time regulated to <1%.

Modeling Lamp: 250W 120VAC Bayonet Style Quartz only. No lamp change is needed when operating from 120VAC or 240VAC. Proprietary voltage regulation for constant Lumen output over the entire input voltage range (lamp cannot reach full brightness at AC voltage below 115VAC). Model Lumens track flash power typically within +/- 1/10f over the entire power range. Ratio of Model Watts to Flash WS may be adjusted for accurate modeling previews when mixed with other units.

Flash Duration: 1/2000 sec. t.5 at full power. The t.1 duration varies from 1/588 to 1/13,500 sec. in Action Mode and 1/588 to 1/8000 sec. in Constant Color Mode (see graph).

Flash Color Temperature: 5600°K +/- 50° over the entire power range in Constant Color Mode. 5600°K to 6300°K in Action Mode (see graph).

Pyrex Dome Cover: Removable frosted dome protects and diffuses flashtube and modeling lamp. Vastly improves pattern coherency and eliminates reflector hotspots. Also adds additional UV reduction from the UV-coated flashtube. Flashtube and Model Lamp are user-replaceable.

Slave Tripper: Flash sensitive slave tripper may be enabled or disabled from rear panel.

Umbrella Mount: Top mounted umbrella tube and clamp mount umbrella shafts up to 9mm (.350").

Reflector / Accessory Mount: Quick-release levers on both sides hold standard WL/AB/Zeus/Balcar accessories securely and allow rotation. Improved gripping and ease of operation.

Thermostatic Fan Cooling: High velocity fan and ample cooling path directs air through the electronics and past the model lamp and flashtube for high volume shooting. Multiple overheat and overvoltage sensors protect the unit.

Micro SD Card Slot: Allows easy download of firmware updates.

Stand Mount: Swivel mount with ratchet handle and metal insert mounts Einstein™ securely to standard 5/8" light stands.

Camera Sync: Standard 1/8" (3.5mm) phone jack applies a camera-safe <5VDC to camera, or fires from optional CSXCV Transceiver / Cyber Commander™ or third party radio triggers.

LCD Display: Backlit, high resolution 2.4" color LCD display (320 x 240 pixels) indicates all parameters below:

- Flash and Model power in bargraph form (1/10f increments)
- Flash WS, EU Number, and f-stop (relative to Full Power)
- t.1 Flash Duration and Color Temperature
- Model Watts and f-stops (relative to Full Power)
- Model Modes: Full, Off, Track and Independently Adjustable
- Recycle Indicator: Audible (Beep), Visual (Dim When Fire), Both or Neither; also indicated by LCD Green/Red change
- Slave Off/On and Action or Constant Color Mode
- Channel and Frequency for optional CSXCV Transceiver

CONVENTIONAL FLASH VS. EINSTEIN™ IGBT CONTROL

Figure 1 Variable Voltage at Full Power

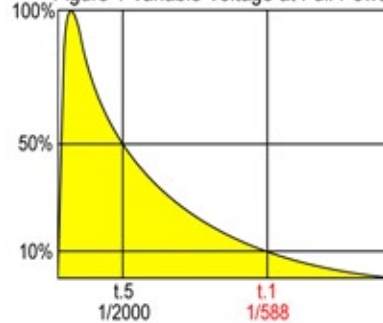


Figure 2 Variable Voltage at 1/2 Power

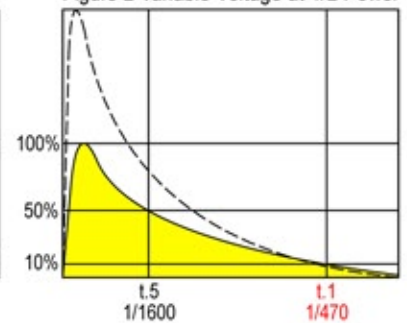


Figure 3 IGBT Control at Full Power

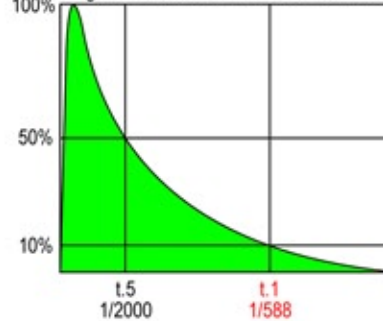
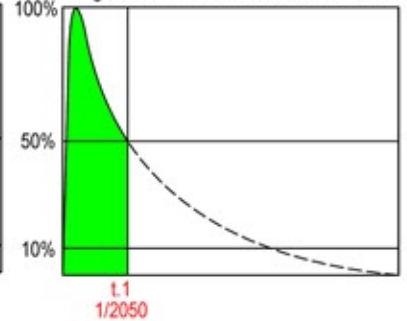
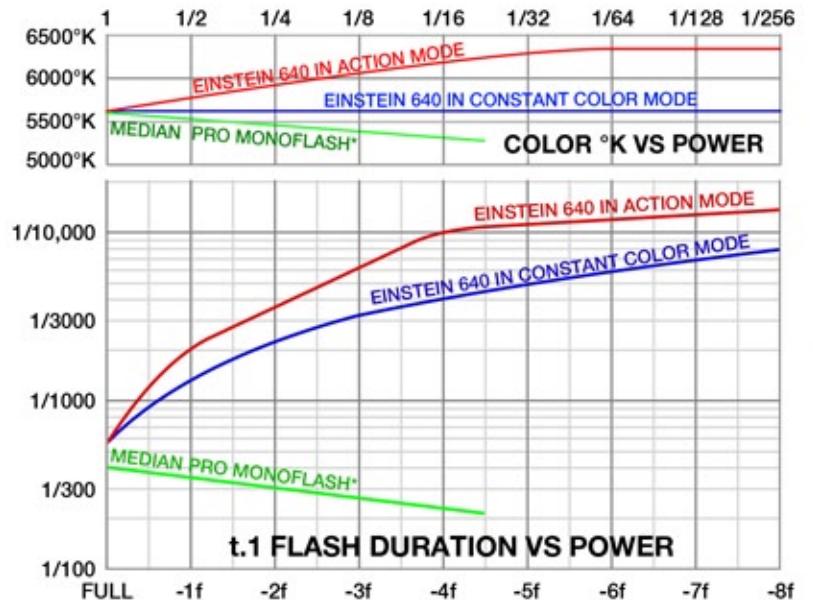


Figure 4 IGBT Control at 1/2 Power



Conventional Voltage Control: Figures 1 and 2 show the flash waveform from a conventional variable voltage monoflash. As power is reduced, both the t.5 and t.1 flash durations become longer as power is reduced. Note that even beyond the t.1 point the flash continues to trail off slowly, adding motion blur. The color temperature drops as power is reduced.

Einstein™ 640 IGBT Control: In Figures 3 and 4, notice the flash abruptly shuts off at whatever point is needed to produce the desired output. The t.1 flash durations can be as fast as 1/13,500 second at low power, producing crisp action freezing. But the color temperature rises as power is reduced. This depicts the Einstein™ **Action Mode**. In the **Constant Color Mode**, the Einstein™ processor compensates by adjusting both the shutoff time and the voltage such that a constant 5600°K color is achieved. The flash duration drops less rapidly as power is reduced, but still produces very short t.1 times (1/8000 second at minimum power) and extremely sharp action freezing. See graph below.



*The median of published specifications for the ten professional studio monoflash units below were used to determine "MEDIAN PRO MONOFLASH" performance. Average B&H Price \$896.78 (Jan. 2010). Specs from B&H (Jan. 2010).

Elinchrom RX600 • Elinchrom 500 BXRi • Broncolor Minicom 80 • Bron Visatec Logos 1600 • Profoto D1 Air 500 • Bowens Gemini 500 Pro • Hensel Integra Pro 500 • Norman 600 • Photogenic 1250DR • Speedotron Force 5