T-One's QT-600 Studio Strobe


Test & Review

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The QT-600 is the midrange product of the QT series of studio strobes, distributed by T-One. The QT-600 strobe is actually a re-branded Godox QT-600, which is also distributed by Lencarta as the 600 SF (or Superfast). In this review I will also spend some words about the LP-450X portable power inverter, which is also distributed by T-One and made by Godox.

A very good review on the Lencarta 600 SF (a.k.a. Godox-/T-One QT-600) has been published by Phil Harbord and I'll frequently refer to Phil's work. I tested these strobes using a different approach and a different experimental setup, so it may be very interesting to compare the two reviews. You can read Phil's review **here**.

I will start with an introduction that explains why a fast flash duration, a short recycling time and the availability of a burst (or stroboscopic) mode are critical to me. In this introduction I also explain why products such as the QT-600 (in all its incarnations) and the Paul C. Buff's Einstein are outstanding exceptions in the market of studio strobes.

All readers that are eager to read my impressions and my measurements may jump to the following sections. Please note that in this review I use quite interchangeably the terms strobe, monoblock and flash. Unless otherwise noted, I mean an integrated, mains powered studio strobe including a generator and a head into a single case.

Introduction

As an amateur photographer, my preferred genre is sports photography and I mainly shoot soccer. Freezing action is a key requirement in my work, even when I'm not shooting sports. My portraiture subjects are athletes more often than not. Even my still life pictures are not so "still", as they frequently involve splashing water or other liquids.

In order to freeze action you need a very fast exposure, which can be obtained in either of the following ways:

- ☞ with available (continuous) light, using a fast shutter speed (like 1/1000" or quicker);
- ☞ with flashes, using equipment with a very fast flash duration.

(I'm deliberately ignoring High Speed Sync and HyperSync technology in this introduction).

Until now I mostly worked with available light or, to a limited extent, with speedlights. When compared to studio strobes and power packs, speedlights do not require a power plug, are easier to carry around and, to some extent, easier to use thanks to TTL technology (which can be very useful when the subject is not standing still; for example, think about a soccer player in a header action). Speedlights, as they name suggests, are also blazing fast: when used at fractional power (such as ¼ or ⅛) flash duration can be as low as $\frac{1}{10{,}000}$", which is roughly equivalent to a shutter speed of $\frac{1}{8{,}000}$".

Nonetheless, speedlight power is faint when compared to studio equipment. Use them on location at noon and you find yourself fighting with the sun with no chance to win. When shooting portraits on a soccer field I was forced to shoot at sunset to be able to overpower the sun with my speedlights and in many cases I had to use 2 or 3 of them at once, especially when I wanted to add a light modifier such as a softbox.

Shooting only at sunset is a major limitation, mainly because ambient light drops down quickly. You need to balance continuously flash light and available light and in less than half an hour the scene may change completely from day to darkness. You need to shoot fast and to think fast, so it is easy to make big mistakes.

For these reasons I decided to purchase a set of studio

strobes together with a portable power pack for location work. This was the easy part, while the hardest one was to find budget-valued strobes with a flash duration that is fast enough to freeze athletes moves and, for my still life shoots, splashing water.

Surprisingly or not, such products are exceedingly rare on the market. The vast majority of studio strobes have a T.1[1] flash duration as slow as 1/300", but even the fastest one among the mainstream products (the Gemini Pro 500) tops out at 1/900" (recently Elinchrom introduced the ELC Pro HD line with a flash duration as low as 1/5000", even tough this may actually be a T.5 time instead of a T.1 time). High-end generators, such as the Broncolor Scoro series, have incredibly fast flash durations, but their price is scary.

Another issue of most studio strobes is that the flash duration is shorter at maximum power, to decrease progressively as the output power is decreased. As a consequence, in order to maximize the freezing capability of these units the photographer is forced to work at maximum power and small apertures. Most studio strobes are also limited in power adjustment, typically within 4 or 5 stops[2]. While this may seem to be an insignificant detail, it actually may be a critical issue for most amateurs and professionals that shoot both outdoors and in studio. On location you need power: 400-500 Ws is the very minimum to fight the sun, 1000-1200 Ws would be definitely better. However, a 500 Ws strobe with a 4-stop range has a minimum power of 31.25 Ws: at that power level you can forget about using wide-open apertures such as f/2.8 or even f/5.6, even at ISO 100 and with an inefficient light modifier such as a soft box with a dual baffle. If you're shooting in a small studio you don't even have the option to recede your lights from the subject, due to the space constraints (and possibly to the required size of the modifiers to maintain the same apparent dimension in relationship with the subject – if you want to preserve the same quality of light).

Recycle time is also critical to me. When shooting a soccer game you rely on burst mode and the higher the frame rate the better. But the same applies when you're shooting a portrait of a soccer player making a bicycle kick: if your flash can keep up with your camera burst speed, then you don't need precise timing when hitting the shutter button. Also, you could play with long time exposures and fire a sequence of flashes, thus obtaining the equivalent of a multiple exposure. But if your flash recycles in 1.5-3 seconds, as most strobes and speedlights do, these wonderful possibilities are precluded to you.

All the above issues were overcome by the Einstein E640 by Paul C. Buff (PCB), a fantastic device that revolutionized the market by introducing the IGBT technology (which is the key factor in speedlights' flash duration performance) into studio strobes. The Einsteins provide two working modes: an "action mode" for fastest flash duration (at the expense of color accuracy), and a color mode that keeps color temperature constant by sacrificing the flash duration. In action mode the flash duration can be as low as 1/13,000" (T.1), while in color mode it still reaches a more than respectable 1/8,000". The power adjustment functions are also superb, with an 8-stop range from 1/1 to 1/256 at steps of 1/10 stop.

The good news is that the price of the Einsteins is cheap: approximately 500 US$ only, much less than competing products from Elinchrom, Bowens and other mainstream flash manufacturers. The bad (really bad!) news is that all PCB equipment is no longer available outside the USA. Until December 2013 PCB equipment was distributed in Europe and Australia by PCB Europe and PCB Australia respectively (actually 1st Line Digital Pty Ltd), two front-ends for a company run by Colin and Julie Smith who took care of supporting PCB customers before and after sales. Starting with 2014, Paul C Buff decided to revoke the partnership with PCB Europe/Australia and to sell their equipment through direct market only. For all practical purposes, PCB is no longer going to sell equipment outside the USA (adventurous customers may still purchase on-line, arrange delivery by themselves through a forwarding service, take care of custom duties and clearance, sand back and forth to the USA their equipment at their expenses for warranty service, just to list a few inconveniences).

In the meantime, PCB Europe/Australia went through a face lift and became T-One (www.t-one.co) with a new mission: selling products that could replace the Einsteins from a performance and price point of view. These products are manufactured by Godox and re-branded by T-One, that also provides a 2-year warranty, a 60-day money-back guaranty and takes care of after sales assistance. I purchased from T-One the QT-600 studio strobe (3 units) and the LP-450X

1 When measuring flash duration, T.5 indicates the time it takes for the flash light to drop to 50% of peak value, while T.1 is the time for a 90% drop. For regular capacitor-discharge strobes (non-IGBT) T.1 is approximately three times longer than T.5. While T.1 is a good indication of the flash's action freezing capability (i.e. it has a meaning for photographers), T.5 is mainly useful for marketing departments.

2 Most vendors use a clever marketing strategy to count stops. For instance, if the power ranges from 1/1 to 1/16 they count 5 stops: 1, 1/2, 1/4, 1/8 and 1/16, but those are actually 5 "power positions". In photographic terms, this is a 4-stop range, because you're dropping power by a factor of 2^4. Again, a handbook example of marketing strategy.

power pack, which are the subject of this review.

The unboxing

The box containing the QT-600 includes everything you need to start and more. Besides the strobe with its flash tube pre-installed, the box contains:

- a 5 meter power cord (T-One will take care to include a suitable plug depending on your Country);
- a 5 meter PC sync cord;
- a flash tube protection cap for transport and storage;
- a 150 W modeling lamp;
- a pyrex glass protection (transparent) that is mounted in front of the flash tube;
- a 7" standard reflector;
- a couple of spare fuses;
- the user manual in English and Chinese.

Nothing to complain here. By comparison, the Einsteins and many other strobes do not include any reflector, like most high-end products.

General features and construction

The QT-600 is the 600-Ws model of the T-One Q-Series family, that includes other four models, with the same features of the QT-600 but with power ranging from 300 Ws up to 1200 Ws. The QT-600 is the midrange product and, with its very useful output range of 5 ÷ 600 Ws, it is likely to be the most popular choice in its family.

At first sight the QT-600 appears to be a regular studio strobe, both in shape and dimensions. The body of the unit is essentially a cylinder, with the flash tube on one side and the user interface on the other one. The lateral surface is substantially free, except for the colorful stickers with T-One logo, the EU flag (I assume that this is only for European customers) and a "2-year warranty" indication which can hardly go unnoticed.

On the bottom the unit there are a standard mounting bracket with a fixing knob. The tilt angle can be adjusted through the usual lever located on the right side of the bracket. The bottom also houses ventilation holes to ensure proper cooling. The availability of a fan is a very welcome feature, allowing for long shooting sessions with no issues related to overheating. The fan is quite and barely noticeable in a typical environment: unless you work in a perfectly silent room, you know it was there only when you switch off the unit, kind of a "refrigerator effect".

When tilting or transporting the unit, the handle on top provides a good grip. The handle is hardly slippery, but a rubber insert would have been beneficial, even though this can not be considered a major issue. The light sensor for the slave function is also mounted on the top, just near the handle, which is generally considered to be a good design choice.

The enclosure is metallic, apparently an aluminum alloy, a material with great heat dissipation features. The general construction feels sturdy and made for a long lifetime, even in harsh conditions. The finishing can be improved, but this is not a big issue for a studio tool. The bracket for the light stand is also made of metal.

The weight is 3 Kg, 1 Kg more than the Einstein which is also considerably smaller than the QT-600, making it more portable. However, the Einstein's body is mainly plastic, so the QT-600 is more resistant to frequent traveling.

The glass cap in front of the flash tube does not add anything from the optical point of view (by contrast, the frosted dome of the Einstein is designed to diffuse the light of the modeling lamp), but it provides an extra degree of protection in case of accidental crashes of the strobe. You'd rather pay a few dollars for a cheap glass cap (or forget about it altogether when it breaks) than spend a hundred or so dollars to replace a broken flash tube.

Strangely enough, the glass cap does not protect the modeling lamp (see for instance **Figure 2** and **Figure 5**). I simply don't understand the rationale behind this. In the first pictures I saw on the web the modeling lamp was smaller and entirely protected by the glass cap, which had cooling holes on the side. In the units I received the modeling lamp is noticeably larger and the glass cap has a single front hole to accommodate the lamp (see attached pictures) and to allow for air exchange. It is possible that European (220 V) versions need a different lamp, but I can't tell for sure. The same applies to the metallic protection cap, which does not cover entirely the modeling lamp.

Speaking about power supply, there are two versions: a 200-240 Vac version and a 100-110 Vac version. Take note: these strobes are not multi-voltage such as the Einsteins or most Elinchrom products. How much this is important depends on you and on your willingness to carry the strobes all around the world. As far as I'm concerned, this is not a problem at all. I was much more worried about the power plugs, given that in Europe we have more power plug "standards" than Countries. To this hand, kudos to T-One for shipping power cords with Schuko plug (CEE 7/4) which is actually a German design, but is very popular here in Italy too and it is becoming the *de facto standard* throughout Europe.

Figure 1. *The unboxing*

Figure 2. *Top view*

Figure 3. *Elevation view*

Figure 4. *Back view with user interface*

Figure 5. *Detail of flash tube and modeling lamp*

Figure 6. *The included reflector and the hole for umbrella*

Regarding light modifiers, the QT-600 is compatible with Bowens (S-type) speedrings, probably the most diffused standard on the market. This opens a world of possibilities, allowing you to use all Bowens modifiers as well as all no-brand, inexpensive imitations. Of course cheap soft boxes or beauty dishes may not provide the light quality of high end modifiers such as the famous Elinchrom Deep Octa, but at least you can choose products that meet your budget. By comparison, the Einstein adopts the Balcar standard, so you basically need to use PCB modifiers or purchase speedring adapters.

The standard reflector and the body of the strobe provide an 8-mm hole for an umbrella shaft. Some users reported that the shaft is locked by a spring-loaded mechanism which is rather stiff. I don't use umbrellas, so I didn't test this.

As regards the modeling lamp, I consider its power to be adequate, but nothing more. Use it in studio with common modifiers at a typical distance from the subject and it will deliver all the output you need to focus on the subject and to get a preview of what you pictures will look like. But don't expect to use the modeling lamp of the QT-600 like a source of constant light and to shoot people at low ISO.

User interface

The user interface of the QT-600 is quite minimalistic: two knobs, four buttons, a 2-digit 7-segment LED display and a power switch, that's all. Compared to this, the 2.4" LCD screen of the Einstein seems to be a product of a science fiction novel. But do you really need something this fancy in a real-life photoshoot? Hardly, in my opinion. When I shoot I prefer to keep my focus on composition, on exposure and on the engagement with the subject , if it's human. I just don't care about the current color temperature and flash duration, as long as I'm confident that they are within a specific range (who cares if the flash duration is 1/12250" instead of 1/11130"?).

By contrast, in my opinion a knob is a much more convenient way to adjust power than a couple of buttons. On the QT-600 you can drop power by 4 stops with a quick gesture of your fingers, while on the Einstein (and all other button controlled strobes) you need to press the "minus" button 40 times (or keep it pressed for a while). The modeling lamp has its own knob, so you don't need to press a "function" button before using the ± buttons to adjust light.

The four buttons are used to control modeling lamp (on/off), buzzer (off/on), optical slave function (on/off/pre-flash mode) and to trigger the flash (test function). All buttons are associated with a LED that lights up when the corresponding function is active (the test LED is lit when the flash is ready to fire). The lamp and buzzer LED's are blue, the test LED's is red. The optical slave LED is bi-color: it glows blue when the standard slave mode is active (the first flash detected by the light sensor triggers the unit), it glows red when the pre-flash slave mode is active (the optical sensors ignores the first flash and triggers the strobe on the second one - this mode may be useful when working in conjunction with TTL speedlights).

Buttons' captions are orange on a dark gray background. While looking great, this is hardly the best choice in terms of readability, particularly in low light conditions. Personally speaking, this is not a problem in most circumstances: How often would you change the setting of the buzzer or the optical slave during a shoot? What you're likely to use the most is the test button, followed by the modeling lamp switch. These two functions are found on the rightmost and leftmost buttons, so they are easy to locate even in complete darkness.

The modeling lamp is adjusted manually through the left knob in continuous mode (there are no fixed steps). Unfortunately, there is no proportional mode regulation, i.e. the modeling lamp can not be adjusted automatically in proportion to the flash power.

Visual confirmation is available instead. This function turns off the modeling lamp when the flash fires and turns it on again when the recycle is complete and the flash is ready to fire again. This offers a visual clue that the strobe has been triggered. Many photographers prefer to use this function instead of the buzzer, which can be annoying particular when there are many strobes active at the same time. In that case it is also difficult to understand which flash is ready and which not. Visual confirmation is always active, so there is no way to turn it off. Not a big concern, as most photographers would keep it on at all times.

Flash power (more precisely, flash energy) is adjusted through the right knob which is not stepless. There are a total of 51 levels or steps, ranging from 10.0 (maximum power) down to 5.0 (minimum power) in 0.1 decrements, plus an additional step that disables the flash tube (displayed as "0F" for "off") . Please see the paragraph below for details about power adjustment.

There are two connectors on the back: one is a standard 6.35 mm jack for synchronization with a PC cord or with any standard wireless trigger (such as a PocketWizard). I tested the unit with a Pixel Soldier wireless radio trigger and it worked flawlessly, never missing a shot. The second connector is an USB port that is specifically predisposed for the con-

nection of the Godox FT-16 wireless receiver. The corresponding Godox FT-16 wireless transmitter basically replicates all functions available on the QT-600, thus allowing to set power, to switch the modeling lamp and the buzzer remotely, right from the top of your camera. The FT-16 kit is inexpensive and allows to control up to 16 groups of strobes, much more than what is needed in typical situations. Anyway, I didn't purchase this remote trigger set (yet), so I'm not including it in this review.

I also tested the optical slave in regular mode and it worked flawlessly. I didn't test the optical slave in pre-flash mode.

Power adjustment

According to the user's manual, the QT-600 allows to adjust power in a range of 7 f-stops[3], i.e. from 1/1 to 1/128th. This is one f-stop less than the Einstein, but still a remarkable range. As most digitally controlled strobes, the QT-600 provides a step-by-step regulation using a scale that goes from 5.0 (lowest energy) to 10.0 (highest energy). This is actually 51 steps, but if each step corresponded to 0.1 f-stops then one would expect 71 steps, for instance from 3.0 to 10.0. How this is explained?

The answer is that the energy scale is not linear: from 10.0 down to 6.0 every step actually corresponds to 0.1 f-stops, while from 6.0 down to 5.0 every step corresponds to roughly ⅓ f-stop. I don't know why Godox engineers chose this solution, which is to some extent counterintuitive (at the bottom of the scale) , but it's likely to be a cost-related decision.

Anyway, the most important fact is that the flash energy is widely adjustable. When using the QT-600 outdoors you can take full advantage of its 600 Ws power, which is roughly equivalent to 8 speedlights working together. In a small studio you can go down as low as 5 Ws, corresponding to a speedlight at 1/16 power. This is what I call flexibility.

Power measurements

In order to verify if the QT-600 lives up to its claims, I performed a number of "lab tests" in my home studio (I'd rather call them "domestic tests"). I wanted to verify:

- the actual power level in relationship with the manufacturer's specifications;
- the consistency of power output from flash to flash and from unit to unit;
- the precision of the power adjustment scale.

The test consisted in measuring the luminous intensity of the flash with a light meter (Sekonik L-358) located at a distance of 1 meter from the flash tube, at ISO 100. The reading of this measure is actually the flash Guide Number (GN) in meters. Of course, there are many factors that may influence the measurement, including:

- the reflections from the environment;
- the light modifier used with the strobe (if any);
- the light meter measuring mode;
- etc.

I performed the test in a 4x3x2.7 m room with white walls and ceiling and a light parquet floor. The strobe was mounted on a light stand at approx 1.2 m from the ground and equipped with the standard 7" reflector. The Sekonik light meter was standing on a desk with the light dome in recessed position.

Several systematic errors may affect the measurements. First of all, I couldn't calibrate the light meter using a reputable reference. In addition, any small variation in the relative position of the light meter and the strobe could have produced a small, yet detectable deviation in the measures. For these reasons, please take the following data with a grain of salt.

For each power level, starting from highest energy (10.0) I took four readings: the first two are consecutive, at most five seconds from each other (i.e. fire, read the result, fire, read the result). Then I dropped the power to the next level, took two more readings and so on down to the lowest energy (5.0). Next, I raised again the energy up to the max and I took the third sequence of single readings from 10.0 to 5.0. Finally, i switched to another strobe and took the fourth sequence of readings. In such a way I tested a short-time power consistency (two consecutive flashes), a mid-term power consistency (comparing two flashes at the same power but at an interval of approx. five minutes) and a unit-to-unit power consistency (comparing two different strobes).

The results are listed in **Table 1**. For each power level you can find a theoretical guide number (based on manufacturer data for full power), the theoretical light meter reading (same as guide number but expressed in f-stop notation) and the actual reading from the light meter in the four measurements. Regarding the notation, I used the normalized f-stop scale (4, 5.6, 8, 11, 16, 22, …) plus decimal f-stops. For instance, 8 + 0.3 means f/8 plus 1/3 stop, i.e. f/9.

Some considerations about the above results. First of all, in my opinion power consistency is nothing short than excellent. For the same strobes (reading #1, #2 and #3) the output level is consistent within 0.1 stops, which for all practical purposes means that the output is absolutely identical. This is

3 *See note on page 2*

Flash energy (display value)	Theoretical guide number	Theoretical f/stop	Reading #1	Reading #2	Reading #3	Reading #4
10.0	76,0	64 + 4/10	45 + 8/10	45 + 8/10	45 + 8/10	45 + 6/10
9.5	63,9	45 + 9/10	45 + 3/10	45 + 3/10	45 + 4/10	45 + 2/10
9.0	53,7	45 + 4/10	32 + 8/10	32 + 9/10	45 + 0/10	32 + 7/10
8.5	45,2	45 + 0/10	32 + 5/10	32 + 4/10	32 + 5/10	32 + 3/10
8.0	38,0	32 + 4/10	32 + 0/10	32 + 0/10	32 + 1/10	22 + 9/10
7.5	32,0	32 + 0/10	22 + 5/10	22 + 4/10	22 + 5/10	22 + 4/10
7.0	26,9	22 + 4/10	22 + 0/10	22 + 0/10	22 + 0/10	16 + 9/10
6.5	22,6	22 + 0/10	16 + 5/10	16 + 5/10	16 + 5/10	16 + 3/10
6.0	19,0	16 + 4/10	16 + 0/10	16 + 0/10	16 + 0/10	11 + 8/10
5.7	13,4	11 + 4/10	11 + 6/10	11 + 6/10	11 + 6/10	11 + 4/10
5.4	9,5	8 + 4/10	8 + 7/10	8 + 8/10	8 + 7/10	8 + 6/10
5.0	6,7	5.6 + 4/10	5.6 + 0/10	4 + 8/10	5.6 + 0/10	4 + 9/10

Table 1. *Measured power output at 1 meter with standard reflector and at different power settings*

also the precision of the measuring instrument, so a 0.1 stop output difference is within the experimental error box.

As regards the second strobe (reading #4), the difference in output is more noticeable, yet limited to an almost negligible 0.2 to 0.3 stops. You may also notice that this series of measurements is consistently fainter than readings #1/#2/#3. As i switched strobes for this test, it may be that I accidentally changed the setup (especially the distance between the strobe and the light meter), thus introducing a systematic error. In any case, to me a 0.2-stop difference among different strobes is still a great result.

One last comment about maximum power. From my measurements it appears to be approximately ⅔ stops below the nominal value. However, if you look at the various readings at different power levels you find a -⅔ value at all power levels. Here I can feel the smell of a systematic error: it is possible that part of the difference is due to my light meter, which has not been calibrated before the test. Perhaps there's also something wrong with my experimental setup. For sure a more efficient reflector, or one with a more focused spread angle, would have produced a higher measurement.

A test performed with a standard reflector at full power and 1 meter distance may be unrealistic from a practical point of view. Therefore, I also carried out a somewhat more "real-world" test using 1.5-meter (5-feet) octagonal softbox (or octabox), again at full power by this time I measured the output at a more typical (in relation to the size of the modifier) distance of 2 meters. I also repeated the test with a 50-cm (20-inch) beauty dish and obtained the same results of the octabox. **Table 2** lists the readings for 3 different test conditions.

Test condition (at full power - 10.0)	Reading at 2m
Beauty dish - white - Ø50 cm	16.0
Octagonal softbox - 150 cm - without baffles	16.0
Octagonal softbox - 150 cm - with baffles	11.8

Table 2. *Measured power at 2 meters with light modifiers*

The results show that the QT-600 can easily balance the environmental light of a sunny day at noon, even with an inefficient light modifier such as a softbox, having the subject 2 meters away from the modifier.

In summary, my feeling is that the actual guide number is less than the declared 76 meters, but I doubt that the difference is as large as 0.6 stops. I'd say that the real guide number is somewhere between 65 and 72, but I can't tell for sure because I reached the precision limits of my home lab. Whichever the truth, this strobe has undoubtedly plenty of power even for outdoor use and is dimmable enough to be used in a small studio with large apertures such as f/4 and even f/2.8.

Color consistency

IGBT flashes are know to be very fast, but in most cases they compromise flash duration with color temperature stability. As the output power is reduced, flash duration becomes faster but color temperature rises towards a more bluish hue. This color drift may be easily in the 300-500 K range. In Action Mode the Einstein works exactly in this way. However, the Einstein also features a Constant Color Mode that keeps color temperature within ±50K over the entire power range.

This is obtained by reducing the voltage applied to the

flash tube. The downside of this technique is a slower flash duration, which drops from 1/13,500" to 1/8000" (at lowest power).

With the QT-600 you can't choose between the equivalent of the Action Mode and the Constant Color Mode. The manufacturer claims a color accuracy of 100 K (more precisely 5600 ± 100 K), which would be a very good performance at any price level and just marginally worse than Einstein's spectacular accuracy.

I have no instrumentation for a direct measurement of the color temperature of a flash, so I tested the color accuracy in an indirect way. Basically, I took a number of shots of a white balanced gray card at different power levels, setting my camera (Canon EOS 7D with EF 70-200 L IS USM II lens) to Auto white balance and shooting tethered into Adobe Lightroom. For each picture I noted the Temperature (Kelvin) and the Tint (Green/Magenta balance) slider values.

Working in Auto White Balance mode my Canon 7D analyzed the scene and applied a color correction to make the gray card appear neutral. It made a great work: in all pictures the red, green and blue channel are accurate to within 0.1-0.2%. To our purposes, this means that the color temperature and green/magenta balance reported by Lightroom are indeed a good representation of the color of the flash light.

I used the same basic procedure I described in the Power Measurement section. I made four series of shots at the various power levels: the first two are consecutive, the third one approx. five minutes later and the fourth one comes from a different strobe. **Table 3** reports the results.

K stands for color temperature (in K – Kelvin degree) and G/M stands for Green/Magenta balance (±100, with 0 being the neutral value); the number refers to the measurement, so for instance K2 refers to the second measurement of color temperature.

I'm really impressed by the results. Within a range of 7 f-stops the color temperature is 5300 ± 100 K, a little bit warmer than the specifications yet accurate to within 100 K as promised. Only four measurements out of 44 fall outside of the specification, namely the second and third one at lowest power, the fourth one (different strobe unit) at 8.5 and 7.5 power levels. We may safely consider them as statistical errors.

The second unit under test (fourth measurement) is slightly cooler the first one, still the color temperature difference is only 100-150 K.

While not as good as the Einsteins, the QT-600 is definitely much better than brand-name expensive strobes. If we take Paul C Buff literature at face value (it may be found **here**), a renowned strobe like the Profoto D1 500 has a color drift of no less than ±300 K over its power range (1/1 to 1/64). Another top selling pro strobe, the Elinchrom RX 600, has a smaller color drift (±200 K), but its power range is also smaller (1/1 to 1/32, or one stop less).

According to Phil Harbord's test (see the review **here**), the Lencarta 600 SF (a.k.a. T-One/Godox QT-600) is voltage compensated to maintain color temperature constant. My measurements are perfectly aligned with Phil's ones and confirm that the QT-600 implements something very similar to the Einstein's Constant Color Mode.

For the sake of completeness, I also measured color consistency in a rapid fire sequence. I first ran a series of 10 shots at 1/4 power (8.0) and approx. 4 fps (frames per second). Next, I repeated the test at 1/8 power (7.0) and 8 fps.

The results are almost incredible: all 10 shots at a given

Power (display)	K1	G/M1	K2	G/M2	K3	G/M3	K4	GM/4
10	5200	17	5200	12	5250	12	5350	11
9.5	5300	12	5300	12	5300	13	5350	11
9	5250	13	5250	13	5250	13	5400	12
8.5	5250	13	5250	13	5300	13	5450	12
8	5300	14	5300	13	5350	14	5400	12
7.5	5250	13	5250	13	5300	13	5500	13
7	5200	11	5200	12	5250	12	5400	12
6.5	5200	12	5250	12	5300	13	5400	12
6	5150	10	5150	10	5200	11	5350	11
5.5	5350	13	5350	13	5350	13	5300	10
5	5400	15	5450	15	5550	16	5350	11

Table 3. *Color temperature and green/magenta balance at different power levels*

power had the same, identical color temperature! At ¼ power (8.0) the temperature was a little bit cooler than at ⅛ power (7.0), but we are still within the ±100 K range.

Recycle time and fast fire

If there is one field where the QT-600 beats the Einstein without question, it is recycle time. The manufacturer claims a recycle time of 1.2 seconds at full power and I can confirm that. In detail, I measured a recycle time of 1.0" at full power, but I performed this measurement by hand with a stopwatch, so it is safe to assume a ±0.2" precision. This means that, in the worst case, the specification is confirmed.

At lower power the recycle time gets more and more quicker, reaching 0.05" at minimum power. I couldn't measure that, as it would require some sort of automatic apparatus. What I tested was shooting in burst mode: I set my Canon 7D in fast burst mode (8 frames per second) and I kept depressed the shutter button (see also the paragraph on color consistency above).

At ¼ power I obtained an alternation of good and totally black pictures: the first good, the second black, the third good, the fourth black and so on. The flash fired on each odd picture, but it hadn't time to recycle before the next even shot in the sequence. This means that, for all practical purposes, at ¼ power the QT-600 has a recycle time of 0.25" or less.

The situation is even better at ⅛ power: all pictures in the 10-shot sequence were lit correctly, meaning that at this power (for all practical purposes) the recycle time is only 0.125" or less.

I'd like to point out that an IGBT flash like the QT-600 may fire before recycling completely (if not working at full power), while regular voltage-controlled flashes can not. This is why I say "for all practical purposes": I just don't care if my strobe has fully recycled or not, as long as it can fire when I want it to. Perhaps at ⅛ power and 8 fps the QT-600 does not recycle completely and eventually, maybe after 50-60 flashes, it will need a short pause to recharge completely its capacitors. But then, who cares of shooting a burst of 50 pictures? 10-15 consecutive frames is all I ask and the QT-600 delivers.

Unfortunately, the QT-600 has no automatic stroboscopic (multi-flash) mode to fire a sequence of flashes at regular, preset intervals. One use of this function is to emulate a multiple exposure in dark environment, by setting a slow shutter speed (like 4 seconds) and firing a burst of flashes at a moving subject. How the lack of this function may affect your photography is highly subjective, but keep in mind that you may obtain similar results (in most cases) by manually triggering the strobe.

Flash duration

Last but not least, I measured the flash duration. To me, this is the key feature for a strobe and any flash duration slower than 1/1000" (T.1) is a game-stopper. I need a super fast flash, because freezing action is the main concern in my photography.

The QT-600 is rated at flash durations of 1/5000" at lowest power, while Lencarta for their identical 600 SF go well beyond and claim an incredible 1/20,000". Which one is correct, if any?

In his review, Phil Hardbord checked the light output with an oscilloscope and substantially confirmed the 1/5000" figure, measuring an even better 1/5400"T.1 at minimum power. According to Phil, T.1 is less than 1/1000" (actually 1/1400") even at ½ power, while at full power (where IGBT technology has no role to play) the T.1 is an unexciting, "regular" 1/500" (but this leaves an open door for HyperSync, see below).

Unfortunately, I have no means to replicate Phil's measurements, because I miss the necessary instruments. Instead, I used an indirect measurement technique, which consists in taking a number of shots of a spinning disk (see **Figure 7**–this is basically the same approach used by Lencarta) with available light only (no flash) and with different shutter speeds ranging from 1/250" to 1/8000". At slower shutter speeds the marks on the disk appear blurred due to the fast disk rotation, but at higher shutter speed they look more and more identical to a picture of the disk when it is standing still.

Then, I took another series of pictures of the spinning

Figure 7. *Test target*

Figure 8. *Still target with continuous light*

disk with flash light only at different power levels. Finally, I compared each flash-light picture with the available-light pictures to find the equivalent level of action freezing. To put it in another words, if a flash-light image presents the same amount of motion blur of an available-light image shot at 1/4000", then we can conclude that the flash duration in the first image was approximately 1/4000".

I know the objections: this is a *qualitative* test (not *quantitative*), the evaluation of motion blur is subjective and it is difficult to compare samples when in each of them the amount of blur is small.

My counter-objection is that I really don't care about the cold numbers, I'm only interested in the end result. If at ¼ power I can get a picture which is equivalent to shooting at 1/4000" then I don't care if T.1 is 1/4000" or 1/3800" or even 1/5000". I want to freeze moving subjects and all I need to know is how much I have to dial down the power to get what I want. Also, I'm publishing the test results, so you can judge by yourself. You can see the still target with continuous light in **Figure 8** and a comparison between continuous light and flash exposure in **Figure 9** to **Figure 24** (all flash exposures are at 1/250" - ISO 100 - aperture from f/11 to f/32; continuous exposures are at f/11 and ISO 6400).

Power - display (Ws)	Equivalent Shutter Speed
10.0 (600 Ws)	1/1250"
9.0 (300 Ws)	1/2000"
8.0 (150 Ws)	1/2500"
7.0 (75 Ws)	1/3200"
6.0 (37.5 Ws)	1/4000"
5.7 (19 Ws)	1/4000
5.4 (9.5 Ws)	1/5000" - 1/6400"
5.0 (5 Ws)	1/5000" - 1/6400"

Table 4. *Flash duration at different power levels*

What i found is reported in **Table 4**. While not as good as Lencarta figures (which, *a priori*, seemed to be more commercial hype than actual facts), my results substantially confirm Phil Harbord's measurements and, consequently, manufacturer data (with a major deviation at full power – see also the paragraph about Hypersync at page 10). Regarding flash duration, the QT-600 is comparable to the Einstein in Constant Color Mode (at the same power output), while the Einstein has the edge when used in Action Mode.

In most situations, including all those involving human subjects, the flash duration of the QT-600 is fast enough to obtain tack sharp results. This alone is enough to put the QT-600 on a higher ground, where only a handful of monolights can stand (including the Einstein, the Elinchrom ELC PRO HD and the Profoto B1). Speedlights may be even faster, but they are definitely less powerful. Generators may also be faster, but a completely different price level.

Considering that I'm shooting mainly people and splashing liquids at moderate magnification, I don't need the extra speed of the Einstein in Action Mode and I'm probably in good company, with the 99% of photographers. The specialists in high speed photography (e.g. bullets shattering fine wine bottles) are desperately in need of the shortest flash duration, regardless of color stability, price and other considerations. Those photographers may well consider the Einstein a better option, even though extreme action freezing may require something even faster.

HyperSync capabilities

Most DSLR does not allow for flash synchronization at shutter speeds faster than 1/160" to 1/320" (depending on camera). This is known as the *X-Sync* speed. Medium format cameras equipped with leaf shutter may have a higher x-sync speed (1/800" to 1/1600"), but only digital cameras with electronic shutter (typically, point and shoot cameras) have no limits in x-sync speed.

For daylight sports photography a slow x-sync speed may be a problem. I won't go into technical details here, but to freeze a moving subject with no visible halos (due to available light coupled with a slow shutter speed) you need to underexpose the environment by at least 3 stops. You can't balance flash and available light, otherwise part of the moving subject would appear "smeared" due to the (relatively) long exposure of the available light.

HyperSync technology (not to be confused with High Speed Sync) was introduced by PocketWizard (see **here**) to overcome the x-speed limits (other trigger manufacturers are

Figure 9. *Continuous light @ 1/8000"*

Figure 10. *Flash @ 5.0 (1/128 power)*

Figure 11. *Continuous light @ 1/4000"*

Figure 12. *Flash @ 5.3 (1/64 power)*

Figure 13. *Continuous light @ 1/3200"*

Figure 14. *Flash @ 5.6 (1/32 power)*

Figure 15. *Continuous light @ 1/2500"*

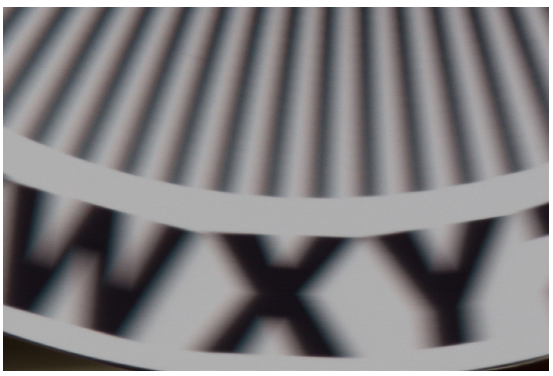

Figure 16. *Flash @ 6.0 (1/16 power)*

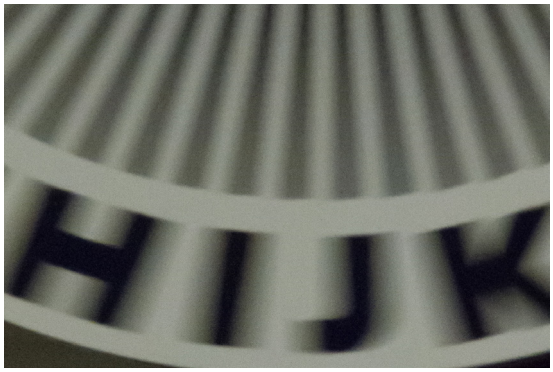

Figure 17. *Continuous light @ 1/2000"*

Figure 18. *Flash @ 7.0 (1/8 power)*

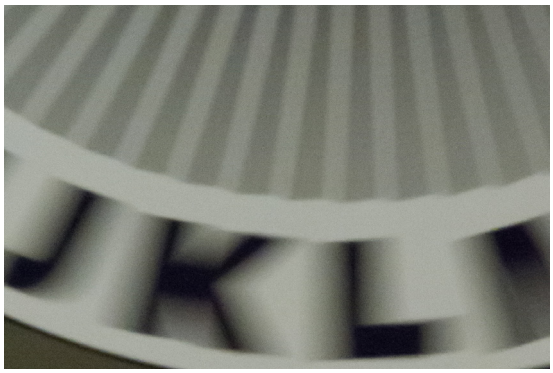

Figure 19. *Continuous light @ 1/1600"*

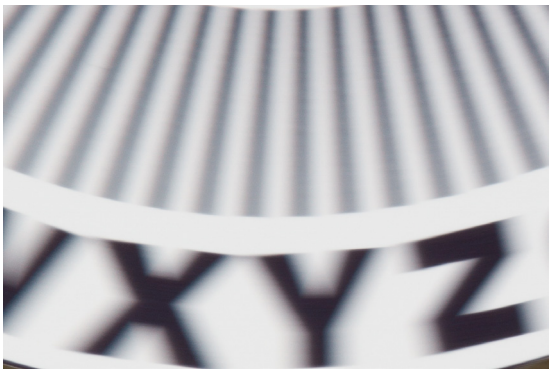

Figure 20. *Flash @ 8.0 (¼ power)*

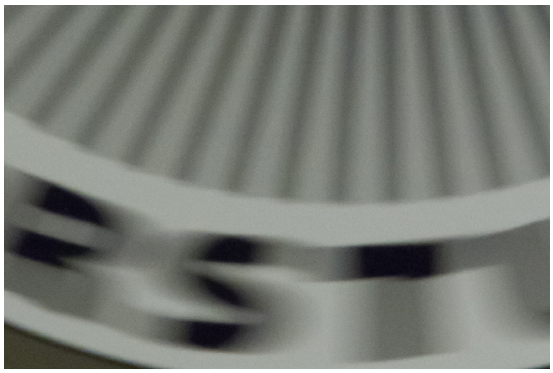

Figure 21. *Continuous light @ 1/1250"*

Figure 22. *Flash @ 9.0 (½ power)*

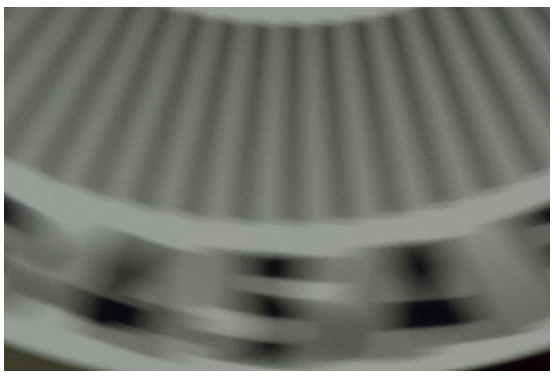

Figure 23. *Continuous light @ 1/1000"*

Figure 24. *Flash @ 10.0 (Full power)*

now proposing similar functions). It allows you to trigger a flash at any shutter speed, but results are a mixed bag and strongly depend on which DSLR and which flash you use. For better results you need to use a strobe with a long flash duration. With super fast flash duration like 1/5000" T.1 this technology simply does not work.

Does this means that you can't HyperSync with the QT-600? Maybe. For sure, at most power settings the flash duration is too short to work with HyperSync. However, at full power the QT-600 works exactly like a conventional strobe, so this leave a door open.

To test this possibility, I triggered the QT-600 using either a PC-sync cable or a couple or radio triggers, and I got the usual banding on the bottom of the frame starting from 1/320" (with the radio triggers – **Figure 25**) and 1/400" (with the sync cord –**Figure 26**). This happens because the flash is fired only when the first curtain is fully open, but the second curtain is already moving. To determine if the QT-600 can hypersync I used the trick to sync the strobe through a speedlight in HSS mode. I mounted my Canon 430 EX II on top of my Canon EOS 7D and set it in High Speed Sync mode to force the 7D to accept shutter speeds faster than 1/250" (which is the x-sync speed of the 7D). I set the 430 EX at minimum power (1/64), so it had no role in the exposure of the scene. The QT-600 was set in Optical Slave mode at maximum power (10.0, corresponding to 1/1).

In this case the flash is fired soon after the fist curtain starts moving (i.e. *before* it is fully open). This time I obtained a top banding, more precisely a very steep gradient (**Figure 27** and **Figure 28**) at the middle of the frame going from white (at the bottom) to black (at the top). Considering the quick falloff, you may assume that the flash duration of the QT-600 is too short, even at full power. Perhaps, the QT-600 cuts the *tail* of the flash pulse also at full power, as suggested by the quick flash duration (1/1000") I found in the above mentioned tests.

On the other hand, you may notice that the frame is relatively dark even on the bottom and using a relatively large aperture (f/5.6), suggesting that the sensor was exposed only to the tail of the flash pulse (i.e. the flash was triggered too late).

Whatever the truth, my tests are inconclusive. Of course, the failure of hypersyncing the QT-600 using my HSS/Slave trick does not prove that the QT-600 can not be hypersynced at all. Other IGBT strobes (including the Einstein) and many speedlights are know to work with hypersync when triggered by PowerWizards or other triggers that support an ad-

Figure 25. *Triggered by Pixel Soldier @ 1/320*

Figure 26. *Triggered by Pixel Soldier @ 1/500"*

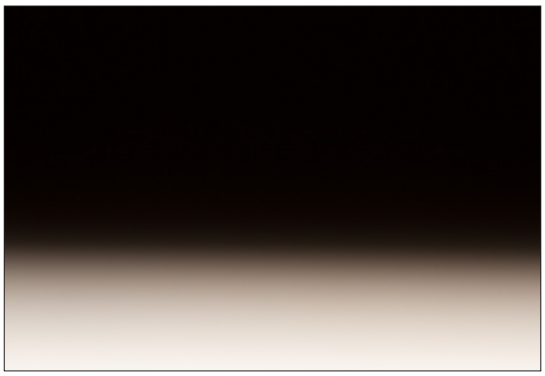

Figure 27. *Triggered by 430 EX II in HSS - 1/500" @ f/5.6 ISO100*

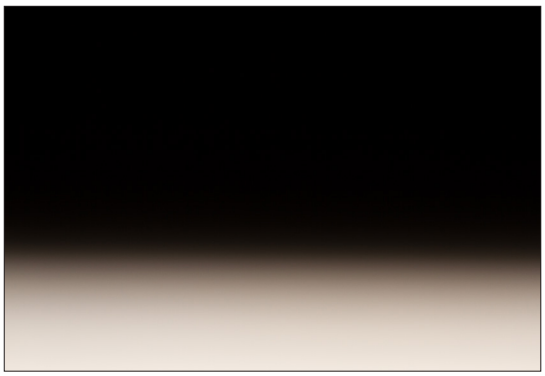

Figure 28. *Triggered by 430 EX II in HSS - 1/2000" @ f/5.6 ISO100*

justable delay such as the new Phottix Odin or the Ojecoco H550.

A final judgment on this matter definitely requires an empirical evidence which, unfortunately, is not available yet.

LP-450X Lithium Battery Inverter

As a mains-powered unit, the QT-600 needs to be connected to a 220 Vac or a 110 Vac power outlet. When your are on location, a battery powered inverter (also known as *battery pack*) allows you to use your strobes anywhere.

Most of my outdoor shootings involve soccer players on soccer fields: no mains outlets there, so I definitely needed an inverter for my strobes. I ordered from T-One an LP-750 unit, but they actually delivered a more advanced LP-450X (see more about this later). The LP-450X is based on newer technology, i.e. a high capacity Lithium Ion ($LiFePO_4$) battery with an excellent 12 Ah capacity.

The LP-450X is relatively compact (267 x 206 x 292 mm) and lightweight (6.8 Kg). Three multi-standard power plugs are available on top of the unit, as well as 3 USB ports for powering or re-charging portable devices (smartphones, GPS navigators, MP3 players, etc.). The unit is composed by two parts: an 8V Lithium battery (bottom) and the *inverter* that transforms the direct voltage into 230 Vac. The two parts are kept together by 4 levers located on the side of the unit and it is very easy to replace the battery with a fully charged one. You can also use and external 12V battery, such as a car battery: you just need to connect it to the two plugs that are provided on the side of the unit.

There is a handle on top for easy transport, but the LP-450X comes with a nice carrying bag with many sockets that can be used to store the AC charger, cables, etc.

The inverter supports two working modes: a *normal* working mode to feed standard appliances (e.g. notebooks, printers, etc.) and a *flash* mode which is appropriate for strobes. In normal mode the maximum continuous power output is 450 W, while in flash mode you need to think in terms of watt-seconds. From a practical point of view, the LP-450X supports multiple strobes up to a total of 1800 Ws, which is perfectly adequate to connect my three QT-600's.

The *normal* mode is a distinguishing feature of the LP-450X. For instance, the Paul C. Buff's Vagabond Mini Lithium, one of the most popular battery packs, is not intended to power continuous loads such as the modeling lamps. Instead, the LP-450 can happily feed any standard electric device, including lamps, up to a total continuous power of 450 W. To this end, the LP-450X uses active cooling by means of a cooling fan on the side of the unit. Other battery packs,

Figure 29. *Bird's eye view of the LP-450x*

Figure 30. *The locks that keep the inverter and battery together*

Figure 31. *Battery and inverter set apart*

including the Vagabond, only offer passive cooling as they are not intended for continuous usage.

Recharge time is nothing less than **phenomenal** for this price range. With a single strobe attached, the LX-450 is as fast as a mains outlet. Even with three QT-600's recycle time is just 3 seconds at full power (see also **Table 5**). Just to put things in perspective, a similarly priced battery pack from Bowens (the Travelpak) recycles two 500 Ws strobes in 10 seconds, a huge difference. The Vagabond Mini Lithium recycles two Einsteins (for a total of 1280 Ws) in 7 seconds, three times as long as the LP-450X.

Battery capacity is also great. When used with strobes, the LP-450X is rated at approximately 300,000 Ws of flash energy. To translate this figure in a number of pops, just divide it by the number of strobes and their power. For instance, when you connect three QT-600's (600 Ws each) at full power you get a number of pops given by:

300,000 [Ws] / 3 [strobes] / 600 [Ws/pop] = 165+ pops

With only two strobes at half power (a more typical situation on location) the number of pops rises to:

300,000 [Ws] / 2 [strobes] / 300 [Ws/pop] = 500 pops

That should be more than enough in most cases. Again, this is better than most of the competition (at the same price level).

For sure, the Paul C Buff Vagabond Mini Lithium is a much more compact and lighter unit than the LP-450X. It is also less expensive: one LP-450X costs as mush as two Vagabonds. However, a direct comparison is not easy, as the Vagabond is a different beast, with a smaller battery capacity and a slower recycle time. The LP-450X should really be compared to a couple of Vagabonds.

The Vagabond is easier to handle and to transport, while the LP-450X is faster and has a considerably higher battery capacity. If you're traveling with just one strobe and you don't need fast recycling, then the Vagabond is a better option. Otherwise, the LP-450X will not disappoint you.

Test condition	Recycle time in seconds
1 x QT-600 @ 10.0 (full power)	1.2 seconds
2 x QT-600 @ 10.0 (full power)	2.0 seconds
3 x QT-600 @ 10.0 (full power)	3.0 seconds
3 x QT-600 @ 7.0 (⅛ power)	0.4 seconds
3 x QT-600 @ 9.0 (½ power)	1.4 seconds

Table 5. *Recycle time of QT-600 powered by an LP-450X*

Figure 32. *A detail of the multi-standard plug*

Figure 33. *The switch, status LED's and the 3 USB ports*

About T-One

T-One is the company that re-brands and sells the QT-Series strobes as well as many other interesting products, including a highly portable flash unit (similar to the Elinchrom Quadra) and the world's first speedlight powered by a lithium battery. You may find them on the web at **t-one.co**.

They sell and ship worldwide through two on-line *stores*, one for Australia and the Pacific Area, the other one for Europe and the rest of the world. T-One has offices and service facilities in Australia and UK.

Customer service is simply fantastic: I've been in contact with Julie and Colin Smith for several months before placing my order, just in the period when they switched from distributing PCB equipment to selling their own brand. They answered my questions, provided advice and supported me in everything until I had my strobes delivered to my door. It was a transition period for T-One and they were initially out of stock, but I was in a hurry and they did they best to expedite the order, arranging with the manufacturer (Godox) an urgent delivery.

I'm buying on-line since 20 years ago, but I never found a customer service that good.

Conclusions

After a month of usage, I'm really impressed by the QT-600. It's not the sexiest of strobes but, as soon as you scratch the surface, its distinguishing features start emerging. It's really hard to criticize this product, especially when you consider its price (approx. 450 € VAT included). It's manufactured in China, but it is not a cheap design at all. Construction is very good, performance is excellent. Sure, the Einstein has a fancier display, a wider power range (9 stops instead of 8) and faster flash duration in action mode. But if you don't need extreme action freezing capability, you may be more interested in simplicity, color and power accuracy, availability of light modifiers and in those fields the QT-600 delivers.

In the 500 € ballpark there is really one alternative only: the PCB's Einstein, but only if you live in the USA. If you're willing to pay twice as much, you may consider the Elinchrom's new kid on the block, the ELC PRO HD series. Personally, I would consider that path only if I had a huge investment in Elinchrom equipment (Skyport transmitters, Rotalux softboxes, etc.).

There is also the new Profoto B1 with TTL support, but for the price of a single B1 you can purchase three QT-600 plus the LP-450X battery pack. The Elinchrom Quadra with A-head is also very fast and very comfortable to carry around, but again it's an expensive piece of equipment. At the Profoto B1 or Elinchrom Quadra price level, the comparison is simply unfair, not to mention generators like the Broncolor Scoro.

If you're searching for a fast and powerful strobe and you live in the USA, then the Einstein is a good alternative to the QT-600: buy either of them and you won't make a mistake. The Elinchrom ELC PRO HD may be a better choice if you already invested a lot in Elinchrom equipment; the Profoto B1 may provide something you could only dream of till now, TTL capability; if you need light and compact flashes because you're a frequent traveler, go with the Quadra; if you're seeking top quality and performance and you don't care about price, then have your Platinum credit card ready and buy a Broncolor Scoro plus a handful of heads.

For anything else, the QT-600 is a great choice and I don't hesitate to recommend it.

Summary

Pros:

- Very good and sturdy build quality;
- Easy to use and minimalistic (no distractions) user interface;
- Excellent power output consistency;
- Excellent color stability;
- Super fast flash duration, better than average even at full power;
- Excellent recycle time;
- Very high frame rate possible, 4 fps at ¼ power and at least 8 fps at ⅛ power or less;
- 7-stop power range regulation, from 600 Ws to less than 5 Ws;
- Accepts the very popular Bowens (S-type) speed rings;
- Comes with a Pyrex glass cap and a standard reflector at no extra price;
- Fantastic customer service from T-One.

Cons:

- Modeling lamp has no proportional mode;
- A 150 W modeling lamp may be too faint for some users;
- The glass cap and the protection cap do not cover the modeling lamp completely;
- Power regulation in one-tenth of a stop in most of the range but only ⅓ of a stop for the lowest three stops;
- No multi-voltage support

ABOUT THE AUTHOR

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