

# Eggtimer Quasar User's Guide

Board Rev G3/G4  
Software Rev. 1.02S



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## Eggtimer Quasar Features

WiFi-Enabled, Three-Output data-logging flight computer with integrated GPS tracker and telemetry

Programming, arming, and downloading can all be done with any WiFi/browser-enabled device

No apps required on your device, just a browser

Fits easily in a 29mm body tube, weighs only 30 grams

Altimeter records data up to 60,000'

Fully "mach immune", deployments are inhibited until the rocket is moving slowly near apogee

Detailed flight data for 15 flights is saved, and can be downloaded using your browser

Summary data can be downloaded or viewed on your browser, immediately after the flight

Main deployment channel can be set to fire from 100' to 2000'

Drogue deployment channel delay configurable from nose-over +0 to +30 secs

AUX channel can be configured as a Drogue, Main, or for doing Airstarts

AUX airstart output can be qualified with altitude@time and/or velocity@time

Deployment channels' on-time can be set from 1-9 secs... great for hot-wire non-pyro deployments

Channels can be set for standard servos for deployments, travel from 23-90 degrees CW or CCW

"Fail-Safe" mode can fire main chute if a drogue failure is detected, preventing a potential high-speed chute deployment or crash

Real-time GPS and altimeter telemetry is streamed during flight for use with the Eggfinder LCD Receiver

Available in license-free and 70 cm Ham versions

Battery input is polarity protected

Works with a 2S/7.4V LiPo battery, 500 mAH or larger capacity recommended

10A current-limited deployment channels protect against "brownouts", shorts, and overcurrent loads

Works with all common deployment ematches

Test mode so you can safely do an actual pyro test up to 100' away from your rocket

Dual-ended deployment outputs, igniters are essentially "dead" until well into the flight

No switch needed, since it's disarmed and the igniters are dead until YOU arm it remotely

## Disclaimers, Legal Stuff, Etc.

The Eggtimer Quasar is meant to be used for hobby and experimental rocketry purposes. Although hobby rocketry has an admirable safety record, largely due to the efforts of the good people at the National Association of Rocketry (NAR) and the Tripoli Rocketry Association (TRA), rocketry can be dangerous if proper safety precautions are not observed. This is particularly true with some of the advanced techniques like pyrotechnic parachute deployment. People can and have been seriously injured by not following recognized and accepted safety practices. We cannot be responsible for your actions.

We *strongly* recommend that if you are not a member of either the NAR or the TRA, you join one of them, join a local rocketry club, and pick the brains of experienced members before you try any kind of multiple deployment or airstart flight. The safety information included in these instructions is by no means comprehensive or complete, and is no substitute for the supervision and advice of experienced rocketeers.

## Important Regulatory Information

**This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

**It is intended to be used for educational use, and experimental use in Class II/III amateur High Power Rockets which are classified as aircraft by the Federal Aircraft Administration (CFR 14 §101.25), and which must by FAA and NFPA regulations be operated at least 1,500' away from any populated buildings. Although unlikely, this device may cause interference with consumer devices that run on the unlicensed 902-928 MHz band, and therefore must not be used in residential areas.**

The Eggtimer Quasar uses RF modules in the 902-928 MHz ISM band manufactured by Hope RF, model HM-TRP-915. These modules have been tested by Hope RF to be compliant with the FCC Part 15 regulations for non-licensed intentional emitters, and as such have been permitted to be imported into the US. However, Hope RF (at the time of this document) has not obtained formal certification with the FCC. As a hobby kit, designed for educational and experimental purposes, the Quasar is considered by the FCC to be “generally exempt” from authorization requirements. Nonetheless, we have made a good faith attempt to comply with all technical regulations, and you should too by building it **exactly** as per the instructions, and by using only the antenna on the transmitter module that is included with the kit.

Because the Eggtimer Quasar runs on an unlicensed band, there is no protection against interference from other sources; basically, you get what you get. We’ve done substantial testing and are confident that your Quasar is unlikely to be significantly affected by outside radio sources, but there’s no guarantee.

If your Eggtimer Quasar causes interference in a residential setting, or with licensed radio systems (such as TV or ham radio), you **must** stop using it until you correct the problem. This is extremely unlikely given the small amount of power and the “tightness” of the transmitter’s output, and in particular the distance from any populated areas that HPR rockets must be flown. Nevertheless, you need to be aware of this, and be willing to abide by the rules. These are the same rules that govern other non-licensed transmitters, such as cordless phones, WiFi and Bluetooth® devices, and garage door openers.

**Important Links:**

FCC Part 15 (governing unlicensed intentional emitters)

<https://www.ecfr.gov/current/title-47/part-15>

Hope RF HM-TRP Documentation (FCC test documentation)

[http://www.hoperf.com/upload/rf/HM-TRP-915\(20dBm\)-FCC.pdf](http://www.hoperf.com/upload/rf/HM-TRP-915(20dBm)-FCC.pdf)

FAA Regulations for Amateur Rocketry (Part 101)

<https://www.ecfr.gov/current/title-14/part-101>

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**Limited Warranty**

Eggtimer Rocketry warrants that all of the parts on the packing list of this Eggtimer Rocketry kit have been included, and that they are all in working condition. If you are missing something, contact us immediately at [support@EggtimerRocketry.com](mailto:support@EggtimerRocketry.com) and we will send you whatever it is that you are missing. If you are missing something really egregious (like the PC board or the processor, for example), we may ask you to return the entire kit unbuilt, we will send you a prepaid shipping label for this purpose. We’d especially like to see the packing list so we can figure out what went wrong so it doesn’t happen again...

If your Eggtimer Quasar does not work properly after assembly, take a deep breath, get out the magnifying glass and a good light, and see if you have inadvertently created a solder bridge somewhere. Chances are pretty good that you have, or that you have installed a part incorrectly. We are a very small company and we just don’t have the resources to repair your board, but we will be more than happy to give you advice and we might be able to help you find your error if you send us some high resolution pictures, to [support@EggtimerRocketry.com](mailto:support@EggtimerRocketry.com) . We cannot take responsibility for your assembly techniques; if you do not have experience building kits of this nature, we recommend that you enlist some help. (Another reason for joining a rocketry club, there is usually at least one electronically-inclined member who can be bribed with a beverage or two to give you a hand. Engineering types love a challenge, especially it it’s easy for them but hard for you.)

Eggtimer Rocketry warrants that when properly assembled this Eggtimer Rocketry product will perform substantially according to the published documentation. This means that we spent a lot of time trying to ensure that it’s going to work the way that we say it does, and we try to fix things that don’t quite work right in a reasonable time. Nevertheless, we can not and do not warrant that this product is perfect and will meet every rocketry purpose, for the simple reason that we can’t test every possible rocket/motor/environmental combination. It is the buyer’s

responsibility to determine the suitability of the Eggtimer Quasar for their particular purpose. If you have a problem with this, please contact us and we will be happy to send you a prepaid return label for your unbuilt kit and we will refund your purchase price.

## Meet the Eggtimer Quasar

The Eggtimer Quasar is a barometric altimeter-based flight computer with an integrated GPS and telemetry transmitter. Its job is to properly deploy your parachutes and bring your high-powered rocket safely to the ground, and to record flight information for later analysis. When used with an Eggfinder LCD receiver, it will track your rocket using GPS technology, and send your rocket's location to your receiver on the ground. It will also give you its real-time altitude, and tell you when key events such as deployment channel firing has occurred. If you install the optional LCD-GPS Module in your LCD receiver, it will point you in the direction of your rocket and tell you how far to go... long recoveries are easy.

It has three high-current output channels: a drogue channel, which is typically fired near the apogee of the flight, a main channel which fires at a somewhat lower altitude that you can choose, and an AUX channel that can be set to act as a secondary drogue or main, or it can be used as an airstart channel to fire on the way up based on a timer. The idea is that the drogue parachute is much smaller, so your rocket comes down at a controlled but relatively fast rate, typically between 50-100 ft/sec. This relatively high rate of descent helps minimize the rocket's drift due to wind, and for you impatient types it also helps it come down faster too. The main parachute is typically opened somewhere between 500'-1000', slowing the rocket down so that it lands gently but preventing it from drifting excessively. The AUX channel can be used for igniting a second stage motor in airstart mode, but it can also be used for things such as air brakes or as a second main chute for three-way deployments.

It's nice to get your rocket down in one piece, but it's also nice to know how the flight went. The Quasar can record your last 15 flights, and you can easily view and/or download both summary statistical information and detailed time vs. event information. Data can easily be downloaded into the standard CSV format for analysis using Excel or other programs.

What makes the Quasar different from other flight computers is that it has a WiFi/browser interface. Instead of using switches, jumpers, or a data cable to your laptop to program it, you simply connect to it with your phone, tablet, or computer using WiFi and a browser like Safari, Firefox, Internet Explorer, or Chrome. You remotely arm it at the pad using your handheld device too, so for many applications you do not need a mechanical switch... it won't turn on until you tell it to. Optionally, you can override remote arming, so it will arm like "other" altimeters when you power it on. Flight data is downloaded to your handheld device using WiFi, and with the installation of an appropriate spreadsheet or other data analysis program you can actually get a flight graph within seconds of recovering your rocket.

Since one of the tenants of successful electronic deployment is ground testing, the Quasar incorporates a ground-test feature so that you can check YOUR battery with YOUR igniters to make sure that they are compatible and will work in flight. This is done remotely over WiFi, so you can even test with "live" pyro charges, standing up to 100' away from your rocket.

The deployment channels are capable of triggering just about any ematch that you're likely to encounter. You can set the output on-time from 1-9 seconds, so it's ideal for use with a hot-wire non-pyro deployment. It uses special current-limiting drivers to ensure that a deployment glitch will not cause your Quasar to "brownout" due to low voltage. You can also use standard PWM hobby servos with the Quasar, for non-pyro parachute deployments. This makes it ideal for use

by TARC teams that want to experiment with electronic deployment but can't use pyrotechnics, or for flights over 30,000' in which pyro charges may not be as effective.

In addition to deployment functions, the Quasar can also be used to "airstart" additional motors in flight, either for "strap on" boosters or for starting a second stage motor. It works as a timer that starts at launch, and can be qualified with velocity-at-time and/or altitude at time. This helps ensure that your second stage won't light unless your rocket is going "up". Since those functions are highly specialized, there's an additional manual for airstart functions... you can find it in the Eggtimer Rocketry web site under Eggtimer Quasar Support/Documentation.

## Getting to know your Quasar

Although the Quasar seems relatively simple, you will want to familiarize yourself with it BEFORE you install it in a rocket, and certainly before you try flying it.

**Battery (BATT)** – Two solder pads for connecting the Quasar’s battery. It’s not polarized... you can’t hook the battery up the “wrong” way. We recommend a 2S/7.4V LiPo battery, 500 mAH or higher... more on that later.

**Buzzer** - “Beeps” out status, warnings, apogee at landing, and other important notifications.

**Main Deployment (MAIN)** - Two solder pads for connecting an electric match or other deployment device such as a hot-wire or a servo. Deployment altitude can be set from 100’ up to 3,000’, or it can be turned off if you don’t need to use it.

**Drogue Deployment (DROG)** - Two solder pads for connecting an electric match or other deployment device such as a hot-wire or a servo. This normally triggers right after nose-over, but you can delay it from 100 ms to 30 seconds for backup use, or deploying some other device. You can also turn it off if you’re not going to use it.

**AUX Channel (AUX)** - Two solder pads for connecting an electric match or other on-off deployment device such as a hot-wire. The AUX channel can be configured as a second Drogue output, a second Main output, or for Airstart functions, which trigger at a set time after launch.

**Programming Cable Header** – 3-pin header that’s used with an Eggtimer USB-Serial cable for updating the software or for viewing the WiFi passkey (in case you lose it).

**Programming Jumper Pins (PGM)** – Two pads used to put the Quasar into programming mode at boot-up, for uploading software updates. Normally you’ll leave this open.

**RUN Jumper Pins (RUN)** – Jumper pin that connects the GPS output to the processor. This is normally shunted, except when you’re updating the firmware (in which case the shunt goes on the PGM header).

**Servo Header Pads** – Pads for connecting servos to your Quasar, they are a logic-level output instead of a high-current output. Note that power for your servos is NOT provided; you must provide it separately, and we strongly recommend additional filtering on your external servo power (more on that later).

**OpenLog Header Pads** – Pads for connecting an OpenLog datalogger. This streams out the serial data that goes to the RF radio module, with the standard NMEA GPS data. You can use the data that the OpenLog saves to get a “track” of your flight using software such as Google Earth.

## **Mounting Your Eggtimer Quasar**

The Quasar is relatively small and light, and can be mounted several ways. The most common way of mounting it is using four #4 screws, either self-tapping screws for wood sleds (put a drop of CA glue in the pilot hole first to prevent the screws from loosening in flight) or machine screws (we recommend using Nylon-insert nuts so they don't come loose). We **STRONGLY** recommend that you use Nylon washers between the board and the screw heads and nuts to prevent any possibility of shorts. You'll also need to put some kind of spacer between the bottom of the board and the sled, about 3/16" high... you don't want the parts on the bottom of the board getting pushed against your AV sled. There's a mounting template on the Eggtimer Rocketry web site to help you plan your installation.

We do **NOT** recommend using double-sided foam "servo" tape to mount the Quasar to your AV sled. There are parts on both sides of the board, so the bottom isn't flat. You won't get 100% coverage with the servo tape, so there's a potential for it coming loose in flight, which is bad.

However you mount it, be careful not to overtighten the screws and possibly bend the circuit board. Parts on the bottom of the board can break if you force them against the bottom of your sled... don't ask us how we know. We recommend that you leave a little space between the components on the bottom of the board and the sled... about the thickness of a credit card.

The Quasar can be mounted in any direction, there's no "up" or "down" side. Since it's longer than it is wider, you'll probably mount it parallel to the centerline of your rocket. We do recommend, however, that you don't mount it so that the pressure sensor is directly across from the vent holes in your AV bay. You can get funny currents during flight, which may compromise the accuracy of the altitude readings.

Since the Quasar uses a barometric pressure sensor to determine altitude, you'll need to drill a few holes in your AV bay to vent it to the outside air. There's a lot of debate about what the right size for the holes is, how many, etc., but the most accepted rule of thumb is: One 1/4" diameter hole for every 100 square inches of AV bay volume.

Now the tricky part is that you don't want ONE vent hole... the optimum number is THREE, equally spaced along the AV bay perimeter. This works out to about three 5/32" holes for every 100 square inches of volume. That's just about the size of a 4" diameter AV bay that's 8" long, so you can work up or down based on that. We've found through experience that the actual size of the holes isn't terribly critical... just drill the three holes and you'll be fine.

## **Wiring Your Eggtimer Quasar**

The Quasar is designed to have the power connector directly soldered to the board. This prevents the battery connections from coming loose in flight due to vibrations and G-forces. The output wires can be similarly soldered to the board, or you can use the included screw terminal block with them.

Most people will use the screw terminal blocks for the outputs, they're convenient but you must be careful to check their tightness before **every** flight. We've found that simply wire-wrapping the igniters to a "pigtail" wire soldered to the board works very well for smaller rockets. It also can help reduce the profile a little bit by eliminating the screw terminal blocks. By soldering the pigtails to the board rather than having screw terminal blocks, you also eliminate the possibility that the wire may work loose from the terminal in flight.

We recommend using #22-#26 gauge wire for wiring to the Quasar board, we like to use the #24 gauge stranded wire that's found in Cat-5 network cables. It's cheap, easy to find, and just the right size. It's also twisted together in nice solid-striped pairs, so it's easy to tell the "+" from the "-" wire, and is color-coded to make it easier to figure out which wire goes where. If you can, get the "plenum" cable, since it has a Teflon jacket and doesn't melt as easily when you solder to it as the standard "riser" cable. You can also use solid wire, but solid wire is harder to work with and has a tendency to break after being bent a few times. These breaks can be a pain to find, because they are typically inside the insulator jacket where you can't see them.

If you use stranded wire, you **MUST TIN THE WIRES BEFORE SOLDERING TO THE BOARD**. This is to prevent stray "whiskers" of wire strands from coming loose and bridging pads, or breaking off and landing on the board in some random place. We've seen the results of this happening, it's not pretty, and they can be very hard to find if the lodge underneath the processor chip or in some other hidden spot on the board.

If you build the board with the terminal block option, be sure to tin whatever wires you are using for your igniters before you insert them into the terminal block. Better yet, get some pin ferrules, and solder and/or crimp them to the pins. Loose strands here can prevent deployments, and they can also lodge underneath components and cause a malfunction during flight. That would be bad...

Last, but not least, we strongly recommend that all wiring on your sled be zip-tied or otherwise securely attached to the sled so that there's no chance of any wires coming loose in flight. We've seen it happen, and the results are not pretty.

## **About Switches...**

The Quasar is designed so that by default it will not self-arm itself. If you power it up, it will sit there on the Status page forever, changing the validation code every 60 seconds... you have to actually arm it using the validation code in order to start a flight. In addition, the unique dual-ended deployment output prevents any significant current from getting to the igniter until it's armed and actually in-flight, and the first output event occurs.

Because of this, for most flights using electronic deployments up through NAR/TRA Level 2 you do not necessarily need a separate power switch. You can simply connect the battery to a locking connector such as a JST connector and you're ready to go until you arm it on the pad. This makes your AV bay build easier and smaller, and of course it makes your pre-flight procedure a lot simpler.

NAR and Tripoli rules require that the "energetics" on a rocket are electrically disabled until you're on the pad. The Quasar is different than most other altimeters because it has dual-ended switching on the deployment outputs: BOTH the "+" and the "-" side are switched off, leaving

the igniter essentially dead until near deployment (except for a tiny trickle current that's used to test continuity). For the igniter to fire, both sides have to be activated independently, and this can't happen until you're in the air and the low-speed deployment enabling logic has been triggered. It's a nice safety feature because it virtually guarantees that you cannot have a deployment charge fire on the ground.

However, you may still decide to use a mechanical power switch, either because your club requires them or because you want to close up your AV bay beforehand and power off everything until you're ready to fly. (We get it... flight day isn't always the best time to be fiddling with your AV bays...) It also saves power, too... which allows you to charge all your batteries up and close up your AV bay several days ahead of time since there's no battery drain.

Whatever switch you use, make sure that it can handle the expected G forces that you expect the rocket to experience during flight. We recommend screw switches, because they lock down tightly and generally can't come loose in flight. Rail-Buttons.com, Featherweight Rocketry, and Missile Works make good small screw-type switches, they use a screw to positively lock down the contacts and completely eliminate any possibility of the switch being jarred open. A lot of people like the Fingertech mini screw switches too, but those require a hex key to actuate so they're not always as convenient.

## **Quasar Battery Options**

The Quasar is designed for a 2S 7.4V LiPo battery. We recommend using one rated at least 500 mAH, since the Quasar draws about 130 mA on average after you connect to the Status Page, however it can pull over 300 mA under some circumstances, and typically draws about 250 mA during flight when it's transmitting constantly. You CAN get away with smaller batteries, IF (and ONLY IF) you connect the fully-charged battery up right before flying. We've used batteries as small as 180 mAH in testing with model rockets, but we have several fully-charged batteries on-hand and we change them out with a fresh one after each flight. With a larger battery, you can take your time... an 800 mAH 2S LiPo is about the same size and weight as a 9V alkaline battery, and will last all day. That's what we use for all but the skinniest of rockets. For 54mm diameter rockets, we like the skinny packs used for Airsoft guns... they're about 100mm x 18mm x 12mm, so it's easy to fit them on the back of the sled, and they have a lot of capacity... over 1000 mAH.

While we're on the subject of 9V alkaline batteries, DO NOT, repeat, DO NOT use a 9V battery to power the Quasar. At all. Even for testing. They don't source much current, especially compared to a 2S LiPo. While it will appear to work fine once it's new, it will quickly drain, and you will find that the range starts to rapidly decrease, and the Quasar will appear to become unresponsive, or it will reset due to low current. WiFi and RF telemetry takes a lot of power, so make sure you feed it well.

In addition, recommend that the current-sourcing ("C") capacity of the battery should be at least 5x the all-fire current of the igniter, to prevent any chance of the voltage dipping (although the drivers will shut off the deployment load if the voltage drops below 5V, preventing a "brown out"). To get that number, multiply the capacity in mAH by the "C" number of the battery. For example, a 300 mAH battery rated at 20C will easily put out 6,000 mA, or 6A. If your igniter is

rated for 750 mA all-fire current,  $5 \times 750 = 3750$  mA, so that 300 mA/20C battery that can put out 6,000 mA would be just fine.

Regardless of what kind of batteries you choose, **charge or swap out your batteries before every session, and check the voltage with a digital voltmeter before every flight.** The voltage/percentage meter on the Status page is a guideline to tell you about how much battery you have left, but it's not as accurate as a decent DVM. You don't want to spend all the time to find the "perfect" battery combination for your 54mm minimum-diameter Mach-buster only to realize after you dig it out of the ground after lawn-staking it that you forgot to charge the battery.

Now, you may be wondering what happens if your igniter fires and causes a "dead short". We've seen that happen a few times, interestingly enough with very low current ematches, probably because their wires are very close together so any mechanical thrashing about after firing can cause the wires to touch.

Unlike deployment controllers that use FET's on the output, the "smart" drivers in the Quasar provide current-limiting to the output igniters, generally around 10A. Especially with a LiPo, this helps prevent dead-shorts from damaging the battery and/or the output drivers. The drivers will also shut off the outputs if the input voltage drops below 5V, which prevents the dreaded "brownout" (which causes the altimeter to reset when the input voltage drops too low). Unlike other altimeters, the Quasar doesn't have a large "brownout capacitor" on the power... it doesn't need one. We've intentionally dead-shortened the Quasar's outputs in testing, with no harm to the Quasar at all.

If you're using an ematch, you only need to set the deployment on-time to ONE second... if they don't fire in a few hundred milliseconds they probably won't fire at all. If you're using a hot-wire (for example, to cut a cable tie or nylon fishing line) you'll need to experiment with the on-time. You're going to want to do this on the ground, of course... flight-time is NOT for experimenting with your deployment parameters!

## About the Quasar's GPS and Telemetry Transmissions...

Besides the 3-output flight computer capabilities, the other major function of the Quasar is to send out GPS data and altimeter-related telemetry. The GPS data is compatible with the Eggfinder LCD receiver, which will display the GPS coordinates on the screen as they are received. When armed for flight, you will also see the real-altitude and deployment channel status on the Eggfinder LCD's screen.

GPS data is transmitted to the Eggfinder LCD receiver as follows:

- 1) Continuously when you power on the Quasar, UNTIL you connect to the Status Page
- 2) When you first connect to the Status Page it will send out ONE GPS location packet to the LCD receiver, and another one every time the Status Page is refreshed
- 3) CONTINUOUSLY after you arm the Quasar for flight
- 4) When the Quasar detects landing, depending on how you configure the buzzer (for example, if you turn on the apogee beep-out it will send out a GPS location packet during the pause after the apogee beeps).

If you have used Eggfinder TX or Mini GPS transmitters, you are probably used to seeing the GPS data transmitted continuously from the time you connect the battery until you power it off, and the GPS location on the LCD receiver screen updated once per second. We've tried to emulate that as much as possible with the Quasar, however due to the limitations of the processor it can't listen for browser input from your phone AND listen to the GPS at the same time. So, every time you refresh the Status Page, the GPS is read once and the fix is displayed on the Status Page and the packet is sent out to the LCD receiver. This allows you to see the status of the GPS fix, so you will know that you have a good GPS fix before you arm for flight.

That also means that even if you get a fix, you will probably see the LCD receiver time-out as if it had "lost" the fix. This is to be expected, since the Quasar is only sending out a GPS packet to the LCD receiver when you refresh the Status Page, or once every 60 seconds if the Status Page times out. If you're used to the continuous "beep" from the LCD receiver from the TX/Mini transmitters, it may be a little disconcerting when it appears to drop after only getting one GPS packet. Be assured that if you see a good fix on the Status Page, you'll also see a good fix on the LCD receiver's screen too.

Note that when you arm your Quasar for flight, it WILL send out the GPS packets once per second, just like the Eggfinder TX and Mini transmitters, and it will keep sending out these packets throughout the flight until landing. After landing, the behavior will depend on how you have set the buzzer... see that section later in the manual.

(Note that the Quasar's predecessor, the Eggtimer TRS, only sent out GPS data when it was armed for flight... the processor did not have the ability to read/decode the GPS data and display it prior to arming. Being able to see the GPS status before arming was one of the major design objectives of the Quasar over the TRS).

## Using your Quasar

What sets the Quasar apart from other hobby rocketry flight computers is that it doesn't use any switches, jumpers, or cables to configure or download flight data. It's all done over a WiFi connection to your handheld device, using a common Internet browser. The pages have been written very simply so that they do not require Java, Javascript, .NET, or any other scripting language to operate... they're all just simple HTML 1.1. The pages are simple text with minimal formatting, and while they may not be particularly pretty they are very easy to read, and they render virtually the same on every browser and platform we've tested.

### About Browsers and OS's...

All of the Quasar's functions will work almost identically with just about any browser that you use. Because of the differences in the way that browsers display things and handle downloaded files, however, you may find that one browser works better than another with your particular platform. Interestingly enough, some browsers are much faster than others... generally the ones that are provided by the vendor. Go figure...

Individual notes regarding browser compatibility and device issues are in Appendix D.

### Connecting to Your Quasar

Each Quasar has its own WiFi SSID network name, which is going to look something like

**Quasar\_1a2b3c**

The last 5 or 6 characters are derived from the unique MAC address of the Quasar's WiFi module, so they're pretty much unique. The Quasar uses the WPA2-PSK WiFi connection protocol, so you need to enter an 8-digit passkey to connect. The passkey is also derived from the MAC address, so it's different for each Quasar. The passkey for your Quasar is on a label on the WiFi module's packaging that you got when you built it. If you accidentally lose it, you can also get it by connecting an EggTimer USB-TTL data cable to the programming header. See the Appendix for instructions on how to do this. We recommend that you put a label on top of the WiFi module with the passkey, or on the side of your rocket... you'll be glad you did at some point.

To connect to your Quasar, hook up the battery and wait about 10 seconds for it to initialize. You'll hear some beeping as it goes through its self-test, and at the end of the beeps it should be discoverable over WiFi. Go to the WiFi Settings on your handheld device, and browse the wireless networks. You should see your Quasar listed as something like "Quasar\_1a2b3c". Choose that network, and enter the 8-digit passkey when prompted. Hint: When asked, be sure to check "save the password" and/or "connect automatically when in range". This will keep you from having to do this every time. Note that if you have multiple Quasar's you might NOT want to save the passkey... keep it handy by using a memo pad app on your device.

Open up your browser. If your home page is something on the Internet, you're gonna get a "Page can not be displayed" message because you're connected to your Quasar, not the Internet. That's OK and normal. Set your browser to the Quasar's home page:

### **192.168.4.1**

and you should see the Status Page. At this point, you should Bookmark this page so you don't have to re-enter the address every time... you're going to be going here a lot.

## **The Status Page**

The first thing you will see is the Status Page. It tells you what your Quasar is doing, and gives you some other important information:

- Device Name/SSID (important if you have more than one of them in your rocket!)
- Regulatory domain, Frequency and ID (if applicable)
  
- Arming Status: Armed or Disarmed
- The current validation code (it changes every 60 seconds that you're idle)
- A text box to enter the validation code into for arming
- An "ARM" button for arming (once you type in the validation code)
  
- Deployment channel status, settings, and link to change the settings (see below)
- Deployment channel "Change" links – for changing deployment channel in-flight settings
  
- GPS status and location information if you have a fix
  
- Battery voltage, and battery percentage remaining (within about 5%)
- Above-Sea-Level (ASL) altitude
- Temperature

At the bottom of the page there will be some links...

- Settings – takes you to the Global Settings page
- Flights – takes you to the Flight Select page, for displaying saved flight info

|                          |                                |
|--------------------------|--------------------------------|
| Quasar_C12794            | 1.02S                          |
| USA/Canada               | 915                            |
| ID:                      | 0                              |
| Flight Status:           | DISARMED                       |
| Validation Code:         | 1234                           |
|                          | <input type="text"/>           |
| <b>REFRESH</b>           |                                |
| Drogue Delay:            | 0.0 sec <a href="#">Change</a> |
| Drogue Status:           | ON                             |
| Main Altitude:           | 500 <a href="#">Change</a>     |
| Main Status:             | OFF                            |
| AUX Mode:                | OFF <a href="#">Change</a>     |
| GPS Status:              | No Fix Yet                     |
| Battery:                 | 8.27 90%                       |
| ASL Alt:                 | 696                            |
| Temp:                    | 72.3                           |
| Mins Since Power-On:     | 2                              |
| <a href="#">Settings</a> | <a href="#">Flights</a>        |

Each of the three deployment outputs has a CHANGE link next to it, this is how you get to the settings for that channel. In the case of the AUX output, the default is for it to be OFF; you click on the CHANGE link to set it to act like a Drogue, Main, or Airstart timer output, once you do that you'll see an OPTIONS link that you can click for the function-specific settings for the AUX channel.

Depending on what you have hooked up to the deployment channels and how it's powered, you may see the deployment channel status displayed in different colors. The colors are:

- Silver – Status does not affect arming (channel turned off, for example)
- Aqua - Good deployment status, i.e. channel is enabled and you have continuity
- Red – No continuity on enabled channel, arming not possible

In our example above, the Drogue channel has continuity so it's aqua, the Main channel does not have continuity so it's red, and the AUX channel is turned off so it's grey.

The Quasar updates the deployment status every time that the page refreshes. If you leave the page alone, it will refresh every 60 seconds. When it refreshes, you'll hear a little beep from the speaker... this also lets you know that you've got power and are connected to your Quasar. In addition, every time the page refreshes a new validation code is created. You can force a page refresh by hitting the refresh icon on your browser, or by clicking on the ARM (or REFRESH) button without entering a validation code or entering an invalid validation code.

The GPS location on the Status page is updated every time that you refresh the page, note that it may take a second or two for the page to appear when you refresh it while it's waiting for the latest GPS data. If you haven't got a satellite fix yet, you'll see **NO FIX YET** highlighted in yellow; once you get one, you'll see the status change to **NEW FIX** in aqua, along with the latest GPS fix data and some quality of fix data and the time since the last fix. Note that if you forgot to put the jumper on the RUN header it won't be able to read the GPS data... you'll see the status as **NO GPS FEED** highlighted in red.

### Arming Your Quasar

In order to start a flight, you need to arm the Quasar. For safety reasons, the Quasar will not self-arm; that is, you must go to the Status page and arm it for the flight sequence to begin. This is different than most other flight computers, which will go into an arming sequence a short time after powering up, assuming that the continuity is OK. The Quasar is a little bit different because it's assumed that you're not using a power switch so you are basically using the arming sequence as a remote switch. This is the reason why we have the dual-ended switching architecture; it ensures that your igniter is essentially "dead" until the Quasar has been armed AND you have a flight in progress AND the first output event occurs. Deployment power is OFF until that happens.

Before you can arm the Quasar, any enabled deployment channels must be in a flyable status. This means that if a channel is enabled there must be continuity; if any enabled channel fails the continuity test then you will not be able to arm your Quasar. You can tell very easily from the Status page if it's ready to fly, because either or both of the failed channels will have the continuity status highlighted in RED. Note that this applies to igniters but not servos; servos will display a grey SERVO status in the continuity area, since there is no continuity check on them. Also, if you have turned a channel OFF you will not see an continuity status, since it's irrelevant as far as arming goes.

To arm the Quasar, enter the 4-digit validation code into the text box then click on the ARM button. After about 5-10 seconds you should see an arming confirmation page:

|                |              |
|----------------|--------------|
| Quasar_C12794  | 1.02S        |
| Flight Status: | <b>ARMED</b> |
| Drogue Status: | <b>ON</b>    |
| Main Status:   | <b>ON</b>    |
| AUX Status:    | <b>OFF</b>   |
| Battery:       | 8.27 90%     |

This page is a truncated version of the status page, but the status is changed to “ARMED”, it doesn’t have the validation code/box, and only the channel continuity status and the battery voltage are displayed. A few seconds later you should start hearing the buzzer beep the “I’m ready” sequence... it beeps several times a second approximately every two seconds. It sounds a bit like Morse code, however it is not. This is an audible confirmation that the Quasar is now in flight sequence mode, and you’re ready for launch.

At this point you should **CLOSE** the browser window on your handheld. We also recommend that you turn OFF your handheld device’s WiFi interface, since you don’t need it at this point... unless you go to reconnect to disarm it (see below).

**IMPORTANT:**

**NEVER “SWIPE” YOUR QUASAR PAGES TO “CLOSE” THEM... YOUR DEVICE LEAVES THEM OPEN. GO TO THE “x” AND ACTUALLY CLOSE THE PAGE. SIMILARLY, DO NOT REFRESH A PAGE USING THE BROWSER’S REFRESH BUTTON, IT WILL RESUBMIT THE PAGE AND IT IS POSSIBLE FOR UNINTENDED CONSEQUENCES TO OCCUR.**

### Disarming Your Quasar

Until the flight actually starts, the Quasar will be listening for activity from your handheld. If you refresh the page you will see a page similar to the arming confirmation page, but with a validation code, text box, and “DISARM” button, as shown below:

|                  |                      |
|------------------|----------------------|
| Quasar_C12794    | 1.02S                |
| Flight Status:   | <b>ARMED</b>         |
| Validation Code: | 1234                 |
|                  | <input type="text"/> |
|                  | <b>DISARM</b>        |
| Drogue Status:   | <b>ON</b>            |
| Main Status:     | <b>ON</b>            |
| AUX Status:      | <b>ON</b>            |
| Battery:         | 8.27 90%             |

This allows you to abort the flight sequence in case you have an issue, i.e. you burn an igniter and the rocket doesn't launch. In that case, you should perform a disarm prior to inserting a new igniter, then re-arm it afterwards. Note that refreshing this page will halt the flight sequence for about 5 seconds while it performs processing and updates the statuses, which is why you should close the browser on your handheld after arming. Closing the browser window after arming helps to prevent potential interruptions to the flight sequence. Note that if you refresh the Disarm page without entering a validation code it will force a deployment status and battery check; this is OK if you intentionally want to do this, but remember that it also halts the flight sequence for about 5 seconds, so don't do it right before launching, and close the browser when you're done.

See the section titled "Flying With Your Quasar" for a further discussion of flight events.

## **Auto-Arming**

The Quasar was designed so that by default it won't arm automatically when you power it up, however there may be some cases in which you DO want to have it arm after powering it on. For example, you may have multiple electronic devices in your rocket, and you want to simplify the pre-launch procedure by having all of them arm by powering on screw switches. To accommodate this, the Quasar can optionally auto-arm. To turn this feature on or off, simply go into the Settings page and select the desired value of the Auto-Arm parameter. "ON" will cause the Quasar to auto-arm after power-on, "OFF" will return it to the default remote-arming behavior.

When Auto-Arm is enabled, you will hear a short "blip" beep from the buzzer every 5 seconds after power-up, lasting for 60 seconds. This is your "getting ready" notification. After the 60 seconds is up, the Quasar will go into the normal arming sequence, i.e if all enabled outputs pass the continuity check you'll hear the "I'm ready" beeps every two seconds, if it's not ready then you'll get a continuous beep that lets you know in no uncertain terms that you should not fly.

At any time during the 60 second waiting period, or if you get the "not ready" tone, you can override the sequence by simply connecting to the WiFi page. That will give you the normal Status Page, and will allow you to change any flight parameters, or to see what may have been preventing it from arming. Afterwards, you can either arm manually, or you can power-cycle your Quasar and it will begin the auto-arming cycle again.

# The Deployment Flight Settings Pages

Each of the deployment channels has a specific purpose:

- Drogue – Deploys a recovery device near the apogee of flight
- Main – Deploys a recovery device at a specified altitude during descent  
OR  
Deploys a recovery device if the FailSafe conditions are met
- AUX – Drogue Mode: Deploys a recovery device near the apogee of flight  
OR  
Main Mode: Deploys a recovery device at a specified altitude during descent  
OR  
Airstart Mode: Triggers at a specified time after launch detect

## Drogue Settings

The Drogue Settings page is accessed by clicking on the “Change” link next to the Drogue status on the Status page. When you click on the link, you’ll see this page:

|                                                    |       |
|----------------------------------------------------|-------|
| Quasar_1a2b3c                                      | 1.02S |
| Drogue Delay                                       |       |
| <input type="text" value="0 sec"/>                 | v     |
| Drogue DMode: <input type="text" value="Igniter"/> |       |
| Drogue Pulse: <input type="text" value="1 sec"/>   |       |
| <input type="button" value="Submit"/>              |       |

### Drogue Delay (OFF, 0-3.0 by 0.1 sec, 4-30 sec by 1 sec)

The purpose of this setting is to set the delay from nose-over for firing the drogue, or to turn it off completely. For most dual-deployment flights, you’ll probably want the drogue to fire as close to apogee as possible, in the Quasar this would be approximately one second after apogee. That’s what we call “nose-over”, since it’s pretty much guaranteed that your rocket is pointing downward.

In general, if you're using dual-deployment then you should set this to ZERO. If you aren't using the drogue channel (for example, you're using motor-deploy for the drogue) then set it to OFF. The other settings are designed for delaying the drogue using the Quasar as a backup deployment controller in a dual-controller redundant setup, or for special-purpose uses (i.e. the 5-second setting is designed for ejecting ARLISS CanSats). Typically, the backup controller will have the drogue setting delayed slightly from the primary controller, so that if the primary controller fails the backup will fire and deploy the drogue. You should model your flight with a program such as OpenRocket or Rocsim in order to determine the best delay setting, you want to make sure that the rocket won't be going too fast before the backup controller deploys the drogue. Typically, 1.0 to 1.5 seconds is adequate.

To change this setting, click on the drop-down list and scroll to the setting that you wish to set. Depending on your browser/OS, you will either click on it or click a "Done" button to select it. Click on the Submit button to save it, and you will be returned to the Status page.

### **Drogue DMode (Deployment Mode)**

**DMode: Igniter or Servo**

**Igniter On-Time: 0.1-3.0 secs by 0.1 secs, 3-9 secs by 1 sec.**

**or**

**Servo Skew: See discussion below**

You can change the Drogue so that it turns on for a specified amount of time when triggered (as it would be with an igniter or hot-wire) or so that it's pulse-width modulated (for hobby servo use). For Igniter mode, you can change the on-time from 1 to 30 seconds. For Servo mode, you can select any of 8 different rotation and skew (amount of rotation) modes.

When you're using igniter mode, you only need to set the on-time and you're good. For most ematches, 1 second is fine... they typically fire in a few dozen milliseconds. The longer times are appropriate for hot-wire deployments or other special purposes... you'll probably know if you need to use them. Note that all deployments are disabled on landing detection.

### **About Servo Mode**

Servo mode assumes that the servo is going rotate to the selected position relative to the zero-degree center position when actuated, and it's going to rotate in the opposite position by the same amount when reset. Typically, you're going to use some kind of trap-door or pull-pin mechanism, and there needs to be some way to close the door or reset the pin before you fly. That's done with the Test Menu... more on that in the Appendixes.

The servo pulses are sent for 2 seconds, which is plenty fast enough for any servo. Once the two seconds are up, no more servo pulses are sent, so the servo basically stays where it is, at the end of its selected travel.

Direction/Skews are in relation to the center point of the servo's travel. Ideally, a servo would have 180 degrees of travel, so full counter-clockwise (CCW) would go 90 degrees to the left, and full clockwise (CW) would go 90 degrees to the right. The reality is that many servos do not have 180 degrees of travel, so we label them by percent of travel which is ALWAYS related directly to the standard pulse-width of the servos.

This label is the “Set” direction of the servo, i.e. the direction/skew that it will rotate when triggered during deployment. The opposite direction/skew is the “Reset” direction, that’s what you will normally use in the Test Menu.

Values are:

100% counter clockwise (CCW)

75% CCW

50% CCW

25% CCW

25% (CW)

50% CW

75% CW

100% CW

**Important Note:** If you change a channel from Igniter to Servo mode (or back), the servo direction/skew or igniter on-time settings will NOT be changed. These settings are dependent on the mode that you choose. You **MUST** click on the Submit button to change the mode, **THEN** you need to go back into the Settings menu and select the proper on-time or direction/skew. This is because web pages are written when the page is first loaded, so any change you make to that page that’s dependent on another setting requires the page to be reloaded.

## Main Settings

The Main settings are accessed by clicking on the Change link next to the Main status. When you click on the link, you’ll see this page.

|                   |           |
|-------------------|-----------|
| Quasar_1a2b3c     | 1.02S     |
| Mail Altitude     | 500 v     |
| Main DMode:       | Igniter v |
| Main Pulse:       | 1 sec v   |
| Failsafe Veloc:   | OFF v     |
| Failsafe Time ms: | 1000v     |
| <b>Submit</b>     |           |

## **Main Altitude (OFF, Nose-Over, Failsafe Only, 100-500 by 50', 600'-3000' by 100')**

This setting allows you to set the descent altitude at which the Main chute deploys, or to turn it off if you're not going to be using it. You can set it from 100' to 500' in 50' increments, and 600' to 3,000' in 100' increments. You can also set it to deploy at Nose-Over, just like the Drogue with a delay of zero seconds. This is for the ARLISS folks... you set the Main to fire at Nose-Over, and the Drogue to fire at Nose-Over + 5.0 seconds, deploying your CanSats. If you don't know what that's about, check it out at [arliss.org](http://arliss.org) ... it's very cool stuff.

The Main altitude that you use depends on a lot of things: the size and layout of your flying field, how much wind is present, how many trees there are around you, the size of your rocket, and not the least, how far you're willing to walk to retrieve your rocket. 500' is the default setting when you first power up your Quasar, it's adequate for probably 80% of all flights. If your field is smaller, you're going to want to take that down a bit, so your rocket doesn't drift as far when the Main is deployed. If you have a big project, you may want to turn that up a bit, since you may not want a larger rocket deploying that close to the ground. If you're not sure what setting to use, ask your buddies at the field... it's guaranteed that they will have an opinion on the subject!

To change this setting, click on the drop-down list and scroll to the setting that you wish to set. Depending on your browser/OS, you will either click on it or click a "Done" button to select it. Click on the Submit button to save it, and you will be returned to the Status page.

We'll discuss the Failsafe Only option later...

## **Main DMode (Deployment Mode)**

**Mode: Igniter or Servo**

**Igniter On-Time: 0.1-3.0 secs by 0.1 sec, 3-9 secs by 1 sec.**

**Servo Skew: See previous discussion**

You can change the Main so that it turns on for a specified amount of time when triggered (as it would be with an igniter or hot-wire) or so that it's pulse-width modulated (for hobby servo use). For Igniter mode, you can change the on-time from 1 to 9 seconds. For Servo mode, you can select any of 8 different rotation and skew (amount of rotation) modes.

The operation is identical to the Drogue Mode, except of course it applies to the Main channel. Also like the Drogue channel, the Main channel is shut off at landing detection. If you select a very low Main altitude (say, 100') and a very long Main on-time (say, 9 secs.), it may be shut off before that on-time threshold is reached. There's no point triggering the chute if you're already on the ground...

## The FailSafe Options

Almost everyone who's had enough electronic-deployment flights has had a flight end badly because of a drogue deployment failure. Some common failures are:

- Motor eject charge fires late, or doesn't fire at all
- Drogue gets stuck in the body tube
- Jammed AV bay coupler
- Insufficient pyro charge to separate the payload bay
- Shear pins a little bit too strong and the payload bay doesn't separate
- Shorted or bad ematch doesn't fire
- Just plain bad luck or you're cursed by the rocket gods

All of these have the same effect... your rocket starts free-falling from apogee and ends up picking up a lot of speed. Sometimes your Main chute will fire at the preset altitude, but this can be a double-edged sword: the high-speed chute deployment can tear up the chute, possibly zipper the body tube as the force of the deploying chute jerks against the shock cord, or it can tear the shock cord right out of the mount if it's glued in. All of these result in damage to your rocket, ranging from minor to catastrophic depending on how lucky you are.

FailSafe helps prevent this from happening by firing the Main chute if you exceed a specified velocity for a specified amount of time after nose-over. For example, if you expect your drogue chute to slow the rocket to 70 ft/sec you might set FailSafe to detect a fall of 100 ft/sec for over one second. In the event that your Drogue fails, the Main will fire at some point much closer to apogee, at a velocity that is much less likely to cause catastrophic damage to your rocket. Yes, your rocket is going to drift a lot more than it would with a successful dual-deploy, and it may even sustain some damage during the higher-than-normal main chute deployment, but at least you'll get it back to figure out what happened, instead of having to get out the shovel and dig it out of the dirt, or spend an hour looking for the parts that scattered about when the Main deployed at 400 ft/sec. at 500' AGL.

**Failsafe Veloc.: OFF, 50 to 200 fps by 25 fps (default OFF)**

**Failsafe Time ms: 500 to 3000 ms. by 250 ms. default (1000)**

We recommend 125 ft/sec for 1000 ms (one second) as a good starting point. Most rockets will hit this threshold 4-5 seconds after apogee, unless it's a very light rocket. If you're flying drogueless you can expect the rocket to fall somewhat faster, so you may want to turn up the velocity threshold a bit, because you don't want FailSafe to fire the Main if you're intentionally coming down "hot". You can estimate how fast a drogueless rocket is going to fall by using RocSim or OpenRocket and simulating a drogue chute with the same area as the cross-sectional area of the rocket. In fact, we recommend that you sim ALL HPR flights... it's easy and fun too.

## AUX Channel Settings

The AUX channel can be configured to be a second Drogue channel, a second Main channel, or as an Airstart output, that triggers on the way “up” after a timer has expired. To change the AUX channel’s function, click on the Change link on the status page... you’ll see this page.

|               |       |
|---------------|-------|
| Quasar_1a2b3c | 1.02S |
| AUX Mode      |       |
| OFF v         |       |
| Submit        |       |

### **AUX Mode: OFF, Drogue, Main, Airstart (default OFF)**

OFF does just that... it turns the AUX channel off so it doesn’t do anything. If you’re not using it, you should turn it off... otherwise, you won’t be able to arm your Quasar because it won’t have continuity.

Drogue behaves exactly like the Drogue channel... all functions are identical.

Main behaves like the Main channel, except that the Failsafe function is not supported.

Airstart fires that channel at a selected time after launch detect, it is typically used for “airstarting” second stage or clustered motors in flight. More on that later.

### The AUX Mode Screens

When you select an AUX mode (other than OFF), you’ll see the mode and its status on the status page. You’ll also see an Options link... that allow you to change the mode-specific settings for the AUX channel.

### **AUX Drogue Mode:**

|                      |       |
|----------------------|-------|
| Quasar_1a2c3c        | 1.02S |
| AUX Delay            |       |
| 0 sec v              |       |
| AUX DMode: Igniter v |       |
| AUX Pulse: 1 sec v   |       |
| Submit               |       |

These functions are identical to the same-named functions on the Drogue channel... we won't repeat the long and boring description of them here.

### **AUX Main Mode:**

|               |           |
|---------------|-----------|
| Quasar_1a2b3c | 1.02S     |
| AUX Altitude  |           |
|               | 500 v     |
| AUX DMode:    | Igniter v |
| AUX Pulse:    | 1 sec v   |
| <br>          |           |
| Submit        |           |

The Main mode screen for the AUX channel is nearly identical to the Main channel, however there are not Failsafe settings; you really wouldn't want to have two Failsafe's on the same flight. Otherwise the settings are identical to the Main channel so we're not repeating them.

### **Airstart Mode**

|                  |          |
|------------------|----------|
| Quasar_a1b2c3    | 1.02S    |
| Airstart Timer:  | 0.3 v    |
| AUX Min Alt:     | OFF v    |
| AUX Min Vel:     | OFF v    |
| AUX Vel Chk:     | @Timer v |
| AUX Pulse Width: | 1 sec v  |
| <br>             |          |
| Submit           |          |

These settings control the AUX channel in Airstart mode. This is a description of the settings, we're not going to go into a discussion of how you might want to use them in an actual airstart... for that, we recommend that you download the Eggtimer Quantum Airstart Guide, which can be found on the Eggtimer Rocketry web site under the Eggtimer Quantum Support page. The airstart settings for the Quasar are nearly identical to the Quantum, so this guide applies to both.

**Airstart Timer: 0.3-3.0 secs by 0.1, 3.2-9.8 sec by 0.2 sec, 10-30 sec by 1 sec (default 0.3 sec)**

This is the delay from launch detect to when the airstart channel is triggered.

**AUX Min Alt: OFF, 300-3000 by 100', 3200-9800' by 200' (default OFF)**

This is the minimum altitude that must have been attained by the rocket when the airstart trigger's timer ends. If the rocket isn't at least as high as this altitude, the channel will not fire. This is typically done as an off-axis protection... if you're not going straight up, you might not achieve this altitude. You need to do a good simulation of your flight to find this value... we recommend setting it to 80% of your simulated altitude@time. You can also turn it OFF, if you are using another off-axis mechanism or you choose not to use one.

**AUX Min Vel: OFF, 100-1000 fps by 50 fps, 1100-2000 fps by 100 fps (default OFF)**

This is the minimum velocity that the rocket must have attained when the airstart timer ends. If the rocket never hits this velocity, the airstart channel will not fire. This is also an off-axis protection, similar to the Minimum Altitude check.

**AUX Vel Chk: @Timer, Anytime (default @Timer)**

This controls when the velocity check can occur, you can set it to @Timer which is a one-time check when the timer expires, or Anytime, which means that if the velocity has hit the threshold at any time in the flight then the check will be accepted. You might want to do the latter if you were going to have a long coasting period for your sustainer... see the Eggtimer Quantum Airstart Guide for an extended discussion of this.

**AUX Pulse Width: 1-9 sec (default 2 sec)**

This is the width of the pulse. If you're using an ematch or a dipped ematch as your airstart motor igniter, we recommend setting it to 1 sec; if you're using a higher-current igniter, you may want to set this to a larger value.

## The Global Settings Page

The Global Settings page is used to change settings that are either hardware-specific or are not generally changed from flight to flight. You get into this page by clicking on the “Settings” link on the Status Page:

|                             |                      |
|-----------------------------|----------------------|
| <b>Quasar_a1b2c3</b>        | <b>1.02S</b>         |
| <b>Global Settings</b>      |                      |
| <b>Launch Detect Alt:</b>   | <b>200 v</b>         |
| <b>Launch Samples/Sec:</b>  | <b>20 v</b>          |
| <b>Descent Samples/Sec:</b> | <b>2 v</b>           |
| <b>Auto-Arm:</b>            | <b>No v</b>          |
| <b>Name:</b>                | <input type="text"/> |
| <b>Submit</b>               |                      |
| <b>Hardware</b>             |                      |

### Launch Detect Altitude (LDA)

**Range: 50'-500' by 50' (default 200')**

This setting allows you to select at what altitude the Quasar decides that a valid flight has started. The 200' default is good for most flights. However, there may be some cases in which you may want to turn it up, and some very special cases in which you may want to turn it down.

If your flying site is subject to wind gusts, you may want to turn it up a bit so that when the wind gust subsides the decrease in pressure isn't viewed as the rocket ascending. That's not likely to happen, however, because we filter the readings to prevent this (and other similar occurrences). You may also want to turn it up if you increase the Launch Samples per Second.

If you have a very low flight you may want to turn it down, although generally we don't recommend it.

## **Launch Samples per Second**

**Range: 10,15, 20, 25, 30, 33 samples/sec. (default 20 samples/sec.)**

This setting allows you to select the number of samples per second that are taken from the time that you arm the Quasar until it detects nose-over. The default setting (20 samples per second) is adequate for most flights. However, there may be reasons why you want to turn it up or down. For example, if you have a very short-burn motor (like a CTI V-Max) you may want to turn it up to 33 samples per second to make the velocity and acceleration figures more accurate. If you have a very long-burn motor you may want to turn it down to 15 samples per second, although 20 should be fine. Note that increasing the sample rate decreases the amount of memory... more on that later.

## **Descent Samples per Second**

**Range: 1, 2, 4, 5, 8, 10 samples/sec. (default 2 samples/sec.)**

The setting allows you to select the number of samples per second that are taken after nose-over is detected. When you're coming down, you're generally not going to be going very fast relative to your velocity going up, even if you freefall for a few seconds and the FailSafe kicks in. Consequently, there's really no reason to have the same high rate of sampling that you use for the ascent part of the flight. Reducing the sampling rate after nose-over saves a lot of memory, and allows you to record longer flights. For most flights, the default 2 samples/sec. rate is fine.

## **About Sampling Rates and Memory Usage**

At this point you may be wondering about how long a flight the Quasar can record before running out of memory, and what happens if that occurs. The Quasar saves about 2,000 samples for each flight. When you're sitting on the pad or launched and have not yet reached LDA, the sampling rotates through those memory locations, saving the last reading < 3' AGL as the "start of flight". Once you hit LDA, the recording continues until either 1) the End of Flight benchmark (your rocket hasn't moved for at least 5 seconds) is reached, or 2) the memory wraps around to the start of flight location. In either case, recording stops there (it won't overwrite valid ascent data), but this does NOT affect any pending deployment events... if you run out of memory before the main chute is deployed, it will still be deployed, but you won't see it in the data downloads because it can't be recorded.

Now, you may be wondering how long a flight you can have with "only" 2,000 memory locations. Quite a long one, actually. Let's say that you want to fly to 30,000' and your motor will get you there in 30 seconds. At 20 samples per second, that's 600 samples. That leaves about 1,400 samples left for the "down" part of the flight. At 2 samples per second, that's 700 seconds, or over 11 minutes. You'd have to be coming down at a rate of about 40 ft/sec under drogue to exhaust the memory, there's no way you're gonna be coming down that slow from 30,000' (unless you really like walking a lot). More likely, it's going to be 50-70 feet/sec. Let's say that we come down at 60 ft/sec from 30,000', that's about 500 seconds, or 1,000 memory locations at 2 samples/sec. You'd still have over 400 samples left when you land, nearly 20% of your memory.

If you have an extreme flight, say 50,000', it may take a bit longer to get up there, let's say 45 seconds. That's 900 samples, leaving 1100. If you take the descent sample rate down to one sample per second (reasonable since the events are happening relatively slowly and the air is pretty thin at 50K), you still have 1100 seconds, or over 18 minutes. No way it's gonna take that long to come down, unless for some reason the main comes out near apogee. At a conservative 50 ft/sec average speed under drogue, it's going to take 1,000 seconds, leaving you with at least 100 samples. Remember that at that altitude the air is very thin, so you're going to be coming down faster near apogee than you will be when the air thickens as you descend. It's very likely that you're going to be using a lot less memory than that.

So, as you see, there's plenty of memory for just about any flight scenario if you manage it wisely. For just about any flight under 30,000', just leave it at 20 samples per second for the Launch rate and 2 samples per second for the Descent rate, and you'll be fine.

### **Auto-Arm**

**Values: Yes/No, default No**

This controls if the Quasar will enter the automatic arming sequence after power is applied. See the discussion of auto-arming previously, in the Arming Your Quasar section.

### **Name**

**Text box, default is blank**

This is an 8-character field that is sent out along with the telemetry data. This would typically be used with the 70 cm Ham version of the Quasar, you should put your Ham call sign here, satisfying the FCC's requirement that your call sign must be transmitted "periodically".

## The Flights Link

Clicking on the Flights link takes you to a page that allows you to select a flight for flight milestone display, and download a detailed .csv file that you can use with Excel or other data analysis programs to extract graphs and do other fun things. We'll go into that a bit later...

## Flying with Your Quasar

The Quasar is very simple to operate. In general, a dual-deployment flight with the Quasar will look something like this:

### At your Work Table

- Charge or swap out your battery/batteries and use a DVM or battery checker to check the voltage **DON'T SKIP THIS STEP!**
- Install the battery(s) with the power switch OFF (if used), then secure everything in the AV bay
- Check your deployment settings to make sure they're set the way you want them to be
- Close up the AV bay
- Install your igniters with the deployment power switch off (if used), with NO powder
- Connect to the Quasar and confirm that you have continuity. If you don't, open up your AV bay and figure out why.
- Turn off the deployment power switch (if used)
- Add powder to the charge wells, and finish prepping your rocket

### At the RSO Table

- Get your rocket safety-checked, get your pad assignment, and swagger out to the pad. Note that your Quasar will beep once every 60 seconds that it's powered on, as the web page refreshes. You may need to show your RSO the Status Page on your phone to show him that it's disarmed if he's not familiar with the Quasar, since many Altimeters only beep when they're armed.

### At the Pad

Put the rocket up on the rail/rod, then go to the Quasar's status page. If you're using a power switch, turn it on. Make sure that you have continuity on whatever channels you're using... if you do not, it's going to be easy to tell because the status will be highlighted in **RED**. If it's OK, it will be either **AQUA** or **GRAY**. Make sure that you have a GPS fix too... if you do not, you'll have to wait to arm until you do. Assuming that everything is OK, enter the validation code into the box and click on the SUBMIT box, after a second or two you should see the armed page. Once that happens, **CLOSE THE WEB PAGE**. Closing the page prevents any data from interfering with the flight sequence. Secondly, we also recommend that you **SHUT OFF YOUR WIFI** on your handheld device... that will prevent you from "pocket dialing" your Quasar if for some reason the browser gets launched accidentally.

After a few seconds, you'll hear a few beeps, then after about 10 seconds of silence (as it takes baseline measurements) you'll hear the "I'm ready" beeping. This will sound like Morse code... several beeps, followed by about one second of silence. Once you hear it, you're not going to mistake it for anything else, including another altimeter that you may have in your AV bay. Connect your igniter, test the continuity, then go back to the safety zone to await your flight.

If you're new to dual-deployments, you can see that it's a lot more involved than just stuffing some wadding and the parachute into the tube, popping in the motor, and hooking up the igniter. Multiple deployments require discipline in order to make them work reliably; we've seen way more than our share of failed deployments, on everything from a small mid-power E-size rocket all the way up to an M-sized 200 pound beast. We've seen deployments fail with the top-end flight computers and with the low-cost units, even with redundancy. The reality is that most deployment failures are not the fault of the electronics; it's usually something mechanical like a bad connection, a nose cone that's too tight, a chute that gets stuck in the tube, etc. Having your blood, sweat, and tears free-fall from 10,000' bury itself in six feet of dirt is going to ruin your whole day.

We STRONGLY recommend that you use a checklist every flight so that you don't forget anything. We also recommend that you get a copy of the book Modern High Power Rocketry, it's full of good information too, and subscribing to a forum like The Rocket Forum ([www.rocketryforum.com](http://www.rocketryforum.com)) is a really good idea, too.

### **In the Air...**

Once your rocket is launched, altitude samples are taken at whatever ascent rate you've selected, typically 20 samples per second. These samples are run through a filter to eliminate "noise" that may be caused by a number of different factors, primarily aerodynamic but also some external factors such as wind and temperature.

Velocity readings are computed based on the difference in altitude between successive samples and the elapsed time between the samples. In a perfect world, this would give you a precise and 100% accurate velocity reading. The reality is somewhat different, however. There are several things that can introduce errors into the velocity reading: angle of attack, wind, errors in the pressure readings due to aerodynamic influences, and time differences. If the pressure ports in your payload bay aren't sized properly, this can introduce an error, particularly if they're too big and you have two of them opposite each other (you'll get a crossflow through the payload bay which makes the pressure readings very noisy). Velocity-related events are run through a digital filter to smooth out any sharp peaks or valleys that may develop due to pressure-induced noise.

### **Mach Transition...**

As your motor continues to burn and the velocity increases, if the velocity exceeds 800 ft/sec aerodynamic shock wave buildup can fool the pressure sensor into thinking that the rocket is descending when in fact it is actually ascending at a rather rapid speed. If this were not taken into account, the flight computer might deploy the main parachute at near-mach speed, which would undoubtedly break something and ruin your day, not to mention what an object falling from the sky at these speeds could do.

To prevent this from happening, the Quasar uses a predictive mechanism to hold off deployments until it's safely out of the mach "danger zone". Deployments are initially disabled when the Quasar is armed. When the noise-filtered velocity drops below 100 ft/sec for at least 1 second after the Launch Detect Altitude has been reached, deployments are enabled. Typically, this will be a second or two before apogee, although it may be a little later in some cases (i.e. a very draggy rocket). In any case, it guarantees that your rocket isn't going very fast when the drogue deployment occurs, which is the ultimate goal. This is the same logic that we've used for several years with all Eggtimer Rocketry altimeters, and in several thousand flights we've never heard of a zipper due to an early/late deployment that wasn't due to the rocket going horizontal.

### **Apogee and Nose-Over**

Assuming that your rocket is moving more or less straight up, it will continue to slow down during the coast phase until it gets as high as it's going to go. If the rocket was going absolutely straight up, the velocity at this point would be zero; it would simply start falling to the ground. In reality, this almost never happens, because for safety you usually angle the rod/rail at a slight angle so that the rocket takes off away from the flight line. This results in the velocity disparity that we've previously mentioned. The rocket usually has some forward velocity at apogee; hopefully it's relatively small so your parachute deployment happens at a low velocity and won't cause any mechanical problems like a broken shock cord or a zippered tube. It also means that you really don't know that you've reached apogee until *after* you've been there.

Accordingly, the Quasar fires the drogue parachute at Nose-Over, which we define as one second past apogee (highest recorded altitude). If the rocket is still going up, chances are that its altitude is going to keep increasing before a one second interval elapses, so you're unlikely to get a false apogee detection. If the rocket hasn't gained any more altitude after one second then you must be starting on your way down, so the Quasar fires the drogue at that point, for one second.

When Nose-Over is detected, the Quasar begins using the Descent Samples value for altitude sampling. This setting is very low, typically 2 samples/sec. As the rocket descends, when the altitude drops below the Main deployment altitude the Main channel is triggered, for one second. At this point your Main chute should pop out, to thundering applause and a hearty round of high-fives all around.

### **GPS and Altimeter Telemetry**

While your Quasar is in flight, it's constantly sending out GPS location data and altimeter data at a rate of approximately one location per second. Your Eggfinder LCD receiver will decode this data, and give you the current GPS coordinates, as well as the AGL altitude and deployment channel status. If you switch the LCD receiver to Compass mode, it will show you the compass point and distance to your rocket in flight, so you know which way to look if the rocket goes out of sight.

You can get more information about the operation of your Eggfinder LCD receiver from the Eggfinder LCD User's Guide. See Appendix B for a quick overview of the LCD receiver screens that you can expect to see with your Quasar.

## On the Ground

The Quasar detects that your rocket is on the ground when it stops moving for over 5 seconds. You can configure the buzzer in the Hardware Menu to be OFF at landing, to provide a continuous “siren” tone for locating your rocket, or to have it beep out the maximum altitude. If you configured the buzzer to beep out the apogee, the beeps work like this:

1 Beep = 1  
2 Beeps = 2  
.....  
9 Beeps = 9  
10 Beeps = 0

So, if you fly to 12,360' you will hear:

Long Pause...  
Long Beep... (“I’m going to give you’re the apogee reading...”)  
Short Pause...

1 Beep (10,000')  
Short Pause

2 Beeps (2 x 1000')  
Short Pause

3 Beeps (3 x 100')  
Short Pause

6 Beeps (6 x 10')  
Short Pause

10 Beeps (zero 1' reading)

<10 second pause, then sequence repeats>

The beeps continue until you turn off the power, and also act as a verification that you had a successful flight, but getting your rocket back in one piece pretty much told you that, didn't it?

After the altitude has beeped out, the Quasar will send out a GPS location packet. This is the “final location” of your rocket. If you are within the ground range of the radio (typically a few hundred yards or so) your LCD receiver will pick up this packet, and give you the updated GPS coordinates. If you have the LCD-GPS Module option on your LCD receiver, it will also give you an updated compass direction/distance to your rocket, and update the bearing/distance to your rocket. This final position data can be very helpful if you can't see your rocket... like if you land in a field of crops.

In addition, the WiFi interface will start back up again, and will take you directly to the Flight Summary page for the flight that you just completed. Note that it may take 10-15 seconds to bring up the Flight Summary page after you connect to the Quasar, because it sends out the page after it's done beeping out the altitude or the siren tone, so you have to wait until it goes quiet for a few seconds. You'll also be able to download/view the flight detail too, so if your handheld device has some kind of data analysis program then you can actually look at your flight right after it's on the ground. Pretty cool, huh?

## Post-Flight Analysis

The Quasar saves your last 15 flights, both summary and detailed time/altitude data. Clicking on the 'Flights' link in the Quasar's Status page takes you to an index page that allows you to select the flight that you want to review. Note that each flight has an index number from 1-15, this is the memory location that it's in, and each flight has a Flight number that is sequential from 1 to however many flights you've had with your Quasar. If you fly it enough, you'll probably get to the point at which flights drop off, and the flight numbers won't start with 1 anymore, but the indexes will always be from 1 to 15.

Each entry in the Flight Select page shows the Flight Index, the Flight Number, the Apogee, and a 'More' link that takes you to the Flight Summary page. Note that after you land and while it's beeping out the altitude, it will take you directly to the Flight Summary page for that flight only.

### The Flight Select Page

You can view the last 15 flights by selecting them from the Flight Select page, you get there by clicking on the "Flights" link from the Status Page. It shows you the Flight Index (the location in memory, 1-15, "Idx"), the Flight Number (which increments every time you start a flight, "Flt"), the Apogee of the flight ("No Flight" means that there was no flight in that memory location), and a link to display the Flight Summary/Detail for that flight ("More").

|                      |                                          |
|----------------------|------------------------------------------|
| Quasar_a1b2c3        | 1.02S                                    |
| <b>Flight Select</b> |                                          |
| Idx: 01              | Flt: 1 Apogee: 2201 <a href="#">More</a> |
| Idx: 02              | Flt: 2 Apogee: 3569 <a href="#">More</a> |
| Idx: 03              | Flt: No Flight                           |
| Idx: 04              | Flt: No Flight                           |
| Idx: 05              | Flt: No Flight                           |
| Idx: 06              | Flt: No Flight                           |
| Idx: 07              | Flt: No Flight                           |
| Idx: 08              | Flt: No Flight                           |
| Idx: 09              | Flt: No Flight                           |
| Idx: 10              | Flt: No Flight                           |
| Idx: 11              | Flt: No Flight                           |
| Idx: 12              | Flt: No Flight                           |
| Idx: 13              | Flt: No Flight                           |
| Idx: 14              | Flt: No Flight                           |
| Idx: 15              | Flt: No Flight                           |
| <a href="#">Exit</a> |                                          |

## The Flight Summary Page

The Flight Summary page gives you a lot of information about what happened during your flight... flight “milestone” information including elapsed time for each event, settings, and static data (such as launch temperature).

Quasar\_a1b2c3 1.02S

### Flight Summary

Flight No.: 1

Flight Status: Landed

Apogee....2201

Time to Apogee...12.40

Max Velocity....429 (Est.)

Time to MaxVeloc...2.80

Avg Accel(G)....4.76 (Est.)

LDA Alt...212

Time to LDA...1.10

AUX Airstart Alt...659

Time to AUX...2.50

Nose-Over Alt...2159

Time to Nose-Over....13.40

Drogue Alt....2159

Time to Drogue....13.40

Mail Alt....690

Time to Main....35.40

Flight Time....52.40

ASL Alt....130

Temp. F....86.4

### Settings

LDA Alt....200

Launch Samp/sec....20

Descent Samp/sec....2

Drogue delay....0.0 sec

Drogue On-time....2

Main Alt....700

AUX: Airstart  
AUX Airstart Delay...2.50  
AUX Min Alt....OFF  
AUX Min Vel...OFF  
AUX On-Time....2

Failsafe Velocity...OFF  
Failsafe Time....1000

Exit

Detail

**Flight Status** – What the last major event was. Typically it will be “Landed”, but it may be something else if there was an anomaly in your flight.

**Apogee** – What the apogee of your flight was, and the time-to-apogee from launch detect (LD).

(About Launch Detect: Because this is a barometric pressure altimeter, there’s no definitive way to say “yeah, we just hit 5 G’s so we must have launched”. To detect launch, the Quasar uses the last reading below 3’ AGL, after the LDA has been reached. While it’s technically possible that this figure may be a little off, our experience has shown that it’s only off by one or two samples at most... typically under 100 ms.)

**Max Velocity** – The maximum velocity that was reached, and the time from LD. Note that this figure works for “most” flights, but it may be fooled by very high-thrust or very low-thrust motors... again, that’s the nature of baro-only altimeters. That’s why there’s an “(Est.)” at the end... it’s a best-guess estimate.

**Avg Acceleration in G’s** – The average acceleration taken at the point of Max Velocity. As with Max Velocity, it’s relatively accurate for “most” but not all flights.

**LDA Alt** – The actual altitude that exceeded the programmed LDA setting, and the time from LD.

**Nose Over Alt** – The altitude at which the rocket nosed over, typically one second past apogee, and the time from LD.

**Drogue Alt** – The altitude at which the Drogue was fired (if enabled), and the time from LD.

**Main Alt** – The altitude at which the Main was fired (if enabled), and the time from LD.

**FailSafe Alt** – The altitude at which the Main was fired in FailSafe mode, if it was enabled and reached, and the time from LD. Note that this supercedes the Main Alt.

**Flight Time** – The elapsed time from LD until landing detect, which is when the rocket drops below ½ of the apogee and hasn’t moved more than 10’ in 5 seconds.

**ASL Alt** – The Above-Sea-Level reading of your launch site.

**Temp** – The temperature in Fahrenheit at the time of launch. This will be very accurate if the Quasar has been powered on for 10-15 minutes, but will tend to be on the low side if you fly shortly after powering up.

**Settings** – All the flight settings that were selected for this flight.

As you can see, that's a lot of stuff to look at. Particularly right after landing, it gives you a pretty good idea of what happened. For example, we did a test in which we intentionally didn't install a drogue charge and left out the motor eject, and turned on FailSafe as a test. (We don't recommend that YOU do this, though...) We expected the Main to pop 3-4 seconds after apogee, but that didn't happen, instead it came out at about 500' as if there was a drogue. When we looked at the Flight Summary data, it turns out that it never fell fast enough to trigger FailSafe... it was a light Estes rocket on an Aerotech F24, and the drag was enough to slow it down below the threshold.

We've had other flights in which we had FailSafe enabled as a safety measure, and it triggered when we thought it should not have. Turns out the drogueless rocket fell faster than we expected... obviously we should have modeled it better! All of this data can tell you a lot.

## Downloading the Flight Detail

In addition to the Flight Summary data, each altitude sample during flight is saved into memory, and the data can be retrieved and time/event correlated as a standard comma-separated-variable (.csv) file by clicking on the 'Detail' link at the bottom of the Flight Summary page.

A .csv file is basically just a text file, with commas separating each field. Depending on what apps you have on your device, it may do one of three things when you click on the Detail link:

- 1) It may display the data as if it were a text-only web page
- 2) It may open up some kind of application (i.e. Excel if you have a laptop)
- 3) It may just sit there and hang because it doesn't know what to do with it

We generally do NOT recommend that you analyze the data with a smartphone, it's just too danged hard to see. That being said, we HAVE done it with an iPhone after installing WPS Office (the default on an iPhone is to display it as a web page). The advantage is that you can literally get a graph of your flight within seconds after landing. The disadvantage is that the screen is too small to be really useful, even if you zoom in.

Note that it can take some time (over a minute or two in some cases) to download the detail data, because of the "on-the-fly" formatting. When you're downloading the data, the little blue LED on the WiFi module next to the antenna will blink... that's a sign that it's working.

We've had good luck with WPS Office for Android and iOS, it's free and works very well with the simple .csv data that the Quasar sends out, and it's very easy to get a flight/event graph. For a Windows laptop, we use Excel, but any data analysis program that can take a .csv file will work.

Each entry in the flight detail file looks like this, of course there's a comma between each field...

**T** (time) – Seconds from Launch Detect

**Alt** (altitude) – the RAW pressure-derived altitude value from the altimeter

**FAIt** (filtered altitude) – the FILTERED pressure-derived altitude value. This is the filtered value that we use for altitude-dependent events on ascent, such as the airstart minimum altitude.

**FVeloc** (filtered velocity) – the FILTERED velocity for that sample. This is the same calculation that we use for velocity-dependent things on ascent like the airstart minimum velocity.

Following that data are the events. Event data is ZERO unless the sample triggers the event, in which case it's the RAW altitude data, since these events theoretically should occur at a relatively low velocity (sub-mach transition). This format causes a scatter graph of the data to show a little spike where the event occurs, which is a very easy and convenient way of viewing where the event occurred.

**LDA** – Non-zero at the sample when the LDA altitude is first exceeded

**Apogee** – Non-zero at the sample when apogee is reached

**N-O** – Non-zero at the sample when Nose-Over is reached, typically one second past apogee

**Drogue** – Non-zero at the sample when the Drogue is first triggered

**Main** – Non-zero at the sample when the Main is first triggered

Due to the many programs that can be used to view/manipulate this data, we're not going to go into what you should do to graph/view it... we recommend that you check the documentation for your data analysis program for that information. We have a document that shows you how to use Microsoft Excel to view and graph the data... see the Eggtimer Rocketry web site under the Support tab.

## Appendix A – Deployment Channel Testing

The Quasar has some special testing functions built in, in particular you can test the deployment channels with your battery and igniter combination to make sure that when it fires you aren't going to get any nasty surprises (such as the Quasar resetting in flight, or the igniter not firing because the battery can't source enough current).

### Deployment Channel Testing

Whenever you try a new type of igniter and/or battery, you should test them together by doing a deployment channel test. This ensures that your battery and igniter combination will work during a flight... you don't want to find out that there's an issue afterwards!

Note: Do NOT perform tests with a live charge until you have become familiar with this procedure, and are at a safe distance away from the rocket! We recommend 30' to the side... the range of the Quasar's WiFi outdoors is well over 100', so you can step away from your rocket safely while performing a deployment test.

There is a special URL that is used to connect to the test page, which is not accessible from the normal pages. This has been done so that you cannot accidentally put it into test mode while your rocket is sitting on the pad or your workbench.

To get to the test page, set your browser to :

**192.168.4.1/test**

You will see the following page

|                                                          |
|----------------------------------------------------------|
| Quasar_1a2b3c 1.02S                                      |
| Channel Test Select                                      |
| Select v                                                 |
| Validation Code: 3372                                    |
| Test                                                     |
| Drogue: Igniter: On-Time: 1<br>Drogue Status : <b>ON</b> |
| Main Igniter: On-Time: 1<br>Main Status: <b>ON</b>       |
| AUX: Igniter: On-Time 2<br>AUX Status: <b>OFF</b>        |
| Battery: 7.7                                             |

This is pretty explanatory... there's a pull-down to select the channel that you want to test, then you simply enter the 4-digit validation code and click on the TEST button. The channel settings are inherited from the Global Settings page... for example, if you have a channel set to be used in igniter mode with a 3-second firing time then that channel will fire for 3 seconds.

If you set a channel up for servo deployment, it will use the same servo direction and direction/skew that you programmed into Global Settings, but you have the option to SET the servo (rotate in the "on" direction) or RESET the servo (rotate the servo in the opposite direction). The RESET function can be used when you're at your worktable to close up the deployment bay... typically, servo deployments use some kind of trapdoor system so you'll generally need to rotate the servo in the opposite direction to close it up after you pack the parachute. You generally don't want to do this by manually moving the servo's output wheel, since that can strip the gears.

After you enter the validation code and click on the TEST button, you'll see a count down screen from 5 to zero seconds, after which time it will trigger the deployment device. When it's done, it goes back to the Deployment Test page. When you are done with your deployment tests, **CLOSE THE BROWSER PAGE.**

If for some reason you need to abort a test, all you need to do is to **CLOSE** your browser BEFORE it counts down to zero. After you close it, you should open the Status Page; re-opening the test page immediately after closing it may cause it to be resumed from that point, depending on how your browser caches pages.

Note: NEVER do a deployment test with just a piece of bare wire, you need to have some kind of resistive load such as an ematch, igniter, or small piece of fine nichrome wire (#36 or #40, for example). We've designed the Quasar very conservatively, and drivers automatically provide current limiting to help protect the circuitry and your battery. Nevertheless, it is still possible to blow something up if you try hard enough.

**IMPORTANT:**

**NEVER "SWIPE" YOUR QUASAR PAGES TO "CLOSE" THEM... YOUR DEVICE LEAVES IT LEAVES THEM OPEN. GO TO THE "X" AND ACTUALLY CLOSE THE PAGE. SIMILARLY, DO NOT REFRESH A PAGE USING THE BROWSER'S REFRESH BUTTON, IT WILL RESUBMIT THE PAGE AND IT IS POSSIBLE FOR UNINTENDED CONSEQUENCES TO OCCUR.**

## Appendix B – Telemetry and the Eggfinder LCD Receiver

The Eggtimer Quasar sends out a variety of telemetry data during flight, it is easy to decode the data using an Eggfinder LCD receiver.

Data sent by the Quasar includes:

**GPS Data** – NMEA formatted data, which includes GMT time, position, and ASL altitude.

**Altitude** – Baro-based real-time AGL altitude, in 100' increments

**Channel Status** – Status of each deployment channel (Enabled, Disabled, Fired)

**Apogee** – Apogee (reported after landing)

**Device Name** – For 70cm Ham version, sends out your FCC call sign  
(not displayed on the LCD receiver)

### A Note on GPS Data Transmission

GPS data is sent continuously after the Quasar is powered on, UNTIL you connect to the Status Page. Once you connect to the Status Page, it will send an updated GPS packet to your LCD receiver when you refresh the screen, instead of continuously... it has to listen for your browser input, after all. Since the Status Page shows you the status of the GPS data, you can easily verify that you have a good GPS satellite fix. Once you arm the Quasar for flight, GPS and altimeter telemetry data will be transmitted continuously until landing. After landing the Quasar will send out the current GPS location after either the siren beeps or the apogee beeps, depending on how you have the landing buzzer configured; if you turn off the buzzer after landing, the GPS data will be transmitted every second just like it is during a flight.

## LCD Screens and the Quasar

The Eggfinder LCD receiver has three screens:

### **Coordinate Display:**

Displays GPS coordinates and fix quality, and Quasar deployment status and baro-derived real-time altitude

|                  |
|------------------|
| 33.12345 8 DM    |
| -116.12345 12345 |

### **Compass Display:**

Displays Compass direction from a “home point” to your rocket, and the distance. If you have the LCD-GPS Module, that will be wherever you happen to be; if you do NOT have the LCD-GPS Module, it is “set” the first time that you enter this screen. In that case, we recommend that you go into the screen from the launch pad, so you have a fixed point of reference.

|                |
|----------------|
| COMPASS: 263 8 |
| Dist.F: 612    |

**Navigation Display: (with LCD-GPS Module only):**

Displays the direction and distance to your rocket **from the direction that you are currently moving**. If you get into this screen and do not move, the direction may not be accurate... it has to resolve the vector between your path and the location of the rocket.

|             |   |
|-------------|---|
| R 73 →      | 8 |
| Dist.F: 612 |   |

Further details on the LCD displays can be found in the Eggfinder LCD User's Guide, and the LCD-GPS User's Guide if you have that option.

## Appendix C - Using Servos with the Quasar

The Quasar was designed to modulate standard PWM hobby servos, for use with non-pyrotechnic deployments. Typically, these will be some kind of “trap door” mechanism that’s released by pulling out a pin. If you go very high, over 30,000’, pyrotechnic charges lose much of their efficiency, because the reduced air pressure requires a larger amount of generated pressure to achieve the same force against the nose cone (or AV bay, for a drogue). With a trap door, it’s altitude-independent; once you pop the door, the parachute is going to come out.

Also, some very large rockets do not lend themselves very well to pyrotechnic deployments, and minors cannot legally use pyrotechnic deployments. For example NAR TARC teams are allowed to use multiple deployments, but they cannot use pyrotechnics. The Quasar’s servo support is ideal for these scenarios.

We strongly recommend that you power the servos with a separate battery. This prevents any motor-startup current spike from affecting the computer side, and possibly resetting the Quasar. In general, you should use whatever battery you would if the servo was going into a R/C model; most of the time a 600 mA 4.8V or 6V NiCad, NiMH, or LiFe pack will suffice. Some micro-sized servos may also operate from a 1S Lipo. If you’re not sure what battery to use, ask your local hobby shop; they probably know more about R/C servos than you’ll want to hear.

To connect a servo, you need to first identify the 3 leads on the servo:

Power – Provides Positive battery power to the servo (usually red)

Ground – Provides Negative battery power to the servo (usually black)

Signal – PWM signal input to the servo (usually white)

If you’re not sure which lead is which, check with your servo manufacturer’s support web site. Not every servo has the leads in the same order, or using the same colors, but they all use the same three leads.

The QUASAR has special logic-level servo outputs, these are labeled SERVO on the board. They are designed to connect to the SIGNAL line of the servo (typically a white wire). We recommend that you install a 330 ohm resistor in series between the servo control line and the QUASAR output; this protects both the servo and the QUASAR from possible noise glitches.

The GROUND wire of the servo(s) (normally black) should be connected to the “-“ side of the servo battery, and also be tied together to the GND pads on the QUASAR; we have conveniently provided extra pads labeled GND next to the SERVO outputs.

The POWER wire of the servo (normally red) should be connected to the separate servo battery. DO NOT connect it anywhere on the QUASAR!

We also recommend that you connect a 220uF to 470uF electrolytic capacitor between the POWER and GND leads of the servo. This helps filter out the motor noise so it won’t get to the Quasar’s logic. Be sure to get the polarity correct; the “-“ side of most electrolytics is marked, so make sure that lead goes to the GND lead.

At this point, bring up your Quasar, go to Settings and set the channel you're using for servo deployment, then go back into the Settings page and select the direction and skew. You should now be able to go into the Deployment Test page and move the servo. If not, check your wiring.

## Appendix D - Browser Notes

Here are some notes regarding browser compatibility. They may or may not apply to your platform... there are a LOT of different hardware/software combinations, particularly with Android. In general, the manufacturer's browser is usually the best choice, except with Android in which case we recommend Firefox.

### **IMPORTANT:**

**NEVER "SWIPE" YOUR QUASAR PAGES TO "CLOSE" THEM... YOUR DEVICE LEAVES IT LEAVES THEM OPEN. GO TO THE "X" AND ACTUALLY CLOSE THE PAGE. SIMILARLY, DO NOT REFRESH A PAGE USING THE BROWSER'S REFRESH BUTTON, IT WILL RESUBMIT THE PAGE AND IT IS POSSIBLE FOR UNINTENDED CONSEQUENCES TO OCCUR.**

### **Apple IOS**

Newer versions of IOS (since 14.2) may generate a message "weak security" when you connect to the SSID. This is because the WiFi connection uses TKIP encryption, an older version which is highly compatible with just about everything. It won't keep you from connecting, it's just an advisory message.

Also, newer versions of IOS assume that if you have a WiFi connection that it must be to get onto the Internet. This is not true of the Quasar, of course. If you get a message that notifies you that you do not have an Internet connection and asks if you want to connect to your cellular data connection, you need to tell it to "Keep using WiFi".

### **Android**

Newer versions of Android may assume that if you have a WiFi connection that it must be to get onto the Internet. This is not true of the Quasar, of course. If you get a message that notifies you that you do not have an Internet connection and asks if you want to connect to your cellular data connection, you need to tell it to "Keep using WiFi".

We recommend using Firefox with Android instead of Chrome, it seems to be faster.

### **Windows**

If you're using Windows, we recommend that you use Internet Explorer if you can, or Edge. You may also have to change some hardware settings on your WiFi device so that it works with 802.11g connections with TKIP encryption; some updates may change you drivers so that they will only work with newer AES encryption.

### **General Tips**

Once you've armed your QUASAR, CLOSE THE WEB PAGE.

Avoid using the BACK arrow... it may lead to inconsistent results.

If you have trouble maintaining a WiFi connection, TURN OFF cellular data on your phone.

**Use the “private” or “incognito” setting on your browser, so it won’t remember your history.**

Bookmark the “192.168.4.1” home page address, and use ONLY THAT to access your QUASAR’s home page.

## Appendix E – Recovering the Passkey

Like any secured WiFi network, you need two things to connect... the SSID and the passkey. The default SSID of your Quasar will be “Quasar\_nnnnnn” where nnnn is the last 6 hexadecimal digits of your device’s MAC address (a unique address given to every Ethernet device). The SSID is broadcast, so you should be able to see it in your device’s WiFi manager.

The passkey is an eight-digit number generated by a random number algorithm the first time that your Quasar is powered on, and is saved in EEPROM memory at that time. It’s going to be unique for every Quasar. There should be a label on the little baggie that the WiFi module came in with the passkey (you kept it, right?), but it’s easy to get it if you lose it...

To get the passkey, connect a USB-Serial cable (the same cable that’s used with all EggTIMER Rocketry products) to the 3-pin header as follows:

BLACK wire (GND) – GND on the Quasar’s header  
WHITE wire (RXD) – TX on the Quasar’s header  
GREEN wire (TXD) – not used

Using an ASCII terminal program such as TeraTerm or HyperTerminal, connect to the serial port at 9600 baud, 8 bits, no parity, 1 stop bit. Now connect the battery on your Quasar. You should see the following information:

**(a few lines of garbage... part of the boot process)**

```
Quasar v1.02S
SSID: Quasar_F87C6E
PASSKEY:  3718 6501
```

Note that there is a space between the first four digits of the passkey and the second four digits, that’s just to make it easier to read; when you actually enter the passkey don’t type the space.

Disconnect the battery, and remove the serial cable. You won’t need the cable again unless you forget the passkey, or you need to flash the software.

Now, fire up your device’s WiFi manager. Connect the battery to your Quasar... you’ll hear the buzzer beep 3 times then stay on for a second, and in about 10-15 seconds you should see your Quasar’s SSID on your WiFi manager. Connect to the SSID using the passkey that you obtained earlier (but don’t put the space between the digits!), and you should see the Quasar’s status page. You’re now connected to your Quasar, and ready to start using it.

## Appendix F – The Hardware Setup Menu

There is a special menu that allows you to program global setup functions that do not change with flights and are not separately reported. Typically, these functions are accessed once and set, at that point you don't need to go into them again.

To access the Hardware Setup menu, connect to the Quasar using its SSID/passkey, and go to the Settings menu. From the settings menu, there is a button for HARDWARE. Click it, and you will get to the menu.

|                   |        |
|-------------------|--------|
| Quasar_a1b2c3     | 1.02S  |
| Hardware Settings |        |
| Voltage Offset:   | 0.2 v  |
| Tone:             | High v |
| Frequency:        | 915    |
| ID:               | 0      |
| Change            |        |
| SSID:             | -----  |
| Submit            |        |

“Voltage Offset” is the difference between the reported and actual battery voltage. This setting allows you to adjust for difference between the two, due to the voltage drop through the rectifier the reported voltage may be higher than the actual voltage. To determine the correct value, use a DVM to measure the voltage across the battery, then set this value to the difference between your DVM value and what's on the display. For example, if your Quasar reports 8.5V and your DVM says the battery is 8.2V you would set it to 0.3V. The default value is 0.0V.

“Tone” controls the frequency of the buzzer, it is Low, Medium, and High. This allows you to pick out your Quasar from other devices that may be in your AV bay which make similar tones; also, some people find that the lower-pitch tones are easier to hear.

Frequency and ID control the settings of the RF Module's radio output. See the discussion of the frequencies later in this section.

“SSID” allows you to set a custom SSID that will be broadcast to your WiFi device. This is very useful if you have multiple Quasars in a rocket such as a primary and a backup, because it easily allows you to tell which Quasar is which. For example, you may want to set one Quasar's SSID to “Rocket\_Pri” and the other one to “Rocket\_BU”. The SSID is displayed on every page so you know for sure which one you connected to. The SSID must be between 8-14 characters; allowable characters are a-z, A-Z, 0-9, and the underscore (“\_”). If you have a custom SSID and

wish to change it back to the default (“Quasar\_” plus the shortened MAC address), you can do so by blanking out this field with spaces; it will revert to the default.

When you submit the page, changes are applied immediately, EXCEPT for the SSID, which does not take effect until you power-cycle your Quasar. Note that changing the SSID does NOT change the passkey; the passkey is fixed and is not changeable.

## Changing the Frequency/ID

The frequency (and ID, if your band supports it) can easily be changed from the Hardware menu, by clicking on the CHANGE button below the frequency display. You will see this screen:

|                                       |       |
|---------------------------------------|-------|
| Quasar_a1b2c3                         | 1.02S |
| Frequency:                            | 915 v |
| ID:                                   | 0 v   |
| <input type="button" value="Submit"/> |       |

The values vary due to the regulatory region that the firmware was designed for. The frequencies and ID’s (if applicable) that are permissible by region are listed below.

### North America/Canada

Frequency: 909 – 925 MHz by 2 MHz (default 915)

ID: 0-7 (default 0)

### EU/UK:

Frequency: 869.425, 869.525 (default), 869.625

(No ID)

### Australia/NZ:

Frequency: 919-925 MHz by 2 MHz (default 921)

ID: 0-7 (default 0)

### Ham

Frequency: MHz: 420-449 MHz (default 433 MHz)

KHz: 0-900 KHz by 100 KHz (default 0 KHz)

Note: a 50 KHz offset is added to the MHZ-KHz frequency,

i.e. 420.300 is actually 420.350 MHz. This ensures that the frequency stays inside the 420.000-449.999 MHz band.

To change the Frequency/ID, select the values that you want from the pulldowns, then click on the Submit button. The new values are applied immediately; you will see both the red and green lights on the RF module blink for a moment as the change is applied.

## Appendix G: Updating the Eggtimer Quasar Firmware

From time to time we may make updates to the Eggtimer Quasar firmware to fix bugs and/or to add new features. The Quasar is designed so that you can update the software easily from any Windows computer, using only the standard Eggtimer USB-Serial cable.

Here's how to do it. We recommend that you read ALL of the steps before you start.

**IMPORTANT NOTE: DO NOT try to perform a firmware update with any pyrotechnic loads attached to the deployment outputs! Although the chance of them firing during an update is virtually zero, it's very bad safety practice to have any pyrotechnic loads connected to an altimeter when the rocket is not being prepped for flight.**

- 1) Download the latest software update from [eggtimerrocketry.com](http://eggtimerrocketry.com), go to the Support/Eggtimer Quasar page.
- 2) Unzip the download file to `c:\eggtimer` (create the directory first if it doesn't exist).
- 3) Open up a Command Prompt, and type `cd c:\eggtimer`
- 4) Plug the USB-Serial cable into your computer.
- 5) Go into Device Manager in Windows and look at the Ports, and see what port it has been assigned. If it is NOT COM2, go to Properties/Ports/Advanced and change the port to COM2. If Windows complains, just do it anyway... it's just Windows being Windows.
- 6) Move the jumper from the RUN pins to the PGM pins, located next to the WiFi processor.
- 7) Disconnect any deployment wires from your Quasar. If they're soldered in, just make sure that there's no igniter or other loads on the deployment channels.
- 8) Connect the serial cable to the 3-pin header on the Quasar as follows:  
  
BLACK (GND) – GND  
GREEN (TXD) – RX  
WHITE (RXD) – TX
- 9) Connect your battery. You should see the light on the WiFi module blink once, and you shouldn't hear the normal startup beeps. If you do, then you probably didn't move the jumper... disconnect the battery and start over from step 6.
- 10) Now, from the Command Line (which should be at "`c:/eggtimer`") type "`quasar_<version>.bat`", where `<version>` is the current version of the software (i.e. `1_02S`). For this example, you'd type

`C:/eggtimer: quasar_1_02S.bat`

You should immediately see some text scrolling across the screen, and in about 3-5 seconds you should see a bunch of dots going across your screen (.....). This should go on for about a minute, then your Quasar should give you the normal power-up beeping. If it does not, unplug the battery, take a look at your files, your COM port, etc., then repeat steps 9-10.

11) Disconnect the battery, and put the jumper back on the RUN pins.

12) Connect the battery... you should hear the normal startup beeps, and the red light on the RF module should start blinking.

You can confirm that you've uploaded the right version by simply connecting to your Quasar with your WiFi device, the software version will be in the upper-right corner of every page. As usual, if you have any questions, feel free to drop us a line at [support@eggtimerrocketry.com](mailto:support@eggtimerrocketry.com).

# Eggtimer Quasar Quick Start Guide

**Power:** 7.4v/2S LiPo, 500 mAH or higher recommended. Bigger mAH's is Better...

## Outputs:

Drogue: Connect to DROG terminals

Main: Connect to MAIN terminals

AUX: For airstarts, etc...

See Appendix C for use with servos

## WiFi Connection

Select the "Quasar\_XXXXX" SSID (or your custom SSID if you set one), and use the passkey that was on the WiFi module's envelope (you did save it, right?), or recover the passkey using the data cable (see Appendix E for instructions)

Set your browser to **192.168.4.1** to open the Status Page...bookmark it for later use!

If asked, tell your device to "keep the connection" even though there's no Internet

## **IMPORTANT:**

**NEVER "SWIPE" YOUR QUASAR PAGES TO "CLOSE" THEM... YOUR DEVICE LEAVES IT LEAVES THEM OPEN. GO TO THE "x" AND ACTUALLY CLOSE THE PAGE. SIMILARLY, DO NOT REFRESH A PAGE USING THE BROWSER'S REFRESH BUTTON, IT WILL RESUBMIT THE PAGE AND IT IS POSSIBLE FOR UNINTENDED CONSEQUENCES TO OCCUR.**

## Status Page

Displays:

SSID and Software Version

Radio Regulatory Domain

Status (Disarmed, normally)

Validation Code (for arming)

Arming Button

Drogue Settings

Main Settings

AUX Settings

GPS Status

GPS Coordinates

Battery Voltage/Percentage

ASL altitude  
Temperature in F

### **Drogue Settings**

Click on Change link next to Drogue settings to change  
Delay: OFF, 0.1-9.0 secs by 0.1 secs, 3-30 secs by 1 sec.  
Descent Samples/sec  
Drogue mode (igniter/servo)  
Drogue on-time or servo direction/skew

### **Main Settings**

Deployment Altitude:  
OFF, Nose-Over, 50'-500' by 50', 500'-3,000' by 100'  
Main Mode (igniter/servo)  
Main on-time or servo direction/skew  
FailSafe:  
Velocity: OFF, 50-200 ft/sec by 25 ft/sec  
Time: 50-3000 ms by 25 ms

### **Global Settings**

Click on the Settings link on the Status Page to change:  
LDA – Launch Detect Altitude  
Launch samples/sec  
Auto-Arm (OFF/ON)  
Name (sent out telemetry port with other data,  
use your Ham call sign if you're using the 70cm Ham version)  
Link to Hardware Setup Menu

### **Hardware Setup Menu**

Voltage Offset: Reported Voltage – Actual Battery Voltage (0.0-0.9v)  
Tone: Buzzer pitch (Low, Medium, High)  
Frequency/ID display, with Change link  
SSID: Custom WiFi SSID (A-Z,a-z,0-9, and underscore), 8-14 characters  
Power-cycle your Quasar to apply the new SSID

### **Arming**

Remote Arming:  
Select the proper flight settings  
Verify that all enabled outputs are **ON** or greyed out (n/a)  
Enter the 4-digit validation code, then click ARM  
When the “Armed” page displays, **CLOSE YOUR BROWSER**  
It wouldn't hurt to turn off your device's WiFi, either.

Auto-Arm:

Quasar will arm itself 60 seconds after power-on, if channels pass continuity check

### **Disarming (for aborted flight)**

Connect to the Status page (192.168.4.1) (this may take several seconds)

Enter the 4-digit validation code, then click **DISARM**

Wait for the normal Status Page... if it takes more than 10 seconds, refresh your browser

### **Downloading Flight Status Data**

Click on the **Flights** link on the Status Page

Click on the 'More' link next to the flight

View the Flight Summary data...

For detail .csv download, click on the 'Detail' link at the bottom of the Flight Summary page

### **Deployment Channel Testing**

Check your Settings first, set appropriately

Go to the test page... **192.168.4.1/test**

Select the channel to fire... it uses the settings from the Global Settings page

Enter the 4-digit validation code then click TEST

To abort a test, close the page before it counts down to zero

### **Using the QUASAR with the Eggfinder LCD receiver**

#### Coordinate Display

Latitude            <Time since Fix>    <Drogue status><Main Status>

Longitude                                    <Current Altitude>

#### Compass Display

<compass heading>                    <Time since Fix>

<distance to rocket>

#### Navigation Display (with LCD-GPS Module only)

<degrees to rocket.                    <Time since Fix>

<distance to rocket>