

APPLICATION

USER MANUAL



Solex

How is Solex different from the standard app?

Solex isn't designed to be a clone of the standard app. It's really more of an attempt to provide similar features, plus extra nice-to-have features that its author wished to see in the original app. More importantly, it's meant to provide a platform for experimentation and more "creative" features than a company app is likely to provide. That's the origin of the name "Solex"... Solo, experimental, etc. (Didn't spend a ton of time coming up with a name, really.)

Reading through this document, you'll notice things that aren't in the 3DR Solo app. Consider this set of features as a starting point, with more coming.

Details

A word about « Fly Me There »

Several of the features in Solex feature the ability to either fly to a required start point (e.g. the start of a Cable Cam) manually, or automatically via a **Fly Me There** button. Once you use this, you're likely to find it more convenient than manually piloting your vehicle to the required location and altitude. Just use caution. Fly me there does not rise to RTL altitude before taking off in the direction of its target location. So if you're low enough to hit an obstacle, it won't automatically rise to a high altitude to miss it. Once you've pressed Fly Me There, you may realize it was a mistake. In that case, press Cancel or the Pause button, and your vehicle will stop immediately. Seriously, though, once you start using it, you'll more than likely prefer that to flying to a target location manually.

Fly Me There has a maximum distance it will fly to a location for you. This is configurable in the App Settings screen. The distances are 100, 500, 1000, 2000, 3000, 4000, and 5000 meters (default 1000 meters, displayed in Imperial units if Solex is set to display Imperial units). If you attempt to fly to a location that is farther than the limit you've set, you'll hear a warning message, and Solex will refuse to fly to the location. The solution (if you're confident in your vehicle's ability to reach the target) is to increase the limit. The max limit you can configure is over 3 miles away. If that's not far enough, well... come on. That's a really long way.

You can now set a "fly at" altitude when you save a location in the flight screen. This is useful (important) when you want to fly to a location that requires a minimum altitude in order to reach it. For example, suppose you need to fly over some trees to reach a specific point. Ordinarily you'd need to manually ensure you were flying high enough to clear the trees before you hit "Fly me there" to fly to a target. If you set a "fly at" altitude on the location to match your altitude when you save the location, then your vehicle will fly to that altitude before flying to the location. This helps it ensure it's high enough to clear whatever obstacles were in the way when you flew to the location to begin with. As always, of course, use care when using "Fly me there" to avoid a crash.

Flight Controls

Some explanation of the various items on the Flight screen is probably in order.

Top Bar

This contains some pretty self-explanatory fields for distance, altitude, speed, flight mode, GPS status, battery status, signal, and flight time. **Flight time** is a measure of how long you've been in the air for the current flight. Once you land and take off again, the timer is reset.

The battery field on the sub bar shows a measure of time, which will likely fluctuate while you're flying around. This is an estimate of how much time you have to fly before battery power is expected to drop to point at which Solex will tell you it's a good idea to land soon.

The reason the **battery remaining** time fluctuates is because it's based on how fast battery power appears to be dropping. As time passes, you may be flying in different conditions (against the wind vs. with the wind, climbing more or less, etc) which affects the estimate. Don't be alarmed if the time-remaining estimate appears to grow at some point. It's just the estimate changing based on current conditions.

Camera Controls

- **EV Comp:** The circled "+" and "-" buttons above the record button are for adjusting EV comp without having to open the settings panel for the camera. This is a frequently-used setting, so it's been provided "up front" to make it easier to get to. Note: You'll find this feature is not available while recording. The GoPro reacts rather violently to having its EV Comp setting changed while recording. Lock-ups, and ominous messages about "The file cannot be repaired" result from messing with these controls while recording is in process. Thus Solex disables these buttons when recording is active. (Thanks to Scott Manthey for the EV Comp feature request.)
- **Record:** Use this to toggle recording on and off. You can also use the paddle on the controller for a Solo, of course.
- **Settings:** Use this to open the settings panel for the camera.
- **Grid:** This can be toggled on and off to make it easier to center objects on the screen.

Telemetry Panel

This contains some basic widgets showing telemetry information. Pitch/Roll (artificial horizon) and vibration views are available.

Map View

When you're in the flight screen, you can switch to a solexMap view by clicking the little Map icon in the bottom right, next to the HUD button. This displays the solexMap view, where you can see your copter flying as an icon on the solexMap. To switch back to the video view, just click on the inset video screen, or click Back to return to the video screen.

Click the **Pan to Vehicle** checkbox to pan the solexMap to follow the copter as it moves. Click the **Pan to Me** checkbox to pan the solexMap to keep your location in view on the solexMap as you and/or the copter move. Click the top bar (showing distance, mode and altitude) to see speed, battery, and signal strength. Click it again to hide the extra items.

Layers

Clicking the Layers button on the solexMap shows a view of the layers available to display on the solexMap.

Geofence Layer

When the Geofence layer is turned on, you can see any geofences near where you're flying. Once you enter the area enclosed by a geofence, the geofence selector appears. If you activate the fence, the geofence is shown on the solexMap in a highlighted color.

Flight Logs

Flight Logs used to occupy a separate screen accessible from the Controls menu, but they're displayed as a layer on the solexMap now. Flight logs will only appear if you've saved a named location by clicking on a GPS coordinate on the flight screen. Future updates will allow for more options in this area, like dropping markers as you fly and creating missions from a sequence of markers.

When you click one of the markers for a saved location, you can fly to its location as before. See the Fly Me There topic to read about its various features.

Flying Locations

When you're planning to fly at a specific place, you can create a Flying Location for it and browse around the location on a solexMap.

Adding a Flying Location

To add a Flying location, click the "Add" button and type in a full or partial address. A marker will appear on the solexMap at the location it finds. You can drag the marker around to position it where you want. Once you've set the position, click the marker, and you'll be prompted to save it as a flying location.

Once you've done that, you can "visit" the location by clicking on its name in the list. The solexMap will zoom to the location, then zoom out over time to show a wider view of the location. A side benefit of this is that the solexMap data is loaded in case you find yourself at the flying location without a network connection.

You can click the Visit All button at the bottom of the list to browse all of your flying locations in the order they appear in the list.

Click the solexMap during this process at any time to stop it.

Smart Shots

Orbit

Orbit is the shot you're familiar with in the Solo app, and works largely the same way. Here's the main difference:

With the standard app, you pick your orbit target by opening a solexMap and tapping the target's location. If you happen to be lucky enough to have pre-loaded solexMap tiles before you went out and put your tablet on Solo's wifi, and your chosen target is permanent enough to have showed up on a satellite solexMap to begin with, it's easy. Otherwise, you have to guess at where the target is, and this author's experience is that it's really difficult to do that.

With Solex, you get a little on-screen reticle that you put on the target. Then hit start. It calculates the target location that way, and is easier to use. Other than that, it's the same thing as standard.

TIP: Targeting an object It seems intuitive to point the reticle at the top of the target. For example, if orbiting a tower from above or near the top, point the target at the top. The orbit is more accurate if you point at the base of the target before hitting "Start", and then aim the camera at the desired location.

TIP: Use a sharper camera angle In Orbit, as with all shots, there is a limit to how shallow the camera angle can be. The reason is that when calculating distances, each degree of tilt increases as it moves away from vertical. Beyond 20 degrees or so, the distances become pretty large, especially at high altitudes. (It's just trigonometry, nothing's broken.) To avoid creating (for example) an orbit point 3 miles from your vehicle, Solex doesn't use a gimbal angle shallower than 20 degrees. If the gimbal is at a shallower angle than that, it caps the value at 20. This is why you're likely to see inaccurate orbit targets when you use a very shallow gimbal angle. If this happens, simply get closer to the target (or more above it) and point the gimbal down at a sharper angle before pressing Start. Once you've set the target point, you can pull out with the pitch/roll stick to get a shallower angle.

Selfie

Selfie. Yawn. It's been done. It's also been done here.

Zipline

Zipline is handy if you haven't mastered the skill of flying in a nice straight line while yawing here and there (as if anyone actually has). Press A to set a new Zipline direction at any time after pressing Start in the Zipline view. Press B to toggle Camera lock and have your vehicle pan to keep the lock point in view. Press 3D before starting a Zipline to angle the flight path to match your gimbal angle. (Note that this means your flight path is no longer "infinite", unless you've equipped your vehicle to fly underground.)

Cable Cam

Cable Cam is the coolest of all shots. It works here like it does in the Solo app. No added features are found here, except with the ability to share saved cable cams with others, or as backups.

Cable Cams are movable

In past versions, you could only fly a Cable Cam from the location where it was created. The points contained in it were absolute. So if you tried, say, to fly a cable cam that was created 20 miles from where you currently are, Solex would refuse to fly your vehicle to the Cable Cam's start location.

This is still true, but you now have the option to move the cable cam so its start location is where your vehicle is currently hovering.

So: If you load a cable cam with a start location more than 20 meters from the copter's current location, you'll see a prompt asking whether you want to treat it normally, or move it to the current location.

If you select **No, Fly in place**, you'll be given an option to fly to the start point manually, or have Solex fly it there for you (with the usual caveats: If it's too far away, Solex will refuse to play along). If you select **Yes, move it**, the Cable Cam will be moved so its start point is at the vehicle's current location. Your vehicle will adjust its altitude to match the start point's altitude, and then indicate that the Cable Cam is ready to start. At this point, the same moves will be performed as they were at the original location, just in the new location. **Note that you need to be careful** when doing this, as obstacles may be in place at the new location that weren't at the original one!

Follow / Optical

Follow/Optical's goal is to let you select a target and follow it using computer vision.

To use it, your gimbal needs to be pointed down at least 30 degrees or so. Start the Follow/Optical shot, select your target by dragging across it on the screen, and a green rectangle will appear. When you release the screen, a marker should appear showing where Solex thinks the target is, and the Start button should be enabled. Press Start, and the vehicle will start tracking the target.

As it moves, the tracking rectangle should move to follow it. Note that you need to have decent lighting for this to work, and it might become confused by shadows, or if your target passes by something that looks a lot like it. Also if you move from (for example) a grass area to (for example) a gravel area, the drastic background change can confuse it. On occasion, starting or stopping recording causes the video stream to go black for a second or so. That can also throw the tracking off.

If the tracking becomes confused, just drag across the target again, and it will restart tracking. Note that when you do this, "Look at" mode is always switched on. This avoids the copter making abrupt moves while trying to track a target. Follow/Optical is very conservative when tracking. When "Look at target" is turned on, Solex will track and follow an object no matter how fast it perceives it moving. Since tracking in this case consists only of panning and tilting the gimbal, this is not likely to cause a problem.

When "Look at target" is turned off, Solex will track a target moving at any speed as long as it doesn't suddenly accelerate drastically. If Solex thinks the tracked target has accelerated to 4x its average speed (rolling average over the 10 previous location updates), it will signal an error and refuse to follow. This is intended to prevent scary behavior in the event the tracking loses track of the target and starts drifting wildly around the screen.

On occasion when you first start Follow/Optical after selecting a target, the Solo "jerks" the gimbal. This tends to throw target tracking completely off. There is no way to predict when this will happen. So as soon as it enters Follow mode, it saves the most recent "pre-follow" location and doesn't track any further ones for 1.5 seconds, to give the Solo a chance to settle before resuming tracking. Without this in place, tracking tends to get lost and wander around, making it difficult to stay on the target. With it in place, you might see the tracking rectangle turn red while the camera is pointing at the target. Just reselect the target to resume, and it should be good to go. It does make it somewhat tricky to start tracking on a target that's already moving, but much less so than without this behavior in place.

NOTE: Be sure you try this in an open area free of obstructions such as houses, trees, and peoples' heads. Think about how reliable computers have been in your life in general, and then think about how you're now trusting a computer with spinning blades on it to follow something around by looking at it. Let that disturbing thought be your guide for where you choose to use this feature.

To track an object manually (where you do the tracking), click the Manual check box. Then Solex will track whatever you point at on the screen. It's not as cool, but it also works in bad light.

Follow / Record

Follow/Record is handy if you can more or less predict the path your target is likely to follow. For example, vehicles on a race track running repeating laps, farm machinery moving back and forth across a field, trains running along tracks, and so on.

.Record a Track

The first thing to do is record a track. Press the Record button and fly along the path your target will follow. Panning, etc isn't important at this stage, you're just recording the path. Press **Stop Recording** when done.

.Fly back to start

When you stop recording, you'll be prompted to fly back to the start of your path. You can do this automatically by tapping "Fly Me There", which will take you back to the beginning.

.Start Following

When you press **Start**, you'll be following the path of your virtual target along its path. By default, it will run at the same speed you flew when recording. You can change the speed to anywhere from 1/4 to 4x original speed with the Playback Speed slider. The typical Follow options (Look at target, Follow Type) are all present. If you're in Orbit and press the forward or back buttons, your vehicle will attempt to "orbit" the target as it moves, which is a cool effect. Free Look also applies here.

In general, think of Follow/Record as playing back a Mission, except you can fly manually "within" the flight path as it's playing back. Try it, it's fun. Just make sure you have ample room for the orbiting, etc.

Follow / Remote

Follow/Remote is for tracking multiple targets that report their locations as they move. It requires cooperation between you (the pilot) and the targets, but it's cooler than the other Follow shots.

.Target Apps

User locations are reported by free apps that are installed on their phones:

- [Solex Target for Android](#)
- [Solex Target/JS](#)

Once these apps are installed and running, their movements can be tracked by Solex.

.Groups and Users

Tracking involves a user in a group. Each user specifies the name of a group, and a unique user name within that group. So, something like this:

Tracking Group: myGroup

Tracking User: joe

Press **Follow Me**, and your locations as you move about are reported to the API. When Solex subscribes to myGroup, the joe user's movements are sent to it whenever joe moves.

.Subscribing to a Group in Solex

Open the **Follow/Remote** shot view, and click the **Map** button. A solexMap appears with an edit field at the bottom. Specify the name of the group you want to subscribe to, and click **Subscribe**. A web-socket connection is opened to the API. A few seconds later, users and their movements appear on the solexMap. Click **Pan to Follow** to pan the solexMap to follow the users in the group. If more than one active user is in the group, a panel showing each of their names will appear.

.Following a user

To follow a specific user, just click their marker in the solexMap, or click their name in the panel (if there are multiple users). The solexMap will close, and Solex will announce "Ready to follow (whatever the user's name is)". Press **Start**, and your vehicle will begin to follow the user. That's pretty much it. All of the normal Follow options apply here; you can orbit a target, use **Leash** to follow behind, employ **Free Look**, etc. just like with any other Follow mode.

.Switching between users

When multiple users are in your group and you're following one of them, you can pick another one to follow by just opening the solexMap and selecting the new user. Your vehicle will start to follow the new target as soon as you pick the new target.

Follow / Remote Connections

Follow/Remote requires 2 connections: The normal one to your vehicle's wifi, and a secondary one. The secondary connection is used for maps, and tracking the movements of targets as they report their positions. This secondary connection can be one of 3 types: Cellular, Bluetooth(tm), or Ethernet.

.Cellular Connection

If your phone or tablet has both wifi and mobile connectivity, this should be more or less automatic. Solex will attempt to look for a cellular connection first. If one is available, it will use that connection for solexMap data, and for connecting to the websocket it uses to receive notifications about target movements.

.Bluetooth

If you have a wifi-only tablet with Bluetooth and an Android device that allows Bluetooth(tm) tethering, you can do this as well. Turn your phone's Bluetooth on and pair with your tablet. In the Bluetooth settings on both devices, make sure they're connected. Then when you open the Follow/Remote screen in Solex, it will try to use the Bluetooth-tethered network connection. Note that a Bluetooth connection is somewhat slower than direct 4G, etc. so you can expect some small lag loading solexMap tiles.

.Ethernet

This is also called "USB Tethering" on some phones; You get it by plugging a USB cable between the two devices and doing USB Tethering on the phone. In the absence of a cellular or Bluetooth connection on your tablet, it will try for an Ethernet connection.

Once a connection is established, you should be able to get solexMap data as well as incoming reported target locations.

Note for Samsung Users

The Android APIs explicitly allow for an application to make use of multiple networks at a time, as of Android 5.0. On all non-Samsung devices where this has been tested, the feature works flawlessly; Connect to Solo, open Bluetooth settings, connect to a paired device running a tethered internet connection over Bluetooth, and all is well (if a little slow because of Bluetooth). On Samsung devices, you see the following message: "Unable to connect to Bluetooth while on Wi-Fi"... which is the entire point of multi-networking in Android 5.0 and above. The fault here is fatal, and lies entirely with Samsung. If you find yourself reading this document prior to buying Solex and/or a tablet to run it on, you are urged not to buy a Samsung device. Instead, use something that works the way it's intended to work, such as a Nexus or Nvidia device.

.Target Options

There are cases where it's handy to influence how you're followed as a target.

For example, suppose you're in an area where you can see an obstruction of some kind that the Solex user can't see from their location, or through the camera. When you're being followed by Solex, you'll see a green "You're It" notification. If you find you're being followed suddenly while you're under some power lines or something, you can select "Look at me" on the target app and the Solo will stop and look at you rather than chasing you. You can get into a clear area, turn "Look at me" off, and your Solo will go back to following you.

You might have an idea for a cool orbit effect while you're being followed. You can do that from the target app as well. You can also select which follow type (orbit, free look, leash) that will be used while you're being followed.

All of this, of course, depends on whether the Use target options option is checked in the Follow/Remote UI of Solex.

.Follow/Remote Questions

What if a user wants to stop being followed?	Press Stop Following . Solex will end the shot immediately if it's following the user who stops.
What happens if the user stops reporting location because of an error?	Every 5 seconds, Solex checks to see if the user has reported a location. If they haven't, it assumes they've had an error, and considers them stopped.
Isn't this some kind of privacy violation?	LOL. No. Following only happens with explicit consent for the user, and no record whatsoever is kept of the user's movements. At all. Only the most recent location is remembered, and that is strictly in-memory. Nothing is recorded to magnetic media of any kind.

TIP: Target Speed

A 3DR Solo has a maximum speed of about 45 mph. At that speed, a lot of lift is being traded for thrust, and maintaining altitude is somewhat difficult for it. A good rule of thumb is to avoid trying to follow an object moving much faster than about 30 mph, to give a Solo some margin and a good chance of being able to keep up. Note that this also applies to switching between two targets distant from each other. Since Solex sends the vehicle a location and that is what the vehicle is actually following, it's not a good idea to switch from a given target to another target 1/2 mile away. If you do that, your vehicle will take off in the direction of the new target at full speed. It's wise to think about the possible implications of doing this. A user not expecting a nearby drone to suddenly turn and close on them at full speed is likely to be highly alarmed when it happens. Something to keep in mind.

TIP: Location Relay API

If you want to make your own target app, you can do so by using the Location Relay API at <https://location-relay.herokuapp.com>. Documentation is available there for the API, as well as at <https://github.com/kellyschrock/location-relay>. There are sample apps there for both a target, and target tracking.

Follow Options

All Follow modes have a similar set of options. Look at target determines whether your vehicle actually tries to follow the target around, or just sits still in the air and "looks" at it as it moves.

As for the Follow types:

- **Orbit:** Maintains a position relative to the target like a human operator might if they were flying and following a target. For example, if it's following a target from behind and the target turns right, the vehicle will start to fly sideways to the right, keeping the target in view. If it then turns right again, the vehicle will fly backwards and keep it in view. The forward/reverse buttons start an "orbit" around the target as it moves, where it will more or less fly in a circle around the object, but without making crazy moves in order to maintain the orbit. The overall effect is what could be considered "natural".
- **Leash:** Tries to follow behind the target. As the target turns while moving, the vehicle will swing to maintain a position behind the target.
- **Free Look:** No attempt is made on the part of the vehicle to keep the target in sight. Instead, you maintain the target in the picture by panning and flying around with the sticks. Altitude is controlled by the paddle in this mode, and camera/gimbal angle is controlled with the throttle stick.

Follow / Me

Follow/Me works just like the Follow Me shot in the standard app. It follows the GPS location on your device, in case you prefer for your vehicle to follow you (vs a different person) around.

HDR Photo

This shot takes EV-bracketed photos in Photo mode. You can control the upper and lower EV bounds. The default bound is -2.0 to +2.0 EV, which results in 9 photos being taken. You can reduce this by choosing upper and lower bounds closer to each other.

Inception

Named after a movie where some really weird things happen to landscapes in the background while the actors are experiencing something puzzling. This shot starts at your vehicle's current altitude. Adjust the **Focus Distance** slider to adjust how far forward the copter will fly during the shot. Adjust the **Height** slider to adjust how high the copter will fly. Set the number of photos to take with the **Count** field. The flight path will be an arc starting at your copter's current position (recommended about 20 feet up), stopping along the way for 3 seconds for each photo, angling down at a specific location. Once it reaches the top altitude, your copter will fly forward twice, taking 2 additional photos. Then it will turn and head back to its original location and altitude. Once it reaches that location, it should end the shot automatically. You can also press FLY to end the shot sooner.

HUD

On smaller screens, it's often kind of nice to get all of the panels and other stuff out of the way so you can see where you're flying. The problem is then how to see all the stuff that was visible. You can always try the HUD. There's a button in the lower right of the flight screen that, when pressed, moves all of the panels out of the way, and exposes the HUD, a quasi-sort-of airplane style view of basic information such as pitch, roll, speed, heading, altitude, and general status like battery percentage and so on.

There's a circle on the right-hand side of the HUD. To adjust color, touch the circle, and a palette drops down below. Slide your finger to pick the color that makes the HUD look right given the current background light conditions, and let go. The palette disappears after a few seconds.

Preflight Checklist

The Preflight checklist is a way to create a list of items you want to do before a flight. The majority of the time, you'd use it to make sure you have an SD card in the camera, the camera is turned on, etc.

To open it, click the little Clipboard icon on the Controls panel. To close it, press Back, or click outside the checklist area.

The System items are fixed, and set by what the vehicle is reporting. They become checked (complete) when a given item is considered "ready to fly". For example, GPS becomes complete when the copter is reporting it can use the fix.

The User items are editable. Click the Edit button and enter items you want to have in the checklist, one per line. When you press OK, they're saved.

TapToFly

TapToFly lets you fly along a straight path at a steady speed while panning wherever you want.

There's really only one mode for TapToFly, but you can fly in any orientation relative to your path of travel. So if you're looking for a reverse "mode", spin the vehicle around in the air until it's flying in reverse.

To start TapToFly, long-press on the video feed screen in any location. A circle appears where you clicked, along with a set of controls along the bottom right of the screen. Select how far you want it to fly in TapToFly mode with the "Stop at" control, and how fast you want to fly with the "Speed" slider. Then tap in the circle. Your vehicle will fly forward toward a point the distance that you specified, and then stop. You can stop at any time by pressing FLY or by tapping outside the circle.

As you fly, an arrow will appear in the circle showing which way you're flying. If you yaw to a different orientation, the arrow will spin around to show your direction of travel. To change speed, move the Speed slider. Note that you may hear spoken notifications of your vehicle's mode being changed. This is because in order to change speed, Solex has to switch to a non-guided mode, change speed, and then re-engage guided mode. Future versions of the copter firmware will (hopefully) allow smooth speed changes during guided flight, but that is not currently the case. Similarly, you can't change altitude in this vehicle mode. Future firmware versions may allow for this, however.

To change direction, long-press on either side of the screen, and tap. The vehicle will change direction and fly toward the point, and the circle will move to the center of the screen.

To stop TapToFly, either press the FLY button on your controller or tap outside of the circle. Your vehicle will switch to FLY mode and the screen will go back to normal.

Ground Alt Offset

If you have **Advanced Mode** turned on in the app settings, you'll find an "Alt Offset" slider on the "tuning" panel in the flight screen (under "Controls"). If you find that your vehicle is flying lower than you expect on a mission, during a Cable Cam or other operation where simply bumping the throttle isn't an option, you can adjust this slider to add up to 3 meters to the altitude. This change happens very slowly. The flight controller adjusts 1 cm at a time to avoid disrupting things.

Note that this value is reset to 0 for each flight. It's not meant to be a setting.

Return To Me

Return To Me is a feature that lets you direct your vehicle to return to your current location in RTL, vs the launch location. To turn it on in Solex, press the little "home" icon in the upper-left corner of the flight screen. The icon will change into a little "person" icon. Initially, it will be disabled, indicating that your device location is being retrieved. Until it turns white (enabled), the RTL location will still be the default launch location.

To go back to the default RTL location, just click the icon again.

Geofences

Geofences are a handy way of avoiding obstacles you know about beforehand. Go to the Geofence item on the main menu of the app, and create a few fences in locations where you want them. You can do this before you go flying, and then select the appropriate fences once you're out in the field.

Making a Fence

Easy: Select the "New" button in the Geofence list to open the Geofence editor. Pan the solexMap to where you want to create the fence, and tap at various locations on the solexMap to set the corners of the fence. Drag the corners around until you're happy with the fence, then press "Save" to save the fence. You can save as many points in a fence as you like, as long as there are at least 3.

You can also use the address search field to find an address. It's meant to allow "vague" addresses. So if you're planning to create a fence at, say, "1107 Main St Mytown MI", you can probably get away with "1107 Main Mytown" and it will try to find the address.

Selecting a Fence in the field

Fences are selected from a list in a little panel at the bottom of the main flight screen.

As you fly around, you'll notice that sometimes the little Fence panel is visible, and other times it's not. Here's why:

As it happens, it's a bit sketchy to activate a fence while you're flying outside it. As soon as you do, your vehicle will think it has breached the fence, and will fly with all haste toward the closest fence wall to get inside it again. It doesn't matter how far away the fence is, it will try. There's obvious potential for that to end badly, especially considering that you're probably using fences to begin with because you're in an area where you wish to avoid crashing into things.

So what Solex does, as you fly around, is to monitor your location relative to any fences you've created. Once you get inside the perimeter of a fence, it pops up a little selector view in the bottom of the flight screen giving you the ability to select that fence and tap the little green check mark to activate the fence. If you happen to be in an area where you've created multiple fences that overlap, you can select the one you want to be in.

To deactivate a fence, just tap the little red "x" button and Solex will clear the fence.

Once you've deactivated the fence, you'll notice the panel will slip out of sight if you fly away from the fence. It may take 5 seconds or so for it to disappear as you fly around.

Fence Behavior

Note that the Solo Geofence works differently than the standard `FENCE_POLY` setting in newer ArduCopter implementations. That implementation simply prevents you flying outside the fence to begin with, and slows down gracefully as you approach the fence edge.

The Solo's implementation detects that you have already flown outside the fence boundary, switches to Guided mode, and flies you back inside, then switches back to the previous mode. This leads to a "bounce" effect, as though the fence is made of rubber or something. The amount of "bounce" seen appears to depend on how fast you're flying when you hit the fence. If you're moving along fast, it bounces well back inside the fence. If you're barely moving, it simply stops. Occasionally it seems to have difficulty deciding to switch back to FLY mode and can get stuck. If that happens, just hit FLY, and you can continue flying around.

Word is that eventually, Solo's flight controller will get the native `FENCE_POLY` setting.

Relays and Servos

Tapping the Relays and Servos displays the Relays and Servos screen, where you can create buttons and switches to control relays and servos on your vehicle. The exact function of these is up to you; You have to connect something to the vehicle for a given relay or servo in order to make use of it. Once you've done that, you can set up a button or switch to control it. For example, if you attach a bright LED to the bottom of your vehicle and wire it to be controlled by a relay on the flight controller, you can set up a switch in Solex to turn it on and off while you fly around.

Servo Sliders

Servo Sliders let you assign an upper and lower range to a servo, and control it with a slider. Just click the "Slider" checkbox in the Servo details screen and specify an upper and lower range, press Set, and then Save. If you want the slider to bounce to the middle of its travel when you stop sliding it, select Auto-center. Then the slider will default to the middle of its travel, and always return to it when you stop sliding it up and down.

Relays

Relays have a name and a number. The name will appear on the switch in the Commands panel. The number will be passed to the vehicle when turning the relay on or off, and the flight controller will take care of the rest. You can test a relay by pressing the Test button.

Servos

Servos also have a name and number, as well as a PWM value. What you specify here depends entirely on what you're doing. You can test these by pressing the Test button on the screen.

GPS Overlay

There's an option in the app settings for GPS Overlay, so you can see the lat/lng position of your vehicle while flying around. On the Controls panel, there's an option for turning on Spot Mode, a variant of GPS Overlay which shows the GPS location of an object you're pointing at with the camera. This is handy if you don't want to actually fly over something but want to know its location for some reason.

Note that neither of these will be visible unless you enable Show GPS Location in the App settings screen.

Spot Mode

In earlier versions, Spot Mode displayed a target over the location your vehicle is pointed at. Spot Mode has been changed so that it actually locks your vehicle to the target with an ROI (Region Of Interest). When turned on, your vehicle will try to keep the target in focus, angling the gimbal if necessary (but not controlling yaw). This makes it really easy to fly around and keep an object on the screen.

Flight Logs

Flight Logs give you a way to do something with the locations you touch on the screen, and a way to record your flights.

Saving Locations

> When you touch the location on the flight screen, you'll get a pop-up dialog asking you for a name for the location. Specify one, or just press OK (which will save the location named for its lat/lng coordinates).

Saved Locations

In the solexMap view, select Flight Logs. It will show a list of your recent flights. Click any of these, and your saved locations will be shown on the solexMap as green markers. If you're currently flying, you'll also see an icon on the solexMap showing where your vehicle is.

Fly to a location

To fly to a location, you can click on it in the solexMap. If you selected Save Picture when you saved the location, you'll see a tiny picture of the location in the bottom left corner of the screen. There's also a "Fly to point" button that appears near the bottom on the right when you click a location. If you select it, the "Guidance" UI you've seen elsewhere appears, and you can either navigate manually using it as a guide, or press the normal "Fly me there" button to have it fly there on its own. As always, when you do this, you can abort the flight by pressing FLY or Pause on the controller, or pressing the **Cancel** button.

Flight Recording

You can record your flights and do something with them at a later time.

Recording Flights

In the Flight Log layer of the solexMap view, pick a recording interval (5, 10, or 30 seconds) from the drop-down menu. When you fly around, Solex will record your vehicle's location at that interval. You'll see orange markers appear on the solexMap as you fly. To stop recording, select "None" from the drop-down menu.

You can also toggle recording from the Controls panel by turning the little "logging" icon on and off. (It looks like a little box with a down arrow on it.) This is handy if you don't want to record your flights.

You can also save specific locations. This is useful if you want to save the exact location of the vehicle.

What to do with a recorded flight

Once you've recorded a flight, click on it in the flight log list (in the Flight Logs layer). If it has recorded flight locations, you'll see an export button and another drop-down list. You can export the flight log to KML (Google Earth, etc), or GPX (Garmin, etc) output. If you have the Missions add-on, you can also export to a mission. In this case, Solex will try to reproduce the speed at which you flew when you recorded by setting speed parameters on the waypoints based on how far the points are from each other and when they were recorded.

When you export a flight log, you're also given an opportunity to share the exported file. You'll most likely want to do this, since (with the exception of Missions) the only reason to export a file is to use it in some other software.

Exporting a Flight Log to a Mission

If you have the Missions add-on, you can export a recorded flight log to a Mission that you can edit, or fly as-is. You can optionally add a takeoff to the beginning of the mission and an RTL at the end. You can also export yaw movements you did while you were flying so that if you were flying sideways or backwards at some point during your recorded flight, those moves are reproduced in the mission. You can also click the Optimize Path option in the Export options dialog to remove unneeded waypoints and make the mission smaller and quicker to load.

Photo Track Exports

If your flight log has pictures in it, you can export those as a track instead of recorded flight locations. Like recorded flight locations, these can be exported to KML, GPX, or Mission files. In the case of Missions, the exported mission will take a picture at each photo location. This is handy if you want to take a series of pictures during a manual flight, and then automate the same series of pictures later.

Deleting a flight log

If you're recording a lot of flight logs, there will be a ton of them in the list. To delete one, long-press it and answer "OK" on the confirmation dialog.

Flight Stats

Along with Flight Logs, Solex also records basic flight stats such as total distance, total number of flights, and total flight time.

Under the **Vehicles** item on the main menu, you'll find a list of the vehicles Solex is aware of (vehicles you've connected to in the past). Each vehicle can be named, given a description, and assigned to a wifi AP name. Whenever you connect to a given wifi AP, the appropriate vehicle will be loaded (or created, if none exists for the AP you're connected to).

In this screen, you'll be able to see how far your vehicle has traveled, how many flights you've taken, and how long you've been in the air. You'll also see an entry for each of your vehicle's 4 motors. Their individual flight time is tracked as well, and you'll see various warnings once your motors are past their recommended maximum flight time.

Note that Solex only records actual flights, not just times when you arm and disarm. Small distinction, but probably worth mentioning.

Replacing a motor

Once you replace a motor, you can go into the detail screen for the relevant vehicle, and hit Reset for the motor you've replaced. This will reset the counter for that motor to 0, so you can track its life independently of the vehicle it's mounted on.

Careful with this. When you hit Reset on a motor, you'll get a confirmation before it actually resets the motor's time value. If you're just messing around and you reset it without meaning to, you can put it back, but you'll have to hand-edit the `/sdcard/Solex/flightstats.json` file in order to do so.

Custom IP and port

There are rare cases where you might want to specify a different IP address and port to connect to your vehicle on. For example, if you've set it up so multiple Solos can be on the same wifi network together. You can set a specific vehicle to connect on a specific IP address and port. **Note that you should not do this unless you are totally sure of what you are doing.** If you specify the wrong IP address, you won't be able to connect. This setting is only available in Advanced Mode, and you should not, repeat not mess with this in almost all cases.

Batteries

In order to help with battery tracking, Solex includes a **Batteries** view where you can define batteries you use in your vehicle. The general idea is to track how long the battery lasts between the time you select it after connecting until you power your copter off to swap batteries.

Battery Definitions

If you have a Green Cube Solo, your battery will be detected automatically and shown in the list. Otherwise, you have to define it manually and select it manually when you insert one. The best workaround for this annoyance is to get a green cube.

Remote Commands

The 3DR Solo has a companion computer along with the flight controller that runs Linux. This is the part of the Solo that runs Smart Shots, and a variety of other tasks. An industrious user can make use of this fact to install custom scripts on the Solo to do whatever they want (and what the Solo allows), and run them over a remote SSH connection. The Remote Commands feature in Solex lets you create buttons that appear in the Flight screen, so you can run these commands by clicking a button.

Adding Commands

To add a remote command, open the **Remote Commands** screen from the main menu, and hit the "Add" button. There, you can give your command a title, specify what command to run remotely on the Solo, and give it a color so it's easy to identify by color on the Flight screen. You can also specify whether the command should actually appear as a button in the Flight screen. If you don't, you can still run it using the **Run** button in the **Remote Commands** screen.

Running commands on connect

You can also click the Run on Connect checkbox on a command's screen to specify that it run when the vehicle connects. This is handy if you always want a specific command on the vehicle when you connect to it.

Output handling

One of the options for a command is how to handle the command's output. By default, the result is just displayed in a little "toast" message when you execute it. This will display either the command output, including any error messages shown by your command. If an error occurs trying to run the command (connection error, etc), the associated error message will be displayed here.

You can also specify **Log to file** to log your command's output to a file. With this option selected, you can click the **Logged Output** button to see the logged output. From there you can clear the output (delete the log file), or copy it to the clipboard so you can paste it into an email or something.

Simple example

Solex comes with a simple example that does nothing useful, just to show how it works. You can delete this without any consequences.

Sliders

A command can be tagged as a "slider", in which case it behaves differently. Instead of specifying one command to run, you specify multiple commands, one for each of the 10 positions available on a slider. In the "Remote Commands" screen, click the "Slider" check box and you'll see a section with a slider and an edit field. Move the slider to a position, type a command to run into the edit field, and press **Set**. Move to another position, and do the same thing. Specify up to 10 commands at different positions, then press **Save**.

This is potentially useful if you've built, say, a giant vehicle with a specific camera on it whose zoom can be controlled through commands. You can set up commands for each position on the slider (e.g. `/usr/bin/zoom_my_camera 10`), which will be executed when you reach the corresponding position on the slider.

Sliders on the panel

When you have a Slider-style command, it will appear as a normal button on the "Commands" panel in the Flight screen. When you click it, a vertical slider will appear next to it. Moving the slider up and down causes the commands to run. Clicking the button again, or clicking another non-slider command button, hides the slider. The slider's "slide area" changes color to match your command's color. So if you have multiple slider commands, it's useful to set them each to a unique color so you can tell easily which one you have selected in the panel.

Remote Commands

Flight Profiles are a way to group parameters together so you can load them quickly and switch between them. For example, you could have a profile for autonomous flights with the RC failsafe set to allow an autonomous mission to continue in the event of a temporary disconnect, or a mode that makes the copter move very slowly for certain types of video recording. You can set button mappings for modes and adjust any parameter on your vehicle.

Profiles are defined as text files that are stored in Solex's `flightprofile/` directory. You can thus make your own, modify existing ones, and share them with others. Because they involve the setting of parameters on your copter, they're intended to require some technical knowledge in order to create. An example flight profile file is shown below.

To go back to your normal settings, click **Reset** in the Flight Profiles screen. This will reset your vehicle back to the parameters it had before you loaded the profile.

When a Flight Profile is active, you'll notice that the Vehicle Settings and Firmware Updates menu items on the main menu are disabled (grayed out). This is because an active Flight Profile means that some of your vehicle's parameters are changed temporarily, and will be changed back to their original values when the profile is cleared. If one of the profile's parameters is the same as one updated by you in Vehicle Settings or by a firmware update, that change will be lost when the profile is reset. So to prevent that, Solex prevents you being able to change them manually while a Flight Profile is active.

If you have the **Verbose Output** option turned on in App Settings (which it is by default), you'll also see a little message box pop up showing the parameters that were changed as a result of loading a Flight Profile, or resetting back to normal settings.

Advanced/Risk-loving Users Only

Because Flight Profiles change your vehicle's parameters however you decide they should be changed, you could potentially void your copter's warranty. Not only that, but the wrong values can make your copter really hard to fly. Unless you know what you are doing and you are comfortable with the idea of taking risks with your copter, you are urged to leave this alone.

Example flight profile

The best way to view the example files is to share your Solex data in an email to yourself (save to Google Drive, etc) and then look at the files in the `flightprofile/` directory.

About the files

They are just simple JSON. The various fields should be self-explanatory to someone familiar with creating this type of file. One thing to note is the button mappings: You need to specify the name of the modes as follows:

Value	Mode
COPTER_STABILIZE	Stabilize
COPTER_ACRO	Acro
COPTER_ALT_HOLD	Alt Hold
COPTER_AUTO	Auto
COPTER_GUIDED	Guided
COPTER_LOITER	Loiter
COPTER_RTL	RTL
COPTER_CIRCLE	Circle
COPTER_LAND	Land
COPTER_DRIFT	Drift
COPTER_SPORT	Sport
COPTER_FLIP	Flip
COPTER_AUTOTUNE	Autotune
COPTER_POSHOLD	PosHold
COPTER_BRAKE	Brake

"High message traffic" warning

Occasionally when you connect to your Solo after powering it up, you'll see a warning appear on the screen saying "High message traffic". This happens because, on occasion, Solo will start to emit a huge number of "parameter received" messages, as though a client application has requested a set of parameters from it (it hasn't). This continues forever, and the message rate is roughly 10 times the normal rate. This uses far more bandwidth than necessary, which interferes with video streaming and other operations.

To try and prevent (or fix) this, Solex periodically monitors how many messages per second it's receiving from the Solo. If it determines the rate is abnormally high, it starts requesting parameters from Solo to trigger a full refresh (which, importantly, eventually ends). The upshot is that eventually the message rate drops back down to normal. Solex also filters these messages out of the message stream sent to various parts of the application, but it still qualifies as an "abnormal condition" that it works to address.

During this time, it's suggested that you just wait until the message goes away. Things will most likely work normally, but not as "normally" as, well, normal.

"High message traffic" warning

The "messages" icon on the Controls panel opens up a window on top of the flight screen, letting you watch MAVLink messages being sent from the vehicle. Messages that have arrived appear in the left-hand list, along with how often they're arriving. Click on one to see the fields in a given message, and see its values update in real time.

LED Control

If you're flying with others, sometimes it's handy to be able to identify your vehicle in the air easily. Sometimes it's beneficial to block the front LEDs' light for filming something in low-light situations. Other times, it's just fun to screw around with the LEDs on your vehicle because they're there. LED Control is for these things.

To use it, select the "Controls" button in the lower-left of the flight screen. The Flight Controls palette appears. Near the bottom is a light-bulb icon. Click it, and select an option. The LEDs on your vehicle will change color, or cycle through colors, depending on the option you select.

Note that not all colors are available. It could be cool to, say, set all the LEDs to green, red, or blue. But the underlying LED logic on the vehicle doesn't support doing that. So what you see in the list is what's possible at this point.

LED Control

You can put your own movies in place in Solex's startup screen.

1. Create a directory on your SD card: `/sdcard/Solex/Startup/Movies`.
2. Put some .mp4 files in it.
3. Restart Solex.

If Solex is able to play your movies, you'll see them play one after the other in the startup screen.

Sharing, Importing

Sharing

All of the files Solex generates during use (recorded flights, cable cams, geo fences, tlogs, etc) can be selected individually and shared via the standard Android Share mechanisms. Any application that can handle file attachments is eligible to be shared with. This includes email, Google Drive, Dropbox, etc.

Importing

When you open a .zip file in Android on a device with Solex installed, it will appear in the list of installed applications that can handle the file. If you choose Solex, it will check to see if the .zip file is a valid Solex-generated zip file (e.g. has `cablecam`, `sessions`, and/or `fence` directories in it), and unzips the file to the appropriate location. Once imported, you can see the new data in your copy of Solex.

Find My Vehicle

Use this to find your vehicle if it becomes lost. Note that the location shown on the `solexMap` in this view is the last location your vehicle reported while the app was connected. If the connection is lost, no locations can be recorded.

Settings

Vehicle Settings

This screen is where vehicle settings (button mappings, performance settings, etc) are set. These are essentially the same settings as used by the standard app (arrived at by extracting parameters after running through all combinations of settings), except one, the Max Distance setting. In addition to setting a maximum altitude, you can also set a maximum distance from home with Solex. If you attempt to fly farther than the max distance, the vehicle will just stop and refuse to fly any farther.

Note: When you are seeing the "high message traffic" warning (described elsewhere), the menu item for accessing this screen is disabled.

Kill Switch

On rare occasions, it may be necessary to stop your vehicle's motors immediately. The Kill Switch is for those occasions.

It probably goes without saying, but you do not want to use this feature casually. By default, it's not available, and has to be enabled in the App Settings screen. Once enabled, a red Kill Switch button will appear on the Controls palette on the Flight screen. When you press it, you'll get a confirmation screen. When you press "Stop motors" on that screen, the motors will stop immediately.

If you have a need to kill the motors immediately without confirmation, you can turn the Instant Kill option on in the settings. When this option is turned on, touching the Kill switch will immediately stop the motors with no confirmation.

There's actually a use case for this. It was requested by a user who needs to land a vehicle on a rocking deck of a ship. To make that easier to do, he sets up a big crate full of foam blocks, positions the vehicle over the crate, and hits the Kill switch to drop it into the pile of blocks.

Unless you're doing something like this, or you're not absolutely sure of your need to immediately kill the motors on your vehicle (and send it dropping like a brick from whatever altitude it's flying at), you are urged to leave these options alone.

Timelapse and timed photos

If you want to do a "hyperlapse" style video, there is a way to do that. Put your GoPro in Photo mode, and you'll notice a small drop-down appear under the shutter button. Select a repeat interval (1 second, 5 seconds, etc). Once you've done that, pressing the shutter button will cause the camera to start taking a picture at the interval you've selected. Fly around while you're doing this, and you'll get a massive collection of photos. (You can change the interval while it's taking pictures, by the way.)

Later, you can stitch these photos together with something like [ffmpeg](#) to make a video of all the photos in sequence.

Bear in mind that you'll need a lot of photos to make a video of any substantial length. If you plan to encode your video at 30fps, you'll need 30 photos for each second of video (which is admittedly pretty easy to figure out). But that's kind of the point of a timelapse video. Just something to keep in mind.

External Storage

As you use Solex to create Cable Cams, flight logs, flight stats, fences and other data, all of these are collected as files on your device. The default location for these is in a private directory for Solex. This directory is "conveniently" removed in the event you uninstall Solex, so you'll definitely want to use the Share screen to send them to yourself in an email or something to save them before you uninstall.

Another option is to use external storage on your device, so that the files are stored in the shared `/sdcard/solex` directory on your device. In this location, they're immune to being deleted should you need to uninstall and re-install Solex. You need to grant Solex permission to actually use the external file system in this case, but you would have been prompted to do so the first time you ran Solex. If you clicked "Deny" in that case, then you'll need to open the App settings for Solex (under System/Settings/Apps) and give it permission to use the external filesystem before this option becomes enabled in the App Settings screen.

TIP: Switching over to external

The first time you switch to external storage, Solex will prompt you to see if you'd like to copy your existing files over to the new location. If you select Cancel here, you'll be prompted again if you switch back and switch over again at some point, as long as you haven't flown or generated any data. If you have, then you'll essentially have 2 storage locations. You can switch between them if you prefer, although it's unknown why you would want to.

Viewing Angle Calibration

For Follow/Optical to work properly, the viewing angle of the camera in combination with your Android device must be set. This is the screen that is used to determine that. The process requires a decent-sized tape measure, something to position inside the markers that appear on the screen during the process, and about 10 minutes. It's a strange process, but thankfully only needs to be performed once for each camera FOV you're using.

Configuration Properties

There are a few settings that are best left to experts, or left alone. A few of these can be altered by creating a `config.properties` file in the root directory of the Solex installation (`/sdcard/Solex` if you have "external storage" turned on). They are:

- `solo.ssh.userid` -- The userid used to SSH into the Solo.
- `solo.ssh.password` -- The password used to SSH into the Solo.
- `artoo.ssh.userid` -- The userid used to SSH into the Controller.
- `artoo.ssh.password` -- The password used to SSH into the Controller.

The format of the `config.properties` file is as you'd expect; key/value pairs, one on each line of the file. Something like this:

```
solo.ssh.userid=root
solo.ssh.password=TjSDBkAu
```

Note that changes to the `config.properties` require a complete restart of Solex in order to take effect. Use the Stop Application item on the main menu to stop Solex so it can be restarted and read new changes you make to the file.

Parameters

The Vehicle Settings screen is where most commonly-edited parameters are adjusted, but you can also view and change all parameters on the vehicle from the Parameters editor.

To open it, ensure you have "Advanced Mode" turned on in App Settings. When you go to the Vehicle Settings screen, you'll notice a set of buttons on the title bar labeled Basic and Params. Click **Params** and you'll see a screen listing all of the parameters downloaded from the vehicle. Most (probably not all) of them will have associated descriptions.

Changing a parameter

To change a parameter's value, tap the right-hand field where the value is shown, and type a new value in. Once you've change it, you'll notice a small panel at the bottom of the screen showing how many parameters have been changed, along with 3 buttons:

- **Show** -- Show the changed parameters
- **Cancel** -- Cancel all changes and put the parameters back the way they were.
- **Send** -- Send the changed parameters to the vehicle.

Saving Parameters to a Flight Profile

One handy thing you can do is save your parameter changes to a flight profile, so they can be applied (and reset) as a named group. To do this, use Show described above, and click Save as **Flight Profile** on the dialog box. You'll get another dialog box letting you specify a name, description, color and some other things. Having saved that, you'll see your Flight Profile listed along with the stock ones that come with Solex.

TIP: Params are dangerous One of the joys of adulthood is being allowed access to things that are potentially dangerous. Guns, alcohol, cars, and the right to vote are all examples of things that are useful (or at least fun and harmless) when used responsibly, and deadly when abused. Vehicle parameters can be added to that list. Be careful when editing parameters. You can completely screw up a vehicle either by rendering it inoperable or by causing it to crash. The best way to edit a parameter you know nothing about is to not edit it. Leave it alone.

Video Path Logging

If you record video during a flight, the paths you take while doing so are recorded. You can see evidence of this in the Flight Logs layer on the solexMap, where the paths will show as long green lines. Click on one of these, and it will highlight and show the vehicle's position at each point that was recorded.

You can also import a .zip file containing your videos from a given flight log into Solex. When you do this, Solex will open a viewer where you can select a flight log from a list, and show the video paths within it on a solexMap. When you click on a video path, the video will play, and a vehicle icon will move on the solexMap to show the location where a given time in the video was recorded.

You can tap the video view and see a seeker control and pause/etc buttons to control playback. If you seek forward or backward through the video, the vehicle position will update to match where it was at the time in the video. You can also click on the path on the solexMap, and the video will skip to the time where the selected location was recorded.

To import videos into Solex, do this:

1. On your computer, make a zip file without paths embedded in it containing all of the video files from a given flight log. You have to include all of them, or Solex can't figure out which file goes with which path.
2. Copy that file into Google Drive, Dropbox, or any other file-sharing service that can be used from Android.
3. Wait for it to upload to the relevant service. This may take a while, since video files are big.
4. In the relevant app on your Android device, open the .zip file.
5. Solex will ask if you want to import the file. Say yes.
6. Solex will churn for a while as it extracts the files to a temporary directory, then open the Video Path UI.
7. Pick the flight log where the videos you just imported were recorded. (It's helpful to name flight logs so they're easy to locate in the list.)
8. Once you see the various video paths displaying on the solexMap, click on one, and watch the video..