EVOLUTION AIRCRAFT INC.
REV X
Operating and Maintenance Instruction Manual
Version 1.0

Released 04/01/2019

INTRODUCTION

REV X is a STOL (short takeoff and landing) single seat trike powered by a Rotax 582 with E box. Its most notable key features are NO FRONT STRUT, All wheel suspension and it Folds onto its REV X trike dolly cart for set up and storage in under 10 minutes.

Components used are of the highest quality and technology on the market today. From the battery to the engine, from the bolts to the Powder Coat, only the Best of the Best is used.

The Rotax 582 engine is dual ignition, liquid cooled, with a gear box. This system has proven to be the highest quality, best running engine in its class. The Rotax provides a surplus of power at 65 HP for impressive climb and continuous cruise.

Stopping power comes from the Black Max Super STOL braking system utilizing 2 calipers and 4 brake pads all on one rotor!

The suspension comes from 4 "flex rods". The entire front end is a swing arm giving the nose wheel equal travel. The entire front end disconnects and "unplugs" to fold the trike in lieu of a folding mast. In its folded form the rear wheels are lifted off the ground creating a counterbalance effect which makes putting the wing up and down quite effortless.

Instrumentation comes from a super bright color display from MGL. The Xtreme EFIS provides valuable information about the engine and flight.

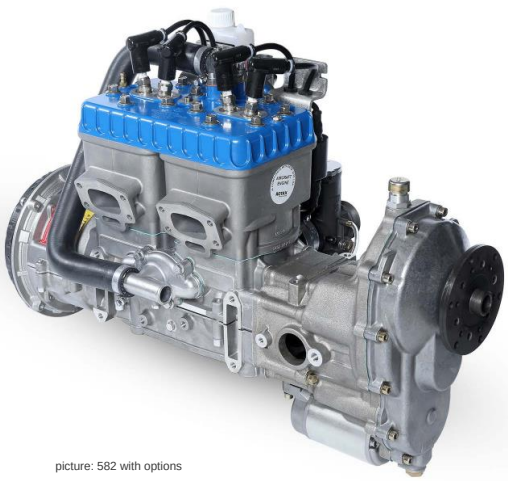
Standard features include:

1. Cantilever mast with no front strut required
2. All wheel suspension
3. Quick fold cart for easy storage
4. MGL Xtreme color instrument panel
5. Tundra tires
6. Electric start and pull start
7. Earth X lithium battery
8. Dual hydraulic disc brake
9. 4130 Chrome Moly high reinforcements in high stress areas
10. Real Aircraft seat belt
11. Extra padded seat cover
12. ¾” chrome moly front axle
13. AN aircraft hardware throughout
14. Tefzel aircraft wire
15. Cannon plug for quick disconnect

ROTAX 582 ENGINE

ENGINE TYPE 582 | 65 hp (u.)

ROTAX® AIRCRAFT ENGINES



picture: 582 with options

DESCRIPTION

- 2-cylinder
- 2-stroke liquid cooled engine with rotary valve intake
- dual electronic ignition
- integrated water pump and thermostat
- exhaust system
- carburetors

FACTS

Over 35.000 units of this popular Rotax 2-stroke engine have been sold. This engine type is well regarded for its easy maintenance and robustness.

ENGINE DATA

WEIGHT	kg	lb
engine	29.1	64.0
2 carburetors	1.8	4.0
exhaust system	5.1	11.2
electric starter	3.5	7.7
propeller speed reduction unit "B" / i = 2.58	4.5	9.9
propeller speed reduction unit "C" / i = 2.62/3.0/3.47/4.0	8.0	17.6
propeller speed reduction unit "E" / i = 2.62/3.0/3.47/4.0	11.2	24.7

VERSION	PERFORMANCE			TORQUE			MAX RPM
	kW	hp	1/min	Nm	hp	1/min	1/min
582 Mod. 17	48	65	6500	75	55.3	6000	6800

BORE		STROKE		DISPLACEMENT	
76 mm	2.99 in	64 mm	2.52 in	580 cm^3	35.4 cu. in.

FUEL	ENGINE LUBRICATION	MIXING RATIO
min. MON 83 RON 91* min. AKI 87*	API-TC-Classification	1:50 or optional with fresh oil pump

* leaded, unleaded, AVGAS 100LL or Ethanol 10

Engine Lubrication

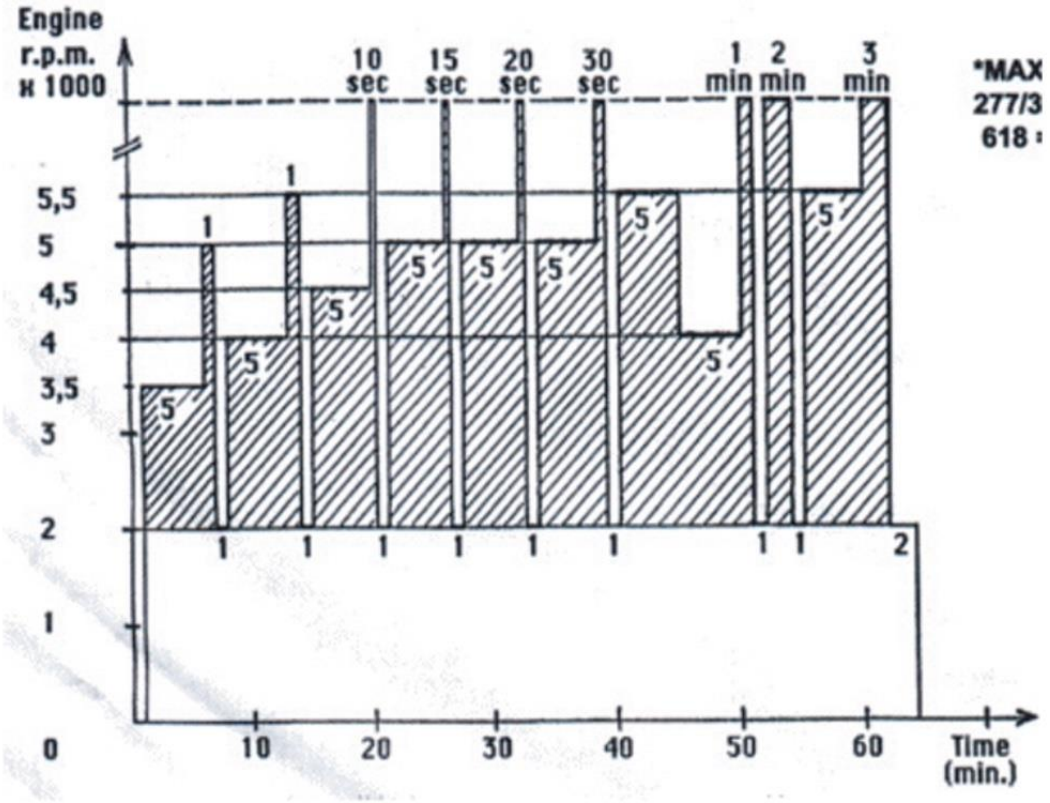
Oil Injection Pump

Use Husqvarna 2-Cycle Synthetic Blend Oil (Commonly sold at Lowes Home Improvement)

CAUTION:

Many 2 stroke oil brands can be used however the REV X is set up at the factory with this oil and it is highly recommended NOT to change oils unless a complete oil reservoir flush is done.

Break in Procedure



PROPELLER

Any running propeller can present a potential danger for the pilot, the passenger and/or the spectators. Never let non pilots touch the propeller, even when the engine is stopped. Always be extremely careful as soon as an engine equipped with a propeller may turn.

WARNING

Before turning the propeller with the hand, always verify attentively that the driving ignition is off.

NOTE:
Each prop blade as well as the prop crush plate has a colored dot which must line up for the purpose of dynamic balance.

Torque and Pitch Maintenance

Torque: 100 inch pounds

- 10 minutes after first assembly, engine warm.
- After the first flight hour.
- As many as necessary, and at minimum every 25 hours and/or every 3 months.

Before each flight:

Visual inspection of the propeller and checking of the screws.

If an incident or prop strike require repair, this must be approved by Hélices E-PROPS in its workshops, or by a specialist after discussion with the E-PROP Team.

All the blades have a reference number and a serial number. These references are important for determining with the E-PROP team what modifications or the possible replacement in necessary. The final checks of the propeller, and in particular balancing, are made by Hélices E-PROPS before the delivery. Any modification of the propeller can damage the balancing and generate vibrations which could damage the engine.

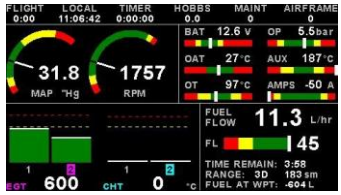
EFIS
MGL Xtreme

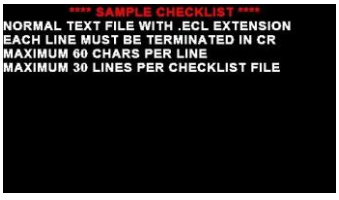
For complete instruction manual click here:
http://mglavionics.com/html/xtreme_efis.html

XTreme - EFIS

Electronic Flight Information System

Operating Manual – English 1.07





Various Screens

Basic Features

- Powerful 32 bit ARM processor
- 4.3” high resolution 480x272, sunlight readable, wide viewing angle, 600 nits TFT LCD display
- LED backlight (brightness can be adjusted for low light flying conditions)
- SD Card interface for data recording, user splash screens, checklists, graphic information pages, firmware upgrades, navigation and route files etc
- 1/8” NPT female fittings for Altitude and Airspeed pitot tube connections
- Rotary control plus 5 independent buttons for easy menu navigation and user input
- External active GPS antenna connection
- Built in RTC (Real Time Clock)
- Wide input supply voltage range of 8 to 30V DC
- Built in voltage reversal and over voltage protection for harsh electrical environments
- Light weight design

Optional Features

- Optional MGL Avionics compass sensor unit (SP2/SP6)
- Optional MGL Avionics AHRS sensor unit (SP4/SP5/SP7)

System Overview

The RDAC (where all the sensors run to) is located behind the pilot seat just opposite of the battery. This design keeps all of the sensor leads short and without the need of extension cables and keeps the wiring lighter and simpler. This RDAC (brain box) is easily accessible by removing the pilot seat by removing the 4 bolts that secure it to the frame. *NOTE due to imperfection in the seat mold, the rear left seat bolt corner has 2 washers that shim the seat in order to make the seat perfectly straight. Be sure to reinstall these washers when putting the seat back in* Most of the sensor wires are very small gauge and can come loose during the life of the machine. Simply retighten any loose sensor wires if a sensor appears to fail. The RDAC is completely labeled making it very simple to figure out. The RDAC has a green blinking light which indicates it is getting power when the key is turned on. If it is not blinking green it is probably not getting power and will not work without being powered. There are only 3 wires which are bundled together in a single shielded cable that connect the RDAC to the EFIS (monitor). If an RDAC fail notice displays on the EFIS, it is referring to a connection break between the EFIS and the RDAC or lack of power to the RDAC. All of the parameters (VNE caution temperatures and warnings are fully programmable under the menu settings. There are 5 different screens to scroll through, but it is recommended to turn off 3 of the 5 screens which are not useful for the REV Xs set up. These other screens include satellite info and artificial horizon. This leaves a screen with large, easy to read round dials for flight instruments and a screen with mostly easy to read bar graphs for engine monitoring. When only 2 screens display it allows the user to use the left square button to toggle between the 2 screens instead of having to go through all 5 screens to get back to the other useful screen.

Using the EFIS

Pressing the left button will scroll between screens.

Pressing the round knob in will bring up a menus. Turning the knob to highlight and then pushing in to select will allow you to navigate the system.

Barometric pressure is located in the top right corner of the EFIS display. Turn the rotary control to change the local pressure setting. The local pressure can be displayed in “mB” or in “HG”. This is used to set the altimeter to MSL or AGL.

NOTE:

This must be checked and adjusted before each flight in order for it to be accurate.

CHT (cylinder head temperature) and EGT (exhaust gas temperature) alternate in the same location. **CHT must remain below 270°F and EGTs must remain below 1200°F**. Coolant must remain below 175°F. These are important to monitor. If one of these temperatures goes too high a red WARNING box will appear and flash on the screen.

Tachometer is displayed on the right side of the screen. Full throttle should yield between 6300-6700 RPM.

Airspeed may or may not be accurate and needs to be calibrated. Using the GPS and making different headings comparing the GPS to the airspeed it is possible to calibrate the airspeed. We recommend your airspeed be set to 120% as a base value to get closer to a correct reading. The value can be adjusted up to 150%.

The Ground Speed is labeled GS EFIS display. The ground speed value will only be displayed when a valid 2D or 3D GPS fix has been achieved.

VSI is vertical air speed or the rate in which climbing or descending. “+” means it is climbing an “–“means it is descending.

Hobbs Meter tells the number of hours on the engine which is important for scheduled maintenance.

Voltage shows the battery voltage when the engine is off and the charging voltage when the engine is running. Keep in mind the voltage is higher (13.1-13.6 volts) than expected lead acid battery voltage.

Wing

For complete instruction manual click here:

http://northwing.com/Mustang3-Wing-Manual.pdf

Braking System

WARNING

This system does NOT use brake fluid.

The brake system is a combination of a Matco master cylinder which uses an internal "intensifier kit" with a black Max caliper system.

Bleeding the brakes should be done by pressure bleeding the system with ATF (automatic transmission fluid). Fluid should be added with some form of a pressurized container (pump sprayer or oil can) with a hose that secures firmly around the lowest bleed screw on the caliper. Loosen Allen set screw at top of caliper to allow all air to escape from the system as ATF fluid is injected into the lowest bleed on the caliper. When all air has escaped, tighten the top bleed screw. Then loosen the large set screw in the top of the Master cylinder and continue to pump ATF fluid into the caliper until all the air is out of the master cylinder. Then tighten large setscrew and the bleed screw supplying the ATF fluid. Ensure the brake pads are not dragging by elevating the nose wheel and spinning the wheel. If the wheel does not spin freely, loosen the large setscrew in the master cylinder while pressing the brake pedal down until a small amount of fluid leaks out. Then tighten the setscrew and test again. Once the wheel spins freely make sure the pedal is hard and not spongy

CAUTION:

Tightening the setscrew may cause the caliper to activate the brake pads.

Replacing the Brake Pads

1. Elevate the front wheel by putting something under the frame such as a stool with padding
2. Loosen all 8 Allen head screws in the triple trees (horizontal CNC fork tube clamps)
3. Once fork tube and nose wheel are free, remove the bolt that go through the port (left) side of the axle
4. Remove the through bolt that secures the caliper to the axle
5. Loosen the setscrew that tightens the caliper to the axle
6. Slide the caliper with the free floating rotor off the axle
7. Separate the rotor from the caliper
8. Remove the piston side brake pad first and then the other
9. Install new pads and reverse steps for reassembly

Support Cables

The 5 support cables on carriage can be removed easily by locating which nut to remove first. The angle of the bolts that secure the cables are orientated in such a way that as one of the nuts is loosened it will relax the cable being removed. The tension of the cables is controlled by twisting the cables. Twisting counterclockwise tightens the cable by shortening its overall length and clockwise loosens it. This tensioning method is effective and lighter and simpler than adding a tensioning mechanism. When replacing a cable try and get the cable snug so that it is difficult to expose only 3-4 threads on the bolt that secures it. Start the nut by hand onto the 3-4 threads and then carefully tighten down the nut with a 7/16" socket and wrench which will start to tension the cable even further. When the nut is all the way down the cable should be extremely tight.

CAUTION:

The X brace behind the pilot seat must be done at the same time in order to not rack (shift) the frame.

EARTH X BATTERY

WARNING

Do NOT charge with a desulfinating battery charger.
Do NOT use Schumacher battery chargers with Earth X batteries.

Recommended to Use the simple noncomputerized 1-2 amp battery charger. These are readily available as the cheapest chargers on the shelf at Walmart and auto part stores.

Model: ETX12A

Nominal Voltage	13.2 V
Ah (Lead-acid equivalent)	12
Ah (1 hour discharge rate)	4 (1C rate)
Pulse Crank Amps (PCA)	220A (3 sec @ 25 °C, voltage >9V)
Cold Crank Amps (CCA)	135A (modified SAE test, 3 sec@ 0°F, voltage >7.2V)
Max Continuous Discharge Amps	40A
Standard Charge Voltage	13.9 - 14.6 V
Maximum Charge Voltage	15 V
Recommended Charger/Maintainer Amps	.8 - 5A
Max Charge Amps	20A (from vehicle charging system)
Life (Charge cycles)	4000 cycles @ 1C discharge rate, 25°C (20% depth of discharge) 2000 cycles @10C discharge rate, 25°C (80% depth of discharge)
Life (Years)	8 Years
Weight	1.3 lb. (.6Kg)
Dimensions	4.5in x 2.6in x 3.7in (113mmX66mmX95mm)
Environmental Rating (resistance to water intrusion)	IP 66 (wash down with a high pressure washer)
Operating Temperature	-30 °C to +60 °C
Storage Temperature	-40 °C to +70 °C

List of Chargers

	Model	Safe to Use	BMS Reset	Suggested Use
TecMate/ Optimate	**Lithium TM-271/TM-291**	Yes	Yes	Use as charger, maintainer and it will reset EarthX's BMS over-discharge protection
TecMate/ Optimate	**Lithium TM-271/TM-485**	Yes	Yes	Use as charger, maintainer and will reset EarthX's BMS over-discharge protection
Battery Minder	Any model	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery
Black N Decker	BM3B	Yes	No	Use as charger
Black N Decker	BC15BD	No	No	Do not use, as full time desulfinating charger
Christie	All Models	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery
CTEC	Lithium US	Yes	Yes	Use as charger, maintainer and it will reset EarthX's BMS over-discharge protection
Deltran	Battery Tender Jr	Yes	No	Use as charger, maintainer, but will not reset EarthX's BMS over-discharge protection
Deltran	Battery Tender (original)	Yes	No	Can be used for charging only. Maintenance voltage is too low.
Deltran	Battery Tender Plus	Yes	No	Can be used for charging only. Maintenance voltage is too low.
Duraboost	Duraboost 750	Yes	No	Can be used for charging. Cannot find a maintenance voltage in manual so if it is less than 13.3V, too low.
Duraboost	Duraboost 1000	Yes	No	Can be used for charging. Cannot find a maintenance voltage in manual so if it is less than 13.3V, too low.
H-D	Tender Jr	Yes	No	Use as charger, maintainer, but will not reset EarthX's BMS over-discharge protection
Moose	Tender Jr	Yes	No	Use as charger, maintainer, but will not reset EarthX's BMS over-discharge protection

NOCO Genius	All Models except the lithium specific one	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery
Tenergy	4cell LiFePO4 Smart Charger	Yes	Yes	Use as charger, maintainer and it will reset EarthX's BMS over-discharge protection
ODYSSEY	Ultimizer	Yes	No	Use as charger and maintainer
Pulsetech	Xtreme XC100	Yes	No	Can be used for charging only. While in operating, verify the pulse output is off.
TecMate/Optimate	**All lead acid charger models**	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery
CTEC (like Multi XS 3600)	**All lead acid charger models**	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery
Schumacher	Any model	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery
Yuasa	Smart Shot 900	No	No	Can be used for charging. Cannot find a maintenance voltage in manual so if it is less than 13.3V, too low.
Yuasa	Smart Shot 1.5mA	No	No	Do not use, as full time de-sulfating mode will damage a lithium battery

NOTE:

This is not an all-inclusive list.

Lithium batteries have a very low self-discharge rate which means the battery, if disconnected from your trike, could "hold its charge" for a year.

The ETX Lithium battery is compatible with most "modern" lead-acid battery chargers or 4cell LiFePO4 battery chargers. By "modern" we mean a charger that automatically turns off when the battery is fully charged, a charger with a micro-processor, or a charger with multiple mode charging. The "full charge" voltage for the ETX Lithium battery is 13.3V or higher. Some lead-acid battery trickle chargers maintenance mode voltage can be below 13.3V, which is too low for a lithium battery. For example, the Battery Tender JR has a maintenance mode voltage of 13.3V which is compatible, whereas the original Battery Tender has a maintenance mode voltage of 13.2V which is too low for a lithium battery. Never charge a faulty battery (a battery that will not accept a charge or hold a charge). Never use the de-sulfate setting on your charger. Be sure the charger's output voltage level does not exceed 15V. If the charger does not display the voltage reading, then use a voltmeter to check the voltage while charging. If the battery gets hot while charging, discontinue charging and use. Do not charge battery in temperatures above 140°F (60°C),

or in direct sunlight. When charging a battery, place it on a non-flammable surface, and remove any flammable items nearby. For maximum battery and vehicle starting system life, do not crank an engine for more than 10 seconds within any 1 minute period.

Troubleshooting

The ETX Lithium battery is an extremely reliable battery with a longer useful life than comparable lead-acid batteries.

Despite the high reliability, you may encounter situations where the battery does not operate as expected. Here are some potential issues you may encounter with the appropriate troubleshooting procedures.

Problem

The charger shuts down during the first few seconds of charging.

Possible Causes and Solutions

Are you using a Constant Voltage (CV) charger? CV chargers may trip when first connected to a drained battery due to a high inrush of current. If this happens, reset the charger and try again. If the problem continues, try using a different charger.

Problem

Zero voltage at the terminals or un-stable voltage (voltage reading drifts slowly to zero). With a lead-acid battery, finding a very low voltage at the terminals often indicates the battery has reached the end of its life. With an ETX Lithium battery this may not be true.
Possible Causes and Solutions

The ETX series lithium battery has built-in over-discharge protection circuitry, which automatically disconnects the battery if the voltage drops below 11.5 volts (98% discharged). When the battery is “disconnected”, the voltage at the battery terminal should be zero.
Some volt-meters may initially indicate a voltage, but it will decay to zero within ten seconds or so. For a drained battery, simply connect the battery to a charger to restore charge (charge with 2A for 20-30 minutes), and then re-check the voltage. If the voltage is 12.8V or greater, the battery should be ok and can be fully charged. Not all chargers will charge a battery that displays zero volts, so check our website for a list of compatible chargers, and specifically chargers that will work for recharging an “over-discharged” battery for which the BMS’s over-discharge protection has activated. This condition is sometimes referred to as a BMS reset.

Problem

The battery seems to suddenly stop working.

Possible Causes and Solutions

A lithium battery voltage remains relatively constant while discharging, but when the battery runs out of power it does so abruptly. Try charging the battery for 30-60 minutes at 1 – 2 Amps. If the battery still does not work, or the measured voltage is less than 12V, the battery may be permanently damaged and needs to be replaced.

Problem

The battery does not hold a charge.

Possible Causes and Solutions

There may be a problem with the engine charging system: While the charging system is in operation, it should output approximately 13.9 -14.6 volts. If the voltage is below this level, the charging system needs to be repaired.

FOLDING THE TRIKE

1. Disconnect throttle and wiring.
2. Lift nose wheel and slide the cart underneath the REV X.
3. Use bungee cord to lift the front of the cart and attach it to the swan catch to help line up pins that secure cart to frame.
4. Install 2 cart/frame pins.
5. Release bungee cord and allow cart to lock its rear wheels against drag links of the REV X's suspension.
6. Secure control bar into the chalices of the cart.
7. Remove front end of trike by removing the 2 speed pins that hold it on.
8. Lower the cart to the ground.
9. Remove the tip battens.
10. Fold in the sprogs.
11. Loosen the haul back cable.
12. Remove all battens except for the nose battens and the longest root battens
13. Ensure the prop is vertical and Ensure engine is cool to the touch.
14. Fold wing back (Chock wheels on dolly cart for ease) Either using 2 people walk the tips back towards each other or connect both ends of a 40' rope to each wing tip strap and pull the center of the rope back for single person folding.
15. Once the wing is folded, carefully pull the fabric up and over to the outside of the folded wing.
16. Insert wing standoffs between the cross tube and the roll cage mast at the very rear of the trike.
17. Roll up fabric and secure with straps.
18. Secure front end in cart for storage.
19. Tie wings together to press and hold the wing standoffs in position.

Click the link below to watch a video on how to fold the Rev X trike.

https://youtu.be/zLQO0Ci-JaQ

OWNER MANUALS

ENGINE

https://www.cps-parts.com/cps/pdf/d04495.pdf

MAINTENANCE MANUAL

https://www.cps-parts.com/cps/pdf/d00288.pdf

Illustrated PARTS CATALOGUE

https://www.cps-parts.com/cps/pdf/d05246.pdf

MGL Xtreme EFIS

http://mglavionics.com/html/xtreme_efis.html

WING

http://northwing.com/Mustang3-Wing-Manual.pdf

PROPELLER

https://ppg.e-props.fr/docs.php Click on NG-D Propellers – pdf file

In case of incident, please contact Hélices E-PROPS as soon as possible at:

Hélices E-PROPS *Aérodrome de Sisteron 04200 Vaumeilh – France ☎ 33 (0)4 92 34 00 00*

helices@e-props.fr ***www.e-props.fr***

FOLDING THE WING

https://youtu.be/zLQO0Ci-JaQ

Thank you

Thank you for your purchase of the REV X. We hope that with proper maintenance you will receive years of enjoyable flying. If you need assistance or have questions call:
Evolution Aircraft at **1 (813) 810-9262**