Safe-Fly 2020 ADS-B Compliant GPS Module with Serial Data Combiner/Expander

Revision P
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GRTAvionics.com

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Revision History

Rev A – Initial Release 2/9/17

Rev B – Added description of supplied cable.

Rev C – Revised for timing output for hardware version RM-2020-02

Rev D – Added EchoUAT support. Revised wiring for SafeFly Rev B Hardware. Updated GPS status indicators.

Rev E – Added a section about recommended GPS configuration for with GRT EFIS.

Rev F – Various Changes

Rev G – Added wiring diagram and settings for Horizon and Sport WS and HS models with uAvionics EchoUAT.

Rev H – Added note to EchoUAT settings to remind user to enter aircraft specific information in the EchoUAT/TT22 settings menu on the general setup page.

Rev I – Minor clarifications of Uavionics EchoUAT wiring diagrams and applicability.

Rev J – Minor improvements for the Trig TT31. Added "Other TT31 Considerations" section.

Rev K – GPS Certification Level Setting changed to "B" for EchoUAT.

Rev L – Added minimum software versions for Trig TT22, settings for Flight ID and Address, GPS Certification level for Echo UAT is now A or B, VFR ID is now N-number

Rev M – Added clarification for each type of equipment supported to perform the Safe-Fly GPS/SPC configuration before performing the setup for the specific equipment.

Rev N – Added a note about TrigTT31 baud rate and clarified manual regarding types of settings.

Rev O – Updated Wiring diagram. Revised mounting screw to 8-32. Noted that the EchoUAT can be mounted to the Safe-Fly GPS, and the Safe-Fly can be mounted to the Sport/Horizon 10.1.

Rev P – Clarified that a connection must be made for stand-alone Safe-Fly/Echo UAT operation, removed EchoUAT settings that are not longer used (for COM2), and added a section on verifying ADS-B operation via the FAA Performance Report, along with tips for resolving problems with this report. Updated the default setting in the Safe-Fly GPS. Updated minimum software version for use with EchoUAT.

Description

The Safe-Fly ADS-B compliant GPS module with serial data combiner provides GPS position data as a stand-alone module to various approved ADS-B out devices, or may be wired to any GRT EFIS to provide high integrity GPS position data, and provide more serial ports for all GRT EFIS display units except the WS and HS models. Included with the unit are a GPS antenna suitable for interior mounting, and mounting hardware.

Compatibility

The Safe-Fly GPS module is fully compatible with any GRT Mini, Sport SX, Horizon HX, Horizon HXr, Sport EX, or Horizon EX EFIS, and compatible with the Sport and Horizon WS and HS models as a GPS navigation source and for use with ADS-B in/out devices, but will not provide a serial combiner function for these models. It can also operate stand-alone with the ADS-B out devices listed in the "Approved Devices" section. The minimum software versions that support the module are:

EFIS	Minimum Software Version
All models of Mini EFIS	3.00
Sport EX/Horizon EX	1.06
Sport SX	13.00
HX	9.00
HXr	5.01
Sport or Horizon WS*	Any
Sport or Horizon HS*	Any

* These units are not compatible with the serial data combiner and GPS accuracy indicator functions provided by the Safe-Fly GPS, nor can these units be used to configure the Safe-Fly GPS. The Safe-Fly may be ordered pre-configured as needed at no charge, allowing it provide GPS data to your ADS-B output device. In addition, a serial output from the Safe-Fly may be configured to provide NMEA0183 GPS data to these EFIS models.

Use with Non-Compatible GRT and other systems

The Safe-Fly GPS module can be used with non-compatible systems, and without any connection to an EFIS, with the following limitations:

- Default settings will allow the Safe-Fly GPS to work with an Uavionix EchoUAT with no settings change.

- Default settings will not allow the Safe-Fly GPS to work with a Trig TT22. However, the module can be ordered with its configuration set as desired at no additional cost.

- The integrity and accuracy data will not be indicated on the EFIS display unit.

- The serial combiner function cannot be used.

For these installations we do recommend using the NMEA0183 output to the EFIS, to provide the EFIS with a high-quality navigation source.

GPS Function

The Safe-Fly GPS Module utilizes a RAIM GPS which provides all data required for ADS-B 2020 compliance for ADS-B out devices listed in the "Approved Devices" section. The GPS data can also be used with any GRT EFIS to provide the EFIS with a high-integrity navigation source. The module communicates with compatible ADS-B out devices via a serial port connection, independent of the EFIS display unit.

Multiple GPS Configuration for your GRT EFIS

The high-integrity nature of this GPS position means the GRT EFIS user should configure the Safe-Fly GPS as one of the two possible GPS sources to the EFIS display unit, if at least one of the GPS inputs is not assigned to a panel mount GPS.

For installations without an external panel-mount GPS, configure the Safe-Fly GPS as GPS1 (or whichever GPS is commonly selected as the navigation source).   For installations with one panel mount GPS that is approach capable, the Safe-Fly GPS should be used in lieu of a non-RAIM external GPS module.

Note that if your display unit includes an internal GPS, it is set as GPS1, GPS2, or NONE via the "Internal GPS" setting on the "General Setup" set menu. The internal GPS is a non-RAIM GPS in all EFIS display units equipped with an internal GPS.

GPS Status Display (This section is preliminary)

All GRT EFIS display units, with the exception of the Sport and Horizon HS/WS models, will show the integrity and accuracy of the GPS in the upper left corner of the screen.   It should not be inferred that the "Approach" accuracy allows the GPS to be used for IFR approaches, however this indication is provided to enhance the understanding of the performance of their GPS installation. If GPS-INTEG is

commonly displayed, or GPS-E or GPS-A is not observed, check the integrity of the antenna connection and location of the antenna.

GPS

No accuracy or integrity information is known about this GPS, or horizontal accuracy limit > 4 nm.

GPS-E

Valid position integrity and horizontal accuracy limit > 1.0 nm, and less than 4.0 nm, typical of IFR enroute requirements. *

GPS-A

Valid position integrity and horizontal accuracy limit > 0.3 nm and less than 1.0 nm, typical of IFR LNAV approach requirements. *

GPS-Integ

No Integrity – Insufficient data for validating data with RAIM integrity test. (Flashes Yellow and Green)

* The GPS and EFIS are not FAA certified.

Serial Data Combiner/Expander Function

In addition to the GPS functions, the module includes a serial port combiner function. The module includes 4 serial ports (input and output). One of these is dedicated for communication with the EFIS display unit. The other 3 serial ports can be configured to send GPS data directly to an ADS-B output device, or used to expand the number of serial ports available to your display unit.

Recommended Usage of Serial Combiner/Expander Serial Ports

The design of the serial port combiner minimizes data latency (delays), however, connecting the following devices is not recommended due to their potential sensitivity to the additional latency.

- GRT Autopilot Servos
- Data to 3rd party autopilots, such as Trutrak and Trio
- AHRS, especially when the system includes a connection to an autopilot

Devices that provide large amounts of data at high baud rates (38400+), such as ADS-B receivers or XM weather will function through the combiner, but could exceed the capacity of the combiner and reduce the available data that could be passed through the other serial ports. For this reason, high data rate devices must be wired directly to the display unit to avoid data loss.

Installation

Mounting holes are provided in the four corners of the case for #8 flat head screws. Two screws are sufficient when located in opposite corners for most installations. The module can be mounted in any orientation. Typically, the unit is mounted in the forward part of the airplane so its antenna can be positioned on the glare shield, and so it is near the GRT EFIS display units. The module should not be exposed to water, or in a location where it is likely to get wet, or where temperatures will exceed 150 deg F when in normal operation.

The Safe-Fly includes threaded holes for 4-40 screws to allow mounting of the Uavionx EchoUAT. This simplifies the installation and reduces the number of devices that must be mounted.

To further simplify the installation, the Horizon and Sport 10.1 EFIS allow the Safe-Fly GPS to be mounted to the rear of the EFIS using 8-32 x ¾" screws. Caution: Do not exceed 1" long screws to avoid damaging the EFIS internal PC board.

Wiring

The Safe-Fly GPS will operate with or without a connection to a GRT EFIS. In most cases it will be wired to a GRT EFIS to supply the EFIS with GPS data, and allow the use of the 3 serial ports on the module. (The serial data from these ports is combined into the one serial data stream to the EFIS, along with the GPS data, and transmitted to the EFIS via the Serial Control Out pin.) Typical wiring is illustrated at the end of this manual.

Power and Ground

Power – Power must be provided to at least one of the three power inputs on pins 23,24,25. +9-32VDc is required at 0.2A maximum. These inputs are isolated, and multiple power inputs can be used for redundancy.

Ground - One ground connection is recommended, to any of the provided ground pins.

GPS Backup Power – This connection is optional. It will draw about 30 uA from the aircraft battery, which is much smaller than the self-discharge rate of an aircraft battery. The GPS will acquire its position in less than 20 seconds when the GPS backup power connection is not used.

Serial Ports

When planning an installation, keep in mind that one serial output on the GPS module is required if the GPS is to provide data to an ADS-B out device. This connection minimizes latency, and allows GPS data to be sent to your ADS-B out device without dependence on a GRT EFIS that may be connected to it.

Control Port In/Out - This serial port is dedicated to use with a GRT EFIS. This connection allows the EFIS to change the configuration of the module's serial ports, and send and receive data from them.

Serial Ports 1,2,3 – These serial ports can be configured to transmit GPS data to an ADS-B output device. Ports 1 and 2 outputs are provided on two pins, and port 3 on three pins, so that "tee-ing" into an output when it is shared with more than one device is not required.

Safe-Fly/SPC Configuration

The module is shipped pre-configured in its default configuration. This configuration can be changed when the module is connected to a compatible GRT EFIS.

Default Safe-Fly Configuration

The Safe-Fly GPS is shipped, configured to transmit NN33 on serial out 1, and NMEA0183 GPS data on serial out 2 and 3, plus RAIM integrity and accuracy data, as indicated in the following table:

Current Default Settings

Serial Port	Default	Pins
Serial Port 1 Out	4800 baud, NMEA0183	19,20
Serial Port 2 Out	9600 baud, NMEA0183 + RAIM	3
Serial Port 3 Out	115200 baud, NMEA0183 + RAIM + RAIM	1,2

Serial Port	Default	Pins
Serial Port 1 Out	38400 baud, Safe Fly NN33	19,20
Serial Port 2 Out	9600 baud, NMEA0183 + RAIM	3,4
Serial Port 3 Out	4800 baud, NMEA0183 + RAIM	1,2,15

The configuration of the module can be changed by connecting it to a compatible GRT EFIS. The configuration data is stored in the GPS module, allowing it to operate stand-alone after it is configured. Unless specified in the setup for a particular transponder or UAT setup, the above settings should be used.

EFIS Configuration Settings

When the Safe-Fly is wired to a GRT EFIS (other than a HS or WS display unit), one serial port on the EFIS display unit must be configured for this module. Since the GPS includes a serial port combiner, the EFIS will provide you with additional serial ports via the Safe-Fly GPS inputs. **Using the "Set Menu", "General Setup", configure the serial port on the EFIS that is wired to the "Serial Control Input/Output" as "Safe-Fly GPS and SPC", at 115,200 baud.** After saving these settings, the General Setup menu will show additional settings associated with this module. They appear just after the serial port configuration settings.

Setting	Description
SPC Serial Port 1,2,3 Rate	Rate applies to input and output
SPC Serial Port 1,2,3 Input	Functions available are the same as the EFIS.
SPC Serial Port 1,2,3 Output	Functions available are the same as the EFIS, with the addition of multiple ADS-B GPS output functions..
GRT Safe-Fly GPS	To use this GPS as a navigation source to the EFIS, set it to "GPS1", or "GPS2". If not used as a navigation source to the EFIS, set it to "Not Assigned". Note that the EFIS supports 2 GPS inputs, and only one GPS input can be assigned to GPS1 or GPS2, so it may be necessary to change an internal GPS input to "Not Assigned", or a serial input configured for GPS1 or GPS2 must be set to "Not Used".

Safe-Fly GPS Post-Installation Checkout Procedure

When used to provide position to an ADS-B out device, an ADS-B receiver can be used to verify position data is being received by referring to the documentation for the ADS-B out device. An ADS-B performance report should also be requested from the FAA after the airplane has been flown, to further validate the installation.

When connected to a display unit, see the "Status Reporting" section, and verify the GPS is communicating (this also verifies serial communication to the display unit), and verify the power inputs used are showing voltage on these inputs. If this page is grayed out, no communication is being received from the GPS module.

Use the Set Menu, Display Unit Maintenance, and GPS Status (select this GPS if more than one is connected to the EFIS), and verify satellite reception. Typically, at least 7 satellites will show up on the GPS status page. If no, or poor reception, check the antenna connection and verify the antenna has a clear view of the sky.

Data to and from serial ports used on the module combiner are verified by any means that validates serial communication. The technique will vary depending on the device.

Status Reporting

When a serial port has been configured for this module, the status of the module may be observed on the Set Menu, Display Unit Maintenance. In the GRT Safe-Fly GPS/SPC menu, the following data is provided:

Name	Description
Module Software Version	Software version of the GPS module
GPS Communicating	Yes/No – Indicates if data has been received from the RAIM GPS within the module. Should always show "Yes" when the module is powered.
Load Module Software	Select to update the software into the module from a GSPCUp*.dat file.
Power Input 1	Voltage present on this power input
Power Input 2	Voltage present on this power input
Power Input 3	Voltage present on this power input
Temperature	Internal temperature of processor

GPS Specific Status

Detailed data about the performance of the GPS, including the number of satellites being tracked, the signal strengths, etc., is available on the Set Menu, Display Unit, GPS Status. If more than one GPS is connected to the EFIS, be sure to select this GPS.

Approved Devices – Wiring and Configuration

Trig TT21/TT22

Note: All steps in the "Safe-Fly/SPC Configuration" section above must be completed before the following settings are made.

Use of the Safe-Fly GPS for the Trig TT21/TT22 is approved by GRT Avionics when installed and configured as described in this section for experimental category airplanes. This installation meets the requirements of FAR 91-227(c), when wired as shown below, and configured as indicated.

The minimum software versions required are as follows:

Device	Minimum Software Version
Safe-Fly GPS	2
Trig Adapter (if used)	5
Trig TT22	SW2.7

Configuration

Setting	Required Selection
SPC Serial Port 1 Rate	38400
SPC Serial Port 1 Output	Safe Fly NN33

TT21/TT22 Settings

These can be found in the Set Menu, General Setup, TT22 menu when controlled by the EFIS.

Setting	Required Selection
GPS Input	GRT Safe-Fly NN33 (select NexNav on non-GRT controllers)
GPS/TIS Rate	38400
GPS Certification Level	C
GPS NACv (m/s)	< 10

Wiring

Safe-Fly GPS Pin	Trig TT21/22 Pin	Notes:
19 – Serial Out 1	5 – GPS Input	If the GRT Trig adapter is installed on the TT21/TT22, the connection is made to pin 5 of this adapter. The data will pass through the adapter into the transponder. The adapter software must be version 5 or higher, as reported on the Set menu, General Setup, TrigTT22/EchoUAT menu (near the top of the General Setup settings).

Post-Installation Checkout - Verifying Trig TT-22 is Receiving GPS Data

When a GPS data stream with a valid position is being received by the TT22, the TT22 reports the received GPS position to the controller. When a GRT EFIS is the controller, this is reported in the Set Menu, General Setup, TT22 page on the GPS Position line. If this line shows a latitude and longitude, the position data is being received from the GPS and will be used for ADS-B out. If this line indicates anything else, the TT22 is not receiving valid position data and will not transmit ADS-B out. An FAA performance report should also be requested after flying the airplane.

Trig TT31

Note: All steps in the "Safe-Fly/SPC Configuration" section above must be completed before the following settings are made.

Use of the Safe-Fly GPS for the TT31 is approved by GRT Avionics when installed and configured as described in this section for experimental category airplanes. This installation meets the requirements of FAR 91.227(c), when wired as shown below, and configured as indicated.

The minimum software versions required are:

Device	Minimum Software Version
GRT Safe-Fly GPS	2
Trig TT31	3.18

Safe-Fly GPS Setting

Safe Fly GPS Setting	Required Selection
SPC Serial Port 1 Rate	38400*
SPC Serial Port 1 Output	Safe Fly NN33*

*These are the default settings for the Safe-Fly SPC Serial port 1, so no setup is normally required.

Wiring

Safe-Fly GPS Pin	Trig TT31 Pin	Notes:
19 – Serial Out 1	Pin 3 of Secondary Connector – RS232 In 2	The TT31 must be configured for NexNav GPS In, at 38400 baud.

TT31 Settings

These settings are made through the Trig TT31 front panel. If the Trig TT31 does not allow its serial port to be set above 19,200, its software will require updating to make the transponder compliant.

Trig TT33 Setting	Required Selection
GPS Input	NexNav on non-GRT controllers)
GPS/TIS Rate	38400
GPS Certification Level	C
GPS NACv (m/s)	< 10

Other TT31 Considerations

Although the GPS is providing GPS based altitude to the Trig TT31 for its ADS-B output, pressure altitude must also be provided to allow for the mode C altitude encoding output. When the Trig TT31 is used with any GRT EFIS, any serial output from the GRT EFIS can be configured as the altitude encoder output. We recommend using the "Fuel/Air Data (Z Format)". The baud rate set in the EFIS

must match that set in the TT31. According to the Trig TT31 installation manual, RS232 In 1 (on the primary connector) is typically used to receive this data.

Sandia

Note: All steps in the "Safe-Fly/SPC Configuration" section above must be completed before the following settings are made.

Testing is underway to validate the use of the Safe-Fly GPS with the Sandia ADS-B out devices. This manual will be updated when GRT Avionics and Sandia and approved the use of this GPS. We expect this approval soon (second quarter 2017 or sooner).

Uavionix

Note: All steps in the "Safe-Fly/SPC Configuration" section above must be completed before the following settings are made.

Use of the Safe-Fly GPS for the uAvionix EchoUAT is approved for experimental category airplanes by GRT Avionics when installed and configured as described in this section. This installation meets the requirements of FAR 91-227(c).

Operation without EFIS Control (Also Legacy Horizon WS and HS models)

When the Safe-Fly and EchoUAT are ordered together with the pre-wired cable, no connection to an EFIS is required. Mounting the Safe-Fly/EchoUAT, connecting the antennas, and supplying power via the cable is sufficient to provide UAT out, meet all 2020 compliance, and provide ADS-B weather and traffic data via Wi-Fi to a tablet. *However, the EchoUAT must be configured as described in the "EchoUAT Settings" section below before the EchoUAT will function as an ADS-B out device **and the connection from pin 1 on the Safe-Fly GPS to pin 6 on the Echo UAT must be made**. This wire is included in the harness but not connected to pin 6 of the Safe-Fly GPS, as shown in the section "Error: Reference source not found" belo..*

Optional connections that allows the GRT EFIS to use the GPS position data, ADS-B weather and traffic, and the serial port combiner features for additional serial ports are also described. These connections also provide the EchoUAT with pressure altitude data from the EFIS (if available).

EchoUAT Settings - (Required)

These settings are accessed via wi-fi using an Android or iphone/ipad and the Echo Install app, in the "Installation" section of the app.

Echo UAT Setting	Required Setting With EFIS controlling Safe-Fly GPS	Required Settings* No EFIS control of Safe-Fly (Includes GRT Avionics WS and HS display units)
Setup Source	EFIS (COM1)	App
Control Source	Set to "EFIS / Panel (COM1)" if the squawk code controlled by this display unit, or another GRT display unit connected to this via the inter-display link. Set to "Transponder Monitor" if the squawk code is set on the transponder or otherwise not set by the GRT EFIS.	Transponder Monitor
GPS Source	EFIS (COM1)	External GPS (Com2)
Traffic/Uplink Output	MFD (COM2)	MFD (Com2)
COM1 Rate	38400	38400
COM1 Data	81O	81O
COM1 PHY	RS-232	RS-232
COM1 Protocol:	TMAP	TMAP
COM2 Rate	115,200	115,200
COM2 Input Protocol	Not Applicable	NMEA

* Other settings are also required corresponding to airplane specific entries, such as aircraft type, length, width, antenna offset, etc.

EFIS Configuration

The following serial port settings are made from the "Set Menu", "General Setup"

GRT EFIS Setting (Set Menu – General Setup)	Required Setting With EFIS controlling Safe-Fly GPS	Required Settings No EFIS control of Safe-Fly (Includes WS and HS)
Flight ID (In Flight ID and Address sub-menu)	Set to aircraft N-number	Not required
Mode S Address	Set to Mode S Address (Hex) from FAA registration	Set to Mode S Address (Hex) from FAA registration
Serial Port X* In	Safe-Fly GPS and SPC	NMEA0183 GPS
Serial Port X* Out	Safe-Fly GPS and SPC	Not Applicable – Not Used
Serial Port X* Rate	115,200	9600
SPC Serial Port 1 Rate	38400	Not Applicable
SPC Serial Port 1 Output	EchoUAT TMAP	Not Applicable
SPC Serial Port 1 Input	EchoUAT TMAP	Not Applicable
Serial Port Y* In	ADS-B	ADS-B
Serial Port Y* Rate	115,200	115,200
TT22/EchoUAT Settings	Required – See below	Not Used

*Serial port "X" refers to the serial port on the EFIS that is wired to the "Serial Control In/Out" of the Safe-Fly GPS module. Serial port "Y" refers to the serial port used to receive ADS-B data into the EFIS. These will be different serial ports. For example, Serial port "X" could be Serial port 1, and Serial Port "Y" could be Serial port 2 (depending on what serial ports are not already in use and are high-speed in your EFIS will determine the serial ports you can use.)

EFIS Configuration - TT22/EchoUAT Settings

After the serial port has been configured per the above paragraph, and serial communication with the Safe-Fly has been confirmed by noting the serial port counter is counting for the serial port configured for, and wired to the Safe-Fly GPS control input/output, then the following settings must be made. **These settings are made from the TT22/EchoUAT page which is accessed from the Set Menu, General Setup, and will be near the top of this page.** Use the "Change to activate menu" selection to show the TT22/EchoUAT page. Set at least the following items in these pages:

GRT EFIS TT22/EchoUAT Setting/Status	Value
DU-SF Communication (Status)	Verify "Yes"
SF-echoUAT Communication	Verify "OK"
Remote Status	Verify "OK"
External GPS Communication	Verify "Yes"
Squat Switch	Set to "None"
Aircraft Category	Set as required, such as "Light Fixed Wing"
Speed Category	Set as Required
Aircraft Width (m)	Set as required in meters (divide wingspan in feet by 3 to enter as meters)
Aircraft Length (m)	Set as required in meters (divide length in feet by 3 to enter as meters)
VFR ID	Set to airplane N-number
GPS Input*	Compliant TMAP
GPS/TIS Rate	Does not apply to EchoUAT
GPS Certification Level*	A or B
TEST Squitters	Not used
TIS Output	Not used
UAT/978 Receiver in Aircraft	Set to "Yes"
1090-ES Receiver in Aircraft	Set to "Yes"

GPS Antenna Offset: Linear (m)	Set in to distance antenna is from nose of airplane in meters (feet divided by 3).
GPS Antenna Offset: Lateral (m)	Set in to distance antenna is from centerline airplane in meters (feet divided by 3)
GPS NACv*	<10
Mode	Verify "On"
Last Reply Count	Reading does not matter
GPS Position	Should show position if valid GPS position available
Transponder Versions	Reading does not matter
Adapter Software Version	Reading does not matter

*These settings are required to allow the EchoUAT to transmit your data.

Required Safe-Fly software version

The software version for the Safe-Fly GPS, when used with the Uavionix EchoUAT, must be 3.0 or later. Minimum EFIS display unit software is as follows:

EFIS	Minimum Software Version
All models of Mini EFIS	4.00
Sport EX/Horizon EX	2.00
Sport SX	14.00
HX	10.00
HXr	6.00
Sport or Horizon WS*	Any
Sport or Horizon HS*	Any

Wiring – GRT SafeFly to EchoUAT for Current GRT EFIS Models

This section applies to to the following models: Sport SX, Sport EX, Horizon EX, Horizon HX, Horizon HXr, and all models of the Mini.
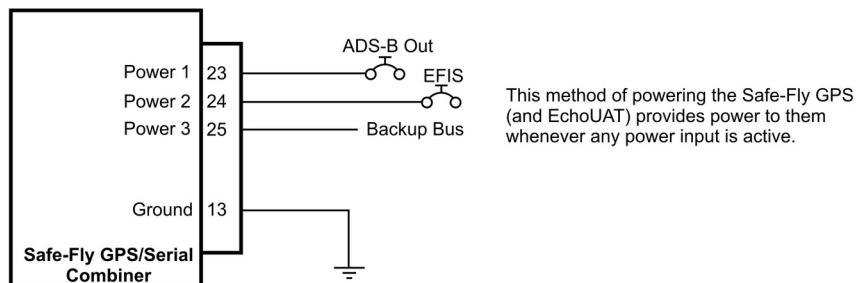
For Sport WS, Sport HS, Horizon WS, and Horizon HS, see "Wiring – GRT SafeFly to EchoUAT with no EFIS control" section below, following this section.

The following figure illustrates the wiring to the Safe-Fly GPS and EchoUAT, when used with a GRT EFIS configured to control the Safe-Fly GPS via the serial control In/Out on the Safe-Fly GPS. This wiring cannot be used with Sport or Horizon HS and WS models.
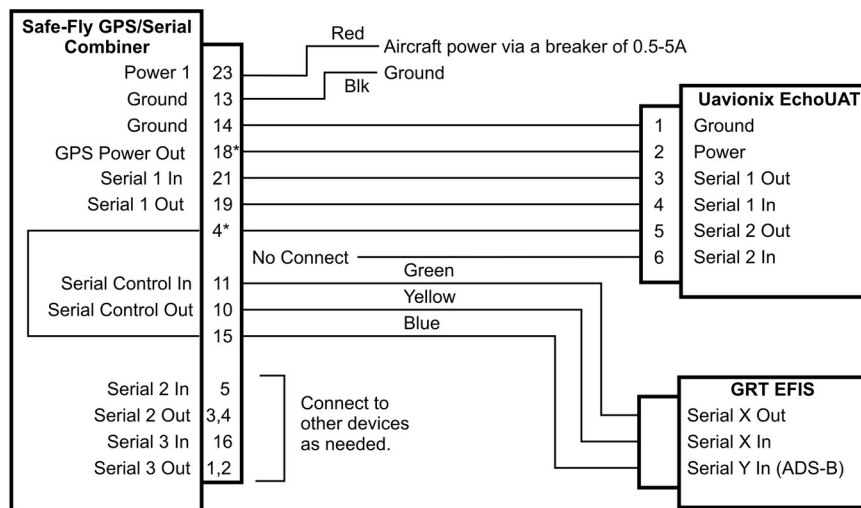
*For Safe-Fly Rev A (may not be indicated on the label, shipped prior to April 2017), does not support these connections. Connect EchoUAT pin 2 to aircraft power, and pin 5 directly to EFIS serial input.
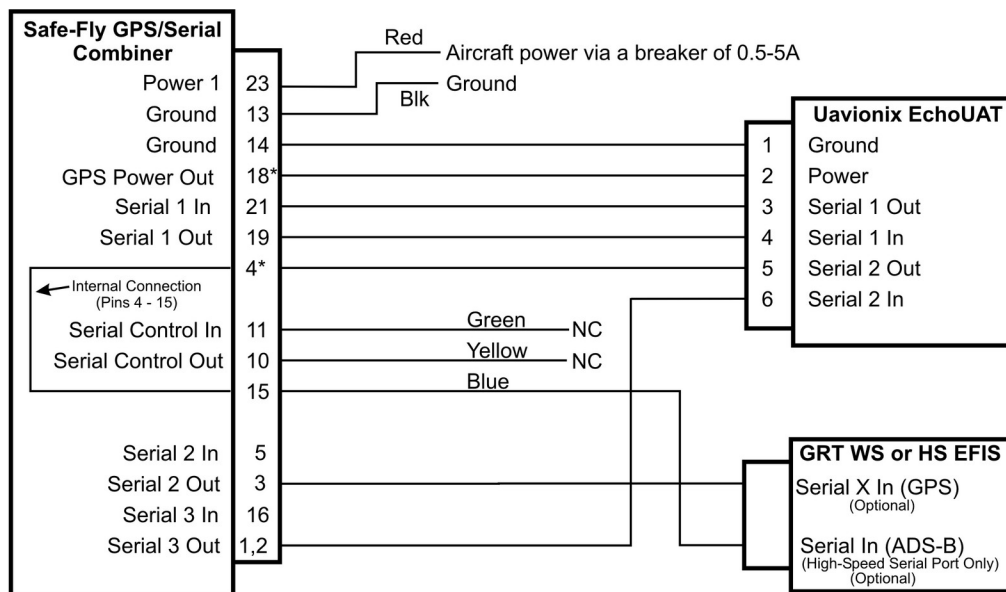
Safe-Fly to EchoUAT Pre-Wired Cable

Typical use of multiple power inputs

Wiring – GRT SafeFly to EchoUAT with no EFIS control (Including Sport and Horizon WS and HS Models)

The following figure illustrates the wiring to the Safe-Fly GPS and EchoUAT, when no EFIS exists, or the EFIS is unable to control the GPS, such as the Sport and Horizon HS and WS models.

*Rev A Safe-Fly, identified with red on label, does not support these connections.

The blue wire must connect to the high-speed serial input, (serial port 4 for HS and WS models) to display ADS-B weather and traffic data.

See Text for required settings.

Safe-Fly to EchoUAT Pre-Wired Cable to HS or WS GRT EFIS

This method of powering the Safe-Fly GPS (and EchoUAT) provides power to them whenever any power input is active.
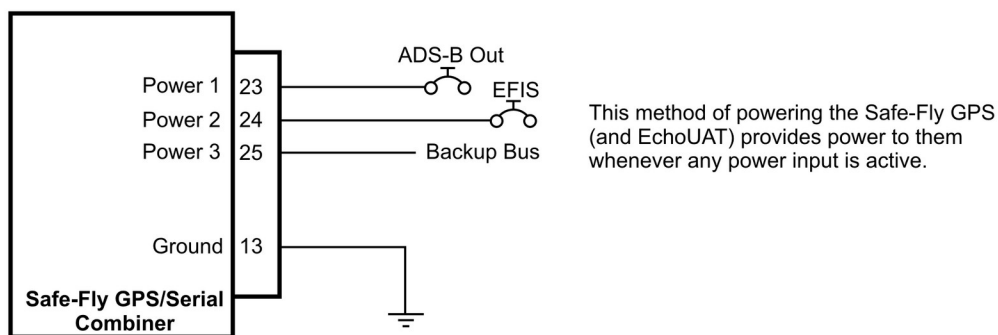
Safe Fly to EchoUAT wiring diagram - for HS and WS.cdr

Typical use of multiple power inputs

Safe-Fly with EchoUAT Post-Installation Checkout Procedure

The following post-installation checkout procedure should be used to validate normal operation of this equipment after installation.   This procedure requires that power is supplied to the equipment.

1. Using the Echo app, select "Monitor" at the top of the app. This will show the Address, call sign, and other data, including Latitude and Longitude. Verify the Latitude and Longitude fields are not dashes (actual latitude and longitude should be displayed. This confirms the EchoUAT is communicating successfully with the Safe-Fly.

2. Refer to the "Status Reporting" section above to verify serial communication is functioning between the EFIS and Safefly control input/output, power connections, and Safe-Fly software version.

3. If ADS-B data is provided to the EFIS via a serial connection, verify the serial data counter is counting on the Set Menu, General setup, for the serial port used to receive this data. When in flight, reception of ADS-B data can be verified on the Set Menu, Display Unit Maintenance, under the ADS-B status setting. Valid frame should be detected. Alternatively, when in-flight and in range of an ADS-B ground station, METARs data will be observed when reviewing airport details.

4. If the Safe-Fly is connected to the EFIS, detailed data about the performance of the GPS, including the number of satellites being tracked, the signal strengths, etc., is available on the Set Menu, Display Unit, GPS Status. If more than one GPS is connected to the EFIS, be sure to select this GPS. Other than the first few minutes after power-up, RAIM integrity should be provided and at least 6 satellites should be used in the calculations. If this is not observed, check the antenna connection and verify the antenna has a clear view of the sky.

5. An FAA Performance report should be requested. See "Verifying operation via the FAA Performance Report Request" section below.

Verifying operation via the FAA Performance Report Request

After completing the post installation checkout procedure, you are ready to fly the airplane and review your ADS-B performance report that is provided upon request from the FAA. We recommend searching on "Public ADS-B Performance Report Request" to find the relevant webpage, and then following the instructions on the webpage to obtain your report.

What to do if your FAA Performance Report shows problems

In cases where no report was found after making the request from the FAA, it is likely your airplane was not detected in the air traffic control system because you had the transponder and/or ADS-B UAT off.

If a report was provided, but includes areas marked in red, this can almost always be fixed by reviewing the settings specified in this manual and correcting any settings.

In some cases, and this is not common, the Uavionix EchoUAT may not be able to distinguish your transponder interrogation response. If this is the case, the sensitivity of the EchoUAT can be increased to allow its detection, using the following procedure.

No ADS-B output.

Check for latitude and longitude or position status in the ADS-B transmitter. ADS-B transmitters are not allowed to transmit without GPS data. Latitude and longitude should appear in SET MENU, General Setup, TT22/echoUAT, GPS Position when the EFIS is the controller and the GPS is receiving enough satellites.

- Verify GPS has reception.

- For Uavionix - Latitude and longitude should appear in the UAvionix echo app in the Monitor mode when the GPS is receiving enough satellites. Check EchoUAT app settings.

- For Trig TT22 - It will report an ADS-B position warning if it is not receiving a valid GPS position. Check all GPS settings. Check Trig control head settings.

SIL or both SIL and SDA fails in report with Safe-Fly and echoUAT

- Check SET MENU, General Setup, TT22/echoUAT, GPS Certification Level: A or B
  (Old manuals specified C and the TT22 works with C but the echoUAT requires "A or B".)

Only SDA fails in report with Safe-Fly and echoUAT:

- Safe-Fly is wired and configured for control but echoUAT is configured for app-only mode.
  Change echo app "Setup Source" to "EFIS (COM1)".

Only NACv fails with Safe-Fly and echoUAT operating without EFIS control:

- This problem was fixed by uAvionix in October 2017.
  Update the main software and transceiver software in the echoUAT.

NACv fails in installations with EFIS control:

- GPS NACv must be set to "< 10" in SET MENU, General Setup, TT22/echoUAT.

Baro Alt fails at a high percentage in Transponder Monitor mode:

- Make sure the Control Source is set to Transponder Monitor in the echo app.
  Baro Alt can be received from the EFIS control interface in systems wired that way if the echoUAT has March 2018 or newer software. Without EFIS control, baro alt must be picked up from the transponder replies in Transponder Monitor mode.

Transponder replies only when transponder is interrogated With EchoUAT

- If Mode 3A also fails and everything else is good, follow the procedure to adjust the EchoUAT Transponder Threshold in the advanced settings in the echo app.

Mode 3A fails at a high percentage in Transponder Monitor mode

- This is the squawk code. In most systems it must be picked up from the transponder replies in Transponder Monitor mode. The transponder replies only occur when the transponder is interrogated by air traffic control radar. Make sure the Control Source is set to Transponder Monitor in the echo app.

- If everything else is good, follow the procedure to adjust the Transponder Threshold in the advanced settings in the echo app.

Mode 3A only fails when squawk code is not 1200:

- Mode 3A is about the squawk code transmitted by ADS-B. If there's no wired control link between the echoUAT and transponder, or EFIS and transponder, then Transponder Monitor mode must be used. Make sure the Control Source is set to Transponder Monitor in the echo app.

Only NIC fails, or the GPS loses position sometimes:

- NIC a category of GPS signal and position quality computed from received signals.
  The minimum NIC for compliance is 8. Most Safe-Fly installations average around 9.
  This is an issue with GPS reception. Check the GPS antenna connections and location.
  The antenna should be facing straight up during level flight with a full view of the sky.
  The antenna should not have any metal objects near it (except below the ground plane) or anything else that may block, reflect, or interfere with signals. Small GPS antennas work best with a 2+ inch diameter flat metal surface underneath them to act as a ground plane. 5+ inches maximizes the ground plane effect. There should be at least an inch between the GPS antenna and any other similar antenna. Try more separation. Large IFR GPS antennas need 9 inches center-to-center and recommend 12 inches center-to-center.

EchoUAT Transponder Threshold Adjustment

These are the instructions should be followed if the only problem is picking up the transponder replies for Mode 3A (squawk code) and Baro Alt. Baro Alt is normally only an issue for no-EFIS-control installations(the EFIS is not wired to the Safe-Fly to control it). EFIS control installations can get Baro Alt through the EFIS connection even in Transponder Monitor mode, as long as the echoUAT has March 2018 or newer software.

If Baro Alt or Mode 3A are the only failures, there is an advanced setting in the echoUAT where you can increase the sensitivity of the Transponder Monitor function. First you should confirm that your Control Source is Transponder Monitor in the echoUAT Configuration to make sure it is set up to listen to the transponder. If that is correct, then you can try adjusting the sensitivity (Transponder Threshold).

Echo UAT Transponder Threshold adjustment procedure:

Adjusting the threshold value on the echoUAT can improve the performance of the transponder monitor. uAvionix does not recommend changing the value unless directed to do so by uAvionix.

The threshold value adjusts the sensitivity of the echoUAT transponder monitor. Higher values reduce sensitivity, lower values increase sensitivity.

To modify the threshold value perform the following steps:

1. Turn the avionics master on.

2. Place the Transponder in "ALT" mode.

3. Connect a mobile device to the echoUAT Wi-Fi.

4. Open the echo mobile application.

5. Verify the app shows "Connected to Device"

6. Tap two fingers simultaneously on the echo logo.

7. Scroll to the bottom of the app screen and find the Transponder Threshold values.

8. Change the Transponder Threshold by -50 and press Update Advanced.

9. Switch to the Monitor screen and watch for pressure altitude and squawk.

Please note transponder must be receiving radar interrogations for the fields to populate. Most transponders have a reply light or indicator.
Note Mode S does not reply with pressure altitude in a ground state.

10. When the appropriate threshold has been reached the Squawk and Pressure altitude will display.
Repeat 8 & 9 until ALL fields are populated

11. Values lower than 1100 should not be used and most installs seem to land between 1400-1600.

If you are still having difficulty and cannot get a reliable/stable readout please contact support@uavionix.com

Specifications

- Power Requirements: 9-32Vdc, 0.2 Amp maximum

- Weight: 0.4 lbs

- Mounting Orientation: Any

- Antenna power is 5V up to 100mA

GPS Specifications:

- GPS Type: 12-channel GPS satellite receiver using GPS constellation and satellite-based augmentation system (SBAS), such as WAAS, EGNOS, MSAS and GAGAN to the extent of WAAS compatibility.

- Approvals: Certified by GRT Avionics to FAR 91.227 when used with a ADS-B out device in the "Approved Devices" section. GPS sensor meets TSO-C199, Appendix 1, Section A1.2.6 and FAR Section 91.227(c) for ADS-B out.

NMEA0183 Sentences Transmitted
$GPGGA
$GPGLL
$GPGSA
$GPGSV
$GPRMC
$GPVTG
$GPZDA
$RAIM (proprietary)

Serial Combiner Specifications:

- User configurable serial ports: 3
- Available buad rates: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
- Available Serial Port Functions: All serial port functions available on the display unit can be used through the combiner, as well as ADS-B specific GPS outputs.

Connector Pinout

Safe-Fly 2020 ADS-B Compliant GPS Pinout
Hardware Version Rev. B

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Power In C — Ground
Power In B — Timing output Y*
Power In A — Serial Control In (to EFIS)
Timing Output Z* — Serial Control Out (to EFIS) - Includes GPS data
Serial 1 In — No connection
Serial 1 Out — No connection
Serial 1 Out — Reserved - Do not connect
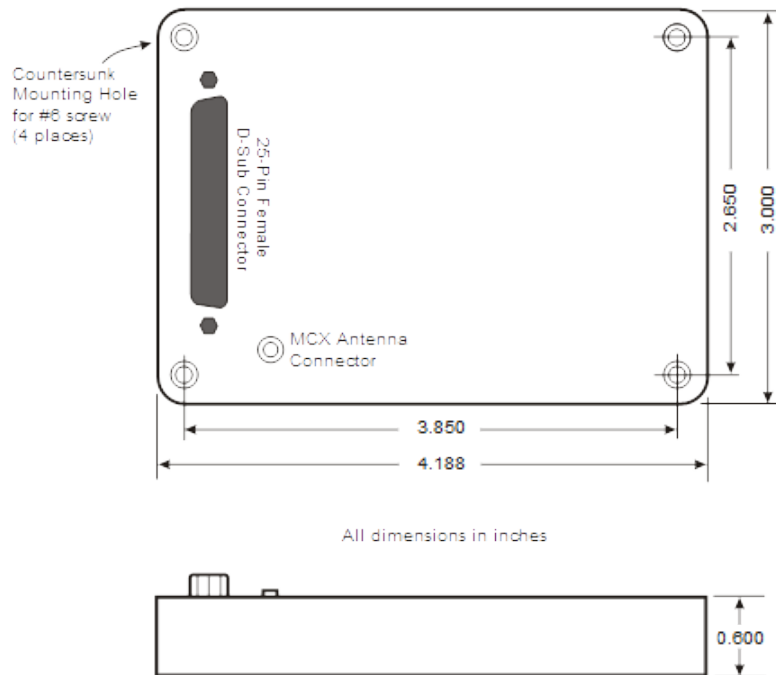No Connection — Ground
GPS Backup Power — Serial 2 In
Serial 3 In — Reserved - Do not connect
Reserved - Do not connect — Serial 2 Out
Ground — Serial 3 Out
— Serial 3 Out

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Safe-fly pinout Rev B Hardware.cdr

Rear View of Connector Housing

This view shows the side of the connector housing that the wire are inserted into.

Male d-sub connector. (GPS unit has female d-sub connector.)

This is a male d-sub connector. It can be identified by its hollow end opposite the side the wires are installed. The contacts for this connector are male pins.

Dimensions

Countersunk Mounting Hole for #6 screw (4 places)

25-Pin Female D-Sub Connector

MCX Antenna Connector

2.650

3.000

3.850
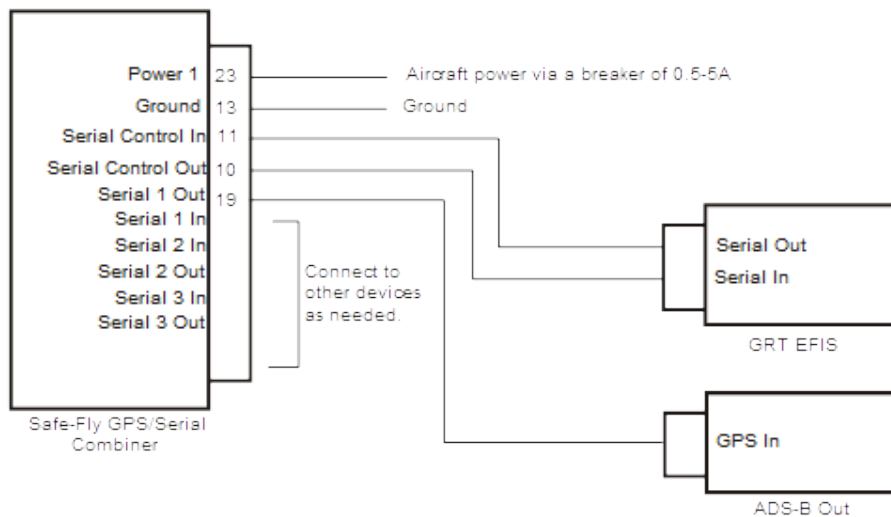
4.188

All dimensions in inches

0.600

Notes:

1. Mount in a location to avoid exposure to water and excessive heat, such as from cabin heat ducts.
2. No cooling required.
3. Secure with 2 or more mounting screws in opposite corners.
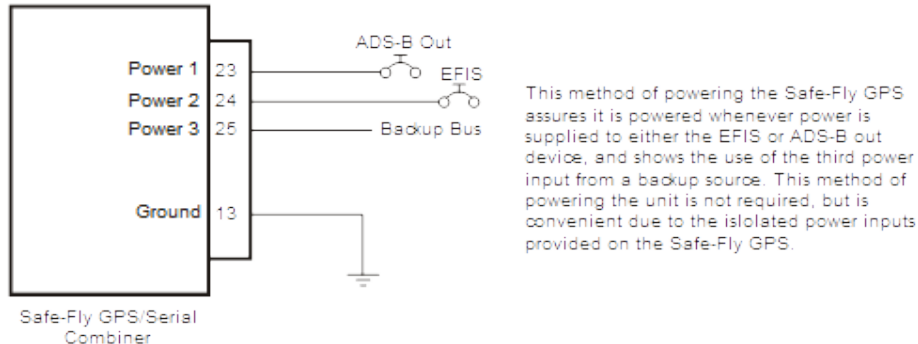4. See user manual for wiring.

Safe-Fly 2020 ADS-B Compliant GPS
Module/Serial Port Combiner

GRT Avionics
Grand Rapids Technologies, Inc.

Typical Wiring

Typical wiring

ADS-B Out

This method of powering the Safe-Fly GPS assures it is powered whenever power is supplied to either the EFIS or ADS-B out device, and shows the use of the third power input from a backup source. This method of powering the unit is not required, but is convenient due to the islolated power inputs provided on the Safe-Fly GPS.

Typical use of multiple power inputs