TWINSYNC DL502 By Down and locked VER:.2.4

The Twin Engine Engine Syncronizer

TWINSYNC QUICKSTART GUIDE

1. Setup your airplane's throttles mechanically so that the throttle servos operate at full throw, with transmitter end points set to a minimum of 100% in both directions (idle to full throttle).
2. If your engines do not have crank shaft mounted magnets, install magnets into the spinner back plates (3/16"x1/16" magnets) or into the prop hub (1/8"x1/4" diametric magnets) see section 3.1 and 3.2 of the "Users Guide".
3. Spinner mounted magnets require you to drill a 3/16" hole near the outside of each spinner just deep enough so that the magnet are flush when installed. Glue one magnet into each spinner using slow curing epoxy.
4. Airplanes without spinners require magnets installed into the prop hub. Drill a 1/8" hole into the prop hub parallel to the crankshaft. Follow the directions in section 3.2 of the "Users Guide" for aligning the magnets before epoxying them in place.
5. RPM sensors must be properly oriented see diagram below. Connect the sensor to the TWINSYNC and turn on power, moving the sensor by a magnet in the turn on one of the Green LEDs. Only one side of the sensor will detect the magnet. Mount both sensors about 1/16" to 1/8" from the magnet so that the Green LEDs turn on once per prop rotation.
6. Install the TWINSYNC in the airplane connecting everything as shown on the diagram. The TWINSYNC can be wrapped with foam rubber or simply held to the aircraft frame with tie wraps or double sided tape.
7. Checking servo direction: With throttle channel from the receiver connected to the TWINSYNC 's throttle input, power on Transmitter then Receiver and TWINSYNC. Both yellow LEDs should be off at either idle or full throttle. If one yellow LED4 stays on increase your end points until both yellow LEDs are off at either idle or full throttle. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator. If the yellow LED4 goes off at idle then the throttle direction on your transmitter is correct. If the LEDs go off at full throttle then reverse your throttle direction on the transmitter so that they go off at idle. Throttle Servo Reversing is explained in step 9.
8. At this point, both the yellow LEDs should go off at idle and yellow LED4 should come on as you advance the throttle. If you're your throttle servos operate in reverse of your requirements Throttle Servo Reversing is explained in step 9. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator.
9. Reversing throttle servos: With the receiver and TWINSYNC power off; move the rotary switch to position "7". Power on Transmitter then Receiver and TWINSYNC. LEDs will flash several times indicating that you are in a programming mode. Press one button for about a half of a second to reverse one servo and repeat with the other button for the other servo. A yellow LED will come on when a servo is reversed and off when it is normal direction. After reversing one or both servos move the rotary switch back to position "0" reversing is complete. Check the servo direction and repeat if necessary.
10. Idle point setting: The TWINSYNC will never move the throttles lower than this point while synchronizing engines or in the event of a dead this is where it will move the running engine to. Set your transmitter throttle endpoints the where they should be for your model (i.e. mechanically setup your airplane so that throttle endpoints are at least 100% in both directions to get an accurate sync). With the receiver and TWINSYNC power off; move the rotary switch to position "3" and power on the transmitter then receiver, and TWINSYNC. The LEDs will flash a few times. After the LEDs stop flashing, move the transmitter stick to idle. Press each button once to setting idle position for each engine, a yellow LED will come on. Move the rotary switch back to position "0", IDLE POINT is set.
11. Full throttle point Setting: This limits maximum RPM of the motors. With the receiver and TWINSYNC power off; move the rotary switch to position "5" power on Transmitter then Receiver and TWINSYNC.

The LEDs will flash a few times. After the LEDs stop flashing, move the transmitter stick to full throttle. Press the button in the corner of the board closer to the rotary switch.
12. Synchronization turn on point setting: When the throttle is moved above this point the TWINSYNC will synchronize the engines. Below this point synchronize is disabled. With the receiver and TWINSYNC power off; move the rotary switch to position “5” power on Transmitter then Receiver and TWINSYNC. The LEDs will flash a few times. After the LEDs stop flashing, move the transmitter stick a couple of clicks above idle. Press the button in the middle of the board closer to the rotary switch. Move the rotary switch back to position “0”, synchronization turn on point is set.
13. Verification of settings: Move the rotary switch back to position “0” and power off the TWINSYNC and receiver and turn them back on. Check that both yellow LEDs (led3, led4) are off at idle and led4 yellow led comes on just above idle. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator.

You are now ready to fly with Synchronized engines. If you want to use the onboard glow drivers or use the AUX Channel input for different operating modes please refer to the Users Guide for connection details, programming and operational instructions. From the factory if the AUX channel is connected it is assumed to be a two position switch and will turn the glow plugs on and off. The glow plugs will not operate based on RPM in the factory default mode.

For optimizing your TWINSYNC read or print out the complete manual available for download at www.downandlocked.com. Additional Tech support is available in the Twin Forum on RCUniverse.

Note: All connections are oriented so that the (-) ground is near the edge of the board, (+) Red is in the middle of the connector, and the signal wire (yellow, white) is toward the middle of the board. See Throttle and Receiver wires for a color example. Push buttons are labeled 1(SW1) and 2(SW2).

The Complete TwinSync manual can be downloaded from:

WWW.DOWNANDLOCKED.COM

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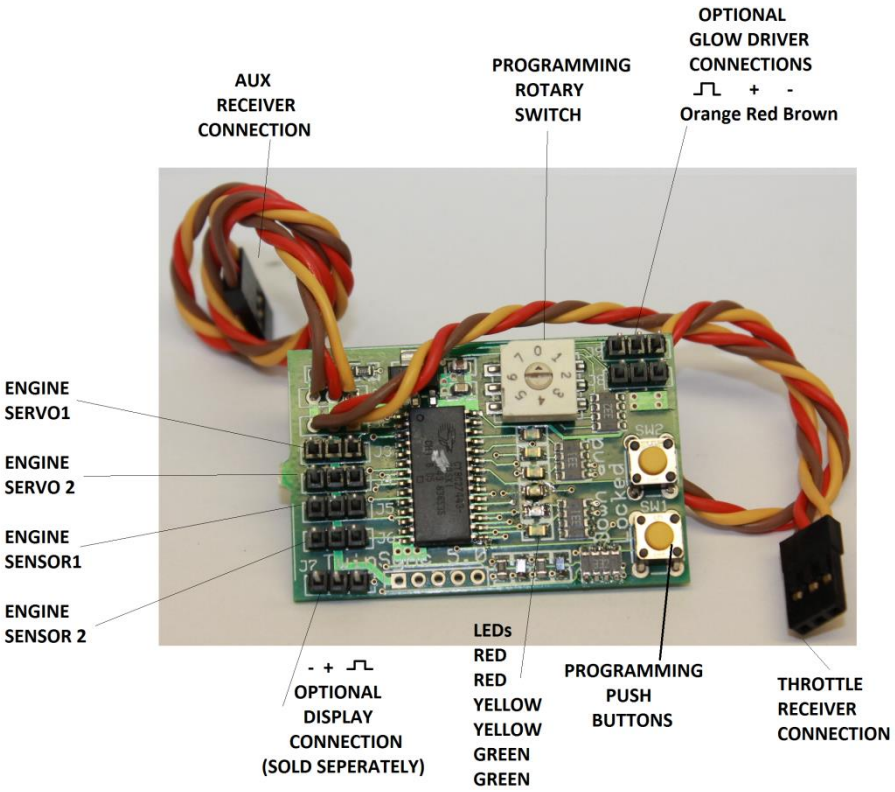
Connection:

J1 8” male JR lead	Auxiliary Function
J2 8” male JR lead	Receiver Throttle connection
J3 3 pin Jumper	Engine 1 Throttle Servo
J4 3 pin Jumper	Engine 2 Throttle Servo
J5 3 pin Jumper	Engine 1 RPM Sensor
J6 3 pin Jumper	Engine 2 RPM Sensor
J7 3 pin Jumper	Optional Display Connector
J8 3 pin Jumper	Optional Glow Driver Connector
J9 3 pin Jumper	Optional Glow Driver Connector
SW1 Button 1	See Programming for use
SW2 Button 2	See Programming for use
Rotary Switch	See Programming for use
LED 1 RED	Glow Driver Status
LED 2 RED	Glow Driver Status
LED 3 YELLOW	On when both engines are running at the same RPM, Sync feedback indicator. and for programming functions
LED 4 YELLOW	On Throttle >20% and programming functions
LED 5 GREEN	RPM sensor Engine 1
LED 6 GREEN	RPM sensor Engine 1

Connection Diagram 1:



Instruction Manual

Synchronizer Introduction and Feature Set
TWINSYNC senses RPM and controls throttle positions to synchronize twin engine airplane engines. Engines running at the same RPM produce that unique sound in flight. No worries in the case of one engine failure because you're TWINSYNC will automatically idle the remaining running engine. This SAFETY FEATURE prevents loss of control when an engine unexpectedly stops. The pilot regains control of the idling engine by simply moving the throttle stick to idle. Control is then returned to the throttle stick and the pilot has full control. This feature can be disabled if desired. If the loss of transmitter signal is detected the TWINSYNC SAFETY idles both engines. The TWINSYNC has several additional modes of operation adding capabilities beyond just keeping the engines synchronized. These modes will be described in detail later in this manual. Six LEDs provide operational status feedback and allow for easy installation and programming.

Five TWINSYNC connections are needed:
Engine 1 RPM sensor
Engine 2 RPM sensor
Engine 1 Throttle servo
Engine 2 Throttle servo
Throttle channel from Receiver
Additional optional connections are available if needed:
AUX channel from Receiver
Onboard glow drivers (2)
RPM and status display.

WARNING: Running sensor wires by a Gasoline engine with a magneto ignition (not an electronic ignition) and using rubber sparkplug caps will likely inject RFI from the magneto and spark into the sensor wires resulting is poor sync or erratic behavior. If used with gas engines only shielded metal sparkplug caps (like the Bosch) should be used and care should be used in routing sensor wire away from engine and magneto as far as possible.

1.0 System Operation and Theory
Dedicated throttle servos are required for each engine controlled. The TWINSYNC monitors each engine's RPM with a sensor and adjusts throttle position to provide for synchronized engines. Rotating magnets mounted on your spinner are sensed by a rigidly mounted sensor providing the TWINSYNC with RPM information needed to control the synchronization process. One magnet is mounted in each spinner (or optionally the prop hub for planes without spinners) and the face of the sensor is mounted within a quarter of an inch of the magnet.
The TWINSYNC reads the throttle signal from the receiver and uses this "speed set point" to control operations of the TWINSYNC. At less than the programed "sync point/RPM", the TWINSYNC passes the throttle signal directly to the throttle servos. In the default mode and below the throttle sync point the TWINSYNC controls glow plugs but does not synchronize the engines. When the throttle is above the sync point and if both engines have an RPM signal (i.e. running), the TWINSYNC moves the servos to match the stick position then adjusts both engine throttles to be synchronized. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator. The slow engine is increased and the faster engine is slowed to be synchronized. This process is continuous until

the throttle stick is moved again. When the stick is moved the process is repeated again. If the stick is brought to less than the sync point of the throttle stick the device disengages and passed the receiver signal directly to the servos again. Without an RPM signal from both engines more than 1500 RPM, the TWINSYNC will not manage the throttle servos to synchronize the engines. Without a RPM signal from both engines the throttle signal is passed directly to the servos. In the event an RPM signal is lost while the throttle is above the sync point and both engines are running, both engines are immediately moved to idle. Control is returned to the throttle stick by moving the stick to idle. This would be what would happen if a magnet or sensor was lost during flight. Sensors face and magnet face must be properly aligned to work properly and detect rotation. If you are using a gasoline engine with an electronic ignition, you can use the existing magnets mounted in the crank shaft to detect RPM. Use only the supplied sensors DL503 TS RPM sensor as other sensors may not be compatible with the TWINSYNC.

2.0 TWINSYNC Servo Adjustments

TWINSYNC is factory programmed to use without any additional program changes if used at 100% endpoints on a Futaba 9C. Use with other radio systems requires setting of idle, full throttle, and sync points. TWINSYNC functions are fully customizable with the following user settable servo parameters:

- Servo center/offset position: Servo fine tuning adjustments rather than manual adjusting linkage.
- Idle position: Dead stick or in independent run up mode idle RPM.
- Engine and servo response time: Adjustable servo response time provides compatibility with brushless esc (the fastest), digital servos on gas engines, digital servos on bug glow engine, to slow standard servos on high RPM glow engines (the slowest response time). The device comes preset to what is likely optimum position for glow and gas engines but if any “hunting” or oscillation is observed it can be removed with this setting.
- Full throttle position: TWINSYNC will not open the throttle past this position in synchronizing mode
- Sync Point: This is the throttle stick position that the synchronizer engages rather than just passing the throttle stick position to the servos like a “y” cable. Above this it syncs the engines. Factory setting is about 20% throttle.
- Servo reversing: Each throttle servo can operate in normal or reverse direction. Servo reversing and center positions are always in use regardless if the device is managing synchronization or not. This aids with setting up a twin engine airplane and provides the additional safety of killing the engines with the loss of TX signal. The servos are moved to idle if 1/4th of a second passes with no transmitter signal. Control is returned once the transmitter signal is received again for 1/10th of a second. If the device senses a loss in transmitter signal it moves the servos to low throttle. Several other options are available by connecting a second auxiliary channel (AUX CH) to the TWINSYNC. Programming and options available to use a second AUX CH are described later in detail in this manual.

3.0 Connections and Installation

Magnet and sensor orientation is critical. If you already have a magnet installed on your crank (gas engine or other type) you might be able to use it instead of mounting a new one as described below. Pass the sensor over the magnet to determine which side must face it, as described in 3.1 below. Mount the sensor within ¼” of the magnet as shown in section 3.1 or 3.2 below. There is no advantage in using two magnets. The device has a limit of 23,000 RPM and treats RPMs above 23,000 as zero RPM.

3.1 Installing Spinner Mounted Magnets DL504

Standard Magnet DL504 orientation is critical before gluing it with JB Weld or slow curing epoxy as the north south poles of the magnet are end to end. Determine the polarity of each magnet. The rpm sensors are polarity sensitive so they only detect one side of a magnet. The sensing side of the sensor is

the beveled side which has writing on them. The correct side of the magnet must face the correct side of the sensor for predictable results.

Find the correct orientation of the magnet DL504:

Connect one of the sensors to the TwinSync along with the throttle channel and apply power to the twin TwinSync by powering your receiver. Move the sensor's beveled/marked side in front of one side of the magnet then the other to find out which side of the magnet turns on one of the green LEDs. Mark the side of the magnet that turns one of the green LED on with a marker to identify the side of the magnet that will face the sensor, repeat for the second magnet.

Find the correct location to mount the magnet DL504:

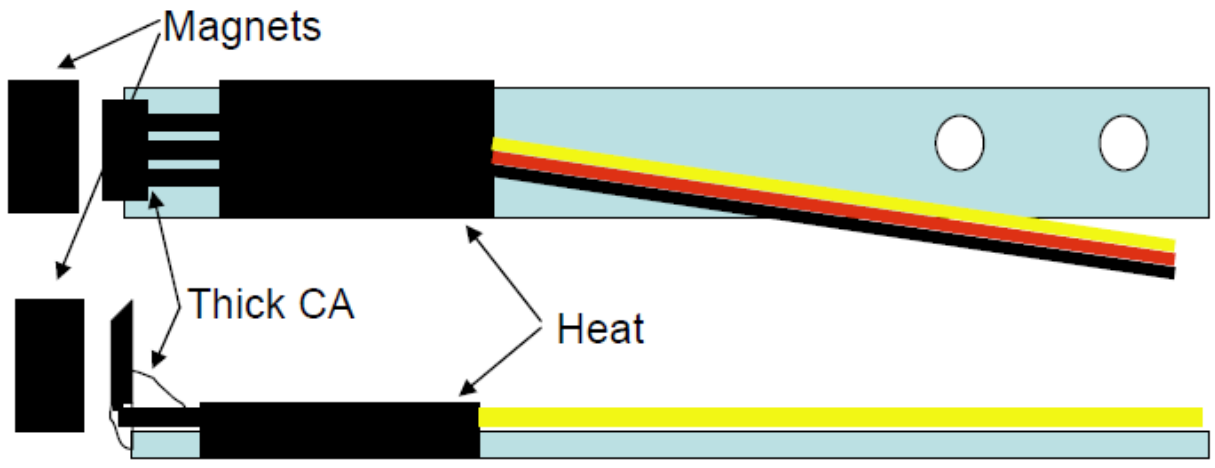
The magnet should not be in front of the sensor when the prop is rotated to the start of the compression stroke. In the event of a dead stick the dead engine prop will rotate to the start of compression stroke and stay there. Vibrations at this point can make the device think both engines are running and try to synchronize them. If this happens the remaining motor will be at idle for the remainder of the flight. Mount the magnet 90 degrees away from this location.

Mounting the magnet DL504:

Mount a spinner mounted magnet by drilling a 3/16" hole in the outer part of the spinner back just deep enough for the magnet to be flush with the back of the spinner. With the magnet properly oriented (marked side out) glue the magnet into the spinner using slow curing epoxy. Balance the spinner if necessary by drilling away some material near the magnet or install a second magnet 180 degrees away orient this magnet backwards so the sensor cannot detect it. Extra magnets Part Number DL504 can be purchased through TWINSYNC dealers.

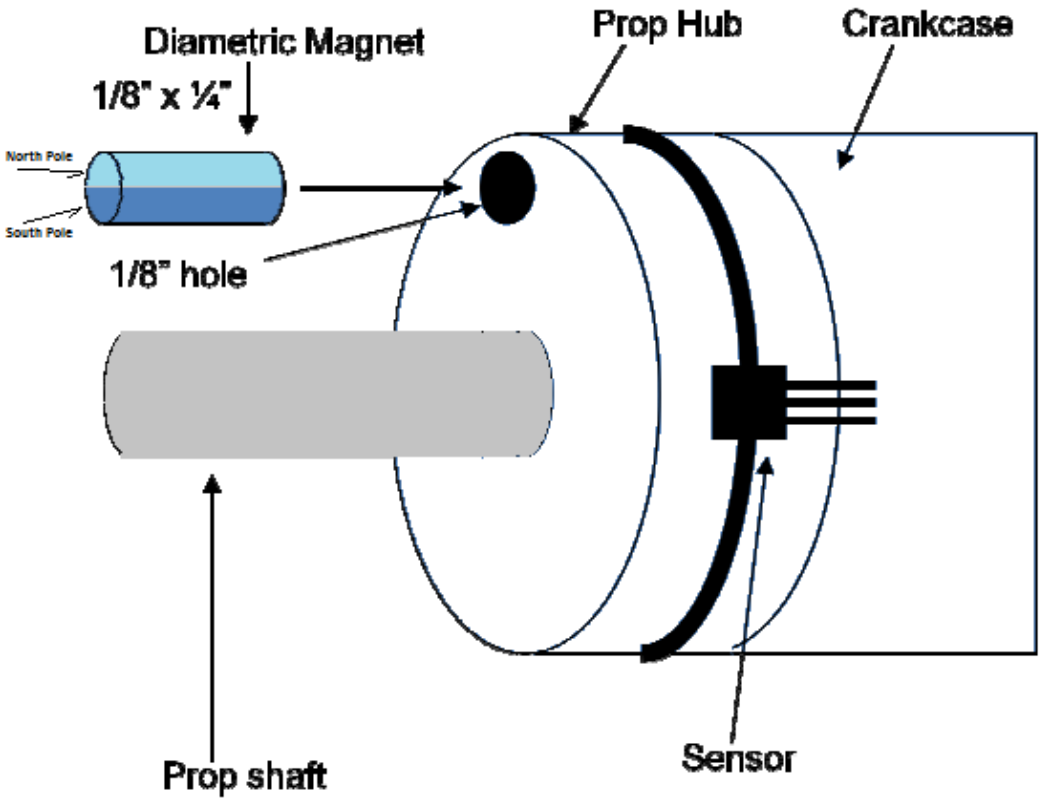
Mounting the sensors DL503:

Locate a spot on the cowl or fuselage where the magnet will pass within 1/8" from the magnet. You may need to bend the sensor wires at 90 degrees so the angled/marked face of the sensor will directly face the magnet. Epoxy the sensors to the fuselage or cowling along with the wires immediately behind the sensors. It is critical to support the sensor solder points and wires within ¼" of the solder points rigidly or vibration will break the sensor wires over time. Broken sensor wires due to vibration are not covered under warranty. If a suitable location is not available on the cowl or fuselage make a sensor mount from 5-ply aircraft plywood or 1/16" or thicker printed circuit board material. Mount material must be ridged, non-conductive and mounted by at least 2 points as shown in the example below. Maximum air gap is ¼ inch between the magnet and sensor face. If your mount vibrates excessively the TwinSync may not work properly.



3.2 Installing Prop Hub Mounted magnets DL505

Magnet alignment is critical before gluing it with JB Weld or slow curing epoxy as the north south poles of the magnet are not end to end the poles are half of the of the round cylinder. Determine the polarity of each magnet. The rpm sensors are polarity sensitive so they only detect one side of a magnet. The sensing side of the sensor is the beveled side which has writing on them. The correct side of the magnet must face the correct side of the sensor for predictable results.



Find the correct orientation of the diametric magnet DL505:
Connect one of the sensors to the TwinSync along with the throttle channel and apply power to the twin TwinSync by powering your receiver. Place the magnet under the sensors beveled/printed side and rotate the magnet until the green sensor LED is off and continue to rotate in the same direction until it comes on. Mark a spot directly under the sensor on the visible end of the magnet. Continue rotating the magnet in the same direction until the green LED goes out and make a mark there. Now make a make in the middle of the two marks made. This middle mark must face the center of the sensor. Check to be sure the green LED turns on as you rotate the prop hub and magnet past the sensor, before gluing it in place. Mount the sensors in a similar manner as described for spinner mounted magnets. The face of the sensor with this method should face the prop hub.

Find the correct location to mount the diametric magnet DL505:
The magnet should not be in front of the sensor when the prop is rotated to the start of the compression stroke. In the event of a dead stick the dead engine prop will rotate to the start of compression stroke and stay there. Vibrations at this point can make the device think both engines are running and try to synchronize them. If this happens the remaining motor will be at idle for the remainder of the flight. Mount the magnet 90 degrees away from this location.

Mounting the diametric magnet DL505:
Mount a prop hub mounted magnet by drilling a 1/8” hole in the face of the hub just deep enough for the magnet to be flush with the face of the hub when inserted into the drilled hole. With the magnet

properly oriented (center mark facing the sensor) glue the magnet into the spinner using slow curing epoxy. Balance the spinner if necessary by drilling away some material near the magnet or install a second magnet 180 degrees away orient this magnet backwards so the sensor cannot detect it. Extra magnets Part Number DL505 can be purchased through TWINSYNC dealers.

Mounting the sensors DL503:

See Mounting The Sensors DL503 Above

3.3 Installing Everything Else

Connect everything including throttle servos, sensors, and throttle channel from the receiver. Connect the Auxiliary channel if you are going to use an AUX CH mode. The device comes preprogrammed to use the AUX CH input for turning the glow plugs on and off. If you want to use AUX channel for a different function, please refer to the AUX CH programming section.

MECHANICALLY SET UP YOUR AIRPLANE THROTTLE LINKAGES TO USE AT LEAST 100% THROW OR ENDPOINTS IN BOTH DIRECTIONS (IDLE AND FULL THROTTLE) BEFORE INSTALLING THE TWINSYNC.

The TWINSYNC needs precise servo control of throttles in order to synchronize the engines. With endpoints set at 100% and with a Futaba 9C no programming of the device is required (depending on your brand and model of radio and unless you have to change servo direction).

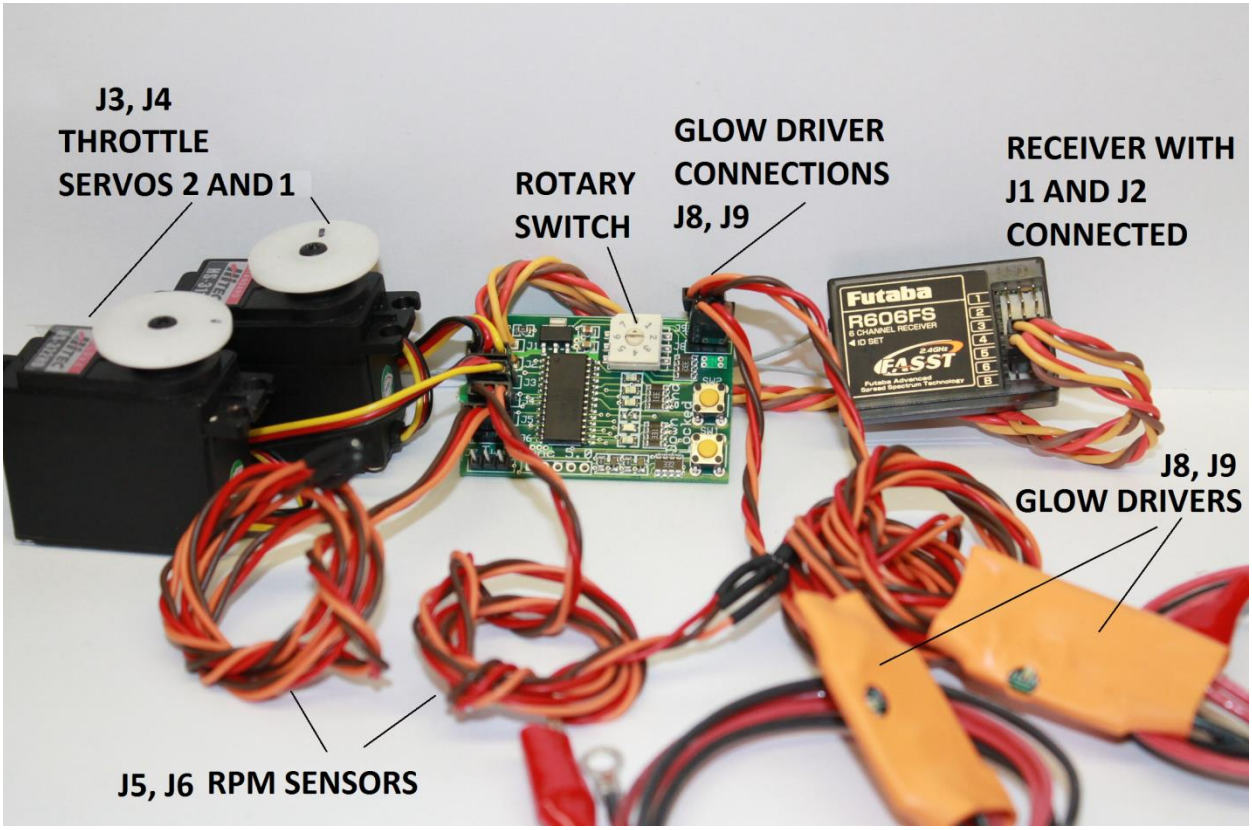
If you want to reprogram the device to use the endpoints you already have you can. However, the change in RPM per 1 degree of servo movement dictates how accurate the device can synchronize the engines. For example if 1 degree of servo movement results in a 200 rpm change then the device may only be able to synchronize the engines within 100-200 RPM rather than the typical 50 RPM difference.

If your endpoints on low throttle are less than 100%, the TWINSYNC may not disengage at idle unless you reprogram the Sync point. You can check this by turning on the transmitter and receiver with throttle connected to the TWINSYNC. The Yellow LED4 should go off at idle and turn on just about idle and stay on through full throttle. If the LED stays on at low throttle you either have your throttle direction backwards on then transmitter or you need to increase your low throttle endpoint. This step also verifies that your transmitter throttle is set to normal and not reverse direction. If the throttle channel is reversed on the transmitter then LED4 will go off at full throttle. Set the transmitter throttle direction so that the LED4 is off at idle. The Yellow LED4 is on when the TWINSYNC will be managing throttles to synchronize the engines and off when the transmitter stick is below 20% and is controlling the throttles.

It is better to adjust the mechanical linkage to get as close as possible before changing any programming settings. If you do have a computer or programmable transmitter and want to change end points, curves, etc. this device has the programmability to work with your setup but if end points are set to less than 100% a loss in resolution will occur and can result in throttle oscillation or less precise RPM control.

If you want to do some advanced programming and get the most accurate synced RPM possible, then you should set your throttle end points at their maximum travel limits (120- 150% depending on the brand of radio you have). Then mechanically adjust the linkage so that one limit kills the engine and the other has the carb at wide open. Then adjust your transmitter so that one limit is reach when you give the engine kill command. The other limit is achieved at full throttle. Continue to adjust your transmitter stick result in the idle that you want (without turning on the engine kill mix/override or with the throttle

trim up). Then after everything works like you want it to WITHOUT the synchronizer, install it and reprogram it to use your throttle position setup by storing the new idle, sync point and full throttle positions into the device. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator.



Connection Diagram

IMPORTANT: Note connector orientation White/Yellow/Orange signal wire is toward the middle of the board. Black wire is always toward the outside edges.

NOTE POLARITY – REVERSING A PLUG CAN DAMAGE THE TWINSYNC AND THE SENSORS

Connectors J1 through J6 all have the negative (nearest the edge of the board. The center pins are all battery positive (+), the pins nearest the large IC are the signal pins, either into the TWINSYNC or leading out from it. You warranty does not cover damage caused by improper connections.

All Futaba and JR connectors have the polarity correct with the negative wire black and the positive wire red. So long as you put the black wire toward the edge of the board you're fine. NOTE PLEASE: Some Airtronics connectors had the negative wire in the center. If you have one of these the wiring MUST be altered or the receiver, the servos, and the TWINSYNC unit can be destroyed.

ALWAYS DO A RANGE CHECK BEFORE FLIGHT.

Refer to the onboard glow plug driver section for setup and operation of the glow plug drivers.

4.0 RUN Mode and Programming

The rotary switch should always be in position “0” as shown above to use the device. When the device is powered up with the rotary switch in any position other than “0” the device is in a programming mode.

Never RUN the engines with the TWINSYNC with the rotary switch in any position other than “0” as a safety precaution.

Programming Mode:

To enter programming modes power the device up with the rotary switch in any position other than “0”. Both Yellow and the RED LEDs will flash ON and OFF for about 3 seconds, to indicate that you are in a programming mode. After that they will still flash at about a 1 second interval but with the programming modes displayed during the regular flashing.

Changing the rotary switch after the device is powered up will not enter programming mode. But if the rotary switch is moved to position “0” the device enters RUN mode and power has to be cycled to re-enter programming mode.

Once in a programming mode, pressing BUTTON1 and BUTTON2 programs new values into the device. The following section describes how to program each parameter for each rotary switch position:

Rotary Switch Position 0:
This is run mode and to re-enter programming mode power has to be cycled with the rotary switch in any position other than “0”. BUTTON1 and BUTTON2 do nothing in run mode.

Rotary Switch Position 1:
This sets the engine1 servo center position. BUTTON1 increments the servo 1 step every 1/4th of a second it is held down. BUTTON2 decrements the servo 1 step every 1/4th of a second it is held down. Mechanical adjustments should be adjusted as close as possible and ideally the user does not need to use this function. Care should be used not to move center to the point that a servo binds at the end points.

Rotary Switch Position 2:
This sets the engine2 servo center position. BUTTON1 increments the servo 1 step every 1/4th of a second it is held down. BUTTON2 decrements the servo 1 step every 1/4th of a second it is held down. Mechanical adjustments should be adjusted as close as possible and ideally the user does not need to use this function. Care should be used not to move center to the point that a servo binds at the end points. Binding the servo will cause it to continuously pull amps and may damage it.

Rotary Switch Position 3:
This sets the preprogrammed idle position of BOTH Engines. The synchronizer moves the servos to idle when a dead stick is detected. Dead stick condition is cleared by moving the throttle stick to idle. This position is preprogrammed to be idle throttle stick with full trim on most radios. This is also the idle position an engine is held in when in the Independent Run-Up mode. Move the throttle stick to the desired idle position and press each button one at a time. Button 1 sets idle of the first engine and Button 2 sets the idle of the second engine.

Rotary Switch Position 4:
This sets the device response time. Please email tech support before changing this parameter. If you accidently change it. Please press the buttons until both yellow LEDs are on and the red led is off. Then move the switch to a position other than 4.

LED1&2 RED	LED3 YELLOW	LED4 YELLOW	MODE
ON	ON	ON	Fastest possible setting
ON	ON	OFF	Very fast setting good with ESCs
ON	OFF	ON	Fast glow engines and servos
ON	OFF	OFF	Slow glow, standard servos, very fast gas engines
OFF	ON	ON	Factory default, fast gas engines
OFF	ON	OFF	Slower
OFF	OFF	ON	Slower still
OFF	OFF	OFF	Slowest possible setting

The above table gives a basic understanding of the available control curves and response time settings. In general a very fast responding engine and servos needs a fast setting and a slow responding engine needs a slower response curve. If your response time setting is too fast the RPM will oscillate and the engines will pass each other trying to sync. If the response time is too slow the engine will take long to sync when you move the throttles than they would with a faster response time.

Rotary Switch Position 5:
This is the full throttle and Sync position programming mode.

Pressing Button 1 (SW1) programs the Full Throttle Point. This is factory set for a Futaba 9C at 100% EPA. To set a new full throttle point, move the throttle stick to the desired full throttle point and press Button 1 (closes to rotary switch). To program more or less maximum servo throw, move the throttle stick to the maximum position the servos can travel and press BUTTON1. The same value is stored for both servos. You must mechanically adjust your linkage so full throttle on your transmitter results in full throttle on both carbs. Think of this setting as just storing the end point in the synchronizer so that it can advance an engine to full throttle without binding a servo.
Pressing Button 2 (SW2) lets you program the point where the unit starts to synchronize the engines. This is the point where the one yellow LED comes on (or both if the engines are running. This should be set just above idle. To program this point move the rotary switch to position 5 then turn power on. After the LEDs stop flashing move your throttle stick to the desired synchronizer turn on point. Then Press Button 2 (the one on the corner of the board). After that move the rotary switch back to zero and verify that the yellow led comes on where you intended and stays on through full throttle. It should be off at idle.

Rotary Switch Position 6:
This is the mode where the use and function of an Auxiliary channel (AUX CH) is defined. The LEDs display the mode the device is in when in this programming mode.

The following table allows the user to determine what mode you are in:

LED1&2 RED	LED3 YELLOW	LED4 YELLOW	MODE
ON ON	ON	ON	1 AUX channel not used, Glow Plugs based on RPM
ON ON	ON	OFF	2 Independent run up mode Glow Plugs based on RPM
ON ON	OFF	ON	3 AUX turns sync on/off Glow Plugs based on RPM
ON ON	OFF	OFF	4 Rudder throttle steering, Glow Plugs based on RPM
OFF OFF	ON	ON	5 AUX controls Glow Plugs FACTORY DEFAULT
OFF OFF	ON	OFF	6 No dead stick detection, AUX controls Glow Plugs

When in this programming mode hitting either BUTTON1 or BUTTON2 advances you to the next mode. If you are in mode 5 and hit a button the device goes to mode 1. If you are in mode 1 and hit a button the devices goes to mode 2. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator.

Rotary Switch Position 7:
This is the servo reversing programming mode. The LED3 reflects whether engine1 servo is normal direction (LED3 off) or reverse direction (LED3 on). To change the engine1 servo direction push BUTTON1. Pressing BUTTON1 a second time reverses the direction again. LED4 reflects the servo direction for engine2 and BUTTON2 changes servo direction for engine2.

THE TRANSMITTER THROTTLE DIRECTION MUST BE SET SO THAT LED4 IS OFF AT IDLE AND ON ABOVE THE SYNC POINT THROUGH FULL THROTTLE.
TWINSYNC WILL NOT OPERATE WITH THE TRANSMITTER THROTTLE REVERSED.

Reset All Programming to Factory Defaults:
If you want to erase all programming in the device and return it to the factory defaults it is possible. Move the rotary switch to position 7. Hold down both button 1 and button 2. Power up the device. After the LEDs stop blinking the device is reprogrammed to all of the factory defaults.

Always do a range check

5.0 Auxiliary Channel Mode Functions and Details
The ability to connect an Auxiliary channel to the device is included and this section explains the detail operation of how the device performs in each mode of AUX CH input functions. The following sections explains each mode in detail:

MODE1: No AUX CH
This is the mode the device should be set to if an AUX CH is not connected to anything. The device lets the throttle stick control servos below 1/5th stick. Above 1/5th stick the devices moves the servos to that position and then synchronizes the engines. If the stick is moved the process is repeated.

MODE2: Independent Run Up Mode
In this mode it is assumed that the AUX CH input is connected to a 3-position switch. If the output of this channel is less than 1/3 deflection engine1 is controlled by the throttle stick while engine2 is held at the programmed idle position. If the AUX CH output is between 1/3 and 2/3rds full deflection then the throttle stick controls both engines and the devices operates just like it was in mode 1. If the AUX CH output is greater than 2/3rds deflection then the throttle stick controls engine2 and engine1 is held in the preprogrammed idle position. This mode is useful for carb adjustments and mixture fine tuning.

MODE3: AUX CH Sync Defeat
In this mode it is assumed that the aux channel input is connected to a channel with a 2-position switch on the transmitter. In one position the synchronization function is enabled. In the other position the device does nothing and is simply a "Y" cable (although servo directions and center is still controlled by the device). This is a useful mode for understanding how your plane will react while the engines are being controlled by the device. Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator.

MODE4: AUX CH is for Rudder Steering
In this mode the device operates as in mode 1 (no AUX CH) above 1/3rd throttle. Below 1/3rd throttle the AUX CH is assumed to be connected to the RUDDER receiver output. There is a dead band around the rudder center (so that rudder trim does not affect engine RPM). When the rudder stick is moved far enough past center to get out of the dead band it starts increasing the throttle on one engine. Moving the rudder stick in the other direction will result in increasing the throttle on the other engine. Full rudder on the stick at idle will result in about half throttle on the engine for that side.

This allows for taxiing airplanes with engine control rather than a steerable wheel. This mode should also result in some interesting aerobatic maneuvers not possible with single engine aircraft.

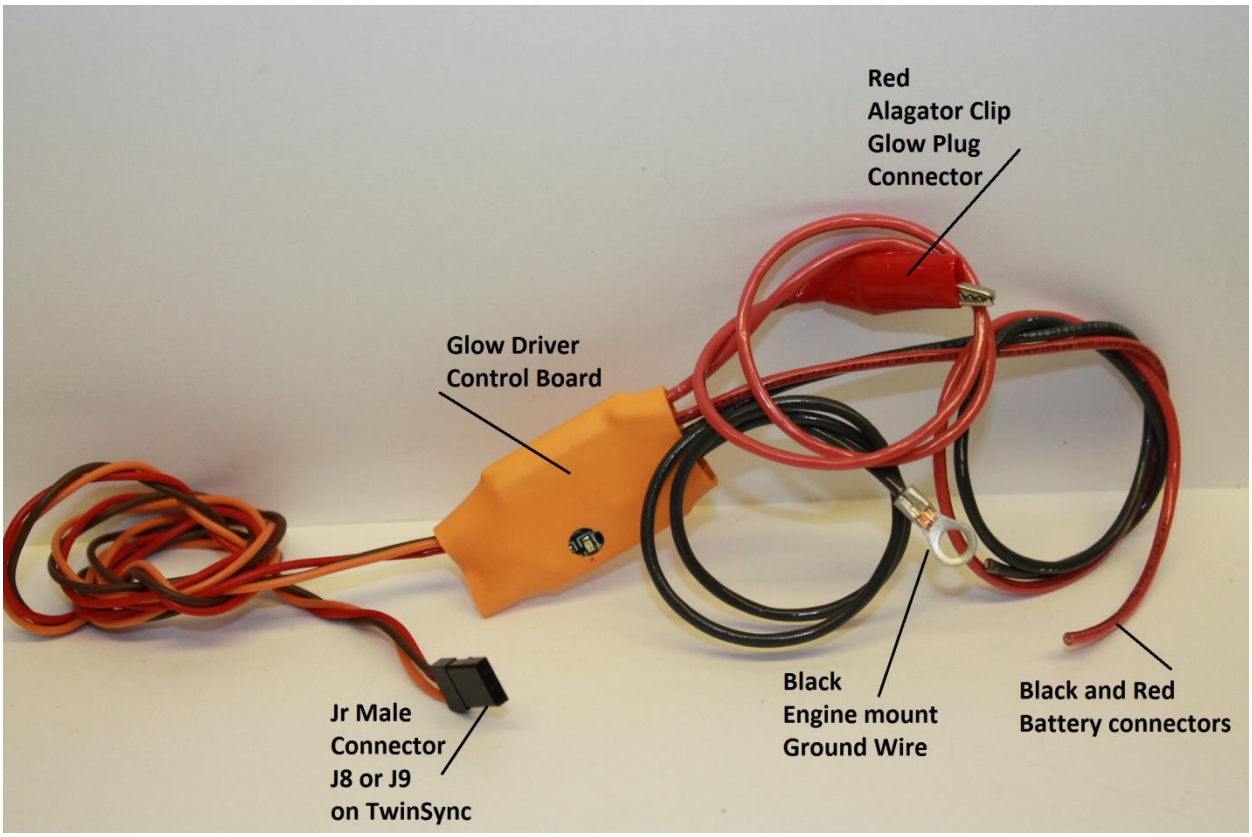
This mode is disabled if only one engine is running. It is operational if both engines or neither engine is running. This allows for bench testing as well as operation only if both engines are running.

Engines are not synchronized until the stick is above the rudder steer disengagement point (33% throttle).

MODE5: AUX CH Controls Glow plugs on and off (FACTORY PRESET MODE)
In this mode the AUX CH turns the glow plug drivers on and off. A two position switch should be used and in one position glow plugs will be off and in the other position the glow plugs will be on.

MODE6: NO DEADSTICK DETECTION with AUX CH Controls Glow plugs
This mode is the same as MODE5 except that the engines are not idled in the event of a deadstick. The engines are synchronized when the stick is above idle and both engines are running. If both engines are not running then the throttle servos are just moved to the transmitter stick position. This allows full throttle control of one running engine at all times.
The reason for this mode is if you have a very stable twin engine plane that flies well on one engine you may not want to idle the running engine in the event of a dead stick on one engine.
Plugs are controlled by the AUX Channel just like in Mode 5.
In this mode the AUX CH turns the glow plug drivers on and off. A two position switch should be used and in one position glow plugs will be off and in the other position the glow plugs will be on.

6.0 **Glow Plug Drivers**
The on board glow plug drivers are now supported by the TWINSYNC version 2.0. The glow drivers are each a small board with a servo type connector that goes to J8 and J9 on the TWINSYNC .



The wires going between the TWINSYNC and the glow drivers can be extended with standard aileron extensions. The intent with the new onboard glow drivers is that they could be mounted and in each nacelle with the battery to reduce wiring complexity of the original TWINSYNC with glow drivers. Additionally, all of the needed wiring and connectors is now included. So the additional purchase of glow plug clips and connectors is no longer required. Each glow driver operates on a single cell nicad or nimh . Each battery should be at least 1500maH. Each glow driver is capable of driving about 8 10 amps so twin cylinder engines can be handled.

Two 18 awg red wires on each glow driver. The one with the alligator clip goes to the tip of the glow plug. The other red wire goes to the positive glow battery terminal (+). There are also two black wires on each glow driver. The black wire with the ring terminal goes to the engine case. The intent is to put one of the engine mount through it. The other black wire goes to the minus (reduce wiring complexity of the cell nicad or nimh battery. (-) side of the glow driver battery.

The glow drivers can be programmed to operate with an auxiliary channel or based on RPM. If running based on RPM wiggle the propeller so that the magnet passes in front of the RPM sensor and glow plug should come on for 10 seconds. Using an electric starter on the engine will also automatically turn on the glow plugs. The glowplugs will come on when the engine is below 3500 RPM in automatic mode.

LED on the glow driver is on solid whenever the glow plugs are on. RED LEDs on the TWINSYNC will turn on continuous when the glow drivers are on. If the glow plug is not connected or burned out the RED led for that glow driver will flash slowly. If a glow driver battery is getting low (below 1.15 volts under load) the RED led for that glow driver on the TWINSYNC will flash rapidly. A glow driver battery can heat a glow plug (depending on the plug) sometimes all the way down to 0.90 volts. The engine may start in

this low voltage condition, when the LEDs are flashing it doesn't mean that the battery is dead, it means they are low. An engine can typically still be started even though the led started flashing. Ensure your batteries are charged correctly prior to flying.

7.0 Remote Display, This item is not stocked, MOQ apply

The TWINSYNC remote display is to allow the user to mount the display where it can be seen from outside the airplane when the plane is ready to fly. Mount in a visible location. The display can now run on a single three wires connection. The Remote display requires Battery Positive (+), Battery Minus (-), and the signal wire. The display plugs into J7 on the TWINSYNC.

8.0 Service, Parts, and Software Updates

For Service, Warranty and Software updates DOWN AND LOCKED
On-line technical support is available at the following link
http://www.rcuniverse.com/forum/m_4700596/tm.htm
This is the synchronizer support forum on RC Universe under the Twin and Multi-Engine Forum or Airplanes.

9.0 Disclaimers, legalities, and warranty.

1) Manufacturer, distributor, and retail agents make no warranty, express or implied, beyond the suitability of the TWINSYNC device as an engine control unit for synchronizing two engines in a model airplane.
2) Warranty period is 90 days from the date of retail sale, plus five days if supported by a mail order invoice. This warranty does not cover damage caused by improper connection or operation. Also excluded from warranty coverage is wire breakage due to any cause.
3) In common with other electronic devices, the TWINSYNC can be destroyed by improper connections. Any electrical damage deemed by the manufacturer or distributor to be due to improper connection or installation will be repaired at owner's expense.
4) By accepting the TWINSYNC unit you assume all responsibility for its use and operation, and any damages that may be incurred while using it. You must be fully familiar with its operation and limitations before flying your airplane with it installed. If you do not accept this return the unused TWINSYNC unit for a full refund, excepting mailing charges and costs.
5) Manufacturer's and distributor's liability is limited to the replacement cost of the TWINSYNC unit.

10.0 Specifications:

General TWINSYNC Specifications:

POWER Consumption: 15mA + 15mA per LED that is on 100ma Maximum
Operating Voltage: 4.0-12.0 volts
Servo Outputs: 5-2.5 us PWM, 40 fps (1.0-2.0us factory defaults)
0-3.3V output
Throttle input: 25-80 fps 0.5-2.5 us PWM (1.0-2.0us factory defaults)
0V to 2.0-5.0V peak-peak
RPM Acuracy: 100 rpm @23,000 and 10 rpm at 5,000
Synchronization accuracy: 25-130 RPM depending on programming and servo geometry
Yellow LED3 will only come on when both engines are running at the same RPM, this is your Sync feedback indicator.