PRELIMINARY INFORMATION

Thomson Automation

Input: Futaba, Output: Pin Header

Landing Gear Controller

Adjustable Speed
Adjustable Direction
Selectable Operating Modes
1 or 2 door operation

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Check for the latest version of this manual at: http://www.thomson-automation.com/RC/WebModules/1041/1041en.aspx

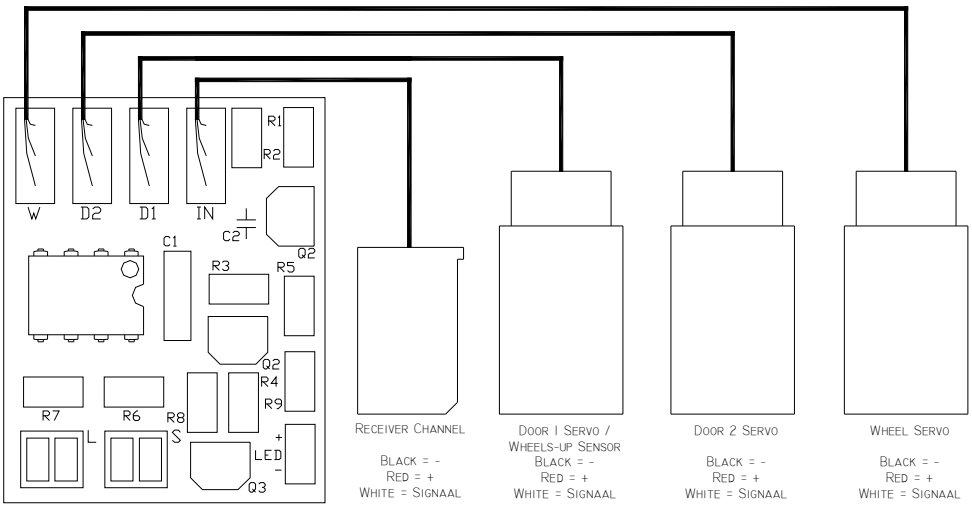


Figure 1

User's Guide

Introduction

The Thomson Automation landing gear controller is a light weight automation sequencer suitable for use in radio-controlled airplanes and other model vehicles using standard radio-control servos. It can be used in either a 2-step or 3-step sequence for controlling landing gear as well as other types of sequential mechanisms. There are operating modes available for double-acting landing gear doors such as the P-51 where the doors close again after the wheels are lowered. The input is a standard servo control signal and is used in normal operation to select gear-up or gear-down. When a change in the input channel is sensed, the three servo output channels are sequentially driven at user-programmed speeds to the user-programmed positions. There are three optional power-up sequences for different mechanical configurations. All settings are automatically stored in permanent memory.

The landing gear controller is intended for hobby use only.

Connection of the module

4-Cell; 4.8V systems

If everything is connected to one 4-cell power source simply plug the servos directly into the module and the receiver plug into the receiver as in connection diagrams 1, 2 or 3. A standard "y" harness can be used to connect 2 or more servos to one output channel. To provide landing gear power from a secondary battery, disconnect the + or middle wire in the receiver cable by cutting it or removing it from the connector shell and use a "Y" harness on any of the servo output connections to connect the secondary battery as in connection diagram 4.

5-Cell; 6.0V or higher voltage systems

For systems with 5 or more cells a reduced 4-cell voltage must be supplied to the module. A power box is available for use with higher voltage systems. This provides full voltage to the servos and a reduced voltage to the module. It also buffers the receiver and servo signals to provide signal level matching. See connection diagram 6

Multifunctional switches

Because ease of in-flight operation and low weight are the primary design considerations, programming the landing gear controller is necessarily somewhat complex. Programming is accomplished through two multi-function switches on the circuit board. These are labeled “L” and “S”. Each switch performs various functions depending on the current operating or settings modes. (See figure 2) The two switches are each composed of two pads on the circuit board and can be operated (turned on) by shorting the pads together with a small piece of aluminum foil or other means. The LED will flash to indicate mode selections and settings values. There is no danger in shorting all 4 pads together during programming.

L Switch

The L switch is used for the following functions:

1.	In settings mode 1 (Operating mode)	turning L on decreases the operating mode number by 1
2.	In settings mode 2 (Standard settings group)	turning L on decrements the standard settings group number
3.	In settings mode 3 (Door 1 position)	* turning L on sets the door 1 open position.
4.	In settings mode 4 (Door 2 position)	* turning L on sets the door 2 open position.
5.	In settings mode 5 (Wheels position)	* turning L on sets the wheels down position.
6.	In settings mode 6 (Door speed)	* turning L on decreases the door speed.
7.	In settings mode 7(Door delay)	* turning L on decreases the doors delay 0.1 sec.
8.	In settings mode 8(Wheels speed)	* turning L on decreases the wheels speed.
9.	In settings mode 9(Wheels delay)	* turning L on decreases the wheels delay 0.1 sec.
10.	In operating mode	holding both L and S on selects a settings mode

S Switch

The S switch is used for the following functions:

1.	In settings mode 1 (Operating mode)	turning S on increases the operating mode number by 1
2.	In settings mode 2 (Standard settings group)	turning S on increases the standard settings group number by 1
3.	In settings mode 3 (Door 1 position)	* turning S on sets the door 1 closed position.
4.	In settings mode 4 (Door 2 position)	* turning S on sets the door 2 closed position.
5.	In settings mode 5 (Wheels position)	* turning S on sets the wheels up position.
6.	In settings mode 6 (Door speed)	* turning S on increases the door 1 speed.
7.	In settings mode 7(Doors delay)	* turning S on increases the doors delay 0.1 sec.
8.	In settings mode 8 (Wheels speed)	* turning S on increases the wheels speed.
9.	In settings mode 9 ((Wheels delay)	* turning S on increases the wheels delay 0.1 sec.
10.	In operating mode	holding both L and S on selects a settings mode

* After a switch is turned off there is a 1 second dead time before the system will respond to a new input. This is to allow time for data storage and to assure that switch inputs do not overlap.

Programming

To enter the settings or programming mode:

1. Turn on both S and L at the same time and hold till the LED flashes once. (See figure 2) There is no danger in shorting all 4 pads together during this process
2. Turn both switches off.
3. The number of flashes of the LED after both switches are turned off indicates the selected settings mode.

1 flash = Settings mode 1 = Select an operating mode number	
2 flashes = Settings mode 2 = Select a standard settings group	
3 flashes = Settings mode 3 = Set door 1 positions	Caution: This setting causes servo motion
4 flashes = Settings mode 4 = Set door 2 positions	Caution: This setting causes servo motion
5 flashes = Settings mode 5 = Set wheels positions	Caution: This setting causes servo motion
6 flashes = Settings mode 6 = Set door speed	
7 flashes = Settings mode 7 = Set door delay	
8 flashes = Settings mode 8 = Set wheel speed	
9 flashes = Settings mode 9 = Set wheel delay	
10 flashes = Switching to operating mode	

When both switches are turned on and held till the LED flashes, if the unit is operating, settings mode 1 will be selected. If it is in a settings mode, the next settings mode will be selected. If it is in settings mode 9, the selected operating mode will be started. If the operating mode is changed in settings mode 1 it is necessary to immediately re-boot by turning the power off and then back on. Programming can then be continued.

Caution: The LED is connected to the wheels servo output. The flashing of the LED during mode selection may cause servo motion to occur. The servo can be disconnected during mode changes and reconnected during position settings.

Indicator LED

In settings modes the LED flashes to indicate the selected modes and new settings values. Since it is connected to the wheels servo output, it shines at reduced brightness during normal operations and during settings modes 3-5 in response to the servo control pulses. The flashes that indicate settings and modes are at full brightness.

Wheels-up Sensors

To overcome problems with variable speeds of air-powered retracts caused by on decaying air pressure and variable wind loading, Operating modes 3, 6 &7 are available. In these operating modes the doors wait to close until the wheels are completely retracted instead of closing after a user-programmed time delay. The door 1 servo output becomes a switch input when these operating modes are selected and responds to a voltage input. Typically, reed switched are used to connect the + pin on the door 1 servo connector to the signal pin when the wheels are up. (See connection diagram 3) Optional reed switches, a connection harness and actuating magnets are available. See figure 3 for details of magnet orientation.

Caution: Be sure to select the appropriate operating mode (3, 6 or 7) and reboot prior to connecting the sensors. Connecting the sensors while the door 1 output is active in modes 1,2,4,or 5 could damage the module.

Caution: Be sure not to plug the sensor harness connector backwards into the module. There is no connector keying to prevent this. The wire colors should be the same orientation as the other cables. The black or – wire is not used.

Selecting the operating mode (Settings mode 1)

To change the operating mode:

1. Select settings mode 1.
2. Turn switch L on to select a higher mode number: or
3. Turn switch S on to select a lower mode number

The LED will flash to indicate the selected mode number. The following operating modes are available:

1. Single acting doors, no sensor, two-step sequence
2. Single acting doors, no sensor, three-step sequence
3. Single acting doors, wheels-up sensor
4. Double acting doors, no sensor, gear down at start-up
5. Double acting doors, no sensor, doors cycle at start-up
6. Double acting doors, wheels-up sensor, gear down at start-up
7. Double acting doors, wheels-up sensor, doors cycle at start-up

The new settings are immediately stored in permanent memory. See the Operation section below for a more detailed description of the operating and start-up sequences.

Always reboot by turning the power off and back on again after changing the operating mode setting.

Selecting a standard setting for speeds and delays (Settings mode 2)

To change the standard settings group selection:

1. Select settings mode 2.
2. Turn switch L on to select a higher settings group number: or
3. Turn switch S on to select a lower settings group number

The LED will flash to indicate the selected standard settings group number. The following standard settings are available:

1. For wheels and doors driven directly by servos.
2. For wheels driven by air cylinders, doors driven directly by servos.
3. For wheels driven directly by servos, doors driven by air cylinders.
4. For wheels and doors driven by air cylinders.

Standard settings only affect speeds and delays. Speeds and delays are appropriate for the selected cycles and can be individually changed if desired. The position settings will need to be altered to fit your application. (See 'Setting door and wheel positions' below) If a new standard setting is not chosen all current speed and delay values will be retained.

The new settings are immediately stored in permanent memory. See the Operation section below for a detailed description of the standard settings.

Setting door and wheel positions (Settings modes 3 – 5)

To set the end points of the door and wheels servo motions:

1. Select settings mode 3, 4 or 5 for door 1, door 2 or wheels positions.
2. Set the door or wheels servo at the desired doors open or wheels down position through the receiver channel. For this step the module must be connected to a receiver with an active transmitter joystick or slider channel or to a servo test box. During settings modes 3, 4 and 5 the receiver channel will be fed directly the chosen servo output channel. The signal will also be present on the wheels servo output during settings modes 3-5.
3. Turn switch L on and hold till the LED flashes and then off to set the wheels down or doors open position.
4. Set the door or wheels servo at the desired doors closed or wheels up position through the receiver channel.
5. Turn switch S on and hold till the LED flashes and then off to set the wheels up or doors closed position.

The LED will turn off briefly during EEPROM storage. Every time that L or S is turned on, a new position will be recorded. The new settings are immediately stored in permanent memory. Reversing is not necessary because servo travel direction is defined by the end point settings.

Setting speeds of motions (Settings modes 6 & 8)

To decrease the speed on the servo one step:

1. Select settings mode 6 or 8 for doors or wheels speed.
2. Turn switch L on and hold till the LED starts to flash and then release it.
3. Count the flashes and use the formula below to determine the traverse time.

To increase the speed on the servo one step:

1. Select the desired speed settings mode as indicated above.
2. Turn switch S on and hold till the LED starts to flash and then release it.
3. Count the flashes and use the formula below to determine the traverse time.

The new settings are immediately stored in permanent memory.

Finding cycle times

(4 * number of sequence steps [2 or 3] / LED flashes)

The modes 6 and 8 settings result in a motion speed setting for the corresponding servos. Traverse times will therefore vary depending on the speed setting as well as the total travel. To calculate the approximate travel time divide 4 seconds per servo motion by the number of flashes of the LED. For a 3-step gear sequence at the minimum speed this will result in around 12 seconds total cycle time. For operation of air valves by the servos the speed is normally set to a high value. (25 is usually enough)

Setting delays after door and wheel motions (Settings modes 7 & 9)

For systems that use servo-operated air valves, a delay is required after the servo motion is complete to allow time for the air cylinders to move

To decrease the delay 0.1 sec:

1. Select settings mode 7 or 9 for door or wheels delay.
2. Turn switch L on and hold till the LED starts to flash and then release. (See figure 2)
3. Count the flashes. Each flash = 0.1 sec delay.

To increase the delay 0.1 sec:

1. Select settings mode 7 or 9 for door or wheels delay.
2. Turn switch S on and hold till the LED starts to flash and then release. (See figure 2)
3. Count the flashes. Each flash = 0.1 sec delay.

The new settings are immediately stored in permanent memory. For systems that do not require delays, the delay value can be set to 0.1 sec.

Quick Start: Typical programming sequence

Before beginning disconnect any servos because of possible motion during programming.

Operating mode selection

1. Select settings mode 1 as indicated above.
2. Set the desired mode of operation using L and S as described earlier.

If the operating mode is changed the power must now be turned off and back on for the new operating mode to be effective.
Note: in operating modes 3,6,and 7 the door 1 output becomes the wheels-up sensor input.

Standard settings group selection

3. Select settings mode 2 as indicated above.
4. Set the desired standard settings group using L and S as described earlier.

Door 1 position settings

5. Select settings mode 3 as indicated above.
6. Connect and set the door 1 servo at the open position through the receiver channel.
7. Turn switch L on hold till the LED flashes.
8. Turn switch L back off.
9. Set the door 1 servo at the closed position through the receiver channel.
10. Turn switch S on hold till the LED flashes.
11. Turn switch S back off.
12. Disconnect the door 1 servo.

Door 2 position settings

13. Select settings mode 4 as indicated above.
14. Connect and set the door 2 servo at the open position through the receiver channel.
15. Turn switch L on hold till the LED flashes.
16. Turn switch L back off.
17. Set the door 2 servo at the closed position through the receiver channel.
18. Turn switch S on hold till the LED flashes.
19. Turn switch S back off.
20. Disconnect the door 2 servo.

Wheels position settings

21. Select settings mode 5 as indicated above.
22. Connect and set the wheels servo at the down position through the receiver channel.
23. Turn switch L on hold till the LED flashes.
24. Turn switch L back off.
25. Set the wheels servo at the up position through the receiver channel.
26. Turn switch S on hold till the LED flashes.
27. Turn switch S back off.
28. Disconnect the wheels servo.

Optional Speed and delay settings

29. Select settings mode 6 as indicated above.
30. Set the desired door speed using L and S as described earlier.
31. Select settings mode 7 as indicated above.
32. Set the desired door delay setting using L and S as described earlier.
33. Select settings mode 8 as indicated above.
34. Set the desired wheels speed using L and S as described earlier.
35. Select settings mode 9 as indicated above.
36. Set the desired wheels delay setting using L and S as described earlier.
37. Turn both switches on and hold till the LED flashes and then turn both switches off again. The LED will flash 10 times and then glow at reduced brightness indicating normal operation.
38. The unit is now ready for operation.

Power can be turned off and then back on to reset the module if the whole programming sequence is not needed.

Editing the program

Selecting a settings mode does not change the old setting until a new value is entered. If no changes are made in a setting before the next setting is selected, the old setting value will be retained. To skip a setting, select the next setting without making any changes. Set the new value as in the description. The module can be reset by turning the power off and then back on. All new settings values are stored immediately in permanent memory.

Operation

Start-up Sequences

Start-up sequences are chosen through the operating mode selection. There are three possible choices:

1. All servos immediately go to the gear-down position. (In operating modes 1, 2, 3: wheels down and doors open)
2. All servos immediately go to the gear-down position. (In operating modes 4, 6: wheels down and doors closed)
3. Modified gear-down sequence for double acting doors. (Operating modes 5, 7) *
    a. The Doors open and the wheels go down.
    b. Time delay.
    c. Doors close.

* If the wheels are already down, the doors will cycle open then closed.

In operating modes 1, 2, 3, 4 and 6 everything goes to the programmed gear down position on power-up. If it is already there, nothing will move so always lower the gear before powering down.

Operating Sequence Single acting doors

Settings mode 1 sets the operating mode of the device. The incoming signal is used as an on-off function and will switch around the middle of the range. Crossing the threshold causes the full gear sequence to run. (Up or down depending on the direction of the input change.)

2-Step Gear-down sequence with single-acting doors, no sensors (Operating mode 1)

1. A gear down command is received from the receiver channel
2. The doors open
1. Time delay
3. The wheels are lowered

2-Step Gear-up sequence with single-acting doors, no sensors (Operating mode 1)

1. A gear up command is received from the receiver channel
2. The wheels are raised
3. Time delay
4. The doors close

3-Step Gear-down sequence with single-acting doors, no sensors (Operating mode 2)

1. A gear down command is received from the receiver channel
2. Door 1 opens
3. Door 2 opens
4. Time delay
5. The wheels are lowered

3-Step Gear-up sequence with single-acting doors, no sensors (Operating mode 2)

1. A gear up command is received from the receiver channel
2. The wheels are raised
3. Time delay
4. Door 2 closes
5. Door 1 closes

2-Step Gear-down sequence with single-acting doors, with sensors (Operating mode 3)

1. A gear down command is received from the receiver channel
2. The doors open
3. Time delay
4. The wheels are lowered

2-Step Gear-up sequence with single-acting doors, with sensors (Operating mode 3)

1. A gear up command is received from the receiver channel
2. The wheels are raised
3. The sensors turn on
4. The doors close

Operating Sequence Double acting doors

Gear-up sequence with double-acting doors, no sensors (Operating modes 4 & 5)

1. A gear up command is received from the receiver channel
2. The doors open
3. Time delay
4. The wheels are raised
5. Time delay
6. The doors close

Gear-down sequence with double-acting doors, no sensors (Operating modes 4 & 5)

1. A gear down command is received from the receiver channel
2. The doors open
3. Time delay
4. The wheels are lowered
5. Time delay
6. The doors close

Gear-up sequence with double-acting doors, with sensors (Operating modes 6 & 7)

1. A gear up command is received from the receiver channel
2. The doors open
3. Time delay
4. The wheels are raised
5. The sensors turn on
5. The doors close

Gear-down sequence with double-acting doors, with sensors (Operating modes 6 & 7)

1. A gear down command is received from the receiver channel
2. The doors open
3. Time delay
4. The wheels are lowered
5. Time delay
6. The doors close

Modes 4-7 are normally used for double acting doors in airplanes such as the P-51

In operating modes 1, 2, 3, 4 and 6 everything goes to the programmed gear down position on power-up. If it is already there, nothing will move so always lower the gear before powering down. If the gear is not always down at power-up, modes 5 and 7 provide a safer power-up cycle for double acting door systems.

Standard Settings Groups

Standard settings groups are designed to simplify setting of speeds and delays. Standard settings for the following configurations are available:

1. Direct Servos driving wheels and doors.
2. Direct Servos driving doors and servo-driven air valve and air cylinders driving wheels.
3. Servo-driven air valve and air cylinders driving doors and direct Servos driving wheels.
4. Servo-driven air valves and air cylinders driving wheels and doors.

For actual standard settings group values, see the table below.

Standard Settings Values

Settings Group	Description	Door Speed	Wheels Speed	Door Delay	Wheels Delay
1	All Direct Servos	5	2	.1 sec	.1 sec
2	Direct Servo Doors / Servo-Air valve Wheels	5	25	.1 sec	2 sec
3	Servo-Air valve Doors / Direct Servo Wheels	25	2	1.5 sec	.1 sec
4	Servo-Air valve Doors / Servo-Air valve Wheels	25	25	1.5 sec	2 sec

Position settings are not affected by standard settings

Check for the latest version of this manual at: http://www.thomson-automation.com/RC/WebModules/1041/1041en.aspx

Operating mode and connection diagram selection guide

Motion Sequence	Door Power	Door Action	Wheel Power	Power-up Cycle	Op Mode	D1 Channel	Typical Settings
2 steps	Direct Servo	Single	Direct Servo	Gear **direct** to down position	1	Servo Output	Group 1
2 steps	Direct Servo	Single	Servo / Air valve	Gear **direct** to down position	1	Servo Output	Group 2
2 steps	Servo / Air valve	Single	Direct Servo	Gear **direct** to down position	1	Servo Output	Group 3
2 steps	Servo / Air valve	Single	Servo / Air valve	Gear **direct** to down position	1	Servo Output	Group 4
3 steps	Direct Servo	Single	Direct Servo	Gear **direct** to down position	2	Servo Output	Group 1
3 steps	Direct Servo	Single	Servo / Air valve	Gear **direct** to down position	2	Servo Output	Group 2
3 steps	Servo / Air valve	Single	Direct Servo	Gear **direct** to down position	2	Servo Output	Group 3
3 steps	Servo / Air valve	Single	Servo / Air valve	Gear **direct** to down position	2	Servo Output	Group 4
2 steps	Direct Servo	Single	Direct Servo	Gear **direct** to down position	3	Wheels-up Sensors	Group 1
2 steps	Direct Servo	Single	Servo / Air valve	Gear **direct** to down position	3	Wheels-up Sensors	Group 2
2 steps	Servo / Air valve	Single	Direct Servo	Gear **direct** to down position	3	Wheels-up Sensors	Group 3
2 steps	Servo / Air valve	Single	Servo / Air valve	Gear **direct** to down position	3	Wheels-up Sensors	Group 4
3 steps	Direct Servo	Double	Direct Servo	Gear **direct** to down position	4	Servo Output	Group 1
3 steps	Direct Servo	Double	Servo / Air valve	Gear **direct** to down position	4	Servo Output	Group 2
3 steps	Servo / Air valve	Double	Direct Servo	Gear **direct** to down position	4	Servo Output	Group 3
3 steps	Servo / Air valve	Double	Servo / Air valve	Gear **direct** to down position	4	Servo Output	Group 4
3 steps	Direct Servo	Double	Direct Servo	Gear **cycle** to down position	5	Servo Output	Group 1
3 steps	Direct Servo	Double	Servo / Air valve	Gear **cycle** to down position	5	Servo Output	Group 2
3 steps	Servo / Air valve	Double	Direct Servo	Gear **cycle** to down position	5	Servo Output	Group 3
3 steps	Servo / Air valve	Double	Servo / Air valve	Gear **cycle** to down position	5	Servo Output	Group 4
3 steps	Direct Servo	Double	Direct Servo	Gear **direct** to down position	6	Wheels-up Sensors	Group 1
3 steps	Direct Servo	Double	Servo / Air valve	Gear **direct** to down position	6	Wheels-up Sensors	Group 2
3 steps	Servo / Air valve	Double	Direct Servo	Gear **direct** to down position	6	Wheels-up Sensors	Group 3
3 steps	Servo / Air valve	Double	Servo / Air valve	Gear **direct** to down position	6	Wheels-up Sensors	Group 4
3 steps	Direct Servo	Double	Direct Servo	Gear **cycle** to down position	7	Wheels-up Sensors	Group 1
3 steps	Direct Servo	Double	Servo / Air valve	Gear **cycle** to down position	7	Wheels-up Sensors	Group 2
3 steps	Servo / Air valve	Double	Direct Servo	Gear **cycle** to down position	7	Wheels-up Sensors	Group 3
3 steps	Servo / Air valve	Double	Servo / Air valve	Gear **cycle** to down position	7	Wheels-up Sensors	Group 4

Alternate connection for extra functions

Motion Sequence	Door Power	Door Action	Wheel Power	Power-up Cycle	Operating Mode	Connection Diagram	Typical Settings
2 steps	Direct Servo	Single	Direct Servo	Gear **direct** to down position	1	2	Group 1
2 steps	Direct Servo	Single	Servo / Air valve	Gear **direct** to down position	1	2	Group 2
3 steps	Servo / Air valve	Single	Direct Servo	Gear **direct** to down position	2	2	Group 3
3 steps	Servo / Air valve	Single	Servo / Air valve	Gear **direct** to down position	2	2	Group 4

Typical Settings

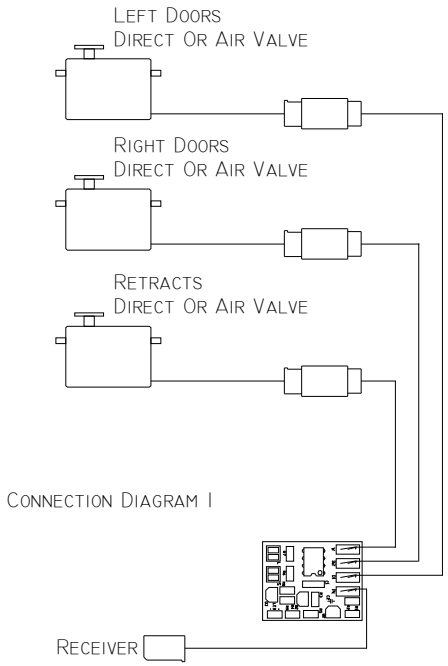
Settings Group	Description	Door Speed	Wheels Speed	Door Delay	Wheels Delay
1	All Direct Servos	5	2	.1 sec	.1 sec
2	Direct Servo Doors / Servo-Air valve Wheels	5	>10	.1 sec	2 sec
3	Servo-Air valve Doors / Direct Servo Wheels	>10	2	1 sec	.1 sec
4	Servo-Air valve Doors / Servo-Air valve Wheels	>10	>10	1 sec	2 sec

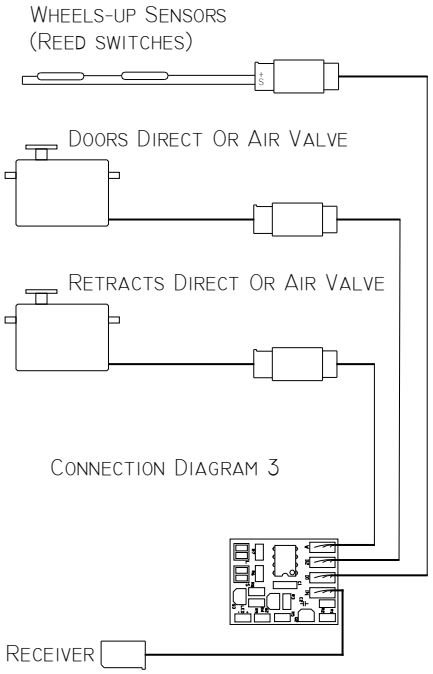
Specifications

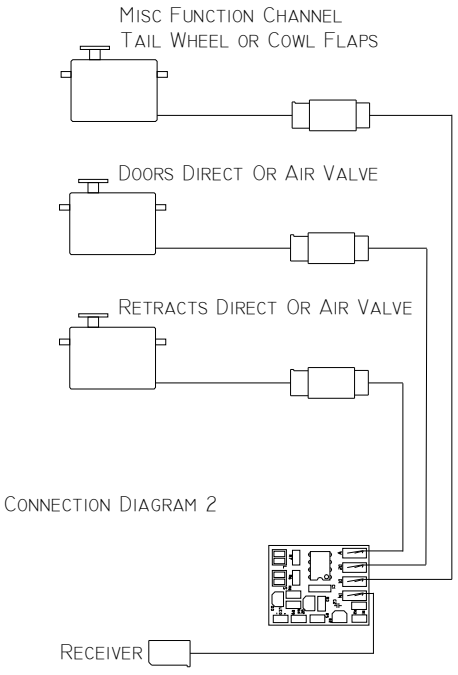
Name	Landing Gear Controller
Part nr.	1041
Hardware rev	1.1
Firmware rev	1.5
Supply Voltage	3.5V – 5,5V (4 NiCd or NiMh cells)
Supply current	3 ma (not including servos)
Servo Channels	1 in, 3 out
Control Signal	1.25V – 5V pulse
Weight without connectors	8 gm
Board Size	34 cm X 27 cm
Cable Length	29 cm
Slowest Traverse Time:	12 Sec*
Fastest Traverse Time:	Per receiver input

* Times will vary depending on the programmed speed and distance of motion

Connection Diagrams







Programming switch locations and servo connections

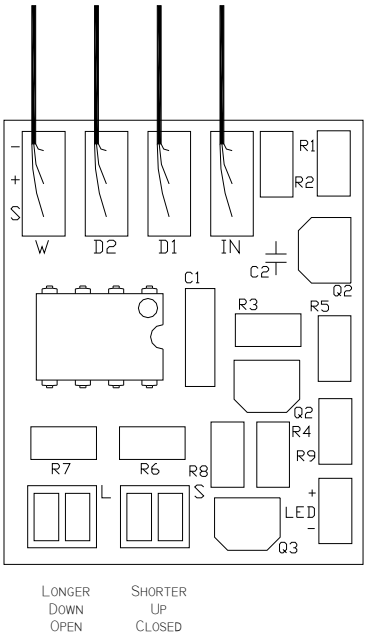
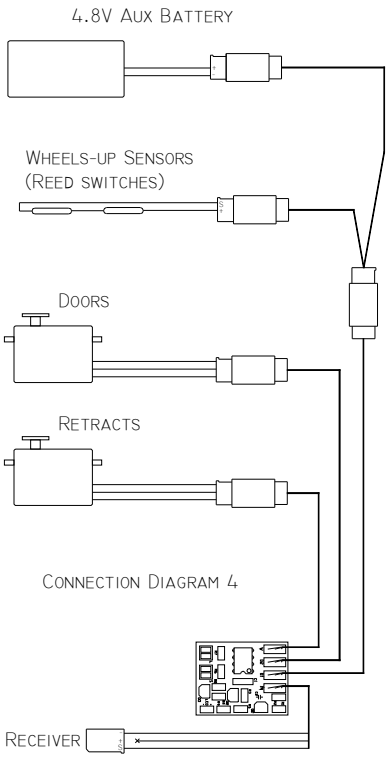
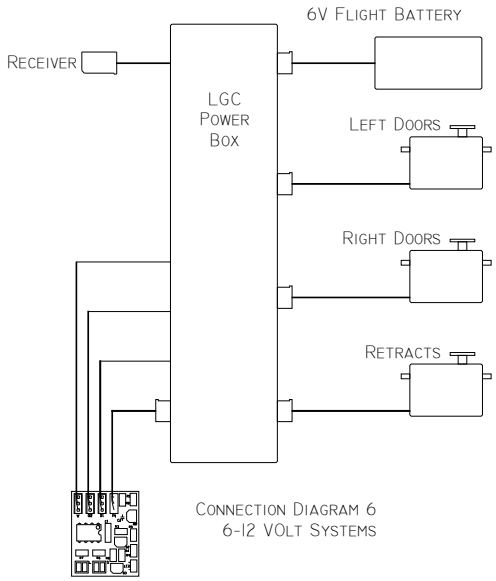


Figure 2





Correct orientation of the wheels-up switch with the actuating magnet.

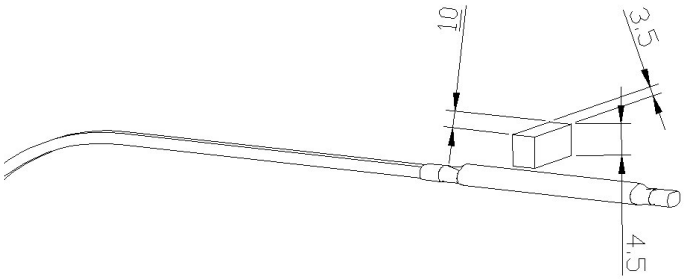


Figure 3