**Thomson Automation**

Input: Futaba, Output: Pin Headers

**Landing Gear Controller I**

Adjustable Speed And Direction
5 Operating Modes inc. P-51
4 Servo Output Channels
Landing Lights Control

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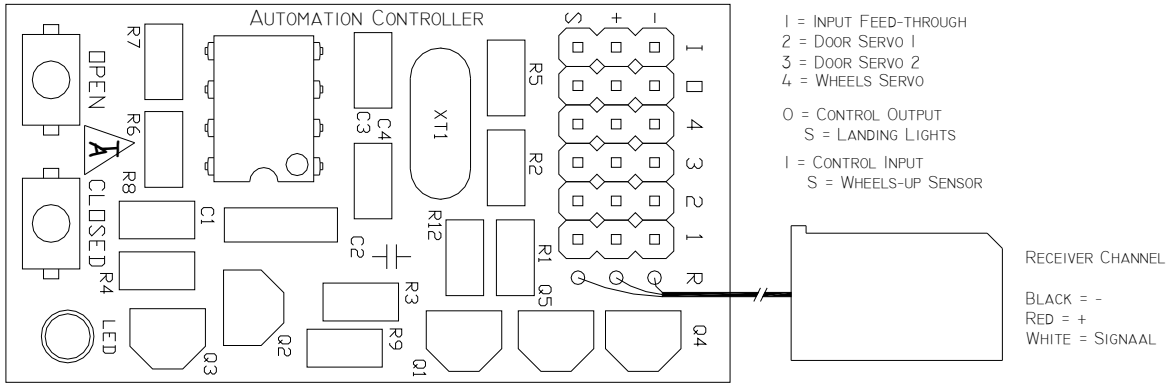


**Figure 1**

# 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 1-step, 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 two power-up options for different mechanical configurations. All settings are automatically stored in permanent memory. Channel 1 is connected directly to the receiver input for use as a Y harness. Channels 2 and 3 are typically used for landing gear doors and channel 4 for wheels. Modules can be coupled together for longer sequences or more control channels. Receiver channel expansion is possible through using different switching set points in parallel connected modules.

### Connecting the module

### 4-5Cell, NiCd / NiMh; 4.8V - 6.0V systems

If everything is connected to one 4-5 cell power source simply plug the servos directly into the module and the receiver plug into the receiver as in connection diagram 1. A "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 connectors to connect the secondary battery as in connection diagram 2. Always turn on the receiver before the LGC module or together with it.

### Above 6.0V systems

For systems with more than 6 Volts, a reduced voltage must be supplied to the module.

#### Wheels-up Sensors

Switches for wheels-up sensing are connected between the 'S' pin on the "C" connector and battery +. If the sensors are not used, the 'S' pin must be directly connected to battery +.

#### Landing Lights

A signal for controlling landing lights is available at the 'S' pin on the "O" connector. See connection diagram 1 for connection information. The maximum current is 100ma. If LED's are used for landing lights, an external current limiting resistor must be used. The output will drive in both + and – directions allowing the operation to be reversed by changing the connection.

### Multifunctional pushbuttons

To reduce weight, there are only two programming pushbuttons on the module. These are labeled “Open” and “Closed”. Each pushbutton performs various functions depending on which setting is being changed. (See figure 1) The LED will flash to indicate new settings values.

The input for the OPEN pushbutton is used as an output for the landing lights during operation. The landing lights output will always turn on if the OPEN pushbutton is pushed. Make sure that the pushbuttons are not pushed while the unit is in operation

## OPEN Switch

The OPEN pushbutton is used for the following functions:

| | | |
|---|---|---|
| 1. | For setting 1 (Operating mode) | pushing OPEN decreases the operating mode number by 1 |
| 2. | For setting 2 (Standard settings group) | pushing OPEN decrements the standard settings group number |
| 3. | For setting 3 (Door 1 position) | pushing OPEN sets the door 1 open position. |
| 4. | For setting 4 (Door 2 position) | pushing OPEN sets the door 2 open position. |
| 5. | For setting 5 (Wheels position) | pushing OPEN sets the wheels down position. |
| 6. | For setting 6 (Door speed) | pushing OPEN decreases the door speed. |
| 7. | For setting 7 (Door delay) | pushing OPEN decreases the doors delay 0.1 sec. |
| 8. | For setting 8 (Wheels speed) | pushing OPEN decreases the wheels speed. |
| 9. | For setting 9 (Wheels delay) | pushing OPEN decreases the wheels delay 0.1 sec. |
| 10. | For setting 10 (Wheels Switch Control) | pushing OPEN deactivates the wheels switch (LED off) |
| 11. | For setting 11 (Switching set point) | pushing OPEN stores the new set point |

## CLOSED Switch

The CLOSED pushbutton is used for the following functions:

| | | |
|---|---|---|
| 1. | For setting 1 (Operating mode) | pushing CLOSED increases the operating mode number by 1 |
| 2. | For setting 2 (Standard settings group) | pushing CLOSED increases the standard settings group number by 1 |
| 3. | For setting 3 (Door 1 position) | pushing CLOSED sets the door 1 closed position. |
| 4. | For setting 4 (Door 2 position) | pushing CLOSED sets the door 2 closed position. |
| 5. | For setting 5 (Wheels position) | pushing CLOSED sets the wheels up position. |
| 6. | For setting 6 (Door speed) | pushing CLOSED increases the door 1 speed. |
| 7. | For setting 7 (Doors delay) | pushing CLOSED increases the doors delay 0.1 sec. |
| 8. | For setting 8 (Wheels speed) | pushing CLOSED increases the wheels speed. |
| 9. | For setting 9 (Wheels delay) | pushing CLOSED increases the wheels delay 0.1 sec. |
| 10. | For setting 10 (Wheels Switch Control) | pushing CLOSED activates the wheels switch (LED on) |
| 11. | For setting 11 (Switching set point) | pushing CLOSED stores the new set point |

After a pushbutton is released there is a 1 second dead time before the system will respond to a new input. This is to allow time for permanent settings storage and to assure that switch inputs do not overlap.

Caution: Make sure that the pushbuttons are not pushed while the unit is in operation.

## Programming (Settings)

To enter the programming mode:

1. While powering up the module, push and hold both pushbuttons until the LED flashes once.
2. Release both pushbuttons.

Be sure to disconnect the sensors during programming.

To select the next setting:

1. Push and hold both switches till the LED starts to flash.
2. Release both pushbuttons.
3. The number of flashes by the LED will indicate which setting is active

1 flash = Setting 1 = Select an operating mode number
2 flashes = Setting 2 = Select a standard settings group
3 flashes = Setting 3 = Set channel 2 (Door 1) positions Caution: This setting causes servo motion
4 flashes = Setting 4 = Set channel 3 (Door 2) positions Caution: This setting causes servo motion
5 flashes = Setting 5 = Set channel 4 (Wheels) positions Caution: This setting causes servo motion
6 flashes = Setting 6 = Set channel 2 & 3 speed
7 flashes = Setting 7 = Set channel 2 & 3 delay
8 flashes = Setting 8 = Set channel 4 speed
9 flashes = Setting 9 = Set channel 4 delay
10 flashes = Setting 10 = Set activation of wheels switch LED on = switch is active
11 flashes = Setting 11 = Switching set point

When finished, re-boot the module by turning the power off and then back on.

Caution: The on-board LED is connected to the channel 4 (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. In setting 3 and 4 the wheels servo will move with the selected door servo.

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## Indicator LED

In settings modes the LED flashes to indicate the selected mode and the selected 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.

## Wheels-up Sensors

To overcome problems with variable speeds of air-powered retracts cause by on decaying air pressure and variable wind loading, a wheels-up sensor input is available. Connecting this input to switches on the main retracts causes the sequence to wait to close the doors until the wheels are completely retracted instead of closing after a user-programmed time delay. Typically, reed switched are connected between the + and 'S' pins on the 'I' connector. (See connection diagrams) Optional reed switches, a connection harness and actuating magnets are available. See figure 3 for details of magnet orientation. If the sensors are not used, either apply a continuous + to the sensor input or turn off setting 10. The module is shipped from the factory with the sensors deactivated. Setting 10 must be changed to activate the switch input. The wheels-up delay timer is always active with or without switch activation.

Be sure to disconnect the sensors during programming.

## Selecting the operating mode (Setting 1)

To change the operating mode:

1. Select setting 1.
2. Push CLOSED to select a higher mode number: or
3. Push OPEN to select a lower mode number

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

1. One-step sequence; All together. (For simultaneous movement of all 3 servos)
2. Two-step sequence; 1 & 2 together. (For Normal landing gear use with left and right door servos)
3. Three-step sequence. (For sequential movement of all 3 servos)
4. P-51 sequence, gear direct to down position at start-up.
5. P-51 sequence, gear cycle to down position 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 modes. Reversing you transmitter channel may be necessary to control the cycle properly. In some modes and if delays are used, there is a difference bwtween the gear-up and gear-down cycles. To find out if you need to reverse your channel, check the landing lights signal at the S pin of O commector. It should be on (at + volts) with gear-down.

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 (Setting 2)

Standard settings groups are available 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.

To change the standard settings group selection:

1. Select settings mode 2.
2. Push CLOSED to select a higher settings group number: or
3. Push OPEN 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. Wheels and doors driven directly by servos.
2. Wheels driven by servo-driven air valve and air cylinders, doors driven directly by servos.
3. Wheels driven directly by servos, doors driven by servo-driven air valve and air cylinders.
4. Wheels and doors driven by servo-driven air valve and 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 always need to be set to fit your application. (See 'Setting door and wheel positions' below)

The new settings are immediately stored in permanent memory. 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 |

### Setting door and wheel positions (Settings 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 receiver connection must be connected to a receiver with an active transmitter joystick or slider channel or a servo test box. During settings modes 3, 4 and 5 the receiver channel will be fed directly the chosen output channel. The signal will also be present on the wheels servo output during settings modes 3-5.
3. Push OPEN and hold it until the LED flashes and then release it 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. Push CLOSED and hold it until the LED flashes and then release it to set the wheels up or doors closed position.

The LED will turn off briefly during EEPROM storage. Every time that OPEN or CLOSED is pushed, a new position will be recorded. The new settings are immediately stored in permanent memory.

### Setting speeds of motions (Settings 6 & 8)

To decrease the speed on the servo:

1. Select setting 6 or 8 for doors or wheels speed.
2. Push OPEN and hold it until 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:

1. Select setting 6 or 8 for doors or wheels speed.
2. Push CLOSED and hold it until 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.

### Setting delays after door and wheel motions (Settings 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 setting 7 or 9 for door or wheels delay.
2. Push OPEN and hold it until the LED starts to flash and then release it
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. Push CLOSED and hold it until the LED starts to flash and then release it.
3. Count the flashes. Each flash = 0.1 sec delay.

The new settings are immediately stored in permanent memory.

### Setting activation of the wheels-up switch (Setting 10)

If activated, the closing of the doors will wait for both the wheels delay and the wheels-up switch

To activate the switch: (The switch will be used)

1. Select setting 10 for wheels switch control.
2. Push CLOSED.
3. The LED will turn on.

To deactivate the switch: (The switch will not be used)

1. Select setting 10 for wheels switch control.
2. Push OPEN.
3. The LED will turn off.

The new settings are immediately stored in permanent memory.

### Setting the switching set point (Setting 11)

The point on the input signal where the module is adjustable. By using two or more modules in parallel multiple sequences can be controlled from one receiver channel. He default switching point is in the middle of the range.

To change the switching set point:

1. Select setting 11 for switching set point.
2. Set the receiver channel to the desired set point
3. Push either button.

The new setting is immediately stored in permanent memory.

### Quick Start: Typical programming sequence

Before beginning disconnect any servos and sensors.

#### Operating mode selection

1. Select setting 1 by holding both pushbuttons while turning the power on .
2. Set the desired mode of operation using OPEN and CLOSED.

#### Standard settings group selection

3. Push and hold both pushbuttons until the LED starts to flash. (twice)
4. Release the pushbuttons.
5. Select the desired standard settings group using OPEN and CLOSED.

#### Servo 1 (Door 1) position settings

6. Push and hold both pushbuttons until the LED starts to flash. (3 times)
7. Release the pushbuttons.
8. Connect the door 1 servo and set it at the open position through the receiver channel.
9. Push OPEN and hold it until the LED flashes.
10. Release the pushbutton.
11. Set the door 1 servo at the closed position through the receiver channel.
12. Push CLOSED and hold it until the LED flashes.
13. Release the pushbutton.
14. Disconnect the door 1 servo.

#### Servo 2 (Door 2) position settings

15. Push and hold both pushbuttons until the LED starts to flash. (4 times)
16. Release the pushbuttons.
17. Connect the door 2 servo and set it at the open position through the receiver channel.
18. Push OPEN and hold it until the LED flashes.
19. Release the pushbutton.
20. Set the door 2 servo at the closed position through the receiver channel.
21. Push CLOSED and hold it until the LED flashes.
22. Release the pushbutton.
23. Disconnect the door 2 servo.

#### Servo 3 (Wheels) position settings

24. Push and hold both pushbuttons until the LED starts to flash. (4 times)
25. Release the pushbuttons.
26. Connect the wheels servo and set it at the wheels-down position through the receiver channel.
27. Push OPEN and hold it until the LED flashes.
28. Release the pushbutton.
29. Set the wheels servo at the wheels- up position through the receiver channel.

30. Push CLOSED and hold it until the LED flashes.
31. Release the pushbutton.
32. Disconnect the wheels servo.

### Optional speed, delay and control settings

33. Select setting 6 by pushing both pushbuttons as above.
34. Set the desired door speed using OPEN and CLOSED as described earlier.
35. Select setting 7 by pushing both pushbuttons as above.
36. Set the desired door delay using OPEN and CLOSED as described earlier.
37. Select setting 8 by pushing both pushbuttons as above.
38. Set the desired wheels speed using OPEN and CLOSED as described earlier.
39. Select setting 9 by pushing both pushbuttons as above.
40. Set the desired wheels delay using OPEN and CLOSED as described earlier.
41. Select setting 10 by pushing both pushbuttons as above.
42. Choose activate or deactivate as described earlier.

### Switching set point setting

43. Select setting 11 by pushing both pushbuttons as above.
44. Set the input receiver channel at the desired switching point.
45. Push either pushbutton to store the new set point.
46. Turn the power off, wait a few seconds and turn it back on.
47. The module is now ready for operation.

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

### Editing the program

Selecting a setting 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 on their entry in permanent memory.

### Operation

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 sequence to run. (Up or down depending on the direction of the input change.)

### Start-up Sequences

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

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

### 1 Step Sequence

1-Step Gear-down sequence (Operating mode 1)

1. A gear down command is received from the receiver channel
2. All servos run to the programmed open position

1-Step Gear-up sequence (Operating mode 1)

1. A gear up command is received from the receiver channel
2. All servos run to the programmed closed position

### 2 Step Sequence (Normal landing gear cycle)

2-Step Gear-down sequence (Operating mode 2)

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

2-Step Gear-up sequence (Operating mode 2)

1. A gear up command is received from the receiver channel
2. The wheels are raised (Channel 4)

3. Time delay
4. The doors close (Channels 2 & 3)

## 3 Step Sequence

3-Step Gear-down sequence (Operating mode 3)

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

3-Step Gear-up sequence (Operating mode 3)

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

## P-51 Sequence

P-51 Gear-down sequence (Operating modes 4 & 5)

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

P-51 Gear-up sequence (Operating modes 4 & 5)

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

For systems that do not require delays, the delay value can be set to 0.1 sec.

In operating modes 1, 2, 3, and 4 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. Mode 5 provides a safer power-up cycle for double acting door systems.

## Specifications

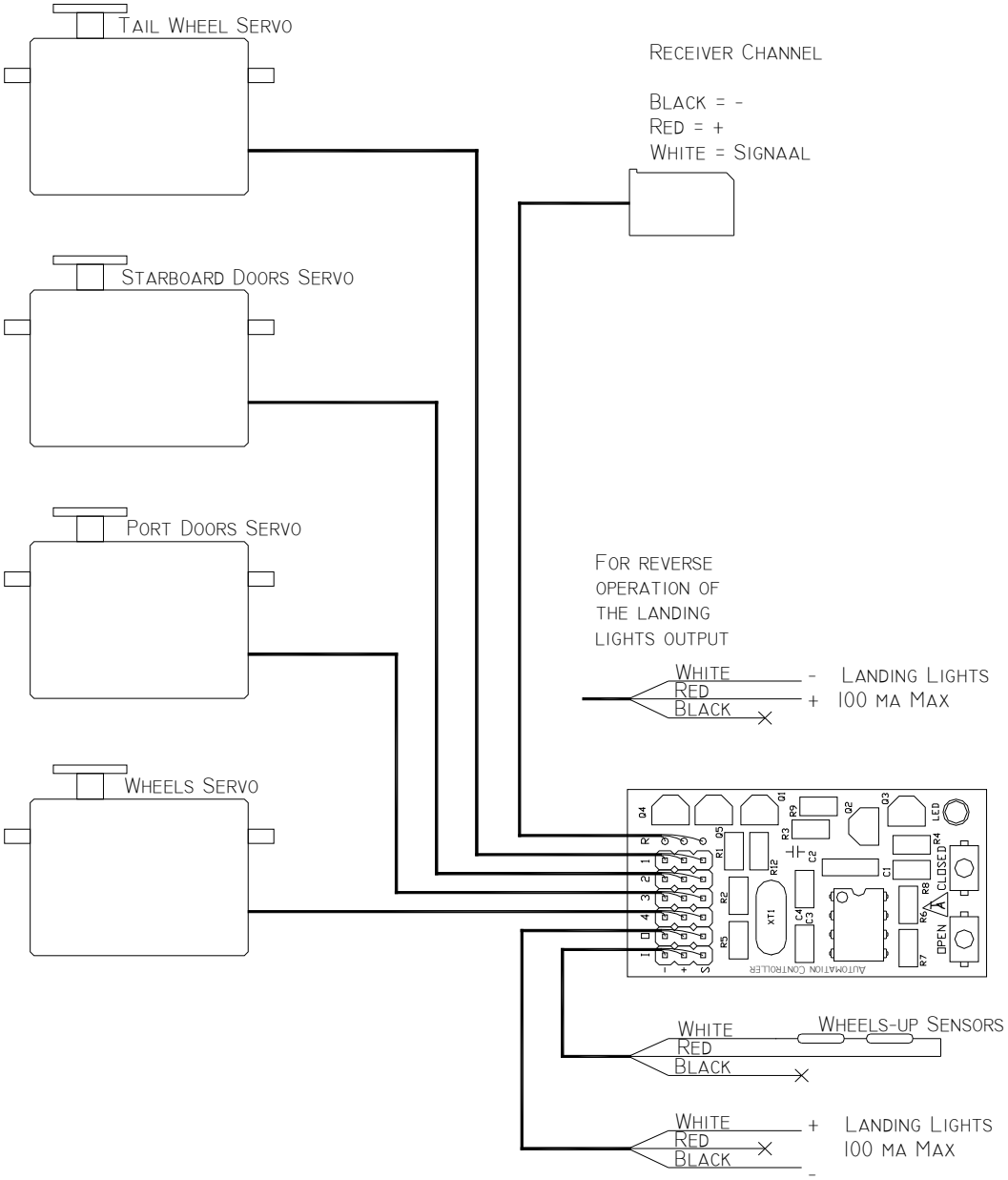
| | |
|---|---|
| Name | Landing Gear Controller 2 |
| Part nr. | 1041-2 |
| Hardware rev | 2.1 |
| Firmware rev | 3.5 |
| Supply Voltage | 3.5V – 5.5V |
| Supply current | 3 ma |
| Servo Channels | 1 in, 4 out (1 Is An Input Follower) |
| Control Channels | 1 Input For Wheels-up Sensors<br>1 Output For Landing Lights |
| Maximum Output Current | 100 ma (Landing Lights) |
| Control Input Voltage | 3.5V – 5.5V |
| Receiver Control Signal | 1.25V – 5V pulse |
| Weight without connectors | 9 gm |
| Board Size | 25 mm X 52 mm |
| 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

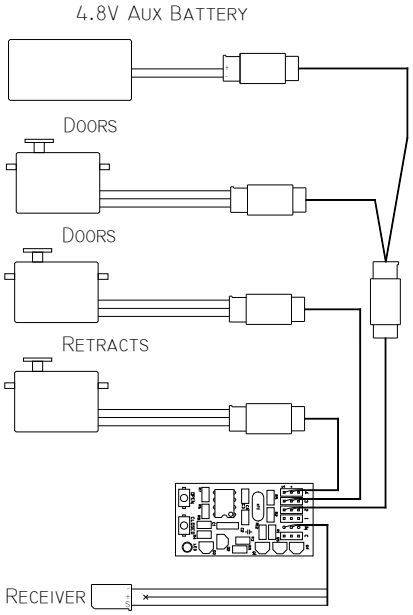
The landing gear controller is intended for hobby use only. Thomson Automation is not responsible for any damage or injury that occurs through the use of this product.

## Connection Diagrams

### Main Connection Diagram



**Connection Diagram For Separate Servo Power**




**Connection Diagram For Wheels-up Switch Cable**