

VELOCITY, Inc.

Retractable Landing Gear

*Electrical
Installation/Operating
Manual*

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Velocity Retractable Gear

Electrical System Installation Guide

Read this manual thoroughly before starting your installation of the retract gear electrical system!

1.0 INTRODUCTION

1.1 Congratulations! You are about to install one of the most complete and easy to install gear retraction electrical systems ever. It is a simple matter of mounting your gear and throttle position switches, the main control box, a gear selector control panel, connect +12 volts, and ground. Your gear system is now wired up! This system is designed exclusively for the Velocity family of RG's. It provides both information and control of the system to the pilot.

1.2 This installation/operation manual will give you step by step installation instructions as well as full operational checkouts and explanations of what the system is telling the pilot. It is recommended that you do not deviate from this manual. *It is also important to note* that during this installation, plan on disassembling and re-assembling parts of the gear system, sometimes several times. This will be a necessary evil to make sure your system components are properly located and installed! However, if your "experimental" fever kicks in, be advised that you are experimenting with a system that has been proven to work in flying aircraft. You should also know that any deviation from these plans may void any warranty, expressed or implied, on the system components.

This manual does not cover the hydraulic plumbing or the installation of any parts not directly associated with the electrical portion of this gear system. You must refer to the Velocity manual for the RG.

1.3 A quick description is given here of the way in which information and control is given to the pilot with the instrument panel Gear Selector Control Panel. A more comprehensive description is given later on in this manual.

- 1) Using a dedicated single green and a single red light, it can inform the pilot the nose gear is down and locked, in transit, or fully retracted into the nose well.
- 2) Using a dedicated single green and a single red light, it can inform the pilot the main gear is down and locked, in transit, or fully retracted into the wheel wells.
- 3) Using a single red light and a gear warning horn, it can inform the pilot that one or both of the gear linkage is not properly locked down for safe landing conditions.
- 4) Using a single amber light, it can inform the pilot when the hydraulic pump is running.
- 5) Using a push type switch on the Gear Selector Control Panel, test all gear system lights and gear horn. This switch also may be used to operate other lamp testing circuits, providing for a single

warning lamp test button on the panel.

- 6) Using a push type switch on the Gear Selector Control Panel, reset the hydraulic pressure switches in the event of errant pressure in the system. It can also be used to bypass the Gear Down position of the selector switch as an emergency back-up to that switch.

1.4 The Proper Sequence of Installation of all of the pieces in this system is done to make this installation as easy as possible. While you may deviate from this sequence, you may encounter some "rework" later to make things function or reach properly.

1.5 Materials Not Included, but necessary to complete this system installation as described in this manual is listed below. Wire should be a Mil Spec 22759-16 or equivalent. A small assortment of Ring terminals will be needed and should be suitable for aircraft use. (.) indicates additional information only. It is not a requirement for this particular installation.

- a) 1/8" rubber tubing approx. 5'
- b) 18' - 2 or 4 ga. Battery / Starter wire (add 15' for engine / starter ground wire)
- c) 10' - 8 or 10 ga. Primary Power / Ground wire (add 15' for Alternator output)
- d) 18 ga. Solenoid control wire (around 200' for complete aircraft requirements)
- e) 20 ga. Starter Engage Light wire (optional)
- f) 4 - 1/4 x 20 x 5/8" bolts
- g) 4 - 1/4" lock washers
- h) 12 - 1/4" flat washers
- i) 10 - #4-40 x 1" screws
- j) 20 - #4 flat washers
- k) 10 - #4-40 fiber lock nuts or lock washers with nuts
- l) assorted cable ties and anchors
- m) 8 - 3" squares of BID
- n) 4 - 4" squares of Peel Ply
- o) small quantities of epoxy and cabosil
- p) Piezo Warning Horn (Pulsing type)

2.0 INSTALLATION OF SYSTEM COMPONENTS

2.1 The Hydraulic Pump Assembly is located on the forward right side (Co-Pilot's side) of the canard bulkhead. Refer to the Velocity manual for the proper installation and hydraulic plumbing of this pump.

2.2 The Main Control Box is located in the right hand side of the nose compartment, just forward and above the Battery Box. It should be rigidly mounted to the side of the fuselage. These instructions will cover the installation of hardpoints to facilitate this goal. Refer to Figures #7 and #8 to aid you in the installation.

With your Battery in place (use a dimensional replica of the battery you plan on using if you

have not yet bought a battery) locate the main control box forward of the battery so that it will fit as flush to the side of the fuselage as possible. Using a marker, locate the four mounting holes on the back plate of the main control box onto the side of the fuselage.

Make four 1" x 1" x 1/4" aluminum hardpoints and tap them in the center for 1/4"-20 bolts. Center each of the hardpoints over the marks indicating the mounting holes of the main control box and recess these hardpoints into the foam of the fuselage. Prior to glassing these hardpoints in, which we will do later, thoroughly sand both sides of the aluminum and an area approximately 3" square around each hole in the fuselage with some 80 grit sandpaper.

Using 2" square pieces of duct tape, cover the back side of the main control panel at each mounting hole. With four 5/8" x 1/4"-20 bolt, place a 1/4" lock washer on each bolt, then a thin 1/4" flat washer. Insert each bolt into a mounting hole on the main control panel. Place 2ea. 1/4" washers on each bolt, then attach the hardpoints to the bolts. Square the hardpoints up visually so that they will slide into the recesses that you made in the fuselage side and tighten the bolts. Make sure the bolts are flush to the end of the tapped hole, but do not stick through the hardpoints.

Next, mix enough 5 minute epoxy and cabosil to generously coat (approximately 3/16" thick) the back side of each hardpoint. Make sure you sanded the aluminum well! Place the main control panel assembly into position pressing firmly into the fuselage. Once the 5 minute mixture is completely set, carefully remove the bolts from the hardpoints and remove the assembly out of the way.

Cut 8 pieces of BID approximately 3" square and 4 pieces of Peel Ply 4" square. Mix enough epoxy to lay up two layers of these BID pieces over each hardpoint and enough cabosil mixture to flush out the four hardpoints in the side of the fuselage. Slide a piece of some thin wall 1/4" ID tubing over your mounting bolts, leaving 1/4" of threads exposed. Make sure the bolt will slide in and out of the tubing easily. Insert the bolts with the sleeves into the hardpoints. The tubing will help prevent any of the cabosil mixture from getting on the threads of the bolt. Carefully fill the hardpoint recesses with the cabosil mixture so that your 3" square pieces will lay flat over the hardpoints. With the cabosil in place, gently remove the bolts and the tubing. Cover all four hardpoints with the two layers of BID. Once the BID is on, cover with the 4" squares of Peel Ply making sure the edges of the BID is covered.

When the hardpoints are cured, carefully use a 1/4" drill bit to remove the BID that is covering the holes. If need be, hand tap the holes to remove any material imbedded in the threads. Mount the main control panel to the fuselage again, using the same bolt and washer assembly as before. (See Figure #8)

You must now connect the Airspeed switch up to your Pitot tube plumbing. Connect a 1/4" / 1/8" "T" into your Pitot line from the Pitot tube to the Airspeed Indicator. Route 1/8" rubber tubing from the port opposite the terminals (the bottom port) on the airspeed switch to the 1/8" fitting on the "T" that you just installed. **MAKE NO ADJUSTMENT TO YOUR AIRSPEED SWITCH AT THIS TIME!!!**

2.3 The Gear Selector Control Panel is mounted directly above the Attitude Gyro in the Instrument panel. Refer to Figure #9 for the cutout information for this panel.

Once the cutout has been cut and the panel is able to slide into and out of the cutout, position the Gear Selector Switch Panel so that the bottom of the panel is parallel to the top of the

flight instruments, or the flight level line if the flight instruments are not installed in a straight line. With the panel properly positioned, back drill the four corner mounting holes with a #36 drill. Tap these holes for a #6-32 screw directly into the fiberglass panel. Now attach the panel to the fiberglass instrument panel with four #6-32 instrument screws. Do not overtighten these screws as the fiberglass panel can be stripped. Considering the weight of the Gear Selector Switch Panel and the strength of four #6 screws, this technique is quite acceptable for the installation of this switch panel.

2.4 The Nose Gear Switches are installed in areas of easy access for both inspection and maintenance. It is highly recommended that the mechanical portions of the retractable landing gear system be installed prior to attempting the installation of these switches. The Velocity instruction manual for your airframe will have the necessary information in it to properly install the mechanical items needed to complete your retract gear system. It is recommended that you have the airplane on jacks during the installation of the gear position switches as it will be necessary to manually "work" the gear linkage to determine proper positioning of the switches.

Refer to Figures #1 and #2 for a depiction of the installation of both the nose gear down switch and the nose gear up switch, respectively. These locations afford the best possible areas to detect positive positions of the nose gear linkage in either the nose gear down and locked position or the nose gear up in the fully retracted position. We will start with the nose gear down switch first.

2.4.1 The Nose Gear Down Switch is to be mounted to the overcenter linkage safety bracket. (See Figure #1) Properly installed, the switch will only be switched "on" when the overcenter linkage is in the down and locked position. Refer to the Velocity instruction manual for your airframe to properly locate and install the overcenter linkage safety bracket.

Position the nose gear down switch so that the actuating arm of the switch is compressed between the overcenter linkage and the switch. Do not mount the switch so that the plunger on the switch is jammed too tightly into the switch body. You can hear the switch "make / break" (switch "on and off") while positioning the switch. It is properly positioned when you hear the switch "make". The actuator arm of the switch should be as close to parallel with the top of the gear linkage as possible when it is in the "make" position. Make sure there is room between the switch terminals and the side of the keel to accommodate the connectors on the electrical harness.

Now that you have properly located the switch, take a pencil and mark the outer edges of the switch. If you want, you may take a long, thin marking device and mark the mounting holes in the switch. This is not always as accurate and may require a small adjustment later. With the body of the switch marked on the overcenter safety bracket, remove the safety bracket and take it to your work bench. There, relocate your switch and using a small clamp, clamp the switch to the bracket. You now need to back-drill the mounting holes in the switch to the bracket. By using a #30 (or 1/8") drill, you should have just a little room for making minor adjustments in the positioning of the switch. Once this is done, mount the switch to the bracket using two #4-40 screws, four #4 flat washers (one between the head of each screw and the switch, one under each nut), and two #4-40 fiber locknuts. If you do not have fiber locknuts, you may use lock washers and nuts instead. Use a small spot of nail polish to secure the nut to the screw threads after you have tightened the nut.

Now you may reinstall the overcenter safety bracket. Manually operate the overcenter linkage and listen for the "make / break" of the switch. If properly located, the switch will only "make" when the overcenter linkage has gone to the overcenter position. (Down and Locked). Minor adjustments may be made by loosening the switch and slightly rotating it. More radical adjustments may be made by gently bending the actuator arm at the end away from the switch plunger to facilitate earlier or later contact.

2.4.2 The Nose Gear Up Switch will be mounted to the right hand side nose gear door actuator guide bracket. (See Figure #2) Properly located, the switch will only "make" when the nose gear doors are fully closed. The nose gear door actuator, gear doors, guide brackets, and linkage between the actuator and the doors must be installed for this step. Refer to the Velocity instruction manual for your airframe for proper installation of these items.

With the nose gear fully retracted and the gear doors closed, position the switch on the right hand guide bracket (Co-Pilots side) so that the "T" bar of the actuator linkage slides up and into the actuator arm of the switch. Make sure that there is room between the bracket and the switch terminals for the connectors on the electrical harness. Mark the outer edges of the switch on the bracket as described in Section 2.4.1. Remove the guide bracket, clamp the switch where you marked it on the bracket, and back-drill the switch mounting holes with a # 30 (1/8") drill. Mount the switch to the bracket with two #4-40 screws, four #4 flat washers (one between the head of each screw and the switch, and one under each nut), and two fiber locknuts.

Re-install the guide bracket, and manually operate the nose gear door actuator with the nose gear doors hooked up. Listen for the "make / break" of the switch while you operate the actuator. The switch, if properly located, will only "make" when the nose gear doors are in the fully closed position. Minor adjustments may be made by loosening the switch and slightly rotating it. More radical adjustments may be made by gently bending the actuator arm at the end away from the switch plunger to facilitate earlier or later contact.

2.5 The Main Gear Switches are installed in areas of easy access for both inspection and maintenance. It is highly recommended that the mechanical portions of the retractable landing gear system be installed prior to attempting the installation of these switches. The Velocity instruction manual for your airframe will have the necessary information in it to properly install the mechanical items needed to complete your retract gear system. It is recommended that you have the airplane on jacks during the installation of the gear position switches as it will be necessary to manually "work" the gear linkage to determine proper positioning of the switches.

Refer to Figures #3 and #4 for a depiction of the installation of both the main gear down switch and the main gear up switch, respectively. These locations afford the best possible areas to detect positive positions of the main gear linkage in either the main gear down and locked position or the main gear up in the fully retracted position. We will start with the main gear down switch first.

2.5.1 The Main Gear Down Switch will be mounted onto the down and locked switch mounting flange. This flange is located on the left side (pilot's side) of the main gear linkage at the center pivot point. (See Figure #3) Properly installed, the switch will only be switched "on" when the

overcenter locking arm in the down and locked position.

With the gear in the down and locked position, position the main gear down switch so that the actuating arm of the switch is compressed between the overcenter locking arm and the switch. Do not mount the switch so that the plunger on the switch is jammed too tightly into the switch body. You can hear the switch "make / break" (switch "on and off") while positioning the switch. It is properly positioned when you hear the switch "make". The actuator arm of the switch should be as close to parallel with the bottom of the gear linkage locking arm as possible when it is in the "make" position. You will notice that the switch will need to be spaced out from the flange to insure positive contact with the overcenter locking arm. This can be done by either spacing the switch out with a piece of aluminum or by installing washers between the switch and the flange when you permanently mount it.

Now that you have properly located the switch, take a pencil and mark the outer edges of the switch. If you want, you may take a long, thin marking device and mark the mounting holes in the switch. This is not always as accurate and may require a small adjustment later. With the body of the switch marked on the flange, using a small clamp, clamp the switch to the flange. You now need to back-drill the mounting holes in the switch to the flange. By using a #30 (or 1/8") drill, you should have just a little room for making minor adjustments in the positioning of the switch. Mount the switch to the flange, spacing out away from the flange as necessary, using two #4-40 screws, four #4 flat washers (one between the head of each screw and the switch, one under each nut), and two #4-40 fiber locknuts. If you do not have fiber locknuts, you may use lock washers and nuts instead. Use a small spot of nail polish to secure the nut to the screw threads after you have tightened the nut.

Manually operate the overcenter locking arm and listen for the "make / break" of the switch. If properly located, the switch will only "make" when the overcenter locking arm has gone to the "Down and Locked" position. Minor adjustments may be made by loosening the switch and slightly rotating it. More radical adjustments may be made by gently bending the actuator arm towards the end away from the switch plunger to facilitate earlier or later contact.

2.5.2 The Main Gear Up Switch will be mounted to a 1" extruded aluminum angle bracket which will be located on the underside of the left side (pilot's side) main gear linkage. Properly located, the switch will only "make" when the main gear is fully retracted.

The first step here is to drill two #30 (1/8") holes approximately 1" apart in the center of one side of the aluminum bracket. The switch should be positioned opposite of this drilled side with the actuator arm side of the switch flush to the edge of the bracket, switch to the outside of the angle. The side adjacent to the plunger should be flush with the edge of the bracket also. Using a small clamp, clamp the switch to the bracket. You now need to back-drill the mounting holes in the switch to the bracket. By using a #30 (or 1/8") drill, you should have just a little room for making minor adjustments in the positioning of the switch. Once this is done, mount the switch to the bracket using two #4-40 screws, four #4 flat washers (one between the head of each screw and the switch, one under each nut), and two #4-40 fiber locknuts. If you do not have fiber locknuts, you may use lock washers and nuts instead. Use a small spot of nail polish to secure the nut to the screw threads after you have tightened the nut.

With the main gear fully retracted (gear doors flush to the strakes, wheels slightly touching

the top of the wheel well) slide this assembly up into the inverted "V" formed by the main gear linkage with the bracket next to the left side (pilot's side) linkage. Once you hear the switch "make", mark one of the two #30 (1/8") holes drilled in the bracket and the edges of the bracket on the linkage. Fully extend the main gear so that it is now down and locked.

Using protective eyewear, drill the hole you just marked with a #30 (1/8") drill bit. Locate the bracket, making sure it is properly located, onto the linkage and using a 1/8" steel pop rivet, rivet the bracket to the linkage. Now, match drill the other hole and install a 1/8" rivet into that hole. Properly located, the switch will only "make" when the main gear is fully retracted. Minor adjustments may be made by loosening the switch and slightly rotating it. More radical adjustments may be made by gently bending the actuator arm towards the end away from the switch plunger to facilitate earlier or later contact.

2.6 The Throttle Switch will be located directly on the fuel servo or carburetor. Properly located, it will be able to detect when the throttle is retarded to a point where straight and level flight is no longer obtainable by engine power.

There are two different mountings that are generally encountered. One is on the Fuel Servo used on the Lycoming engine installations, and the Carburetor used on the Franklin engine installations. Refer to Figures #5 and #6 for bracket cutouts and mounting locations.

With the brackets in place, pull the throttle back to where approximately 1" of throttle handle travel is left. Locate the switch so that it will "make" with the throttle body arm and maintain contact with that arm until the power setting is advanced once again.

Now that you have properly located the switch, take a pencil and mark the outer edges of the switch. If you want, you may take a long, thin marking device and mark the mounting holes in the switch. This is not always as accurate and may require a small adjustment later. With the body of the switch marked on the flange, using a small clamp, clamp the switch to the flange. You now need to back-drill the mounting holes in the switch to the flange. By using a #30 (or 1/8") drill, you should have just a little room for making minor adjustments in the positioning of the switch. Mount the switch to the flange, spacing out away from the flange as necessary, using two #4-40 screws, four #4 flat washers (one between the head of each screw and the switch, one under each nut), and two #4-40 fiber locknuts. If you do not have fiber locknuts, you may use lock washers and nuts instead. Use a small spot of nail polish to secure the nut to the screw threads after you have tightened the nut.

3.0 ROUTING OF THE ELECTRICAL HARNESSSES

3.1 The General routing of the Harnesses is very easy and requires minimal securing to structural parts. However, these harnesses should be secured to the fuselage or bulkheads at a maximum distance of 18" spacings, except where the harness(es) are in the ducts. All of the harnesses terminate at the Main Control Panel. There is some flexibility in that some of the harnesses may be routed more than one way. All of these harnesses should be bundled together exiting the Main Control Panel and routed down and aft toward the right side duct opening on the canard bulkhead. Refer to Figure #10 for all of the proper wiring connections of the wires to their respective switches. For references made in the following text, P1 is the connector that is on the

bundle of wires coming from the Gear Selector Switch Panel. P2 is the connector in which all of the gear switch wiring is connected to. J1 is the connect that comes from the Gear Pump assembly.

Route these harness completely before securing them to anything. Attach the spade type terminals to the respective switches. Starting from the switches, secure the harnesses as required. Leave a small 3" diameter service loop somewhere near (within 12" or so) of the switches and pull any extra cable lengths back toward the Main Control Panel. Any extra cable may be looped and secured behind the battery next to the fuselage.

3.2 The Nose Gear Switch Harness originates at the Main Control Box. This harness is approximately 10 feet long and is the shortest harness coming out of P2. It should be routed down and aft toward the right side duct opening with the other gear wiring harnesses. From there, it may be routed either through the duct then up behind the canard bulkhead or inboard on the front side of the canard bulkhead and up to the top of the right side (Co-Pilot's side) nose-gear door actuator guide bracket.

If it is routed through the duct then up behind the canard bulkhead, it should be brought inboard to the Co-Pilot's side of the keel. Just above the location of the Nose Gear Up Switch and the guide bracket, a 1/4" hole should be drilled into the canard bulkhead. The White and Black wires of this harness should then be routed through this hole and attached to the Nose Gear Up Switch. The Red, Orange, and Green should be routed towards and attached to the Nose Gear Down Switch. (See Figure #9)

If this harness is routed on the forward side of the canard bulkhead, it should be routed from the duct opening horizontally inboard to a point below the outboard side of the Nose Gear Up Switch, then vertically to a point just above the Nose Gear Up Switch. Just above the location of the Nose Gear Up Switch and the guide bracket, a 1/4" hole should be drilled into the canard bulkhead. The Red, Orange, and Green should be routed through this hole and attached to the Nose Gear Down Switch. The White and Black wires of this harness should be routed towards and attached to the Nose Gear Up Switch. (See Figure #9)

3.3 The Main Gear Switch Harness is routed down through the right side duct opening and should be brought back up through the duct just in front of the gear bulkhead. From there it should be routed up and along side of the fuselage to the top of the spar. Once it is on top of the spar, it should be routed inboard to a point centered between the fuselage sides on the spar. Route and attach the Red, Orange, and Green wires to the Main Gear Down switch. Route and attach the White and Black wires to the Main Gear Up Switch. (See Figure #9) Secure the harness to the left side (Pilot's side) of the overcenter linkage just outboard of the Main Gear Down switch. Secure the harness at the center point of the spar, allowing the harness to loop down and then back up (approximately 14" - 18" of harness) to the center-hinge point of the overcenter gear linkage. Now secure the harness to the firewall and down the front side of the gear bulkhead.

3.4 The Throttle Switch Harness is routed down through the right side duct opening and run completely through to the duct opening at the firewall. From there it should be routed along the bottom of the firewall to the area near the fuel servo or carburetor. Route and attach the White and the Black wires to the Throttle Switch. (See Figure #9) Secure the harness to the firewall, leaving a small service loop on the firewall.

3.5 The Gear Pump Harness is routed down and towards the hydraulic pump assembly. Connect the two cable plugs together.

3.6 The Gear Selector Switch Panel Harness is routed from the area above the Attitude gyro down and across the bottom of the instrument panel to the Co-Pilot's side of the fuselage. From there it should go down to the right side duct and forward through the duct to the Main Control Panel, or it may go forward through the canard bulkhead and then toward the Main Control Panel.

3.7 The Power Wires are coming from the hydraulic pump assembly and should be routed with the Gear Selector Switch Panel harness. The 5 and 30 Amp Circuit Breakers should be mounted in the right hand side of the instrument panel and labeled "GEAR CONTROL" and "GEAR PUMP" respectively. The white 18 ga. wire will be connected to the 5 Amp Circuit Breaker while the larger black 12 ga. wire will be connected to the 30 Amp Circuit breaker. A wire (minimum 12 ga.) should go between these circuit breakers and the main power buss going to the other circuit breakers in your panel.

4.0 ELECTRICAL CONNECTIONS

4.1 All the Electrical Connections will be made with either a spade type connector, typically found on the switch harnesses, or ring type terminals like the ones used on the power and ground connections. On the switches, the terminal opposite the actuator lever is the "Common" ("Com") terminal. The terminal closest to the "Com" is the "Normally Open" ("N.O.") terminal. The terminal closest to the side of the actuator arm is the "Normally Closed" ("N.C.") terminal. Refer to Figures 7 - 12 for a pictorial diagram of the connections described in this Section.

4.2 The Nose Gear Switches will be wired as follows:

- a) The Nose Gear Down Switch has a Red, Orange, and Green wires going to it. Red to N.C., Orange to N.O. and Green to Com.
- b) The Nose Gear Up Switch has a Black and a White wire going to it. Black to N.C. and White to Com.

4.3 The Main Gear Switches will be wired as follows:

- a) The Main Gear Down Switch has a Red, Orange, and Green wires going to it. Red to N.C., Orange to N.O. and Green to Com.
- b) The Main Gear Up Switch has a Black and a White wire going to it. Black to N.C. and White to Com.

4.4 The Throttle Switch will be wired as follows:

The throttle switch has a Black and a White wire going to it. Black to N.O. and White to Com.

4.5 The Primary Power Wires will be wired as follows:

GREEN

- a) The ~~White~~ 18 ga. wire goes to the 5 Amp Circuit Breaker GEAR CONT
- b) The ~~Black~~ 12 ga. wire goes to the 30 Amp Circuit Breaker GEAR HYD
GREEN

4.6 The Ground Wire for the entire system is a 10 ga. wire (not included) going from the 1/4 - 20 stud on the mounting plate of the Main Control Panel to the negative (-) terminal on the battery.

4.7 The Battery Master Solenoid should have a 2 - 4 ga. wire going from the "+ Bat" to the positive (+) terminal on the battery. A 18 ga. wire should go from the "C" terminal to the Battery Master Switch. (Note: The Battery Master Switch needs to switch to ground to energize the solenoid.)

4.8 The Starter Solenoid should have a 2 - 4 ga. wire going from the terminal opposite the bus bar (connecting the Starter Solenoid to the Battery Master Solenoid) to the starter motor. A 18 ga. wire should go from the "S" terminal to the Starter Switch. (Note: The Starter Switch needs to switch to + 12 Volts to energize the Starter Solenoid. The +12 Volts should go through a 5 Amp Circuit Breaker, but is not absolutely necessary.) A 20 ga. wire may be connected between the "T" terminal and a +12 volt lamp to indicate when the Starter Solenoid is engaged. This "Starter Engage" light will let the pilot know the solenoid is engaged while he is contacting the Starter Switch. More importantly, it will let him know if the solenoid is stuck in the engaged position once he releases the Starter Switch.

4.9 The Primary Bus Power Wire should be a 8 - 10 ga. wire going from the bottom 1/4" hole on the bus bar that ties the two solenoids together to the circuit breakers in the aircraft.

4.10 The Gear "Horn" Wire is connected to the "Horn" terminal on the back of the Gear Selector Switch Panel. This terminal supplies a switched +12 Volts to the Gear Horn. The negative (-) side of the horn should go ground. If you are using a pulsing piezo buzzer, you may want to wire the negative (-) side of the gear horn to an unswitched audio input of an audio selector panel, or a aux audio input on the back of your Com radio. Wiring your piezo buzzer in this fashion will allow you to hear your gear warning horn through your headsets.

4.11 The "Test" Button Wire is an optional output terminal on the back of the Gear Selector Control Panel. If you are using a warning lamp test board that requires a switched ground to test your other aircraft warning lamps, you may hook that wire to the "Test" terminal. The "Test" terminal provides a momentary ground when the test button on the front of the Gear Selector Control Panel is pressed. This will allow for a single point "Press to Test" lamp button for all of your warning lights.

5.0 OPERATION / CHECKOUT

5.1 The Gear Selector Switch Panel face is shown below. Referring to figure at the bottom of the page, here is an explanation of each part on the gear selector control panel.

- Item A: Gear Selector Switch - Provides for selecting "Gear Up" or "Gear Down"
- Item B: Nose Gear "Down and Locked" light - indicates when the nose gear linkage is in the down and locked position.
- Item C: Main Gear "Down and Locked" light - indicates when the main gear linkage is in the down and locked position.
- Item D: Gear "Unsafe" light - indicates when either gear is in transit or not in the "Up" position.
- Item E: Hydraulic Pump "Run" light - indicates when the pump is running.
- Item F: Test Switch - provides for testing of the gear warning lamps and horn.
- Item G: Reset Switch - provides for resetting of the hydraulic pressure switches. Can act as an emergency bypass to the Gear Selector Switch for "Down" control.

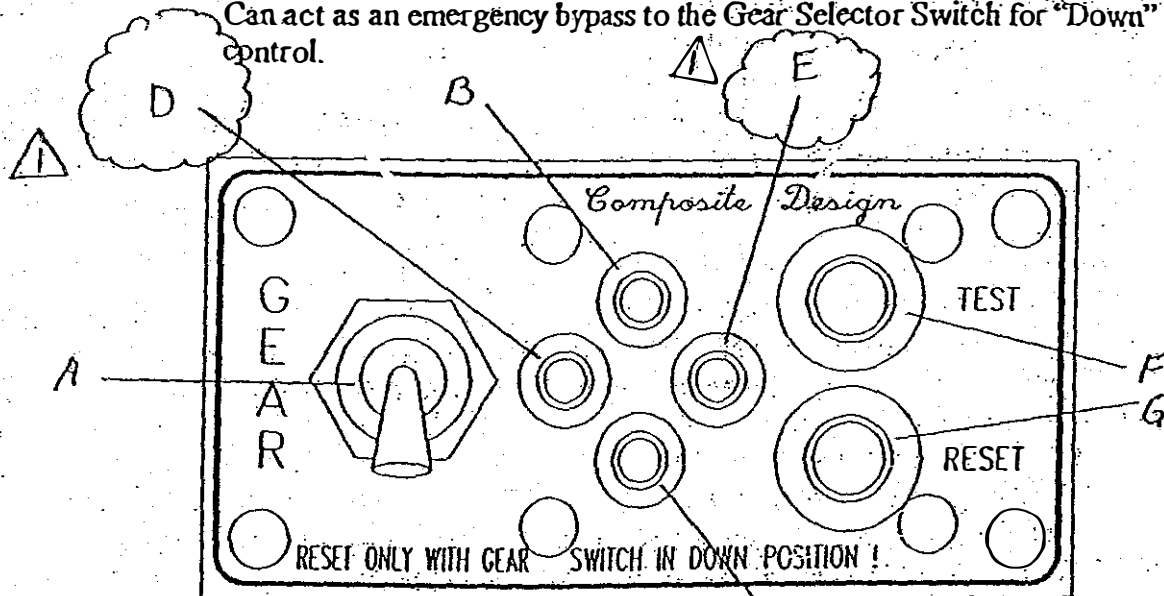


FIG. #15

5.2 The Airspeed Switch is used to prevent the landing gear from being retracted electrically on the ground by accident. When no airspeed is present, the switch is open, preventing any power from being delivered to the hydraulic pump. Once sufficient airspeed is achieved to maintain flight, the switch closes allowing power to be delivered to the hydraulic pump so that it may pump the gear up into the retracted position. See Appendix A for switch adjustment.

5.3 Understanding What You See and Hear from this system might well mean the difference between a bad gear warning light and a bad landing, smooth flying at cruise power and ripping a gear door off in the slipstream, even a safe landing and a gear up landing. Knowing the difference between what is normal and what is abnormal in the indications that you might see will offer you a better insight into what needs to be done to correct any undesirable situation.

5.3.1 **FIRST AND FOREMOST! IF YOU ARE LANDING AND DO NOT HAVE AT LEAST TWO GREEN LIGHTS — DO NOT LAND JUST YET!!!!** Never assume anything with your gear system. Test the lamps and horn with the Test Button. If none of the lamps illuminate and the horn does not sound, don't assume they are all burnt out! You may have lost power to your gear control circuit. Check the "Gear Control" circuit Breaker. If the breaker is OK, still don't assume they are all burnt out. Maintain power setting for 120kts or less and retract the gear. If you did not see a change in airspeed, reach over and rotate the pressure relief valve to dump the system pressure. As soon as your gear starts to extend, your airspeed should slow because of the added drag.

5.3.2 Normal Operating Indications from this system are straight forward and simple. There are some basic rules to understanding what the lights are telling you.

1) Each Green "Down and Locked" light is switched "on" only by the respective down switch or when the test mode is enabled. If the linkage is not down and locked and the switches are properly adjusted, the Green lights will not illuminate, unless you press the "test" button. They should immediately extinguish upon release of the "Test" button if the linkage is not down and locked.

2) The Amber "Gear Pump Run" light will only illuminate when the hydraulic pump has +12 volts being applied to the motor or when the test mode is enabled. If the pump motor is bad, the light should still illuminate as long as there is + 12 volts going to the motor. Say your motor burns out during a flight. You come in for a landing and select the gear selector to the "Down" position. The Amber light comes on, telling you +12 volts is being applied to the motor, but the gear does not move. AH! Bad gear pump motor! Use the pressure relief valve to lower the gear. OR, you come in for a landing and select the gear selector to the "Down" position. The amber light doesn't come on. Push the "Test" button and the Amber light illuminates. You release the button and the light goes out. AH! No power to the gear pump motor! Use the "Reset" button. The light still does not come on. Use the pressure relief valve to lower the gear.

3) If the Red light is "on" at any time, the Gear is "UNSAFE" for landing or cruise speeds. It tells you that one or both of the gear is not down and locked, OR, fully retracted in the up position. Cross check with your Green lights on landing to tell which gear is not down and locked: If the Red light is "on" and just the nose gear Green Light is "on" then the main gear linkage is not down and locked. If just the main gear Green Light is "on" and the Red light is "on", the nose gear is not down and locked. If neither Green light is illuminated, neither gear is down and locked!

If the Red light comes on during your flight, it is an indication that one or more of your gear has dropped down from its fully retracted position and that your airspeed should be checked and possibly slowed until the cause of the Red light is determined. Normally, even if your system should

"bypass" pressure once in a while during a long trip, your Amber hydraulic pump run light should come on before your red light. Under normal circumstances you may occasionally see the amber light illuminate momentarily. You should never see the red light illuminate unless you are retracting or extending the gear and the gear is "In Transit".

4) The only time your gear horn should sound is if the gear "system" is not properly configured for a safe landing or the test mode is enabled. If your engine power is retarded to a point where straight and level flight is no longer maintainable (approach power settings) with either or both gear linkage not down and locked, the horn should sound. The only way the horn should stop sounding at the power setting described above is when both gear linkages are in the down and locked position.

5.3.3 THE GEAR HORN IS NOT CONNECTED TO THE RED "UNSAFE" LIGHT! If your gear is in the fully retracted position, it is not considered to be unsafe! If your power setting is retarded to a point where straight and level flight is no longer maintainable, and the gear is fully retracted, your gear "system" is receiving contradictory information from its sensors and the horn will alert you to the fact that your gear "system" is not configured properly for landing!

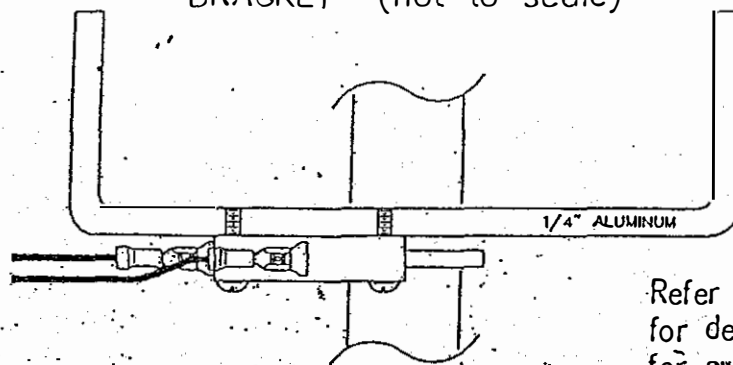
5.3.4 The Test Mode allows the pilot to check the four warning lights and the gear warning horn for proper operation at the push of a single button. If an additional lamp test board is used in the aircraft to functionally test other warning lamps in the airplane, this system provides for a switched ground output for those other lamp test systems. The Gear Selector Control Panel lights and gear warning horn should be tested prior to each flight.

5.3.5 Troubles? Case #1 Let's say you come in for a landing and all of the lights are illuminated. Execute a go around until you get things sorted out. First, retract the gear and reduce the power settings to approach power. See if the green lights extinguish and the gear warning horn starts to sound. If so, lower the gear again and if the green lights come back on and the horn stops sounding...land. Your Green lights should only illuminate when the gear linkages are down and locked or the test mode is enabled. You know the test mode is not stuck because the lights extinguished when you raised the gear.

Case #2 The test mode, for whatever reason, is stuck in the enabled position. Lights and horn all of the time. Pull the gear Control Circuit Breaker and rotate the pressure relief valve. Properly installed and adjusted, the gear should free-fall into the down and locked position. Remove the back panel of the cabin and visually check that the overcenter linkage on the main gear is in fact overcenter and down and locked. Reach into the Keel with a dowel or screw driver and make sure the nose gear linkage is in the down and locked position.

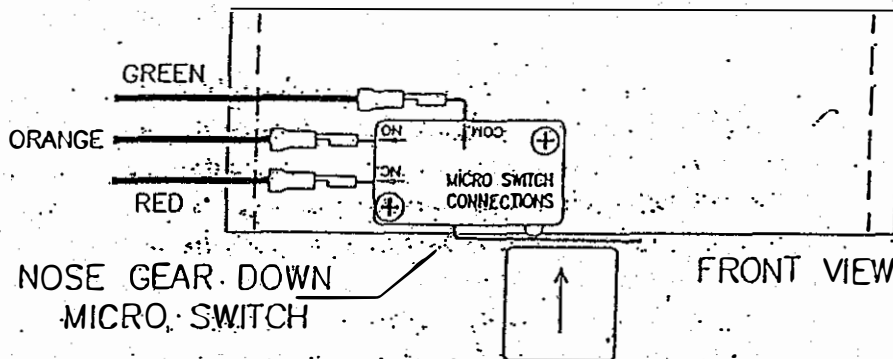
FIGURE #1

NOSE GEAR OVERCENTER SAFETY
BRACKET (not to scale)



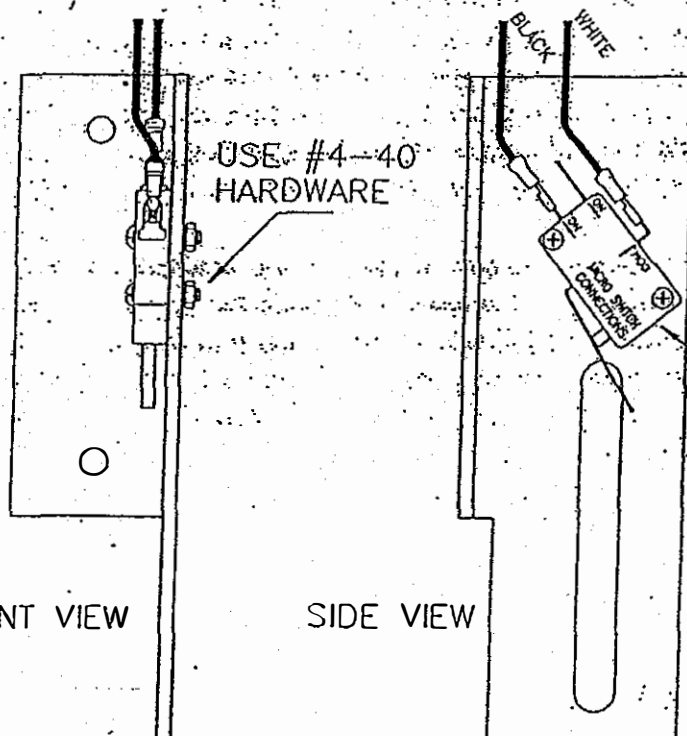
TOP VIEW

Refer to installation instructions
for determining proper location
for switch and bracket.



FRONT VIEW

FIGURE #2



FRONT VIEW

SIDE VIEW

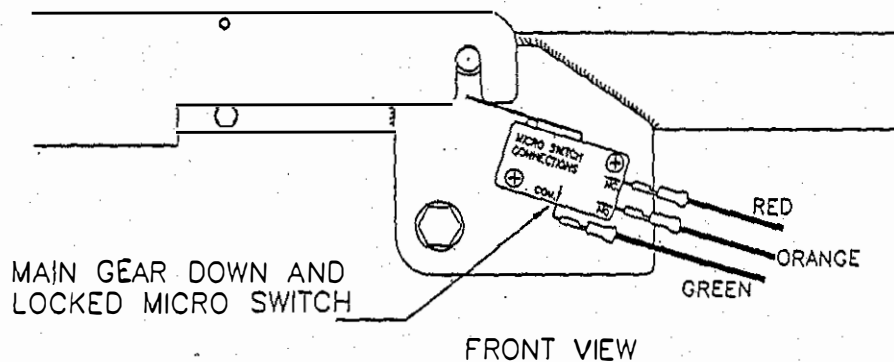
Refer to installation instructions
for determining proper location
for switch and bracket.

NOSE GEAR UP
MICRO SWITCH

Velocity Inc.			
TITLE Velocity Retactable Landing Gear Nose Gear Micro Switches Mounting Diagram			
DRAWN BY Wayne Lanza	DATE 12/29/97	SCALE N/A	
DWG # vrgsys1		REV 0	

FIGURE #3

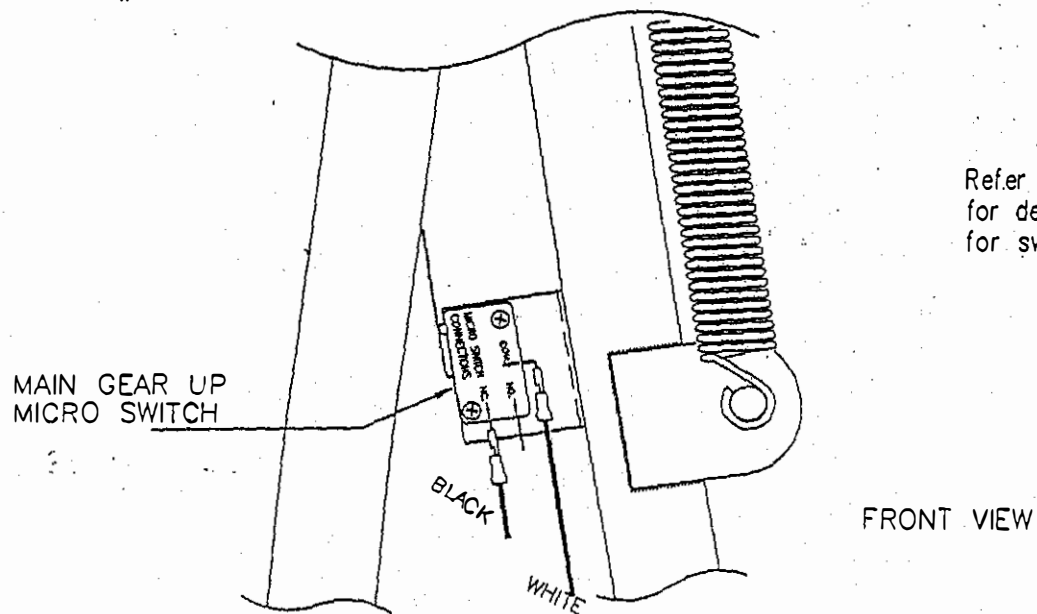
MAIN LANDING GEAR LINKAGE SHOWN IN
DOWN & LOCKED POSITION (not to scale)



Refer to installation instructions
for determining proper location
for switch and bracket.

FIGURE #4

MAIN LANDING GEAR LINKAGE SHOWN IN
UP & LOCKED POSITION (not to scale)

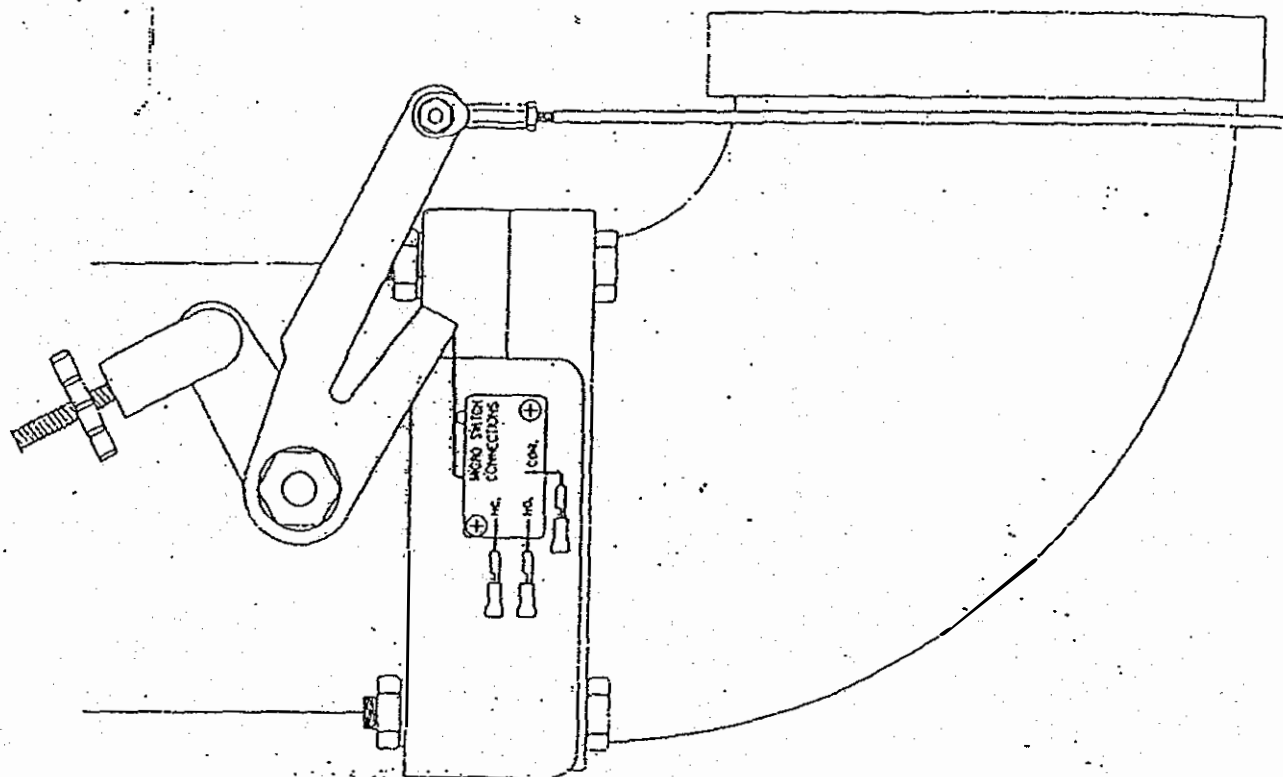


Refer to installation instructions
for determining proper location
for switch and bracket.

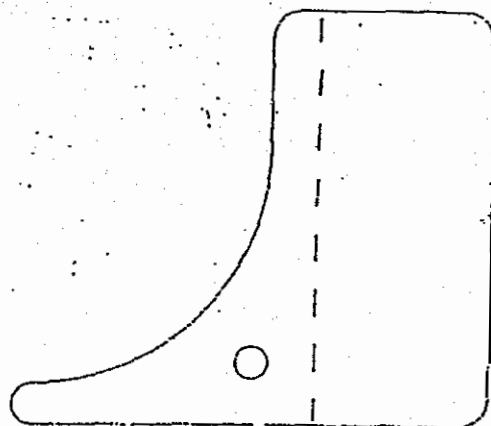
Velocity Inc.		
TITLE	Velocity Retactable Landing Gear Main Landing Gear Linkage Micro Switch Mountings	
DRAWN BY	Wayne Lanza	DATE
		12/29/97
DWG #	vrgsys1	SCALE
		N/A
		REV
		0

FIGURE #????????????

LOW THROTTLE MICRO SWITCH
THROTTLE BODY BRACKET (not to scale)



Refer to installation instructions
for determining proper location
for switch and bracket.



Velocity Inc.		
TITLE Velocity Retactable Landing Gear Low Throttle Micro Switch Throttle Body Mounting		
DRAWN BY Wayne Lanza	DATE 2/25/98	SCALE N/A
DESIGNED vrgsysl		REV 0

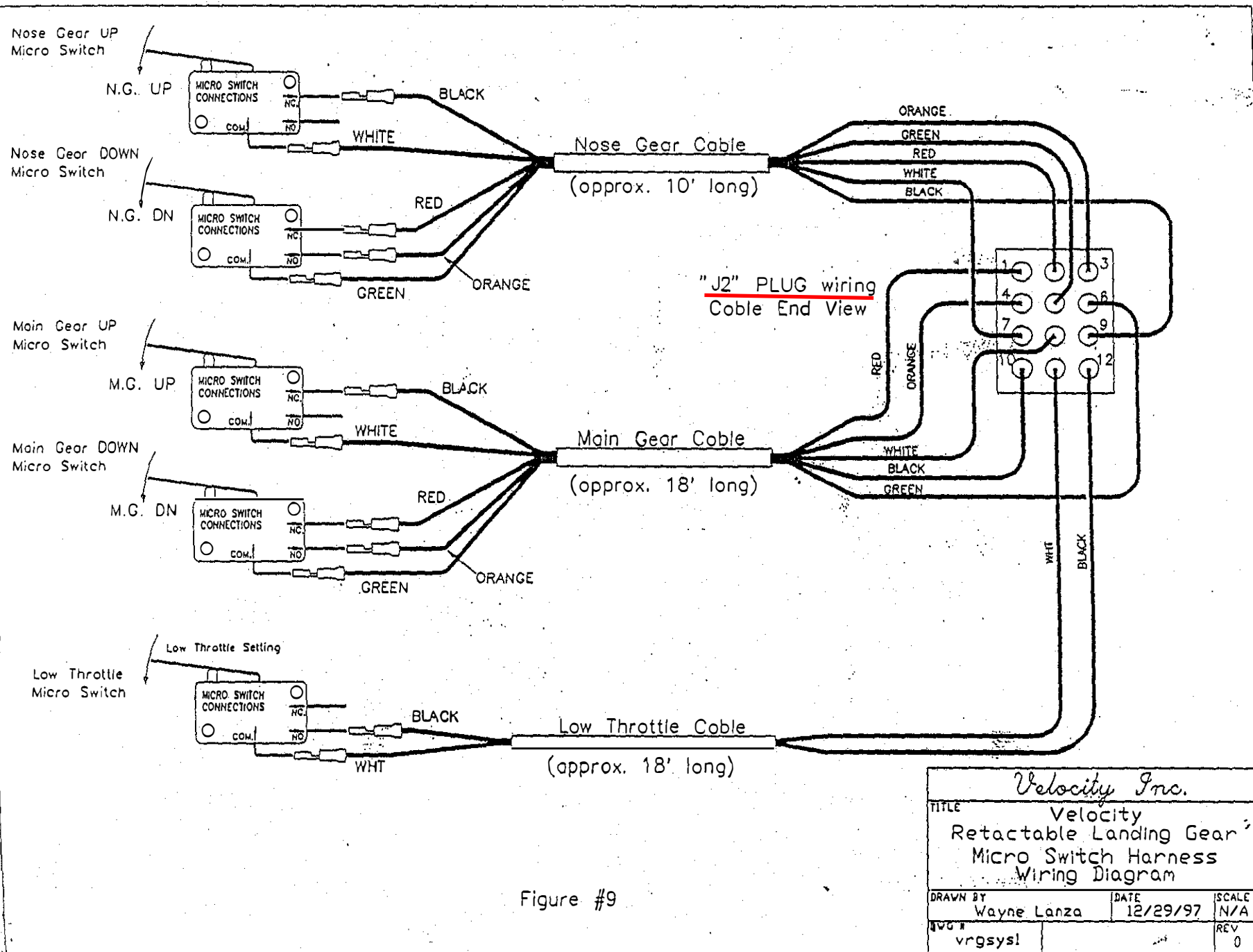
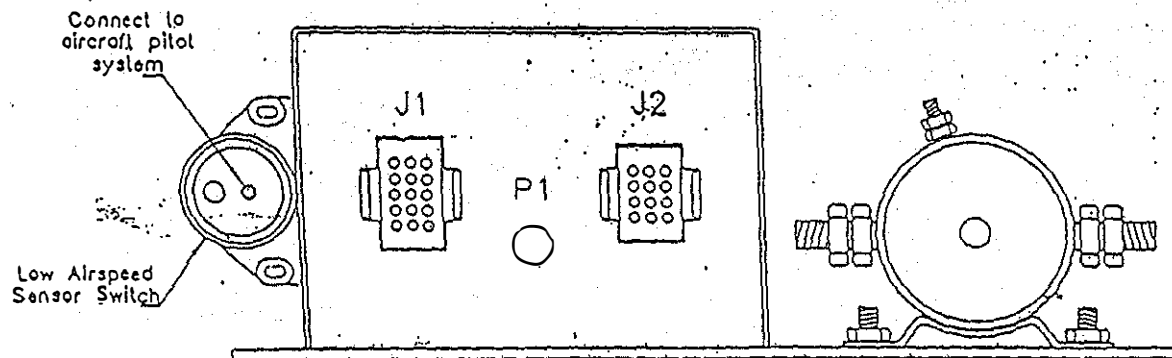
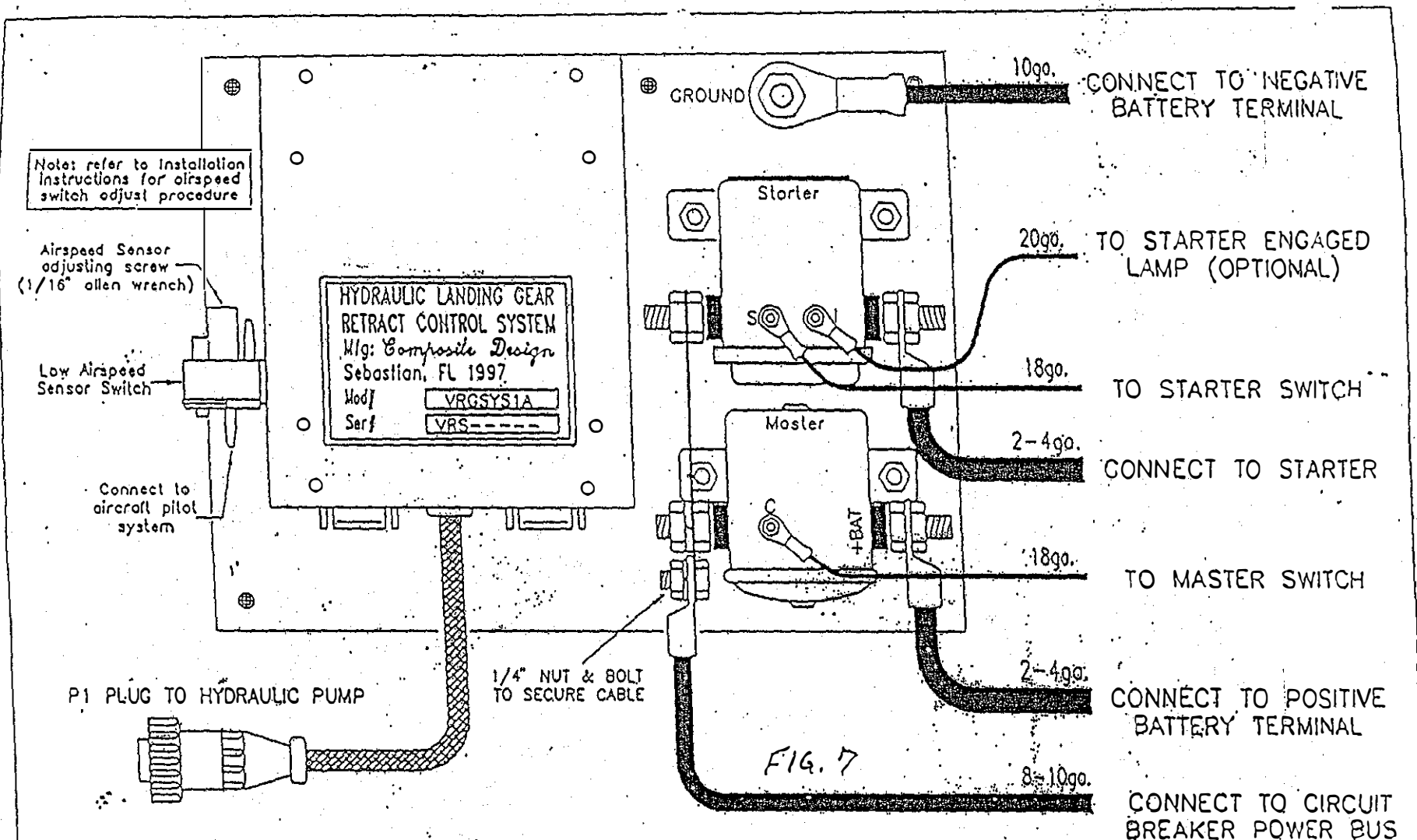


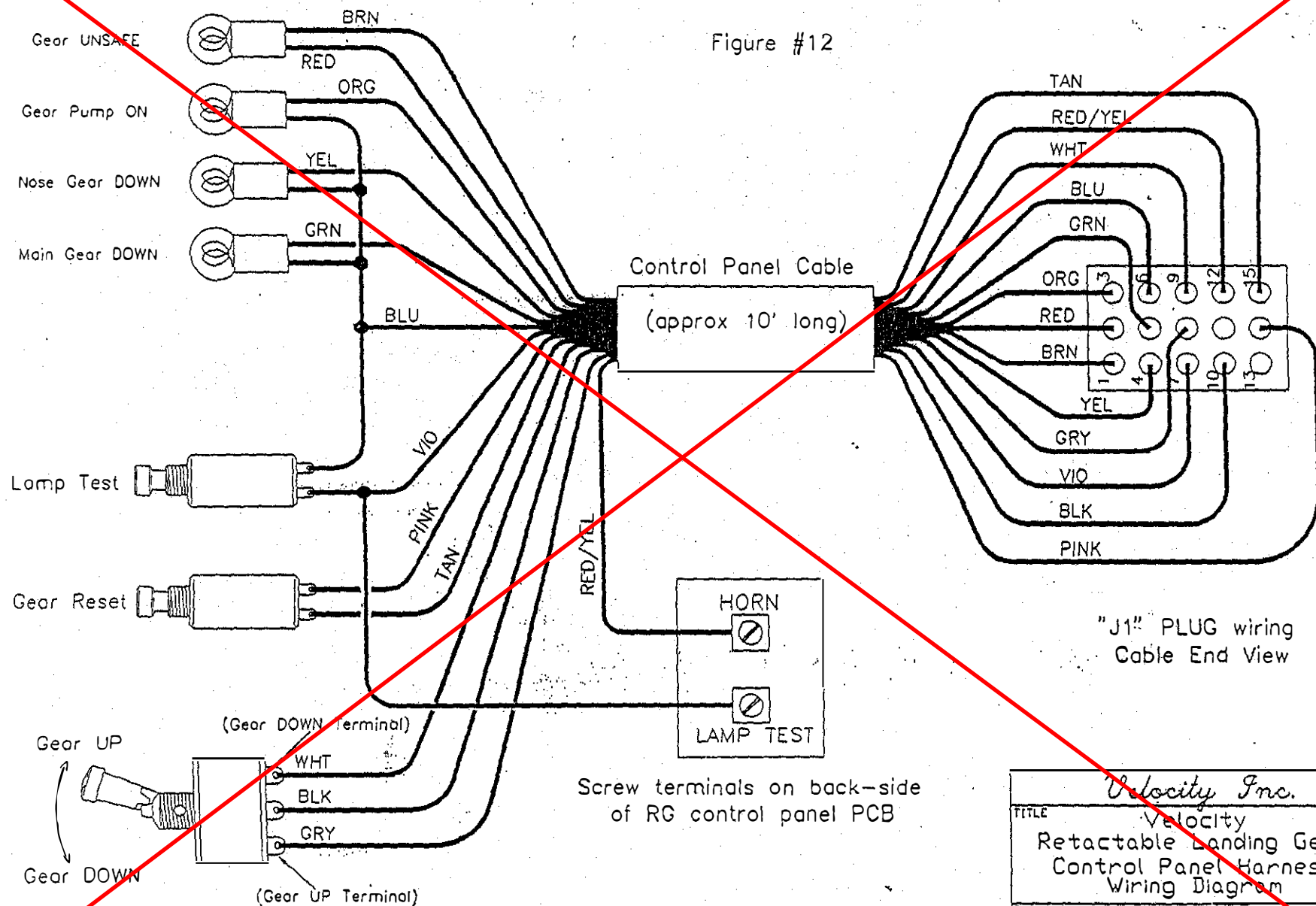
Figure #9

Velocity Inc.		
TITLE Velocity Retactable Landing Gear Micro Switch Harness Wiring Diagram		
DRAWN BY Wayne Lanza	DATE 12/29/97	SCALE N/A
WGS vrgsysl		REV 0



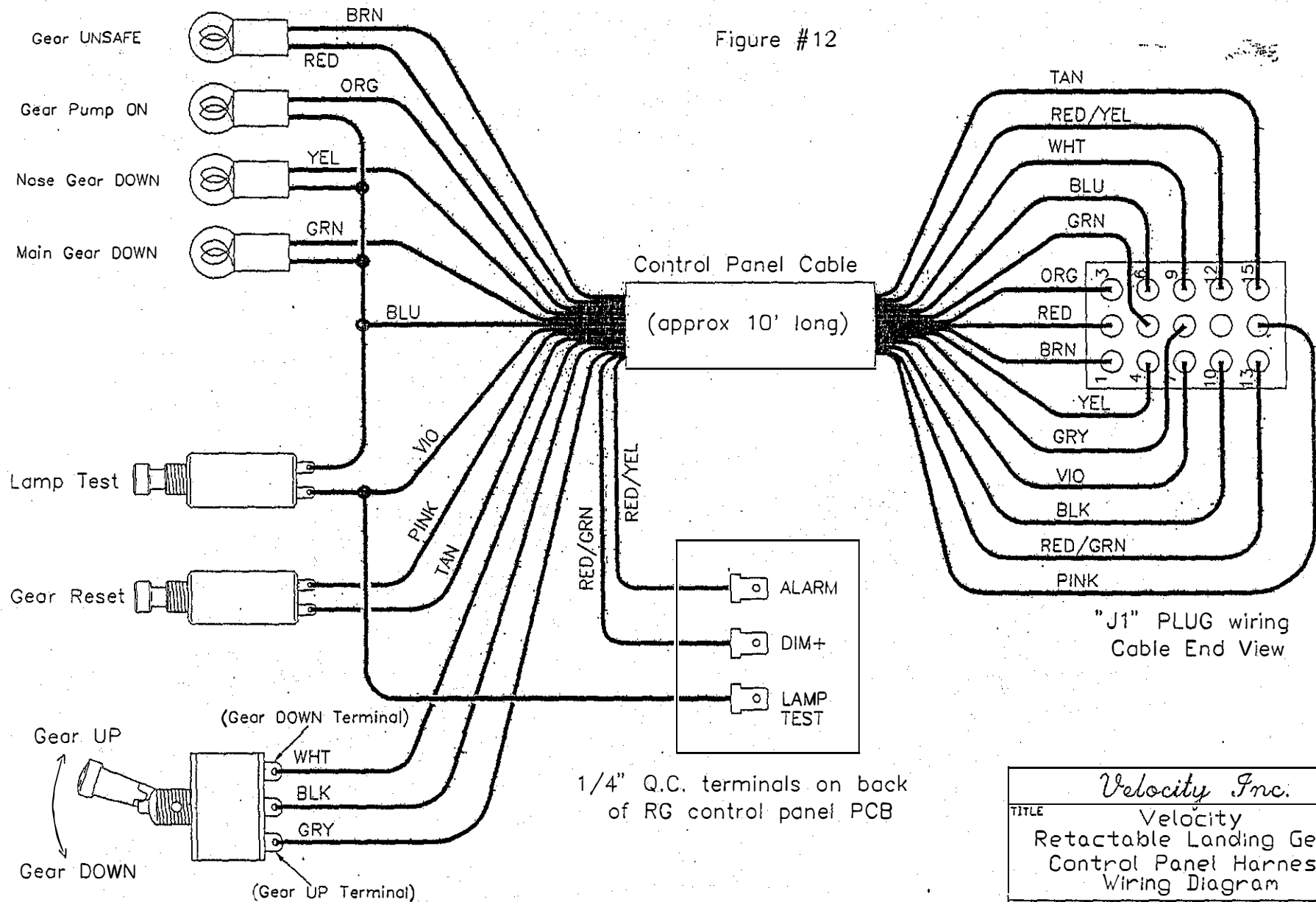
Composite Design		
TITLE		
Landing Gear Control Master & Starter Solenoid Wiring		
DRAWN BY	DATE	SCALE
Wayne Lonzo	12/19/97	N/A
DWG #	SHEET	REV
rgsys1a	5 of 5	A

Figure #12

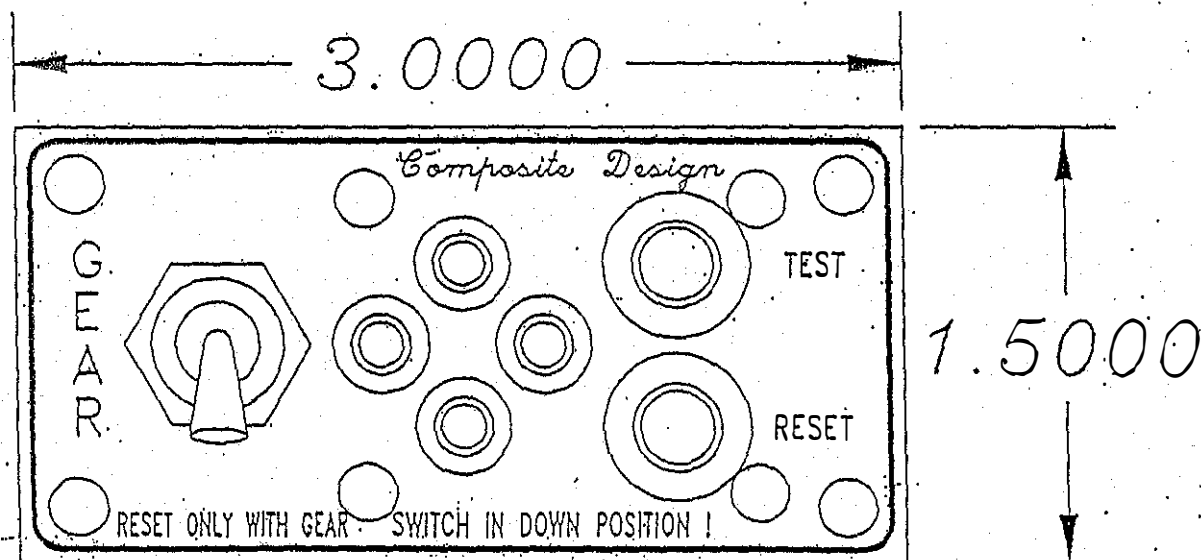
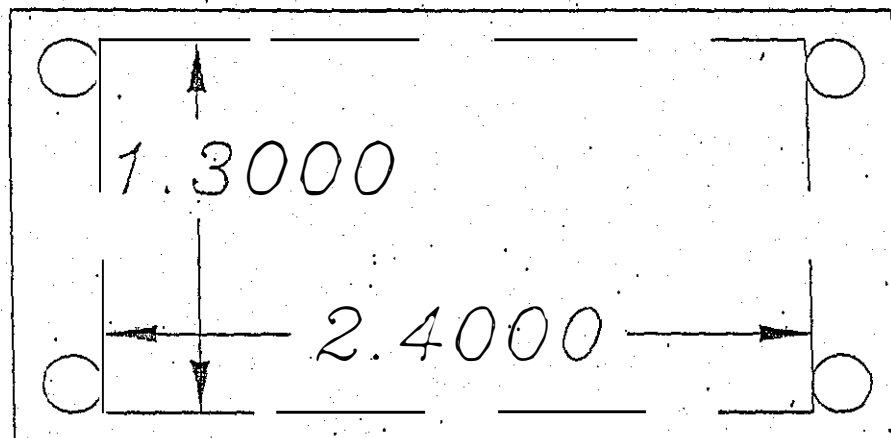


Velocity Inc.			
TITLE Retactable Landing Gear Control Panel Harness Wiring Diagram			
DRAWN BY Wayne Lanza	DATE 12/29/97	SCALE N/A	
DWG # vrgsys1		REV 0	

Figure #12



Velocity Inc.		
TITLE	Velocity Retactable Landing Gear Control Panel Harness Wiring Diagram	
DRAWN BY	Wayne Lanza	DATE
		5/29/00
DWG #	rgrevb1	SCALE
		N/A
		REV
		B



Pump Plug Wiring
Backside View

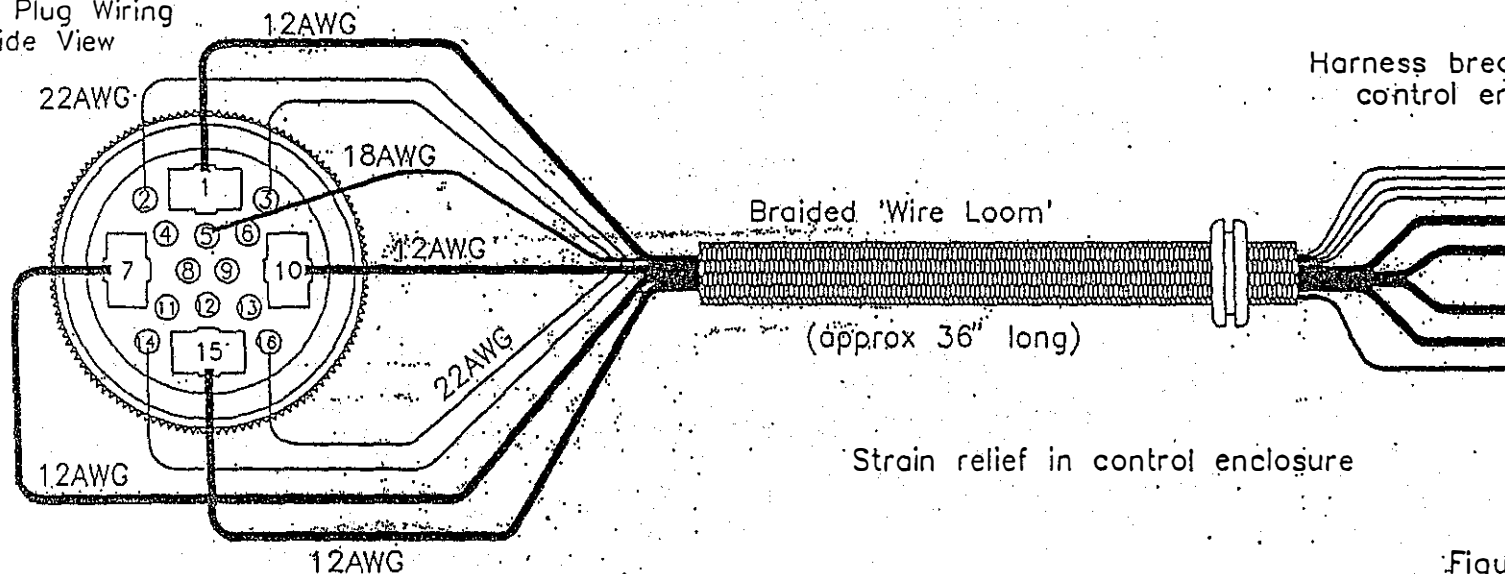


Figure #10

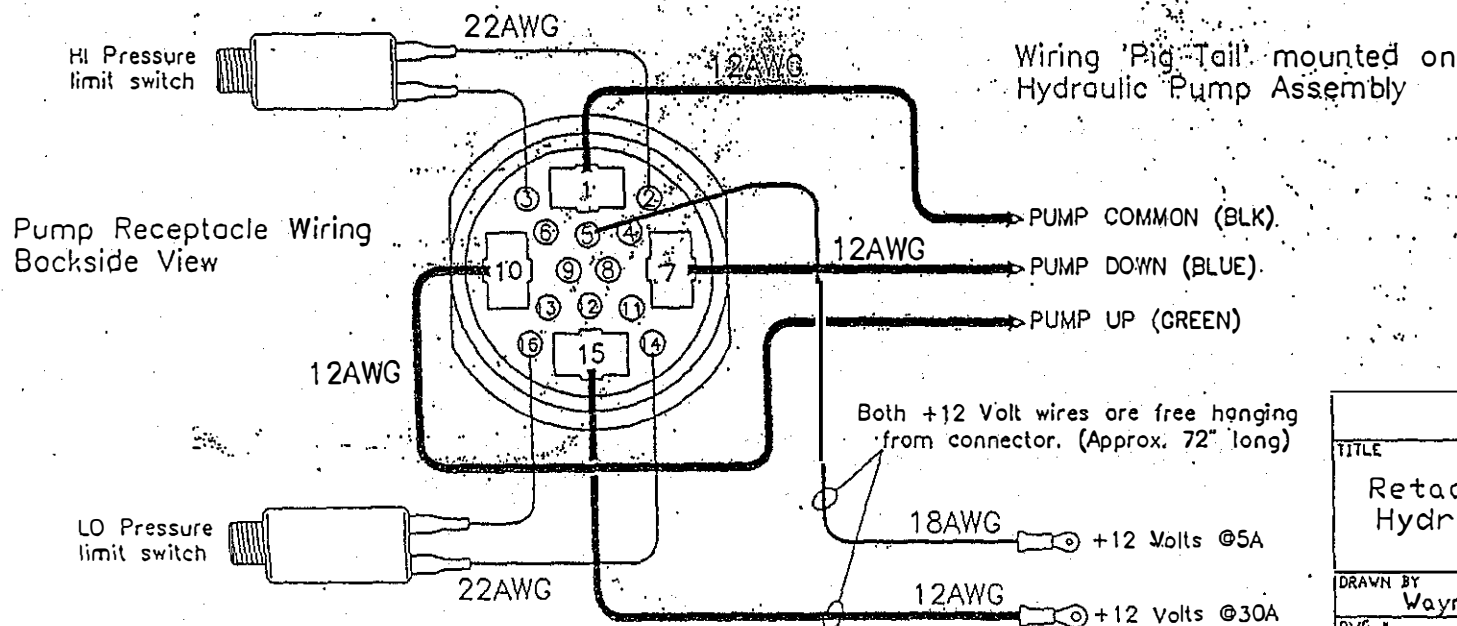
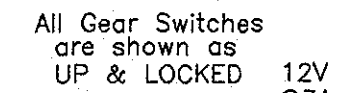


Figure #11

Velocity Inc.			
Velocity Retactable Landing Gear Hydraulic Pump Harness Wiring Diagram			
DRAWN BY	Wayne Lanza	DATE	1/29/98
DWG #	vrgsys1	SCALE	N/A
		REV	A



APPENDIX A

The Airspeed switch should be adjusted just above the stall speed of your aircraft. Typically, the stall speed of the Standard Velocity is 65 knots and the 173 Velocity is 60 knots. Your airplane stall speed may vary slightly, so set your airspeed switch just above your actual tested stall speed.

Adjustment of the airspeed switch should be done as follows: (This will also work to check for system leaks in your Pitot lines.)

1. Slide the end of a 5' piece of flexible hose over the end of your Pitot tube. Tape over the water drain / vent port(s) on the Pitot tube as necessary.
2. Fill a 5 gallon bucket 2/3 full of water.
3. Slowly immerse the open end of the flexible hose into the water while watching the airspeed indicator.
4. Once the desired airspeed is reached, secure the flexible hose to the bucket so that it does not fall into or out of the bucket.
5. If the indicated airspeed "bleeds down", you probably have a leak in the system. Make sure that the drain hole in the Pitot tube is securely taped over. Check your fittings for proper assembly and / or tightness. Make sure there are no leaks in the lines themselves. When all else fails, check the airspeed indicator. Once all leaks have been found and repaired, repeat steps #3 and #4.
6. Place the leads of an OHM meter across the airspeed switch terminals and adjust the airspeed switch so that the contacts just close. Your meter should change from indicating an "open" to indicating a "short".
7. By slowly raising and lowering the flexible hose in the bucket of water, operation of the switch can be checked at the desired airspeed.

REMEMBER! Your gear will not retract while testing the gear system on jacks without either placing a jumper across the terminals of this switch, or generating an appropriate faux airspeed reading by using the method above.