



SKID AVOIDANCE TRAINING

Accountability

SkidCar System Service, Maintenance, Troubleshooting Guide

**TABLE OF CONTENTS**

SkidCar Frame Installation to Vehicle	3
SkidCar Frame Removal from Vehicle	7
Hydraulic System Schematic	9
Initial Hydraulic Charge Procedure for SkidCar	10
Troubleshooting the Hydraulic System	11
Pre-Class Checklist	12
Manual Controller	13
HAL SCC (Hal SkidCar Controller)	14
HAL SCC Operation Manual	15
Warning / Error Codes	22
Specification Data for SkidCar Frame	25
Suggested Maintenance Schedule	26
SkidCar Critical Parts List	27
Contact SkidCar Personnel	28

SkidCar Frame Installation

1. Select a level area to conduct the installation. If the area to do the installation is limited, remember that we will be backing over the frame, so we need room to the front to maneuver the car.
2. Place a small angled wood block under one side of the rear of the ladder frame, raising it about 1 inch off of the ground.
3. Remove the rear outrigger from its carrier and secure it to the frame using the main frame bolts. Be sure to start the main frame bolts into the frame by hand to avoid cross threading. Remove angled wood block from beneath frame.
4. Place the small angled wood block under the front of the frame, raising it about 1 inch off of the ground.
5. Coil all of the hydraulic and electrical lines where they will not be driven over by the car as it backs over the SkidCar frame.
6. Stack two wood blocks with the wedges facing the front of the frame just outside each of the side of the front cross member. These blocks should be located so that the rear tires will be centered on them as the car backs up.



At this point, your installation should look like this

7. Using a spotter to observe both the SkidCar frame and the car, slowly back over the SkidCar frame. The spotter should carefully watch to assure that the rear rubber mounts are high enough to clear the front cross member as the car backs over the frame.



M

Make sure rear mounts clear the front cross member

8. Continue backing until the rear tires of the car are off of the wood blocks and the rear rubber mounts are clear of the cross member and then stop.
9. Remove only the top wood block from each side and place them just outside of the rear cross member, so that the rear tires will be centered on them as the car continues to back up.
10. Using the spotter, continue to back up until the car is on the wood blocks and both the front and rear rubber mounts are located approximately above the respective cross members.



11. Push the electrical connections for the pump and controller cable up into the trunk through the access holes in the bottom of the trunk.
12. Secure the electrical connections for the pump and the controller cable to their connections.
13. Push the hydraulic lines on the rear of the SkidCar up into the trunk.
14. Connect the hydraulic lines in the trunk to the pump.
15. Remove the front outrigger from its carrier and secure it to the frame using the main frame bolts. Be sure to start the main frame bolts into the frame by hand to avoid cross threading. Remove angled wood block from beneath frame.
16. Connect the electrical connection from the long frame rail to the front outrigger.
17. Connect the front hydraulic line from the long frame rail to the front outrigger.
18. Push the main power connection up into the engine compartment and connect to the battery or power distribution box.
19. Connect the manual controller to the system.
20. Slowly adjust the front outrigger until the holes in the cross members are immediately beneath the bolts from the front rubber mounts.
21. Raise the front to full elevation with the manual controller, making sure that the bolts from the rubber mounts fit into the cross member.
22. Secure the frame to the rubber mounts. (18mm nuts and deep-well socket are needed here)



23. Remove wood blocks from beneath front tires.
24. Return front rams to fully parked position.
25. Slowly adjust the rear outrigger until the holes in the cross members are immediately beneath the bolts from the rear rubber mounts. Remember that the rear rubber mounts can be moved by loosening and sliding them back and forth.



26. Raise the rear to full elevation with the manual controller, making sure that the bolts from the rubber mounts fit into the cross member.
27. Secure the frame to the rubber mounts. (18 mm nuts and deep-well socket are needed here)
28. Remove wood blocks from beneath rear tires.
29. Return rear rams to fully parked position.
30. Pull up slack in all hydraulic and electrical lines and cable tie to insure they do not drag on the ground.
31. Conduct a daily maintenance inspection.



SkidCar Frame Removal

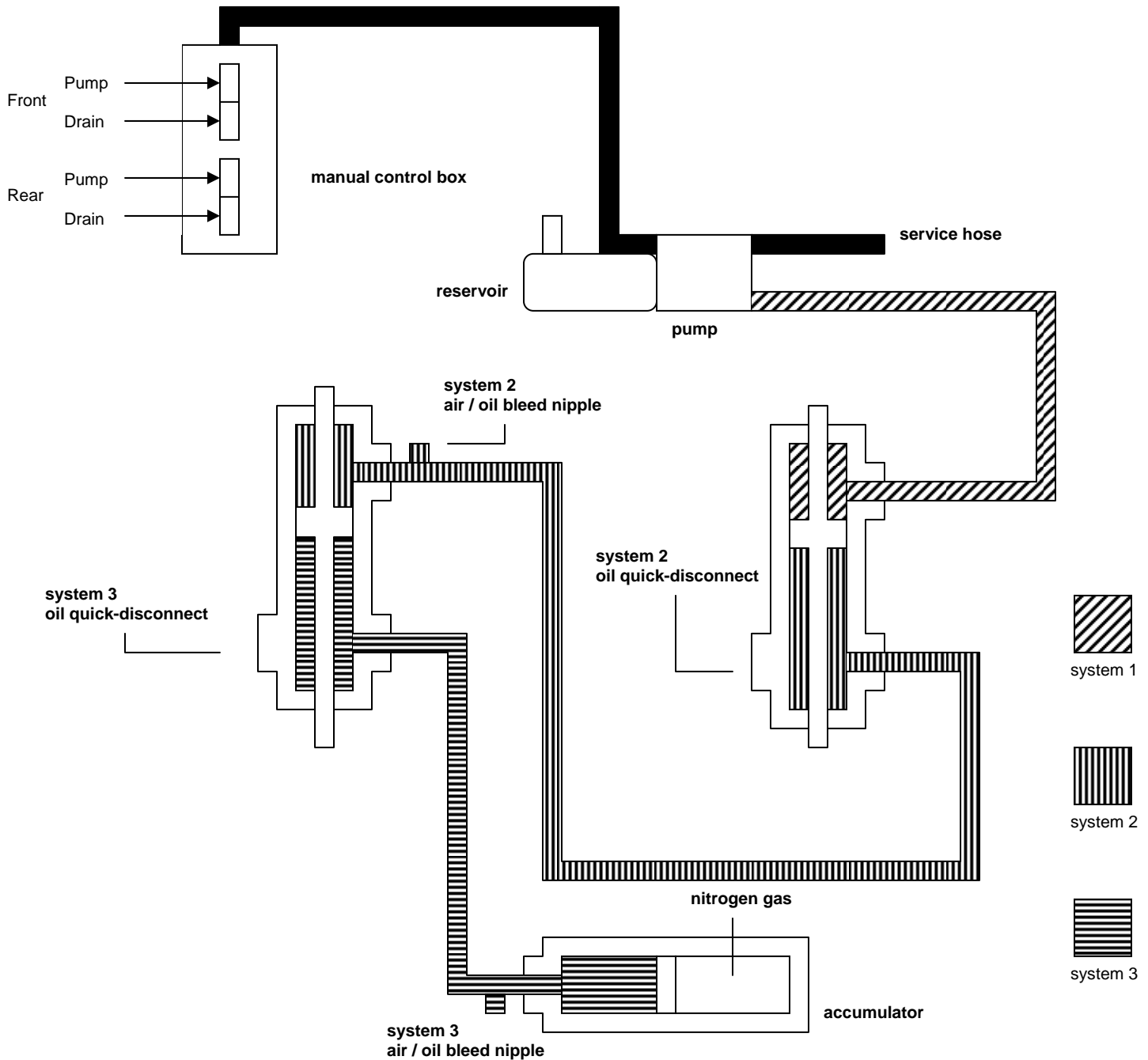
1. Park SkidCar on level ground in area you want to remove frame.
2. Connect the Manual Controller.
3. Raise SkidCar frame to full elevation and slide wood blocks beneath each tire. (Blocks under front tires should have wedge facing to rear)
4. Remove nuts holding SkidCar frame to rubber mounts. Put nuts where you can find them when re-attaching the SkidCar frame.
5. Lower the SkidCar frame to the ground.
6. Cut the cable ties holding the hydraulic lines and electrical lines from dragging on the ground.
7. Disconnect the electrical connector from the front power supply (battery or distribution box) and pull line to ground. Coil line inside of frame where the car will not drive on it.
8. Disconnect electrical lines from pump and from controller cable and push them down through the trunk to the ground. Coil lines inside of frame where the car will not drive on them.
9. Disconnect front hydraulic line from outrigger and coil line inside of frame where the car will not drive on it.
10. Disconnect the front electrical connection from the front outrigger to the long rail.
11. Disconnect hydraulic lines from pump and push them down through the trunk to the ground. Coil lines inside of frame where the car will not drive on them.
12. Remove two main frame bolts connecting front outrigger to SkidCar frame. Place bolts where you can find them when re-attaching the SkidCar frame. Remove front outrigger and place in secure holder for storage.
13. Do a visual inspection to be sure that all lines and parts are free from the car.
14. With a spotter observing the SkidCar frame and the car, drive slowly forward off of the wood blocks and then stop.



Accountability

15. Take the wood blocks that were under the rear tires and place them directly on top of the wood blocks for the front tires. The wedges should face the rear of the car and now be double in height.
16. With the spotter observing the SkidCar frame and the car, drive slowly forward and over the wood blocks and then off of the frame.

Hydraulic System Schematic





Initial Hydraulic Charge Procedure for SkidCar

Things to Know: The front and rear outriggers are fully independent from one another. If you have a problem with one it will not transfer to the other unless there is a problem with the electro-hydraulic pump unit.

To figure the proper hydraulic port to use when servicing the front or rear hydraulics:

- a. The top or front port of the pump is connected to the front outrigger system. The bottom or rear port is connected to the rear outrigger.
- b. To service the front outrigger system you must disconnect the rear or bottom hydraulic hose. Then connect the service hose to the bottom or rear port using the double male adapter supplied in the tool kit.
- c. To service the rear outrigger system you must disconnect the front or top hydraulic hose and connect the service hose to the top or front port.

Front Hydraulic

1. Check hydraulic fluid level in reservoir.
2. Connect service hose to bottom or rear port (rear hydraulics) and the other end to system #2.
3. Connect air-bleed hose to system #2 bleed nipple (refer to Hydraulic System Schematic diagram on page 32) and insert open end in catch bottle. Open bleed nipple.
4. Using the dual switch manual controller, fill system #1 until the ram is at its highest point.
5. Fill system #2 until air is gone from bleed hose and clean fluid runs freely. Close system #2 bleed nipple. Fill system #2 until ram is at its highest point.
6. Connect the service hose to system #3.
7. Connect the air-bleed hose to system #3 bleed nipple (refer to Hydraulic System Schematic diagram) and insert open end into catch bottle. Open bleed nipple.
8. Add oil to system #3 and pump fluid until air is out and fluid runs freely. Close system #3 bleed nipple. Pump oil into system #3 while drain valve to system #1 is open, and fill system #3 until both rams are parked (fully retracted). With rams fully parked run pump two (2) seconds for correct accumulator pressure.
9. Level left and right side rams:
Add oil to system #3.
Be careful to run accumulator side ram just to top, and stop.
10. If there is too much pressure in system #3 it may be difficult to raise rams to full height. You may have to balance between system #2 and system #3.
11. With rams level, run pump two (2) seconds more for correct accumulator pressure.
12. Balance for maximum height if necessary (system #2). May have to bleed system #2 again.

Rear Hydraulic

1. For rear hydraulic charge, fit service hose to the top or front port of pump (front hydraulics).
2. Follow steps 1 - 12 above.

Troubleshooting the Hydraulic System

If an error occurs and no hydraulic leaks are visible, it's possible that an electrical malfunction has occurred. Push the red emergency button and then follow the on-screen instructions. If the error code does not correct itself, then follow the troubleshooting directions below.

1. Problem: "Car won't go up"
 - a. Check electricity to pump; make sure the car is running.
 - b. Check fluid level in reservoir. It should be half full when rams are parked.
 - c. Check to see that the hydraulic fittings are properly connected.
 - d. Could be a leaky valve at pump - check pressure. Pressure should not drop off. You can raise the vehicle - it should not fall.
 - e. Pump could be worn out. Output pressure should be 1500 psi (180 bar).
 - f. There could be too much fluid in system #3.
 - g. Ram could be bent.
2. Problem: "Car won't come down"
 - a. Check electrical connections.
 - b. May need more fluid in system #3.
 - c. May need more gas in accumulator.
(300 psi Nitrogen)
 - d. Ram could be bent.
 - e. Seals could be dry. (lubricate)
3. Problem: "Ram heights are uneven at full elevation"
 - a. Fully park the rams. Connect service hose to system #2 (see Hydraulic System Schematic). With the hydraulics, raise the rams to full elevation. Pump fluid into system #2 until ram (on accumulator side) is to the top. Push the appropriate drain button on the manual controller (system #1) to park the rams. If it does not park fully, then drain a little oil from system #2 with the manual controller until it parks. You may have to play with the balance to get it right.
4. Problem: "The rams do not fully park"
 - a. Could be too much oil in system #2.
Correction: Park rams. Connect service hose to system #2. Drain some fluid from system #2 with the manual controller until rams fully park.
 - b. Could be too little oil in system #3.
Correction: Park rams. Connect service hose to system #3. With drain to system #1 depressed, pump fluid into system #3.



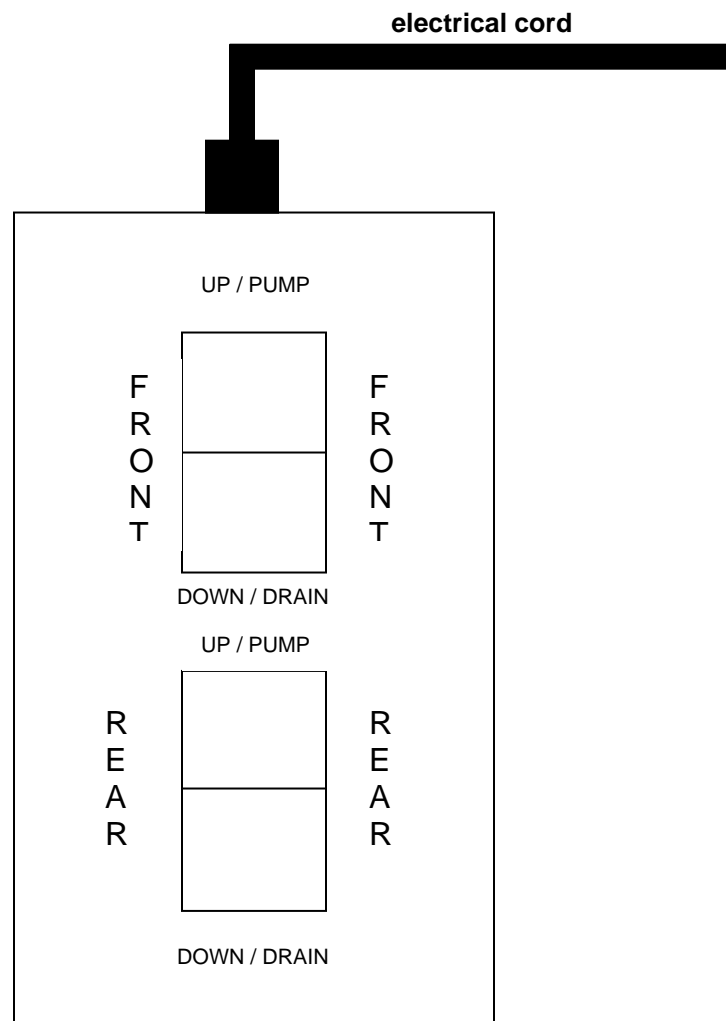
Pre-Class Checklist

1. SkidCar wheel bearings, suspension components, and relevant bolts.
2. Tightness of SkidCar platform to vehicle suspension mounting points.
3. Check platform frame for signs of fatigue or damage.
4. Check for abnormal bearing wear in castor pivots.
5. Equalize ram heights (front beam) if necessary.
6. Equalize ram heights (rear beam) if necessary.
7. Loosen and re-torque the four (4) main frame securing bolts.
8. Check for and eliminate any possible chafing of hoses and wires on SkidCar, frame, or ground.
9. Check tightness of hydraulic ram assembly clamp bolts, castor wheel hub bolts, and mudguard retaining bolts.
10. Check oil level in hydraulic pump. Reservoir should be half full. Use hydraulic oil.
11. Set vehicle road tires to recommended pressures.
12. Set castor tires to 100 – 120 psi (if not foam filled.)
13. Turn on control box.
 - 13.1 After self-test is complete, you must push the left and right “UP” buttons in order to activate the box
14. System Calibration as follows:
 - 14.1 Press key # 1.
 - 14.2 Adjust with the arrow keys so that the extra wheels just touch the ground, both front and rear. (Equal to maximum grip)
 - 14.3 Press key # C.
 - 14.4 Adjust with the arrow keys so that the wheels of the car are just off of the ground, using the calibration wand. (Equal to zero grip)
 - 14.5 Press key # C.
 - 14.6 Preset values are now calculated and saved. System calibration is finished.
15. Enter systems check in car's logbook. Date and initial.

The Manual Controller

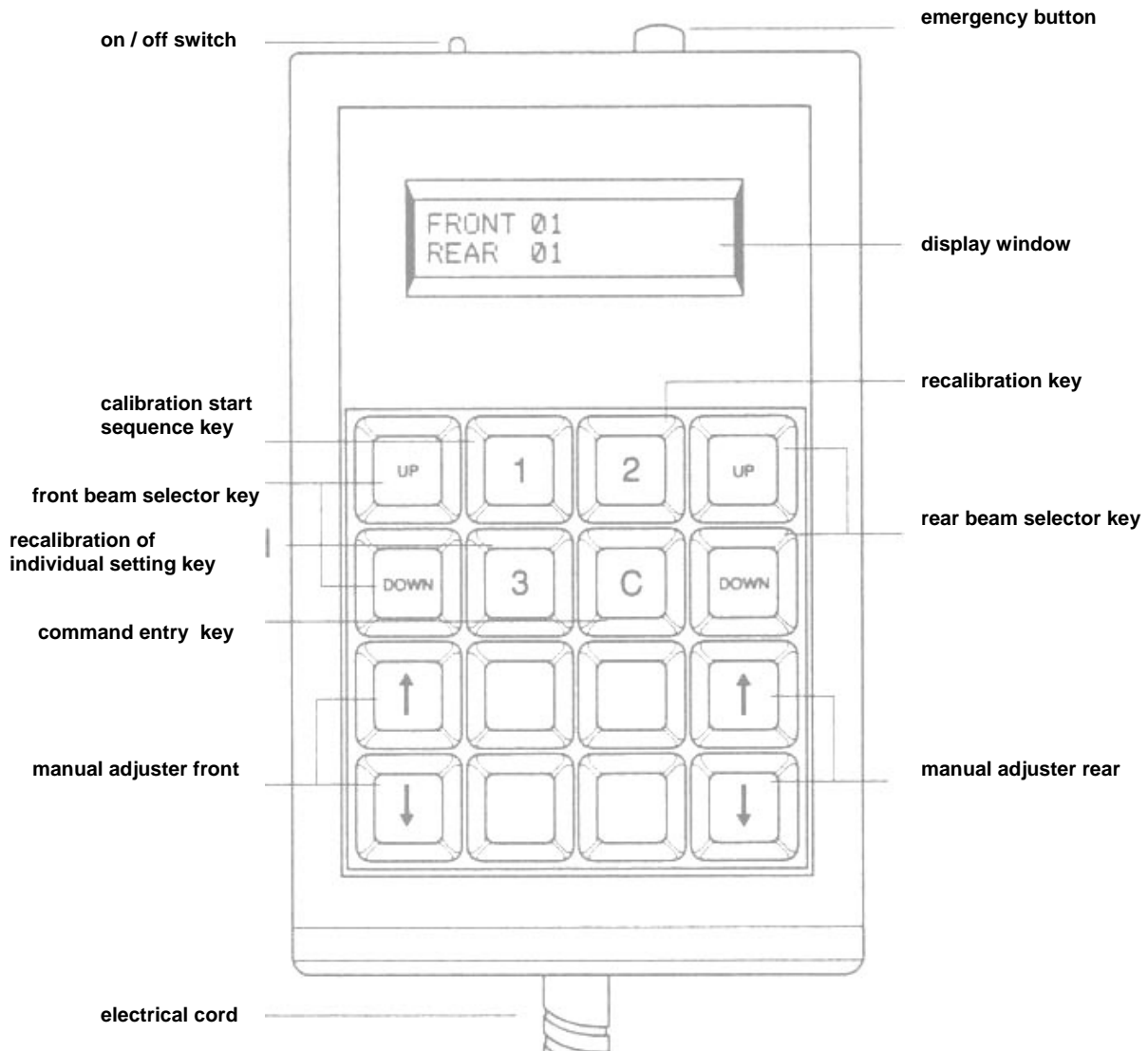
The manual controller can be used to operate the SkidCar System in case the computer controller has a malfunction.

The controller should be held so that the electrical cord is coming out of the top of the controller. The top switch is for the front hydraulics or top (front) port on the pump and the bottom switch is for the rear hydraulics or bottom (rear) port on the pump. Both switches are double function. Press up to pump, and press down to drain.



Manual Control Box

HAL SkidCar Controller (HAL SCC)



SkidCar Controller User's Manual

This manual applies to HAL SCC, program version 3.09.

The HAL SkidCar Controller (HAL SCC) is a complete intelligent control unit for SkidCar. When it is switched on, HAL SCC performs a complete system self-test and then informs the user of the result.

After completing a simple calibration, the system is ready to use. The user now has the opportunity to select different preset grips, while HAL SCC takes care of the regulation.

The preset grips can be adjusted all together or individually at any time to make the user able to retain the grip at the specific setting when the weather changes the friction on the road. There is also a possibility to manually lower and raise the car.

For your safety, HAL is equipped with a certain amount of protecting hardware and software that will automatically lower the car in case of a malfunction.

This control unit must be protected from static shock. An alternative ground strap may have to be installed on the vehicle.

It is our desire and conviction that you will feel comfortable and safe when using HAL SkidCar Controller.

CONTENTS:

1. Description of HAL SCC
2. Functional Operation
 - 2.1 Normal operation
 - 2.2 Calibration
 - 2.3 Adjustment of single preset position
 - 2.4 Security and supervision functions
 - 2.5 Automatic function check
3. Mechanics
 - 3.1 Keyboard and controls
 - 3.2 Control box unit
 - 3.3 External connectors
4. Specification data
 - 4.1 SkidCar torque specifications
 - 4.2 Suggested maintenance schedule
 - 4.3 SkidCar critical parts list

1. Description of HAL SCC

HAL SCC is connected to the SkidCar and used to control all mechanics of the SkidCar. It provides the user an easy-to-use interface to command the equipment to give different grip.

2. Functional operation

HAL SCC consists of a control unit and separate cable. The control unit must be turned on to be active.

2.1 Normal operation

You can use ten different preset grips which are activated by using the front/rear beam selector keys (see control box diagram on page 37). The lowest position gives the maximum grip and the highest position gives the lowest grip. Using the up / down key will step the unit up or down one position (from one to ten) at every press of the key.

There are different keys for the control of the front and rear of the SkidCar. The front is controlled by the yellow keys on the left side of the controller and the rear is operated with the blue keys on the right side of the controller.

For manual adjustment of the preset positions, you can use four other keys to raise or lower the car. The keys with an up-arrow raise the car and thereby reduce the grip. The keys with the down-arrow lower the car and thereby increase the grip. Again, the yellow keys on the left of the HAL SCC are for the front and the blue keys on the right of the HAL SCC are for the rear.

2.2 Calibration

System calibration should be done after initial installation, after changing the tires, or after a change in pressure. During this calibration the ten preset positions are calculated on a logarithmic scale between zero grip and maximum grip.

Calibrate with the vehicle engine running. Before switching on the control box, ensure that all personnel are away from the vehicle and that there is no other equipment near or under the vehicle. Make sure the vehicle is on a flat, level surface.

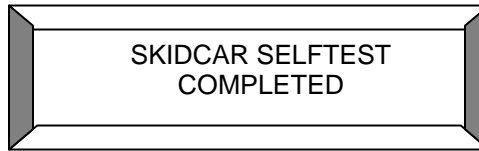
2.2.1 Turning on the Control Box

- A. Push metal switch on top of control box. The control box carries out mechanical and electrical system checks and the display window will read:

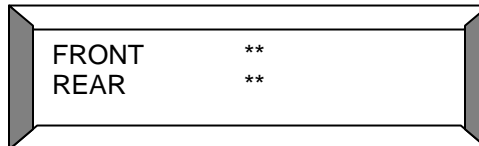


- B. After the self-test is complete the display will read:

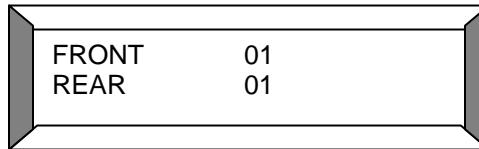
1



2

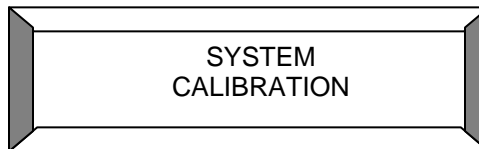


- C. Push the left and right "UP" buttons in order to activate the program. The display will now read:

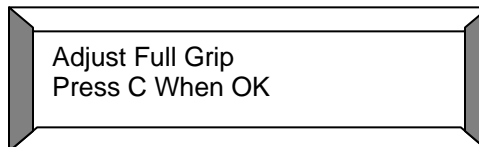


- D. Press key 1.
The display will now read:

1

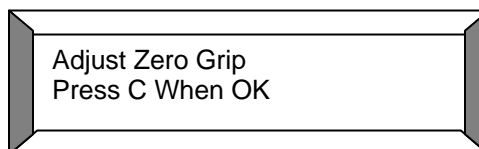


2



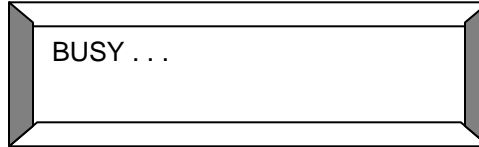
- E. Adjust with the arrow keys so that the outrigger wheels just touch the ground, both front and rear. (Equal to maximum grip)

- F. Press key C.
The display will read:



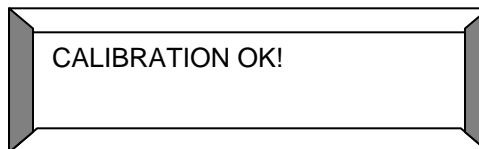
- G. Adjust with the arrow keys so that the wheels of the car are just off of the ground. (Equal to zero grip). Measure using the height measuring tool.

- H. Press key C.
The display will read:

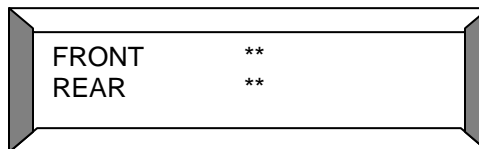


The control box will now calculate ten preset positions between minimum and maximum grip. The display will now read:

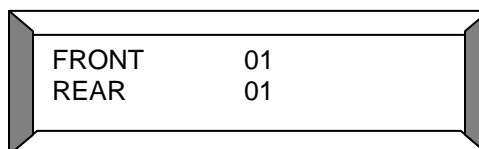
1



2



- I. Push the "UP" buttons (front and rear) to activate the program. The car will now drop to its lowest point. Preset values are now calculated and saved. System calibration is finished.
The display will read:

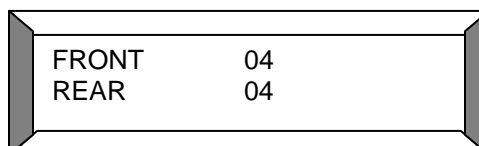


2.2.2 Calibration due to change in the weather:

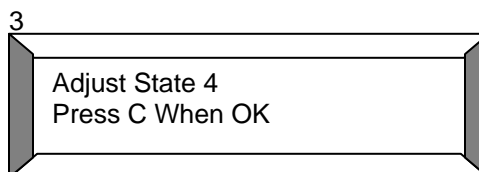
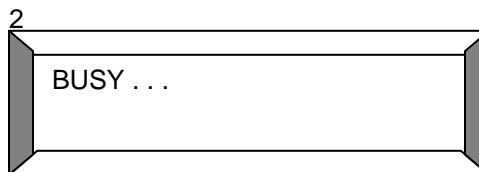
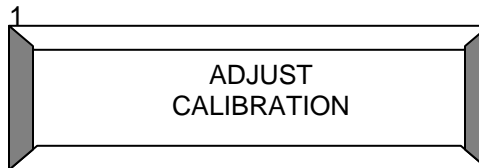
Should be done when the actual grip of the ground has changed due to rain or snow. The purpose is to compensate the preset values so that the rest positions will feel the same grip as before.

Please observe that after a weather calibration, some of the lowest preset positions will not give any change in grip because they all give maximum grip.

- A. Adjust control box to front 4; rear 4.

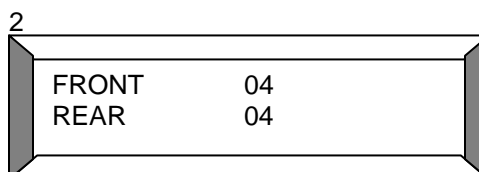
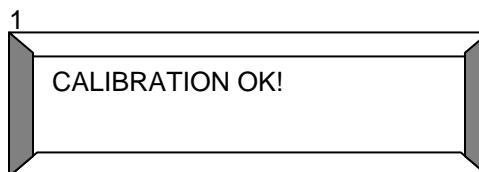


- B. Press key 2.
HAL is now regulating and puts the car in a predefined position.
The display will read:



Then:

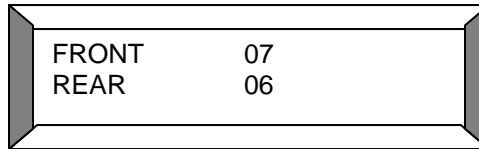
- C. Adjust the height with the arrow keys so that you will feel the same grip as you did at the time of system calibration.
- D. Press key C.
The display will read:



2.3 Adjustment of single preset position (Custom Setting)

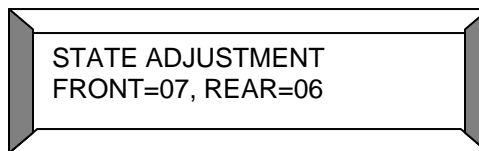
This is used when you want to change a single preset position.
The new value is saved but will be overwritten when a new system calibration is done.

- A. Choose the preset position you want to change by using the front/rear beam selector keys. The display will read (example):

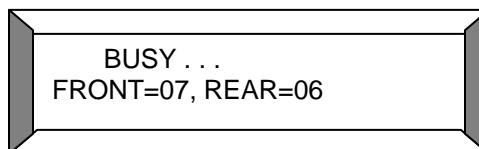


- B. Press key 3.
The display will read:

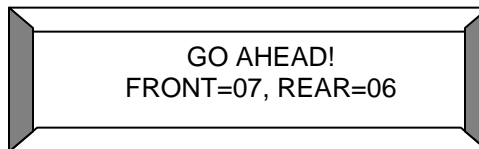
1



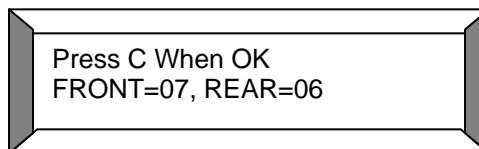
2



3



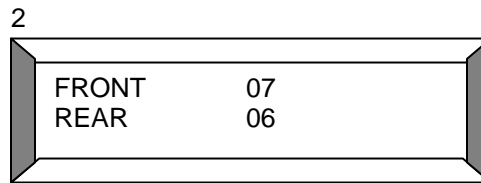
- C. Adjust the arrow keys until you are satisfied with the grip.
The display will read:



- D. Press key C.
The display will read:

1



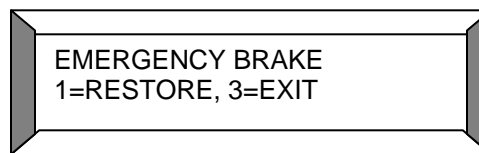


E. Adjustment is now finished and saved.

2.4 Security and supervision functions

Please observe that lowering of the car to its maximum grip can only be done when there is a +12 VDC connected to HAL SCC!

The Emergency Brake, (lowering the car to its maximum grip) is activated by pushing the red emergency brake button (refer to control box diagram on page 37). When the button is pushed, the display will read:



A built-in safety mode is regularly reset by the microprocessor and will lower the car if the microprocessor is not working.

Note: The red button may be used to escape any operation. The vehicle will simply fall to its lowest position.

2.5 Automatic Function Check

This is done when the power is on and will check the following:

- Internal functional check
- Power for the pump valves
- Raising and lowering of the car with the SkidCar hydraulics
- Elevation sensors

If an error occurs and no hydraulic leaks are visible, it is possible that an electrical malfunction has occurred. To verify this, push the red emergency button and then follow the on-screen instructions. If the error code does not correct itself then follow the troubleshooting directions below.

2.5.1 Self Test Warnings or Errors

WARNING OR ERROR 1

Cause: An error occurred during test of the internal read/write memory.

Action:

1. Make sure the car's engine is running during the self-test.
2. Check all electrical connections.
3. Contact SkidCar System personnel.

WARNING OR ERROR 2

Cause: An error occurred during test of the program memory. The program is damaged.

Action: Replace prom.

WARNING OR ERROR 3

Cause: An error occurred during test of internal timing and interrupted logic of HAL SCC.

Action: Same as WARNING OR ERROR 1.

WARNING OR ERROR 4

Cause: An error occurred during testing of the analogue input circuitry of HAL SCC.

Action: Same as WARNING OR ERROR 1.

WARNING OR ERROR 5

Cause: A short circuit was detected from the front elevation sensor circuitry.

Action:

1. Check front elevation sensor for broken wires. Clean if necessary.
2. Check circuitry leading from the front sensor to pump.
3. Replace sensor.



WARNING OR ERROR 6

Cause: An open circuit was detected from the front elevation sensor circuitry.

Action: Same as WARNING OR ERROR 5.

WARNING OR ERROR 7

Cause: A short circuit was detected from the rear elevation sensor circuitry.

Action: Same as for WARNING OR ERROR 5, though you should examine the rear instead of the front.

WARNING OR ERROR 8

Cause: An open circuit was detected from the rear elevation sensor circuitry.

Action: Same as for WARNING OR ERROR 5, though you should examine the rear instead of the front.

WARNING OR ERROR 9

Cause: An error was detected during testing of the front hydraulics.

Action:

1. Check that the car engine is running.
2. Check that the car is parked on a flat surface.
3. Check that the pump is raising the vehicle through the sensor arc for system test within 10 seconds. Check battery and pump pressure. Check the third hydraulic system to make sure it is completely retracted off the ground and starts from park.
4. Check that the hydraulic rams are the same height.
5. Check that there is no air in the hydraulic system (see the Initial Hydraulic Charge Procedure, pg. 33).
6. Contact SkidCar System personnel.

WARNING OR ERROR 10

Cause: An error was detected during testing of the rear hydraulics.

Action: Same as for WARNING OR ERROR 10, though you should examine the rear instead of the front.

WARNING OR ERROR 11

Cause: This is an error that occurs as a result of a malfunction inside the microprocessor that controls the system. The error may occur when the voltage from the car's battery is too low, or when HAL SCC gets a shock from static electricity.

This error is likely to occur when you are operating HAL SCC without the engine running.

Action:

1. If an electrical error occurs and no hydraulic leaks are visible, it is possible that an electrical malfunction has occurred. To verify this, push the red emergency button and then follow the on-screen instructions. In most cases, this action will be sufficient. However, on rare occasions HAL may have lost the information from the last calibration session and therefore a new calibration should take place.
2. Check the car's battery.
3. Contact service personnel.

3. Mechanics

3.1 Keyboard and controls consist of the following:

- One keyboard with sixteen keys
- Four step keys that choose one of ten different preset positions.
- Three keys for starting different calibration modes.
- Four keys for manually raising and lowering the car.
- One key for returning to normal operation.
- One 32 (2*16) digit display with background light of information of actual preset position, guiding at calibration, the reporting of errors, and so on.
- One red-colored switch for emergency brake.
- One switch for power off/on.

3.2 Control Unit Box

Dimensions: 10.1 x 19.5 x 4.4 cm
Design: Flat
Color: White / Gray



3.3 External connectors

The control unit is connected to a cable. In the cable there are four contacts:

- One for HAL SCC
- Elevation sensor front
- Elevation sensor rear
- Power and relay/pump valves - control

4. Specification Data

Resolution in Height:	+/- 0.25 mm
Accuracy in height when regulating:	1.5 mm
Current Consumption:	
Normal operation	350 mA
Standby, Power off	200 mA
Additional per active valve	2 A
Power requirement:	10 - 20 VDC
Temperature range (Fahrenheit):	-4° - + 158°

4.1 SkidCar Torque Specifications

Wheel axle bolts	maximum	recommended
Size M20	260 ft. lbs.	125 ft. lbs.
Wheel half bolts		
Size M10		32 ft. lbs.
Frame bolts (outrigger car & van) --	loosen and re-torque	
Size M16/M18	210 ft. lbs.	125 ft. lbs.
Ram to outrigger bolts		
Size M10		32 ft. lbs.
Fork to ram bolts		
Size M10		32 ft. lbs.
Frame to rubber mounts		
Size M12		58 ft. lbs.



4.2 Suggested Maintenance Schedule

Hydraulic Oil - Change every two years.

Recommended Hydraulic fluid: Valvoline #721, Valvoline Vintrac, or equivalent.

Severe Cold Weather Hydraulic Fluid: Nemco all season Hydraulic fluid #HV122

If your Frame is Manufactured after June 2002, you may need to use Mobil EAL EnviroSyn (Or its equivalent) Contact SkidCar for Information on this product.

Ram Seals - Change every three years

Rubber Mounts - Change front annually, rear every two years

Sensors - Change every two years or as needed

Hoses - Change as needed

Fork Bearings - Change every three years

Wheel Bearings - Change as needed

Tires - Change as needed

Pump - Change as needed

Electric motor and hydraulic pump - Change or repair as needed

SkidCar Frame - Grease wheels every 10 days of use

When the SkidCar is not in use, liberally grease rams and their seals to protect.

**4.3 SkidCar Critical Parts List**

Part	Part Number
Ram Seal Kit Large Car Rams (Caprice, Crown Victoria)	100191
Ram Seal Kit Small Car Rams	100133 - 8
Bearing (fork)	400101 / 400114
Seal (fork) (rebuild rams every four years)	400102
Bearing (wheel) Frame #'s 100 - 234	400108
Bearing (wheel) Frame #'s 235 - present	400121
Seal (wheel) (rebuild wheels every five years) Frame #'s older than 235	400107
Frame #'s 235 or newer	400121-0
Wheel (complete)	100213
Fork (complete) Frame #'s 100 - 234	100142-9
Fork (complete) Frame #'s 235 - present	100230
Rubber mount, 40 mm	700142-3
Rubber Mount, 25 mm (If used daily, replace annually)	700144-9
Sensor (Replace on failure or every 18 months)	600117-6
Fender	200107-1



Part	Part Number
Tire	400103-8
Tube	400104-6
Rim Tape (Wheel Liner) (Replace if worn or every 18 months. If foam filled, replace every two years.)	400119-4
Pump Motor	300138
Billet Hydraulic Pump	300123

REFERENCE NUMBERS:

SkidCar System – Sales, Parts, Service
Arnco Tire Foaming System

702-395-2896
800-821-4147

See us on the World Wide Web at:

www.skidcar.com