IMPORTANT SAFETY INSTRUCTIONS FOR DRIVING ROBOTS

General

These safety instructions apply to the following types of driving robots:

- Steering robots
- Pedal robots
- Brake robots
- Accelerator robots
- Gearchange robots
- Flex-0 by-wire controller
- S-Brake
- Driverless robots

All users of AB Dynamics Driving robots MUST follow the applicable Important Safety Instructions listed below.

Driving robots are designed to automatically steer, brake, and accelerate a vehicle under computer control and may be operated either with or without a human driver in the vehicle. Driving robots are capable of putting large inputs into the vehicle's steering and/or pedal systems at high velocities in order to test the characteristics of a vehicle. The robots, when operated together with a vehicle, are capable of generating POTENTIALLY DANGEROUS responses in the vehicle if improperly used. Vehicle testing involves an inherent general risk to the user of the vehicle and those in the vicinity where the vehicle is being tested or used.

All users of driving robots must be fully trained and shall receive a certificate and sign a statement verifying such training. The important safety instructions in this document shall be included as part of training.

All users of driving robots must read the relevant technical documentation and follow the detailed instructions given. Reading the manual is NOT a substitute for training.

WARNING!

POSSIBLE SERIOUS INJURY TO VEHICLE OCCUPANTS AND THOSE IN THE VICINITY OF THE VEHICLE: DRIVING ROBOTS AND VEHICLES, WHEN OPERATED TOGETHER, CAN GIVE POSSIBLE DANGEROUS RESPONSES RESULTING IN: A LOSS OF VEHICLE CONTROL, COLLISION OR VEHICLE ROLLOVER. THE USER MUST ENSURE ALL RISKS HAVE BEENFULLY ASSESSED BEFORE USINGTHE DRIVING ROBOTS.

www.abdynamics.com
info@abdynamics.com

Proving Ground Safety Requirements:

1. Robot controlled vehicles must only be operated on a suitable private test track and not on public highways, freeways, or other roadways. The user must ensure that there is sufficient clear space, with no obstacles to perform the desired test safely.
2. Robot vehicles must only be operated within a Restricted Access Zone (RAZ). Suitable barriers must be in place at the perimeter of the RAZ to prevent access from pedestrians, unauthorised vehicles, and animals.
3. Robot vehicles must be safely separated from any other vehicles on the test track. Except where test scenarios necessitate the use of other vehicles. Where multiple test vehicles are operating in the same scenario, the relative speed must be kept low and safe.
4. As part of the risk assessment the user should consider additional safety measures such as: Utilising roll cages, outriggers, full harness, helmet, and fire protection, or utilising driverless test equipment to remove the vehicle occupants from hazards.

Driving robot safety instructions:

5. Robots must only be fitted to safe and road worthy vehicles.
6. Safety belts must be worn by all occupants within a robot-controlled vehicle.
7. Situate and secure the emergency stop box within easy reach of the driver.
8. On system power-up the user must test the E-Stop functionality by pressing the E-Stop and cycling the reset.
9. Ensure all components of the driving robot system are fitted securely and correctly in the vehicle as detailed within the installation manuals. Particular attention must be paid to safety critical components including:
    1. Robot connections to vehicle controls (steering robot, brake pedal robot)
    2. Pneumatic struts and suction cup mounts must be firmly in place and pressurised.
    3. The motion pack used for position and speed feedback must be securely attached within the vehicle.
10. Disable all airbags (including airbags inside the driver's seat) that could hit the installed robot or accessories such as tablet PC's, unless the robot has been specifically designed to work safely alongside the airbag i.e. Torus, Halo and Orbit robots.
11. When operating driving robots from within the vehicle, the user must occupy the driver’s seat and remain vigilant at all times. If the robot should malfunction, or if emergency intervention is required, the user must be ready to take over control of the vehicle by immediately releasing the activate switch and taking full control of the vehicle.

www.abdynamics.com
info@abdynamics.com

12. The operator must always ensure that the test has been setup correctly.
    1. Ensure the software limits are setup appropriately (e.g. steering angle, velocity, acceleration, motion pack accuracy and path following error limits). The limits must not be set to excessively large values as this can effectively disable an important safety function.
    2. Always examine and check the configuration of the test, consider running the test in simulation and utilising the preview function before executing the test.
    3. Always try out new tests at a low speed, below 30 kph, to check that the test is correctly configured, and the robots are functioning as expected.
13. The user must ensure that nothing can become entangled in the rotating robots, care must be taken with clothing and hair. Long hair must be tied back and lose clothing must be avoided.
14. The homing procedure (and, for Steering robots, the Zero Steering procedure) must be carried out every single time a driving robot is mounted to the steering wheel/column.
15. Do not continue to use the driving robot if it is damaged, or malfunctions.
16. Never attempt to disassemble or modify any AB Dynamics products, unless instructed to do so by AB Dynamics. Unauthorised disassembly and/or modification can result in failed or incorrectly functioning hardware, which in turn can lead to potentially dangerous situations.
17. Never test or continue testing with the driving robot when tired, under the influence of drugs or alcohol, whether prescribed or otherwise.
18. Where the robot and vehicle are used indoors, effective exhaust extraction must be used to avoid the build-up of poisonous exhaust fumes within the cabin.

Additional proving ground safety requirements for driverless testing

19. Suitable barriers must be in place at the perimeter of the RAZ (restricted access zone) to prevent the escape of a “runaway” vehicle and prevent access from unauthorised vehicles, pedestrians, or animals. Ensure that no other vehicles are allowed to enter the RAZ or are placed in the test area except for other driverless vehicles and support vehicles specially required as part of the testing.
20. Pedestrians and vehicles MUST NOT go near or stand in the path of a robot-controlled vehicle in operation. Only approach a driverless vehicle when the safety brake is in a fired position holding the vehicle stationary.
21. The test vehicle must only be operated if there is a direct line of sight between the base station and the test vehicle.

www.abdynamics.com
info@abdynamics.com

Additional driverless testing safety instructions

22. The safety brake and pedal actuators are critical for ensuring the vehicle can be stopped during driverless operation. Ensure that the brake linkage, pedal bracket, and brake robot are securely and correctly fitted.
23. Before driverless operation ensure the safety brake gives sufficient dynamic braking force and that the resulting stopping distance is appropriate for the vehicle and planned test scenarios.
24. Ensure the engine kill relay has been fitted in the vehicle, the function of the engine kill relay must be tested and proven to stop the vehicle.
25. The base station Emergency Stop button must be within easy reach of the operator at all times.
26. The operator must remain vigilant at all times when operating a driverless vehicle.
27. Ensure all software safety features are setup appropriately, specifically:
    a. The software safety boundary must be set up appropriately for the test area. Note that if the vehicle is travelling parallel to the boundary and at high speed, a sudden change in direction may result in the vehicle crossing the boundary whilst still moving. Extra margin should therefore be considered around fixed objects on the test track.
    b. Ensure that the watchdog timeouts and abort parameters are set appropriately for the vehicle before the vehicle is placed into driverless. Increasing the watchdog timeout will delay the time it takes the vehicle to stop when the emergency stop is pressed.
    c. The test's driverless speed limit must be set appropriately.
28. Where it is safe to do so ensure tests are setup and validated in non-driverless or through simulation.

I have read the above 'Important Safety Instructions for driving robots and agree to comply with the aforementioned requirements.

Signature: _____ **Name:** _____

Position: _____ **Company:** _____

Date: _____

www.abdynamics.com
info@abdynamics.com

Disclaimer

The information in this document is the property of Anthony Best Dynamics Ltd and may not be copied, or communicated to a third party, or used, for any purpose other than that for which it is supplied without the express written consent of Anthony Best Dynamics Ltd. While this information is given in good faith based upon the latest information available to Anthony Best Dynamics Ltd, no warranty or representation is given concerning such information, which must not be taken as establishing any contractual or other commitment binding on Anthony Best Dynamics Ltd or any of its subsidiaries or associated companies.

www.abdynamics.com
info@abdynamics.com